Republic of the Philippines
Department of Energy (DOE)
Philippine National Oil Company (PNOC)

Preparatory Survey for The Batangas-Manila Natural Gas Pipeline Project (Batman 1) including the Entire Gas Value Chain (LNG Facility, Regasification Facility, Pipeline, Offtake Facility)

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Project Map

Source: Survey Team

Executive Summary

1. Introduction

(1) Necessity of Project

To provide the vital link between the sellers of natural gas and the market, the government will actively promote the setting up of gas distribution networks in Luzon. The Luzon network will primarily depend on the pipeline connecting the Camago-Malampaya field to power plants in the Batangas and Cavite areas. This pipeline system will be expanded to cover Metro Manila and Bataan and later the rest of Central Luzon and Southern Luzon. The onshore pipeline from Batangas to Manila will be about 110 km. When this is continued, it will extended all the way to Bataan via Bulacan and Pampanga provinces up to 250 km in length. In addition, an LNG receiving facility will be built in Bataan or in Batangas.

Over the long term, the expansion of the Philippine gas industry into the rest of Luzon and Mindanao will entail extension of the transmission pipelines and the construction of distribution pipelines. While these expect the participation of the companies that have the necessary capital and technical expertise in pipeline construction and operation, the role of the government needs to be clarified.

In summary, the objective of the Project is to utilize domestic/ imported natural gas resources efficiently and widely, contributing to the development of natural gas industry, thus contributing to energy diversification and ultimately sustainable economic and social development of the Country, by constructing a natural gas pipeline from the receiving site (Batangas) to the consumption site (up to Metro Manila), Batman 1, and LNG receiving terminal in Batangas, and natural gas fired power plant, establishing the entire value chain of the natural gas industry. Batman 1 Project constitutes one of the most important, strategic position on the value chain.

(2) Objectives of Study

In order to further facilitate the development of natural gas industry in the country and to enhance the implementation of the Projects, it is necessary to carry out the Study for PNOC to have a further study to assess the feasibility of the Project.

The specific objectives of the Study are summarized as follows;

- Examine the feasibility of Batangas-Manila 1 Natural Gas Pipeline Project (Batman 1) Including the Entire Gas Value Chain (LNG Facility, Regasification Facility, Pipeline, Offtake Facility) under PPP scheme and propose the appropriate implementation strategy;
- Collect necessary information on the related infrastructures such as, Malampaya and other gas fields, gas fueled power plants, industrial parks, commercial buildings, CNG bus, LNG terminals (Bataan, Mindanao, Pagbilao).etc; and
- Collect and analyze current rules and regulations of the Philippines regarding natural gas related projects/ PPP Projects; analyze the necessary modifications in order to implement the Projects smoothly.

2. Batman 1 Project Formation

2.1 Project Scope

The scope of the project is determined as follows.

(1) High-Pressure Gas Pipeline

Batangas Gas Supply Point – Cabuyao Exit of SLEX Highway

(2) Medium-Pressure Gas Pipeline

(i) Supply Route to Lima Technology Center
（Around Malver Exit of STAR Highway - Lima Technology Center)

(ii) Supply Route to Calamba Eco Zome
（Around Santo Tomas Exit of STAR Highway - First Philippine Industrial Park)
(iii) Supply Route to Laguna Technopark
（Around Cabuyao Exit of STAR Highway - Laguna Technopark)

(3) Other Related Facilities

Block-valve Station, Governor Station, Metering Station, etc

2.2 Natural Conditions along the Pipeline Route

(1) Tectonic Setting

The Philippine archipelago is divided into the Eurasian margin and the Philippine mobile belt. The Batman 1 project area is located within a region that is tectonically, seismically and volcanically active.

Five earthquake generators are found within 150km of the Batman 1 pipeline route as follows:

- The Valley Fault System is an active fault system that cuts through Metro Manila and the planned Batman 1 pipeline route.
- The Infant Fault, which skirts the coastline of Quezon, is a segment of the main Philippine Fault associated with a seismic gap.
- The offshore Lubang Fault, between Batangas and Mindoro, is a major splay of the Philippine Fault
- The Aglubang River Fault, the splay of the Mindoro Fault, gives rise to the magnitude 7.1 Mindoro earthquake of 1994.
- The Manila Trench, which has not moved for the last 400 years. PHIVOLCS estimate the magnitude to be at 8.4.

(2) Liquefaction Susceptibility

Generally, liquefaction is more likely to occur in loose silt and fine sand with shallow ground water levels and low standard penetration test (SPT) N values (SPT<15). The PHILVOCS has identified the location of areas potentially susceptible to liquefaction. The western lakeshore of the Laguna Lake, where the Batman 1 pipeline will traverse, is identified to be liquefaction susceptible is classified to be moderate hazard. In the central area, the eastern lakeshore of the Taal Lake, where the majority of the pipeline route is located, is not identified to be liquefaction susceptible. In the south of Batangas area, where no liquefaction susceptible area is identified by the PHIVLCS, the Quaternary alluvium sediments could be estimated to be liquefaction susceptible.

Given these facts, the seismic design complying with the “High-Pressure Gas Pipeline Seismic Design Guidelines for Liquefaction” stipulated by the Japan Gas Association with long-term performances in the seismic safety in the seismic country and similar standards must be applied to the Batman 1 pipeline installation in liquefaction susceptible areas, in order to ensure the safety as a requisite for the high-pressure gas pipeline.

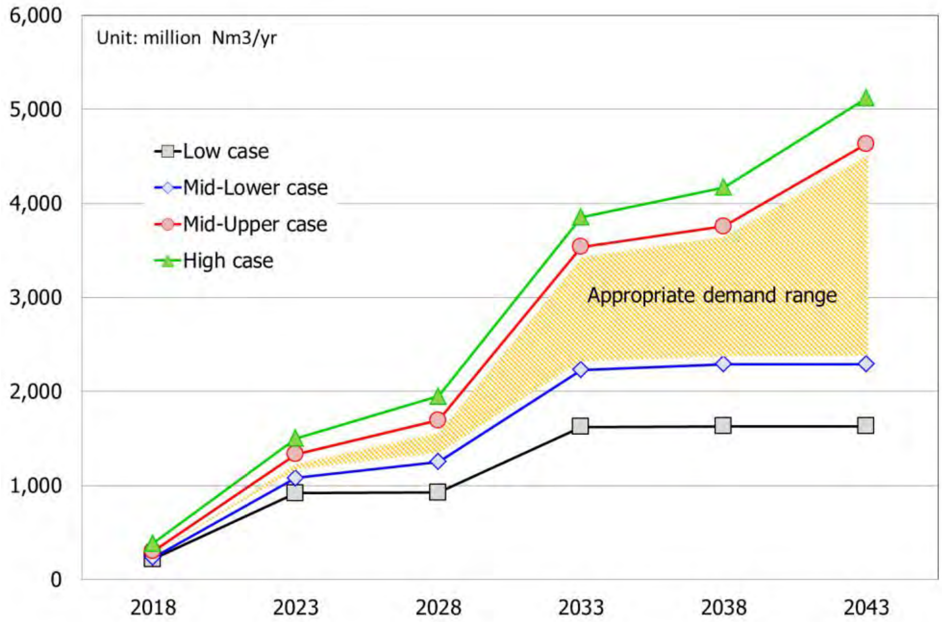
2.3 Supply and Demand Analysis

(1) Case Assumptions

In conducting natural gas demand projection analysis, four case assumptions were set. These are Low, Mid-Lower, Mid- Upper, and High cases.

(2) Summary of Estimated Natural Gas Demand for Batman 1 Natural Gas Pipeline

Summarizing the demand projection for Batman 1 natural gas pipeline by power generation, industry, commercial, households and transport sectors, the total demand and the breakdown from 2018 up to 2043 will be as indicated in the following figure.



Source: Projection by the Survey Team

Figure 1 Case Comparison: Natural Gas Demand for Batman 1

(3) Expected Demand Range

Among the four case settings for demand projection, Low case was “do nothing” setting under unfavorable macroeconomic condition and pricing, which is the extreme scenario that can be naturally anticipated. Here, the government is supposed to be without any substantial promotional measures.

Mid-Low case is a setting in which price competitiveness of natural gas is better. This is also a probable setting where government artificially controls the gas price even under unfavorable macroeconomic condition. Mid-Low case, therefore can be regarded as the bottom side of the “do something” cases, i.e. even if the government is competent to promote the use of natural gas by controlling the price. Further, Mid-Upper case is the setting where favorable macroeconomic condition reacts to give a boost to the financial viability of the project. The demand range between Mid-Lower and Mid-Upper cases is where actual demand is likely to correspond, under the condition that the gas price remains competitive against other fuels, or if not, under the condition that there is a commitment from the government to encourage the penetration of natural gas. In this sense it is desired that the financial viability of the project could be confirmed within this demand range.

Finally the High case expects further expansion of the market, which is the result of inducement of natural gas usage in wider area, and also with the expectation that the private sector will lead the popularization of natural gas by expanding their distribution infrastructure. The case may turn out to be in excess of designed capacity, therefore in a need for a separate, additional supply infrastructure such as Batman 2 (Bataan-Manila) which is also on the list of proposed natural gas infrastructure in PEP 2012.

(4) Significance of Government’s Commitment to Promote the Use of Natural Gas

Demand estimation under four cases in this survey verified that macroeconomic climate will be the most crucial element for gas demand. However, it should be noted that macroeconomic growth can rarely be under the control of the government, regardless of policy and measures. On the other hand, price competitiveness of natural gas, which is another crucial factor for demand, is somewhat controllable provided that the government has the commitment and regulatory capacity. For this reason, Mid-Lower case is regarded as the lowest possible case if there were to be government’s commitment to promote the use of natural gas. The significance of the commitment by the government is therefore the requisite for the project to be viable regardless of the macroeconomic conditions.

Further, there can be various measures by the government to ensure that the demand will be existent. One is the government's role in pursuing the ongoing program to introduce CNG buses. The initial target of more than 7,500 buses fueled by natural gas by 2030 is the commitment that should be met. In transport sector, the government may also promote the use of natural gas on taxis by introducing more filling stations around Batman 1 natural gas pipeline route.

Gas heat pump and on-site power generation can also be promoted with the aim to relieve the burden on electricity infrastructure investment that will be required to cope with the peak demand. Limited availability of space for further grid extension will inevitably make marginal cost for developing the electricity grid high. Promotion to popularize gas equipment expecting peak cut is an alternative option that the government may consider. Government policy to promote the use of natural gas in parallel with electricity and oils will, from wider viewpoint, will contribute to widening the diversity of energy source for power generation, industry, commercial, household and transport sectors. There is also an element of energy security against supply risk and also against natural disaster.

2.4 Gas Pipeline

(1) Design Concept

- Safety design for facilities resistant to earthquake and typhoon is the first priority.
- The design is based on the potential cooperation with the high pressure trunk line to be constructed in the future following the Batman 1.
- The facility design is based on the projection for the demands in the future.
- Routine operation and maintenance may be conducted securely and at ease.

(2) Applicable Standards

The applicable standards for the Batman 1 pipeline comply with the international standard, Interim Rules and Regulations Governing the Transmission, Distribution and Supply of Natural Gas(DOE Circular No.2002-08-005 (27 August 2002). However, as described in the other sections, Japanese seismic design standards are applied to meet the need to satisfy the design life in the Philippines with high occurrence rate of natural disasters, especially earthquake.

(3) Location Class and Design Factor

The Location Class is an important standard in determining the installation depths of the pipeline and intervals of the block valve stations. Location Class stipulated in ANSI/ASME B31.8 is hereby employed. The design factor of the distribution line is calculated at 0.4 under the assumption that the distribution line will increase in the future.

(4) Specifications for Pipes and Different Diameter Pipes

Steel pipes with high strength and excellent toughness will be adopted for the pipeline as set forth by the American Petroleum Institute (hereafter referred to as API). This project is planning to apply the API 5L X-65 (diameter: 24 inch), API 5L X-52 (16 inch) and API 5L X-42 (12 inch), which have been the most commonly used in Japan and are suitable for field welding and handling. (16 inch is to be applied to Phase-2). Polyethylene coating will be applied on the outer surface of the pipes in order to protect against the corrosive environment underground. Also, epoxy coating will be applied on the inner surface of the pipes to prevent rust from generating during the construction period.
As the result of trial calculations starting from 16 inch diameter, 24 inch pipe is assumed to be laid from Batangas to Cabuyao (GS3) and 16 inch pipe from thereon up to Sucat.

(5) Seismic Design

The concepts of the "Seismic Design Guideline for High Pressure Gas Pipeline" and "Seismic Design Guideline for Liquefaction for High Pressure Gas Pipeline", which have been established through the various tests and verification experiments conducted in Japan, are to be applied in the Philippines possibly susceptible to earthquake damage to the pipeline similar to Japan. The specifications for pipeline, which have incorporated Japanese techniques and know-how in construction in urban areas, will be employed in consideration of the fact that the line will be buried underground in densely populated areas. The Batman 1 specifies the material specifications for the line pipes and acceptance standards for the field girth welds as follows, in light of the rate of earthquake occurrence, population density and ground properties.

(6) Study of Construction Specifications

1) High-pressure Trunk Pipeline Joining (Quality Standards for Field Welded Parts)

The quality of the field girth welds of the pipeline is particularly important. As for the welding method and inspection standards, the welding methods and quality standards are defined by Location Class and SA Level as follows:

a. [Seismic Areas]SA Level 2, 3 (Location Class 3, 4)

The welding method for the seismic design areas will be the fully automatic welding (MAG welding), which has proven performances in high-pressure trunk lines in Japan. As for the welding materials, the JIS materials manufactured according to Japanese standards will be used. The acceptance criteria for the radioactive permeability test on the field welded parts will apply the judgment based on the aforementioned JIS Standard, and the total inspection will be executed. In this case, the air-tightness test is to be applied.

b. [Non-Seismic Areas]SA Level 1 (Location Class 2)

Shielded metal arc welding will be applied as the welding method for the non-seismic areas.
The acceptance criteria for the radioactive permeability test will apply the judgment based on the API Standard, and the sampling rate is to be 15% or more. When the radioactive permeability test is executed by the sampling inspection, the air-tightness test is to be applied.

(7) Selection of Pipeline Routes

The High-pressure trunk-line pipeline route planned at the beginning of the route survey is between the newly-installed LNG receiving terminals in Batangas City to Sucat Power Station (105.2 km), as reported in the previous survey conducted in 2012. This time, however, the survey is conducted on the high-pressure trunk-line route by dividing it largely into the following three sections based on the supply and demand survey.

1. Phase-1 Route: from the Energy Supply Company in Batangas City to Cabuyao City: approximately 65.7km
2. Phase-2 Route: from Cabuyao City to Sucat：approximately 29.1km
3. Future Optional Route: from PNOC-ESB, an applicant for the future LNG receiving terminal in Mabini Municipality, up to Lipa City accessing to the PHASE-1 Route：approximately 33.8km

In addition, the distribution lines to the following two Japanese Industrial Parks and one Industrial Area, as the Phase-1 Route connecting Batangas City and Cabuyao City, have been investigated.

- Lima Technology Center（hereafter referred to as LTC）
- First Philippine Industrial Park(Future Plan)（FPIP（Future Plan））
- Laguna Industrial Area（LIA）

(8) Study on Construction Plan

1) Construction Methods for General Parts

In terms of pipeline installation, the parts of the underground pipes in the expressways (the vegetated areas towards Manila) and under the roads are generically called general parts.
A typical construction procedure for general parts is as follows: “Road Excavation →Pipe Lowering →Welding →Inspection → Painting and Coating → Backfilling → Road Restoration”. Some other options such as daytime or nighttime construction, and same-day restoration could be selected considering various factors including road configuration, scale of traffic jam and situations of shops and residences. In reality, directions from road operators and requests from the local communities are more often than not must be taken into consideration, and comprehensive examination and discussion must be conducted at the detailed design before the start of construction work.

2) Construction Methods for Special Parts

There is a variety of crossing methods for special parts (including rivers, roads and bridges) such as (1) open-cut, (2) pipe jacking, (3)shield, (4)HDD (Horizontal Directional Drilling), (5) laying pipeline through gas pipe bridge and (6)attaching to existing bridge. From among them, the construction methods are selected in view of economic rationality; the open-cut method with short construction period and cheap costs is selected to be basically employed for this pipeline, and the HDD and pipe jacking methods are to be applied in case where the open-cut method would be possibly difficult to be applied. Laying pipeline through gas pipe bridge and attaching to existing bridge mentioned above require exposing high-pressure pipes. Considering the possibility of terrorist attacks and malicious mischief, exposing pipes would be highly disadvantageous in terms of the safety of the pipeline, and added maintenance costs, as such, these are excluded from the options for this project. (The exposed pipelines at the stations are monitored by security guards 24/7.)

2.5 LNG Receiving Terminals

The transportation of the supply of natural gas to Batman 1 will be assumed to be imported from the LNG since the Malampaya gas field has no sufficient capacity to supply natural gas to Batman 1.
New LNG Receiving Terminals are intended to be constructed in six locations. However, it is most appropriate and important that the LNG Terminals will be built in Batangas area for the following reasons:

- Natural gas needs to be supplied to the thermal power station with a total capacity of 2,700 MW in Batangas area even after the depletion of the gas reserves at the Malampaya gas field. Therefore, the construction of LNG Receiving Terminals in Batangas area is necessary.
- Natural gas is currently transported to the thermal power station with a total capacity of 2,700 MW through the only one submarine pipeline in Malampaya. If the pipeline ceases the supply for any reason, then an alternative route backup for the other natural gas supply is vital for the steady supply.
- There are a lot of industrial parks and commercial facilities along the gas pipeline route from Batangas to Manila, and it will enable natural gas to be efficiently supplied from the pipeline. It will lead to the expansion of industrial infrastructure and promulgation of employment.

2.6 Project Cost Estimate

This section is not available on this disclosure version report.

2.7 Business Plan and Development Schedule

(1) Business Scheme Model Alternatives

As project scheme model alternatives, there is one extreme case that the public would design, build, finance and operate (DBFO) as a conventional procurement. On the other hand, there is another extreme case that private would conduct DBFO as conventional BOT. Between those extreme cases, there are the cases in middle such as O&M separation and Joint Venture. The possible project scheme alternatives are shown on the table below.

Table 1 Project Scheme Model Alternatives

Model no.	Scheme	Finance	Build	O & M	Tariff Reception
1	Conventional Public Procurement	Public	Public	Public	Public
2-1*	O&M Separation (Outsourcing)	Public	Public	Private	Public *
2-2*	O&M Separation (Leasing)	Public	Public	Private	Private*
3	Joint Venture	Public/Private	Public/Private	Public/Private	Public/Private
4	Conventional BOT	Private	Private	Private	Private

*O&M Separation could be divided into two options. One is O&M outsourcing to private and pay commission. Another is to lease the facility to private and collect lease payment from private. The collected tariff from end-users shall be the income of public in the former case but be the income of private in the latter case.

As a result of analysis, the Survey Team concluded that Model 2 (O&M Separation) is the best project schemes among the alternatives. There are still two alternatives within Model 2. Since the selection of Model 2-1 and Model 2-2 is strongly connected to the discussion of Scope of Work for private proponents, it should be discussed in detail and selected in later project preparation stage when the private proponents will have clearer idea on their own business schemes than now. Model 3 is secondly recommended; however, the applicability of ODA fund needs to be clarified. If availability payment is introduced for Model 3, the project would be more attractive for private investor by sharing demand risk to public sector. Model 1 (public procurement) cannot be selected mainly because public does not have the capability to construct and operate gas pipeline facility by themselves. Model 4 (conventional BOT) cannot be selected mainly because financial viability would be low since soft loan cannot be applied and the control of gas charge level would be difficult to achieve the government policy.

(2) Implementation Capacity of PNOC

PNOC would be the Implementing Agency (IA) for the Batman 1 project. If ODA finance would be utilized for this project, PNOC could be the direct debtor as well. The required capacities for the IA of Batman 1 are as follows;

- Capacity of Loan Arrangement for foreign loan
- Contracting Capability including PPP agreement
- Project Monitoring
- Project Procurement(including preparation of PPP arrangement and technical consideration)

The Survey Team conducted a survey on the capability of PNOC based on the interview to concerned department of PNOC in January 2014. The tentative results of our assessment are the followings. The most missing capacity for PNOC for the implementation of Batman 1 is considered as the capacity of Project Procurement including preparation of PPP arrangement and technical consideration.

Table 2 Result of Evaluation of Capacity of PNOC

Capacity	Result of Tentative Assessment
Capacity of Loan Arrangement for ODA	*Enough with Outside Specialist* Revenue Management Division (RMD) in Treasury Department is in charge of loan arrangement. RMD has experiences on the foreign loan from JICA and ADB and the staffs who were in charge of those loan are still in the Department. Capacity of PNOC should be enough to arrange the ODA loan with support of outside consultant as necessary.
Contracting Capability including PPP agreement	*Enough with Outside Specialist* PNOC has five cooperate lawyers in the Legal Department with experience of various projects with private sectors. They are considered having enough capability for the management the contracting including PPP agreement. Since the volume of work especially for the PPP contract is usually tremendous, the independent legal firm with well experienced for PPP contract might be utilized.
Project Monitoring	*Enough with Outside Specialist* PNOC has been monitoring their subsidiaries' projects through Project Management Department. They have been monitoring more than 30 projects with pre-operational stage and evaluating 7 projects with after-operational stage. They have enough know-how for the monitoring the projects as a holding company. The daily monitoring consultant might be utilized on-site basis.

Project Procurement(including preparation of PPP arrangement and technical consideration)	*Not Enough* PNOC has not experienced for large infrastructure project procurement and does not have staff for this role. Since this project would be procured by international competition, it is very important to have experience for international competition in order to conduct the procurement smoothly. Also, the engineers who are experienced in energy sector especially gas should be required.

Source: Survey Team, based on interviews to PNOC

(3) Role of Government in Development of Gas Pipeline

1) Role of the Philippines Government

Since the gas market has not been established in the Philippines, it is not appropriate to refer to the advanced examples in the USA and Germany that have long history of development. Rather the Philippines can refer to the examples in a small-scale market at the beginning of the market development. In this case, it is expected that the increase of gas demand and revenue would take more time compared with the initial investment. Thus the private investment may not be expected given the size of the market risks. In addition, the profitability of the transmission facilities such as gas pipelines is considered to be small, the development by the private entity has not been common in the world.

Therefore, it can be considered appropriate that the government would develop gas pipeline by its initiative and provide the related infrastructure. In addition some demand risks at the beginning of the market development can be handled by the government. This will lead to encourage the gas demand in the consumer market. The government participation will provide a comfort to the stakeholders and the new investors in the gas market, and stimulate the additional investment and development to enlarge the market in the future.

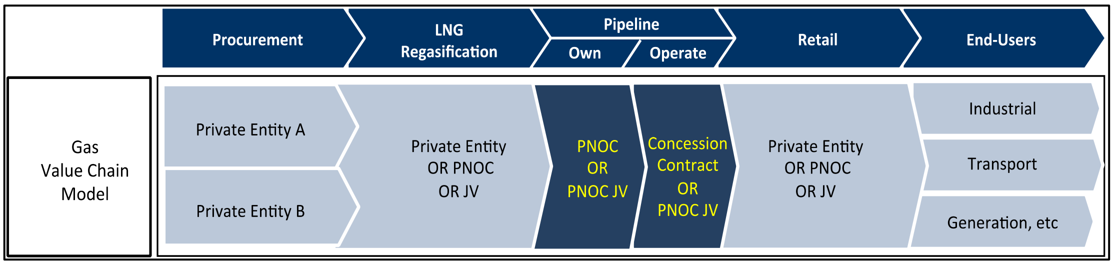
As a conclusion, it is desirable that the government initiative would lead the development through the low-cost financing, establish the regulatory rules in the market, and aim to develop the fair and transparent gas market.

2) Market Regulation

The gas market can be divided into three segments of upstream, middle-stream and downstream. The upstream segment can be composed of the Malampaya gas field and the LNG import in the future. The end-users in the downstream will be the industrial users, transport sector and private generation companies. The role of the government can rest in the middle-stream market such as gas pipeline.

The value chain of the gas sector in the Philippines can be illustrated in the following figure. It is expected that the development of the LNG terminal and procurement of natural gas would be handled by the private sector. On the retail business side, while the end-users will spread out in terms of the supply area, size and the amount of consumption, the government organization like PNOC is unlikely to lead the initiatives for the retail business.

On the other hand, it is anticipated that the development and investment of the gas pipelines would be made by the PNOC or the joint venture with the private entity for the stable start-up and operation of the gas sector development. The operation and maintenance of the gas pipeline can be outsourced to the private sector taking advantage of the experiences and skills. PNOC is expected to exercise the franchise right in order to develop the gas pipeline.



Source: Survey Team

Figure 2 Value Chain of Gas Sector in the Philippines

2.8 Financial and Economic Analysis

(1) Pipeline Project Scheme

In the Philippines, as for a project scheme to implement construction and operation of gas pipelines, public, private, and public-private joint ventures are all eligible. As for business formation, separating pipeline operation business from ownership of gas pipeline infrastructure, as well as integration of both operation and ownership, is allowed. For this reason, various project schemes can be possible for the implementation of the Project.

The previous survey (2012) revealed that the use of soft loan is favorable in terms of financial costs. For this reason, this survey firstly selects project schemes assuming the concessional loan from the previous survey. Secondly a JV to be established jointly by the public sector and the private sector is added this time. The ODA loan would be available for a Public-Private JV, though the provision of loan depends on arrangement of JV. Lastly, the project scheme in which the private sector would own and operate is also included for the sake of comparison. Project schemes assessed in this report are summarized in the following table. On the project schemes, further details are in "2.7 Business Plan and Development Schedule."

Table 3 Project Schemes

	Model 1	Model 2	Model 3	Model 4
Equity	Public 100%	Public 100%	Public 49% Private 51%	Private 100%
ODA loan	Yes	Yes	Yes	No
Commercial Loan	No	No	No	Yes
Ownership / O&M	Integrated	Separated	Integrated	Integrated
Others	-	Asset is leased to a private enterprise	Private ownership needs to be more than 50%.	-

(2) Calculation of FIRR for Pipeline by Project Schemes

In Model 1, Project FIRR surpasses WACC. Equity IRR surpasses cost of equity by a small margin. Thus, Model 1 is financially viable. However, an operational issue matters in Model 1 as PNOC is engaged in O&M directly.

In Model 2, Project FIRR stays above WACC for both the owner and the operator. Furthermore, Equity IRR reaches cost of equity. Model 2 is considered financially viable. As a private company is responsible for O&M, an operational issue is unlikely. This project scheme is the most desirable among the four schemes. Lease fee is to be determined so that the fee could cover expenses of the pipeline owner even in the earlier phase of the operation when gas transport volume is relatively small. This arrangement does not require the pipeline owner to contribute to additional equity after the commencement of pipeline operation. A private operator separately arranges debt financing with its credit capacity and enhances return from their equity investment.

In Model 3, Project FIRR surpasses WACC. As private sector's equity contribution pushes up cost of equity, Equity IRR does not reach cost of equity. However, a margin between cost of equity and Equity IRR is quite slim and equity IRR can be improved by additional debt financing (see the next section). The financial viability of Model 3 depends on financial arrangement. This project scheme can take advantage of operational knowledge in the private sector.

In Model 4, Project FIRR does not surpass WACC and Equity IRR does not reach cost of equity either. Cost of equity is higher due to private sector's full ownership. Furthermore, a shorter grace period increases equity injection in Model 4 compared with Models 1 and 3. As a result of additional equity injection, the cost of equity pushes up WACC.

(3) Calculation of EIRR for Pipeline by Project Schemes

Economic benefit is the same amount for all project schemes. For this reason, the Model 1 in which O&M is higher than other project schemes has the lowest return. In all project schemes, EIRR surpasses the hurdle rate.

As a result of sensitivity analysis on EIRR, regardless of project schemes, key variables affect the return severely in order of sales, capital expenditure, and foreign exchange. Under any condition of reduction of economic benefit by 20%, increase of capital expenditure by 20%, appreciation of Japanese Yen by 20%, the results surpass the hurdle rate in all project schemes.

2.9 Environmental and Social Considerations (ESC)

(1) Legal and administrative framework on the ESC for the Projects

In the Philippines, the types of projects which are environmentally critical or located within an environmentally critical area, 'Environmentally Critical Project (ECP)' and 'Environmentally Critical Area (ECA)' respectively, are required of preparing an Environment Impact Statement (EIS). Those projects must go through the evaluation process of an EIS by the Environmental Management Bureau (EMB) of Department of Environment and Natural Resources (DENR) and obtain an Environmental Compliance Certificate (ECC).

(2) Project categories in the EIS scheme

Projects are categorized into 5 groups, depending on project type and location, with the Revised Procedural Manual 2007 for DENR Administrative Order (DAO) No. 2003-30, as the below table shows. A pipeline project is defined as Non-Environmentally Critical Project (NECP) and belongs to Group II or III.

Table 4 Project Categories by the PEISS

Group	Kinds of businesses and location implemented
I	All Environmentally Critical Projects (ECP)（regardless of locations implemented）
II	Non-Environmentally Critical Projects (NECP) in Environmentally Critical Areas (ECA)
III	NECP in Non-Environmentally Critical Areas (NECA）
IV	Co-located Projects (Several business operators implement and manage business in a contiguous area. Economic zone and industrial park etc are included.）
V	Other projects not listed in any of groups

Source：Revised Procedural Manual for DAO 2003-30 (2007)

As to a pipeline construction project with the length exceeding 25km, it is required to prepare and submit an EIS to DENR and obtain an ECC before implementation of the project. It should be approved by the director of Local EMB. However, this Batman 1 project is located over two provinces, Batangas and Laguna. Therefore, the PEISS process, in regard of the EIA review and the ECC certification, has been examined by the EMB headquarters of DENR. The project category of this Batman 1 will be judged by the EMB in the EIA review process though it is assumed to be Group II or III.

(3) Scoping

Proponent of a project is required to hold stakeholders meetings both at the Scoping stage and at the EIS review stage. The key participants are representatives of LGUs/barangays in project affected area and leaders of sectoral/community organizations. At the scoping stage, the Public Scoping will be held with identified stakeholders, following a preliminary examination scoping project impacts and the disclosure of project information to the concerned communities. On submission of necessary project documents by the project proponent, the central/local EMB will convene an EIA Review Committee. Project proponent and EIS preparer is required to hold meetings on project outline and the Technical Scoping with the EIA Review Committee, as well as the Public Scoping with the local community where the project will be implemented. At the EIS review stage, the explanation of a draft EIS and consensus making on it to the local stakeholders shall be made through the Public Hearing/Consultation, followed by its feedback to the project planning. Current assumption of the scoping matrix is as follows:

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Table 5 Scoping Matrix (1/2)

Category of Impacts	Items of Impacts	Degree of possible adverse impacts: before/during Construction	Degree of possible adverse impacts: during Operation	Reason of the assessment
Pollution Control	1 Air Quality	B-	D	**During Construction (DC):** The amount and frequency of heavy machines and vehicles operation are supposed to be limited since there will not be large amount of material transportation in the construction work for the project. However, during construction works in urbanized areas, measures such as dust control will be necessary. **During Operation (DO):** There will be no sources of emission gas in project facilities.
	2 Water Quality	B-	D	**DC:** There will be temporary impact of muddy water on turvidity of downstreem water with excavated soil during the work laying pipelines underground. In case ground improvement become necessary at a few sections, the impacts of chemical injection on circumambient groundwater need to be monitored. **DO:** There will be no sources of effluent water in project facilities.
	3 Wastes	B-	D	**DC:** Though most excavated soil of pipeline installation work will be filled in again, the proper management of disposal process should be required for small amount of surplus waste soil. **DO:** It is not assumed for this project to generate any large scale storage and disposal place of industrial or any hazardous wastes.
	4 Soil Contamination	D	D	There will be no sources of chemicals, polluted leachet water and other hazardous materials, regarding project facilities. For the pipeline test under applied pressure before commissioning, air-pressure test without any chemicals is assumed in the basic design, rather than hydrotest.
	5 Noise and Vibration	B-	D	**DC:** The amount and frequency of heavy machines and vehicles operation during construction work are supposed to be limited. However, during construction works in urbanized areas, measures such as work time constraint will be necessary. **DO:** There will be no sources of noise and vibration in project facilities.
	6 Subsidence	D	D	There will be no groundwater extraction for this project.
	7 Odor	D	D	There will be no sources of offensive odor in project facilities.
	8 Sediment	B-	D	**DC:** It is assumed that pipelines will be installed underground at river crossing points. However the impacts on river sediment are not supposed to be significant since it is riverbeds under existing bridges. (Of 27 river crossings along the assumed pipeline route, most are small rivers while two rivers have bridges around 200 m in length. For wider river crossing sections, the basic design assumes the pipeline installation method that can avoid adverse impacts on river sediment such as the pipe-jacking or HDD method.) **DO:** There will be no sources of possible pollutants or sludge, regarding project facilities
Natural Environment	9 Protected Areas	D	D	There will be no project facilities to be installed in, around and adjacent to protected areas. The protected area nearest to the assumed pipeline route is Taal Volcano Island NP at approximately 15km away from the route, and the next nearest one is Mt.Banahaw-San Cristobal NP at approx.36 km away, according to the DENR-PAWB protected area list.
	10 Ecosystem	C-	D	There will be no construction works for project facilities in where significant natural ecosystems are existent. The impacts on natuiral grove beside bridges at river crossing points of pipelines are projected to be minimal from the view point of ecological impacts. However, it is better to be confirmed with the examination of water quality and impacts on slope conditions in the EIA study concerned. The impacts on roadside plants in the expressway section are classified into '17 Land use and utilization of local resources', instead of being into 'Ecosystem'.
	11 Hydrology	B-	D	**DC:** There will be cases to temporally control river flow during installation works at river crossings. But it will be small scale of flow control. **DO:** There will be no project structures that could possiblly give impacts on river flow at the project operational stage.
	12 Topography and Geology	B-	D	**DC:** Special cares should be taken for installation and related works that will be conducted in slope at steep creek-type river crossings. Since the Philippines are prone to earthquake disaster, it is necessary to have areal zoning of the project areas according to the levels of liquefaction risk and reflect the zoning categories in the safety criteria for pipeline design. **DO:** Provided that proper safety measures are taken at pipeline installation work, it is not supposed to be any problems for topography and geology due to underground pipelines at the operational stage.

Table 5 Scoping Matrix (2/2)

Category of Impacts	Items of Impacts	Degree of possible adverse impacts: before/during Construction	Degree of possible adverse impacts: during Operation	Reason of the assessment
Social Environment	13 Resettlement *)	B-	D	**DC:** A few houses standing beside rivers at river crossing points of pipeline might be affected by pipeline installation works. In addition, the land acquisition or lease will be necessary for 3 Governor & 1 Valve Stations respectively with the area of around 1200-1600 m^2 inside or aside of expressway lot area.
	14 People in poverty	D	D	As well as pipelines are installed undeground of existing roads in principle, the areas that might have any effects on poor communities are not included in project sites.
	15 Ethnic Minorities and Indigenous Peoples	D	D	The pipeline routes will not pass through the settlements of ethnic minorities and indigenous peoples.
	16 Local economies, such as employment and livelihood	B+	B+	**DC:** Some positive effects on employment of local labor are expected during construction works for the project. **DO:** It is expected that local job opportunities will be boosted with the local employment of monitoring personnels for equipment inspection and gas supply to industries.
	17 Land use and utilization of local resources	C-	D	While pipelines will be installed underground of existing roads, there may be impacts on road side planting along the expressway section. Especially, road side trees standing along the edge of roadside in the section of around 5 km between Calamba Exit and Cabuyao Exit, which are roughly assumed to be of 15 to 30 years old trees, might be cleared consecutively. Since ancillary facilities, such as GSs and BVSs, are planned to be installed inside the lots or beside of existing express ways, their impacts on land use and local resources will be minimized.
	18 Water usage	D	D	There will be no utilization of water regarding the project.
	19 Existing social infrastructure and services	B-	D	**DC:** Possible impacts on other social infrastructure, utilities, and local traffic along the roads and at the river crossings where pipelines will be installed need to be studied and examined.
	20 Social structure and local decision-making institutions	D	D	It is not expected that there are any local impacts on social structures of municipalities and communities along the pipeline routes.
	21 Uneven distribution of benefits and damages	D	B-	**DO:** Target areas and users for gas supply may differ from the areas where pipelines pass through in the project plan. Feasibility need to be examined for taking measures to compensate for misdistribution of benefits, such as inclusion of ancillary facilities in the project to supply not only for the target areas but for the areas along the pipelines.
	22 Local conflicts of interest	D	B-	The effects on this aspect need to be examined with the same reason as 21 above.
	23 Heritage	D	D	There will be no impacts on any cultural heritages since all project facilities will be installed along existing main roads.
	24 Landscape	D	D	There will be no impacts on local landscapes since ground installation of project facilities are limited to small scale governor and valve stations along trunk roads.
	25 Gender	D	D	Project effects on gender issues are not expected.
	26 Children's rights	D	D	Projects effects on children's life are not expected.
	27 Infectious diseases such as HIV/AIDS	D	D	**DC:** The setup of large scale construction camp is not expected for this project. Therefore, it is not expected that there will be a large number of influx of migrant workers from other regions.
	28 Working environment	B-	B-	**DC:** Safety measures for labor workers should be examined on road traffics, especially for works in expressways, and on construction work in slopes, particularly during construction works at river and road crossings and in urban areas. **DO**: Accident prevention measures need to be examined and planned for the following; such as for safety measures in handling high-pressure gas and for traffic accidents prevention in maintenance work inside expressway lot areas.
Global Issues	29 Accident	B-	A-	**DC:** The effects of pipeline installation works on local traffic and traffic accidents of local people should be examined. **DO:**With the base of project study and examination on accidents preventive design and maintenance plan of facilities, the project effects and mitigation measures should be examined.
	30 Climate Change/ Global Warming	D	B+	**DO:** It is expected that natural gas utilization will replace the energy generated by coal thermal power plant as alternative source, which will lead to the reduction of CO2 emission.

A+/-: Significant positive/negative impact is expected. B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

(4) Resettlement Action Plan

1) Necessity of Land Acquisition and Resettlement

Project component required resettlement is high pressure trunk pipeline. There are two affected areas in Batangas City. Project components that requires land acquisition are equipment such as block valve station, governor stations, governor-metering station and metering stations.

2) Initial Alternatives to avoid and minimize Resettlement

The trunk Pipeline is buried 1.2 m below the road on right side basically. In the case of crossing river, the trunk pipeline is buried applying open-cut method or pipe jacking method on the right side.
In the Batangas city, there are two river crossing points. The trunk Pipeline is buried on the left side instead of right side to minimize resettlement of households and shops.

2.10 Operation and Effect Indicators

(1) Operation and Effect Indicators

Operation and Effect Indicators are chosen for the assessment of project effects after the completion of project The reference document for the ex-post evaluation of ODA loan projects "Operation and Effect Indicators Reference, 2nd Edition", which was established by JBIC in October 2002, identifies operation and effect indicators in major sectors.

For fair judgment in evaluation, it is desirable to select operation and effect indicators which directly reflect operational situation of the infrastructure built by the project and, at the same time, are not affected by factors other than the project. As data collection is a cumbersome task, it is unsustainable to establish data collection scheme on numerous indicators only for monitoring project effects. For this reason, selecting several indicators which can be collected routinely in O&M activities is appropriate. In consideration of the above arguments, appropriate operation and effect indicators are following:

Table 6 Operation and Effect Indicators

Indicator	Target	By when	Details
Operation Indicators			
Carry-out amount of natural gas	406 million Nm3/year	second year after project completion	
Operation outage time	0 hour/year	Within two years after project completion	Operation outage time is not assumed for high pressured pipeline as there are several customers.
due to human errors	0 hour/year	Within two years after project completion	
due to machine troubles	0 hour/year	Within two years after project completion	
due to planned outage	0 hour/year	Within two years after project completion	
Availability factor	100%	Within two years after project completion	(Actual operation hours / hours per annum x 100)
Effect Indicators			
Sales amount of natural gas	406 million Nm3/year	second year after project completion	Sales amount is the same amount of carry-out amount as transmission loss is not expected.
Number of industrial parks which introduce natural gas	3 industrial parks	Within two years after project completion	
Number of claims on supply stoppage from gas consumers	0 time/year	Two years after project completion	Operation outage is not expected for high-pressured pipeline. The pipeline has line pack function. Supply stoppage is not expected.

(2) Qualitative Effects

In addition to the realization of targets for operation and effect indicators, the ex-post evaluation of ODA loan projects assesses the incidence of qualitative effects. The Project is expected to produce following qualitative effects:

Extension of Feeder Pipelines: As a result of the Project, PNOC and gas distributors would construct feeder pipelines (medium-pressured and low-pressured pipes) to supply for final consumers. Although the length of feeder pipelines can be measured, some issues (i.e. difficulty in setting targets, effects by factors other than the Project and cumbersome data collection of infrastructure development by gas distributors) need to be taken into account. For this reason, this effect should be regarded as one of the qualitative effects.

Investment in the Energy Sector: The Project can be a catalyst for wider use of LNG. The introduction of LNG would stimulate not only the construction of feeder pipelines but also investment in LNG related facilities such as LNG receiving terminals, supply stations for CNG vehicles and gas-fired power stations. In addition, each consumer would invest in facilities to switch from fuel oil to natural gas.

Legislation and Enhancement of Regulatory Body: In tandem with operation of natural gas pipeline, legislation on relevant fields and enhancement of a regulatory body to implement laws would be accelerated.

Reduction of CO_2 Emission: The construction of natural gas pipeline, together with the construction of LNG receiving terminal, would result in energy shift from petrol and diesel oil to natural gas and, consequently, reduction of CO_2 emission. As shown in the following section, reduction of CO_2 emission can be estimated. However, it is quite difficult to verify a reduced amount by collecting energy shift data across numerous consumers. For this reason, this effect should be regarded as one of the qualitative effects.

2.11 Business Environment and Legal Status

The general observation after comparing the DOE Circular with the several legislations is that needs to be expanded to cover gaps in relevant information needed to encourage investments in the natural gas industry while maintaining fair competition and achieving greater energy self-sufficiency that would serve the interests of the related stakeholders

The suggestions for possible changes in the content of the DOE Circular are based on the following reasons:

- Revisions to make sure that the circular is in line with DOE's Reform Agenda (ERA). The DOE's ERA is significant because it shows the three priorities of the agency: (1) ensure energy security, (2) Achieve Optimal Energy Pricing; and (3) Develop Sustainable Energy System.
- Revisions are based on the practical lessons from the study of Thai Gas Act and Japan Gas Act. The two legislations are relevant for the Philippines because Japan has a comprehensive and mature natural gas business while Thailand is most similar to the Philippines since natural gas business is relatively new and gas supply is both sourced domestically and imported.
- Suggestion for revision takes into consideration existing laws and regulations on natural gas business in the Philippines and other laws that affect natural gas business and the mandate of DOE, as regulator of natural gas business.

In the content of the DOE Circular, the actual wording should be considered in future projects and should be adapted to Philippine situation.

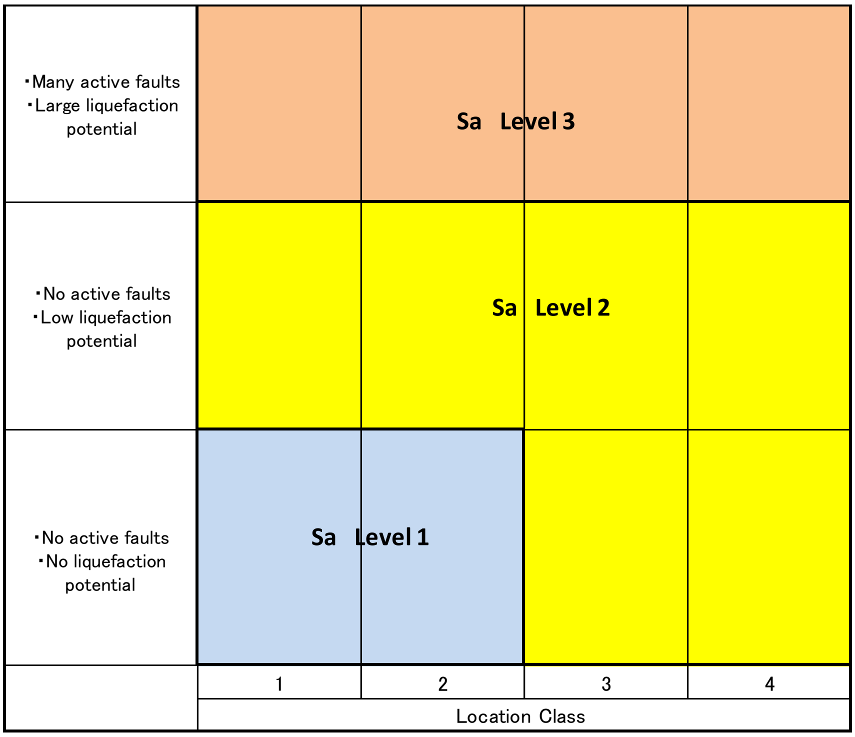
3. Recommendations

3.1 Gas Pipeline Safety

The natural features, soil conditions and weather conditions of the Batman 1 pipeline route are similar to Japanese natural features such as the existence of active faults, typhoons and annual rainfall. Considering a large number of existing active faults and constant threat of earthquake, among others, the application of seismic technology developed in Japan is strongly proposed.

In case of earthquake, the high pressured gas pipeline should ensure the prevention of gas leakage. That is, the high pressure gas pipelines should possess highly deformability such as the Japanese gas pipelines specified by the Japanese original seismic design standards which were verified with highly deformability and reliability with many full-scale pipe bending experiments and the FEA studies. The seismic safety of the Japanese original pipelines also has good records in Japan. In case of any accident, the high pressured gas pipeline should not only ensure the prevention of gas leakage, but also the safety of people.
In conclusion, the JICA team and the experts of ESCA have an agreement on the importance of the deformability and reliability of the pipelines to ensure safety. Hence, the Japanese original aseismic design standards have to be applied to ensure the safety of the Batman 1 pipeline.

The zones of SA Level 2 and SA Level 3 have high seismic damage risks compared to SA level 1, and highly dense population. For the Batman 1, it is recommended to combine Japanese standards and API standard for each zone. Safety Assessment Levels (SA Levels) are defined by the figure below:



Source: Survey Team

Figure 3 Classification of the Safety Assessment Levels (SA Level)

The Survey Team concludes that the following proposals shall be recommended as the standards to ensure the safety of the Batman 1 pipeline:

Proposal 1: The seismic design for Level 2 earthquake is to be applied to the entire pipelines
For the design of gas pipeline, a higher level of safety is necessary.
The high-pressure gas pipeline seismic design guidelines are the two-level seismic design method

based on earthquake motion, and its standard is to maintain the earthquake resistance of gas pipeline against Level 1, a standard earthquake motion, and Level 2, a very strong earthquake motion. The ground deformation due to liquefaction-induced flow of inclined ground and quay walls is defined. These design concepts are applied to the Batman 1.

Proposal 2: The Japanese specifications, such as JIS standard, is to be applied to the materials for the line pipe materials and field girth welds in the areas with active faults and/or high density population.

For the design of gas pipeline, high-level safety is necessary. Especially in the areas where substantial deformation of pipeline is anticipated particularly in the plastic region level, the gas pipeline should assure its higher reliability. In this study, the Japanese pipe materials and Japanese welding quality are applied in specific areas.

a. Specifications for line pipes

JGA standard is applied to the material specifications for the line pipes in the proximity to active fault areas and the high population density areas. JGA standard examined the pipe deformability on the real Japanese line pipes in full scale test.

b. Specifications for welds

The JIS standard, a Japanese standard, is recommended for the specifications for welds in the proximity to active fault areas and high population density area because the JIS stipulates severe acceptance criteria compared to API Standard.

The acceptance standards for the materials specifications for line pipes and field girth welds are proposed herein for the Batman 1 from the point of view of the earthquake occurrence probability, population density and soil properties. The figure below shows the applicable standard (SA Level) stipulated according to the ANSI/ ASME Class Location indicated in the active faults map and liquefaction hazard map.

- SA Level 1: Along the expressway with little possibility of liquefaction and low population density.
- SA Level 2: Batangas City and Cabuyao City areas with a possibility of liquefaction and high population density
- SA Level 3: Sucat area, with liquefaction hazard areas, active faults and high population density.

It turned out that damage in pipeline has not be found in Japan, because the materials satisfying high-pressure gas pipeline seismic design guidelines stipulated by the Japan Gas Association (JGA) have been used. The JGA high-pressure gas pipeline seismic design guidelines define the value of allowable strain in earthquakes, based on full-scale experiments on steel pipes, in order to secure the quality of pipelines against large deformation and cyclic deformation (fatigue) caused by earthquakes. Therefore, the JGA guidelines are considered as the prime code to prevent pipelines fracture. Based on the above reasons, steel pipes in compliance with the JGA specifications should be used in seismic design areas and urban areas.

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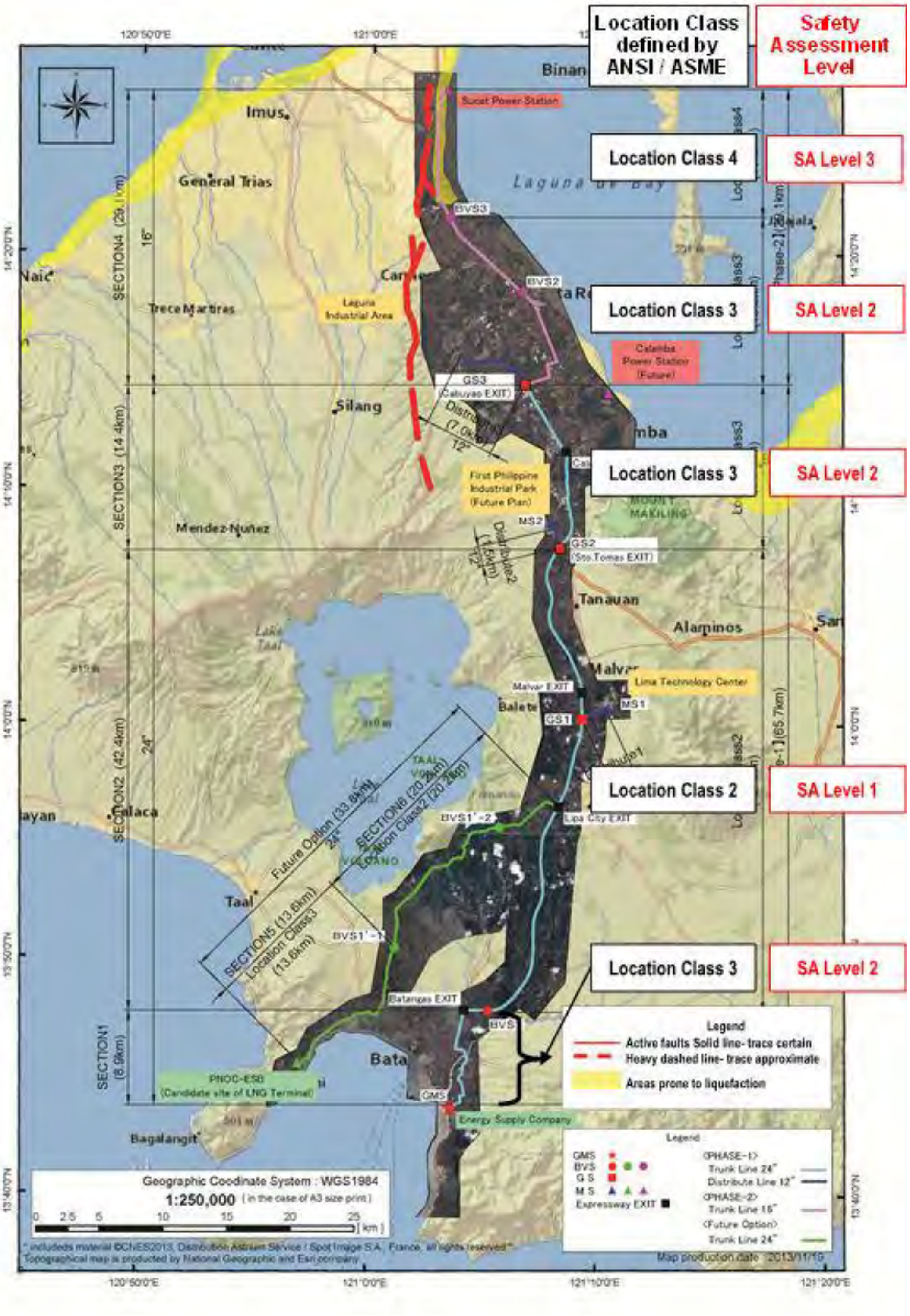

Source: Survey Team

Figure 4 Proposed Standards by Area for Batman 1

3.2 LNG Receiving Terminal - LNG Receiving Terminals Best Ownership Proposal -

FSRU at Tabangao is chosen as the potential supplier of natural gas to the Batman 1, considering its realization possibility. The land owned by PNOC-ESB facing the tranquil waters on the west side of Batangas area could be possibly converted into LNG receiving terminals in the future.

3.3 Recommendation on the Supply Source of Natural Gas

From where the natural gas is brought in order to supply for the Batman 1 is a crucial factor. The following three points are focused on as supplier selection requirements:

1) Being a source which can surely supply natural gas the same time as the completion of Batman 1 construction,
2) Being a source whose stable supply plan can be confirmed at this point
3) Being a source which may possibly supply natural gas at a relatively stable price in the future.

The result of the examination leads to the selection of natural gas supply from the FSRU which the Energy Supply Company at Tabangao has been planning to commence to operate, meeting the aforementioned points,1) and 2). Some energy supply companies will be able to supply their future gas to demand market such as industrial parks and commercial facilities through the Batman 1 in order to meet. 3).
In addition, as a future perspective, it is considered to construct LNG receiving terminals in PNOC-ESB owned by PNOC for connecting to the Batman 1 and to link stable supply to natural gas.

Based on the above, this survey designates within the site in Tabangao as the custody transfer point located on the upstream side for the Batman 1. In the facilities for the Batman 1, nozzles are to be installed to receive natural gas supply from other companies. Other energy supply companies would be able to supply natural gas to the Batman 1 with the nozzles.

3.4 Proposal on Technical Cooperation Capacity Development for Gas Pipeline

(1) Reinforcing the Legal Framework

The only current legal framework for the gas pipeline business regulation is the circular of DOE. Hence the legal framework is not considered to be well developed. The safety standard for the gas pipeline business in the Philippines is also based on the Circular No.2002-08-005 of DOE. In this clause the construction and operation of the gas pipelines should follow the ISO. In particular, the design of the gas pipeline and the environmental matters should follow the ISO 13623 and the domestic other laws, respectively.

Furthermore, the construction of the natural gas facilities should be based on the ISO 13623 or the others stipulated by DOE. Since the Philippines have a number of earthquakes, it is suggested that the Japanese earthquake practices will be applied wherever necessary. The JICA Study applied the Japanese design to the active faults, the areas where the distortion is expected, and the locations with high population density as a result of the consultation of local experts. The establishment of the legal and regulatory systems is expected in the Philippines.

(2) Recommendations on Improvement of Technical and Safety Standard

It is crucial to develop the technical standard for the technical standard of the pipeline in order to design, procure and construct the gas pipelines. Batman 1 project is the first trunk gas pipeline in the Philippines to utilize the city gas and hence the smooth implementation is the priority. It is suggested that the major technical standard can be developed as shown in the below.

Table 7 Major Technical Standards to be Developed

(1) Design Standard

№	Item	Contents
1	Material	Material standard
2	Welding	Welding confirmation test, etc.
3	Structural Design	Appropriate engineering requirement
4	Anticorrosion	Anticorrosion method

(2) Construction Standard

№	Item	Contents
1	Civil Works	Inspection of land fill
2	Welding Works	Welding method, Qualification text for technician
3	Anticorrosion Works	Anticorrosion method

4	Antipressure, Airproof Test	Antipressure, air proof tests and inspection
5	Inspection before completion	Testing method

(3) Standard for maintenance and operation

№	Item	Contents
1	Pipeline and facility	Inspection items and method
2	Anticorrosion management	Anticorrosion management based on method
3	Other construction method	Method for checking, meeting and protection
4	Measures for escape	Notification, shutdown, reduction of pressure, recovery, etc.

It is also important to develop the additional legislations according to the development and the operation of the gas pipelines in the Philippines. The technical standard in Japan has been developed so that the new technology is adopted and the voluntary efforts are promoted. Thus it is possible to voluntarily select the technologies that are adapted to the technical standard in addition to minimize the involvement of the government with respect to the development and the application of the technical standard. The development of the technical standard in the Philippines can also consider these aspects. Furthermore, it is necessary to study the demarcation of the responsibilities with the end-users, and the approval and request for the facility installment.

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List of Abbreviated Terms
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AC	Alternate Current
ADB	Asian Development Bank
AGA	American Gas Association
ANSI	American National Standards Institute
ASEAN	Association of Southeast Asian Nations
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
APEC	Asia-Pacific Economic Cooperation
APERC	Asia Pacific Energy Research Centre
API	American Petroleum Institute
ARR	Annual Requiring Revenue
AWS	American Welding Society
BAU	Business as usual
BH	Blow Hole
BIR	Bureau of Internal Revenue
BOG	Boil-Off Gas
BOT	Build Operate Transfer
BSI	British Standards Institution
BVS	Block Valve Station
CALA	Cavite – Laguna
CAPM	Capital Asset pricing Model
CCA	Climate Change Adaptation
CCGT	Combined Cycle Gas Turbine
CD	Cathodic Protection Cost of Debt
CE	Cost of Equity
CEO	Chief Executive Offic
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMVR	Compliance Monitoring and Validation Report
CNG	Compressed Natural Gas
COA	Commission on Audit
DAO	DENR Administrative Order
DBFO	Design, Build, Finance and Operate
DC	Direct Current
DENR	Department of Environment and Natural Resources
DEPO	Deposit Metal
DIN	Deutsches Institut für Normung
DNV	Det Norske Veritas
DO	Department Order
DOE	Department of Energy
DOF	Department of Finance
DPWH	Department of Public Works and Highways
DRR	Disaster Risk Reduction
EC	European Community
ECP	Environmentally Critical Project
ECA	Environmentally Critical Area
ECP	Environmentally Critical Project
EGIG	European Gas Pipeline Incident data Group
EIS	Environment Impact Statement
EMP	Environmental Management Plan

EO	Executive Order
EPIMB	Electric Power Industry Management Bureau
EPIRA	Electric Power Industry Reform Act
EPPB	Energy Policy and Planning Bureau
ERA	Energy Reform Agenda
ERB	Energy Regulatory Board
ERC	Energy Regulatory Commission
ERDB	Energy Resource Development Bureau
ESD	Emergency Shut Down System
EUMB	Energy Utilization Management Bureau
FEA	Finite Element Analysis
FEP/PE	Perfluorinated etylene-propylene/polyethylene
FERC	US Federal Energy Regulatory Commission
FGHC	First Gas Holding Corporation
FIRR	Financial Internal Rate of Return
FPIP	First Philippine Industrial Park
FS	Feasibility Study
FSRU	Floating Storage and Regasification Unit
FSU	Floating Storage Unit
GMS	Governor and Metering Station
GOCC	Government-owned and controlled corporation
GOP	Government of the Philippines
GS	Governor Station
HDD	Horizontal Directional Drilling
HUDCC	Housing and Urban Development Coordinating Council
HMI	Human Machine Interface
IA	Implementing Agency
IC	Inter Change
ICC	Investment Coordination Committee
IFC	International Finance Corporation
IFD	Incomplete Fusion
IFRS	International Financial Reporting Standards
IGE	Institution of Gas Engineers
IO	Implementing Office
IP	Incomplete Penetration Indigenous People
IPAP	Indigenous People'ss Action Plan
IPRA	Indigenous People's Rights Act
IROW	Infrastructure Right-of-Way
ISO	International Organization for Standardization
IRR	Internal Rate of Return Implementation Rules and Regulations
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standards
JGA	Japan Gas Association
JCC	Joint Coordination Committee
JV	Joint Venture
ICC	Investment Coordination Committee
KBA	Key Biodiversity Area
KL	kiloliter
LAPRAP	Land Acquisition Plan / Resettlement Action Plan.
LARRPIP	Land Acquisition, Resettlement, Livelihood Recovery and Indigenous People
LCS	Low Carbon Scenario
LRES	Local Retail Electricity Supplier

LGU	Local Government Unit
LIA	Laguna Industrial Area
LNG	Liquefied Natural Gas
LOS	levels of service
LPG	Liquefied Petroleum Gas
LTC	Lima Technology Center
MAG	Metal Active Gas
MAR	Maximum Allowable Revenue
MAP	Maximum Allowable Price
MC	Memorandum Circular
MM	man-month
MMB	Million barrels
MMDA	Metropolitan Manila Development Authority (MMDA)
MMO	Mixed Metal Oxide
MMT	Multi-partite Monitoring Team
MPa	Mega Paskal
MS	Metering Station
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
MT	Magnetipartic Testing
MTU	Master Terminal Unit
MW	megawatt
NACE	National Association of Corrosion Engineers
NCR	National Capital Region
NDI	Nondestructive Inspection
NEA	National Electrification Administration
NECA	Non-Environmentally Critical Area
NECP	Non-Environmentally Critical Project
NEDA	National Economic Development Authority
NHA	National Housing Authority
NGCP	National Grid Corporation of the Philippines
NGIIDAS	Natural Gas Industry and Infrastructure Development and Administration Section
NGMD	Natural Gas Management Division
NGMDMS	Natural Gas Market Development and Monitoring Section
NPC	National Power Corporation
NSCP	the National Structural Code of the Philippine
NSO	National Statistics Office
NTC	National Transmission Corp
O&M	Operation and Maintenance
ODA	Official Development Assistance
OIMB	Oil Industry Management Bureau
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PAGC	Presidential Anti-Graft Commission
PAP	People affected by the Project
PAWB	Protected Areas and Wildlife Bureau
PBR	Performance Based Regulation
PD	Presidential Decree
PDP	Power Development Plan
PECR	Philippine Energy Contracting Round
PEISS	Environmental Impact Statement System
PEMC	Philippine Electricity Market Corp
PEP	Philippine Energy Plan

PEZA	Philippine Economic Zone Authority
PIP	Public Investment Program
PIS	Performance Incentive Scheme
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PHMSA	Pipeline & Hazardous Materials Safety Administration
PLDT	Philippine Long Distance Telephone Company
PM	Particulate Matter
PMO	Project Management Office
PMS	Periodical Maintenance Services
PNOC	Philippine National Oil Company
PNOC-EC	Philippine National Oil Company Exploration Corporation
PNOC-AFC	The PNOC Alternative Fuels Corporation
PNOC-DMC	The PNOC Development and Management Corporation
PNOC-RC	The PNOC Renewables Corporation
PNOC-STC	The PNOC Shipping and Transport Corporation
PNR	Philippine National Railways
PQ	Prequalification
PPP	Public-Private Partnership
PS	Percellary Survey
PSC	Power Supply Contracts
PSALM	Power Sector Assets & Liabilities Management Corp
QCBC	Quality and Cost Based Selection of Consultants
RAP	Resettlement Action Plan
RCOA	Retail Competition and Open Access
REMB	Renewable Energy management Bureau
RES	Retail Electricity Supplier
RFP	Request for Proposal
RMD	Revenue Management Division
ROR	Rate of Return
RORB	Return-on- Rate Base
ROW	Right of Way
RSC	Retail Supply Contracts
RT	Radiographic Testing
RTU	Remote Terminal Unit
SA LEVEL	Safety Assessment Level
SC	The Steering Committee
SCF	Standard Conversion Factor
SCV	Submerged Combustion Vaporizer
SCADA	Supervisory Control and Data Acquisition
SDR	Social Discount Rate
SLEX	South Luzon Expressway
SIS	Standardiser- ingskommissionen i Sverige (The Swedish Standards Institute)
SMR	Self-Monitoring Report
SMTS	Specified Minimum Tensile Strength
SOLR	Suppliers of Last Resort
SPEX	Shell Philippines Exploration B.V..
SPC	Special Purpose Company
SSPC	Steel Structures Painting Council
STAR	South Tagalog Arterial Road
STV	Shell & Tube Vaporizer
SWR	Shadow Wage Rate
TDM	Time Division Multiplexing

TDMA	Time Division Multiple Access
THT	tetrahydrothiophene
TOR	Terms of Reference
TRANSCO	Transmission Corporation
TRB	Toll Regulatory Board
USD	United States Dollars
USGS	U.S. Geological Survey
UT	Ultrasonic Testing
VAT	value-added tax
VCR	Volume Capacity Ratio
VHF	Very High Frequency
VPMS	Vice President for Management and Services
VSAT	Very Small Aperture Terminal
VSLAE	Vice President for Legal, Administrative, and Estate Management
VT	Visual Testing
WACC	Weighted Average Cost of Capital
WB	World Bank
WC	Wheeling Charge
WEO	World Energy Outlook
WESM	Wholesale Electricity Spot Market
WPS	Welding Procedure Specification
WTP	Willingness-to-Pay

Units

Category	Abbreviation		Unit	Remarks
Natural Gas	scf	:	standard cubic feet	1 scf = 0.0268 normal cubic meters
	ton	:	tonnes	1,000 tonnes = 48,700 cuf = 51,750 million Btu = 0.05458 PJ
	Btu	:	British thermal unit	1 Btu = 1,055.056 joules
	PJ	:	peta joule	1 PJ = 23.9 toe
	toe	:	tonne oil equivalent	1 toe = 41.8 GJ
	BCF	:	billion cubic feet	
	MMscf/d	:	million standard cubic feet per day	
	MMscf/h	:	million standard cubic feet per hour	
	Nm^3	:	normal cubic meter	
	$MMNm^3/h$	:	million Normal cubic per hour	
Distance	ft.	:	feet	1 feet = 12 inch = 0.303 meter
	m.	:	meter	1 meter = 100 cm = 0.001 km
Area	m^2	:	square meters	1.0 m * 1.0 m
	km^2	:	square kilometers	1.0 km* 1.0 km
	Ha	:	hectare	1 ha = 10,000 m^2
	acre	:	acre	1 acre = 4,046.86 m^2
Currency	JPY	:	Japanese Yen	
	USD	:	United States Dollars	USD = JPY 103.9 USD = PHP 44.9
	PHP	:	Philippines Pesos	PHP = JPY 2.31 (as of Jan 2014, at the time of project cost estimation)
Power	kV	:	kilo volts	
	kW	:	kilo watts	1 kW = 1,000 W
	MW	:	mega watts	1 MW = 1,000 kW
	Wh	:	watt-hours	
	kWh	:	kilo watt-hours	1 kWh = 1,000 Wh
	MWh	:	mega watt-hours	1 MWh = 1,000 kWh
	GWh	:	giga watt-hours	1 GWh = 1,000 MWh
Volume	L	:	Litter	

Main Text

Chapter 1 Introduction

1.1 Background of Project

Natural gas utilization in the Philippines has commenced since the start of commercial operation of Camago-Malampaya gas field in 2002. The gas is transported by offshore pipelines (maximum capacity: 650MMcf/d) and supplied to three power plants (Ilijan, Santa Rita and San Lorenzo. Total: 2,700 MW). The master plan including a construction project of natural gas pipeline network-related facilities was developed based on the "Master Plan Study on the Development of the Natural Gas Industry in the Republic of the Philippines" assisted by JICA in 2002 (hereinafter referred to as "Natural Gas M/P (2002)").

Although the Philippine government has promoted policies including the increase of utilization of domestic natural gas based on the Natural Gas M/P (2002), encouraging entry of private sector, some projects including construction of related facilities were not materialized for such reasons as undeveloped investment environment. However, under the Aquino administration established in June 2010, infrastructure development by public-private partnership (PPP) have been put up as a top priority issue and improvement of PPP promotion-related systems and policies and specific project formation have been promoted.

Taking into the consideration the above, JICA, in coordination with the Department of Energy (DOE), assisted conduct of "Data Collection Survey on Utilization of Clean Alternative Energy in the Republic of the Philippines" in 2012 (hereinafter referred to as "the Previous Study"), which updated the Natural Gas M/P (2002) and made a basic assessment on the entire value chain for Natural Gas Industry; i.e., LNG Receiving Terminal, Batman1 and Natural Gas Fired Power Plants (Sucat (850MW) and Calamba (1,400MW)), as well as several Industrial Parks and CNG Fueling stations as a potential customer.

In order to further facilitate the development of natural gas industry in the country and to enhance the implementation of the Projects as candidate projects for Japanese ODA loan, in the event that decides to avail of the Japanese ODA Loan, JICA, coordinating with PNOC, has started this Preparatory Survey to further study on the Projects encompassing the whole value chain of natural gas industry.

1.2 Objectives and Necessity of Project

1.2.1 National Development Plan

According to the Medium-Term Philippine Development Plan (2011-2016) of the Philippine government, for the purpose of reducing the traditional dependency on oil, increase of utilization of alternative energy is set out as one of the key policies in the energy field. Because natural gas is considered as environmentally friendly among alternative energy source, increase of utilization of natural gas in the industrial and commercial sectors is positioned as a priority issue. Specifically, for both domestic natural gas development and increase of utilization and import of LNG, the government demonstrated policies to promote development of gas pipeline network, gas conversion of the existing thermal plants and increase of utilization of natural gas in transport sector (e.g., introduction of CNG vehicles).

The Philippine Energy Plan (PEP) announced by DOE each year focuses on plans and programs in energy sector. The future of energy development, which is an important issue for the prosperity of the Philippines, is a major consideration for the PEP. The comprehensive goal of the PEP is "Ensuring the best energy choices for a better quality of life". The PEP indicates the changes required for the current energy sector for the future energy outlook. The PEP is based on the following three policies;

- Ensure energy security
- Pursue effective implementation of energy sector reforms

・ Implement social mobilization and cross-sector monitoring mechanisms

The Aquino administration, inaugurated in July 2010, is following the energy policy of the former administration basically.
The energy policies of the Aquino administration are presented in the Energy Reform Agenda (ERA), which includes its goals for the next 6 years. The ERA states that energy is a measure for poverty reduction and also it is a social infrastructure as it serves as an enabling factor to promote grassroots development with the delivery of public services to marginalized and disadvantaged sectors of the society. Along these lines, the ERA emphasizes its guiding vision to mainstream access of the larger populace to reliable and affordable energy services to fuel by "Energy Access for more". It also states that local productivity and countryside development are the most important.

The Aquino administration outlined the following three major pillars of energy sector. The first pillar is "Ensure energy security" which is the same as the former administration. The second and the third pillars are "Achieve optimal energy pricing" and "Develop a sustainable energy plan".

1.2.2 Background of Gas Sector

In October 1989, Occidental Philippines, Inc. (Oxy), a subsidiary of Occidental Petroleum Corporation, discovered natural gas in a deep-water well (the Camago well) located within a 350,000 hectare area 75 km. northwest offshore Palawan province and 500 km. south-SW of Luzon. While this was not the first natural gas discovery in the country - in 1980, the Philippine National Oil Company Exploration Corporation (PNOC-EC) discovered natural gas in Isabela, Northern Luzon sufficient to generate about 3MW of power – it seemed a promising find which augured well for the establishment of a Philippine natural gas industry. After a year, Oxy's exploration contract was converted into a service contract (SC38) with Shell Philippines Exploration B.V. (SPEX).

As part of its investment commitment, SPEX took over operation of the field and drilled three more wells, the second of which resulted in the discovery of the Malampaya gasfield in 1992, which is connected to the Camago structure. Continuing with its drilling program over the next two years, SPEX was able to ascertain proven recoverable reserves of about 2.5 trillion cubic feet (TCF) of gas and some 85 million barrels (MMB) of condensate. The Malampaya gasfield was declared a commercial find in May 1998. In September the same year, SPEX acquired full ownership in SC38 and then formed a consortium with Texaco Philippines, Inc. (now ChevronTexaco) and PNOC-EC.

This SC 38 consortium set about making the largest single foreign investment in the country's history by developing the Malampaya gasfield, laying 504 km. of pipeline through some of the world's best undersea vistas and building an on-shore gas facility in Tabangao, Batangas Province (Southern Luzon) that now processes the natural gas that is drawn from the gasfield. On October 16, 2001, President Gloria Macapagal-Arroyo inaugurated the Malampaya Deep Water Gas-to-Power Project, which now supplies gas to fuel three combined cycle gas turbine (CCGT) power plants with a combined capacity of 2,760 MW, comprising about 20 percent of the country's total installed capacity in 2002. The gasfield has a potential capacity to produce up to 4.3 TCF of gas.

The project was completed in little over three years, landing gas for power plant commissioning and commercial operations in January 2002. While the three power plants are all located within a 12 km. radius from the Batangas onshore gas plant, they are certainly not the only potential users of the gas. It therefore became critical to prepare a blueprint for this emerging downstream industry, which would encompass both physical and regulatory aspects.

1.2.3 Necessity of Project

To provide the vital link between the sellers of natural gas and the market, the government will actively promote the setting up of gas distribution networks in Luzon. The Luzon network will primarily depend on the pipeline connecting the Camago-Malampaya field to power plants in the Batangas and Cavite areas. This pipeline system will be expanded to cover Metro Manila and Bataan and later the rest of Central Luzon and Southern Luzon. The onshore pipeline from Batangas to Manila will be about 110 km. When this is continued, it will extended all the way to Bataan via Bulacan and Pampanga provinces up to 250 km in length. In addition, an LNG receiving facility will be built in Bataan or in Batangas.

Over the long term, the expansion of the Philippine gas industry into the rest of Luzon and Mindanao will entail extension of the transmission pipelines and the construction of distribution pipelines. While these expect the participation of the companies that have the necessary capital and technical expertise in pipeline construction and operation, the role of the government needs to be clarified.

In summary, the objective of the Project is to utilize domestic/ imported natural gas resources efficiently and widely, contributing to the development of natural gas industry, thus contributing to energy diversification and ultimately sustainable economic and social development of the Country, by constructing a natural gas pipeline from the receiving site (Batangas) to the consumption site (up to Metro Manila), Batman 1, and LNG receiving terminal in Batangas, and natural gas fired power plant, establishing the entire value chain of the natural gas industry.Batman1 Project constitutes one of the most important, strategic position on the value chain.

The ratio of the natural gas use in the total energy consumption in the Philippines is approximately 8%, which is one of the lowest in the ASEAN countries. The comparative price of the natural gas is expected to be lower in the future. Therefore it is anticipated that the ratio of the natural gas use in the fossil fuels should be higher in view of the reduction of the energy cost and the greenhouse gas emission.

1.2.4 Regional Context

The project area covers from Batangas to Laguna provinces, which have established one of the major industrial developments in the country. The area has for instance the major vehicle manufacturers in the city of Santa Rosa. It is also considered as the Silicon Valley of the Philippines because of the vast number of electronic and semi-conductor companies operating in the province. The region therefore needs infrastructure developments such as natural gas, fuel, and power.

While the Malampaya gas field is in operation, there is no gas supply through gas pipelines to the project area. To provide more gas resources to the region, the government promotes the development of the gas sector. The establishment of gas downstream sector is expected to work towards maximizing the gas utilization of the country through providing the natural gas infrastructure and developing the local gas markets.

1.3 Objectives of Study

In order to further facilitate the development of natural gas industry in the country and to enhance the implementation of the Projects, it is necessary to carry out the Study for PNOC to have a further study to assess the feasibility of the Project.

The specific objectives of the Study are summarized as follows;

- Examine the feasibility of Batangas-Manila 1 Natural Gas Pipeline Project (Batman1) Including the Entire Gas Value Chain (LNG Facility, Regasification Facility, Pipeline, Offtake Facility) under PPP scheme and propose the appropriate implementation strategy;
- Collect necessary information on the related infrastructures such as, Malampaya and other gas fields, gas fueled power plants, industrial parks, commercial buildings, CNG bus, LNG terminals (Bataan, Mindanao, Pagbilao).etc; and
- Collect and analyze current rules and regulations of the Philippines regarding natural gas related projects/ PPP Projects; analyze the necessary modifications in order to implement the Projects smoothly.

1.4 Study Area

The area of survey is the following:

- Batman 1;	Batangas - Metro Manila
- LNG Receiving Terminal;	Batangas
- Gas-fired Thermal Power Plant;	South Luzon - Metro Mania
- Batman 1 :	Batangas - Metro Manila

1.5 Counterpart of Study

The counterpart of the study is the Philippine National Oil Company (PNOC).

1.6 Scope of Study

This Survey comprises with six major components, which are described as follows.

1. Collect information on the natural gas sector necessary for the smooth implementation such as the Batman1, the related business (LNG receiving terminal in Batangas, and the gas-fired thermal plants in Sucat and Calamba),
2. Carry out the necessary investigations to implement the Batman1 (as a candidate project for Japanese ODA loan);
3. Conduct the studies to promote the entire gas value chain that comprises with the upstream facilities (e.g. LNG terminal) and the downstream facilities (e.g. gas-fired thermal power plants.);
4. Collect necessary information on the related infrastructures such as, Malampaya and other gas fields, gas fueled power plants, industrial parks, commercial buildings, CNG bus, LNG terminals (Bataan, Mindanao, etc.);
5. Analyze the current gas-related legal framework and safety standard, and study and propose the plan to improve and strengthen the capacity development (including the proposal on the future technical assistance project); and
6. Assist in the preparation, explanation, meeting and approval on the reports and explanation materials for the government of the Philippines

The feasibility study on the Batman1 Project addresses the following issues.

i. Introduction
- Background
- Objective of the Project
- Necessity of the Project
- Rationale of the Project (timing, scale, concessional loan)

ii. Gas Sector Overview

iii. Condition of the Project Area

vi. Demand and Supply Analysis
- Current Demand and Supply
- Future prospect of Demand and Supply
- Energy Mix Policy and Import Policy of LNG

v. Basic Design
- Engineering Survey
- Design Standard
- Gas Pipeline Design

vi. Project Cost Estimate

vii. Economic and Financial Analysis (including PPP Scheme consideration)

viii. Environmental and Social Considerations (including EIS, RAP, EMP drafting)

ix. Project Implementation Plan
- Project Implementation Scheme
- Project Implementation Schedule
- Procurement Plan
- Financial Plan (Project Cost/ year and available fund/ year)

1.7 Schedule of Study

The schedule of study is as illustrated in the following.

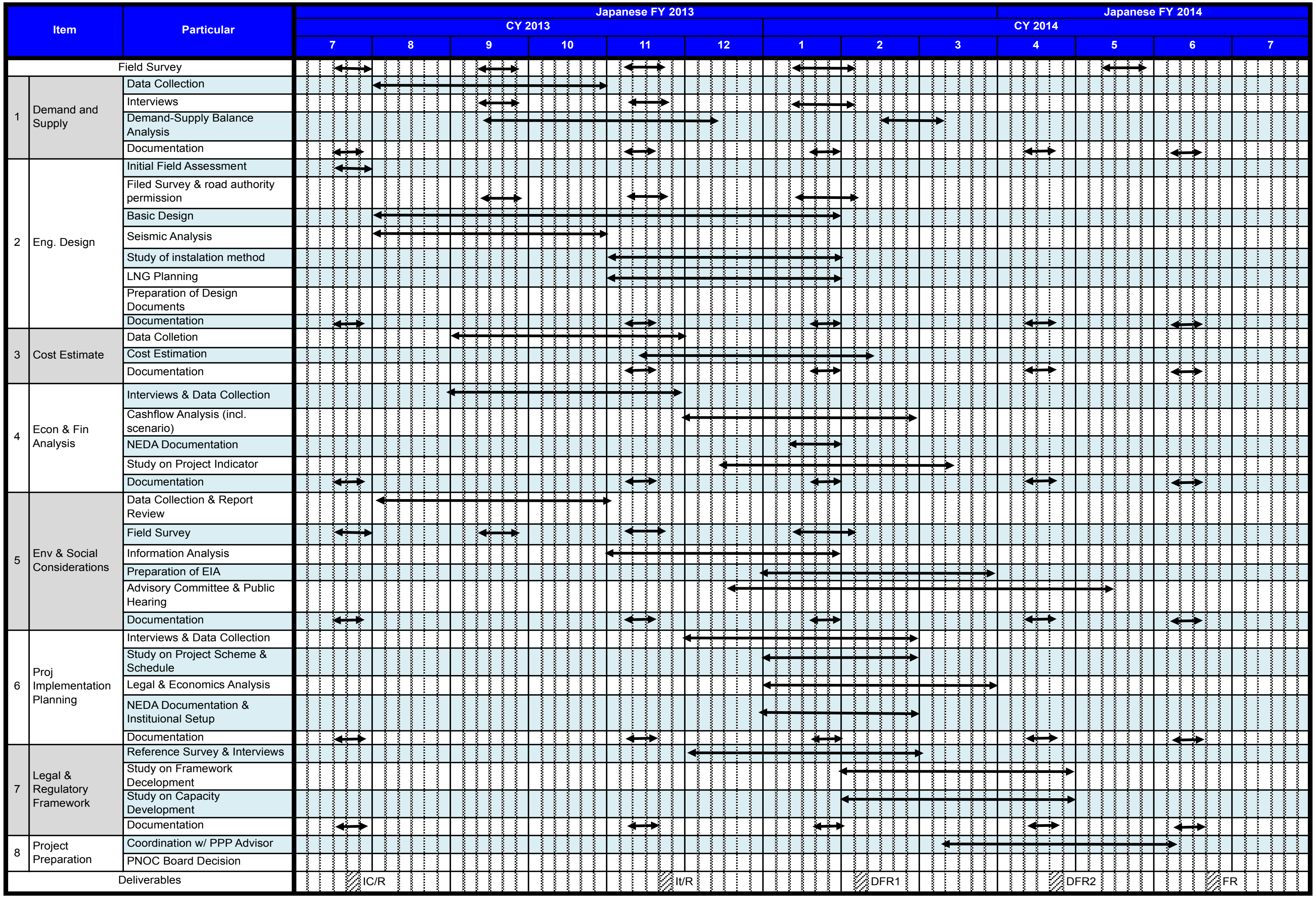


Figure 1.7-1 Survey Schedule

Chapter 2 Batman 1 Project Formation

2.1 Overview of Study

2.1.1 Study Process

The study comprises with the several components; (i) demand projection, (ii) engineering design, (iii) cost estimation, (iv) PPP project scheme, (v) financial/economic design, (vi) environmental and social analysis, and (vii) overall recommendations. The basic process for the study can be summarized in the following. The detailed tasks and procedures for the study will be discussed in the relevant sections.

	Demand Projection	Engineering Design	Cost Estimation	PPP Project Scheme	Financial/ Economic Analysis	
Major Output	1) Gas demand by customer, year, and location 2) Gas demand scenarios 3) Implication for gas promotion	1) Gas pipeline layout and technical specifications 2) Design for related facilities 3) Basic design for O&M	1) Construction cost for gas pipeline 2) Other costs for project implementation 3) Comparison of costs	1) Project scheme 2) Organizational design for implementation 3) Staffing requirements	1) Revenue estimates 2) Financial/economic analysis 3) Sensitivity analysis	1) EIS Study Result 2) Environmental assessment 3) Social assessment 4) ECC
Approach	1) Gas conversion for Industry; by interviews and fuel price competitive analysis 2) New gas demand for industry; by sub-industry 3) Power demand; based on power demand/supply analysis 4) Others; by interviews and estimates	1) Gas supply scenario analysis 2) Site survey and route study 3) Project scoping 4) Seismic design 5) Capacity design by max demand in 2038 6) Design of related facilities	1) Cost estimates by technical requirements 2) Reference to similar projects 3) Cost comparisons 4) Estimates for related facilities	1) Alternatives; 100%Public, 100%Private, and hybrid models 2) Interviews with related organizations including public and private entities 3) Organizational design 4) Staffing study	1) Annual revenue; hourly max demand *8760 hr *70% 2) Assumptions; standard or based on interviews 3) Wheeling charge recovers the full investment costs 4) Sensitivity analysis by increase/decrease in conditions	1) Scoping of survey by public scoping 2) Site survey and data collection 3) Data analysis 4) Feedback to stakeholders 1) Acquisition of ECC

Figure 2.1-1 Study Process

The workflow for the financial and economic analysis including the revenue projection and the cost estimation is as shown in the following chart.

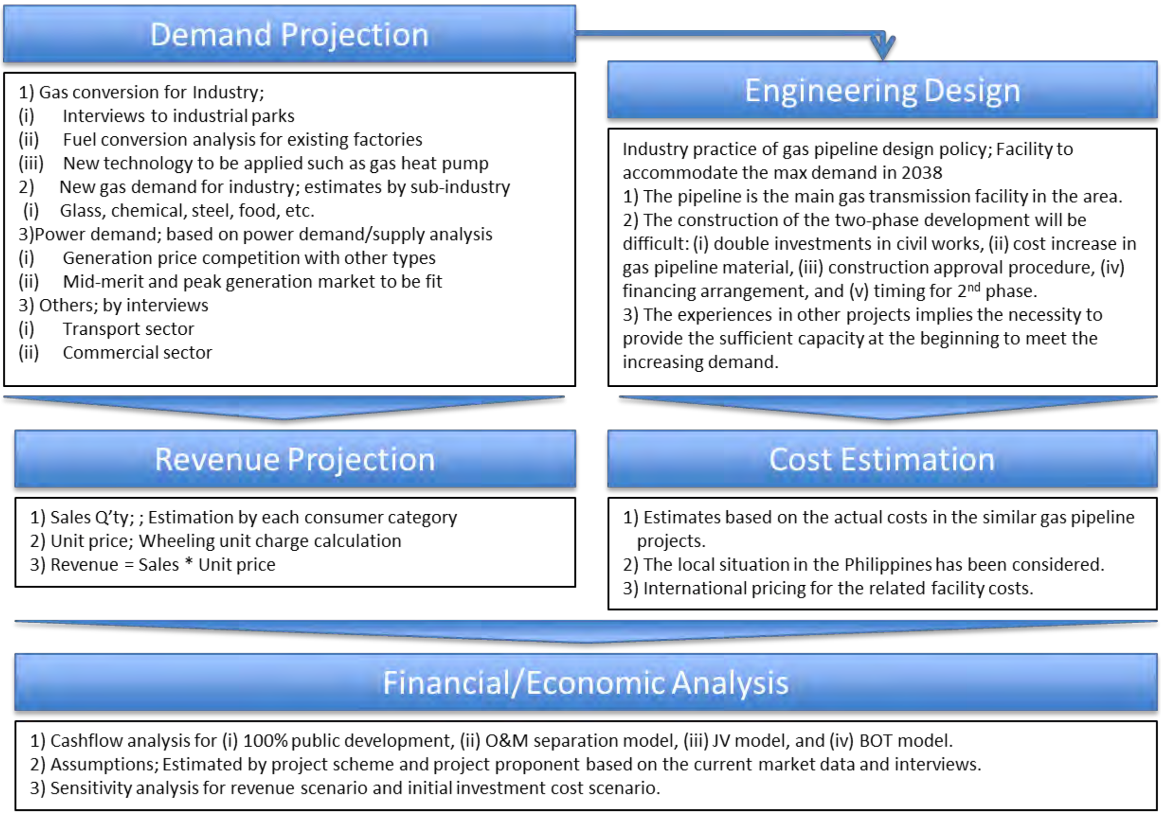


Figure 2.1-2 Workflow for Financial and Economic Analysis

The basic approach for financial and economic analysis is (i) technical and cost studies based on the demand projection, and (ii) revenue estimation based on the demand projection. The procedures for each step will be discussed in detail in each section of the study.

2.1.2 Project Scope

The scope of the project is determined as follows.

(1) High-Pressure Gas Pipeline

Batangas Gas Supply Point – Cabuyao Exit of SLEX Highway

(2) Medium-Pressure Gas Pipeline

(i) Supply Route to Lima Technology Center
(Around Malver Exit of STAR Highway - Lima Technology Center)
(ii) Supply Route to Calamba Eco Zome
(Around Santo Tomas Exit of STAR Highway
- First Philippine Industrial Park)
(iii) Supply Route to Laguna Technopark
(Around Cabuyao Exit of STAR Highway - Laguna Technopark)

(3) Other Related Facilities

Block-valve Station, Governor Station, Metering Station, etc

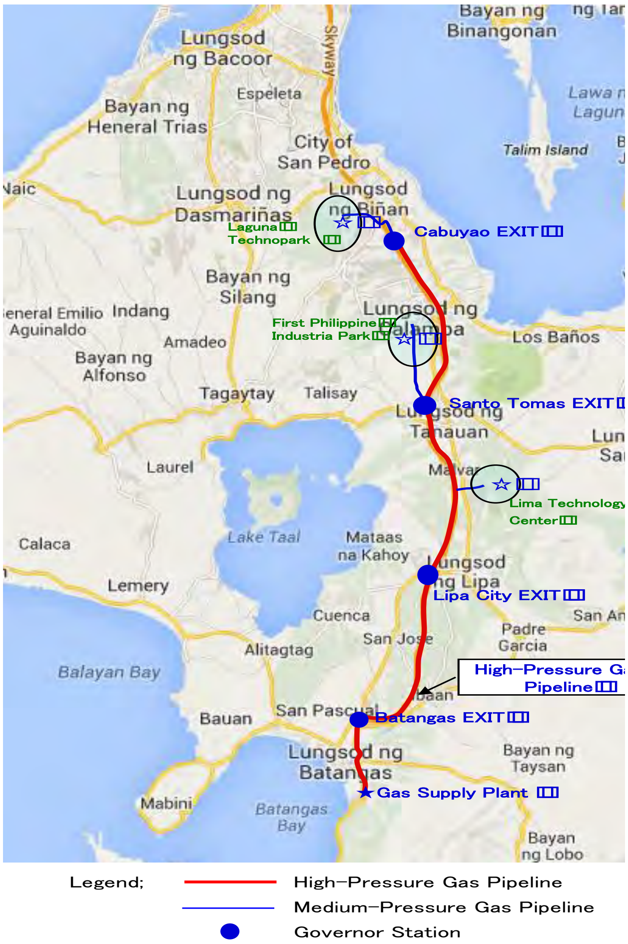


Figure 2.1-3 Project Scope

The scope of the study covers the areas from Batangas to Sucat. On the other hand, based on the study result the project scope has been selected to be the areas from Batangas to Cabuyao.

The inseparable integrity of the project can be summarized as follows.

(i) LNG terminal
The LNG terminal can be independent from the gas pipeline because there are end-users that are supplied directly from the LNG terminal.

(ii) Gas Pipeline
The gas pipeline needs the LNG terminal as a supply source.

(iii) End-users
The gas pipeline is essential for supplying the gas to the end-users. The end-users are not limited to the power plants as there are various demands for gas along the pipeline route.

2.2 Natural Conditions along the Pipeline Route

2.2.1 Weather Conditions

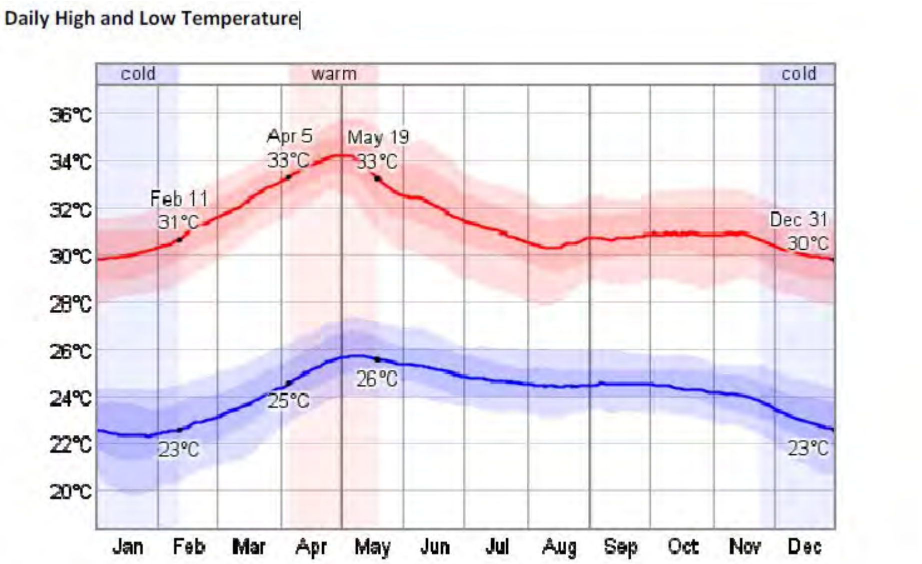
This section describes the typical weather conditions for the past two years (2011 and 2012) based on the information from the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), and the characteristic of geographical features based on the information from the Philippine Institute of Volcanology and Seismology (PHIVOLCS) for the areas along the BATMAN1 pipeline route. The data on the weather conditions contributes to a calculation base of the actual construction days and a selection base of the methods of construction.

As for the study of geographical features, the existence of the active faults and liquefaction layers affecting the safety of high-pressure gas pipeline, and the effects of ground displacement of liquefied soil are examined in detail, and these data contribute to the material design for pipeline and design for field welded parts. The result is reflected in “2.4.1 Basic Design of Pipeline”.

(1) Temperature

Throughout the year, the temperature typically varies from 28°C to 35°C and is rarely below 20°C or above 36°C. The hottest days of the year last from the second week of April to the third week of May with a daily high temperature reaching above 36°C. The coldest days last from December to February with a daily low temperature below 20°C.

The figure below shows the daily high and low temperature throughout a year.

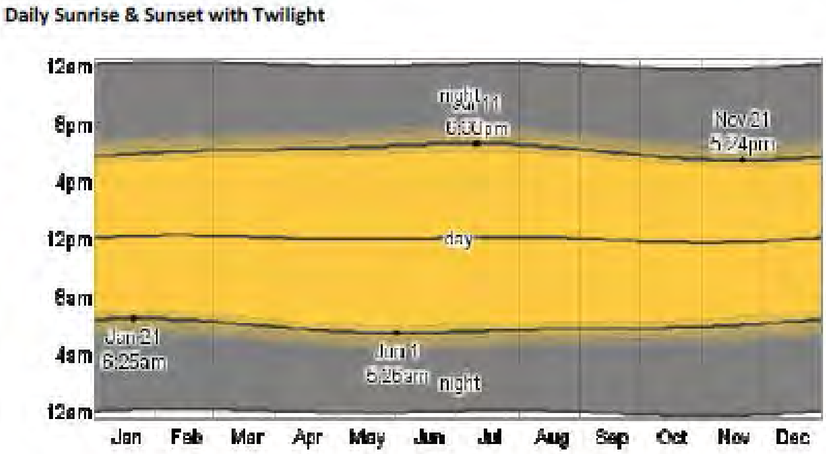


The daily average low (blue) and high (red) temperature with percentile bands (inner band from 25th to 75th percentile, outer band from 10th to 90th percentile).

Figure 2.2-1 Annual Daily Average Temperature

(2) Sunrise & sunset

The figure below shows the time of daily sunrise and sunset in 2012.

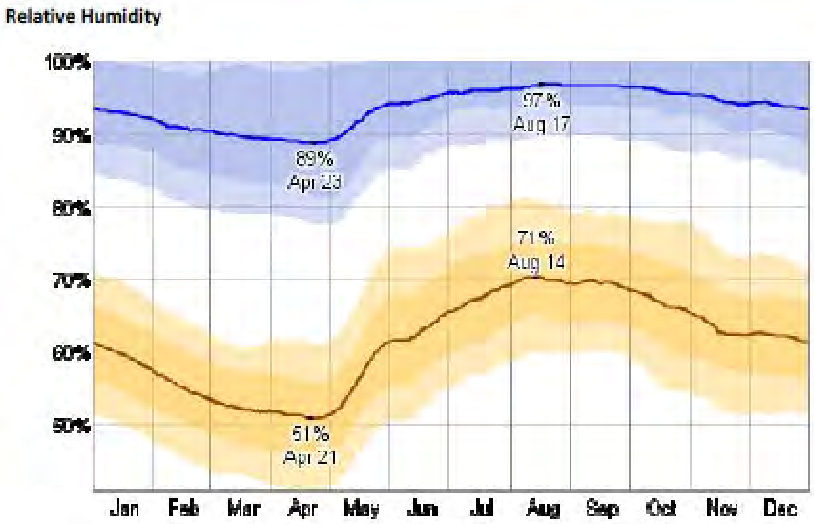


The solar day over the course of the year 2012 . From bottom to top, the black lines are the previous solar midnight, sunrise, solar noon, sunset, and the next solar midnight. The day, twilights (solar, civil, nautical, and astronomical), and night are indicated by the color bands from yellow to gray.

Figure 2.2-2: Sunrise, Afternoon, and Sunset in 2012

(3) Humidity

Throughout the year, the relative humidity typically ranges from 61% to 98%, with an average of above 80%. The air is driest around April. It is most humid around August, reaching 98%. The figure below shows the daily average humidity throughout the year.



The average daily high (blue) and low (brown) relative humidity with percentile bands (inner bands from 25th to 75th percentile, outer bands from 10th to 90th percentile).

Figure 2.2-3 Average Daily Humidity throughout the Year

(4) Precipitation

The highest probability of precipitation is 77% around July while the lowest is 16% around April. The figure below shows probability of precipitation at some point during the day.

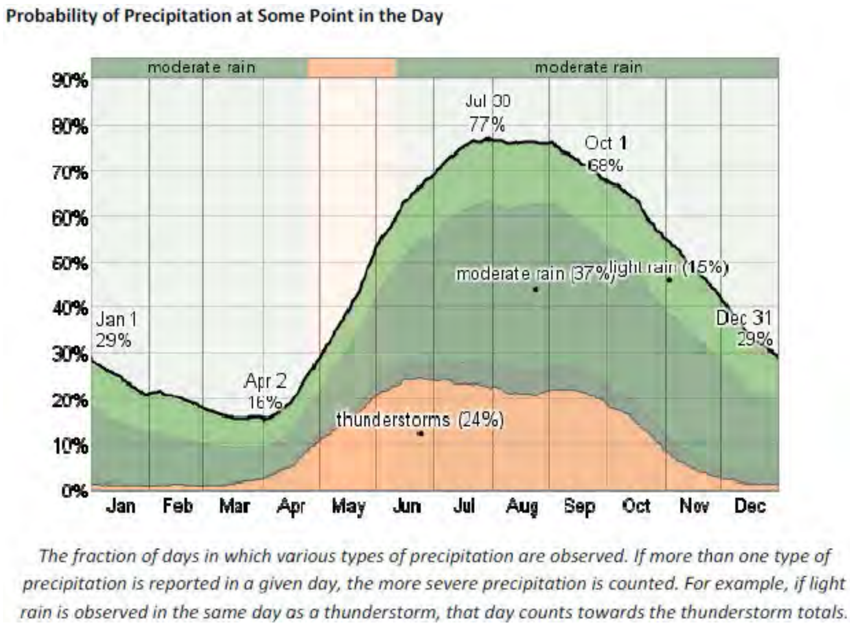
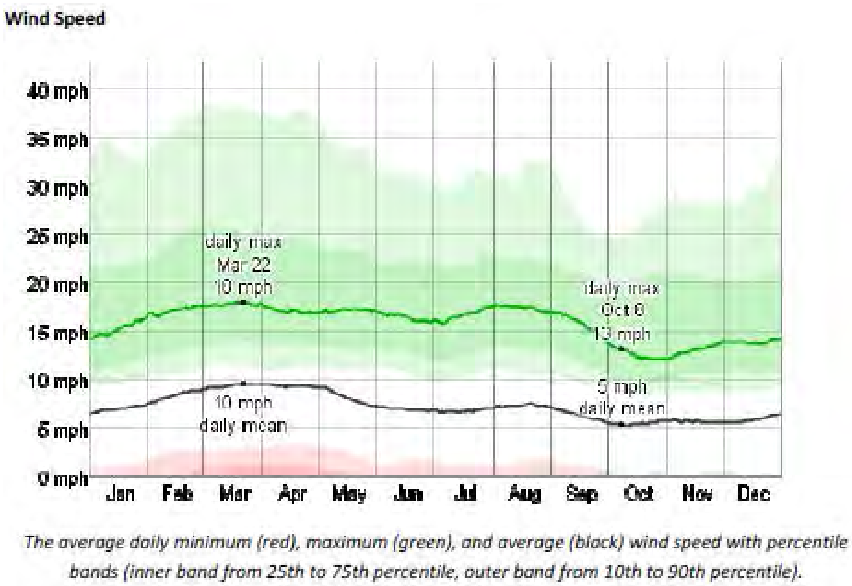


Figure 2.2-4: Probability of Precipitation at Some Point during the Day

(5) Wind Velocity

Over the course of the year, typical wind speed varies from 0 to 18 mph (miles per hour) (calm to fresh breeze), rarely exceeding 39 mph (gale). The figure below shows the daily average maximum wind speed and daily average wind speed.



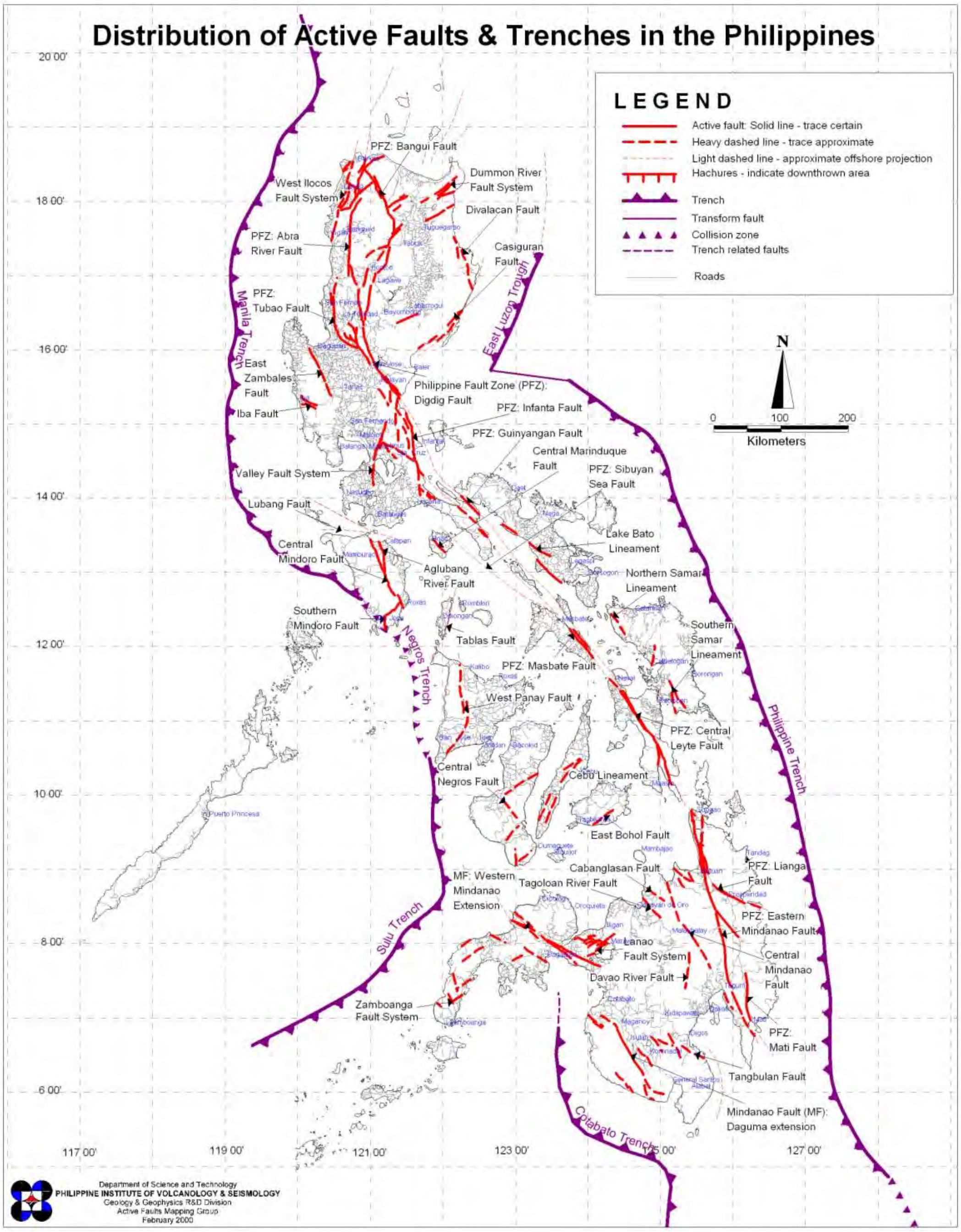
Note: mph: miles per hour

Figure 2.2-5 Daily Average Wind Speed throughout a Year

2.2.2 Topography and Geology

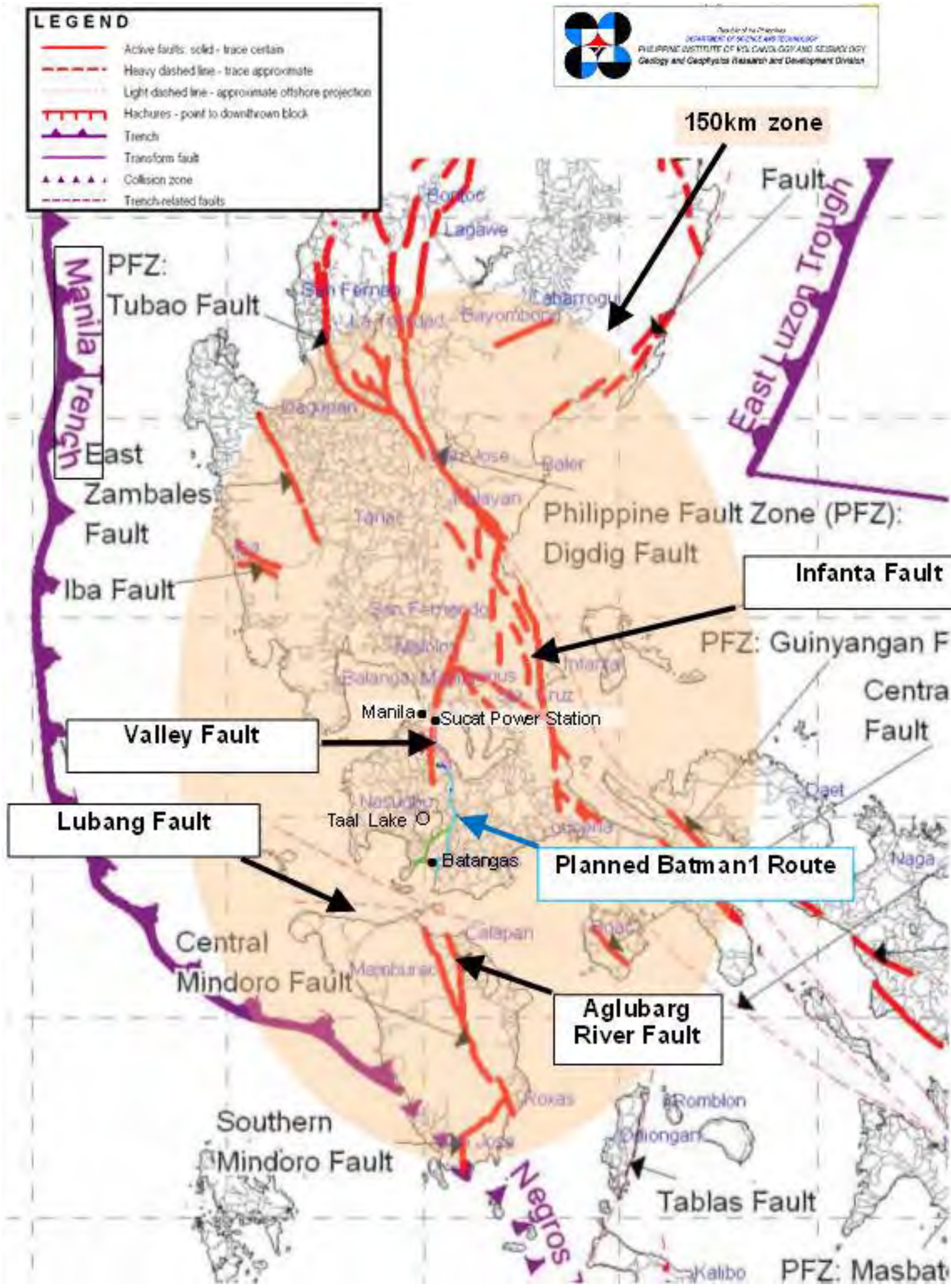
(1) Tectonic Setting

The Philippine archipelago is divided into the Eurasian margin and the Philippine mobile belt. The Batman1 project area is located within a region that is tectonically, seismically and volcanically active. The information on the active faults and trenches in the Philippines is shown in Figure 2.2-6, and the neighborhood of the planned Batman 1 route is magnified in Figure 2.2-7.



Source:Active Faults Map, PHIVOLCS

Figure 2.2-6 Location Map of Active Faults and Trenches in the Philippines



Source: Active Faults Map, PHIVOLCS

Figure 2.2-7 Location Map of Major Active Faults within 150km Radius and Proposed Batman 1 Route

Five earthquake generators are found within 150km of the Batman1 pipeline route as follows:

- The Valley Fault System is an active fault system that cuts through Metro Manila and the planned Batman1 pipeline route.
- The Infant Fault, which skirts the coastline of Quezon, is a segment of the main Philippine Fault associated with a seismic gap.
- The offshore Lubang Fault, between Batangas and Mindoro, is a major splay of the Philippine Fault
- The Aglubang River Fault, the splay of the Mindoro Fault, gives rise to the magnitude 7.1 Mindoro earthquake of 1994.
- The Manila Trench, which has not moved for the last 400 years. PHIVOLCS estimate the magnitude to be at 8.4.

As for volcanic activity, the Taal Volcano is located in the center of the Taal Lake, which is a caldera lake (water level is 5.0m, surface area 234.2km^2, average water depth 100m, and deepest point 172m), located 70 km south towards Manila, and considered as the deepest lake in the Philippines. At the center of the lake, an active volcano, the Taal Volcano (the relative height from the lake surface is 295m.), is situated and regarded as the smallest (shortest) volcano in the world. The Taal Volcano has a lake in the 2 km diameter crater, forming a double caldera structure. Multiple fumaroles have been identified in the volcano and more than 30 volcanic eruptions have been recorded since1572. The most destructive eruption on record occurred January 30, in 1911, which induced the base surge (low-temperature pyroclastic flow) taking 1,307 lives. The latest volcano eruption occurred September 28 to 30, in 1965, which also induced the base surge taking 190 lives.

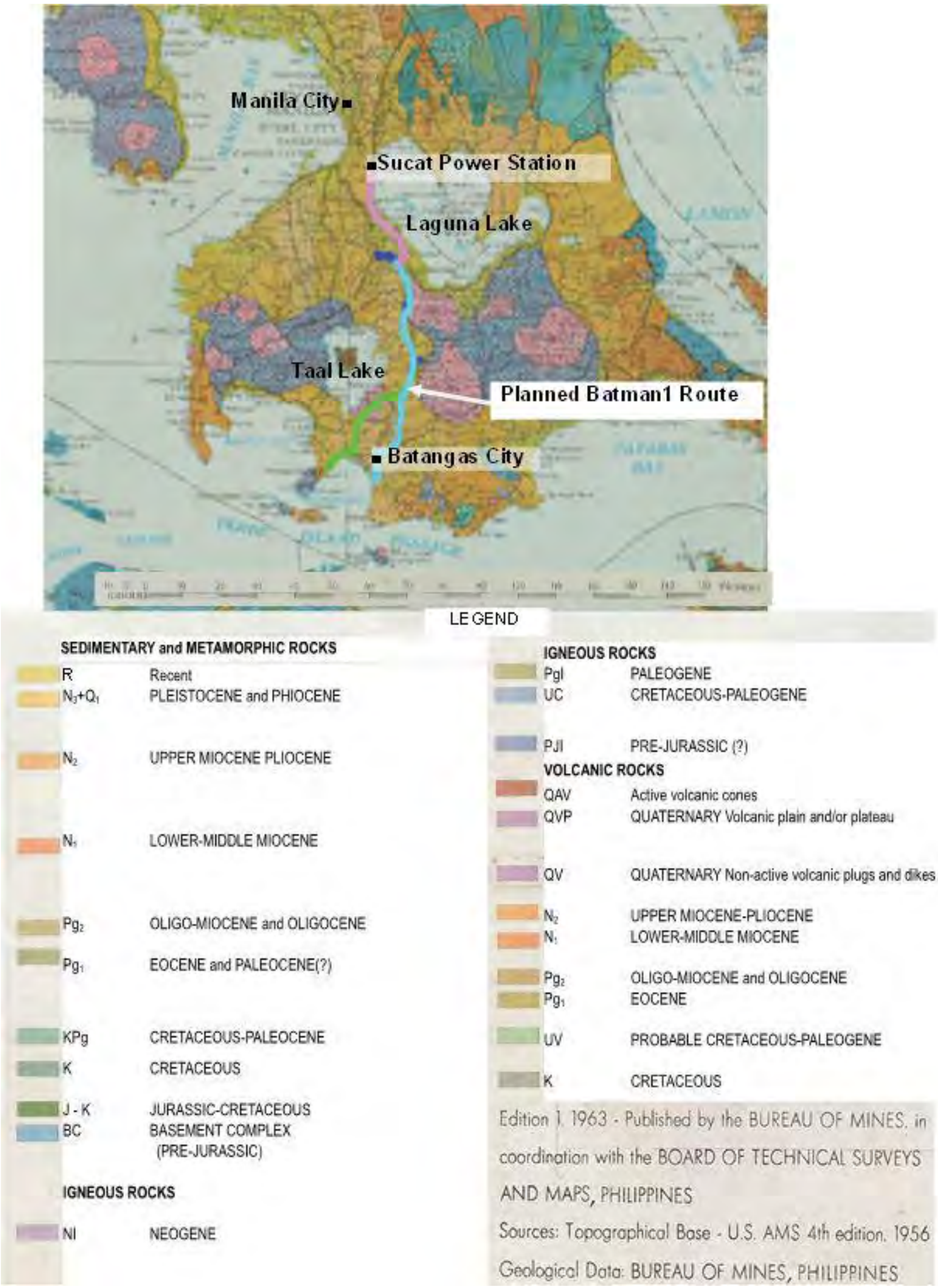
(2) Characteristics of Geographical Feature Study

1) Geographical features

There are bodies of water and landforms that are situated along the proposed Batman 1 pipeline, such as Laguna Lake, which has both a structural and volcanic origin and Taal Lake, and Mount Makiling and Malepunyo which are located on the east of Taal Lake and south of Laguna Lake. The proposed pipeline route will pass east of Taal Lake between Mount Macolod on the west and Mount Makiling and Malepunyo on the east. On the north of the pipeline, a small plain is formed between the escarpment marks of the Valley Fault and the Laguna Lake. The plain spreads less than half a kilometer in Sucat, and several kilometers near Calamba.

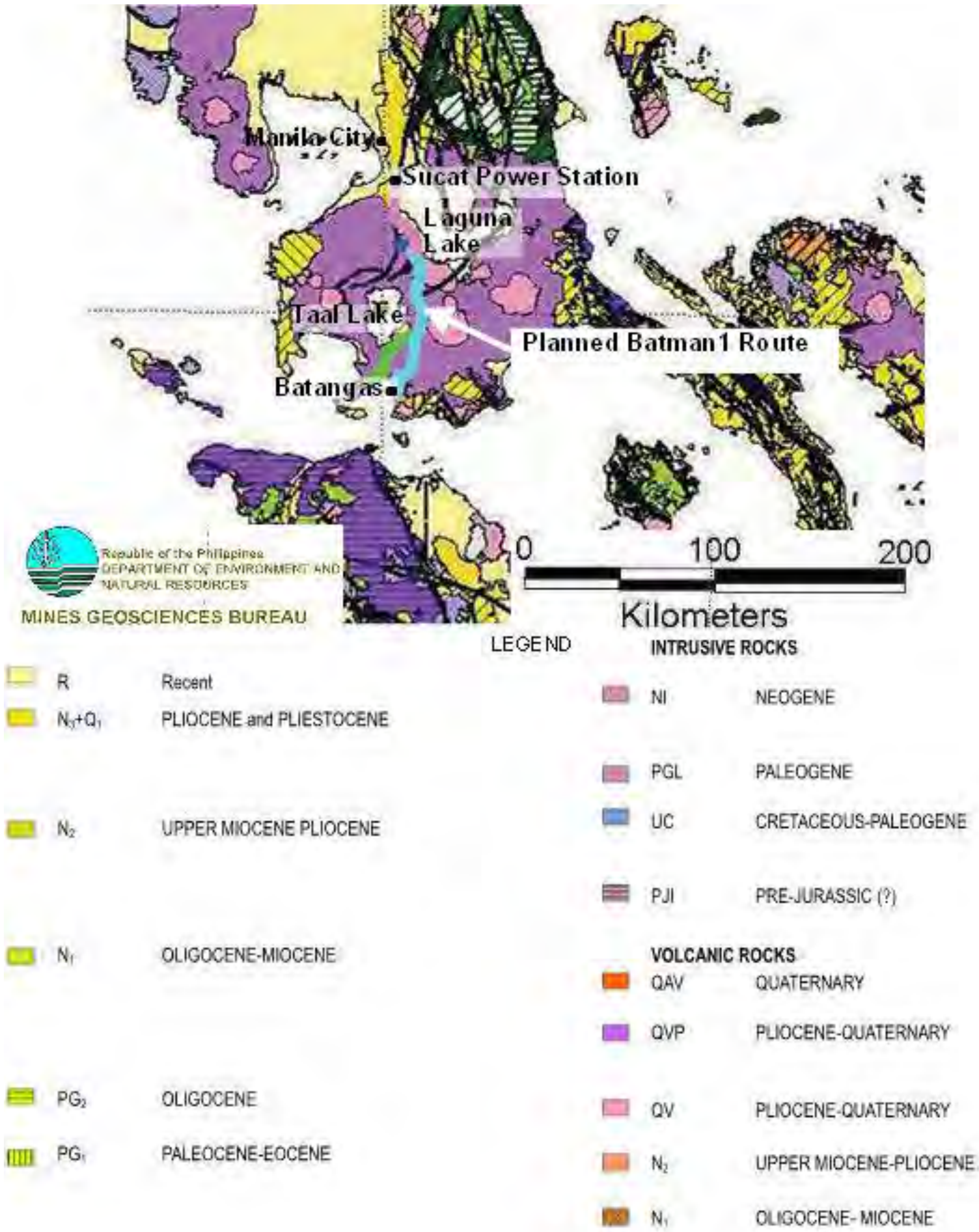
2) Stratigraphy

Based on the 1:1,000,000 scale Geologic Map of the Philippines (Bureau of Mines, 1963) and individual 1:50,000 scale quadrangle geologic maps, the geological features are divided into five units. The geological map and geological stratigraphy table are shown in the figure and table respectively below. A large portion of the proposed Batman1 pipeline route will pass through Taal Tuff while the northern portion of the route will run on Recent Deposits.



Source: Geological map, 1st edition, 1963, BUREAU OF MINES, PHILIPPINES)

Figure 2.2-8: Geological Map (1963) and Proposed Batman 1 Route



Source: Geological map, 2nd edition, 1994, MINES and GEOSCIENCES BUREAU, PHILIPPINES)

Figure 2.2-9: Geological Map (1994) and Proposed Batman 1 Route

Table 2.2-1: Geological Stratigraphy Table

Unit	Age	Lithology	Distribution
Sedimentary Units			
Recent Deposits (R)	Recent	present-day alluvial & lacustrine deposits composed of thick, unconsolidated sands, silts & clays w/ shallow ground water levels & low SPT N-values	western lakeshore area of Laguna Lake
Diliman Tuff of Guadalupe Fm&Taal Tuff (N3 + N1)	Plio-Pleistocene	locally known as adobe; tuffaceous sequence consists of thick welded tuffs & thinner tuffaceous sandstones, shales & siltstones; sequence contains paleosol layers	includes Diliman Tuff of Guadalupe Formation & Taal Tuff; underlies Tagaytay Ridge west of West Valley Fault; underlies most of pipeline alignment in Batangas-Laguna area
Volcanic Units			
active volcano (QAV)	active volcano	active basaltic to andesitic volcanoes, domes & plugs	Taal Volcano at middle of Taal Lake
Quaternary Pyroclastics (QVP)	Quaternary	andesitic to basaltic pyroclastic deposits; pyroclastic apron of Quaternary Volcanics (QV)	• includes pyroclastic aprons of Mount Batulao & associated domes & plugs near Tagaytay Ridge west of Taal Lake • includes pyroclastic aprons of Mounts Makiling & Malepunyo south of Laguna Lake and east of Taal Lake; east of proposed pipeline alignment
Quaternary Volcanics (QV)	Quaternary	andesitic to basaltic volcanoes, domes & plugs	• includes Mount Batulao & associated domes & plugs at southwestern end of Tagaytay Ridge west of Taal Lake • Mount Macolod on southeastern coast of Taal Lake; west of proposed pipeline alignment • includes Mounts Makiling&Malepunyo south of Laguna Lake and east of Taal Lake; east of proposed pipeline alignment

3) Geological structures: The Valley Fault System

The Valley Fault System (formerly known as the Marikina Valley Fault System) is a system of active faults that cuts through Metro Manila. It consists of the West Valley Fault and East Valley Fault. The West Valley Fault will cut through the proposed Batman1 pipeline route. The West Valley Fault extends from the southern Sierra Madre to Tagaytay over a distance of 110 kilometers. A well-defined, east-facing escarpment separates the Guadalupe-Diliman Plateau from the Marikina Basin. The fault plane is almost vertical, and right-lateral motion is prominent.

