

6 Policy and Institutional Measures for Gas Use

When making estimates and analyses for the Gas Use Scenario in sections above, we found (a) that gas-related businesses cannot necessarily obtain enough profit in the High Case, (b) that they can obtain enough profit in Option 2 of the Low Case, and (c) that no potential demand is estimated in the transportation sector, in which, from the viewpoint of anti-pollution measures, it is particularly important for gas to be used.

Accordingly, we consider that the introduction of policy and institutional measures for promoting gas use should be examined to address (a) and (c) above.

In this section, we propose policy and institutional measures that should be generally introduced for the Philippines to use gas on a large scale, and then propose more specific ones, which should be adopted to further promote gas use.

6-1 Recommended Measures for Gas Use

Principles specific to the Philippines to be considered will be: (i) to avoid distorting market principles as much as possible, (ii) not to be detrimental to the existing government revenue system, and (iii) to naturally abide with existing legal systems and jurisprudence, as well as policies as much as possible. Further we will take in (iv) the principles implied by the new Power Industry Reform Act (RA9136) such as common access, abolishing subsidies, privatization, and competition promotion as much as possible.

Based upon such considerations, we propose the following policy and institutional measures.

6-1-1 The economic and financial regime for gas promotion

(1) Establishing Preferred Gas Status to Allow Incentive Policies Accepted

a) Create a policy status of gas as a preferred energy due to: merits on urban air cleanliness, friendliness to the globe (less carbon dioxide), inherent higher efficiency, urban convenience, superior urban piped energy transportation (e.g., superior to truck energy transportation through the streets), cutting power generation peaking and

decreasing stratospheric ozone depleting gases by promoting gas air-conditioning, etc.

b) Consider incentives while avoiding detriment to market principles and existing government financial balance as much as possible. Consider basic principles shown in the Power Industry Reform Act such as common access, abolishing of direct and cross subsidies, private sector business promotion, competition promotion, etc., as much as possible while noticing the difference between gas and electricity at the same time.

c) Award incentive to gas facility investment based on the preferred status stated above for certain initial period. Award investment tax saving while avoiding direct appropriations by the government through, e.g., taxable income deduction, direct tax credit to deduct from tax amount, or special depreciation.

(2) Fiscal Incentive Measures

Based on the pioneer status and inclusion in the Investment Priority Plan (IPP) of the gas network development, and considering comparatively weak financial viability of the gas public infrastructure business, we would propose the following incentive measures to be taken:

a) Apply tax holiday policy to the gas network facilities as is used in locating factories in new industrial estates including, e.g., zero corporate income tax for initial 10 years for specifically defined pipeline projects.

b) Excise tax for gas may be zero from scratch. Consider abolishing LNG import tax from 2006, after confirming successful installation of Camago/Malampaya gas, for example. Reduce import duties for materials for gas network from 2005, for example.

c) In general difficulty of project financing scheme for tariff revenue dependent projects like distribution without firm gas purchase agreement, customers can fund in the distribution projects in the form of initial connection fee payment outside gas tariff. This is common in gas distribution business. Customers also have to invest in interior pipes, or the pipe installation within their premises, which could be directly subsidized in the form of tax credit. The government can give caps on the credit amounts, say 30% of the publicly certified costs.

(3) Special Trust Fund

a) Natural gas vehicle projects may require public help due to the public environmental merit and due to high estimated costs. Public subsidy for this kind of project is common in many countries. The part of public infrastructure, i.e. gas filling stations, may receive investment tax credit on, say, 30% to 50% of the certified investment amount. Public bus entities, as well as others having fleet vehicles, could invest and own model gas filling stations, possibly by help of international financial institutions, partly for a public research purpose.

b) Gas cogeneration and gas air-conditioning may have recognized merits due to high energy efficiency to receive investment tax credit on, say, 30 to 50% of certified investment amount. If we need a comparable foreign example, about 7% of tax credit assistance and 30% gas price discount are common in Japan.

c) Gas conversion from oil (heavy fuel oil or diesel fuel oil) may receive investment tax credit on, say, 20 to 40% of the certified amount of investment in gas conversion facilities.

(4) Securing Public Financial Institutions for Gas Use Projects Having Environmental Benefit

(5) Funding for Research Projects to Promote Use of Gas

6.1.2 Legal and regulatory measures

(1) Making Gas Regulatory System Simpler

a) Integrated Law

A final goal for a simpler system is to install an integrated natural gas law and the Philippines will eventually need it. Since creating an act in the legislature may require too big an effort as in any country, we hope and assume that this will be done, e.g., in ten years.

b) One Stop System Guideline: The next best measures will be to integrate all the existing statutes or important provisions into one guideline document so that investors, financiers, sponsors and customers can come to the DOE and instantly know what the rules are, which agency handles them, and what to do to do the business under the

current legislative and regulatory systems. We will assume that this kind of measures will be established in five years.

Such an integrated document will normally specify the provisions, e.g.,:

- Basic policy
- Gas business inception procedures
- Accounting and inspecting system
- Facility installation approval procedures
- Gas technical standard
- Right of way
- Tariff and transmission fees

(2) Basic Tariff Considerations for Gas Use

Economy of scale principle has to be considered for larger customers since the cost per thermal value is truly lower for those customers compared to smaller customers. Such principle is automatically realized by adopting two-part (or three-part) tariff system where a gas rate consists of fixed monthly payment to reflect the fixed cost (i.e., capacity charge) plus energy charge based on the amount of gas used.

When a new project is launched without past cost and revenue data, often considered is LRMC (long range marginal cost) based tariff making. Another system is the value based tariff system, where tariff is determined by the market conditions like international oil prices, economic indices, and gas prices in the upstream, etc. The tariff for extra large customers is often based on this system. While lacking transparency, this often reflects a real market value.

Gas tariff for special purposes, including gas for power generation, may be left outside the normal rate regulation requiring certain transparency and general approval. One is the interruptible tariff system, which give discount to the customers accepting interruptible supply, or otherwise semi-flat load customer tariff, which gives discounts due to high load use of pipelines.

6-2 DOE Organization for Gas Use Promotion and Training

For implementing all the gas downstream promotional measures stated above as well

as a few more important measures to be described below, the DOE will need a group of personnel for gas industry administration with certain expertise and experiences. Looking at the current DOE organization, such a group may be well created under the Energy Industry Administration Bureau, or either an ad-hoc group with Undersecretary Office for a transition period, although other bureaus will be closely linked to it in many specialized items.

There is still uncertainty on which agency will regulate gas prices after the Electricity Industry Reform Act (RA 9136), Sec.43, has defined that the functions of the ERC are limited to items in the electric industry, and the former ERB is expressly abolished by Sec.38. Attaching the gas ratemaking power to the ERC will require a Congress action. Otherwise, without any agency having legal jurisdiction over gas prices, the DOE now may be able to play to guide gas prices to economically appropriate directions, such as ways of deregulated oil prices. The DOE may consider gas prices anyway as an important key in gas use promotion, even without price regulatory powers.

The group of several personnel in the DOE to be newly created will be taking initiatives forming and fostering gas industry by accommodating rules and policies, for gas infrastructure, gas supply conditions to the market, administering gas market enterprises and promoting financing, etc.

Many people in many departments of the DOE already have deep knowledge and expertise on natural gas resources along with the long time development in the upstream. Only additional knowledge is required in the gas downstream development area, particularly for building up regulatory systems. The people in the expected group as well as others in relevant bureaus will need to acquire expertise and knowledge on existing practice in the existing gas industries in other countries as well as in those governments, by dispatching them to those countries or by inviting instructors from.

One of the first tasks of DOE for the promotion may be to plan such training and education of a few dozen officials including some committed officials of the private sector by talking to other governments.

6-3 Linkage to Scenarios in the Master Plan

We have already addressed two scenarios for the Plan: i.e.: (i) a scenario without new

policies ("Gas Use Scenario") and (ii) an extra quantitative promotional scenario ("Gas Promotion Scenario").

The quantitative promotional scenario will extract the promotional policies stated above and include the following policies:

- 1) 10-year tax holiday for corporate tax (32% of profit) for the pipeline sector
- 2) Tax exemption of LNG customs (5% of import value) for the LNG sector
- 3) Tax exemption of machine/materials (5% of import value) for the pipeline sector.
- 4) Applying low-interest rate from international development facilities

6-4 Incentive programs for NGV, cogeneration, and others

In addition to policies mentioned above, we propose the following incentive programs shown below (Table 6-1).

Table 6-1 Proposed Incentive Programs

Proposed Incentive Program (with estimated size in around 2010)					
Incentive Credit Program (Preliminary)	Kind of Assistance	Level of Assistance (example)	Approximate annual size for approvals	Preliminary Investment Amount (\$'000)	Credit Amount (\$'000)
NGV Incentive Programs	Tax credit to qualified private filling stations	50% assist	5 stations	2,685	1,342
	Expenditure to public filling stations	100%	2 stations	1,008	1,008
	Assistance to conversion kits	100%	300 vehicles	645	645
	Special gas price discount (High Case)	20% discount	0.98 mmcf/d	2,776	555
	Subtotal			7,114	3,550
Cogeneration Investment Tax Credit Program	Tax credit to qualified private sector Co-generation	20% assist to investment	5 units	5,370	1,074
	Assist to public & welfare entities (hospitals, schools, etc.)	30% assist	5 units	4,296	1,289
	Subtotal			9,666	2,363
Gas Air-Conditioning Tax Credit Incentive Program	Tax credit to qualified private sector co-generation	20% assist to investment	10 units	21.5	43
	Assist to public & welfare facilities (hospital, schools, etc.)	30% assist to investment	5 units	1,611	483
	Subtotal			1,633	526
Credit to Gas Conversion from Other Fuels (assist to in-house pipes and conversion work)	Industrial customers	20% assist	50 customers	268	54
	Commercial customers	30% assist	70 customers	150	45
	Residential customers	30% assist	1,700 customers	3,851	1,461
	Subtotal			4,069	1,560
Grand Total of Incentives (\$'000)					7,999
Estimated net national government take from C/M gas (\$'000)					276,410
Rate of incentive payment to the national government take total (%)					2.89

6-5 Four Policy Measures

We select the following policy measures to be incorporated in the Gas Promotion Scenario. Specifically, "the four policy measures" are as follows (Table 6-2):

① 10-year tax holiday for corporate tax (32% of profit) for the pipeline sector

The current tax credit system for gas-related business gives permission of a six-year corporate tax holiday. Then LNG and pipeline sectors in the base Case have a six-year corporate tax holiday. As the first policy measure, a ten-year corporate tax holiday is applied only to the pipeline sector.

