No.

Department of Energy
Republic of the Philippines

The Study on Capability Enhancement on Policy and Planning for a More Effective and Comprehensive Philippine Energy Plan (PEP) Formulation

Final Report
(Main Report)

December 2008

Japan International Cooperation Agency

The Institute of Energy Economics, Japan

Tokyo Electric Power Company

IDD
JR
08-056

PREFACE

In response to a request from the Government of Republic of the Philippines, the Government of Japan accepted to carry out the Study on Capability Enhancement on Policy and Planning for a More Effective and Comprehensive Philippine Energy Plan (PEP) Formulation. The study was implemented by the Japan International Cooperation Agency (JICA).

From September 2007 to September 2008, JICA dispatched to the Philippines five times a study team led by Mr. Kensuke Kanekiyo of the Institute of Energy Economics, Japan (IEEJ). During staying in the Philippines, the team consisting of member from IEEJ and Tokyo Electric Power Company, conducted related field surveys and held discussions with the officials concerned of the Government of Republic of the Philippines. While in Japan, the team conducted further studies, the result of which they compiled in this final report.

It is our wish that this report will contribute to devise the optimum strategy for the Development of Energy Plan in the Republic of the Philippines and at the same time to enhance the relationship between both countries.

I express my sincere appreciation to the officials concerned of the Government of the Republic of the Philippines for their close cooperation in conducting the study.

December 2008

Seiichi NAGATSUKA
Vice President
Japan International Cooperation Agency

December 2008

Mr. Seiichi Nagatsuka
Vice President
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Letter of Transmittal

We are pleased to submit to you the Final Report of The Study on Capability Enhancement on Policy and Planning for a More Effective and Comprehensive Philippine Energy Plan (PEP) Formulation. Under the contract with your esteemed organization, the subject study was carried out during 16-month period from September 2007.

With due consideration of the current situation of energy supply and demand, and also of related law, rules and regulations in the Philippines, the present study has been conducted to determine a comprehensive and long-term energy plan that enables the Department of Energy (DOE) to promote utilization of energy continuously after the completion of the study.
In the process of conducting the study, technical transfer to DOE's officers by means of On-the-Job Training has been conducted constantly. The result of this technical transfer has been strengthened by occasional workshops attended by people from related government institutions and industry participants as well as DOE.

This report is compiled an energy plan showing a twenty-year program using energy demand forecasting model and energy supply and demand balance model. Those comments by officials from DOE have been taken into consideration occasionally in making the energy outlook, and are reflected in the contents of the report.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affaires, and Ministry of Economy, Trade and Industry. We also wish to express our deepest gratitude to the Department of Energy (DOE), the Embassy of Japan in the Republic of the Philippines and the JICA Philippine office for the close cooperation and assistance extended to us during the period.

Very truly yours,

Kensuke Kanekiyo
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The Study on Capability Enhancement on Policy and Planning for a More Effective and Comprehensive Philippine Energy Plan (PEP) Formulation

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Abbreviation

AFETD	Alternative Fuels & Energy Technology Division
CWPO	Consumer Welfare & Protection Office
ECCD	Energy Cooperation & Coordination Division
EECD	Energy Efficiency & Conservation Division
EPIMB	Electric Power Industry Management Bureau
EPPB	Energy Policy and Planning Bureau
ERDB	Energy Resource Development Bureau
ERTLS	Energy Research Testing & Laboratory Services
EUMB	Energy Utilization Management Bureau
GCRDD	Geothermal & Coal Resources Development Division
GRTL	Geoscientific Research & Fuel Testing Lab. Division
IPO	Investment Promotion Office
LATD	Lighting & Appliance Testing Division
NGMD	Natural Gas Management Division
OICMD	Oil Industry Competition & Monitoring Division
OIMB	Oil Industry Management Bureau
OISMD	Oil Industry Standards & Monitoring Division
PD	Planning Division
PFRD	Policy Formulation & Research Division
PMDD	Power Market Development Division
PPDD	Power Planning & Development Division
PRDD	Petroleum Resources Development Division
REMD	Renewable Energy Management Division
RMMSCD	Retail Market Monitoring & Special Concerns Division

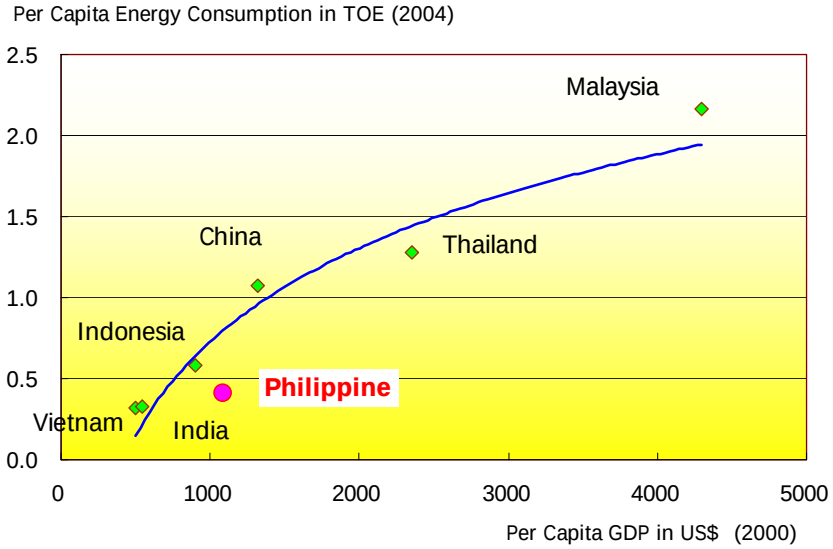
Introduction: For Support to Formulate

“PEP 2008 Update”

Introduction: For a More and Comprehensive PHP Formulation

The economy of the Philippines has returned on to a high-growth trend in 2003 after the Asian currency crisis of 1997, and since then recorded 5% plus annual economic growth; 5.6% in 2005 and 6.2% in 2006. In accordance with the economic recovery, the per capita consumption of energy also increased recording 0.465 ton in 2005, although it slightly decreased to 0.45 ton in 2006.

These figures are about 1/10 of that of Japan and ranking in the lower group among ASEAN countries. As shown in Figure 0.1-1, the economic structure of the Philippines may be Light Energy Economy type. Nevertheless, should economic growth continue at 5% plus annual rate, the per capita GDP would exceed US$2,000 sooner or later and its per capita energy consumption may become closer to that of China or Thailand.



Source: IEA, IMF

Figure 0.1-1 Per Capita GDP and Energy Consumption in Asia

Energy is a very fundamental factor for economic development and its secured supply is an important policy objective for the Philippines. Under the circumstance, the government of the Philippines espouses "Energy Independence" as one of the Five-Point Reform Package[1], aiming to raise the energy self-sufficiency to 60%. The same policy is pursued in the Philippine Energy Plan 2007 Update (herein after referred to as the "PEP2007"); the "Energy Independence" and "Energy Sector Reform", which will rationalize and strengthen the energy sector in order to pursue the Energy Independence, are the two main energy policies of the country.

[1] They are 1) Economic growth and job creation, 2) Anti-corruption through good governance, 3) Energy Independence, 4) Social justice and basic needs and 5) Education and youth opportunity.

Long-term Energy Outlook and Developing Issues

In the Philippines, energy demand is on a slightly decreasing trend in recent years reflecting the energy price hike, while the country's energy self-sufficiency is improving except for the temporary damages caused by typhoons last year. The aforementioned two major energy policies of the Philippines may be appraised as being successfully achieved.

However, if we look to a long term period say up to 2030, it is questionable if the country could continue the current success all the way. According to the "Energy Outlook of World/Asia 2007" released by The Institute of Energy Economics, Japan (IEEJ), the primary energy consumption of the Philippines will grow at annual 4% and will reach 87 million tons oil equivalent in 2030, which is 2.5 times greater than the 2005 consumption. Against this huge increase in the demand, is it possible for the country to keep the current successful trend through to 2030? Is it appropriate to supply the incremental demand with fossil fuels as projected in this forecast? Then, its energy import dependence would again turn upward unless discoveries of huge deposits of coal, oil or gas were made.

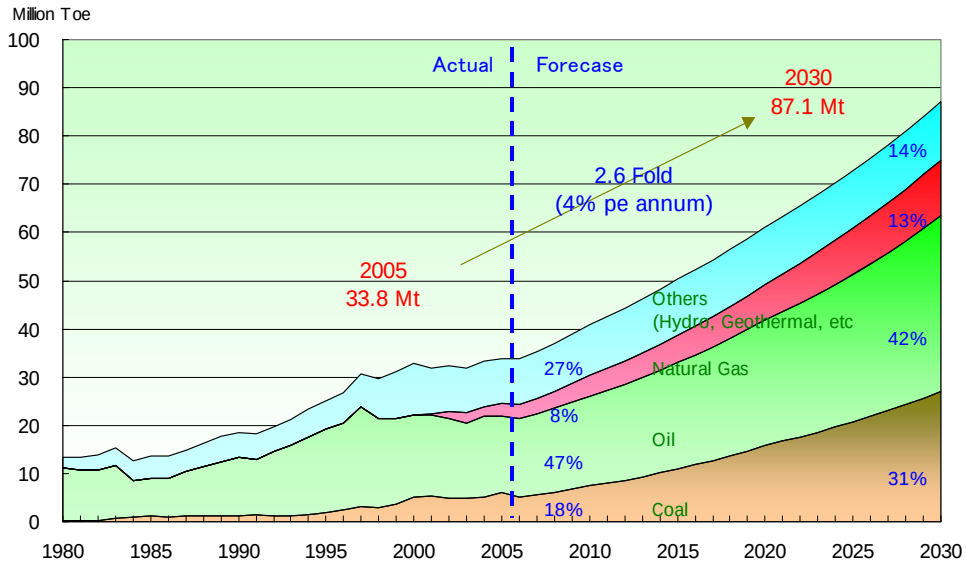


Figure 0.1-2 Energy Outlook of the Philippines

From this simple questioning, it is deemed necessary to reinforce the countermeasures on the issues currently identified as below from a super long-term viewpoint.