Although an earthquake was recorded with a magnitude 5.7 in 1658, there is no record on other seismic activity, and also, any seismic activities have not found in recent years. The evidence showing that the Valley Fault System has active faults (such as soil displacement, fault octocrop and trench survey), is recognized by the topographical and geological surveys, and the potential earthquake would be possible magnitude 7+ by West Valley Fault. A recurrence interval of 200 to 400 years during the last 1400 years has been figured based on Carbon-14 dating (Daligdig et al, 1997). The same study has the last event occurring during the 18th or 19th century.

In 2004, the "Earthquake Impact Reduction Study for Metropolitan Manila, Republic of the Philippines" was conducted by JICA, MMDA and PHIVOLCS (Philippine Institute of Volcanology and Seismology) in the Philippines, which studied the recurrence intervals of earthquake and magnitudes for the short-, mid-and long-term prediction. According to the ground motion information, the Lubang Fault, West Valley Fault and Manila Trench Fault are considered to possibly affect the Batman 1. The PHIVOLCS estimates the earthquakes' magnitudes incurred by those faults as magnitude 7 or more for the Lubang Fault, magnitude 7.2 for the West Valley Fault, and magnitude 8.4 for the Manila Trench Fault.

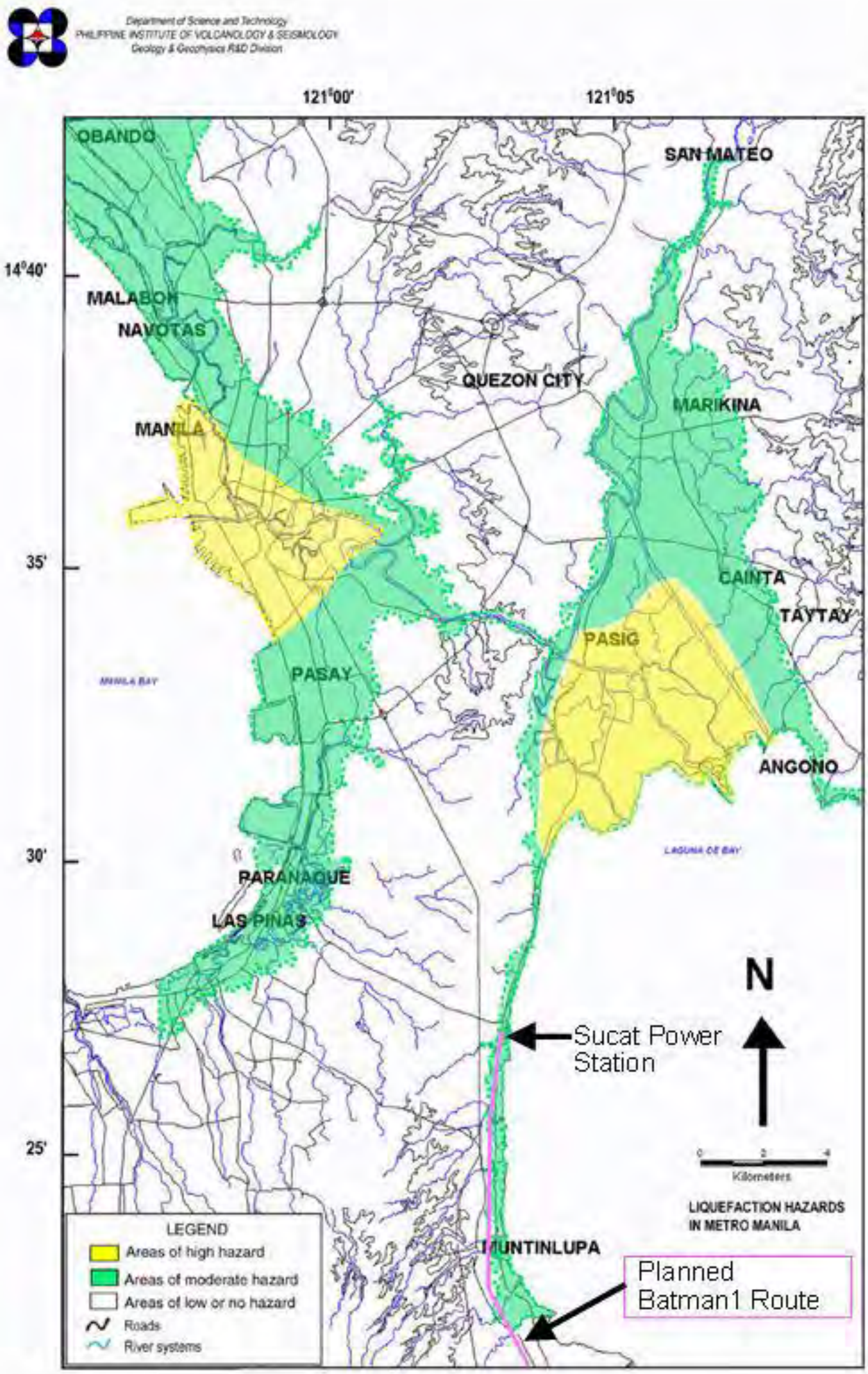
Given these facts, the seismic design complying with the "High-Pressure Gas Pipeline Seismic Design Guidelines" stipulated by the Japan Gas Association with long-term performances in the seismic safety in the seismic country and similar standards must be applied to the Batman 1 pipeline installation in the Philippines, where the existence of active faults affecting the safety of pipeline has been identified, in order to ensure the safety as a requisite for the high-pressure gas pipeline.

2.2.3 Liquefaction Susceptibility

Generally, liquefaction is more likely to occur in loose silt and fine sand with shallow ground water levels and low standard penetration test (SPT) N values (SPT<15). The PHILVOCS has identified the location of areas potentially susceptible to liquefaction. The soil liquefaction hazard map in Metro Manila and the location of the proposed Batman 1 route are shown in the figure below.

The western lakeshore of the Laguna Lake, where the Batman 1 pipeline will traverse, is identified to be liquefaction susceptible is classified to be moderate hazard. In the central area, the eastern lakeshore of the Taal Lake, where the majority of the pipeline route is located, is not identified to be liquefaction susceptible. In the south of Batangas area, where no liquefaction susceptible area is identified by the PHIVLCS, the Quaternary alluvium sediments could be estimated to be liquefaction susceptible.

Given these facts, the seismic design complying with the "High-Pressure Gas Pipeline Seismic Design Guidelines for Liquefaction" stipulated by the Japan Gas Association with long-term performances in the seismic safety in the seismic country and similar standards must be applied to the Batman 1 pipeline installation in liquefaction susceptible areas, in order to ensure the safety as a requisite for the high-pressure gas pipeline.

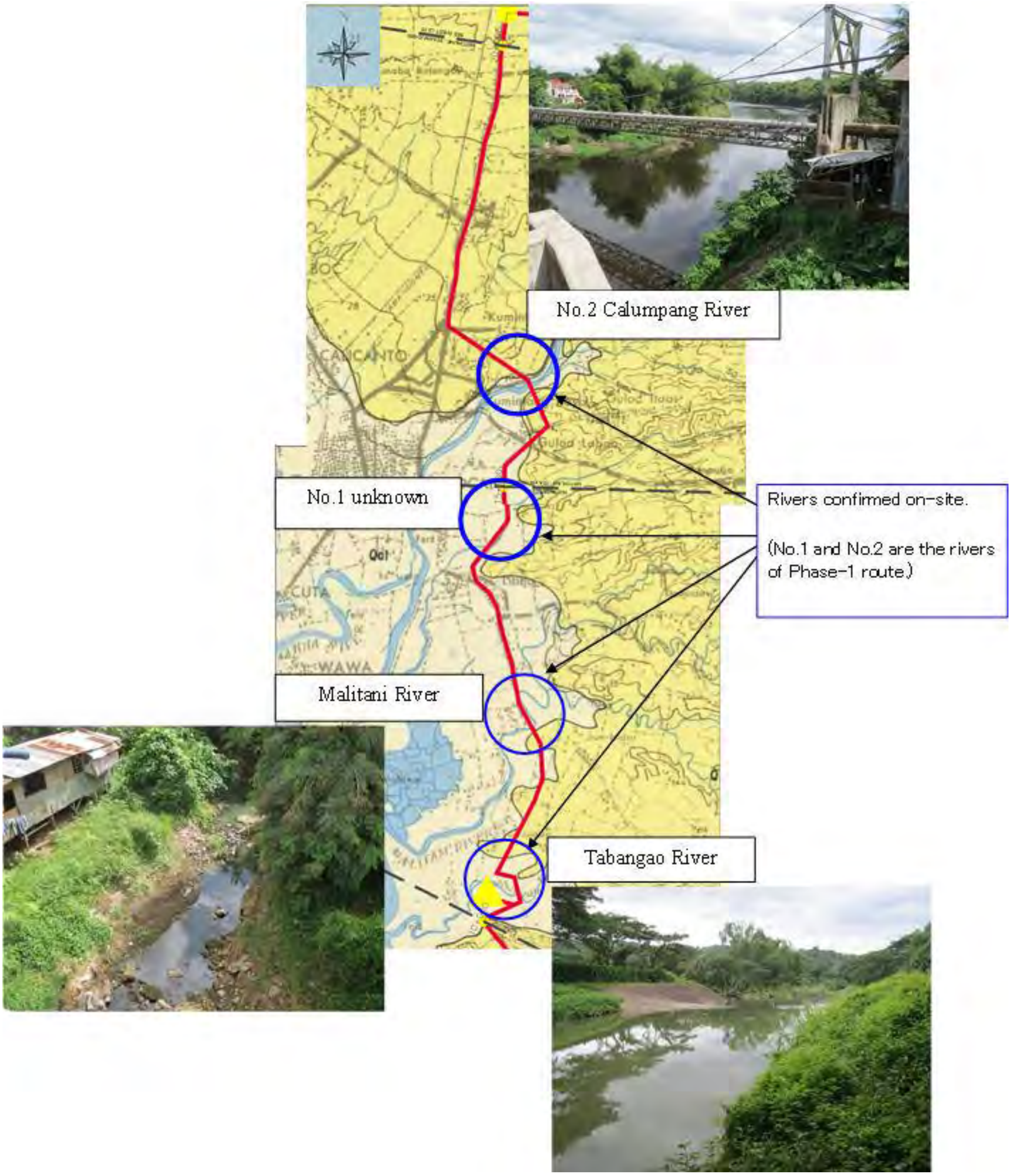


Source: Liquefaction Hazard map of Metro Manila of the Philippines, PHIVOLCS

Figure 2.2-10: Liquefaction Hazard Map and Location of the Proposed Batman 1 Route

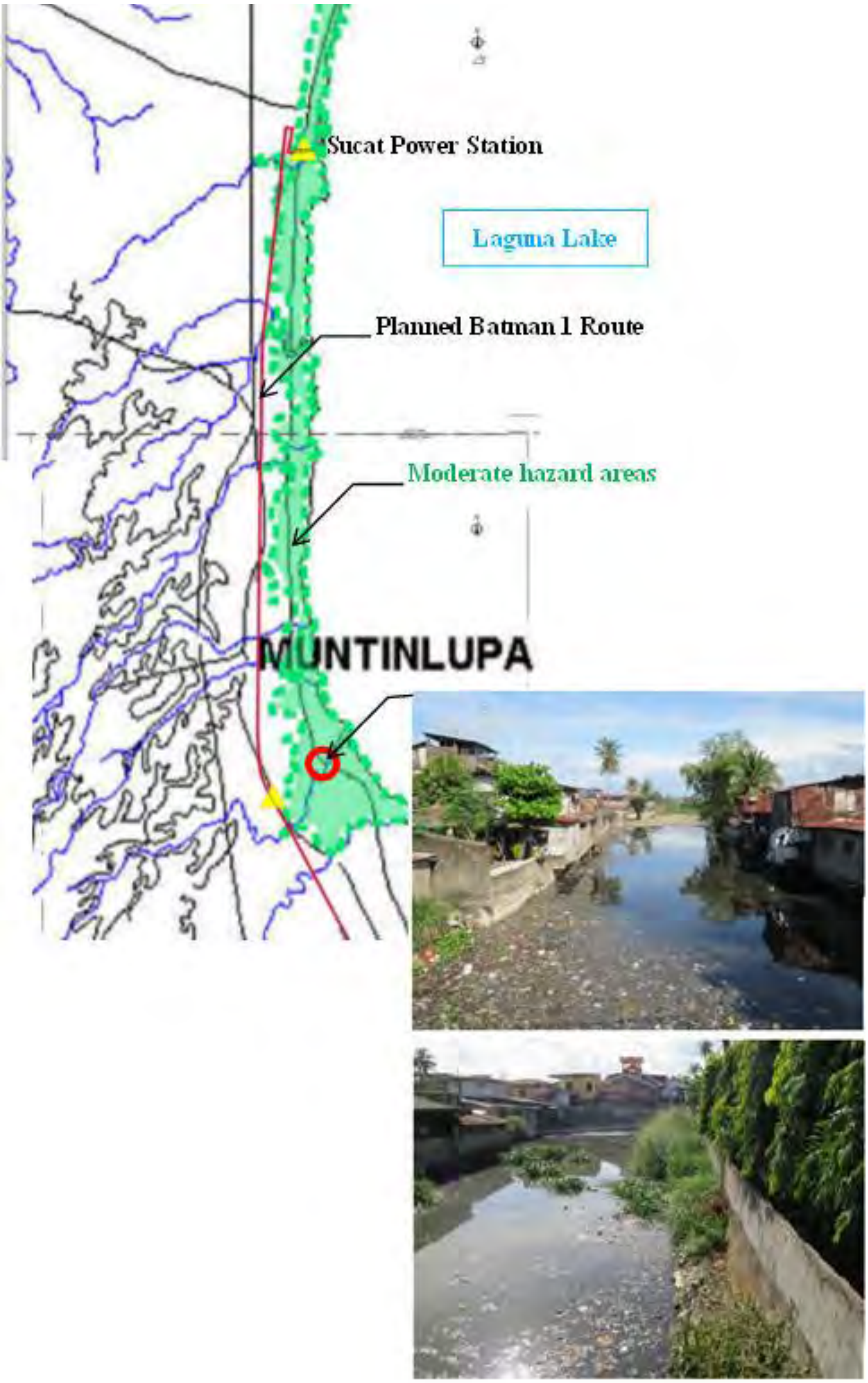
2.2.4 Onsite Observation Report

Based on the above 1) Tectonic Setting, 2) Characteristics of Geographical Feature study, and 3) Liquefaction Susceptibility, the JICA has confirmed the onsite observation on Batangas city and Muntinlupa, through which rivers traverse, with the geological specialists of the OYO Corporation, a geological engineering consultant in Japan. The locations of the onsite observation are shown in the figures below.



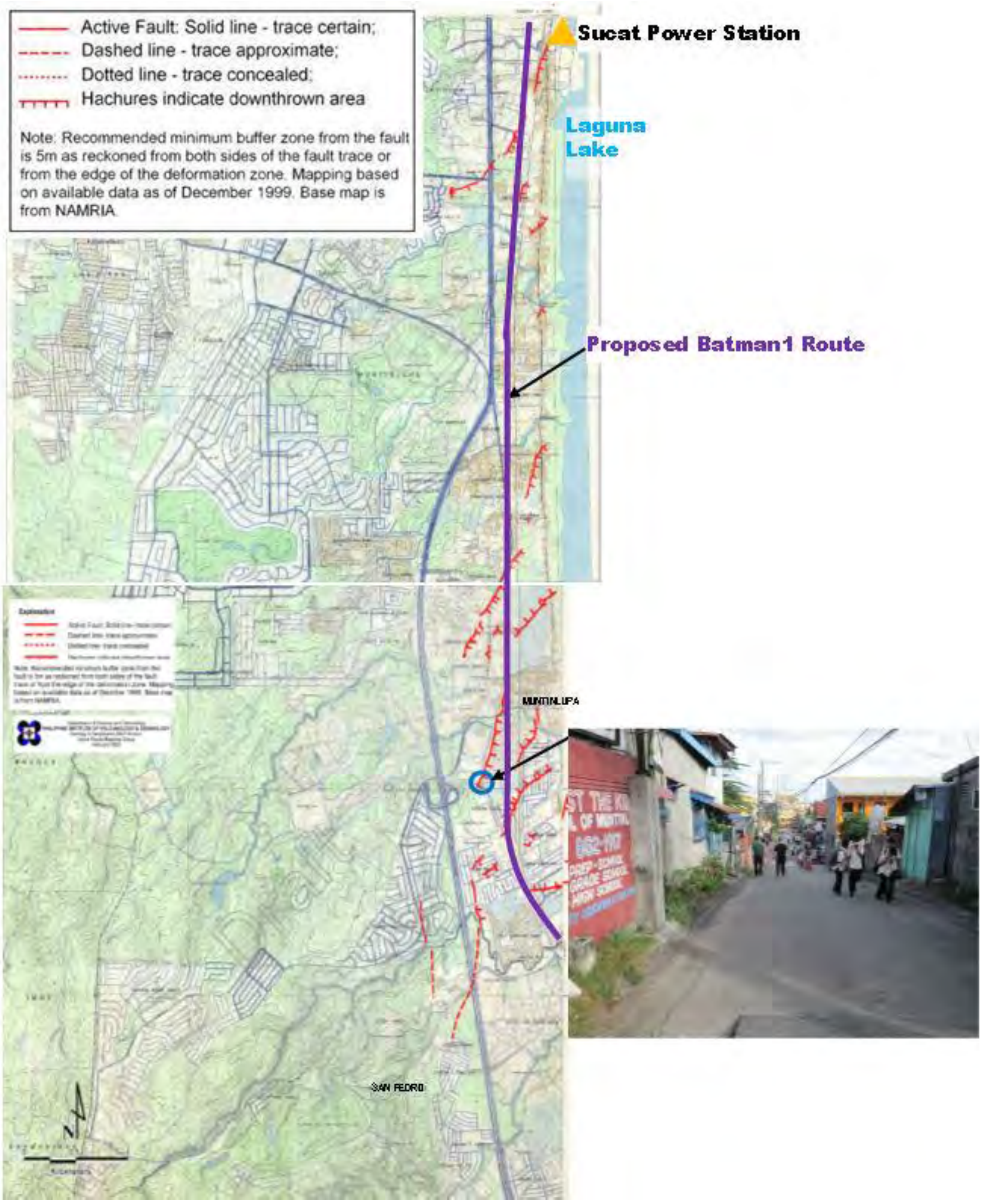
Source: Geological map of Batangas Quadrangle, Sheet 3261 III, PHILIPPINE BUREAU OF MINES AND GEO-SCIENCES

Figure 2.2-11: Location of Onsite Observation (Suburbs of Batangas City)



Source: Liquefaction Hazard map of Metro Manila of the Philippines, PHIVOLCS

Figure 2.2-12: Location of Onsite Observation (Suburbs of Muntinlupa) (Liquefaction hazard area shown in green color in the figure)



Source: the PHIVOLCS
(Active faults are shown in red line in the figure: i.e. Certainty, Estimation and Concealment)

Figure 2.2-13: Location of Onsite Observation (Suburbs of Muntinlupa)
(Active faults are shown in red line in the figure)

(1) Batangas Area at the Starting Section of the Pipeline Route

According to the geological map, the alluvial soils could be seen extended along the valleys in Batangas area. So, the onsite observation was conducted focusing on the two rivers (from south, 1. unknown, and 2. Calumpang River), where the proposed pipeline route shall traverse. Mainly, the Taal Tuff of Neogene System is distributed in this area, and the outcrops of tuffs, sandstones and mudstones is identified along the riverbeds of those rivers (see Photograph 2.2-1). Therefore, the distribution of soft alluvial soil could be considered local.

Photo 2.2-1 (1): Crossing part of Calumpang River, which is the largest scale river at the starting section. Alluvial lowlands are identified locally there.
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Photo 2.2-1 (2): Outcrops in the Bedrock of Calumpang River, which could be considered to belong to the Taal Tuff of Neogene System

(2) Along STAR TOLLWAY in the Middle Section

The STAR Tollway covering the majority of the proposed pipeline route is located on the pyroclastic flow plateau of Taal Volcano. The Taal Tuff (pyroclastic flow deposits) of Neogene System is distributed in this section. The lithofacies of Taal Tuff are partially consolidated and tightened as a whole, largely composed of tuff and tuffaceous sandstones. On the pipeline route, there are not many relatively large rivers except for Patay River, Tinga River, Sabang River and Malainin River near the starting section of the route, and San Juan River near the finishing section, and the groundwater level could be considered low in general.

Photo 2.2-2: Excavation site along the STAR Tollway, located on the pyroclastic flow plateau, where partially-consolidated tuff or volcanic ashes are distributed. The excavation site is under the “dry” environment with the groundwater level low.

(3) Muntinlupa Area in the Finishing Section

According to the geological map, the majority of Muntinlupa area is located on the alluvial plain, and soft alluvial soil could be distributed in this area. Furthermore, the PHIVOLCS has identified the West Valley Fault (mainly east-dipping low fault scrap) in this section, especially between San Pedro and Muntinlupa. The field survey near this area has confirmed the north-south low cliff with train change at some area. However, it could not be determined whether it is terrain displacement induced by the active fault, other lacustrine terrace cliff, or erosion forms. Also, the final judgment on the identified very short east-west multiple lineaments has not been reached yet, since their continuity is not sufficient enough to be regarded as the active fault segment, and the soil condition at the shallow part underground could not be directly examined, although there is a possibility of uneven settlement of the foundation in light of the property of repetition of the lineaments (see Photo 2.2-3)

Photo 2.2-3: Low cliff in the Muntinlupa urban area. The road descends moderately from the back up to the persons at the front (on the side of the lake) in the picture. The PHIVOCS has identified the terrain displacement induced by the active faults in this section

(4) Additional Information from PHIVOLCS

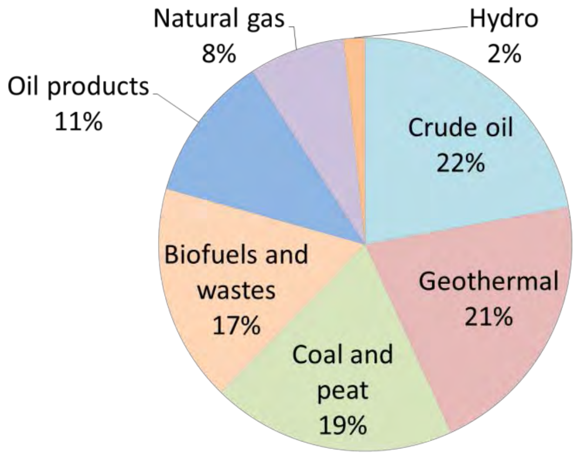
According to the interview with PHIVOLCS, the Valley Active Fault System has been currently under review. The unpublished-yet new edition of the 1:5,000 scale distribution maps of the active faults in the areas related to the proposed pipeline route (composed of twelve sheets covering from north, the Taguig City, Muntinlupa City, Laguna and Cavite) precisely identify the topography of the target areas, and provide a clear basis for the judgment on the fault displacement topography by photograph.

2.3 Supply and Demand Analysis

2.3.1 Current Status of Natural Gas Supply and Demand

(1) Primary Energy Supply

The largest portion of the Philippines' primary energy supply is crude oil, counting for 22% of the total. This is followed by geothermal, coal & peat, and biofuels and wastes which are mostly similar in portion. Natural gas, accounts for 8% of the total primary energy supply as of 2010.

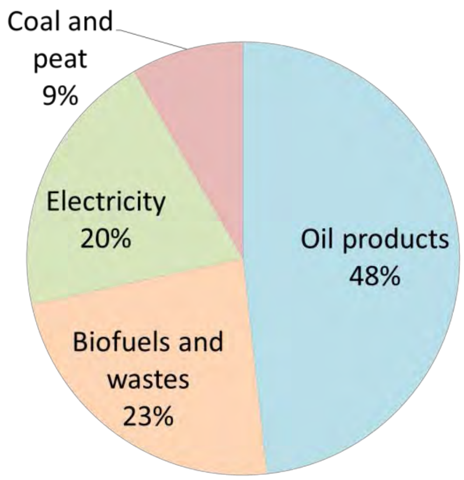


Source: Compiled from IEA Database 2010

Figure 2.3-1 Total Primary Supply by Types of Energy

(2) Final Consumption

Approximately a half of the total consumption in the Philippines is in the form of oil products. Biofuels and wastes take up 23% of the total consumption which is more than that of the electricity. As the current use of natural gas is almost entirely for power generation, natural gas is being consumed in the form of electricity.



Source: Compiled from IEA Database 2010

Figure 2.3-2 Total Final Consumption by Types of Energy

(3) Natural Gas Production and Consumption

There are two sources of natural gas production in the Philippines: one being Camago-Malampaya and another being Libertad, which is a small scale gas field on the island of Cebu. Camago-Malampaya gas field started its commercial production in 2002, and has been supplying natural gas for three gas fired power stations (Ilijan, Sta. Rita and San Lorenzo), with the total power generation capacity of

2,700 MW. Other uses from the gas field are industrial use (for Shell refinery) and transport use (CNG buses), which are both minimal compared with that for power generation. Libertad gas field commenced its modest production in 2012, fueling only one 1MW power generator on the island.

Chronological data on the supply (production) and demand (consumption) of natural gas in the Philippines from 1994 up to June 2013 is as on the following table. .

Table 2.3-1 Consumption of Natural Gas by Sector

Year	Consumption			
	Power	Industrial	Transport	Total
1994	5	0	0	5
1995	5	0	0	5
1996	9	0	0	9
1997	5	0	0	5
1998	9	0	0	9
1999	7	0	0	7
2000	10	0	0	10
2001	149	0	0	149
2002	1,508	0	0	1,508
2003	2,343	0	0	2,343
2004	2,260	0	0	2,260
2005	2,985	14	0	3,000
2006	2,766	59	0	2,825
2007	3,302	89	0	3,391
2008	3,458	79	0	3,537
2009	3,502	81	0	3,583
2010	3,268	82	0	3,350
2011	3,570	88	1	3,660
2012	3,424	66	1	3,492
*2013	1,765	39	1	1,805
Total	**34,351**	**596**	**4**	**34,951**

Unit: Million Nm3/yr (converted from original unit of MMscf/yr)
Note: * figure for 2013 is for up to June 2013 only.
Source: DOE

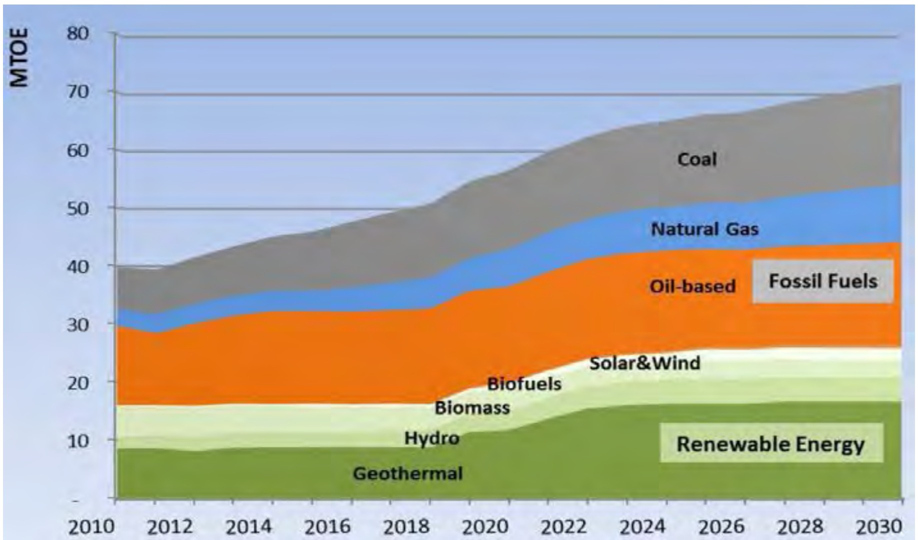
Estimated reserve of Camago-Malampaya gas field is approximately 76 billion Nm3 (original data: 2.7 trillion cf). On the other hand, accumulated total production so far as of now is 37 billion Nm3, implying that the reserve has halved in its 10 years of production. Unless additional reserve is to be discovered expected remaining production from the field should be less than 10 years. This situation of Camago-Malampaya gas field shows that most of the gas to be transported through Batman1gas pipeline will have to be procured from elsewhere, namely from imported LNG. According to estimation by DOE as of 2011, natural gas available for Batman1, when ready for service, is approximately equivalent to supply for 100 MW power generation, which is 4,000 Nm3/h.

2.3.2 Existing Gas Demand Estimations

(1) Estimation in Philippine Energy Plan 2012-2030

Philippine Energy Plan 2012-2030 (PEP) sets two scenarios which are: Business as Usual (BAU) and Low Carbon Scenario (LCS) scenarios. The BAU scenario simulates the future energy supply based on market forces interaction. On the other hand, LCS scenario considers the policy interventions and aggressive implementations of plans and programs for clean and environment-friendly energy fuels and technologies.

Natural gas is seen to contribute an average share of 9% to the total primary supply, increasing at an annual average growth rate of 5% under BAU. The supply of gas will be basically sourced from Camago-Malampaya gas field, with additional (uncontracted) gas from other potential fields. LNG import is expected to fill additional gas supply requirement in the LCS, provided that no new gas fields will be discovered during the projection horizon.

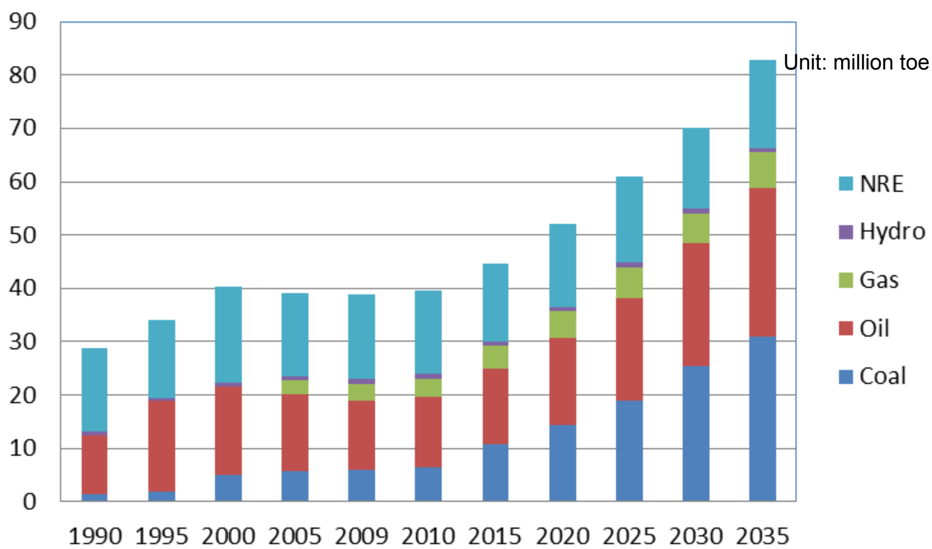


Source: DOE, Philippine Energy Plan 2012-2030

Figure 2.3-3 Outlook for Total Primary Energy by Fuel (Low Carbon Scenario)

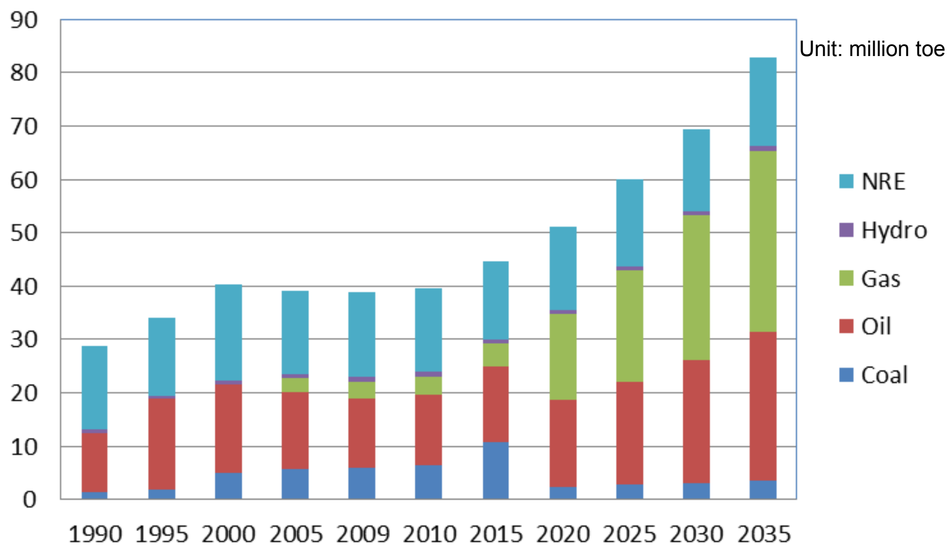
(2) Estimation in APEC Energy Demand Supply Outlook

There are various outlooks for energy demand publicly available. The most well-established and well quoted is the World Energy Outlook, published by OECD-IEA. The latest version, however does not provide the breakdown of the figure by country. APEC Asia Pacific Energy Research Centre publishes the APEC Energy Demand Supply outlook of which the 5th version (February 2013) is the latest. Energy outlook in this report is presented in two scenarios; one being the business as usual scenario, while the other being the "high gas scenario". The high gas scenario takes into account the further enhanced use of the non-conventional gas such as shale gas, replacing a significant portion of coal usage worldwide.



Source: Compiled from APERC, APEC Energy Demand and Supply Outlook 5th Edition

Figure 2.3-4 Outlook for Primary Energy Supply in the Philippines (BAU case)



Source: Compiled from APERC, APEC Energy Demand and Supply Outlook 5th Edition

Figure 2.3-5 Outlook for Primary Energy Supply in the Philippines (High Gas Case)

Underlying condition for the estimation in APEC Energy Demand Supply outlook is that real GDP growth is approximately 4%, while population growth is 0.4% to 0.5 % in APEC region. As this is the average growth in APEC as a whole, the growth assumption in the Philippines may be assumed to be higher than the figure indicated, i.e., at around 5% (c.f. IEA World Energy Outlook 2013 assumption is GDP growth of ASEAN at 5.5% (2011-2020) and 4.6% (2011-2035)).

Table 2.3-2 Assumed APEC GDP and Population Growth Rates

	2005-2030	2005-2035	2010-2035
Population	0.5%	0.5%	0.4%
GDP	4.0%	4.0%	4.1%

Source: APERC, APEC Energy Demand and Supply Outlook 5th Edition

Extracting the supply outlook for natural gas and converting the original million toe data into million Nm3/yr, the required supply is estimated to double by 2030 in business as usual case, while it will grow more than ten times in high gas case.

Table 2.3-3 Natural Gas Supply and Demand Estimation

	2010	2015	2020	2025	2030	2035
Business as usual case	3,389	4,384	5,030	5,811	5,688	6,690
High gas case	3,389	4,384	16,261	21,166	27,683	34,616

Unit: million Nm3/yr (converted from original data in million toe)
Source: Compiled from APERC, APEC Energy Demand and Supply Outlook 5th Edition

In this preparatory survey, non-conventional source of natural gas is not positively explored as the exploration for such is currently being pursued mostly in the North America, therefore the possibility of benefitting from the technology in the Philippines may not realize in a limited time. Business as usual case, having the natural gas demand doubling by 2035 can be regarded as the "do nothing" scenario, where the natural gas demand will grow in country as a whole, even if there were to be no natural gas pipeline developed.

(3) Estimation for New Demand based on Natural Gas Power Plant Development

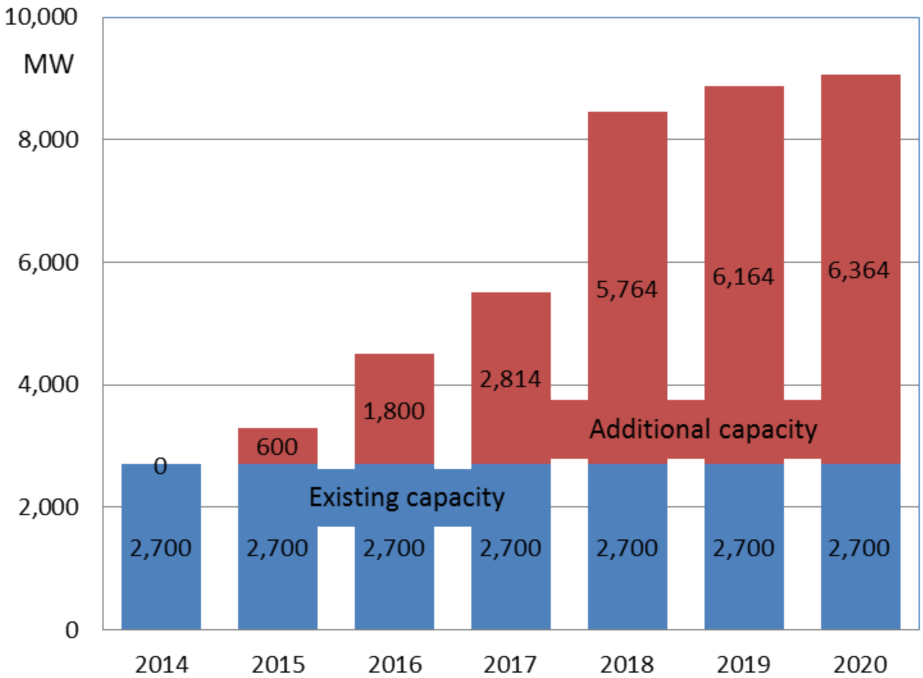
According to the DOE documents as well as various media releases, there are at least five major plans to develop natural gas fired power plants in the Philippines. These are all concentrated in Luzon. A plan by Energy World at Pagbilao, as well as First Gen's San Gabriel power station in Batangas are expected to be the earliest to start up the business, with their first phase inauguration due in 2015. Nearly all of these power plant development plans are assumed to be completed by 2020, with their total capacity reaching more than 6,300 MW. Supposing that all of these five power station plans are to be realized as announced, the total capacity of the natural gas fired power plants in Luzon, which is currently 2,700 MW will be more than triple of the current capacity.

Table 2.3-4 Plans for Natural Gas Fired Power Plants in Luzon

Project owner	Project name / Location	Phase	Capacity	Inauguration
1 Energy World	Pagbilao	Phase 1	200 MW	2015
		Phase 2	200 MW	N/A (2017*)
		Phase 3	200 MW	N/A (2020*)
2 First Gen	"San Gabriel" / Sta Rita, Batangas	Phase 1	400 MW	2015
		Phase 2	400 MW	2017
		Phase 3	400 MW	2019
3 AG&P	PNOC AFC Industrial Estate / Bataan	Phase 1	1200 MW	2016
		Phase 2	1200 MW	2018
4 Meralco+Chubu	Atimonan, Quezon	Phase 1	1200 MW	N/A (2018*)
		Phase 2	550 MW	2018
5 TransAsia	Shell Tabangao Refinery / Batangas		414 MW	2017

Note *: Survey team assumption
Source: Compiled by the Survey team from press release and media coverage information

It should be noted here that nearly all of these five power plants will have to be equipped with their proper and original source of natural gas, which is more likely to be imported LNG, gasified in vicinity of the power station. Energy World project is currently being developed in tandem with the LNG receiving terminal, while First Gas San Gabriel power plant will have to resort to Camago-Malampaya gas, at least for the first operational years. As for the remaining others, the plan will have to be backed by plans for LNG receiving facility, otherwise the plans will not be feasible.



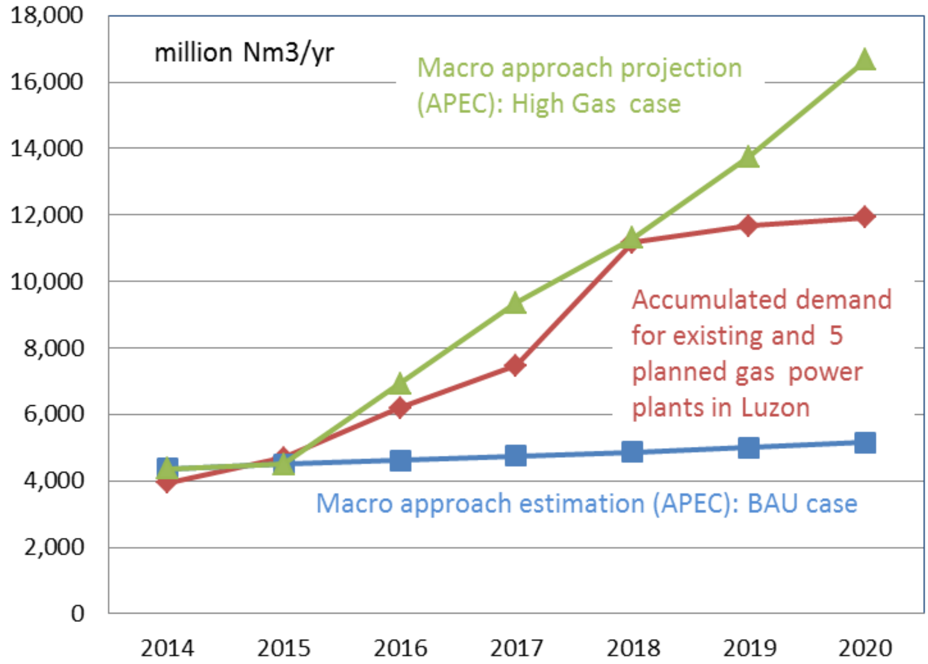
Source: Compiled by the Survey team from press release and media coverage information

Figure 2.3-6 Estimation of Natural Gas Power Generation Capacity in Luzon

(4) Comparison of Natural Gas Demand from Three Different Angles

Estimated natural gas demand for power generation, which is currently 450,000 Nm3/h or 3,942 million Nm3/yr for the capacity of 2,700 MW (converted assuming 50% conversion efficiency with natural gas energy density of 40 MJ/Nm3) will grow by 900,000 Nm3/h or 8,000 million Nm3/yr (converted assuming 60% efficiency due to the introduction of gas turbine combined cycle power generation), hence adding up to 1,360,000 Nm3/h or 11,914 million Nm3/yr. This growth curve is broadly consistent with the projection in APEC Energy Demand Supply outlook high gas case, which is approximately 16,000 million Nm3/yr in 2020.

The fact that accumulation of individual power station development plans is in line with the macro approach gas demand estimation shows that micro approach by identifying each potential users and accumulating these demands, under different assumptions, will also become an essential input as estimation of future demands.



Source: Compiled by the Survey team

Figure 2.3-7 Comparison of Macro Estimation and Plan Accumulation of Natural Gas Demand in Luzon

2.3.3 Batman 1 Gas Demand Projection

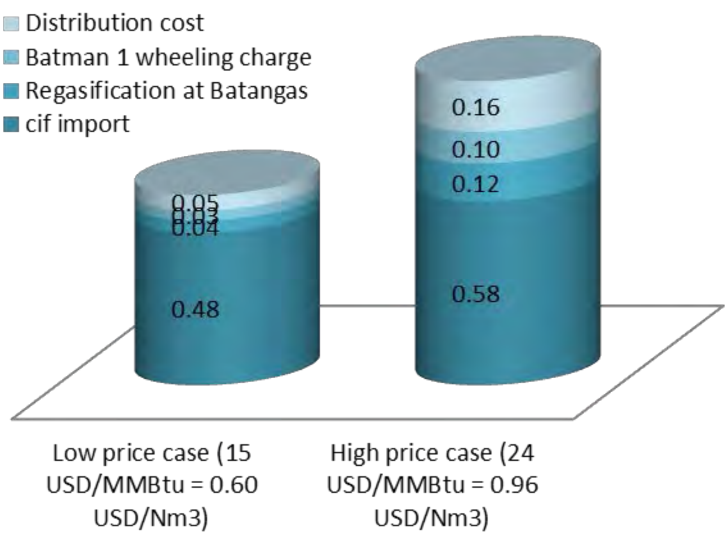
In this preparatory survey, demand for natural gas through Batman 1 pipeline is estimated from micro approach; first by identifying the potential user of natural gas along the pipeline route, segregating demands into conversion and newly developed demands, then estimating the number of such potential users. The survey looked into (i) power generation, (ii) industry (factories) (iii) commercial, (iv) households and (v) transport sectors.

(1) Assumptions on Natural Gas Price

Price of natural gas for end users along Batman 1 natural gas will purchase gas from gas distributors at negotiated unit price, which may differ from customer to customer. Large volume users may purchase at competitive rate while small scale users such as households may pay against the standard tariff.

The typical cost structure of natural gas for the end users is the accumulation of: (i) LNG import price, (ii) regasification cost, (iii) transmission cost, and (iv) distribution costs. Current LNG import price differs significantly from region to region, with the import price in East Asia being the highest due to heavy and constant demand. However, World Energy Outlook 2013 sets a hypothesis that this regional divergence in price will gradually converge mainly due to diversification of natural gas sources. Unit cost (USD per MMBtu, cif base) at higher end in Asia is estimated to be 14.5, while that of the lower end is 12.0. Regasification cost, in this analysis, is assumed to be in the range of USD 1 to 3 per MMBtu, based on interviews with potential operators. This cost is significantly higher than average cost found in WEO document due to the assumption that the scale of regasification facility is small compared with many of the other cases. Transmission (wheeling) charge for Batman 1 natural gas pipeline is set between the range of 0.8 to2.5 USD per MMBtu (0.03 – 0.10 USD/Nm3), with reference to preceding cases in other countries, as well as with considerations for financial viability of the pipeline operator. The distribution cost is assumed to be between 1.2 to 4 USD per MMBtu (0.05 – 0.16 USD/Nm3), which is higher in relation to transmission cost due to the condition that the distribution business will be developed purely on private finance basis, without the benefit of concessional loan.

End user price, as the result of accumulation of the cost elements mentioned above, is between the lowest being 15 USD/MMBtu (0.60 USD/Nm3) and the highest being 24 USD/MMBtu (0.96 USD/Nm3). Much of the difference between these assumptions is due to the range of assumptions for costs which will incur after importing, i.e. the costs that incur within the Philippines.



Source: Projection by the Survey team

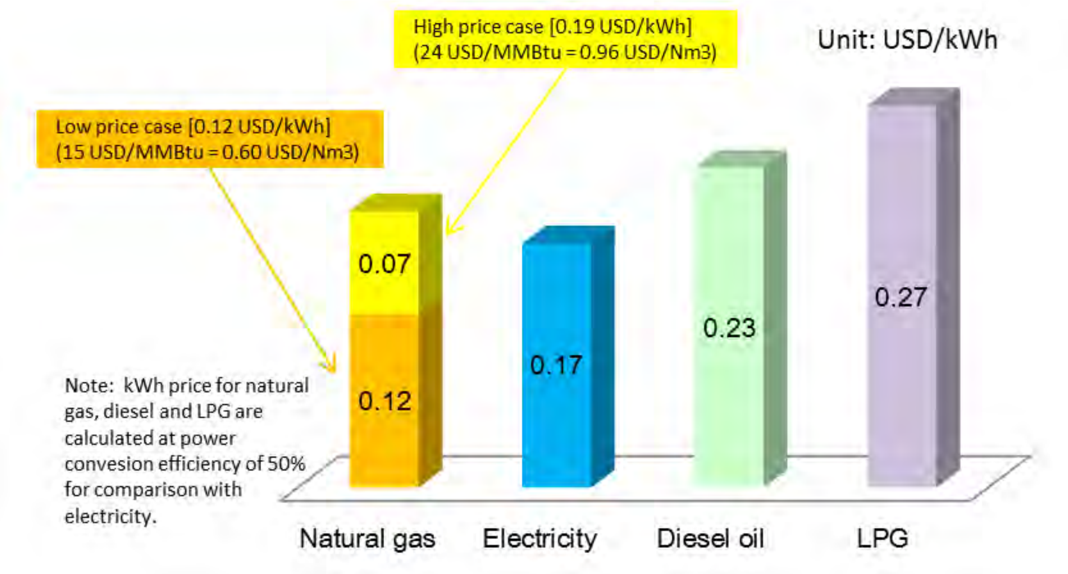
Figure 2.3-8 End User Unit Price of Natural Gas

(2) Price Competitiveness of Natural Gas

The level of end user price of natural gas is one of the most decisive factors for competition with other fuels. Estimated price of natural gas may be compared with those of electricity, diesel oil and LPG by converting all of these prices to comparable unit of USD/kWh. Prices of natural gas, diesel and LPG were converted assuming that the power generation efficiency is 50%, as to be comparable to the use in the form of electricity.

According to Meralco summary schedule of rates, retail price of electricity for home consumption, as of February 2014 is approximately 10 PHP/kWh (0.23 USD/kWh). Price for large consumers is set at 7 to 8 PHP/kWh (0.16-0.19 USD/kWh). The result of the interviews conducted by the Survey Team also implied that the average electricity price for factory use is around 7 PHP/kWh (converted to 0.17 USD/kWh). The actual diesel oil and LPG prices were available from DOE statistics which showed that LPG as of March 2014 was 75 PHP/kg (0.27 USD/kWh), while diesel price for the same period was 43 PHP/L (0.23 USD/kWh).

Lower end natural gas price was converted to on-site electricity generation cost of 0.12 USD/kWh, while the higher end price was 0.19 USD/kWh. The lower end price resulted in the most competitive compared with other sources of energy. If the price of natural gas turns out to be on the lower end of estimated range, trend to convert to natural gas from other fuels will be expected. Also, newly locating factories newly developed commercial and residential facilities will be likely to be equipped with gas distribution infrastructure that will enable the use of gas heat pumps and on-site cogeneration instead of electric equipment. On the other hand, if the price of natural gas actualizes on the high end of the estimation range at 0.19 USD/kWh, natural gas will still be competitive against diesel and LPG, while it will lose its edge against electricity. In this case, it will only be conversion from diesel and LPG that will occur, as well as introduction of natural gas using equipment instead of those powered by diesel or LPG, with the new locators. Gas heat pumps for cooling and gas on-site cogeneration will penetrate only in certain cases where electricity may not be sufficient or in cases where heat use will be beneficial.



Source: Projection by the Survey team based on DOE statistics, Meralco schedule of rates.

Figure 2.3-9 Price Competitiveness of Natural Gas

(3) Case Assumptions

In conducting natural gas demand projection analysis, four case assumptions were set. These are Low, Mid-Lower, Mid- Upper, and High cases. Low assumes that the demand can only be expected from conversion from existing oils (mostly diesel oil) and LPG. This is the ultimate worst case where natural gas price actualizes on the higher end (USD/Nm3), under unfavorable macroeconomic climate where new demand cannot be expected.

Mid-Low case also is under unfavorable macroeconomic climate where new demand cannot be expected. However, natural gas price is on the low end of estimation range so that the natural gas is competitive against electricity. This case is also applicable to condition where the government enforces measures to promote the use of gas by maintaining the price of natural gas to lower end.

With Mid-High case, the macroeconomic climate is assumed to be good, with new development of industrial estates, commercial facilities and residential complexes being realized, under the natural gas price at low end of the estimation range. This case setting also anticipates the use of natural gas beyond Cabuyao, in area surrounding the phase 2 route, but under separate individual project.

The fourth case, the High case assumes that natural gas distribution business activities will be active, serving wider area along the route, also in the eastern part of Cavite Province where industrial, commercial and residential establishments are present. This development of distribution businesses is anticipated in this High case based on the assumption that the competitiveness of natural gas price combined with the economic growth will induce investment in utility business to further benefit from the existence of natural gas trunk pipeline.

Table 2.3-5 Four Case Assumptions for Natural Gas Demand Projection

		Low	Mid-Low	Mid-High	High
Macroeconomic climate		Bad		Good	
Gas price		High end	Low end		
Market area	Batangas & Laguna	✓	✓	✓	✓
	Southern Metro Manila			✓	✓
	Eastern Cavite				✓

Source: Prepared by the Survey team

(4) Projection of Natural Gas Demand for Power Generation

PDP 2012-2030 estimates 4.2% growth of electricity in Luzon up to 2015 thereafter 4.8% growth till 2020. Currently, as of 2013 available generation capacity is 10,500 MW. Unless development of additional generation capacity takes place, supply-demand capacity deficit of 184 MW in 2015, 635 MW in 2016, 339 MW in 2017, and 833 MW in 2018 is anticipated. With regard to such circumstances, committed new power generation projects fueled by in coal, geothermal, renewable energy will avert supply-demand gap up to 2016. However, as to overcome expected gap foreseen in 2017 and after, there will be a need for further development of power generation capacity additionally to committed projects.

To cope with such demand, DOE has listed up “indicative” power generation projects. The breakdown of this list by source of energy is as in the following table. It shows that the largest portion is natural gas, adding up to 5,300 MW capacity, indicating a strong expectation for natural gas powered generation plants in the coming years.

As previously mentioned, there are at least five privately announced plans for natural gas fired power plants of which the capacity will add up to 5,800 MW in 2018 and 6,300 MW by 2020. If all of these five plans were to be realized within the time frame that they are being announced for, much of the demand-supply gap for power generation in Luzon will be relieved. It should however be noted that all of these gas fired power plants will have to be backed by their own source of natural gas, i.e., LNG receiving and gasification facility development. It is for this constraint that having all of these five plans realized as initially scheduled may not be a realistic scenario, thus resulting in short of power generation capacity.

Table 2.3-6 Indicative Power Generation Projects in Luzon by Source of Energy

Energy	Capacity	Expected service entry
Natural gas	5,300 MW	2014-2018
Coal	4,140 MW	2015-2020
Wind	367 MW	2014-2017
Diesel oil	150 MW	TBD
Geothermal	120 MW	2018-2019
Solar	50 MW	2014-2016
Biomass	18 MW	2015
Hydro	8 MW	2015

Source: Extracted from DOE Secretary presentation document “Investment Opportunities in the Philippine Energy Sector”

Although exact locations are yet to be identified, there are few candidate sites for power generation plants along Batman1 natural gas pipeline. The study assumes the development of two new natural gas combined cycle power generation plants, one near governor station 3 (GS3) (Site A: Calamba) and another at terminus of the pipeline (Site B: Sucat). As for Calamba, an interest was once expressed by Meralco as a candidate site for their 300 MW fuel oil power generation facility. However, it was for the lack of competitiveness due to the high price of fuel oil that the plan was dropped. If natural gas were to be available, there is a high possibility of this power station plan to be converted to gas fired, to be on the list again. The survey team sees that once Batman 1 pipeline is in service, Calamba power station plan will turn to reality, in few years.

The first phase is to have a set of 350 MW combined cycle units (300 MW gas turbine plus 50 MW steam turbine) to be in at Calamba by 2023 (5 years after the start of operation of Batman 1 pipeline), to be doubled up to 700 MW by 2033. This assumption of demand at Calamba power station will be applicable from Low case demand assumption setting, as it will be broadly in line with the government's draft power sector masterplan that is being developed. Installation at site B is assumed to be a similar sized combined cycle in 2033 to be doubled to 700 MW by 2043. This site B power generation plan is supposed to be realized from Mid-High case and beyond, where natural gas price is competitive at low end of the estimation range, while economy is growing for the reason that additional investment for transporting the gas beyond Cabuyao will have to be justified on private business basis.

Technical assumption of generation efficiency of 55%, availability rate of 80% with thermal unit for natural gas of 40 MJ/Nm3 is employed for the analysis. Based on these assumptions the estimation of natural gas demand for power generation in 2023 to 2043 in five years intervals, are as shown in the following tables:

Table 2.3-7 Natural Gas Demand at Newly Installed Combined Cycle Power Generation Plants

(Low / Mid-Lower case)

	2018	2023	2028	2033	2038	2043
Site A Calamba (MW)	0	350	350	700	700	700
Site B Sucat (MW)	0	0	0	0	0	0
Total capacity (MW)	0	350	350	700	700	700
Demand (MMNm3/yr)	0	697	697	1,395	1,395	1,395

(Mid-Upper / High case)

	2018	2023	2028	2033	2038	2043
Site A Calamba (MW)	0	350	350	700	700	700
Site B Sucat (MW)	0	0	0	350	350	700
Total capacity (MW)	0	350	350	1,050	1,050	1,400
Demand (MMNm3/yr)	0	697	697	2,092	2,092	2,790

Source: Survey Team projections

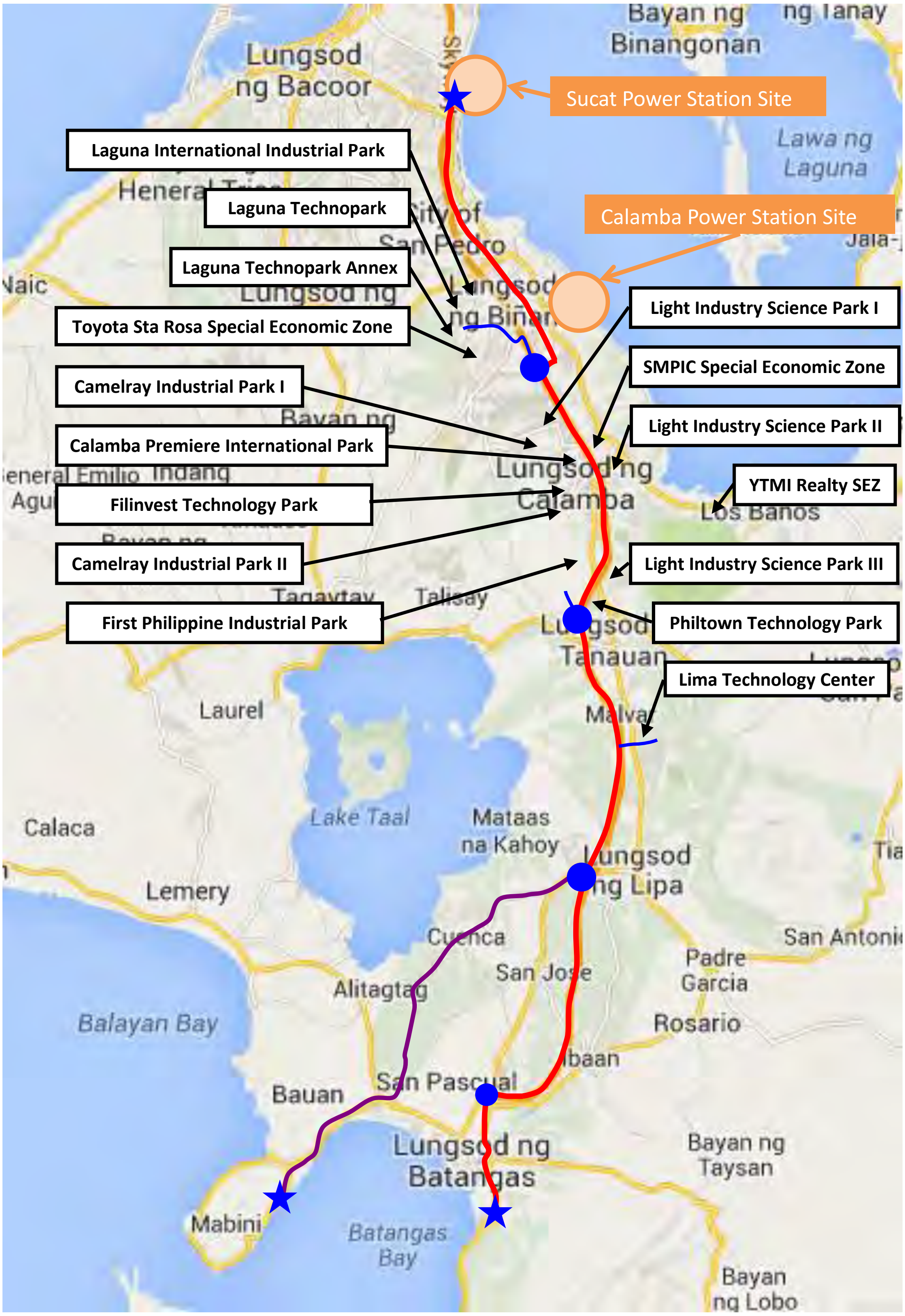
(5) Projection of Natural Gas Demand for Industry Purposes

According to Philippine Economic Zone Authority (PEZA) data, there are 19 major industrial estates that are located along Batman1 natural gas pipeline in Batangas and Laguna Provinces. Gas demands at these industrial estates are most likely to become strong not only for conversion but also with newly induced demand. The total land area of these industrial estates adds up to 1,962 hectares.

Table 2.3-8 Major Industrial Estates along Batman1

Name	Location	Developer/Operator	Area (ha)
Calamba Premiere International Park	Batino, Parian and Barandal, Calamba City, Laguna	Starworld Corporation	65.63
Carmelray Industrial Park	Canlubang, Calamba City, Laguna	Carmelray Industrial Corporation	89.29
Carmelray Industrial Park II	Punta & Tulo, Calamba City, Laguna	Carmelray - JTCI Corporation	143.03
Carmelray International Business Park	Canlubang, Calamba City, Laguna	Carmelray Industrial Corporation	40.00
Filinvest Technology Park - Calamba	Punta, Burol & Bubuyan, Calamba City, Laguna	Filinvest Land Inc.	51.07
First Philippine Industrial Park	Barangays Ulango and Laurel, Tanauan City and Sta. Anastacia, Sto. Tomas, Batangas	First Philippine Industrial Park Inc.	331.85
Greenfield Automotive Park	Don Jose, Sta. Rosa City, Laguna	Balibago Land Corporation	65.95
Laguna International Industrial Park	Ganado & Mamplasan, Biñan City, Laguna	Laguna Int'l. Industrial Park Inc.	34.88
Laguna Technopark	Sta. Rosa and Biñan City, Laguna	Laguna Technopark Inc.	322.98
Laguna Technopark Annex	Barangay Biñan, Biñan City, Laguna	Laguna Technopark, Inc.	29.00
Light Industry & Science Park I	Diezmo, Cabuyao, Laguna	LISP-I Locators' Association, Inc.	71.75
Light Industry & Science Park II	Real & La Mesa, Calamba City, Laguna	LISP-II Locators' Association, Inc.	68.01
Light Industry & Science Park III	San Rafael & Sta Anastacia, Sto. Tomas, Batangas	RFM-Science Park of the Phils. Inc.	110.48
Lima Technology Center	San Lucas, Bugtong na Pulo & Inosluban, Lipa City and Santiago & Payapa, Malvar, Batangas	Lima Land Inc.	280.17
Philtown Technology Park	Trapiche, Pagaspas & Baloc-Baloc, Tanauan, Batangas	Philippine Townships Inc.	66.63
SMPIC Special Economic Zone	Barangay Paciano Rizal, Calamba City, Laguna	Taurus First Properties, Inc.	3.31
Tabangao Special Economic Zone	Tabangao, Batangas	Tabangao Realty, Inc.	86.00
Toyota Sta. Rosa (Laguna) Special Economic Zone	Pulong Sta. Cruz, Sta. Rosa City, Laguna	Toyota Motors Philippines Corporation	81.67
YTMI Realty Special Economic Zone	Brgy. Makiling, Calamba City, Laguna	YTMI Realty Corporation	20.66

Source: Screened by the Survey team from PEZA Economic Zone list as of June 2013



Source: JICA Survey Team based on PEZA data

Figure 2.3-10 Major Industrial Estates along Batman1

First, as for conversion demand, the source of demand was assumed to be from already existing factories whereby LPG and diesel / other fuel oils will be converted in full to natural gas. Along Batman 1 natural gas pipeline, industrial accumulation is notable especially around GS3 (Calamba, Cabuyao, Santa Rosa among other cities). From the result of the surveys conducted by the team, a representative consumer of LPG and other petroleum fuels was a complex of an automobile manufacturer in where the demands were equivalent to approximately 1.4 million Nm3/yr, growing at 10% per annum, reaching 2.6 million Nm3/yr by 2020. Two more similar automotive factories are also found in the vicinity, implying that the natural gas demand from these factories may add up to approximately 7.8 million Nm3/yr by 2020. Another probable conversion is that of the food processing factories. A brewery/distillery complex, which is located at proximity of GS3, currently consumes LPG and fuel oil which is equivalent to 7.5 million Nm3/yr of natural gas. There are three more large scale food processing factories (for confectionery, soft drinks, dairy products and canned food) which are assumed to be using similar quantity of fuel. Adding up these conversion demands, approximately 30 million Nm3/yr, can be estimated at around GS3. This conversion demand is assumed to stay constant after 2020 in the analysis. Although limited in number, a chemical factory was found to be energy intensive locator with annual LPG and diesel oil consumption equivalent to of approximately 8.8 million Nm3/yr. All of the conversion demand from existing LPG and oil usage combined in areas around governor station 1 (GS1) to GS3, the total conversion demand which could be expected even at high end natural gas price is 62 million Nm3/yr.

There are plans to expand some of the industrial estates along Batman 1 pipeline route. Some of these industrial estates have expressed their intention to promote their property by publicizing the availability of natural gas infrastructure. This is due to experience with many of the industrial estates having their potential customers walk away after hearing about the energy supply conditions. One example of such is Lima Technology Center (situated near GS1 with 240 ha of land ready for new development), and another is First Philippine Industrial Park (situated near GS2 with 100 ha of new development plan). Further expansion of industrial estates around GS1, up to total of 600 ha within the radius of few kilometers, and up to 400 ha near GS2, is also deemed to be feasible judging from the availability of the vacant land.

In Mid-High case, such new development is expected to take place, with 20% of the newly available properties along the pipeline to be occupied by food processing and chemical factories. Another 10% is assumed to be for metal processing factories (lower percentage assumption is due to the fact that similar kinds of factories are already in existence).

High case takes into account potential demand of natural gas in districts I to V of the Province. Industrial estates in these districts add up to approximately 1/3 of the aggregation of those counted in Batangas and Laguna Provinces along Batman 1 pipeline. Potential demand was calculated with regard to the comparative size of the current industrial estates.

Table 2.3-9 Natural Gas Demand for Industry

(Low case)

	2018	2023	2028	2033	2038	2043
Industrial processing						
GS1	5	5	5	5	5	5
GS2	10	10	10	10	10	10
GS3	47	47	47	47	47	47
Cooling and electricity	0	0	0	0	0	0
Demand (MMNm3/yr)	62	62	62	62	62	62

(Mid-Lower case)

	2018	2023	2028	2033	2038	2043
Industrial processing						
GS1	5	5	5	5	5	5
GS2	10	10	10	10	10	10
GS3	47	47	47	47	47	47
Cooling and electricity	6	30	60	90	119	119
Demand (MMNm3/yr)	68	92	122	152	181	181

(Mid-Upper case)

	2018	2023	2028	2033	2038	2043
Industrial processing						
GS1	7	55	155	205	255	305
GS2	13	60	85	110	160	210
GS3	47	47	47	47	47	47
Cooling and electricity	7	42	87	126	167	179
Demand (MMNm3/yr)	74	204	374	488	629	741

(High case)

	2018	2023	2028	2033	2038	2043
Industrial processing						
GS1	7	55	155	205	255	305
GS2	13	60	85	110	160	210
GS3	47	47	47	47	47	47
Beyond	49	87	137	168	207	247
Cooling and electricity	10	59	122	176	234	251
Demand (MMNm3/yr)	126	308	546	706	903	1,060

Source: Survey Team projections

(6) Projection of Natural Gas Demand for Commercial Sector

Potential demand in commercial sector was estimated from three purposes, which are; (i) food processing (cooking) purpose; (ii) cooling purpose and (iii) on-site power generation purpose. Currently much of the food processing is done with LPG, which can be expected to convert to natural gas in all of the projection cases. As LPG consumption data specifically for this purpose was not available, the demand projection was done based on the unique assumption figure of 3 Nm3/hour per facility, which is the data obtained from pilot project conducted in Manila by one gas equipment manufacturer.

For cooling purpose, the natural gas demand was calculated under the assumption that gas heat pumps will penetrate when natural gas price is on the low end of the estimation range, i.e., in cases Mid-Lower cases and above. Number of existing commercial facilities was calculated by aggregating the list of major shopping malls and restaurants. Unit gas consumption is based on data obtained from a gas heat pump manufacturer, Yanmar Energy System Co., Ltd., who is currently actively seeking for market in Manila.

On-site power generation is another purpose for which natural gas might be utilized. This demand is assumed to be realized when natural gas price is on the low end of the estimation range (same condition as the realization of cooling demand). However, unlike cooling, the introduction of on-site power generation is most likely to be an additional investment on top of electricity grid connection (for the same reason the demand is limited to new development as retrofitting of additional equipment in already existing facilities may not be common). New development in Batangas and Laguna Provinces are estimated to be 100 ha (as identified at Malviar), additional 50 ha beyond Cabuyao, in Southern Metro Manila, and another 60 ha in districts I to V of Cavite Province. Further, the demand estimation is done under assumption that the penetration rate of on-site power generation will be half of that of the cooling equipment.

Table 2.3-10 Natural Gas Demand in Commercial Sector

(Low case)

	2018	2023	2028	2033	2038	2043
Food Processing	1	1	1	1	1	1
Cooling	0	0	0	0	0	0
Electricity	0	0	0	0	0	0
Demand (MMNm3/yr)	1	1	1	1	1	1

(Mid-Lower case)

	2018	2023	2028	2033	2038	2043
Food Processing	1	1	1	1	1	1
Cooling	1	2	3	5	6	7
Electricity	0	0	0	0	0	0
Demand (MMNm3/yr)	2	3	4	6	7	8

(Mid-Upper case)

	2018	2023	2028	2033	2038	2043
Food Processing	2	2	2	2	3	4
Cooling	20	23	29	35	42	50
Electricity	9	10	12	14	15	17
Demand (MMNm3/yr)	31	35	43	51	60	71

(High case)

	2018	2023	2028	2033	2038	2043
Food Processing	2	2	2	2	3	4
Cooling	38	41	47	54	60	68
Electricity	20	21	23	24	26	27
Demand (MMNm3/yr)	60	64	72	80	89	99

Source: Survey Team projections

(7) Projection of Natural Gas Demand for Households Sector

Household demand composition is identical to that of the commercial sector, with; (i) cooking, (ii) cooling and (iii) on-site power generation being the demand factors. As household LPG consumption data was not available, sample data for a household use of LPG of approximately 2/3 Nm3 per day is employed. Upper threshold of penetration rate is set at modest 20%, with annual demand growth rate of 7% (population growth rate and economic growth rate combined). Further, a half of new residential development along Batman 1 pipeline route was assumed to be installed with gas supply. This new development demand was taken into consideration from Mid-High case and above.

Gas demand for cooling in household sector was calculated based on data obtained from Yanmar Energy System Co., Ltd., which anticipates gas consumption for average load of 40%. Cooling demand was deemed to realize only with the favorable macroeconomic climate as much of the existing demand for cooling is already taken by electric air conditioners. Upper threshold of penetration rate was set at 5%.

On-site power generation demand for household was estimated to be minimal, even if natural gas price were to be on the low end of the range. This is due to the trend that the advantage of such equipment will only be brought about where the demand for hot water is there. For this reason the maximum penetration rate was set at 1%.

In High case, the demand in households in Cabuyao districts I to V was estimated by simple proportional rate against that of Batangas and Laguna combined.

Table 2.3-11 Natural Gas Demand in Households Sector

(Low case)

	2018	2023	2028	2033	2038	2043
Cooking	1	5	9	9	18	18
Cooling	0	0	0	0	0	0
Electricity	0	0	0	0	0	0
Demand (MMNm3/yr)	1	5	9	9	18	18

(Mid-Lower case)

	2018	2023	2028	2033	2038	2043
Cooking	2	10	21	21	41	41
Cooling	4	4	9	9	19	19
Electricity	2	2	5	5	11	11
Demand (MMNm3/yr)	6	14	30	30	60	60

(Mid-Upper case)

	2018	2023	2028	2033	2038	2043
Cooking	2	52	79	102	156	202
Cooling	4	11	20	24	40	48
Electricity	0	1	1	3	3	4
Demand (MMNm3/yr)	6	64	100	129	199	254

(High case)

	2018	2023	2028	2033	2038	2043
Cooking	3	80	122	159	242	313
Cooling	6	18	31	38	61	75
Electricity	0	2	3	3	5	7
Demand (MMNm3/yr)	9	100	156	200	308	395

Source: Survey Team projections

(8) Projection of Natural Gas Demand for the Transport Sector

Natural gas consumption in transport sector can be expected in: (i) buses and (ii) taxis. A pilot program (NGVPPT: Natural Gas Vehicle Program for Public Transport) to supply CNG for buses that links Batangas and Manila is currently being conducted. In this project there is a "mother station" in Batangas from where CNG is distributed to the "daughter stations". As of today there is only one daughter statin operating in Laguna that is capable of supplying CNG for 50 buses per day. More daughter stations are planned to be developed in Batangas, Laguna and around Manila. The actual operational number of buses being fueled by CNG is approximately 26 per day, under constraints of operational reasons. The amount of CNG loaded on a bus is 113 kg per fueling.

The target for the project is to increase the number of CNG buses to 7,500 by 2030. However, the current condition shows that the target is unlikely to be attained due to lack of daughter station development and also due to road transport regulation that restricts the new number of buses to be introduced. Such being the case, the Low case assumes the current stagnation in the project will sustain. As for the Mid-Lower case, NGVPPT is expected to be back on the track, encouraged by competitiveness of natural gas and also due to government shore up in the light of the significance of the program. Further, for Mid-Upper case the program is further encouraged to meet the economic growth by 20% increase in CNG buses.

Currently, there is a large demand for LPG being utilized for taxis that may become convertible to CNG. According to the DOE data, demand for LPG for vehicle use has been stable for some years at approximately 1.6 million barrels per year (calorific value equivalent to 154 million Nm3/yr of natural gas). This demand can be expected to be realized immediately after the start of supply of CNG. The demand is assumed to be stable up to 2043. As for Mid-High case and over, the demand for CNG for taxis is assumed to increase by 20%, in response to the economic growth.

Table 2.3-12 Natural Gas Demand in Households Sector

(Low case)

	2018	2023	2028	2033	2038	2043
CNG buses	2	2	2	2	2	2
CNG Taxis	154	154	154	154	154	154
Demand (MMNm3/yr)	156	156	156	156	156	156

(Mid-Lower case)

	2018	2023	2028	2033	2038	2043
CNG buses	7	124	247	494	494	494
CNG Taxis	154	154	154	154	154	154
Demand (MMNm3/yr)	161	278	401	648	648	648

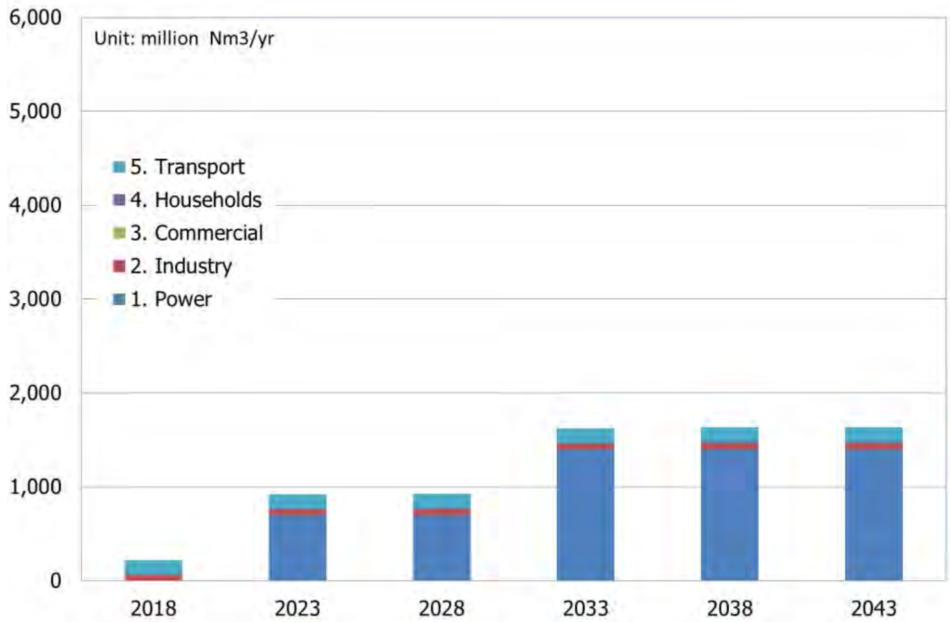
(Mid-Upper / High case)

	2018	2023	2028	2033	2038	2043
CNG buses	8	148	296	593	593	593
CNG Taxis	185	185	185	185	185	185
Demand (MMNm3/yr)	193	333	481	778	778	778

Source: Survey Team projections

(9) Summary of Estimated Natural Gas Demand for Batman 1 Natural Gas Pipeline

Summarizing the demand projection for Batman 1 natural gas pipeline by power generation, industry, commercial, households and transport sectors, the total demand and the breakdown from 2018 up to 2043 will be as indicated in the following figures and tables.



Source: Projection by the Survey Team

Figure 2.3-11 Natural Gas Demand (Low case)

Table 2.3-13 Natural Gas Demand (Low case)

	Power MMNm3/yr	Industry MMNm3/yr	Commercial MMNm3/yr	Households MMNm3/yr	Transport MMNm3/yr	TOTAL MMNm3/yr
2018	0	62	1	1	156	220
2023	697	62	1	5	156	920
2028	697	62	1	9	156	925
2033	1,395	62	1	9	156	1,623
2038	1,395	62	1	18	156	1,632
2043	1,395	62	1	18	156	1,632

Source: Projection by the Survey Team

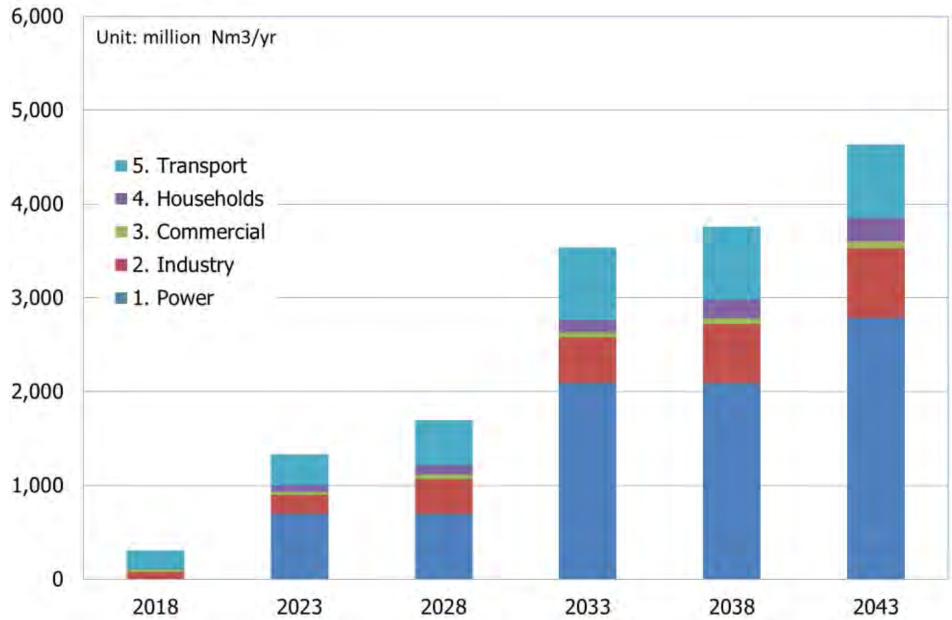
Source: Projection by the Survey Team

Figure 2.3-12 Natural Gas Demand (Mid-Lower case)

Table 2.3-14 Natural Gas Demand (Mid-Lower case)

	Power MMNm3/yr	Industry MMNm3/yr	Commercial MMNm3/yr	Households MMNm3/yr	Transport MMNm3/yr	TOTAL MMNm3/yr
2018	0	68	2	6	161	236
2023	697	92	3	14	278	1,083
2028	697	122	4	30	401	1,254
2033	1,395	152	6	30	648	2,230
2038	1,395	181	7	60	648	2,290
2043	1,395	181	8	60	648	2,292

Source: Projection by the Survey Team



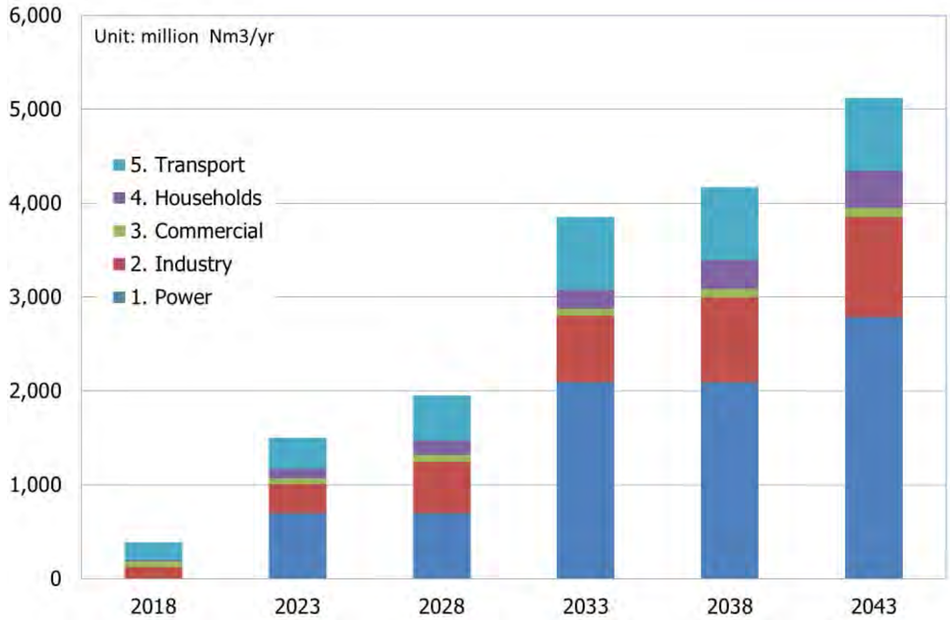
Source: Projection by the Survey Team

Figure 2.3-13 Natural Gas Demand (Mid-Upper case)

Table 2.3-15 Natural Gas Demand (Mid-Upper case)

	Power MMNm3/yr	Industry MMNm3/yr	Commercial MMNm3/yr	Households MMNm3/yr	Transport MMNm3/yr	TOTAL MMNm3/yr
2018	0	74	31	6	193	303
2023	697	204	35	64	333	1,333
2028	697	374	43	100	481	1,695
2033	2,092	488	51	129	778	3,537
2038	2,092	629	60	199	778	3,757
2043	2,790	741	71	254	778	4,633

Source: Projection by the Survey Team



Source: Projection by the Survey Team

Figure 2.3-14 Natural Gas Demand (High case)

Table 2.3-16 Natural Gas Demand (High case)

	Power MMNm3/yr	Industry MMNm3/yr	Commercial MMNm3/yr	Households MMNm3/yr	Transport MMNm3/yr	TOTAL MMNm3/yr
2018	0	126	60	9	193	388
2023	697	308	64	100	333	1,502
2028	697	546	72	156	481	1,952
2033	2,092	706	80	200	778	3,856
2038	2,092	903	89	308	778	4,170
2043	2,790	1,060	99	395	778	5,122

Source: Projection by the Survey Team

Above charts compare the projection figures by cases. Common trend in all of the cases is that the power generation demand takes up a significant portion of the demand, being the anchor load for the pipeline. Transport sector demand is another essential factor for the pipeline. By comparing the Low case with the Mid-Lower case it becomes apparent that governmental shoring up of the program will play an important role in realizing a large portion of the transportation demand as the second anchor load. It should also be noted that conversion demand from existing LPG and oil use is limited in amount.

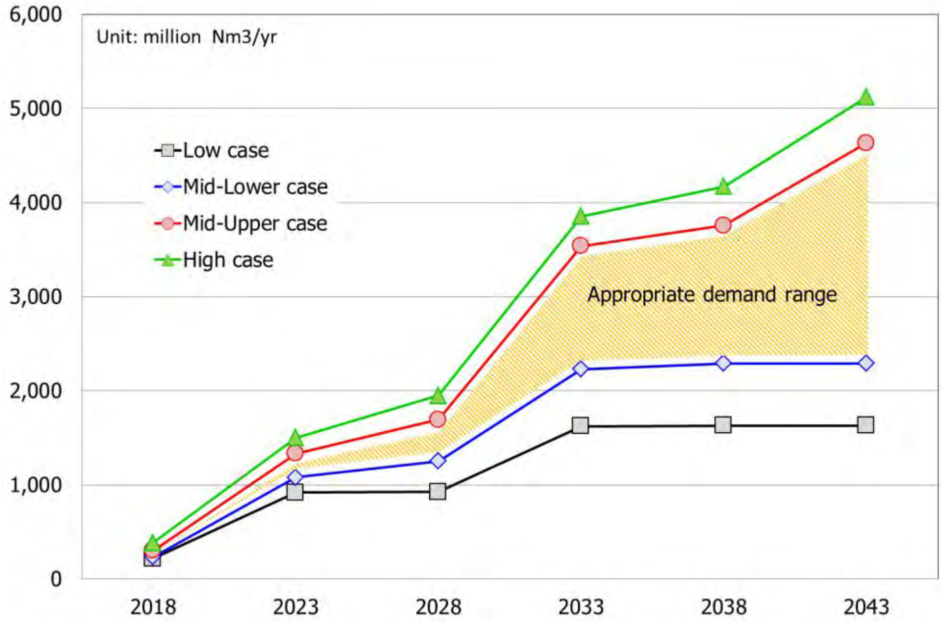
2.3.4 Analysis of the Natural Gas Market for the Pipeline

(1) Expected Demand Range

Among the four case settings for demand projection, Low case was “do nothing” setting under unfavorable macroeconomic condition and pricing, which is the extreme scenario that can be naturally anticipated. Here, the government is supposed to be without any substantial promotional measures.

Mid-Low case is a setting in which price competitiveness of natural gas is better. This is also a probable setting where government artificially controls the gas price even under unfavorable macroeconomic condition. Mid-Low case, therefore can be regarded as the bottom side of the "do something" cases, i.e. even if the government is competent to promote the use of natural gas by controlling the price. Further, Mid-Upper case is the setting where favorable macroeconomic condition reacts to give a boost to the financial viability of the project. The demand range between Mid-Lower and Mid-Upper cases is where actual demand is likely to correspond, under the condition that the gas price remains competitive against other fuels, or if not, under the condition that there is a commitment from the government to encourage the penetration of natural gas. In this sense it is desired that the financial viability of the project could be confirmed within this demand range.

Finally the High case expects further expansion of the market, which is the result of inducement of natural gas usage in wider area, and also with the expectation that the private sector will lead the popularization of natural gas by expanding their distribution infrastructure. The case may turn out to be in excess of designed capacity, therefore in a need for a separate, additional supply infrastructure such as Batman 2 (Bataan-Manila) which is also on the list of proposed natural gas infrastructure in PEP 2012.

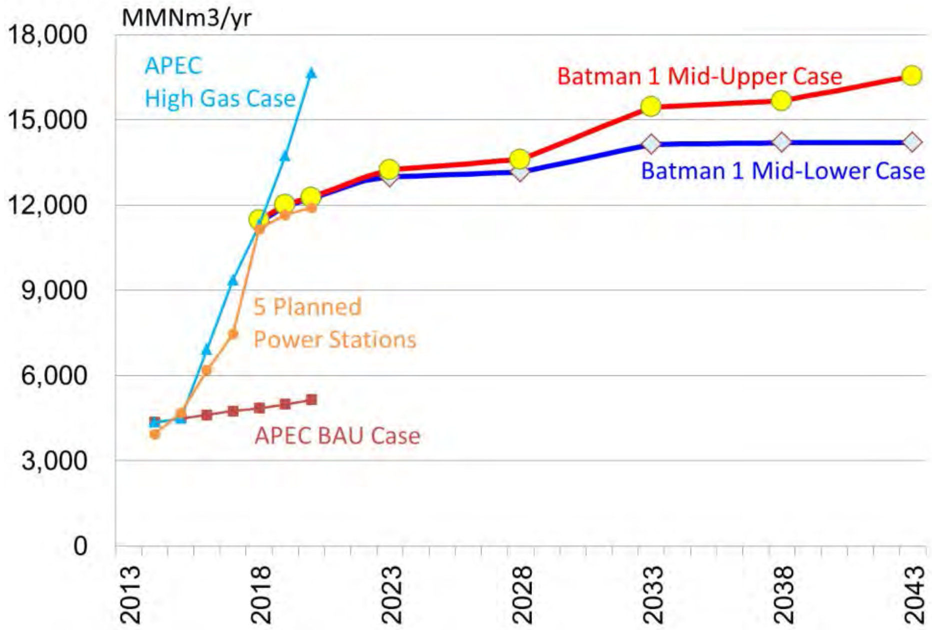


Source: Projection by the Survey Team

Figure 2.3-15 Case Comparison: Natural Gas Demand for Batman 1

(2) Overall Future Natural Gas Demand in Luzon

Supposing that all of the five planned natural gas fired power plants in Luzon, other than those along Batman 1 pipeline would be developed as planned, accumulated natural gas demand in Luzon will reach approximately 12,000 million Nm3/yr by 2020. Natural gas demand along Batman 1 pipeline, as projected in this survey, will push up this demand to more than 14,000 million Nm3/yr under Mid-Low case, and to more than 16,000 million Nm3/yr under Mid-Upper case. By comparing the Batman 1 pipeline demand with that of APEC study High Gas case, it can be said that Batman 1 demand projection is well within the macro approach demand estimation range.



Source: Projection by the Survey Team

Figure 2.3-16 Batman 1 Demand in Comparison with Macro Approach Estimation

One of the primary objectives of laying a pipeline between Batangas and Manila is to promote the development of gas industry along the route so as to contribute to improving the competitiveness of the industry sector in the Philippines. There were various cases observed during the survey where the industrial estate managers told about their experiences of potential locators walking away because of the absence of gas natural gas supply. These potential locators are seen to have selected other Southeast Asian countries as the suitable place to situate their factories. Many of the industrial estate managers therefore confirm the necessity and demand for natural gas for their potential customers. Some of the industrial estates suggest referring to the possible availability of natural gas in their marketing activities for new locators. Demand for newly locating factories that have long been avoiding the Philippines because of the lack of proper energy infrastructure was reconfirmed to be persistent.

(3) Significance of Government’s Commitment to Promote the Use of Natural Gas

Demand estimation under four cases in this survey verified that macroeconomic climate will be the most crucial element for gas demand. However, it should be noted that macroeconomic growth can rarely be under the control of the government, regardless of policy and measures. On the other hand, price competitiveness of natural gas, which is another crucial factor for demand, is somewhat controllable provided that the government has the commitment and regulatory capacity. For this reason, Mid-Lower case is regarded as the lowest possible case if there were to be government’s commitment to promote the use of natural gas. The significance of the commitment by the government is therefore the requisite for the project to be viable regardless of the macroeconomic conditions.

Further, there can be various measures by the government to ensure that the demand will be existent. One is the government’s role in pursuing the ongoing program to introduce CNG buses. The initial target of more than 7,500 buses fueled by natural gas by 2030 is the commitment that should be met. In transport sector, the government may also promote the use of natural gas on taxis by introducing more filling stations around Batman 1 natural gas pipeline route.

Gas heat pump and on-site power generation can also be promoted with the aim to relieve the burden on electricity infrastructure investment that will be required to cope with the peak demand. Limited availability of space for further grid extension will inevitably make marginal cost for developing the electricity grid high. Promotion to popularize gas equipment expecting peak cut is an alternative option that the government may consider.

Government policy to promote the use of natural gas in parallel with electricity and oils will, from wider viewpoint, will contribute to widening the diversity of energy source for power generation, industry, commercial, household and transport sectors. There is also an element of energy security against supply risk and also against natural disaster.

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2.4 Gas Pipeline

2.4.1 Basic Design of Pipeline

(1) Design Concept

- Safety design for facilities resistant to earthquake and typhoon is the first priority.
- The design is based on the potential cooperation with the high pressure trunk line to be constructed in the future following the Batman 1.
- The facility design is based on the projection for the demands in the future.
- Routine operation and maintenance may be conducted securely and at ease.

(2) Scope of Design

The pipeline system is the natural gas transportation system from new LNG receiving terminals to be constructed in Batangas as the starting point towards Manila. On its way, the system will supply the two industrial parks (Lima Technology Center and First Philippine Industrial Park) and one region (Laguna Industrial Area) which serve as the main scope (Phase-1) as well as, supply the Batangas area. Also, future options such as extension (Phase-2) branches for power stations, CNG stations, and natural gas receiving branches from the LNG receiving terminal candidate site (PNOC-ESB) (Future Option) are considered.
Accordingly, the scope of project consists of a high-pressure trunk line from Batangas area to Cabuyao area and distribution lines to the industrial parks.

The pipeline-related facilities include valve stations to ensure the safety of the gas transmission pipeline; governor stations to reduce the pressure from the high-pressure trunk line to the supply pressure ; metering stations to manage gas transactions; cathodic protection system; branch valve stations (including valve pits); the SCADA System,; pig launcher/receiver equipment ; and control monitoring room.
Furthermore, cathodic protection, periodic pig inspection and repairs will enable the pipeline to operate semi-permanently when needed. The design life for the pipeline is set at 40 years on the assumption that consumable parts for the related facilities will be replaced and periodic maintenance will be performed.

In addition, the basic design for the pipeline is implemented based on the flow chart in Figure 2.4-1.

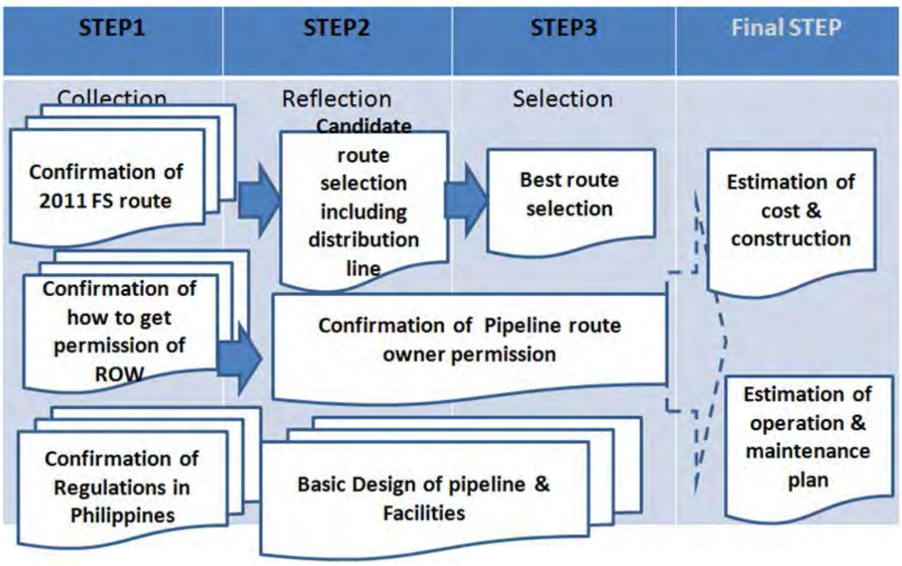

Figure 2.4-1 Design Flow

(3) Design Standards and Specifications

1) Applicable Standards

The applicable standards for the Batman 1 pipeline comply with the international standard, Interim Rules and Regulations Governing the Transmission, Distribution and Supply of Natural Gas(DOE Circular No.2002-08-005 (27 August 2002). The typical international standards are shown in Table 2.4-1. However, as described in the other sections, Japanese seismic design standards are applied to meet the need to satisfy the design life in the Philippines with high occurrence rate of natural disasters, especially earthquake.

Table 2.4-1 Major International Standards

ANSI/ASME (American National Standards Institute)
ANSI/ASME B31.4 Liquid Petroleum Transportation Piping Systems
ANSI/ASME B31.8 Gas Transmission and Distribution Piping Systems
ANSI/ASME B16.5 Steel Flanges and Flanged Fittings
ANSI/ASME Factory-made Wrought Steel Butt Welding Fitting
ASME (American Society of Mechanical Engineers)
ASME Boiler And Pressure Vessel Code
ASME Section V Nondestructive Examination
ASME Section VIII Pressure Vessels
ASME Section IX Welding and Brazing Qualifications
API (American Petroleum Institute)
API SPEC 5L
API SPEC6D
ASTM (AMERICAN Society for Testing and Materials)
ASTM A105 Forgings, Carbon Steel, for Piping Components
ASTM A370 Mechanical Testing of Steel Products
NACE (National Association of Corrosion Engineers)
SSPC (Steel Structures Painting Council)
BSI (British Standards Institution)
DIN (Deutsches Institute fur Normung)
DNV (Det Norske Veritas)
ISO (International Organization for Standardization)

2) Location Class and Design Factor

The Location Class is an important standard in determining the installation depths of the pipeline and intervals of the block valve stations. The following are excerpt of definition of Location Class stipulated in ANSI/ASME B31.8.

Location Class 1

Location Class 1 is any 1 mile section that has 10 or fewer buildings intended for human occupancy. Location Class 1 is intended to reflect areas such as wasteland, deserts, mountains, grazing land, farmland, and sparsely populated areas.

(a) Class 1 Division 1 - Location Class 1, a design factor for the pipe, is greater than 0.72 but equal to or less than 0.80, and the pipe has been hydrostatically tested for 1.25 times at the maximum operating pressure.
(b) Class 1 Division 2 - Location Class 1, a design factor for the pipe, is equal to or less than 0.72, and the pipe has been tested for 1.1 times at the maximum operating pressure.

Location Class 2
Location Class 2 is any 1 mile section that has more than 10 but fewer than 46 buildings intended for human occupancy. Location Class 2 is intended to reflect areas where the degree of population is intermediate between Location Class 1 and Location Class 3 such as fringe areas around cities and towns, industrial areas, ranch or country estates, etc.

Location Class 3
Location Class 3 is any 1 mile section that has 46 or more buildings intended for human occupancy except areas where Location Class 4 prevails. Location Class 3 is intended to reflect areas such suburban housing developments, shopping centers, residential areas, industrial areas, and other populated areas not meeting Location Class 4 requirements.

Location Class 4
Location Class 4 includes areas where multistory buildings are prevalent, and traffic is heavy or dense, and there may be numerous other utilities underground. Multistory means 4 or more floors above ground including the first or ground floor. The depth of basements or number of basement floors is immaterial.

Figure 2.4-2 shows the map of the entire route and Location Class for each section.
The Location Class and design factors are assigned as shown in Table 2.4-2.
The design factor of the distribution line is calculated at 0.4 under the assumption that the distribution line will increase in the future.

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Figure 2.4-2: Route Map

(Reappears as Figure 2-9-2)

Table 2.4-2 Location Class and Design Factor

Location Class

Part	Trunk Line					Distribution Line
Section	Section1	Section2	Section3	Section4	FutureOption	–
Location Class	3	2	3	3,4	2,3	3

Design Factor

Part	Trunk Line					Distribution Line
Location Class	1 division1	1 division2	2	3	4	3
Design Factor	0.8	0.72	0.6	0.4		0.4

3) Specifications for Pipes and Different Diameter Pipes

Steel pipes with high strength and excellent toughness will be adopted for the pipeline as set forth by the American Petroleum Institute (hereafter referred to as API). This project is planning to apply the API 5L X-65 (diameter: 24 inch), API 5L X-52 (16 inch) and API 5L X-42 (12 inch), which have been the most commonly used in Japan and are suitable for field welding and handling. (16 inch is to be applied to Phase-2).

Polyethylene coating will be applied on the outer surface of the pipes in order to protect against the corrosive environment underground. Also, epoxy coating will be applied on the inner surface of the pipes to prevent rust from generating during the construction period.

- Specifications: API 5L X-65 (24 inch), X-52 (16 inch) and X-42 (12 inch)
- Outer surface coating: High-density polyethylene coating
- Inner surface coating: Epoxy coating

The different diameter pipes will also conform to the pipe specifications.
Table 2.4-3 shows the standard thickness and typical specifications for the pipes and different diameter pipes for the high-pressure trunk line.
The result of pipe thickness calculations is given in Attachment to this report.

Table 2.4-3 Pipe Specifications

Pipe Wall Thickness

Part	Size(Grade)	Design Pressure	Location Class / Pipe Wall Thickness (mm)				
			1 division1	1 division2	2	3	4
Trunk Line	24inch（API 5L X65）	7.0Mpa	—	—	10.3	14.3	
	16inch（API 5L X52）	7.0Mpa	—	—	8.7	11.9	
Distribute Line	12inch（API 5L X42）	2.0Mpa	—	—	9.2 (7.0)		

※16inch：Phase2

Pipe Spec

Part	Pressure	Size	Grade	Location Class	Pipe Type	External Coating	internal Coating	Sour
Trunk Line	7.0Mpa	24inch	API 5L X-65	3.4	UOE	Hi PEL 3.5mm	Epox min. 50μ	Non Sour
				2	UOE	Hi PEL 3.5mm	Epox min. 50μ	Non Sour
		16inch	API 5L X-52	3.4	S'MLESS	Hi PEL 3.5mm	Epox min. 50μ	Non Sour
Distribute Line	2.0Mpa	12inch	API 5L X-42	3	S'MLESS	Hi PEL 3.0mm	Epox min. 50μ	Non Sour

※16inch：Phase2

4) Seismic Design

The concepts of the "Seismic Design Guideline for High Pressure Gas Pipeline" and "Seismic Design Guideline for Liquefaction for High Pressure Gas Pipeline", which have been established through the various tests and verification experiments conducted in Japan, are to be applied in the Philippines possibly susceptible to earthquake damage to the pipeline similar to Japan. The specifications for pipeline, which have incorporated Japanese techniques and know-how in construction in urban areas, will be employed in consideration of the fact that the line will be buried underground in densely populated areas.

The Batman 1 specifies the material specifications for the line pipes and acceptance standards for the field girth welds as follows, in light of the rate of earthquake occurrence, population density and ground properties.

a. Specifications for Line Pipe

The specifications for the line pipes to be installed in the seismic areas are to employ the Japanese seismic technologies, although the performance tests and deformation tests of the actual pipes to verify the various pipe performances.

The examples of the API Standard (for non-seismic areas) and adopted material specifications based on the Japanese seismic technologies are shown in Table 2.4-4.

Table 2.4-4 Pipe Specifications 2

Main Item			[Non-seismic Zones] Trunk Line API 5L-2012	[Seismic Zones] Trunk Line API 5L-2012 (Japanese Standard Specifications)	[Seismic Zones] Distribute Line API 5L-2012 (Japanese Standard Specifications)
Outer Diameter			610mm (UOE)	610mm (UOE)	323.9mm (SML)
Pipe Thickness			10.3t	14.3t	9.2t（7.0t Security）
Grade			L450M (X65M) PSL2	L450M (X65M) PSL2	L290Q (X52Q) PSL2
Chemical Composition		Pcm	≦0.25 (C≦0.12)	≦0.22 (C≦0.12)	≦0.22 (C≦0.12)
		Ceq	≦0.43 (C>0.12)	≦0.43 (C>0.12)	≦0.43 (C>0.12)
Tensile Properties	Circumferential Direction	Proof Stress	450-600	450-600	—
		Tensile Strength (Base Material)	535-760	535-670	—
		Tensile Strength (Welding)	535 or above	535-760	—
		Yield Ratio	≦0.93	≦0.93	—
	Axial Direction	Proof Stress	—	—	290-495
		Tensile Strength	—	—	415-760
		Yield Ratio	—	—	≦0.93
Bending			Length 3mm、Depth 0.125t	Length 3mm、Depth 0.125t	API
Hardness			≦345HV	≦250HV	≦220HV
Charpy		Test Temperature	0℃/Minimum operating temperature	0℃	0℃
		vE	Average≧27J (Base material, HAZ and Depo) Individual ≧0.75×27J	Base material, HAZ and Depo: Individual≧Average 40J	Base material, HAZ and Depo: Individual≧34J Average 65J
		SA	Recommended average ≧85% (Base material)	Reference	Reference
DWTT		Test Temperature	0℃/Minimum operating temperature	0℃	—
		SA	Average ≧ 85% *Implemented if there is a request for 20" or greater	≧ Average 85%	—
Water Pressure			Pipe thickness: 90% SMYS	API: However, 100% SMYS, calculation at the minimum pipe thickness and 10 seconds	API: However, 100% SMYS, calculation at the minimum pipe thickness
Appearance		Dents	0.5D (length) and 6.4mm (depth)	300mm (length) and 1.6mm (depth)	150mm (length) and 1.6mm (depth)
		Lamination	6.4mm	None	None
		Other Damage	0.8mm (Undercut) 0.125t (Damage)	(Damage) Over 0.4mm = Repairs (welding not possible) Over 0.8mm = Cutting	(Damage) Over 0.4mm = Repairs (welding not possible) Over 0.8mm = Cutting
Dimensions		Outer Diameter (Pipe Ends)	±1.6mm	±1.6mm	±1.6mm
		Outer Diameter (Center)	±3.2mm	±3.2mm	±0.0075D
		Pipe Thickness	±1.5mm	(+)15% and (-)0	(+)15% and (-)12.5%
		Degree of Roundness	1.5% (Pipe ends) 2% (Center)	1.0% (Pipe ends) 2% (Center)	1.0% (Pipe ends) 2% (Center)
		Bending	2/1000 Pipe end: 1m (4mm or less)	2/1000 Pipe end: 1m (4mm or less)	2/1000 Pipe end: 1m (4mm or less)
		Length	±500mm	±500mm	±500mm
		Weight	(Individual) +10% and -3.5% (Lot average) -1.75%	(Individual) +15% and -0% (Lot average) -1.75%	(Individual) +15% and -0% (Lot average) -1.75%
Non-destructive Inspections		Steel Plate UT	—	No lamination on pipe ends No lamination of a length of over 25mm	—
		RT	Both pipe ends (200mm)	Both pipe ends and welding adjustments & UT instructions (2 or more of API & JISZ3104)	—
		UT	Implementation	Total length of the seam except the 200mm pipe ends	Whole surface Length N5 Notch warranty
		MT	—	Inside/outside surface of pipe ends = 100mm (including welding) and groove surface (No cracks or lamination)	Inside/outside surface of pipe ends = 100mm (including welding) and groove surface (No cracks or lamination)
		Residual magnetism	(average) 3.5mmT (Individual) 3.0mmT	(average) 3.5mmT (Individual) 3.0mmT	(average) 3.5mmT (Individual) 3.0mmT

b. Weld Specifications

The Japanese JIS standards, which have set the strict acceptance criteria for weld defects compared to the API standards, will be applied to the weld specifications for densely populated areas and areas which are possibly affected by active faults.

Figure 2.4-3 shows the applicable standards by area. The setting of the Location Class and Safety Assessment Level (hereafter referred to as SA Level) is displayed in Table 2.4-5.

The process leading up to the decision to adopt these specifications is detailed in Section 3.1.1.

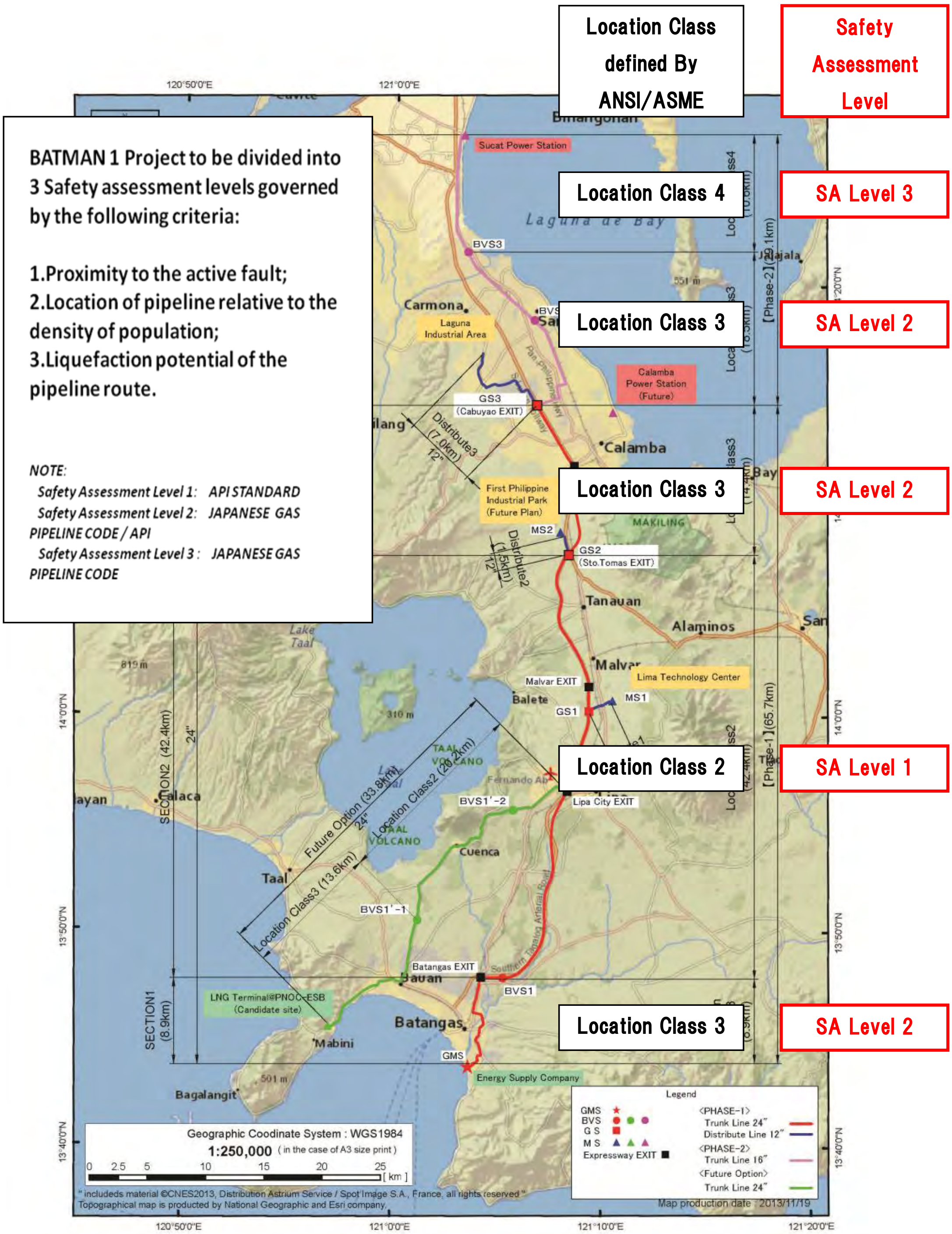

Figure 2.4-3 Applicable Standards by Area

Table 2.4-5 Setting of SA Level

・Many active faults ・Large liquefaction potential	Sa Level 3			
・No active faults ・Low liquefaction potential	Sa Level 2			
・No active faults ・No liquefaction potential	Sa Level 1			
	1	2	3	4
	Location Class			

c. Weld Standards

The acceptance criteria for the field girth welds for the Batman 1 are specified based on a., as shown in Table 2.4-6. As for the Visual Test (VT), either the JIS Standard or API Standard would be adoptable since both their details of assessment are the same, but the international API Standard will be applied to the Batman 1.

The JIS Standard will be applied to the Radiographic Test (RT) in order to prevent accidents in seismic areas and urban areas.

The correlation between the material specifications and the weld quality levels is shown in Table 2.4-7. The process leading up to the decision to adopt these specifications, difference of standard between API Standard and JIS Standard and difference of JIS Z 3104 between Class 2 and Class 3 is detailed in Section 3.1.1.

Table 2.4-6 Acceptance Criteria for Field Girth Welds by Area

	Safety Assessment		
	Level 1	Level 2	Level 3
VT	API1104	API1104	API1104
RT	API1104	JIS Z 3104	JIS Z 3104

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Table 2.4-7 Correlation between Material Specifications and Weld Quality Level

Material specifications	Material specifications to meet the seismic design of Japan	N.A	Sa Level 2 ※1 RT 100%	Sa Level 3 RT 100%
	As Per API	Sa Level 1 X-ray Test sampling	N.A	N.A
		As Per API	JIS 3104 Class3	JIS 3104 Class2
		Weld Quality Level		

※ 1: The quality level of such JIS3104 Class2 or more is desirable

(4) Setting of Diameter, Design Pressure and Supply Volume from Supply/Demand Predictions

The best specifications will be selected for the design pressure, diameter selection and supply volume, by collecting the information below and performing the transmission analysis:

- Delivery pressure from the LNG receiving terminals
- Minimum supply pressure and flow rate to each supply destination
- Composition of the natural gas
- Response to the networking of pipelines such as the Batman 2 in the future

1) Study Criteria

a. Pressure Loss Equation

The AGA formula, which is often used in the transmission calculations of high-pressure natural gas, has been applied to this design. The AGA formula is given below.

$$Q = 38.774 \times 10^{-6} \times \frac{Tb}{Pb} \times \left(\frac{P_1^2 - P_2^2 - (0.0375 \times G \times h \times P_m^{\ 2} / Z_m \times T_{abe})}{G \times L \times T_{ave} \times Z_m} \right)^{1/2} \times D^{2.5} \sqrt{\frac{1}{f}}$$

Where ;

Q	Flow Rate (MMCFD)
T_b	Temperature Base (°R)
P_b	Pressure Base (PSIA)
P_1	Inlet Pressure (PSIA)
P_2	Outlet Pressure (PSIA)
G	Gas Specific Gravity (dimensionless)
h	Vertical Drop (feet)
P_m	Average Gas Pressure (PSIA)
Z_m	Compressibility Factor (dimensionless)
T_{ave}	Average Gas Temperature (°R)
L	Pipe Length (mile)
D	Pipe Diameter (inch)
f	Friction Factor (dimensionless)

b. Target Lines

The pipelines and its extensions as the target of study are as follows:

- Trunk Line(form Batangas to Sucat Power Station) : 95 km
- Distribution Line (from GS1 to Lima Technology Center) : 2.2 km
- Distribution Line (from GS2 to First Philippine Industrial Park) (Future) : 1.5 km
- Distribution Line(from GS3 to Laguna Industrial Area) : 7.0 km

c. Gas Delivery Rate

The demand predictions from respective customers are shown in Table 2.4-8.

Table 2.4-8 Demand predictions (Table 1. Trend of Demand)

Customer Name		Lima Technology Center	First Philippine Industrial Park	Calamba Power Station	Laguna Industrial Area	Sucat Power Station	TOTAL
Demand (MNm^3/Year)	2018	46.5	52.5	39.5	86.5	79.0	304.0
	2023	134.0	139.0	776.0	126.0	158.0	1,333.0
	2028	273.5	203.5	815.5	165.5	237.0	1,695.0
	2033	385.7	290.7	1,575.7	227.7	1,058.3	3,538.0
	2038	455.7	360.7	1,595.7	247.7	1,098.3	3,758.0
	2043	518.7	423.7	1,608.7	260.7	1,822.3	4,634.0

In designing this transmission, as demand predictions in the above Table, flow rate per hour (Nm3/h) is newly established and gas delivery flow rates to respective customers are shown in Table 2.4-9.
In addition, considering the peak time in transmission, around 10% volume relative to the average value per hour is added to the predictions.

In considering diameters, the four cases for 2028, 2033, 2038 and 2043 in the above Table are considered as target of study.

Table 2.4-9 Maximum gas flow rate

Customer Name		Lima Technology Center	First Philippine Industrial Park	Calamba Power Station	Laguna Industrial Area	Sucat Power Station	TOTAL
Demand (Nm^3/h)	2018	6,000	7,000	6,000	12,000	11,000	42,000
	2023	18,000	18,000	100,000	17,000	21,000	174,000
	2028	36,000	27,000	105,000	22,000	31,000	221,000
	2033	50,000	38,000	203,000	30,000	137,000	458,000
	2038	59,000	47,000	206,000	32,000	142,000	486,000
	2043	67,000	55,000	208,000	34,000	235,000	599,000

d. Arrival Pressure

The arrival pressure at the final point of each line is set at 2.0 MPa or more for this basic design, since the supply pressure of natural gas CCGT (Combined Cycle Gas Turbine) is 1.5 MPa.

e. Flow Velocity

The flow velocity of gas for the high-pressure pipeline is set at 20 m/s or less.
The calculation for the transmission pipeline will be over 35 m/s at the maximum. However, it is left out of consideration since the calculation is for one transmission pipeline, although the gas may be transported to some industrial parks in the future.

f. Gas Specific Gravity

The gas specific gravity is set at 0.65.

2) Study Results

The study results are detailed in Attachment to this report.

a. Diameter

Based on the trial calculation on each diameter from 16 inch, 24 inch is selected for the route between Batangas and Cabuyao (GS3), and 16 inch is for the route between Cabuyao (GS3) and Sucat. The result of the flow analysis is shown in the figure below.

The result of the flow analysis relative to the supply and demand in 2028 and 2038 are shown below.