② Tax exemption of LNG customs (5% of import value) for the LNG sector

LNG imported tax will change from 10% to 3% beyond 2006. When the import tax is completely lifted beyond 2006, we can consider that the FIRR of the LNG sector will increase. Then, by reducing the gas sales price of the LNG sector, the additional profit of the LNG sector moves to the pipeline and power generation sectors. This is the second policy measure for the pipeline sector.

③ Tax exemption of machine/materials (5% of import value) for the pipeline sector.

We assume that many machine/materials for constructing LNG, pipeline, and power generation sectors will be imported. Then it is assumed that 60% of the equipment investment of each sector has a machine/materials import tax (5%) levied before policy measures. As the third policy measure, we consider that the import tax on machine/materials is not levied only in the pipeline sector.

④ Applying low-interest rate from international development facilities

Before instituting policy measures, capital funds for the projects are financed 25% from own capital, 25% from commercial banks, 25% from international development bank A (interest rate: 2%), and 25% from international development bank B (interest rate: 7%). As the fourth policy measure, the pipeline sector can use 75% of the low interest rate (2%) from international development facility A, with the remainder (25%) financed by own capital. Through this fourth policy measure, we can consider that the pipeline sector will take advantage of the low interest rate with less interest payable, than it will without the policy measure.

Table 6-2 Contents of the four policy measures

Credit scenario		LNG	Pipeline	Power
1. Corporate tax credit	No policy	6 years	6 years	0
	With policy	6 years	10 years	0
2. LNG import tax	No policy	3%		
	With policy	0%		
3. Machine/materials import tax	No policy	5 %	5 %	5 %
	With policy	5 %	0 %	5 %
4. Financed by low interest rate	No policy	OCP 25% CMB 25% ID-A 25% ID-B 25%	OCP 25% CMB 25% ID-A 25% ID-B 25%	OCP 25% CMB 25% ID-A 25% ID-B 25%
	With policy	Same as Above	OCP 25% ID-A 25%	Same as above

For High Case, the sales prices affected by the four policy measures are shown in the following table. In Option 1, no prices are affected by the policy measures, because FIRR cannot reach 12% even after introducing them. In Option 2, the prices are reduced only 0.4%, because the FIRR can be decreased from 12.1% to 12.0% after introducing the measures.

Since gas prices are slightly reduced even in Option 2 by the policy measures, we have made no estimation of potential gas demand after introducing the measures.

Table 6-3 Changes of gas sales prices between with the four policy measures and without the measures (High Case) (%)

Case/Option	Policy	User sectors	2010	2015	2020	2025
High	Without policy	Industry	7.58	8.02	8.58	9.83
		Commercial	8.87	9.38	10.03	11.49
		Residential	9.85	10.42	11.14	12.76
		Transportation	8.18	8.65	9.25	10.59
		Prices for power	7.39	7.81	8.35	9.57
High Option 1	With policy	Industry	Same	Same	Same	Same
		Commercial	Above	Above	Above	Above
		Residential				
		Transportation				
		Prices for power				
High Option 2	With policy	Industry	7.58	8.01	8.57	9.81
		Commercial	8.85	9.36	10.01	11.47
		Residential	9.84	10.40	11.13	12.75
		Transportation	8.17	8.64	9.23	10.58
		Prices for power	7.38	7.80	8.34	9.56

7 Evaluation of Two Options in Gas Promotion Scenario

7-1 Actual demand for gas

In both Cases, actual demand for gas in this scenario is the same as that in the Gas Use Scenario.

7-2 Pipeline networks

The networks are the same as those in the Gas Use Scenario, because, as mentioned above, actual gas demand in this scenario is estimated to be the same as that in the Gas Use Scenario.

7-3 Evaluation of two options

7-3-1 Evaluation by optimal supply model

The cost/benefit ratios in this scenario are the same as those in the Gas Use Scenario, because the networks are the same as those in the Gas Use Scenario, as mentioned above.

7-3-2 Evaluation by financial analysis

(1) Area L

Policy measures taken for promoting gas use will affect the FIRR for Area L shown in the table below.

Table 7-1 FIRR of the pipeline sector after implementing the four policy measures

Tax and finance credit policies	High Option1	High Option2	Low Option1	Low Option2
(0) Non-credit policy	10.3	10.9	11.0	12.7
(1) 10-year corporate tax holiday	10.8	11.5	11.9	13.9
(2) Except LNG import duty	10.6	11.3	11.2	12.9
(3) Except machine/materials import duty	10.7	11.3	11.4	13.1
(4) Low interest rate from IDF	10.0	10.7	10.9	12.7
(1)+(2)	11.1	11.8	12.0	14.0
(1)+(2)+(3)	11.6	12.2	12.3	14.4
(1)+(2)+(3)+(4)	11.4	12.1	12.2	14.3

1) High Case

The FIRR in Option 1 is estimated to be less than 12%, while in Option 2 it reaches 12.2% if such measures as the ten-year exemption from corporate tax, the exemption of LNG import tariff, and the exemption of machine / materials import tax are taken.

2) Low Case

As already mentioned, in this Case, the FIRR of Option 2 is estimated to be 12.7%. Accordingly, we consider that no policy measure needs to be introduced in this Case.

(2) Areas C-M and D

In Areas C-M and D, the pipeline and power generation sectors are not economically feasible as in the Gas Use Scenario.

7-4 Conclusion

The following are the conclusions of the evaluation.

On Luzon Island, Option 2 is superior to Option 1 in terms of profitability in the High Case. The profitability of Option 2 will be sufficient for gas-related businesses, including LNG supply, gas pipeline, and gas-fired power generation.

As mentioned above, we consider that no policy measure needs to be introduced in the Low Case (Option 2).

On the other hand, in Areas C-M and D, gas-related businesses will not be economically feasible as in the Gas Use Scenario, assuming that gas demand is as low as that estimated for the target period (2000 to 2025).

8 Potential Gas Demand in the Transportation Sector and Others

As mentioned already, no gas demand is estimated in the transportation sector, even in the Gas Promotion Scenario. To supplement the estimation made by the macro method, we estimate potential demand for gas for the case that additional policy measures are taken using the bottom-up method.

8-1 Policy Measures for Introducing NGV

The exhaust gas from a diesel engine is one of the biggest problems. NGV conversion of diesel vehicles cannot be expected from the estimated fuel prices. The following political supports are effective for NGV conversion of diesel vehicles.

- ① Investment support for conversion kits
- ② Investment support for gas filling stations
- ③ Gas price support for NGV

Even if 100% support for conversion kit (①) and filling station investment (②) is given, NGV conversion is not economical. Gas price support is inevitable. "Gas Promotion Scenario-A" gives 100% support for conversion kit and filling station investment, and gas price support that make gas price competitive with diesel fuel oil. The results are shown in Table 8-1.

Table 8-1 Estimated Gas Price Support

Case	Gas price to stations (A)	Margin for filling station	Gas price to users (B)	Gas price for covering conversion kit cost (C)	(B) - (C) (D)	(Ps/Nm ³)
						Revised gas price to filling stations (A) - (D)
High	20.1	2.2	22.3	19.2	3.1	17.0
Low	16.9	1.9	18.8	13.5	5.3	11.6

Gas prices to filling stations are 20.1 Ps/Nm³ in the High Case and 16.9 Ps/Nm³ in the Low Case. And, gas prices to NGV (users), which include the margin for filling stations, are 22.3 Ps/Nm³ in the High Case and 18.8 Ps/Nm³ in the Low Case.

On the other hand, gas prices for covering conversion kit costs are 19.2 Ps/Nm³ in the

High Case and 13.5 Ps/Nm³ in the Low Case. As a result, necessary gas price supports are 3.1 Ps/Nm³ in the High Case and 5.3 Ps/Nm³ in the Low Case (As of 2010).

8-2 Estimation of Potential Gas Demand for NGV

Gas Promotion Scenario-A gives investment support and gas price support targeting diesel vehicle conversion to NGV. Without investment support, a gasoline taxi can take benefit by converting to NGV, if the gas price becomes low. A large number of gasoline taxis, in addition to diesel cars (taxies, jeepneys, and buses), can be converted to NGV.

If a sufficient number of filling stations are not constructed, the convenience of filling CNG is greatly reduced, because the number of NGV becomes high. If the number of gas filling stations becomes high, the amount of support becomes large and at the same time the amount of gas price support becomes large. A detailed feasibility study is necessary to implement support policies.

8-3 Other New Types of Gas Use

Finally, we consider the following gas uses when estimating potential demand using the bottom-up method. They are:

- ◆ Gas use for co-generation and cooling mainly in newly developed urban areas,
- ◆ Fuel cell,
- ◆ Micro-gas turbine,
- ◆ Freezing storage, and
- ◆ DME (Di-methyl ether).

Items others than the first and fourth have been technologically and economically premature.

For the first item, we estimated potential demand, assuming a similar urban area by referring to the "Land Use Plan" for Fort Bonifacio in Metro Manila, where urban

development is underway.

This area is 25 ha, composed of a) a business district, b) a residential district, and c) a large recreational district. Laying gas pipelines is planned for the area, through which natural gas is to be supplied in the future with LPG supplied for the time being.

If a similar urban area to Fort Bonifacio is developed, its potential gas demand will be 0.7mmscfd.

9 Comprehensive Evaluation of Two Scenarios

We have concluded that, for Area L in the Gas Use Scenario of the Low Case, Option 2 is superior and gas-related businesses, including LNG supply, gas pipeline, and gas-fired power generation, in the Option are profitable, as mentioned above. Accordingly, we consider that the Gas Use Scenario should be incorporated in the master plan for promoting gas use without any examination of the Gas Promotion Scenario.