- Expanding energy demand, in particular in the power and transport sectors, as economy grows
- Developing efficient energy system on both sides of supply and consumption
- Developing renewable energies in particular in the power and motor fuel sectors
- Promoting regional energy cooperation regarding emergency response and other issues

While the world energy balance is tightening, another concern on the global warming issues is shifting from a stage of a concept to a policy objective even for developing countries as was recognized in the Cebu Declaration on East Asia Energy Security at the East Asia Summit meeting held in January 2007. Under the circumstance, Dr. Francisco G. Delfin, Assistant Secretary of DOE, requested the JICA Study team, at a

meeting held on September 26, 2007, to consider the following matters in the study, explaining the presidential directive to look into the energy and environmental issues seriously:

1) In the next PEP, the projection should be made for 20 years rather than the current 10 years to consider issues from a longer-term viewpoint.
2) The issue of global warming must be considered seriously.
3) To this end, the nuclear power option should be carefully looked into.

In view of the global energy trend, they are quite appropriate as objectives of this study, though much yet remains to be done for solutions of these subjects.

Capacity Enhancement on Energy Policy Formulation

The Department of Energy is responsible for formulating policies to cope with the above challenges. They have been engaged in formulation of the Philippine Energy Plans and have made due contribution in analysis of energy issues and preparation of countermeasures. However, they also face certain challenges in the work, which would be demonstrated by the fact that no review has been made on the demand forecast since the PEP was set out in 2003. This may be mainly caused by the lack of sufficient database, analytical tools and study systems. In particular, it would be attributed to the data collection system that is not efficiently functioning and lack of the aggregation system to integrate the various sector studies; these impediments are hampering a comprehensive study.

From this observation, we have constructed the fundamental tools for energy supply/demand analysis as the first approach as below, which are expected to support the energy policy making mandate of the DOE.

- Energy Sector Database
- Energy Demand Forecasting Model
- Energy Supply Optimization Model, which calculates the energy supply balance consistent among energy sectors

The above work have been carried out with due consideration on the current study procedure at DOE and the continuity to the newly developed system. The models have been constructed giving priority on easy operation and summary views. Then, technical transfer has been conducted intensively relating to fundamental model theories, model construction, operation and maintenance through seminars and On-the-Job Trainings.

In the later part of the study, the JICA team has supported the Counterpart in formulating the PEP 2008 Update with consideration on the following principles.

- Formulation of energy policy consistent with the country's economic development plan
- Formulation of energy policy with consistency among energy sectors
- Good coordination of the national and regional energy plans
- Formulation of energy policy with specified objectives

In the course of the Study, the JICA team has also endeavored in capacity development of the Counterpart on energy policy formulation introducing Japanese experiences and other precedents.

Part 1 Present Status of the Philippine Energy Plan and Challenges

Chapter 1 Present Status of Energy Plan Formulation and Challenges

1.1 PEP 2007 Update

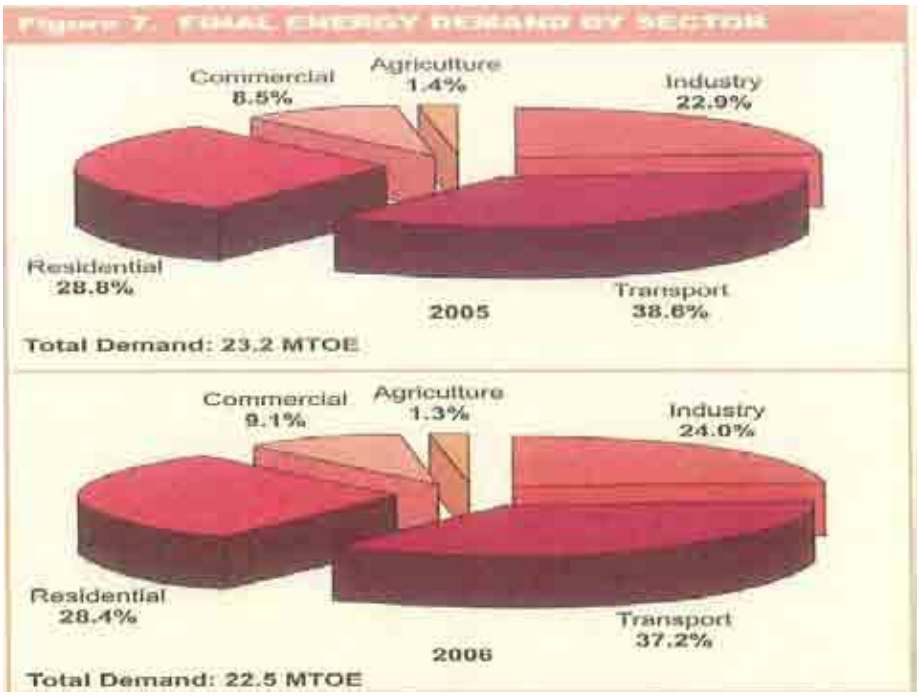
1.1.1 Present Status of Energy Supply and Demand

The "PEP 2007 Update" was approved by the Government and the Congress in early 2008, as its preparation by the Department of Energy (DOE) was behind the regular schedule of submission in September every year. In this report, the present energy situation in the Philippines is touched upon based on the "PEP 2007 Update" which was given by DOE. The data shown here may be deemed as the latest one available in the Philippines at present.

(1) Energy demand

The final energy consumption in 2006 decreased by 3% from 23.20Mote (million ton oil equivalent) in 2005 to 22.50Mtoe in 2006. The main reason is deemed to be a 3.3% decrease of the oil demand due to the crude oil price hike.

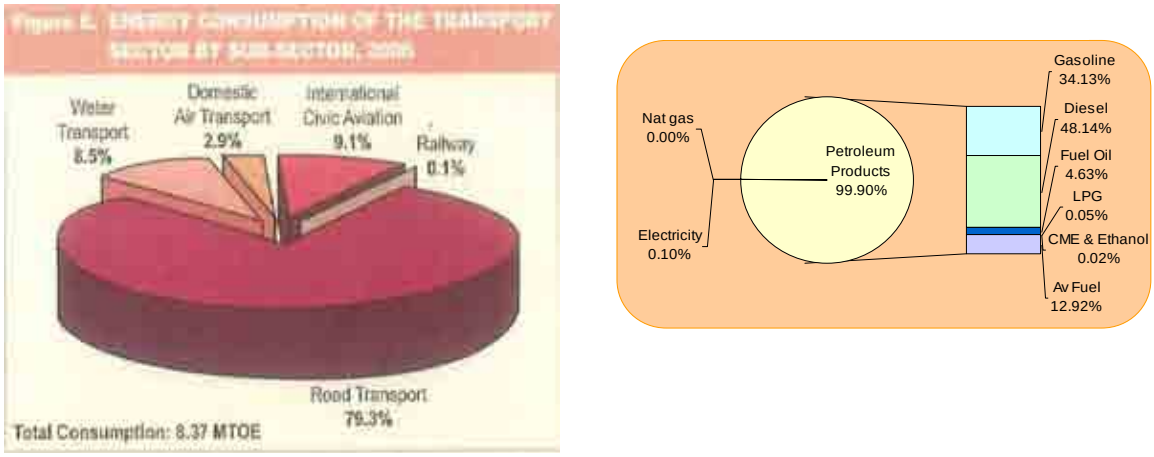
As for the sectoral energy consumption, the transport, domestic and agriculture sectors decreased their shares slightly while the commercial and industry sectors increased slightly. The transport sector recorded the biggest share of 37.2% followed by 28.4% of the residential sector as the second. The shares of industry and commercial sectors were 24.0% and 9.1%, respectively.



Source: "Draft PEP 2007 Update"

Figure 1.1-1 Final Energy Consumption by Sector

Looking into sectoral movements, the energy consumption in the transport sector, the biggest energy consumption sector of the Philippines, decreased by 6.4% from 8.94Mtoe in 2005 to 8.37Mtoe in 2006 affected by the global crude oil price hike. By energy source, the decrease is mostly represented by decline in the petroleum products consumption, while the decrease in the electricity consumption was only 0.1%. In the transportation fuel sector, LPG and CME (coco-methyl ester) and ethanol significantly increased reflecting the government promotion policy of renewable energy. Nevertheless, CME consumption was 0.54Ktoe, ethanol consumption 1.41Ktoe and LPG consumption is 4.03Ktoe, all remaining in small quantity. The petroleum products shared major portion, 48.1% for diesel oil and 34.1% for gasoline, while LPG and CME/ethanol shared only 0.04% and 0.02%, respectively.