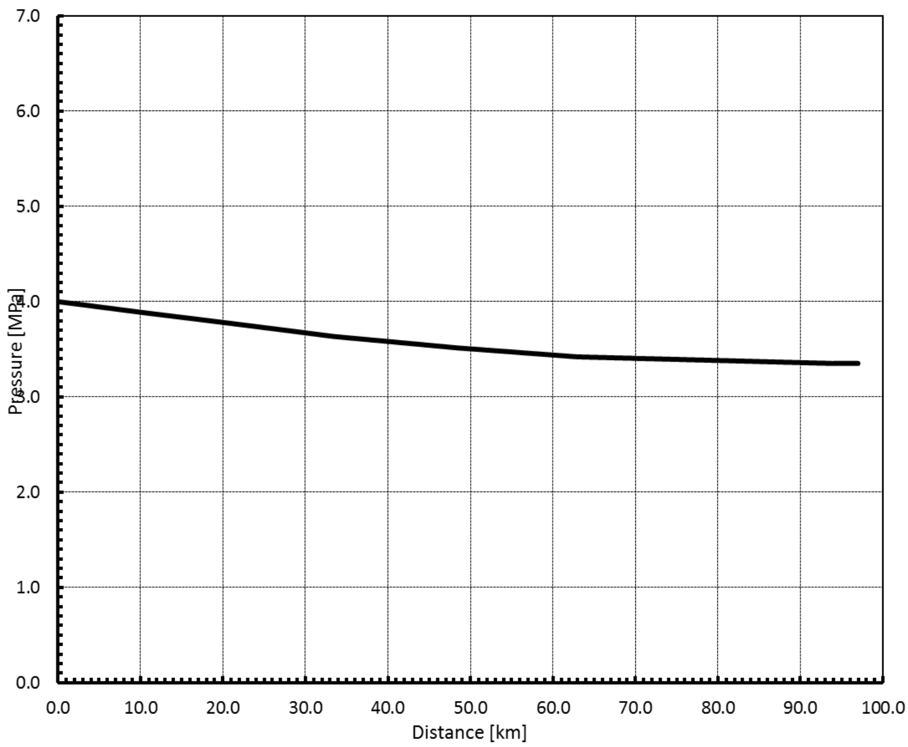


Figure 2.4-4 Flow analysis result in 2028

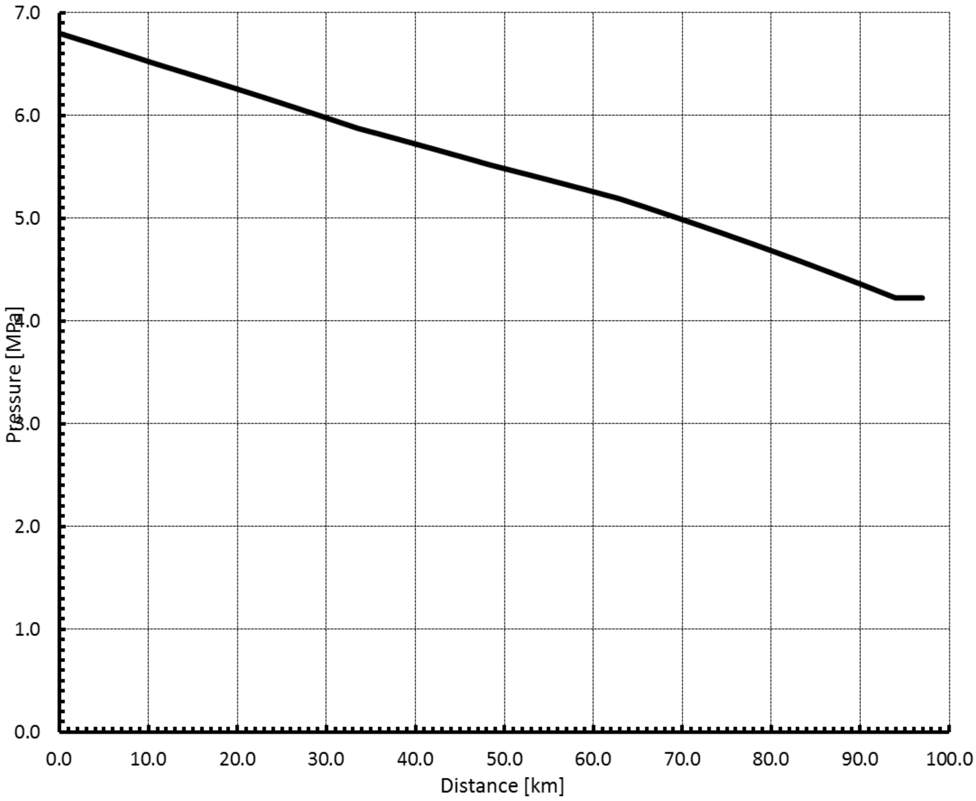


Figure 2.4-5 Flow analysis result in 2033

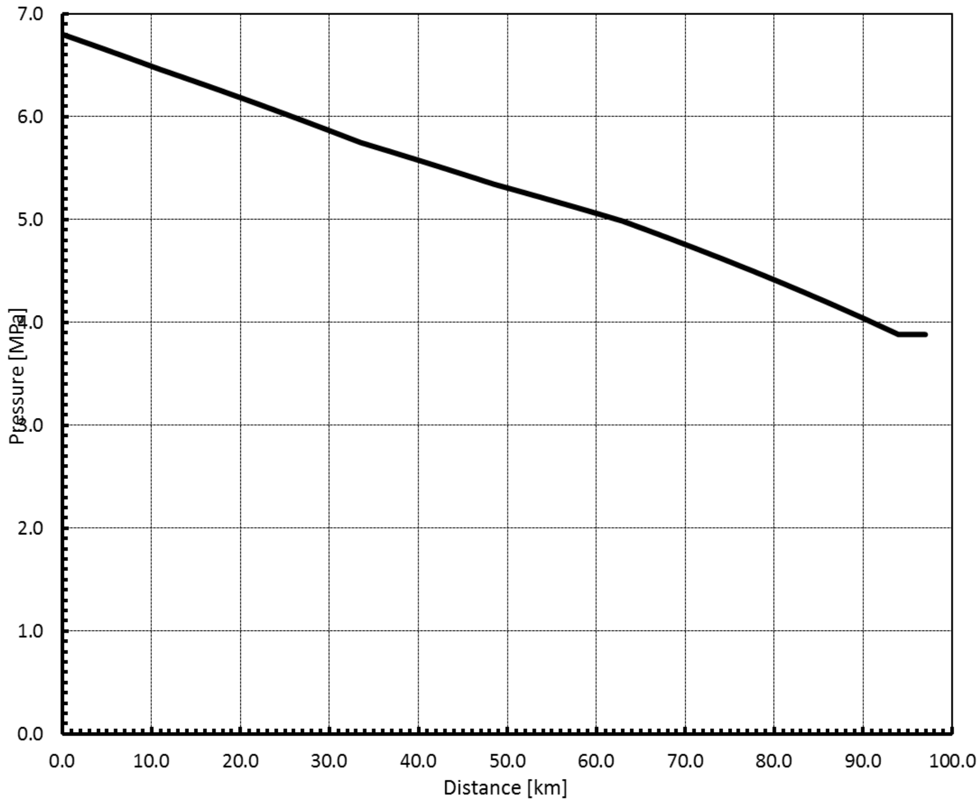


Figure 2.4-6 Flow analysis result in 2038

The diameter for each section is selected as follows:

- Trunk Line (form Batangas to Sucat Power Station)
  - from Batangas to GS3 : 24”
  - from GS3 to Sucat Power Station : 16”
- Distribution Line (from GS1 to Lima Technology Center) : 12”
- Distribution Line (from GS2 to First Philippine Industrial Park) : 12”
- Distribution Line (from GS3 to Laguna Industrial Area) : 12”

The result of the flow analysis relative to the supply and demand in 2043 is shown below. As shown in the below chart, the gas has not reached the final point (Sucat Power Station).
This result is caused by growth in gas demand, as Sucat Power Station is predicted to generate 350 MW of electricity until 2038 and 700 MW in 2043 and later.

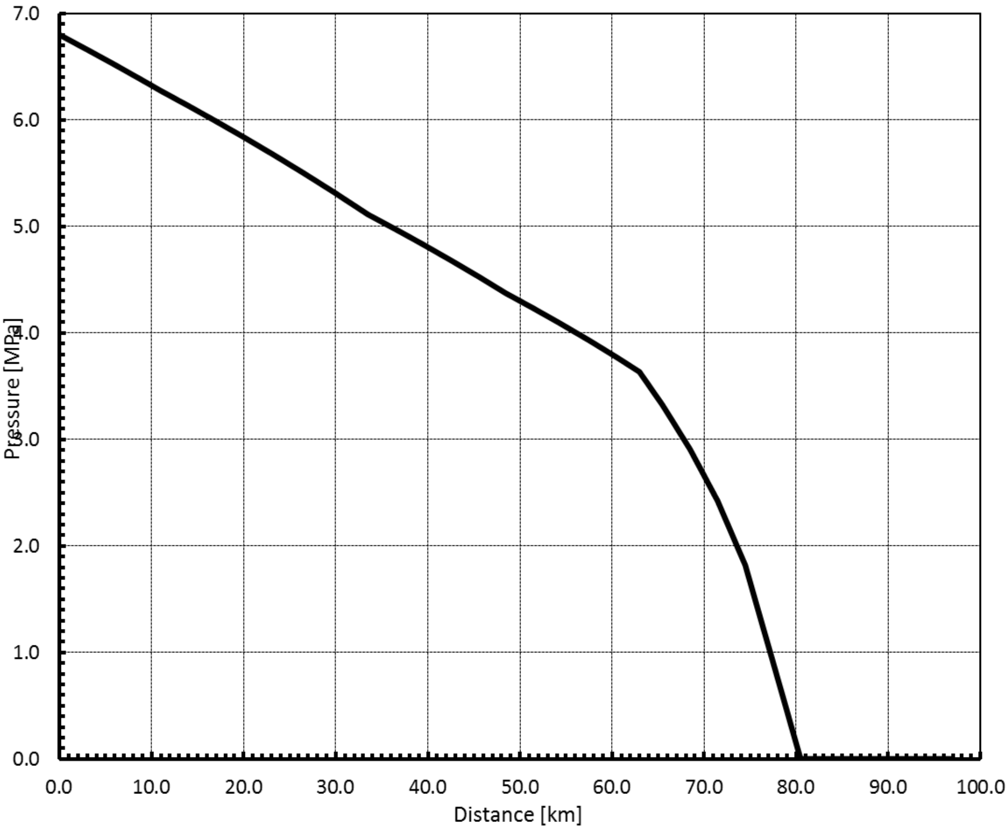


Figure 2.4-7 Flow analysis result in 2043

If Sucat Power Station is expected to generate 700 MW of electricity in the future, the diameter from GS3 to Sucat Power Station should not be 16”, but 24” which is the same diameter as that from Batangas to Sucat Power Station.
Given a decrease in capital investment, review results, based on demand predictions including electric power output in Sucat Power Station for 2048, should be considered as a future study item.

For reference, if all the diameters for all Trunk Lines are set at 24”, the result of the flow analysis is shown below.

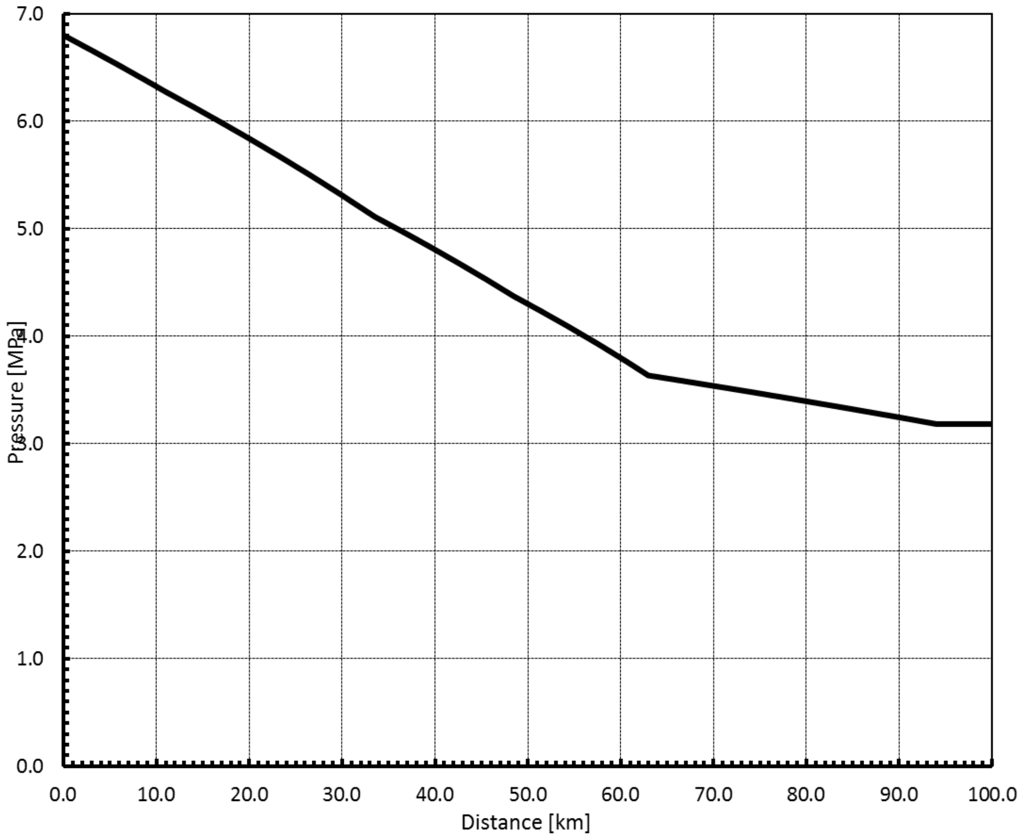


Figure 2.4-8 Flow analysis result in 2043 (2): 24” diameters for all Trunk Lines

b. Delivery Pressure

The delivery pressure of 4.0 MPa from the starting point until 2028 will be possible by selecting the aforementioned diameters. However, it will be necessary to increase the delivery pressure from the starting point up to 6.8 MPa in order to deliver the estimated demand volume for 2033.

The inlet pressure of each Distribution Line will be 2.0 MPa. Therefore, the gas will be supplied to each Distribution Line by decreasing the pressure to 2.0 MPa with pressure regulators installed in GS1, GS2 and GS3, which will function as branch points for each Distribution Line. These results are summarized as follows:

- Trunk Line (form Batangas to Sucat Power Station)
  - from 2018 to 2033 : 4.0 MPa
  - from 2038 : 6.8 MPa
- Distribution Line (from GS1 to Lima Technology Center) : 2.0 MPa
- Distribution Line (from GS2 to First Philippine Industrial Park) : 2.0 MPa
- Distribution Line (from GS3 to Laguna Industrial Area) : 2.0 MPa

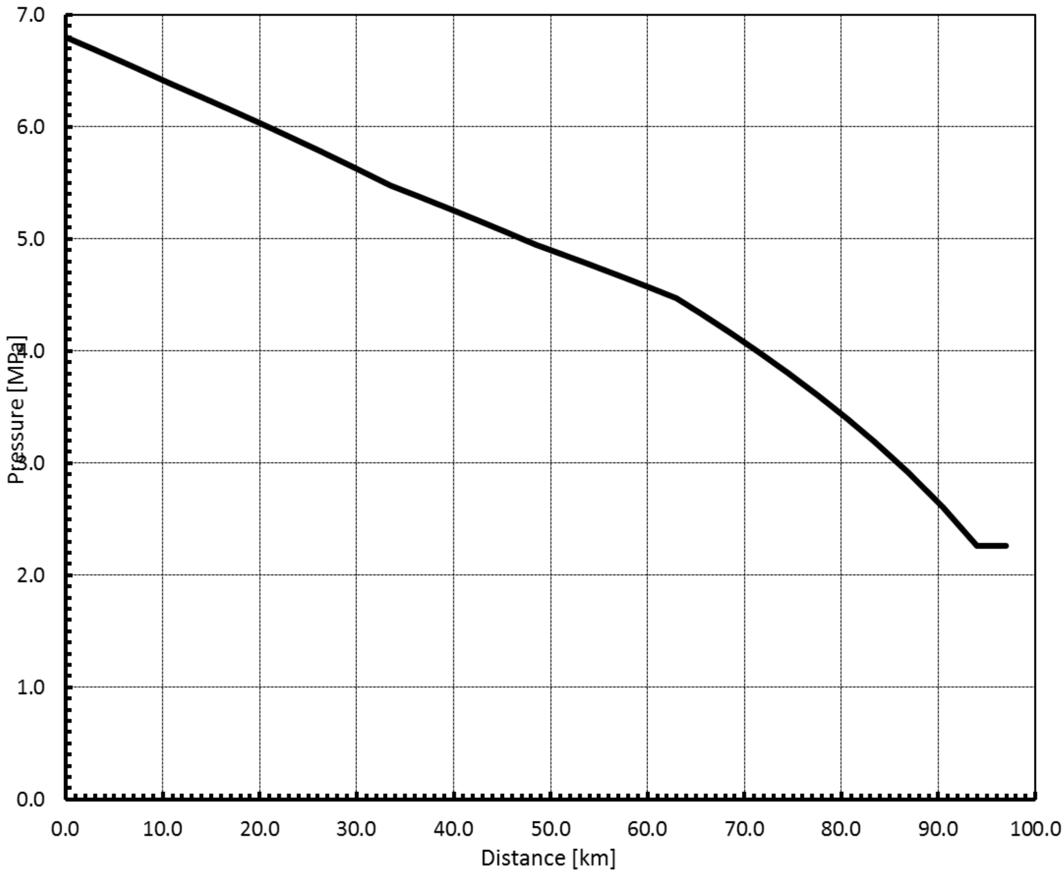
In addition, if the diameter for the route from Batangas up to Cabuyao (GS3) is set at 16”, it will be possible to supply the estimated demand volume until 2028, but it will not be possible to supply after this.

Furthermore, even if the diameter within the applicable range is set at 16”, the construction costs will be reduced only to around two-thirds of the 24” diameter. So it is preferable to select 24” in consideration of the demand volume in the future.

c. Design Pressure
Taking into consideration the aforementioned delivery pressure, the design pressure is set as follows:

- Trunk Line (form Batangas to Sucat Power Station) : 7.0 MPa
- Distribution Line (from GS1 to Lima Technology Center) : 2.0 MPa
- Distribution Line (from GS2 to First Philippine Industrial Park) : 2.0 MPa
- Distribution Line (from GS3 to Laguna Industrial Area) : 2.0 MPa

d. Maximum Possible Gas Transmission Volume
If the diameter for the route from GS3 up to Sucat is set at 16", the maximum flow rate against the expected demand volume in 2043 is 539,000 Nm3/h in total, which is obtained by subtracting 60,000 Nm3/h from the demand volume in Sucat Power Station.



Lima Technology Center	:	66,000 Nm3/h (Based on 2043 level)
First Philippine Industrial Park	:	54,000 Nm3/h (Based on 2043 level)
Calamba Power Station	:	203,000 Nm3/h (Based on 2043 level)
Laguna Industrial Area	:	33,000 Nm3/h (Based on 2043 level)
Sucat Power Station	:	179,000 Nm3/h (229,000Nm3/h – 50,000Nm3/h)

Figure 2.4-9 Maximum possible gas transmission volume

Meanwhile, in order to satisfy 700MW of electric power output expected in Sucat Power Station, if the diameter from GS3 up to Sucat is set at 24", it is possible to supply 635,000 Nm3/h.

(5) Study of Construction Specifications
1) High-pressure Trunk Pipeline Joining (Quality Standards for Field Welded Parts)
The quality of the field girth welds of the pipeline is particularly important. As for the welding method

and inspection standards, the welding methods and quality standards are defined by Location Class and SA Level as follows:

a. [Seismic Areas]SA Level 2, 3 (Location Class 3, 4)
The welding method for the seismic design areas will be the fully automatic welding (MAG welding), which has proven performances in high-pressure trunk lines in Japan. As for the welding materials, the JIS materials manufactured according to Japanese standards will be used. The acceptance criteria for the radioactive permeability test on the field welded parts will apply the judgment based on the aforementioned JIS Standard, and the total inspection will be executed. In this case, the air-tightness test is to be applied.

b. [Non-Seismic Areas]SA Level 1 (Location Class 2)
Shielded metal arc welding will be applied as the welding method for the non-seismic areas.
The acceptance criteria for the radioactive permeability test will apply the judgment based on the API Standard, and the sampling rate is to be 15% or more. When the radioactive permeability test is executed by the sampling inspection, the air-tightness test is to be applied.

2) Installation Depth and Protective Measures

The guidelines for installation depth of pipeline are stipulated by ANSI. Table 2.4-10 shows the guidelines for the earth covering depth by ANSI/ASME B 31.8.

Table 2.4-10 Guidelines for Installation Depth of Buried Pipeline

Location		Cover Depth (inch)		
		Normal area	Rock area	
			Pipe OD Less 20”	Pipe OD Over 20”
Class 1	Any 1 mile section that has 10 or fewer buildings intended for human occupancy. A Location Class 1 is intended to reflect areas such as wasteland, deserts, mountains, grazing land, farmland, and sparsely populated areas.	24	12	18
Class 2	Any 1 mile section that has more than 10 but fewer than 46 buildings intended for human occupancy. A Location Class 2 is intended to reflect areas where the degree of population is intermediate between Location Class 1 and Location Class 3 such as fringe areas around cities and towns, industrial areas, ranch or country estates, etc.	30	18	18
Class 3	Any 1 mile section that has 46 or more buildings intended for human occupancy except when a Location Class 4 prevails. A Location Class 3 is intended to reflect areas such suburban housing developments, shopping centers, residential areas, industrial areas, and other populated areas not meeting Location Class 4 requirements.	30	24	24
Class 4	Where multistory buildings are prevalent, and where traffic is heavy or dense and where there may be numerous other utilities underground. Multistory means 4 or more floors above ground including the first or ground floor.			
Public road and Railway Crossing for all class location		36	24	24

The installation depths are specified as shown in Table 2.4-11 after conducting a field survey and interviewing with the road operators, based on the above guidelines. Furthermore, the minimum installation depth for the expressway ROW is set at1.2m, since it is difficult to identify the future widening plans and clearing status at the present moment.
Moreover, protective iron plates will be installed in the areas other than the highway ROW in order to avoid risk of damage to the pipeline by other construction since the pipeline will be installed in or near urban areas.
Since double-track construction works and other buried facility construction are being planned along the PNR line scheduled in the future, protective iron plates will be installed the same with the urban areas.

Table 2.4-11 Setting of the Installation Depth of Buried Pipeline

Part	Trunk Line			Distribution Line		
Section	Section1	Section2	Section3	Distribution 1	Distribution 2	Distribution 3
Location Class	3	2	3	3	3	3
Depth (m)	1.2	1.2	1.2	1.2	1.2	1.2
Protective plate	Need	None	None	Need	Need	Need

3) Backfilling Specifications

The typical excavation cross-section for the general underground section and the backfilling specifications are shown below.
The standard installation depths have been specified as mentioned above. Nonetheless, the excavation depths need to be determined at the detailed design stage considering the result of consultations with road operators and separation from other underground facilities.
Backfilling will also be determined in accordance with the instructions of the road operators. Still, backfilling with high-quality sand is implemented for 30 cm from the lower roadbed to the top of the underground pipes. Additionally, protective iron plates will be laid on top of the backfill sand in the roads other than the highway ROW.
Basically, backfilling with excavated soil (soil generated by construction) will be applied from the surface of the protective plates to the roadbed; backfilling for the lower roadbed and upper roadbed will be based on the structure of each road (instructions from the road operators).
When backfilling, sufficient rolling compaction must be conducted in order to avoid subsidence of the roads.

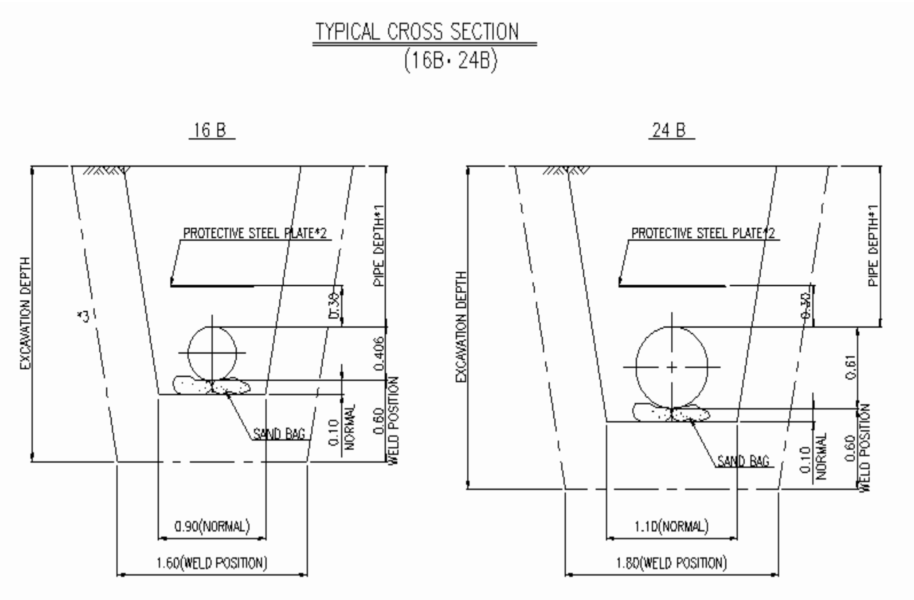


Figure 2.4-10 Typical Excavation Cross Section

(6) Station Facilities

1) Role of Each Facility

Each different station will be installed to the pipeline for the purpose of measurement, maintenance and operation; and emergency response individually.
The following shows the roles and functions of each facility:

a. Block Valve Station (BVS)

BVSs will be installed at the middle point of the pipeline network for the maintenance and operation of the gas pipeline.
Emergency shut-off valves will be installed in the BVSs as pipeline isolation device as well as release devices for the pipeline (release valves and release towers).
Center Station with the pipeline central controlling system will monitor and measure the pipeline pressure and open/close status of the valves in the BVSs for 24 hours, and also be able to remotely control the emergency shut-off valve from there.

b. Governor Station (GS)

The design pressure for the Trunk Line is set at 7.0MPaG in order to increase the gas transportation capacity, while GSs will be installed to lower the pressure (depressure) of the operating pressure of the Distribute Lines.
Self-actuated pressure regulating valves (governor), which utilize the lowered pressure as the source of its driving force, and two governor systems will be installed in preparation for continuous supply during a breakdown or during periodic inspections. Moreover, filters to remove dust in the pipeline and heating devices in preparation for temperature drops during depressuring will be installed so that the governor systems are able to run normally.
Center Station with the pipeline central controlling system will be able to monitor and measure the pipeline pressure and operating conditions of each device in the GSs for 24 hours.

c. Metering Station (MS)

MSs will be installed in each branch point and near custody transfer points with customers in order to identify the delivery situations of the pipeline and the supply situations to customers.
Flow meters will be installed in the MSs, and filters will be installed to remove dust in the pipeline for the smooth maintenance and operation of the flow meters as well.
Center Station with the pipeline central controlling system will be able to monitor and measure the flow volume of the pipeline in the MSs for 24 hours.

d. Governor Metering Station (GMS): Station located at the starting point

GMSs will be installed near the custody transfer points with the Supply Company.
Flow meters will be installed in the GMSs in order to measure the gas flow rate from the Supply Company, and the two flow meters will be installed in series in order to identify measurement errors and accuracy of the flow rate reading. Moreover, some devices (gas chromatographs and calorimeters) for measuring the gas composition and calories for transactions with the Supply Company will be installed as well.
Furthermore, GS-function facilities for lowering the pressure of the supply gas to the working pressure of the pipeline are used. Launcher equipment for running the inspection pigs necessary for the maintenance and operation of the pipeline will be installed in the GS as a function of the station located at the starting point.
Center Station with the pipeline central controlling system will be able to monitor and measure each measurement value and operating conditions of each device in the GMSs for 24 hours.

2) Process Flow Diagram

The process flow diagram for Phase-1 is shown in Figure 2.4-11. Those for Phase-2 and Future Option Route are shown in Attachment to this report.

3) Typical Plot Plan

The typical plot plans for each station for Phase-1 are shown in from Figure 2.4-12 to Figure 2.4-16. Those for the Metering Stations (MSs) to be installed in the Sucat Power Station for Phase-2 are shown in Attachment to this report.

- Block Valve Station（BVS1）
- Governor Station（GS1,GS2）
- Governor Station with PIG Launcher/Receiver Line（GS3）
- Governor & Metering Station with PIG Launcher Line（GMS）
- Metering Station （MS1,MS2）

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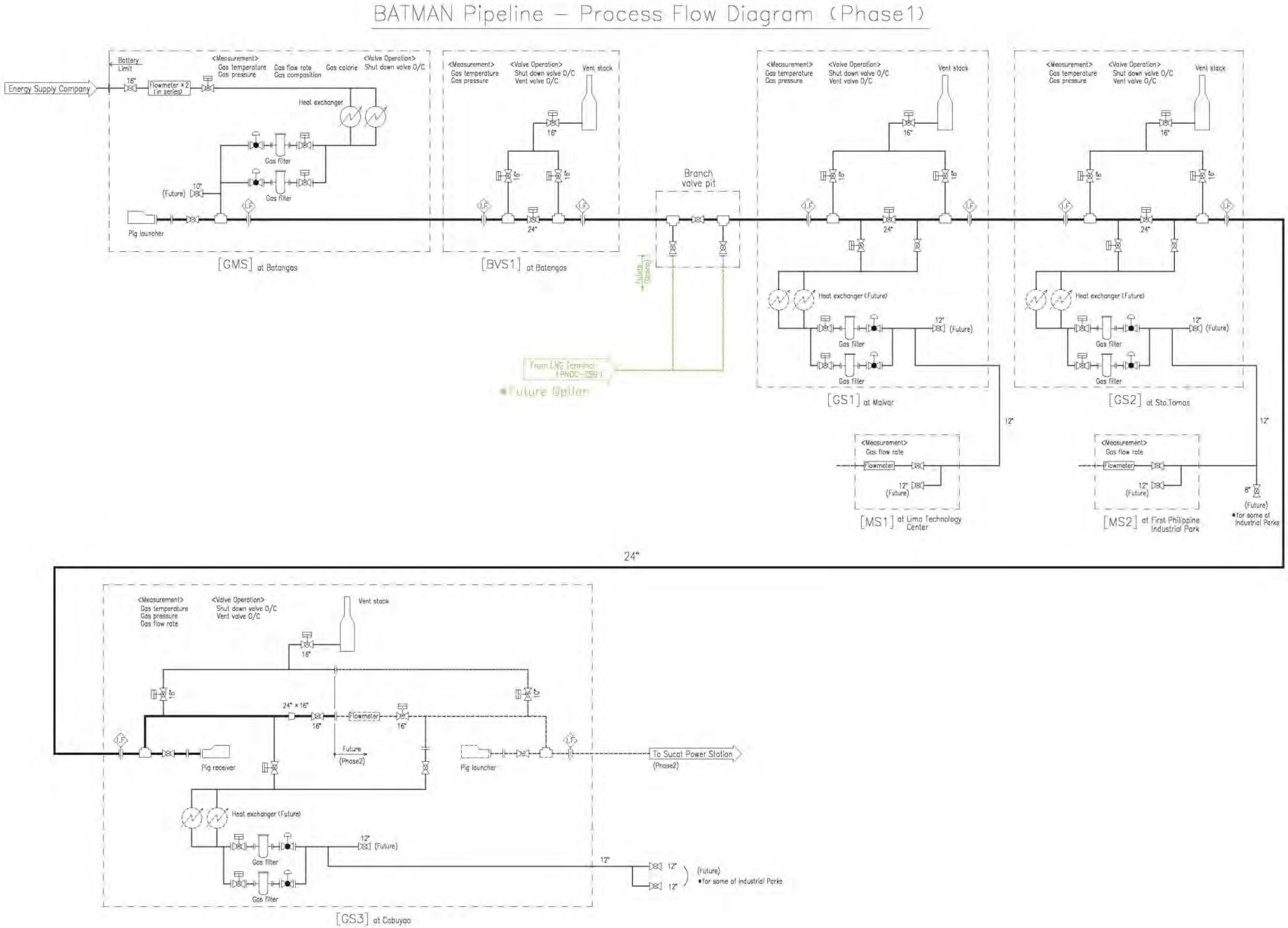

Figure 2.4-11 Process Flow Diagram「Phase1」

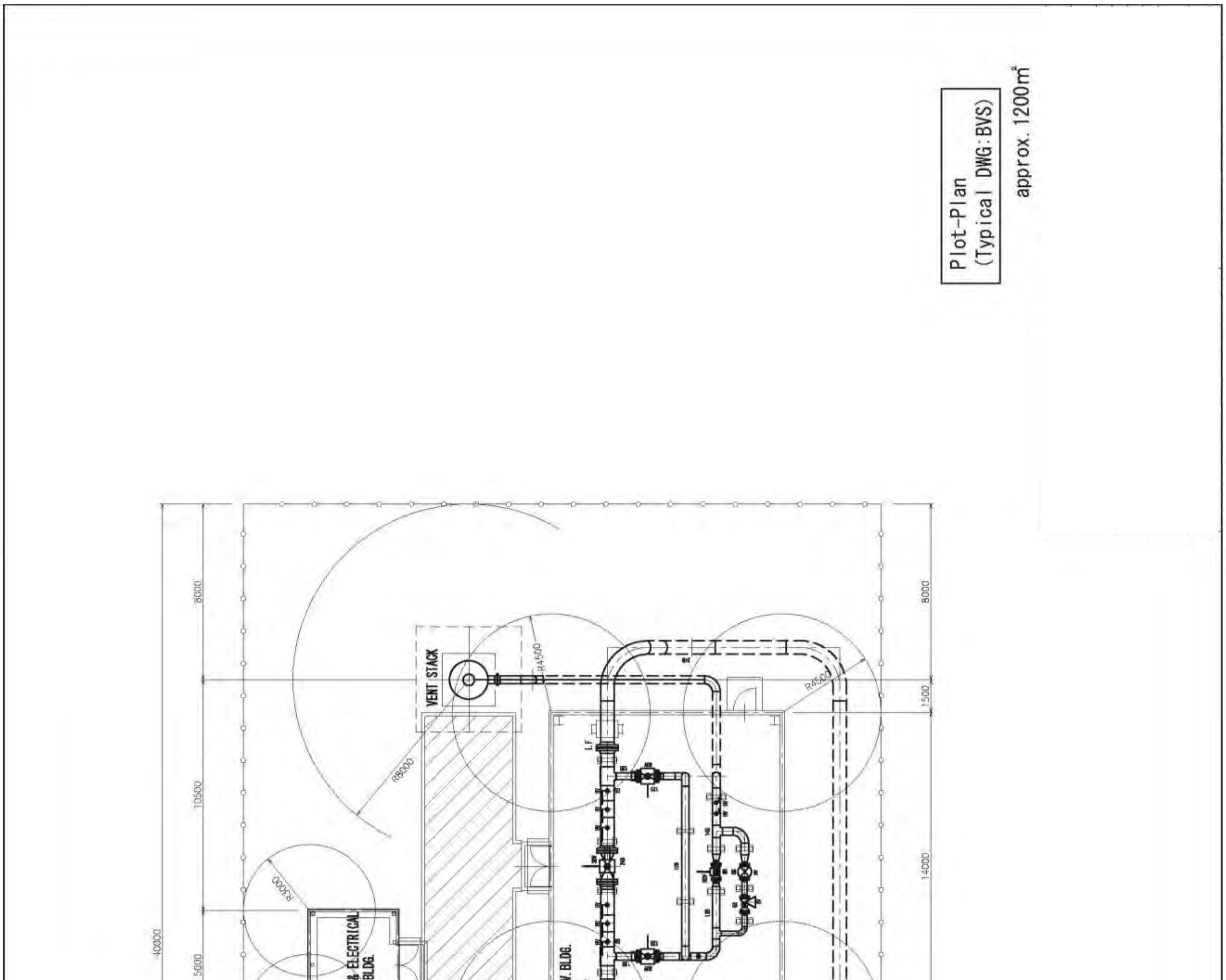

Figure 2.4-12 Typical Drawing of Block Valve Station(BVS1)「Phase1」

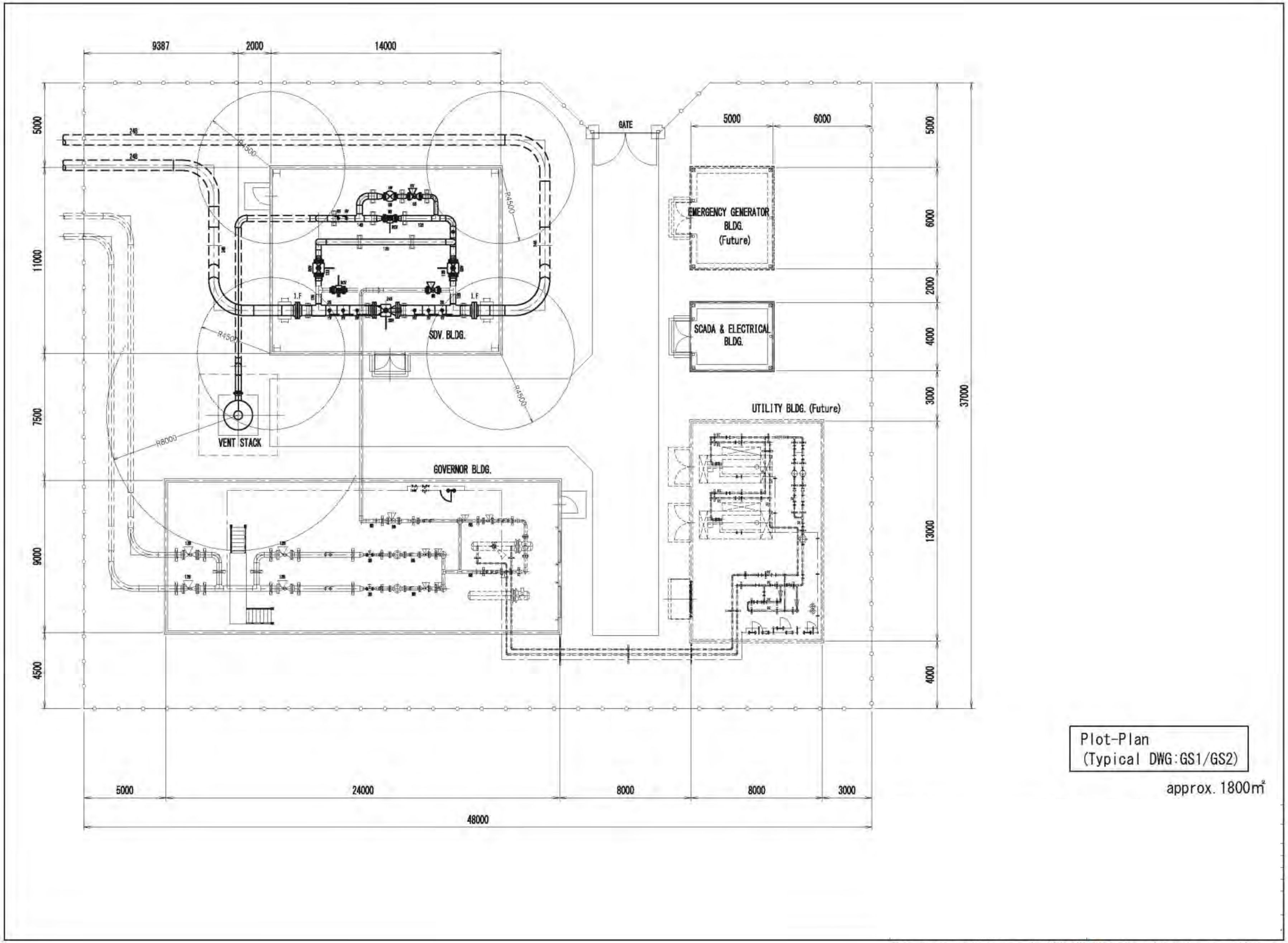

Figure 2.4-13 Typical Drawing of Governor Station(GS1,GS2) 「Phase1」

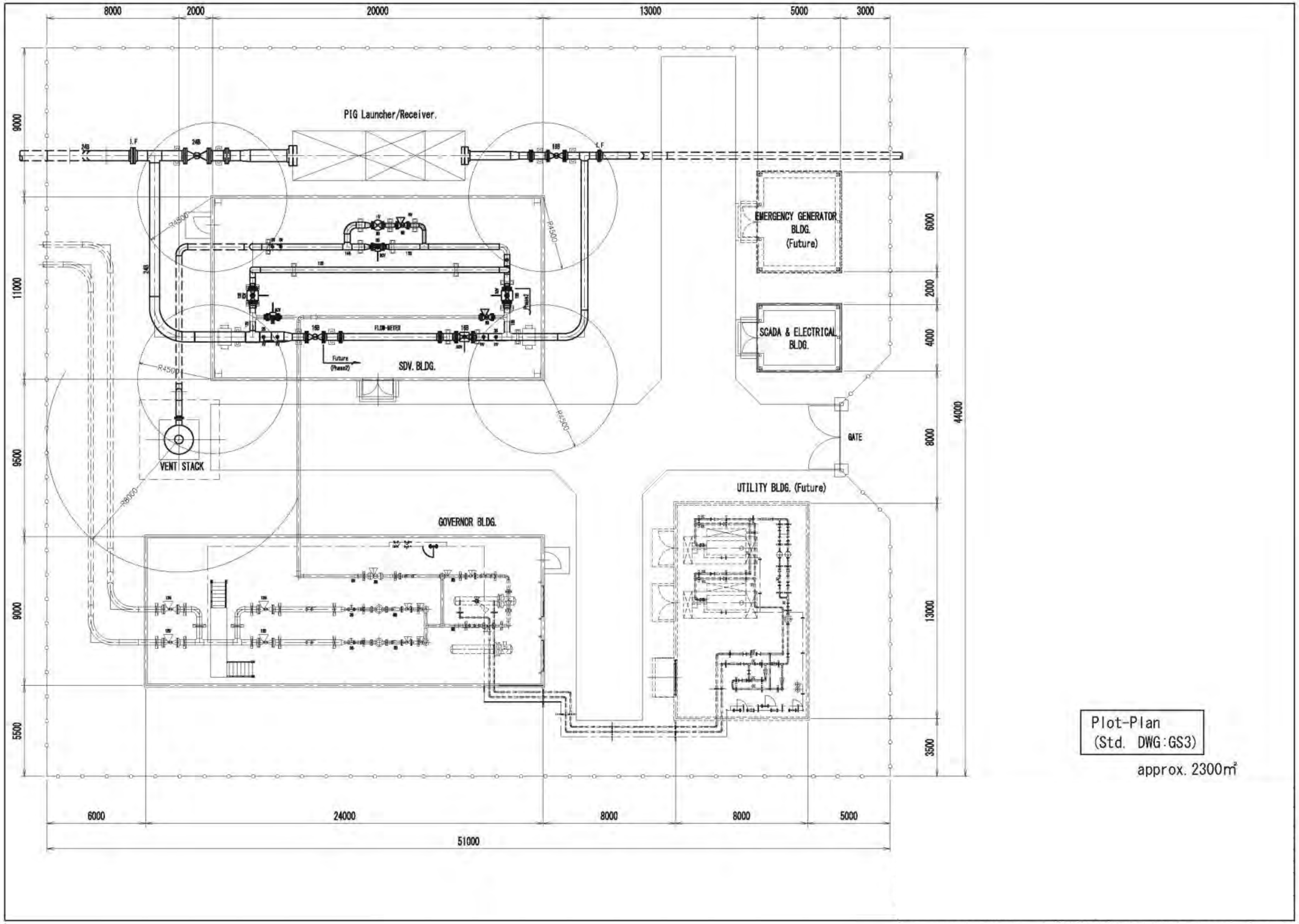

Figure 2.4-14 Typical Drawing of Governor Station with PIG Launcher/Receiver Line (GS3)「Phase1」

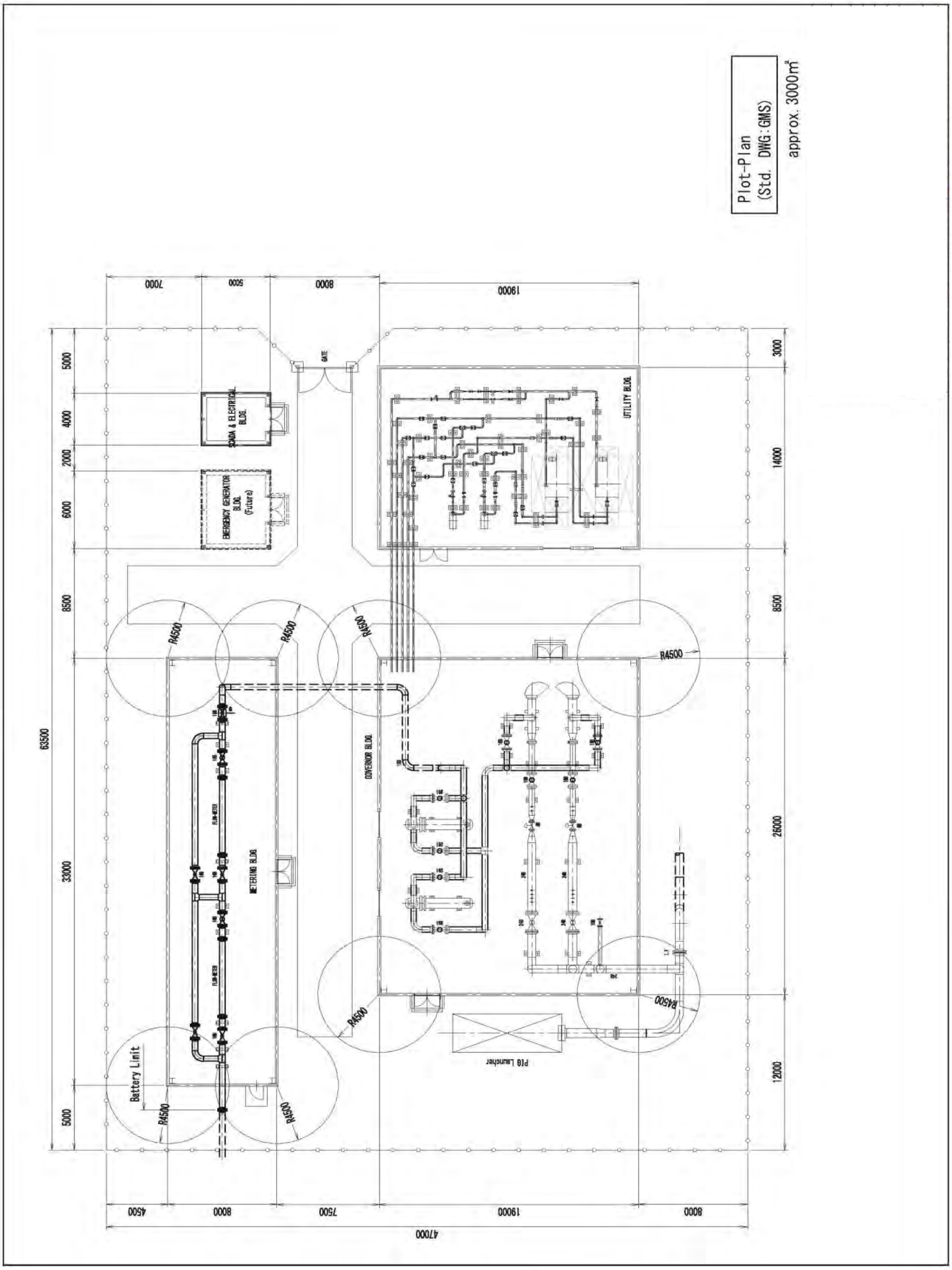

Figure 2.4-15 Typical Drawing of Governor & Metering Station with PIG Launcher Line (GMS)「Phase1」

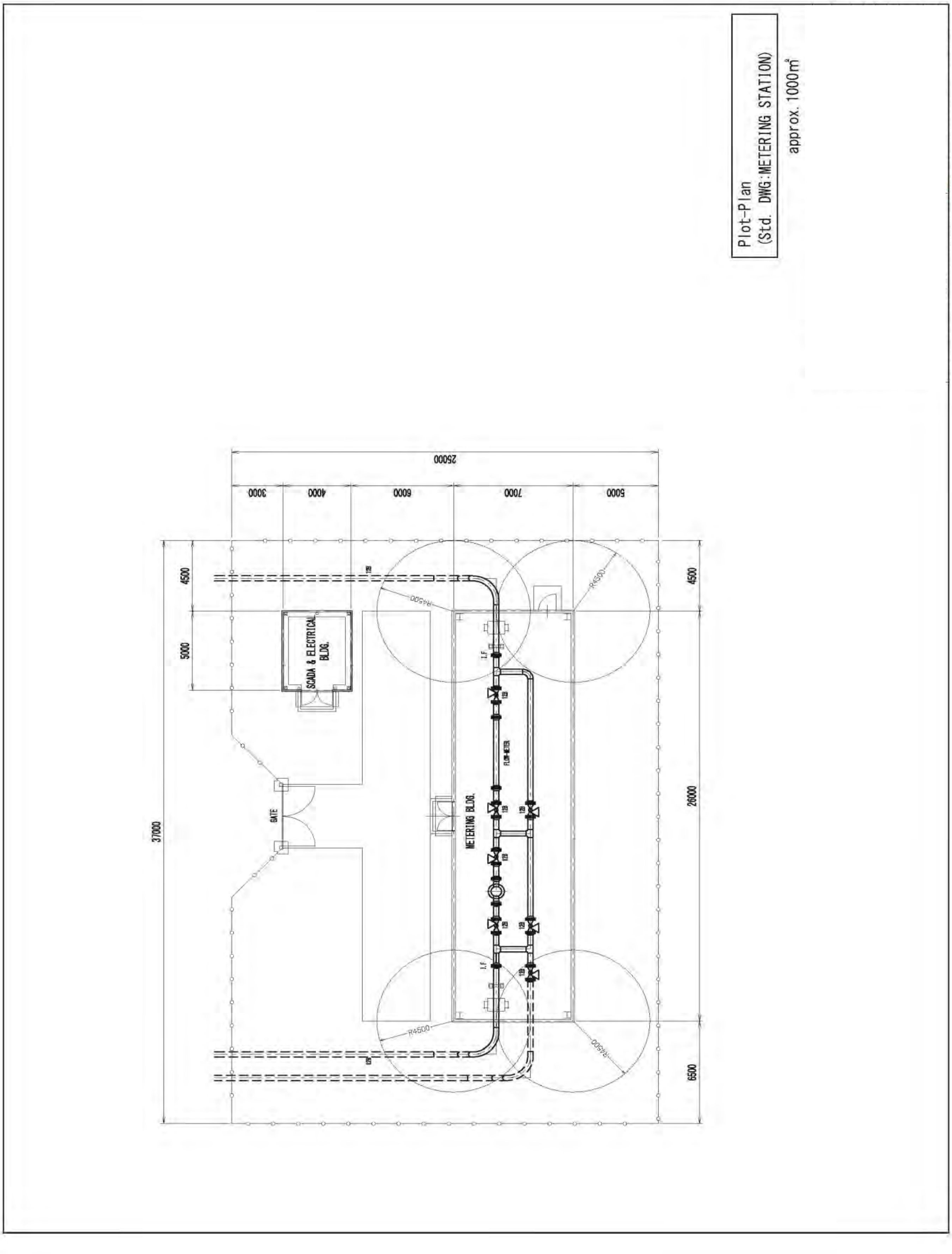

Figure 2.4-16 Typical Drawing of Metering Station (MS1,MS2)「Phase1」

The buildings and steel towers in the stations must be constructed considering the follwing:

- A top light structure is to be applied only on the roofs of the buildings. The designs for the buildings is to comply with the Philippine construction standards. Typhoon resistance measures must be also applied including prevention of roof material separation (such as diminution of the intervals between steel frames for groundwork).
- the National Structural Code of the Philippines (NSCP) 2010 in the Philippines is to be applied to the design standards for steel towers and others. This project area belongs to ZONE II (v=200 km/h). However, given that the revison of the standards is currently under consideration taking into account the typhoon damages occuring this time, the reference wind speed of 250 km/h, equivalent to the Visayas level of the current standards, is proposed for this area ahead of the revision.

(7) SCADA System

1) SCADA System

SCADA is an abbreviation for Supervisory Control and Data Acquisition, a system for monitoring and controlling, and is usually composed of the following main items:

a. Master Terminal Unit (MTU)

MTU is installed in the Monitoring and Controlling Station (Central Station). This is a device as the core of the SCADA System. The MTU collects data from the remote terminal unit (RTU) and then sends commands to the RTU.

b. Human Machine Interface (HMI)

HMI is installed in the Monitoring and Controlling Station together with the MTU. This is a device, which displays the data of the target system to the operator in order to enable the operator to monitor and control the system.

c. Remote Terminal Unit (RTU)

RTU is a device connected to the sensors installed in the Remote Stations, and sends the sensor signals and various status data to the MTU in the Central Station. Also, it functions as a controller of external devices through commands from the MTU.

d. Communication Medium

The communication medium connects the Monitoring and Controlling Stations with the Remote Stations. As for the types of communication networks and communication methods, there are various methods utilizing wire systems for exclusive use, wireless networks, public communication networks and mobile telephone networks, as well as satellite communication networks.

2) System Overview for Batman

a. SCADA: Monitoring and Controlling System

Figure 2.4-17 shows the basic overview of SCADA.

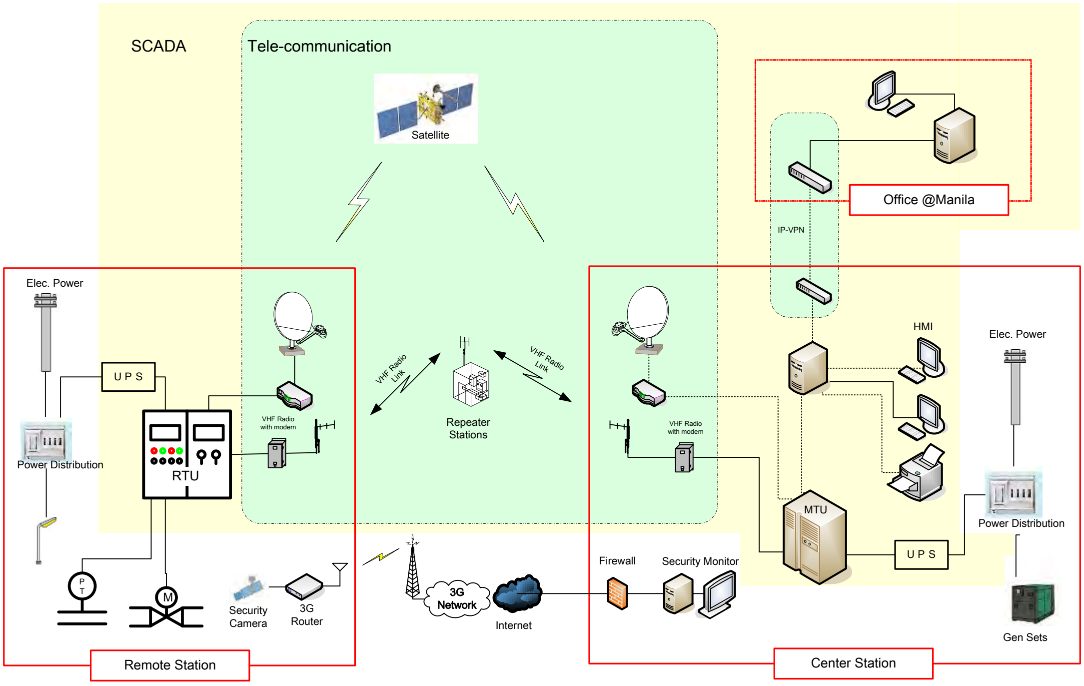

Figure 2.4-17 SCADA Overview

b. Monitoring and Controlling

The SCADA System in the gas pipeline facilities transmits the data necessary for the operation and maintenance of the facilities via the communication medium, and remotely monitors and controls the pipeline through the Monitoring and Controlling Station in order to ensure the safe and efficient operation of the pipeline.

For the monitoring and controlling, the system transmits the following data from each station (GMSs, BVSs, GSs and MSs).

- Gas flow volume
- Gas pressure
- Gas temperature
- Protection current of the external power supply

In an emergency, such as gas leakage in the pipeline, it is possible to open/ shut the shut-off valves and release valves through remote control. Figure 2.4-18 shows the overall image of this system.

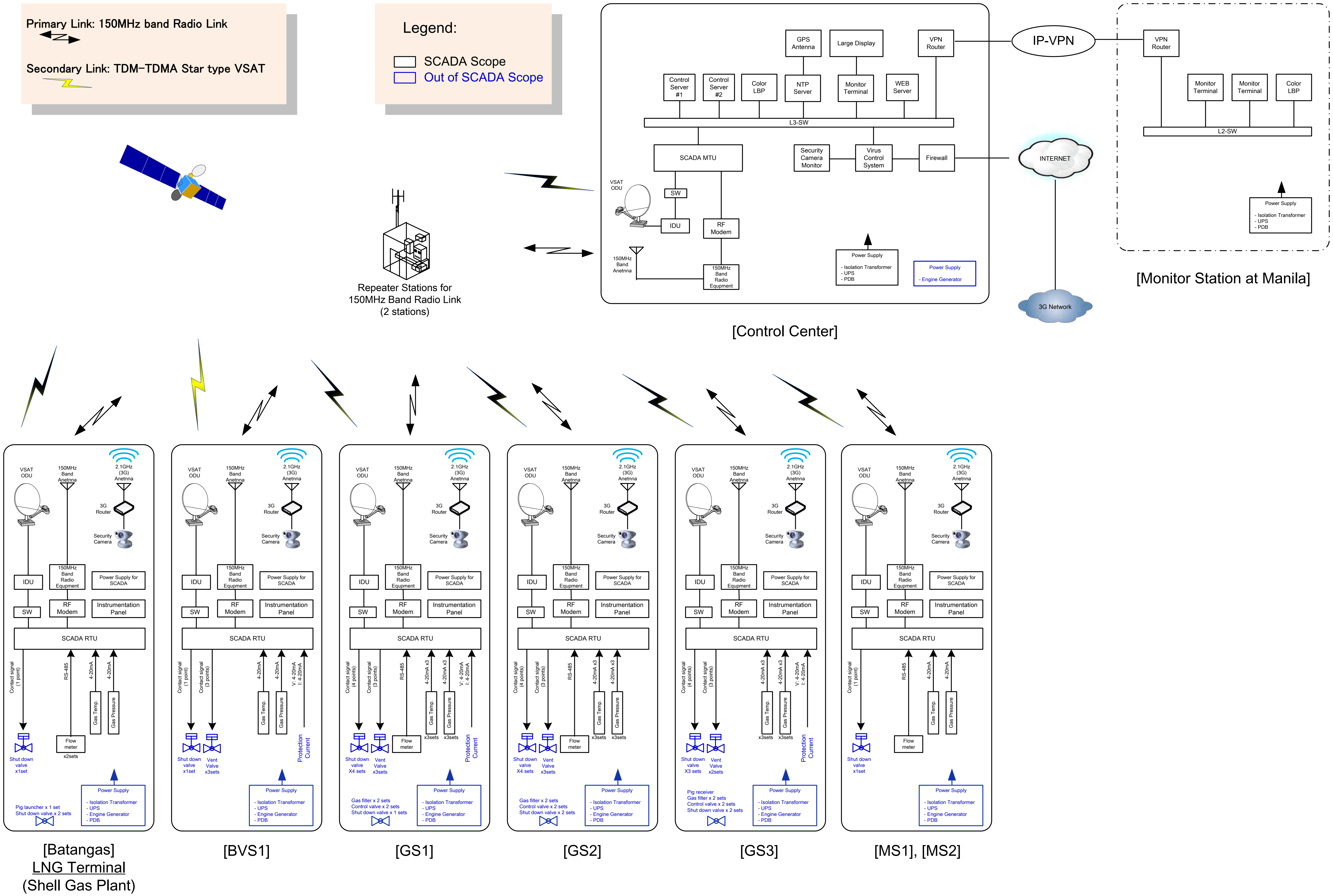

Figure 2.4-18 Overall Image of SCADA System

3) Communication Line

As for the types of communication networks and methods, there are a variety of methods, such as utilization of wire systems for exclusive use, wireless networks, public communication networks and mobile telephone networks, as well as satellite communication networks. As a result of the study on the communication environment and operating conditions in terms of the transmission information amount, transmission rate, reliability of transmission, operating environment, feasibility and economic efficiency, the use of the VHF wireless network for the main line and the VSAT satellite network for the sub-line are judged appropriate.

a. Comparison of Communication Networks

The result of the comparative study of communication networks is shown as follows:

Table 2.4-12 Comparison of Communication Networks

CASE		A1	A2	A3	A4	A5
Single / Double		Single	Single	Single	Double	Double
Double	Main	Fiber optic link	Satellite link	Radio link	Radio link	Satellite link
	Backup	-	-	-	Satellite link	Radio link
Cost		(Extremely expensive)	(Average)	(Inexpensive)	(Average)	(Average)
Advantages		-High speed communications are possible - It is also possible to connect cameras	- Relatively high-speed monitoring and control is possible	- Highly reliable with a private line	- With duplication through the easy satellite network in addition to the highly reliable VHF network, it is possible to ensure even greater reliability - By making the main network a highly reliable VHF network, the control sequence is made simple	- It is possible to ensure even greater reliability by duplication of networks - The time for data collection becomes quicker at the time of the establishment of the satellite network
Disadvantages		- High initial costs - High maintenance costs	- Interruption to communications during rain etc. - There are operating costs	- Low-speed communications rate - If a VHF Central Station is necessary, land acquisition is necessary	- If a VHF Central Station is necessary, land acquisition is necessary - There are operating costs	- If a VHF Central Station is necessary, land acquisition is necessary - There are operating costs - There is a possibility of an interruption to communications during rain etc., so it is necessary to consider line interruptions in control; this leads to a more complicated sequence
Judgment		×	△	△	◎	○

b. VHF Wireless Network

The basic specifications for the VHF wireless network, which will be the main network for the Batman 1 have been specified as shown below in consideration of the basic requirements for the SCADA system and specifications for the duplexed backup network:

- Basic specifications for the VHF wireless network
  Frequency band: 150 MHz
  Transmission output: 1W/10W
  Transmission rate: 1200 bps

The effectiveness of the VHF wireless network is examined including the basic plan and its extension plan, as well as Future Option Route. When the basic plan (from Batangas to Cabuyao) is adopted, it will be necessary to construct two relay stations in the middle of the route. Furthermore, when the gas pipe extension plan (to Sucat) or Future Option Route (from PNOC-ESB) is adopted, one additional cross-relay station at each route must be constructed.

c. VSAT Satellite Network

The basic specifications for the VSAT satellite network, which will be the backup network for this project, have been specified as shown below in consideration of the basic requirements for the SCADA system and specifications for the duplexed backup network:

- Basic specifications for the VSAT satellite network

Multiplex system	: TDM
Multiple access	: TDMA
Topology	: Gatewaysuta-Star Type
TDM CH transmission rate	: 32 kbps
TDMA CH transmission rate	: 32kbps

Figure 2.4-19 shows the network connection diagram for this pipeline.

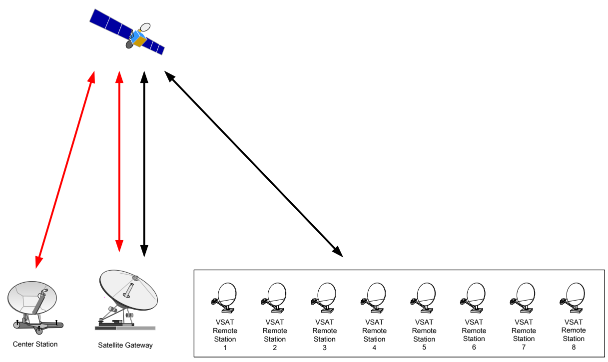

Figure 2.4-19 VSAT Network Connection Diagram

d. Security

This pipeline is a principal infrastructure, and the stable and continuous supply of gas will be required. Considering that each station is exposed above ground, it will be necessary to take countermeasures against theft and mischief, and at the same time, to organize a rapid report system in the event of an emergency. As for the security, the installation of camera surveillance system and deployment of security guards who can respond for 24 hours are determined based on the following comparative study.

Table 2.4-13 Comparison Table for Security Measures

CASE		B1	B2	B3	B4
Security	Camera surveillance	Yes	Yes	No	No
	Security guards	Yes	No	Yes	No
Cost		△	○	○	×
Advantages		- Safest measures	- Possible to expect there to be an anti-theft effect Possible to record proof	- There is a higher anti-theft effect than from surveillance cameras	
Disadvantages		- Surveillance camera installation costs and communication costs; security guard personnel costs	- Fear of a delayed response for the blind spots of the cameras		- Constant threat of the danger of vandalism
Judgment		◎	△	○	×

Figure 2.4-20 shows the configuration image of camera surveillance system.

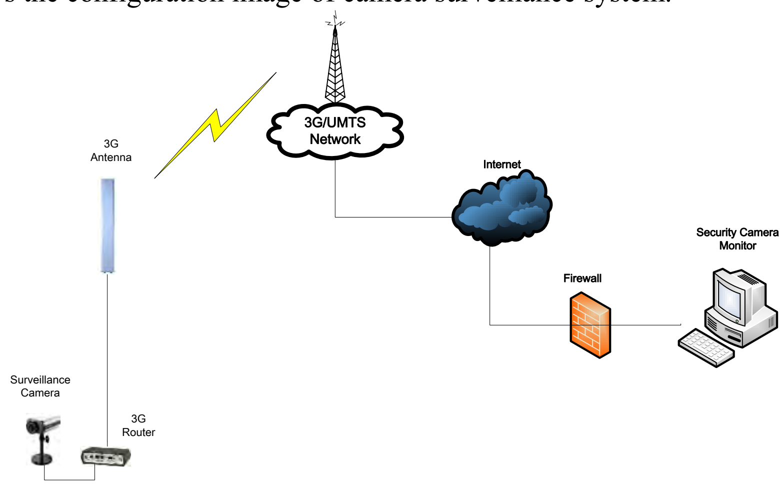

Figure 2.4-20 Configuration Image of Camera Surveillance System

(8) Cathodic Protection System

The high-pressure gas pipeline needs to suppress the progress of corrosion (brought by natural corrosion, electrolytic corrosion and damage caused by other construction works).Therefore, it is necessary to maintain the state of corrosion protection over the long term.

Batman 1 has a large overall scale, and a great number of its underground sites are located in the urban areas. Therefore, the "external power supply system", which makes it possible to monitor the state of corrosion protection in a comprehensive manner, will be adopted for the cathodic protection.

The benefits of the external power supply system are listed below.

- Suitable for the corrosion protection of large-scale pipeline because its anti-corrosion effect range is wide
- Possible to adjust the protection current
- Possible to respond to changes in the environment

1) Basic Specifications

The specifications for the corrosion protection system, and layout of electrodes and the basic specifications for the external power supply system are given below.

In addition, the soil resistivity value is assumed value at the present stage. Therefore, the measurement and analysis of the soil resistivity must be conducted at the detailed design stage. Figure 2.4.21 shows the overview of the external power supply system.

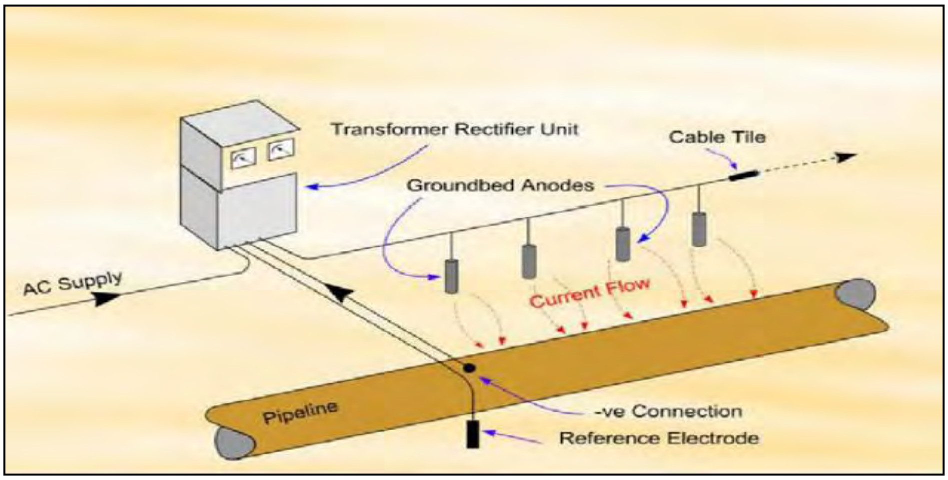

Figure 2.4-21 External Power Supply (Underground Electrode System)

2) Design Outline

a. Targets of Corrosion Protection

Targets of Corrosion Protection	Total Length	Pipe Diameter
Gas pipes	65.7km (Trunk Line) 10.7km (Distribution Line)	24 inch (Trunk Line) 12 inch (Distribution Line)

b. Corrosion Protection System

The external power supply system through electrode devices using oxide-coated electrodes (MMO electrodes) will be applied.

c. Placement of Cathodic Protection System

Figure 2.4-22 shows the placement outline of the cathodic protection system.

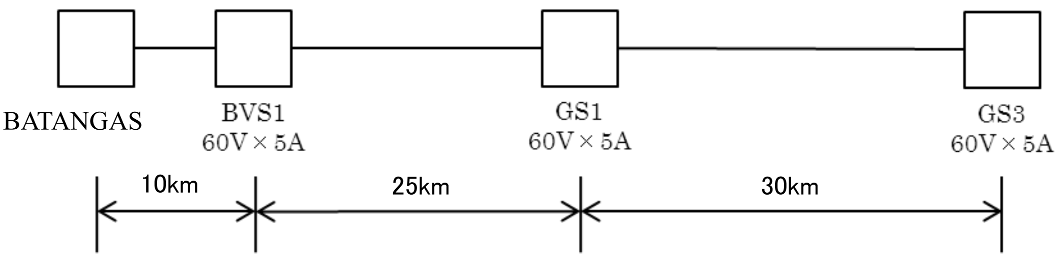

Figure 2.4-22 Placement Plan for Cathodic Protection System

3) Design Requirements (External Power Supply System)

Both ends of the facility subject to corrosion protection are insulated by insulation flange.

a. Design life : 40 years
b. Soil resistivity : 30000Ω / m (assumed value)
c. Application temperature : Normal temperature
d. Coating : Polyethylene lining
e. Coating film resistance : 10000Ω / m^2

4) Reference Potential for Corrosion Protection

The pipe-to-ground potential for the facilities subject to corrosion protection is set at -850 mV or a more negative value based on the copper/copper sulfate reference electrode standards.

5) Cathodic Protection Facility Structure

This system uses DC power supply devices and electrode devices as the main components.

a. DC Power Supply Device

DC power supply device is a silicon rectifier with weather and corrosion resistance in order to withstand long-term continuous use, and houses switch boards, transformers and silicon elements inside of the steel casing. The switchboard is equipped with meters (voltage and current meters) and voltage switching equipment necessary for operation monitoring.
Figure 2.4-23 shows an example of the installation of cathodic protection system in Japan.

Figure 2.4-23 Installation of Cathodic Protection System (Example)

b. Electrode Device

Electrode device is a deep electrode device, for which electrodes are installed deep in the soil, taking into account the improvement of current distribution and reduction of anode interference, and houses NST electrodes inside of the steel casing pipes, fills the backfill and then electrically integrates the electrodes and the steel casing pipes. The electrodes are highly durable coated with platinum metal oxide on a titanium substrate, and are lightweight and easy to handle without deformation of the electrode. Fluorine resin insulation polyethylene sheath cables (FEP/PE) will be applied as electrode leads in order to withstand the harsh chemical environment around the electrodes.

(9) Pig Launcher/Receiver Facilities

The PIG launcher and receiver facilities are included into this Feasibility Study in respect that it is necessary to conduct pig cleaning of the entire pipelines after the construction of the pipelines and before the commissioning, and inspect the pipeline integrity by Intelligent Pig after starting the operation (example: Figure 2.4-24). The launcher/receiver will be a portable type considering the future pipeline plan such as the Batman 2. The 24 inch pig launcher line is planned to be installed in the Governor and Metering Station located at the starting point of the high-pressure trunk line of the Phase-1 route, and the 24 inch pig receiving line is planned in Governor Station 3 at the end of the high pressure trunk line. This Feasibility Study also includes the installation of 16 inch pig launcher line considering the high pressure trunk line of the Phase-2 route in Governor Station 3.

Figure 2.4-24 Inspection of pipeline integrity by Intelligent Pig (Example)

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2.4.2 Selection of Pipeline Routes

The High-pressure trunk-line pipeline route planned at the beginning of the route survey is between the newly-installed LNG receiving terminals in Batangas City to Sucat Power Station (105.2 km), as reported in the previous survey conducted in 2012. This time, however, the survey is conducted on the high-pressure trunk-line route by dividing it largely into the following three sections based on the supply and demand survey as shown in Figure 2.4-25

1. Phase-1 Route: from the Energy Supply Company in Batangas City to Cabuyao City： approximately 65.7km (indicated in red line in Figure 2.4-25)
2. Phase-2 Route: from Cabuyao City to Sucat：approximately 29.1km (green line)
3. Future Optional Route: from PNOC-ESB, an applicant for the future LNG receiving terminal in Mabini Municipality, up to Lipa City accessing to the PHASE-1 Route：approximately 33.8km (purple line)

In addition, the distribution lines to the following two Japanese Industrial Parks and one Industrial Area, as the Phase-1 Route connecting Batangas City and Cabuyao City, have been investigated (blue line).

- Lima Technology Center (hereafter referred to as LTC)
- First Philippine Industrial Park (Future Plan) (FPIP (Future Plan))
- Laguna Industrial Area (LIA)

Based on the aforementioned prerequisites and the results of the Preliminary Survey (2012), this survey determines the route selected by the Preliminary Survey (2012) except the connection location between pipeline and LNG receiving terminal as the high-pressure trunk-line pipeline route for the Phase-1 Route factoring in the installation environment, economic efficiency, construction period, constructability, maintainability, and also the various elements mentioned below. (The distribute lines are not covered by the Preliminary Survey (2012)).

- Current situations and future plans of land use
- Difficulty of site acquisition
- Current situations and future plans of the buried facilities and structures
- Restrictions on construction methods
- Current situations and future plans of roads, railways and river-crossings
- Confirmation on the possibility of acquiring the permission for the ROW with road operators
- Confirmation of the information on the buried facilities (such as water pipes and power lines) located on the selected route with the facility operators
- Confirmation on the availability of White Oil pipeline (14 inch) and Black Oil pipeline ROW owned by First Philippine Industrial Corporation (FPIC)

The survey results on the Phase-1 Route are stated below (The other topics are mentioned in the Appendix of this report).

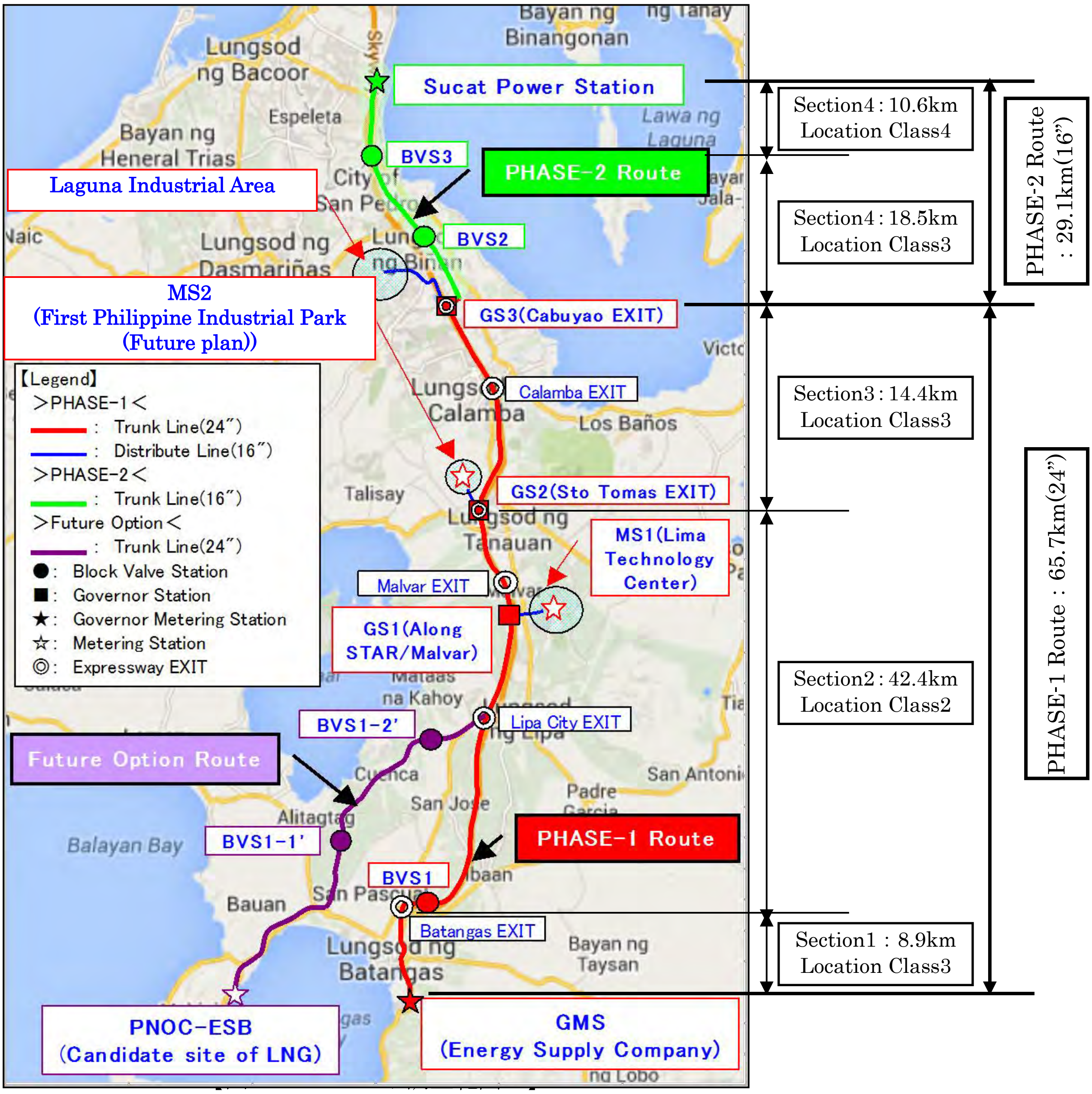


Figure 2.4-25 Route Survey Area

(1) Pipeline Route Anticipating Entitlement of Yen Loan（Phase-1）

The Phase-1 Route is divided into the following parts:

- Section 1 (Trunk Line):The Batangas urban area (Governor and Metering Station (hereafter referred to as GMS) at the Energy Supply Company - the Batangas EXIT)
- Section 2 (Trunk Line) : Along the Southern Tagalog Arterial Road (STAR) Expressway
- (the Batangas EXIT -GS2 at the Sto. Tomas EXIT)
- Section 3 (Trunk Line) : Along the South Luzon Expressway (SLEX)
- (GS2 at the Sto. Tomas EXIT - GS3 at the Cabuyao EXIT)
- Distribution Line1 : Designed for the LIMA Technology Center (GS1-MS1)
- Distribution Line2 : Designed for the First Philippine Industrial Park (GS2-MS2)
- Distribution Line3 : Designed for the Laguna Industrial Area (GS3-)

1) Survey Results on Section 1 (Trunk Line)

The 8.9 km ranging from the GMS located in the natural gas supply company (Energy Supply Company) in Batangas City to the Batangas EXIT of the STAR Expressway is designated as the selected route for Section 1(indicated in red line in Figure 2.4-26). The route consists of 1 km of the Barangay Road (operated by Batangas City)from the Energy Supply Company to the National Highway and 7.9 km of the National Highway up to the Batangas EXIT with a heavy traffic volume during day time (little traffic at night), two river-crossing points as special parts and a major shopping mall along the road(operated by DPWH Batangas 2nd District). As for the pipe-laying method, the General Open-Cut Method is to be conducted at night time considering the imaginable impacts of traffic jam caused by the day-time construction in the neighboring areas.

The road operators have confirmed that there is no difficulty in acquiring the ROW for the pipeline as of this Feasibility Study (hereafter referred to as FS). Nevertheless, the final confirmation with the road operators must be required on the detailed locations of the ROW at the detailed design. The survey on the existing buried pipes along the route has proved the presence of the following: one water pipeline (operated by the Batangas City Water District), two oil pipelines (owned by the First Philippine Industrial Corp) and communication cables (PLDT, GLOBE and SMART).

Based on the route survey, the alternative route (indicated in light blue line in Figure 2.4-26)is expected to experience a heavier traffic jam than the selected route since the alternative one is designed to run through the urban areas that is congested by businesses and residences (indicated with green circle in Figure 2.4-26).
Section 1 is classified as Location Class 3 under the ANSI/ASME B31.8.

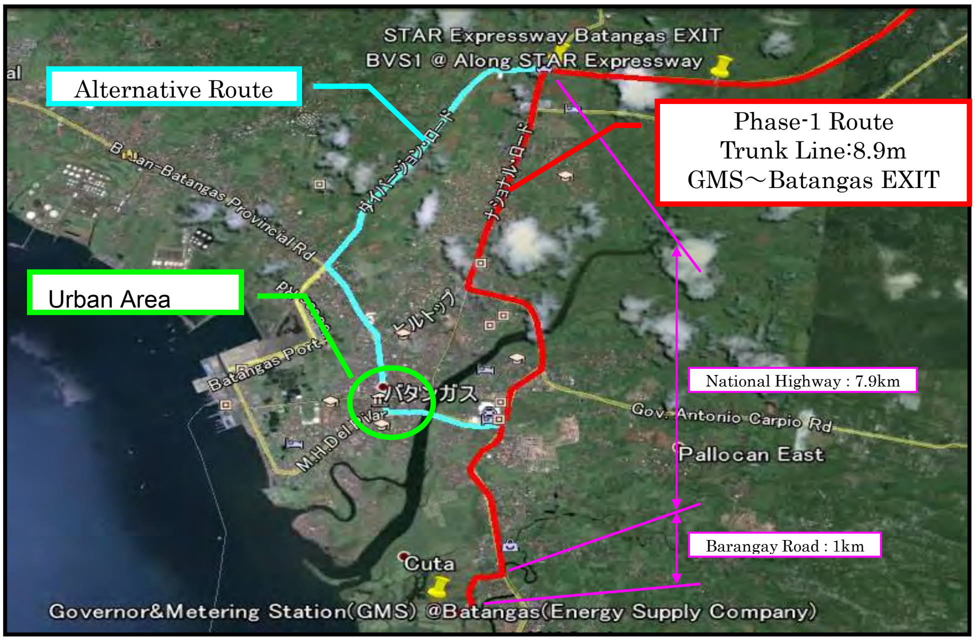


Figure 2.4-26 Route Survey Results (Section 1)

Barangay Road

River Crossing point as special part

National Highway

National Highway (night)

Urban Area (Alternative)

Urban Area (Alternative)

2) Survey Results on Section 2（Trunk Line）

The 42.4 km ranging from the Batangas EXIT of the STAR Expressway to GS2 close to the Sto. Tomas EXIT is designated as the selected route for Section 2 (indicated in red line in Figure 2.4-27). Specifically, the route includes nine river-crossing points and six road-crossing points as special parts. In addition, there are four crossing tollgates points, six crossing Inter Changes (ICs) and Service Areas (SAs) points, and 21 overpasses. Furthermore, in the two-way traffic section between the Batangas EXIT and Lipa EXIT, some two-lane expansion works are currently underway.

The road operator (STAR Tollway Corporation) has confirmed that there is no difficulty in acquiring the ROW for the pipeline as of this FS. Also, the discussion on the locations of the ROW with the operator has determined the vegetated area along the traffic lane towards Manila as the basic plan. Nevertheless, the final confirmation with the road operator must be required on the detailed locations of the ROW at the detailed design since the expansion works on the road currently underway. The survey on the existing buried pipes along the route has proved that only cable of electric light and camera are installed in the area.

As for the pipe-laying method, the General Open-Cut Method is to be conducted during day time as the ROW for the pipeline instead of the Spread Method in the central divider area as proposed by the Preliminary Report (2012). Also, the clearance in the area must be conducted before the construction work starts.

Based on the route survey, the alternative route (indicated in light blue line in Figure 2.4-27) with concrete pavement 23cm thickness is expected to experience a heavier traffic jam and more reduced work progress than the selected route since the alternative one is designed to run through the urban areas that is congested by businesses and residences (indicated with green circle in Figure 2.4-27). Section 2 is classified as Location Class 2 under the ANSI/ASME B31.8.

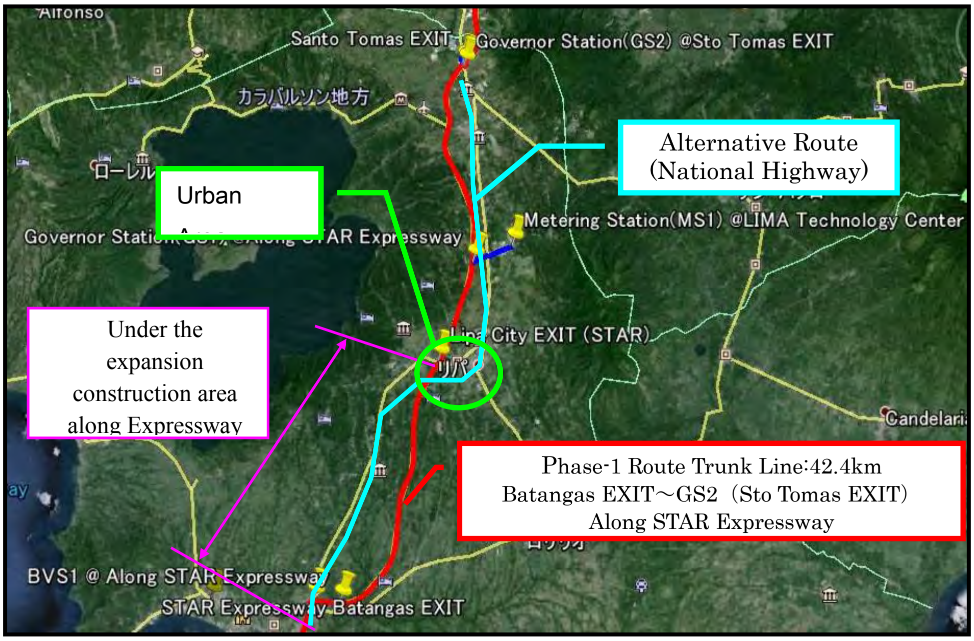
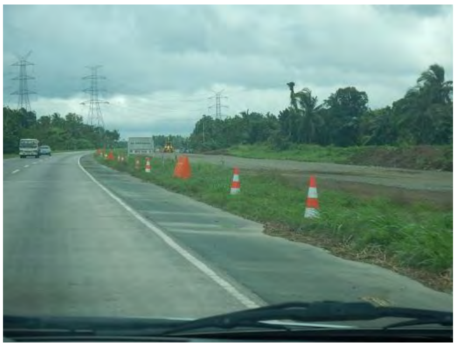
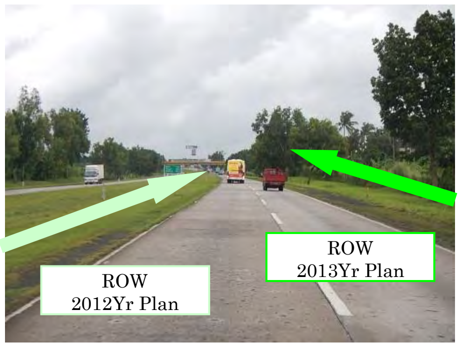


Figure 2.4-27 Route Survey Results (Section 2)



Expansion works

Expansion works (Bridge)



Plan of ROW as Pre FS (2012)/FS (2013)

River Crossing point as special part

Urban area @ Lipa city (alternative)

Urban area @ Lipa city (alternative)

3) Survey Results on Section 3（Trunk Line）

The 14.4 km ranging from GS2 in the neighborhood of the Santo Tomas EXIT along the SLEX Expressway to GS3 located in the Cabuyao EXIT site is designated as the selected route for Section 3 (indicated in red line in Figure 2.4-28). Specifically, the route includes 12 river-crossing points and five road-crossing points as special parts. In addition, two crossing tollgates points, four crossing ICs and SAs points, and 10 overpasses.

The road operator (South Luzon Tollway Corporation) has confirmed that there is no difficulty in acquiring the ROW for the pipeline as of this FS. Also, the discussion on the locations of the ROW with the operator has determined the vegetated area along the traffic lane towards Manila as the basic plan. Nevertheless, the final confirmation with the road operator must be required on the detailed locations of the ROW at the detailed design since the expansion works on the road currently underway. The survey on the existing buried pipes along the route has proved that only cable of electric light and camera are installed in the area. As for the pipe-laying method, the General Open-Cut Method is to be conducted during day time. The clearance in the area must be conducted before the construction work starts, as well.

Based on the route survey, the alternative route (indicated in light blue line in Figure 2.4-28) with concrete pavement 23cm thickness is expected to experience a heavier traffic jam and more reduced work progress than the selected route since the alternative one is designed to run through the urban areas that is congested by businesses and residences (indicated with green circle in Figure 2.4-28).
Section 3 is classified as Location Class 3 under the ANSI/ASME B31.8.

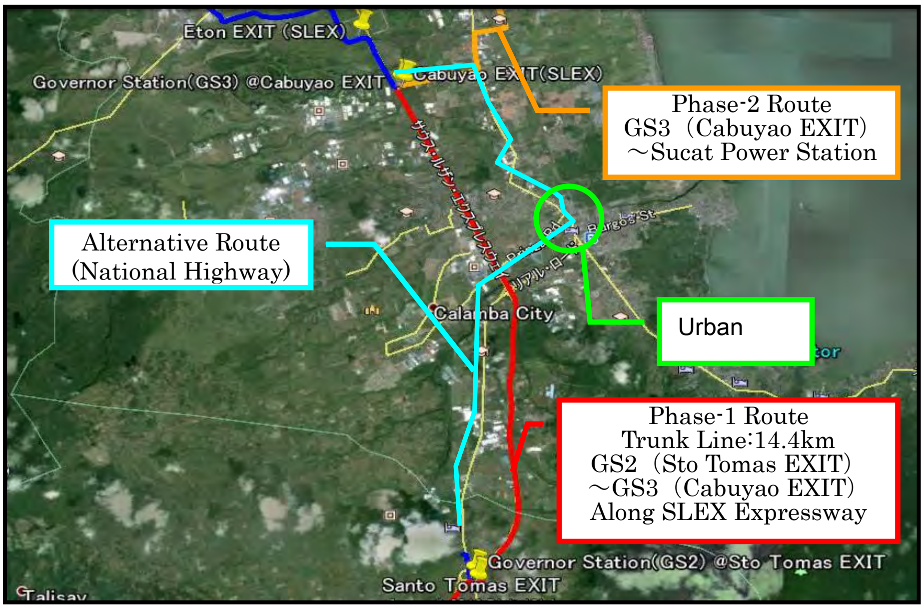
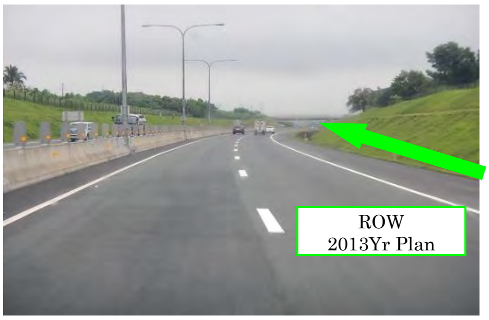


Figure 2.4-28 Route Survey Results（Section 3）



Plan of ROW (around Calamba)

Plan of ROW (around Cabuyao)

Plan of ROW (as Over Pass)

River crossing point as special part

Urban area @ Calamba(Alternative)

Urban area @ Calamba(Alternative)

4) Survey Results on Distribution Line 1

The 2.2 km ranging from GS1 (Malvar Municipality) along the STAR Expressway up to MS1 in the Lima Technology Center（hereafter referred to as LTC） is designated as the selected route for Distribution Line 1 (indicated in blue line in Figure 2.4-29). The route consists of 2.13 km of narrow Barangay Road(operated by Malvar Municipality)with two river-crossing points as special parts and commercial area along the road, and 0.07 km of the National Highway（operated by DPWH Batangas 3rd District）.It is noticeable that there are tricycle parking areas and shops at the junction of the National Highway and the Barangay Road. As for the pipe-laying method, the General Open-Cut Method is to be conducted at night time considering the imaginable impacts of traffic jam caused by the day-time construction on the neighboring areas, as well as, the advice provided by the Malvar Municipal Engineer. The road operators have confirmed that there is no difficulty in acquiring the ROW for the pipeline as of this FS. Nevertheless, the final confirmation with the road operators must be required on the detailed locations of the ROW at the detailed design. The survey on the existing buried pipes along the route has proved that one water pipeline (operated by the Metro Lipa Water District) and two oil pipelines（owned by the First Philippine Industrial Corp）are installed in the area. The existing buried communication cable (GLOBE and SMART) is installed underground along the National Highway. The route survey has revealed that the alternative route (indicated in light blue line in Figure 2.4-29) of 5km ranging from the Malvar EXIT of the STAR Expressway to the National Highway is long in length compared to the selected pipeline route in length.

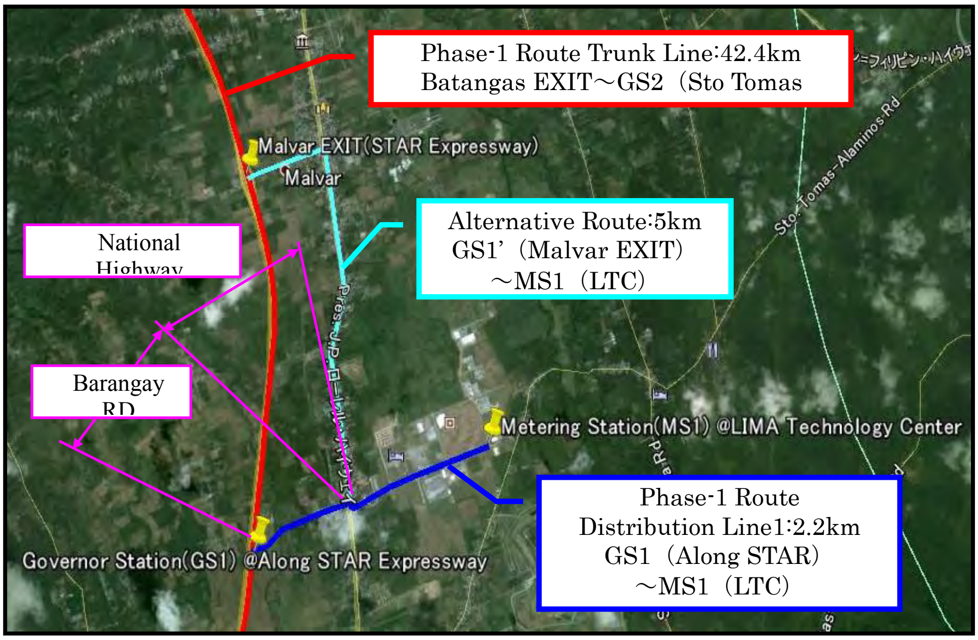


Figure 2.4-29 Route Survey Results (Distribution 1)

National Highway (night)

Barangay Road (day)

Barangay Rd (Crossing point)

Barangay Rd (river crossing point)

5) Survey Results on Distribution Line 2

The 1.5 km ranging from GS2 (Sto. Tomas Municipality) close to the Sto. Tomas EXIT along the STAR Expressway up to MS2 in the First Philippine Industrial Park (hereafter referred to as FPIP(Future plan)) ,which has an expansion plan in the future, is designated as the selected route for Distribution Line 2 (indicated in blue line in Figure 2.4-30). The route consists of 1.5 km of the four-lane National Highway (operated by DPWH Batangas 3rd District) with a heavy traffic volume during day time. It is noticeable that the LIGHT INDUSTRY & SCIENCE PARKⅢ near the Sto. Tomas EXIT, the Yakult Philippines and Yazaki-Torres Manufacuring and Carmelray Industrial Park

located between the FPIP (Future Plan) and Calamba EXIT are seen. As for the pipe-laying method, the General Open-Cut Method is to be conducted at night time considering the imaginable impacts of traffic jam caused by the day-time construction on the neighboring areas.
The road operators have confirmed that there is no difficulty in acquiring the ROW for the pipeline as of this FS. Nevertheless, the final confirmation with the road operators must be required on the detailed locations of the ROW at the detailed design. The survey on the existing buried pipes along the route has proved that one water pipeline (operated by the Sto. Tomas Municipality), two oil pipelines (owned by the First Philippine Industrial Corp) and the existing buried communication cable (PLDT, GLOBE and SMART) are installed in the area.

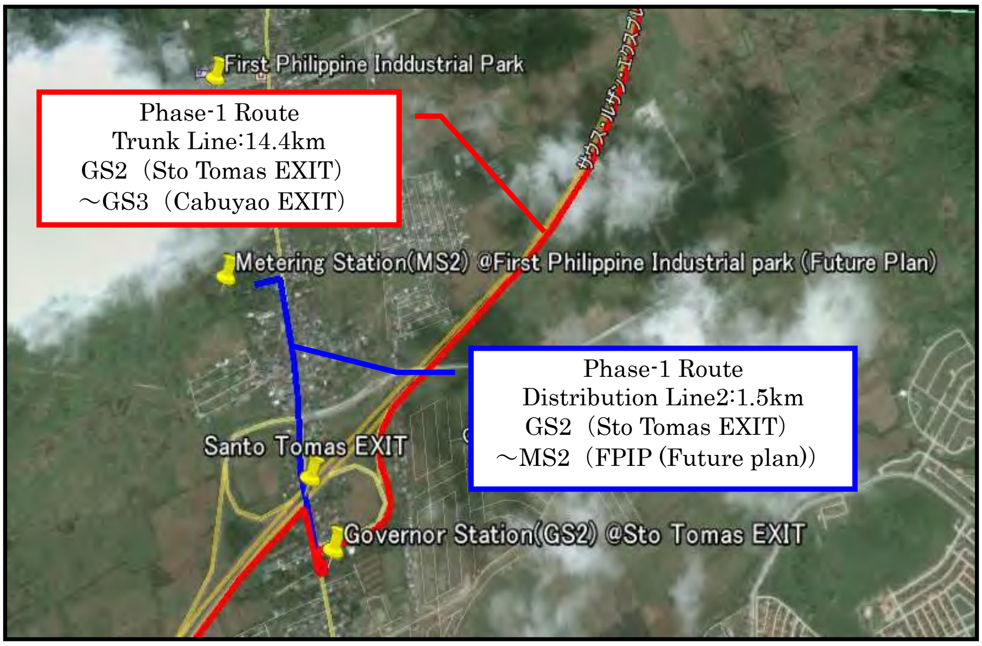
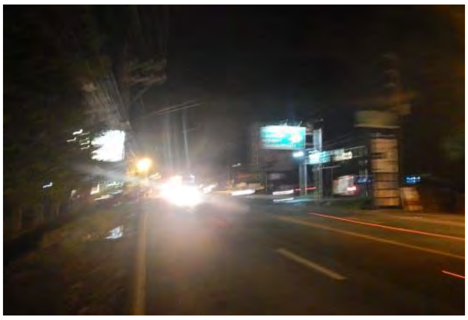


Figure 2.4-30 Route Survey Results(Distribution 2)

National Highway (day)



National Highway (night)

National Highway（at EXIT）

National Highway（FPIP entrance）

6) Survey Results on Distribution Line 3

The 7.0 km ranging from GS3 (Cabuyao City) located in the Cabuyao EXIT site of the SLEX Expressway through the Eaton EXIT to the Laguna Industrial Area including the Laguna Technopark and TOYOTA is designated as the selected route for Distribution Line 3 (indicated in blue line in Figure 2.4-31). The route consists of 2.0 km of the SLEX Expressway and 5 km of the private road (operated by Santa Rosa City).

It is noticeable that there is one road-crossing point situated from GS3 to the vegetated area along the traffic lane towards Batangas of the SLEX Expressway and one river-crossing point, as special parts. In addition, there is one river-crossing point as a special part in the private road, which has a heavy traffic volume during day time near the junction at the end of the road. As for the pipe-laying method at this junction area, the General Open-Cut Method is to be conducted at night time, considering the imaginable impacts of traffic jam caused by the day-time construction on the neighboring areas. Also, the clearance in the SLEX Expressway must be conducted before the construction work starts. Based on the result of the confirmation with the Santa Rosa City Mayor on the possibility of acquiring the ROW for the pipeline, the discussion with two owners of the private road (Eaton and Greenfield Subdivisions) is to be planned in the near future. The survey on the existing buried pipes along the route has proved that the communication cable is not installed underground, but there is information that the water pipeline may be installed underground along the route.

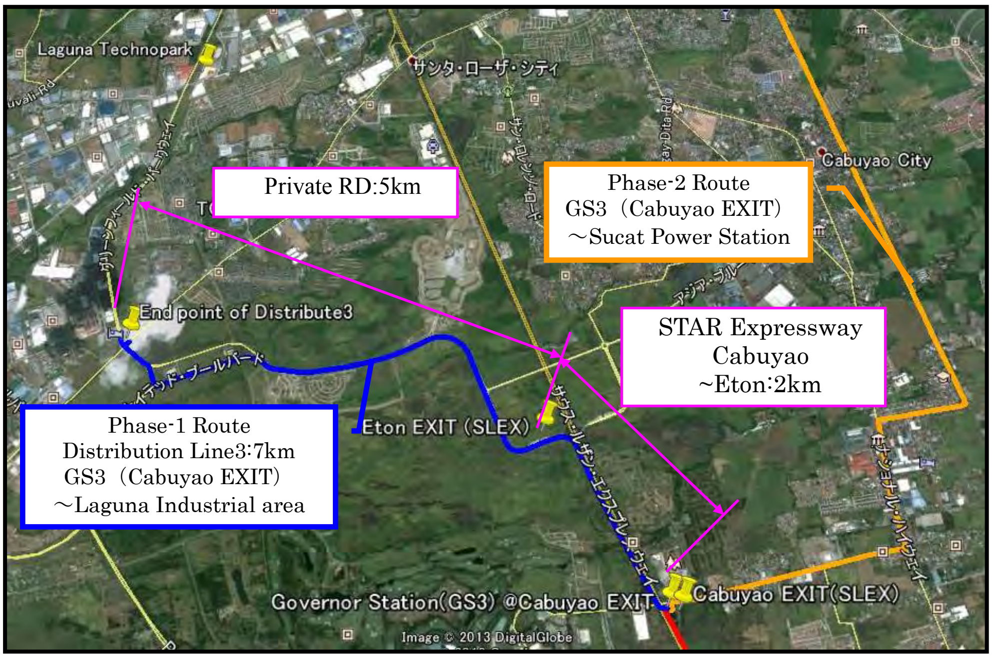


Figure 2.4-31 Route Survey Results (Distribution 3)

Road crossing point as GS3

Plan of ROW along SLEX

Private RD River crossing point

Private RD Junction point

7) Survey Result on ROW of two pipelines owned by FPIC (Batangas to Calamba)

The seven locations survey results on ROW (Indicated in pink line in Figure 2.4-32) of two pipelines owned by FPIC which is buried along the abandoned railway from Batangas to Calamba are as follows.

- Survey Location
  - Batangas City : 2-Locations (No.1 and No.2 in Figure 2.4-32)
  - San Jose Municipality : 1-Location (No.3 in Figure 2.4-32)
  - Lipa City : 1-Location (No.4 in Figure 2.4-32)
  - Malvar Municipality : 1-Location (No.5 in Figure 2.4-32)
  - Tanauan City : 1-Location (No.6 in Figure 2.4-32)
  - Calamba City : 1-Location (No.7 in Figure 2.4-32)

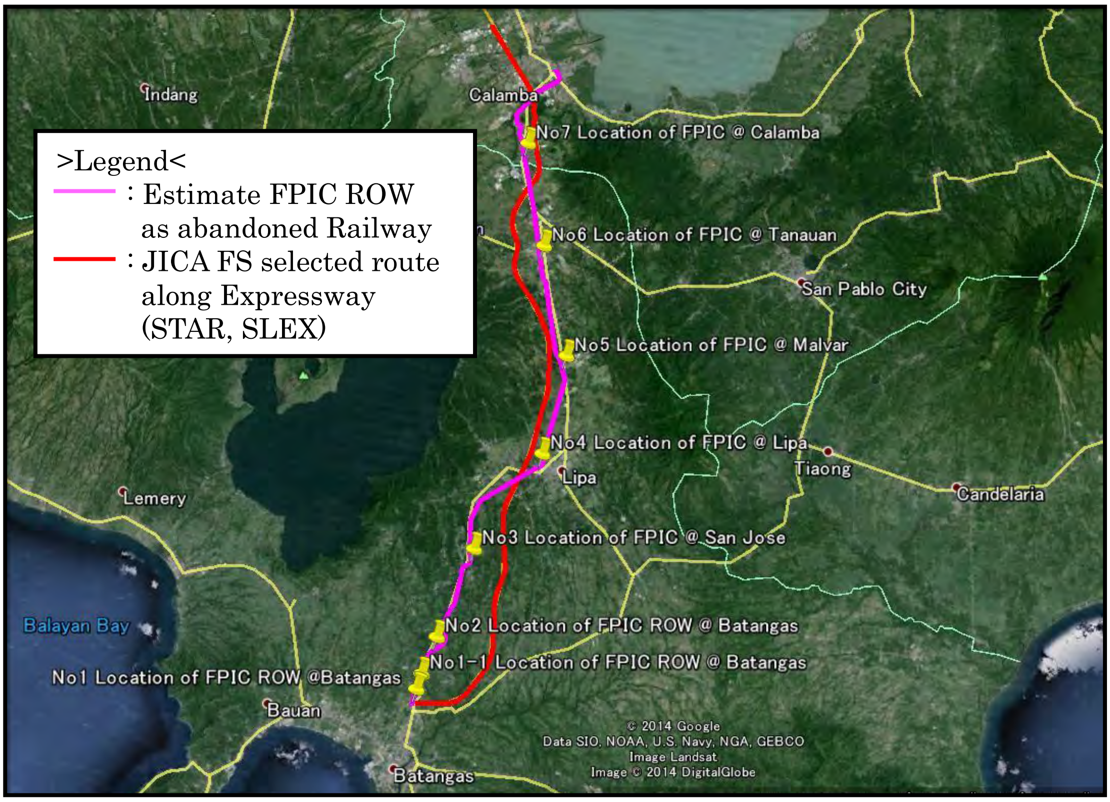


Figure 2.4-32 Outline map of ROW of two pipelines owned by FPIC

➢ Survey Result

- There is no space to construct newly 24inch pipeline due to many residences in close vicinity to ROW and its narrow width (Width : 2.0m to 4.0m)
- Even though there is no space to construct new 16inch pipeline (See Figure 2.4-33)

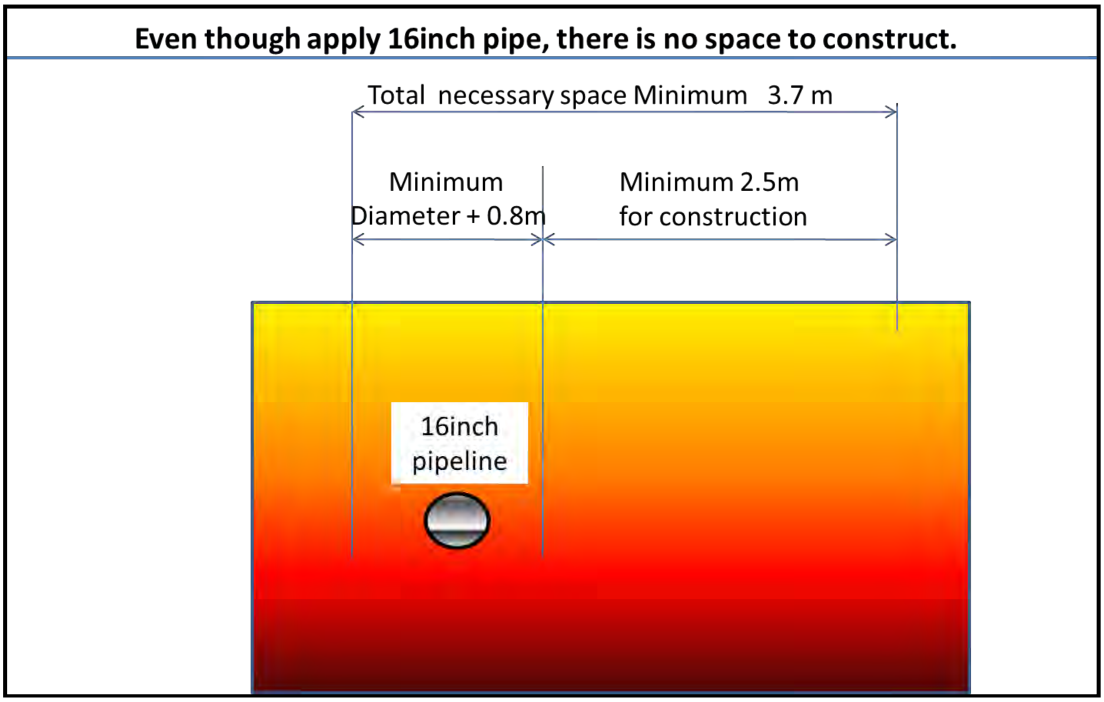


Figure 2.4-33 Outline drawing of 16inch pipeline construction space

- There are many necessary resettlements to occupy the construction space
- There are influences on the construction cost increase and schedule extension due to the removal of the existing buried pipeline

Based on the above results, considering the effect on environment, construction cost and progress, the optimum route is along the expressway from Batangas to Cabuyao by the selected JICA study (Indicated in red line in Figure 2.4-32).

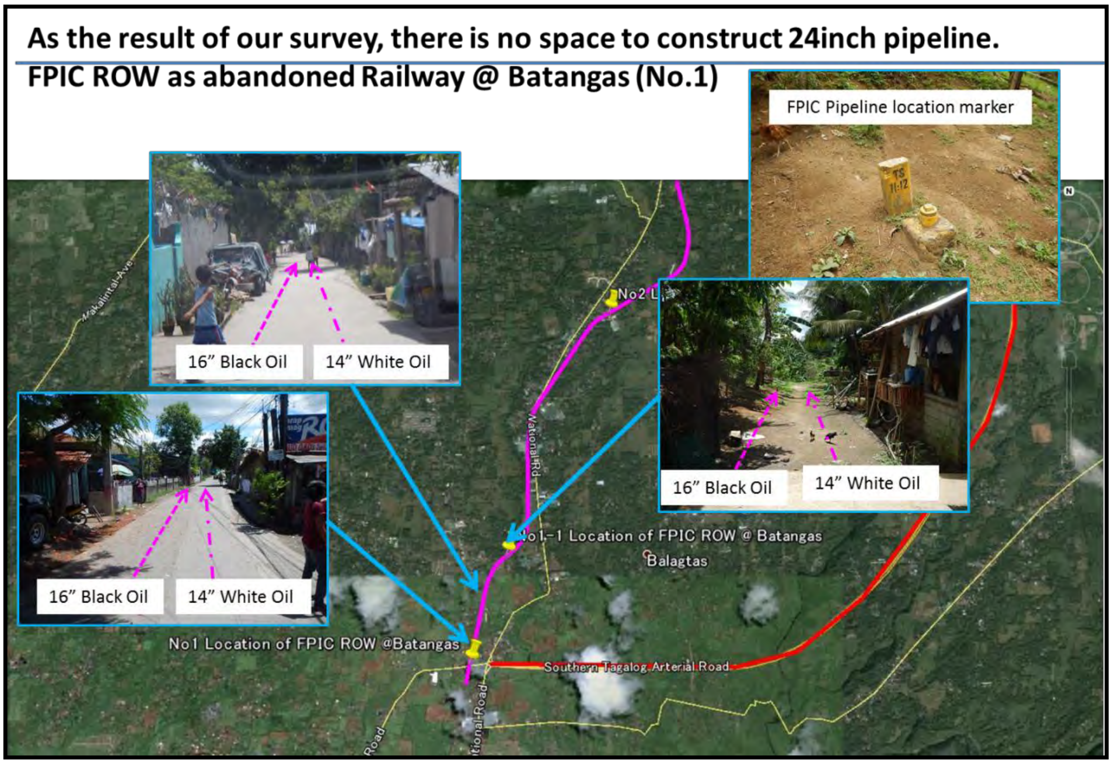


Figure 2.4-34 Survey Results in Batangas City (No.1)

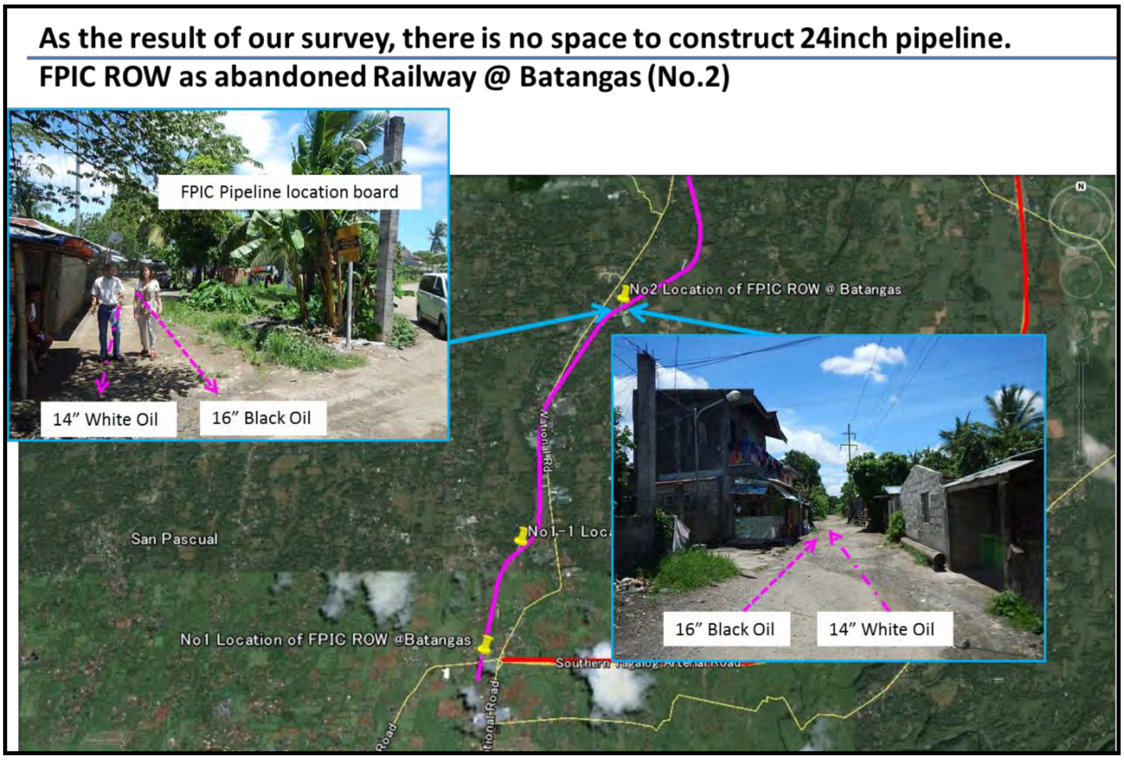


Figure 2.4-35 Survey Results in Batangas City (No.2)

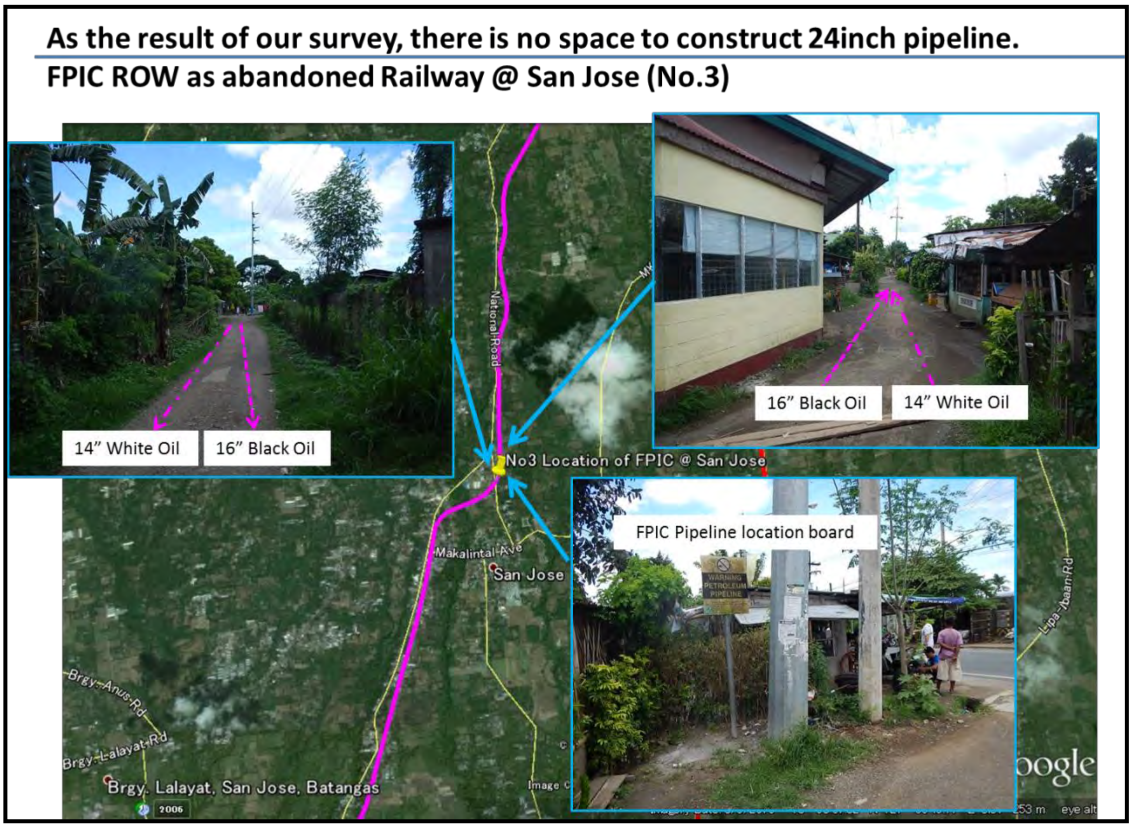


Figure 2.4-36 Survey Results in San Jose Municipality (No.3)

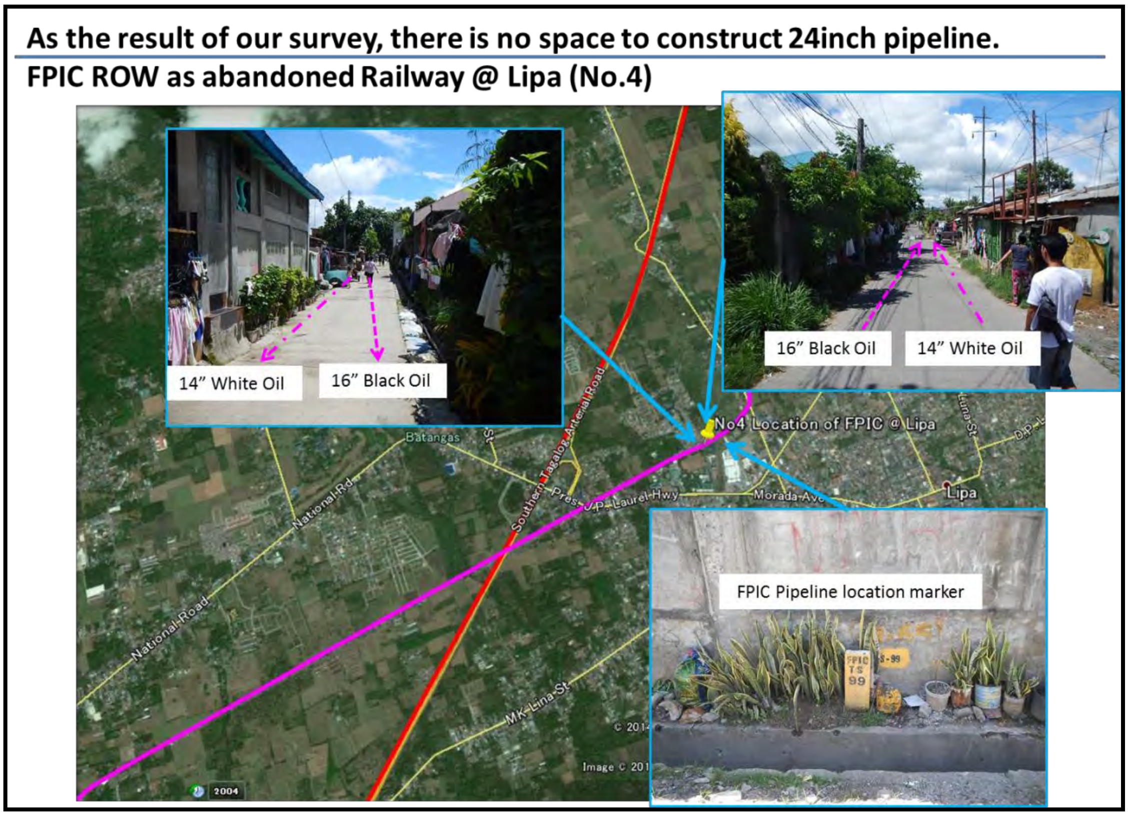


Figure 2.4-37 Survey Results in Lipa City (No.4)

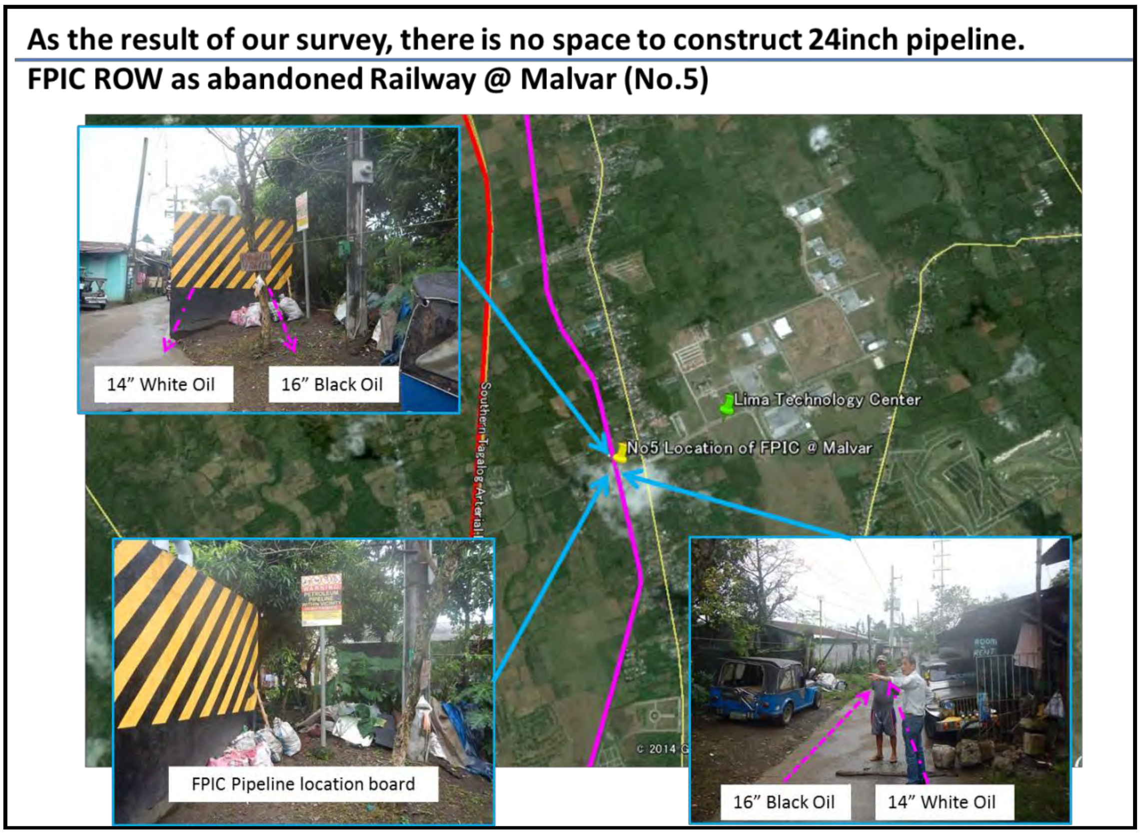


Figure 2.4-38 Survey Results in Malvar Municipality (No.5)

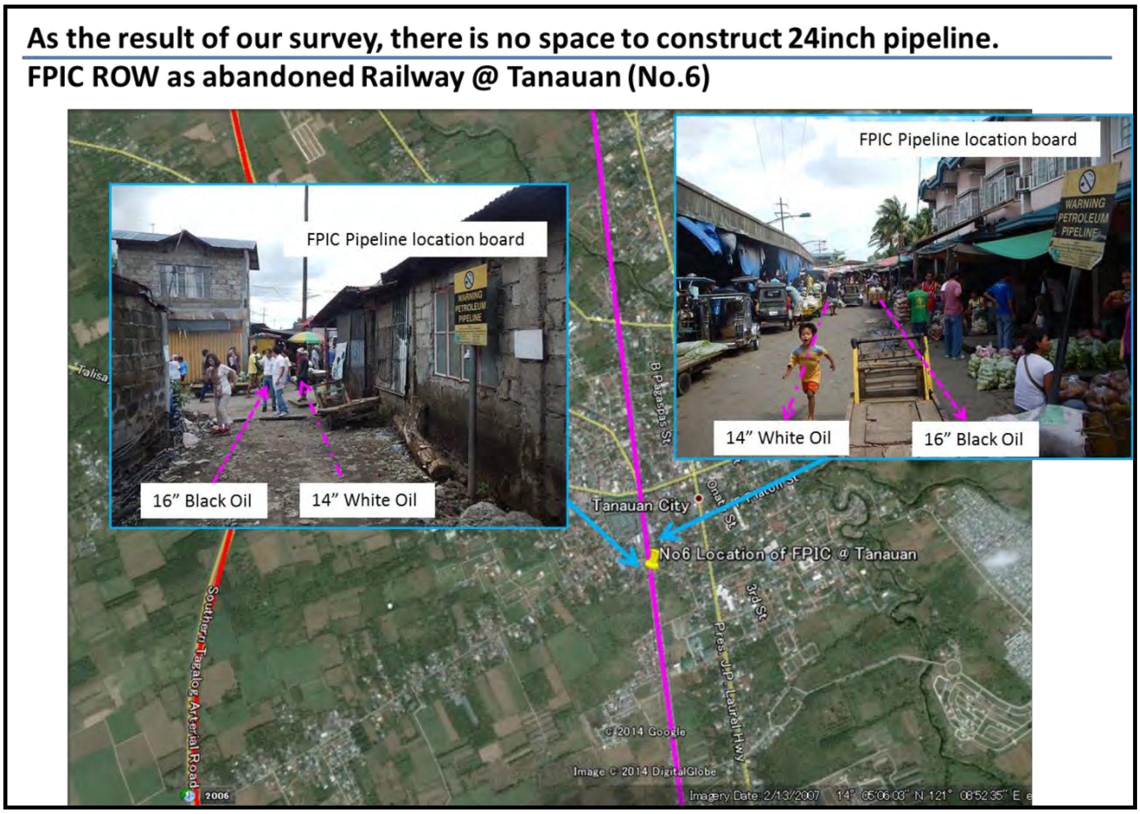


Figure 2.4-39 Survey Results in Tanauan City (No.6)

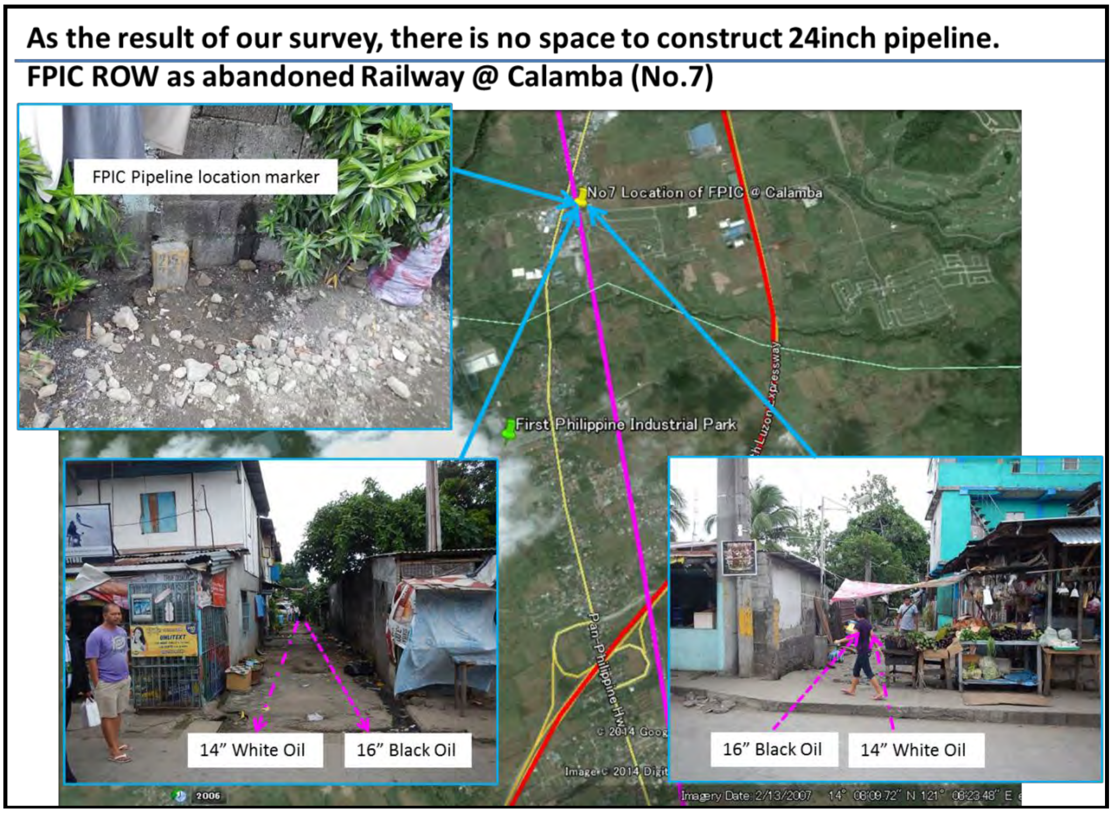


Figure 2.4-40 Survey Results in Calamba City (No.7)

In addition, there is difficulty in reusing the existing buried pipeline as casing pipe for new gas pipeline installation due to the following reasons.