For Area L in the High Case, we have concluded, through comparing two Options in two scenarios, that Option 2 is superior to Option 1 in both of the scenarios in terms of profitability, and that the gas-related businesses in Option 2 can operate with economic viability only in the Gas Promotion Scenario.

For Areas C-M and D, gas businesses have been evaluated to be economically unfeasible.

Here, in this section, mainly focusing on the High Case, we evaluate two scenarios in terms of such criteria as economic benefits, macro-economic indicators, environment and safety, and socio-economic effects to select one scenario, which is more desirable for the Philippines as a whole.

9-1 Evaluation of the Economic Effects

9-1-1 The economic analysis

In natural gas-related businesses, LNG import customs, machines/material import customs, property tax, value added tax, corporate tax, business tax, withholding tax, etc., are levied. These taxes are inputted to government revenues. Therefore, it is expected that the economic analyses have the internal rate of returns (IRRs) of a higher value than that of the financial analyses.

As shown in the following table, the total project sector (including LNG, pipeline, and power sectors) in Luzon has a higher economic internal rate of return (EIRR) at over 20%. We can say that the EIRRs are sufficiently high, which we can often see in

energy-related projects.

In the following table, the EIRR of the total project (includes LNG, pipeline, and power sectors) does not change between with the four policy measures and without the four policy measures. When instituting the four policy measures, we decrease the gas sales price in the LNG sector to adjust profit. As a result, the EIRR of the pipeline sector with the four policy measures is higher than one without the four policy measures.

Table 9-1 EIRR in Area L in the Gas Use Scenario

Sector	High Option1	High Option2	Low Option1	Low Option2
LNG	19.6%	19.7%	20.6%	20.6%
Pipeline	15.7%	16.5%	16.4%	18.5%
Power	21.9%	21.9%	32.7%	32.7%
Total	23.3%	23.5%	30.3%	30.9%

Table 9-2 EIRR in Area L in the Gas Promotion Scenario

Sector	High Option1	High Option2	Low Option1	Low Option2
LNG	17.9%	18.0%	18.8%	18.7%
Pipeline	16.6%	17.3%	17.0%	19.0%
Power	22.5%	22.5%	33.0%	33.0%
Total	23.3%	23.5%	30.3%	30.9%

9-1-2 Effects on the Philippine Economy

By implementing gas-related projects, the nominal GDP increases 0.3-0.5%, compared to the nominal GDP forecasted in Chapter 4.

**Table 9-3 Effects on the Philippine economy of gas use
(High Case / Option 2)**

Case / Option		Unit	2010	2015	2020	2025
GDP High / Option 2	Without	Billion peso	14,059	21,210	32,550	49,104
	With	Billion peso	14,107	21,296	32,691	49,343
	Difference	%	0.3%	0.4%	0.4%	0.5%
Govt. revenue High / Option 2	Without	Billion peso	2,515	3,786	5,795	8,716
	With	Billion peso	2,521	3,801	5,825	8,771
	Difference	%	0.2%	0.4%	0.5%	0.6%
Un-employment High / Option 2	Without	%	9.6	8.3	6.6	4.7
	With	%	8.5	7.3	5.8	4.0
	Difference	%	-1.1	-1.0	-0.8	-0.7

The government revenue with the project increases 0.2-0.6% compared to the Case

without the project. The government revenue without the project is also forecasted in Chapter 4.

Un-employment rate in 2025 decreases 0.7-1.1% compared to that without project. Un-employment rate with the project in 2025 is 4.0%, which can be compared to 4.7% without the project.

9-2 Environment and Safety

In gas supply businesses, there are the following fields or opportunities, in which environmental effects and safety should be examined seriously.

First, with regard to gas pipelines, we can find fields or opportunities for constructing and operating them on-shore as well as offshore.

Second, with regard to LNG supply, they are: (1) constructing and operating LNG terminals, and (2) operating LNG tankers and ships, including not only those transporting LNG from original sources to importing countries, but also those shipping LNG from receiving terminals in Luzon to Cebu and Davao, as well as in receiving LNG to storage tanks.

We consider that the environment can be duly preserved and safety be sufficiently secured in these fields or opportunities, if pipelines and LNG terminals are constructed and operated properly, using experience and devices in advanced countries in gas utilization. However, appropriate policy measures should be implemented to cope with such problems, especially because the U.S. and the UK, for instance, have experienced pipeline accidents even in recent years.

In addition, with regard to pipelines, we should note that there are areas or districts where it is difficult to lay pipelines. For instance, there are useful agricultural areas in Area D and soft ground along the Pampanga River in Area L-2.

Global environmental problems are important items for us to consider regarding the environmental effects of gas use. The Philippine Clean Air Act of 1999 stipulates in "Section 31. Greenhouse Gases" the following:

The Philippine Atmospheric, Geophysical and Astronomical Service Administration shall regularly monitor meteorological factors affecting environmental conditions including ozone depletion and greenhouse gases and coordinate with the Department (DNRE) in order to effectively guide air pollution monitoring and standard-setting activities.

The Department, together with concerned agencies and local government units shall prepare and fully implement a national plan consistent with the United Nations Framework Convention on Climate Change and other international agreements, conventions and protocols on the reduction of greenhouse gas emissions in the country.

Gas use can provide the Philippine government with powerful countermeasures for tackling the problem.

Finally, gas use will naturally contribute to reducing SO_x, NO_x, dust, and other air pollutants, which are sources of the so-called local environmental problems. Also, in this regard, gas use can contribute to the Act reaching its targets.

We have made quantitative evaluations on the effects of these greenhouse gases and air pollutants being reduced by increased gas use, which show that reduction effects on CO₂ (carbon dioxides) are very large in the power generation sector in particular and that the effects on SO_x are large even in non-power sectors (Figure 9-1, 9-2).

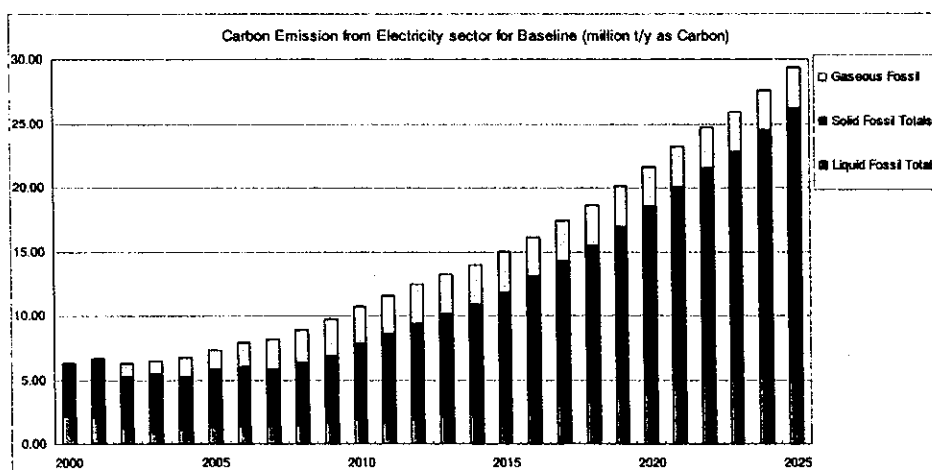


Figure 9-1 CO₂ Emissions in the Power Sector (Baseline)

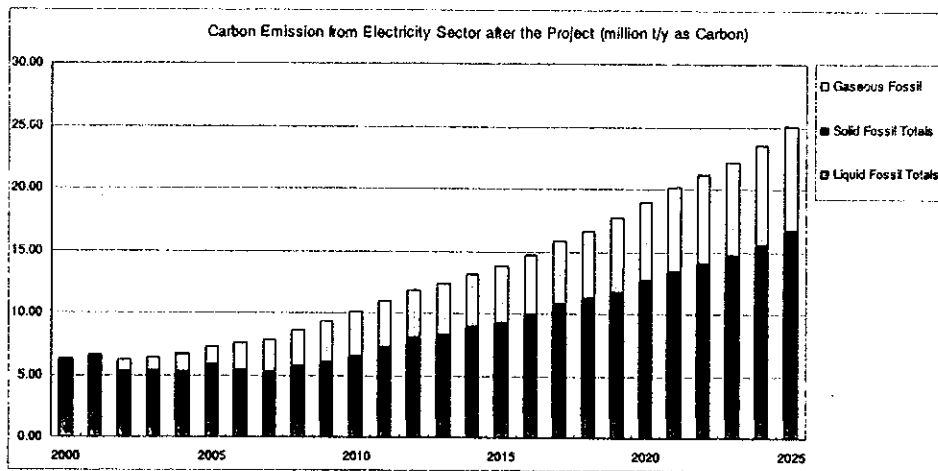


Figure 9-2 CO₂ Emissions in the Power Sector (After gas use)

In the power sector, 4.08 million and 5.37 tons of CO₂ will be reduced by decrease in consumption of petroleum products and coal, respectively, in 2025, while 5.16 million tons of CO₂ will be generated by gas consumption. As a result, 4.30million tons of CO₂ can be reduced. In addition, 0.90 million tons of CO₂ will also be reduced by the decrease in petroleum refining which gas use will cause. In total, 5.33 million tons of CO₂ can be reduced compared to the baseline, in which there is no additional gas use (In the High Case).

The largest reduction among greenhouse gases and air pollutants is estimated to be SO_x, which will be reduced by 17.3% compared to the baseline in 2025. Figures 9-3 and 9-4 show SO_x emissions in the baseline and after gas use, respectively.