Source: "Draft PEP 2007 Update"

Figure 1.1-2 Energy Consumption by Source in Transport Sector

The energy consumption of the residential sector decreased by 4.3% from 6.70Mtoe in 2005 to 6.40Mtoe in 2006. The main reasons are the decrease of the petroleum products consumption reflecting the crude oil price hike as well as the decrease of the biomass fuels like firewood. The government's promotion of energy efficiency and conservation may have also contributed to the decrease of the sector's energy use.

The industrial sector energy consumption increased to reach 5.39Mtoe in 2006. The manufacturing sector consumed 96.4% of the total industry sector consumption. As for energy consumption by source, the petroleum products consumption decreased by 7.3%, demand for electricity and coal have increased 1.4% and 11.2%, respectively.

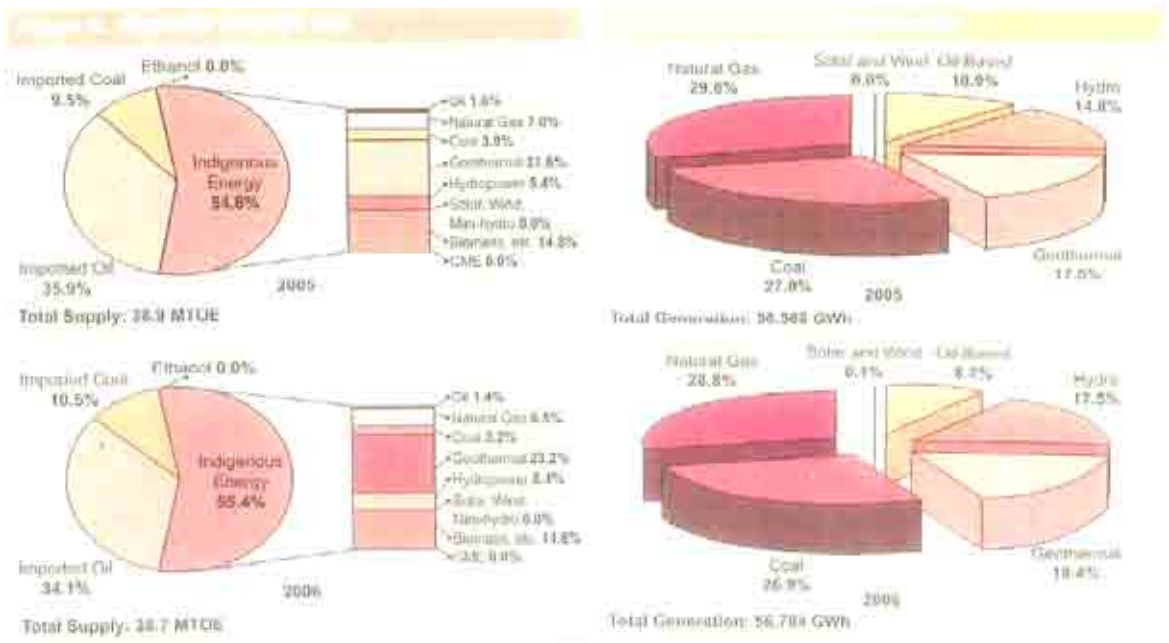
The commercial sector energy consumption increased by 4.7% from 1.96Mtoe in 2005 to 2.05Mtoe in 2006. The biggest energy source in this sector was the electricity with a share of 57.2%, followed by oil products as the second at 28.1% and the renewables at 14.7%. The electricity demand in 2006 increased by 3.9% from the previous year.

The agricultural energy demand accounted for merely 1.3% of the total energy consumption, and decreased by 10.0% from the previous year. In this sector, oil consumption accounts for 85.4% of the sector's total energy demand and electricity accounts for only 14.6%.

(2) Energy Supply and Transformation Sector

The total primary energy supply decreased by 0.3% from 38.90Mtoe in 2005 to 38.70Mtoe in 2006. The energy independence ratio was 55.4% while the import ratio was 44.6%, which was almost same as the previous year. Among the imported energies, coal import accounted for 10.5% of the total energy supply and oil import 34.1%. Among the domestic energies, renewable energy accounted for a relatively big share of 44.2%, of which the geothermal, hydropower and the renewable energy shared 23.2%, 6.4% and 14.6%, respectively. The fossil energy accounted for only 11.1%, of which natural gas, coal and oil shared 6.5%, 3.2% and 1.4%, respectively. The domestic fossil energy supplies are scarce and the Philippines depends mostly on the imported energies and renewables.

In the transformation sector, some references were made on the oil refinery and power generation. In 2006, the refinery throughput was 10.05Mtoe and the produced petroleum products were 9.73Mtoe, or 96.8% of the total throughput. Power generation was 56.78TWh with an increase of 0.4% from the previous year. In the power generation mix, natural gas, coal, geothermal and hydropower shared 28.8%, 26.9%, 18.4% and 14.8%, respectively.



Source: "Draft PEP 2007 Update"

Figure 1.1-3 Primary Energy and Power Mix

1.1.2 Issues and Challenges on Energy Policies

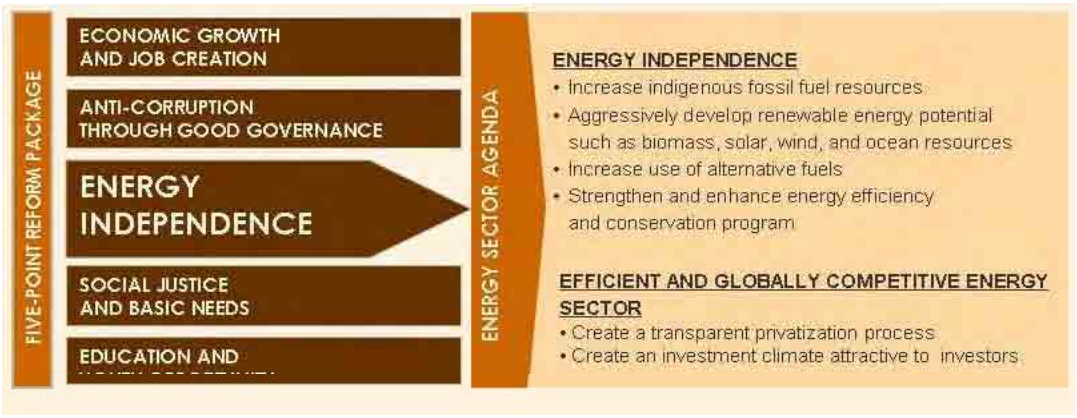
The objectives of the 2007 Philippine Energy Plan (PEP) Update were to confirm the achievement of the two energy policies stipulated in the Energy Sector Agenda set out in the 2006 Update; namely, the energy independence and reinforcement of the international competitive ability of the energy sector with improved efficiency. These are the policies as espoused in the energy independence framework under the Five-Point Reform Package of the government.

The Energy Sector Agenda focuses on achievement of the 60.0 percent energy self-sufficiency by 2010, which is 55.8% at present. This agenda is anchored on the effective implementation of the following

goals: (a) accelerating the exploration; development and utilization of indigenous energy resources; (b) intensifying renewable energy resource development; (c) increasing the use of alternative fuels; (d) enhancing energy efficiency and conservation; and, (e) forming strategic alliances with other countries.

Regarding the reinforcement of the energy sector, it is emphasized that continued reforms in the power sector as well as the downstream oil and gas industries will pave the way in realizing a globally competitive Philippine energy sector.

One of the characteristics of this year PEP would be the decision not to make a long-term energy demand and supply forecast. The reason is explained that the expected results of the forecast would only yield minor difference from the last year forecast. It seems that the "PEP 2007" ignores the effects of the world oil price hike that may actually have given serious impacts on the Philippine energy scene. On the other hand, it is pointed that a new 10year forecast shall be introduced considering the results from the mandatory biofuel blending starting in May 2007. During the first mission of the Joint-Study in the Philippines, the JICA team was informed of the directive given by President Arroyo asking DOE to formulate the "PEP 2008 Update" with 20 year energy demand and forecast. The directive was made to seriously consider measures against the global warming problem with a view to introducing nuclear power stations again.



Source "Draft PEP 2007 Update"

Figure 1.1-4 Framework of PEP 2007 Update

The "PEP 2007" summarizes the present situation of the energy sector in the following five points;

(1) Energy Independence

The energy independence ratio in 2005 was 55.8% against the target of attaining 60% of the independence ratio by 2010. Renewable energy, especially geothermal energy played a very big role to this end. DOE continued to promote intensive upstream exploration and development through the Philippine Energy Contracting Round (PECR). The promulgation of the Biofuels Act of 2006 is expected to reduce the country's dependence on imported fuels.

(2) Power Sector Reform

In power generation, the country's self-sufficiency level rose to 66.0% in 2006. Natural gas posted the largest contribution to this end. The DOE continued to ensure the reliability of energy supply through the

installation of new power plants and upgrading of existing power projects.

(3) Response to Oil Price Hike

As a safety net to counter the effects of intermittent increase in the price of oil to the country's economy, the DOE issued and implemented "Temporarily Modifying the Rates of Import Duty on Crude Petroleum Oils and Refined Petroleum Products" for a six-month period and offered domestic petroleum price discounts for the public transport sector.

(4) Energy conservation

DOE conducted such as the spot check program of government agencies, energy standards and labeling program and energy audit of various commercial and industrial entities in order to save energy. In results, it attained energy savings of about 0.88Mtoe with equivalent carbon dioxide (CO_2) emission avoidance of 2.1 million metric tons.