- In cases such as considering the protection of external coating of new gas pipeline as insert, the new pipe size is below the half size of the casing pipe (See Figure 2.4-38)
- Unavailability to insert straight pipe into curve point on existing pipeline

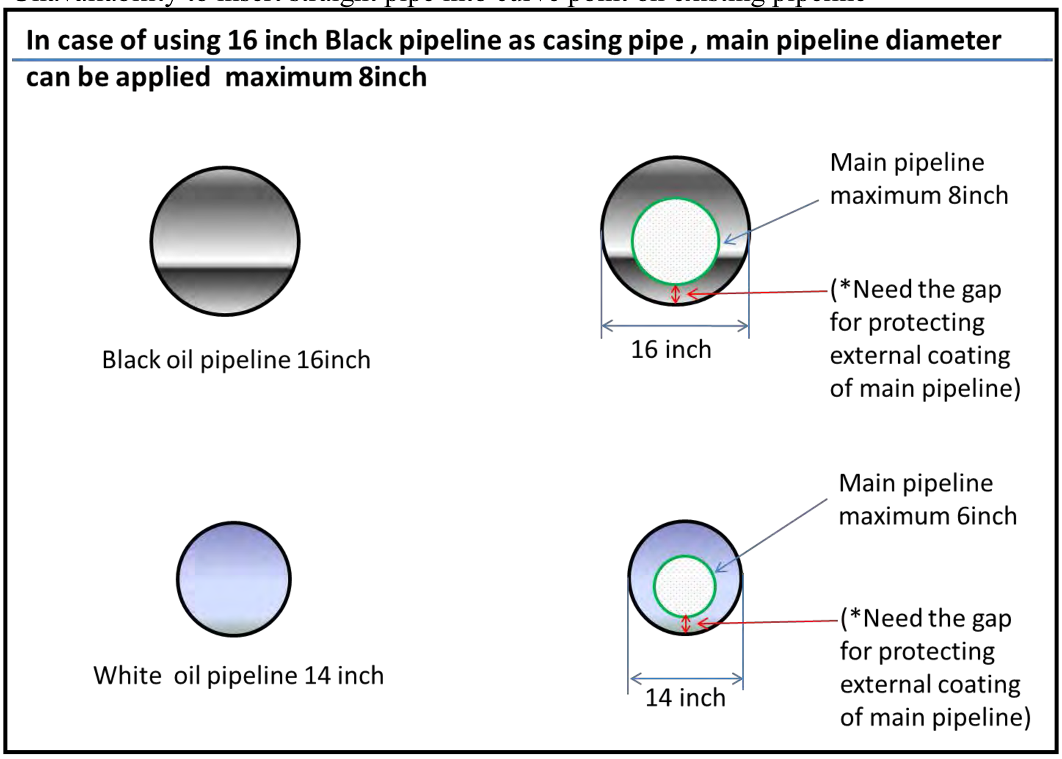


Figure 2.4-41 Pipe size of reusing existing buried pipeline as casing pipe

(2) Pipeline Route Map

The 1:10,000 scale pipeline route map is attached to the Appendix
The map is based on the satellite photograph taken in 2013.

(3) Pipeline Route Anticipating Entitlement of Yen Loan（Phase-1）

Table 2.4-14 shows the summary of the special parts for each section.
The special parts include river-crossing and road-crossing parts.
The special parts for the Phase-2 and the Future Optional Route are described in the Appendix.

Table 2.4-14 List of Special Parts (Phase-1)

「PHASE１」SpesialPART（RiverCrossing＆RoadCrossing）

№	Drawing №	Line	Section	Location Class	PART №	Road	KP№	Object	Bridge/UnderPass/C-Box	Distance (m)	Bridge Distance (m)	Height (m)
1	2	Trunk Line	1	3	1BRi-1	NationalH･W	―	River	BRIDGE/River	30	20	7
2	2				1BRi-2		―	River	BRIDGE/River	150	115	12
3	3		2	2	2BRi-1	STAR	KM101.6	River	BRIDGE/River	120	85	25
4	4				2BRi-2		KM100.6	River	BRIDGE/River	150	115	27
5	5				2BRi-3		KM99.2	River	BRIDGE/River	300	227	50
6	5				2BRi-4		KM98.1	River	BRIDGE/River	100	70	6
7	5				2BRo-1		KM96.9	Road	BRIDGE/Road	70	42	8
8	5				2Bri-5		KM96.6	River	BRIDGE/River	100	76	18
9	6				2URi-1		KM95.6	River	UP/C-BOX/River	20	3	4
10	8				2BRo-2		KM89.8	Road	BRIDGE/Road	70	42	8
11	9				2URo-1		KM86.4	Road	UP/C-BOX/Rord	20	5	6
12	10				2BRi-6		KM82.6	River	BRIDGE/River	80	54	15
13	10				2BRo-3		KM82.3	Road	BRIDGE/Road	150	105	8
14	10				2BRo-4		KM82.1	Road	BRIDGE/Road	80	49	9
15	13				2BRi-7		KM73.8	River	BRIDGE/River	80	52	13
16	16				2BRi-8		KM61.2	River	BRIDGE/River	120	85	20
17	16				2BRo-5		KM60.0	Road	BRIDGE/Road	60	58	7
18	16		3	3	3URo-1	SLEX	STA57.3	Road(PNR)	UP/C-BOX/Road	30	15	5
19	16				3BRo-1		STA57.2	Road	BRIDGE/Road	140	90	13
20	17				3BRi-1		STA55.5	River	BRIDGE/River	120	78	23
21	17				3URo-2		STA53.8	Road	UP/C-BOX/Rord	10	5	5
22	17				3URi-1		STA53.6	River	UP/C-BOX/River	30	16	4
23	18				3BRi-2		STA51.0	River	BRIDGE/River	110	77	25
24	18				3BRo-2		STA50.2	Road	BRIDGE/Road	20	20	10
25	19				3BRi-3		STA49.6	River	BRIDGE/River	193	193	30
26	19				3URi-2		STA48.2	River	UP/C-BOX*2/River	50	50	10
27	19				3BRi-4		STA47.7	River	BRIDGE/River	70	40	17
28	19				3BRo-3		STA47.1	Road	BRIDGE/Road(Rail)	40	21	8
29	19				3BRi-5		STA46.9	River	BRIDGE/River	90	52	15
30	20				3URi-3		STA46.4	River	UP/River(C-BOX*2)	21	21	4
31	20				3URi-4		STA46.1	River	UP/River(C-BOX)	10	10	2
32	20				3URi-5		STA45.3	River	UP/River(C-BOX)	6	6	2
33	20				3URi-6		STA44.9	River	UP/River(C-BOX)	5	5	2
34	20				3BRi-6		STA44.1	River	BRIDGE/River	90	61	21
35	12	Distrribute Line1		3	―	Brangay Road	―	River	BRIDGE/River	10	5	5
36	12				―		―	River	BRIDGE/River	10	5	5
37	20	Distrribute Line3			―	SLEX	―	Road	Road	50	50	―
38	42				―	Field Park Way	―	River	BRIDGE/River	30	20	5
39	42				―		―	River	BRIDGE/River	60	45	4

(4) Selection of Candidate Station Sites

1) Installation Sites of Block Valve Stations and Governor Stations

The installation intervals of Block Valves for shutdown of pipeline are defined in accordance with the Location Classes of the ANSI/ASME B31.8.

- Location Class 1 : 20 miles(32km) in predominant areas
- Location Class 2 : 15 miles(24km) in predominant areas
- Location Class 3 : 10 miles(16km) in predominant areas
- Location Class 4 : 5 miles(8km) in predominant areas

Figure 2.4-42 shows the selected candidate sites for the Block Valve Stations (hereafter referred to as BVS) and the Governor Stations (GS) for shutdown of pipeline to be installed in the high-pressure trunk-line pipeline for the Phase-1 route based on the aforementioned installation intervals and the condition of selection BVS and GS location as following.

The condition of selection BVS and GS location

a) A possible to occupy implement land as per each Station
b) Minimum affect for around station when emergency vent
c) Close by Demander area (Only GS)
The target of Demander area is around LTC, Eco-zone around Sto Tomas and Industrial Park around Cabuyao exit

The distances between each station are shown in Table 2.4-15.

Table 2.4-15 Distance between Each Station

Block No.	Upstream side (Location)	Downstream side (Location)	Distance (Approx. km)	Location Class (ANSI/ASME B31.8)
Block1	GMS (Batangas)	BVS1 (Batangas)	11.0km	Location Class3
Block2	BVS1 (Batangas)	GS1 (Malvar)	25.5km	Location Class2
Block3	GS1 (Malvar)	GS2 (Sto Tomas)	14.8km	Location Class2
Block4	GS2 (Sto Tomas)	GS3 (Cabuyao)	14.4km	Location Class3

(Blank space)

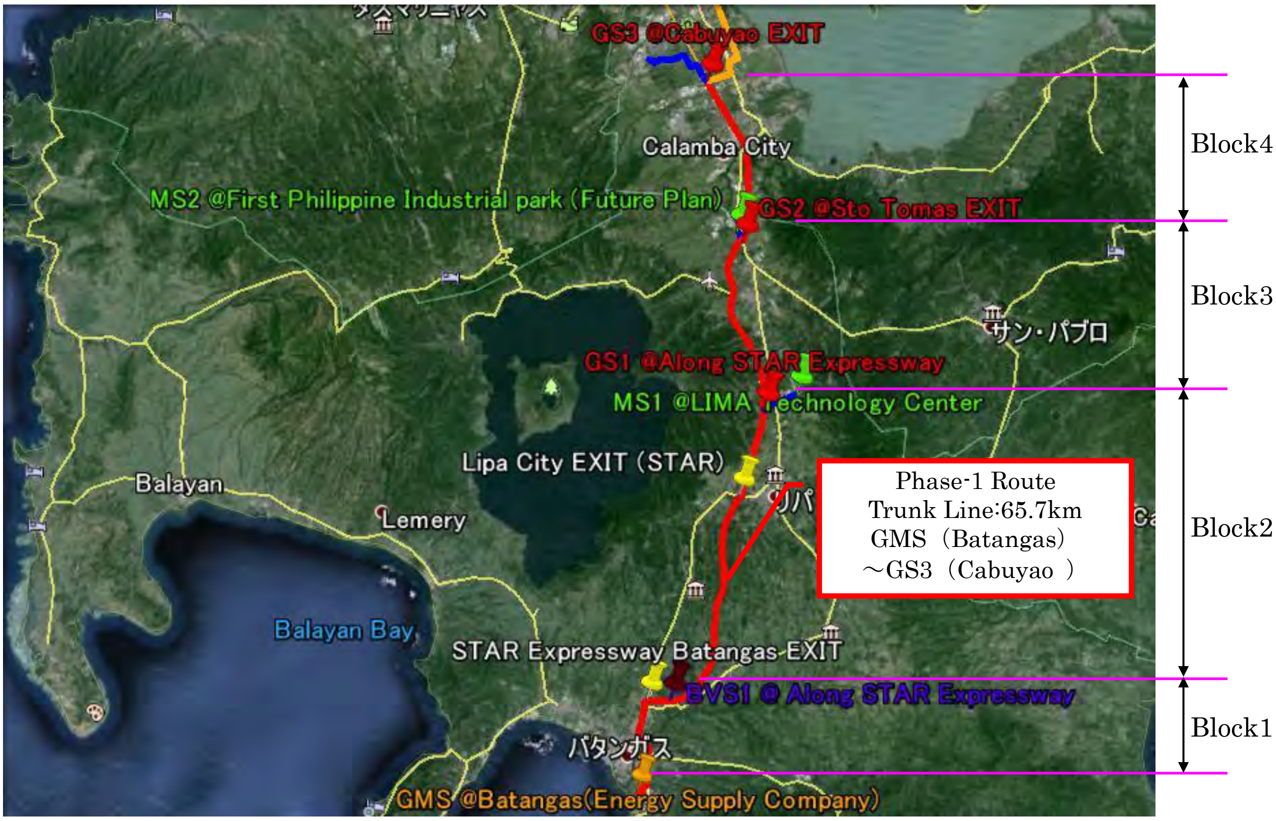


Figure 2.4-42 Location Map of Candidate Station Sites

(Blank space)

a. BVS1 Location: The 2 km-long private land along the STAR Expressway from Batangas exit towards Manila

(Batangas City, Batangas Province)

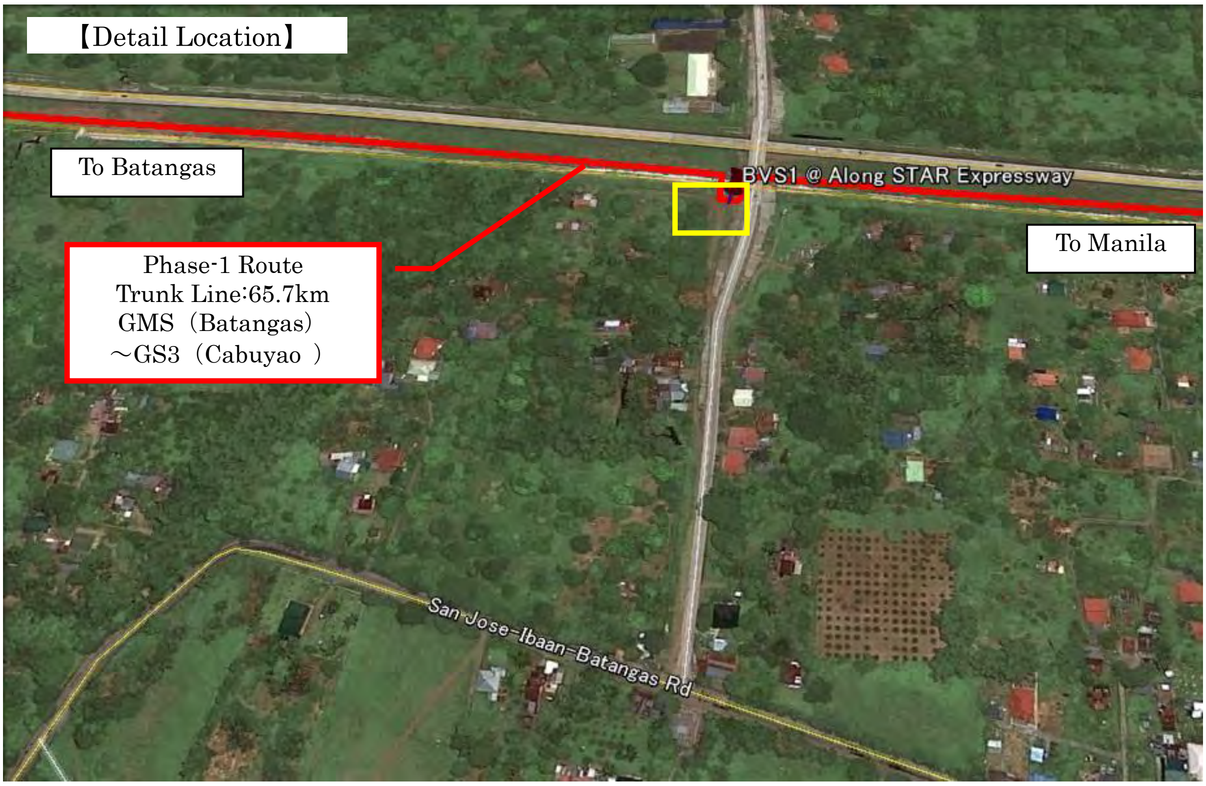
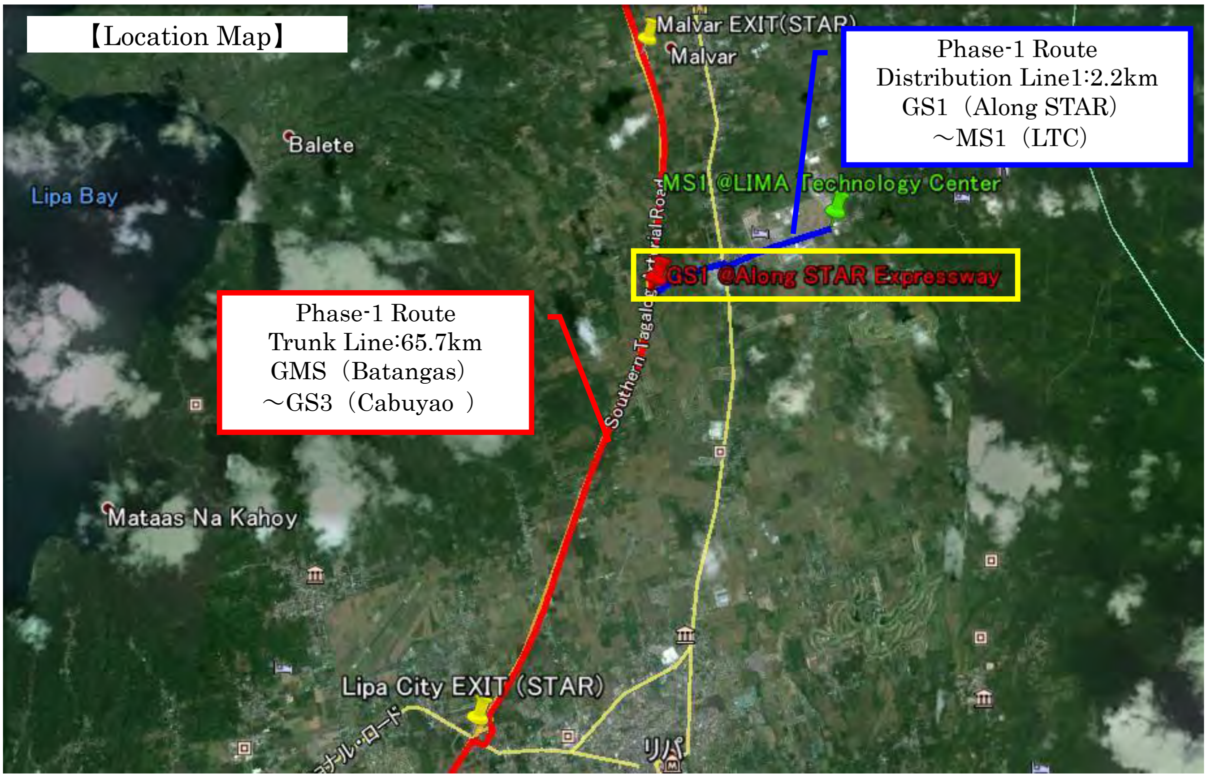


Figure 2.4-43 Location Map of BVS1

b. GS1 Location : The 7 km-long private land along the STAR Expressway from Lipa City exit towards Manila

(Malvar Municipality, Batangas Province)



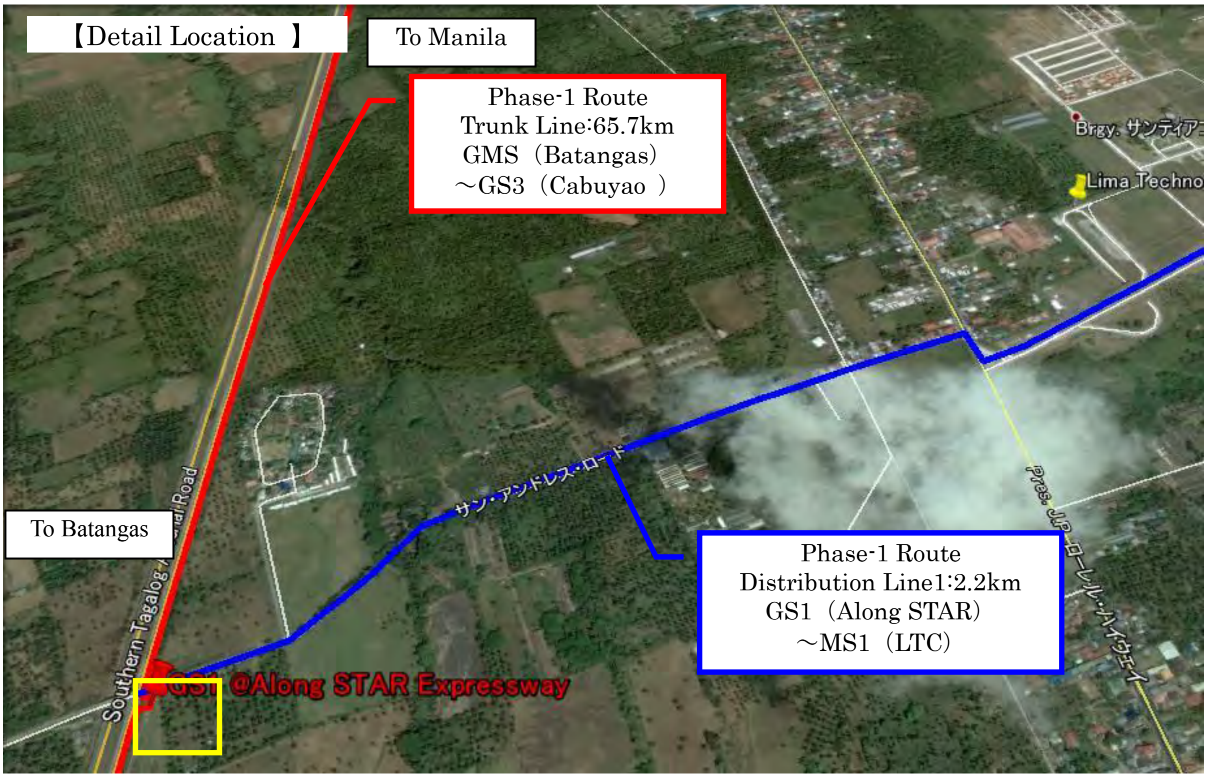


Figure 2.4-44 Location Map of GS1

c. GS2 Location :The private land close to Sto Tomas exit

（Sto Tomas Municipality, Batangas Province）

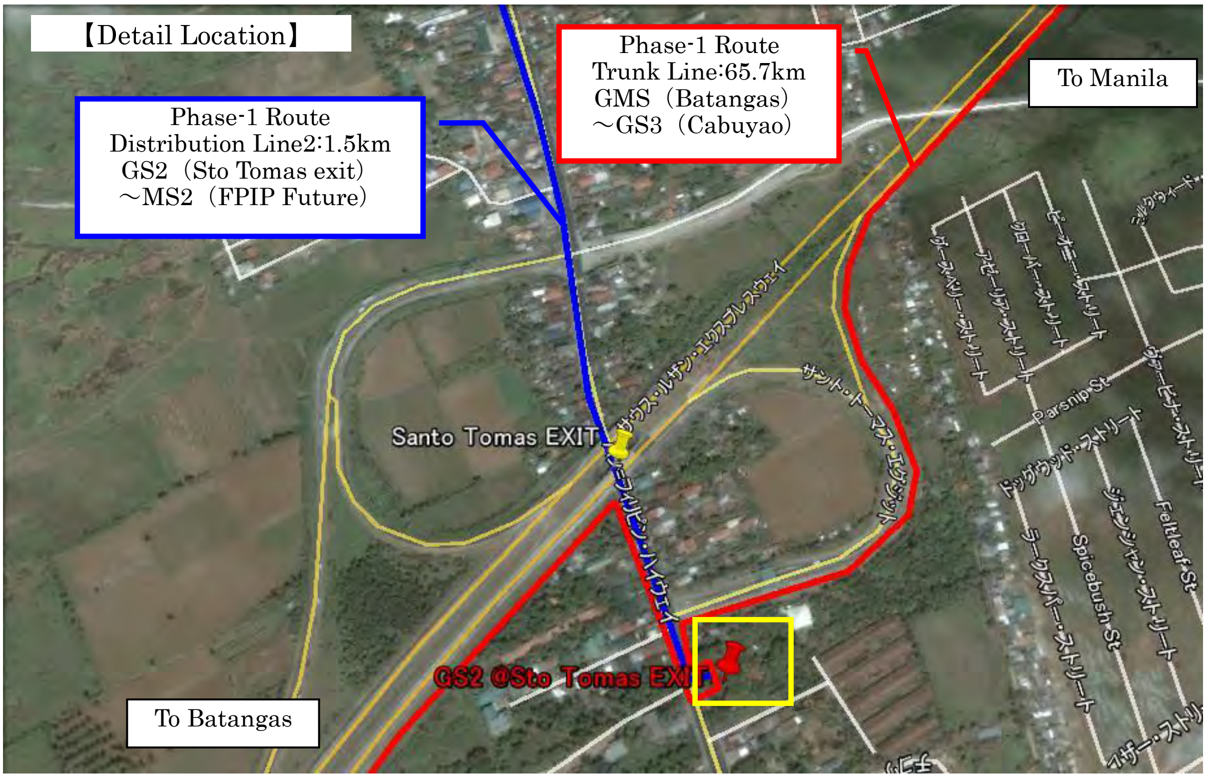
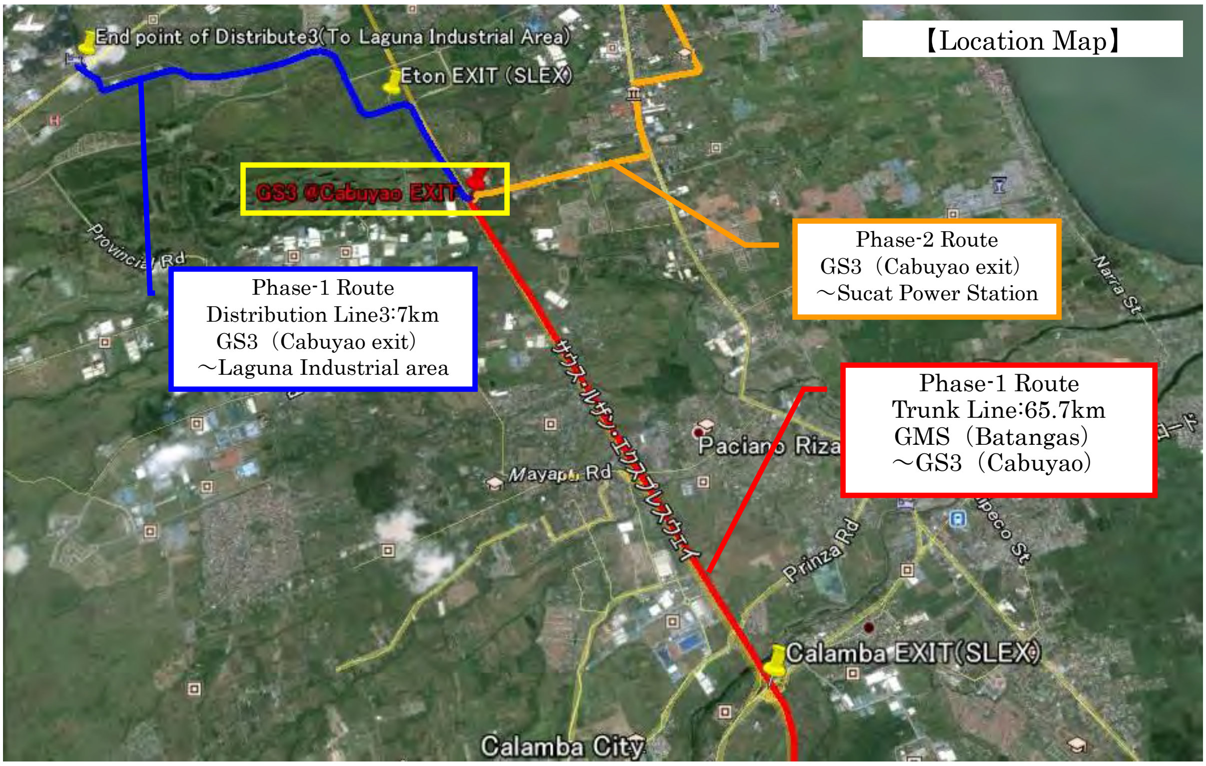


Figure 2.4-45 Location Map of GS2

d. GS3 Location :The Cabuyao exit located in the SLEX site

(Cabuyao City, Laguna Province)



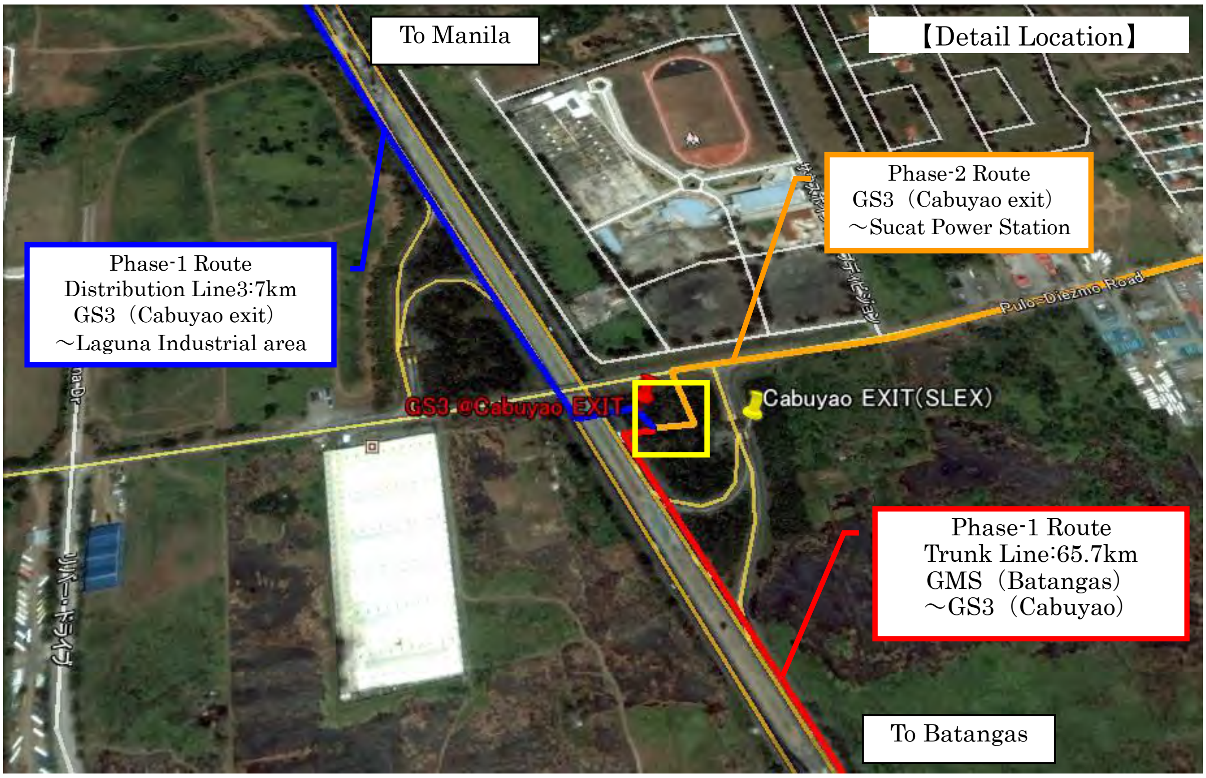


Figure 2.4-46 Location Map of GS3

2) Locations of Metering Stations

The candidate installation sites of Governor & Metering Stations (hereafter referred to as GMS) for measuring the operation gas volume from the Energy Supply Company and Metering Stations (MS) for assessing the supply situations for each customer are shown as follows (see Figure 2.4-47):

- GMS：Energy Supply Company site (Batangas City, Batangas Province)
- MS1：Lima Technology Center site（Malvar Municipality, Batangas Province）
- MS2：First Philippine Industrial Park(Future Plan)site（Sto Tomas Municipality, Batangas Province）

This survey has been conducted on the confirmation with each relevant agency on the availability of installation within the sites mentioned above. By contacting the agencies, the definite locations of the stations must be determined at the next detailed design.

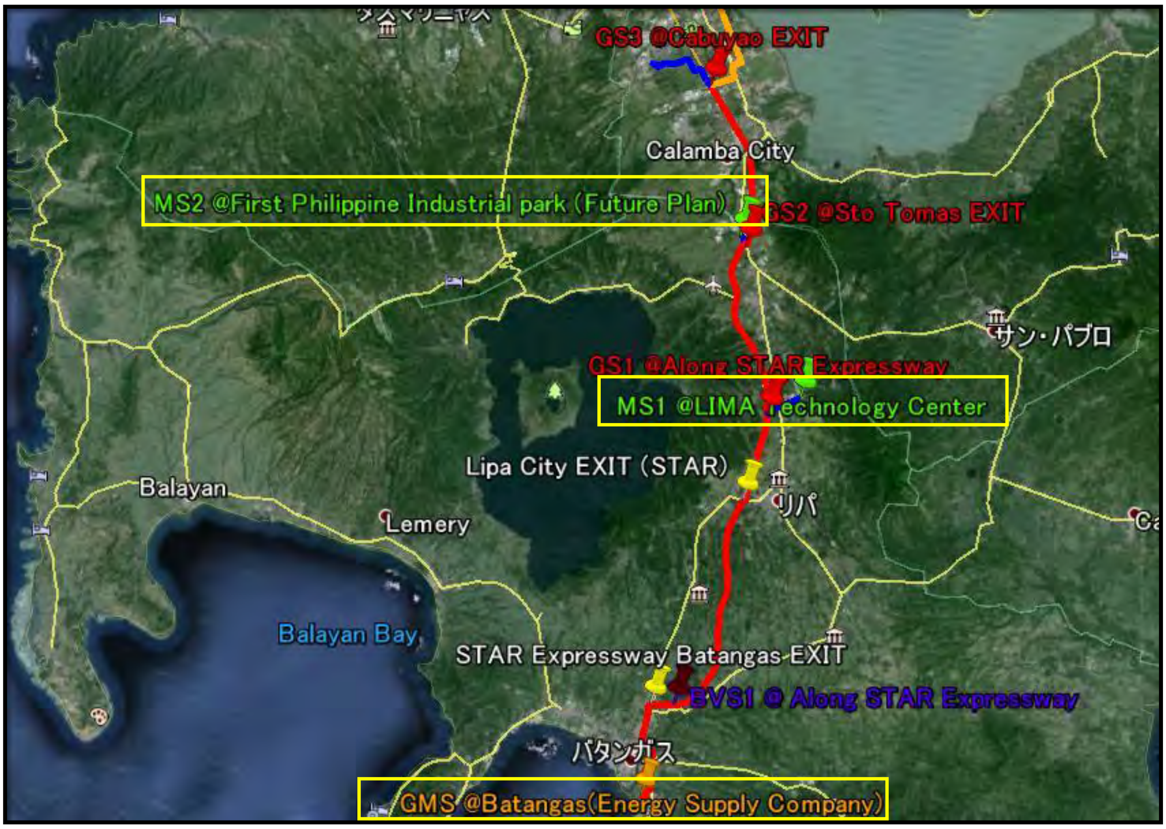


Figure 2.4-47 Location Map of Candidate GMS and MS sites

2.4.3 Study on Construction Plan

(1) Examination of Construction Methods

1) Construction Methods for General Parts

In terms of pipeline installation, the parts of the underground pipes in the expressways (the vegetated areas towards Manila) and under the roads are generically called general parts.

A typical construction procedure for general parts is as follows: “Road Excavation →Pipe Lowering →Welding →Inspection → Painting and Coating → Backfilling → Road Restoration”. Some other options such as daytime or nighttime construction, and same-day restoration could be selected considering various factors including road configuration, scale of traffic jam and situations of shops and residences.

In reality, directions from road operators and requests from the local communities are more often than not must be taken into consideration, and comprehensive examination and discussion must be conducted at the detailed design before the start of construction work.

2) Construction Methods for Special Parts

There is a variety of crossing methods for special parts (including rivers, roads and bridges) such as (1) open-cut, (2) pipe jacking, (3)shield, (4)HDD (Horizontal Directional Drilling), (5) laying pipeline through gas pipe bridge and (6)attaching to existing bridge. From among them, the construction methods are selected in view of economic rationality; the open-cut method with short construction period and cheap costs is selected to be basically employed for this pipeline, and the HDD and pipe jacking methods are to be applied in case where the open-cut method would be possibly difficult to be applied. Laying pipeline through gas pipe bridge and attaching to existing bridge mentioned above require exposing high-pressure pipes. Considering the possibility of terrorist attacks and malicious mischief, exposing pipes would be highly disadvantageous in terms of the safety of the pipeline, and added maintenance costs, as such, these are excluded from the options for this project.

(The exposed pipelines at the stations are monitored by security guards 24/7.)

The matters stated below must be noted for the application of the open-cut, pipe-jacking, and HDD methods. The following comprehensively describes the matters to be noted for the application of those three methods, instead of focusing on one specific method.

a. Damming the Rivers

In principle, the river crossing by the open-cut method is to be conducted during the dry season (from October to March) with little water. When there is a certain amount of water in the river, the riverbed excavation is to be executed while damming up and temporarily diverting the rivers with sandbags and sheet piles.

Furthermore, in case of the large-scale rivers with a large amount of water, the non-open cut methods such as the pipe jacking method are chosen considering the difficulty of damming such rivers.

b. Excavation of Riverbeds and Slopes

As excavation works of riverbeds and slopes require excavators to enter the sites, provisional construction work is to be conducted before pipe-laying work in order to enable the heavy equipment to enter there from both sides of the river. In case of steep slope, the provisional construction work is to be carried out by the bench-cut method to facilitate safe construction works.

River banks and slopes in some rivers carry risk of collapse and other problems if the water rapidly increases due to flood and other reasons. Consequently, the slopes need to be restored according to location.

c. Protection of Gas Pipes for River-Crossing Parts

Protective concretes are to be installed around the gas pipes since the river flows would possibly wear away the riverbeds, and also such concretes could function as an anchor preventing the pipes from floating up. Moreover, protective concretes are also to be installed in locations with the possibility of collapse of the river slopes by the flood as well.

Concrete-coated gas pipes are to be used as an anchor in the locations where protective concretes are not to be installed.

d. Depth of Riverbed Excavation

The depth of the gas pipe installation in the riverbeds set as the basic design is 2.0 m in principle. The depth in slopes is 0.8 m or more. Nevertheless, the depth of pipe installation must be decided based on the studies of the shapes and conditions of the riverbeds and ground.

e. Pipe Jacking Method

The pipe jacking method is selected for some river-crossing parts, where the open-cut method seems to be difficult to be employed in the river with large water volume, or excavation and backfilling are expected to be difficult to be executed due to the steep river slopes as mentioned above.
Pipe jacking machines appropriate for the ground conditions must be selected the same as the HDD method, and the selection and examination of methods of pip-jacking and the vertical shaft construction must be executed based on the ground survey at the detailed design.

f. HDD (Horizontal Directional Drilling) Method

The HDD method is best applied to the “San Juan Bridge” in the SLEX, given that the bridge is 200 meters long and 30 meters high above the riverbed, and that there are large-scale road-crossing parts and an interchange near the bridge. The HDD method could cross such parts at one time. At the detailed design, the ground survey and studies on the impacts on the surrounding structures must be conducted, and then, the construction methods must be considered.

Figure 2.4-48～Figure 2.4-51 show the outlines of typical construction methods and pictures of the construction works.

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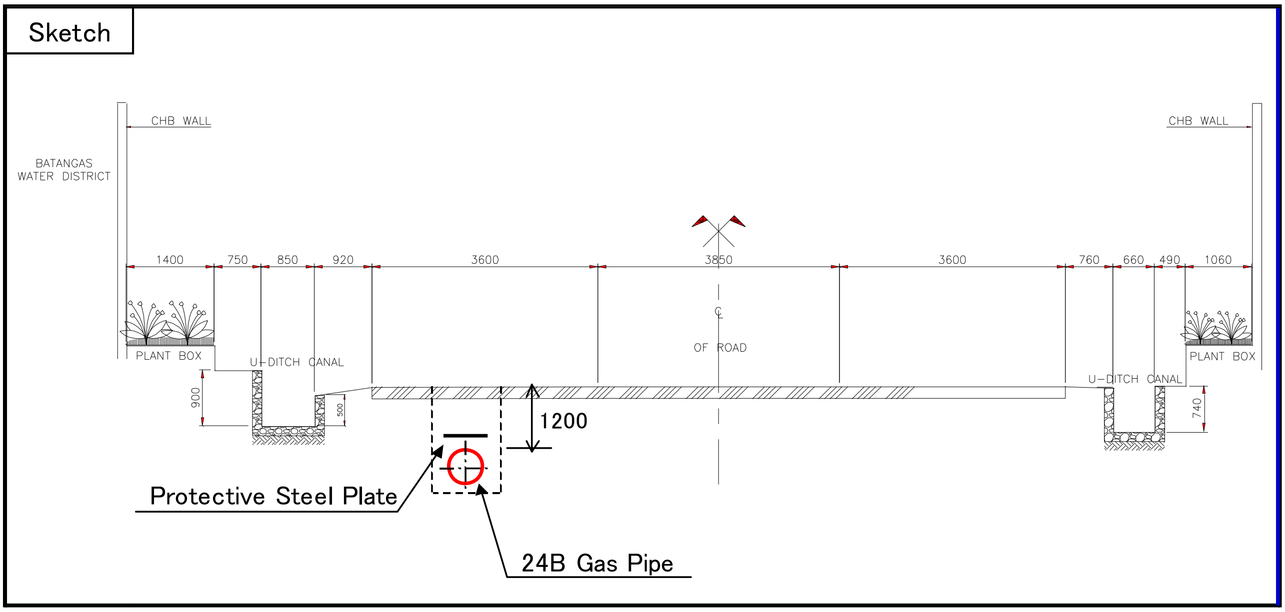


Figure 2.4-48 General Burying Method (example)

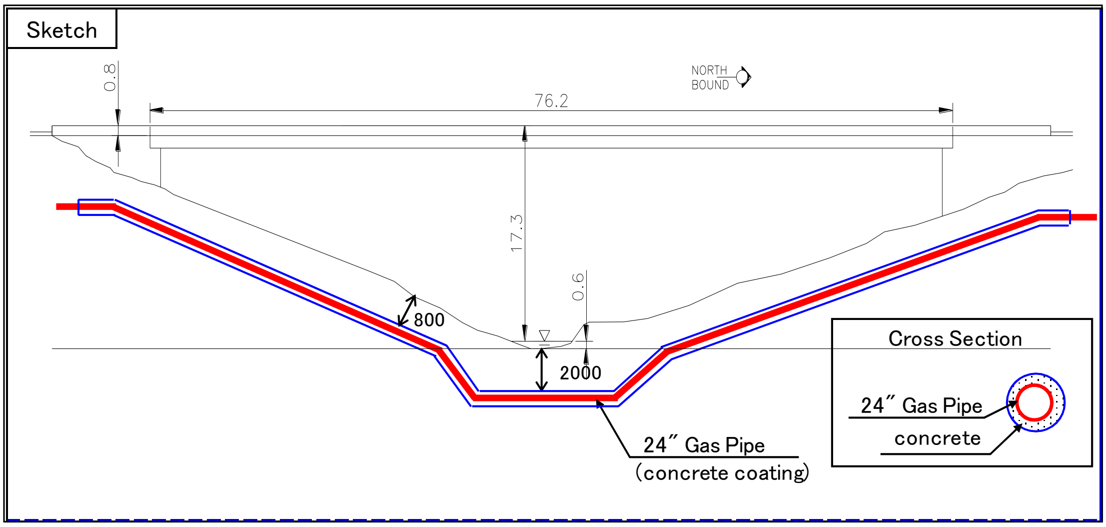
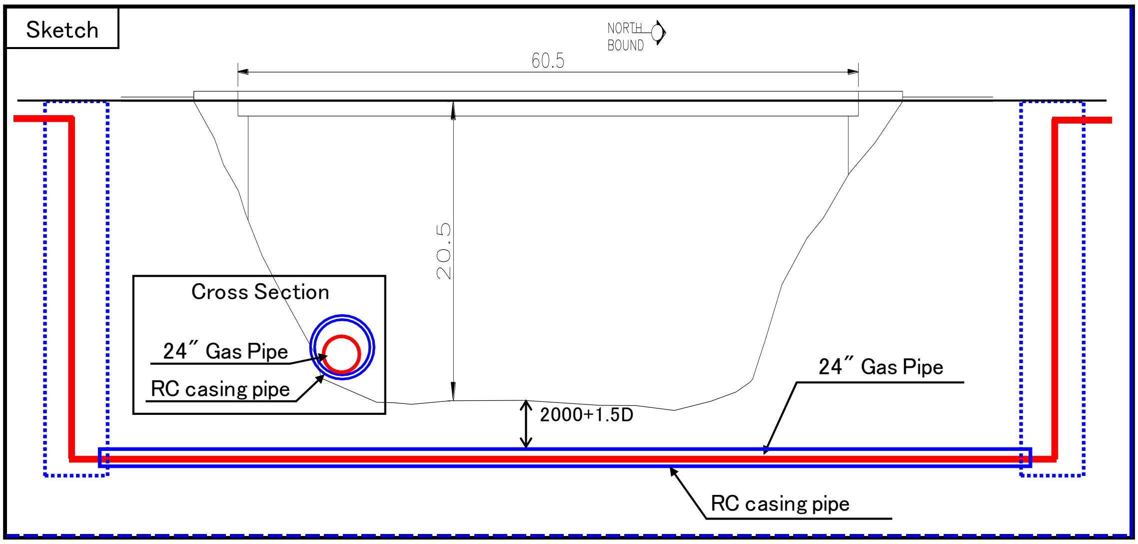


Figure 2.4-49 Open-Cut Method for Special Part (River Crossing)



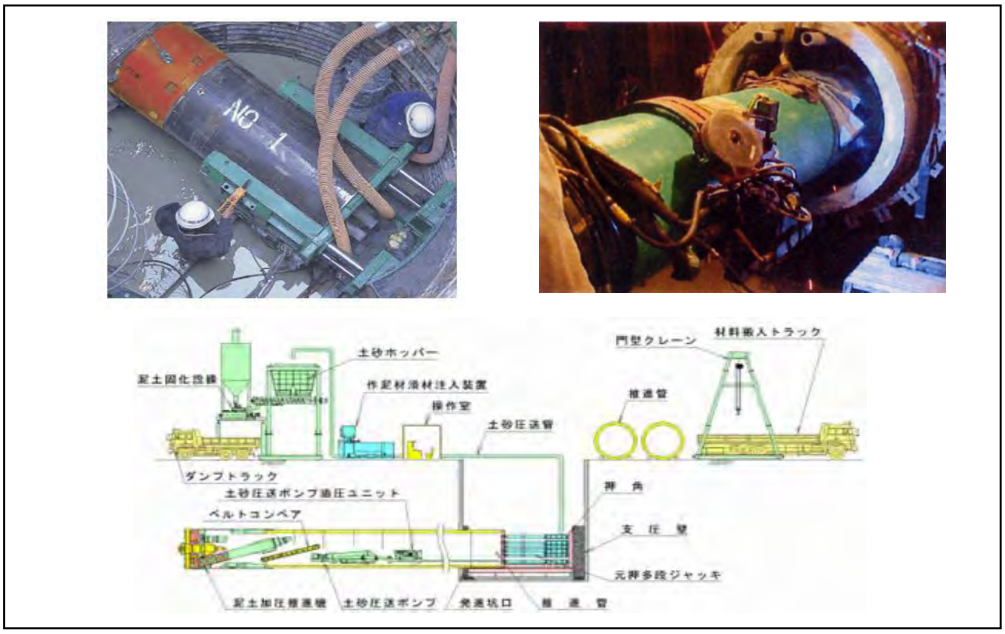


Figure 2.4-50 Pipe Jacking Method for Special Part「River Crossing」(example)

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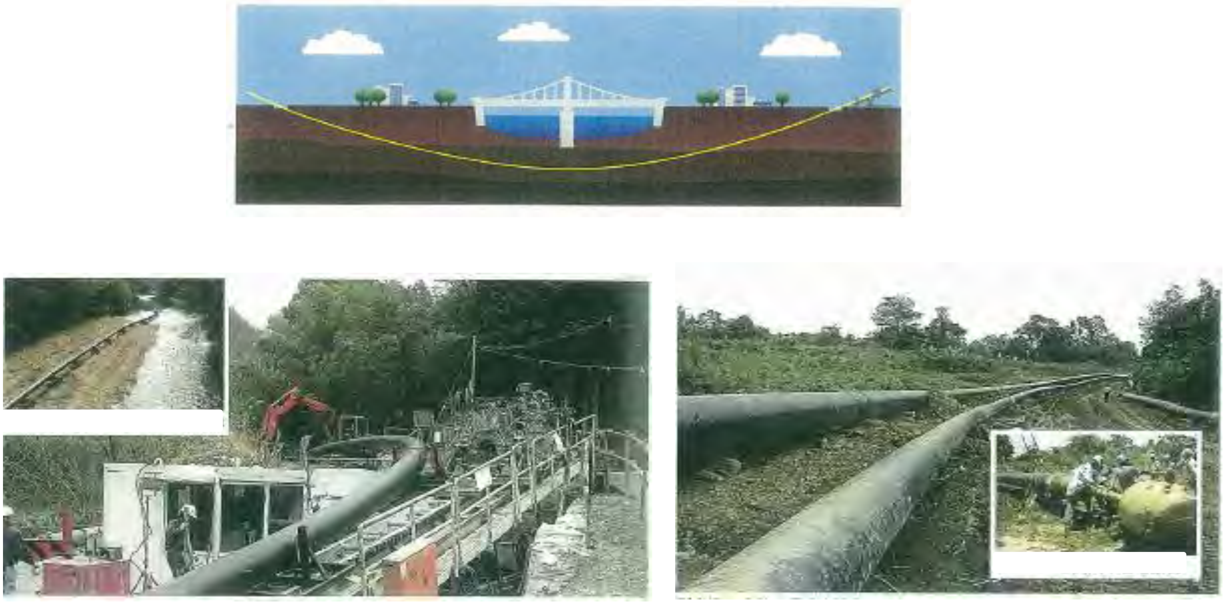


Figure 2.4-51 HDD Method (example)

(2) Provisional Construction Work Plan

1) Material/Equipment Transportation Plan (Logistics)

It is necessary to procure most components of piping materials from Japan among materials or equipment needed for Batman1 construction work. Those materials are to be transported from major ports in Japan to Manila Port or Batangas Port by cargo vessel. A storage yard is set up at either of the ports to receive the incoming materials in the Philippines, which will be transported, by road or rail, to the material storage yard serving as a base point for several construction sites after customs clearing.

Construction work is to be conducted, while materials or equipment are transported from the material storage yard to each storage yard of the construction sites, depending on the needs. Civil materials or others, which can be procured in the Philippines, are to be procured in the Philippines as much as possible and transported, by road or rail, to the material storage yard or each storage yard of the construction sites.

2) Provisional Construction Work Plan

The general installation construction, to be buried under the road width of national roads and expressways, is implemented on the premise that the road width needed for construction is used.

After discussions with road or shop operators along the road, who will suffer inconvenience from the construction, permission for the use of the road width needed for the construction should be obtained beforehand.

As for the pipe installation in the vegetated areas of the expressways, the sites where the clearance has been conducted are to be used as provisional sites for construction work.

For special parts such as river-crossing and road-crossing parts, provisional construction sites are required for shaft construction on both sides of the rivers or roads. Provisional roads are set up if needed in order to enable heavy equipment to enter the site from the both sides, before provisional sites for shaft and other construction are built.

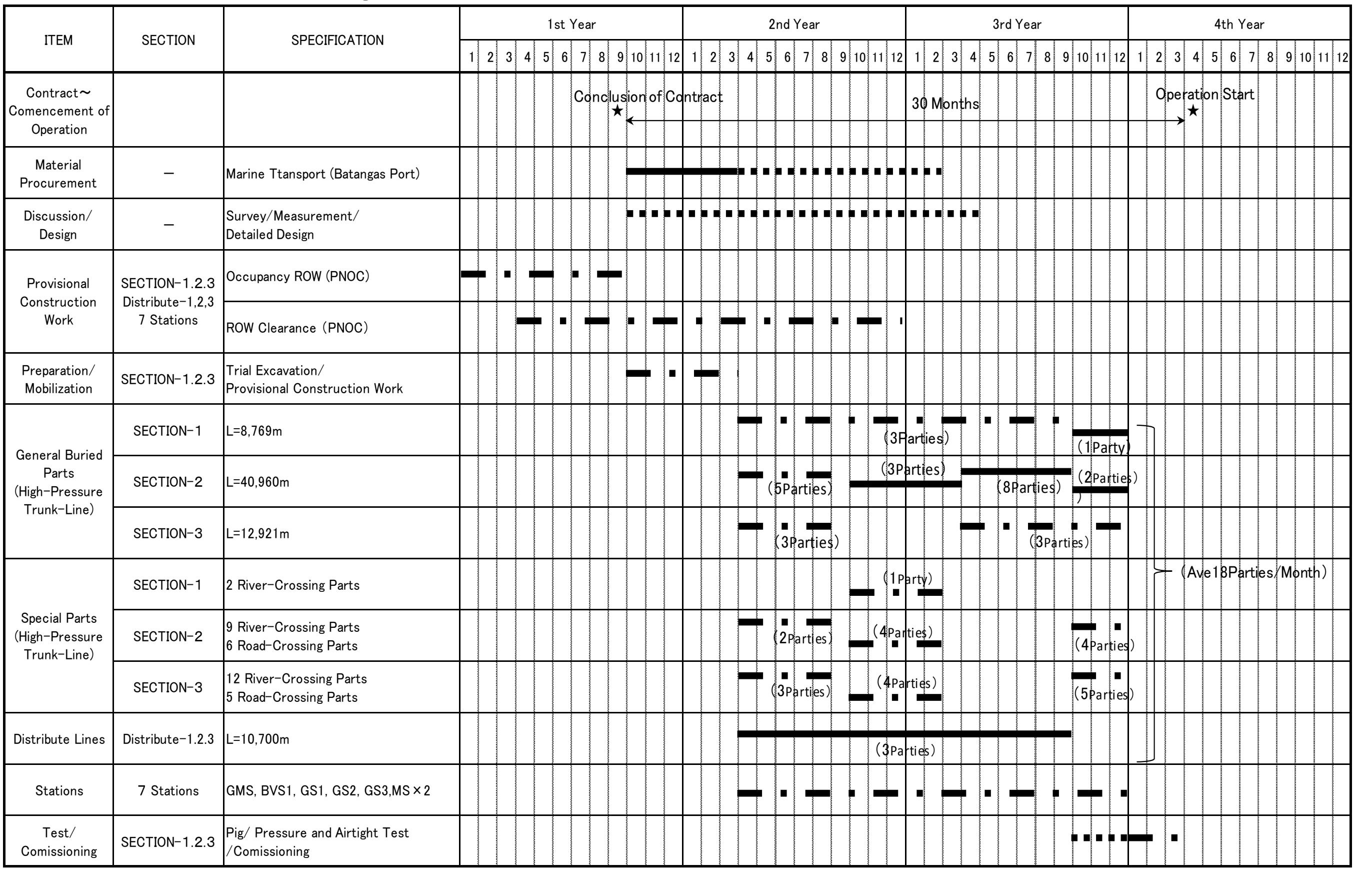
(3) Process Design for Construction

Table 2.4-6 describes the process design for Phase-1.The period from the conclusion of contract of the construction to commencement of operation is set at 30 months.

As for the estimation of the number of annual workable days, the annual average working rate is set at 75% based on the result of nature environment survey and experience in the existing construction in the Philippines.

Table 2.4-16 Process Design for Construction (Phase-1)

BATMAN1/PHASE1 Process Design for Construction



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2.4.4 Operation and Maintenance of High-Pressure Pipeline and Gas Supply Facilities

(1) Concept of Operation and Maintenance

The working pressure of the Batman 1 Trunk Line will be set at 4 MPa at the initial stage, and 6.8 MPa for the operation in the future, while the working pressure of the Distribution Line will operate at 2 MPa. The pipeline for Phase-1, with a total length of 76.4 km (24 inchh or km, 12 inchh or km), will be laid underground in urban areas, thus, it is predicted that there would be a great deal of damage in the event an accident occurs in which high-pressure gas ejects and ignites. Moreover, the Batman 1 high-pressure pipeline will be a completely one-way line until Batcave is connected with the Batman 2. This means that there is also a possibility that the high-pressure pipeline operator will have to stop the supply of gas to customers in order to perform repair work if there is damage to the pipeline or a breakdown in the gas supply facilities.

Accordingly, it is necessary for the high-pressure pipeline operator to operate and maintain the high-pressure pipeline based on the following concepts in order to ensure the safety and stable supply of gas. Also, the pipeline is expected to operate for a long period of time in view of the large scale of its initial investment cost. Thus, the function and safety of the pipeline needs to be maintained over a long term. Cathodic protection, periodic pig inspection and prevention of damage caused by the third party construction activities by daily patrol will enable the Batman 1 underground pipeline to operate semi-permanently. In addition, if the pipeline in the Philippines, which is an earthquake-prone country similar to Japan, maintains the quality of earthquake-resistant materials and field welded parts, its structure can secure the adequate safety against natural disaster.

However, no matter how excellent the quake-proof structure is, the proper safety performance cannot be ensured without preventing aging degradation.

The concepts and specific methods of operation and maintenance of the pipeline, which the engineers in the Philippines needs to master in order to operate and maintain the Batman 1 pipeline, are described below. First of all, in terms of the basic concept of operation and maintenance, 2) Preventative Maintenance from the following four maintenance concepts is selected as a premise for operation and maintenance activities of the Batman 1. It is based on the ideas that the proper consideration must be provided to the social influence and economic damage inflicted by the suspension of natural gas supply, which is a requisite to people’s lives and industrial activities, due to breakdown and other incidents.[1]

1) Breakdown Maintenance

Repair and Replacement after breakdown of facilities

2) Preventive Maintenance

Repair and Replacement before breakdown of facilities

3) Productive Maintenance

Choice between Preventive Maintenance and Breakdown Maintenance in consideration of economic efficiency instead of preventive repair before breakdown

4) Corrective Maintenance

Quality improvement of facilities and utilization of maintenance-free materials and parts to prevent the breakdown and deterioration of facilities and decrease repair cost

The following training that is to be conducted in a Japanese city gas company is expected to help the trainees to take the initiative in establishing the structure necessary for operation and maintenance and staff recruitment and training, based on the assumption that the engineers of PNOC, the owner of the

[1] Japan Society of Civil Engineering (eds), Pipeline – New Series of Civil Engineering 96, Chapter 7 Operation and Maintenance

Batman 1 will conduct 2) Preventive Maintenance, that is, the preventive inspection and repair before breakdown of facilities.

(2) Operation and Maintenance of the Pipeline

Other construction work, sand blasting, corrosion and ground displacement are considered risks that may cause damage to the pipeline. Some methods to reduce such risks are described as follows:

1) Route Patrols

Patrols above the route of the pipeline will be conducted with the aim of finding out whether any other construction work or abnormalities near the pipeline is present. If other construction work is discovered, the other construction work company will be notified that the pipeline has been laid in the vicinity and a request will be made to the company to stop work as necessary in order to strive to protect the pipeline. Moreover, if a leak is discovered near the pipeline, it will be confirmed whether or not it will affect the pipeline with exploratory drilling as there is a risk of sandblasting. Other construction work carries the largest risk among the factors that may lead to damage to the pipeline. Therefore, it will be preferable to conduct route patrols every day on the entire line.

2) Monitoring of Other Construction Work

In order to prevent damage to pipelines due to other construction work in Japan, in addition to the aforementioned route patrols, information on other construction work is collected, discussions will take place with other construction work companies; pipeline safety measures are implemented and witness inspections are carried out on the sites of other construction work. At present, it is not common to receive construction work notifications from other construction companies or to consult with other construction work companies in the Philippines. However, if there is an increase in the length of the pipeline operated by extension (including a medium-low pressure line) in the future, it will be difficult to prevent damage due to other construction work with just route patrols. Accordingly, it is necessary to take a view to build a system of construction work notifications and discussions upon considering the future of the pipeline in the Philippines. The following describes the collection of information on other construction work, consultations, safety measures and witness inspections.

a-1. Collection of Information on Other Construction Work

The high-pressure pipeline operator will establish a reception for other construction work and then receive construction work notifications from other construction work companies. Moreover, the high-pressure pipeline operator will then collect themselves information on other construction work by checking the construction work plans of underground installation managers and builders.

a-2. Discussions with Other Construction Work Companies

There will be discussions with other construction work companies with regards to the placement and method of the applicable construction work so that the range of the other construction work in the area of the pipeline is outside the range that will have an effect on the pipeline. If the range of the other construction work has to be inside the range that will have an effect on the pipeline as a result of the discussions, the high-pressure pipeline operator will select a method of pipeline safety measures. The implementation of safety measures will be determined upon discussions about whether these should be performed by the other construction work company or the high-pressure pipeline operator.

If an accident occurs in which there is damage to a pipeline due to other construction work, this will develop into a question of who is responsible between both the other construction work company and the high-pressure pipeline operator. Therefore, after consultations with the other construction work company, it is important to keep a record of the matters discussed and to exchange such correspondence with the other construction work company.

a-3. Safety Measures

Protective measures, including supporting protection or suspending protection, will be taken if a pipeline is exposed due to other construction work or if it enters into the range having an impact on the excavation of the other construction work.

In Japan, in addition to the aforementioned safety measures, the pressure of gas is reduced in order to minimize damage in the event of damage to a pipeline. Moreover, if a pipeline impedes on other construction work, the pipeline is sometimes relocated prior to the other construction work. However, because the Batman 1 pipeline is a one-way line for the time being, it is not practical to adopt these techniques.

a-4. Witness Inspections

Witness inspections will be carried out at the sites of other construction work in order to confirm the location, method and protective measures of the other construction work. If the location or method differs to that which was discussed previously with the other construction work company, upon notifying the other construction company to that effect, the other construction work company will be made to follow the matters discussed in order to protect the pipeline.

b. Pig Inspections

Pigs are inspection equipment that runs inside pipelines to detect thinning, dents and the position of the pipeline. Among pig inspections, in online pig inspections, the pressure of the gas is the driving force of the pigs. This is advantageous because it is not necessary to stop the supply of gas to conduct inspections. In some Western countries, laws have been established which state that pig inspections must be conducted on a periodic basis. In Japan, although there is no such law, some pipeline operators conduct pig inspections on a periodic basis.

Polyethylene-coated steel pipes will be adopted in the Batman 1 pipeline and corrosion prevention measures will be taken through the external power supply method, so the risk of corrosion will be low. Nevertheless, it is preferable to inspect whether there is corrosion with corrosion inspection pigs as it is thought that there is a possibility of defects when the pipeline is manufactured and damage when the pipeline is constructed. Furthermore, typhoons and earthquakes are likely to occur in the Philippines. There is a fear that the pipeline may deform and buckle due to ground displacement caused by seismic motion or landsides from rain brought about by a typhoon. Therefore, it is desirable to know the shape of the pipeline (absolute position of the pipeline) through mapping pigs.

With regards to the implementation period of the pig inspections, there should be an initial corrosion pig inspection and mapping pig inspection conducted after construction of the pipeline. It is possible to detect defects at the time of manufacture by running a corrosion inspection pig directly after construction and it is then possible to clearly distinguish between corrosion and defects at the time of manufacture when running subsequent corrosion inspection pigs. Moreover, it is possible to determine the initial position of the pipeline by running a mapping pig and it is then possible to identify places where there has been a large displacement of the pipeline when running subsequent position detection pigs. For the aforementioned reasons, it will be desirable to conduct an initial pig inspection directly after the construction of the pipeline. After the initial inspection, it will be best to run corrosion inspection pigs on a periodic basis and to run mapping pigs as necessary, such as after the occurrence of ground displacement caused by an earthquake.

c. Leakage Surveys

As mentioned above, there is a low risk of corrosion leakage in the Batman 1 pipeline. Nevertheless, defects at the time of manufacture or damage at the time of construction may develop penetrating into the pipeline, so efforts will be made to discover leakages through periodic leakage surveys in the pipeline using a gas detector.

d. Subsidence Measurements

Among ground displacements, there is also a danger that land subsidence will cause deformations in the pipeline. If the pipeline is installed in a region where there is potential for land subsidence, periodic measurements will be taken after installation to determine whether the depth of the pipeline from the ground surface has changed or not. If deformation to the pipeline is determined beyond what can be allowed as a result of these measurements, stress relief will take place to prevent the destruction of the pipeline.

(3) Operation and Maintenance of Stations

Stations are facilities that function as gas pressure reduction, gas cutoff, gas dissipation and gas measurement. The main stations are governor stations, valve stations and metering stations. A breakdown to the supply facilities installed in these stations may lead to an interruption in the supply of gas. Therefore, it is important to check whether any abnormalities in these functions on a periodic basis are found.

1) Common Items

Monthly patrolling on these stations will be carried out to inspect the supply facilities, instrumentation facilities, corrosion prevention equipment and buildings. The inspections will check the appearance, as well as possibility of leakage or any other abnormalities. In addition, precautionary measures will be taken to prevent intruders since stations are very significant in the supply of gas As such, there will be monitoring on the site of stations and in station buildings as a measure to prevent intruders.

2) Governor Station

Governor station is the source of the supply of gas to consumers, so a stable pressure governor is required. It is necessary to conduct periodic inspections to ensure the stable pressure governor performance. A function inspection of governors and ancillary facilities will be conducted around once a year. These will check the pressure governor functions of both the regular and preliminary systems, as well as check the operation of the valves. Moreover, an overhaul of governors will be performed on a pre-determined periodic basis with consumable parts replaced and checks made for abnormalities in each part. Overhauls will also be performed on a periodic basis on the filters installed upstream of governors to check whether there are any impurities such as dust.

3) Block Valve Station

Valve station plays a role in cutting off and dispersing gas in the event of damage to a pipeline, so they will be periodically inspected in order to maintain these functions. There will be an inspection of the functions of the valves around once a year to confirm their open/shut functions.

4) Metering Station

The amount of gas supplied to customers is weighed in metering stations. Calibrations and inspections of the meters will be performed on a periodic basis to ensure accurate transactions.

5) Governor and Metering Station

Governor and metering station has a combination of two functions, governor station and metering station. Therefore, its implementation items of operation and maintenance activities correspond to the implementation items of those two stations.

(4) Daily Monitoring

1) Monitoring of the Transportation and Supply Pressure

“Stable supply” refers to the delivery of gas at a stable pressure/flow to consumers. Demand for gas fluctuates according to the time and season, so it is necessary to adjust the amount of gas supplied in accordance with fluctuations in demand in order to ensure a stable supply. There will be monitoring of whether gas is being supplied at the pressure/flow required by consumers through SCADA with adjustments made to the amount supplied as necessary.

2) Monitoring of Corrosion

In the Batman 1 pipeline, measures to protect against corrosion will be taken through the external power supply method. However, there will be monitoring of the protection current through SCADA in order to confirm whether the functions to protect against corrosion are working or not. In the event of damage to a pipeline due to other construction work, there will be a change in the protection current, so it will also be effective to monitor the protection current in the operation and maintenance of the pipeline.

(5) Emergency Response

In the event of damage to the pipeline due to other construction work or corrosion and a leakage in the pipeline, it will be necessary to take an emergency response to prevent secondary damage such as explosions. The following describes the emergency response procedures.

1) Reception, Communication and Mobilization

In order to take an emergency response, the high-pressure pipeline operator will install a reception and accept notifications with regards to gas leakages and the like. It is important that the contact information for this reception is well-known by those along the pipeline, including the general population. In Japan, methods are taken to inform consumers of this information when signing a contract for gas supply and to specify this information in the vicinity of gas consumption equipment. In the Philippines, it is thought there is still a low level of recognition with regards to the gas pipeline business, so it is necessary to provide sufficient explanations when starting service for the pipeline.
After receiving a notification, this information will be communicated to the relevant parties according to its details. There is a danger of fire during a gas leakage, hence the fire department and the police agency will be contacted as necessary in order to provide evacuation guidance to residents.
Furthermore, the pipeline operator will mobilize in an emergency and provide an on-site response according to the details of the notification. Together with this, it may be necessary to set up a countermeasure task force in the office to focus on the emergency response depending on the scale of the incident. In particular, it is preferable to set up a 24 hour a day system for receipt, communication and mobilization in urban areas, because it is essential to rapidly respond after a gas leakage or similar occurs.

2) Initial Response

The emergency dispatch personnel of the pipeline operator will confirm the on-site situation after arriving at the site of incident and report this information to the pipeline office. The next step will be determined and taken in accordance with the on-site situation. For example, in case of a gas leakage, it will be necessary to ensure safety and then reduce the pressure/cutoff of the supply of gas. Hazard areas will be established and residents are evacuated outside of these areas in order to ensure safety. In addition, firearms will be removed to prevent ignition and explosion.

3) Emergency Repairs

The emergency repair method for the breakdown will be determined and emergency repairs will be performed in accordance with the details of the breakdown to the pipeline and that of the supply location. In preparation for emergencies, the equipment necessary to perform emergency repairs (e.g. sleeves) will be stockpiled.

4) Permanent Repairs

Although there are differences according to the method of emergency repairs, it is believed that there is insufficient strength for deformations caused to pipelines by ground displacement in comparison with healthy pipelines in places where there have been emergency repairs. Therefore, it is necessary to perform permanent repairs. Permanent repairs will be determined according to the situation of where the breakdown occurred. An example of permanent repairs is the method of cutting out a place where there has been a breakdown and replacing it with a new pipe.

(6) Information Management

It is necessary to review the operation and maintenance techniques of the high-pressure pipeline and the gas supply facilities in accordance with breakdown/trouble trends and changes in the installation environment. Therefore, it is important to record and manage information pertaining to operation and maintenance. The quality of operation and maintenance will be improved by identifying and reviewing problems in the existing operation and maintenance techniques from the results of the pipeline/station inspections outlined above, as well as the history of the details of breakdowns and troubles.

The pipeline O&M Proposal is shown in Table 2.4-17.

Table 2.4-17 Pipeline O&M Study Proposal

Philippine BATMAN 1 Pipeline O&M Study Proposal

Item			Implementation Item	Implementation Details (Outline)	Implementation Frequency	Number of Targets	Remarks
O&M of Pipeline (PL)	(a) Route patrols		Patrol by vehicle along buried PL route	Confirm the status of the road surface Confirm the status of hand holes etc. Confirm the status of other referenced construction work Understand other construction work not referenced	One round trips / day	76.4 km	
	(b) Other construction work management	Collection of information on other construction work	Understanding of other construction work	Confirm the construction work schedule with each underground structure manager	Once per month		
			Discovery of other construction work not referenced	Conduct route patrols ((a) Route patrol)	One round trips / day	76.4 km	
		Discussions with other construction work companies	Discussions about construction location and method	Hold discussions so that construction work takes place outside the range where there will be an impact on the pipes			
			Selection of safety measures	Determine appropriate measures according to the contents of other construction work			
			Determination of the time of witness inspections	Establish details of what has been determined in writing			
		Safety measures	Marking	Mark the gas pipe position			
			Protection	Determine protective measures			
		Witness Inspections	Witness inspections at other construction sites in vicinity of the PL	Confirm the location and method of other construction work Confirm the status of the protective measures			
	(c) Pig inspections		Corrosion inspections	Pig for corrosion detection Analyze growth of corrosion	0.1 times per year	65.7 km	
			Three-dimensional mapping	Pig for three-dimentional mapping Analyze bending strain		65.7 km	Implement at the initial pig inspection after commencement of operation Implement as necessary such as in case of large-scale soil displacement due to earthquake after the initial inspection
	(d) Leakage surveys		Leakage surveys	Check for leaks with detectors	Once per year	76.4 km	
	(e) Settlement measurement		Settlement measurement	Measure the depth of pipes from the ground surface Obtain the subsided soil (measure, if not available)			Implement at the locations carrying risk of groung subsidence in PL buried area Measurement frequency depends on the subsidence velocity at location of target
O&M of Stations	(a) Common items		Inspections of supply facilities	Check for gas leaks with detectors Check for abnormalities	Once per day	7 st	Implement with personnel permanently stationed at stations Overhaul and similar as necessary in case of detection of abnormalities such as gas leaks
			Inspections of instrumentation facilities	Detect external abnormalities	Once per day		
			Inspections of corrosion protection facilities		Once per day		
			Inspections of structures		Once per day		
			Monitoring of intrusion	Monitor for intruders	24 hours		Implement with security guards and personnel permanently stationed at stations
	(b) Governor Station (GS)		Governor periodical inspections	Check for the pressure history	Once per month	3 st	
			Governor function inspections	Maintain the secondary pressure within the set range Check operations of emergency shut down valves at the set pressure Check there is no gas beyond the valves on the secondary side	Once per year		
			Governor overhauls	Replace consumable parts Check for abnormalities in each part Cleaning and lubrication			Overhaul frequency is determined with reference to the yet-to-be installed governor maker's recommended frequency
			Filter periodical inspections	Check for impurities such as dust	Once per month		
			Filter overhauls	Check for abnormalities in each part			Implement accompanying governor overhauls
			Valve function inspections	Check open/shut operations Check remote open/shut operations are possible	Once per year		
	(c)Block Valve Station (BVS)		Function inspections	Check open/shut operations Check remote open/shut operations are possible	Once per year	1 st	
	(d) Metering Station (MS)		Meter periodical inspections	Check for abnormal operations	Once per month	2 st	
			Meter calibration/ inspection	Calibrate meters for gas transaction			Implementation frequency complies with Philippine laws and regulations related to metering.
			Valve function inspections	Check open/shut operations Check remote open/shut operations are possible	Once per year		
	(e) Governor and Metering Station (GMS)		Applies the items for Governor Station and Metering Station			1 st	
Daily monitoring	(a) Monitoring of gas transportation /supply pressure	Understanding of transportation and supply pressure	Daily monitoring	Monitor the supply pressure Monitor for facility abnormalities Record the supply load	24 hours		
		Maintenance of transportation and supply pressure	Supply adjustment	Study supply Draft annual supply plan Draft supply improvement plan	Each time		
			Operation	Control the supply pressure Study supply (in case of emergency)	24 hours		
	(b) Monitoring of corrosion protection status		Monitoring of corrosion protection current	Monitor corrosion protection current through external power supply system	24 hours		
Corrosion management	Inspections of buried pipes		Check cathodic protection status	Measure the pipe to ground potential	Once per year	76.4 km	
			Check pipe bodies	Check the coating condtions (when exposed)			
	Inspections of exposed pipes		Check pipe bodies	Check the rustproof coating conditions Check for corrosion	Once per year	7 st	
Emergency response	(a) Reception, contact and mobilization		Reception	Receive and record in-house reports Receive and record customer reports	24 hours		
			Contact	Contact relevant parties according to the content received	24 hours		
			Mobilization order	Order mobilization according to the content received	24 hours		
	(b) Initial response		Understanding of the on-site situation	Check for damage			
			Safety confirmation	Give evacuation guidance Establish hazard areas			
			Gas pressure reduction	Reduce pressure (dissipation and consumption)			
			Gas cutoff	Operate valves and governors			
	(c)Emergency repairs		Emergency repairs	Order emergency repairs (e.g. patches and sleeves) Manage construction			
	(d) Permanent repairs		Repairs and restoration	Order repairs and restoration work Manage construction Operate valves and governors			

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2.4.5 Project Test Analysis and Feasibility Study

This section describes the issues and efforts for the future towards the realization of this project.

(1) Construction Approval from Road and Highway Operator along the Pipeline Route

As discussed in the aforementioned section “2.4.3 Study on Construction Plan,” this pipeline will be constructed underground on green or lawned areas (hereinafter referred to as vegetated areas) outside the side strip near ordinary roads and on the sides of highways. The permission from road operators will be a minimum requirement when carrying out the construction work. Moreover, the acquisition of ROW will become an important issue to the project implementing body since ROW will be necessary as much and long as possible during construction and as supervised roads after the completion. The procurement of permission to lay the pipeline for this project has been confirmed upon discussions with road operators as shown in Figure 2.4-52 and Table 2.4-18 (see “2.4.2 Selection of Pipeline Route” for details).

It will be necessary to determine site occupations for the pipeline in the roads including highways, upon understanding of the future plans for the roads as well as the status of other buried facilities. Therefore, prior discussions will be required.

Furthermore, , there are existing structures (e.g. waterways, telephone poles and signboards)in some areas that will possibly obstruct the construction work, and these are needed to be temporarily removed and restored afterwards.

(2) Selection of Construction Method

As for the pipeline installation method, the common underground construction method, which is the lowest-priced and most performed in Japan, has been determined as the standard. Nevertheless, there will be a possibility that non-open cut construction methods is necessary to be selected according to the environment issues and demands from local residents.

Non-open cut methods such as the pipe jacking, shield and HDD methods would be introduced for the first time in the Philippines. Therefore, the introduction of the Japanese technologies with an array of experiences in urban areas is considered.

As non-open-cut methods require larger-scale construction, thorough surveys including soil survey and studies must be conducted for the selection. Also, the security of procurement of civil work equipment and construction machines will be important as well as the cooperation from the local Japanese construction companies since the non-open-cut methods have been rarely applied in the Philippines.

(3) Local Relations

The common underground methods during the daytime in the urban areas may escalate traffic congestion. The result of the field survey has identified the necessity of nighttime construction in some areas.
Still, nighttime construction work may possibly cause noise or vibration problems, and it will be necessary to gain the understanding of local residents and shop owners in advance.

(4) Welding Technology

The reliability and criteria (API/JIS) of the field girth welds for the high-pressure trunk line have been frequently mentioned in this report. It will be necessary to secure welding engineers with more than a certain level of skills of fully automatic welding (MAG) at or during the construction period.

Therefore, welding training will be a requisite and the operation of training facilities and maintenance of the skills will be required, including the operation and maintenance work after the commencement of operation of the pipeline.

(5) Surveys and Design

It is suggested to confirm if there are any locations where large soil deformation is caused by soil liquation at detained engineering in Phase-1. In addition, construction methods need to be selected after detailed geological surveys including boring survey are conducted in special parts like river-crossing parts.
Additional active fault and soil liquation surveys in Phase-2 are to be proposed on the basis of site reconnaissance in the planning stage. The active fault map of PHIVOLCS indicates that the route scheduled for Batman1 passes the active fault area where the possibility of large-scale earthquakes is high from the viewpoint of geological structure. Attention is paid to the necessity to identify the right location of potentially risky active fault in a cautious manner in an effort to secure pipeline safety. And furthermore, it is important to accurately estimate active fault structure type, sliding angle of active fault and sliding angle between pipeline and active fault, etc.

(6) Construction Work Schedule

The construction work schedule must be arranged reasonably and consistently according to the actual project implementation period. This project, for which construction sites are spread in some different areas, would possibly be subject to some environmental restrictions in the neighborhood, and the construction sequence for each section would largely affect the construction work schedule. Therefore, the results of discussions with the parties concerned and conditions in the local areas must be reflected in the construction work schedule.

It will be preferable to conduct the construction work for the river crossing parts during the dry season considering the major impact of typhoons and heavy rains. It will be necessary to carry out thorough surveys and consideration on the construction period and number of workable days at the detailed design stage.

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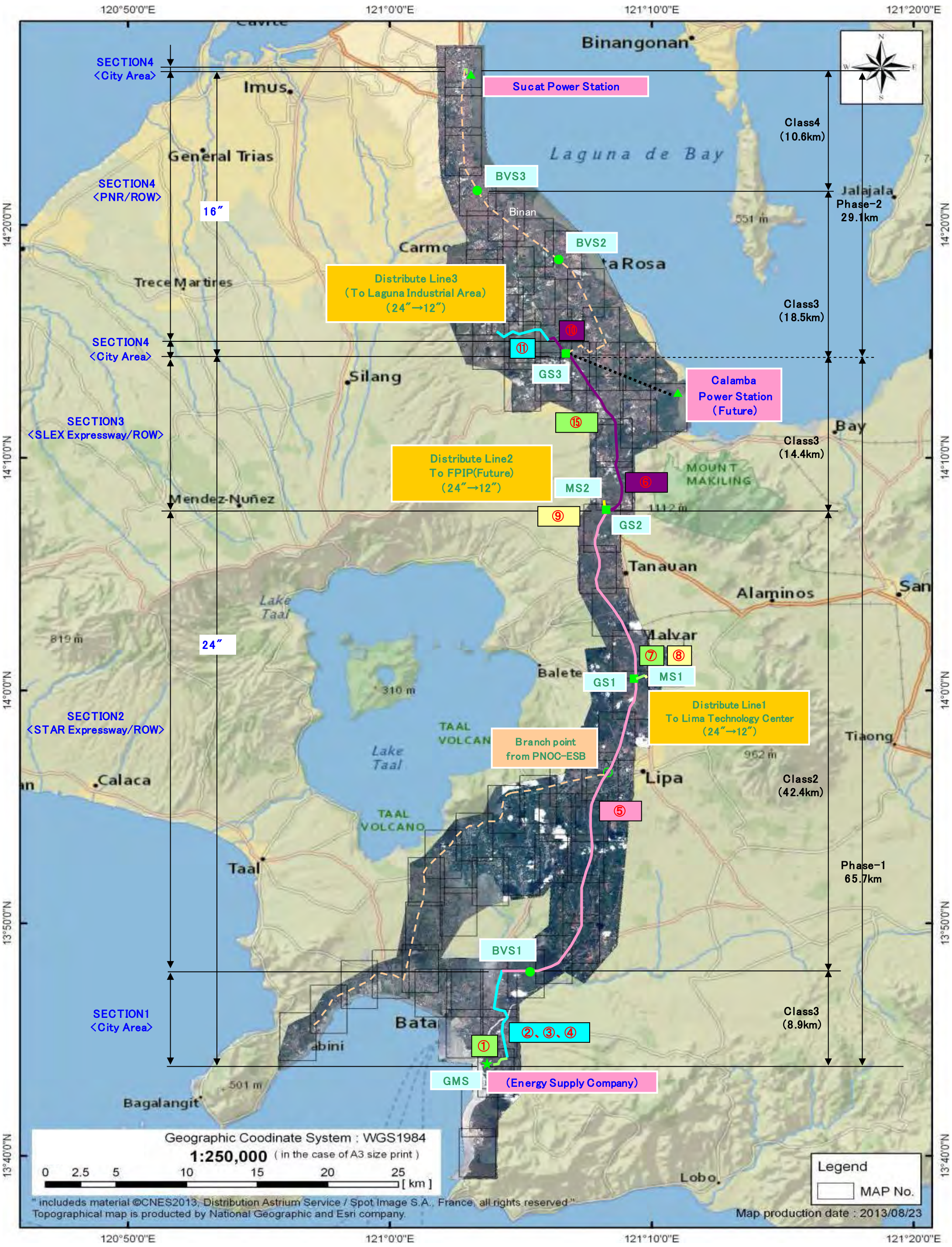

Figure 2.4-52 Route Map for Confirmation with Road Operators

Table2.4-18 Situations of Pipeline Route Confirmation to Road Operators for Phase-1 Route.

Situation of Pipeline route confirmation to road operators as PHASE-1 Route.

Authority / Agency					LGU	DPWH-BATANGAS		TRB		LGU		Reference Length (km)
					Batangas City	2nd District @Batangas	3rd District @Tanauan	STAR	SLEX	Malvar Municipality	Santa Rosa City	
SECTION 1	From SHELL OGP to Batangas EXIT(STAR)	①	Barangay Road (LIBJO-TAKAD Road)	Occupancy permit for pipeline	Possible							1.0Km
				Pipeline space	Possible							
		②	National Highway BATANGAS TABANGAO LOBO ROAD	Occupancy permit for pipeline		Possible						7.9Km
				Pipeline space		Possible						
		③	National Highway BATANGAS LOBO ROAD	Occupancy permit for pipeline		Possible						
				Pipeline space		Possible						
		④	National Highway MANILA BATANGAS ROAD	Occupancy permit for pipeline		Possible						
				Pipeline space		Possible						
SECTION 2	From Batangas EXIT(STAR) to Santo Tomas EXIT	⑤	STAR Expressway From Batangas/Basic route From Lipa/Alternative route	Occupancy permit for pipeline				Possible				42.4Km
				Pipeline space				Possible				
SECTION 3	From Santo Tomas EXIT to Cabuyao EXIT(SLEX)	⑥	SLEX Expressway	Occupancy permit for pipeline					Possible			14.4Km
				Pipeline space					Possible			
DISTRIBUTE 1	Distribute Line1 to Lima Technology Center From GS1 (Along STAR in Malvar) to MS1at Lima Technology Center	⑦	Barangay Road (San Andress Road) From GS1 to National Highway	Occupancy permit for pipeline						Possible		2.1Km
				Pipeline space						Possible		
		⑧	National Highway J.P. Laurel Highway Road	Occupancy permit for pipeline			Possible					0.1Km
				Pipeline space			Possible					
DISTRIBUTE 2	Distribute Line2 to FPIP(Future) From GS2(Sto Tomas EXIT(STAR) to FPIP(Future))	⑨	National Highway (Pan Philippine Highway) From GS2 to FPIP(Future)	Occupancy permit for pipeline			Possible					1.5Km
				Pipeline space			Possible					
DISTRIBUTE 3	Distribute Lin3e to Laguna Industrial Area From GS3(Cabuyao EXIT(SLEX) to Laguna Industrial Area)	⑩	SLEX Expressway From G3(Cabuyao EXIT(SLEX) to Eton EXIT(SLEX))	Occupancy permit for pipeline					Possible			2.0Km
				Pipeline space					Possible			
		⑪	Green Field Park way (Private Road/Santa Rosa City) From Eton EXIT(STAR) to Laguna Industrial Area	Occupancy permit for pipeline							Informed*	5.0Km
				Pipeline space							Possible	

*Informed to Santa Rosa city but not yet confirm to two private road owners. (Eton and Greenfields Subdivisions)

2.4.6 Design Standards and Comparative Analysis of Similar Projects of Other Countries

The Batman 1 high-pressure gas pipeline route is to be constructed along the National Road in the urban areas of Batangas and the expressway from Batangas to Cabuyao.
The construction of high-pressure gas pipeline under the road, which is dense with population and buildings, could not be seen except for Japan. Therefore, Japanese projects are the basis for such similar projects of other countries.
Generally, high-pressure gas pipeline is constructed after acquiring the Right of Way (ROW) in other countries.

The western standards and guidelines for pipeline, which are relatively more frequently applied than others and also referred and applied in Japan, are shown below:

(1) ANSI/ASME (American National Standards Institute/American Society of Mechanical Engineers)

B 31.4 Liquid Petroleum Transportation Piping Systems
B 31.8 Gas Transmission and Distribution Piping Systems
B 16.5 Steel Pipe Flanges and Flanged Fittings
B 16.9 Factory-Made Wrought Steel Buttwelding Fittings

(2) ASME (American Society of Mechanical Engineers)

Boiler and Pressure Vessel Code
Section V Nondestructive Examination
2.4 Related Laws, Regulations and Guidelines 41
Section VII Pressure Vessels
Section IX Welding and Brazing Certifications

(3) API (American Petroleum Institute)

SPECIFICATION 5 L (SPEC 5L) Specifications for Line Pipe
SPECIFICATION 6 D (SPEC 6D) Specifications for Pipeline Valves
STANDARD 1104 Welding of Pipelines and Related Facilities
RECOMMENDED PRACTICE 1110 Recommended Practice for the Pressure Testing of Liquid Petroleum Pipelines
RECOMMENDED PRACTICE 1111 Recommended Practice for Design, Construction, Operation and Maintenance of Offshore Hydrocarbon Pipelines

(4) ASTM (American Society for Testing and Materials)

A105 Standard Specification for Forgings, Carbon Steel for Piping Components
A370 Mechanical Testing of Steel Products

(5) IGE (Institution of Gas Engineers)

TD/1 Recommendations on Transmission and Distribution Practice, Steel Pipelines for High-Pressure Gas Transmission
TD/9 Recommendations on Transmission and Distribution Practice, Offtakes and Pressure-Regulating Installations for Inlet Pressures between 7 and 70 Bar

Some other standards stipulated by the following agencies are relatively frequently applied as well:

AGA American Gas Association
AWS American Welding Society
MSS Manufacturers Standardization Society of the Valve and Fittings Industry
NACE National Association of Corrosion Engineers
SSPC Steel Structures Painting Council
BSI British Standards Institution

DIN Deutsches Institut für Normung
SIS Standardiser- ingskommissionen i Sverige (The Swedish Standards Institute)
DNV Det Norske Veritas
ISO International Organization for Standardization

The above are the standards to be applied for the Batman 1, the first high pressure gas pipeline in the Philippines, and commonly applied international standards. The comparison between ANSI, ISO and Japanese Gas Business Act (including related standards) is shown in Table 2.4-19.

Table 2.4-19 Comparison of Standards

Item	Gas Business Act	ASME (B31.8-1999)	ISO (13623-2000)
Materials	Main materials for gas facilities must have safe and electric natures at both maximum and minimum allowable working temperature. (referred to JIS, API and other standards)	Referred to ASTM and API The names of standards for main materials are stipulated in the article, and the names of allowable standards are in the appendix.	Materials used for pipeline system is required to have electric natures of the strength and tenacity to meet the requirements for the design, and also to be appropreate for assembling and construction methods.
Earthquake Resistance	Seismic design for gas pipeline is referred. Seismic Level 2 is applied (only for high-pressure pipeline).	No specific standards	Earthquake is required to be considered as environment load. However, no equations are mentioned.
Pressure Test	Pressure Test must be appropriately conducted on pressured parts. The test pressure is 1.5 times the maximum working pressure. However, there some exceptions, such as that the RT-passed parts do not require the Pressure Test.	Varies with Location Class (desigin factors and locations). Class 1 Division 1 : water 1.25 times Class 1 Division 2 : water and air 1.1 times Class 2 : water and air 1.25 times Class 3&4 : water 1.4 times	Water. Or, air, If water could not be used. The minimum test time is 1 hour at more than 1.25 times the maximum working pressure (1.20 times is allowable if the test pressure could not excess 1.05 times by C or D fluids. More than 1.1 times for at least 8 hours as the Leak Test after the Strength Test.
Airtight Test	There must be no leakage when the Airtight Test is appropriately conducted such as the Airtight Test is conducted at the maximum working pressure or by the flowing gas pressure.	No standards	No standards
Welded Parts	Welded parts pressured at more than 0 Pa, where the gas of the gas facilities flows, must have the full fusion and no harmful defects such as cracks caused by welding, and also have the strength more than required for the design. Welding methods for high-pressure and more than 150 mm middle-pressure pipelines muse be confirmed. Welder Appropriate Non Destruction Test Standard for judging RT is Z3104.	Welding instructions and welders must comply with API 1104 API 1104 Welding instructions and welders	ISO13847 must be complied with. ISO13847 Welding methods Welders

The notable difference between the standards for Batman 1 and other countries is the allowance criteria for flaws of site welded parts.
Nevertheless, the international standards are to be applied for some areas with low population density and little impacts induced by earthquake, as detailed in the table below.

Table 2.4-20 International Standards

Standard / Flaw Type	International standard API 1104	Japanese standard JIS Z3104 2nd class
IP  Incomplete penetration	25 mm Individual or cumulative 25mm in 300mm length	5mm One third (1/3) of Wall Thickness
IFD  Incomplete fusion due to cold lap	50 mm Individual: 50mm Cumulatived:50mm in 300mm length	5mm One third (1/3) of Wall Thickness
BH  Blowhole	3mm Φ3mm 25% of Wall Thickness	3mm 6 of φ1mm BH in 1cm² 3 of φ2mm BH in 1cm² 2 of φ3mm BH in 1cm²
REMARKS	In case 15mm Wall Thickness Pipe	

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2.5 LNG Receiving Terminals

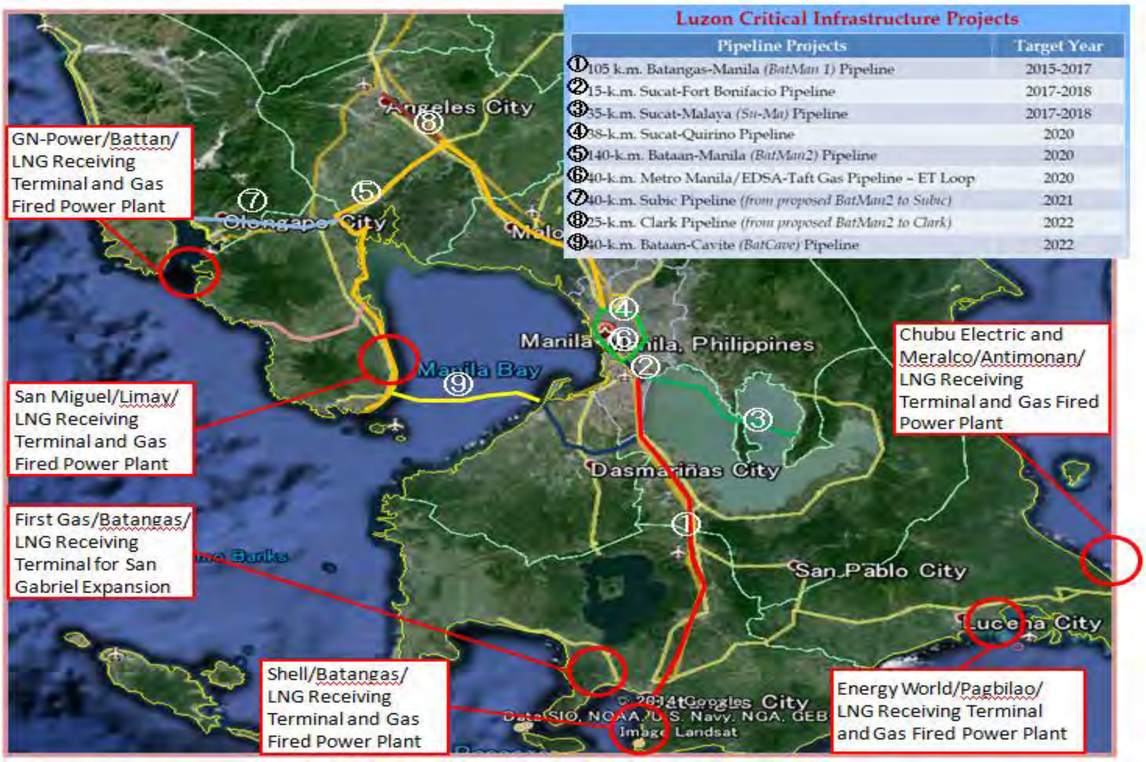
2.5.1 Essential Reasons for LNG Receiving Terminals Construction in Batangas Area

The transportation of the supply of natural gas to Batman1 will be assumed to be imported from the LNG since the Malampaya gas field has no sufficient capacity to supply natural gas to Batman1.
New LNG Receiving Terminals are intended to be constructed in six locations as shown in the figure below. However, it is most appropriate and important that the LNG Terminals will be built in Batangas area for the following reasons:

- Natural gas needs to be supplied to the thermal power station with a total capacity of 2,700 MW in Batangas area even after the depletion of the gas reserves at the Malampaya gas field. Therefore, the construction of LNG Receiving Terminals in Batangas area is necessary.

- Natural gas is currently transported to the thermal power station with a total capacity of 2,700 MW through the only one submarine pipeline in Malampaya. If the pipeline ceases the supply for any reason, then an alternative route backup for the other natural gas supply is vital for the steady supply.

- There are a lot of industrial parks and commercial facilities along the gas pipeline route from Batangas to Manila, and it will enable natural gas to be efficiently supplied from the pipeline. It will lead to the expansion of industrial infrastructure and promulgation of employment.



Source: Survey Team based on DOE documents

Figure 2.5-1 Construction Plan of Natural Gas-Related Facilities in South Luzon

2.5.2 Types and Features of LNG Receiving Facilities

(1) Onshore LNG Receiving Terminal

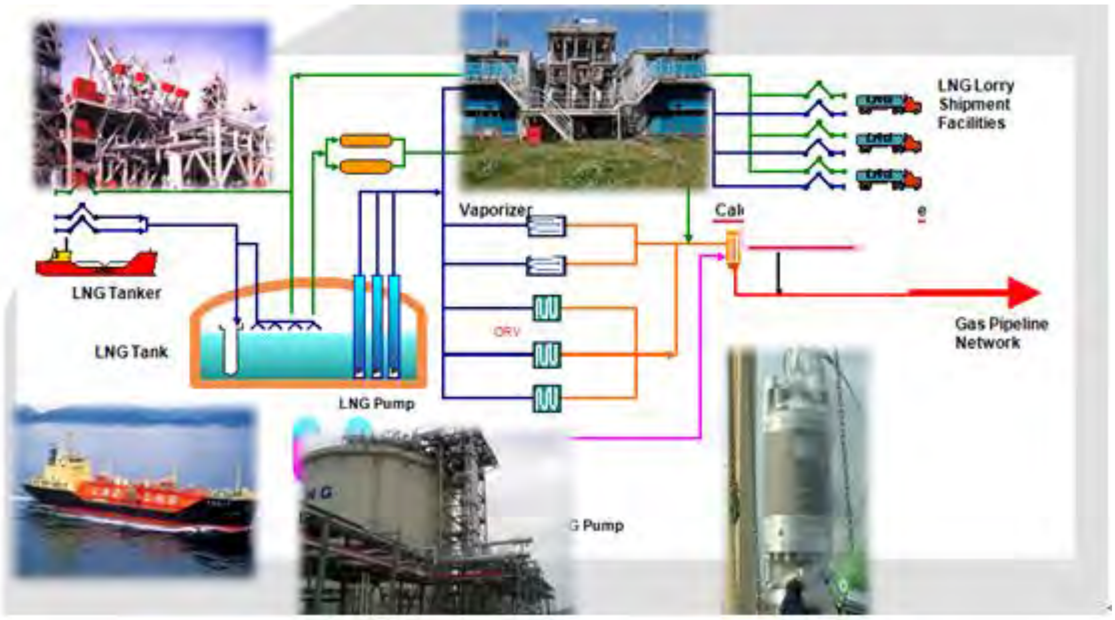
LNG Terminal is a facility that receives and re-gasifies the liquefied natural gas shipped by sea- LNG -producing countries.

Main Functions of LNG Terminals:

- Receiving of LNG transported by LNG tanker
- Storing of LNG in cryogenic tanks that withstands temperatures below -162°C
- Re-gasifying of LNG to meet demands
- Feeding of gas into the pipeline network.

1) Basic Components of Onshore LNG Receiving Terminal

LNG receiving terminal consists of tanks, pumps, compressors, vaporizers, odorizing facilities, and other facilities. The basic components of LNG receiving terminal is based on many factors such as reliability, usefulness and ease of operation and maintenance. As a result, the most appropriate basic components are selected.



Source: Survey Team

Figure 2.5-2 Typical Composition of Onshore LNG Receiving Terminal

2) Gas Production Capacity and LNG Tank Capacity

It is important to fix the maximum gas demand volume and gas production capacity of the terminals in advance in order to determine the capacity and scale of the LNG receiving terminals. It is also necessary to reflect the gas production capacity for the future plan at the same time.
Moreover, the assessment of LNG tank capacity for the terminal plan significantly affects the scale of capital investment. Hence, the capacity of LNG tank must be planned considering the gas demand in case of seasonal variations and emergency. It is also important because of its great influence on investment and the plan for the terminal. Regulation of the capacity of LNG storage is, therefore, made based on the quantity of gas required in case of emergency and seasonal variations.

3) Design for Facilities

The design and selection of each facility of which the LNG receiving facility is composed, such as receiving facilities, LNG storage facilities, gasification facilities, supply facilities, disaster prevention facilities, do not only need to include the performance, structure, materials quality and operation method in compliance with applicable laws and standards, due date and cost and electrical and measuring facilities, but also to consider natural conditions (such as weather, marine phenomena and geological conditions), seismic design requirements, LNG conditions (such as LNG producer, composition, density and calorie) and feed stream requirements (such flow velocity, delivery pressure, calorie).

Receiving Facility

Upon arrival at the LNG receiving terminal, LNG tanker (200-300 meters in length) carrying LNG is moored at the dock, and connected to the unloading arms in order to transfer the LNG to the storage tanks. The received LNG flows into the steel pipes specially designed to withstand the extremely low temperatures (below -162°C). This receiving process is completed in approximately 12 hours.

Boil-off gas (BOG) generating at receiving process is returned to the tanks in the LNG tank.

Storage Facility

The received LNG is stored in double-walled tanks to contain boil-off. These tanks are able to withstand the temperatures below -162°C designed to maintain the gas condensed in a liquid state. The outer walls are made of pre-stressed reinforced concrete or steel.

The storage tanks can maintain the condensed state of gas with high-quality technology. Nonetheless, the inflow of a small amount of heat into the tanks is inevitable allowing a small boil-off. The generated boil-off is mixed with LNG using compressors and recondensation system, and then fed back. This recycling system will be able to prevent useless consumption of natural gas on normal operation.

Compression and Vaporization Facilities

The stored LNG is subsequently pressurized and re-gasified using heat exchangers when transported from the tanks.

The tanks are equipped with submerged pumps to transfer the LNG through high-pressure pumps. The compressed LNG is then turned back into a gaseous state with vaporizers.

The LNG is simply warmed using heat from sea water. The heating process is done with heat exchangers (with no contact between the gas and the sea water). The temperature drop of the sea water utilized as the heating medium for the process is set at around 6°C, and the sea water is discharged into the sea through drainpipes.

Measurement Facility

Before the vaporized natural gas is sent out to the pipeline networks, the flow volume is measured.

4) Layout

The layout design for these LNG facilities is based on the determined basic components of the LNG receiving terminals (pier / receiving facility -> LNG tank -> LNG pump -> vaporizer -> sending out). These facilities are to be laid out according to each function, and the sites are to be divided into several areas by roads to improve the operational performances

Further, the layout design is to consider the expandability of the facilities in the future and ease of maintenance.

5) Location of LNG Receiving Terminal

The locations of the LNG receiving terminals are chosen taking the following conditions into consideration:

- Sending out point (The pipeline network as a sender is located near the terminal).
- Harbor facilities availability and receiving possibility of LNG with no problem.
- Ease and stability of supply of electricity and seawater
- Environment protection of the surroundings against disasters
- Economy

(2) Floating LNG Receiving Terminal

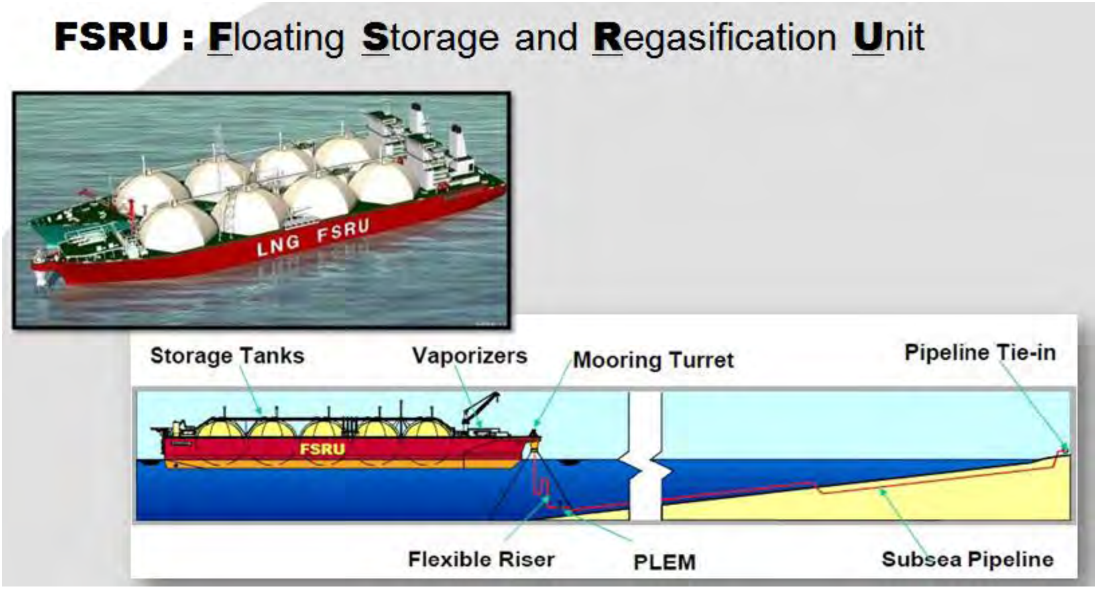
Floating LNG receiving terminal is a LNG storage and re-gasification facility floating on the seas without constructing terminals onshore.
This Floating LNG receiving terminal (Floating Storage and Regasification Unit) is abbreviated as FSRU.
Floating LNG Receiving Terminals FSRU, as substitute for traditional onshore LNG Receiving Terminals, are planned and constructed one after another on a global scale, some of which have already started to be operated.
Recently FSRU are applied as the reason below.
-Construction costs and periods in FSRU are cheaper and shorter respectively than those in onshore LNG Receiving Terminals. And furthermore, the present LNG vessels (LNG tanker) have been frequently remodeled for FSRU purposes, whose construction costs and terms can be much lower and shorter.
- With these characteristics in mind, the use of FSRU, as an emergency solution, is expected in the area where gas demand and supply (including electricity demand) is more likely to be tight for a short period of time. Especially, the importance of gas, as energy source to replace oil, has been growing in developing countries due to soaring oil prices in recent years and FSRU are therefore considered as an effective solution.
In addition, FSRU are used temporarily for a limited time until the completion of constructing onshore LNG Receiving Terminal, because removal operations are easy, even if they are unnecessary.

- When FSRU are installed, a wide variety of layouts can be considered in mooring, cargo handling and gasification operations, considering the functional coordination with onshore construction facilities.
- Meanwhile, floating facilities are vulnerable to meteorological or hydrographic conditions.
- Although the number of floating LNG Receiving Terminal (FSRU) construction is also expected to rise in the future, their usage will be basically considered or desired as an emergency or temporary solution in most cases.

Detail factors in selecting floating LNG receiving facilities are provided as follows:

- Strong Opposition campaigns against onshore terminals by local residents
- Difficult acquisition of Permission for onshore terminals
- Unavailability or impossibility of procurement of Installation sites (spaces) for terminals
- Huge amount of time and costs to solve issues such as environment and fisheries compensation.
- Difficulty of installing terminals on the ground due to bad conditions such as remote areas and adverse environmental conditions.
- Onshore construction plausibility in consideration of possible impacts of terrorist attacks
- Undesirability to damage the landscape
- Considerable costs to construct sea lanes, harbors and ports
- Necessity to install terminals for a short term period
- Planning of Moving to other site after using the terminal

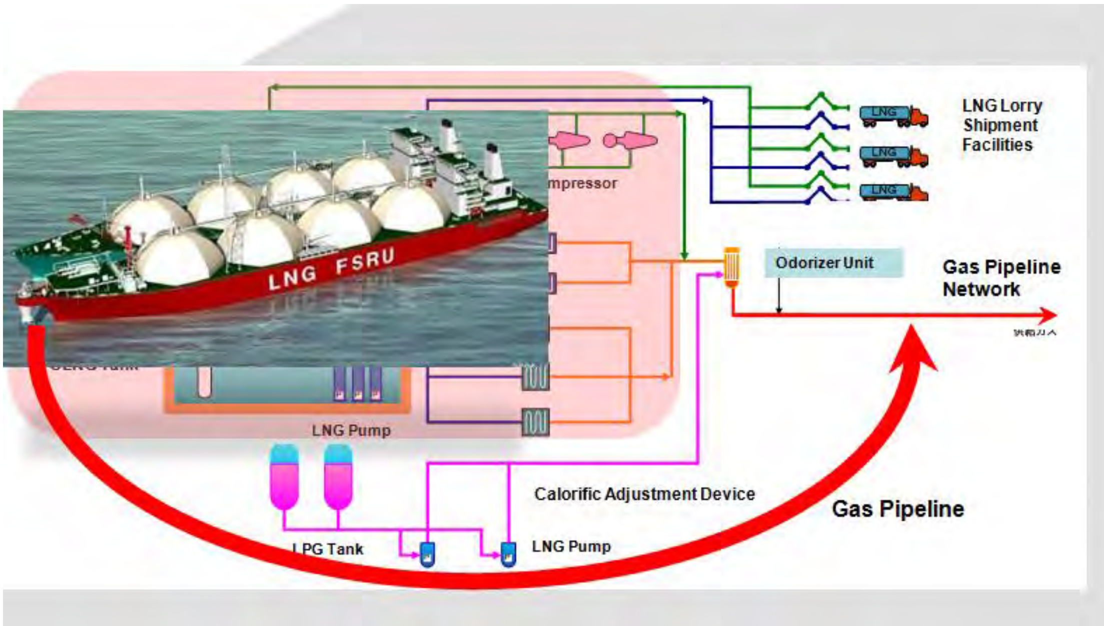
In Recent years, FSRU has been increasingly chosen as a solution to the above-mentioned problems concerning LNG receiving plans.



Source: Survey Team

Figure 2.5-3 Basic Concept of FSRU

All the portions in the shaded area shown in the typical flow diagram below are installed onboard of LNG tanker for FSRU.
In general, odorizer unit and calorific adjustment device are not installed in FSRU. If these devices are necessary, they need to be installed on land.
Natural gas evaporated by FSRU is sent out directly to the gas pipeline network onshore.



Source: Survey Team

Figure 2.5-4 Typical Composition of FSRU

FSRU is fabricated by building a new vessel with LNG storage and gasification functions, or modifying an existing tanker.
The FSRU's main components are as follows:

- LNG unloading facility (unloading system),

- Storage facility (onboard/ inboard)
- Boil-off gas treatment facility,
- LNG pumping facility,
- Gasification facility,
- Delivery facility, and
- Auxiliary facility.

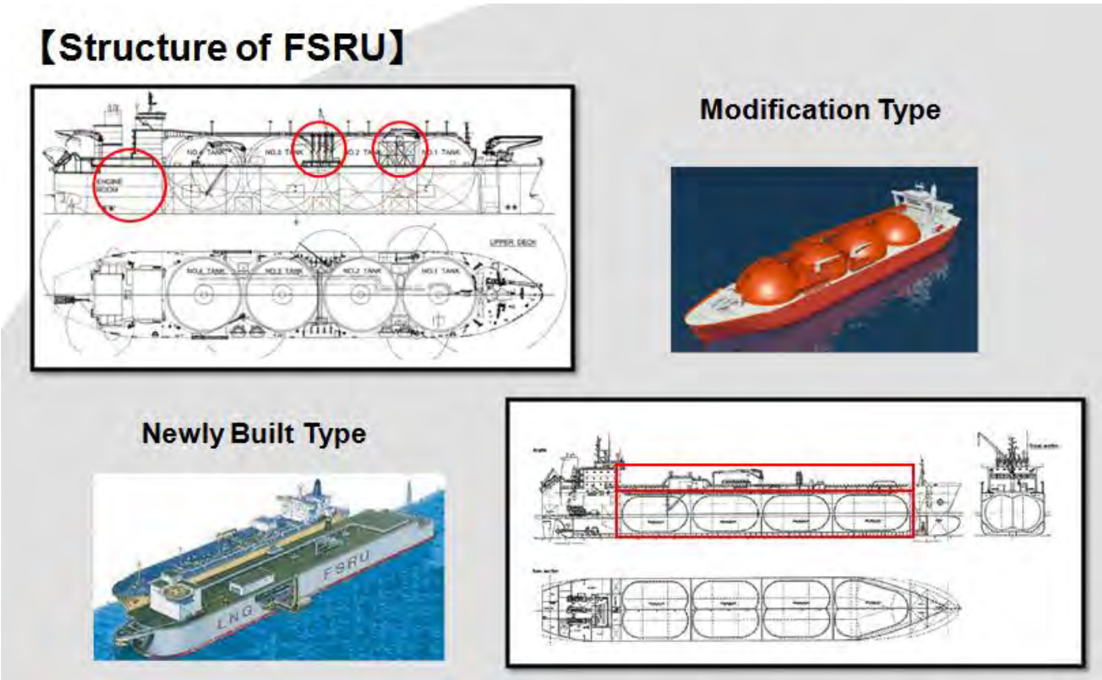
In the FSRU, the LNG delivered by LNG tankers is received by the FSRU unloading system, stored in tanks, pumped; and re-gasified into natural gas. Then, the vaporized natural gas is sent out directly to the subsea pipeline, or onshore through high-pressure loading arms. Before the natural gas is sent out, the flow volume is measured with flow meters.

There are three ways of LNG vaporization;

- Open Loop Seawater : Vaporization with use of sea water
- Closed Loop Water : Vaporization with use of warm water produced by boilers
- Closed Loop Steam : Vaporization with use of vapor produced by boilers

6) Structure of FSRU

There are two manufacturing methods of FSRU: Modification Type and Newly Built Type.
The 1st method is to modify an existing LNG tanker into FSRU by setting up vaporizers and LNG pumps in empty spaces in the tanker.
The 2nd method is to design and construct a FSRU from scratch reflecting the LNG functions. Basically, LNG tanks are installed inside the hull, while vaporizers and LNG pumps are inside the hull or onboard.