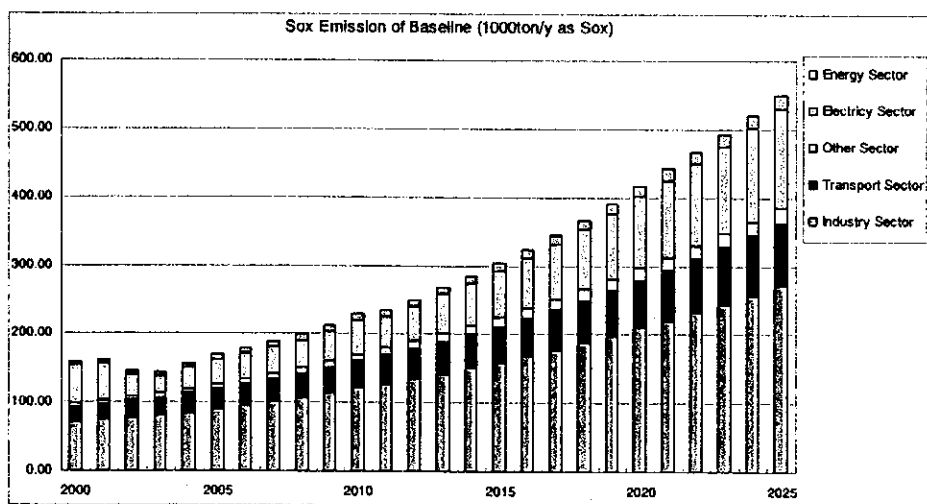


Figure 9-3 SO_x Emissions in the Non-Power Sector (Baseline)

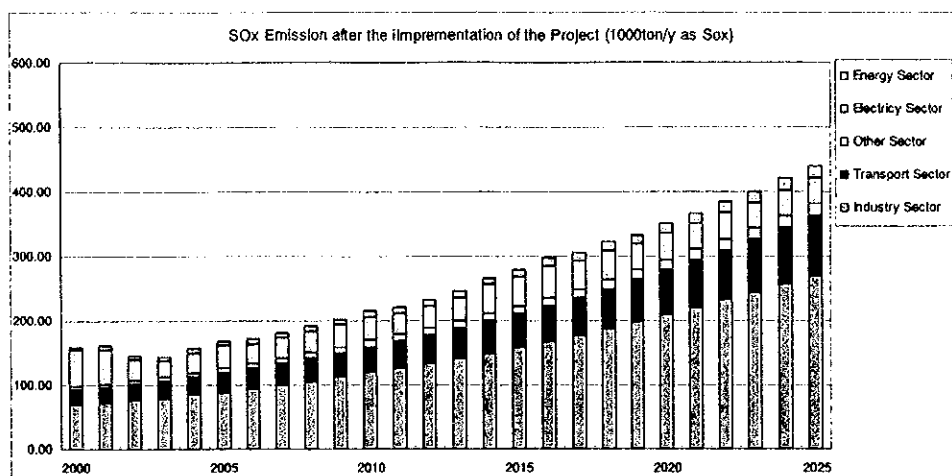


Figure 9-4 SOx Emissions in the No-Power Sector (After gas use)

In the power sector, SOx emissions after gas use is estimated 41,000tons in 2025, which is less than 30% of the baseline (146,000tons).

9-3 Socio-economic Effects

In the Philippines, many NGO, PO or NPO have been active in various sectors, including regional development plans and programs, and it is very common for people or residents to join the planning process of regional developments.

Accordingly, in implementing gas-related development programs, supply system formations in particular, it is necessary for related organizations and companies to try to disclose information and to accept people joining the planning process from the initial stage.

9-4 Comprehensive Evaluation

First, there is no major difference between the two scenarios in the effects of gas-related businesses on the Philippine economy. Specifically, we can see no major difference in EIRR (total), economic growth, government revenues, and employment, although the Gas Promotion Scenario is slightly superior to the Gas Use Scenario in criteria other than EIRR (total).

Looking at the EIRR in the gas pipeline sector, however, it is higher in the Gas

Promotion Scenario than that in the Gas Use Scenario, which, we can say, means the former is more desirable than the latter, considering the importance of gas supply in the country in the future.

Second, on environment and safety, we can see no difference between the two scenarios.

Third, on socio-economic effects, it might be rather difficult for gas-related businesses to acquire public acceptance for the construction of LNG terminals and laying pipelines. However, there is no difference in the difficulty between the scenarios.

Fourth, there is no difference between the scenarios for securing a stable supply of gas.

In summary, we can say that the Gas Promotion Scenario is the superior in terms of economic benefits, but can see no difference between two scenarios in other criteria (Table 9-4).

We, however, consider that it is reasonable for the Philippine government to implement the policy measures proposed in the Gas Promotion Scenario, taking into account the results of the financial analysis, showing that gas-related businesses cannot be profitable in the Gas Use Scenario in the High Case.

Table 9-4 Comprehensive Evaluation of the Scenarios

	EIRR	GDP	Employment	Government budget	Environment	Public acceptance
High case (Option 2)						
Gas Use Scenario	*LNG: 19.7% *Pipeline: 16.5% *Power: 21.9% *Total: 23.5%				*CO2: -7.2% in power sector. *SOx: -17.3% in non-power and -72.0% in power.	*Laying pipelines to and/or through NCR and other sub-areas may be difficult.
Gas Promotion Scenario	*LNG: 18.0% *Pipeline: 17.3% *Power: 22.5% *Total: 23.5%	*Growth rate: From +0.3% to +0.5%	*Rate of unemployment: -0.7% to -1.1% per annum	*Govern. revenue: +0.2% to +0.6% per annum	*CO2: -7.2% in power sector. *SOx: -17.3% in non-power and -72.0% in power.	*Laying pipelines to and/or through NCR and other sub-areas may be difficult.

10 A Master Plan for Promoting Gas Use

10-1 High Case

10-1-1 Gas Promotion Scenario (Option 2)

We have selected the Gas Promotion Scenario to be incorporated in the master plan for promoting gas use in the High Case.

On the gas demand side of this scenario, the construction of the following gas fired power plants is assumed for the period from 2001 to 2012.

2005 :	San Pascual (300MW)
2008 :	Sucat (300MW)
2009 :	Sucat (300MW)
	A power plant (300MW) in Bataan area
2010 :	A power plant (300MW) in Batangas area
2011 :	A power plant (900MW) in Bataan area

In addition, we assume gas filling stations for NGV will be commercially operated in NCR by 2006.

On the supply side, we assume a gas pipeline will be laid from Tabangao to NCR by 2006 to meet gas demand in Sucat power plant and the gas filling stations.

A LNG terminal will be constructed in Bataan by 2009 to supply LNG to power plants built in the area. In addition, investment will be made for constructing another LNG terminal in Batangas, which will be commissioned in 2013.

In this section, we consider a master plan, which shows a ten-year program for the construction of pipelines and LNG terminals, investments and financing, development of manpower, and policy measures to be implemented to accomplish the targets shown in the schedules mentioned above. Furthermore, we propose priority projects, which should be implemented preferably in the near future to make the master plan effective and efficient.

10-1-2 An Action Plan (2001 to 2012)

(1) Construction

1) Pipelines

A pipeline from Tabangao to NCR needs to have been laid by 2005 so that it can start operation in 2006.

Accordingly, an implementing entity (a private company having a construction permit given by the government) should determine the plan for construction including the pipeline route, and should start design works at the latest by 2002. At the same time, it should start buying the R.O.W. land according to the route to be finalized by the end of 2004.

From 2004, it should start construction of transmission (high pressure) and distribution (low and middle pressure) lines, along with continued purchases of the land. After that, the construction of pipelines should be continued according to the following schedule.

2005: Construction of transmission and distribution lines to Cavite, in addition to NCR.

2006 to 2012: Construction of distribution lines to NCR and Cavite

2) LNG terminals

LNG terminals are to start their operations on Bataan peninsula in 2000, which should have been constructed by each preceding year.

An implementing entity (a private company having a construction permit given by the government) for the LNG project should determine its plan and start to make the detailed design of the LNG terminal (and a LNG power plant) at the latest by 2004. At the same time, it should continue various administrative measures and buy the necessary land to be finalized by the end of 2004.

It should start constructing the terminal in 2006 to be completed by the end of 2008.

(2) Investments and financing

1) Investments

a) Pipelines

Investments will be as large as US\$62.5 and US\$78.1 million in 2004 and 2005, respectively, because construction of a pipeline from Tabangao to NCR will start at the latest by 2004 and its part of a transmission line will be constructed in 2004 and 2005. After that, they will fluctuate between US\$25.0 and US\$32.0 million, because the targets of investments will shift to part of the distribution lines (Investments are shown in the nominal price. Hereinafter the same).

b) LNG terminals

Investments in the LNG project will be US\$10.8, US\$11.0, and US\$11.2 million in 2006, 2007, and 2008, respectively.

2) Financing

We assume that investments in LNG terminals will be financed in the following: 25% by own capital, 25% by borrowing from commercial banks, 25% by borrowing from an international financial institution (IFI-A) (with interest rate of 2%), and 25% by borrowing from IFI-B (with interest rate 7%).

In comparison, we assume that investments in gas pipelines will be financed in the following: 25% by own capital and 75% by borrowing from IFI-A (with interest rate of 2%).

The LNG and pipeline sectors should finalize their negotiations for borrowings at latest by around the preceding year of investments starting as mentioned above.

(3) Policy and Institutional Measures

1) Preparation of laws and regulations

- ◆ **Implementing Rules and Regulations (IRR) (DOE)**
 - To prepare IRR for transmission and distribution lines from 2001 to 2004.
- ◆ **Integrated laws and institutions (DOE)**
 - To prepare "One-stop Legal System Guideline" from 2005 to 2006 and "Integrated Natural Gas Law" from 2008 to 2010.

- ◆ Gas tariff system (DOE and ERC)
 - To define tariff regulator and systems from 2002 to 2003.
- ◆ Industry structure (DOE)
 - To define transmission and distribution entities and others by the end of 2003.

2) Implementation of economic and financial incentives

- ◆ Comprehensive studies on economic and financial incentives (DOE, DOF, and DTI (BOI))
 - To conclude incentives for development and competitiveness, integrated fiscal incentive policy, and others by the end of 2004.
- ◆ Special Gas Fund (DOE, DOF, and DTI (BOI))
 - To establish it through inter-department adjustments by the end of 2002.
- ◆ NGV initiatives (DOE) ---- To establish NGV policy for implementation including incentives by the end of 2004.

3) Establishment of communication networks

- ◆ Public and inter-departmental communications (DOE)
 - To form a national gas association which, jointly with the government, communicates to and from the international gas community.

4) Education

- ◆ Local government education (DOE)
 - To educate local governments to achieve public acceptance of pipelines, in particular.
- ◆ Vocational education (DOE)
 - To publish texts for energy and gas to be employed by schools and universities.