(5) Centrally Management System of Energy Data (One Database, One System, One DOE)

The Energy Information Management Program (EIMP) has been continuously implemented under the theme "One Database, One System, One DOE," to provide timely up-to-date, reliable and accurate energy data and information for the Department and its stakeholders. To effectively implement the EIMP, the Four Cs Strategy was adapted, namely: Centralization, Computerization, Connectivity and Collaboration.

As the way forward, reviving of the nuclear power program, privatizations of power sector and legislative measures to ensure energy supply securities are referred to.

With regard to introducing nuclear power, there is a history in the Philippines that the once endorsed nuclear program was suspended and abandoned. The revival of the nuclear power plan is intended in this PEP because nuclear power is considered to be one of the cheapest options in ensuring electricity supply as well as most effective measure to counter the global warming and energy security issues. In collaboration with the Department of Science and Technology (DOST), DOE is undertaking a close review of scientific and technical options to revive the country's nuclear power program. A comprehensive human resource development program and training of young nuclear scientists and technical experts in various aspects of nuclear power are examined at present. DOE will also look into all possible measures to address emerging environmental issues and concerns consistent with the Philippine Sustainable Development Agenda.

On the privatization of the power sector, timeliness and transparency are considered important to response to the various market needs and requirements. The Power Sector Assets and Liabilities Management Corp. (PSALM) is set to launch more aggressive marketing efforts to further expand its investment base.

The legislative measures on stabilizing energy supply and market reform are as follows.

-Renewable Energy Bill (Development and commercialization of renewable energy resources)

-Natural Gas Bill (Establishment of the downstream natural gas industry)

-Liquefied Petroleum Gas (LPG) Bill (Monitoring and supervisory framework for the LPG industry)

-Energy Conservation Bill (Promotion of energy conservation)

-TransCo Franchise Bill (National Transmission Company)

DOE will re-file with the 14th Congress the above-mentioned legislative measures:

1.2 Challenges in Formulating PEP

1.2.1 Characteristics of PEP

(Energy white paper, Energy forecast and Regular review)

Even before publication of the PEP under the Arroyo regime, the PEP had been published many times. In the past cases, very long-term energy forecast covering 30 years or 40 years, instead of 10 years for the present ones, were formulated with an intention to introduce nuclear power. Publications were made frequently almost one for every two years. For example, there were “PEP: 1994-2010” in 1994, “PEP: 1996-2025” in 1996, “PEP: 1998-2035” in 1998, “PEP: 2000-2009” in 2000 and “PEP: 2002-2011” in 2002. The Basic PEP under the Arroyo regime was prepared as the “PEP 2003: 2003-2012” published in 2003. After that, PEPs were published every year such as “PEP 2004”, “PEP 2005”, “PEP 2006” and “PEP 2007”. All the PEPs since 2004 versions were characterized as “Update”, in principle being based on the 2003 version. The Arroyo regime hung out "Five-Point Reform Package" as the main governmental policy and the PEP aims at achievement of the third policy of Energy Independence.

The fundamental composition of “PEP 2003” is composed of 1) Energy Plan Framework, 2) Energy Supply-Demand Outlook, 3) Power Development Plan, 4) Sectoral Plans, 5) Rural Electrification Program, 6) Investment Opportunities and 7) Financial Requirements. As it was the first year of the PEP, its content was considerably enthusiastic. This composition has been maintained in the following “PEP” afterwards with some simplifications along with lapse of time. In the “PEP 2005”, for example, the contents were 1) Energy Plan Framework, 2) Energy Demand Outlook and Supply, 3) Energy Sector Agenda and 4) Investment Requirements. In the “PEP 2006”, however, it is composed of seven items same as the “PEP 2003”, which are 1) Overview, 2) Energy Supply and Demand Outlook, 3) Energy Independence, 4) Power Sector Reform, 5) Other Energy Programs, 6) Investment Portfolio and 7) Legislative Agenda. Comparing the past PEPs, we notice that their fundamental components were recognition of energy policy objectives, energy supply/demand outlook, sectoral and regional plans/targets and budget plans

Comparing main policy targets in the energy sector of PEPs, the “PEP 2003” stipulated 1) Stable and secure energy supply, 2) Wider access to energy supply, 3) Fair and reasonable energy prices, 4) Clean and efficient energy fuels and infrastructures, 5) Enhanced consumer welfare and protection 6) Technology transfer and manpower development, and 7) Job creation from energy activities. Looking conversely, these items were indicating both targets and challenges facing the Philippines at that time. As the contents were reduced to four items in the “PEP 2004”, it can be said that the fundamental concepts such as stable energy supply, energy conservation and international cooperation remain unchanged. In the “PEP 2005” and “PEP 2006”, the main targets are further simplified to two items; 1) Energy Independence and 2) Power Sector Reform.

The above changes of the contents may indicate transition of main policies along with lapse of time.

However, as the Energy Independence remains the core policy, strenuous efforts may have been paid every year to highlight the distinctive feature of the PEPs to bring about certain impact. From the above observation, nature of the PEPs may be characterized as an energy white paper, energy outlook and/or periodical review of energy policy.

There would not be any objection that accurate grasp of the present status is the important precondition in formulation of an energy plan. To this end, it is required to set out common recognition on the international energy situation, relating to energy supply/demand balance, price outlook, environmental issues (though no analysis is attached in the PEPs in this regard) and so on, analysis on the domestic energy position, issues to be considered in the energy policy. These will require the PEPs to prepare some elements as an energy white paper.

Table 1.2-1 Major Objectives of PEPs in the Past

PEP	Term of Plan	Main Targets
PEP2003	2003-2012	1) Stable and secure energy supply
		2) Wider access to enrgy supply
		3) Fair and reasonable energy prices
		4) Clean and efficient energy fuels and infrastructure
		5) Enhanced consumer welfare and protection
		6) Technology tranfer and manpower development
		7) Job creation from enrgy activitie
PEP2004update	2004-2013	1) Ensure sufficient, stable, secure, accessible and reasonably-priced energy supply
		2) Pursue cleaner and efficient energy utilization and clean energy technologies applications
		3) Cultivate strong partnerships and collaboration with key partners and stakeholders
		4) Empower and balance various interests of the energy publics
PEP2005update	2005-2014	1) Energy Independence and Save
		2) Power market reforms
PEP2006updaye	2005-2014	1) Energy Independence
		2) Power market reforms

An energy supply/demand outlook is expected to provide a future outlook that should be the platform to formulate the objectives of the energy policy. In the PEPs compiled under the Arroyo regime, an outlook for the next ten years was in principle projected, where the energy demand were assessed separately by different research groups in five sectors, namely, manufacturing, commercial, residential, transport and agriculture, and the results were aggregated. No optimization model is applied in the process of aggregation.

The objective of periodical review of energy policy is to examine the target or policies set out in the previous year for improvement in the next formulation or implementation of policies. However, as the examination interval is limited only to one year, it seems too short to evaluate the effects of energy policies. It would be difficult to accurately recognize the relationship of cause and result within a time span of one year.

Considerable difficulties may have been encountered in the process of formulating the PEPs, which was

given an important assignment to maintain the unchanged energy policy objective (Energy Independence), to produce time and manpower consuming forecasting work and policy evaluation within limited time. Judging from the fact that compilation of demand outlook was ceased in the "PEP 2007", formulation of it is coming to a crossroad. It may have become stereotyped compared with the enthusiasm at the outset, and may need some epoch making proposal to return to the truck as originally intended in the PEP.

1.2.2 Issues in formulating PEP

Five PEPs have been formulated including the "PEP 2007" to date. In order to consider continued formulation of the PEP, let us look into major issues and problems encountered in past formulation. These may be relating to 1) database, 2) demand forecasting, 3) projection period and 4) capacity development or enhancement.

In principle, EPPB (Energy Policy and Planning Bureau) of DOE is responsible for formulation of the PEP, though EPPB could not conduct the assignment individually. Thus the formulation is implemented under collaboration of various offices and organizations in and outside of DOE, in a form of division and collaboration of studies. This may have caused some indifference on the parts one is not engaged, though with good insights on the responsible part, resulting in a situation that evaluation of the overall work or role of the part in the integral work would increasingly become difficult. In this sense, EPPB/DOE may be able to improve their capability through enhancing the evaluation capacity on the data and information provided from inside and outside of their organization, but not just procuring and incorporating them in to the PEP. To this end, it would be necessary to pay more attention on the following four points.

(1) Database

In order to evaluate the result of an energy policy, quick collection of accurate data and its analysis are necessary. Looking into the current procedure of data collection in the Philippines, energy data are not necessarily collected regularly to be compiled into a database. As far as the necessary data would be collected only when there arises a situation to require analysis of energy issues and policy measures, we could not avoid time lag and delay in output. In addition, such data would not be managed under a standard system consistently; there would exist some firewall between organizations. To avoid such situation, EPPB/DOE should collect energy data on regular basis continuously and compile them into the energy database.

(2) Demand Forecasting

At present, energy demand is being forecasted separately in five sectors. According to the explanation by EPPB, energy demands by product are estimated by each sector using "Simple.E" as the forecasting software, and then the final results are aggregated.