Source: Survey Team

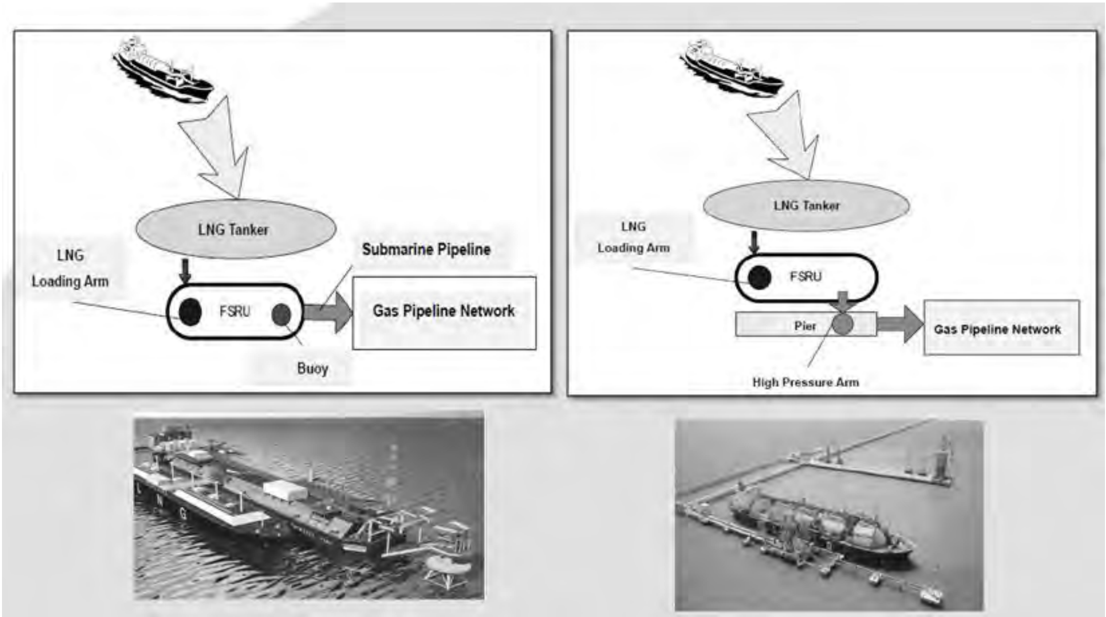
Figure 2.5-5 Structure of a Typical FSRU

Disadvantages of Modification Type;

- Inability to utilize Boil-Off-Gas (BOG) generation
- (BOG is expected to generate at a rate of 100 ton/day on BOG rate basis of 0.15 wt%/day.)
- Short lifetime
- Although the tank capacity is limited, it has been larger in recent years.

7) Receiving Formation

Offshore LNG terminal is moored at piers connected to the land or buoys (fastened with anchor chains) floating on the sea.
The selection of mooring and receiving formations is highly important since it will largely affect the operation cost, flexibility, usefulness and reliability of the terminal.
In order to select suitable formations, it is necessary to consider several factors such as location characteristics (such as climatic conditions and sea water depth), storage and send-out requirements and environmental considerations.



Source: Survey Team

Figure 2.5-6 FSRU Gas Receiving Methods

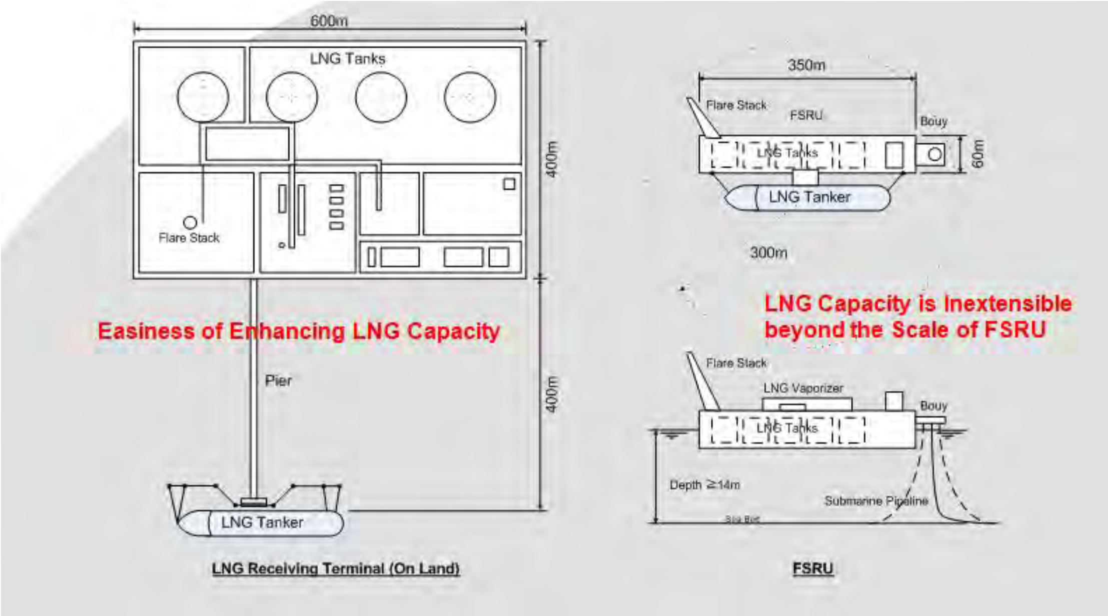
FSRU is usually in a state where it is connected to the buoy or pier. LNG is periodically delivered to FSRU by LNG tanker. The LNG unloaded from the LNG tanker is stored in cryogenic tanks installed in the FSRU. Then, the natural gas vaporized in FSRU is sent out to the gas pipeline network on land.

In addition, during bad weather accompanied with storm or tsunami, FSRU is separated from the anchoring buoy or pier and moved offshore to stand by. Proper actions are needed in order to prevent the supply of natural gas from suspending until the bad weather settles in.
Dependency on weather conditions will be disadvantage for FSRU from a viewpoint of a stable supply.

(3) Comparison between Onshore and Offshore Terminals

1) Arrangement

The figure below shows the size and arrangement of onshore LNG terminal and FSRU.
Typically, in onshore LNG receiving terminal, each facility is laid out at a certain interval according to the safety standard. In FSRU, all facilities are arranged in the limited spaces of the hull and the deck.
Thus, FSRU requires small space compared to onshore LNG terminal. However, as the capacity of FSRU is restricted, its facility design is needed in accordance with the plan.



Source: Survey Team

Figure 2.5-7 Arrangements for FSRU

2) Construction Period and Cost

In terms of construction period, FSRU is predominant rather than onshore LNG terminal.
In general, new onshore LNG terminal is constructed in approximately 48 months, while tanker-remodeling type FSRU takes around half to two-thirds of the period for the onshore terminal.

The construction cost of FSRU is commonly regarded as cheaper than onshore LNG terminal. However, cost comparisons are needed, considering all the various factors together such as installation of receiving facilities connecting to offshore including piers and buoys, additional security measures, upgrading of corrosion protection and increase in operation and maintenance cost besides the construction cost of FSRU.

In case of 100,000kl ~ 180,000kl x 1 tank

(month)

	Period of Construction	Commissioning	Total	Ratio of Construction Cost
LNG Receiving Terminal	36 ~ 42	6	42 ~ 48	1.0
FSRU - Newly Build Type	34 ~ 37	6	40 ~ 43	1.0
FSRU - Tanker Remodeling Type	24	3	27	0.6 ~ 1.0

Demerits of Remodeling Type

1. There is no facilities of using BOG for power generation.
   (BOG is generated at a rate of 100 ton/day based on 0.15 wt%/day of BOG rate)
2. Lifetime is shorter than Newly build type.
3. Tank volume of the old tankers is limited. (≦ 150,000kl)

Source: Survey Team

Figure 2.5-8 Construction Period and Cost

3) Advantages and Disadvantages

General advantages and disadvantages of each onshore and offshore LNG receiving terminals are summarized as follows;

<u>Onshore LNG Receiving Terminal</u>

Main Advantages;

- Stability of supply with no dependency on weather conditions
- Expandability of LNG storage and production capacity (acquisition of additional spaces beforehand is needed.)

Main Disadvantages;

- Larger site space compared with FSRU
- Longer construction period compared with FSRU
- Longer period for environmental assessment compared with FSRU

<u>FSRU</u>

Main Advantages;

- Onshore facility is unnecessary (If calorie adjustment facilities are necessary, they need to be installed onshore).
- Shorter construction period compared with onshore LNG terminal
- Construction cost is cheaper than on shore-type.

Main Disadvantages;

- Stability of supply is not easy compared with on shore-type as influenced by weather conditions.
- Little expandability of LNG storage and production capacity.

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2.6 Project Cost Estimate

This section is not available on this disclosure version report.

2.7 Business Plan and Development Schedule
2.7.1 Project Scheme

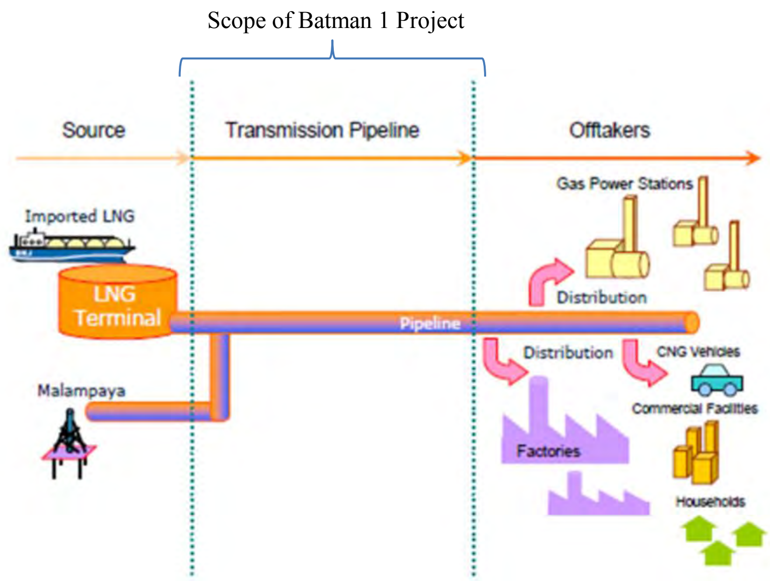
(1) Scope of Work

Natural gas value chain in the Philippines start from the supply from the source (either gas well or LNG receiving terminal), continues to transmission, and on to distribution to the offtakers through wholesale then to retail. Here, the chain is assumed to be separable into these four scopes (segments), i.e., source, transmission, wholesale and retail. The natural gas value chain may be developed and managed either as a whole or separated (=unbundled) into different scopes.

The advantage of having the whole value chain under one entity is that investment and marketing strategy will be made from holistic approach. The entire value chain will therefore be developed and managed in optimal condition as a whole. On the other hand, the advantage of unbundling is that entry barrier will be lowered, and that level playing field will be created for these entrants. For example, a company may enter into gas distribution business without investing on supply and transmission infrastructure.

Assuming that there is only a single transmission line linking the supply source and the distribution facilities for the offtakers (c.f. figure below), unbundling of business scope will bring about competition environment in both supply scope and wholesale / retail scopes. Meanwhile the transmission stakeholder will be in a dominant position to be able to influence both the source and wholesale businesses by giving favor or discriminating its upper and lower customers. The unbundling model, to ensure level playing field for the stakeholders, requires the transmission company to operate on open access basis.

Against these backgrounds, the survey for Batman 1 project presupposes that the natural gas industry in the Philippines will be of unbundled type, developed to offer low entry barrier and level playing field for the supply, wholesale and retail businesses. Hence, the scope of work for the Batman1 project is intended to be the development of gas transmission pipeline and related facilities, with O&M of these facilities, as shown in the figure below. This section discusses on the optimal project scheme model for Batman 1, including PPP (public private partnerships) schemes.



Source: Survey Team

Figure 2.7-1 Figure Overall Picture of LNG Project and Scope of Work of the Project

First, supposing that the options for a wider scope for the project is not rejected, i.e. with the proponent of Batman 1 project having a scope of work rather than construction and O&M of pipeline, the possible variations may be as shown in the example of scope of work options in the next table (Option 4 is the case where the whole value chain is developed and managed by a single entity).

Table 2.7-1 Example of Scope of Work Options for the Proponent

	Scope				Charges	
Option No.	Supply (purchase)	Transmission	Distribution (wholesale)	Distribution (retail)	Content	Payer
1					Wheeling charge (transmission charge)	Distributor (wholesaler)
2					Gas charge (inc. gas purchase & transmission)	
3					Gas charge (inc. gas purchase, transmission & wholesale)	Distributor (Retailer)
4						
5					Gas charge (inc. all costs from purchase to distribution)	End users
6						

Source: Survey Team

In case of Option 1, the project deals with only construction and O&M of pipeline. In this option, the involvement of public sector for the gas business would be the minimum. All public sector does is to lend the gas pipeline to private proponent and collect wheeling charge to cover their investment (excluding the regulatory work for the gas business). Options 2, 3 and 5 are the options with wider public roles, which might include gas purchase. Options 3 to 6 may include whole sales and retail businesses. Charges that will be collected from the customers will also differ as indicated.

It is important to take into account the private sector's intent for their Scope of Work of the project; however, the proponents still do not have clear idea at this point based on the interviews conducted on January 2014. The final arrangement of Scope of Work for proponents should be considered in the later stage of project preparation.

(2) Business Scheme Model Alternatives

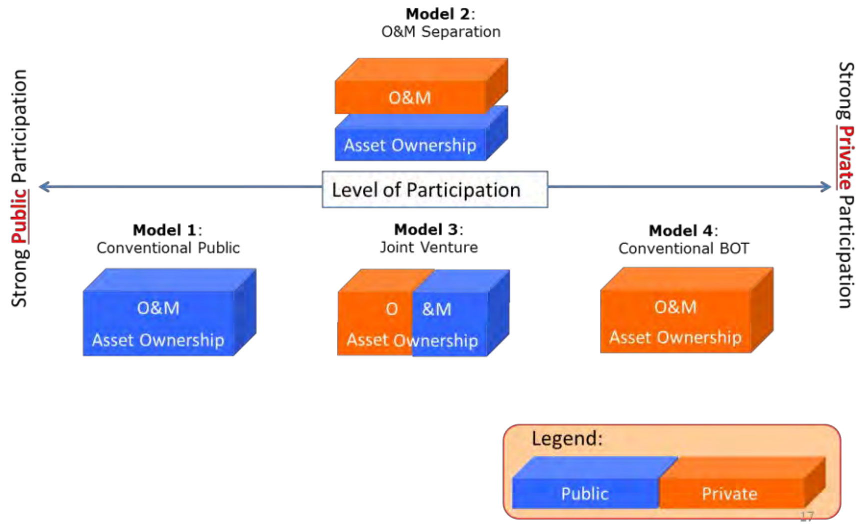
As project scheme model alternatives, there is one extreme case that the public would design, build, finance and operate (DBFO) as a conventional procurement. On the other hand, there is another extreme case that private would conduct DBFO as conventional BOT. Between those extreme cases, there are the cases in middle such as O&M separation and Joint Venture. The possible project scheme alternatives are shown on the table below.

Table 2.7-2 Project Scheme Model Alternatives

Model no.	Scheme	Finance	Build	O & M	Tariff Reception
1	Conventional Public Procurement	Public	Public	Public	Public
2-1*	O&M Separation (Outsourcing)	Public	Public	Private	Public *
2-2*	O&M Separation (Leasing)	Public	Public	Private	Private*
3	Joint Venture	Public/Private	Public/Private	Public/Private	Public/Private
4	Conventional BOT	Private	Private	Private	Private

*O&M Separation could be divided into two options. One is O&M outsourcing to private and pay commission. Another is to lease the facility to private and collect lease payment from private. The collected tariff from end-users shall be the income of public in the former case but be the income of private in the latter case.

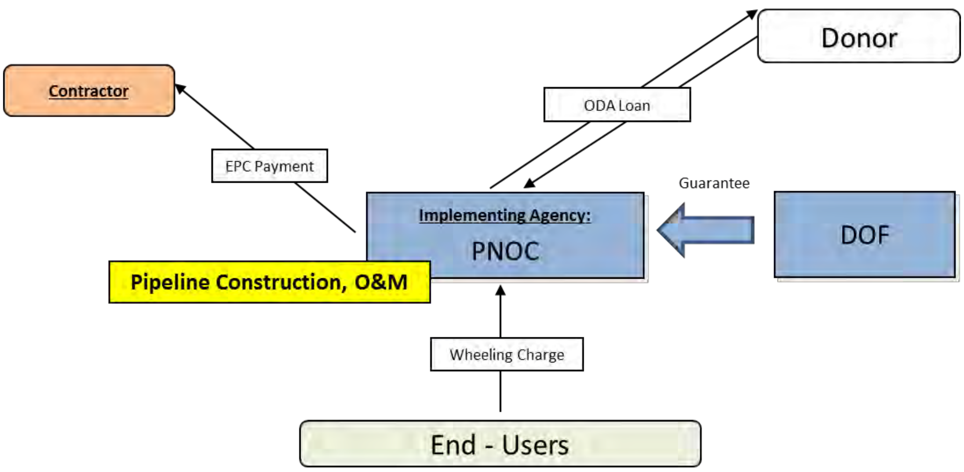
The degree of private involvement, as the figure bellow shows, would be the weakest in Model 1 and the strongest in Model 4.



Source: Survey Team

Figure 2.7-2 Degree of Private Involvement for Business Scheme Alternatives

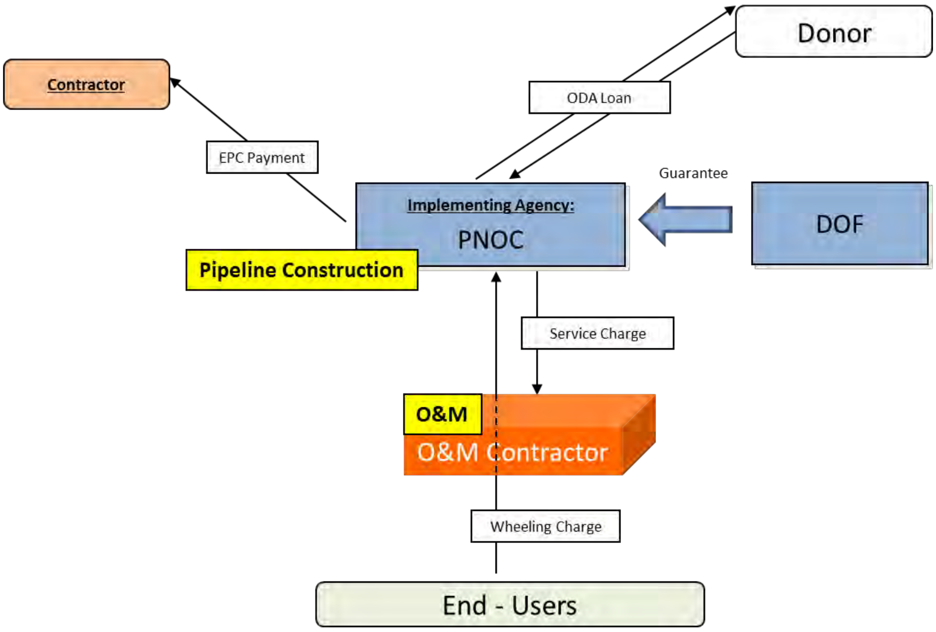
Model 1 is conventional public procurement and the PNOC would design, build, finance and operate. The wheeling charge (gas transfer fee) from end-users shall be the income of PNOC. PNOC shall receive ODA loan and DOF (Department of Finance) would guarantee it. Initially, there was an alternative that PNOC establish its subsidiary for O&M of pipeline; however, GCG (The Government Commission for Government Owned and Controlled Corporations) has been shown the negative response for the creation of new PNOC Subsidiary.



Source: Survey Team

Figure 2.7-3 Business Scheme of Model1 (Conventional Public Procurement)

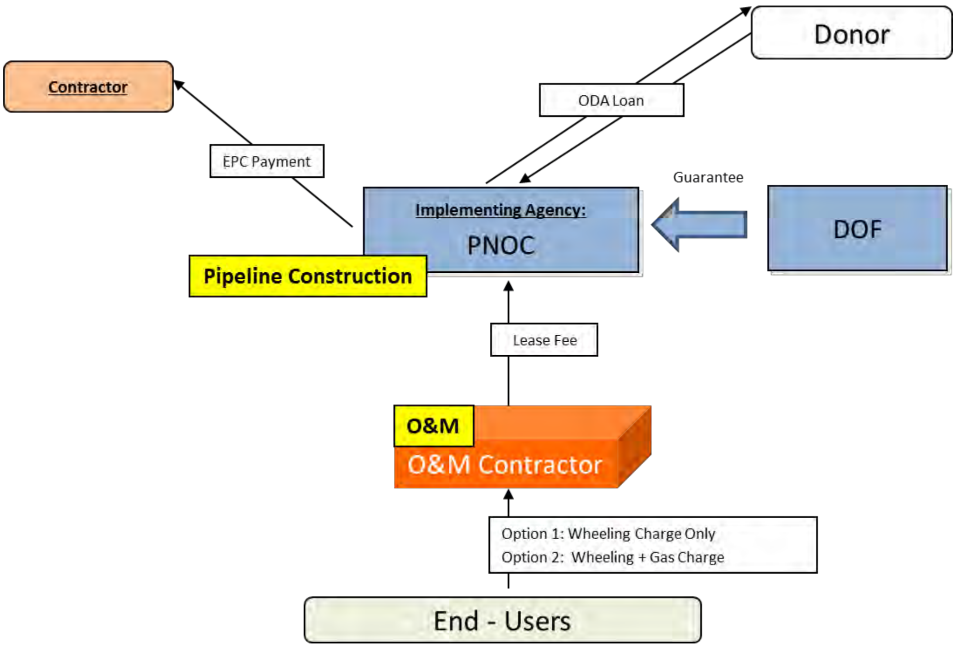
Model 2 is the O&M separation and the PNOC shall design, build and finance for the facility and a private proponent (O&M Operator in this Model) shall operate the facility. The PNOC would outsource the operation or lease the facility to private proponent. In the former case (Model 2-1), all the wheeling charge from end-users would be the income of PNOC.



Source: Survey Team

Figure 2.7-4 Business Scheme of Model 2-1 (O&M Separation: Outsourcing)

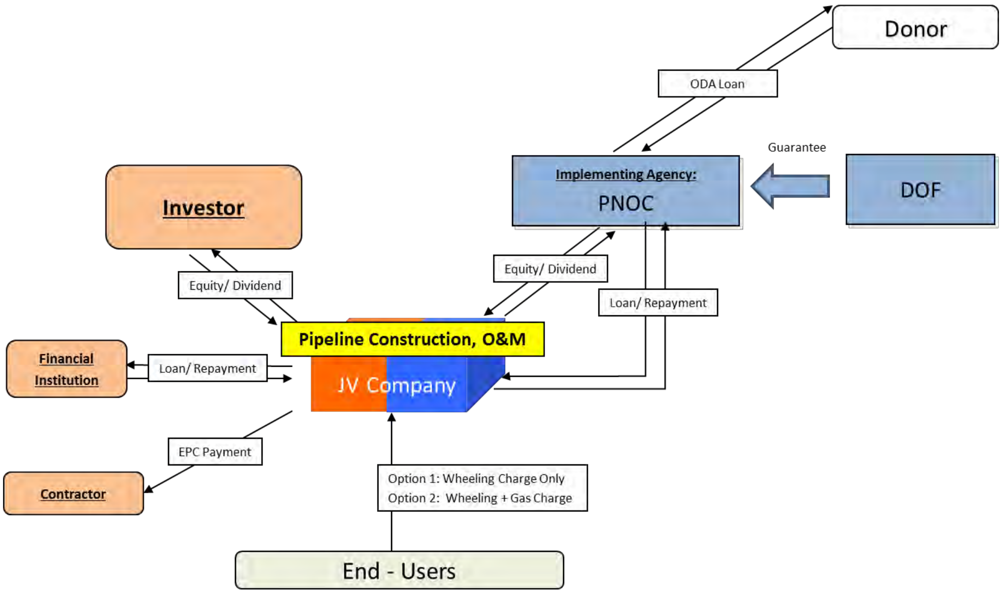
In the latter case (Model 2-2), the PNOC would lease the facility to private proponent and collect lease fee from the private proponent, and private proponent would collect wheeling charge (option 1) or wheeling and gas charge (option 2) from end-user as their own income. Option 1 would be selected when O&M contractor conduct O&M of pipeline only. On the other hand, option 2 would be selected when O&M contractor has wider scope of work such as purchase of gas, whole sale, and retail. The concept of Option 1&2 is common through Model 2-2, 3 and 4.



Source: Survey Team

Figure 2.7-5 Business Scheme of Model 2-2 (O&M Separation: Lease)

Model 3 is the case of Joint Venture that PNOC and private proponent would establish JV Company, which would conduct DBFO. JV Company would receive ODA sub-loan through PNOC. At the same time, the JV Company would receive the loan from private financial institution. By utilizing those funds, the JV Company would construct the facility. The JV Company would collect wheeling charge from end-users and repay to the financial institution and allocate dividends to their holding companies.

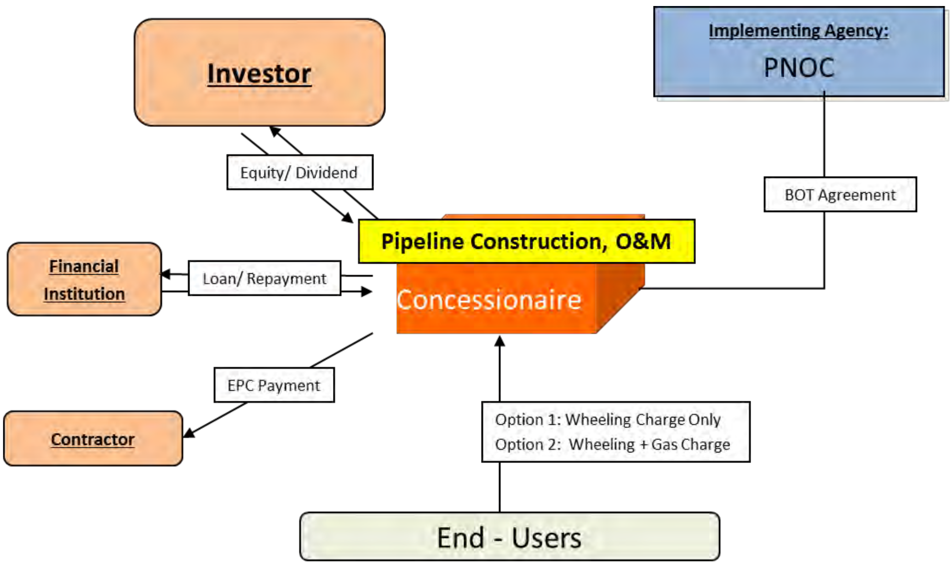


Source: Survey Team

Figure 2.7-6 Business Scheme of Model 3 (Joint Venture)

As variance of Model 3 (Joint Venture), availability payment method could be introduced. Availability payment method is the payment method that public sector would pay a certain amount as long as the facility is available. In this case, all the income from end-users shall be transferred to PNOC first and demand risk would be taken by PNOC.

Model 4 is conventional BOT and a private proponent would conduct DBFO of the gas pipeline. Practically the private proponent would establish the SPC (special purpose company) and the SPC would make BOT agreement with PNOC. The SPC would get finance from private financial institution and construct the gas pipeline. The SPC would collect wheeling charge from end-users and use those for repayment and dividends.



Source: Survey Team

Figure 2.7-7 Project Scheme of Model 4 (BOT)

As variation of Model 4 (BOT), availability payment method also could be introduced. In this case, all the income from end-users shall be transferred to PNOC first and demand risk would be shared between PNOC and private investors.

(3) Comparative Analysis of Project Scheme Model Alternative

Comparative analysis was done for the four business scheme model alternatives which were indicated as possible alternatives of the project. The evaluation criteria are shown in the table below.

Table 2.7-3 Evaluation Criteria of Project Scheme Model Alternatives

Evaluation Criteria	Contents
Lifecycle Public Net Income (View point of VFM)	To estimate lifecycle net public income in present value for each project schemes model alternatives and see which alternative has the better financial merit from the view point of VFM.
Financial Viability	To see financial viability especially from the view point of the possibility of soft loan applicability by utilizing creditworthiness of Gov't.
Economic Impact	To see whether the public policy to promote gas utilization by setting affordable gas price can be implanted under the proposed scheme option.
Early Realization of Project	To see the possibility of early realization of project.
Conformability to Public Capability	To see if the competent private operator can participate the project by complementing public capacity.
Opportunity of Capacity Development	To see if the public sector has a chance for capacity development of gas pipeline management through competent private operator.
Legal Consistency	To see if the scheme is consistent with laws/ regulations.

Source: Survey Team

As a result of analysis, the Survey Team concluded that Model 2 (O&M Separation) is the best project schemes among alternatives (See the table below for the detail analysis). There are still two alternatives within Model 2. Since the selection of Model 2-1 and Model 2-2 is strongly connected to the discussion of Scope of Work for private proponents (See 2.9-1 (1)), it should be discussed in detail and selected in later project preparation stage when the private proponents will have clearer idea on their own business schemes than now.

Model 3 is secondly recommended; however, the applicability of ODA fund needs to be clarified. If availability payment is introduced for Model 3, the project would be more attractive for private investor by sharing demand risk to public sector.

Model 1 (public procurement) cannot be selected mainly because public does not have the capability to construct and operate gas pipeline facility by themselves.

Model 4 (conventional BOT) cannot be selected mainly because financial viability would be low since soft loan cannot be applied and the control of gas charge level would be difficult to achieve gov't policy.

Table 2.7-4 Result of Evaluation of Business Scheme Alternatives

Evaluation Criteria	Model 1 (Conventional Public Procure)	Model 2 (O&M Separation)	Model 3 (Joint Venture)	Model 4 (BOT)
Lifecycle Public Net Income (View point of VFM)	<u>High</u> GoP: 163 Mil USD(NPV) PNOC: 191Mil USD (NPV)	<u>High</u> GoP: 200 Mil USD (NPV) PNOC: 104 Mil USD (NPV) (in case of Model2-2: leasing)	<u>High</u> GoP:167 Mil USD (NPV) PNOC: 93 Mil USD (NPV)	<u>Low</u> GoP: 161 Mil USD (NPV) PNOC: 0
Financial Viability	<u>High</u> ○: Higher viability with the least capital cost utilizing soft loan ×: Initial investment needs to be financed by PNOC	<u>High</u> ○: Higher viability with the least capital cost utilizing soft loan. Also PNOC can receive stable income from the early stage of operation through lease payment (in case of Model 2-2). ×: Initial investment needs to be financed by PNOC	<u>Middle</u> ○: The public burden for capital investment shall be reduced ×: Utilizing private fund partially, the cost of debt would increase	<u>Low</u> ○: Almost no public burden for initial investment ×: Capital cost would be highest among Models because of private finance
Economic Impact	<u>High</u> ○: Higher economic impact with the controlled low gas price, which promotes wider utilization of gas	<u>High</u> Same as Model 1	<u>High</u> Same as Model 1	<u>Middle</u> ×: Gov't is more difficult to control the gas price; therefore, it might not be succeed in promoting wider utilization of gas
Early Realization of Project	<u>High</u> ○: Contractual relation and selection process are simpler and more predictable ×: Takes a certain time for preparation of ODA loan	<u>High</u> ○: Construction can be started prior to the selection of O&M contractor. ×: Takes a certain time for preparation of ODA loan.	<u>Middle</u> ○: Selection of Private can be done by utilizing JV guideline as legal bases ×: Contractual relation and selection process are more complicated and less predictable	<u>Middle</u> ○: Process is clear under BOT law and its IRR ×: Construction work cannot start until all arrangement including O&M would be agreed among parties.
Conformability to Public Capability	<u>Low</u> ×: Public does not have enough capacity to operate gas facility by themselves	<u>High</u> ○: Even capacity of public is insufficient for gas business, decent private proponents can operate for public. ○: Quality of operation can be	<u>Middle</u> ○: By operating together with competent private proponents, capability of public can be complemented ×: Private might not fully	<u>Middle</u> ○: Even capacity of public is insufficient for gas business, decent private proponents can operate ×: Control of private proponents

Evaluation Criteria	Model 1 (Conventional Public Procure)	Model 2 (O&M Separation)	Model 3 (Joint Venture)	Model 4 (BOT)
		controlled through decreasing amount of payment in case of unqualified operation(in case of Model2-1:Outsourcing)	utilize their know-how in case that public hold majority of share	would be more difficult since there will no payment from public to private (cannot reduce the payment to private as penalty)
Opportunity of Capacity Development	<u>Low</u> ×:No opportunity for capacity development from private to public side	<u>Middle</u> ○:Possibility of capacity development for public through monitoring of operation of competent private.	<u>High</u> ○:Plenty opportunity of capacity development for public by conducing the project together with competent private proponents.	<u>Low</u> ×:No opportunity for capacity development for public side
Legal Consistency	<u>High</u> Conventional public procurement and no legal obstacles	<u>High</u> No important issue can be observed in case of "Outsourcing". In case of "Leasing", the construction part can be done as normal ODA scheme and leasing part can be done as PPP under BOT Law (based on the interview to concerned officials).	<u>Middle:</u> Guidelines can be legal basis, which prescribe that the maximum share for public is less than 50%. The applicability of ODA fund under such condition is unclear.[1]	<u>High</u> Can be conducted based on BOT law
Overall Evaluation	<u>Low</u> Lifecycle public net income is high and it is easy to control fee level; however, public does not have capability to construct and operate gas facility by themselves	**<u>High</u>** Lifecycle public net income is high and it is easy to control fee level. By utilizing competent private which has sufficient know-how and control them by contract, safety of gas pipeline operation can be secured. For "Outsourcing", public would take demand risk. For "Leasing", proponent would take demand risk. The selection "Outsourcing" and "Leasing" need further study.	**<u>High</u>** Lifecycle public net income is high and joint operation with competent private would bring safety operation and capacity development for public side. The applicability of ODA fund needs to be clarified.	<u>Low</u> Most of risks can be allocated to private; however, lifecycle public net income is low. Also, it is difficult to control fee level and might bring difficulty to achieve gov't policy.

[1] There is idea that private give up their certain voting power in order to make JV Company as public company which ODA loan can be applicable; however, no private proponent is expected to invest under such condition.

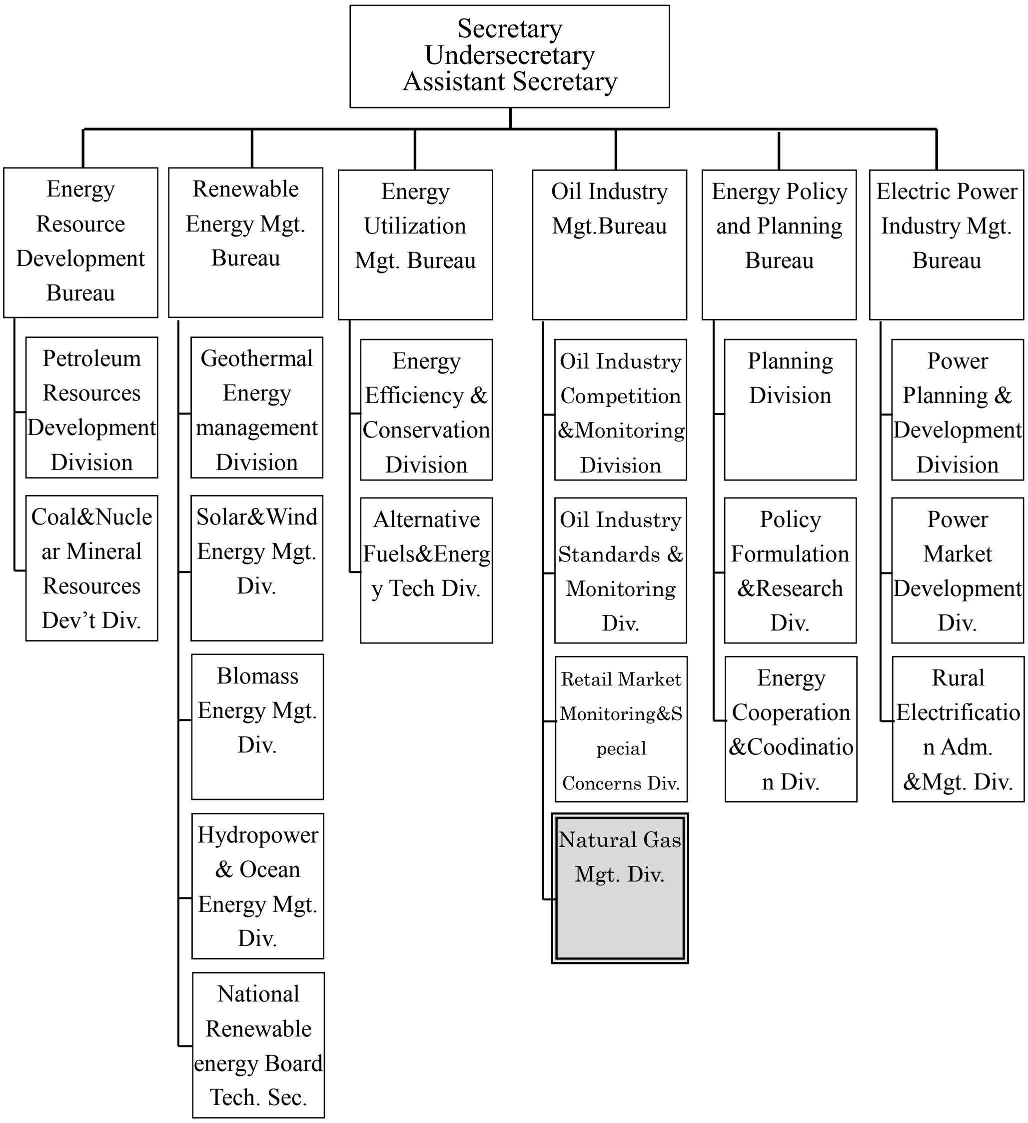
2.7.2 Implementation and Management Structure

(1) Executing and Concerned Agencies

1) Function, Organizational Structure, and Staff Organization

a. Department of Energy (DOE)

DOE is responsible for the policy and planning on energy sector. The following figure shows the major organizational structure of DOE(except the staffs attached to secretary, administrative sections, and field office). DOE has the following bureaus; i)Energy Resource Development Bureau (ERDB); ii)Renewable Energy management Bureau (REMB), iii) Energy Utilization Management Bureau (EUMB), iv) Oil Industry Management Bureau (OIMB), v) Energy Policy and Planning Bureau (EPPB), vi) Electric Power Industry Management Bureau (EPIMB)[2]. Under OIMB, there is Natural Gas Management Division (NGMD) which is dealing with policy regarding to natural gas.



Source: Survey Team based on DOE website information

Figure 2.7-8 Organizational Structure of DOE

2 DOE website, http://www.doe.gov.ph/about-doe/who-we-are/organizational-structure

NGMD has the objectives to formulate and implement policies, plans, programs and regulations on the development and promotion of downstream Natural Gas as well as undertakes product and market development activities.[3] NGMD have 2 sections; one is Natural Gas Market Development and Monitoring Section(NGMDMS) and another is Natural Gas Industry and Infrastructure Development and Administration Section(NGIIDAS). The main objectives of the 2 sections are the followings.

Objectives of NGMDMS

- Formulates policy recommendations and implements policies, plans and programs on natural gas market development
- Promotes and monitors the use of natural gas in power and other demand sectors
- Evaluates emerging trends in the use of natural gas and its impact on other fuels and the economy
- Evaluates available and emerging technologies for end-use in the natural gas industry
- Reviews and updates natural gas industry performance, trends and developments
- Maintains computerized database on natural gas utilization, market development, etc.
- Coordinates with various DOE units, concerned government agencies, private sector and other stakeholders on matters related to the above-enumerated functions
- Performs Ad Hoc functions as may be assigned

Objectives of NGIIDAS

- Formulates policy recommendations and implements policies, plans, programs and standards on the development of natural gas infrastructure
- Formulates, reviews and implements the natural gas infrastructure development program
- <u>Prepares and updates the natural gas pipeline and facilities development plan and programs</u>
- <u>Evaluates potential sites for natural gas pipelines and other natural gas facilities</u>
- Performs licensing/permitting functions
- <u>Monitors and ensures compliance with applicable rules and regulations on standards on pipelines, facilities, gas plants, etc.</u>
- Conducts inspections and investigations of natural gas facilities, with due regard to production, safety, health, environment and security
- Coordinates with various DOE units, concerned government agencies, private sector and other stakeholders on matters related to the above-enumerated functions
- Performs Ad Hoc functions as may be assigned

As the above-listed objectives of NGIIDAS shows, NGIIDAS have roles of preparation of natural gas pipeline and facilities development plan and programs, and evaluation of potential sites for natural gas pipelines and other natural gas facilities.

DOE also has the following companies under its control. Among those companies, Philippine National Oil Corporation (PNOC) should have the main role for implementation of gas pipeline project.

i) <u>Philippine National Oil Corporation (PNOC)</u>
ii) National Power Corporation (NPC)
iii) National Electrification Administration (NEA)

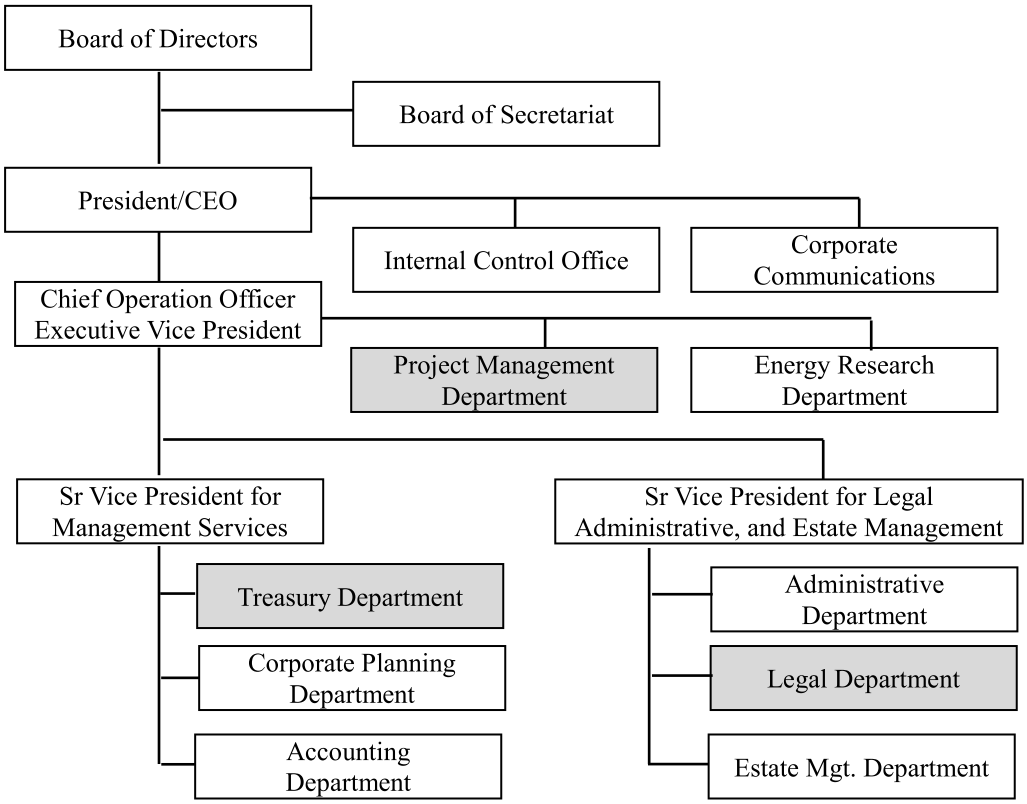
[3] DOE website, https://www.doe.gov.ph/about-doe/what-we-do/bureau-services-functions/1791-natural-gas-management-division

iv) Power Sector Assets & Liabilities Management Corp (PSALM)
v) National Transmission Corp (NTC)
vi) Philippine Electricity Market Corp (PEMC)

b. Philippine National Oil Company (PNOC)

PNOC was created in 1973, at the beginning of oil crisis, through Presidential Decree No.334 to provide and maintain an adequate and stable supply of oil. Eventually, PNOC expanded its operations to include total energy development, including indigenous energy sources like oil and gas, coal, and geothermal.

The following figure shows the organizational structure of PNOC. The Board of Directors, highest organ of decision-making, currently consist of one chairman, one president and CEO, and 5 members, and one corporate secretary.



Source: Survey Team based on PNOC website information

Figure 2.7-9 Organizational Structure of PNOC

Under the President/CEO, there is Chief Operation Officer/Executive Vice President, who controls Project Management Department and Energy Research Department. Project Management Department is responsible for monitoring pre-operation projects and evaluating after-operation projects, which conducted by subsidiaries of PNOC. Project Management Department should have the important role for the monitoring of Batman 1 as well. Under Chief Operation Officer/Executive Vice President, there are Sr Vice President for Management and Services (VPMS) and Sr Vice President for Legal, Administrative, and Estate Management (VSLAE). The Treasury Department under VPMS shall have an important role for foreign loan arrangement. Legal Department under VSLAE should have an important role for contracting with private proponents of Batman 1.

c. PNOC Subsidiaries

PNOC has five subsidiaries as shown the figure below. The actual operation of the current business is done by the subsidiaries and the PNOC manages her subsidiaries. The subsidiary which has the biggest number of employees with 236 staffs is PNOC Exploration Corporation (PNOC-EC). PNOC-EC has been established since 1976 for the purpose of exploration and development of oil, gas and coal. At present, PNOC EC has seven (7) petroleum Service Contracts (SCs), namely: SC 37 (Cagayan Basin), SC 38 (Malampaya), SC 47 (Offshore Mindoro), SC 57 (Calamian), SC 58 (West Calamian), SC 59 (West Balabac) and SC 63 (East Sabina). The Company is the operator in SC 37, SC 47 and SC 63 and a non-operating partner in SC 38, SC 57, SC 58 and SC 59. PNOC EC used to operate the very first natural gas facility in the country- the San Antonio Gas Power Plant within SC 37 before joining the Malampaya consortium (SC 38) in 1999 with a 10% stake. Malampaya is the country's single biggest investment of its kind.[4]

The PNOC Alternative Fuels Corporation (PNOC-AFC), formerly PNOC Petrochemical Development Corporation, was established in 2006. The prime mandate of PNOC-AFC is to explore, develop and accelerate the utilization and commercialization of alternative fuels in the country. The PNOC-AFC also has its mandate to pursue the development, operation and management of a petrochemical industrial estate.[5]

The PNOC Shipping and Transport Corporation (PNOC-STC) was established in 1978 to engage in the business of shipping, tankering, lighterage, barging, towing, transport, and shipment of goods, chattels, petroleum and other products, marine, and maritime commerce in general.[6]

The PNOC Development and Management Corporation (PNOC-DMC) was incorporated in 1959 and was renewed in 2009 for another 50 years. PNOC-DMC is the only company in the PNOC Group that is empowered by its articles and by-laws to develop, manage and add value to the real estate properties which PNOC and the other subsidiaries hold. It is also empowered by its charter to engage in the business of developing vital energy infrastructure such as refineries, pipelines, pumping station and the like.[7]

The PNOC Renewables Corporation (PNOC-RC) is organized in 2008 as the newest PNOC subsidiary. The mandate of PNOC-RC is in promoting, developing and implementing new and renewable energy sources in the country. The mandate of PNOC-RC is to promote and undertake research, development, utilization, manufacture, sale, marketing, distribution and commercial application of new, renewable, non-conventional and environment-friendly energy sources and systems.[8]

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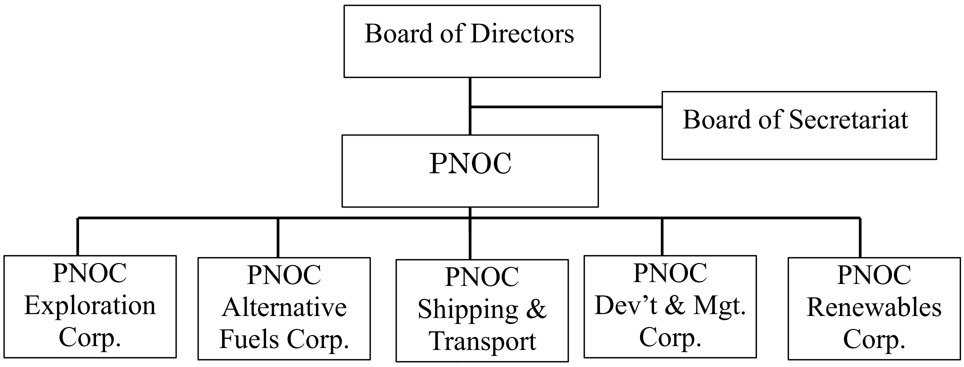
[4] PNOC-EC website: http://pnoc-ec.com.ph/aboutus.php
[5] PNOC website: http://www.pnoc.com.ph/subsidiaries.php?sectionid=e4f3bb95-1514-11df-a7de-92d1637a39b1&menuid=2a67a209-15cf-11df-bb83-e1a07d93674e
[6] PNOC website: http://www.pnoc.com.ph/subsidiaries.php?sectionid=e4f3bb95-1514-11df-a7de-92d1637a39b1&menuid=61112596-15cf-11df-bb83-e1a07d93674e
[7] PNOC website: http://www.pnoc.com.ph/subsidiaries.php?sectionid=e4f3bb95-1514-11df-a7de-92d1637a39b1&menuid=862d0008-15cf-11df-bb83-e1a07d93674e
[8] PNOC-RC website: http://www.pnoc-rc.com.ph/cprofile.html



Source: Survey Team based on PNOC website information

Figure 2.7-10 Relation between PNOC and Subsidiaries

2) Financial Condition of Concerned Organization

As mentioned previously, it is difficult to established new subsidiaries of PNOC under current gov't policy. It is also difficult to formulate existing subsidiaries of PNOC as implementing agency of Batman 1 based on the discussion with the officials if PNOC. The Survey Team assumes that PNOC would be the Implementing Agency (IA) for Batman 1 and the debtor of ODA loan. From the above situation, the Survey Team concentrate the financial analysis on PNOC.

a. Reliability of PNOC's Financial Information

Philippine National Oil Corporation (PNOC) was established in 1973 for the stable supply of oil. As of July 2012, a holding company PNOC owned five subsidiaries (PNOC Exploration Corp., PNOC Alternative Fuels Corp., PNOC Shipping and Transport Corp., PNOC Development and Management Corp., PNOC Renewables Corp.). PNOC applies the International Financial Reporting Standards (IFRS) to its financial statements in 2012. The financial statements of the holding company had been audited until 2012 and the consolidated financial statements until 2009. The Commission on Audit (COA), a national audit office in the Philippines, conducted external audit of PNOC. COA's audit opinion is "unqualified." Thus the financial statements are prepared in accordance with the accounting standards and no material misstatement which may cause misjudgment was pointed out. COA's audit report in 2012 mentions not only audit results of the fiscal year but also follow-up of recommendations in the previous year. Within PNOC, three types of internal audits (compliance audit, management/performance audit and operation audit) are conducted. Audit results are reported directly to the audit committee consisted of three external board members of PNOC and, thus, internal auditors are considered independent. In light of the audit results and the internal audit system, financial information of PNOC is considered highly reliable.

b. Financial Ratio Analysis

On consolidated basis, sales of PNOC have fluctuated along with market conditions of fuels. Market conditions of fuels and other incomes (or charges) affect the profitability of PNOC but swings of profitability is relatively mild. From 2009 to 2012, ROA ranged between 3.9% and 4.7% and ROE ranged between 5.0% and 6.2%. On consolidated basis, PNOC consistently posted profits and its profitability is stable. For this reason, it can be concluded that PNOC has solid profit base.

PNOC reduced interest-bearing debt for last several years. At the end of 2012, PNOC and its subsidiaries had no interest bearing debt and their liabilities were mainly trade payables and dividends payables. While total liabilities had declined for the period of 2009-2012, shareholders' equity stayed at the same level billion during the same period. As a result, debt-to-equity ratio decreased from 0.34 times in 2009 to 0.22 times in 2012. This shows that PNOC has healthy balance sheet today. In addition, any serious problem is not found in liquidity as in 2012 liquidity ratio was 8.50 times and quick ratio was 6.68 times. Although operating cash flow continuously stays at positive side, the amount of cash remains stable for the period of 2009-2012. This is due to dividend payment to the Philippine government, a shareholder of PNOC. The amount of working capital (current assets - current liabilities) has been approximately at the same level since 2009.

Table 2.7-5 PNOC's Financial Ratios (Consolidated basis)

	2009	2010	2011	2012
ROA (%)	4.6%	3.9%	4.7%	4.2%
ROE (%)	6.2%	5.0%	5.7%	5.1%
Net Profit Margin (%)	38.0%	24.0%	25.2%	24.8%
Asset Turnover (Times)	0.12	0.16	0.18	0.17
Financial Leverage (Times)	1.37	1.28	1.22	1.22
D/E Ratio （times）	0.34	0.23	0.21	0.22
D/E Ratio (interest bearing debt only, times)	0.10	0.01	0.01	0.00
Liquidity Ratio (times)	4.73	5.87	7.56	8.50
Quick Ratio (times)	3.80	4.60	6.13	6.68
Account Receivables Turn-over Period (days)	141.25	52.86	60.47	49.86

Source: Survey Team based on PNOC website information

3) Capacity of Each Organization

a. Capacity of PNOC

As mentioned previously, the PNOC would be IA for the Batman1 project. If ODA finance would be utilized for this project, PNOC could be the direct debtor as well. The required capacities for the IA of Batman1 are as follows;

- Capacity of Loan Arrangement for foreign loan
- Contracting Capability including PPP agreement
- Project Monitoring
- Project Procurement(including preparation of PPP arrangement and technical consideration)

The Survey Team surveyed on the capability of PNOC based on the interview to concerned department of PNOC on January 2014. The tentative results of our assessment are the followings. The most missing capacity for PNOC for the implementation of Batman 1 is considered as the capacity of Project Procurement including preparation of PPP arrangement and technical consideration.

Table 2.7-6 Result of Evaluation of Capacity of PNOC

Capacity	Result of Tentative Assessment
Capacity of Loan Arrangement for ODA	*Enough with Outside Specialist* Revenue Management Division (RMD) in Treasury Department is in charge of loan arrangement. RMD has experiences on the foreign loan from JICA and ADB and the staffs who were in charge of those loan are still in the Department. Capacity of PNOC should be enough to arrange the ODA loan with support of outside consultant as necessary.
Contracting Capability including PPP	*Enough with Outside Specialist* PNOC has five cooperate lawyers in the Legal Department with experience of various projects with private sectors. They are considered having enough

agreement	capability for the management the contracting including PPP agreement. Since the volume of work especially for the PPP contract is usually tremendous, the independent legal firm with well experienced for PPP contract might be utilized.
Project Monitoring	<u>*Enough with Outside Specialist*</u> PNOC has been monitoring their subsidiaries' projects through Project Management Department. They have been monitoring more than 30 projects with pre-operational stage and evaluating 7 projects with after-operational stage. They have enough know-how for the monitoring the projects as a holding company. The daily monitoring consultant might be utilized on-site basis.
Project Procurement(including preparation of PPP arrangement and technical consideration)	<u>*Not Enough*</u> PNOC has not experienced for large infrastructure project procurement and does not have staff for this role. Since this project would be procured by international competition, it is very important to have experience for international competition in order to conduct the procurement smoothly. Also, the engineers who are experienced in energy sector especially gas should be required.

Source: Survey Team, based on interviews to PNOC

b. Capacity of PNOC Subsidiaries

The Team conducted a survey on the capacity of PNOC Subsidiaries from the view point how PNOC subsidiaries can support PNOC for the implementation of Batman 1. PNOC has four subsidiaries under its arms and several affiliates with minor share. However, only PNOC-EC, PNOC-AFC, and PNOC-RC have a function which would support the project implementation. The outline and capacity of above-mentioned three subsidiaries are as follows.

Table 2.7-7 Outline and Capacity of PNOC Subsidiaries

Name of Subsidiaries	Year of Establishment	No. of Staff	Major Project	Experience of Int'l Competition
PNOC Exploration Corp.	1976	235 staffs (incl. 5 lawyers)	Major projects (Malampaya Gas Project)	<u>Experienced</u>
PNOC Alternative Fuels Corp.	1993	65 staffs (incl. 2 lawyers)	Major projects (PAFC Industrial Park)	Not experienced
PNOC Renewable Corp.	2006	24 staffs (incl. 2 lawyers)	Major projects (Hydropower Nalantang(46MW))	Not experienced

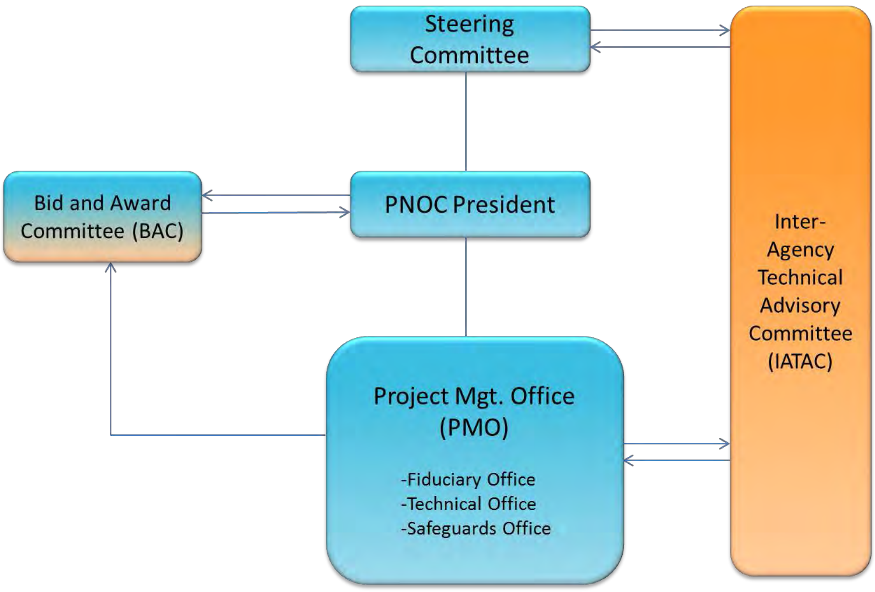
Source: Survey Team, based on interviews to PNOC Subsidiaries

Within the PNOC Subsidiaries, <u>PNOC Exploration Corp. has experienced for the procurement with international competitions.</u> As mentioned previous section, the capacity of project procurement including preparation of PPP arrangement and technical consideration is missing within PNOC, it would be possibility for PNOC to be able to find appropriate human resources from PNOC-EC for Batman 1 project.

(2) Project Management Structure

1) Management Structure before Contracting

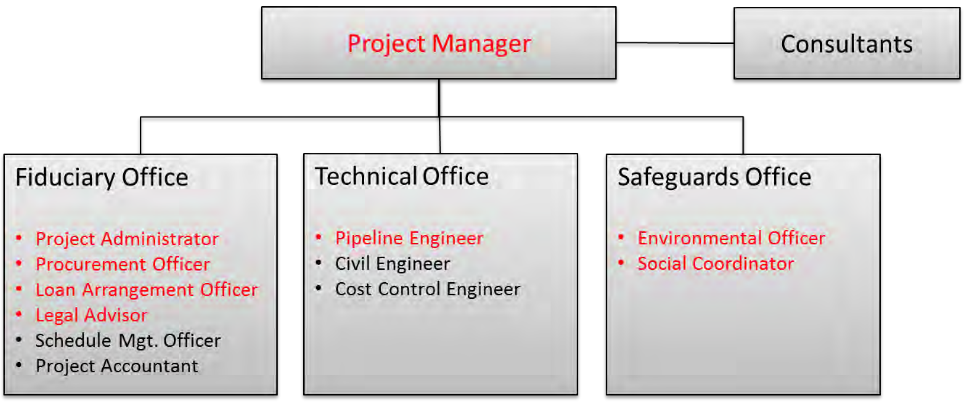
The following figure is the example of organizational set up for Batman 1. The Steering Committee (SC) shall be set as a highest decision making body of the project. Under SC, the president of PNOC has a role and responsibility of implementation of the project. PNOC president control Project Management Office (PMO) directly. Inter-Agency Technical Advisory Committee (IATAC) consists of concerned Departments and Agencies and provides advice and recommendation based on the request from each committee and office. Bid and Award Committee (BAC) would monitor the procurement process and evaluate the proposals from proponents. It is considered as more or less independent committee which should not be politically affected.



Source: Survey Team

Figure 2.7-11 Example of Organizational Setup in PNOC before Contract

The following figure is the example of PMO. PMO is headed by Project Manager (PM) supported by outside consultants. PM would manage Fiduciary Office, Technical Office and Safeguards Office.



Source: Survey Team

Figure 2.7-12 Example of Organizational Setup in PNOC before Contract

a. Steering Committee (SC)

The example of members of SC is the followings.

- Chairman: President/CEO of PNOC
- Vice Chairman: Executive Vice President of PNOC
- Co-Vice Chairman: Sr Vice Presidents

- Members: Head of Concerned Department
- Observer: Consultant

Example of TOR for SC is the followings.

- Oversight of the project
- Decision making on important issues
- Review on the feasibility study
- Review on procurement plan/documents
- Coordination among departments within PNOC
- Review of the project monitoring

b. Inter-Agency Technical Advisory Committee (IATAC)

The example of members of IATAC is the followings.

- Department of Energy (DOE)
- Department of Finance (DOF)
- National Economic Development Authority (NEDA)
- Department of Environment and Natural Resources (DENR)
- Department of Public Work and Highway (DPWH)
- Public Private Partnership (PPP) Center
- Energy Regulatory Commission (ERC)
- Philippine National Oil Corporation (PNOC)
- Concerned Local Governments Units (LGUs)

Example of TOR for IATAC is the followings.

- Coordination among concerned governmental organization (including Energy Policy, ODA loan, National Economic Development policy, PPP policy)

c. Bid and Award Committee（BAC）

The example of members of BAC is the followings.

- PNOC
- DOE
- Expert from other organizations

Example of TOR for BAC

- Monitoring the procurement process and evaluation of the proposals from proponents
- Provision of advice and recommendations for issues regarding to procurement

d. Project Manager

Project Manager (PM) is the key person for the success of the Batman 1 and should have leadership and well-knowledge on Batman 1. It is also important to have a full time PM for Batman 1.

Example of TOR for PM

- Management of overall Batman 1 project
- Responsible on reporting to President of PNOC
- Management of three offices of the project (Fiduciary, Technical, and Safeguards Office)

e. Fiduciary Office

Fiduciary Office will conduct administrative work, procurement management, loan arrangement, legal service, and schedule management. Most of officer can be selected within PNOC, however, the procurement officer should be selected from the related companies or outside of PNOC since there is no procurement specialist within the PNOC. TOR of the major officers is as follows.

Example of TOR for Deputy Project Manager
- Support Project Manager
- Manage project budget

Example of TOR for Procurement Officer
- Review the Pre-Qualification documents which consultant prepare
- Review the Request for Proposal which consultant prepare
- Review the Proposal from proponents

Example of TOR for Loan Arrangement Officer
- Consideration of funding to the project
- Arrangement of loan(including foreign loan)
- Negotiation with financial institution
- Preparation of necessary documents for loan
- Preparation of repayment schedule

Example of TOR for Legal Advisor
- Consideration of legal issues regarding to the project
- Review on the draft contract
- Negotiation with private proponents

f. Technical Office

Technical Office shall conduct the necessary technical consideration on the project. Since PNOC does not have enough technical staff, those staff shall be seconded from related organization or recruited from outside. Example of TOR for the major officer(Pipeline Engineer) is as follows.
- Review the route and design which prepared by consultant
- Review the PQ documents regarding to pipeline
- Review the RFP documents regarding to pipeline
- Review the proposals from private proponents

g. Safe Guards Office

Safe Guards Office shall conduct the necessary environmental and safe guard consideration on the project. TOR of the major officer is as follows.

Example of TOR for Environmental Officer
- Review the Environmental Impact Assessment and concerned documents
- Review the PQ documents regarding to Environmental Impact
- Review the RFP documents regarding to Environmental Impact
- Review the proposals from private proponents regarding to Environmental Impact

Example of TOR for Social Coordinator
- Review the Public Scoping and concerned documents
- Review the PQ documents regarding to Social Impact
- Review the RFP documents regarding to Social Impact

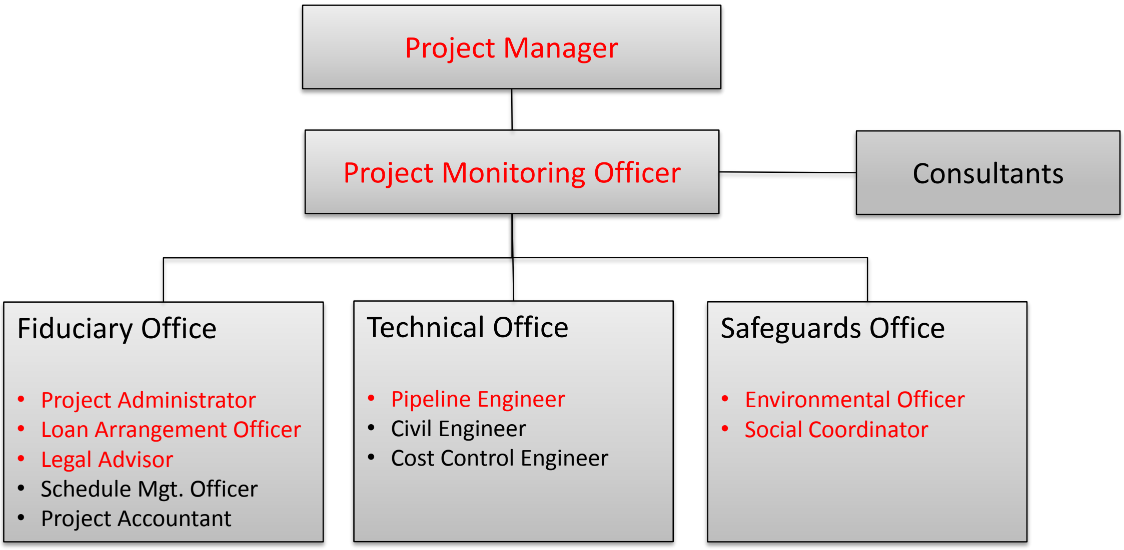
- Review the proposals from private proponents regarding to Social Impact

2) Management Structure after Contracting

After the contract is made, the major tasks of PNOC shall be shifted to monitoring. Since PNOC has long experience on monitoring for subsidiaries projects, it is expected to select Project Monitoring Officer within PNOC. At this stage, procurement officer is not necessary but other project member shall continue to support the project mainly from the view point of project monitoring. TOR of the Project Monitoring Officer is as follows.

Example of TOR for Project Monitoring Officer

- Monitor the construction and O&M of the project
- Prepare the monitoring report
- Prepare the recommendation to recovery for unqualified performance by private proponent



Source: Survey Team

Figure 2.7-13 Example of Organizational Setup in PNOC after Contract

(3) Promotion of Disbursement

The project progress status will be monitored during the course of the project implementation. These will include the matters associated with the design, construction, engineering, and the environment and social considerations. In addition, the procedures for project implementation are considered important as well such as the effectuation of the loan agreement, the procurement, the disbursement, the payment of interests, and the amortization of principal.

The type of the disbursement will be examined in the following phase. The procedures for the disbursement in general can be categorized as follows; (i) the reimbursement method, (ii) the transfer method, (iii) the transfer method, (iv) the special account method, and (v) the advance method. It is expected however that this project will follow the general reimburse method given that the major procurement components in this project will be the employment of consultant and the construction of gas pipeline.

This project is expected to apply the state-of-the-art technology such as the seismic design. Thus the specialized consultant will be employed to guide the engineering work and to supervise the project implementation. The consultant will be in charge of the full support on the project management, the management of project procedure, and the project promotion. For instance, the consultant will be engaged in the management of the construction period, cost and the measures to mitigate the risks including the environment and social aspects, and will provide the options and recommendations for taking necessary actions to implement the project as planned. Therefore the consultant is required to be equipped with the knowledge of the high level that is applied to this project, and to have the capacity to address the wide-ranging needs for the project supervision.

The implementing agency of this project does not have the experiences on the Japanese ODA loan in the recent years. The organization does not have the sufficient capacity on the engineering and the procurement particularly on the Japanese ODA loan. Since the disbursement in particular will be made based on the request from the organization in the Philippines, the speedy transaction to meet the project progress is critical. Therefore, the consultant is expected to solve the project issues, to prepare the documents for disbursement, and to expedite the disbursement process within the organizations of the Philippines. These tasks will enable the acceleration of the project implementation, and the promotion of the disbursement. In addition, it is important that the consultant should coordinate with the JICA Philippines office, JICA headquarters and the project supervision mission throughout the project supervision.

In addition to the promotion of disbursement procedures, the strengthening of the implementation of the project will contribute to the disbursement indirectly. It is important that the prior countermeasures can be made to address the project issues and risks. The following will be the possible issues that could cause the delay in project implementation.

a) Delay in employment of consultant and contractor
b) Time for detailed design including mapping
c) Procedures and approval on construction commencement and implementation
d) Matters on contractor (material procurement, capital preparation)
e) Preparation of domestic currency for implementation agency
f) Weather, natural disaster
g) Unstable political situation and other force majeure

It is important that the consultant should study and discuss the measures for the controllable issues with the related organizations except the force majeure.

(4) Anti-corruption

The major regulations for the ant-corruption in the Philippines are the revised penal code and the (Republic Act 3019). The revised penal code stipulates the definition and penal provisions for the bribery and corruption and is applied to both of public servants and citizens. The anti-graft and corrupt practice act stipulates the specific bribery acts such as the following conducts.

- Arrangement and graft conducts, to make profits associated with the contracts with the government
- Not to conduct the duties for private profits, To conduct the extremely disadvantageous deals
- To produce the unjustifiable damages in exercising the rights of the public and legal administration.
- Other unjustifiable profits and approvals

Other related laws and regulations include the plunder law (RA7080), the anti-red tape act

(RA9485), and the anti-money laundering act (RA9160). The implementing agency and related government offices have the obligations to follow and enforce the conditions in the above-mentioned laws in implementing the project.

On the other hand, the Japanese ODA loan projects strengthen the countermeasures on the anti-corruption as follows.

- Strengthening the procedures for JICA approval on the procurement.
- Strengthening the ex-post audit for verifying the procurement activities.
- Assistance for the implementing and related organizations in the procurement procedures
- Collection of information on the companies that are engaged in the corruption.

JICA has also implemented the additional measures to improve the situation. It is thus expected that the following measures will be effective as well.

- Introduction of the quality and cost based selection of consultants (QCBC) method
- Strict application of the single-source contract
- Introduction of de-briefing

It is expected that the major contracts on this project will include the employment of consultant for construction supervision, and the construction work for the gas pipeline. These contracts are generally found in many other similar projects. Thus the standard documents for procurement will also be applied in the contract including the procedures, the bid document and the standard contract. Since the procedures will also be standard without any specific special conditions, it is considered that the standard procedures can be followed in order to process the right procurement activities.

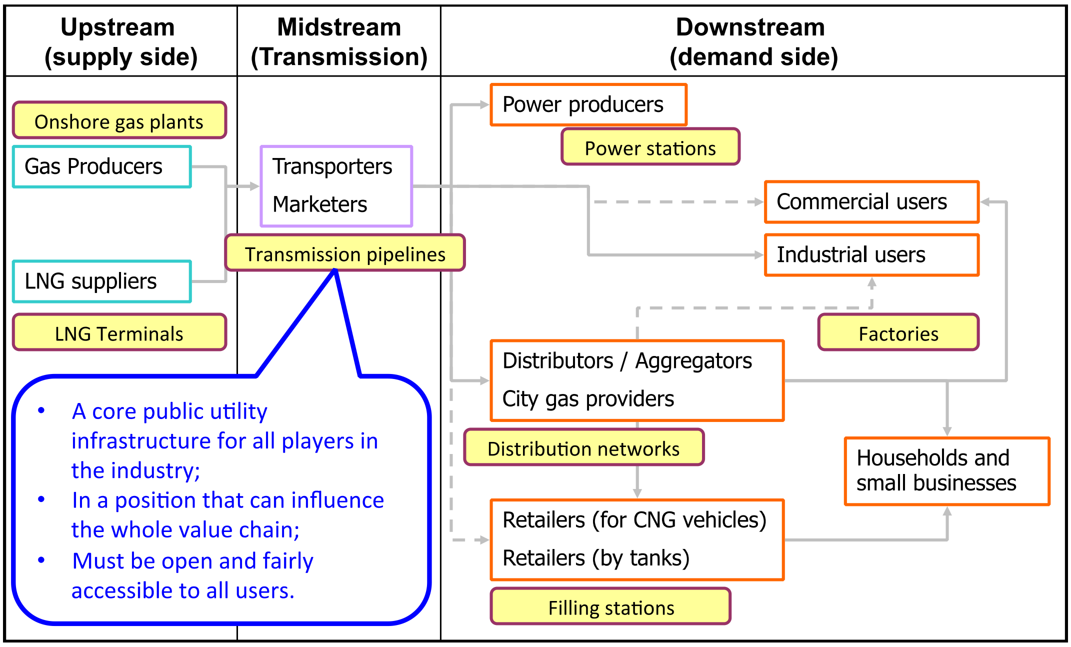
On the other hand, it would be necessary to request the Philippines side to strengthen the implementation to follow the appropriate procurement manner, and provide supports on the implementation through the advice of the consultants. It is also effective to request the Philippines side the provision of information and the thorough accountability. In addition, it is important to promote the anti-corruption and have a close coordination with the related anti-corruption organizations such as the office of the ombudsman, the prosecutors' office, the courts, the national police, and the presidential anti-graft commission (PAGC).

2.7.3 Role of Government in Development of Gas Pipeline

(1) Development of Gas Pipeline in Other Countries

1) Market Regulation

The gas market is generally composed of the three segments of upstream, mid-stream and downstream. In the upstream market, the gas is usually supplied by gas producers and LNG suppliers. In the mid-stream, the gas pipeline companies and the gas transport companies take the role of transporting the gas. In the downstream market, power generation companies and large-scale industrial users purchase the gas directly. In some other cases the gas is sold by the gas brokers to the end-users, and the city gas companies provide the residential users and the small-scale business users with the gas. There are various marketing channels for transportation.

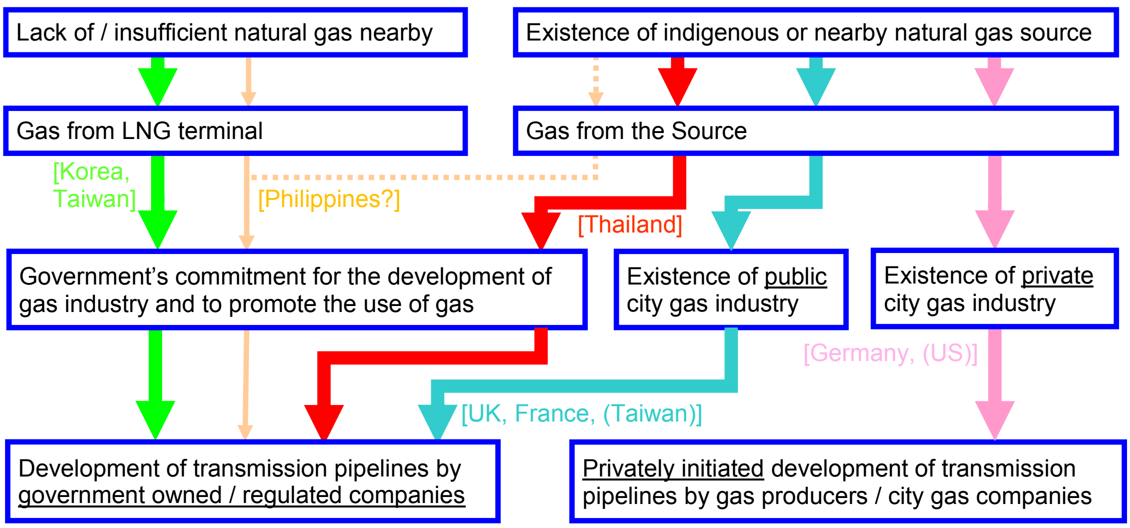


Source: Survey Team

Figure 2.7-14 Overview of Gas Market

The below chart illustrates some examples in the gas market. In economies such as Korea and Taiwan, the objective of the natural gas development is to replace the fuel use by the natural gas. The natural gas in imported through the LNG terminal and the state-owned company supplies the gas through the gas pipeline.

With the example of Thailand, the domestic gas is supplied to the end-users through the gas pipeline. In the UK, France, Taiwan (partially), the domestic gas is supplied to the end-users through the gas pipeline and the state-owned gas companies. In Germany, the private companies supply the gas through the gas pipelines owned by the private companies. However there are only a few countries that use privately-owned gas pipelines to supply the natural gas.



Source: Survey Team

Figure 2.7-15 Examples of Gas Markets

2) Development of Gas Pipeline and Capital Procurement

The examples of the owners of the pipeline facilities and the procurement of the capital for development are shown in the following. In the UK, the state-owned company constructs and owns the gas pipeline facilities. In France and Italy, the state-owned companies own the gas pipelines by the capital mobilized by the state-owned financial institutions.

In Korea, the state-owned company constructs the gas pipelines whereas the capital for development is provided by either the state-owned power companies or the local governments. In Taiwan and Thailand, the state-owned companies own the pipelines and the capital is procured by the state-owned financial institutions.

Table 2.7-8 Development of Pipeline and Capital Procurement in the World

country	Pipeline developer	Financial/Public assistance
UK	National company (British Gas Corporation)	•Financial assistance by the government
France	The government formulated an investment plan National company (Gas de France)	•Establishment of a finance corporation to raise funds for gas pipeline development •Capital investment/long-term loan using the profits of Gas de France
Italia	National company (Snam)	•Treasury payment to import pipeline construction/ debt guarantee by the government •Pipeline construction costs were covered by the regional government
Korea	The government formulated a basic natural gas supply plan and constructed Gas Transmission Pipeline National company (KOGAS)	•Financed by the national government, Korea Electric Power Corporation and the regional governments •Long-term low-interest loan •Corporate/local tax break
Taiwan	National company (China Petroleum Corporation)	•Development by national company •Nationally driven to promote LNG usage
Thailand	Petroleum Authority of Thailand (PTT)	•Owned and operated by PTT

Source: Survey Team

3) Market Design

One of the most important aspects in the gas market design is to secure the open access to promote the competition. In EU, the open competition is to stipulated in the EC Directive (2009/73/EC of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC). In the USA, the FERC Order No. 636 determines the open access and the market competition of the gas market.

In some gas markets, there are examples where the competitiveness is designed by the segregation of the market segments of gas supply, storage and transportation. In the UK, the segregation is put in place by the ownership separation of the facilities. In France, Germany and Belgium, the account separation substitutes the organizational separation. In addition, in Spain and Italy, the companies are separated based on the roles in the markets. In any cases the independent regulatory agencies play a critical role in the market monitoring and guidance of the market.

(2) Gas Market Design in the Philippines

1) Role of Government

a. Role of the Philippines Government

Since the gas market has not been established in the Philippines, it is not appropriate to refer to the advanced examples in the USA and Germany that have long history of development. Rather the Philippines can refer to the examples in a small-scale market at the beginning of the market development. In this case, it is expected that the increase of gas demand and revenue would take more time compared with the initial investment. Thus the private investment may not be expected given the size of the market risks. In addition, the profitability of the transmission facilities such as gas pipelines is considered to be small, the development by the private entity has not been common in the world.

Therefore, it can be considered appropriate that the government would develop gas pipeline by its initiative and provide the related infrastructure. In addition some demand risks at the beginning of the market development can be handled by the government. This will lead to encourage the gas demand in the consumer market. The government participation will provide a comfort to the stakeholders and the new investors in the gas market, and stimulate the additional investment and development to enlarge the market in the future.

As a conclusion, it is desirable that the government initiative would lead the development through the low-cost financing, establish the regulatory rules in the market, and aim to develop the fair and transparent gas market.

b. Policy Implementation Tool

Typical tools for the government intervention can be shown in the following table. First there is a subsidy. It is not however considered applicable in the Philippines given the policy of the Philippine government and the nature of the gas sector.

The government could also consider the supplement of certain risks. But it is not desirable for the government to assume the direct risks such as ‘take-or-pay’ contract. Private companies should take the market demand risks whereas the government supports the business operation by the market regulations such as determining the appropriate wheeling charge, and encourage the expansion of the gas market.

In the capital procurement, the government can play a role in the investment on the uncertainty at the beginning of the market development by securing the capital that the private entity may not be able to tap.

Finally the sector regulation is one of the most important areas in which the government should put efforts for the growth of the sector. The government should encourage the increase of the amount of consumption, the expansion of the supply area and the growth of the consumer basis. The government should also build the pricing regulation, safety management standard, and the technical operation standard, and establish the sector operation rules.

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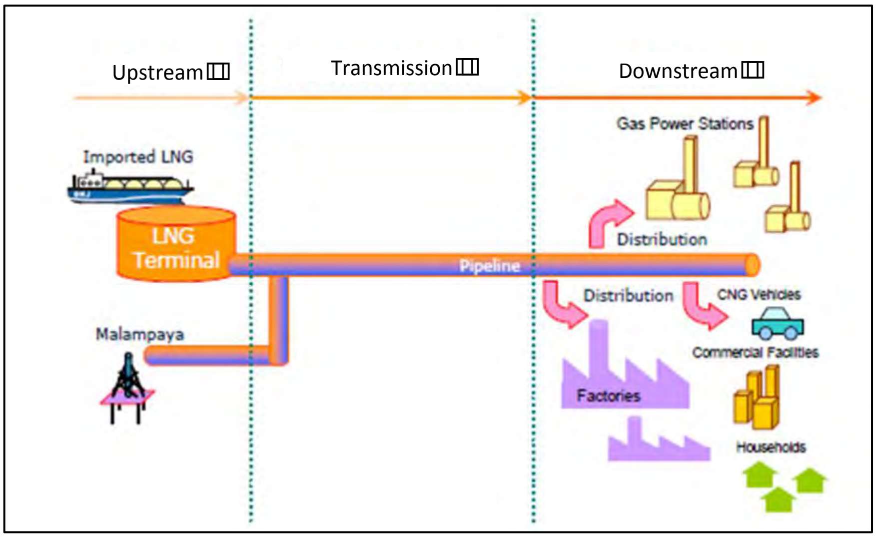
Table 2.7-9 Options for Government Intervention

Options	Examples	Pros	Cons
Subsidy	Providing financial support for the development of infrastructure	Straightforward support to encourage private participation	Not sustainable Difficult to be justified
Risk bearing & Guarantees	Take or pay contract for the first years of operation	Promotes autonomous growth of the industry	Difficult to be justified
Financing	Infrastructure developed and owned by the government	Sustainable and easy to be justified	Requires sophisticated risk sharing arrangements
Regulation	Enforcing rules to promote fair competition	In line with the global trend to develop a competitive industry	Requires expertise and institutional capacity development

Source: Survey Team

2) Market Regulation

The gas market can be divided into three segments of upstream, middle-stream and downstream. The upstream segment can be composed of the Malampaya gas field and the LNG import in the future. The end-users in the downstream will be the industrial users, transport sector and private generation companies. The role of the government can rest in the middle-stream market such as gas pipeline.

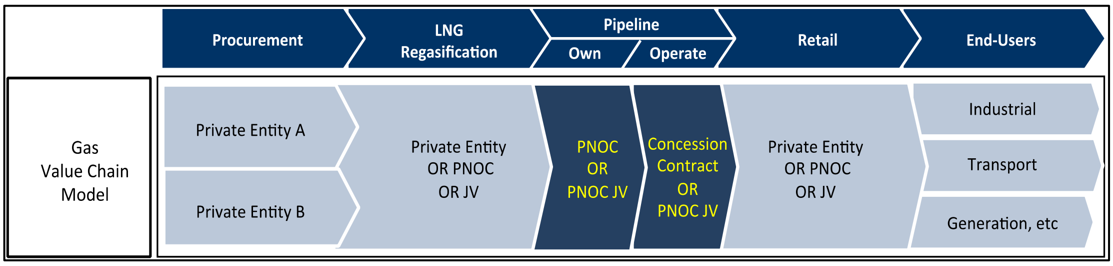


Source: Survey Team

Figure 2.7-16 Overview of Gas Sector in the Philippines

The value chain of the gas sector in the Philippines can be illustrated in the following figure. It is expected that the development of the LNG terminal and procurement of natural gas would be handled by the private sector. On the retail business side, while the end-users will spread out in terms of the supply area, size and the amount of consumption, the government organization like PNOC is unlikely to lead the initiatives for the retail business.

On the other hand, it is anticipated that the development and investment of the gas pipelines would be made by the PNOC or the joint venture with the private entity for the stable start-up and operation of the gas sector development. The operation and maintenance of the gas pipeline can be outsourced to the private sector taking advantage of the experiences and skills. PNOC is expected to exercise the franchise right in order to develop the gas pipeline.



Source: Survey Team

Figure 2.7-17 Value Chain of Gas Sector in the Philippines

3) Operation in Gas Sector

a. Upstream Sector

One of the most critical factors in the gas sector operation is the procurement of the natural gas. The proposed gas pipeline is not the comprehensive development with the regasification facility in this project. Therefore the coordination with the existing Malampaya gas field and the new LNG terminal will be indispensable.

Since there are a few development plans for the new FSRU, it is necessary to design and establish the legal and regulatory framework to secure the open access to the gas pipeline. In addition, the future demand growth of the LNG will require the new investment in the land-based LNG terminal. The report reviewed the coordination with the LNG terminal. The final report studies the directions for the legal and regulatory provisions in the future.

b. Gas down-stream sector

In the down-stream of the gas sector, the gas supply company will provide the end-users with the gas through the gas pipeline. The legal and regulatory framework will need to be developed in the near future. During the initial stage of the gas sector development, the government will be required to take the leading role in the development of the gas sector at the beginning.

The study proposes the development of the middle-pressure gas pipeline development in addition to the high-pressure gas pipeline. The middle-pressure pipeline is expected to demonstrate the successful showcases at the early stage of the project and stimulate the expansion of the gas market. The facilities may be transferred to the private sector after completing the mission.

From the viewpoint of protecting the end-users, the regulatory body is also expected to coordinate the relations and transactions between the corporations in the upstream and downstream of the gas sector.

2.7.4 Development Schedule

The following table shows the development schedule for the case of PNOC as implementing agency and the case of Joint Venture.

Table 2.7-10 Development Schedule (PNOC as Executing Agency)

Natural Gas Study Schedule (Draft) Detail Version

PNOC: Implementing Agency Phasing Development

		Item	Target Date	Actions by
Project Preparation	1	TOR Ⅰ (Introduction)		Consultants
	2	TOR Ⅱ (Natural Gas Master Plan)	September, 2013	Consultants
	3	TORⅢ (Feasibility Study of Batman1)	Feburuary, 2014	Consultants
	4	TORⅣ (Feasibility Study of LNG Receiving Terminal Project)	Feburuary, 2014	Consultants
	5	TORⅤ (Feasibility Study of Natural Gas Fired Power Plant Project)	Feburuary, 2014	Consultants
	6	TORⅥ (Data Collection on Related Projects)	Feburuary, 2014	Consultants
	7	Technical Assistance Package included in TOR Ⅱ	June, 2014	Consultants
	8	Reports		Consultants
	9	Submit EIS*2	Jan, 2014	PNOC
	10	Approval of Updated EIS (ECC)*2	Mar, 2013	PNOC
	11	Submit ICC PE Form to NEDA*1	November,2013	PNOC
	12	NEDA Board Approval*1	December, 2013	PNOC
	13	Official Request (DFA to EOJ at Manila)	Feburuary, 2014	GOP
	14	F/F Missions	Oct - Nov, 2014	JICA
	15	Pre-Appraisal Review Meeting with GOJ	before appraisal	JICA-GOJ
	16	Appraisal	Nov, 2013	JICA
	17	Reporting to JICA Board of Directors	as soon as appraisal end	JICA
	18	Post-Appraisal Meeting with GOJ	as soon as appraisal end	JICA-GOJ
	19	Pledge by GOJ to GOP	as soon as recieval of Request	GOJ-GOP
	20	L/A Negotiation	as soon as recieval of Request	JICA-GOP
	21	E/N between GOJ and GOP	preferably within March, 2014	GOJ-GOP
	22	L/A and P/M between JICA and GOP	preferably within March, 2014	JICA-GOP
Procurement	1	Preliminary F/S	late-June to late-Dec, 2013	PPPCP Tas
	1_1	Demand and Supply Analysis	late-June to late-Sep, 2013	PPPCP Tas
	1_2	Technical Study	late-Jul to late-Nov, 2012	PPPCP Tas
	3	Selection of D/D Consultant	late-Dec, 2013 to mid-Apr, 2014	PPPCP Tas
	4	Detail Engennering Design	mid-Apr, 2014 to mid-Nov, 2014	PPPCP Tas
	5	Selection of Contructor	mid-Nov, 2014 to mid-Nov, 2015	PPPCP Tas
	5_1	Listing of Project	mid-Nov, 2014	PPPCP Tas
	5_2	Approval of Project	late-Nov to late-Dec, 2014	PPPCP Tas
	5_3	Issuing Draft Contract	late-Dec, 2014	DOF
	5_4	Invitation to Pre-qualify and to Bid	early-Jan to late-Jun, 2015	PPPCP Tas
	5_5	Preparation of Pre-qualification Documents	early-Jul, 2015	PPPCP Tas
	5_6	Evaluation of Pre-qualification Documents	mid-Jul, 2015	PPPCP Tas
	5_7	Approval of Pre-qualification	late-Jul, 2015	PPPCP Tas
	5_8	Pre-bid Conference	Aug to Sep, 2015	PPPCP Tas
	5_9	Bidding	late-Sep, 2015	PPPCP Tas
	5_10	Qualification of Bidder	late-Sep to mid-Oct, 2015	PPPCP Tas
	5_11	Decision and Notice of Award	late-Oct to mid-Nov, 2015	PPPCP Tas
Construction / Services	1	Construction	Dec, 2015 to Sep, 2017	PPPCP Tas
	2	O&M	Dec, 2015 to Sep, 2018	PPPCP Tas

Japanese FY 2013 / FY 2014 / FY 2015; CY 2013 (4–12) / CY 2014 (1–12) / CY 2015 (1–12); 2016 / 2017 / ・・・ / 2057

Reports: IC/R, IT/R, DF/R, F/R①, F/R②

Table 2.7-11 Development Schedule (Joint Venture)

Natural Gas Study Schedule (Draft) | Detail Version

JV: Implementing Agency | Phasing Development

		Item	Target Date	Actions by	Japanese FY 2013 / FY 2014 / FY 2015 (CY 2013 / CY 2014 / CY 2015), 2016, 2017, ···, 2057
Project Preparation	1	TOR Ⅰ (Introduction)		Consultants	
	2	TOR Ⅱ (Natural Gas Master Plan)	September, 2013	Consultants	
	3	TORⅢ (Feasibility Study of Batman1)	Feburuary, 2014	Consultants	
	4	TORⅣ (Feasibility Study of LNG Receiving Terminal Project)	Feburuary, 2014	Consultants	
	5	TORⅤ (Feasibility Study of Natural Gas Fired Power Plant Project)	Feburuary, 2014	Consultants	
	6	TORⅥ (Data Collection on Related Projects)	Feburuary, 2014	Consultants	
	7	Technical Assistance Package included in TOR Ⅱ	June, 2014	Consultants	
	8	Reports		Consultants	IC/R, IT/, DF/R, F/R①, F/R②
	9	Submit EIS*[2]	Jan, 2014	PNOC	
	10	Approval of Updated EIS (ECC)*[2]	March, 2014	PNOC	
	11	Submit ICC PE Form to NEDA*[1]	November,2013	PNOC	
	12	NEDA Board Approval*[1]	December, 2013	PNOC	
	13	Official Request (DFA to EOJ at Manila)	Feburuary, 2014	GOP	
	14	F/F Missions	Oct - Nov, 2014	JICA	
	15	Pre-Appraisal Review Meeting with GOJ	before appraisal	JICA-GOJ	
	16	Appraisal	Jan. 2014	JICA	
	17	Reporting to JICA Board of Directors	as soon as appraisal end	JICA	
	18	Post-Appraisal Meeting with GOJ	as soon as appraisal end	JICA-GOJ	
	19	Pledge by GOJ to GOP	as soon as recieval of Request	GOJ-GOP	
	20	L/A Negotiation	as soon as recieval of Request	JICA-GOP	
	21	E/N between GOJ and GOP	preferably within March, 2014	GOJ-GOP	
	22	L/A and P/M between JICA and GOP	preferably within March, 2014	JICA-GOP	
Procurement	1	Preliminary F/S	late-June to late-Dec, 2013	PPPCP Tas	
	1_1	Demand and Supply Analysis	late-June to late-Sep, 2013	PPPCP Tas	
	1_2	Technical Study	late-Jul to late-Nov, 2012	PPPCP Tas	
	2	Selection of D/D Consultant	late-Dec, 2013 to mid-Apr, 2014	PPPCP Tas	
	3	Selection of Yen Loan Consultant	late-Dec, 2013 to mid-Aug, 2014	GOP	
	4	Detail Engennering Design	mid-Apr to mid-Oct, 2014	PPPCP Tas	
	5	ROW Acquisition	mid-Nov to early-Nov, 2014	PPPCP Tas	
	6	Bidding Preparation/ Bidding Assistance	mid-Nov, 2014 to late-Jul, 2015	PPPCP Tas	
	6_1	JV Proposal	late-Oct, 2014	PPPCP Tas	
	6_2	Project Approval	late-Oct to late-Nov, 2014	NEDA	
	6_3	Project Approval	mid-Dec, 2014 to mid-Jan, 2015	DoF	
	6_4	Project Approval	mid-Dec, 2014 to mid-Jan, 2015	DBM	
	6_5	Preparing Selection/Tender Documents	mid-Jan to mid-Feb, 2015	PPPCP Tas	
	6_6	Instruction to Private Sector Participants	mid-Feb, 2015	PPPCP Tas	
	6_7	Minimum Design, Performance Standard / Specification and Economic Parar	mid-Feb to mid-Mar 2015	DENR	
	6_8	Preparing Draft Contract	mid-Feb to mid-Mar 2015	PPPCP Tas	
	6_9	Publication of Invitation to Apply for Proposal (IAESP)	mid-Mar to mid-Apr, 2015	PPPCP Tas	
	6_10	Evaluation of Participant's Qualification	late-Apr to early-Apr, 2015	PPPCP Tas	
	6_11	Approval of Eglible Partners	early-Apr, 2015	PPPCP Tas	
	6_12	Issuance of Tender Documents	mid-Apr, to late May, 2015	PPPCP Tas	
	6_13	Pre-Selection Conference	late-Apr, 2015	PPPCP Tas	
	6_14	Publication of Competitive Selection Bulletins	mid-Apr, to late-May, 2015	PPPCP Tas	
	6_15	Opening and Evaluation of Proposals	Jun, 2015	PPPCP Tas	
	6_16	Decision and Notice of Award	late-Jun, 2015	PPPCP Tas	
Construction / Service	1	Construction	Jul, 2015 to Jul, 2017		
	2	O&M	Aug, 2017 to Jul, 2057		

*[1] Subject to NEDA-ICC schedules for TB. CC, and NEDA Board

*[2] Subject to DENR ECC approval

2.8 Financial and Economic Analysis

2.8.1 Pipeline Project Scheme

In the Philippines, as for a project scheme to implement construction and operation of gas pipelines, public, private, and public-private joint ventures are all eligible. As for business formation, separating pipeline operation business from ownership of gas pipeline infrastructure, as well as integration of both operation and ownership, is allowed. For this reason, various project schemes can be possible for the implementation of the Project.

The previous survey (2012) revealed that the use of soft loan is favorable in terms of financial costs. For this reason, this survey firstly selects project schemes assuming the concessional loan from the previous survey. Secondly a JV to be established jointly by the public sector and the private sector is added this time. The ODA loan would be available for a Public-Private JV, though the provision of loan depends on arrangement of JV. Lastly, the project scheme in which the private sector would own and operate is also included for the sake of comparison. Project schemes assessed in this report are summarized in the following table. On the project schemes, further details are in “2.7 Business Plan and Development Schedule.”

Table 2.8-1 Project Schemes

	Model 1	Model 2	Model 3	Model 4
Equity	Public 100%	Public 100%	Public 49% Private 51%	Private 100%
ODA loan	Yes	Yes	Yes	No
Commercial Loan	No	No	No	Yes
Ownership/O&M	Integrated	Separated	Integrated	Integrated
Others	-	Asset is leased to a private enterprise	Private ownership needs to be more than 50%.	-

Table 2.8-2 Comparison of Project Schemes

Outline	Soft Loan	Previous Survey	This Survey
Ownership and operation by the public sector	Yes	Model 1A	Model 1
	No	Model 1B	—
Ownership by the public sector/ Operation by the private sector	Yes	Model 2A	Model 2
	No	Model 2B	—
Ownership and operation by JV of the public sector and private sector	Yes	—	Model 3
Ownership and operation by the private sector	No	Model 0	Model 4

The Model 1 is a conventional scheme for an ODA loan project. An executing agency owns and operates infrastructure. However, this scheme requires PNOC to directly operate a pipeline. In the Model 2, an executing agency owns infrastructure, commissions operation to the private sector and obtain leasing fee. A major advantage of the Model 2 was reduction of O&M cost. In the Model 3, a public-private joint venture owns and operates infrastructure. If the public sector and the private sector jointly establish a JV, the private sector is required to own more than 50% of equity in accordance with the JV guideline. At the same time, ODA loan demands that the public sector can make managerial decisions. A major advantage of Model 3 was reduction of capital cost borne by an executing agency. The Model 4 is a conventional BOT scheme in which a private enterprise fully finances, owns, and operates infrastructure. Wheeling charge is likely to be higher than other schemes. The provision of ODA loan cannot be allowed to a private enterprise.

2.8.2 Wheeling Charge

This sub-section is not available on this disclosure version report.

2.8.3 Assumptions: FIRR for Pipeline

This sub-section is not available on this disclosure version report.

2.8.4 Calculation of FIRR for Pipeline by Project Schemes

In Model 1, Project FIRR surpasses WACC. Equity IRR surpasses cost of equity by a small margin. Thus, Model 1 is financially viable. However, an operational issue matters in Model 1 as PNOC is engaged in O&M directly.

In Model 2, Project FIRR stays above WACC for both the owner and the operator. Furthermore, Equity IRR reaches cost of equity. Model 2 is considered financially viable. As a private company is responsible for O&M, an operational issue is unlikely. This project scheme is the most desirable among the four schemes. Lease fee is to be determined so that the fee could cover expenses of the pipeline owner even in the earlier phase of the operation when gas transport volume is relatively small. This arrangement does not require the pipeline owner to contribute to additional equity after the commencement of pipeline operation. A private operator separately arranges debt financing with its credit capacity and enhances return from their equity investment.

In Model 3, Project FIRR surpasses WACC. As private sector's equity contribution pushes up cost of equity, Equity IRR does not reach cost of equity. However, a margin between cost of equity and Equity IRR is quite slim and equity IRR can be improved by additional debt financing (see the next section). The financial viability of Model 3 depends on financial arrangement. This project scheme can take advantage of operational knowledge in the private sector.

In Model 4, Project FIRR does not surpass WACC and Equity IRR does not reach cost of equity either. Cost of equity is higher due to private sector's full ownership. Furthermore, a shorter grace period increases equity injection in Model 4 compared with Models 1 and 3. As a result of additional equity injection, the cost of equity pushes up WACC.

The rest of the contents of this sub-section are not available on this disclosure version report.

2.8.5 Calculation of FIRR under Different Financial Arrangement

In the previous section, financing conditions are those can be applied for a private company in Model 4 comparison purpose (For capital expenditure, Debt 70%: Equity 30%). If a proponent chose an ODA loan, the level of debt financing can be raised furthermore. In the case that a new financing condition (Debt 80%: Equity 20%) is applied to Models 2 and 3, both of which are considered financially viable and relatively free of an operational issue.

In Model 2, the use of ODA loan results in higher D/E ratio and affects only the owner. Higher D/E ratio reduces WACC, widens its margin over Project FIRR, and raises Equity IRR. In Model 3 the same effects are observed. As a result, Equity IRR surpasses Cost of Equity. This financial arrangement makes Model 3 financially viable.

2.8.6 Calculation of FIRR in the Case of Pipeline Extension

This sub-section is not available on this disclosure version report.

2.8.7 Assumptions: EIRR for Pipeline

This sub-section is not available on this disclosure version report.

2.8.8 Calculation of EIRR for Pipeline by Project Schemes

Economic benefit is the same amount for all project schemes. For this reason, the Model 1 in which O&M is higher than other project schemes has the lowest return. In all project schemes, EIRR surpasses the hurdle rate.

As a result of sensitivity analysis on EIRR, regardless of project schemes, key variables affect the return severely in order of sales, capital expenditure, and foreign exchange. Under any condition of reduction of economic benefit by 20%, increase of capital expenditure by 20%, appreciation of Japanese Yen by 20%, the results surpass the hurdle rate in all project schemes.

2.8.9 Calculation of EIRR by Demand Cases

This sub-section is not available on this disclosure version report.

2.8.10 Estimation of Regasification Charge

This sub-section is not available on this disclosure version report.

2.8.11 Estimation for Reduction of CO2 Emission

Combined with LNG receiving terminal, gas-fired power plant, and capital expenditure by gas users, this project would contribute to energy shift and reduction of CO2 emission. Thus, this section estimates reduction of CO2 emission caused by the use of natural gas, a result of all investment, not that of pipeline alone. Comparison of "With" case (the project would be implemented) and "Without" case (the project would not be implemented) shows an estimated amount for reduction of CO2 emission. Specifically, "With" case assumes that the project would result in the supply of natural gas while "Without" case assumes that energy conversion would not occur and the same amount of energy which the supply of natural gas could generate in "With" case would come from other energy sources. The amount of CO2 emission is to be estimated in accordance of energy consumption in both "With" and "Without" cases. A difference between two cases can be considered an effect of energy conversion.

In this study, the demand for natural gas supplied by the pipeline was total amount of gas demand from power sector, industry sector, commercial sector, residential sector, and transport sector. Demand forecast is based on the Mid-lower case in "2.3 Natural Gas Demand Projection". As the sources of energy to be replaced differ in each category of demand, the estimated amount of CO2 emission is also based on the estimation in each category. Emission factors for energy sources are following:

Table 2.8-3 Emission Factors for CO2

Energy Source	Emission Factors
Natural Gas	0.0139 t-CO2/GJ
Kerosene	0.0185 t-CO2/GJ
Diesel Oil	0.0187 t-CO2/GJ
Fuel Oil	0.0195 t-CO2/GJ
LPG	LPG0.0161 t-CO2/GJ
Electricity	0.480kg/kWh

Source: METI and MOE (2013) " Estimation and Reporting Guideline on Green House Gas Ver. 3.4"
IEA (2012), "CO2 Emissions from Fuel Combustion Highlights (2012 Edition)"

Gas Demand from Power Sector: In "With" case, newly-constructed GCCT plants would generate electricity by consuming natural gas provided by the pipeline. The energy efficiency for a gas-fired power plant is assumed at 55%. A source of energy to be replaced is power generated by existing facilities. While "With" case is CO2 emission based on natural gas consumed in the new power plants, "Without" case is CO2 emission which existing facilities would emit for generating the same amount of electricity.

Gas Demand from Industry Sector: In "With" case, natural gas supplied by the pipeline would be heat source for factories. A source of energy to be replaced is fuels and electricity consumed by the factories. While "With" case is CO2 emission based on natural gas consumed in the factories, "Without" case is CO2 emission from fuels and electricity of which the factories would consume the same amount of heat. In the Previous Study, the sample survey found that kerosene 1,800 liters, diesel 0.32 million liters, fuel oil 1.16 million liters and LPG 5.7 ton could be replaced in each industrial park (73 factories). Based on heat amount, kerosene accounts for 0.1% of total fuel consumption, diesel for

19.7%, fuel oil for 79.7% and LPG for 0.5%, respectably. For electricity, it is assumed that the amount of electricity is generated with the existing power sources.

Gas Demand from Commercial Sector: In “With” case, natural gas supplied by the pipeline would be heat source for commercial facilities. A source of energy to be replaced is fuels and electricity consumed by the commercial facilities. While “With” case is CO2 emission based on natural gas consumed in the factories, “Without” case is CO2 emission from fuels and electricity which have the same heat amount of natural gas. Food processing assumes the use of LPG and cooling/electricity is sourced from existing power stations.

Gas Demand from Residential Sector: In “With” case, natural gas supplied by the pipeline would be heat source for households. A source of energy to be replaced is fuels and electricity consumed by the households. While “With” case is CO2 emission based on natural gas consumed in the residences, “Without” case is CO2 emission from fuels and electricity which have the same heat amount of natural gas. Cooking assumes the use of LPG and cooling/electricity is sourced from existing power stations.

Gas Demand from Transport Sector: In “With” case, taxies and buses would consume natural gas provided by the pipeline. A source of energy to be replaced is auto LPG and diesels consumed by the existing vehicles. While “With” case is CO2 emission based on natural gas consumed by taxies and buses, “Without” case is CO2 emission from LPG and diesels which have the same heat amount of natural gas.

A difference between total amounts in both cases is considered reduction of CO2 emission brought by this project. As a result of estimation, the annual reduction of CO2 gradually increases from Year 1 and reaches 7.8 million ton in the last year (Year 25). The total amount is expected to 44.6 million ton for the entire project life (25 years). The CO2 reductions from the power sector, the industrial sector ,the commercial sector, the residential sector, and the transport sector account for 51.7%, 29.1%, 0.7%, 2.5%, and 16.0%, respectively.

Table 2.8-4 Reduction of CO2 Emission from the Use of Natural Gas

Unit: thousand ton

	Year 1	Year 5	Year 10	Year 15	Year 20	Year 25	Project Life
Without Case							
Power	0.0	1,778.7	2,223.4	4,004.7	4,450.1	4,450.1	75,634.9
Industrial	225.9	414.9	670.7	937.2	1,196.6	1,248.1	20,312.0
Commercial	7.4	12.0	17.8	28.3	35.2	41.0	602.6
Residential	28.3	44.0	95.5	107.4	193.4	214.8	2,902.6
Transport	416.3	695.5	1,058.8	1,721.6	1,868.9	1,868.9	33,163.2
Total	678.0	2,945.2	4,066.3	6,799.2	7,744.1	7,822.9	132,615.3
With Case							
Power	0.0	1,236.2	1,545.3	2,783.3	3,092.8	3,092.8	52,566.3
Industrial	150.8	193.3	257.2	323.7	388.4	401.3	7,318.5
Residential	4.4	6.2	8.4	12.4	15.1	17.3	270.5
Transport	13.3	27.5	59.4	66.5	119.7	133.0	1,791.4
Transport	359.7	568.8	840.9	1,337.3	1,447.6	1,447.6	26,035.3
Total	528.2	2,032.0	2,711.2	4,523.2	5,063.7	5,092.0	87,981.9
Reduction of CO2 (Without Case – With Case)							
Power	0.0	542.5	678.1	1,221.4	1,357.3	1,357.3	23,068.6
Industrial	75.1	221.6	413.6	613.5	808.2	846.8	12,993.6
Residential	3.0	5.8	9.4	15.9	20.2	23.7	332.1
Transport	15.0	16.5	36.1	40.9	73.6	81.8	1,111.3
Transport	56.7	126.7	217.9	384.3	421.2	421.2	7,127.9
Total	149.8	913.2	1,355.1	2,276.0	2,680.5	2,730.9	44,633.4

2.9 Environmental and Social Considerations (ESC)
2.9.1 Project Description for the ESC Study

(1) Project Profile

1) Project Name
Batman1 Project (hereinafter referred to as 'the Project')

2) Study Scheme
Preparatory Survey (Loan-aid Project Formation)

3) Project Category for ESC and its reasoning
Categorized as: Category A
The Project is a Category A project because a large-scale project in gas pipeline sector falls into 'Sensitive Sector' under JICA Guidelines for Environmental and Social Considerations (April 2010)

4) Implementing Scheme

Loan Borrower	Government of the Philippines (GOP)
Supervisory Authority	Department of Energy (DOE), GOP
Implementing Organ	Philippine National Oil Company (PNOC)
Operation and Maintenance Structure	Commissioning to a Private Company is assumed on Public Private Partnership Scheme

(2) Project Alternatives (including Without Project Case as Zero Option)

The following four (4) alternative project routes have been hitherto examined for the Project.
(i) Route-Plan in 2003 Study
(ii) Route-Plan in 2011 Study
(iii) Route-Plan 1 in 2013 Study: a plan of pipeline installation from the Gas Supply Base (LNG Terminal Candidate Site1) through Batangas Exit of STAR Expressway to Cabuyao Exit of SLEX Expressway
(iv) Route-Plan 2 in 2013 Study: a plan of pipeline installation from the Energy Supply Base (LNG Terminal Candidate Site 2) through Lipa City Exit of STAR to Cabuyao Exit of SLEX

A brief review study was conducted on the Route-Plan (i) and (ii) in this 2013 Study. In the review study, the following issues became clear in respect to their original plans; a) Between Cabuyao and Sucat, load density in gas demand is lower than that between Batangas and Cabuyao, resulting in a lower cost-effectiveness and b) Around the Sucat area where residential houses are congested, high social hurdles such as involuntary resettlement exist, as well as in the section between Cabuyao and Sucat. Considering these conditions and with the original Plan (i) and (ii) downsized, the primary target of pipeline development has been reset to the section between Batangas and Cabuyao, In accordance with this change of plan, the measures for possible future extension of the pipeline facility will be taken in the facility design of new plan.

In the 2013 Study, the following two routes are compared with each other: namely the one from the Gas Supply Base in Batangas (LNG Terminal Candidate Site1) through Batangas Exit into STAR Expressway (the Route-Plan (iii)); and the other from the Energy Supply Base of PNOC (LNG Terminal Candidate Site 2) through Lipa City Exit into STAR (the Route-Plan (iv)). The study result has clarified that the need of resettlement and construction costs are lower in the Route-Plan (iii) than in Plan (iv). With the examinations above, the Plan (iii) was judged to be the better option from technical, economic and socio-environmental aspects. .

Figure 2.9-1 shows the alternatives of Route Plans and Table 2.9-1 Results of Comparison among the Alternative Route Plans does the results of comparison among the Alternative Route Plans. The

Route-Plan (iii) is evaluated to be the optimal option from the aspects of technical and economic feasibility and environmental and social considerations.

Figure 2.9-1 Alternative Route Plans

Table 2.9-1 Results of Comparison among the Alternative Route Plans

Item		Without the project (Zero Option)	(i) Route-Plan in 2003 Study	(ii) Route-Plan in 2011 Study	(iii) Route-Plan 1 in 2013 Study	(iv) Route-Plan 2 in 2013 Study
Outline of the Trunk Line	Start Point	—	Gas Supply Base in Batangas	Gas Supply Base in Batangas	Gas Supply Base in Batangas (LNG Terminal Candidate Site1)	PNOC Energy Supply Base (LNG Terminal Candidate Site 2)
	End Point	—	Sucat	Sucat	Cabuyao Exit of SLEX Expressway	Lipa City Exit of STAR Expressway
	Extension	—	95km	105m	65km	70km
	Route	—	from Batangas GSB along mountain ridges east of Batangas thru STAR Expressway thru SLEX Expressway up to Sucat Thermal Power Plant	From Batangas GSB thru a national highway in Batangas thru STAR Expressway thru SLEX Expressway up to Sucat Thermal Power Plant	From LNG Terminal Candidate Site1 thru STAR Exp. Batangas Exit thru STAR Exp. Lipa City Exit thru STAR Exp. Santo Tomas Exit up to SLEX Exp. Cabuyao Exit	From LNG Terminal Candidate Site 2 thru STAR STAR Exp. Lipa City Exit thru STAR Exp. Santo Tomas Exit up to SLEX Exp. Cabuyao Exit
	Structure	—	Combination of pipeline installed underground and on surface	Combination of pipeline installed underground and on surface	Underground installation of pipeline	Underground installation of pipeline
Technical Aspects		—	• In mountain forest near Batangas access road for construction work need to be constructed • Around Sucat area, construction works will be difficult because of congested residential houses	• Around Sucat area, construction works will be difficult because of congested residential houses	• Between LNG Terminal Candidate Site1 and Lipa City Exit of STAR Exp., there exist 14 special parts for river and road crossings	• Between LNG Terminal Candidate Site 2 and Lipa City Exit of STAR Exp., there exist 9 special parts for river crossings, many of which are steep creek-type rivers
Economic Aspects		• While no project cost is required, overall energy cost reduction of the Philippines will be stagnant • This option cannot contribute to the policy of stable electric power supply for the Luzon Grid, including Metro Manila, by the enhancement of gas thermal power plants	• High construction cost, necessary for land acquisition of private mountain forests near Batangas and for construction works in congested area near Sucat	• High construction cost, necessary for construction works in congested area near Sucat	• Low construction cost (is assumed) with shortened length of pipeline than the alternative routes and with only one Block Valve Station (BVS) required	• High construction cost (is assumed) with a longer pipeline route and with two BVS's required

Item		Without the project (Zero Option)	(i) Route-Plan in 2003 Study	(ii) Route-Plan in 2011 Study	(iii) Route-Plan 1 in 2013 Study	(iv) Route-Plan 2 in 2013 Study
Env. & Social Aspects	Natural Env.	• Emission gases from power generation (mainly with coal thermal power) and vehicles (mainly with gasoline fuel) will continue air pollution as things are. • Clean energy conversion and CO_2 emission reduction will be stagnant	• Cutting of natural trees is required in private mountain forests near Batangas • Mitigation for environmental impacts around Sucat. is required during construction	• Impacts on natural environment will be small in urban areas • Mitigation for environmental impacts around Sucat. is required during construction	• Impacts on natural environment will be small in urban areas • Road plant clearance will become necessary between Santo Tomas Exit of STAR and Cabuyao Exit of SLEX if open cut method is used for excavation work, while that would not be necessary if pipe-jacking method be used.	• Impacts on natural environment will be small in urban areas. • Road plant clearance will become necessary between Santo Tomas Exit of STAR and Cabuyao Exit of SLEX if open cut method is used for excavation work, while that would not be necessary if pipe-jacking method be used.
	Social Env.	• Air pollution with emission gases as above will continue to badly affect human health • Traffic risk, generated with tanker truck for CNG transport, will be continued	• Mitigation for social impacts along the section between Cabuyao and Sucat. is required during construction	• Mitigation for social impacts along the section between Cabuyao and Sucat. is required during construction	• 6 or 7 houses will need to be resettled at river crossings.	• Around 10 houses will need to be resettled at river crossings.
Recommended Optimal Option and Reasoning		Not recommended • The option cannot contribute to energy cost reduction, stable power supply and GHG emission reduction policies of the GOP	Not recommended • Gas demand of industrial parks will be satisfied • Large resettlement of inhabitants along the route is assumed	Not recommended • Gas demand of industrial parks will be satisfied • Large resettlement of inhabitants along the route is assumed	Recommended as the optimal plan • Gas demand of industrial parks will be satisfied • Relatively low project cost is assumed • Small and least resettlement is assumed among alternatives	Not recommended • Gas demand of industrial parks will be satisfied • Relatively high project cost is assumed • Small resettlement, but more than Plan (iii), is assumed

(3) Components in the Project Scope (Batman1-Phase1)

Figure 2.9-2 Location Map of the Project (Batman1-Phase1)
(Identical with Figure 2.4-2)

The Project is a gas pipeline construction, consisting of the Trunk Line (65.7 km), Distribution Lines (10.7 km in total) and the following ancillary facilities. The trunk line is from an LNG terminal candidate site in Batangas City of Batangas Province to Cabuyao Exit of SLEX[9] Expressway in the area of gas demand in Laguna Province and on the south of Metro Manila. Pipeline will be installed underground in the entire route. The outline of the project scope is tabulated in Table 2.9-2. The specifications of concerned facilities are discussed and designed in '2.4.1 Basic Design of Pipeline'. Refer to the section in this report for the details of specifications.

- Block Valve Station(BVS): a station for shut-off gas supply in emergency situation
- Governor Station (GS): a station to lower the gas pressure (de-pressure) from the high pressure of trunk line into the operating pressure of distribution lines
- Metering Station (MS): a station of measuring the gas flow rate from the supplier company to the buyer or user company for management of gas transaction
- Electrolytic Corrosion Protection System: a system to protect the pipeline of steel from natural and electrolytic corrosion and other damages
- Branch valve stations (including valve pits): a device for future extension or inlet of pipeline
- SCADA[10] System: a system for remote monitoring and control including central station
- Pig Launcher/Receiver Facilities: a launching and receiving facility of measurement and cleaning device called 'Intelligent Pig' for inspection of pipeline integrity

Table 2.9-2 Outline of the Project Scope

<table>
<tr><th colspan="3">Project Components</th><th colspan="3">Location</th><th>Size</th></tr>
<tr><td rowspan="10">Pipeline</td><td colspan="2" rowspan="3">Trunk Line</td><td colspan="3">Starting from LNG Terminal Candidate Site</td><td rowspan="3">65.7 km</td></tr>
<tr><td colspan="3">to Cabuyao Exit of SLEX Exp.</td></tr>
<tr><td colspan="3">Attribute/ along National Highway and Expressway</td></tr>
<tr><td rowspan="7">Distribution Line</td><td rowspan="3">Lima Technology Center</td><td colspan="3">From a south point of Malvar Exit of STAR Exp.[11]</td><td rowspan="3">2.2 km</td></tr>
<tr><td colspan="3">To Lima Technology Center</td></tr>
<tr><td colspan="3">Attribute/ along Barangay Road and National Highway</td></tr>
<tr><td rowspan="2">First Philippine Industrial Park</td><td colspan="3">From Santo Tomas Exit of STARExp.
To First Philippine Industrial Park</td><td rowspan="2">1.5 km</td></tr>
<tr><td colspan="3">Attribute/ along National Highway</td></tr>
<tr><td rowspan="2">Laguna Industrial Area</td><td colspan="3">From Cabuyao Exit of SLEX Exp.
To Laguna Industrial Area</td><td rowspan="2">7.0 km</td></tr>
<tr><td colspan="3">Attribute/ along Expressway and Municipal Road</td></tr>
<tr><td rowspan="9">Ancillary Facilities</td><td colspan="2">Governor Metering Station (GMS)</td><td colspan="3">Inside LNG Terminal Candidate Site in Batangas City
Attribute/ combined with the metering station (MS) on supplier side</td><td>3,000m^2</td></tr>
<tr><td colspan="2">Block Valve Station (BVS)</td><td colspan="2">Aside of STAR Exp.</td><td>Private farm land</td><td>1,200m^2</td></tr>
<tr><td colspan="2" rowspan="3">Governor Station (GS)</td><td>GS1</td><td>Aside of STAR Exp.</td><td>Private farm land</td><td>1,800m^2</td></tr>
<tr><td>GS2</td><td>Near Santo Tomas Exit of STAR Exp.</td><td>Private farm land</td><td>1,800m^2</td></tr>
<tr><td>GS3*</td><td>Inside Cabuyao Exit of SLEX Exp.</td><td>Vegetation zone inside SLEX property</td><td>2,300m^2</td></tr>
<tr><td colspan="2" rowspan="2">Metering Station (MS) on customer side</td><td>MS1</td><td colspan="2">Inside Lima Technology Center</td><td>1,000m^2</td></tr>
<tr><td>MS2</td><td colspan="2">Inside First Philippine Industrial Park</td><td>1,000m^2</td></tr>
<tr><td colspan="3">SCADA System</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="3">Pig Launcher/Receiver</td><td colspan="2"></td><td></td></tr>
</table>

9 South Luzon Expressway (SLEX Expressway or SLEX Exp)

10 SCADA is an abbreviation for Supervisory Control and Data Acquisition, a system for computerized monitoring and process control of industrial system

11 Southern Tagalog Atrerial Road (STAR Expressway or STAR Exp)

2.9.2 Baseline Environmental and Social Conditions
(1) Country Summary of the Philippines

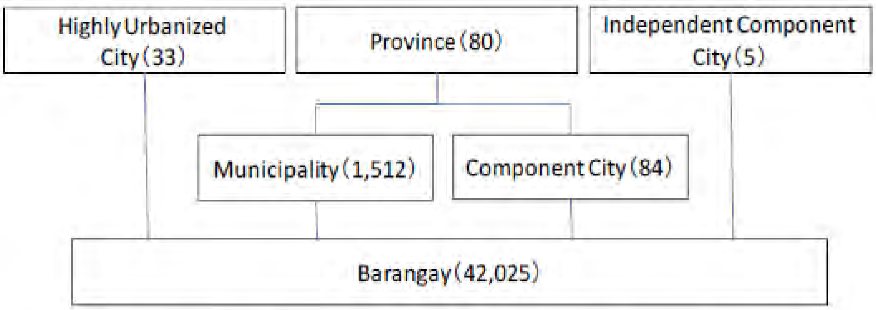
1) Country Outline
The country outline of the Philippines is tabulated on Table 2.9-3. The economic growth rate of Philippines in the third quarter of 2013 showed 7.9 %, which is at the highest rate in the ASEAN countries, having earned a rating of investment-grade by credit rating agencies.