(4) Development of Manpower

1) Pipelines

We assume that around 240 persons will be needed for constructing transmission pipelines each in 2004 and 2005, and that around 100 persons will be needed for constructing distribution lines each in the following years.

In addition, persons necessary for operation and maintenance will number around 240 in 2006 and 660 in 2012, for instance, including manpower necessary for marketing gas to the industrial, commercial, and residential sectors.

2) LNG terminals

We assume, for the LNG project, that around 400 persons will be needed for constructing the terminals each year and around 100 persons also for operation and maintenance each year.

3) Administrative measures and others

Manpower will be needed for proceeding with administrative measures related to the gas industry in the central and local governments, in addition to those mentioned on pipelines and LNG above. They include those for planning, approvals and permits, environment and safety, etc. on gas use and supply.

In addition, manpower will be needed for establishing information networks between the governments and gas-related industrial circles, as well as between those and international gas-related organizations

More specifically, manpower should be trained for the preparation of laws and regulations and the implementation of economic and financial incentives in the following (Table 10-1).

a) Preparation of laws and regulations

i) Implementing rules and regulations (IRR) (DOE)

For preparing IRR from 2002 to 2004, DOE staff will have been trained at the latest around by the end of 2002.

We assume that DOE will need to entrust outside consultants with the preparation of IRR, therefore, the staff will be trained for them to get the ability for their entrusting.

The staff in DOE will belong to a section or group newly established in DOE as proposed in Chapter 3, which consists of one senior staff (having more than fifteen year experiences), two middle class staff (having five to fourteen year experiences), and one junior staff (having less than five year experiences).

Finally, they will be trained by foreign experts in the Philippines and in self-development through using reports and books.

ii) Integrated laws and institutions (DOE)

For preparing "One-stop Legal System Guideline" from 2005 to 2006 and "Integrated Natural Gas Law" from 2008 to 2010, DOE staff will have been trained at the latest around by the end of 2003 and 2007, respectively.

We assume that a project team will be formed in DOE; therefore, the staff will be trained to get the ability necessary for preparing the laws and regulations for themselves.

Each staff will consist of one senior staff, three middle class staff, and four junior staff, who will collaborate with the group mentioned above.

Finally, they, at least some of them, will be trained in foreign countries and in self-development through using reports and books.

iii) Gas tariff system (DOE and ERC)

For defining tariff regulator and systems from 2002 to 2003, DOE and ERC staff will have been trained at the latest around by the end of 2002.

We assume that DOE and ERC will need to entrust outside consultants with the preparation of the system; therefore, the staff will be trained for them to get the ability necessary for their entrusting.

A part of the staff will be the same as those in the group newly established in DOE and others will be selected in ERC.

Finally, they will be trained by foreign experts in the Philippines and in self-development through using reports and books.

b) Implementation of economic and financial incentives

i) Comprehensive studies on economic and financial incentives (DOE, DOF, and DTI(BOI))

For concluding the incentives for development and competitiveness, integrated fiscal

incentive policy, and others by the end of 2004, the staff will have been trained at the latest around by the end of 2002.

We assume that DOE, DOF, and DTI (BOI) will form a project team, respectively; the staff will be trained to get the ability necessary for concluding the incentives for themselves.

The staff of each Department will consist of one senior staff, three middle class staff, and four junior staff, who will collaborate with the group in DOE mentioned above.

Finally, they, at least some of them, will be trained in foreign countries and in self-development through using many kinds of publications.

ii) Special Gas Fund(DOE, DOF, and DTI (BOI))

For establishing the fund through inter-department adjustment by the end of 2002, the staff will have been trained at the latest around by the middle of 2002.

We assume that DOE, DOF, and DTI (BOI) will need to entrust outside consultants with the preparation of SGF; therefore, the staff will be trained for them to get the ability for their entrusting.

The staff will be the same as a new group mentioned in a)- i) above in DOE and similar groups will be formed by DOF and DTI (BOI).

Finally, they will be trained by foreign experts in the Philippines and in self-development through using reports and books.

iii) NGV initiatives (DOE)

For establishing NGV policy for implementation including incentives by the end of 2004, the staff will have been trained at the latest around by the end of 2002.

We assume that DOE will form a project team; the staff will be trained to get the ability necessary for concluding the incentives for themselves.

The staff will be the same as a project team mentioned in b)- i) above in DOE, who will collaborate with the group mentioned above.

Finally, they, at least some of them, will be trained in foreign countries and in self-development through using many kinds of publications.

Table 10-1 How to train manpower (On policies and regulations)

	Time of implementation	Time of training	Who and how to implement	Responsible Dept.	Staff (Note 1)	How to train
<Laws and regulations>						
IRR	* 2002 – 2004	* By the end of 02	* Entrust foreign consultants	* DOE	* S 1; M 2; J 1	* Foreign experts * publications
Integrated laws & regulations * One-stop Legal System Guideline	* 2005 – 2006	* By the end of 03	* Project team	* DOE	* S 1; M 3; J 4	* Trained in foreign countries * publications
* Integrated Natural Gas Law	* 2008 – 2010	* By the end of 07	* Project team	* DOE	* S 1; M 3; J 4	* Trained in foreign countries * publications
Gas tariff system	* 2002 – 2003	* By the end of 02	* Entrust foreign consultants	* DOE * ERC	* S 1; M 2; J 1	* Foreign experts * publications
<Incentives>						
Incentives	* 2002 – 2004	* By the end of 02	* Project team	* DOE * DOF * DTI	* S 1; M 3; J 4	* Trained in foreign countries * publications
Special Gas Fund	* 2001 – 2002	* By the middle of 02	* Entrust foreign consultants	* DOE * DOF * DTI	* S 1; M 2; J 1	* Foreign experts * publications
NGV initiatives	* 2002 – 2004	* By the end of 02	* Project team	* DOE	* S 1; M 3; J 4	* Trained in foreign countries * publications

(Note) S: Senior, M: Middle, J: Junior

10-1-3 Proposals of Priority Projects

(1) Construction of Tabangao - Sucat pipeline

1) Outline of the project

--- To construct a pipeline from Tabangao, where domestic gas is to be landed, to Sucat, where we assume that a gas-fired power plant will be reconstructed after the currently operating oil-fired plant has been decommissioned by the end of 2001(Commissioning in 2006).

-- Length: 90 km

-- Pipe diameter: 16, 12 inch

2) Importance of the project

- ◆ A pipeline can be constructed with economic viability, if it supplies gas to a power plant, because gas demand for power generation is usually large enough for the pipeline to be operated economically.
- ◆ This line will pass through areas where there is a large potential demand for gas, including that in industrial parks.
- ◆ This line can easily reach NCR by being extended from Sucat.
- ◆ This line can contribute to improving the environment through fuel conversion from fuel oil to gas in Sucat.

3) Necessary investments

- ◆ US\$64.6 million (Transmission line) (In 2000 price. Hereinafter the same)

4) Period for completion

- ◆ Design and other preparations: 2 years
- ◆ Administrative and local procedures: 1 year (included in 2 years above)
- ◆ Construction: 2 years
- ◆ Total: Around 4 years

5) Profitability

The profitability of this project has been proved by the financial analysis for the Gas Promotion Scenario already made.

(2) Construction of a LNG terminal in Limay / Mariveles area in Bataan

1) Outline of the project

.... To construct a LNG terminal to supply gas to a gas-fired power plant, which will be constructed in Limay/Marivelles area and to consumers in NCR and its surrounding areas (Commissioning in 2009).

Table 10-2 Outline of the LNG Project in Bataan (High Case)

Nominal annual LNG quantity	4 million t/y
Jetty	1 unit
LNG storage tanks	140,000 kl×4 units
LNG vaporizers	150 t/h×7 units

2) Importance of the project

- ◆ This terminal will supply LNG to a power plant, which will have to be built to

meet increased power demand during and after 2009.

- ◆ The power plant will contribute to the diversification of power sources, which have been concentrated in Batangas area, by sending electric power to NCR through an offshore power transmission line constructed from Bataan to NCR.
- ◆ In addition to a gas pipeline from Batangas area, an offshore gas pipeline, which we assume will be laid from Bataan to NCR, can meet increased gas demand in NCR and its surrounding areas.

Furthermore, we have to point out the following important matters common to this pipeline and another one, which is mentioned below.

- ◆ The construction of this pipeline can improve the security of gas supply by diversifying gas supply origins to NCR, which has a large potential demand, in adding one more pipeline to the already existing line from Batangas to NCR.
- ◆ It can contribute to improving the gas pipeline sector's competitiveness in purchasing gas by its having plural gas purchasing methods.
- ◆ It can contribute to increasing employment, because 400 persons will be needed for its construction and a maximum of 140 persons for its operation and maintenance.

3) Necessary investments

- ◆ US\$514 million (Total investments until 2025)

4) Period for completion

- ◆ Design and other preparations: 1 year
- ◆ Administrative and local procedures: 1 year (included in 1 year above)
- ◆ Construction: 3 years
- ◆ Total: Around 4 years

5) Profitability

The profitability of this project has been proved by the financial analysis for the Gas Promotion Scenario already made.

(3) Construction of Gas Filling Stations for NGV in NCR area

1) Outline of the project

- To construct gas filling stations in NCR area (Commissioning in 2006).

2) Importance of the project

- ◆ PM (Particulate Matter) contained in emissions from diesel cars is said to be the most harmful to the health among air pollutants. Many taxis and jeepneys (and buses) are powered by diesel engines, and they usually operate long distances, emitting large volumes of PM. Accordingly, conversion of these vehicles to NGV can contribute to decreasing PM emissions, and, at the same time, such pollutants as NO_x, SO_x, and CO₂.
- ◆ A pipeline supplying gas to filling stations for NGV will also supply gas to customers in the commercial and residential sectors, resulting in gas use in these sectors.

4) Necessary investments

- ◆ Around US\$500 thousand per one filling station

5) Period for completion

- ◆ Design and other preparations: 1 year
- ◆ Administrative and local procedures: 1 year
- ◆ Construction: 0.5 years
- ◆ Total: Around 3 years

6) Profitability

Profitability does not matter, because this project will be implemented as a model project by the government.