Although all the sectors are using the same assumption on the macro economic data, if the model structures are different among sectors, outputs may diverse even if the same assumptions were applied. While there is a merit in this method that the specific sector is looked into with specific expertise, there is a risk whether the overall consistency is maintained or not. It is also important for EPPB to check and

review the estimations made by individual sectors; EPPB is required to brush up its capability regularly to this end.

(3) Projection Period

As the formulation of the PEP is implemented taking one year according to EPPB, the main work schedule is as follows (month is estimated by the JICA team).

- Review of implementation of the previous plans and policies (January)
- "Philippine Energy Summit" (Special meeting) (January-February)
- Sectoral workshop or collaboration meetings (March)
- Setting out draft energy plan (April – May)
- Public consultation/workshop (including Regional Workshop) (May-August)
- Public hearings and workshops (June)
- Review of the PEP first draft (June – July)
- Explanation to energy firms and relevant entities (August)
- Finalization of the drat PEP (September)
- Submit to Cabinet and Congress (September 15)

In the formulation of the PEP, various offices in DOE as shown in Figure 1.2-1 are engaged as well as other organizations of DOE and other relevant ministries.

The above work schedule shows that the formulation cycle starts from very beginning of a year and is supposed to complete in September, though it usually does not proceed very smoothly as scheduled. In general, the final approval is made toward the end of a year after discussion and review at the cabinet and the congress. Then, upon the approval, the very busy schedule of the next formulation cycle starts immediately. The review of the implementation result is conducted early in a year before necessary data are collected and compiled and thus it is very difficult to assure sufficient review in the work.

(4) Capacity Development

With regard to capacity development, there are two aspects; education of experts and their stable stay in the organization. Capacity development of experts may be enhanced with preparation of good training program and manuals. However, there is no effective countermeasure on the job-hopping of experts. It is difficult to stop such practice, as it is an assured right of individuals to look for better jobs; EPPB alone could not change the employment circumstance and practices in the Philippines.

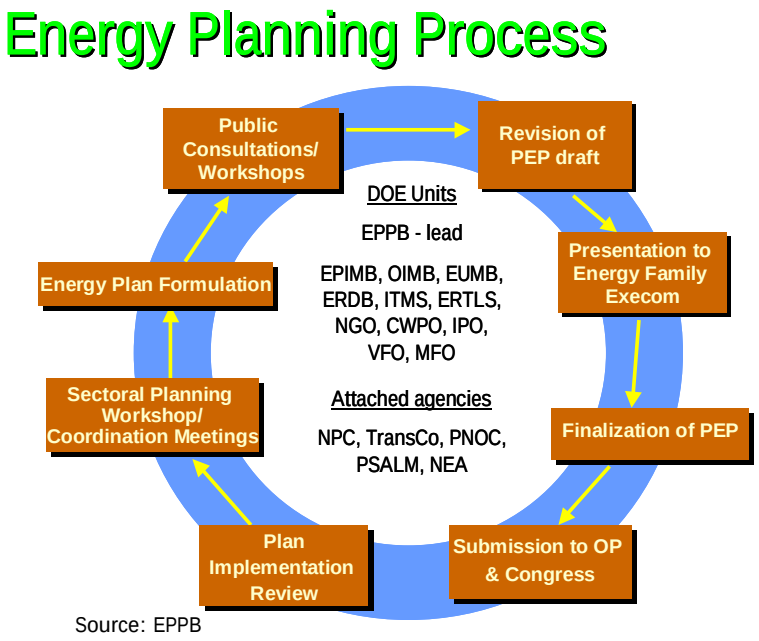


Figure 1.2-1 PEP Formulation Cycle

1.3 Japanese Energy Policy Formulation

In this section, the following four energy policy papers issued in Japan are introduced for reference of the PEP formulation; 1) The Basic Energy Plan, 2) Annual Energy Report or White Paper, 3) Long-Term Energy Supply/Demand Forecast, and 4) New National Energy Strategy.

While the PEP is prepared and issued every year, covering rather wide range of Basic Policy, Qualitative Forecast (sector-, and region-wise), and Policies/Measures taken, etc., the papers released in Japan are varying in their content and issuance frequency from time to time according to their own specific objective. (Table 1.3-1)

Table 1.3-1 Energy Policy Papers

Title	Content	Issuance	Latest
(Japan)			
The Basic Energy Plan	Basic Policy, Qualitative Forecast	At least once in every three years	2007.3
Annual Energy Report	Report on the Policies/Meatures taken	Every year	2007.5
Long-Term Energy Supply/Demand Forecast	Quantitative Forecast	Every 2-3 year	2005.3
New National Energy Strategy	Specific indication of strategiccally important items	(Ad hoc)	2006.5
(Philippine)			
Philippine Energy Plan 2007	Report on the Basic Policy, Qualitative Forecast, and Policies/Meatures taken	Every year	2007.9

1.3.1 The Basic Energy Plan

The Basic Energy Plan has been established by the government pursuant to the Basic Law on Energy Policy Formulation (June 2002), and describes the fundamental direction of Japan's energy policy for the next decade, based on the following three basic principles of this policy:

- Securing stable energy supply
- Conforming to environmental requirements
- Utilizing market principles

The first version, which was formulated in October 2003, was revised in March 2007 to meet the recent changes to the situation surrounding energy issues. The Basic Law on Energy Policy Formulation stipulates that the Basic Energy Plan should be reviewed at least once in every three years and be modified, if needed.

The purpose of this Act is, given that energy is essential for improving the stability of citizens' lives and for maintaining and developing the national economy, and that its use has a major impact on the local and global environment, to promote measures on energy supply and demand on a long-term, comprehensive and systematic basis by laying down the basic policy and clarifying the responsibilities of the State and local public entities with respect to measures on energy supply and demand and by prescribing matters that form the basis of measures on energy supply and demand, thereby contributing to the preservation of the local and global environment and to the sustainable development of the Japanese and global economy and society.

The Basic Energy Plan[2] is the qualitative one on energy supply and demand forecasting, indicating the fundamental direction of the policies/measures, looking towards about next 10 years range. It is approved by the cabinet, and is different from the quantitative forecast of Long-Term Energy Supply/Demand

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2 Basic Energy Plan stipulated in the Basic Law on Energy Policy Formulation is as follows:

Article 12 (Basic Energy Plan):

(1) The government shall formulate a basic plan on energy supply and demand (hereinafter referred to as the "Basic Energy Plan") in order to promote measures on energy supply and demand on a long-term, comprehensive and systematic basis.

(2) The Basic Energy Plan shall prescribe the following matters:

(i) Basic policy on measures on energy supply and demand

(ii) Measures that should be taken in relation to energy supply and demand on a long-term, comprehensive and systematic basis

(iii) Technologies related to energy where intensive measures should be taken for their research and development in order to promote measures on energy supply and demand on a long-term, comprehensive and systematic basis, and measures that should be taken in connection with such technologies

(iv) In addition to what are listed in the preceding three items, any matters necessary for promoting measures on energy supply and demand on a long-term, comprehensive and systematic basis

(3) By hearing the opinions of the heads of the relevant administrative organs and hearing the opinions of the Advisory Committee for Natural Resources and Energy, the Minister of Economy, Trade and Industry shall formulate a draft of the Basic Energy Plan and seek a cabinet decision thereon.

(4) When the cabinet decision prescribed in the preceding paragraph has been made, the Minister of Economy, Trade and Industry shall promptly report the Basic Energy Plan to the Diet and publicize the plan.

(5) The government shall review the Basic Energy Plan at least once every three years by taking into consideration the changes in the situation concerning energy and based on an evaluation of the effects of measures concerning energy, and if it finds necessary, make changes to the plan.

(6) The provisions of paragraph 3 and paragraph 4 shall apply mutatis mutandis to making changes to the Basic Energy Plan.

(7) The government shall endeavor to make necessary arrangements for the smooth implementation of the Basic Energy Plan by, for example, appropriating in its budget each fiscal year, -to the extent permitted within the limits of the nation's finances, funds necessary to ensure payment of the expenses required for implementation of the plan.

Forecast prepared by the Advisory Committee for Natural Resources and Energy to the Minister of Economy, Trade and Industry.

The major contents of the Basic Energy Plan are as follows:

1) Demand side:

Basic direction of strategies/measures to control the increasing energy demand in residential/commercial and transport sectors

2) Supply side:

Basic direction to introduce nuclear power, new energy, natural gas and etc., to reduce oil dependency as well as carbon-dioxide emissions

3) R&D:

Basic direction of intensive R&D fields and subjects, aiming to the increase of supply security and cost reduction through enhancement of further technology development

The original plan set out in October 2003 was revised based on the recent circumstance changes in March, 2007. (Approved by the cabinet on March 9, 2007)

The major points are as follows:

1) Increase of nuclear power generation including nuclear fuel cycle, and steady introduction/penetration of new energy
2) Strengthening of strategic and comprehensive measures to secure stable supply of oil, etc.
3) Leadership for constructing the effective international framework for strengthening energy conservation policy and global warming issue
4) Break-through of energy and environmental restrictions by technology (strengthening the technologies and the strategic use/application)

1.3.2 Annual Energy Report

Article 11 of the Basic Law on Energy Policy Formulation stipulates that “Every year, the government shall submit to the Diet a report on the general situation regarding the measures it has taken in relation to energy supply and demand”. In accordance with this article, the latest issue of Annual Energy Report or so-called “White Paper on Energy 2006” has been approved by the cabinet and reported to the Diet on May 25, 2007.