Table 2.9-3 Country Outline

Geography	Characteristics	an archipelagic country comprising 7,107islands
	Total land area	298,170 km^2
	Coastline	36,289 km
	Climate	tropical maritime; high temperature, high humidity and abundant rainfall; and generally dry season of northeast monsoon in November to April and wet of southwest monsoon in May to October including the project regions
Demography	Population	105,720,644 (July 2013 est.)
	Population growth rate	1.84% (2013 est.)
	Religion	Catholic 82.9%, Muslim 5%, Others 12.1% (by 2000 census)
	Urban population	48.8% of total population (2011)
	Population below poverty line*	26.5% (2009 est.) (*1.25 US dollar per day)
Economy	GDP (nominal)	$ 250 billion (2012 IMF)
	GDP real growth rate	6.8% (2013 est.)
	GDP per capita (PPP)	$ 4,700 (2013 est.)
	GDP composition by sector of origin	agriculture 11.2%; industry 31.6%; services 57.2% (2013 est.)
	Unemployment rate	7.4 % (2013 est.)
	Inflation rate	2.8 % (2013 est.)
	Current account balance	$7.51 billion (2013 est.)
	Trade balance	▲$16.46 billion (2013 est)
Energy	Electricity production	67.45 billion kWh (2011 est.)
	Electricity-installed generation capacity	16.36 million kW (2010 est.)
	Electricity from fossil fuels	66.9% of total installed capacity (2010 est.)
	Annual CO2e emission	81.15 million Mt (2011 est.)

Source: Referred from CIA World Factbook, IMF data (for nominal GDP) et al.

2) Administrative Structure
In the Philippines, decentralization has been promoted with most administrative functions transferred to the jurisdiction of LGUs by the Local Government Code of 1991. There are four (4) administrative strata in the LGU units in the Philippines: 1) regions; 2) provinces and independent cities; 3) component cities and municipalities; and 4) barangays. The Philippines has 80 provinces, 122 cities, 1512 municipalities and 42,025 barangays as of June, 2009.



Note: The number in the brackets shows the number of administrations as of June 2010.
Source: Department of Interior and Local Government website(http://www.dilg.gov.ph/lgu.php) (Accessed on April2011)

Figure 2.9-3 Local Administrations in the Philippines

(2) Environmental and Social Outline of the Project Regions

1) Metropolitan Manila - National Capital Region (NCR)

a. Natural Environment

It is generally rainy from June to November and dry from December to May. Annual mean temperature is around 26 to 27 °C. Some areas are occasionally flooded with heavy precipitation such as typhoons. The concerned region is the political and economic center of Philippines and not enriched with natural environment.

b. Social Environment

The population of NCR is around twelve million, comprising over 10 % of the nation's population, with its GDP more than 30 % of the nation. A mixture of offices, commercial buildings and residential houses are found in the politico-economic city.

2) Region IV-A (CALABARZON)

a. Natural Environment

The region is located in the south of NCR. Although the estates of industrial parks and residential buildings have been developed, it is still enriched with natural environment such as forests and grass field.

b. Social Environment

Many industrial parks and residential estates have been developed along SLEX and STAR Expressways up to the southern city of Batangas. Japanese firms are starting to run their businesses in those industrial parks.

3) Two concerned Provinces along the proposed Pipeline Route

a. Batangas Province

The following sections of pipeline route pass through Batangas Province: namely the section of high-pressure Trunk Line from the proposed GMS at the Energy Supply Company in Batangas City to Santo Tomas Exit of STAR Expressway; and the Distribution Line from a point south of Malvar Exit of STAR to the LIMA Technology Center and another Distribution Line from Santo Tomas Exit of STAR to the First Philippine Industrial Park. The trunk line passes through a 9 km of national highway section through the east of Batangas City and a 42 km of STAR Expressway section. The two distribution lines are about 2 km respectively, passing through national highways and a barangay road.

The province is composed of plains and hills, and characterized with a sea and mountainous range in the south. Along the pipeline route, however, the sea and mountains are not located.
At 2 locations in the national highway section and at 9 locations in the STAR section the proposed pipeline route passes under river crossings, the width of which are roughly between several 10 meters to 150 m (at only one river crossing the bridge length is over 200 m). Though natural forests can be

sighted aside of rivers, the route does not go through the protected area or primary forests.

Census 2010 by the National Statistics Office (NSO) showed the provincial population at around 2.4 million and the annual population growth rate between 1990 and 2010 at 2.41 % in average. Approximate populations of cities and municipalities along the pipeline route are respectively 300 thousands in Batangas, 50 thousands in IBAAN, 70 thousands in SAN JOSE, 280 thousands in LIPA, 50 thousands in MALVAR, 150 thousands in TANAUAN, and 120 thousands in SANTO TOMAS.

In the trunk line section, that of about 5 km through the east of Batangas City faces continually standing houses and shops along the road. The pipeline of the concerned section is designed to be installed 1.2 meter below the ground under the national highway road including the road shoulder, in principle. The distribution line will be laid down under the general road and ancillary stations be placed in such spaces as open field beside the expressway.

b. Laguna Province

The proposed pipeline route goes from STAR into SLEX Expressway at Santo Tomas Exit. Then it crosses the provincial border from Batangas into Laguna Province at 2 km north of Santo Tomas Exit. The following sections of pipeline pass through Laguna Province to the north from here: namely the trunk line section up to Cabuyao Exit of SLEX and the distribution line from Cabuyao Exit to the Laguna Industrial Area. The straight-line distance from Cabuyao Exit to the border with NCR is about 15 km, to Sucat Power Generation Plant, which has been out of operation, is about 25 km and to the Makati center of NCR about 35 km .

While the province surrounds Laguna Lake, the pipeline route along the SLEX Expressway runs north-south at 4 to 6 km west of the Lake. Along the south border of the province stand dormant volcanoes such as Mt. Makiling, feeding geothermal energy. Mt. Makiling sits about 5.5 km to the east of north-south SLEX Expressway. The river crossings of concerned section exist at 12 rivers along SLEX, the width of which are between several meters and 100 m, except one river with the bridge length slightly below 200 m in between Calamba and Cabuyao Exit. This expressway section passes generally through farmland and pasture for paddy fields and cattle grass, except the river crossing sections stated above. Mostly uniform and plain lands prevail. At a few river crossings the bridges of expressway are surrounded by a tiny patch of natural forests.

Census 2010 by NSO showed the provincial population at around 2.7 million and the annual population growth rate between 1990 and 2010 at 3.39 % in average. Approximate populations of cities and municipalities along the pipeline route are respectively 390 thousands in CALAMBA, 250 thousands in CABUYAO and 280 thousands in SANTA ROSA.

The pipeline is designed to be installed underground of the existing expressway structure. The distribution line will be laid down under general roads.

4) Natural and Social Environment of the Proposed Project Route

a. Natural Conditions of the Pipeline Route

a) Meteorological Conditions

The concerned natural conditions are described in Section 2.2 of this Report, *Natural Conditions along the Pipeline Route*, at Sub-Section 2.2.1. (Please refer to the concerned section)

b) Topography and Geology

The concerned natural conditions are described in Section 2.2 of this Report, *Natural Conditions along the Pipeline Route*, at Sub-Section 2.2.2. (Please refer to the concerned section)

c) Terrestrial Vegetation

Batangas City to Malvar: Immediately after the proposed LNG terminal site, the project will traverse two rivers, where aside of existing bridges exist a thin strip of fringing-type mangrove area composed of Pagatpat (Sonneratia alba L. Smith) and Bungalon (Avicennia marina (Forsk.) Vierh.). From there on up to the entrance of STAR Expressway, the vegetation is typical of an urban setting whose composition is primarily for beautification or landscape; the species are mostly exotic or introduced. Most of the tree species are common reforestation species like Auri (Acacia auriculiformis A. Cunn. ex. Benth.), Yemane or Gmelina (Gmelina arborea Roxb.) and Rain tree (Samanea saman (Jacq.) Merr.). Others include common cash crops like Mangga (Mangifera indica L.) and Saba banana (Musa paradisica). Almost all lower plants are ornamental.

STAR to SLEX Expressway: The long expanses of STAR Expressway and SLEX are predominantly grassland with strips of fast-growing, mostly exotic reforestation tree species. These species are composed of Auri, Murray Redgum (Eucalyptus camaldulensis Dehnh.), and Small leaf mahogany (Swietenia mahogani (L.) Jacq.). Some cash crops like Mangga were left along the tree line of the expressway during its construction.

Cash crops like Mangga (Mangifera indica L.), Saba banana (Musa paradisiaca L.), Niog (Cocos nucifera L.) dominate species that would be affected in rural areas and agroecosystems (plantations) mixed with naturally growing tree species. Fast-growing reforestation tree species like Acacia (Acacia auriculiformis A. Cunn. eix. Benth.), Fire tree (Delonix regia (Bojer.) Raf.), Yemane (Gmelina arborea Roxb.) and Small leaf mahogany (Swietenia mahogani (L.) Jacq.), and ornamental species like Indian tree (Polyafthia Iongifolia Benth. & Hook. f.) dominate the urban tree landscapes, in association with some crops like Mangga, Niog and banana.

Endemism and Conservation Status:
About two-fifths (37.24%) of the species identified in the study area is exotic or introduced from other countries. Many of the exotics are common ornamental plants while others are common grassland-associated species that have been naturalized in the country’s terrestrial biota. Many of the shrubs and herbs are food sources and ornamentals. Many of the exotic arboreal and arborescent species have edible fruits. The encountered ferns and their allies were all endemic. About 10 species, protected by national and even international statutes, conventions and/or agreements that the country is party to, were identified, half of which are trees and/or arborescent species. The summary of the threatened species (with corresponding conservation status) that were encountered in the study area and its immediate vicinities is Table 2.9-4

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Table 2.9-4 Threatened Species identified around the Study Area

Common local Name	*Scientific Name*	*Family*	*Uses (actual & potential)*	*Conservation Status*
Ferns and Fern Allies				
Pakpak lawin lalaki	*Asplenium nidus* L.	Aspleniaceae	ornamental	Vulnerable Species[b]
Kabkab	*Drynaria quercifolia* (L.) J. Sm.	Polypodiaceae	ornamental	Vulnerable Species[b]
Herbs and Herbaceous Species				
Gabi	**Colocasia esculentum* (L.) Schott	Araceae	food, medicinal, occasionally ornamental	Least Concern[a]
Palms and Rattans				
Manila palm	*Adonidia merrillii* (Becc.) H. E. Moore	Arecaceae	ornamental	Lower Risk/near threatened[a]; Endangered[b]
Bungang ipod	*Areca ipot* Becc.	Arecaceae	masticatory, ornamental	Vulnerable A1c[a], Vulnerable Species[b]
Trees and Arborescent Species				
Piling liitan	*Canarium luzonicum* (Blume) A.Gray	Burseraceae	edible fruit, medicinal, source of resin	Other Threatened[b]
Bitaog	*Calophyllum inophyllum* L.	Clusiaceae	oil, ornamental	Lower Risk/Least Concern[a]
Takip asin	*Macaranga grandifolia* (Blanco) Merr.	Euphorbiaceae	medicinal, food covering	Vulnerable A1cd[a]
Prickly narra	*Pterocarpus indicus* Willd. forma *echinatus* (Pers.) Rojo	Fabaceae	ornamental, medicinal, furniture, cabinets, flowers have medicinal values, reforestation species	Vulnerable A1d[a]; Critically Endangered[b]
Molave	*Vitex parviflora* Juss.	Lamiaceae	heavy construction, railroad ties, bridges, wharves, occasionally ornamental, medicinal	Vulnerable A1cd[a]; Endangered[b]
Small leaf mahogany	**Swietenia mahogani* (L.) Jacq.	Meliaceae	veneer, furniture, interior finishing, musical instruments, ship-building ornamental shade tree, valves as fuel, endocarp and core for dry arrangements	Endangered A1cd[a]

Note: *- Exotic species; a - IUCN List; b - DAO 2007-01; c -CITES List

Ecological Implications:
From the landscape ecological point of view, as land is converted to tree farms, agricultural uses, or is urbanized, the area and continuity of native vegetation is transformed from the original composition and arrangement to alternative structures and functions. The study area already has a low biodiversity. The route straddles areas punctuated with vast grasslands, barelands, cultivated lands, and shrublands, intensively cultivated areas, and vast built-up areas and roads. The project will traverse some areas that enjoy high-moisture conditions like riparian areas (rivers and creeks). The soil substrate is generally clayey with high humus content. This is manifested by the preponderance of figs in association with euphorbias, legumes and mallows, and the melioid Igyo (Dysoxylum gaudichaudianum (A. Juss). Miq.). Grasses play a significant role in the area as manifested by being next to the legumes in terms of number of species.The presence of big percentage (37.24%) of exotic species in the project site depicts the great degree of human intervention and disturbance. Most of these exotics are highly ornamental and some are agricultural, suggesting current habitation, cultivation and landscaping.Most of the open and brushland areas are undergoing seral succession.

Economic and Ethno-botanical Importance of the Identified Plant Species:
Majority of the plant species that were identified in study area have commercial and aesthetic/ornamental values while some food sources and still others have commercial and medicinal properties. In fact, the most dominant arborescent species in the area, Coconut (Cocos nucifera L.), is the so-called “poor man’s tree” due to multiple uses from roots to leaves. It can be used as medicine, food (nut meat and juice), source of material for cottage products, construction material (coco lumber), and as ornamental/landscaping plant.
Most of the big tree species could be utilized for lumber, furniture, and light construction uses. Although many of the lower species are considered weeds, they can be utilized for medicinal purposes, construction materials and ornamental plants. Others can be utilized for handicrafts, agricultural implements, fibers, ground cover, dyes and forage.

d) Terrestrial Wildlife

A total of 41 species were recorded in the vicinities of the proposed route for Batman1 Pipeline Project, with ocular observations, interview surveys with the locals and rapid assessment of the fauna in the proposed route and vicinities. Endemic and Near Endemic species accounted to 21 constituting 26% of the total species recorded. A very low endemism was observed on the associated fauna. Most of the species recorded at the site were associated with open grassland to wetlands and agricultural areas.

Amphibians and Reptiles: a total of six herpetofauna were recorded at the study sites. Table 2.9-5 gives the listing of amphibians and reptiles that were encountered in the study sites during the above-mentioned survey.

Table 2.9-5 Amphibians / reptiles recorded around the Study Area (March 2014)

No	FAMILY/ Species Name	Common Name /Local Name	Residency Status /Occurrence	Conservation Status
1	BUFONIDAE *Bufo (Rhinella) marinus*	Giant Marine Toad	Introduced/ Common	Least concern
2	*Fejervarya vittigera*	Ricefield Frog	Philippines only/ Common	Least concern
3	GEKKONIDAE *Hemidactylus cf. frenatus*	Common House Gecko	Non-endemic/ Common	Least concern
4	*Mabuya cf. multifasciata*	Common Mabuya	Non-endemic/ Common	-
5	VARANIDAE *Varanus sp.*	Monitor Lizard *"Bayawak"*	Common but heavily hunted	CITES Appendix II
6	PYTHONIDAE *Python(Broghammerus)reticulates*	Reticulated Python "Sawa"	Non-endemic, Common but normally persecuted or killed for food	CITES Appendix II

Note: Taxonomy and nomenclature and conservation status follow the IUCN Redlist of Threatened Species 2011 (http://www.iucnredlist.org)

Birds: A total of 30 species belonging to 19 families and 26 genera of birds recorded at the site. Most of these are considered common. Table 2.9-6 gives the listing of birds that were sighted in the study sites during the above-mentioned survey.

Table 2.9-6 Birds recorded around the Study Area (March 2014)

No	FAMILY/ Species Name	Common Name /Local Name	Residency Status /Occurrence	Conservation Status	Feeding Guild
1	ARDEIDAE *Egretta alba*	Great Egret	Migrant, Uncommon	Least concern	GP
2	*Egretta garzetta*	Little Egret	Migrant, common	Least concern	GP
3	*Egretta intermedia*	Intermediate Egret	Migrant, common	Least concern	GP
4	*Bubulcus ibis coromandus*	Cattle Egret	Resident, Common	Least concern	GP
5	*Ixobrychus cinnamomeus*	Cinnamon Bittern	Resident, Common	Least concern	GP
6	ACCIPITRIDAE *Amaurornis phoenicurus javanica*	White-breasted Waterhen	Resident, Common	Least concern	TI
7	ROSTRATULIDAE *Rostratula benghalensis*	Greater Painted Snipe	Resident, Uncommon	Least concern	TIF
8	COLUMBIDAE *Streptopelia tranquebarica humilis*	Red Turtle Dove/Red-collared dove	Resident, Fairly common	Least concern	TF
9	*Geopelia striata*	Zebra Dove	Resident, Common	Least concern	TF
10	APODIDAE *Collocalia sp.*	Swiftlet	-	-	SwI
11	*Collocalia troglodytes*	Pygmy Swiftlet	Philippines only, Fairly Common	Least concern	SwI
12	*Halcyon chloris collaris*	White-collared Kingfisher	Resident, Common	Least concern	PP
13	MEROPIDAE *Merops viridis*	Blue-throated Bee-eater	Resident, Fairly common	Least concern	Sal
14	HIRUNDINIDAE *Hirundo tahitica javanica*	Pacific Swallow	Resident, Common	Least concern	SwI
15	*Hirundo rustica*	Barn Swallow			
16	PYCNONOTIDAE *Pycnonotus goiavier suluensis*	Yellow-vented Bulbul	Resident, Common	Least concern	AIF
17	ORIOLIDAE *Oriolus chinensis yamamurae*	Black-naped Oriole	Resident, Common	Least concern	AF

No	FAMILY/ Species Name	Common Name /Local Name	Residency Status /Occurrence	Conservation Status	Feeding Guild
18	CORVIDAE *Corvus macrorhynchos philippinus*	Large-billed Crow	Resident, Common	Least concern	AFF
19	TURDIDAE *Copsychus saularis mindanensis*	Oriental Magpie Robin	Resident, Uncommon	Least concern	FGI
20	*Megalurus palustris forbesi*	Striated Grassbird	Resident, Common	Least concern	FGI
21	MUSCICAPIDAE *Rhipidura javanica nigritorquis*	Pied Fantail	Resident, Common	Least concern	FGI
22	ARTAMIDAE *Artamus leucorynchus*	White-breasted Woodswallow	Resident, Common	Least concern	SwI
23	LANIIDAE *Lanius cristatus*	Brown Shrike	Migrant, common	Least concern	SpI
24	MOTACILLIDAE *Motacilla sp.*	Wagtail	Migrant, common	-	TI
25	*Anthus sp.*	Pipit	-	-	TI
26	STURNIDAE *Aplonis panayensis*	Asian Glossy Starling	Resident, Common	Least concern	AF
27	NECTARINIIDAE *Nectarinia jugularis jugularis*	Olive-backed Sunbird	Resident, Common	Least concern	IN
28	PLOCEIDAE *Passer montanus*	Eurasian Tree Sparrow	Introduced, Common	Least concern	G
29	ESTRILDIDAE *Lonchura leucogastra manueli*	White-bellied Munia	Resident, Common	Least concern	G
30	*Lonchura malacca jagori*	Chestnut Munia	Resident, Common	Least concern	G

Note 1: Taxonomy, nomenclature and conservation status follow IUCN Redlist of Threatened Species 2012 (http://www.iucnredlist.org) and Kennedy et al. 2000

Note 2: On Legend: (Feeding guild) grabber piscivore (GP), plunging piscivore (PP), raptorial (R), terrestrial faunivore/frugivore (TFF), arboreal faunivore/frugivore (AFF), sweeping insectivore (SwI), sallying insectivore (SaI), sweeping and sallying insectivore (SSI), foliage gleaning insectivore (FGI), bark gleaning insectivore (BGI), arboreal insectivore/frugivore (AIF), insectivore/nectarivore (IN), arboreal frugivore (AF), terrestrial frugivore (TF), terrestrial insectivore (TI), specialized insectivore (SpI), lastly, terrestrial insectivore (including invertebrates)-frugivore (TIF), graminivore (G).

Mammals: A total of five species of mammals were recorded at the site, all but one are domesticated. Endemic and CITES listed species both accounted to one species. Table 2.9-7 gives the listing of the mammals that were encountered in the study sites during the above-mentioned survey.

Table 2.9-7 Mammals recorded around the Study Area (March 2014)

No	FAMILY/ Species Name	Common Name /Local Name	Residency Status /Occurrence	Conservation Status
1	CANIDAE *Canis familiaris*	Domesticated dogs	Abundant in residential areas	-
2	FELIDAE *Felis domestica*	Domesticated cats	Abundant in residential areas	-
3	BOVIDAE *Bubalus bubalis carabanesis*	Carabao	Seen in some areas	-
4	*Bos primigenius Taurus*	Domestic cow	Abundant in some farm areas	-
5	MURIDAE *Rattus tanezumi*	Oriental House Rat	Non-endemic/ abundant in urban and agri. Areas, common in disturb lowland & mountane forest.	Least concern

Note: Taxonomy and nomenclature, status, occurrence and conservation follow the IUCN Redlist of Threatened Species 2011 (http://www.iucnredlist.org) and Heaney and collaborators 1998.

b. Protected Areas in the vicinity of the Project Route

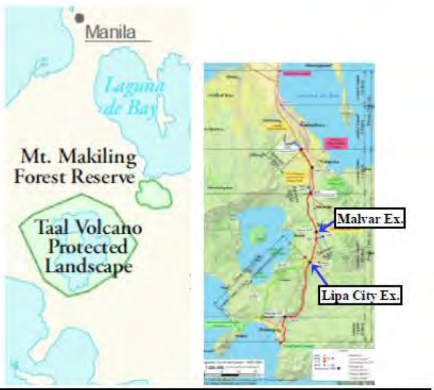
a) Natural Protected Area

The protected area nearest to the assumed pipeline route is Taal Volcano Island NP at approximately 15km away from the route, and the next nearest one is Mt.Banahaw-San Cristobal NP at approx.36 km away, according to the protected area list issued by the DENR- Protected Areas and Wildlife Bureau (PAWB).

b) Key Biodiversity Area (KBA)[12]
Two (2) KBA sites are listed in the vicinity of the proposed project route as below, according to the reference literature on Philippine KBA sites by Conservation International, DENR-PAWB and Haribon Foundation.

- Taal Volcano Protected Landscape (KBA27)
- Mt. Makiling Forest Reserve (KBA 28)

As the right picture indicates, the proposed pipeline route passes through about 5 km to the west of KBA28, but cut across the east edge of KBA27 in between Lipa City Exit and Malvar Exit of STAR Expressway, according to the map information of the above literature. However, KBA27 is a conservation area centered around Taal Volcano and Taal Lake surrounding the volcano, with its main conservation targets as protection of threatened lake fish species.



Left-Fig. <Map of KBA Sites in the vicinity of the Project Route>
Right-Fig. <Red line/ the Project Route; Blue arrow/ Lipa City Exit and Malvar of STAR Expressway>
Note: Left and right maps correspond to the nearly identical area of the same scale for comparison.

Considering the project characteristics of underground pipeline installation along and under the existing expressway, it is not conceivable that this project might affect the conditions of KBA27 and 28.

c) Environmentally Critical Area (ECA)
It is a category of areas, which is defined with its area characteristics and for which no specific site is designated by administration. A project proponent is required to verify no ECA is related to the concerned project or the other way around in the EIS submission to DENR-EMB. The fact is being studied in the EIA Study and EIS under preparation.

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[12] Reference literature: Conservation International, DENR-Protected Areas and Wildlife Bureau, Haribon Foundation, *Priority Sites for Conservation in the Philippines: Key Biodiversity Areas,* 2006, accessed and downloaded from http://www.conservation.org/global/philippines/publications/Pages/Priority-Sites-for-Conservation-Key-Biodiversity-Areas.aspx in March 2014

c. High-pressure Trunk Line (Section 1):

From the proposed GMS at the Energy Supply Company in Tabangao Barangay, Batangas City to Batangas Exit of STAR Expressway.

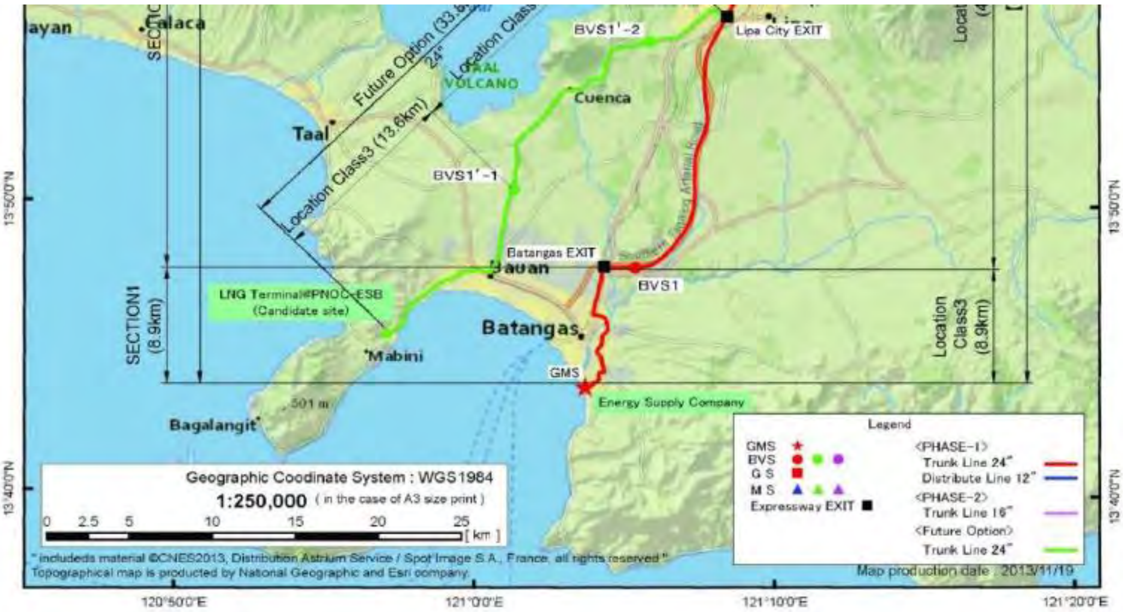

Figure 2.9-4 Location of Section 1 in the Project Route

a) Physical conditions in/around the Project Site

Section length is 8.9 km.

The national road passes through in the east of Batangas urban area with the section length at around 5 km, where it is not condensed like a downtown area but houses and shops are intermissive. The pipeline is planned to be installed 1.2 meter under the right side edge of main road, including the road shoulder part, in the direction of Manila, in principle. There are 2 river crossing points in this section. Shell oil pipeline bridges are set up in parallel with one of the two bridges. The river width is approximately between several tens and a hundred and fifty meters.

b) Biological conditions in/around the Project Site

The highway road does not pass through any protected area, primary forest and ecologically fragile area. Roadside trees are planted in the section near Shell OGP and where roadside buildings are scattering. Some natural vegetation is sighted along riverside.

c) Socioeconomic conditions in/around the Project Site

In the section of around 5 km in the east of Batangas city, houses standing beside bridges along the route and busy traffic along the national highway need attention. Impacts on those during the construction of pipeline installation need assessment and mitigation measures if necessary.

d) Current and proposed development activities within the project area

No marked development activities are noticed in the vicinity of this section after 2003 EIS submission and 2004 ECC issuance on then Batman 1 project with field reconnaissance studies.

e) ECA in DENR Manual[13] or sensitive area noted in JICA ESC Guidelines

This type of areas does not exist along this section. However, there remain patches of natural vegetation aside of the bridges at river crossings along the route. In order to avoid impacts on natural environment at the concerned river crossing sections, pipe jacking method is being examined to apply for pipeline installation, avoiding damage on the surface environment by the excavation method deep underground.

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[13] DENR, Revised Procedural Manual for DAO 2003-30, 2007

d. High-pressure Trunk Line (Section 2 and 3):
From BatangasExit of STAR Expressway to Cabuyao Exit of SLEX Expressway

Figure 2.9-5 Locations of Section 2 and 3 in the Project Route

a) Physical conditions in/around the Project Site

Section length is 56.8 km.

There are totally 32 special crossing points in this section. River crossings are at 21 locations. Road crossings are at 11 points. (Within those 32, 9 river crossings and 7 road crossings are in the STAR expressway section and 12 river crossings and 4 road crossings in the SLEX expressway section.) Along the outer edge of road structure of expressway, there stand road side plants. The thin-stemmed plants supposedly aged below 15 years-old are common in the south of Calamba Exit while relatively thick-stemmed plants, which are roughly assumed to be of 15 to 30 years old trees, stand consecutively in the section of around 5 km between Calamba Exit and Cabuyao Exit.



b) Biological conditions in/around the Project Site
The Expressways in the concerned sections are passing through mostly agricultural land, such as paddy fields and grazing grounds of livestock (mostly cows), except river crossing sections stated above. The lands are mostly uniform and plain. At a few river crossings, the Expressway bridges are surrounded around their feet with natural forests. The pipeline is planned to be installed under the right side of the Expressway road structure toward Manila.



c) Socioeconomic conditions in/around the Project Site
The surroundings of the Expressway are generally agricultural land in this section. It is not passing through any urbanized community.

d) Current and proposed development activities within the project area
Since the pipeline passes through inside and under the Expressway structure in this section, it has nothing to do with any development activities by other developers. On the other hand, the road expansion plan of the concerned Expressway Corps will affect the alignment plan of pipeline. With road side plants standing along the outer edge of road structure, the impacts of pipeline installation on and mitigation measures for them will be assessed in the EIA Study. The assessment result will be a feedback to comprehensive examination of the project basic design.

e) ECA in DENR Manual or sensitive area noted in JICA ESC Guidelines
This type of areas is not supposed to exist along the concerned section. However, river crossing sections require careful assessment study. While 21 river crossings are mostly across small rivers, two exceptions are across rivers with bridge length around 200 m. With the view to conservation of river valleys, patches of natural forests remaining at foot of the bridges, riverside slopes and water quality, possible impacts and necessary mitigation measures are assessed in the EIA Study.

e. Distribution Line
a) Outline of Distribution Lines
Distribution Line 1: Route to Lima Technology Center
The route length is 2.2 km from the STAR Expressway, through narrow Barangay Road (operated by Batangas Province) and into the National Highway (operated by DPWH Batangas 3rd District) up to Lima Technology Center. A governor station, where the gas pressure is lowered to middle-pressure, is planned in a farmland beside the Expressway in the south of the Malvar Exit.

Distribution Line 2: Route to First Philippine Industrial Park
The route length is 1.5 km from the STAR Expressway along national highway up to First Philippine Industrial Park. A governor station is planned in a private land adjacent to the Santo Tomas exit of the STAR Expressway.

Distribution Line 3: Route to Laguna Technopark
The route length is 7.0 km, from the SLEX Expressway passing through the Municipal Road and the vegetation zone on the side of the traffic lane toward Manila along SLEX Expressway up to Laguna Technopark. A governor station is planned in a vegetation zone inside the Cabuyao exit of SLEX.

Figure 2.9-6 Locations of Distribution Line 1, 2 and 3 in the Project Route

b) Environmental Conditions of Distribution Lines

All three lines above will be installed respectively along existing roads in already developed urban areas and will not encounter any natural environment except a river of a few meters wide. Therefore, they are supposed to have little impacts on natural environment.

Potential impacts are conceivable on the following: namely on roadside trees and grazing land around the Exits of Expressway; land preparation for Governor and Valve Stations (lot areas of which are typically in the range between 30m x 40 m and 40m x 50 m), and traffic control during construction at local road to industrial parks. Those impacts and mitigation needs assessment. Especially, since the Barangay road for about 1 km in the Distribution Line 1 to Lima Technology Center is narrow and surrounded on both side of the road by houses and stores, it requires particular considerations during construction.

2.9.3 Legal and administrative framework on the ESC for the Project

(1) Legal and administrative framework of the Philippines

In the Philippines, the general rules and requirements regarding environmental and social considerations and assessment are regulated under the legal system called 'Philippines Environmental Impact Statement System (PEISS)'. The key laws and regulations on PEISS are listed on the table below.

Table 2.9-8 Key Laws and Regulations on Philippine EIS System (PEISS)

Laws and Regulations	Prescription
Presidential Decree (PD) No. 1152, 1977, known as '*Philippine Environment Code*'	This decree comprehensively laid down the principal measures for environmental protection and management and incorporated the concept of environmental assessment into a law for the first time.
PD No. 1586, 1978, *establishing the*	This decree established the system of

Philippine EIS System (PEISS)	environmental impact assessment (EIA) in the Philippines and required the preparation of environmental impact statement (EIS) on environmentally critical projects and areas.
Presidential Proclamation (PP) No.2146,1981, *proclaiming Certain Areas and Types of Projects as Environmentally Critical and Within the Scope of the EIS System established under Presidential Decree No.1586*	This proclamation stipulated certain types and areas of projects as 'Environmentally Critical Projects (ECP)' and 'Environmentally Critical Areas (ECA)' that should be within the scope of the EIS System because of potentially significant impacts on the environment.
DENR Administrative Order (DAO) No. 2003- 30, 2003 and Revised Procedural Manual for DAO 2003-30, 2007	This order, known as '*Implementing Rules and Regulations (IRR) for the PEISS',* stipulated on the detailed implementing rules and regulations of the PD No.1586 and defined on the technical terms concerned.

Source: DENR-EMB Website (accessed between April 2011 and November, 2013)

Other major legislation on ESC in the Philippines can be listed as follows.

a) Presidential Decree and Executive Order ▪ Presidential Decree No.1151, June 6, 1977; Philippine Environmental Policy ▪ Presidential Administrative Order 42; Rationalizing the Implementation of the PEIS System and giving Authority in addition to the Secretary of the DENR to the Director and Regional Directors of the EMB to Grant or Deny the issuance of ECCs ▪ Presidential Administrative Order 300; Further Strengthening the PEIS System and Clarifying the Authority to Grant or Deny the Issuance of ECC ▪ Executive Order No.291, January 12, 1996; improving the Environmental Impact Statement System
b) DENR Administrative Order and Memorandum Circular regarding ESC, the Philippine EIS System ▪ DENR Administrative Order (DAO), No.11, March 28, 1994 (Sup-Dao21,S1992); Providing for programmatic compliance procedures within the EIS system ▪ DENR DAO, No.96-37, December 02, 1996 (Rev-Dao21, S1992); Further strengthen the implementation of the EIS system ▪ DENR DAO, No. 2000–05, January 06, 2000 (Rev-Dao No.94-11, Sup-DAO No.96-37); Providing for programmatic compliance procedures within the EIS system ▪ DENR Memorandum Circular (MC) ▪ , No.2002-15, November 25, 2002; Scope of violations and guidelines for the impositions of penalties for violations under the Philippine EIS System (P.D.1586) ▪ DENR MC, No.2003-21, September 30, 2003; Guidelines on the availment of the reduction of the penalties for projects found operating without ECC in violation of the Philippine EIS System (P.D.1586) ▪ Procedural Manual for DAO 2003-30 (2004) ▪ DENR MC, No.2008-08, December 24, 2008; Clarification of the Role of LGUs in the Philippine EIS System in Relation to MC 2007-08 ▪ DENR DAO, No. 2009-15, November 24, 2009; Implementation of EIS-Information System, CNC Automated Processing System, GIs Maps of Environmentally Critical Areas ▪ DENR MC, No. 2010-14, January 29, 2010; Standardization of requirements and enhancement of public participation in the streamlined implementation of the Philippine EIS System
c) DENR-EMB Guidelines and Manuals ▪ Environmental Impact Assessment (EIA) Technical Guidelines Incorporating Disaster Risk

Reduction (DRR) and Climate Change Adaptation (CCA) Concerns Under the Philippine EIS System (EIA DRR/CCA Technical Guidelines), November 2011 ▪ EIA Series 04 – 2007, A Brief Guide for the Industry Sector and EIA Reviewers on the Revised Procedural Manual of DAO 2003-03 ▪ EIA Series 02 – 2007, Initiatives to Streamlining : A Brief Guide for LGUs ▪ EIA Series 03 – 2007, The Role of Government Agencies in the Philippine EIS System (PEISS) under the Revised Procedural Manual
d) Act and Administrative Order relevant to environmental assessment and management ▪ Protected Area Act of 1992 (RA7586), June 01, 1992; An act providing for the establishment and management of the national integrated protected areas system ▪ CLEAN AIR ACT OF 1999 (RA 8749), June 23, 1999; An act providing for a comprehensive air pollution control policy ▪ CLEAN WATER ACT of 2004 (RA 9275), March 02, 2004; An act providing for a comprehensive water quality management and for other purposes ▪ DAO 2005-10 – General Implementing Rules and Regulations of Clean Water Act ▪ ECOLOGICAL SOLID WASTE MANAGEMENT ACT (RA 9003) ▪ DAO 2001-34 "Implementing Rules and Regulations of Republic Act 9003"
e) Prescription relevant to Natural Resources Development ▪ Presidential Decree No.1585, Prescribing certain standard conditions for government contracts, concessions, licenses, permits, leases, or similar privileges involving the exploration, development exploitation or utilization of natural resources

(2) Environmental standards

The following environmental quality standards of the Philippines on pollutants that can be the reference to this EIA Study are listed in Attachment 1.

- Air Quality Standards (National Ambient Air Quality Guideline Values)
- Noise Standards (Environmental Quality Standards for Noise in General Areas)
- Ambient Water Quality Standards for Fresh Waters (Water Quality Criteria for Conventional and Other Pollutants Contributing to Aesthetics and Oxygen Demand and for the Protection of Public Health)
- Waste Management and Control (Non-Hazardous Wastes, Hazardous Wastes)

(3) Procedure and relevant agencies for Environmental Impact Assessment (EIA)

In the Philippines, the types of projects which are environmentally critical or located within an environmentally critical area, 'Environmentally Critical Project (ECP)' and 'Environmentally Critical Area (ECA)' respectively, are required of preparing an Environment Impact Statement (EIS). Those projects must go through the evaluation process of an EIS by the Environmental Management Bureau (EMB) of Department of Environment and Natural Resources (DENR) and obtain an Environmental Compliance Certificate (ECC).

1) Project categories in the EIS scheme

Projects are categorized into 5 groups, depending on project type and location, with the Revised Procedural Manual 2007 for DENR Administrative Order (DAO) No. 2003-30, as the below table shows. A pipeline project is defined as Non-Environmentally Critical Project (NECP) and belongs to Group II or III.

Table 2.9-9 Project Categories by the PEISS

Group	Kinds of businesses and location implemented
I	All Environmentally Critical Projects (ECP)（regardless of locations implemented）
II	Non-Environmentally Critical Projects (NECP) in Environmentally Critical Areas (ECA)
III	NECP in Non-Environmentally Critical Areas (NECA）
IV	Co-located Projects (Several business operators implement and manage business in a contiguous area. Economic zone and industrial park etc are included.）
V	Other projects not listed in any of groups

Source：Revised Procedural Manual for DAO 2003-30 (2007)

As to a pipeline construction project with the length exceeding 25km, it is required to prepare and submit an EIS to DENR and obtain an ECC before implementation of the project. It should be approved by the director of Local EMB. However, this Batman 1 project is located over two provinces, Batangas and Laguna. Therefore, the PEISS process, in regard of the EIA review and the ECC certification, has been examined by the EMB headquarters of DENR. The project category of this Batman 1 will be judged by the EMB in the EIA review process though it is assumed to be Group II or III.

2) Agencies concerned with the PEISS

a. Supervisory and approval authority of the assessment: the EMB of DENR

The EMB of DENR is the responsible authority in processing the review and evaluation process of the EIA regarding development projects and for the issuance of ECC. The EMB Central Office chiefly supervises the assessment of Group I projects in the PEISS project categories. The Central Office also supervises the one for the co-located projects of Group IV and V majority of which are Group I projects. The Batman-1 project, though not a Group I project, is supervised by the Central Office since it extends over two provinces. EMB Regional Offices are charged with supervising and evaluating an EIA for a local development project in respective region and locality.

b. Implementing agency of the assessment: PNOC

As the proponent of Batman-1 project, PNOC is the responsible agency in implementing the EIA Study and preparing the EIS for the Batman-1. JICA, as the agency considering the assistance for the Batman-1, is in the position of supporting PNOC in implementing the EIA Study and preparing the EIS for this Project.

3) Approval procedure for the EIS

Figure 2.9-7 shows the flowchart of environmental and social considerations based on the PEISS, from the scoping of an EIA Study, implementation of the study, review and approval of the EIS, issuance of ECC and up to monitoring and evaluation after project implementation. The assessment process can be divided into 3 stages, namely (a) scoping of an EIA Study, (b) implementation of the study and (c) review and evaluation of the EIS, as follows.

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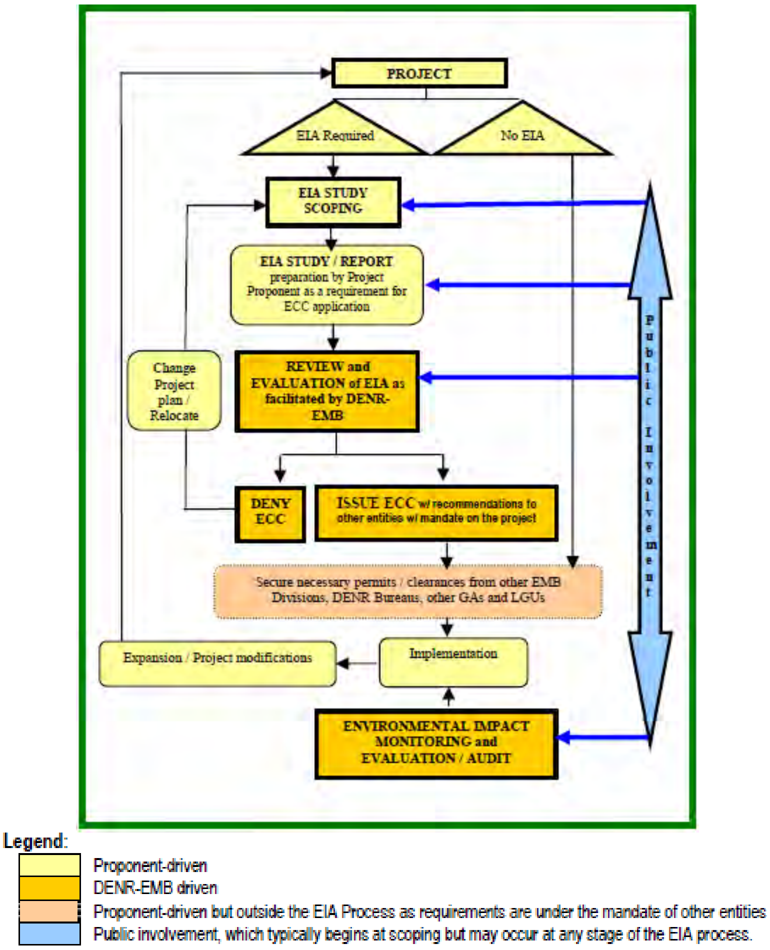

Source: Quoted from 'DENR, Revised Procedural Manual for DAO 2003-30, 2007, p14'

Figure 2.9-7 Summary flowchart of the EIA process

a. Scoping

Proponent of a project is required to hold stakeholders meetings both at the Scoping stage and at the EIS review stage. The key participants are representatives of LGUs/barangays in project affected area and leaders of sectoral/community organizations (Refer to Annex 2-3, Revised Procedural Manual for DAO 2003-30, 2007). At the scoping stage, the Public Scoping will be held with identified stakeholders, following a preliminary examination scoping project impacts and the disclosure of project information to the concerned communities. On submission of necessary project documents by the project proponent, the central/local EMB will convene an EIA Review Committee. Project proponent and EIS preparer is required to hold meetings on project outline and the Technical Scoping with the EIA Review Committee, as well as the Public Scoping with the local community where the project will be implemented. At the EIS review stage, the explanation of a draft EIS and consensus making on it to the local stakeholders shall be made through the Public Hearing/Consultation, followed by its feedback to the project planning.

Table 2.9-10 Stakeholder Meetings in the EIA process

Stage in the EIA process		Purpose of the meeting
The Scoping stage	Public Scoping	Meeting with the local stakeholders on the scoping of EIA Study
The EIA (Draft EIS) review stage	Public Consultation /Hearing	Meeting for the explanation and consensus making of a draft EIS with the local stakeholders, to feedback the results into the project plan

b. Preparation of the EIS

With the TOR for the EIA Study approved by EMB, the project proponent will conduct the EIA Study based on the TOR, to prepare and submit the drafted EIS report to EMB.

c. Review and evaluation of the EIS

The EIA Review Committee, reconvened by EMB, will review the draft EIS. In parallel, the project proponent needs to disclose information and explain about the draft EIS to the local stakeholders of the project area by holding a Public Consultation or Public Hearing, to which the EIA Review Committee may attend on a Site Visit for the EIS review. With the certification of the draft EIS by the Review Committee after these activities, the pertinent ECC will be issued.

(4) Environmental monitoring procedure

1) Purpose of the monitoring

The primary purpose of monitoring, validation and evaluation/audit in the PEISS is to ensure the judicious implementation of sound environmental management within a company/corporation and its areas of operation, according to *the Revised Procedural Manual for DAO 2003-30, 2007*, p29. Specifically, it aims to ensure the following 4 items:

- Project compliance with the conditions set in the ECC;
- Project compliance with the Environmental Management Plan (EMP);
- Effectiveness of environmental measures on prevention or mitigation of actual project impacts which correspond to the predicted impacts used as basis for the EMP design; and
- Continual updating of the EMP for sustained responsiveness to project operations and project impacts.

2) Frequency/Timing of monitoring

It is also required in the above manual that proponents issued ECCs are primarily responsible for monitoring their projects, with the submission of a standardized semi-annual ECC Compliance Monitoring Report (CMR) and the quarterly Self-Monitoring Report (SMR) to the designated monitoring EMB Regional Office. Further, the Multi-partite Monitoring Team (MMT) is required to submit the semi-annual Compliance Monitoring and Validation Report (CMVR) to the concerned EMB Regional Office, when formed after the ECC issuance and composed of representatives of the proponent and of the stakeholders including concerned LGUs, NGO/NPOs, the community, concerned EMB Regional Office and relevant government agencies.

3) Actions on adverse monitoring findings

ECC may be suspended and cancelled and/or imposed fines and penalties for violation of Proponents to comply with ECC conditions, with environmental standards, rules and regulations. EMB directors may also issue a Cease and Desist Order for violations under the PEISS but cannot be attributed to specific environmental laws and that present grave/irreparable damage to the environment.

(5) Requirements on EIA of the PEISS, JICA Guidelines and WB Safeguard Policy

Rules and regulations on EIA are compared among the Philippine pertinent regulations, JICA Guidelines for Environmental and Social Considerations (JICA ESC Guidelines, April 2010) and World Bank Safeguard Policy. Table on EIA rules and regulations compared among the pertinent regulations of the Philippines, JICA ESC Guidelines and WB Safeguard Policy shows the result of comparison. Mostly they do not make significant differences with each other. However, environmental standards or criteria are not laid down on such items as soil property, sediment conditions and vibration, in the Philippines. Therefore, if any significant impacts are assumed in such items as the result of the environmental scoping and impact assessment, it should be noted that mitigation measures need to be examined for them with a reference to the acknowledged international guidelines (such as WHO and IFC) or standards of advanced countries.

Table 2.9-11 EIA rules and regulations compared among the pertinent regulations of the Philippines, JICA ESC Guidelines and WB Safeguard Policy

JICA ESC Guidelines / WB Safeguard Policy OP 4.01	Pertinent Philippine Regulations (PEISS)	Major differences	Policy to bridge the gap
Projects must comply with the laws, ordinances, and standards related to ESCs established by the governments that have jurisdiction over project sites (including both national and local governments). They must also conform to the environmental and social consideration policies and plans of the governments that have such jurisdiction.	In the Philippines, the Environmental Impact Statement (EIS) is required of all public and private entities for every proposed project and undertaking which significantly affect the quality of the environment. Any environmentally critical project (ECP) or project in environmentally critical area (ECA) must secure an Environmental Compliance Certificate (ECC) with the preparation of EIS. (from PD1586,1978)	Not found	-
Environmental impacts that may be caused by projects must be assessed and examined in the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan.	Between the Project Concept and Pre-Feasibility Stages of the project cycle, the Proponent undertakes an initial rapid assessment on site and impacts to determine the criticality of the project location and have an initial scope of key issues. During the Feasibility Study Stage, the Proponent defines its range of actions and consider project alternatives to initiate the detailed EIA and prepare the EIS. (From Revised Procedural Manual for DAO 2003-30, 2007)	Not found	-
Multiple alternatives must be examined in order to avoid or minimize adverse impacts and to choose better project options in terms of ESCs.	A detailed statement on the environmental impact of the proposed action shall be prepared as well as any adverse environmental effect unavoidable with the proposal and alternative to the proposed action. (from Philippine Environmental Policy, PD1151) The EIA Study involves a description of the proposed project and its alternatives to be presented in the EIS (From Revised Procedural Manual for DAO 2003-30, 2007)	Not found	-
The impacts to be assessed with regard to ESCs include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts.	Key environmental issues to be given analysis and evaluation in the assessment and stated in an EIS include; Land (land use, pedology, geology and geomorphology, terrestrial biology), Water (hydrology and hydrogeology, oceanography, water quality, freshwater biology, marine biology), Air (meteorology, air quality and noise) and People (resettlement, migration, indigenous people, public health, local benefit, delivery of basic services and resources, traffic situation, and environmental risk and management. (From Revised Procedural Manual for DAO 2003-30, 2007, ANNEX 2-7a and	Major differences are not found in scoping and assessment items. Environmental standards or criteria are not laid down on such items as soil property, sediment conditions and vibration, in	If any significant impacts are assumed in such items as the result of scoping and assessment, mitigation measures are examine with a reference to acknowledged international guidelines or standards of advanced countries.

JICA ESC Guidelines / WB Safeguard Policy OP 4.01	Pertinent Philippine Regulations (PEISS)	Major differences	Policy to bridge the gap
	Annex 2-20)	Philippine.	
For projects with a potentially large environmental impact, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans may be examined. The outcome of such consultations must be incorporated into the contents of project plans.	The Revised Procedural Manual (2007) stress the process of 'Public Participation', stating that it should be demonstrated in the following activities. ・IEC of LGUs ・Public Scoping ・Inputs of local stakeholders ・Public Hearing/ Public Consultation ・Disclosure of the EIA findings and recommendations Prior to Public Hearing or Public Consultation, the Proponent is required to give copies of the full EIA Report to the EMB RO and host municipalities; copies of Executive Summary to the host barangays. Once an ECC is issued, the EIA recommendations are transmitted by the DENR-EMB to the concerned GAs and LGUs.	Not found	-
Over a certain period of time, JICA confirms with project proponents etc. the results of monitoring the items that have significant environmental impacts. This is done in order to confirm that project proponents etc. are undertaking ESCs The information necessary for monitoring confirmation by JICA must be supplied by project proponents etc. by appropriate means, including in writing.	Proponents issued ECCs are responsible for the submission of the semi-annual ECC Compliance Monitoring Report (CMR) and the quarterly Self-Monitoring Report (SMR) to the concerned EMB Regional Office. Besides, the Multi-partite Monitoring Team (MMT) is required to submit the semi-annual Compliance Monitoring and Validation Report (CMVR) to the concerned EMB Regional Office (From Revised Procedural Manual for DAO 2003-30, 2007)	Not found	-

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2.9.4 Scoping

Table 2.92.9-12 Scoping Matrix (1/2)

Category of Impacts	Items of Impacts	Degree of possible adverse impacts: before/during Construction	Degree of possible adverse impacts: during Operation	Reason of the assessment
Pollution Control	1 Air Quality	B-	D	**During Construction (DC):** The amount and frequency of heavy machines and vehicles operation are supposed to be limited since there will not be large amount of material transportation in the construction work for the project. However, during construction works in urbanized areas, measures such as dust control will be necessary. **During Operation (DO):** There will be no sources of emission gas in project facilities.
	2 Water Quality	B-	D	**DC:** There will be temporary impact of muddy water on turvidity of downstreem water with excavated soil during the work laying pipelines underground. In case ground improvement become necessary at a few sections, the impacts of chemical injection on circumambient groundwater need to be monitored. **DO:** There will be no sources of effluent water in project facilities.
	3 Wastes	B-	D	**DC:** Though most excavated soil of pipeline installation work will be filled in again, the proper management of disposal process should be required for small amount of surplus waste soil. **DO:** It is not assumed for this project to generate any large scale storage and disposal place of industrial or any hazardous wastes.
	4 Soil Contamination	D	D	There will be no sources of chemicals, polluted leachet water and other hazardous materials, regarding project facilities. For the pipeline test under applied pressure before commissioning, air-pressure test without any chemicals is assumed in the basic design, rather than hydrotest.
	5 Noise and Vibration	B-	D	**DC:** The amount and frequency of heavy machines and vehicles operation during construction work are supposed to be limited. However, during construction works in urbanized areas, measures such as work time constraint will be necessary. **DO:** There will be no sources of noise and vibration in project facilities.
	6 Subsidence	D	D	There will be no groundwater extraction for this project.
	7 Odor	D	D	There will be no sources of offensive odor in project facilities.
	8 Sediment	B-	D	**DC:** It is assumed that pipelines will be installed underground at river crossing points. However the impacts on river sediment are not supposed to be significant since it is riverbeds under existing bridges. (Of 27 river crossings along the assumed pipeline route, most are small rivers while two rivers have bridges around 200 m in length. For wider river crossing sections, the basic design assumes the pipeline installation method that can avoid adverse impacts on river sediment such as the pipe-jacking or HDD method.) **DO:** There will be no sources of possible pollutants or sludge, regarding project facilities
Natural Environment	9 Protected Areas	D	D	There will be no project facilities to be installed in, around and adjacent to protected areas. The protected area nearest to the assumed pipeline route is Taal Volcano Island NP at approximately 15km away from the route, and the next nearest one is Mt.Banahaw-San Cristobal NP at approx.36 km away, according to the DENR-PAWB protected area list.
	10 Ecosystem	C-	D	There will be no construction works for project facilities in where significant natural ecosystems are existent. The impacts on natuiral grove beside bridges at river crossing points of pipelines are projected to be minimal from the view point of ecological impacts. However, it is better to be confirmed with the examination of water quality and impacts on slope conditions in the EIA study concerned. The impacts on roadside plants in the expressway section are classified into '17 Land use and utilization of local resources', instead of being into 'Ecosystem'.
	11 Hydrology	B-	D	**DC:** There will be cases to temporally control river flow during installation works at river crossings. But it will be small scale of flow control. **DO:** There will be no project structures that could possiblly give impacts on river flow at the project operational stage.
	12 Topography and Geology	B-	D	**DC:** Special cares should be taken for installation and related works that will be conducted in slope at steep creek-type river crossings. Since the Philippines are prone to earthquake disaster, it is necessary to have areal zoning of the project areas according to the levels of liquefaction risk and reflect the zoning categories in the safety criteria for pipeline design. **DO:** Provided that proper safety measures are taken at pipeline installation work, it is not supposed to be any problems for topography and geology due to underground pipelines at the operational stage.

Table 2.9-12 Scoping Matrix (2/2)

Category of Impacts	Items of Impacts	Degree of possible adverse impacts: before/during Construction	Degree of possible adverse impacts: during Operation	Reason of the assessment
Social Environment	13 Resettlement *)	B-	D	**DC:** A few houses standing beside rivers at river crossing points of pipeline might be affected by pipeline installation works. In addition, the land acquisition or lease will be necessary for 3 Governor & 1 Valve Stations respectively with the area of around 1200-1600 m^2 inside or aside of expressway lot area.
	14 People in poverty	D	D	As well as pipelines are installed undeground of existing roads in principle, the areas that might have any effects on poor communities are not included in project sites.
	15 Ethnic Minorities and Indigenous Peoples	D	D	The pipeline routes will not pass through the settlements of ethnic minorities and indigenous peoples.
	16 Local economies, such as employment and livelihood	B+	B+	**DC:** Some positive effects on employment of local labor are expected during construction works for the project. **DO:** It is expected that local job opportunities will be boosted with the local employment of monitoring personnels for equipment inspection and gas supply to industries.
	17 Land use and utilization of local resources	C-	D	While pipelines will be installed underground of existing roads, there may be impacts on road side planting along the expressway section. Especially, road side trees standing along the edge of roadside in the section of around 5 km between Calamba Exit and Cabuyao Exit, which are roughly assumed to be of 15 to 30 years old trees, might be cleared consecutively. Since ancillary facilities, such as GSs and BVSs, are planned to be installed inside the lots or beside of existing express ways, their impacts on land use and local resources will be minimized.
	18 Water usage	D	D	There will be no utilization of water regarding the project.
	19 Existing social infrastructure and services	B-	D	**DC:** Possible impacts on other social infrastructure, utilities, and local traffic along the roads and at the river crossings where pipelines will be installed need to be studied and examined.
	20 Social structure and local decision-making institutions	D	D	It is not expected that there are any local impacts on social structures of municipalities and communities along the pipeline routes.
	21 Uneven distribution of benefits and damages	D	B-	**DO:** Target areas and users for gas supply may differ from the areas where pipelines pass through in the project plan. Feasibility need to be examined for taking measures to compensate for misdistribution of benefits, such as inclusion of ancillary facilities in the project to supply not only for the target areas but for the areas along the pipelines.
	22 Local conflicts of interest	D	B-	The effects on this aspect need to be examined with the same reason as 21 above.
	23 Heritage	D	D	There will be no impacts on any cultural heritages since all project facilities will be installed along existing main roads.
	24 Landscape	D	D	There will be no impacts on local landscapes since ground installation of project facilities are limited to small scale governor and valve stations along trunk roads.
	25 Gender	D	D	Project effects on gender issues are not expected.
	26 Children's rights	D	D	Projects effects on children's life are not expected.
	27 Infectious diseases such as HIV/AIDS	D	D	**DC:** The setup of large scale construction camp is not expected for this project. Therefore, it is not expected that there will be a large number of influx of migrant workers from other regions.
	28 Working environment	B-	B-	**DC:** Safety measures for labor workers should be examined on road traffics, especially for works in expressways, and on construction work in slopes, particularly during construction works at river and road crossings and in urban areas. **DO**: Accident prevention measures need to be examined and planned for the following; such as for safety measures in handling high-pressure gas and for traffic accidents prevention in maintenance work inside expressway lot areas.
Global Issues	29 Accident	B-	A-	**DC:** The effects of pipeline installation works on local traffic and traffic accidents of local people should be examined. **DO**:With the base of project study and examination on accidents preventive design and maintenance plan of facilities, the project effects and mitigation measures should be examined.
	30 Climate Change/ Global Warming	D	B+	**DO:** It is expected that natural gas utilization will replace the energy generated by coal thermal power plant as alternative source, which will lead to the reduction of CO2 emission.

A+/-: Significant positive/negative impact is expected. B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

2.9.5 TOR for the Environmental and Social Considerations Study

Regarding the items having been evaluated as A, B or C in the scoping, Terms of Reference (TOR) for the pertinent environmental and social considerations study are prepared as follows.

Table 2.9-13 TOR for the ESC study (on Pollution and Natural Environment)

Category of Environmental Impacts	Study Item	Method of the Study
Air Quality	(1) Environmental standards (Philippines, international reference such as WHO and Japan) (2) Confirmation of surrounding social environment (check residence, hospitals, schools) along the pipeline routes (3) Order of amount and frequency of heavy machines and vehicles operation in the construction work at peak period and time (4) Work schedule for mitigating impacts	(1) Existing literature and legal circulation (2) On-site survey along the route (3) Inquiry to facility engineer of the study team (4) Examination of work schedule for mitigating impacts with reference to other construction cases in similar projects
Water Quality	(1) Environmental standards (Philippines, international reference such as WHO and Japan) (2) Baseline data of river water quality at river crossings on Water Temperature, Flow volume, Turbidity, pH, BOD, Suspended Solids (SS), Dissolved Oxygen (DO) and Coliform group (3) Confirmation of work type and contents of work at river crossings (4) Confirmation of slope conditions, vegetation cover and bottom sediments	(1) Existing literature and legal circulation (2) Water quality measurements of river water at river crossings of pipeline route (3) Inquiry to facility engineer of the study team (4) On-site survey
Wastes	(1) Waste management regulations in Philippines (2) How to dispose surplus waste soil (3) How to dispose other construction waste	(1) Existing literature and legal circulation (2) Clarification of disposal procedure for waste soil and waste-soil disposal sites along the pipeline route (3) Clarification of disposal procedure for construction wast and industrial waste disposal sites along the pipeline route
Noise and Vibration	Same as for 'Air Quality', (1) Environmental standards (Philippines, international reference such as WHO and Japan) (2) Confirmation of surrounding social environment (check residence, hospitals, schools) along the pipeline routes (3) Order of amount and frequency of heavy machines and vehicles operation in the construction work at peak period and time (4) Work schedule for mitigating impacts	(1) Existing literature and legal circulation (2) On-site survey along the route (3) Inquiry to facility engineer of the study team (4) Examination of work schedule for mitigating impacts with reference to other construction cases in similar projects
Sediment	(1) Confirmation of river bottom conditions	(1) On-site survey in rivers along pipeline route
Ecosystem	(1) Conditions of vegetation cover around bridges at river crossings (2) Impacts on vegetation cover around bridges at river crossings	(1) On-site survey of vegetation cover at river crossings (2) Assessment of impacts based on assumed construction work
Hydrology	(1) Confirmation of assumed flow control of river (2) Downstream water use	(1) Inquiry to facility engineer of the study team (2) On-site survey downstream of river crossings and local hearing at local administration
Topography and Geology	(1) Confirmation of assumed slope work at steep creek-type river crossings. (2) Current slope conditions and vegetation cover	(1) Inquiry to facility engineer of the study team (2) On-site survey of slopes at river crossings

Table 2.9-13 TOR for the ESC study (on Social Environment)

Category of Social Impacts	Study Item	Method of the Study
Land Acquisition and Resettlement	(1) Identification of possibly affected houses at river crossing points (2) Confirmation of assumed locations of Governor and Valve Stations for land occupation/ lease (supposedly inside expressway lot area)	(1) On-site survey of river crossing points (2) Land registration survey for the assumed land spaces and necessary procedure (3) Preparation of Resettlement Action Plan (RAP)
Land use and utilization of local resources	(1) Approximation of expressway road side planting to be cut down (2) Necessary mitigation and compensation for the removed planting (3) Relevant regulations	(1) On-site survey along express way (2) Clarification of mitigation measures including method, required replantation amount, sites for replantation and its cost (3) Local stakeholders opinion (4) Confirmation of concerned regulations
Existing social infrastructure and services	(1) Possible impacts on other social infrastructure and utilities along the roads and at the river crossings (2) Possible impacts on local traffic along the roads and at the river crossings	(1) Review of engineering survey results (2) Traffic volume survey and analysis at condensed urban areas and special crossing points
Uneven distribution of benefits and damages	(1) Identification of benefits for the areas where pipelines pass through (2) Feasibility of installation of ancillary facilities to supply natural gas not only for the target areas but for the areas along the pipelines	(1) Review of public scoping results and examination in the study team (2) Inquiry to facility engineer of the study team
Local conflicts of interest	(1) Same as 'Uneven distribution of benefits and damages' above (2) Demand and expectation of local stakeholders	(1) Same as 'Uneven distribution of benefits and damages' above (2) Review of public scoping results
Working environment	(1) Safety measures to be taken for labor workers on road traffics, especially for works in expressways, and on construction work in slopes, particularly during construction works at river and road crossings and in urban areas. (2) Accident prevention measures to be taken for labor workers on the following; such as on safety measures in handling high-pressure gas and on traffic accidents prevention in maintenance work inside expressway lot areas.	(1) - Review of the concerned mitigation measures in similar projects - Inquiry to facility engineer of the study team (2) Review of standard safety measures and procedure for the concerned works with literature, ILO's manual on 'Safety and Health in Construction' and Inquiry to facility engineer of the study team
Accident	(1) Effects and necessary measures of pipeline installation works on local traffic and traffic accidents of local people (2) Accidents preventive design and maintenance plan of facilities	(1) - On-site survey at condensed urban areas and special crossing points - Literature survey on standard measures on traffic safety (2) Inquiry to facility engineer of the study team

2.9.6 Environment and Social Considerations Study Outcomes

Based on the TOR for the ESC study, an environmental impact assessment (EIA) has been conducted on A, B and C items identified in the scoping.

(1) Air Quality

Heavy machines and vehicles, such as backhoe, dump, truck, crane and compressor, will be used in construction work for the project. All machines and vehicles are supposed to use diesel oil (light oil) for fuel.

Emission standards:
The Philippines, as well as Asian countries (China, Indonesia, Malaysia and Thailand), is adopting EURO Standards (1 to 6) as emission standards for vehicles. While EURO2 and partially EURO3 are current standards for passenger vehicles with EURO4 to be effective from 2016 according to DAO2010-23 (Sep 2010), there are no emission standards yet for heavy machines and vehicles of construction work in the Philippines. Therefore, as reference standards, Next table shows EU Emission Standards for heavy-duty diesel engines, g/kWh (smoke in m−1), which generally includes trucks and buses.

Table 2.9-14 EU Emission Standards for Heavy-Duty Diesel Engines

規制開始年	規制	CO (g/kWh)	HC (g/kWh)	NOx (g/kWh)	PM (g/kWh)	Smoke (g/m)
1992	EURO-I ,<85kW	4.5	1.1	8.0	0.612	
	EURO-I ,>85kW	4.5	1.1	8.0	0.36	
1998	EURO-II	4.0	1.1	7.0	0.15	
2000	EURO-III	2.1	0.66	5.0	0.10	0.8
2005	EURO-IV	1.5	0.46	3.5	0.02	0.5
2008	EURO-V	1.5	0.46	2.0	0.02	0.5
2014	EURO-VI	1.5	0.13	0.4	0.01	

Possible impacts in Pre-Construction and Construction Phases/
The period of work is assumed to be 21 months in the basic design for the project. The work areas are divided in Batangas City, Sections of high-pressure trunk line of STAR and SLEX Expressways, and Distribution Lines and categorized in sections of general excavation and special crossings. Based on operation hours by type of machine and vehicle, assuming the work period and areas above, the total fuel consumption of construction machines and vehicles in the project is estimated to be around 3,783kL. This amount approximately corresponds to the consumption of 8.2kL per day during the construction period, assuming 22.5 working days per month. This consumption rate also corresponds to the total fuel of 80 vehicles with 100 L fuel tank being consumed every day during the construction period.

- Dust in the PM level will possibly increase temporally at the construction sites and adjacent areas
- Particularly dust pollution sensitive receptors areas such as residential, hospitals, and schools due to dust suspension should be controlled
- The concentration levels of CO, HC, NOx and SOx will possibly increase as well due to emission gas from construction vehicles and machineries

(2) Water Quality

Possible impacts in Pre-Construction and Construction Phases/
Surface hydrology:

- Temporarily muddy water with excavated soil might have impact on turbidity of downstream water during the work laying pipelines underground.
- Water at river crossings of the proposed pipeline alignment possibly increase in the oil & grease level, due to oil spillage from heavy equipment and machineries
- Water flow of the rivers and creeks, with relatively wide stretch and abundant flow, at the crossings of the pipeline alignment might temporally and partly be diverted during the work laying pipelines underground.
- Water flow rate of the rivers and creeks at the crossings of the pipeline alignment will possibly decrease due to impediment caused by improper management of construction spoils and debris, particularly stripped vegetation.
- Hygiene level of water may temporarily deteriorate where hygienic facilities are not in place.

Ground water:
- Upper layer of groundwater might possibly contaminated due to oil seepage and indiscriminate disposal of toxic chemicals (i.e. paints and used oils)

Possible impacts in Construction Phases/
Ground water hydrology and neighboring water source (e.g. well water):
In the basic design of the project, pipe jacking method is assumed for pipeline installation, trenching under river crossing at three sites as below
1) Wide River Crossing in Batangas
2) River Crossing in the south vicinity of CANLBANG I/C along SLEX Expressway
3) River Crossing in the south vicinity of CABUYAO I/C along SLEX Expressway

- Depending on the soil conditions of both bank of respective river crossing as above, there might be very slight possibility of polluting ground water and neighboring water source due to chemical injection for ground improvement work.

(3) Wastes

The volume occupied by installed pipeline is estimated to be 19,132 m^3 in the high-pressure trunk line, 852 m^3 in the three distribution lines and 19,984 m^3 in total. The estimated volume of surplus waste soil that will remain after backfilling of excavated soil will be in the range of 20,000 to 25,000 m^3, considering the burial of protection plates as ancillary facility and the volumetric expansion of excavated soil. This volume will be approximately equal to a cube from 27 to 29 m on a side.

Possible impacts in Construction Phases/
- While most excavated soil will be backfilled after underground installation of pipeline and ancillary facilities, approximately 20,000 to 25,000 m3 of surplus waste soil will remain and need to be disposed in appropriate place.
- Environmental deterioration from waste construction materials, used oil and grease contamination may occur.

(4) Noises and Vibration

Noise Standards:
Allowed levels and permit values of noise are regulated by the areal categories and the time-zones of a day in Philippines. Noise standards in general areas are categorized as below.

Table 2.9-15 Noise Standards in General Areas

Areal factor	Time factor		
Category of Areas	Daytime (dBA)	Morning & Evening (dBA)	Nighttime (dBA)
Class AA: section or contiguous area which require quietness such as area within 100 meters from (school sites, nursery schools, hospitals and special home for the aged)	50	45	40
Class A: section or contiguous area which is primarily used for residential purposes	55	50	45
Class B: section or contiguous area which is primarily a commercial area	65	60	55
Class C: section or contiguous area primarily reserved as a light industrial area	70	65	60
Class D: section or contiguous area primarily reserved as a heavy industrial area	75	70	65

Source: Rules & Regulations of the National Pollution Control Commission (1978), Section 78, Table 1. Environment Quality Standards for Noise in general Areas (maximum allowable noise levels in general areas)

Category of time zone in division of 24-hr. period/

Morning:	6:00 AM to 9:00 AM	Evening:	6:00 PM to 10:00 PM
Daytime:	9:00 AM to 6:00 PM	Nighttime:	10:00 PM to 5:00 AM

Project areas are assumed to fall in the below categories.

High-pressure Trunk Line (National highway/ urban area of Batangas City): Class B
High-pressure Trunk Line (Expressway sections of STAR and SLEX): Class B (or Class C)
Distribution Line 1 (from GS1 up to Lima Technology Center): Class B
Distribution Line 2 (from GS2 up to First Philippine Industrial Park): Class B
Distribution Line 3 (from GS3 up to Laguna Industrial Area): Class B

Vibration Standards:
In the Philippines, there are no existing vibration standards for any construction works and for areas that are comparable to the noise standards. Therefore, the impacts in vibration, generally comparable to noise pollution, should be considered with noise standard categories as the substitute.

Possible impacts in Construction Phases/

- Noise level in the area possibly increase due to operation of various construction vehicles and machineries
- Ground vibration possibly occur due to excavation and pipeline laying works and related activities

(5) Sediment/ Ecosystem/ Hydrology

There will be 27 river crossings along the pipeline route of this project, based on the basic design. Among them, two (2) river crossings locate in the national highway section in Batangas City, twenty-one (21) in the expressway section of STAR and SLEX, and two (2) respectively in Distribution Line 1 and Distribution Line 3.

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A river crossing along the national highway in Batangas City: Bridge Length115m (pipe jacking section)	A river crossing with the longest bridge at 2km from STAR Express Way - Batangas Toll Gate: Bridge Length 227m (open-cut section)

The pipeline route of the project passes through the already-developed ground under existing national highways, municipal and barangay roads in urban areas and under existing arterial express ways. Therefore, natural vegetation and ecosystems that would be a target of conservation do not exist even in these river crossings. However, a batch of natural vegetation can be observed on river banks at foot of the bridges at five (5) river crossings where the length of existing bridges is exceeding 100 m, among which the bridges are between 100 and 200 m long at four (4) crossings and the longest bridge at one (1) crossing has a length of 227 m. For the two (2) river crossings among these, the pipeline installation work is planned to be conducted with the pipe-jacking or Horizontal Directional Drilling (HDD) method, with which adverse impacts on remaining natural vegetation can be avoided.

To sum up the above, migration measures will be necessary for the impacts on a batch of natural vegetation by the pipeline installation work on the slope of river crossings, especially for the three (3) crossings with the bridge length more than 100 m.

Possible impacts in Pre-Construction Phase/
Ecosystem:

- Activities for preparation of the project that might affect natural vegetation at river crossings include pipeline alignment survey, transport and temporary storage of materials and equipment for geotechnical investigations. Those activities might trample or break branch and roots of natural vegetation and bush. The weight of those might also disturb root development due to soil compaction.

Possible impacts in Construction Phase/
Sediment:

- The waterways downstream of river crossings along the pipeline route may possibly experience an increased siltation with temporary structures and vegetation clearance in the river during construction work.

Ecosystem:

- In the construction phase, the vegetation, trees and their roots, will be removed for soil excavation along a few meter band of river bank and slope aside the road bridges, where the proposed pipeline will be installed underground.
- The same activities might injure the tree roots of even wider range and have them susceptible to pests and diseases, spreading unhealthy vegetation. Further, if soil excavation activities are not properly managed, they will disturb the topsoil layer. The topsoil layer contains beneficial microorganisms that decompose and recycle nutrients into the ecosystem. Disturbing the topsoil layer could also affect the healthy growth of surrounding vegetation.

An example of construction work for pipeline installation at a river crossing (a case in Japan)

Hydrology and freshwater aquatic biota:
In the Open Cut method, which will be applied for the smaller 23 river crossings among the total 27 in the entire pipeline route, a trench will be dug along the banks set inside the stream through the streambed between river banks.

- While on the banks beside the trench the excavated materials are set and refilled back into the trench after pipeline installation, above normal flows due to local heavy rainfall may cause diversion of waterways with overflows and increased sediment movement downstream during trenching activities. Provided that the works are undertaken during the dry season with a low or no-flow period, the impacts on water turbidity and flow rate, including sedimentation and disturbance on vegetation and riparian zones, will be minimal and short-termed.
- For the four river crossings planned with the pipe-jacking or HDD method, it is expected that there will be no hydraulic impact on flow capacity, flood level and flow pattern.
- Trenching in some areas with groundwater near surface will require dewatering. The pumped-out water will be silt- or sediment-laden, which will have an effect on surface hydrology associated with impacts on turbidity of downstream.

(6) Topography and Geology

The Philippine archipelago is divided into the Eurasian margin and the Philippine mobile belt. The Batman1 project area is located within a region that is tectonically, seismically and volcanically active. Majority of the proposed alignment is situated within Macolod Corridor, a volcanic field found in southern Luzon. It is part of West Luzon Arc associated with the Manila Trench. Active tectonic structures that could affect this area include the Manila Trench, Valley Fault System, Lubang Fault, Central Mindoro Fault, Aglubang River Fault and the Philippine Fault Zone. Historical earthquakes have been recorded in the vicinity of the proposed alignment with seismic activity clustering towards the offshore Lubang fault.

Major active faults adjacent to the proposed Batman1 route are shown below in Figure 2.9-8.

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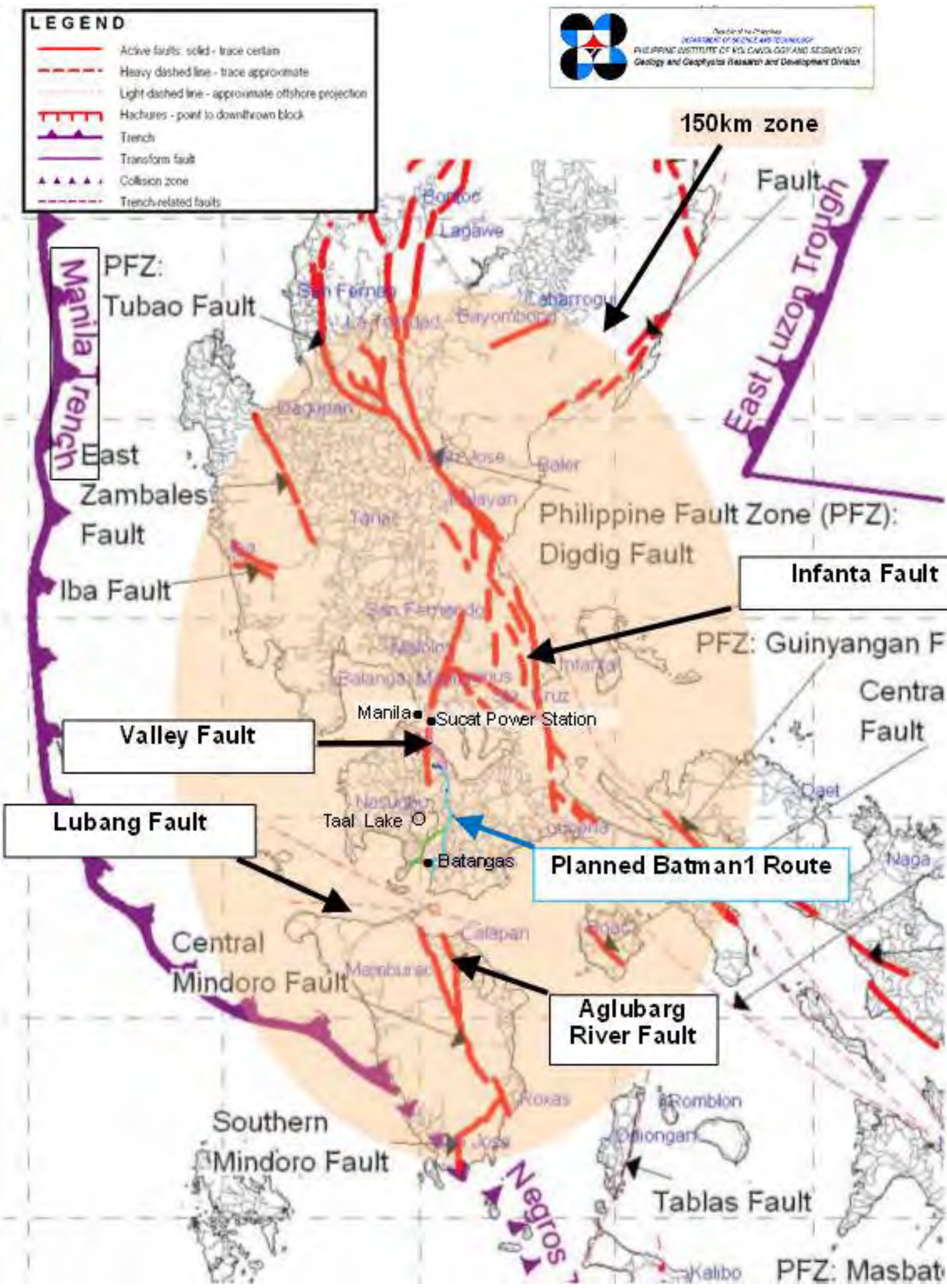

Source: Active Faults Map, PHIVOLCS

Figure 2.9-8 Major Active Faults within 150km radius of the proposed Batman-1 Route
(Identical with Figure 2.2-7)

Five earthquake generators are found within 150km of the Batman1 pipeline corridor as follows:

- The Valley Fault System is an active fault system that cuts through Metro Manila and the planned Batman1 pipeline corridor.
- The Infant Fault, which skirts the coastline of Quezon, is a segment of the main Philippine Fault associated with a seismic gap.
- The offshore Lubang Fault, between Batangas and Mindoro, is a major splay of the Philippine Fault
- The Aglubang River Fault, the splay of the Mindoro Fault, gave rise to the Mindoro earthquake

with the magnitude of 7.1 in 1994.
- The Manila Trench has not moved for the last 400 years while PHIVOLCS assumes an earthquake with the magnitude of 8.4.

In 2004, the “Earthquake Impact Reduction Study for Metropolitan Manila, Republic of the Philippines” was conducted by JICA, MMDA and PHIVOLCS (Philippine Institute of Volcanology and Seismology) in the Philippines, which studied the recurrence intervals of earthquake and magnitudes for the short-, mid-and long-term prediction. According to the ground motion information, the Lubang Fault, West Valley Fault and Manila Trench Fault are considered to possibly affect the Batman 1. The PHIVOLCS estimates the earthquakes' magnitudes incurred by those faults as magnitude 7 or more for the Lubang Fault, magnitude 7.2 for the West Valley Fault, and magnitude 8.4 for the Manila Trench Fault.

Liquefaction phenomenon:
Generally, liquefaction is more likely to occur in loose silt and fine sand with shallow ground water levels and low standard penetration test (SPT) N-values[14] (SPT<15). In regional scale, the proposed route, Phase-1 of the Batman 1, is not prone to liquefaction. In the central area, the eastern lakeshore of the Taal Lake, where the majority of the pipeline route is located, is not identified to be liquefaction susceptible. In the south of Batangas area, where no liquefaction susceptible area is identified by the PHIVLCS, the Quaternary alluvium (Qal) sediments could be estimated to be liquefaction susceptible.

Zoning of the Batman1 route with Safety Assessment Level:
The planned Batman1 route is divided into 3 zones based on Safety Assessment Level (SA Level) 1 to 3, from the views of the seismic risks with three criteria 1) proximity to the active fault; 2) location of pipeline relative to the density of population; and 3) liquefaction potential of the pipeline route[15].
- SA Level 1: Along the expressway with little possibility of liquefaction and low population density.
- SA Level 2: Batangas City and Cabuyao City areas with a possibility of liquefaction and high population density
- SA Level 3: Sucat area, with liquefaction hazard areas, active faults and high population density.
- The zones of SA Level 2 and SA Level 3 have high seismic damage risks compared to SA level 1, and highly dense population. For the Batman1, it is recommended to combine Japanese standards and API standard for each zone mentioned above.

(7) Land Acquisition and Resettlement

Necessity of resettlement:
Beside Libjo Bridge in Batangas City: At most 5 households (1landowner and 4 tenant households) beside Libjo Bridge in Batangas City would need to be resettled. The number of affected households will depend on the pipeline installation method (either open-cut or pipe jacking). If the open cut method, which is assumed in the basic design, is used in installation work, affected households will be fewer than 5.

Beside Bridge of Promise in Batangas City: 1households (owner not identified) beside Bridge of Promise in Batangas City will be affected by installation work, assuming the pipe jacking method planned in the basic design according to the conditions of river crossing which pipeline will intersect.

Necessity of land acquisition:
Open grass fields or spaces in private lands beside STAR Expressway will be used for BVS (1200 m^2

[14] N-value shows the result (value) of examination which evaluates a pertinent ground stability with the standard penetration test (SPT). Higher the N value becomes, stronger and more stable the ground is. Generally, an N value of a soft clay ground is not more than 4. A ground with the N value higher than 30 is judged as a safe ground for a large construction structure.
[15] The detailed process into the decision for the zoning categorization above can be referred to ‘3.1.1 Application of Japanese Seismic Technology, Operation and Maintenance Technology for the High-Pressure Gas Pipeline, especially pp 3-1 to 3-12’ of this report.

near Batangas Exit), GS1(1800 m^2 near Malvar Exit) and GS2 (1800 m^2 near Santo Tomas Exit) according to the basic design. Land acquisition will be required at this site.

For GMS, GS3, MS1 and MS2, the location will be inside the corporate properties of the related LNG Terminal, Expressway Corp and Industrial Parks. Therefore, while land use agreement will be necessary with those business entities, land acquisition will not be needed.

Possible impacts in Pre-Construction Phase/

- 6 households (at most) standing beside rivers at river crossing points of pipeline would need to be resettled.
- Open grass fields or spaces in private lands beside STAR Expressway will need to be acquired for BVS (1200 m^2 near Batangas Exit), GS1 (1800 m^2 near Malvar Exit) and GS2 (GS1(1800 m^2 near Santo Tomas Exit).

(8) Land use and utilization of local resources

There are approximately 1,200 trees along the Expressway Section, including a developed pocket park near the Cabuyao exit. Especially, road side trees standing along the edge of roadside in the section of around 5 km between Calamba Exit and Cabuyao Exit, which are roughly assumed to be of 15 to 30 years old trees, might be cleared consecutively. The road side trees along the Expressway Section will be evaluated in coordination with PNOC, if converted into monetary value.

Since ancillary facilities, such as GSs and BVSs, are planned to be installed inside the lots or beside of existing express ways, their impacts on land use and local resources will be minimized. Significant impacts on land use and local resources are not expected.

Possible impacts in Construction Phase

- While pipelines will be installed underground of existing roads, there may be impacts on road side planting along the expressway section. Especially, road side trees standing along the edge of roadside in the section of around 5 km between Calamba Exit and Cabuyao Exit might be cleared consecutively if the pipeline alignment pass along the road edge, which is to be decided in the detailed design.
- The consecutive clearance of road side trees would also adversely affect the local landscape along the Expressway and the functions of trees that should be reducing noise and air pollution by passing vehicles over neighboring environment.

(9) Existing social infrastructure and services

1) Regulations on the construction, operation and compensation rule of gas pipeline and ancillary stations that are placed in the vicinity of residential quarters or important public facilities such as school, hospital and religious facilities:

Regulations and compensation rules on these aspects are yet to be drafted in the Philippines.

2) Conditions of traffic in the road sections concerned with the project

Traffic volumes along the barangay roads and National Highways:

- Method of Analysis

The analysis of the traffic situation is based on observations, interviews and the traffic counts/surveys conducted by DPWH through the various engineering districts of Region 4A on roads to be used by the Project from Batangas to Laguna as of 2011 Summary of Traffic data (annual average daily traffic).

- Sections analyzed

From the LNG Terminal at Tabangao, by way of the east side of Batangas City along a National Highway, and via the Batangas Exit through the STAR express way and the SLEX extension and express way to the ETON Exit after the Cabuyao Exit of SLEX. The National Highway is a two lane road; the STAR toll road from Batangas Exit to Lipa City/Exit is also a 2-lane road although there were on-going road widening activities to 4 lanes; the STAR expressway and SLEX extension are 4-lane roads and the SLEX expressway is a 6-lane roadway. The shoulders of the expressways are set wide, getting wider to the southward and vegetated with grass and roadside trees while that in the National Highway is 1.5 to 2.0 meters.

Table 2.9-16 Current traffic volume along the project route

Section	No. of Vehicles for both directions	No, of Lanes
Sec1: National Highway from Tabangao to Batangas City	8,038	2
Sec2: STAR Tollway from Batangas to Lipa City	10,439	2
Sec3: STAR Tollway from Lipa City to Sto. Tomas	19,818	4
Sec4: SLEX Extension	20,764	4
Sec5: SLEX Expressway	47,951	6

Source: DPWH, 2011 Summary of Traffic data (annual average daily traffic)

Indicator for 'Level of congestion':
The Volume Capacity Ratio (VCR) is the indicator used to describe the degree of congestion of a road section. It is a measure of the traffic density for a given capacity of a road. It is computed by dividing the actual traffic volume by the capacity of the road as estimated on the prevailing conditions of the roads. In traffic study, the critical time where congestion could possibly or mostly occur is the peak hour. In theory, if the value of the VCR approaches 0.85 or more, the road section being analyzed is experiencing congestion. This congestion ratio is explained in table below, categorizing the different levels of service (LOS) of a road section based on VCR.

Table 2.9-17 Levels of congestion in LOS of a road section

LOS Category	Characteristics	VCR
LOS-1	Condition of free flow with high speed and low traffic volume	0.00 – 0.19
LOS-2	Stable flow. Reasonable freedom to select speed	0.20 – 0.44
LOS-3	Stable flow. Restricted selection of speed	0.45 – 0.69
LOS-4	Approaches unstable flow with nearly all drivers restricted	0.70 – 0.84
LOS-5	Traffic volumes near or at capacity	0.85 – 1.00
LOS-6	Forced or congested flow at low speeds	Greater than 1.00

The traffic volumes, converted into the equivalent passenger car units (PCUs) corresponding to the extrapolated amounts at peak hours are analyzed and results are shown below.

Table 2.9-18 Existing and expected volume capacity of road sections

Section	Peak Hours Volume (PCU) Existing/ Expected	Number of Lanes One Direction	Estimated Capacity (PCUs/Hour)	Existg VCR	Exp'd VCR	Existing LOS	Expected LOS
Sec-1	472/945	1	865	0.55	1.09	LOS-3	LOS-6
Sec-2	736	1 (to 2)*	865/1300	0.85	0.69	LOS -5	LOS-3
Sec-3	1051	2	1730	0.61	0.81	LOS-3	LOS-4
Sec-4	1063	2	1730	0.61	0.82	LOS-3	LOS-4
Sec-5	1885	3	2600	0.73	0.87	LOS-4	LOS-5

VCR – volume capacity ratio
LOS – level of service
PCU – passenger car unit: car = 1.9; Van/Bus = 6.5; Truck = 2.0; Tricycle/Motorcycle = 0.75
**Widening to 2 lanes each way*

Possible impacts in Construction Phase

- There is stable flow of traffic along the national highway from Tabangao to Batangas City, although the vehicles have already a restricted selection of speed (LOS-3). This is expected to worsen to the state of forced or congested flow at slow speeds (LOS-6), during pipe installation work due to the heavy traffic at the circle (rotunda) in Batangas City.
- Traffic volume, on the other hand, from Batangas exit along the STAR toll road towards Lipa City is near or approaching full capacity due to its being a single lane road in both directions and the on-going widening activities. With the completion of the widening activities (2-lane), however, it is expected that traffic will become stable, although limited speed (LOS-3).
- STAR Tollway from Lipa City and SLEX Extension going to Manila has presently a stable flow with limited restriction of speed (LOS-3), but will approach unstable flow with drivers restricted (LOS-4)during pipe laying.
- Along the SLEX Expressway, traffic is presently approaching unstable flow (LOS-4) and will become near or almost full road capacity (LOS-5) during pipe installation work.

(10) Uneven distribution of benefits and damages/ (22) Local conflicts of interest

Possible impacts in Construction and Operation Phase

- Target areas and users for gas supply may differ from the areas where pipelines pass through in the project plan. The local people and LGUs where pipelines pass through would also expect reasonable benefits from the project in exchange for inconvenience and risks with pipeline installation they bear during construction works and operational phase. Actually, in the public scoping held in the municipalities concerned with the project, the following two questions were the two major concerns of local stakeholders;
  - ✓ Does the pipeline go through their locality so that they will have access to the pipeline gas?
  - ✓ Is it safe for the gas pipeline to run through their municipality?
- The failure for them to receive reasonable benefits in balance with unfavorable impacts might result in local conflicts of interest between local people along the pipeline route who receive benefits of gas and who not. Therefore, measures to compensate for misdistribution of benefits need to be taken.

(11) Working environment

Possible impacts in Construction Phase/

- Safety measures for labor workers should be examined on road traffics, especially for works in expressways, and on construction work in slopes, particularly during construction works at river and road crossings and in urban areas.

Possible impacts in Operation Phase/

- Accident prevention measures need to be examined and planned for the following; such as for safety measures in handling high-pressure gas and for traffic accidents prevention in maintenance work inside expressway lot areas.

(12) Accidents

Baseline conditions on potential pipeline accidents are same as the study about the seismic hazard risk related to the batman1 route, stated in '(6) Topography and Geology' and Chapter 3 Recommendations 3.1 Gas Pipeline' of this report.

Baseline conditions on traffic accidents in the project route are same as the survey on current traffic volume and conditions along the project route, stated in '(9) Existing social infrastructure and services' of this section.

(13) Climate Change/ Global Warming

1) CO_2 emission <u>during construction</u> by construction machine and vehicles

- Total fuel consumption of construction machines and vehicles in the project will be **around 3,783kL**

As shown in '(1) Air Quality', regarding the calculation on fuel consumption by construction machines and vehicles during the construction period of this project, all machines and vehicles are supposed to use diesel oil (light oil) the fuel. The period of work is assumed to be 21 months. The total fuel consumption of construction machines and vehicles in the project is estimated to be around 3,783kL. This amount approximately corresponds to the consumption of 8.2kL per day during the construction period, assuming 22.5 working days per month.

- Annual CO_2 emission during the construction period of the project will be **5,580 tCO2/yr**

The calculation is given as follows.
Unit CO_2 emission per kL Diesel Oil from construction machines and vehicles is 2.58 tCO2 per kL Diesel Oil. This value is based on the next formula, with
Unit calorific value for kL of Diesel Oil as 37.7 [GJ/ kL],
Emission factor as 0.0187 [tC/GJ], and
37.7 UCV [GJ/ kL] * 0.0187 EF [tC/GJ] * 44/12 = 2.58 [tCO2 emission /kL Diesel Oil],
referring to the calculation formula on 'Emissions of greenhouse gases associated with the business activities of Specified Emitters (GOJ, METI and MOE Ordinance No.3, 2006/3/29; Latest Amendment METI and MOE Ordinance No.8, 2013/12/27)'

Therefore, total amount of CO_2 emission with the construction work of the project is estimated to be 9,760 tCO_2. Annual CO_2 emission during the construction period of the project will be 5,580 tCO2/yr.

2) CO2 emission during operation from the natural gas supplied by this project

It is expected that natural gas proposed in this project will replace the partial demands of energy in power sector, industry sector, commercial sector, residential sector, and transport sector in the form of electric power, fuels and heat.

As discussed in the section, '2.8.11 Estimation for Reduction of CO_2 Emission' of this report, where "With project" case assumes that the project would result in the supply of natural gas while "Without project" case assumes that energy conversion would not occur:
in "Without project" case (the project would not be implemented) the total CO_2 emission during operation is estimated to be 132.6 million ton, with power sector, industry sector, commercial sector, residential sector, and transport sector combined; and
in "With project" case (the project would be implemented) it is estimated to be 88.0 million ton. Therefore, 44.6 million ton of CO_2 emission will be reduced with this project in total of the project life.

Assuming the project life of 25 years, the annual reduction of CO_2 gradually increases from 0.15 million ton in Year 1 and reaches 7.8 million ton in the last year (Year 25), which corresponds to 1.7 million ton of annual reduction in average.

Possible impacts in Construction Phase/

Annual CO_2 emission in the construction phase of the project at 5580 tCO_2, compared with the estimated annual total of Philippine GHG emission 159 $MtCO_2$ in 2010[16], can be evaluated as a small amount at approximately 1/28495.

Yet, the practice of eco-driving throughout the construction work can possibly reduce fuel consumption rate further up to 25 % respectively, with the use of finely maintained machines and

[16] Data quoted from 'Senate Economic Planning Office (SEPO), Senate of the Philippines, *GHG emissions at a glance*, March 2013, based on the source from European Commission Joint Research Centre (JRC)/ Netherlands Environmental Assessment Agency (PBL), *Emission Database for Global Atmospheric Research (EDGAR), GHG Emissions of the World, ASEAN Countries and the Philippines, MtCO2, 1990-2010.*

vehicles, avoidance of unnecessary engine-idling, and control of engine rotation. Provided with the reduction of fuel consumption up to 25 %, annual CO_2 emission in the construction phase will be reduced by 1,395 tCO2/yr.

Possible impacts in Operation Phase/
1.7 million ton of CO_2 emission will be reduced annually, in average, with this project during 25 operation years. This amounts to around 300 times as much effect of reduction annually and 4,570 times as much in the project life as the emission amount of 5,580 tCO_2/year for less than 2 years in the construction phase.

2.9.7 Mitigation Measures

(1) Air Quality

Mitigation measures to be taken in Pre-Construction and Construction Phases/

- Practicing and instruction of eco-driving, such as the use of finely maintained machines and vehicles, avoidance of unnecessary engine-idling and control of engine rotation, by the contractor and its staff and drivers working in the construction and related maintenance works.
- Periodical maintenance services (PMS) of construction vehicles and machineries to ensure these equipment are in good condition during construction works at all times
- Daily check of construction vehicles and machineries to be conducted routinely before the work begins every day
- A 20 km/h speed limit along the construction areas, particularly at air and dust pollution sensitive receptor areas will be strictly enforced
- Cover material for delivery and hauling trucks to minimize dust re-suspension
- Tarpaulin or cover material for temporary stockpiles of un-recycled materials and construction spoils to prevent re-suspension of particulate matters
- Regular water spray over exposed and cleared construction areas to minimize dust re-suspension
- Periodical monitoring of particulate matter (PM) at dust sensitive receptor areas during the pre-construction and construction phases of the project

(2) Water Quality

Mitigation measures to be taken in Pre-Construction and Construction Phases/

- Periodical maintenance services (PMS) of construction vehicles and machineries to ensure these equipment are in good condition during construction works at all times
- Daily check of construction vehicles and machineries to be conducted routinely before the work begins every day

<u>Surface hydrology</u>

- Temporary rechanneling of stream flow within existing river structure
- Temporary sanitation facilities, particularly portable toilets and garbage bins for all construction sites and temporary field offices
- All temporary sanitation facilities to be dismantled and removed from the construction sites immediately after construction works are completed, particularly those near the waterways

<u>Groundwater</u>

- Temporary storage depots for used oils and other toxic wastes to be provided with in the motor pool area
- No washing of construction equipment and machineries along the waterways to prevent oil and grease contamination
- On-site repair and maintenance of the construction equipment to be strictly prohibited

<u>Ground water hydrology and surrounding water source (e.g. wells)</u>

- In case of pipe jacking method at special parts of the route, conduct the ground survey and the impact analysis on the surrounding structures in the detailed design, and select the specific method of pipe jacking and pipe jacking machines appropriate for the ground conditions (existence or non-existence of aquifers, soft grounds, etc.). With an appropriate method and pipe jacking machines, control adverse impacts, such as contamination of ambient ground water and sources with muddy water or chemical injection material for ground improvement.

- Setting of monitoring wells around vertical shafts for pipe jacking sections to monitor contamination of ground water if any chemical injection is conducted for ground improvement
- Should the contamination be observed in the surrounding wells of the concerned sections, the selected construction method should be re-examined immediately
- Should the contamination of monitoring wells be observed for prolonged periods even after the above measures, PNOC and the pertinent LGU should provide clean drinking water with water tank trucks periodically as the compensation for the affected residents

(3) Wastes

Mitigation measures to be taken in Construction Phase/

- Practicing waste segregation properly during construction works
- All surplus waste soil after excavation to be disposed properly to the designated dumpsite in concerned LGUs and not abandoned inappropriately
- Regular hauling and disposal of construction spoils and debris, particularly stripped vegetation, to designated dumpsite in concerned LGUs
- Hazardous wastes such as used oils, worn out parts, and related materials to be handled by DENR accredited company and disposed to DENR-approved sites regularly
- Complete removal of all temporary stockpiles of construction spoils and debris from the construction areas, disposed properly to the designated dumpsite in concerned LGUs and not abandoned in the construction areas
- Complete closure of motor pool area and all toxic wastes such as used oils, worn out motor parts, and other toxic chemicals and disposal to sites duly approved by DENR at concerned locals

(4) Noises and Vibration

Mitigation measures to be taken in Construction Phase/

- Installation of noise suppressors in construction equipment and machineries whenever necessary to maintain noise generated at permissible level
- Installation of temporary noise barriers at noise sensitive receptor areas such as residential, schools, hospitals, and places of worships to maintain noise level at permissible limit
- For high noise generating construction activities to be undertaken only in the daytime to minimize noise disturbance to nearby residential and other noise sensitive receptors areas
- Periodical maintenance services (PMS) of construction vehicles and machineries to ensure these equipment are in good condition during construction works at all times

(5) Sediment

Mitigation measures to be taken in Construction Phase/

- Minimization of soil disturbance that may cause surface run off, with cautious undertaking of earth moving activities and related construction works particularly along cut and slope areas and bridge sites
- Installation of temporary silt traps along the waterways to prevent siltation caused by surface run-off, particularly during high precipitation periods
- Re-vegetation of exposed and open construction areas adjacent to the waterways to prevent surface run-off

(6) Ecosystem

For preservation of vegetation:

Mitigation measures to be taken in Pre-Construction Phase/

- Conducting site survey, such as pipeline alignment survey and geotechnical investigations, in controlled manner and with proper care under appropriate supervision of site manager to minimize the disturbance to surrounding vegetation at the study site, though impacts of those activities are localized, short-term and temporary.

Mitigation measures to be taken in Construction Phase/

- Species of trees and vegetation shall be identified onsite with botanical specialists before necessary clearance for excavation and pipeline installation work. If threatened species of trees and vegetation are present in proposed pipeline alignment, especially at bank slopes of river crossings, and their removal is unavoidable, transplantation to a nearby appropriate site shall be considered.
- For other common species of vegetation, re-vegetation of the excavated sites with diversified and indigenous plant species will be recommended as far as considerations of safety measures against river bank and slope failure allow.
- During soil excavation over riparian vegetation cover, the topsoil layer of 0-20 cm from the surface should be separated to save beneficial microorganism and fine root biomass present in this layer. Major roots that will be affected by excavation through the layer should be coated with paint or coal tar to prevent entry of pathogens through the damaged parts. When pipeline installation work is done, the reserved topsoil should be placed back for re-vegetation.

For preservation of freshwater aquatic biota:

Mitigation measures to be taken in Pre-Construction Phase/

- Impacts of pipeline alignment survey and geotechnical investigations are localized, short-term and temporary. Nevertheless, those activities should be conducted in controlled manner and with proper care under appropriate supervision of site manager, to minimize the disturbance to surrounding vegetation and water flow, with such as solid waste, oil leaks from boats and sediment runoff, at and downstream of the study sites.

Mitigation measures to be taken in Construction Phase/

(Soil erosion)

- Confining land clearances to a minimum and the coordination of work schedule not to expose the bare land for a prolonged period during pipeline installation work
- Re-vegetating and mulching excavated land and slope progressively as each section of works is finished

(Sediment control)

- Installation of temporary sediment and litter traps during work

(Work in waterways)

- Minimizing the extent and duration of work
- Diversion of water flow to be done only one side of a water flow at a time in order to maintain minimum flows to ensure the viability of the aquatic communities downstream
- Use of water filled-dams and other low-impact method for temporary diversion of water flow
- Conduct of construction work for a section of stream crossing at low flow periods and not during wet weather, with a contingency plan prepared for high rainfall events
- For vehicles crossings to use only crushed rock and avoid using earth even partially to control turbidity downstream

(7) Hydrology

Mitigation measures to be taken in Construction Phase/

- Appropriate flow diversion will be planned. In the basic design, one side of a river flow will be kept open during pipeline installation work with the open-cut method in a water way. In such a way, impacts on drainage will be controlled minimal and short term. The waterway will be reinstated as soon as the pipe has been laid.
- Conduct of construction work for a section of stream crossing at low flow periods and not during wet weather, with a contingency plan prepared for high rainfall events
- Use of water filled-dams and other low-impact method for temporary diversion of water flow

(8) Topography and Geology

Mitigation measures to be taken in Pre-Construction Phase (in the Basic Design)/

The acceptance standards for the materials specifications for line pipes and field girth welds are proposed herein for the Batman1 from the point of view of the earthquake occurrence probability, population density and soil properties. The figure below shows the applicable standard (SA Level) stipulated according to the ANSI/ ASME Class Location indicated in the active faults map and liquefaction hazard map.

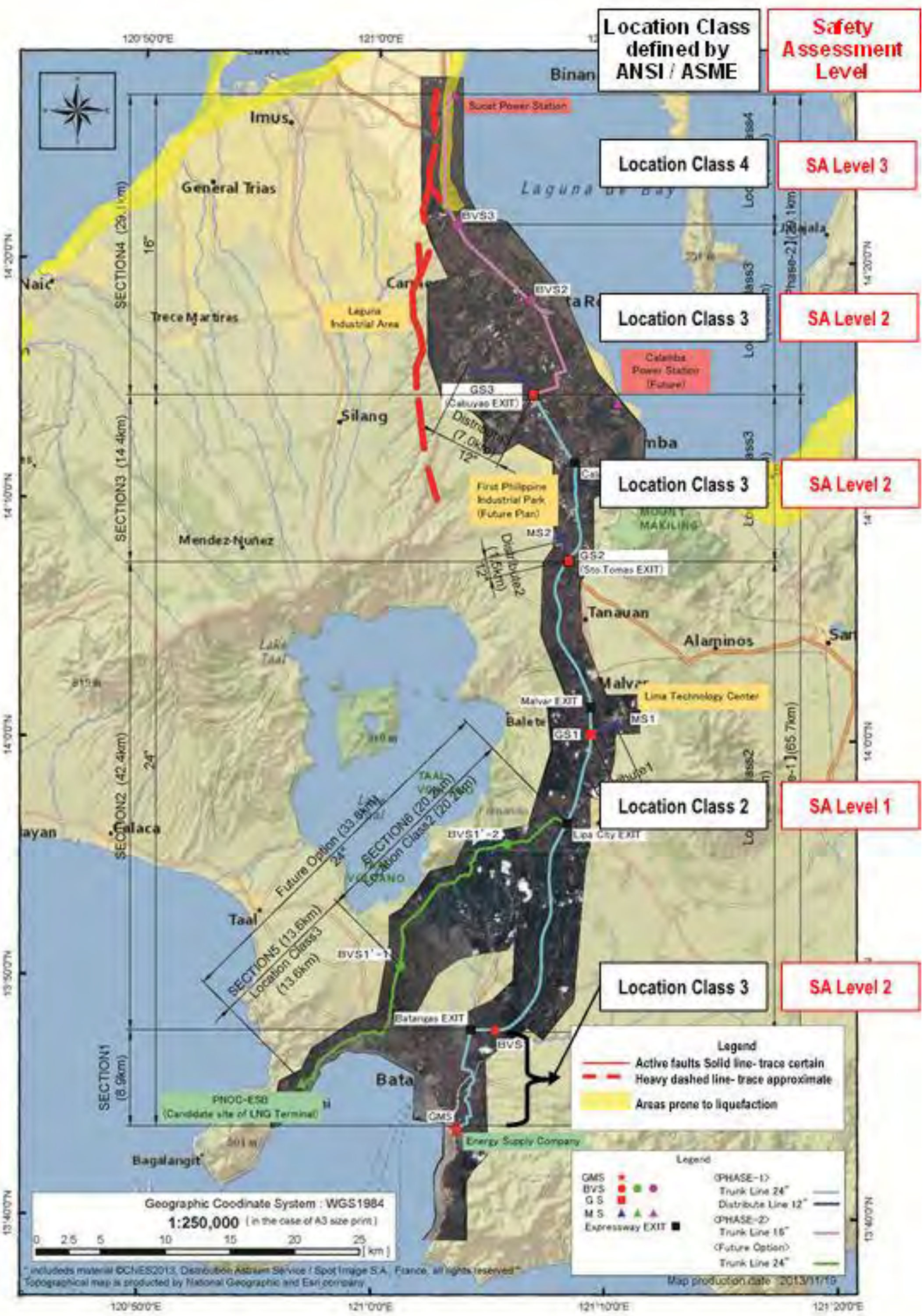

Figure 2.9-9 Proposed Standards by Area for Batman1
(Identical with Figure 3.1-12)

(9) Land Acquisition and Resettlement

Mitigation measures to be taken in Pre-Construction Phase

- Measures to avoid resettlement should be taken. In case resettlement becomes necessary, supports including sufficient compensation and livelihood recovery will be required.
- If resettlement is to be required, RAP will be formulated in accordance with the Philippine regulations (LGUs concerned and the EMB of DENR) and JICA Guidelines for Environment and Social Considerations.
- Sufficient information and proper consultation about the project and resettlement impacts and needs shall be provided with the PAPs (directly affected households) by the project proponent before an unforced agreement on resettlement.

Mitigation measures to be taken in Pre-Construction to Post-Construction Phase

- A monitoring plan is to be prepared and monitoring conducted properly, regarding the RAP implementation which will include the execution of compensation and other supports, the completion of resettlement process, and the new life after resettlement.

(10) Land use and utilization of local resources

Mitigation measures to be taken in Pre-Construction (Design) Phase

- Pipeline installation under the road-shoulder-side of the Expressway need to be examined in the detailed design, which would minimize the cutting of road side trees that stand along the edge of road side space. Whether the pipeline alignment could trace under the road-shoulder-side or the road-edge-side in the design work depend on trilateral talks among the local stakeholders, the ROW authority (the concerned Expressway Corp and DPWH) and the PNOC (the project proponent).
- From the environmental aspect to keep the functions of road-side-trees reducing noise and air pollution by passing vehicles, the road-shoulder-side alignment of pipeline should be recommended.
- If the pipeline would pass along the road-edge-side and the consecutive clearance of road side trees become inevitable, the tree cutting shall be compensated either in money or re-plantation of sapling trees if spaces are available.
- In this mitigation option, the re-plantation is more recommended than the monetary compensation since it would save the functions of road-side-trees reducing noise and air pollution. Legally, however, the re-plantation may not be required since the Section 2.2 of the Executive Order No. 23 (EO 23), which orders that the DENR is prohibited from issuing/renewing tree cutting permits in all natural and residual forests nationwide, make exception for 'the clearing of road right of way by the DPWH'.
  Note: The Executive Order No. 23 (EO 23), signed into law by President Aquino on February 1, 2011, mandates a moratorium on the cutting and harvesting of timber in all natural and residual forests of the entire country.

(11) Existing social infrastructure and services

Traffic Management:

Mitigation measures to be taken in Pre-Construction (Design) Phase

- Traffic management plan for pipeline installation works during the construction phase, corresponding to each road section respectively, shall be prepared in detailed design, while closely coordinating with local government units concerned in order to consolidate the measures with DPWH and the plans and programs already drawn-up by them.
- Traffic management plan shall prescribe
  - Method of protection of the public and motorists and give details of the hours of operation, location, types and numbers of traffic safety devices, barricades, warning signs, flagmen and the like.
  - Safety management regarding transportation for haulers, equipment and machineries,

especially at the gateways of construction bases and temporary facilities for the project, at construction sites for pipe installation
- Control of traffic and street parking surrounding the work sites
- Assignment of sufficient security personnel and well-trained traffic enforcers for the safety management above
- Assignment of appropriate ad hoc signage in construction areas of the project site, such as traffic warning lights and signaling system in critical areas and warning signs and/or billboards announcing approaches to the construction area in strategic locations
- Scheduling for delivery of materials and hauling of construction debris to avoid peak hours and truck ban hours
- Avoidance for construction vehicles to traverse narrow residential or commercial streets to prevent traffic accidents against human lives
- Coordination with DPWH Traffic Engineering Center and the LGUs, especially on routes and period of deployment of construction equipment and vehicles
- Coordination with DPWH Traffic Engineering Center and the LGUs, especially on the contents of engineering work such as closure of the roads, detouring routes for through traffic and restoration of excavated site to the original state
- Proper information to the local public and motorists on construction work schedule prior to the work periods in each section

Mitigation measures to be taken in Pre-Construction Phase
- The Program for the flow of traffic to be prepared by the Contractor must comprehensively address the following areas of concern: traffic law enforcement, traffic engineering, traffic road signs and safety devices, transport management scheme, information and education, and continuous traffic coordination

Mitigation measures to be taken in Construction Phase
- Proper implementation of the traffic management plan/program as planned and coordinated as above, throughout the construction work

(12) Uneven distribution of benefits and damages/ Local conflicts of interest

Mitigation measures to be taken in Pre-Construction (Design) Phase
- Inclusion of ancillary facilities in the project to supply not only for the target areas but for the areas along the pipelines route is planned in the basic design, which plans to install in GMS (Batangas), GS1 (Malvar), GS2 (Santo Tomas), GS3 (Cabuyao) annexed structure of valve for future extension line.

Mitigation measures to be taken in Construction Phase
- Local employment of construction workers for pipeline installation from the municipalities and barangays along the pipeline route should be maximized as far as technical requirements allow.

Mitigation measures to be taken in Operation Phase
- Local employment of maintenance workers for safeguarding pipeline from the municipalities and barangays along the pipeline route should be arranged as far as technical requirements allow.

(13) Working environment

Mitigation measures to be taken in Construction Phase
(For safety measures for construction workers)
- To prepare safety manuals, especially in regard of heavy machine and vehicle movement during construction activities, of works in slope and in urban area
- To employ advance safety management plan on each work site
- To use safety sign and measures during construction activities
- To use proper protective gear, such as helmet, gloves, safety footwear and reflective jacket

- And to give thorough instruction of safety routines to workers before work

(On road traffics)

- In order to avoid a risk of traffic accident for labor workers, as well as general public, during construction work beside busy road traffic, proper traffic management plan shall be prepared before construction work on sight as the mitigation measures for '(9) Existing social infrastructure and services' of this section
- Site manager on each work site shall get proper instruction on the traffic management plan before work each site and properly implement it on work days
- Security personnel and well-trained traffic enforcers shall be placed on work sites during construction work
- Especially for works in expressways; in preparing on-sight work plans and during work period, contractor and site manager should keep proper coordination with DPWH Traffic Engineering Center and the toll-way corporations of STAR and SLEX.

Mitigation measures to be taken in Operation Phase

(For safety measures in handling high-pressure gas)

- To prepare safety manuals for maintenance work and emergency response
- To establish and have periodical check of emergency contact network
- To use proper protective gear in maintenance works
- And to give thorough instruction and training of routines for safety and emergency response to maintenance and monitoring workers, periodically

(On road traffics)

- To always use safety sign and measures during maintenance and monitoring work on and beside roads, especially on express ways
- To always conduct maintenance and monitoring work with a team of well-trained multiple personnel to be able to secure safety from traffic and other accidents
- To inform maintenance and monitoring work schedule in advance and have proper coordination with the road administrator in LGUs and toll-way corporations of STAR and SLEX.

(14) Accidents

In case of any accident, the high pressured gas pipeline should not only ensure the prevention of gas leakage, but also the safety of people.

Mitigation measures to be taken in Pre-Construction (Design) Phase
Proper seismic design shall be employed as the mitigation measures against seismic hazard risks in Pre-Construction (Design) Phase.

- The seismic design for Level 2 earthquake is to be applied to the entire pipelines (to maintain the earthquake resistance of gas pipeline against Level 1, a standard earthquake motion, and Level 2, a very strong earthquake motion)
- The Japanese specifications, such as JIS standard, is to be applied to the materials for the line pipe materials and field girth welds in the areas with active faults and/or high density population. (In the areas where substantial deformation of pipeline is anticipated particularly in the plastic region level, the gas pipeline should assure its higher reliability. According to this study, the Japanese pipe materials and Japanese welding quality should be applied in specific areas.)

Mitigation measures to be taken in Construction Phase
(Application of proper construction standards in pipeline installation)

- The standards to be applied include civil work (soil cover test)/ welding quality/ corrosion protection/ pressure resistance and air tightness test/and pre-service inspection.

(Safety measures against traffic accidents)

- Traffic management plan for pipeline installation works during the construction phase, corresponding to each road section respectively, shall be prepared in detailed design, while closely coordinating with local government units concerned in order to consolidate the measures with DPWH and the plans and programs already drawn-up by them.
- The same requirements for the traffic management plan, as in '(9). Existing social infrastructure and services' of this section, are supposed to minimize traffic accidents during pipeline installation works in the project.
- However, it will be especially important, as safety measures for the community people with regard to the movement of construction material and heavy machine and vehicle, to inform adjacent community on work schedule and safety caution in advance.

Mitigation measures to be taken in Operation Phase

(Application of operation and maintenance standards)

- The standards to be applied include pipe and facility maintenance/ corrosion protection management/ management of other construction works/ and response to leaks and other abnormality.

(Pipeline operation and maintenance)

- Sufficient and proper training of the engineers to master the contents stated before the commencement of operation of the pipeline
- Conduct the following activities systematically:
  (1) Daily supervision and inspection
  (leak test/ patrol inspection/ periodical overhaul inspections and operation tests/ remote monitoring with the SCADA system at the proposed remote control station with the functions of a training center and a patrol staff base/ and updates of drawings on pipeline layout and its environment such as alteration of road configuration)
  (2) Establishing the system of preparedness for emergency or abnormal situation
  (identification of the abnormality/ systematic response to emergency situation with manuals, standard procedure/ notification and guidance for the residents in the neighborhood, such as evacuation in case of a leakage caused by an earthquake/ inspection and repair of damaged parts/and required training for such cases)
  (3) Monitoring of third party projects, such as water pipes, other energy supply pipes, communication cables and possible sewage systems, to prevent the pipeline to be affected or incidentally damaged.

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2.9.8 Environmental Management Plan

Key mitigation measures to be taken for the project are summarized with the assumed implementing agency, responsible agency and necessary costs for the measures, as follows on the tables.