(4) Construction of a LNG terminal in Batangas area

1) Outline of the project

---- To construct an LNG terminal to supply gas to a gas-fired power plant, which will be constructed in Batangas area and to consumers situated along the pipeline from Batangas to NCR (Commissioning in 2013).

Table 10-3 Outline of the LNG Project in Batangas (High Case)

Nominal annual LNG quantity	3 million t/y
Jetty	1 unit
LNG storage tanks	140,000×3 units
LNG vaporizers	150 t/h×5 units

2) Importance of the project

- ◆ This terminal will supply LNG to a power plant, which will have to be built to meet increased power demand during and after 2013.
- ◆ This terminal can supply gas to the power and other sectors, substitute for gas supply from Camago/Malampaya, if it is interrupted by an equipment failure or natural disaster.
- ◆ When the gas supply from Camago/Malampaya has been finalized, this terminal can play the role of a substitute supply source of gas to contribute to the long-term stable supply of gas.

3) Necessary investments

- ◆ US\$491 million

4) Period for completion

- ◆ Design and other preparations: 1 year
- ◆ Administrative and local procedures: 1 year
- ◆ Construction: 3 years
- ◆ Total: Around 5 years

5) Profitability

The profitability of this project has been proved by the financial analysis for the Gas Promotion Scenario already made.

(5) Construction of an Offshore Pipeline from Bataan to NCR

1) Outline of the project

- To construct an offshore pipeline from Bataan, where a LNG terminal is to be located, to NCR (Commissioning in 2016).
- Length: 38 km
- Pipe diameter: 12 inch.

2) Importance of the project

- ◆ This pipeline will be constructed after gas supplied by the pipeline mentioned above has been used by a gradually growing number of customers, mainly in NCR and its surrounding areas.
- ◆ Thus, it can contribute to the stable supply of gas to these and new customers

by providing another gas origin, which means the establishment of a system with dual supply sources (domestic and imported gas) and dual supply origins (two LNG terminals).

3) Necessary investments

US\$18.2 million

4) Period for completion

- ◆ Design and other preparations: 2 years
- ◆ Administrative and local procedures: 1 year
- ◆ Construction: 1 years
- ◆ Total: Around 4 years

5) Profitability

The profitability of this project has been proved by the financial analysis for the Gas Promotion Scenario already made.

10-2 Low Case

10-2-1 Gas Use Scenario (Option 2)

We have selected the Gas Use Scenario to be incorporated in the master plan for promoting gas use in the Low Case.

On the gas demand side of this scenario, the construction of the following gas fired power plants is assumed for the period from 2001 to 2012.

2005:	San Pascual (300MW)
2012 :	Sucat (600MW)

In addition, we assume gas filling stations for NGV will be commercially operated in NCR by 2006.

On the supply side, we assume a gas pipeline will be laid from Tabangao to NCR by 2006 to meet gas demand in Sucat power plant and the gas filling stations.

On the other hand, no LNG terminal and LNG-fired power plant will be commissioning

during this period, although they will be under construction. The first LNG terminal will be constructed in Bataan by 2013.

In this section, we consider a master plan, which shows a ten-year program for the construction of pipelines and LNG terminals, investments and financing, development of manpower, and policy measures to be implemented to accomplish the targets shown in the schedules mentioned above. Furthermore, we propose priority projects, which should be implemented preferably in the near future to make the master plan effective and efficient.

10-2-2 An Action Plan (2001 to 2012)

(1) Construction

1) Pipelines

A pipeline from Tabangao to NCR needs to have been laid by 2005 so that it can start operation in 2006.

Accordingly, an implementing entity (a private company having a construction permit given by the government) should determine the plan for construction including the pipeline route, and should start design works at the latest by 2002. At the same time, it should start buying the R.O.W. land according to the route to be finalized by the end of 2004.

From 2004, it should start construction of transmission (high pressure) and distribution (low and middle pressure) lines, along with continued purchases of the land. After that, the construction of pipelines should be continued according to the following schedule.

2005: Construction of transmission and distribution lines to Cavite, in addition to NCR.

2006 to 2012: Construction of distribution lines to NCR and Cavite

2) LNG terminals

A LNG terminal is to start its operation on Bataan peninsula in 2013, which should have been constructed by the preceding year.

An implementing entity (a private company having a construction permit given by the government) for the LNG project should determine its plan and start to make the detailed design of the LNG terminal (and a LNG power plant) at the latest by 2008. At the same time, it should continue various administrative measures and buy the necessary land to be finalized by the end of 2009.

It should start constructing the terminal in 2010 to be completed by the end of 2012.

(2) Investments and financing

1) Investments

a) Pipelines

Investments will be as large as US\$35.7 and US\$44.7 million in 2004 and 2005, respectively, because construction of a pipeline from Tabangao to NCR will start at the latest by 2004 and its part of a transmission line will be constructed in 2004 and 2005. After that, excluding 2011, they will fluctuate between US\$7.1 and US\$9.1 million, because the targets of investments will shift to part of the distribution lines. In 2011, however, investments will be as large as US\$29.0 million, because construction of a transmission pipeline from NCR to Bataan will start in the year (Investments are shown in 2000 price. Hereinafter the same).

b) LNG terminals

Investments in the LNG project will be US\$11.2, US\$11.3, and US\$11.5 million in 2010, 2011, and 2012, respectively.

2) Financing

We assume that investments in LNG terminals will be financed in the following: 25% by own capital, 25% by borrowing from commercial banks, 25% by borrowing from an international financial institution (IFI-A) (with interest rate of 2%), and 25% by borrowing from IFI-B (with interest rate 7%).

In comparison, we assume that investments on gas pipelines will be financed in the following: 25% by own capital and 75% by borrowing from IFI-A (with interest rate of 2%).

The LNG and pipeline sectors should finalize their negotiations for borrowings at latest

by around the preceding year of investments starting as mentioned above.

(3) Policy and Institutional Measures

1) Preparation of laws and regulations

- ◆ **Implementing Rules and Regulations (IRR) (DOE)**
 - To prepare IRR for transmission lines and distribution from 2001 to 2004.
- ◆ **Integrated laws and institutions (DOE)**
 - To prepare "One-stop Legal System Guideline" from 2005 to 2006 and "Integrated Natural Gas Law" from 2008 to 2010.
- ◆ **Gas tariff system (DOE and ERC)**
 - To define tariff regulator and systems from 2002 to 2003.
- ◆ **Industry structure (DOE)**
 - To define transmission and distribution entities and others by the end of 2002.

2) Implementation of economic and financial incentives

- ◆ **Comprehensive studies on economic and financial incentives (DOE, DOF, and DTI (BOI))**
 - To conclude incentives for development and competitiveness, integrated fiscal incentive policy, and others by the end of 2003.
- ◆ **Special Gas Fund (DOE, DOF, and DTI (BOI))**
 - To establish it through inter-department adjustments by the end of 2002.
- ◆ **NGV initiatives (DOE)**
 - To establish NGV policy for implementation including incentives by the end of 2004.

3) Establishment of communication networks

- ◆ **Public and inter-departmental communications (DOE)**
 - To form a national gas association which, jointly with the government, communicates to and from the international gas community.

4) Education

- ◆ **Local government education (DOE)**
 - To educate local governments to achieve public acceptance of pipelines, in particular.

◆ Vocational education (DOE)

---- To publish texts for energy and gas to be employed by schools and universities.

(4) Development of Manpower

1) Pipelines

We assume that around 240 persons will be needed for constructing transmission pipelines each in 2004 and 2005, and that around 50 persons will be needed for constructing distribution lines each in the following years.

In addition, persons necessary for operation and maintenance will number around 123 in 2006 and 250 in 2012, for instance, including manpower necessary for marketing gas to the industrial, commercial, and residential sectors.

2) LNG terminals

We assume, for the LNG project, that around 400 persons will be needed for constructing the terminals each year and around 100 persons also for operation and maintenance each year.

3) Administrative measures and others

Manpower will be needed for proceeding with administrative measures related to the gas industry in the central and local governments, in addition to those mentioned on pipelines and LNG above. They include those for planning, approvals and permits, environment and safety, etc. on gas use and supply.

In addition, manpower will be needed for establishing information networks between the governments and gas-related industrial circles, as well as between those and international gas-related organizations

More specifically, manpower should be trained for the preparation of laws and regulations and the implementation of economic and financial incentives in the following (Table 10-4).

a) Preparation of laws and regulations

i) Implementing rules and regulations (IRR) (DOE)

For preparing IRR from 2002 to 2004, DOE staff will have been trained at the latest around by the end of 2002.

We assume that DOE will need to entrust outside consultants with the preparation of IRR; therefore, the staff will be trained for them to get the ability for their entrusting.

The staff will belong to a section or group newly established in DOE as proposed in Chapter 3, consisting of one senior staff (having more than fifteen year experiences), two middle class staff (having five to fourteen year experiences), and one junior staff (having less than five year experiences).

Finally, they will be trained by foreign experts in the Philippines and in self-development through using reports and books.

ii) Integrated laws and institutions (DOE)

For preparing "One-stop Legal System Guideline" from 2005 to 2006 and "Integrated Natural Gas Law" from 2008 to 2010, DOE staff will have been trained at the latest around by the end of 2003 and 2007, respectively.

We assume that a project team will be formed in DOE; the staff will be trained to get the ability necessary for preparing the laws and regulations for themselves.

The staff will consist of one senior staff, three middle class staff, and four junior staff, who will collaborate with the group mentioned above.

Finally, they, at least some of them, will be trained in foreign countries and in self-development through using reports and books.

iii) Gas tariff system (DOE and ERC)

For defining tariff regulator and systems from 2002 to 2003, DOE and ERC staff will have been trained at the latest around by the end of 2002.

We assume that DOE and ERC will need to entrust outside consultants with the preparation of the system; therefore, the staff will be trained for them to get the ability necessary for their entrusting.

A part of the staff will be the same as those in the group newly established in DOE and others will be selected in ERC.

Finally, they will be trained by foreign experts in the Philippines and in self-development through using reports and books.

b) Implementation of economic and financial incentives

i) Comprehensive studies on economic and financial incentives (DOE, DOF, and DTI (BOI))

For concluding the incentives for development and competitiveness, integrated fiscal incentive policy, and others by the end of 2003, the staff will have been trained at the latest around by the end of 2002.