The report is composed of the following three parts:

Part 1: Challenges and problem-solving approaches toward energy issues

Part 2: Energy trends

Part 3: Summary of the measures implemented during FY2006 to seek balanced supply and demand for energy

In Part 1, important events happened in the subject year are taken up, intending to investigate and analyze from various view points, and to sort out the issues to indicate the way to the solutions. In the report of 2006 issue, under the theme of the "sky-rocketing crude oil price" recorded the highest figure in summer 2006, its effect on the Japanese economy was analyzed and the structural change of the

international energy market was introduced under the high oil price circumstance.

In Part 2, the latest statistical data of supply trend of such energy resources as oil, natural gas, coal, nuclear, and new energies in Japan and the world, as well as demand trend of industry, transport and residential sectors, are summarized by the tables and diagrams.

In Part 3, the government's activities with budget allocation in FY2006 such as R&D, international conference or bi-lateral discussion with various countries are introduced.

The important events taken up in the recent Annual Energy Reports are as follows:

FY2006:(Japan's strengthened resistance to soaring prices of crude oil and energy policy)

1. Soaring price of crude oil and the Japanese economy
2. Efforts to strengthen the energy supply and demand structure (Changing environment surrounding energy issues and approaches of individual foreign countries)
3. Structural changes of the international energy market
4. Movements to address the issues of global warming
5. Strategies of individual countries (Evolution of Japan's energy policies from a global viewpoint)
6. Reconstitution of energy policies as the national strategy
7. New strategic measures

FY2005: (Structural changes of the international energy market)

1. Soaring crude oil price and world's tight energy supply-demand conditions
2. The U.S. hurricane damage
3. International movements related to global warming (Energy strategies of countries)
4. The reconstruction of national energy strategies being promoted in key countries (Energy policy of Japan)
5. Japan actively promotes its resource diplomacy
6. Strengthening measures for energy demand centered on the commercial/residential sector and the transport sector
7. Promoting steady nuclear energy including nuclear fuel cycles
8. Institutional improvements for the comprehensive and strategic promotion of energy policy

FY2004:

1. Energy prices increase
2. Energy supply and demand forecast till 2030
3. Effectuation of Kyoto Protocol
4. Drastic strengthening of measures to energy conservation
5. Promotion of nuclear fuel cycle etc.
6. Resource Development problem in East China Sea
7. The steam piping system rapture accident in Mihama nuclear power plant, Kansai Electric Power Company

8. Correspondence to natural disaster

FY2003:

1. Oil market before and after the attack to Iraq
2. Electric power supply-tight problem in the Kanto region and nuclear power safety regulation reform
3. Trend on the Japanese carbon-dioxide emissions and Kyoto Protocol
4. Strengthening of energy conservation measures in the office, etc.
5. Promotion of new energy introduction (enforcement of the RPS regulation)
6. Symptom for hydrogen energy introduction
7. Amendment of Electricity and Gas Utilities Industry Laws

1.3.3 The Advisory Committee for Natural Resources and Energy to the METI and Long-Term Energy Supply/Demand Forecast

(1) The Advisory Committee for Natural Resources and Energy to the METI

The Advisory Committee for Natural Resources and Energy to the Minister of Economy, Trade and Industry, has been established based on Article 18 of Act for Establishment of the Ministry of Economy, Trade and Industry, and consists of the members appointed by the Minister of the Ministry of Economy, Trade and Industry[3]. At this moment, 6 sub-committees and 14 sessions are installed to investigate and discuss various energy-relating problems and issues.

Every organization/committees are actively conducted to watch, investigate, and discuss on moving energy and resource circumstance of Japan and the world. Looking at the latest fiscal year (April 2006-March 2007), 33 meetings of sub-committees and sessions as well as other small group ones were held, concluding 22 reports. METI's Home Page contains the pre-notice of the meetings which are basically organized on the open-basis, summary of the meeting discussion results, and concluded reports, etc.; the Home Page is widely utilized contributing to actual implementation of the measures and public relations.

(2) Long-Term Energy Supply/Demand Forecast

Long-Term Energy Supply/Demand Forecast is prepared as the Interim Report including the quantitative description of the Energy Supply-Demand session of the Committee, periodically every 2-3 years.

The forecast was revised in December 1998 and July 2001, reflecting to efforts to secure energy supply, from the viewpoint of further improvement of efficiencies in energy consumption and enhancement of the

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[3] Article 19 of the Act stipulates as follows:
The Advisory Committee for Natural Resources and Energy shall administer the following affairs:
(i) Concerning the energy master plan provided in Article 12, Paragraph 1 of the Basic Law for Energy Policy, matters provided in the Paragraph 3 of the said article shall be processed; and
(i-2) Investigate and examine the important matters concerning the comprehensive policies relating to security of stable and efficient supply for mineral resources and energy, and an adequate utilization of energy, in response to an inquiry issued from Minister of the Ministry of Economy, Trade and Industry.

non-fossil energy introduction such as new energy/nuclear etc., based on incorporating the Japanese CO_2 emission reduction target for 2010 set forth at the COP3 (the Conference of the Parties of the United Nations Climate Change Conference), December 1997. Further amendment had been made in July 2005 indicating the skeleton of energy supply and demand to be aimed at in future, where the forecast for 2010 and 2030 are described.

Two years have passed since then, and energy circumstance has greatly changed. So, the next revision work of the forecast has started targeting to complete within this fiscal year 2007. In order to respond to the changes in energy circumstance which the essence is interpreted as a resource restriction and an environmental restriction, "New National Energy Strategy" was established in FY2006, and the "Basic Energy Plan" was revised in March 2007, accordingly. Having acknowledged such situation and that the energy policy that stands comparatively in a long-term aspect is indispensable to overcome these restrictions, the following two forecasts are going to be revised this time.

1) Preparation of the Forecast for 2010

Reflecting the amendment work of the target achievement plan for the Kyoto Protocol in both 1) the Global Environment Committee, Central Environment Council and 2) the Global Environmental Subcommittee, Environment Committee, Industrial Structure Council, the forecast for 2010 (the midpoint of the First Commitment Period) will be prepared, which figure will be an aim/criteria to judge the "for or against" the agreement of Kyoto Protocol.

2) Preparation of the Forecast for 2030

The forecast for 2030 will be prepared, where 2030 is also set as a target year in the New National Energy Strategy, incorporating the trend of long-term economic activity including 1) demand side trend of the Japanese socio-economic structure change/energy conservation and 2) supply side trend of diversification of energy sources etc. as well as the effects of social infrastructure conversion and long-term innovative technology introduction.

1.3.4 New National Energy Strategy

In view of the recent severe energy situation including crude oil price escalation, the Ministry of Economy, Trade and Industry has been advancing the formulation of its "New National Energy Strategy" with energy security as its core policy. METI announced the interim report of the Strategy on March 30, 2006. Following this, detailed aspects of the strategic items were determined by taking into account discussions by at the Coordination Subcommittee of the Advisory Committee for Natural Resources and Energy. METI Minister reported the summary to the Council on Economic and Fiscal Policy to be held on May 31.

The three objectives to be achieved by the Strategy are: 1) establishment of energy security measures that our people can trust and rely on, 2) establishment of the foundation for sustainable development through a comprehensive approach for energy and environmental issues combined, and 3) commitment to assist Asian and world nations in addressing energy problems. In particular, the following efforts shall be made.

(1) Establishment of a state-of-the-art energy supply-demand structure

Target: Oil dependence will be reduced to less than 40% by 2030, from the current approximately 50%.

Measures: The following four plans will be implemented:

i) Energy Conservation Frontrunner Plan

Target: At least another 30% improvement in energy efficiency by 2030

ii) Transport Fuel for the Next Generation Plan

Target: Reduction of oil dependence of the transport fuel to around 80% by 2030

iii) New Energy Innovation Plan

Target: Reduction of solar energy power generation cost to the level of that of thermal power generation by 2030, and improvement of the self-sufficiency ratio of the energy supply in the regions through supporting local production for local consumption using biomass and other forms of energy.

iv) Nuclear Power National Plan

Target: The ratio of nuclear power to the total power production will be increased to the level of 30% to 40% or more in and after 2030. Early establishment of the nuclear fuel cycle and the practical application of fast-breeder reactors shall be addressed.

(2) Comprehensive Strengthening of Resource Diplomacy and Energy and Environment Cooperation

i) Comprehensive Strategy for Securing Resources

Target: The oil supply ratio procured from the Japanese exploration and development projects shall be raised to around 40% by 2030.

ii) Asia Energy and Environment Cooperation Strategy

Target: Coexistence with other Asian countries will be aimed at through energy cooperation including energy conservation.

(3) Enhancement of Emergency Response Measures

Enhancement of emergency response measures shall be addressed such as the revision and strengthening of the oil stockpiling system, including the introduction of petroleum product stockpiling and the preparation of the emergency response system for natural gas.

(4) Other

In order to promote cooperation between the public and private sectors, the Energy Technology Strategy should be formulated incorporating technical challenges to be solved by 2030; this approach should take into account the technologies needed from a strategic viewpoint by envisaging the situation in 2050 or 2100 and back casting from then.

Chapter 2 Present Status of Energy Supply/Demand Model and Challenges

2.1 Current Situation and Issues of Energy Database

2.1.1 Database by EPPB/DOE

(1) Organization

Policy Formulation and Research Division of Energy Policy and Planning Bureau (EPPB) which is an organization in Department of Energy (DOE) is collecting energy data in the Philippines from inside and outside of DOE, and is summarizing them for the database.