Table 2.9-19 Environmental Management Plan for Mitigation Measures (Design, Pre-Construction and Construction Phases: 1/3)

Category of Impacts	Items of Impacts	Project Stage	Key Mitigation Measures to be taken	Implementing Agency	Responsible Agency	Undertaking Cost
Pollution Control	1 Air Quality	At Pre-Construction At Construction	- Periodical maintenance services (PMS) of construction vehicles and machineries - Practicing and instruction of eco-driving - Low speed at dust pollution sensitive receptor areas of construction vehicles - Cover material for trucks and stockpiles to minimize dust re-suspension	Construction Contractor	PNOC	in general construction cost with no significant extra cost
	2 Water Quality	At Pre-Construction At Construction	For surface hydrology and ground water - PMS of construction vehicles and machineries - Temporary rechanneling of stream flow - Temporary sanitation facilities for construction sites and field offices - Temporary storage depots for used oils and other toxic wastes in the motor pool area	Construction Contractor	PNOC	in general construction cost for special parts
			For ground water hydrology and surrounding wells - Selection of method appropriate for the ground conditions in case of pipe jacking method - Setting monitoring wells at pipe jacking sections to monitor contamination of ground water - In case of contamination of monitoring wells, stop chemical injection immediately, and if it is prolonged, periodical provision of clean drinking water as the compensation for the affected residents	Construction Contractor	PNOC	Cost to be included in Contractor's Bid as monitoring cost
	3 Wastes	At Construction	- Practicing waste segregation properly - Surplus waste soil, construction spoils and debris and stripped vegetation, to designated dumpsite - Hazardous wastes such as used oils, worn out parts, and related materials to be disposed to DENR-approved sites with accredited disposer - Complete removal of all temporary stockpiles of spoils and debris from the construction areas	Construction Contractor	PNOC	in general construction cost as waste disposal cost
	4 Noise and Vibration	At Construction	- Installation of noise suppressors in construction equipment and machineries - Installation of temporary noise barriers at noise sensitive receptor areas - For high noise generating construction activities to be undertaken only in the daytime - PMS of construction vehicles and machineries	Construction Contractor	PNOC	in general construction cost with no significant extra cost
	8 Sediment	At Construction	- Installation of temporary silt traps in waterways - Re-vegetation of exposed and open construction areas adjacent to the waterways	Construction Contractor	PNOC	in general construction cost for special parts

Table 2.9-19 Environmental Management Plan for Mitigation Measures (Design, Pre-Construction and Construction Phases: 2/3)

Category of Impacts	Items of Impacts	Project Stage	Key Mitigation Measures to be taken	Implementing Agency	Responsible Agency	Undertaking Cost
Natural Environment	10 Ecosystem	At Pre-Construction	- Conducting site survey, such as pipeline alignment survey and geotechnical investigations, in controlled manner and with proper care	Detaled Design Contractor	PNOC	in contract with no extra cost
		At Construction	For preservation of vegetation - Species of trees and vegetation shall be identified onsite with botanical specialists. For threatened species, if any and removal unavoidable, transplant to a nearby appropriate site - For other common species, revegetation of the excavated sites is recommended with considerations on safety measures against a failure of river bank and slope - During soil excavation over riparian vegetation cover, the topsoil layer should be separated and placed back for revegetation	Construction Contractor	PNOC	in general construction cost for special parts as contingency transplantation and revegetation.
			For preservation of freshwater aquatic biota - Soil erosion control with minimum land clearances, and a shortened exposure period of bare land before re-vegetation - Maintained minimum flows and use of a low-impact method for temporary diversion of water flow - Scheduling the work period for a section of stream crossing at low flow periods - Avoidance of using earth for vehicles crossing passes in waterways	Construction Contractor	PNOC	in general construction cost for special parts
	11 Hydrology	At Construction	- Appropriate flow diversion with one side of a river flow kept open for a maintained flow - Scheduling the work period for a section of stream crossing at low flow periods - Use of a low-impact method for temporary diversion of water flow	Construction Contractor	PNOC	in general construction cost for special parts
	12 Topography and Geology	At Basic Design	- The acceptance standards for the materials specifications for line pipes and field girth welds are defined by areal category on Safety Assessment Levels from the view point of the earthquake occurrence probability, population density and soil properties, in accordance with ANSI/ ASME Class Location	JICA team	PNOC	-

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Table 2.9-19 Environmental Management Plan for Mitigation Measures (Design, Pre-Construction and Construction Phases: 3/3)

Category of Impacts	Items of Impacts		Project Stage	Key Mitigation Measures to be taken	Implementing Agency	Responsible Agency	Undertaking Cost
Social Environment	13	Land Acquisition and Resettlement	At Pre-Construction	- Proper formulation and implementation of the RAP - PAPs be provided with sufficient information and proper consultation about the project and impacts	PNOC	DENR-EMB Region IV-A/ LGUs concerned	in RAP as compensation cost.
	17	Land use and utilization of local resources	At Detailed Design At Pre-Construction	- Minimizing the cutting of road side trees along the expressway through trilateral talks among the local stakeholders, the ROW authority and the PNOC in the detailed design phase - If clearance of road side trees become inevitable, the re-plantation of sapling trees is the second recommended, and the monetary compensation last	Detail Design Consultant/ PNOC/ ROW Authority	CENRO Region IV-A/ RED of LGUs/ Sec. DENR	T.B.D
	19	Existing social infrastructure and services	At Detailed Design At Pre-Construction At Construction	- Preparation of traffic management plan for pipeline installation works in detailed design, coordinating with LGUs concerned and DPWH - Preparation of detailed traffic management program by the contractor based on the agreed scheme in detailed design - Proper implementation of the traffic management plan/program throughout the construction work	Detail Design Consultant/ Construction Contractor	PNOC/ Road administrator in LGUs/ DPWH Region IV-A	in general construction cost
Social Environment	21	Uneven distribution of benefits and damages	At Basic Design At Construction	- Inclusion of ancillary facilities not only for the target areas but for the areas along the pipeline route - Maximized local employment of construction workers for pipeline installation from the municipalities and barangays along the pipeline route	Basic Design: JICA team / Construction: Construction Contractor	PNOC	in general construction cost
	22	Local conflicts of interest					
	28	Working environment	At Construction	For safety measures for construction workers - Preparing safety manuals, especially in regard of heavy machine and vehicle movement and of works in slope and in urban area - Prep advance safety management plan and giving thorough instruction of safety routines to workers - Use of proper safety signs, measures and protective gears	Construction Contractor	PNOC	in general construction cost
				On road traffics - Preparation of proper traffic management plan to avoid a risk of traffic accident for labor workers, as planned for general public in '19. Existing social infrastructure and services' above - Placement of well-informned site manager, security personnel and traffic enforcers on each work site		PNOC/ Road administrator in LGUs/ DPWH Region IV-A	

	29 Accidents	At Basic Design	Seismic design - Proper seismic design for the entire pipelines shall be employed against seismic hazard risks of Level 2 earthquakes, which is a very strong earthquake motion - Application of Japanese specifications, such as JIS standard, to the materials for the line pipe materials and field girth welds in the areas with active faults and/or high density population	JICA team	PNOC	-
		At Construction	Construction standards in pipeline installation - Application of proper construction standards, including civil work (soil cover test)/ welding quality/ corrosion protection/ pressure resistance and air tightness test/and pre-service inspection	Construction Contractor	PNOC	in general construction cost
			Safety measures against traffic accidents - Same requirements for the traffic management plan, as in '19. Existing social infrastructure and services' - Especially important are the safety measures for the community people with regard to the movement of construction material and heavy machine and vehicle, and to inform adjacent community on work schedule and safety caution in advance		PNOC/ Road administrator in LGUs concerned	in general construction cost

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Table 2.9-20 Environmental Management Plan for Mitigation Measures (Operation Phase)

Category of Impacts	Items of Impacts	Project Stage	Key Mitigation Measures to be taken	Implementing Agency	Responsible Agency	Undertaking Cost
Social Environment	21 Uneven distribution of benefits and damages 22 Local conflicts of interest	At Operation	- Local employment of maintenance workers for safeguarding pipeline from the municipalities and barangays along the pipeline route	Operation Company	PNOC/ LGUs concerned	in OPEX as OM budget of Operation Company
	28 Working environment	At Operation	For safety measures in handling high-pressure gas - Preparation of safety manuals for maintenance work and emergency response - Establishment and periodical check of the emergency contact network - Periodical thorough instruction and training of routines for safety and emergency response to maintenance and monitoring workers	Operation Company	PNOC/ DOLE	in OPEX as OM budget of Operation Company
			On road traffics - Use of safety sign and measures during maintenance and monitoring work - Conducting maintenance and monitoring work with a team of well-trained multiple personnel - Informing work schedule in advance to and for coordination with the road administrator in LGUs and toll-way corporations		PNOC/ Road administrator in LGUs and toll-way corporations	
	29 Accidents	At Operation	Operation and maintenance standards - Application of proper OM standards, including pipe and facility maintenance/ corrosion protection management/ management of other construction works/ and response to leaks and other abnormality	Operation Company	PNOC/ DOE	in OPEX as OM budget of Operation Company
			Pipeline operation and maintenance - Sufficient and proper training of the engineers - Systematic conduct of the below activities 1) Daily supervision and inspection 2) Establishing the system of preparedness for emergency or abnormal situation 3) Monitoring of third party projects to prevent the pipeline to be affected or incidentally damaged	Operation Company/ LGUs concerned wrt Activities 2)	PNOC/ DOE	

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2.9.9 Environmental Monitoring Plan

Table 2.9-21 Environmental Monitoring Plan (1/2)

Phase	Item	Indicator	Location	Method / Frequency	Reference Standard	Implementer/ Responsible Agency / Cost	Reporting interval to JICA office
Construction Phase	Air Quality (exhaust gas)	Dust / TSP or its comparables	At construction sites adjacent to urban sensitive receptor areas, such as residential, hospitals and schools At garage yard of construction machines and vehicles	Daily site inspection of exhaust of construction machines and vehicles at construction sites Bimonthly measurement with digital dust meter at sensitive receptor areas for dust Periodical inspection (daily, monthly, once a year) for maintenance of machines and vehicles	Daily observance on site Bimonthly- DENR standard for TSP 300 μg/Ncm (1 hour) Periodical -Inspection checklist for machine maintenance	Site manager and ESHO of the Contractor, under supervision PNOC in coordination with DENR-EQD Region IV-A Cost to be included in Contractor's Bid – for the entire duration of construction phase	Quarterly reporting (once every 3 months)
		NO_2, SO_2	Same as Dust / TSP		Daily observance on site NO_2: Abnormal rust colour SO_2: Abnormal irritating odor Periodical -Inspection checklist for machine maintenance		
	Noise/ Vibration	Noise	Same as Dust, NO_2, SO_2	Measurement with Digital Noise Level Meter and Monitoring Checklist Daily for high noise level generating activities and weekly for other activities during construction Investigation on a complaint basis shall be immediately undertaken	Class B "a category of areas which is primarily a commercial area" 60 dBA (Morning 6:00-9:00) 65 dBA (Daytime 9:00-18:00) 60 dBA (Evening 18:00-22:00) 55 dBA (Nighttime 22:00-5:00)	Site manager and ESHO of the Contractor, under supervision PNOC in coordination with DENR-EQD Region IV-A (Cost included in Air Quality above)	
	Water Quality (river water)	Color, Oil flow Maintained water flow	Work sites in all river crossing sections of the pipeline route	Daily site inspection of work sites with Monitoring Checklist	Daily observance on site Abnormal color and flow	Site manager and ESHO of the Contractor, under supervision PNOC in coordination with DENR-EQD Region IV-A approx PHP 5,000.00 per sampling and analysis for each location	
		pH,BOD,TSS, DO,Total Coli., oil & grease	Reference points in EIS study and their downstream points at river crossing sections of the pipeline route	Sampling once in each reference point at end of construction period and analysis of samples at labo	DENR Surface freshwater Classification Wrt this project, mostly Class C and exceptionally Class A Example: Calumpang River (C), San Juan River in Batangas (A), San Juan River in Laguna (C), San Cristobal River (C).		

Phase	Item	Indicator	Location	Method / Frequency	Reference Standard	Implementer/ Responsible Agency / Cost	Reporting interval to JICA office
Construction Phase	Sediment Ecosystem Hydrology Topography and Geology (river crossings)	Soil erosion Vegetation and Slope condition at embankment and bridge sites	Around work sites at river crossings along the pipeline route	Daily site inspection of work sites with Monitoring Checklist	Based on the Environmental Management Plan (EMP) of this EIA	Site manager and ESHO of the Contractor, under supervision PNOC in coordination with DENR-EQD Region IV-A Part of the construction costs	Quarterly reporting (once every 3 months)
	Wastes (waste disposal)	Disposal procedure of surplus waste soil and other construction wastes	All construction sites and garage yards of pipeline and ancillary facilities Disposal sites where the wastes to be carried	Daily site inspection of concerned sites with Monitoring Checklist Weekly site inspection of concerned sites with Monitoring Checklist	Daily observance on site with consideration on safety and sanitation Authorization of disposal sites and disposal activity by the LGUs concerned	Site manager and ESHO of the Contractor, under supervision PNOC in coordination with DENR-EQD Region IV-A Part of the construction costs	
	Water Quality (groundwater)	pH, COD (or TOC) fluoride, formaldehyde (HCHO), Cr(VI)	Monitoring wells within 100m around vertical shafts of pipe jacking sections (assumed to be 3 sections in the Basic Design)	Once before chemical injection (baseline data) for ground improvement Once daily during injection Once until 2 weeks after and Twice monthly until a half year after injection	Reference to corresponding MHLW-Japan ordinance 1966-11 pH not exceed 8.6 (or not exceed baseline data) COD not exceed 10 ppm (or not exceed baseline data) / (TOC not exceed 5mg/L (or not exceed baseline data)) When injected chemicals contain the pertinent chemical, fluoride not exceed 0.8 mg/L HCHO not exceed 0.8mg/L Cr(VI) not exceed 0.05 mg/L	Site manager and ESHO of the Contractor, under supervision of PNOC in coordination with DENR-EQD Region IV-A Cost to be included in Contractor's Bid – for the entire period of the monitoring concerned	

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Table 2.9-21 Environmental Monitoring Plan (2/2)

Phase	Item	Indicator	Location	Method / Frequency	Reference Standard	Implementer/ Responsible Agency / Cost	Reporting interval to JICA office
Operation Phase	Uneven distribution of benefits and damages (local employment)	Local employment of maintenance staff	By section of pipeline route with reference to LGUs concerned	Yearly review of maintenance staff inventory by section	Based on the EMP of this EIA	Operation Company under agreement and coordination with PNOC and the LGUs concerned To be included in annual OM budget of the Operation Company	Semi-annual reporting (once every 6 months) for the first 3 years of operation and Annual reporting (once a year) after 3 years of operation
	Working environment (safety measures for OM staff)	Safety measures in handling high-pressure gas facilities, underground and roadside (manual/ SOP, network system, training, protect gear)	Archive of OM division of Operation Company for; - existing documents (manual/ SOP, chart of network system, etc.) - records/photo of training & OM activities	Daily working record of OM activity by the paired staff themselves Weekly review of OM activities by unit/section of OM Monthly/Quarterly review of OM activities and Yearly review of OM plan/manual by the OM department	OCCUPATIONAL SAFETY AND HEALTH STANDARDS (As Amended, 1989) Department of Labor and Employment, Philippines ILO Guidelines on occupational safety and health management systems, 2001	OM Department of the Operation Company under supervision of DOLE To be included in annual OM budget of the Operation Company	
	Accident (maintenance activities)	OM records, Trouble/ incident records, Emergency response system	Archive of OM division of Operation Company for relevant records regarding entire stretch of the pipeline	Monthly/Quarterly review of OM activities and Yearly review of OM system/plan/manual by the OM department of Operation Company	Operation and Maintenance Standards to be prepared by DOE in coordination with the LGUs concerned for the emergency response system (according to RA7160, the Local Government Code 1990)	OM Department of the Operation Company, PNOC under supervision of DOE and the LGUs concerned To be included in annual OM budget of the Operation Company	

2.9.10 Stakeholders Meetings

Refer to 2.9.11 (8).

2.9.11 Resettlement Action Plan (RAP)

(1) Necessity of Land Acquisition and Resettlement

1) Project Components Required Resettlement and/or Land Acquisition

Project component required resettlement is high pressure trunk pipeline. There are two affected areas in Batangas City. Table below shows project components required resettlement and affected areas.

Table 2.9-22 Project Components required Resettlement and Affected Areas

Project Component		Affected Area	Photograph
Pipeline	Trunk Line	Bridge1（Batangas City）	Photograph2.9.2-1 Photograph2.9.2-2
		Bridge2（Batangas City）	Photograph 2.9.2-3 Photograph2.9.2-4

Source: Survey Team

Project components that requires land acquisition are equipment such as block valve station, governor stations, governor-metering station and metering stations.

Table 2.9-23 shows project components required land acquisition and affected areas. Photograph 2.9-5 through Photograph 2.9-10 show each station site.

: Bridge1　: Bridge2

Source: Survey Team

Figure 2.9-10 Location of Bridges

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Photograph 2.9-1 Bridge 1

Photograph 2.9-2 Bridge 1

Source: Survey Team

Photograph 2.9-3 Bridge 2

Photograph 2.9-4 Bridge 2

Source: Survey Team

Table 2.9-23 Project Components required Land Acquisition and Affected Areas

Project Component			Affected Area	Photograph
Other Equipment	Block Valve Station (BVS)		Private firm land outside STAR expressway	Photograph2.9.2-5
	Governor Station (GS)	GS1	Private firm land outside STAR expressway	Photograph2.9.2-6
		GS2	Private firm land near Santo Tomas exit of STAR expressway	Photograph2.9.2-7
		GS3	Vegetation area in Cabuyao exit of SLEX	Photograph2.9.2-8
	Governor/Metering Station (GMS)		Candidate LNG import terminal in Batangas City	—
	Metering station (MS)	MS1	In Lima Technology Center	—
		MS2	In First Philippines Industrial Park	—

BVS: Block Valve Station, GS: Governor Station, GMS: Governor/Metering Station, MS: Metering Station

Source: Survey Team

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Photograph 2.9-5 BVS site

Photograph 2.9-6 GS1 site

Source: Survey Team

Photograph 2.9-7 GS2 site

Photograph 2.9-8 GS3 site

Source: Survey Team

2) Initial Alternatives to avoid and minimize Resettlement

The trunk Pipeline is buried 1.2 m below the road on right side basically. In the case of crossing river, the trunk pipeline is buried applying open-cut method or pipe jacking method on the right side.
In the Batangas city, there are two river crossing points. The trunk Pipeline is buried on the left side instead of right side to minimize resettlement of households and shops.

3) Measures to minimize resettlement during construction

There are no measures to minimize resettlement during construction

(2) Legal Framework of Land Acquisition and Resettlement

1) Overview of Legal Framework for Land Acquisition and Resettlement

a. Related Laws and regulations

Next table shows laws and regulations related land acquisition and involuntary resettlement.

Table 2.9-24 Laws and regulations related land acquisition and involuntary resettlement

Laws and Regulations	Summary
Local Government Code of 1991 / Republic Act No.7160, 1991	• Land acquisition without prior presentation of appropriate compensation amount to landowners is prohibited. • It stipulates the eminent domain procedures of local authorities with the 15 % deposit of the market land price based on the tax declaration soon after the application for arbitration for land acquisition. The remaining payment is decided by the court based on the fair market land price.

Urban Development and Housing Act：UDHA, Republic Act No.7279,　1992	• It stipulates measures for better livelihood and housing for the urban poor and squatters, and their access to employment opportunities. • It stipulates the fair land ownership system and measures for ensuring compensation payment including guarantees of land leasehold from project beneficiaries and rights of diminutive property owners. • The eviction of residents and demolition are approved whenever right-of-way and public places are inhabited, or government projects with secure budget are implemented, or the courts so order. • It stipulates the provision of basic infrastructure in the resettlement site and housing for low income earners by local authorities and National Housing Authority (hereinafter called NHA).
The Act to Facilitate the Acquisition of Right-of-Way / Republic Act No. 8974, 2000	• It describes the guidelines for land acquisition and unified compensation standards for ensuring smooth acquisition. • It stipulates the acquisition procedures to be undertaken by executing agencies based on the guidelines, prior to the court decision, if the acquisition of ROW or private lands is necessary for public works. • It requires executing agencies to make a prompt payment for the full cost of ownership calculated based on the Zonal Value set by the Bureau of Internal Revenue (BIR), and the cost of land improvement and construction. • It prescribes the standards of cost estimation of land acquisition by eminent domain or by negotiation. • It obligates local authorities and NHA to provide basic services in collaboration with private sector developers and institutions concerned for eviction of squatters out of ROW of infrastructure projects.
Indigenous Peoples' Rights Act, 1997	• It defines and protects the rights of indigenous people, and prescribes conditions, requirements and safeguards for plans, programs and projects that may affect them.
DPWH, Department Order (DO) No.5, 2003	• It stipulates the guideline for land acquisition and the creation of the resettlement assistance office. It also prescribes budget securement for ROW acquisition by executing agencies, and preparation of Land Acquisition Plan / Resettlement Action Plan (LAPRAP).
DPWH, Infrastructure Right-of-Way (IROW) Procedural Manual, 2003	• It covers all the procedures from the planning to management stages of all the projects related to ROW acquisition and management.
DPWH, Department Order (DO) No.327, 2003	• It is the guideline for land acquisition for infrastructure projects and preparation of LAPRAP.
Policy for DPWH Land Acquisition, Resettlement, Livelihood Recovery and Indigenous People (LARRIP Policy[17]) (3rd edition), 2007	• This policy includes involuntary resettlement, legal grounds, benefit receiving right, compensation & qualification, measures for indigenous people, implementation process, internal & external monitoring of LAPRAP implementation and consideration for minorities, based on the Philippine laws, reflecting the guidelines of international donors including World Bank (WB) and Asian Development Bank (ADB). It has been continuously revised with the assistance of WB and ADB, and its 3rd edition was released in March 2007 with the addition of the DPWH's policy for indigenous people based on the Indigenous People's Right Act and the Administrative Order (No.01 of 2006) of the National Commission on Indigenous People.

[17] The abbreviation of Land Acquisition, Resettlement, Rehabilitation and Indigenous People's Policy

b. Procedures for land acquisition and involuntary resettlement

a) Overview

LAPRAP will be renewed at the stage of detailed design and public consultation will be conducted with respect to each barangay to formulate agreements of People affected by the Project, PAPs in the Philippines.

There is no professional governmental organization addressing land acquisition and involuntary resettlement. Each project proponent conducts land acquisition and involuntary resettlement.

Only DPWH has clear-cut procedures, proponents except DPWH conducts land acquisition and involuntary resettlement in accordance with procedures of DPWH and guidelines of donors.

b) Procedure for land acquisition and involuntary resettlement

Set out below are land acquisition procedures based on IROW Procedural Manual 2003 and LARRIP Policy 2007 etc. by DPWH.

- Implementation of the Percellary Survey and Formulation of the report
- Preparation of LAPRAP
- Contents of Livelihood Recovery
- Information Disclosure
- Public Consultation
- Grievance Mechanism
- Land Acquisition
- Considerations：

• Qualified Beneficiaries :	Residents owning or using the specific land before the date of initiation of investigation (cut-off date).
• Compensation Contents :	Land, fixed assets, other guarantee package (income subsidy, vocational training, compensation for nuisance, etc.)
• Consideration for Indigenous People :	Special consideration including the preparation of Indigenous People's Action Plan：IPAP, etc.
• Resettlement of Squatters :	According to the Republic Act No. 7279, eviction without the provision of alternative land is not allowed. It stipulates the responsibility of local authorities for the provision of alternative land, and the support by NHA and Housing and Urban Development Coordinating Council：HUDCC. Those squatters who meet all the following conditions are entitled for the compensation by the Republic Act No. 7279. ○ Possessing the Philippine nationality. ○ Personal or family income is below the Poverty Threshold. ○ Not possessing property in other places. ○ Not being professional squatters, nor being members of any squatter syndicates. Professional squatters mean individuals or groups who occupy the land of other people without the permission of the owners in spite of

	their income affordable for lawful residence. Squatter syndicates mean individuals or groups involved in illegal residence for benefit.
• Eminent Domain：	The principle is to make efforts to obtain consent from all the PAPs. However, there is a stipulation to allow forceful takeover of the private land if the landowner refuses the price presented for the 2nd time in the negotiations conducted based on IROW Procedural Manual, 2003 of DPWH.

c. Monitoring

The aid project by the donors conducts periodical external monitoring by the independent agencies.

a) Internal monitoring

The supervision and in-house monitoring of implementation of the RAPs and land acquisition shall be conducted based on LAPRAP etc. The findings are documented in the quarterly report to be submitted to the Project Management Office, PMO.

b) External monitoring

An external monitoring agent shall be commissioned by the PMO to undertake independent external monitoring and evaluation. An external monitoring agent monitors once a month to verify results of internal monitoring, the results of the information disclosure, compensation process, resettlement, and adequacy of compensation. The results of monitoring shall be disclosed during the public consultation conducted in accordance with each project resettlement plan. The final evaluation will be conducted three months after the completion of payments of compensation. The post-evaluation will be undertaken a year after the completion of the project to determine whether the social and economic condition of the PAPs and IPs.

2) JICA Policies on Involuntary Resettlement

The key principle of JICA policies on involuntary resettlement is summarized below.

I. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.

II. When, population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.

III. People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.

IV. Compensation must be based on the full replacement cost[18] as much as possible.

V. Compensation and other kinds of assistance must be provided prior to displacement.

VI. For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. It is desirable that the resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP 4.12, Annex A.

[18] Description of "replacement cost" is as follows,

Land	Agricultural Land	The pre-project or pre-displacement, whichever is higher, market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes.
	Land in Urban Areas	The pre-displacement market value of land of equal size and use, with similar or improved public infrastructure facilities and services and located in the vicinity of the affected land, plus the cost of any registration and transfer taxes.
Structure	Houses And Other Structures	The market cost of the materials to build a replacement structure with an area and quality similar or better than those of the affected structure, or to repair a partially affected structure, plus the cost of transporting building materials to the construction site, plus the cost of any labor and contractor fees, plus the cost of any registration and transfer taxes.

VII. In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.
VIII. Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.
IX. Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

Above principles are complemented by World Bank OP 4.12, since it is stated in JICA Guideline that "JICA confirms that projects do not deviate significantly from the World Bank's Safeguard Policies". Additional key principle based on World Bank OP 4.12 is as follows.

X. Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits.
XI. Eligibility of Benefits include, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.
XII. Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.
XIII. Provide support for the transition period (between displacement and livelihood restoration.
XIV. Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.
XV. Even for projects that entail land acquisition or involuntary resettlement of fewer than 200 people, resettlement plan is to be prepared.

In addition to the above core principles on the JICA policy, it also laid emphasis on a detailed resettlement policy inclusive of all the above points; project specific resettlement plan; institutional framework for implementation; monitoring and evaluation mechanism; time schedule for implementation; and, detailed Financial Plan etc.

3) Gaps between Philippines' Legal Framework and JIC Guidelines

Next table shows analysis of gaps between current relevant regulations related land acquisition and involuntary resettlement in the Philippines and JICA guidelines for Environmental and Social Considerations including World Bank's safeguard policy. There are no Lows related preparation of LAPRAP, public participation, livelihood rehabilitation and monitoring evaluation etc. in the Philippines.
In the case of the project implementation based on the regulations and policy of DPWH, there aren't major gaps. Compared to World Bank's safeguard policy, the rules and regulations of public participation, grievance mechanism and monitoring plan are not set forth in the current rules and regulations of resettlement plan for DPWH. It is needed to combine guidelines of donors with the rules and regulations of DPWH.

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Table 2.9-25 Analysis of Gaps between Current Relevant Regulations in the Philippines and JICA guidelines for Environmental and Social Considerations

JICA Guideline	Laws and Guidelines of the Philippines	Gap relative to JICA GL	Project Policy
Involuntary resettlement and loss of means of livelihood need to be avoided by all means. Even with all these efforts, if the avoidance is impossible, measures must be taken to minimize the negative influence and compensate the loss effectively by consent of the affected.	No person shall be deprived of life, liberty, or property without due process of law. (Article 3, Constitution) Private property shall not be taken for public use without fair compensation. (ditto) Right to stay in the territory: In case the resettlement is inevitable, obtaining prior consent based on the free will of the indigenous people and their cultural community is necessary. (IPRA, 1997)	None	-
Those affected by involuntary resettlement and loss of means of livelihood must be provided with enough compensation and assistance at the appropriate timing by the government. The government must ensure the improvement or at least the recovery of the previous living and production standard and income opportunity for the affected residents.	There is a provision that requires local authorities and NHA to develop the infrastructure of the land for squatters' resettlement and housing for low income residents. (RA7279)	In the Philippines, lawful landowners are entitled to financial compensation. In case of resettlement of squatters, there is a relevant law to ensure the livelihood support and recovery for them.	Based on the results of the socio-economic study, livelihood recovery measures will be considered in consultation with beneficiaries.
Compensation must be provided in advance and based on the price for re-acquisition to the extent possible.	For the land acquisition, the project owner presents the compensation amount calculated based on the Zonal Value set by BIR for negotiation. If the landowner refuses the amount, the project owner re-negotiates with the landowner based on the amount proposed by the assessment committee or by an individual land assessor. (RA 8974)	Since the Zonal Value set by BIR is decided with reference to the past land sales records, it is not necessarily equivalent to the current re-acquisition price.	The compensation amount should be the re-acquisition price reflecting the appropriate market price that can be obtained from a re-acquisition price survey. And it is to be so described in the RAP draft after consultations with executing agencies.

JICA Guideline	Laws and Guidelines of the Philippines	Gap relative to JICA GL	Project Policy
In case of large scale involuntary resettlement projects, the resettlement plan must be prepared and made public.	In the Philippines there are no laws that stipulate the requirements for the resettlement plan preparation.	Since laws that require the preparation of the resettlement plan do not exist in the Philippines, they are prepared only in accordance with the guidelines of financial institutions.	Will prepare the RAP draft with reference to the World Bank's safeguard policy OP4.12 Annex A "Resettlement Plan".
For the preparation of the resettlement plan, consultations with the community to be affected must be undertaken with prior and sufficient information disclosure. Extreme care must be taken to the needs of the socially disadvantaged people to be affected including those poor, landless and aged people, women, children and indigenous people.	The community participation is taken much account of in the environment impact assessment system in the Philippines. The practice of the community participation through public hearings, open scoping, etc. is stipulated in the Revised Procedural Manual for DAO 2003-30, 2008.	While there are no laws concerning the public consultation for the preparation of the resettlement plan, public hearings are organized in the course of the environment impact assessment.	Will support the organization of stakeholders meeting with the participation of the residents to be affected. Will reflect opinions expressed in the meetings to the RAP draft.
The participation of the community to be affected must be appropriately ensured for drafting, implementing and monitoring measures for involuntary resettlement and livelihood recovery. The monitoring results must be made public to local stakeholders.	There exist no laws concerning the monitoring evaluation in the Philippines.	There exist no laws concerning the monitoring evaluation in the Philippines. The monitoring evaluation plan is prepared only in accordance with the guidelines of financial institutions.	Will draft a mechanism for encouraging community participation in the process of the monitoring undertaken by executing agencies and external independent institutions.

JICA Guideline	Laws and Guidelines of the Philippines	Gap relative to JICA GL	Project Policy
A mechanism to respond to complaints from people and community to be affected by the land acquisition must be developed.	There exist no laws concerning the complaint management in the Philippines.	There exist no laws concerning the complaint management in the Philippines. The complaint management mechanism has been developed only in accordance with the guidelines of financial institutions.	Will establish a complaint management mechanism in which members include residents' representatives, NGOs, legal experts, etc. for ensuring reliable complaint management.
Beneficiaries include followings: ・Those who possess the legal rights of the land. (incl. the customary and traditional rights recognized by the country's legal system.) ・Those who possess no legal rights of the land, but if they apply for the rights, their rights are approved by the country's legal system. ・Those who are unable to confirm the legal rights and claim rights for the land they occupy.	In the Philippine law, it is stipulated that the lawful landowners are entitled to the financial compensation. It is also stipulated that the government is required to provide the alternative land and basic services to squatters. (RA 8974)	In the Philippines, there exist no laws concerning those who are unable to confirm the legal rights and claim rights for the land they occupy. However, they are included in the category of beneficiaries in accordance with the guidelines of financial institutions.	Based on the results of the socio-economic survey, a matrix of entitlement in which all types of loss, beneficiaries of compensation or assistance and compensation details are described irrespective of their legal status will be set up.
If the livelihood of the affected people is based on land, the resettlement strategy based on land must be given priority.	In the Philippine law, it is stipulated that the lawful landowners are entitled to the financial compensation. It is also stipulated that the government is required to provide the alternative land and basic services to squatters. (RA 8974)	There exist no laws concerning the compensation based on the land to acquire. However, the land-based compensation is included in the category of compensation for beneficiaries in accordance with the guidelines of financial institutions.	Will survey on the exchangeable land with equivalent value in and around the city, and include them in the compensation options.

4) Policy of Land Acquisition and Resettlement for the Project

Here is policy of land acquisition and resettlement for the project.

I. The Government of the Republic of the Philippines will use the Project Resettlement Policy (the Project Policy) for the Batangas-Manila Natural Gas Pipeline Project (Batman 1) specifically because existing national laws and regulations have not been designed to address involuntary resettlement according to international practice, including JICA's policy. The Project Policy is aimed at filling-in any gaps in what local laws and regulations cannot provide in order to help ensure that PAPs are able to rehabilitate themselves to at least their pre-project condition. This section discusses the principles of the Project Policy and the entitlements of the PAPs based on the type and degree of their losses. Where there are gaps between the Philippines' legal framework for resettlement and JICA's Policy on Involuntary Resettlement, practicable mutually agreeable approaches will be designed consistent with Government practices and JICA's Policy.

II. Land acquisition and involuntary resettlement will be **avoided** where feasible, or **minimized**, by identifying possible alternative project designs that have the least adverse impact on the communities in the project area.

III. Where displacement of households is unavoidable, all PAPs (including communities) losing assets, livelihoods or resources will be **fully compensated** and assisted so that they can improve, or at least restore, their former economic and social conditions.

IV. Compensation and rehabilitation support will be provided to any PAPs, that is, any person or household or business which on account of project implementation would have his, her or their:

・ Right, title or interest in any house, interest in, or right to use, any land (including premises, agricultural and grazing land, commercial properties, tenancy, or right in annual or perennial crops and trees or any other fixed or moveable assets, acquired or possessed, temporarily or permanently;

・ Income earning opportunities, business, occupation, work or place of residence or habitat adversely affected temporarily or permanently; or

・ Social and cultural activities and relationships affected or any other losses that may be identified during the process of resettlement planning.

V. All affected people will be eligible for compensation and rehabilitation assistance, **irrespective of tenure status**, social or economic standing and any such factors that may discriminate against achievement of the objectives outlined above. Lack of legal rights to the assets lost or adversely affected tenure status and social or economic status will not bar the PAPs from entitlements to such compensation and rehabilitation measures or resettlement objectives. All PAPs residing, working, doing business and/or cultivating land within the project impacted areas **as of the date of the latest census** and inventory of lost assets(IOL), are entitled to compensation for their lost assets (land and/or non-land assets), at replacement cost, if available and restoration of incomes and businesses, and will be provided with rehabilitation measures sufficient to assist them to improve or at least maintain their pre-project living standards, income-earning capacity and production levels.

VI. PAPs that **lose only part of their physical assets** will not be left with a portion that will be inadequate to sustain their current standard of living. The minimum size of remaining land and structures will be agreed during the resettlement planning process.

VII. People **temporarily affected** are to be considered PAPs and resettlement plans address the issue of temporary acquisition.

VIII. Where a **host community** is affected by the development of a resettlement site in that community, the host community shall be involved in any resettlement planning and decision-making. All attempts shall be made to minimize the adverse impacts of resettlement upon host communities.

IX. The **resettlement plans** will be designed in accordance with Philippines' Involuntary Resettlement Policy and JICA's Policy on Involuntary Resettlement.

X. The Resettlement Plan will be **translated** into local languages and **disclosed** for the reference of PAPs as well as other interested groups.

XI. Payment for land and/or non-land assets will be based on the principle of **replacement cost**.

XII. Compensation for PAPs dependent on agricultural activities will be **land-based** wherever possible. Land-based strategies may include provision of replacement land, ensuring greater security of tenure, and upgrading livelihoods of people without legal land titles. If replacement land is not available, other strategies may be built around opportunities for re-training, skill development, wage employment, or self-employment, including access to credit. Solely cash compensation will be avoided as an option if possible, as this may not address losses that are not easily quantified, such as access to services and traditional rights, and may eventually lead to those populations being worse off than without the project.

XIII. Replacement lands, if the preferred option of PAPs, should be **within the immediate vicinity** of the affected lands wherever possible and be of **comparable productive capacity and potential**. As a second option, sites should be identified that minimize the social disruption of those affected; such lands should also have access to services and facilities similar to those available in the lands affected.

XIV. Resettlement assistance will be provided not only for immediate loss, but also for a **transition period** needed to restore livelihood and standards of living of PAPs. Such support could take the form of short-term jobs, subsistence support, salary maintenance, or similar arrangements.

XV. The resettlement plan must consider the needs of those most **vulnerable** to the adverse impacts of resettlement (including the poor, those without legal title to land, ethnic minorities, women, children, elderly and disabled) and ensure they are considered in resettlement planning and mitigation measures identified. Assistance should be provided to help them improve their socio-economic status.

XVI. PAPs will be **involved** in the process of developing and implementing resettlement plans.

XVII. PAPs and their communities will be **consulted** about the project, the rights and options available to them, and proposed mitigation measures for adverse effects, and to the extent possible be involved in the decisions that are made concerning their resettlement.

XVIII. Adequate **budgetary support** will be fully committed and made available to cover the costs of land acquisition (including compensation and income restoration measures) within the agreed implementation period. The funds for all resettlement activities will come from the Government.

XIX. **Displacement does not occur before provision of compensation and of other assistance** required for relocation. Sufficient civic infrastructure must be provided in resettlement site prior to relocation. Acquisition of assets, payment of compensation, and the resettlement and start of the livelihood rehabilitation activities of PAPs, will be completed prior to any construction activities, except when a court of law orders so in expropriation cases. (Livelihood restoration measures must also be in place but not necessarily completed prior to construction activities, as these may be ongoing activities.)

XX. **Organization and administrative arrangements** for the effective preparation and implementation of the resettlement plan will be identified and in place prior to the commencement of the process; this will include the provision of adequate human resources for supervision, consultation, and monitoring of land acquisition and rehabilitation activities.

XXI. Appropriate reporting (including auditing and redress functions), **monitoring and evaluation mechanisms**, will be identified and set in place as part of the resettlement management system. An external monitoring group will be hired by the project and will evaluate the resettlement process and final outcome. Such groups may include qualified NGOs, research institutions or universities.

Cut-off-date of Eligibility

The cut-off-date of eligibility refers to the date prior to which the occupation or use of the project area makes residents/users of the same eligible to be categorized as PAPs and be eligible to Project entitlements. In the Project, Cut-off dates for titleholders will be the date of notification under the Land Acquisition Act and for non-titled holders will be the beginning date of the population census; xx April, 2014. This date has been disclosed to each affected village by the relevant local governments and the villages have disclosed to their populations. The establishment of the eligibility cut-off date is intended to prevent the influx of ineligible non-residents who might take advantage of Project entitlements

Principle of Replacement Cost

All compensation for land and non-land assets owned by households/shop owners who meet the cut-off-date will be based on the principle of replacement cost. Replacement cost is the amount calculated before displacement which is needed to replace an affected asset without depreciation and without deduction for taxes and/or costs of transaction as follows:

a. Productive Land (agricultural, aquaculture, garden and forest) based on actual current market prices that reflect recent land sales in the area, and in the absence of such recent sales, based on recent sales in comparable locations with comparable attributes, fees and taxes or in the absence of such sales, based on productive value;

b. Residential land based on actual current market prices that reflect recent land sales, and in the absence of such recent land sales, based on prices of recent sales in comparable locations with comparable attributes; fees and taxes.

c. Existing local government regulations for compensation calculations for building, crops and trees will be used where ever available.*

d. Houses and other related structures based on actual current market prices of affected materials;

e. Annual crops equivalent to current market value of crops at the time of compensation;

f. For perennial crops, cash compensation at replacement cost that should be in line with local government regulations, if available, is equivalent to current market value given the type and age at the time of compensation.

g. For timber trees, cash compensation at replacement cost that should be in line with local government regulations, if available, will be equivalent to current market value for each type, age and relevant productive value at the time of compensation based on the diameter at breast height of each tree.

(3) Scope of Resettlement Impact

1) Population Census

Occupants in the affected areas are squatters in Batangas City. Next table shows the number of Project Affected Units (PAUs) and Affected Persons (Aps).

Table 2.9-26 Number of Project Affected Units (PAUs) and Affected Persons (Aps)

Type of loss	No of PAUs			No of APs		
	Legal	Illegal	Total	Legal	Illegal	Total
Required for displacement						
Households of Bridge 1	5	0	5	24	0	24
Households of Bridge 2	6	0	6	29	0	29

Source: Survey Team

2) Estate Survey

a. Land

The area of land acquisition and condition of land use is shown in the next table.

Table 2.9-27 List of Land Acquisition

No.	Location	Land Type	Affected(m^2)
1	Bridge 1 (Batangas City)	Privately Owned Land	2,000
2	Bridge 2 (Batangas City)	Privately Owned Land	480

Source: Survey Team

b. Buildings

The resettlement households and Aps are shown in the next table.

Table 2.9-28 Resettlement Households

No.	Location	Type of Building	Legal / Illegal	APs	Total HH
1	Bridge 1 (Batangas City)	Single story, wood	Legal	24	5
2	Bridge 2 (Batangas City)	Double story, Mixed wood and Concrete	Legal	29	6

HH: House Hold, Aps: Affected Persons
Source: Survey Team

c. Trees

There are no trees for resettlement. Several trees are needed to be cut.

3) Household Budget and Living Survey

The household budget is shown in the next table.

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Table 2.9-29 Household Budget

Range (PHP)	No. of Household
0	2
0 – 1,000	2
2,001 – 3,000	1
4,001 – 5,000	1
5,001 – 6,000	1
9,001 – 10,000	1
12,001 – 15,000	1
15,001 – 20,000	2
Total	11

Source: Survey Team

a) Vulnerable Groups

Under survey in coordination with PNOC.

(4) Concrete Plan of Compensation and Assistance

Concrete plans for compensation will be prepared by PNOC. Livelihood recovery assistance plan will also be considered by PNOC.

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1) Entitlement Matrix

Entitlement matrix is as shown in the table below.

Table 2.9-30 Entitlement Matrix

Item No.	Type of loss	Entitled Persons (Beneficiaries)	Entitlement (Compensation Package)	Implementation Issues/Guidelines	Responsible organization
1	Loss of agricultural land	Legal owners of land	Cash compensation under low(CCL)	Assessment of CCL	PNOC
2	Loss of houses	Squatters	Cash compensation under low(CCL)	Assessment of CCL	PNOC
3	Loss of house	Legal owners of land	Cash compensation under low(CCL)	Assessment of CCL	PNOC
4	Loss of trees	Legal owners of land	Cash compensation under low(CCL)	Assessment of CCL	PNOC

Source: Survey Team

(5) Grievance Mechanism

There is no established grievance mechanism for land acquisition. The people who opposes have to tell their grievance to the project proponent or the Court. However under the RA No.8975, no court, except the Supreme Court, shall issue any temporary restraining order.

Based on the consultation of ADB and WB, the DPWH proposes the grievance mechanism in the LARRIP Policy (2007) as follows:

a. The PAPs will lodge their grievances by writing to the Resettlement Implementation Committee (RIC) for immediate resolution.
b. If the complaint is not satisfactorily resolved in 15 days or the PAP does not receive any response from the RIC, the PAP can forward the complaint or file an appeal at the DPWH Regional Office (RO).
c. If the complaint is not satisfactorily resolved in 15 days or the PAP does not receive any response from the DPWH RO, the PAP can file a legal complaint in any appropriate Court of Law.

Institutional Arrangement, Implementation Schedule, are issued to be arranged in coordination with PNOC.

(6) Estimated Cost and Financial Arrangement

All necessary cost except purchasing/providing the resettlement sites shall be arranged, budgeted and released by PNOC. LGU shall provide available relocation sites of which procurement cost shall be arranged by the LGU.

(7) Monitoring and Monitoring Form

Institutional arrangements for monitoring will be determined under arrangements with the executing agency, PNOC.

Monitoring will be summarized according to the next table in coordination with PNOC. Preparation of Resettlement Sites will be conducted where necessary.

Table 2.9-31 Preparation of Resettlement Sites

No.	Explanation of the Site (e.g. Area, no of resettlement HH, etc.)	Status (Completed(date)/ not complete)	Details (e.g. Site selection, identification of candidate sites, discussion with PAPs, Development of the site, etc.)	Expected Date of Completion
1				
2				

Source: Survey Team

Table 2.9-32 Monitoring Form

Resettlement activities	Planned Total	Unit	Progress in Quantity			Progress in %		Expected Date of Completion	Responsible Organization
			During the Quarter	Till the Last Quarter	Up to the Quarter	Till the Last Quarter	Up to the Quarter		
Preparation of RAP									
Employment of Consultant		Man-month							
Implementation of Census survey (including socioeconomic survey)									
Approval of RAP			Date of Approval						
Finalization of PAPs list		No of PAPs							
Progress of Compensation Payment		No of HHs							
Lot 1		No of HHs							
Lot 2		No of HHs							
Progress of Land Acquisition(All)		12,100m2							
GMS		3,000m2							
BVS		1,200m2							
GS1		1,800m2							
GS2		1,800m2							
GS3		2,300m2							
MS1		1,000m2							
MS2		1,000m2							
Progress of Asset Replacement(All)		No of HHs							
Lot 1		No of HHs							
Lot 2		No of HHs							
Progress of Relocation of People(All)		No of HHs							
Lot 1		No of HHs							
Lot 2		No of HHs							

Source: Survey Team

(8) Public Consultation

1) Public Scoping Meeting

The result of Public scoping meeting is indicated the next table.

Table 2.9-33 Public Scoping Meeting

No.	Date	Place	Contents of the consultation/main comments and answers
1	February. 7, 2014	BATANGAS City	Comment: One of the concerns is the welfare of the community. Answer: Social Development Program for this project will be presented during public consultation. Question: What are the benefits that the host community will get from the project? Answer: There are Social Development Program and increase revenue for the LGUs. Question: Has the PNOC already conducted a study with regard to the traffic? Answer: A traffic study will be conducted to know the impacts of the project, pre-construction, during construction and on the decommissioning. Question: What will happen if a disaster will occur? Answer: Project Proponent make a study on safety plan. Question: What are the possible health hazards that the people might encounter? Answer: The Multi-Partite Monitoring Team will ensure the sustainability of the project. Question: Requested presentation material etc. Answer: Everything will be presented during the public consultation.
2	March 14, 2014	Municipality of IBAAN	Comment: One of the concerns is the safety of the people living in the barangays. Answer: The proposed project will use the latest methodology and is design for safety. The natural gas is lighter-than-air, it will dissipate in the air in leak. There are certain conditions that need to be present for explosion to occur. Question: What are the benefits that the host community will get from the project? Answer: There are Social Development Program and increase revenue for the LGUs. Comment: There will be no danger and risk if there will be no project. Answer: The identification of risk and hazards are part of the EIS. Comment: If it is possible, for consideration that their municipality be included as one of the priorities to be given supply. Answer: The project should be technically and financially viable.

			Question: When will the project start? How long is its duration? Answer: The target year is 2016. Question: Will we be able to enjoy cheaper energy? Answer: As of now, no forecast on the price is available.
3	February.4, 2014	Municipality of SAN JOSE	Question: Will the proponent lay pipeline only? Answer: The proposed project is just pipeline. Question: Will the proposed project acquire a private area? Answer: What seems to be feasible, lease or acquire, will be the action taken.
4		LIPA City	
5	January 16, 2014	Municipality of MALVAR	Question: What will happen if there will be an occurrence of leak? Answer: The natural gas is lighter-than-air, it will dissipate in the air in leak. There are certain conditions that need to be present for explosion to occur. Question: How will it affect the people living in the host community? Answer: The identification of risk and hazards are part of the EIS. Question: What are the benefits that the barangay will get from the project? Answer: There is Social Development Program. Comment: The barangay has narrow thoroughfare and is heavily populated. Answer: Mentioned concerns will be included in the study.
6	January 15, 2014	TANUAN City	Question: Where will the route of pipeline pass through in the STAR Tollway? Answer: The pipeline will be lay on the right lane of the STAR Tollway. The pipeline route is inside the STAR Tollway. Question: What are the mitigating measures? Answer: The consideration of mitigation measures are part of the EIS. Question: What contingency plan does the PNOC have? Answer: Concern is noted and will be raised to the proponent. Question: What are the benefits that the barangay will get from the project? Answer: There are Social Development Program and increase revenue for the LGUs. Question: Dose the barangay have the right to oppose the project? Answer: The concerns and apprehension about the project are written in the public scoping forms. Question: If there is one barangay that did not allow the project, will the project push still though or not?

			Answer: The scoping is a vehicle for the stakeholders to express their concerns and apprehensions on the project. The inputs from the stakeholders are very essential on the study.
7	January 29, 2014	Municipality of STO. TOMAS	Question: How fast will the SCADA system respond? Answer: The proponent will implement Information, Education, Communication Campaign (IEC). Question: When will the project start? Answer: The target year is 2016. Question: What are the benefits that the host community will get from the project? Answer: There are Social Development Program and increase revenue for the LGUs. Comment: Tangible specific activities for the sectors that might be affected are needed. Answer: Noted the suggestion. Comment: We will be able to train people in order to be qualified for employment. Answer: Noted the suggestion.
8	April 30, 2014	CALAMBA City	Question: What magnitude of earthquake can the pipeline bear? Answer: Magnitude 8.5 to 9.0 based on Japanese Standard. Question: When will the project start? Answer: The target year is 2016. Question: Is the pipeline easy to dig out? Answer: The pipeline will be buried 1.2m depth. Comment: The project should be presented to the residents in a manner readily and easily understandable. Answer: Noted the suggestion. Question: Did the proponent conduct direct boring? Answer: Noted the question. Question: What will be the measures that will be taken if there is a need to pull out the trees along the Expressway? Answer: There will be corresponding measures based on the laws and regulations. Question: What are the benefits that the host community will get from the project? Answer: There are Social Development Program and increase revenue for the LGUs.
9	January 17, 2014	Municipality of CABUYAO	Comment: Passing through the PNR should not be considered as there are subdivisions in that area. Answer: Noted the comment. Comment: It could be best if the pipeline will pass through after ETON exit to prevent the pipeline passing through the thickly populated area. Answer: Noted the comment. Question: What are the benefits that the host community

			will get from the project? Answer: There are Social Development Program and increase revenue for the LGUs. Question: What barangay jurisdiction will the governor station be located? Answer: The governor station will be located near CABUYAO exit inside the SLEX. Question: How strong will the explosion be if there will be occurrences of leakage? Answer: The natural gas is lighter-than-air, it will dissipate in the air in leak. There are certain conditions that need to be present for explosion to occur. Comment: There might be occurrence of leaks, the intelligent pig might not function properly. Answer: Noted the comment. Question: What magnitude of earthquake can the pipeline bear? Answer: Magnitude 8.5 to 9.0 based on Japanese Standard. Question: If there are peoples that did not allow the project, will the project push still though or not? Answer: The concerns and apprehension about the project are written in the public scoping forms.
10	January 21, 2014	STA. ROSA City	Question: Dose the city have the right to reject the project? Answer: The concerns and apprehension about the project are written in the public scoping forms. Question: What are the benefits that the LGU will get from the project? Answer: There are Social Development Program, increase revenue for the LGU and IRA. Question: What will be the benefits that regional environmental projects will get from the project? Answer: Making a study on Social Development Program. Comment: Main concern is the impact of the project on the safety and health of the people in their community. Answer: Noted the comment. The natural gas is lighter-than-air, it will dissipate in the air in leak. There are certain conditions that need to be present for explosion to occur. Question: When will the project start? Answer: The target year is 2016. Comment: The responsible organization for the construction should be able to fixed what will be demolished especially the thoroughfares and return to its original state. Answer: Noted the comment.

Source: Survey Team

2) Public consultation

After completion of Public consultation, the result will be summarized according to the table below.

Table 2.9-34 Public Consultation

No.	Date	Place	Contents of the consultation/main comments and answers
1			
2			

2.10 Operation and Effect Indicators

2.10.1 Project Objectives

The objective of this project is to attribute for introduction of natural gas and fuel conversion from oil to natural gas via the establishment of transport infrastructure from embankment place to the Manila metropolitan area where potential demand exists by the construction of natural gas pipeline, thereby contributing to sustainable development of society and economy. In most projects funded by ODA loan, output means infrastructure constructed by the project. While outcome is considered immediate effects derived from operation of infrastructure, impact is regarded as long-term and secondary effects. This framework can be applied to this project as follows:

Output: construction of natural gas pipeline
Outcome: introduction of natural gas and fuel conversion from oil to natural gas
Impact: sustainable development of society and economy

In the consideration of the above outline, the following evaluation information should be obtained for assessing the attainment of project objectives in ex-post evaluation:

Output: Completion of middle-pressured and high-pressured natural gas pipeline constructed by this project (see "2.6 Project Cost Estimate")
Outcome: Attainment of targets for Operation and Effect Indicators, Status of Qualitative Effects (see the section below).
Impact: Status of Qualitative Effects, Before/After analysis of reference indicators (see the section below).

2.10.2 Operation and Effect Indicators

Operation and Effect Indicators are chosen for the assessment of project effects after the completion of project The reference document for the ex-post evaluation of ODA loan projects "Operation and Effect Indicators Reference, 2nd Edition", which was established by JBIC in October 2002, identifies operation and effect indicators in major sectors.

For fair judgment in evaluation, it is desirable to select operation and effect indicators which directly reflect operational situation of the infrastructure built by the project and, at the same time, are not affected by factors other than the project. As data collection is a cumbersome task, it is unsustainable to establish data collection scheme on numerous indicators only for monitoring project effects. For this reason, selecting several indicators which can be collected routinely in O&M activities is appropriate. In consideration of the above arguments, appropriate operation and effect indicators are following:

Table 2.10-1 Operation and Effect Indicators

Indicator	Target	By when	Details
Operation Indicators			
Carry-out amount of natural gas	406 million Nm3/year	second year after project completion	
Operation outage time	0 hour/year	Within two years after project completion	Operation outage time is not assumed for high pressured pipeline as there are several customers.
due to human errors	0 hour/year	Within two years after project completion	
due to machine troubles	0 hour/year	Within two years after project completion	
due to planned outage	0 hour/year	Within two years after project completion	
Availability factor	100%	Within two years after project completion	(Actual operation hours / hours per annum x 100)

Effect Indicators			
Sales amount of natural gas	406 million Nm3/year	second year after project completion	Sales amount is the same amount of carry-out amount as transmission loss is not expected.
Number of industrial parks which introduce natural gas	3 industrial parks	Within two years after project completion	
Number of claims on supply stoppage from gas consumers	0 time/year	Two years after project completion	Operation outage is not expected for high-pressured pipeline. The pipeline has line pack function. Supply stoppage is not expected.

2.10.3 Qualitative Effects

In addition to the realization of targets for operation and effect indicators, the ex-post evaluation of ODA loan projects assesses the incidence of qualitative effects. The Project is expected to produce following qualitative effects:

Extension of Feeder Pipelines: As a result of the Project, PNOC and gas distributors would construct feeder pipelines (medium-pressured and low-pressured pipes) to supply for final consumers. Although the length of feeder pipelines can be measured, some issues (i.e. difficulty in setting targets, effects by factors other than the Project and cumbersome data collection of infrastructure development by gas distributors) need to be taken into account. For this reason, this effect should be regarded as one of the qualitative effects.

Investment in the Energy Sector: The Project can be a catalyst for wider use of LNG. The introduction of LNG would stimulate not only the construction of feeder pipelines but also investment in LNG related facilities such as LNG receiving terminals, supply stations for CNG vehicles and gas-fired power stations. In addition, each consumer would invest in facilities to switch from fuel oil to natural gas.

Legislation and Enhancement of Regulatory Body: In tandem with operation of natural gas pipeline, legislation on relevant fields and enhancement of a regulatory body to implement laws would be accelerated.

Reduction of CO2 Emission: The construction of natural gas pipeline, together with the construction of LNG receiving terminal, would result in energy shift from petrol and diesel oil to natural gas and, consequently, reduction of CO2 emission. As shown in the following section, reduction of CO2 emission can be estimated. However, it is quite difficult to verify a reduced amount by collecting energy shift data across numerous consumers. For this reason, this effect should be regarded as one of the qualitative effects.

2.10.4 Reference Indicators

Reference Indicators which can be obtained for the assessment of impact are mentioned below. Data for a and b are available from National Statistical Coordination Board, data for c and d are from DOE, and data for e are from PNOC. It is difficult to set targets for these indicators. Since the indicators are affected by factors other than this project, before/after analysis requires precaution at the time of ex-post evaluation.

a. Regional GDP of the Region IV-A Calabarzon (2012: PHP 108.6 billion (Current Price))
b. Employment Rate of the Region IV-A Calabarzon (2012: 91.1%)
c. Consumption of Natural Gas (2013:112,260 mmscf)
d. Implored Amount of LNG (2013: None)
e. PNOC's financial ratios (2012: ROA 4.2%, ROE 5.1%, D/E 0.22, liquid ratio 8.50)

2.11 Business Environment and Legal Status

2.11.1 Business Environment and Legal Status in Energy Sector

(1) Business Environment in Energy Sector

The Philippine government plans to reduce the country's dependency in imported oil products and coal by developing energy sources that is indigenous or naturally abundant in the country and increasing the share of green energy in both electricity and transport. However, the Asian Development Bank (ADB) predicts that despite efforts of the government, the expected growth in the economy of the Philippines and the demand for private cars and transportation (due to insufficient public transport infrastructure) will likely keep the Philippines heavily dependent on energy imports especially oil "in the foreseeable future" or at least until 2035[19].

Table 2.11-1 Philippine Government Strategy to Diversify Energy Mix

(1) To advocate immediate passage of energy laws to address the growing sectoral demand for the country; (2) To accelerate the alternative fuels programs such as biofuels, CNG, hydrogen, etc.; and (3) To encourage more private sector investments in the development and promotion of indigenous and renewable energy sources through information campaigns and investment forums, as well as through the continuous implementation of the Philippine Energy Contracting Round, a government activity by which blocks of potential energy bearing areas are bid out to interested developers.

Source: ASEAN Energy, The 3rd ASEAN Energy Outlook. Energy Supply Security Planning for ASEAN (ESSPA) 2011

In its three strategies to ensure energy security, the DOE has been most successful in its energy contracting round. So far the DOE had successfully conducted four rounds with the fifth one first half of 2014. The Philippine Energy Contracting Round 5 (PECR 5) is currently processing applications from interested parties to participate in petroleum and coal exploration contracts. A regular activity conducted by the DOE, the PECR is a transparent and competitive system for awarding service contracts to explore "blocks". PECR 4 received 11 offers for petroleum blocks and 69 bids for coal areas. The goal is to showcase the petroleum exploration opportunities in the country and to attract energy investors to develop the country's indigenous oil and gas resources. The Energy Contracting Round aim to increase the Philippines oil, gas, coal and condensate production amounting to 78.0MMB of Oil, 2,837.8BCF of Gas, 70.8MMB of Condensate and 229.9MMMT of Coal by 2030 as shown in Figure 2.11-1.

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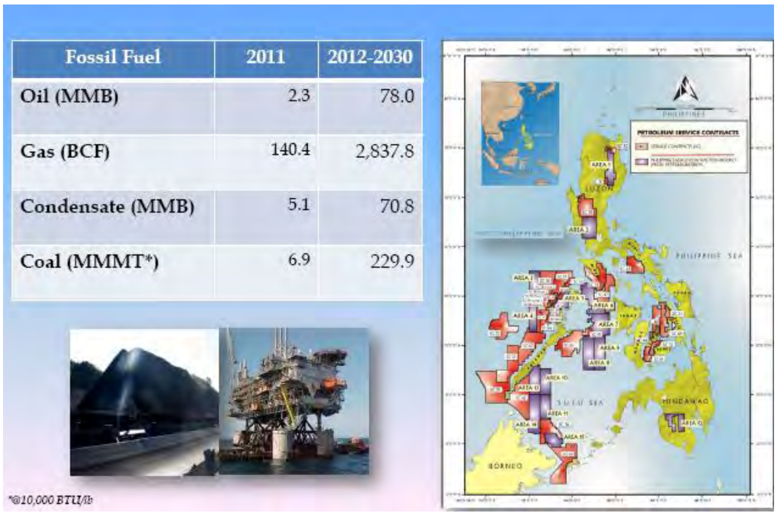
[19] http://business.inquirer.net/126791/ph-to-remain-heavily-dependent-on-oil-imports-adb#ixzz2xQcfNG9K



Fossil Fuel	2011	2012-2030
Oil (MMB)	2.3	78.0
Gas (BCF)	140.4	2,837.8
Condensate (MMB)	5.1	70.8
Coal (MMMT*)	6.9	229.9

Source: Department of Energy

Figure 2.11-1 Indigenous Energy Output Targets, PEP 2012-2030

(2) Legal Status in Private Sector Involvement in Energy – BOT Law

The Philippine BOT Law (Republic Act 7718), which revised the previous BOT Law (RA. 6957) is the basis for private sector involvement in infrastructure projects in energy, which includes the construction of natural gas pipeline. As prescribed by Sec 2 (a) and Sec 3 below:

> ***Section 2 (a):*** *The general description of infrastructure or development projects normally financed and operated by the public sector but which will now be wholly or partly implemented by the private sector, including but not limited to, power plants, highways, ports, airports, canals, dams, hydropower projects, water supply, irrigation, telecommunications, railroads and railways, transport systems, land reclamation projects, industrial estates or townships, housing, government buildings, tourism projects, markets, slaughterhouses, warehouses, solid waste management, information technology networks and database infrastructure, education and health facilities, sewerage, drainage, dredging, and other infrastructure and development projects as may be authorized by the appropriate agency/LGU pursuant to this Act.*

> ***Section. 3.*** *Private Initiative in Infrastructure. - <u>All government infrastructure agencies, including government-owned and controlled corporations (GOCC) and local government units (LGUs) are hereby authorized to enter into contract with any duly pre-qualified project proponent for the financing, construction, operation and maintenance of any financially viable infrastructure or development facility through any of the projects authorized in this Act</u>. Said agencies, when entering into such contracts, are enjoined to solicit the expertise of individuals, groups, or corporations in the private sector who have extensive experience in undertaking infrastructure or development projects.*

Sec. 3 allows government-owned and controlled corporations (GOCC) like PNOC to enter into a "contract" with a project proponent (private company) for operations and maintenance of a infrastructure project (e.g. natural gas pipeline).

The BOT Law defines the types of arrangements that the Philippine Government can enter into with the private sector in a PPP project.

Table 2.11-2 The PPP Arrangements Allowed Under Philippine BOT Law

Sec 2
(b) Build-operate-and-transfer - A contractual arrangement whereby the project proponent undertakes the construction, including financing, of a given infrastructure facility, and the operation maintenance thereof. The project proponent operates the facility over a fixed term during which it is allowed to charge facility users appropriate tolls, fees, rentals, and charges not exceeding those proposed in its bid or as negotiated and incorporated in the contract to enable the project proponent to recover its investment, and operating and maintenance expenses in the project. The project proponent transfers the facility to the government agency or local government unit concerned at the end of the fixed term which shall not exceed fifty (50) years: Provided, That in case of an infrastructure or development facility whose operation requires a public utility franchise, the proponent must be Filipino or, if a corporation, must be duly registered with the Securities and Exchange Commission and owned up to at least sixty percent (60%) by Filipinos.
(c) Build-and-transfer - A contractual arrangement whereby the project proponent undertakes the financing and construction of a given infrastructure or development facility and after its completion turns it over to the government agency or local government unit concerned, which shall pay the proponent on an agreed schedule its total investments expended on the project, plus a reasonable rate of return thereon. This arrangement may be employed in the construction of any infrastructure or development project, including critical facilities which, for security or strategic reasons, must be operated directly by the Government.
(d) Build-own-and-operate - A contractual arrangement whereby a project proponent is authorized to finance, construct, own, operate and maintain an infrastructure or development facility from which the proponent is allowed to recover its total investment, operating and maintenance costs plus a reasonable return thereon by collecting tolls, fees, rentals or other charges from facility users: Provided, That all such projects, upon recommendation of the Investment Coordination Committee (ICC) of the National Economic and Development Authority (NEDA), shall be approved by the President of the Philippines. Under this project, the proponent which owns the assets of the facility may assign its operation and maintenance to a facility operator.
(e) Build-lease-and-transfer - A contractual arrangement whereby a project proponent is authorized to finance and construct an infrastructure or development facility and upon its completion turns it over to the government agency or local government unit concerned on a lease arrangement for a fixed period after which ownership of the facility is automatically transferred to the government agency or local government unit concerned.
(f) Build-transfer-and-operate - A contractual arrangement whereby the public sector contracts out the building of an infrastructure facility to a private entity such that the contractor builds the facility on a turn-key basis, assuming cost overrun, delay and specified performance risks.
(g) Contract-add-and-operate - A contractual arrangement whereby the project proponent adds to an existing infrastructure facility which it is renting from the government. It operates the expanded project over an agreed franchise period. There may, or may not be, a transfer arrangement in regard to the facility.
(h) Develop-operate-and-transfer - A contractual arrangement whereby favorable conditions external to a new infrastructure project which is to be built by a private project proponent are integrated into the arrangement by giving that entity the right to develop adjoining property, and thus, enjoy some of the benefits the investment creates such as higher property or rent values.
(i) Rehabilitate-operate-and-transfer - A contractual arrangement whereby an existing facility is turned over to the private sector to refurbish, operate and maintain for a franchise period, at the expiry of which the legal title to the facility is turned over to the government. The term is also used to describe the purchase of an existing facility from abroad, importing, refurbishing, erecting and consuming it within the host country.
(j) Rehabilitate-own-and-operate - A contractual arrangement whereby an existing facility is turned over to the private sector to refurbish and operate with no time limitation imposed on ownership. As long as the operator is not in violation of its franchise, it can continue to operate the facility in perpetuity.

Source: RA 7718, the Philippine BOT Law Sec 2(b-j). Excerpt.

Since the Philippine BOT Law was enacted in 1990 (RA 6957) and revised in 1994(RA7718), most of the big infrastructure projects in the Philippines have been undertaken under BOT Scheme. The most recent and relevant in energy is the BOT contract of NGCP with the government (represented by the Transco) for the operations and maintenance of the national electricity transmission grid.

(3) Legal Status in Energy - Petroleum Act (excerpt)

The Philippine Petroleum Act regulates the granting of permits for pipelines and provides the legal background for a pipeline concession agreement. It is the only policy enforced that clarifies and defines pipeline parameters in the concept of public-private-partnership scheme. This law's influence in natural gas business on the definition given to "petroleum" and "natural gas" in Chapter 1, Article 2 (a) and (c).

> ***Article 2 (a):*** *"Petroleum" shall include any mineral oil, hydrocarbon gas, bitumen, asphalt, mineral wax, and all other similar or naturally associated substances; with the exception of coal, peat, bituminous shale, and/or other stratified mineral fuel deposits.*
>
> ***Article 2 (c):*** *"Natural gas" means gas obtained from boreholes and wells and consisting primarily of hydrocarbon.*

The law is useful for Batman 1 because of the regulations defining what the rights included in a pipeline concession. The law gives the Philippine government the right to give pipeline concession.

> ***Article 10 (e):*** *Pipe Line Concession, which grants to the concessionaire the right to provide and operate pipe line systems for transporting petroleum.*

The law gives the holder of concession rights over use of land – public and private for the purpose of building pipeline. The law states that the concessionaire may enter into agreements with owner or legal occupant of private lands affected by the project – if they deemed it necessary for the concession to use the said property.

> ***Article 21:*** *Easements over private land. – When easements of temporary occupancy over private lands are needed by a concessionaire for the purpose of carrying out any work essential to his operations under the provisions of this Act, he may enter into the necessary agreement with the owner or legal occupant of such private lands.*
>
> ***Article 22:*** *Easement over public land. – When easement or right of temporary occupancy over public land is needed by a concessionaire for the purpose of carrying out any work essential to his operations under this Act, such right may be granted by the Secretary of Agriculture and Natural Resources with due regard to prior rights of third parties and subject to applicable laws and regulations.*

The law serves as a guide for the DOE Circular on what rights are included in a pipeline concession.

> ***Article 85:*** *Rights conveyed under Pipe Line Concession. – A pipe line concessionaire acquires the non-exclusive right to transport petroleum, by means of, and through, a pipe line or system of pipe lines, between the sources of production and/or refining and the places defined in the Pipe Line Concession, in accordance with the provisions of this Act and the Regulations.*

The law also serves as guideline on the term duration of agreement. In this case a pipeline concession is good for 25 years.

> ***Article 87:*** *Term of Pipe Line Concession. — The term of a Pipe Line Concession shall not exceed twenty-five years counted from the date of its issuance, renewable for another twenty-five years, upon application of the concessionaire filed prior to the expiration of the original term.*

The law says that the pipeline should grant access to all subject to "rates" paid to pipeline owner.

> ***Article 86:*** *Pipe line concessionaire as common carrier. – A pipe line concessionaire shall have the preferential right to utilize his installations for the transportation of petroleum owned by him, but is obligated to utilize any remaining transportation capacity pro rata for the transportation of such other petroleum as may be offered by others for transport, and to charge without discrimination such rates as may have been approved by the Secretary of Agriculture and Natural Resources.*

The law defined the roles of Department of Agriculture and Department of Environment in the construction of petroleum pipeline. This also means for natural gas pipeline permit will be needed from these two agencies before activities such as construction are commenced.

2.11.2 Business Environment and Legal Status in Natural Gas

(1) Business Environment in Natural Gas

Part of the national government's plan for energy security includes the development of natural gas as an alternative fuel for electricity generation and for transport. Up to present, however, the natural gas industry of the Philippines is still largely underdeveloped. Natural gas has been part of electricity generation since gas reserves in Malampaya was discovered in 1992 and developed to power three natural gas-fired power stations with a total generating capacity of 2,700 megawatts to provide 40-45% of Luzon's power generation requirements in 2001. Since then no other big developments had happened to the sector, despite plans by the DOE.

The Philippine government had recently announced that the country is increasing the use of natural gas as a primary energy supply in a bid to limit the risk of climate change. President Benigno S. Aquino III said that by 2030, the share of the use of natural gas as a primary energy supply will go up to 14 percent from the current 8 percent.

The Malampaya gas field supplies all of its natural gas output for domestic consumption – about 98% of the output is used to fuel three natural gas power plants and 2% dedicated to supply the start-up natural gas transport program of the national government (e.g. plans to test-run public buses on natural gas). According to the PNOC, the two biggest issues in the current natural gas situation of the Philippines are the expected depletion of Malampaya gas reserves by 2024 and that there is no new gas discoveries in sight despite. This supply situation, with increasing clamor for more natural gas especially from the industrial sector (e.g. economic zones) has prompted many studies on Liquefied Natural Gas and its importation as proposed long-term solution to low supply versus high demand for natural gas[20].

Other than the concern over enough gas supply, the natural gas industry in the Philippines faces several regulatory and commercial challenges that stall its full development. Among these are the lacks of one policy that guide the sector and reduce the uncertainty amongst the various agencies with roles in the sector's promotion, the limited financing options for a capital-intensive industry, etc.

It is worth noting that discussion to build a natural gas pipeline has been going on for more than a decade. The idea of constructing a pipeline connecting Batangas to Manila (BatMan1) first surfaced when the gas reserves were discovered in Malampaya. The discussion never progressed to actual implementation of the pipeline due to the high cost of the project, the changing priorities of the national government and lack of regulatory clarity on natural gas. Table 2.11-3 summarizes some difficulties of pipeline development.

Table 2.11-3 Issues in Natural Gas Pipeline Development

- Lack of fiscal incentives.
- Lack of clarity in regulatory environment.
- Need for capacity development in the sector.
- Need for education, information to get stakeholders engaged in the program
- Insufficient demand in commercial and residential sectors

Source: The Philippine Natural Gas Master Plan, World Bank 2013

[20] PNOC –EC (2013) "Challenges of Commercializing Imported Natural Gas in the Philippines – How ASEAN can benefit from its experience?" Presented by Rolando V. Oliquino, Jr. , Project Manager, PNOC-Exploration Corporation. November 28-30, 2013 at Saigon Convention Center, Ho Chi Minh City, Vietnam.

(2) Legal Status in Natural Gas -The Review of the Philippines Regulatory Framework on "Natural Gas Business"

1) Executive Order (EO) No. 66 and DOE Circular

The natural gas policy dialogues in the Philippines started in 2001 when it was first discovered that there is a significant gas reserve in Malampaya and the development of the gas field commenced. To support the development of natural gas as reliable energy resource, then Philippine-president, Gloria Macapagal Arroyo signed Executive Order (EO) No. 66, which designated the Department of Energy (DOE), as the lead agency for the development of the natural gas industry in the Philippines. In support of this EO, the DOE enacted the Department Circular 2002-08-005, which now serves as the only standing policy on natural gas in the Philippines.

2) Regulations for Natural Gas Business

As the primary government agency in the development of the natural gas business in the Philippines, the Department of Energy (DOE) is tasked to work in cooperation with the Energy Regulatory Commission (ERC) which is in charge of determining the rates and pricing structure in transmission and distribution utilities. Although there are several regulations that influence the framework on natural gas business in the Philippines as shown in Table 2.11-4, there is no single law dealing with the regulation of the downstream segment of the natural gas business in the Philippines. However, the two pending bills, i.e. Philippines Gas Business Act (House Bill No. 1521) and Philippines Pipeline Act (House Bill Act No. 5477) are identified in the Philippine Congress that would, if passed in both the lower and upper houses, form the basis of the law on natural gas business in the Philippines. The entire process from House Bill draft to Law takes three to five years, depending on the political priorities of the ruling political parties. Therefore, the only standing policy and regulation in natural gas business in the Philippines is currently the DOE Circular No. 2002-08-005 (DOE Circular) which is the most recent and comprehensive regulatory framework in the development of the natural gas business in the Philippines.

Table 2.11-4 Regulations for Natural Gas Business

(1) Constituting an Inter-Agency Committee on Natural Gas Development.(Department Adm. Order No.193 (22 August 1990)
(2) An Act Creating the Department of Energy, Rationalizing the Organization and Functions of Government Agencies Related to Energy, and for Other Purposes (Republic Act no. 7638 (9 December 1992)
(3) Rules and Regulations Implementing Section 5 of DOE Act of 1992 or RA 7638(Energy Regulation ER 1-94.May,24,1994)
(4) Policy Guidelines on the Overall Development and Utilization of Natural Gas in the Philippines(DOE Circular No.95-06-006.June,15,1995)
(5) Creating the Philippine Gas Project Task Force (Executive Order No.254(30, June 1995)
(6) Department of Justice Opinion No.95,S.1988 (May,11,1988)
(7) Department Circular No.2000-03-003 (March,17,2000)
(8) Department Circular No.2000-06-010 and other several circulars in 2000
(9) Department of Justice Opinion No.95,S.2000 (June,6,2000)
(10) Designating the Department of Energy as the Lead Agency in Developing the Philippine Natural Gas Industry(18 January 2001)
(11) Rules of Practice and Procedure Before the Department of Energy (DOE Circular No.2992-07-004(31 July 2002)
(12) DOE Reorganization (Administrative Order No.38 (23 August 2002)
(13) Interim Rules and Regulations Governing the Transmission, Distribution and Supply of Natural Gas(DOE Circular No.2002-08-005(27 August 2002)

(14) Assignment of Personnel at the Natural Gas Office (DOE Special Order No.2002-12-050 (3 December 2002) (15) Implementing the Natural Gas Vehicle Program for Public Transport(Executive Order No.290 24 February 2004) (16) Guidelines on the Issuance of Certificate of Accreditation and Certificate of Authority to import under the Natural Gas Vehicle Program for Public Transport(NGVPPT)(DOE Circular No.2004-04-004(2 April 2004) (17) Enhanced Implementation of the NGVPPT and the Development of Compressed Natural Gas (CNG) Supply and Infrastructure (DOE Circular No. 2005-07-006 (5 July 2005)

Source: JICA's March 2013 pre-study report

3) Influence of Laws to DOE Circular

Developed in 2002, the DOE Circular's regulation was founded in four specific laws that affect natural gas business: (1) The Philippine Geothermal Energy, Natural Gas and Methane Gas Law (Republic Act No. 5092); (2) The Philippine Petroleum Act (Republic Act 387); (3) The Philippine Public Service Law (Commonwealth Act No. 146) and specifically (4) The Electric Power Industry Reform Act of 2001 (Republic Act No. 9136), here on referred to as EPIRA.

Table 2.11-5 Influence of Laws to DOE Circular

Regulation/ Policy	Parameters related to natural gas business
(1) The Philippine Geothermal Energy, Natural Gas and Methane Gas Law (Republic Act No. 5092)	The focus of this legislation is the development of the upstream geothermal, natural gas and methane gas industries and is one of the first legislations that mention integral function of natural gas development in the Philippines' goals of energy security and reliability.
(2) The Philippine Petroleum Act (Republic Act 387)	The Philippine Petroleum Act has specific regulations on the granting of permits for pipelines and provides the regulatory framework background to pattern a pipeline concession agreement. It is the only policy enforced that clarifies and defines pipeline parameters in the concept of public-private-partnership scheme.
(3) The Philippine Public Service Law (Commonwealth Act No. 146)	The Public Service Law defines what constitutes a "public service" and what are "public utilities" in turn becoming the main law that determines what sector of the economy that necessitates private sector participation will require a congressional approval in the form of franchise before start of business operations. **Chapter II, Section 13b:** The term "public service" includes … any common carrier, railroad, street railway, traction railway, sub-way motor vehicle, either for freight or passenger, or both with or without fixed route and whether may be its classification, freight or carrier service of any class, express service, steamboat or steamship line, pontines, ferries, and water craft, engaged in the transportation of passengers or freight or both, shipyard, marine railways, marine repair shop, [warehouse] wharf or dock, ice plant, ice-refrigeration plant, canal, irrigation system, **gas, electric light, heat**

	<u>and power water supply and power, petroleum</u>, sewerage system, wire or wireless communications system, wire or wireless broadcasting stations and other similar public services.
(4) The Electric Power Industry Reform Act of 2001 (EPIRA, Republic Act No. 9136)	While the primary purpose of EPIRA is to restructure the Philippine electricity business, the important points in the law, especially in areas of transmission, distribution utilities regulation, pricing and tariff set the pre-condition or model for regulation in the Philippine energy sector. EPIRA also crafted, revised and expanded the mandate of the DOE, giving the agency authority to develop indigenous energy sources (of which natural gas is counted), and the ERC as the quasi-judicial agency that handles all pricing and rates regulation and oversees first and foremost the distribution utilities. **<u>Sec 37</u>** The EPIRA law gives DOE the mandate in the development of natural gas pipeline pipeline. **<u>Sec. 37e(i)</u>** This law gives DOE the revised mandate to create policy that "deregulate power and energy industry" and "reduce dependency on oil-fired plants". Most importantly, the EPIRA law gives DOE the mandate to encourage private sector investments in the electricity sector and promote development of indigeneous and renewable energy sources. **<u>Sec43 (r) (u)</u>** EPIRA gives ERC the mandate to investigate acts of anti-competitive behavior, cross-ownership and abuse of market positions and the right to decide on cases over questions of rates, fees, fines and penalties.

Source: Survey Team

4) Current Discussion on Legal Framework for Natural Gas and Influence of Other Natural Gas Laws in Similar Countries

There are two current events that will influence the legal framework on natural gas business in the Philippines – the discussion on the LNG Terminal and proposed resolution of the World Bank-Lantau Group on the best possible outcome for the Philippines in the matter of developing a LNG Facility as alternative source of natural gas for business; and the current revisions being made on the DOE Circular on Natural Gas Business.

Presently, the DOE Circular is under review to strengthen its position as the only existing policy on Natural Gas Business. The revisions are suggested based on the current situation in the industry, the existing energy reform agenda of the DOE, and the lessons learned from two similar natural gas business policies in Japan and Thailand.

Table 2.11-6 Influence of Discussions to Legal Framework in Philippine Natural Gas

The World Bank-Lantau Group Discussion on LNG Hub	Currently in its second phase of public discussion and consultation, the study aims to determine the best possible resolution to the downstream degasification in natural gas that would be very important in developing the gas supply value chain in the natural gas business in the Philippines. The recommendation in the report calls for FSRU as against onshore facility, that is multi-used for purposes that include transportation, and non-power consumption for industry as well as consumption for new natural gas power plants. The study states that a strong policy on regas is required.
Thai Gas Act	This legislation is the basis for Thai's natural gas business. The law is very useful since Thailand and Philippines natural gas industry is similar in a lot of ways – both are looking to develop import as well indigenous source for gas, and is a good guideline for a natural gas industry that is starting-up. In Thailand, pipeline business is a monopoly under the state-owned PTT, and Third Party Access is not practiced, with suppliers selling to PTT directly.
Japan Gas Act	This legislation is the basis for Japan's mature natural gas business. The legislation is useful for review of DOE Circular since it is very comprehensive, covering regulations involving transportation of gas (e.g. trucking), regas, and retail consumption, including safety standards for gas equipment for industry and household use.

2.11.3 Business Environment and Legal Status in Electricity

(1) Impact of EPIRA in Private Sector Participation

1) Reform in Power Sector

Since the government of the Philippines enforced the Electric Power Industry Act of 2001 (EPIRA), private sector's participation and investments in the industry has improved. The generation sector had been deregulated since 2001, shifting market share from 90% public sector ownership to more than 95% private sector share at present (only off-grid, rural electricity generation remain in public sector, i.e., National Power Corporation's ownership and management). Meanwhile the electricity transmission sector, a natural monopoly, has transferred the business contract for operation and maintenance (O&M) of the transmission grid to a private consortium, the National Grid Corporation of the Philippines in 2008. In electricity distribution, private sector involvement has started to shift from limited market players, dominated by the utilities holding franchise agreements, to increased number of companies due to the start of retail competition and open access in 2013.

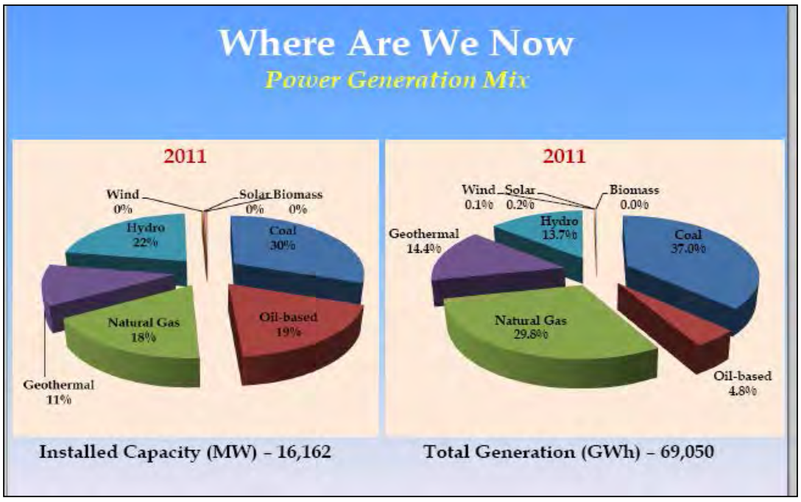
Table 2.11-7 Details in Private Sector Participation in Philippine Electricity Sector

Industry Structure	Participants
Electricity Generation	Independent Power Producers/ Generation Companies (Privately-owned) Public-owned National Power Corporation Generation Assets were privatized through public transparent bidding.
Electricity Transmission	Franchise transferred and concession contract to private consortium, the National Grid Corporation of the Philippines (NGCP).
Electricity Distribution	Privately-owned distribution companies (with franchise), Retail Electricity Supplier (RES)/ Local Retail Electricity Supplier (LRES)

Source: Survey Team (Excerpted from the interview with DOE)

2) Electricity Generation

EPIRA has been most successful in improving the Philippines' electricity generation sector. From high dependency in coal and oil, the power mix has improved, with more renewable energy in the mix.



Source: Department of Energy

Figure 2.11-2 Power Mix in Electricity Generation

Despite the successes, challenges remain. For one, electricity supply still falls below the expected demand in the next few years and very few new power plants are being built. There is also a danger that most investments are skewed to Luzon grid with little going to Mindanao and Visayas grids, both of which needed more variety in electricity generation sources. Mindanao, for instance, remains highly dependent on cheap but seasonable energy source of hydro.

(2) Legal Status in Power Sector

1) Electric Power Industry Reform Act of 2001 (EPIRA: Republic Act No. 9136)

EPIRA currently dictates the regulatory framework followed in the development of the Philippine electricity business and had been successful in encouraging private investments into the sector. Prior to the enactment of the EPIRA in 2001, there is no single law that defines all the important parameters of regulation in the Philippine electricity sector and the entry of private participants. Table 2.11-8 reviews the principal of EPIRA.

Table 2.11-8 Principals of EPIRA

Parameters	Principals of EPIRA
Defined Industry Structure	Defines industry structure broken down into components: - Section 6. Generation - Section.7. Transmission including sub-transmission - Section. 22. Distribution - Retail - Supply - Rural Electrification (Missionary) EPIRA discussion of appropriate details follows the flow of the industry structure. Thus, Generation was tackled first followed by all appropriate regulations on Transmission including the discussion of TRANSCO, etc.
Clarity in business regulations and requirements	EPIRA's discussion of the various components of the electricity sector structure contains the following for the investor: <u>Clear definition</u> of what constitutes the industry component and the degree of market competition per component. In Section. 6. Generation Sector, Section.7. Transmission Sector and Section. 22. Distribution Sector, the first line clearly states what encompass the business, whether it's a regulated business,

	competitive and open one or whether it requires a franchise and which government entity has the permitting and rate-making authority.
Delineation of Roles of DOE and Relationship with other Agencies	EPIRA clearly defines the role of the DOE in the electricity sector and its working relationship with other sector related government agencies, especially the ERC and TRANSCO, in the transmission and distribution utilities.
Guidelines in Rates and Pricing	Provisions in the rates and pricing in transmission, distribution utilities, includes wheeling charges and retail rates are subject to the authority of the ERC (Section. 19, Section. 23, Section 25) A more detailed regulatory description was released by the ERC through various IRRs in support of the EPIRA mandate on pricing, rates and tariffs.
Guidelines in Open Access/Third Party Access	Discussion on Retail Competition and Open Access is contained in Section 31 of EPIRA and supported by Department Circulars in the DOE and ERC on the topic and the IRRs (Implementation Rules and Regulations). An important component of the EPIRA discussion on open access is the conduct of business with high-volume end users (contestable market) and its adjustment mechanism to allow all end-users, particularly the households to benefit in the open access regime of electricity (gradual adjustments in the measure of contestable market subject to ERC market evaluation).
Guidelines in Competition	EPIRA expounds on the guidelines in competition by: (1) Defining scope – "No Electric Power Industry Participant or any other Person may engaged in anti-competitive behavior-or other unfair trade practices detrimental to the encouragement and protection of Contestable Markets or the WESM" (Rule II, Section 1, EPIRA IRR.). (2) Prohibition of Cross Ownership (EPIRA IRR Rule II, Section3), including limits in (3) Limits in Bilateral Supply Contracts (EPIRA IRR Rule II, Section 5) (4) The Duties and Responsibilities of the ERC regarding competition and ownership regulations
General Provisions Discussion	EPIRA includes guidelines in: (1) Reportorial Requirements (2) Joint Congressional Power Commission (3) Separation Benefits of Officials and Employees of Affected Agencies (4) Fiscal Prudence (5) Environmental Protection (6) Benefits to Host Communities (7) Review of Existing Contracts (8) Missionary Electrification (9) Electric Power Crisis Provision (10) Mandated Rate Reduction, Lifeline Rate and Cross Subsidies (11) Education and Protection of End Users

Source: Survey Team (Excerpted from Republic Act No. 9136)

EPIRA changed the way pricing is regulated in electricity sector. The energy pricing regulator in the Philippines is the Energy Regulatory Commission (ERC), formerly known as Energy Regulatory Board (ERB) prior to year 2001 and the passing of the EPIRA law. The price of electricity paid for by consumers is determined by adding the cost of electricity supply (generation charge), the transmission wheeling charge and the distribution wheeling charge. How the ERC regulates the price of electricity is enumerated in the table below.

Table 2.11-9 How ERC Regulates Price of Electricity

Generation (Supply of Electricity)	• ERC reviews the power supply contracts (PSC) of generation companies with distribution companies. ERC conducts a cost-benefit analysis of PSCs with current capital recovery rate of 16%.
Transmission	• ERC approves the wheeling charges of transmission company, NGCP. The transmission wheeling charge is computed using the performance based regulation (PBR) methodology. The ERC approves the Maximum Allowable Revenue (MAR) in the PBR. The MAR is applicable in 5-year period (called regulatory period) but can be adjusted annually. • The ERC also encourages NGCP to improve operational efficiency by setting the performance targets in the Performance Incentive Scheme (PIS) under the PBR. If NGCP performs higher than targets set in PIS, it is allowed a higher MAR. If NGCP fails to meet targets in PIS, NGCP gets lower MAR.
Distribution	• ERC approves the wheeling charges of distribution companies. The distribution wheeling charge is computed using the performance based regulation (PBR) methodology. The ERC approves on an annual basis the Maximum Allowable Price (MAP) in the PBR.
Retail Electricity Suppliers (RES)	• ERC reviews the power supply contracts (PSC) of retail suppliers with generation companies.

The following figure shows the electricity tariff structure in the Philippines.

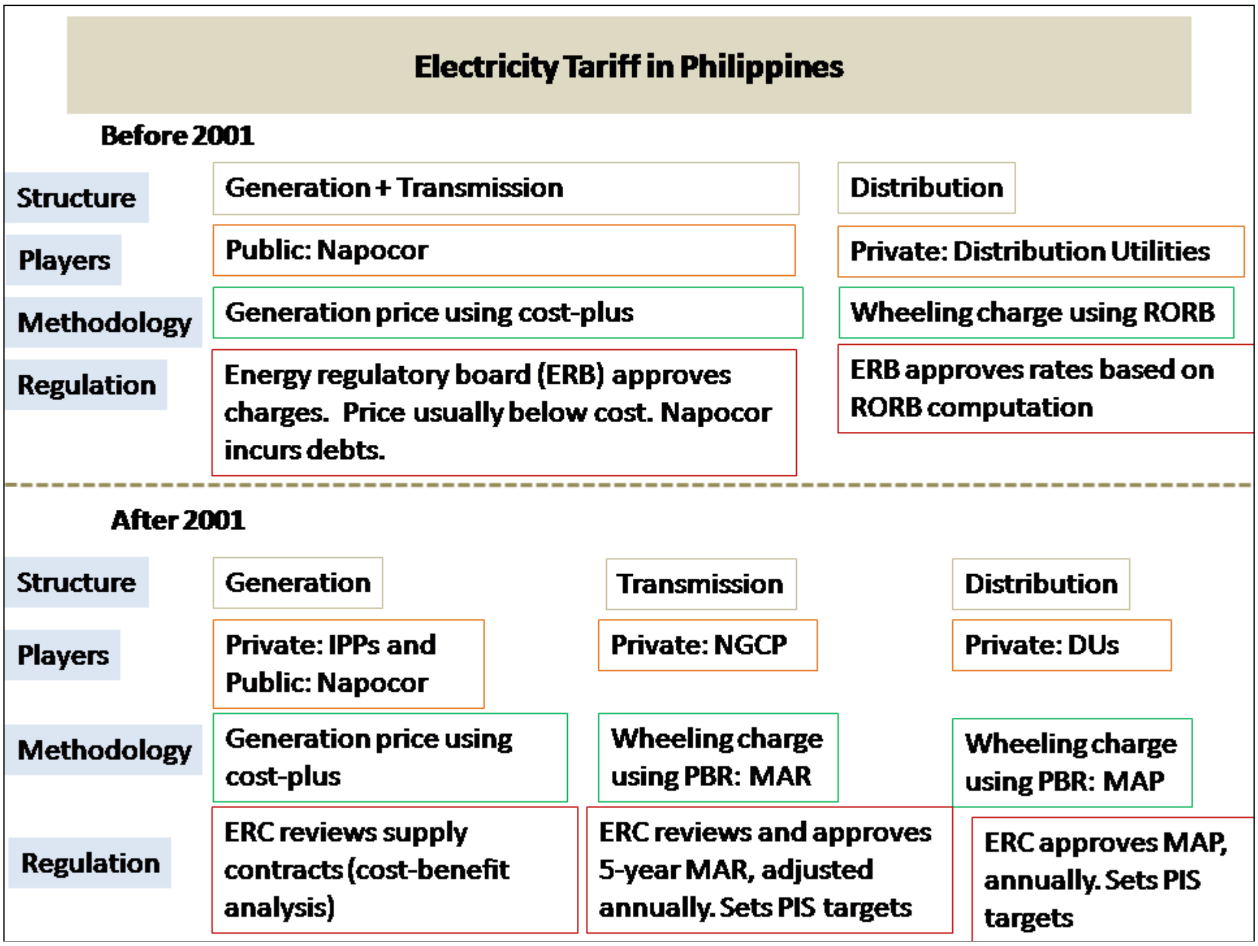


Figure 2.11-3 Electricity Tariff Structure in the Philippines

2.11.4 PPP Business Environment and Legal Status

(1) Current PPP Business Environment

It is considered that the PPP business condition has been gradually improved since the current administration took office. In case of legal frame work, Implementation Rule and Regulation (IRR) has been amended which would solve some of the bottlenecks for implementation of PPP such as clarification of direct subsidy or equity which is prohibited for unsolicited project. For financing, the recent high liquidity would help private proponents to enter the PPP project. Also, the capacity of government institution are considered to be improved by establishing PPP Center as well as by the capacity development programs which has been provided by donors such as ADB and JICA. The government of Philippines also announced to create a P30-billion contingent liability fund for the Public-Private Partnership (PPP) program, which would assure government's payment to private proponents for the liability incurred based on PPP contract[21].

The number of PPP project as of April 10, 2014 is shown as follows.

[21] The information sited from PPP website: http://ppp.gov.ph/?tag=contingent-liability-fund

Table 2.11-10 Number of PPP Projects as of April.10, 2014

Status	No.	Example of Project
Contract Award	7	Daang Hari-SLEX Link Road Project, PPP for School Infrastructure Project (PSIP) Phase I, NAIA Expressway Project
Bidding Stage	5	Cavite - Laguna (CALA) Expressway, LRT Line 1 Cavite Extension and O&M
NEDA Board Approval	4	Enhanced Operation and Maintenance of the New Bohol (Panglao) Airport
ICC-Cabinet Committee Approval	1	Laguna Lakeshore Expressway Dike-Calamba-Los Banos Toll Expressway
IC-Technical Board Approval	0	
Finalization of Project Structure	2	Regional Prison Facilities through PPP
Preparation of Business Case/Feasibility Studies	12	Integrated Luzon Railway Project- Phase 1 (North-South Commuter Rail)
Procurement of Transaction Advisor	10	Clark International Airport Project
Project under Conceptualization	1	Civil Registration System – Information Technology Project Phase II
Total	33	

*excluding three other projects for implementation
Source: PPP Center Website
http://ppp.gov.ph/wp-content/uploads/2014/04/STATUS-OF-PPP-PROJECTS_10-APRIL-2014.pdf

(2) Current Status of PPP Laws and Regulations

The BOT Law was enacted in 1990 and amended in 1994 by Republic Act No. 7718. This BOT Law was originally enacted to promote mainly private investments for power sector in order to overcome the serious power shortage in the latter half of the 1980s under Corazon C. Aquino's Administration. The Philippine BOT Law stipulates the different PPP modalities allowed, nationality restriction, PPP project approval process, solicited and unsolicited mode[22], government guarantee and support, and etc. BOT Law has not been amended since 1994; however, many issues which should be amended have been raised from various institutions and representatives of the congress. The pressure for the amendment of BOT Law has been increased after the current president Aquino's took office who admit essential role of the private sector as the main engine for national growth and development

The other legal basis of PPP in the Philippines is the "Revised Guidelines and Procedures for Entering into Joint Venture (JV) Agreement Between Government and Private Entities (herein after "2013 JV Guideline") issued by NEDA in 2013 (previous version is issued in 2008, herein after "2008 JV Guideline") pursuant to EO No. 423 dated 30 April 2005. The JV Guidelines prescribe the rules, guidelines and procedures forging JV Agreements between private entities and GOCCs, government corporate entities, government instrumentalities with corporate powers, government financial institutions, and SUCs.

2008 JV Guidelines prescribe that the head of the government entity concerned is the sole approving

[22] There are no unsolicited proposals under RA 6975. It is not provided for. The general intention of RA 7718 is to make the BOT Law (RA6975) easier and more attractive to investors. The lawmakers intended to expand the coverage and liberalize the procedure. The inclusion of Unsolicited Proposals is a major amendment from RA 6975. (Source:, A. C. Agra, et al. (2011) Knowing PPP, BOT and JV, A Legal Annotation, p. 79)

authority; however, 2013 Guideline requires the approval from the Approving Authority such as NEDA Board Investment Coordination Committee (ICC). For instance, the project that are public utilities as defined under Section 5.11 of 2013 JV Guideline with government contribution amounting One Hundred Fifty Million Pesos (PhP 150 Million) and above is required the approval from NEDA-ICC (Section 7.2 b.ii of 2013 JV Guideline). Also, 2013 JV Guideline requires that prior to submission of JV proposal to the Approving Authority, the approval from concerned entities shall be secured. For example, project which involve the formation of a JV company shall be required to secure approval from GCG pursuant to RA No. 10149, otherwise known as the GOCC Governance Act of 2011(Section 7.2.a.ii. of 2013 JV Guideline).

Another notable change is the increase of maximum Government Entity's equity contribution in the JV Company to 50% of the outstanding capital stock (Section 6.2 b.). Previously, the government entity's contribution is limited to less than 50% of the outstanding capital stock.

(3) The Difference between BOT Law and JV Guidelines

The major difference between BOT Law and JV Guidelines are the followings.

Table 2.11-11 Comparison between BOT Law and 2013 JV Guidelines

Aspects	BOT Law	JV Guidelines
Eligible PPP Modalities	Combination of Build/ Operate/ Transfer/ Lease/ Rehabilitate/ Add/ Develop/ Own/ Management/ Supply/ Construct/ Finance	Joint Venture (continuing/ ongoing concern/ operation/ management)
Approval Requirements	NEDA-ICC; OP; DOF/ DBM approvals may be required	NEDA ICC or Government Entity Concerned depending on the size of project
Finance Resources	Private Sector Proponent	Joint between Government Entity and Private Sector Proponent
Reasonable Rate of Return	Prior-to-negotiation/ comparative proposal approval by NEDA-ICC for public utility monopolies (Maximum 12%)	No requirement for imposition of Rate of Return
Conditions for Unsolicited Proposal	Requirements: New concept or technology/ not priority project; No direct government guarantee; No comparative/ competitive proposal received; NEDA-ICC clearance before negotiations	No such requirements; JV allowed for any project
Processing Period	250 to 410 days	Unkonwn

Source: Alberto C. Agra (2011) Knowing PPP, BOT and JV: A Legal Annotation devised by JICA Survey Team based on amended 2013 JV guidelines

2.11.5 Specific Legal Schemes

(1) Specific Regulations and Reviews

1) Franchise and Concession in Public Utilities

There are several Philippine regulations that define how franchise and concession agreement are applied in public utilities and the energy sector in particular (see Table 2.11-12).

Table 2.11-12 Philippine Laws in Franchise and Concession in Public Utilities

The Philippine Public Service Law (Commonwealth Act No. 146)
The Electric Power Industry Reform Act of 2001 (EPIRA: Republic Act No. 9136)
The Philippine Geothermal Energy, Natural Gas and Methane Gas Law (Republic Act No. 5092)
The Philippine Petroleum Act (Republic Act 387)
DOE Circular No. 2002-08-005 "Interim Rules and Regulations Governing the Transmission, Distribution, and Supply of Natural Gas"
First Gas Holdings Corporation Franchise Bill (Republic Act No. 8997)
MERALCO Franchise Bill (Republic Act No. 9209)
NGCP Franchise Bill (Republic Act No. 9511)

Source: Survey Team

Fundamentally, the necessity of a franchise is based on the Philippine Public Service Law (Commonwealth Act No. 146), which defines that all private sector companies involved in public service would need to get a franchise agreement (franchise bill) from the Congress of the Philippines. An entity is considered in the business of conducting a public service if it falls within the category prescribed by, Chapter II, Section 13b:

> *The term "public service" includes any common carrier, railroad, street railway,…canal, irrigation system,* ***gas, electric light, heat and power water supply and power, petroleum****, sewerage system, wire or wireless communications system, wire or wireless broadcasting stations and other similar public services.*

A legislative franchise gives authority for those who are interested to invest or do business in public services, such as the case of public utilities, in a certain geographic scope or service area (also called franchise area). Thus, among the important features of a franchise bill are the: scope of franchise, the franchise duration, and the terms and condition for retaining and renewing the franchise. Franchises are acquired through congressional approval (both house of legislature – upper and lower houses sign and approve the franchise bill given to the private party). According to the Public Service Law, a party given the legislative franchise cannot sell, mortgage, lease, merge transfer the said franchise without Congressional approval (Public Service Law, Chapter III, Section 20g).

Regarding gas business, the DOE Circular classifies the operation of Gas Transmission and Distribution Systems as a public utility operation and thus requires a franchise (DOE circular, Part II, Rule 10, Section 1). Currently, two companies hold gas franchises – the PNOC and First Gas Corporation. Rule 10, Section 2 of the DOE Circular states, that *"any person that is party to a Service Contract which authorizes the construction and/or operation of Pipelines are related facilities for transporting Natural Gas shall be required to obtain a Franchise to an extent that such pipelines are operated as public utility".* The DOE circular, Part II, Rule 10, Section 3 states that the giving of franchise to any company in the transmission, distribution and supply of natural gas is subject to the ownership restrictions of the Philippine Constitution, which states that "franchise shall only be granted to citizens of the Philippines or to corporations or associations organized under the laws of the Philippines". This means that any company looking to construct, operate the natural gas pipeline in the Philippines should have an ownership of 100% Filipino or 60% Filipino/40% Foreign ratio.

On the other hand, a concession agreement (concession) is a contract or award given by the Philippine government to a qualified entity that would finance, operate, expand, maintain and/or manage specific government-owned assets (EPIRA Chapter 1, Section 4g). It is a scheme to promote private sector participation in public utilities (a form of privatization). Because of the complexity of acquiring a franchise from Congress and because the transfer of franchise to another needs Congressional approval, the concession agreement is used to allow the faster transfer of rights (build, operate and maintain) through competitive bidding.

The DOE Circular also states that in order to meet the objectives of the Natural Gas Industry development, the DOE may recommend the bidding out of a gas project subject to existing laws and regulations (DOE Circular, Rule 12, Section 2).

(2) Third Party Access and Open Access in the Philippines

Third Party Access and Open Access in energy sector in the Philippines was introduced in EPIRA as a mechanism to improve competition and encourage investors and market participants. Third Party Access refers to the access of a third party participant that is not the transmission franchise holder and the distribution franchise holder to the transmission and distributions facilities. Meanwhile, Open Access "refers to the system of allowing any qualified person the use of transmission, and/or distribution systems and associated facilities subject to the payment of transmission and/or distribution retail wheeling rates duly approved by the ERC" (EPIRA, Chapter 1, Section 4, ll).

Third Party Access and Open Access are the two terms both suggest that no energy transmission and distribution infrastructure owner can deny use of its facilities to a qualified person, entity or group. The qualified person, entity, or group is defined as all Wholesale Electricity Spot Market or WESM participants, Transco or the business entity with transmission franchise, in the current case, NGCP, distribution utilities, economic zones, suppliers, independent power producers, market operator WESM, end-users in contestable markets, high volume users [23] (EPIRA IRR, Rule12, Section2). Refusal of utilization is punishable under Philippine law.

Open access in the Philippines started in July 2013, upon the declaration of the ERC that all pre-conditions have been met, with initial participants numbering 239, which includes Meralco's subsidiary MPower.

Under open access, the generation companies or the retail electricity supplier (RES) will transact with the distribution utility on behalf of the contestable customer for the Distribution Wheeling Service. The distribution utility shall be responsible for procuring and charging for Transmission Wheeling Service on behalf of the contestable customers that are connected to the distribution network. The RES will handle the provision of billing, settlement and collection services in behalf of its customers. The contract therefore is between the RES and the contestable market end-user, with the RES taking the role of the distribution utility in the captive market. The relationship between the end-user and the distribution utilities is defined by a connection agreement and is limited to the use of the distribution utilities lines.

(3) Service Provider Regulation

The only regulation that currently exists on service provider for natural gas or distribution is the few items in the DOE Circular that covers which government agency has authority to grant permit to operate, infrastructure to be used, the service obligations of gas distribution utilities and provision on distribution-related facilities.

[23] Defined as all electricity end-users with a monthly average peak demand of at least one megawatt (1MW) for the preceding twelve months (EPIRA, Chapter II, Section 31 (e). These are typically the commercial and industrial users, after two years of start of open access, the law dictates that ceiling brought down from 1MW to 750 KW to allow high-volume consumers to participate, after five years another reduction until it reaches household levels.

(4) Pricing and Billing Structure

1) Gas Pricing

Currently, there is no policy on natural gas pricing, and the computation of gas tariff rates and wheeling charges in the Philippines. The DOE Circular, however, assumes a policy in gas prices and explicitly states that gas tariff rates and prices are to be "just and reasonable" (DOE Circular, Part 3. Rule 15.Section 3). The DOE role in relation to gas pricing and tariff is to ensure gas prices are competitive, energy value of gas sold to consumers is of standard, and prices of products and services in competitive markets are deregulated (DOE Circular Part 3. Rule 15.Section 2). Ensuring that gas prices and tariffs are "just and reasonable" and "competitive" are grounded on several policies that dictate the mandate of the DOE, as the lead agency in-charge of the development of the natural gas industry (Department of Energy Act, Section 2, Section 4, 5(a) and 5(b)).

In the absence of a policy on natural gas pricing it is not known how to measure and compute for the just, reasonable and competitive rates. However, the Philippine electricity sector provides possibilities on how to determine tariffs and wheeling charges. There are several regulations and policies on the determination of rates and wheeling charges in electricity transmission and distribution.

Table 2.11-13 Regulations determining electricity price and wheeling charges

(1) Republic Act No. 9136, Electric Power Industry Reform Act of 2001, Chapter II: Organization and Operation of the Electric Power Industry, Section 24: Distribution Wheeling Charges, Section 25: Retail Rate, Section 26: Distribution Related Business; Section 29, Supply Sector; and Section 36: Unbundling of Rates and Functions.
(2) Republic Act No. 9136, Electric Power Industry Reform Act of 2001, Implementing Rules and Regulations (IRR)
(3) Republic Act No. 9136, Electric Power Industry Reform Act of 2001, Distribution Code
(4) Republic Act No. 9136, Electric Power Industry Reform Act of 2001, The Philippine Grid Code
(5) Energy Regulatory Commission's Rules for Setting Distribution Wheeling Rates for Privately Owned Electricity Distribution Utilities Operating Under Performance Based Regulation, 01 December 2009
(6) Energy Regulatory Commission, Rules for Setting Transmission Wheeling Rates for 2003 to around 2027 ERC Case no. 2009-xx, 16 September 2009
(7) ERC CASE NO. 2012-109 RC Decision. Dated December 2, 2013. In the matter of the application for the MAR for CALENDAR YEAR (CY) 2013 and the PIS.

Source: Survey Team

The current methodology to determine tariff rates and wheeling charges in the electricity transmission and distribution sector is the performance based regulation (PBR) wherein the "just and reasonable" and competitive rates is determined using the Maximum Allowable Revenue (MAR) for transmission companies and the Maximum Allowable Price (MAP) for distribution companies.

The MAR determines the average price per kilowatt hour that the transmission can charge its customers. The computation for MAR in transmission is expressed in this formula[24]:

[24] ERC Rules in Setting Transmission Wheeling Rates, Article III Section 3.2, and Article IV Section 4.2

$$MAR_t = [MAR_{t-1} \times \{1 + CWI_t - X\}] - K_t - RBR_t$$

MAR_t	MAR for the applied regulatory period
MARt-1	Approved MAR of the previous regulatory period
CWI_t	Currently, this stands at 3.0265%
X	Efficiency factor. Currently at 3%
K_t	Correction for revenue over or under-recovery in previous year.
RBR_t	Net Income from allied business (if any). Presently, NGCP, the Philippine electricity transmission utility has none.

The Maximum Allowable Price in Distribution is computed using this formula:

$$MAP_t = [MAP_{t-1} \times \{1 + CWI_t - X\}] + S_t - K_t - ITA_t$$

MAP_t	MAP for the applied regulatory period
MAPt-1	Approved MAP of the previous regulatory period
CWI_t	Currently, this stands at 3.0265%
X	Efficiency factor. Currently at 3%
S_t	Performance Incentive Factor for regulatory year
K_t	Correction for revenue over or under-recovery in previous year.
ITA_t	Tax adjustment to adjust for over or under recovery of the corporate income tax in regulatory year t

The return on rate base (RORB) is the methodology used to compute for the wheeling charge in the electricity sector in the Philippines prior 2001. The RORB has a simple computation:

$$\textbf{RORB} = \textbf{Rate of Return (ROR)} \times \textbf{Rate Base} \times \textbf{Operating Expense} \times \textbf{Depreciation} \times \textbf{Taxes}$$

Rate Base	Rate Base is the sum of the net fixed assets in service (Property, Plant and Equipment less Accumulated Depreciation), Allowance for Working Capital, Plant Held for Future Use, Construction Work Progress (CWIP) and Materials and Supplies Inventory.
Rate of Return	The allowable return on investment. Currently, Philippine law peg this rate of return at 12%.

It adds all the assets of the transmission or distribution company (rate base) and multiple this value against an allowable rate of return (ROR). The permitted assets included in the computation of rate base are defined by the ERC and EPIRA, and is re-assessed in value once every three years of business operation. The rate of return (ROR) is also determined by law. In the Philippines, this allowable ROR was fixed at 12% based on Executive Order. 86.

In 2001, the Philippines shifted to PBR to encourage private transmission and distribution companies to fix efficiency problems in the existing electricity transmission and distribution grids. However, the issue, whether RORB is more practical than PBR, is under discussion. The ERC is currently reviewing if the Philippines electricity sector will return to RORB methodology.

Pricing regulation in natural gas falls within the mandate of the ERC and it is thus expected that the ERC will be the main regulatory agency on natural gas pricing regulation. However, the DOE also serve a very important role of promoting the natural gas business to encourage more market players and investments, especially in the supply point, i.e. LNG terminal including FSRUor FSU[25], to improve competition and get to a price level that is affordable to consumers while giving investors

[25] Floating Storage Regasification Unit or Floating Storage Unit

reasonable rate of returns.
The RORB methodology used in the early years of Philippine electricity sector is the proposed methodology for natural gas transmission and distribution wheeling charge computation. The RORB is preferred for natural gas industry because it is at its early development stage wherein, performance incentives for better operational efficiency are not as relevant. In addition, RORB is widely accepted and used globally in energy sectors and easier to understand in terms of computation for investors and gives long-term predictability in expected revenue.

Table 2.11-14 Advantages of RORB versus PBR

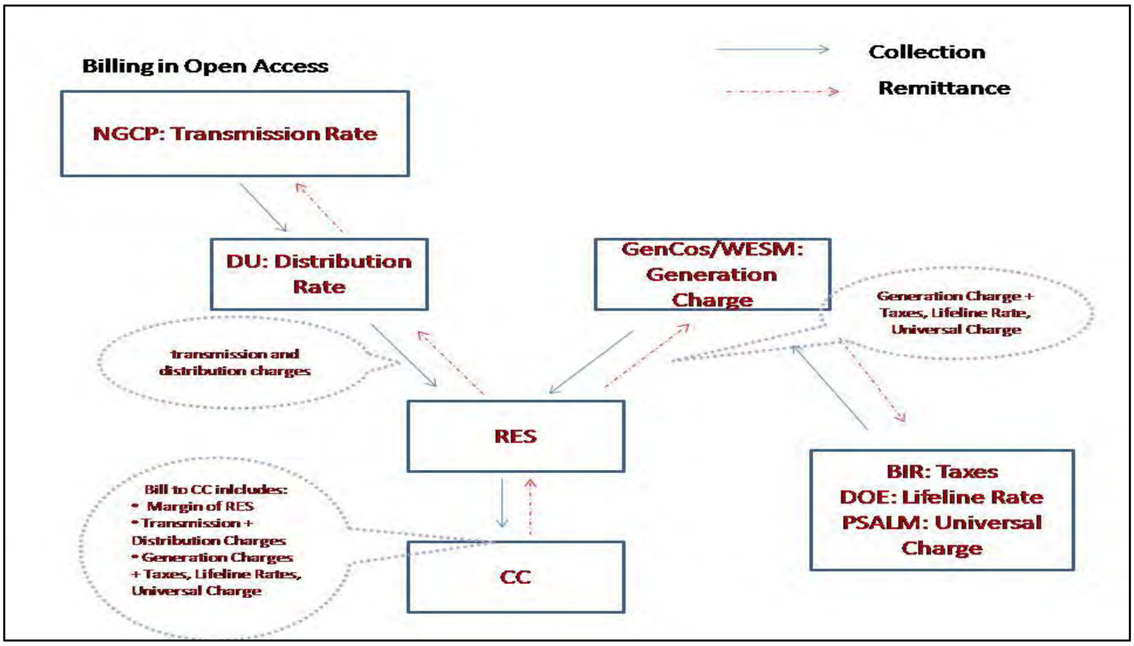
Rate of Return Base Methodology	Performance Base Regulation Methodology
Advantages: • Revenue level is predictable since the rate base is clearly defined and adjusted every 3 years, and rate of return is already fixed. • Simpler computation.	Advantages: • Encourage investments in expansion in mature markets where inefficiency in system is a big problem. • Gives investors the chance to earn more if it is very efficient under the PIS.
Disadvantages: • Does not encourage more investments in expansion and operation efficiency if infrastructure is already existing. • Since rate of return is fixed, this might discourage some market players to enter the market.	Disadvantages: • Actual revenue is not predictable since adjustments in MAR/MAP are done based on hitting targets under PIS. • Computation is a lot complicated versus RORB.

2) RCOA/ Billing Framework in Electricity Transmission and Distribution

Third party access is mandated in natural gas business in the Philippines. Therefore, a focus on open access scheme of electricity business is reviewed as follows:
The most important recent development in the transmission and distribution electricity business in the Philippines is the onset of retail competition and open access (RCOA) in June 2013. While privately owned utilities dominated electricity distribution even before EPIRA, entry barriers were high for private investors due to difficulty of gaining a distribution franchise which necessitated Philippine congressional approval. The limited players in electricity distribution and limited competition were identified by the DOE as one of the reasons for the inefficiencies in electricity distribution and high prices of electricity[26]. RCOA allows other private sector investors to participate in distribution business as a licensed retail electricity supplier (RES) reducing entry barriers such as high investment cost for putting up distribution facilities and need for congressional franchise.

According to the ERC, out of the 963 Contestable Customers or qualified electricity end-users (consuming 1MW and above), 263 have signed live retail supply contracts (RSCs) and have participated in RCOA since it was launched. There are at present, 17 licensed RES, 21 authorized local RES, and 27 appointed SOLRs (Suppliers of Last Resorts). RCOA creates a new business framework in electricity distribution in the Philippines. In billing process for instance, business possibilities are now open for private companies to participate as metering devices providers for RES. The new business framework in RCOA, billing process under open access is reviewed in Figure 2.11-4.

[26] http://www2.doe.gov.ph/FAQ%27S/power%20restruc.htm



Source: Excerpted by Survey Team from interview with ERC Philippines

Figure 2.11-4 Billing Framework in RCOA

Since third party access is mandated in natural gas business in the Philippines, we recommend the duplication of the billing framework similar to RCOA but adopted to natural gas business.

(1) Comparison among Natural Gas Business Regulations in the Philippines, Japan and Thailand

Recognizing the importance of the DOE Circular as the only existing policy that instructs and defines the regulatory framework of the natural gas business in the Philippines, the DOE is planning to update and revise the DOE Circular written in 2002 to encourage more private sector participation and investments. In order to determine what changes and improvements are relevant to the DOE Circular, comparison of the policy with three legislations, Republic Act No. 9136, Electric Power Industry Reform Act of 2001(EPIRA), the Japanese Gas Act and the Thai Gas Act, has been completed.

1) DOE Circular and EPIRA

Comparison with EPIRA is a good guideline for revisions in the DOE Circular. EPIRA currently dictates the regulatory framework followed in the development of the Philippine electricity business and had seen successes in encouraging private sector investments into the sector. Prior to the enactment of the EPIRA in 2001, there is no one law that defines all the important parameters of regulation in the Philippine electricity sector and the entry of private sector participants.

Table 2.11-15 Comparison DOE Circular and EPIRA

Parameters	DOE Circular	EPIRA
Defined Industry Structure	Focus is: ✓ Transmission (Rule 6) ✓ Distribution (Rule 7) ✓ Supply (Rule 9) Not included: Commercial Gas Business (transport, commercial, industrial and	Defines industry structure broken down into components: ✓ Generation ✓ Transmission including sub-transmission ✓ Distribution ✓ Retail

	household use). Yet in Rule 12, Section 5 discussion over pipeline mentioned petroleum operations.	✓ Supply ✓ Rural Electrification (Missionary) EPIRA discussion of pertinent details follows the flow of the laid out industry structure. Thus, Generation was tackled first followed by all pertinent regulations on Transmission including the discussion of TRANSCO, etc.
Clarity in business regulations and requirements	Descriptions on requirements are brief. For instance, Rule 6. Transmission Sector – is a short two-liner sentence containing only one significant information for potential investors, "The Transmission of Natural Gas by Gas Transmission Utilities is subject to the permitting authority of the DOE". This is followed by the statement, "The DOE may determine additional functional and physical standards that shall distinguish Transmission from Distribution. The discussion for both distribution and supply sector contains more information including the universal service obligations of gas distribution utilities (Rule 7, Section 3). Unlike in EPIRA, the mention of the franchise requirement is found in Rule 10, separate from the discussion of the sector component. The Franchise requirement discussion under the DOE Circular, however, is better than EPIRA with the inclusion of the Philippine Ownership Restrictions and Cross-ownership.	Descriptions of requirements, restrictions and supervising authority is clearly laid out and defined. EPIRA's discussion of the various components of the electricity sector structure contains these important information for the investor: <u>Clear definition</u> of what constitutes the industry component and the degree of market competition per component. In Sec. 6. Generation Sector, Sec.7. Transmission Sector and Section 22. Distribution Sector, the first line clearly states what encompass the business, whether it's a regulated business, competitive and open one or whether it requires a franchise and which government entity has the permitting and rate-making authority.
Guidelines in Rates and Pricing	Provisions in rates and pricing are mentioned in Part I, Rule 4, Section 3 and Rule 15. The DOE Circular is clear that the rates and prices of piped gas to be charged by duly franchised gas companies that distribute gas by means of underground pipe system shall remain the responsibility of the ERC. (Rule15, Section 1). Rule 15, Section 2 defines the parameters of DOE's involvement in pricing. It is not clear whether the rates and pricing mechanism for transmission and other sector component will also be subject to the rate-making responsibility of the ERC. It is also not clear whether the rates and prices mentioned under ERC jurisdiction covers wheeling charges and retail rates.	Provisions in the rates and pricing in transmission, distribution utilities, includes wheeling charges and retail rates are subject to the authority of the ERC (Sec. 19, Sec. 23, Sec 25) A more detailed regulatory description was released by the ERC through various IRRs in support of the EPIRA mandate on pricing, rates and tariffs.

Guidelines in Open Access/Third Party Access	The DOE Circular provides details Third Party Participation in Gas Transmission and Gas Distribution. Similar to the Retail Competition and Open Access Discussion in EPIRA, Rule 11 in the DOE Circular contains majority of the important points and investors needs to know regarding Third Party Access. Annex 2 of the DOE Circular goes into the details for access conditions for pipelines. The DOE Circular, however, should reiterate as in EPIRA the need for a separate IRR or policy that govern Third Party Access detailing for instance the accounting mechanism (billing and charging) and process for settling disputes.	Discussion on Retail Competition and Open Access is contained in Sect 31 of EPIRA and supported by Department Circulars in the DOE and ERC on the topic and the IRR. An important component of the EPIRA discussion on open access is the conduct of business with high-volume end users (contestable market) and its adjustment mechanism to allow all end-users, particularly the households to benefit in the open access regime of electricity (gradual adjustments in the measure of contestable market subject to ERC market evaluation).
General Provisions Discussion	The DOE Circular includes in its guidelines the rules on: (1) Transitory provisions; (2) Reportorial Requirements; (3) Offenses and Penalties; (4) Standards for Construction, Operation and Safety (5) Environmental Protection.	EPIRA includes guidelines in: (1) Reportorial Requirements (2)Joint Congressional Power Commission (3) Separation Benefits of Officials and Employees of Affected Agencies (4) Fiscal Prudence (5) Environmental Protection (6) Benefits to Host Communities (7) Review of Existing Contracts (8) Missionary Electrification (9) Electric Power Crisis Provision (10) Mandated Rate Reduction, Lifeline Rate and Cross Subsidies (11) Education and Protection of End Users

Source: Survey Team

2) DOE Circular and Natural Gas Business Law in Japan

The DOE Circular is compared to the Japan Natural Gas Business Law which is a comprehensive legislation pertaining to natural gas development. The Japan Gas Business Act No. 51 is the main regulation framework for the gas business in Japan. The policy covers in particular: (1) regulations in construction of gas infrastructures, (2) maintenance and operation of gas facilities and (3) manufacturing and sale of gas equipment.

3) DOE Circular and the Gas Law in Thailand

The comparison of the DOE Circular and the Thai Gas Act of 2007 yields interesting results since the Thai legislation governs both the electricity and natural gas industries in Thailand. The coverage of the Thai legislation is vast including electricity generation, procurement, transmission, distribution and control of systems while pertaining to natural gas it focus on transmission which is defined as including storage and transformation from liquid to gas, procurement and wholesale, or retail of natural gas via a Natural Gas Distribution System, exclusive of natural gas industry operation in transportation sector.