We assume that DOE, DOF, and DTI (BOI) will form a project team, respectively; the staff will be trained to get the ability necessary for concluding the incentives for themselves.

Each staff will consist of one senior staff, three middle class staff, and four junior staff, who will collaborate with the group mentioned above.

Finally, they, at least some of them, will be trained in foreign countries and in self-development through using many kinds of publications.

ii) Special Gas Fund (DOE, DOF, and DTI (BOI))

For establishing the fund through inter-department adjustment by the end of 2003, the staff will have been trained at the latest around by the middle of 2002.

We assume that DOE, DOF, and DTI (BOI) will need to entrust outside consultants with the preparation of IRR; therefore, the staff will be trained for them to get the ability for their entrusting.

The staff will be the same as a new group mentioned in a)- i) above in DOE and similar groups will be formed by DOF and DTI (BOI).

Finally, they will be trained by foreign experts in the Philippines and in self-development through using reports and books.

Table 10-4 How to train manpower (On policies and regulations)

	Time of implementation	Time of training	Who and how to implement	Responsible Dept.	Staff (Note 1)	How to train
<Laws and regulations>						
IRR	* 2002 – 2004	* By the end of 02	* Entrust foreign consultants	* DOE	* S 1; M 2; J 1	* Foreign experts * publications
Integrated laws & regulations * One-stop Legal System Guideline	* 2005 – 2006	* By the end of 03	* Project team	* DOE	* S 1; M 3; J 4	* Trained in foreign countries * publications
* Integrated Natural Gas Law	* 2008 – 2010	* By the end of 07	* Project team	* DOE	* S 1; M 3; J 4	* Trained in foreign countries * publications
Gas tariff system	* 2002 – 2003	* By the end of 02	* Entrust foreign consultants	* DOE * ERC	* S 1; M 2; J 1	* Foreign experts * publications
<Incentives>						
Incentives	* 2002 – 2004	* By the end of 02	* Project team	* DOE * DOF * DTI	* S 1; M 3; J 4	* Trained in foreign countries * publications
Special Gas Fund	* 2001 – 2002	* By the middle of 02	* Entrust foreign consultants	* DOE * DOF * DTI	* S 1; M 2; J 1	* Foreign experts * publications
NGV initiatives	* 2002 – 2004	* By the end of 02	* Project team	* DOE	* S 1; M 3; J 4	* Trained in foreign countries * publications

(Note) S: Senior, M: Middle, J: Junior

iii) NGV initiatives (DOE)

For establishing NGV policy for implementation including incentives by the end of 2004, the staff will have been trained at the latest around by the end of 2002.

We assume that DOE will form a project team; therefore, the staff will be trained to get the ability necessary for concluding the incentives for themselves.

The staff will be the same as a project team mentioned in b)- i) above in DOE, who will collaborate with the group mentioned above.

Finally, they, at least some of them, will be trained in foreign countries and in self-development through using many kinds of publications.

10-2-3 Proposals of Priority Projects

(1) Construction of Tabangao - Sucat pipeline

1) Outline of the project

---- To construct a pipeline from Tabangao, where domestic gas is to be landed, to Sucat, where we assume that a gas-fired power plant will be reconstructed after the currently operating oil-fired plant has been decommissioned by the end of 2001 (Commissioning in 2006).

-- Length: 90 km

-- Pipe diameter: 16, 12 inch

2) Importance of the project

- ◆ A pipeline can be constructed with economic viability, if it supplies gas to a power plant, because gas demand for power generation is usually large enough for the pipeline to be operated economically.
- ◆ This line will pass through areas where there is a large potential demand for gas, including that in industrial parks.
- ◆ This line can easily reach NCR by being extended from Sucat.
- ◆ This line can contribute to improving the environment through fuel conversion from fuel oil to gas in Sucat.

3) Necessary investments

- ◆ US59.6 million

4) Period for completion

- ◆ Design and other preparations: 2 years
- ◆ Administrative and local procedures: 1 year (included in 2 years above)
- ◆ Construction: 2 years
- ◆ Total: Around 4 years

5) Profitability

The profitability of this project has been proved by the financial analysis for the Gas Use Scenario already made.

(2) Construction of a LNG terminal in Limay / Mariveles area in Bataan

1) Outline of the project

.... To construct an LNG terminal to supply gas to a gas-fired power plant, which will be constructed in Limay / Marivelles area and to consumers in NCR and its surrounding areas (Commissioning in 2013).

Table 10-5 Outline of the LNG Project in Bataan (Low Case)

Nominal annual LNG quantity	4 million t/y
Jetty	1 unit
LNG storage tanks	140,000 kl×4 units
LNG vaporizers	150 t/h×7 units

2) Importance of the project

- ◆ This terminal will supply LNG to a power plant, which will have to be built to meet increased power demand during and after 2013.
- ◆ The power plant will contribute to the diversification of power sources, which have been concentrated in Batangas area, by sending electric power to NCR through an offshore power transmission line constructed from Bataan to NCR.
- ◆ In addition to a gas pipeline from Batangas area, an offshore gas pipeline, which we assume will be laid from Bataan to NCR, can meet increased gas demand in NCR and its surrounding areas.

Furthermore, we have to point out the following important matters common to this pipeline and another one, which is mentioned below.

- ◆ The construction of this pipeline can improve the security of gas supply by diversifying gas supply origins to NCR, which has a large potential demand, in adding one more pipeline to the already existing line from Batangas to NCR.
- ◆ It can contribute to improving the gas pipeline sector's competitiveness in purchasing gas by its having plural gas purchasing methods.
- ◆ It can contribute to increasing employment, because 400 persons will be needed for its construction and a maximum of 140 persons for its operation and maintenance.

3) Necessary investments

- ◆ US\$491 million

4) Period for completion

- ◆ Design and other preparations: 1 year
- ◆ Administrative and local procedures: 1 year (included in 1 year above)
- ◆ Construction: 3 years

- ◆ Total: Around 4 years

5) Profitability

The profitability of this project has been proved by the financial analysis for the Gas Use Scenario already made.

(3) Construction of Gas Filling Stations for NGV in NCR area

1) Outline of the project

---- To construct gas filling stations in NCR area (Commissioning in 2006).

2) Importance of the project

- ◆ PM (Particulate Matter) contained in emissions from diesel cars is said to be the most harmful to the health among air pollutants. Many taxis and jeepneys (and buses) are powered by diesel engines, and they usually operate long distances, emitting large volumes of PM. Accordingly, conversion of these vehicles to NGV can contribute to decreasing PM emissions, and, at the same time, such pollutants as NO_x, SO_x, and CO₂.
- ◆ A pipeline supplying gas to filling stations for NGV will also supply gas to customers in the commercial and residential sectors, resulting in gas use in these sectors.

3) Necessary investments

- ◆ Around US\$500 thousand per one filling station

4) Period for completion

- ◆ Design and other preparations: 1 year
- ◆ Administrative and local procedures: 1 year
- ◆ Construction: 0.5 years
- ◆ Total: Around 3 years

5) Profitability

Profitability does not matter, because this project will be implemented as a model project by the government.

(4) Construction of an Offshore Pipeline from Bataan to NCR

1) Outline of the project

- To construct an offshore pipeline from Bataan, where a LNG terminal is to be located, to NCR (Commissioning in 2012).
- Length: 38 km
- Pipe diameter: 12 inch.

2) Importance of the project

- ◆ This pipeline will be constructed after gas supplied by the pipeline mentioned above has been used by a gradually growing number of customers, mainly in NCR and its surrounding areas.
- ◆ Thus, it can contribute to the stable supply of gas to these and new customers by providing another gas origin, which means the establishment of a system with dual supply sources (domestic and imported gas) and dual supply origins (two LNG terminals).

3) Necessary investments

US\$18.2 million

4) Period for completion

- ◆ Design and other preparations: 2 years
- ◆ Administrative and local procedures: 1 year
- ◆ Construction: 1 years
- ◆ Total: Around 4 years

5) Profitability

The profitability of this project has been proved by the financial analysis for the Gas Use Scenario already made.

Table 10-6 Action Plan (High Case)

Specific issues			Implementing entities	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Demand & supply															
Demand for gas	Domestic gas (Power plants)				*Commissioning of Santa Rita, San Lorenzo and Iliján			*Commissioning of San Pedro			*Commissioning of Santa (300MW)	*Commissioning of Santa (300MW)	*Commissioning of 300MW p. p. in Betanzos		
	Domestic gas (Others)/ Imported gas (Power plants)								*NOV filling stations	*NOV filling stations	*NOV filling stations	*NOV filling stations	*NOV filling stations	*NOV filling stations	*NOV filling stations
												*Commissioning of 300MW p. p. in Betanzos		*Commissioning of 900MW p. p. in Betanzos	
Gas supply system	Pipelines								*Commissioning of a pipeline from Taberna to NCR						
	LNG											*Commissioning of an LNG terminal in Betanzos			
Action plan															
Construction works	Pipelines	Feasibility studies	Private sector	*Planning/Design	*Planning/Design	*Feasibility									
		Administrative measures	Private sector			*Purchase of R.O.W Land	*Purchase of R.O.W Land								
		Construction works	Private sector				* Construction of transmission/PL Distribution/PL(NCR)	*Construction of Transmission/PL Distribution/PL(NCR/Betanzos-Cerite)	*Construction of Distribution/PL(NCR/Betanzos-Cerite)	*Construction of Distribution/PL(NCR/Betanzos-Cerite)	*Construction of Distribution/PL(NCR/Betanzos-Cerite)	*Construction of Distribution/PL(NCR/Betanzos-Cerite)	*Construction of Distribution/PL(NCR/Betanzos-Cerite)	*Construction of Distribution/PL(NCR/Betanzos-Cerite)	*Construction of Distribution/PL(NCR/Betanzos-Cerite)
	Operation	Private sector				*Operation of Transmission PL(Betanzos-NCR)	*Operation of Distribution/PL(NCR/Betanzos-Cerite)	*Operation of Distribution/PL(NCR/Betanzos-Cerite)	*Operation of Distribution/PL(NCR/Betanzos-Cerite)	*Operation of Distribution/PL(NCR/Betanzos-Cerite)	*Operation of Distribution/PL(NCR/Betanzos-Cerite)	*Operation of Distribution/PL(NCR/Betanzos-Cerite)	*Operation of Distribution/PL(NCR/Betanzos-Cerite)	*Operation of Distribution/PL(NCR/Betanzos-Cerite)	*Operation of Distribution/PL(NCR/Betanzos-Cerite)
LNG	Feasibility studies	Private sector													
	Design	Private sector				*Basic Design	*Detailed Design								
	Administrative measures	Private sector					*Application of authors								
Investment (Million US\$)	Pipelines	Construction works	Private sector				62.5	78.1	27.1	24.7	25.1	25.5	31.7	32.2	31.3
	LNG (*)	Construction works	Private sector						108.3	109.9	111.5		114.9	116.6	118.4
Financing	Pipelines	Construction works	Private sector												
	LNG (*)	Construction works	Private sector												
Max power (Percent)	Pipelines	Construction works	Private sector				239	239							
	LNG (*)	Construction works	Private sector						240	291	342	394	481	569	637
Operational policy measures	Pipelines	Operation & maintenance	Private sector						400	400	400				
	LNG (*)	Operation & maintenance	Private sector									100	100	100	100
Functional policy measures	Implementing Rules and Regulations	Government (DOE)	Transmission (dist)	Transmission & distribution	Transmission & distribution	Distribution & gas tax									
	Legal System for Natural Gas	Government (DOE)													
	Legal System for Natural Gas	Government (DOE, ERG)													
	Legal System for Natural Gas	Government (DOE, ERG)													
	Legal System for Natural Gas	Government (DOE, etc.)													
	Legal System for Natural Gas	Government (DOE, etc.)													
	Legal System for Natural Gas	Government (DOE, DOE)													
	Legal System for Natural Gas	Government (DOE, DOE, DTD)													
	Legal System for Natural Gas	Government (DOE)													
	Legal System for Natural Gas	Government (DOE)													