(2) Item of Collected Data

Socio-economic and energy data which are absolutely necessary to formulate the Philippine Energy Plan (PEP) are collected regularly and summarized on the database by EPPB. Table 2.1-1 shows the list of the collected data items.

Table 2.1-1 Collected Data Item

Data Source	Reporting Frequency		
	Monthly	Annually	Others
I. Internal Data			
1. Oil Industry Management Bureau (OIMB)			
Crude oil and petroleum products (import/export)	●	●	
Sales and Inventory of petroleum products	●	●	
Refinery products, capacity, crude run, own use and losses	●	●	
2. Energy Resource Development Bureau (ERDB)			
Oil and Gas, Coal, and Geothermal (Reserve and Production)	●	●	
Coal Importation	●	●	
Fuel Oil Displacement and Savings		●	
3. Energy Utilization Management Bureau (EUMB)			
Data on Energy Efficiency and Conservation		●	Quarterly
Data on Renewable Energy (hydropower, biomass, solar, and wind) and Alternative fuel	●	●	
4. Electric Power Industry Management Bureau (EPIMB)			
Power Capacity and Generation	●	●	
Fuel Input to Power Generation	●	●	
System and Distribution Losses	●	●	
5. Energy Policy and Planning Bureau (EPPB)			
Sectoral Final Energy Demand (Residential/Transport/Industry/Commercial/Agriculture)		●	
Coal Utilization Report (by industry)	●	●	
Household Energy Consumption Survey (HECS)			Every 5 Years
II. External Data			
1. National Economic and Development Authority (NEDA)			
Projected Economic Accounts (GDP, GVA by Sector)		●	
2. Central Bank of Philippines (BSP)			
Foreign Exchange	●	●	Daily
3. National Statistics Office (NSO)			
Population, Statistical Indicators		●	
Conduct of Household Energy Consumption Survey (HECS)			Every 5 Years
4. National Statistical Coordination Board (NSCB)			
Philippine Statistical Yearbook (PSY)		●	
Economic Indicators	●		
5. Philippine Institute of Petroleum (PIP)			
Industry Petroleum Sales	●	●	

Source: Information by EPPB/DOE

Data collected from internal offices of DOE include the basic data on primary energies such as reserves, production, export and import, petroleum products data, electricity related data, final energy consumption data by sector and so on. These data are collected from five bureaus in DOE, namely, Oil Industry Management Bureau (OIMB), Energy Resource Development Bureau (ERDB), Energy Utilization Management Bureau (EUMB), Electric Power Industry Management Bureau (EPIMB), and EPPB.

DOE collects socio-economic data from outside of DOE such as population, GDP and foreign exchange rate from National Economic and Development Authority (NEDA), Central Bank of Philippines (BSP), National Statistics Office (NSO), National Statistical Coordination Board (NSCB), and also petroleum sales record for industries from the Philippine Institute of Petroleum (PIP).

2.1.2 Improvements on DOE's Database

(1) Regular Data Collection (Monthly Data)

Except for the daily data on the foreign currency exchange rate, data collection is in principle conducted monthly, quarterly and/or annually as shown in Table 2.1-1. However, there are some issues on the data collection system as follows,

a) All of energy and socio-economic data are not necessarily reported monthly. Therefore, data changes and their backgrounds are not analyzed on month by month basis for all of the data.
b) Energy data is held in Excel files by each division who are in charge of sectoral data collection, and is not managed by a particular division integrally.

(2) Scale of Database

Database items are different from the energy balance table of International Energy Agency (IEA), being designed in the Philippines' own style. At present, this local style of the database contains several problems as follows;

a) There is no data on energy inventory changes except for crude oil and petroleum products.
b) A part of energy consumption classification does not correspond to the international standard industrial classification (ISIC).
c) All kinds of statistics in the Philippines are collected by NSCB. However, DOE does not seem to be using the NSCB's statistics data effectively. This is because items and regional classifications of the collected data do not fit for use in the DOE's energy database.
d) Past data have not been modified despite changes in the thermal efficiencies applied for geothermal and non-commercial energies.
e) For standard conversion of crude oil and petroleum products, "barrel fuel oil equivalent (BFOE)" was used in the Philippines in the past, but recently this unit was changed to the IEA based "ton oil equivalent (toe)." However, BFOE is still used at various sectors.

(3) Disclosure of Database

The energy database prepared by DOE is utilized for developing the PEP, and a part of the data is

publicized on the PEP, but not all of them. At this moment, these energy data are not publicized on the DOE website yet. To accommodate people's concern, it should be considered to provide them for those who want to utilize the energy database.

Regarding the above points, the improved status after construction of Energy Database through this study will be described in Chapter 13.

2.1.3 Existing Energy Database and PEP

(1) Energy Database by IEEJ

The Energy Data and Modeling Center (EDMC) of the Institute of Energy Economics, Japan (IEEJ) has created an energy data bank of Japan since 1984 as its original product. EDMC offers energy information on the IEEJ's web site for its members, and also publishes annually the "Handbook of Energy & Economic Statistics in Japan" since 1992.

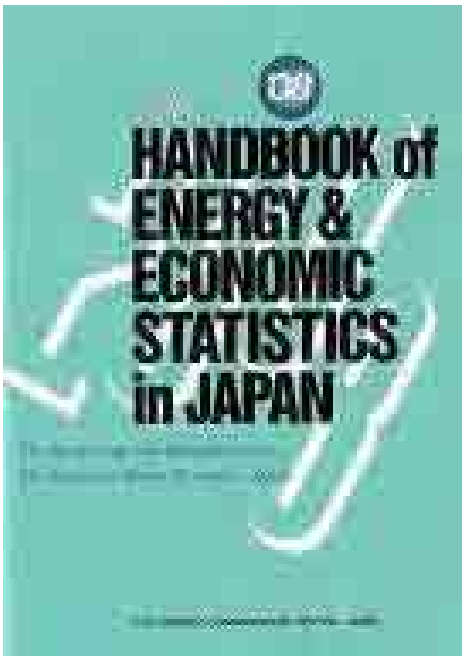


Figure 2.1-1 Handbook of Energy & Economic Statistics in Japan by EDMC / IEEJ

For the members of the IEEJ's web site service, the following monthly domestic data over the past 20 years are provided.

- Economic Indices
- Primary energy supply
- Demand and supply of electricity
- Demand and supply of petroleum products
- Demand and supply of crude oil, import and export of petroleum products
- Town gas, LNG, coal and cokes
- Prices of petroleum products
- Average import price of energy