2.11.6 Items Reviewed for Improvement

(1) Comparison among Natural Gas Business Regulations in the Philippines, Japan and Thailand

Recognizing the importance of the DOE Circular as the only existing policy that instructs and defines the regulatory framework of the natural gas business in the Philippines, the DOE is planning to update and revise the DOE Circular written in 2002 to encourage more private sector participation and investments. In order to determine what changes and improvements are relevant to the DOE Circular, comparison of the policy with three legislations, Republic Act No. 9136, Electric Power Industry Reform Act of 2001(EPIRA), the Japanese Gas Act and the Thai Gas Act, has been completed.

1) DOE Circular and EPIRA

Comparison with EPIRA is a good guideline for revisions in the DOE Circular. EPIRA currently dictates the regulatory framework followed in the development of the Philippine electricity business and had seen successes in encouraging private sector investments into the sector. Prior to the enactment of the EPIRA in 2001, there is no one law that defines all the important parameters of regulation in the Philippine electricity sector and the entry of private sector participants.

Table 2.11-16 Comparison DOE Circular and EPIRA

Parameters	DOE Circular	EPIRA
Defined Industry Structure	Focus is: ✓ Transmission (Rule 6) ✓ Distribution (Rule 7) ✓ Supply (Rule 9) Not included: Commercial Gas Business (transport, commercial, industrial and household use). Yet in Rule 12, Section 5 discussion over pipeline mentioned petroleum operations.	Defines industry structure broken down into components: ✓ Generation ✓ Transmission including sub-transmission ✓ Distribution ✓ Retail ✓ Supply ✓ Rural Electrification (Missionary) EPIRA discussion of pertinent details follows the flow of the laid out industry structure. Thus, Generation was tackled first followed by all pertinent regulations on Transmission including the discussion of TRANSCO, etc.
Clarity in business regulations and requirements	Descriptions on requirements are brief. For instance, Rule 6. Transmission Sector – is a short two-liner sentence containing only one significant information for potential investors, "The Transmission of Natural Gas by Gas Transmission Utilities is subject to the permitting authority of the DOE". This is followed by the statement, "The DOE may determine additional functional and physical standards that shall distinguish Transmission from Distribution. The discussion for both distribution and supply sector contains more information including the universal service obligations of gas distribution utilities (Rule 7, Section 3). Unlike in EPIRA, the mention of the franchise requirement is found in Rule 10, separate from the discussion of the sector component. The Franchise requirement discussion under the DOE Circular, however, is better than EPIRA with the	Descriptions of requirements, restrictions and supervising authority is clearly laid out and defined. EPIRA's discussion of the various components of the electricity sector structure contains these important information for the investor: Clear definition of what constitutes the industry component and the degree of market competition per component. In Sec. 6. Generation Sector, Sec.7. Transmission Sector and Section 22. Distribution Sector, the first line clearly states what encompass the business, whether it's a regulated business, competitive and open one or whether it requires a franchise and which government entity has the permitting and rate-making authority.

	inclusion of the Philippine Ownership Restrictions and Cross-ownership.	
Guidelines in Rates and Pricing	Provisions in rates and pricing are mentioned in Part I, Rule 4, Section 3 and Rule 15. The DOE Circular is clear that the rates and prices of piped gas to be charged by duly franchised gas companies that distribute gas by means of underground pipe system shall remain the responsibility of the ERC. (Rule15, Section 1). Rule 15, Section 2 defines the parameters of DOE's involvement in pricing. It is not clear whether the rates and pricing mechanism for transmission and other sector component will also be subject to the rate-making responsibility of the ERC. It is also not clear whether the rates and prices mentioned under ERC jurisdiction covers wheeling charges and retail rates.	Provisions in the rates and pricing in transmission, distribution utilities, includes wheeling charges and retail rates are subject to the authority of the ERC (Sec. 19, Sec. 23, Sec 25) A more detailed regulatory description was released by the ERC through various IRRs in support of the EPIRA mandate on pricing, rates and tariffs.
Guidelines in Open Access/Third Party Access	The DOE Circular provides details Third Party Participation in Gas Transmission and Gas Distribution. Similar to the Retail Competition and Open Access Discussion in EPIRA, Rule 11 in the DOE Circular contains majority of the important points and investors needs to know regarding Third Party Access. Annex 2 of the DOE Circular goes into the details for access conditions for pipelines. The DOE Circular, however, should reiterate as in EPIRA the need for a separate IRR or policy that govern Third Party Access detailing for instance the accounting mechanism (billing and charging) and process for settling disputes.	Discussion on Retail Competition and Open Access is contained in Sect 31 of EPIRA and supported by Department Circulars in the DOE and ERC on the topic and the IRR. An important component of the EPIRA discussion on open access is the conduct of business with high-volume end users (contestable market) and its adjustment mechanism to allow all end-users, particularly the households to benefit in the open access regime of electricity (gradual adjustments in the measure of contestable market subject to ERC market evaluation).
General Provisions Discussion	The DOE Circular includes in its guidelines the rules on: (1) Transitory provisions; (2) Reportorial Requirements; (3) Offenses and Penalties; (4) Standards for Construction, Operation and Safety (5) Environmental Protection.	EPIRA includes guidelines in: (1) Reportorial Requirements (2)Joint Congressional Power Commission (3) Separation Benefits of Officials and Employees of Affected Agencies (4) Fiscal Prudence (5) Environmental Protection (6) Benefits to Host Communities (7) Review of Existing Contracts (8) Missionary Electrification (9) Electric Power Crisis Provision (10) Mandated Rate Reduction, Lifeline Rate and Cross Subsidies (11) Education and Protection of End Users

Source: Survey Team

2) DOE Circular and Natural Gas Business Law in Japan

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3) DOE Circular and the Gas Law in Thailand

The comparison of the DOE Circular and the Thai Gas Act of 2007 yields interesting results since the Thai legislation governs both the electricity and natural gas industries in Thailand. The coverage of the Thai legislation is vast including electricity generation, procurement, transmission, distribution and control of systems while pertaining to natural gas it focus on transmission which is defined as including storage and transformation from liquid to gas, procurement and wholesale, or retail of natural gas via a Natural Gas Distribution System, exclusive of natural gas industry operation in transportation sector.

2.11.7 Items Reviewed for Improvement in the DOE Circular

The general observation after comparing the DOE Circular with the several legislations is that needs to be expanded to cover gaps in relevant information needed to encourage investments in the natural gas industry while maintaining fair competition and achieving greater energy self-sufficiency that would serve the interests of the related stakeholders

The suggestions for possible changes in the content of the DOE Circular are based on the following reasons:

- Revisions to make sure that the circular is in line with DOE's Reform Agenda (ERA). The DOE's ERA is significant because it shows the three priorities of the agency: (1) ensure energy security, (2) Achieve Optimal Energy Pricing; and (3) Develop Sustainable Energy System.
- Revisions are based on the practical lessons from the study of Thai Gas Act and Japan Gas Act. The two legislations are relevant for the Philippines because Japan has a comprehensive and mature natural gas business while Thailand is most similar to the Philippines since natural gas business is relatively new and gas supply is both sourced domestically and imported.
- Suggestion for revision takes into consideration existing laws and regulations on natural gas business in the Philippines and other laws that affect natural gas business and the mandate of DOE, as regulator of natural gas business.

The suggestions below are for possible changes in the content of the DOE Circular. Nevertheless, the actual wording should be considered in future projects and should be adapted to Philippine situation.

Table 2.11-17 Reviewed Items for Improvement in DOE Circular

Section	Direction for Revision	Reviews
Part 1. General Provisions		
Rule 1. Title and Scope	No change. Suggestion to review section after changes in other section content to ensure that everything is covered.	• No change.
Rule 2. Declaration of Policy	Should cover the three priority energy reform agenda of the DOE - (1) ensure energy security, (2) Achieve Optimal Energy Pricing; and (3) Develop Sustainable	• Add a statement specific to achieving optimal energy pricing that would lead to energy security and sustainability.

	Energy System.	
Rule 3. Responsibilities of the DOE	Should cover the three priority energy reform agenda of the DOE - (1) ensure energy security, (2) Achieve Optimal Energy Pricing; and (3) Develop Sustainable Energy System.	• Expound on Rule 3(b): Add a few lines relevant to an entity looking into investing/participating in natural gas development in the Philippines before ending with, “All other measures allowed under existing laws”. Possibilities include: ✓ Role of DOE as regulator of natural gas requiring natural gas transmission, distribution franchisees or pipeline concessionaires to submit a development plan to the DOE. Examples can be seen in Japan Gas Act, Article 25 and EPIRA’s mandate to electricity transmission and distribution companies on development plan. ✓ Include a statement that reiterates that natural gas transmission and distribution participants have the duty to “inform and seek approval” with the DOE on important matters such as changes in leadership and ownership, safety and inspection guidelines, plans to expand or add capacity. ✓ Mention the DOE role as facilitator of LGU concerns for natural gas investors. • Add a section that describes the working relationship of DOE with other relevant government agencies involved in the natural gas development – e.g. ERC as the rates-making authority, the DOF for incentives especially in supply of gas, etc. A statement referring to EO 66 that mandates “all relevant agencies should work together in the development of natural gas business in the Philippines” should also be included.
Rule 4. Measurement of Natural Gas	As part of developing a sustainable energy system, this regulation should allow for future progress in natural gas technology.	• Add a section that allows the DOE to change the technical specifications based on technology advancement in natural gas.
Part II. Structure and Operation of the Natural Gas Industry		
Rule 6. Transmission Sector Rule 7. Distribution	Revisions based on the priority goal of ensuring energy security.	• What constitutes a natural gas transmission/ distribution/ supply must be clearly defined and the

Rule 8. Transmission and/or Distribution Related Facilities		requirements for operations in each sector. In EPIRA, Japan Gas Act and Thai Gas Act, the sectors contain the following relevant items: ✓ <u>Clear definition</u>: In Thai Gas Act, Natural Gas Transmission has this clear-cut definition at the start of discussion, "a pipeline system used for receiving natural gas from a natural gas purchasing point and for transmitting it to a natural gas distribution point or a Natural Gas Distribution System or power plants of the Electricity Generating Authority of Thailand or power plants of Independent Power Producers, including equipment or any other thing necessary for receiving and transmitting natural gas." (Section 5) ✓ <u>Inform primary requirement for start of business operations:</u> what encompass the business, whether it's a regulated business, competitive and open one or whether it requires a franchise and which government entity has the permitting and rate-making authority. (See EPIRA) • Details the general business provisions in the natural gas business and includes: ✓ Where and How to Get Business License ✓ Terms and Conditions of the Business License ✓ Obligations tied to License including obligations to supply immediately, obligations not to be discriminatory in supply and obligations to inform the government of changes, transfers of ownership and leadership in company operations or company information that may impact business operations. • Details in Setting of Tariff Rates, Pricing and Wheeling Charges. Similar to EPIRA, there must be a line or two discussing the authority to set rates, the right of the gas transmission and distribution utility to charge wheeling

		charges and under what circumstances and the provision that a separate IRR or circular will be released to determine the computation/methodology for pricing. In EPIRA, the use of RORB or a methodology that is better suited was already included. The same stating the use of PBR may also be added in each sector discussion on gas transmission and distribution. • Add the provision for the submission and approval of a gas transmission and distribution plan. • Add provision on safety regulation, inspection and maintaining safety in gas transmission and gas distribution.
Rule 9. Supply Sector	To ensure a sustainable and complete energy system, all components in the natural gas value chain should be covered in the DOE Circular.	In Japan Gas Act, the regulations on transportation of gas supply including trucking and trading is included in the policy. This should also be the case in the DOE Circular. • Add discussion on regulations on transport of supply. • Add regulation on the importation of supply • Add regulation on the export of gas supply • Add regulation on qualifications of participants eligible for transport, importation and export of gas supply. • Add regulation on approval mechanism with DOE regarding supply sector transport, import and export. • Add regulation and discussion on terminal or retail gas
	To ensure a sustainable and complete energy system, all components in the natural gas value chain should be covered in the DOE Circular.	In Japan Gas Act, regulations on equipment and natural gas appliances is also included this should likewise be included in the DOE Circular. • Add regulation on appliances and equipment used on natural gas, should include safety product standards, etc.
Rule 11. Third Party Access	Encouraging market participants will achieve the goal of energy security as well as optimal energy pricing for all.	• Add a section on third party contracts, regulatory mechanism, including approval, review and evaluation. • Add a section on third party rates and pricing. • Add provision on third party access to serve large-volume users.
Rule 14. Standards for Construction, Operation and Safety	Safety standards should be set as part of developing a sustainable energy system.	• Elaborate on the maintenance, operations and safety in gas infrastructures. A possibility is the inclusion of the following found in the Thai Gas Act and Japan Gas Act:

		✓ qualifications to ensure that the government does not "unnecessarily burden market players and limit or hinder competition" and regulations on: ✓ Guidelines for self-inspection – how frequent and reporting requirements. ✓ Guidelines for on-site inspection of DOE ✓ Standards of equipment used. ✓ Licensing of inspection agents ✓ Burden of maintenance, repair and ensuring efficient operations is in the operator. ✓ Grounds for revoking license and business permit.
Rule 15. Natural Gas Pricing	Should be made based on the principles of attracting investors to invest in the natural gas business as part of the energy security plan, with proper consideration to reaching an optimal energy pricing for all.	• Could include these guidelines found in the Thai Gas Act but revised in Philippine setting: To provide the important guidelines for tariff regulations: (1) should reflect the actual cost and take into account the reasonable return on investment of efficient energy industry operation; (2) should be at the level ensuring efficient and adequate energy procurement to meet energy demand of the country; (3) should incentivize licensees to improve efficiency in energy industry operation; (4) take into account fairness to both energy consumers and licensees; (5) take into account the assistance to the underprivileged power consumers or the electricity supply to decentralize development to provincial areas; (6) have a clear and transparent tariff calculation and make it public: and (7) constitute no unjust discrimination against energy consumers or those who wish to use energy. • ERC as rate-making authority will clarify and define the computation of natural gas pricing and wheeling charges including the definition of "just and reasonable rates"

2.11.8 Applicability of PPP Regulations

The legal basis of BATMAN1 would be differentiated depending on the project schemes. As discussed in section 2.9, mainly four business scheme models are proposed; Model 1: Conventional Public

Procurement, Model 2: O&M Separation (2-1 Outsourcing / 2-2 Lease), Model 3: Joint Venture, and Model 4: BOT. In case of Model 1, there will be no major legal issue because it would be done as ordinal public procurement under Republic Act No. 9184 (the "Procurement Law") in 2003. For Model 3, the legal basis should be 2013 JV guideline. In case of Model 4, it is also clear that the project shall be done by BOT Law.

For Model 2 especially 2-2 (O&M Separation with lease), the construction shall be done by PNOC as conventional public procurement and the lease would be based on BOT Law. It is not clearly mentioned that this type of "lease" is applicable under BOT law; however, the BOT law also mentioned that the other variations which are not prescribed in BOT Law can be applicable with the President of Philippines's approval (Sec 2 (a) of BOT Law). Based on the interview to PPP Center, this type of "Lease" as PPP modality should be applicable as long as NEDA ICC board which is chaired by President of Philippines approved the project.

Chapter 3 Recommendations

3.1 Gas Pipeline

3.1.1 Application of Japanese Seismic Technology, Operation and Maintenance Technology for the High-Pressure Gas Pipeline

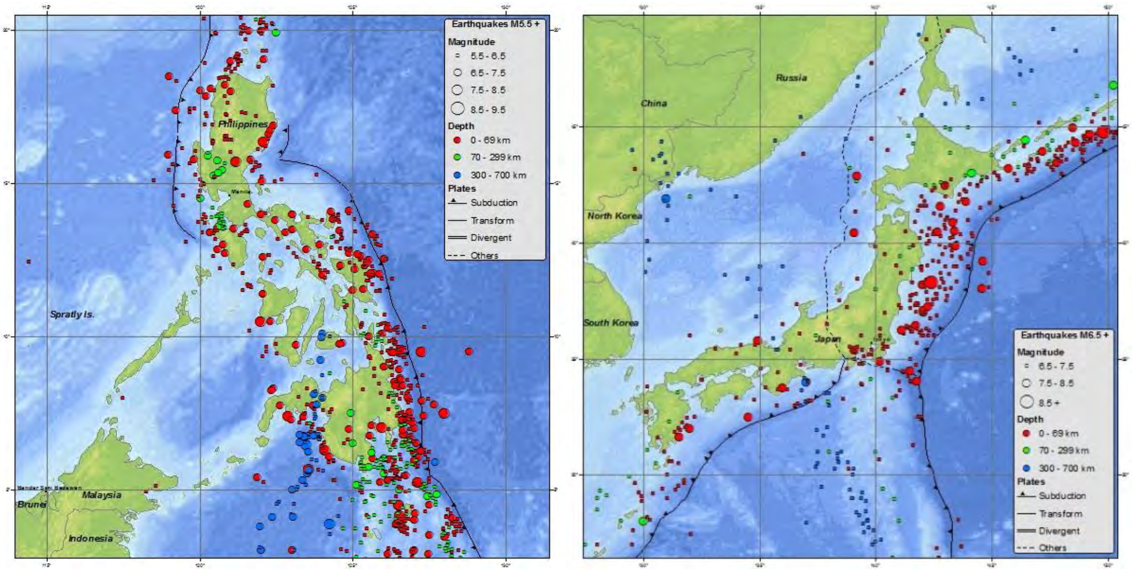
As mentioned in Section 2.2, the natural features, soil conditions and weather conditions of the Batman 1 pipeline route are similar to Japanese natural features such as the existence of active faults, typhoons and annual rainfall. Considering a large number of existing active faults and constant threat of earthquake, among others, the application of seismic technology developed in Japan is strongly proposed.

This section states the development process of Japanese seismic technologies and also the importance of operation and maintenance of pipeline by referring to the accident cases that happened in other countries.

(1) Japanese Seismic Technology

The Philippines is located in the subduction zone of the western Pacific Ocean. This means that the country is has geographically similar conditions with Japan. Therefore, the security against earthquake must be established for the first high-pressure gas pipeline in the Philippines. This section proposes the application of Japanese seismic technologies for the areas with possible impacts by the earthquakes and highly population dense areas on the pipeline route of this project in the future.

The figure below shows the records of the epicenters of the earthquakes of 1900-2012 March in the Philippines and Japan.



The Philippines Japan

Source: http://earthquake.usgs.gov/earthquakes/world/

Figure 3.1-1 Seismicity Map (1900-2012 March)

The planning proceeds from STEP 1 to STEP 3 as shown below. STEP 1 introduces the Japanese standards for seismic design, which could possibly contribute to the survey on the technical standards related to the gas pipeline in the Philippines and design for the pipeline. STEP 2 evaluates the seismic risk of the Batman 1 route. The survey is conducted on the geological features along the Batman 1 route with special consideration on the existence or absence of active faults and liquefaction risks.

STEP 3 proposes the specifications for the pipeline and quality of field girth welds in accordance with the risks along the Batman 1 route. The survey is preceded by discussing with geologists, seismologists and structure experts belonging to ESCA, a local engineering consulting company.

1) Survey and organization of current seismic design codes for underground structures in the Philippines and introduction of seismic design standards in Japan (STEP1)

The collection and arrangement of the information on the natural gas-related laws and technology standards in the Philippines is conducted. The result is shown in the Appendix 3.1.1(1).
Table 3.1-1 shows the comparison of the design standards for the natural gas pipeline between the Philippines and Japan.

Table 3.1-1 Comparison of Design Standards for Natural gas Pipeline between the Philippines and Japan

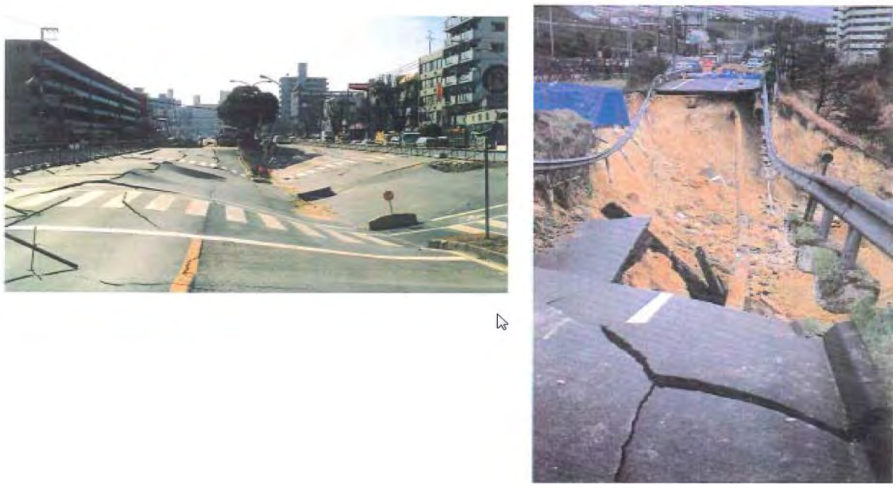
The Philippines	JAPAN
Interim Rules and Regulations Governing the Transmission Distribution and Supply of Natural Gas (Department of energy circular No.2002-08-005) **Rule 14** Standards for construction, operation and safety **Section 3.** Pipeline Design Standard The design standard for Pipelines shall comply with the requirements of ISO 13623 or other internationally-accepted standards as the DOE may approve.	**Gas Business Act (Act No. 51 of March 31, 1954)** **Section4.** Gas Facilities **Subsection 1.** Conformity of technical standards etc. **Article 28 (1)** A General Gas Utility shall maintain Gas Facilities to be used for the General Gas Utility Business to ensure that they conform to the technical standards established by an Ordinance of the Ministry of Economy, Trade and Industry.
ISO13623(Petroleum and Natural Gas Industries–Pipeline Transmission System)	Recommended practices for design of gas pipelines issued by the JGA (Japan Gas Association)

Source: Interim Rules and Regulations Governing the Transmission Distribution and Supply of Natural Gas (Department of energy circular No.2002-08-005) Gas Business Act (Act No.51 of March 31, 1954)

There is no single legislation to date, which governs the regulation of the natural gas industry in the Philippines. This survey focuses on DOE (the Philippines' Department of Energy) as the lead agency in developing the Philippine natural gas industry. The Rule 14 of Circular No.2002-08-005, which is the official announcement of DOE issued in August of 2002, stipulates the design standards for the gas pipeline to comply with ISO13623 or other internationally-accepted standards, which DOE may approve. Nonetheless, ISO13623 and ASME/ANSI31.8, the global design standards for natural gas pipelines, are not design manuals, or do not stipulate the safety assessment methods either, even though showing the earthquake loads as requirements for the design.

Similarly, NSCP2010 (the National Structural Code of the Philippines 6th Edition Volume 1 issued by the Association of Structural Engineers of the Philippines) is the design code for civil engineering structure, primarily covering general structure such as buildings and towers in the Philippines. It includes the provisions for steel structure, and specifies the estimating combined effects of loads such as dead, live, earthquake, wind loads. Nevertheless, it does not stipulate seismic design codes for the gas pipeline, which is a kind of petro chemical-related structure.
.
In Japan, for the high-pressure gas pipeline design, technical standards for gas facilities including pipes, pressure governors and appurtenant facilities are detailed in the Gas Business Act as a gas law, Ordinance for Enforcement of the Gas Business Act, ministerial ordinances of technical standards for gas facilities, and bulletins stipulating technical standards for gas facilities.
From the experience in the past earthquake occurrence, Japan Gas Association (JGA) examined the safety of the pipelines, the methods of seismic design. As a result, high-pressure gas pipeline design guidelines and high-pressure gas pipeline seismic design guidelines for liquefaction were established. The high-pressure gas pipelines with high earthquake-resistant performance complying with these guidelines in Japan were constructed.

The photo below shows the damage by the Hyogo Nanbu Earthquake in 1995.



Source: Japan Society of Civil Engineers, Report on Hanshin-Awaji Great Earthquake – Damage and Recovery of Lifeline facilities, 1997

Figure 3.1-2: Damage by the Hyogo Nanbu Earthquake in 1995

The table below shows the history of the revision of the earthquake-resistant standards conducted each time of occurrence of the large-scale earthquakes in Japan.

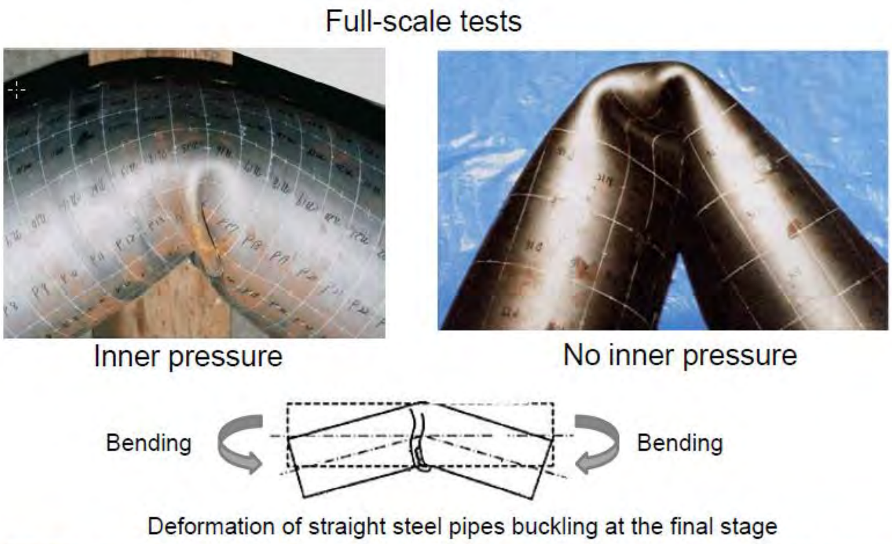
Table 3.1-2 Technical Knowledge and Know-how Accumulated through Earthquakes

Year/Month	Earthquakes (Magnitude)	Technical knowledge and know-how accumulated through earthquakes
1983/5	Central Japan Sea Earthquake (M7.7)	• Issuance of the Guidelines for Aseismic Design of Production Facilities etc.
1987/12	East Off Chiba Prefecture Earthquake (M6.7)	• Issuance of the Manual for Work for Placement of Gas Pipelines Back into Service after Earthquakes
1993/1	Kushiro Offshore Earthquake (M7.5)	• Contains facility measures, emergency measures, and resumption measures • Issuance of the Manual for Emergency Measures for Gas Pipelines in the Event of Earthquakes
1993/7	Hokkaido Nansei-Oki Earthquake (M7.8)	
1995/1	Great Hanshin-Awaji Earthquake (M7.3)	• Revision of the Earthquake Disaster Prevention Guidelines • Revision of the Guidelines for Aseismic Design of High-pressure Gas Pipelines • Issuance of the Guidelines for Aseismic Design to Protect High-Pressure Gas Pipelines from Ground Liquefaction • Revision of the Guidelines for Aseismic Design of Production Facilities etc. • Effectuation of the Law for Special Measures for Promotion of Measures to Prevent Disaster in the Event of the Tonankai and Nankai Earthquakes
2004/10	Niigata Chuetsu Earthquake (M6.8)	• Effectuation of the Law for Special Measures for Promotion of Measures to Prevent Earthquake Disaster in Relation to Subduction Zone Earthquakes around the Japan Trench and the Chishima Trench • Revision of the Manual for Emergency Measures for Gas Pipelines in the Event of Earthquakes • Revision of the Manual for Work for Placement of Gas Pipelines Back into Service after Earthquakes
2007/7	Niigata Chuetsu Offshore Earthquake (M6.8)	• Issuance of the Guidelines for Aseismic design to prevent long-column buckling
2011/3	Great East Japan Earthquake (M9.0)	

THE JAPAN GAS ASSOCIATION NIPPON STEEL ENGINEERING 15

Source: Japan Gas Association

Since the Hyogo Nanbu Earthquake, the fatigue strength of the steel material against Level 2 earthquake motion, a very strong seismic motion, has been inspected by the fatigue strength study, which has been considered as one of the standards for the high-pressure gas pipelines in Japan.



SOURCE : Japan Gas Association, Recommended practice for the design of gas transmission pipelines in areas subiect to liquefaction. 2000

Figure 3.1-3 Deformability Test of Steel Pipe

Based on the survey above, each seismic design is compared to every other design.
The comparison of the seismic design standards such as NSCP, ISO, ANSI/ASME and JGA guidelines is shown in the table below.

Table 3.1-3 Comparison of Seismic Design Standards

Items \ Standard/ Guideline	NSCP vo.1 National Structural Code of the Philippines	ISO 13623 Petroleum and natural gas industries-Pipeline transportation systems	ASME 31.8 Gas transmission and distribution piping systems	Japan Gas Association Recommended Practices for Seismic design of gas pipelines
Application	Buildings and other structures	Pipeline systems	Pipeline facilities	Buried steel pipelines onshore
Contained fluids	Not mentioned	Gases and liquids	Gases and liquids	Natural gas
Seismic zoning	Specified on level1 motion	Not mentioned	Not mentioned	Specified
Earthquake loads		Mentioned as requirement	Mentioned as requirement	
Level1 motion	Specified			Specified
Level2 motion	Not mentioned			Specified
Ground liquefaction	Not mentioned			Specified
Safety estimation method	not mentioned	Mentioned as requirement	Specified	Specified

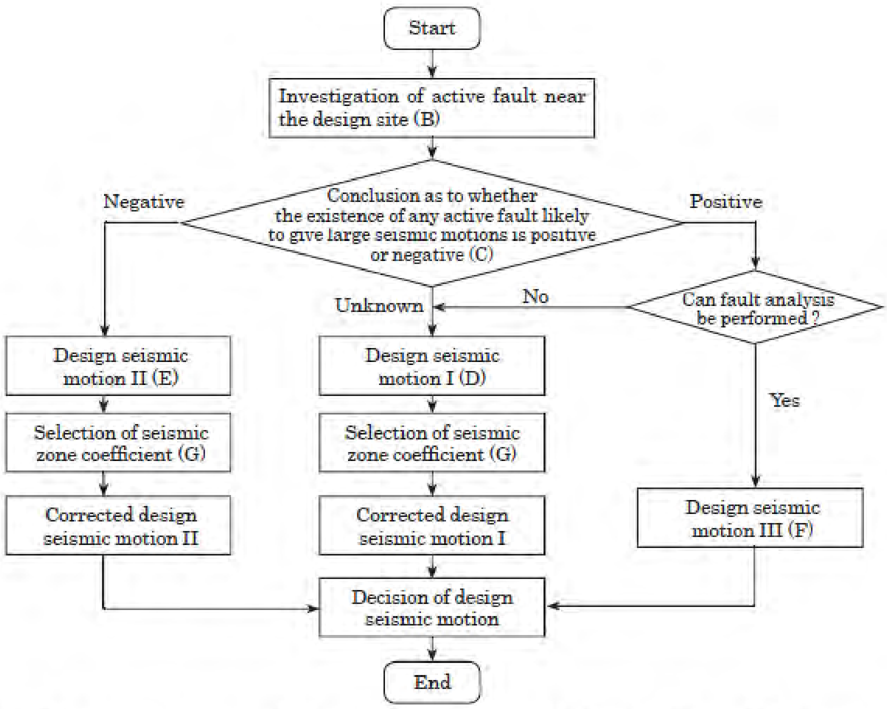
Source: National Standard Code of The Philippines SIXTH EDITION 2010
ISO 13623 (Petroleum and natural gas industries Pipeline transportation systems)
ASME 31.8 (Gas transmission and distribution piping systems)

The JGA high-pressure gas pipeline design guidelines and high-pressure gas pipeline seismic design guidelines for liquefaction stipulate the earthquake motions (probability of earthquake) and deformation performances of pipes to be ensured as shown in the table below. Level 2 design seismic motion and the design flow diagram of JGA guidelines on soil liquefaction are shown in figures below.

Table 3.1-4 Basic Concept of the Recommended Practices for Earthquake Resistant Design of High Pressure Gas Pipelines Issued by JGA

Classification of earthquake load	Probability of earthquake during the service	Requirements for pipeline performance
Level 1 earthquake	General seismic motion	No severe deformation and **no repair**
Level 2 earthquake	Very strong seismic motion	Large deformation but **no gas leakage**
Ground liquefaction	Ground displacement caused by soil liquefaction	Large deformation but **no gas leakage**

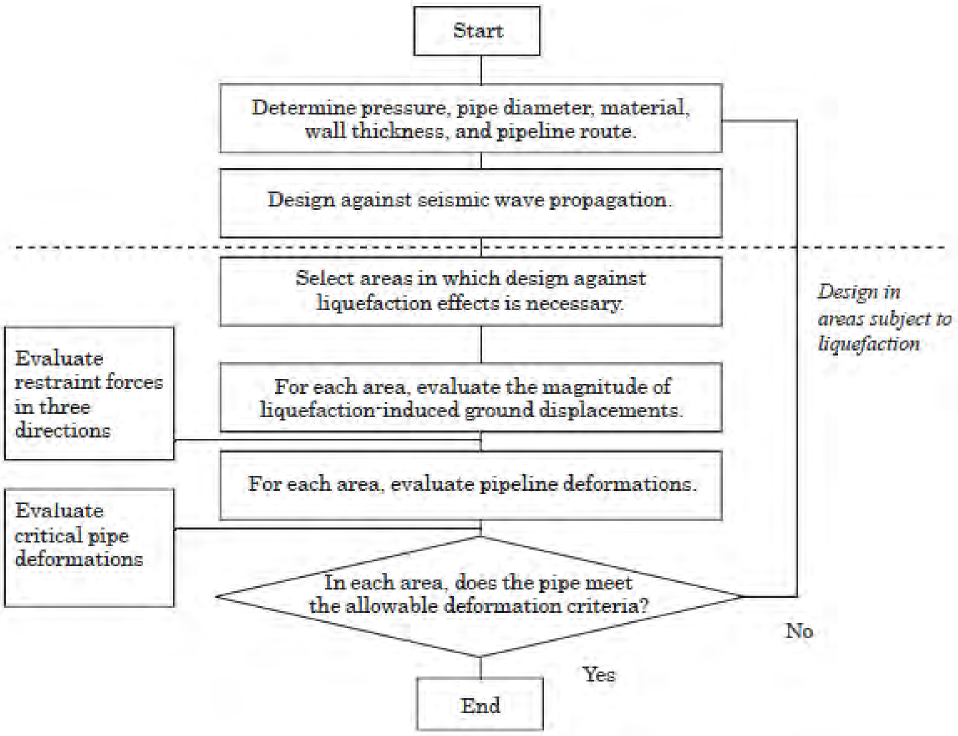
SOURCE : Japan Gas Association, Recommended practice for the design of gas transmission pipelines, 2000



*1) If the design seismic motion III is smaller than the corrected design seismic motion II, the corrected design seismic motion II is used as the design seismic motion.

Source: T. Kobayashi, K. Shimamura, N. Oguchi et al : Seismic Design for Gas Pipelines (2000) (By Japan Gas Association), 1. Recommended Practice for Earthquake-Resistant Design of Gas Pipelines (2000)

Figure 3.1-4 Design Seismic Motion Setting Flow in the JGA Recommended Practice



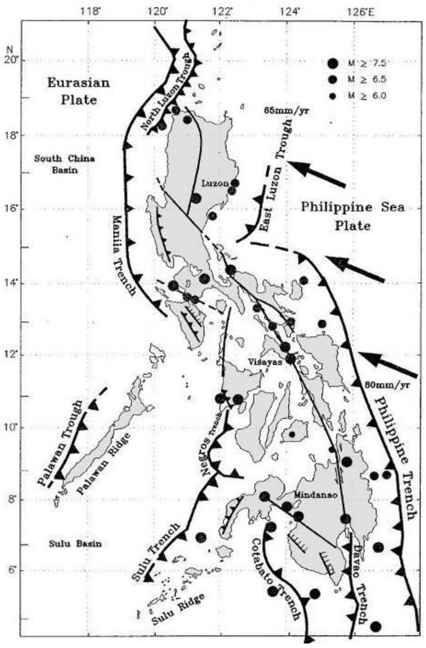
Source: Japan Gas Association, Recommended Practice for Design of Gas Transmission Pipelines in Areas Subject to Liquefaction

Figure 3.1-5 Design Flow Diagram in JGA Recommended Practice for Soil Liquefaction

In the active faults existing areas, the earthquake-proof countermeasures should be confirmed based on the careful survey and the reliable estimation. The Japanese seismic-resistance design guidelines are directed to the performance regulations. That is, the natural gas pipeline is to secure the earthquake-resistant performance for the ground seismic motions and the ground liquefaction in case of a very strong earthquake of Level 2. In general, it is to take practical countermeasures such as adopting the quality line pipe which proved the deformability and ductility besides the girth-welding quality which proved the reliable joints at the fault crossing based on the seismic design concept.

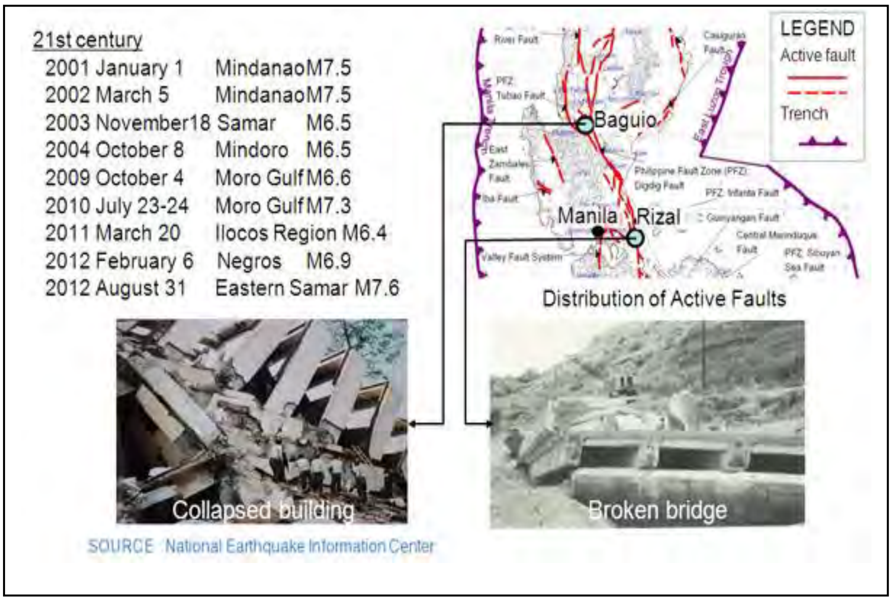
2) Study about the Seismic Hazard Risk Related to the Batman1 Route (STEP 2)

In this section, the information is collected from the Philippine government and public agencies, and the records on the major earthquakes occurring in the Philippines, the damage cases and probability of earthquake occurrence are surveyed. The survey result is shown in the figure below.



Source: Cassaro, M.A. (1991) Lifeline Earthquake Engineering Technical Council on Lifeline Earthquake Engineering Monograph No. 4, New York)

Figure 3.1-6 Location of Faults and Major Earthquakes from 1589 to 1990



Source: USGS (U.S. Geological Survey) National Earthquake Information Center
PHIVOLCS, Distribution of Active Faults & Treanches in the Philippines (2000)

Figure 3.1-7 Active faults in the Philippines and Recent Earthquake Damage (example)

The earthquake load provisions are covered in Section 208 of NSCP2010. It divides the coutry into two seismic zones based on The Batman1 belonging to Zone 4 (0.4g). The seismic zones and corresponding peak ground acceleration values are shown in the figure below.

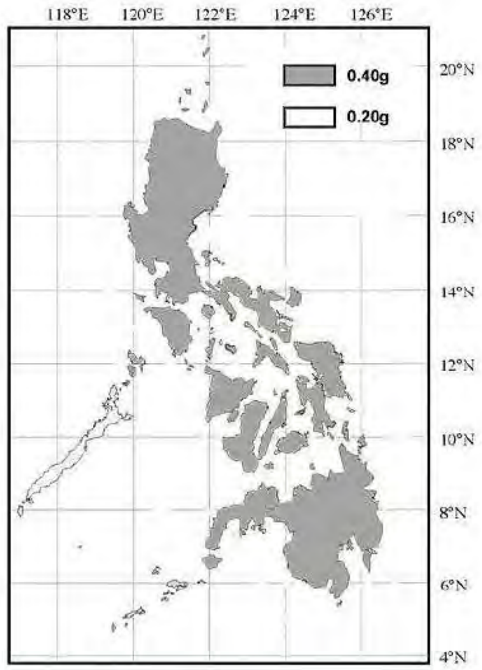


Figure 3.1-8 Seismic Zone Map of the Philippines (NSCP 2010)

It has become clear that it is important that Batman1 should satisfy quake resistance from the point of view of the magnitude of earthquake.

3) Review of Japanese design standards for gas pipeline that should be applied to the Batman1 (STEP 3)

Based on the aforementioned study of 1) and 2), the Japanese technological standards for gas pipeline to be reflected in the Batman1 are to be selected. The JICA Survey Team conducted a group discussion with the presence of a geologist, a seismologist and a structure expert of ESCA, a local consultant. The result of this study was reported and confirmed to DOE and PNOC on September 25th, 2013. The photos below show the meetings.


Figure 3.1-9 Exchanging opinions (ESCA Inc. and JICA team)

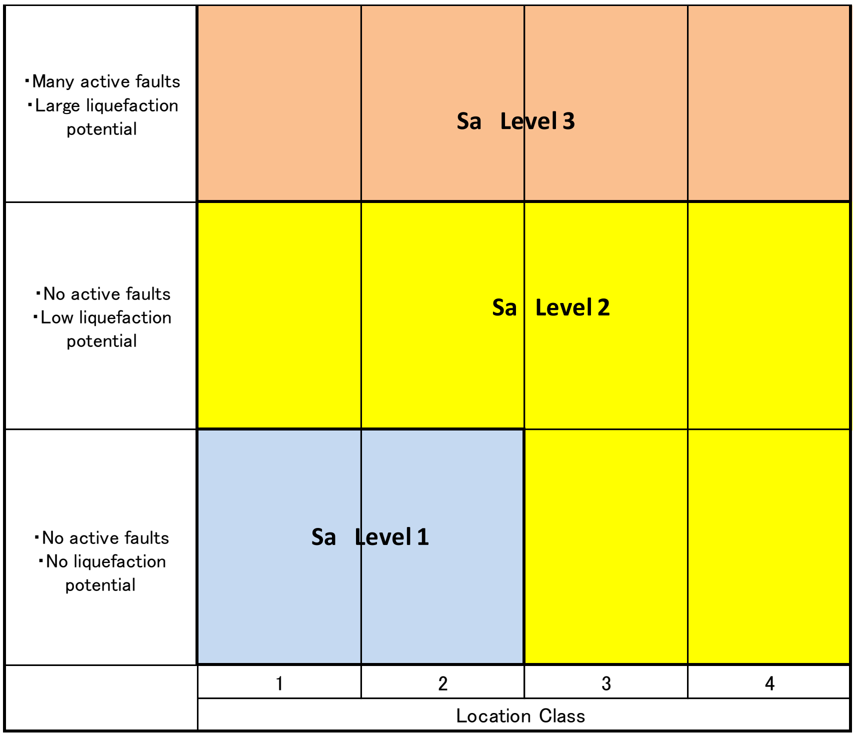
Figure 3.1-10 Debriefing Meeting (DOE, PNOC, ESCA Inc. and JICA team)

In case of earthquake, the high pressured gas pipeline should ensure the prevention of gas leakage. That is, the high pressure gas pipelines should possess highly deformability such as the Japanese gas pipelines specified by the Japanese original seismic design standards which were verified with highly deformability and reliability with many full-scale pipe bending experiments and the FEA studies. The seismic safety of the Japanese original pipelines also has good records in Japan. In case of any accident, the high pressured gas pipeline should not only ensure the prevention of gas leakage, but also the safety of people.

In conclusion, the JICA Survey Team and the experts of ESCA have an agreement on the importance of the deformability and reliability of the pipelines to ensure safety. Hence, the Japanese original aseismic design standards have to be applied to ensure the safety of the Batman1 pipeline.

The zones of SA Level 2 and SA Level 3 have high seismic damage risks compared to SA level 1, and highly dense population. For the Batman1, it is recommended to combine Japanese standards and API standard for each zone.

Safety Assessment Levels (SA Levels) are defined by the figure below.



Source: Survey Team

Figure 3.1-11 Classification of the Safety Assessment Levels (SA Level)
(Identical with Figure 2.4-5)

The Survey Team discussed with the experts of ESCA and produced the following proposals as the standards to ensure the safety of the Batman1 pipeline.

Proposal 1: The seismic design for Level 2 earthquake is to be applied to the entire pipelines
For the design of gas pipeline, a higher level of safety is necessary.
The high-pressure gas pipeline seismic design guidelines are the two-level seismic design method based on earthquake motion as shown in the table below, and its standard is to maintain the earthquake resistance of gas pipeline against Level 1, a standard earthquake motion, and Level 2, a very strong earthquake motion.
The ground deformation due to liquefaction-induced flow of inclined ground and quay walls is defined. These design concepts are applied to the Batman1.

Table 3.1-5 Aseismic Performance and Check Method against External Force from Earthquake "Recommended Practice for Earthquake Resistant Design of Gas Transmission Pipelines" "Recommended Practice for Design of Gas Transmission Pipelines in Areas Subject to Liquefaction"

Estimated external force		Aseismic performance	Check method
Level 1 Earthquake motion	General earthquake motion that has the probability of 1 to 2 times occurrence during the supply period	The system is not damaged. Operation can be performed without repair	Allowable strain of 1% or less or 35% t/D% or less, whichever is smaller
Level 2 Earthquake motion	Low probability of occurrence during the supply period, but it is very strong	Pipes are deformed, but gas leakage does not occur.	Allowable strain of 3% or less
Soil liquefaction	Ground transformation due to liquefaction lateral flow of inclined ground or ground at the back of revetment	Pipes are deformed, but gas leakage does not occur.	Equivalent plastic strain of 30% or less in case of a straight pipelines for example

Source: Japan Gas Association

Proposal 2: The Japanese specifications, such as JIS standard, is to be applied to the materials for the line pipe materials and field girth welds in the areas with active faults and/or high density population.

For the design of gas pipeline, high-level safety is necessary. Especially in the areas where substantial deformation of pipeline is anticipated particularly in the plastic region level, the gas pipeline should assure its higher reliability.
In this study, the Japanese pipe materials and Japanese welding quality are applied in specific areas.

a. Specifications for line pipes

JGA standard is applied to the material specifications for the line pipes in the proximity to active fault areas and the high population density areas. JGA standard examined the pipe deformability on the real Japanese line pipes in full scale test.

b. Specifications for welds

The JIS standard, a Japanese standard, is recommended for the specifications for welds in the proximity to active fault areas and high population density area because the JIS stipulates severe acceptance criteria compared to API Standard.

BATMAN 1 Project to be divided into 3 Safety assessment levels governed by the following criteria:

- **Proximity to the active fault;**
- **Location of pipeline relative to the density of population;**
- **Liquefaction potential of the pipeline route.**

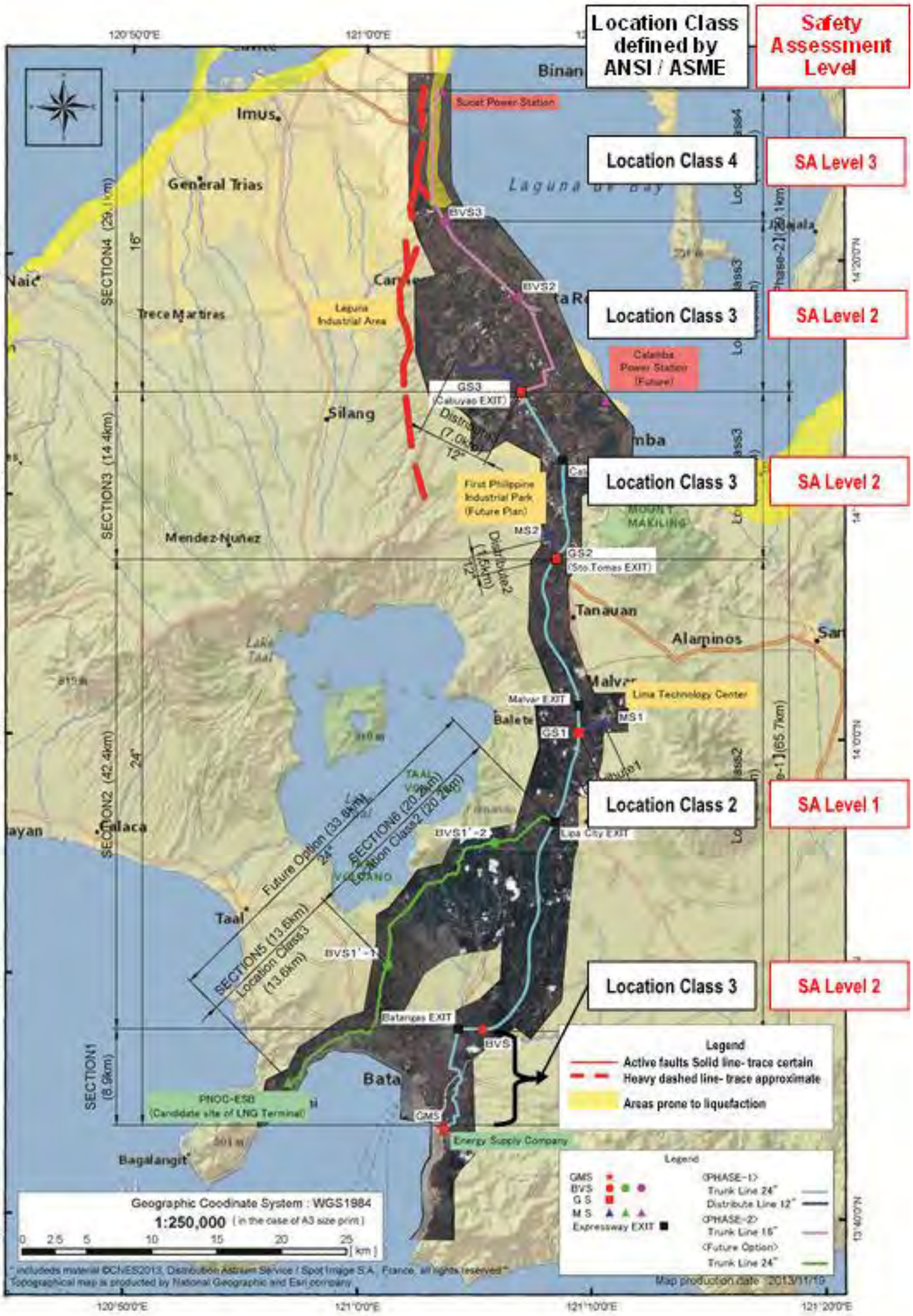
NOTE:
Safety Assessment Level 1: API STANDARD
Safety Assessment Level 2: JAPANESE GAS PIPELINE CODE / API
Safety Assessment Level 3 : JAPANESE GAS PIPELINE CODE

【Proposal from ESCA and JICA Survey Team】

4) Survey of the Earthquake-Resistant Technical Application Area along the Batman1 Route (STEP3)

The acceptance standards for the materials specifications for line pipes and field girth welds are proposed herein for the Batman1 from the point of view of the earthquake occurrence probability, population density and soil properties. The figure below shows the applicable standard (SA Level) stipulated according to the ANSI/ ASME Class Location indicated in the active faults map and liquefaction hazard map.

・SA Level 1: Along the expressway with little possibility of liquefaction and low population density.
・SA Level 2: Batangas City and Cabuyao City areas with a possibility of liquefaction and high population density
・SA Level 3: Sucat area, with liquefaction hazard areas, active faults and high population density.



Source: Survey Team

Figure 3.1-12 Proposed Standards by Area for Batman1
(Identical with Figure 2.9-9)

5) Recognized Standards for Material Specifications and Field Welded Parts Applied to SA Level 2 and 3 (STEP3)

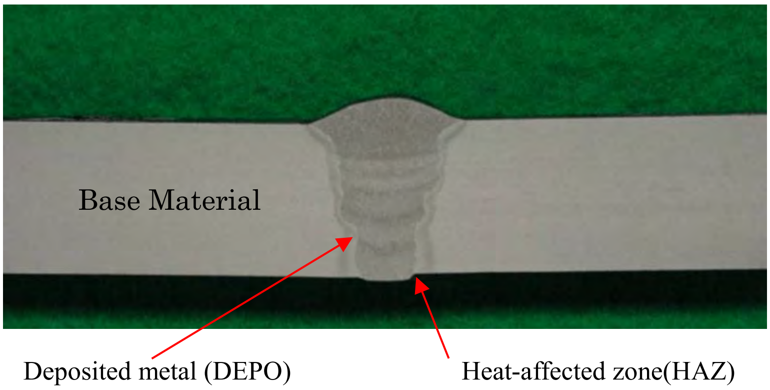
a. Material specifications

As a result of the discussions on pipeline material specifications with the local consultants, it turned out that damage in pipeline has not be found in Japan, because the materials satisfying high-pressure gas pipeline seismic design guidelines stipulated by the Japan Gas Association (JGA) have been used.
The JGA high-pressure gas pipeline seismic design guidelines define the value of allowable strain in earthquakes, based on full-scale experiments on steel pipes, in order to secure the quality of pipelines against large deformation and cyclic deformation (fatigue) caused by earthquakes. Therefore, the JGA guidelines are considered as the prime code to prevent pipelines fracture.
Based on the above reasons, steel pipes in compliance with the JGA specifications should be used in seismic design areas and urban areas.

b. Acceptance Criteria of Field Girth Welds

The safety of pipelines is secured on the premise that they have no local strain concentration.
Field girth welds (below photo), where strain concentration is likely to occur, are discontinuous parts in terms of locality and materials in the entire pipeline. It needs to meet the following two requirements in order to prevent local strain concentration:

a) Security of Strength of Field Girth Welds
b) Defect Tolerance of Field Girth Weld Defects



Source: Survey Team

Figure 3.1-13 Macro Weld join

a) Security of Strength of Field Girth Welds

Along with the complexity of the pipeline in recent years, technical selection of appropriate welding methods to create over-matching has been increasingly required and maintained by the following methods:

i)Verification by the Welding Procedure Qualification Test

- Verification by the Mechanical Test (such as the Tensile Strength Test and Bend Test)
- Selection of welding methods, welding materials, control of weld heat input and other items.

ii)Verification by the Welders Performance Test

iii)Field management based on the Filed Welding Procedure Specification

The picture below shows an image of the Tensile Strength Test, one of the Welding Procedure Qualification Test / Mechanical Test.
Recognition for the Tensile Strength Test requires rapture positions not being cut by deposited metals (DEPO), and that the tensile strength is higher than the standard minimum tensile strength of the base materials.

Source: Survey Team

Figure 3.1-14 Tensile strength test

b) Defect Tolerance of Field Girth Weld Defects

Nondestructive Inspections (NDIs) applied to test pipelines include the Visual Testing, Radiographic Test and Ultrasonic Test.

The standards of NDIs stipulating defect tolerance include API 1104, an international standard, and JIS Z 3104, a Japanese standard, reflecting the impacts of earthquakes.

As for the Visual Testing and Radiographic Test which are regarded as total inspections in Japan, the comparison between an international testing standard (API) and its Japanese counterpart (JIS) are shown below:

Table 3.1-6 Comparison of NDI standards

	International standard	Japanese standard
VT (Visual Testing)	API1104	JIS B 8265
RT (Radiographic Testing)	API1104	JIS Z 3104
UT (Ultrasonic Testing)	API1104	JIS Z 3060

VT and RT are 100% inspection in Japan and API.
UT is sampling(5~10%)inspection in Japan.

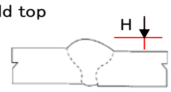
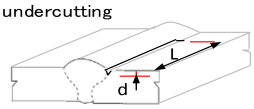
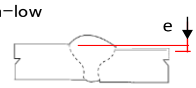
Source: Survey Team

i) Visual Testing

Through visual inspections, inspectors verify the heights of reinforcement of the weld, width and depth of undercut, offsets and others. The comparison table between the API Standard and the JIS

Standard is shown below.

Table 3.1-7 Comparison of Visual Testing Standards

Standard / Type	International standard API1104	Japanese standard JIS B 8265
weld top 	WPS	T≦12mm ： H≦1.5mm 12＜T≦25 ： H≦2.5mm
undercutting 	d≦0.4mm 0.4＜d≦0.8：L≦50mm and L≦1/6 weld length	WPS
high−low 	e≦3.0mm	T≦8.0mm ： e≦2.0mm 8＜T≦50mm ： e≦3.5mm

WPS: Welding Procedure Specification.
T: Wall Thickness

Source: Survey Team

ii) Radiographic Test

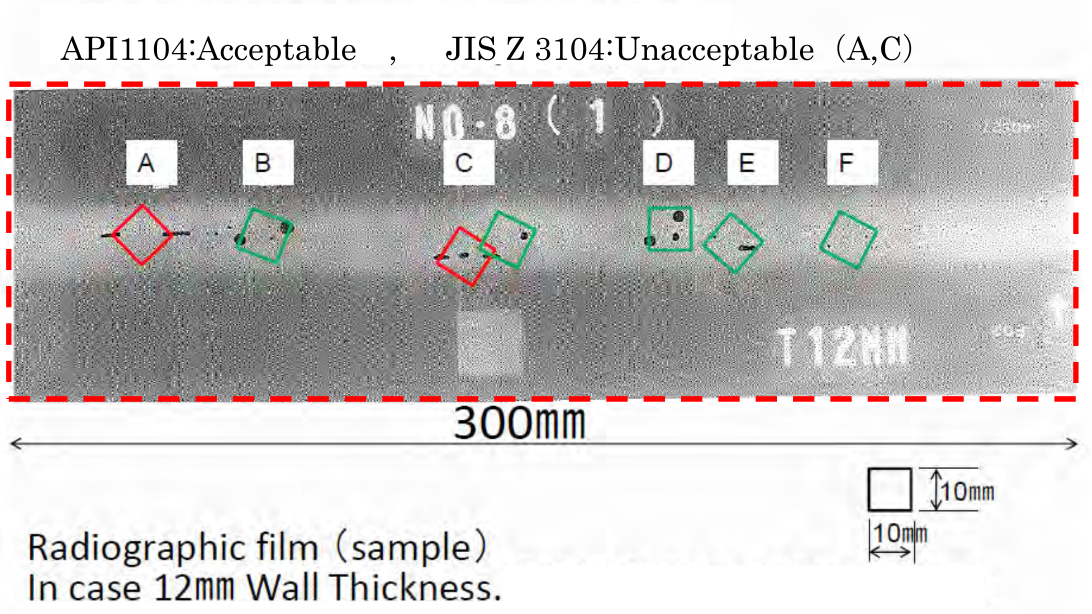
The Radiographic Test is used to judge the existence or absence, and sizes of flaws by checking the images of the pipes exposed to X-ray films by radiation.
Welding flaws include Incomplete Penetration (IP), Incomplete Fusion (IFD) and Blowhole (BH). The JIS Standard is strict compared to the AIP Standard in terms of the judging criteria for all kinds of defects.
In Japan, Distortion Tolerance caused by earthquakes has been defined based on the Deformation Performance Test of pipes in order to secure the quality of high pressure gas pipelines against large deformation and cyclic deformation (fatigue) caused by earthquakes. The Distortion Tolerance is secured by the field girth welding technique that will ensure strength exceeding that of the original material, which is a welding quality categorized as of over Class 3 of JIS Z 3104. Automatic welding machines have been introduced to enable field girth welding that will result in strength over exceeding that of the original material, and also meeting the required quality of Class 3 of JIS Z 3104. In the case of Japan, high quality welding is being realized by using these automatic welding machines.

Table 3.1-8 Comparison of standards for welding defects

Standard / Flaw Type	International standard API 1104	Japanese standard JIS Z3104 2nd class
IP  Incomplete penetration	25 mm Individual or cumulative 25mm in 300mm length	5mm One third (1/3) of Wall Thickness
IFD  Incomplete fusion due to cold lap	50 mm Individual: 50mm Cumulatived:50mm in 300mm length	5mm One third (1/3) of Wall Thickness
BH  Blowhole	3mm Φ3mm 25% of Wall Thickness	3mm 6 of φ1mm BH in $1cm^2$ 3 of φ2mm BH in $1cm^2$ 2 of φ3mm BH in $1cm^2$
REMARKS	In case 15mm Wall Thickness Pipe	

Source: Survey Team

<<Reason why JIS standard categorized as over Class 3 is required>>
The JGA high-pressure gas pipeline seismic design guidelines, as described earlier, define the value of allowable strain in earthquakes, based on full-scale experiments on steel pipes, in order to secure the quality of pipelines against large deformation and cyclic deformation (fatigue) caused by earthquakes.
The field girth welding technique classified as over Class 3 is required because distortion tolerance is able to be secured by the current technique categorized as over Class 3 of JIS Z 3104.
Welding Flaw Tolerance is compared between the API Standard, an international standard, and the JIS Standard with specific examples.
The X-ray film shown below is judged by the API Standard and the JIS Standard.
According to the image of the X-ray film below, the red frame represents Class 4 or rejection, the green one represents Class1, 2, 3 or recognition, and then the result of the overall judgment is determined as rejection.
The API Standard would determine the result of the X-ray film below as recognized.



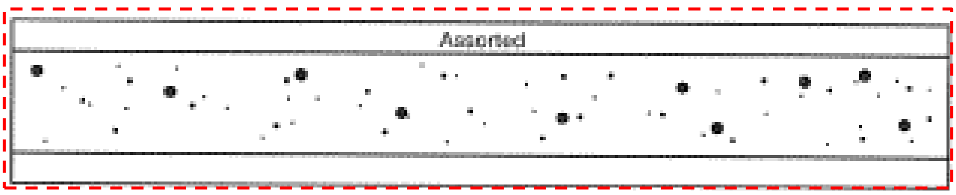
Field of vision: API1104 300 mm, JIS Z 3104 10 mm x 10 mm

Source: Survey Team (Photo from the Japanese Society for Non-Destructive Inspection)

Figure 3.1-15 API Standard and JIS Standard

[API Standard]

The API Standard regards the entire length of the X-ray films (length: 300 mm) as the test field of vision.
For instance, BH is judged by comparison with Figure below.



Source: API 1104 Fig 19

Figure 3.1-16 API 1104 for T≦12.7mm

[JIS Standard]

On the other hand, the JIS Standard adjusts the test field of vision depending on the wall thickness of the base materials, and then makes judgment.

Every flaw is classified into four types as Type 1 (Blowhole), Type 2 (Incomplete Penetration and other defects), Type 3 (Cracking) and Type 4 (Tungsten Inclusion), and then sub-classified as Class 1, 2, 3 and 4 based on the measurement of its size for each test field of vision.
Each flaw in Type 1 and 4 is a provided point and is classified based on "JIS Z 3104 Annex 4 Table 5 Subclassification of Flaws of Type 1 and 4" shown in the table below. The points of a flaw depend on its size. For example, the size between 0.5 mm and 1.0 mm is given one point while the size between 1.0 mm and 2.0 mm is given two points.
Flaws in Type 2 are classified based on the lengths in accordance with "JIS Z 3104 Annex 4 Table 6 Subclassification of Flaws of Type 2" shown in the table below.
Flaws in Type 3 are all classified as Class 4.
According to the JGA (Japan Gas Association) Standard for NDI of high pressure gas pipeline, Class 1 (the best quality including no defect), 2 and 3 are recognized while Class 4 is rejected.
For example, in the case of 12mm wall thickness and a 10mm x 10mm test field vision, both flaws with below 12 points in Type 1 and 4, and the flaw of the length of less than 6 mm in Type 2 are recognized. (There is shown that 24inch/WT=14.3mm is yellow highlight and 12inch/WT=9.2mm is blue highlight in below table)
According to the image of the X-ray film below, the red frame represents Class 4 or rejection, the green one represents Class1, 2, 3 or recognition, and then the result of the overall judgment is determined as rejection.
The API Standard would determine the result of the X-ray film below as recognized.

Table 3.1-9 JIS Z 3104 standard

Annex 4 Table 5 Subclassification of flaws of type 1 and type 4

Unit: mm

Subclassification	Test field of vision				
	10 × 10		10 × 20		10 × 30
	Thickness of base metal				
	10 or under	Over 10, up to and incl. 25	Over 25, up to and incl. 50	Over 50, up to and incl. 100	Over 100
Class 1	1	2	4	5	6
Class 2	3	6	12	15	18
Class 3	6	12	24	30	36
Class 4	Where the score of flaw is larger than that of class 3				

Annex 4 Table 6 Subclassification of flaws of type 2

Unit: mm

Subclassification	Thickness of base metal		
	12 or under	Over 12 and under 48	48 or over
Class 1	3 or under	1/4 or less of the thickness of the base metal	12 or under
Class 2	4 or under	1/3 or less of the thickness of the base metal	16 or under
Class 3	6 or under	1/2 or less of the thickness of the base metal	24 or under
Class 4	Where the flaw length is larger than that of class 3		

Source: Japanese Standards Association, Japan Gas Association

iii) Acceptance Criteria of Field Girth Welds

i. Visual Testing

After the consultation with local consultants, it is applied that the API Standard.

ii. Radiographic Test

After the consultation with local consultants, it is suggested that the JIS Standard, under which no pipeline fracture has been found in the past, should be applied in order to prevent accidents in seismic design areas and urban areas and the API Standard should be applied in other areas.

The acceptance criteria in field welded parts are shown below.

Table 3.1-10 Acceptance Criteria of Field Girth Welds

	Safety Assessment		
	Level 1	Level 2	Level 3
VT	API1104	API1104	API1104
RT	API1104	JIS Z 3104	JIS Z 3104

Source: Survey Team

iv) Detailed specifications in Japanese urban gas operators

Japanese urban gas operators consider that it is desirable to secure the quality categorized as over Class 2 of JIS Z 3104 in an effort to assure the safety against cyclic load caused by earthquakes.
Therefore, the operators require to meet the acceptance criteria classified as over Class 3 in their specifications for order placement and regard Class 1 passing rate of all the films as an important evaluation item.
The pictures below show automatic welding works at an open cut area and inside a tunnel (inner diameter: 2 m).
Guide rails and welding head are equipped outside of the steel pipe, and one-sided welding work is being conducted from outside of the pipe.
The welding quality of gas pipeline construction works by automatic welding machines in Japan secures a Class 1 passing rate of 98-99% of all the films inspected.

(at open cut area) (inside of tunnel)

Source: Survey Team

Figure 3.1-17 Automatic Welding Works

(2) Facts of Pipeline Accidents

Japan has never experienced any accident of high-pressure gas pipelines. The reason that could be considered is that Japan has paid thorough attentions from the design to its operation and maintenance, based on the idea that “Leakage of gas pipeline could not be tolerated”.

This section summarizes the analysis results of the various accident cases occurred mainly in the U.S, and Western European countries, and the accident frequency. The table below shows the laying lengths of gas pipelines in North America, Western Europe and Japan. In the U.S. and Western European countries, the longer the pipeline is, the more often accidents occur. Appendix 3.1.1 2) “List of Accidents in Other Countries” includes a list of accident cases occurred in some countries.

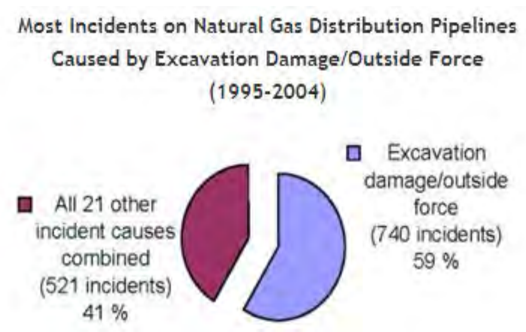
Table 3.1-11 Total length of natural gas transportation pipeline in North America, Europe and Japan (example)

Area	Total Length		Source
United States	1,984,321 km	2013	The World Factbook, CIA
EGIG Members	135,211 km	2010	8th EGIG-Report
Japan	4,344 km	2010	Japan Gas Association

1) Summary of accidents of natural gas pipelines in the U.S. (Source: DOT Report)

The 1.98 million km natural gas transmission pipeline has been constructed in the U.S. to which 50% is more than 50 years old.

According to the statistics by DOT, approximately 60 % of all of the accidents of distribution pipelines reported from 1995 to 2004 is caused by excavation damage. The results of the statistics are shown in the figure below.



Source: http://www.aga.org/Kc/aboutnaturalgas/consumerinfo/Pages/CausesofNGPipelineAccidents.aspx

Figure 3.1-18 Causes of Pipeline Incidents reported from 1995 to 2004

According to Pipeline & Hazardous Materials Safety Administration, or PHMSA, U.S. DOT, the causes and rates of the major accidents occurred from 1993 to 2012 are as follows: Out of the 1519 cases of all onshore transmission gas pipeline accidents, 250 cases (27%) are related to flaws of materials/ welding/ facilities

179 cases (19%) to excavation damage 171 cases (185) due to corrosion and 78 cases (8.5%) are caused by damage by natural disaster. The 33 cases (3.5%) related to Damage by ground movement is included in the damage by natural disaster. The major accidents mentioned above include damage on the human body such as fatal wound and requiring hospitalization, damage worth 50 thousand dollars, and shutdown of distribution facilities in case of emergency. The table and figure below show the accident rate per accident cause.

Table 3.1-12 Details of Incidence Rate for Gas Transmission Pipeline (onshore)

National Gas Transmission Onshore: Significant Incident Details: 1993-2012

Reported Cause of Incident [8]	Number	%	Fatalities	Injuries
CORROSION				
EXTERNAL CORROSION	109	9.0%	1	3
INTERNAL CORROSION	62	5.1%	12	1
Sub Total	171	14.1%	13	4
EXCAVATION DAMAGE				
OPERATOR/CONTRACTOR EXCAVATION DAMAGE	24	1.9%	0	5
THIRD PARTY EXCAVATION DAMAGE	147	12.1%	14	38
PREVIOUS DAMAGE DUE TO EXCAVATION	4	0.3%	0	0
UNSPECIFIED EXCAVATION DAMAGE	4	0.3%	1	1
Sub Total	179	14.7%	15	44
INCORRECT OPERATION				
INCORRECT VALVE POSITION	2	0.1%	0	0
PIPELINE/EQUIPMENT OVERPRESSURED	1	0.0%	0	0
INCORRECT INSTALLATION	1	0.0%	0	0
OTHER INCORRECT OPERATION	7	0.5%	0	1
UNSPECIFIED INCORRECT OPERATION	20	1.6%	0	8
Sub Total	31	2.5%	0	9
MAT'L/WELD/EQUIP FAILURE				
CONSTRUCTION, INSTALLATION OR FABRICATION-RELATED	21	1.7%	0	0
MANUFACTURING-RELATED	10	0.8%	8	51
ENVIRONMENTAL CRACKING-RELATED	14	1.1%	0	3
BODY OF PIPE	19	1.5%	0	0
PIPE SEAM	17	1.4%	0	0
BUTT WELD	25	2.0%	0	0
FILLET WELD	6	0.5%	0	0
JOINT/FITTING/COMPONENT	19	1.5%	0	1
MALFUNCTION OF CONTROL/RELIEF EQUIPMENT	38	3.1%	0	2
PUMP/COMPRESSOR-RELATED EQUIPMENT	3	0.2%	0	1
THREADED CONNECTION/COUPLING FAILURE	20	1.6%	0	3
NON-THREADED CONNECTION FAILURE	6	0.5%	0	2
FAILURE OF EQUIPMENT BODY	2	0.1%	0	0
OTHER EQUIPMENT FAILURE	4	0.3%	0	1
UNSPECIFIED MAT'L/WELD/EQUIP FAILURE	46	3.8%	0	7
Sub Total	250	20.6%	8	71
NATURAL FORCE DAMAGE				
EARTH MOVEMENT	33	2.7%	0	1
HEAVY RAINS/FLOODS	17	1.4%	0	0
LIGHTNING	7	0.5%	0	0
TEMPERATURE	4	0.3%	0	0
HIGH WINDS	6	0.5%	0	0
OTHER NATURAL FORCE DAMAGE	1	0.0%	0	0
UNSPECIFIED NATURAL FORCE DAMAGE	10	0.8%	0	1
Sub Total	78	6.4%	0	2
OTHER OUTSIDE FORCE DAMAGE				
FIRE/EXPLOSION AS PRIMARY CAUSE	8	0.6%	0	2
VEHICLE NOT ENGAGED IN EXCAVATION	26	2.1%	0	10
MARITIME EQUIPMENT OR VESSEL ADRIFT	1	0.0%	0	0
PREVIOUS MECHANICAL DAMAGE	4	0.3%	0	1
INTENTIONAL DAMAGE	1	0.0%	0	0
OTHER OUTSIDE FORCE DAMAGE	4	0.3%	0	0
UNSPECIFIED OUTSIDE FORCE DAMAGE	1	0.0%	0	0
Sub Total	45	3.7%	0	13
ALL OTHER CAUSES				
MISCELLANEOUS CAUSE	153	12.6%	4	57
UNKNOWN CAUSE	15	1.2%	0	2
Sub Total	168	13.8%	4	59
Totals	922	76.1%	40	202

Source
http://primis.phmsa.dot.gov/comm/reports/safety/AllPSIDet_1993_2012_US.html?nocache=7945#_ngtranson

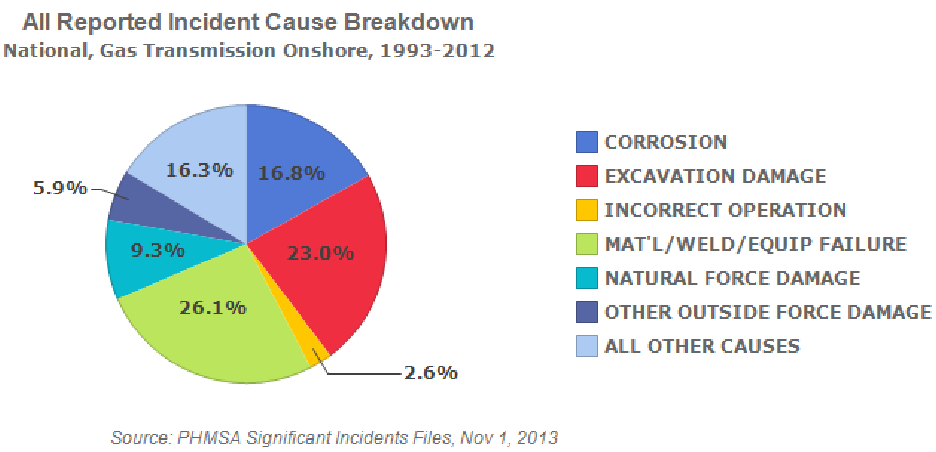


Figure 3.1-19 Incident Cause Breakdown of Onshore Gas Transmission Pipeline

2) Summary of Incidents of Gas Transmission Pipeline in Western Europe（Source：8th EGIG-report 1970-2010）

EGIG (European Gas Pipeline Incident data Group), the cooperation of fifteen major gas transmission system operators in Western Europe, is the owner of a database of pipeline incident data maintained and collected since 1970. The 15 member companies are as follows:

- Bord Gais (Ireland)
- DGC (Denmark)
- ENAGAS, S.A. (Spain)
- Fluxys (Belgium
- Gasum (Finland)
- GRT Gaz (France)
- National Grid (UK)
- NET4GAS (Gzech Republic)
- N.V. Nederlandse Gasunie (The Netherlands)
- OMV Gas GmbH (Austria)
- Open Grid Europe (Germany)
- Ren Gasodutos S.A. (Portugal)
- Snam Rete Gas (Italy)
- Swedegas A.B. (Sweden)
- SWISSGAS (Switzerland)

According to EGIG, the total length of the Western European gas transmission pipelines system is 135,211 km in 2010. Some data extracted from the EGIG incident report are shown below. The data covers the onshore and steel pipes, and incidents occurring outside of manufacturing facilities.

Over the span of 41 years from 1970 to 2010, the number of gas pipeline incidents totals to 1249 and the primary failure frequency per 1000 km is 0.35 per year. The frequency over the past five years has decreased annually; the frequency per 1000 km over the period from 2006 to 2010 is 0.16 per year. The statistics of EGIG's incidents is shown in the table below.

Table 3.1-13 Primary Failure Frequency of gas pipeline

Period	Interval	Number of incidents [-]	Total system exposure [km·yr]	Primary failure frequency per 1000 km·yr
1970 - 2007	7th report 38 years	1173	$3.15.10^6$	0.372
1970 - 2010	8th report 41 years	1249	$3.55.10^6$	0.351
1971 - 2010	40 years	1222	$3.52.10^6$	0.347
1981 - 2010	30 years	860	$3.01.10^6$	0.286
1991 - 2010	20 years	460	$2.25.10^6$	0.204
2001 - 2010	10 years	207	$1.24.10^6$	0.167
2006 - 2010	5 years	106	$0.654.10^6$	0.162

Table 1: Primary failure frequencies

Source：8th EGIG-report 1970-2010, Table1

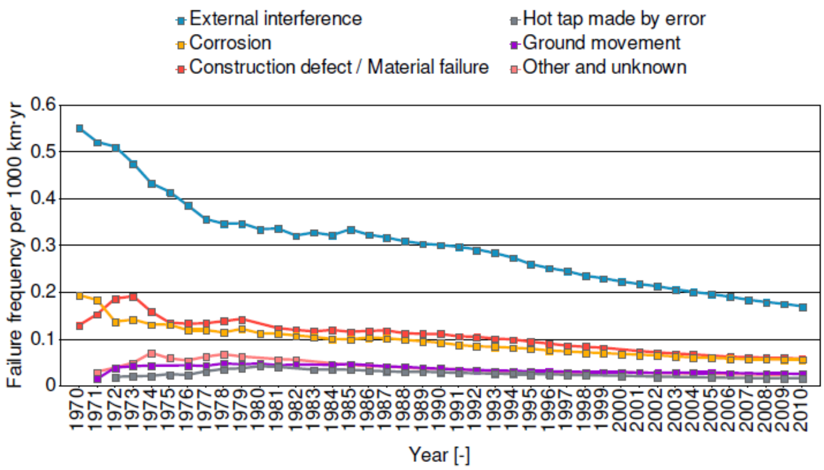
The table below shows the distribution of incident per cause. The top five causes are external interference (48%), construction defect/ material failure (16%), corrosion (16%), ground movement (7%) and hot-tap made by error (4%).

Table 3.1-14 Distribution of incident per cause

Cause	Distribution [%]
External interference	48.4
Construction defect / Material failure	16.7
Corrosion	16.1
Ground movement	7.4
Hot-tap made by error	4.8
Other and unknown	6.6

Source：8th EGIG-report 1970-2010, Table2

The figure below shows the primary failure frequencies per cause. The data shows a decline in each cause of the failure frequencies. It could be due to protective measures against incidents at the gas pipeline in terms of management, construction, structure and materials.



Source：8th EGIG-report 1970-2010, Figure 1

Figure 3.1-20 Trend of Primary Failure Frequencies per Cause

3) Accident Cases

The summary of the incidents caused by Northridge Earthquake (1994) and the explosion and fire due to inappropriate quality and maintenance of the pipe joints in San Bruno (2010) are shown below.

a. Accident 1

1994 Northridge Earthquake (M 6.8)

(Source: T.D. O'Rourke, M.C. Palmer: Earthquake performance of gas transmission pipelines http://cidbimena.desastres.hn/docum/crid/Diciembre2004/pdf/eng/doc7491/doc7491-contenido.pdf#search='1994+Northridge+gas+pipeline+diamiter+26in')

Summary

- Area: Northridge, U.S.A.
- Operation Company: The Southern California Gas Company
- Causes: Severe ground shaking, significant permanent ground deformation
- Summary of the pipelines

【Specifications for the pipelines (example)】

Installation Date	Line No.	Nominal Diameter (in)	Wall Thickness (in)	Operated Pressure (MPa)
1925	1001	12	0.22	1.7
1941	104	10	0.203	1.4
1931	85	26	0.25	2.2

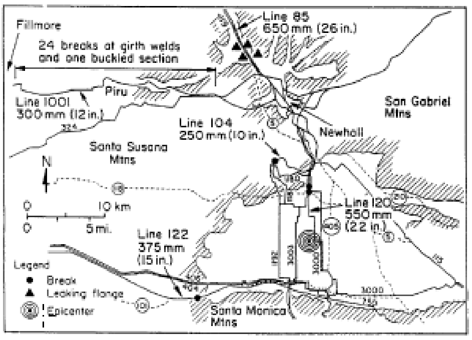


FIGURE 5. Map of Gas Transmission Pipelines in the Area of Strong Ground Shaking


Figure 1. Balboa Neighborhood Burned by Exploding Gas Line in Northridge Earthquake (left); Fire ball that Burned the Neighborhood.

Source:
Above left side: T.D. O'Rourke, M.C. Palmer: Earthquake performance of gas transmission pipelines
Above right side: The Shake Out Scenario, USGS Open File Report 2008-1150

Figure 3.1-21 Damage Map (Example) and Accident Damage Images

b. Accident 2

San Bruno California, Gas Pipeline Explosion and Fire in 2010

(Source: http://www.ntsb.gov/doclib/reports/2011/PAR1101.pdf, Pipeline Accident Report, Pacific Gas and Electric Company Natural Gas Transmission Pipeline Rupture and Fire, San Bruno, California, September 9, 2010, National Transportation Safety Board)

Summary

- Area: California, U.S.A.
- Operator: the Pacific Gas and Electric Company
- Causes: (1)Insufficient quality of welded joints, (2) The insufficient safety management system
- Summary of pipelines: Constructed in 1956, API 5L X42
- Internal fluid: Natural gas

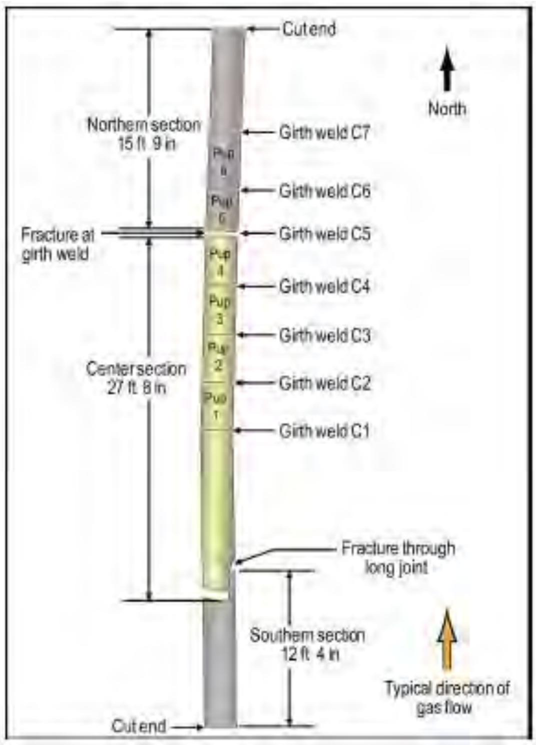
- Pipeline：Line132 –O.D.:30in, Wall thickness :0.375-inch
- Maximum Allowable Pressure: Approximately 2.76MPa
- Maximum Operating pressure: Approximately 2.59MPa

Picture of ejected pipe section.

Aerial view of fire.

Source: http://www.ntsb.gov/doclib/reports/2011/PAR1101.pdf

Figure 3.1-22 Accident Damage Image



Source: http://www.ntsb.gov/doclib/reports/2011/PAR1101.pdf

Figure 3.1-23 Schematic of Accident Pipe

3.1.2 Concepts for Working Pressure to Meet Supply and Demand for Batman 1

(1) Initial Working Pressure (supply of 4MPa)

The supply amount of natural gas is expected to be less than three hundred thousand Nm3 /h, and the working pressure is designed to be 4MPa after the installation of the pipeline up to 2032.

(2) Working Pressure to Meet Peak Gas Demand after 2030 (supply of 6.8MPa)

After the installation of the Phase-2 pipeline in 2030, the supply amount of natural gas is expected to be over three hundred thousand Nm3/h, and the total length will be 95km. Therefore, the working pressure is to be set at 6.8MPa, and heaters are to be installed also at this point since the rapid decompression range at the governor stations, GS1, GS2 and GS3, would cause the adiabatic expansion, that would eventually lead to a drop in the gas temperature.

3.1.3 Preparation for Gas Supply Operation

This section proposes the details of the operation and maintenance of the pipeline facilities mentioned in 2.4.4. The engineers in the Philippines are expected to master the contents of the proposals stated here at the training in Japan before the commencement of operation of the pipeline.

(1) Daily Supervision and Inspection

The supervision and inspection methods mentioned below are to be conducted in order to know the operation conditions such as the gas pressure and flow volume and the conditions of the installations for the safe and stable operation of the pipeline:

1) Patrol Inspection

Patrol inspections are to be implemented to confirm possible leakage from the surface of the ground under which the pipeline is installed, effects from other construction works and other pipeline safety and operation issues. The pipeline patrol inspection is to be given at a frequency of once a day or more.

2) Inspection of Safety and Operation Control Systems

The operational performances of the gas pressure and flow control systems including pressure governors and shutdown devices are to be examined by periodical overhaul inspections and operating tests.

3) Examination of Operational Conditions

The necessary measures to deal with problems of the pipeline operation is to be taken based on the operational conditions such as the pressure and flow volume of the pipeline identified by patrol inspection and remote monitoring. The Batman 1 is generally to employ the remote monitoring with the SCADA system.

It would be suggested that the remote control stations should be installed in Lipa City located in the center of the Batman 1 pipeline route, at 367 m elevation, which is the highest area along the route. Moreover, the training center and patrol staff office should be constructed here. The training center is to provide the staff with training programs periodically to improve the patrol, maintenance, inspection and ultimately operation techniques of the staff.

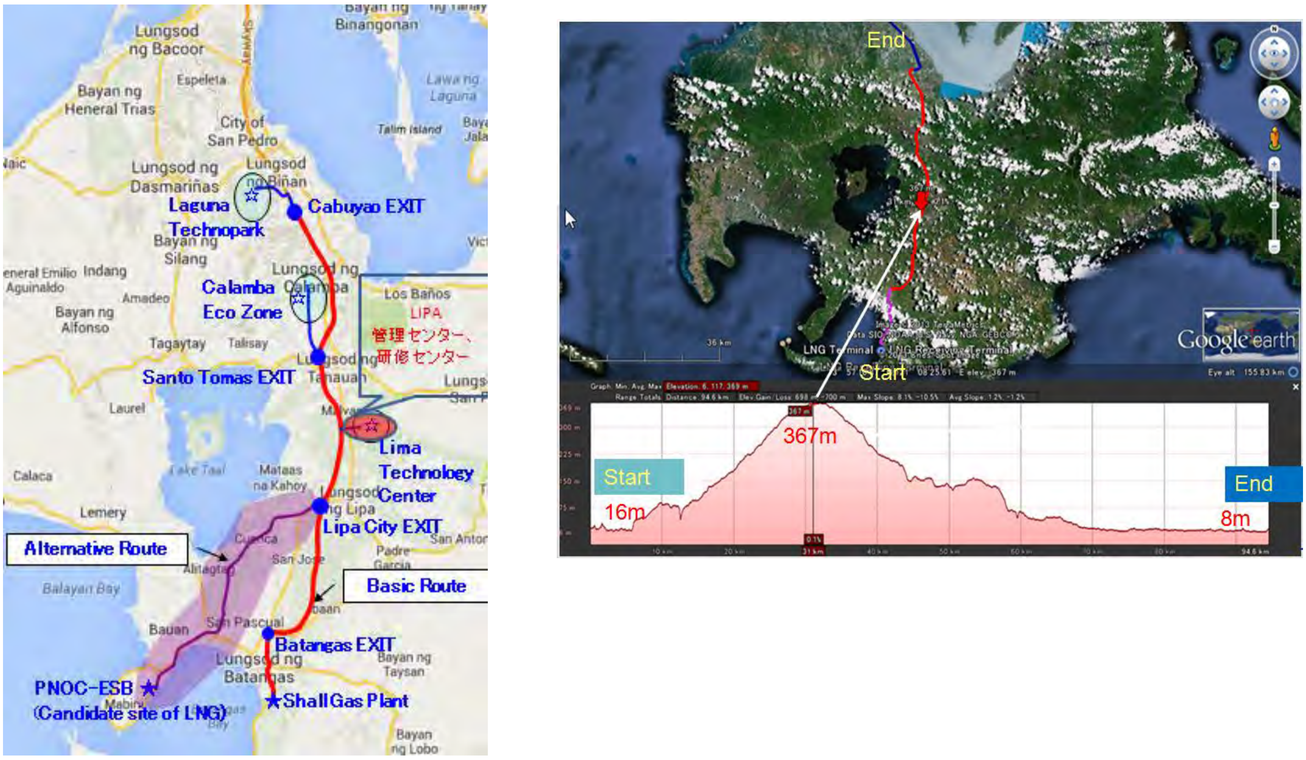


Figure 3.1-24 Location of Central Monitoring Center

If the Central Monitoring Center is set up in Lipa City, the access from the Central Monitoring Center to any pipeline location is one hour or shorter. And furthermore, the altitude is high at 360 m with strong reliability against heavy flood.

4) Update of Drawings

The drawings as a basis of operation and maintenance of the pipeline are required to be revised and corrected appropriately as necessary to reflect the latest conditions of the pipeline depending on the changes in the pipe-laying environment such as alteration of road configuration.

It could be suggested that the Batman 1 control and training center in Lipa City should be in charge of the management of the drawings.

(2) Management/Inspection response to emergencies

If the functions of the pipeline are damaged, by any chance, it is essential to secure the safety and restore the pipeline as soon as possible. Japan, one of the most earthquake-prone countries in the world, has laws, regulations and standards to deal with earthquakes in terms of both hard and soft infrastructures since the social demands in this sphere are strong compared to other countries.

The Batman 1 applies Japanese state-of-the-art seismic technologies to the materials and construction works. Therefore, appropriate standards for the pipeline operation must be created in the Philippines based on the Japanese ones, though stringent operation standards the same as Japan are not necessary.

(3) Monitoring Methods of Third Party Projects

The Batman 1 pipeline is buried under the national roads and expressways. There is a possibility of the existence of the buried facilities underground such as water pipes, other energy supply pipes, communication cables, and also in the future, possible sewage systems to be installed . It is important to monitor those third party construction projects in order to prevent them from affecting the pipeline. Not to mention the daily patrol, other necessary measures to be conducted on a daily basis are mentioned below:

1) Knowledge on Third Party Projects

The Standards for the confirmation of construction works with the owners of the existing pipelines buried under the roads, where the Batman 1 pipeline is to be installed, must be established when executing the construction works on the roads.

The pipeline operator must not only contact with the owners of other buried facilities, but also conduct discussions and arrangements for the security of safety of the pipeline by acquiring the information on third party projects early with the cooperation of the relevant agencies such as road operators and traffic management agencies.

2) Discussion with Other Construction Companies

When receiving an inquiry about the construction from other construction companies, the pipeline operator must conduct discussions and arrangements with them about the impacts of the pipeline on the construction work and protective measures for the security of safety of the pipeline after identifying the pipeline-laying site with the drawings and trial excavation. In addition, it is also necessary to conclude pipeline safety agreements with other companies in advance, and promote the security of safety.

The Philippines has not yet established corporate agreements in this sphere. They must be prepared before the gas supply from Batman 1 commences.

3) Protective Measures

When the pipeline is exposed by excavation or when other construction is conducted near the pipeline, necessary protective measures are to be executed depending on the situations. Also, when the ground deformation is expected to occur, the identification of the situations by measuring the deformation must be executed in addition to the necessary protective measures.

4) Witness and Inspection

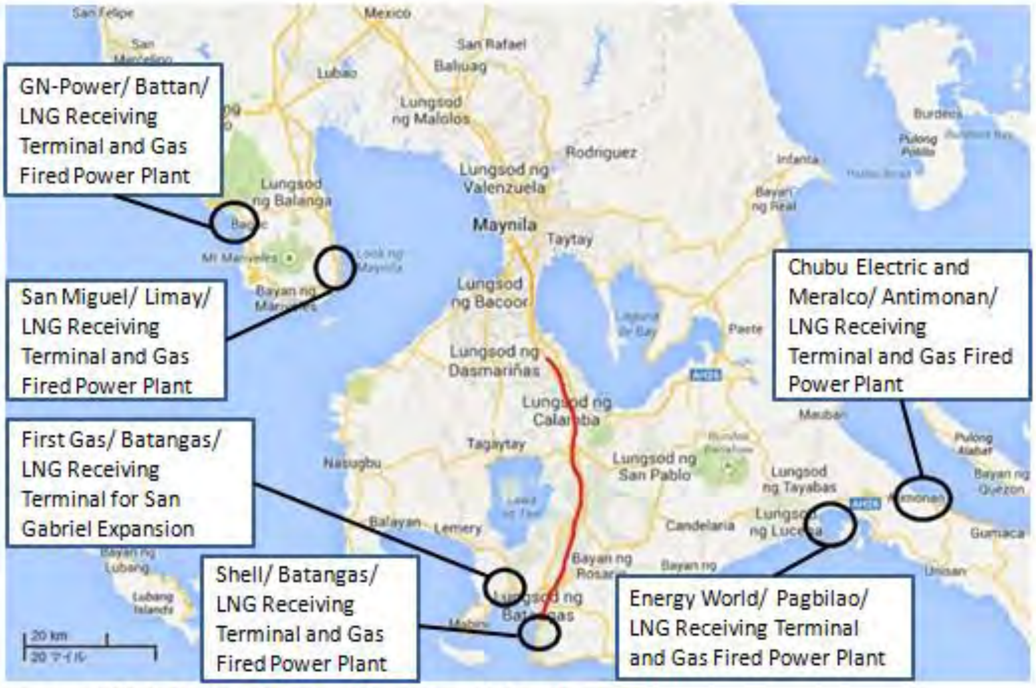
The witness is to inspect the conditions of the pipeline in accordance with the time-table jointly agreed upon between the pipeline operator and other construction companies, and also the identification of the existence or absence of abnormalities of the pipeline must be conducted by inspection as necessary.

(Blank space)

3.2 LNG Receiving Terminal - LNG Receiving Terminals Best Ownership Proposal -

3.2.1 Candidate sites for installation of LNG Receiving Terminals in Batangas

Six construction plans for LNG receiving terminals have been planned in South Luzon including the Batangas area, as shown in
Figure **3.2-1**. Out of the six, two construction works have been planned in Batangas area; one in San Gabriel, and the other in Tabangao. The plans set for these two are not onshore facilities, but the FSRU will be constructed offshore. Among these, FSRU in Tabangao is chosen as the potential supplier of natural gas to Batman1. Furthermore, PNOC, which would be an owner of the Batman1, though excluded from the figure below, is chosen to be examined below as the potential owner of the LNG receiving facilities.



Source: JICA Study Team based on Broadcasted Information, etc

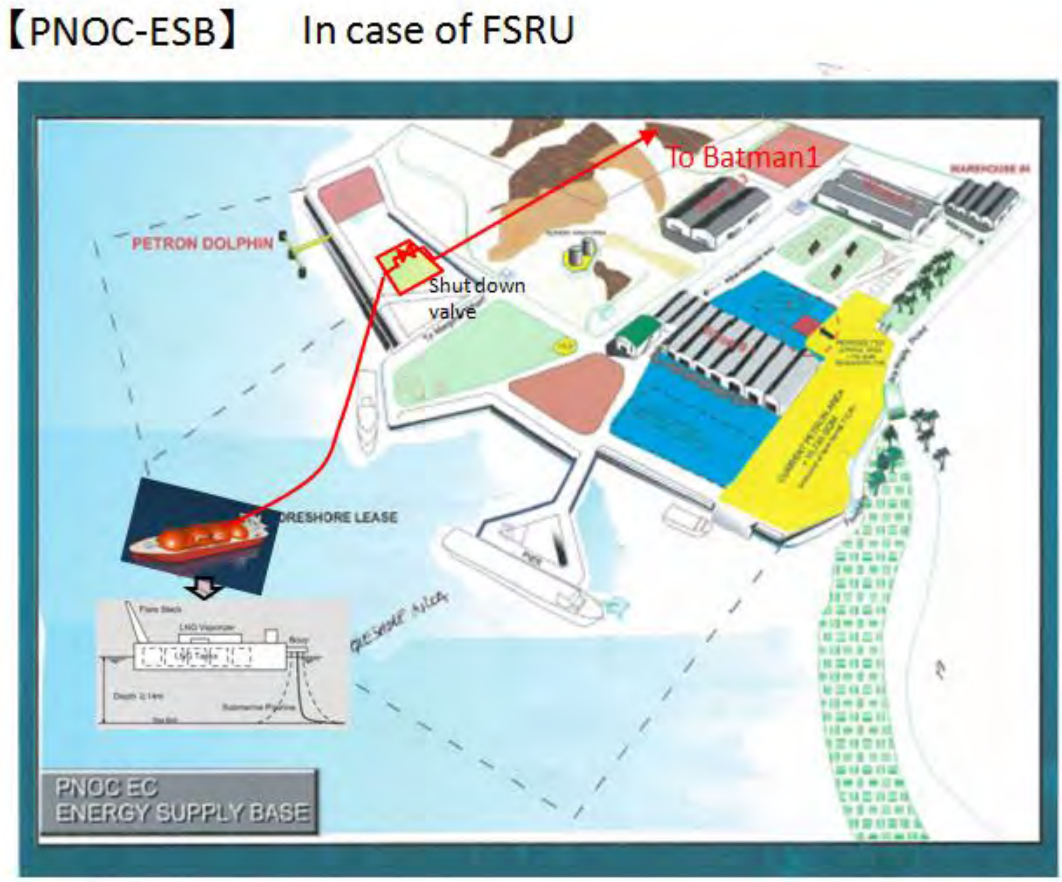
Figure 3.2-1 Candidate sites for installation of LNG Receiving Terminals

(1) Natural Gas Supply from FSRU Tabangao FSRU

The commencement of the natural gas supply from Tabangao FSRU alongside with the start of operation of the Batman1 pipeline could be considered as feasible.

(2) In the Case of Planning at PNOC-ESB

The land owned by PNOC-ESB facing the tranquil waters on the west side of Batangas area could be possibly converted into LNG receiving terminals in the future. It could also be possible to construct FSRU off the coast of the land of PNOC-ESB and distribute natural gas to the Batman 1. However, out of the total land of 15.2 ha owned by PNOC-ESB, 4ha has been lent to PETRON on contract until 2020, and the rest, 11.2 ha in substance, could be regarded as the land area that PNOC-ESB could use. The surrounding area of the PNOC-ESB's piers cannot be utilized as dock for LNG carriers due to the depth of the water of 11-14 m. Nevertheless, the area at the 40 m off the coast, which depth is 20m, could be utilized as LNG receiving terminals except for the restriction on the 11.2 ha land. This 11.2 ha land has been currently utilized as storage spaces for drill pipes for offshore drilling and warehouses for ocean development companies, and it could be difficult, but still be considered as feasible to move those facilities installed on the land to other places, and convert this land to LNG receiving terminal site, keeping in mind the future demand, supply conditions and other necessary elements.


【PNOC-ESB】 In case of FSRU
To Batman1
PETRON DOLPHIN
Shut down
valve
FORESHORE LEASE
PNOC EC
ENERGY SUPPLY BASE


【PNOC-ESB】
Total Land Area is 15.7 ha.
4.0ha is owned by PETRON .
Shut down
valve
PNOC EC
ENERGY SUPPLY BASE

3.2.2 Design Requirements for LNG Receiving Terminals (both Onshore and Offshore)

In this section, the way of ownership of the LNG receiving terminals is to be examined based on the supply plan to meet the demand for the Batman1 in terms of comparative analysis of construction cost and operation and maintenance cost between FSRU and onshore receiving terminal.

LNG handling capacity includes Middle-upper demand forecasts based on this survey and shortage caused by depletion in Malampaya. The result of the demand analysis is shown below.

Table 3.2-1 Demand Analysis

Mid-Upper case

	1. Power	2. Industry	3. Commercial	4. Households	5. Transport	TOTAL	MTPA	Malampaya Oil Depletion Management	Total demand
						MNm3/yr		MPTA	MPTA
2018	0	74	31	6	193	303	0.233		0.233
2023	697	204	35	64	333	1,333	1.025		1.025
2028	697	374	43	100	481	1,695	1.304	1	2.304
2033	2,092	488	51	129	778	3,537	2.721	1	3.721
2038	2,092	629	60	199	778	3,757	2.890	2.5	5.390
2043	2,790	741	71	254	778	4,633	3.564	2.5	6.064

The quantity of stockpile in the onshore terminals is to be decided based on various factors such as the position of LNG thermal power generation, necessity of continuous gas supply, and risk assessment of the LNG chain. Here, the combined amount for stockpile and receiving operation is set to be worth 15 days of the average daily gas feeding quantity.
The FSRU could not secure similar amount of stockpile due to the limitation of its storage capability.

The tank capacity for LNG vessels commonly ranges from 125,000m3 to 153,000m3. In recent years, however, LNG vessels have been getting bigger. Q-Flex Type (216,000m3) was constructed in 2007 and Q-Max Type (266,000m3) was constructed in 2008. The inclusion of reception of LNG vessels up to Q-Max into the plan would enable LNG importing countries to have extended options and hold advantages in price negotiation. Moreover, dredging is not necessary for the candidate LNG receiving terminal site for this project to accept Q-Max due to the very deep water depth. Therefore, the scale of LNG vessels is expected to be smaller than the world's largest capacity as of 2011. Still, conventional sized LNG vessels are able to dock at the piers where Q-Max is expected to dock.
LNG Tank Capacity: 266,000 kl (Q-Max), 153,000 kl (conventional size)

3.2.3 Case Comparison

(1) Preconditions for Review of LNG Receiving Terminal Plan

The comparative review of the following two cases is conducted based on the demand along the Batman1 route and the increase of gas demand in the case of depletion of the Camago - Malampaya gas field; Case 1 represents the gas supply with solo application of onshore terminals, and Case 2 represents the gas supply with switching from the offshore type to be installed at an initial stage to the onshore type after some time passes. *

*In the case of the offshore type (FSRU), the terminal is not able to reserve the stockpile.

(2) Comparison of Construction cost & Facilities Amortization cost

<Case 1> Gas supply with Solo Application of Onshore Terminals

- Calculation of required LNG tanks
  The required storage quantity at LNG receiving terminal is calculated based on the following

equation:

Required storage quantity= Stockpile + Amount of seasonal difference + Amount for receiving operation + Cargo capacity of LNG vessel

The quantity of stockpile is to be decided based on various factors such as the position of LNG thermal power generation, necessity of continuous gas supply, and risk assessment of the LNG chain. Here, the combined amount for stockpile and receiving operation is set to be worth 15 days of the average daily gas feeding quantity. Therefore, the stockpile, in the case of the annual handling capacity of 3.72 million t (as of 2033), is as follows:

$$3.72 \text{ million t/year} \div 0.46 \text{ t/m3} \div 365 \text{ days/year} \times 15 \text{ days}$$
$$= 332.0 \text{ thousand kl}$$

It could be said that there is no seasonal difference in view of the weather in the Philippines. The cargo capacity of LNG vessel is set at 266.0 thousand kl hypothetically for a major vessel, in view of the transport efficiency. Out of the cargo capacity of LNG vessel, the LNG quantity that it is able to actually unload is 263.0 thousand kl. Therefore, the required LNG storage quantity is as follows:

$$332.0 \text{ thousand kl} + 263.0 \text{ thousand kl} = 595.0 \text{ thousand kl}$$

On the assumption that the tank is 180.0 thousand kl, and the dead stock (the amount of gas which could not be utilized due to pump operation) is 3%, the number of required tanks is four as shown below:

$$595.0 \text{ thousand kl} \div (180 \text{ thousand} \times 0.97) = 3.41$$

The numbers of required tanks for each specific year is calculated with the aforementioned equation as follows table.

The construction cost for LNG receiving terminal. The cost for the terminal includes LNG tanks and main machinery, and offshore facilities include piers, pipes and other costs (auxiliary equipment, electric instrumentation facilities and civil work). The costs for site preparation, dredging inside the bay, and breakwaters are included.

As the construction cost is based on the preliminary calculation from the JICA team in 2012, detailed cost estimates are necessary, reflecting the location condition.

Table 3.2-2 Number of Required Tanks and Facility Amortization Cost (Case 1)

Year		2018-22	2023-27	2028-32	2033-37	2038-42	2043-47	
Total Demand	MTPA	0～0.233	～1.025	～2.304	～3.721	～5.39	～6.064	
Number of Required Tanks	Base	2		3	4	5		
Total Investment	MUS$	500		700	900	1150		Total F.A.C
Facility Amortization Cost	MUS$	180		210	120	390		900

<Case 2> Gas supply with switching from the offshore type to be installed at an initial stage to the onshore type after some time passes

Considering the gas supply capacity in the scenario of the supply and demand analysis in Table 3.2-1, excluding amount of stockpile, if the FSRU annual supply volume should be 1.8 MTPA, the solo application of the FSRU until 2023 could be considered as an option. In this case, while operating the FSRU at an initial stage, the construction of onshore terminal must be conducted at the same time for the commencement of operation after 2028*.

*It is estimated that the gas demand around 2036 would exceed the FSRU capacity and onshore receiving terminal would be required, based on the demand analysis.

Table 3.2-3 Number of Required Tanks and Facility Amortization Cost (Case 2)

This calculation has done under the assumption FSRU capacity is limited 3MTPA

Year		2018-22	2023-27	2028-35	2036-37	2038-42	2043-47	
Total Demand	MTPA	0～0.233	～1.025	～3.1542	～3.721	～5.39	～6.064	
Number of Required Tanks	Base	FSRU			4	5		
Total Investment	MUS$	400			1200	1550		Total F.A.C
Facility Amortization Cost	MUS$	173			48	690		911

The construction cost for FSRU, which is based on the preliminary calculation from the JICA team. Detailed cost estimates are necessary, reflecting the location condition. The construction cost includes offshore facilities (i.e. piers), hulls, and onboard facilities. Operation and Maintenance Cost.

(3) Comparison of O & M Cost

<Case 1>

Table-3.2-4shows the operation and maintenance cost for onshore LNG receiving terminal. The operation and maintenance cost includes the costs for electricity, maintenance, labor and other expenses.

Table 3.2-4 Annual Operation and Maintenance Cost for Onshore LNG Receiving Terminal

Annual Handling Capacity	ten thousand ton /year	200～600
Operation and Maintenance Cost	JPY/LNG-ton	1000～1100

<Case 2>

Table3.2-5 shows the operation and maintenance cost for FSRU.

Table 3.2-5 The Operation and Maintenance Cost for FSRU

Annual Handling Capacity	ten thousand ton /year	200
Operation and Maintenance Cost	JPY/LNG-ton	1100

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(4) Construction Schedule

Table 3.2-6 shows the construction schedule for onshore receiving terminal.

Table 3.2-6 Construction Schedule for Onshore Receiving Terminal

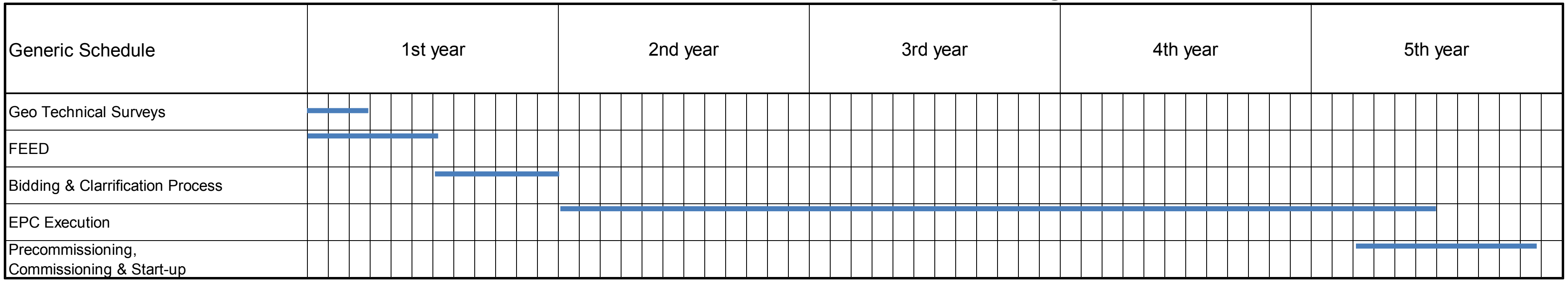
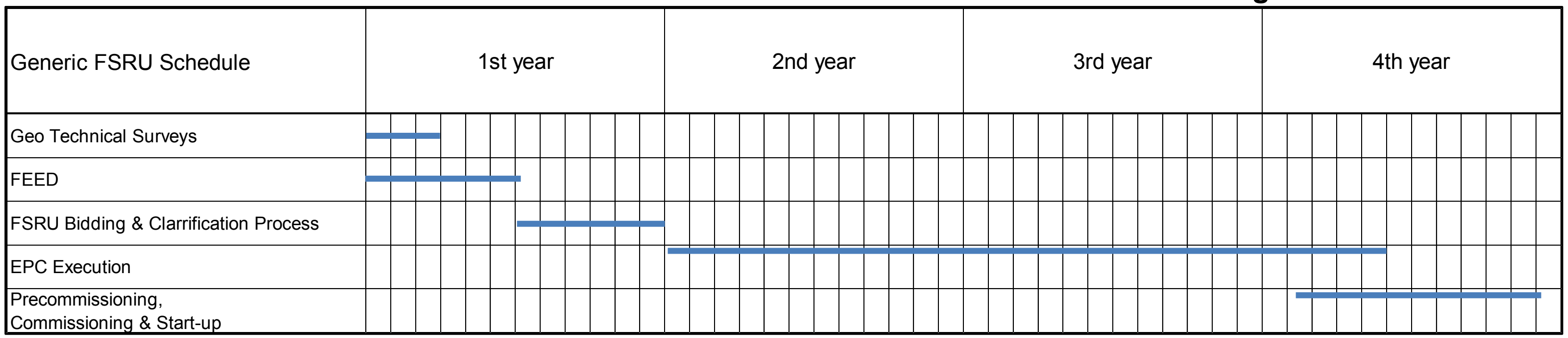


Table 3.2-7 shows the construction schedule for offshore receiving terminal.

Table 3.2-7 Construction Schedule for Offshore Receiving Terminal



3.2.4 Result of Comparative Analysis

The demand forecast based on this survey has identified the possibility of the necessity of the LNG receiving terminal handling approximately 6 million t/ year in the future.
The comparative analysis between the case of ownership of only onshore terminals and the case of switching ownership from FSRU at an initial stage and to onshore terminals at the later stage is outlined in terms of cost, schedule and other factors as follows:

Table3.2-8 Result of Comparative Case Analysis

○ is shown superior or equal to another
△ is shown inferior

<table>
<tr><th></th><th>Case-1 onland system</th><th>Case-2 From FSRU to Onland system</th></tr>
<tr><td rowspan="2">Facilities & Construction Cost</td><td colspan="2">Generally, FSRU Construction cost is cheaper than Onshore system.
But ,like this comparison,firstly apply FSRU and later change the system to onshore system,Onshore system base is a little bit superior than the another. However in case of actual demand is less than planning demand ,amortization cost of onshore facilities will give the damage to the business.
As such a reason,to be applied FSRU firstly is right choice.</td></tr>
<tr><td>○</td><td>○</td></tr>
<tr><td>O&M Cost</td><td>○</td><td>○</td></tr>
<tr><td>Construction Period</td><td>△</td><td>○</td></tr>
<tr><td rowspan="2">Supply Stability</td><td colspan="2">Generally,FSRU is influenced against the weather condition.
So that FSRU usually not use base LNG receiving terminal .But,in case of this project,there is no problem as the reason follows. 1) There is a natural gas pipeline from malampaya fIeld. It is usefull as back up. 2) Line pack of 65 km pipeline is useful for emergency .
There is no difference of superior between onshore and FSRU.</td></tr>
<tr><td>○</td><td>○</td></tr>
<tr><td>Availability of Facilities Expantion</td><td>○</td><td>○</td></tr>
</table>

As shown in Table 3.2.-8, when the gas needs to be supplied by constructing LNG receiving terminal in a short period of time, the scheme to quickly construct FSRU is preferable.
In addition to above mentioned, considering FSRU recent facility improvement and their progress, the general problems in FSRU, as mentioned in this report, have been substantially settled in recent years.

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3.3 Proposal for natural gas supply from Tabangao LNG receiving terminal

From where the natural gas is brought in order to supply for the Batman1 is a crucial factor. The following three points are focused on as supplier selection requirements
1) Being a source which can surely supply natural gas the same time as the completion of Batman1 construction,
2) Being a source whose stable supply plan can be confirmed at this point
3) Being a source which may possibly supply natural gas at a relatively stable price in the future. The result of the examination leads to the selection of natural gas supply from the FSRU which the Energy Supply Company at Tabangao has been planning to commence to operate, meeting the aforementioned points,1) and 2). Some energy supply companies will be able to supply their future gas to demand market such as industrial parks and commercial facilities through the Batman1 in order to meet. 3).
In addition, as a future perspective, it is considered to construct LNG receiving terminals in PNOC-ESB owned by PNOC for connecting to the Batman1 and to link stable supply to natural gas.

Based on the above, this survey designates within the site in Tabangao as the custody transfer point located on the upstream side for the Batman1. In the facilities for the Batman1, nozzles are to be installed to receive natural gas supply from other companies. Other energy supply companies would be able to supply natural gas to the Batman1 with the nozzles.

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3.4 Proposal on Technical Cooperation Capacity Development for Gas Pipeline

(1) Understanding on Current Status of Gas Pipeline

1) Analysis of Current Legal Framework

The only current legal framework for the gas pipeline business regulation is the circular of DOE. Hence the legal framework is not considered to be well developed. The safety standard for the gas pipeline business in the Philippines is also based on the Circular No.2002-08-005 of DOE. In this clause the construction and operation of the gas pipelines should follow the ISO. In particular, the design of the gas pipeline and the environmental matters should follow the ISO 13623 and the domestic other laws, respectively.

Furthermore, the construction of the natural gas facilities should be based on the ISO 13623 or the others stipulated by DOE. Since the Philippines have a number of earthquakes, it is suggested that the Japanese earthquake practices will be applied wherever necessary. The JICA Study applied the Japanese design to the active faults, the areas where the distortion is expected, and the locations with high population density as a result of the consultation of local experts. The establishment of the legal and regulatory systems is expected in the Philippines.

2) Recommendations on Improvement of Technical and Safety Standard

It is crucial to develop the technical standard for the technical standard of the pipeline in order to design, procure and construct the gas pipelines. Batman 1 project is the first trunk gas pipeline in the Philippines to utilize the city gas and hence the smooth implementation is the priority. It is suggested that the major technical standard can be developed as shown in the below.

Table 3.4-1 Major Technical Standards to be Developed

(1) Design Standard

№	Item	Contents
1	Material	Material standard
2	Welding	Welding confirmation test, etc.
3	Structural Design	Appropriate engineering requirement
4	Anticorrosion	Anticorrosion method

(2) Construction Standard

№	Item	Contents
1	Civil Works	Inspection of land fill
2	Welding Works	Welding method, Qualification text for technician
3	Anticorrosion Works	Anticorrosion method
4	Antipressure, Airproof Test	Antipressure, air proof tests and inspection
5	Inspection before completion	Testing method

(3) Standard for maintenance and operation

№	Item	Contents
1	Pipeline and facility	Inspection items and method
2	Anticorrosion management	Anticorrosion management based on method
3	Other construction method	Method for checking, meeting and protection
4	Measures for escape	Notification, shutdown, reduction of pressure, recovery, etc.

It is also important to develop the additional legislations according to the development and the operation of the gas pipelines in the Philippines. The technical standard in Japan has been developed so that the new technology is adopted and the voluntary efforts are promoted. Thus it is possible to voluntarily select the technologies that are adapted to the technical standard in addition to minimize the involvement of the government with respect to the development and the application of the technical standard. The development of the technical standard in the Philippines can also consider these aspects. Furthermore, it is necessary to study the demarcation of the responsibilities with the end-users, and the approval and request for the facility installment.

(2) Study on Capacity Development Plan

1) Overview of Technical Assistance

a. Objectives

It is necessary to develop the legislation to maintain and operate the pipelines and pressure adjustment and other facilities in order to run the gas business in the Philippines. Thus the objective of the technical assistance is to develop the standard for the Philippines in light of the examples in other countries. In addition, the generalization of the construction technical standard is also necessary including those that are applied in this study.

b. Duration

from September 2015 to August 2017

c. Counterpart

Department of Energy , Philippines
Philippine National Oil Company (PNOC)

d. Target of Project

Target Area ; Gas Sector
Field ; All the provinces of the Philippines

2) Framework for Assistance

a. Items for acivity

(i) Assessment of technical and safety standard
1) Analysis of current situation
2) Analysis of current issues on the legal and regulatory framework (Labor law, fire defense law, environment law, business law, etc)
3) Analysis of related international law and standard
4) Review of the ongoing similar project (e.g. energy world project)

(ii) Revision and addition of technical and safety standard
1) Design, material and production standard
2) Inspection rules
3) Completion inspection standard
4) Security inspection standard
5) Maintenance and operation and safety surveillance rules
6) Other related matters

(iii) Measures for application and revision of technical and safety standard
(iv) Recommendations for organizational setup for application of standard
(v) Assistance for procedures on formulation of standard for counterpart

b. Output

(i) Formulate the technical and safety standard that stipulates the minimum quality level on design, production operation and maintenance of gas pipelines and related facilities
(ii) The standard to be understood by the C/P and the organizations to be established so that the C/P can apply appropriately
(iii) Study the succeeding projects after this project if necessary

c. Input

(i) Consultant（Expertise/ number of experts）
Leader/ 1

Mechanical engineer/2
Design engineer/2
Material and production/1
Operation/1
Maintenance and management/1
Law/1
Environment/1
Business regulation/1

(ii) Others
Reception of trainees; 5 staffs x 3times

3) Expected outcome after completion of assistance
- To apply the technical and safety standard appropriately
- To supply gas in a safe and stable manner

4) External factors
- There will be no changes in the government policy on the gas sector
- There will be no significant delay and changes in the project implementation.

5) Considerations on poverty, gender and environment
This project is one that aims at establishing the standard and legal framework, which have no impacts on the environment. Thus the classification of the category will be C based on the JICA environment and social guidelines. There are no specific matters on the poverty and gender issues.

6) Lessons learned from similar project in the past
There is no other projects that dealt with the establishment of the gas sector standards in the past. However the lessons have been identified from the similar projects.

- The project should assist the C/P in understanding the contents and application and in putting into effect appropriately, in addition to establishing the technical standards.
- It is important to encourage the active participation of the C/P and to develop the capacity of the C/P.
- The views from the third parties should be well considered including the related organization, related private companies and general public.
- The project should be intended to develop the standards that are useful for the whole gas sector including the C/P.
- The discussions should be made for collecting information from other countries and collaborating with them in the future.

7) Evaluation plan in the future
The indicators for ex-post evaluation can be the following.

a. Progress of utilization of standard
(i) The technical and safety standards have the legal binding force.
(ii) The standards are applied and maintained appropriately by the C/P and regulatory agency.
(iii) The contents and application methods are well informed to the related organizations and companies.
(iv) The technical standards are applied to all the facilities and project in the country appropriately.

b. Indicators for evaluating the achievement of goals
(i) Legalization of standards
(ii) Situation of application and management of standards
(iii) The coverage areas, number and participants of the public consultation on the standards

(iv) The coverage areas, number and participants of the seminars for information sharing on the standards
(v) Evaluation on achievements that apply the standards

(3) Pilot activities and discussion on the capacity development on the safety standards

1) Provision of information on standards

The pilot activities were conducted in February 2013 with the five trainees from the Philippines.

Objectives of training in 2013:

- To introduce the history of the gas supply industry in Japan and help the development of the gas industry in the Philippines
- To introduce the test data for the basis of the seismic design for the gas pipelines and understand the importance of the seismic design
- To introduce the production process of the gas pipelines and to understand the high-quality Japanese steel pipes.
- To understand the importance of the construction technology and quality management of welding such as automatic welding through the factory and construction site visits.
- To refer to the construction in the Philippines through the technical study at the LNG receiving terminal.

2) Activities

The technical discussion in Japan will lead to the future gas sector development in the Philippines through the in-depth knowledge and expertise of the gas pipelines. Then the C/P can actively promote the gas development.

Figure 3.4-1 Training activity in Japan

End of Document

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- Plunder Law (Republic Act 7080)
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