(*) An LNG terminal will be commissioning in Betanzos in 2013.

(*) Nominal price.

Table 10-7 Action Plan (Low Case)

			Specific issues	Implementing entities	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Demand & supply																
Demand for gas	Domestic gas (Power plants)					*Commissioning of Santa Rita, San Lorenzo and Iliján			*Commissioning of San Pascual							*Commissioning of Santa (600MW)
	Domestic gas (Others)									*NOV filling stations	*NOV filling stations	*NOV filling stations	*NOV filling stations	*NOV filling stations	*NOV filling stations	*NOV filling stations
Gas supply systems	Pipelines									*Commissioning of a pipeline from Taboasco to NCR						
Action plan																
Construction works	Pipelines	Feasibility studies	Private sector	*Planning/Design	*Planning/Design	*Preparation										
		Administrative measures	Private sector			*Purchase of R.O.W Land	*Purchase of R.O.W Land									
		Construction works	Private sector			*Construction of Transmission/PL/ Distribution/PL/NCR)	*Construction of Transmission/PL/ Distribution/PL/NCR/ Batague-Cerito)	*Construction of Distribution/PL/NCR/Batague-Cerito)	*Construction of Distribution/PL/NCR/Batague-Cerito)	*Construction of Distribution/PL/NCR/Batague-Cerito)	*Construction of Distribution/PL/NCR/Batague-Cerito)	*Construction of Distribution/PL/NCR/Batague-Cerito)	*Construction of Distribution/PL/NCR/Batague-Cerito)	*Construction of Distribution/PL/NCR/Batague-Cerito)	*Construction of Distribution/PL/NCR/Batague-Cerito)	*Construction of Distribution/PL/NCR/Batague-Cerito)
		Operation	Private sector					*Operation of Transmission PL/Batague-NCR)	*Operation of Distribution/PL/NCR/Batague-Cerito)	*Operation of Distribution/PL/NCR/Batague-Cerito)	*Operation of Distribution/PL/NCR/Batague-Cerito)	*Operation of Distribution/PL/NCR/Batague-Cerito)	*Operation of Distribution/PL/NCR/Batague-Cerito)	*Operation of Distribution/PL/NCR/Batague-Cerito)	*Operation of Distribution/PL/NCR/Batague-Cerito)	*Operation of Distribution/PL/NCR/Batague-Cerito)
	LNG (*)	Feasibility studies	Private sector													
		Design	Private sector									*Basic Design	*Detail Design			
		Administrative measures	Private sector										*Application of standards			
		Construction works	Private sector													
Investment (Million US\$)(*)	Pipelines	Construction works	Private sector				33.7	44.7	7.8	7.1	7.2	7.2	44.6	48.7	12.6	
	LNG (*)	Construction works	Private sector										111.9	113.2	114.6	
Financing	Pipelines	Construction works	Private sector													
	LNG (*)	Construction works	Private sector													
Man power (Persons)	Pipelines	Construction works	Private sector				239	239								
		Operation & maintenance	Private sector							240	291	342	394	491	549	637
	LNG (*)	Construction works	Private sector											400	400	400
		Operation & maintenance	Private sector													
Practical policy measures																
		Implementing Rules and Regulations	Government (DOE)	Transmission	Transmission & distribution	Transmission & distribution	Distribution & gas use									
		Legal System for Natural Gas	Government (DOE)					One-stop Legal System Checklist						Integrated Natural Gas Law		
		Tariff system	Government (DOE, ERC)		Define tariff regulator and systems											
		Industry structure	Government (DOE, etc.)		Define transmission and distribution entities, etc.											
		Special Gas Fund Account	Government (DOE, DOP)		Inter-departmental adjustment											
		Incentives for development and competitiveness improvement	Government (DOE, DOP, DTI)		Inter-departmental adjustment											
		Integrated fiscal incentive policy	Government (DOE)		Integrate pioneer industry incentives and Special Gas Fund initiative for an integrated incentive plan											
		NOV initiative	Government (DOE)		Detailed NOV study and preparation		Final NOVs and studies	(Begin expanding NOV's)								
		Project implementing studies			Detailed feasibility studies for project implementation											
		Technology transfer			Get public utility operations											
		Public and inter-departmental communications	Government (DOE)		Form a national gas association which, jointly with the government, communicate to and from the nation and international gas connectivity											
		Local government education	Government (DOE)		Appraise public acceptance for pipelines											
		Vocational education	Government (DOE)		Publish tests for energy and gas to be employed by schools and universities. Ask ADE and foreign government for technology transfer											

(*) As LNG terminal will be commissioning in 2013.

(*) Nominal price.

10-3 Other Issues to be Studied

It is essential for the Philippine government to take measures necessary for effectively and efficiently implementing the Action Plan and the Priority Projects mentioned above, after considering them more thoroughly and concretely.

Important issues to be considered for implementation are as follows:

(1) Considerations at the level of feasibility study

We think that the following studies at the level of a feasibility study should be done based on this Study, which has been done at the level of a master plan study.

1) Estimation of potential gas demand

In this study, we established two cases ---- the High and Low Cases ----, for which economic growth rates and energy prices are incorporated, to estimate potential gas demand (In 2 in this Summary).

To estimate potential gas demand when actually laying pipelines, however, it is not only necessary for us to make forecasts or assumptions of demand more thoroughly and concretely, but also to grasp current energy use in target sectors and areas using data and information that reflect the actual conditions of energy use more completely.

2) Evaluation of pipeline routes

In this Study, to select the optimum pipeline route, we established two supply options (In 2 of this Summary) to conclude that Option 2, which includes the offshore pipeline across the Manila Bay, is superior to Option 1, by evaluating them in terms of costs/benefit ratio and the financial internal rate of return (FIRR) (In 5 and 7 in the Summary).

The difference between the costs/benefit ratio and FIRR, however, is not necessarily as large for the two Options. Accordingly, we think that, when actually laying pipelines in the future, the costs/benefit ratio and FIRR should be investigated more deeply using the results of the study mentioned in 1) above.

(2) Considerations at the level of master plan study

Next, we think that studies on regional development plans for Areas L-2, and L-3 should be done at the level of a master plan study to supplement this Study.

Some studies, including JICA studies^{9), 10)}, have already been done on the regional development plans for the areas.

The master plan for the Southern Luzon (CALABARZON) area was originally planned by the Department of Trade and Industry, aiming at the industrialization of areas neighboring Metro Manila, into which population and investments had been concentrated. A JICA study report, which was finalized in October 1991, proposed plans for the development of ports and harbors including the Batangas port, as well as those for roads and highways including the Southern highway, in addition to those for urban and rural development, social development, and environmental management.

The master plan for the Central Luzon area had basically the same aim as that of the plan for the Southern Luzon above. Another JICA study report, which was finalized in September 1995, proposed plans for the re-development of Clark and Subic, both of which had been returned by the U.S. early in 1990s, and that for the Central Luzon highway, which was planned to connect Subic, Clark, and Tarlac.

The reasons we insist upon the necessity of doing additional studies on regional development for Areas L-2 and L-3 are as follows:

First, we have proposed in this study the construction of pipelines, LNG terminals, and LNG-fired power plants in the near future in these areas, all of which occupy a major part of the two areas mentioned above, respectively. Naturally, these projects will possibly have effects and impacts on regional development in these areas. Accordingly, we consider that the economic, social, and environmental effects and impacts of these projects should be more deeply examined than have been done in this study

⁹⁾ Japan International Cooperation Agency (JICA), *The Master Plan Study on the Project CALABARZON*, October 1991

¹⁰⁾ JICA, *The Master Plan Study for Central Luzon Development Programs*, September 1995

Second, we consider that, if we look at only the period to 2010 targeted by the two JICA studies mentioned above, plans proposed in the studies should be reviewed, taking into account new projects that have been implemented or planned until recently, as well as recent developments related to formulating the plans, including, for instance, current and future economy of the Philippines and prospects for global energy prices.

Third, we consider that plans in the JICA studies should be reviewed as those that will target the period to 2025, because projects proposed in this study target the period to 2025.

In addition, we think that these reviews will contribute to promoting gas use in the Philippines through, for instance, an improved estimate of potential gas demand in consuming sectors, which is indispensable for preparing plans for constructing pipelines.

JICA