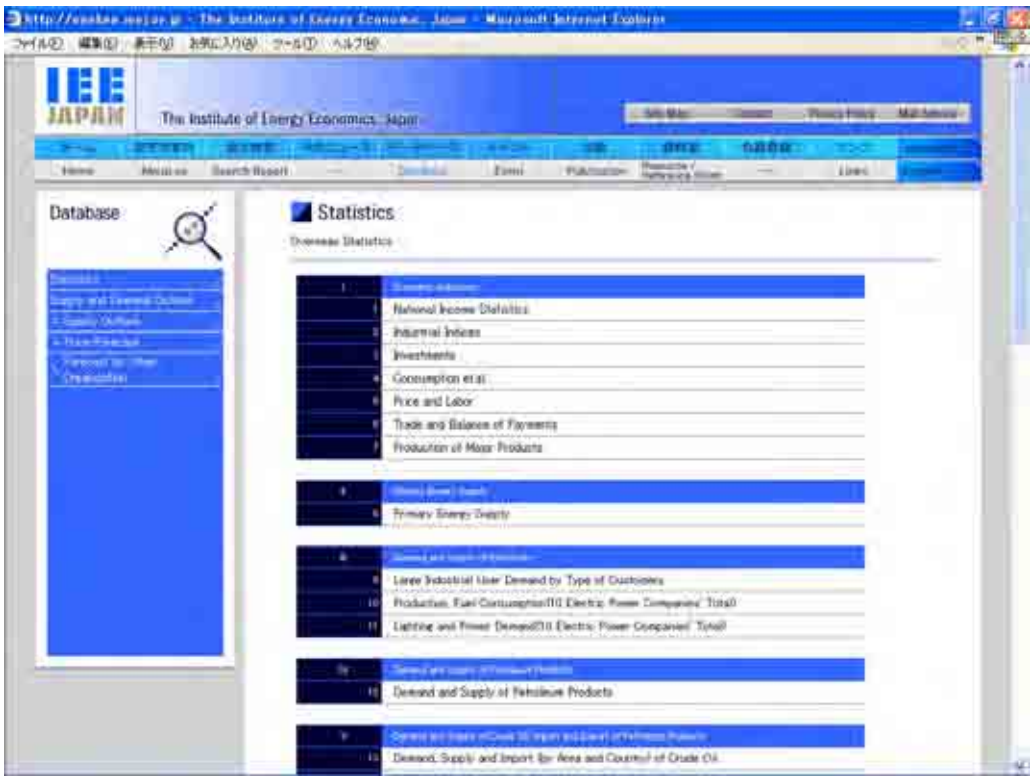


Figure 2.1-2 Energy Economics Database on IEEJ's Web Site

Figure 2.1-3 Domestic Statistics Database on IEEJ's Web Site

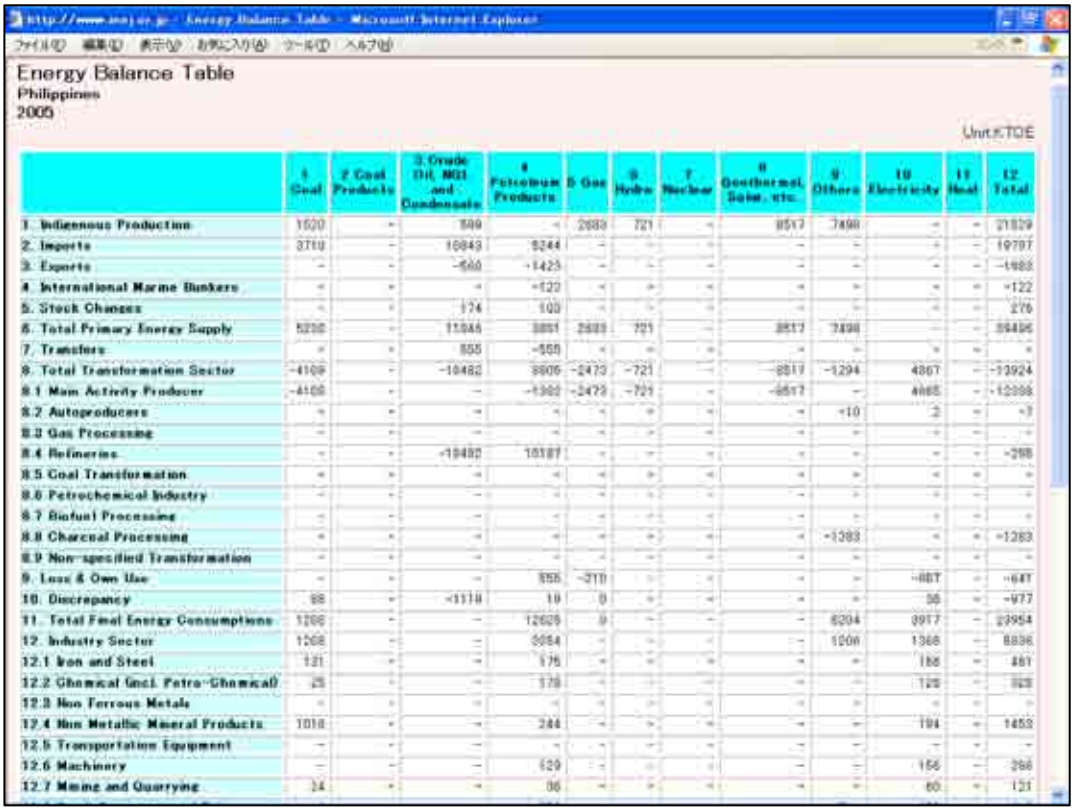
Annual energy data are classified into three items as below, and basic information such as energy balance table and specific energy consumption are being updated from time to time.

- Energy resources, demand and supply, and facilities
- Energy price and cost
- Economic indices and others

(2) Energy Database by EGEDA / APEC

The Expert Group on Energy Data and Analysis (EGEDA) is set up as an organization of Energy Working Group (EWG) of Asia-Pacific Economic Cooperation (APEC). EGEDA has commissioned to the Asia Pacific Energy Research Centre (APERC) of IEEJ energy data collection from APEC economies and creation of an energy database. The collected data are published annually as "APEC Energy Statistics"; the database is also available on the IEEJ's web site.

EGEDA provides data by country and by year as follows; oil supply and demand data monthly, primary energy supply and demand data quarterly, and primary energy supply and demand data, energy balance table, electricity related data, and stock changes annually.


Energy Balance Table
Philippines
2005
Unit:KTOE

	1 Coal	2 Coal Products	3 Crude Oil, NGL and Condensate	4 Petroleum Products	5 Gas	6 Hydro	7 Nuclear	8 Geothermal, Solar, etc.	9 Others	10 Electricity	11 Heat	12 Total
1. Indigenous Production	1520	-	599	-	2883	721	-	8517	7498	-	-	21829
2. Imports	3710	-	10843	5244	-	-	-	-	-	-	-	19797
3. Exports	-	-	-599	-1425	-	-	-	-	-	-	-	-1983
4. International Marine Bunkers	-	-	-	-122	-	-	-	-	-	-	-	-122
5. Stock Changes	-	-	174	103	-	-	-	-	-	-	-	276
6. Total Primary Energy Supply	5230	-	11046	3801	2883	721	-	8517	7498	-	-	39496
7. Transfers	-	-	855	-855	-	-	-	-	-	-	-	-
8. Total Transformation Sector	-4109	-	-10482	8905	-2473	-721	-	-8517	-1294	4867	-	-13924
8.1 Main Activity Producer	-4109	-	-	-1382	-2473	-721	-	-8517	-	4865	-	-12338
8.2 Autoproducers	-	-	-	-	-	-	-	-	-10	2	-	-7
8.3 Gas Processing	-	-	-	-	-	-	-	-	-	-	-	-
8.4 Refineries	-	-	-10482	10287	-	-	-	-	-	-	-	-288
8.5 Coal Transformation	-	-	-	-	-	-	-	-	-	-	-	-
8.6 Petrochemical Industry	-	-	-	-	-	-	-	-	-	-	-	-
8.7 Biofuel Processing	-	-	-	-	-	-	-	-	-	-	-	-
8.8 Charcoal Processing	-	-	-	-	-	-	-	-	-1283	-	-	-1283
8.9 Non-specified Transformation	-	-	-	-	-	-	-	-	-	-	-	-
9. Loss & Own Use	-	-	-	855	-310	-	-	-	-	-687	-	-641
10. Discrepancy	88	-	-1118	19	0	-	-	-	-	56	-	-977
11. Total Final Energy Consumptions	1208	-	-	12625	0	-	-	-	6204	3917	-	23954
12. Industry Sector	1208	-	-	3054	-	-	-	-	1208	1368	-	6836
12.1 Iron and Steel	121	-	-	175	-	-	-	-	-	166	-	461
12.2 Chemical (incl. Petro-Chemical)	25	-	-	178	-	-	-	-	-	128	-	328
12.3 Non Ferrous Metals	-	-	-	-	-	-	-	-	-	-	-	-
12.4 Non Metallic Mineral Products	1018	-	-	284	-	-	-	-	-	194	-	1453
12.5 Transportation Equipment	-	-	-	-	-	-	-	-	-	-	-	-
12.6 Machinery	-	-	-	129	-	-	-	-	-	156	-	286
12.7 Mining and Quarrying	24	-	-	36	-	-	-	-	-	60	-	121

Figure 2.1-4 APEC Energy Database (Energy Balance Table)

(3) Energy Database of Vietnam

For reference, we would like to introduce the energy database the JICA team has recently developed for Vietnam. Data for the energy database are entered into Microsoft Excel spread sheets and then stored in the Microsoft Access sheets, since Microsoft Access is deemed suitable for data handling such as retrieval and sorting rather than Microsoft Excel. Microsoft Access is also suitable for future expansion and/or system upgrading, for example, data sharing on a network through a database server. The data stored in the Microsoft Access sheets are processed by the database program for retrieval, sorting, and graph generation and are displayed on a PC screen with an Excel and/or PDF format.

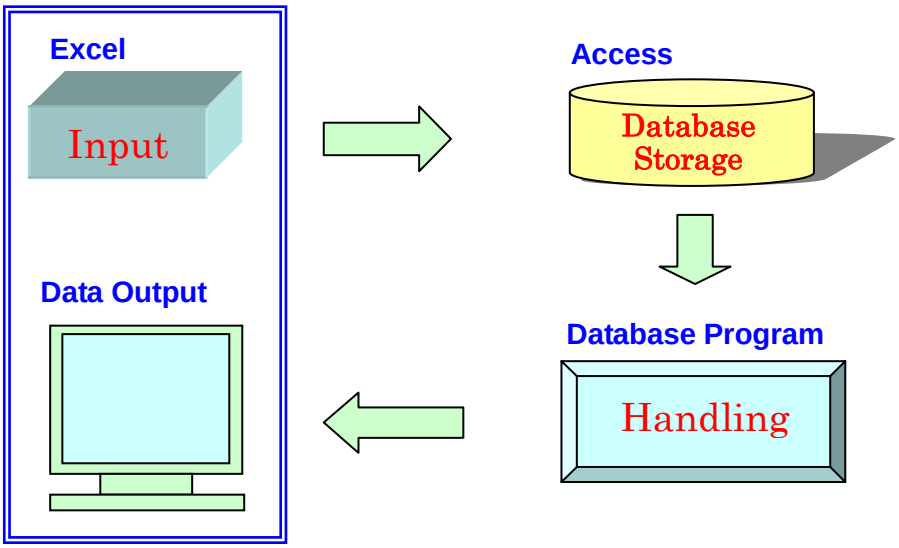


Figure 2.1-5 System Configurations

1) Data items

In the IEA energy balance table, there are 61 energy sources and 82 supply and demand items; the total data entry cell is about 4,500 (61×75=4,575). However, all the listed items would not be necessary as some energy sources and energy plants may not exist in a country. In case of Vietnam, there is no coking coal, geothermal, CHP plant, liquefied coal plant, etc. In the energy balance table of Vietnam, therefore, we have reduced the data items to meet the country's energy situation considering the future development plan such as refinery, nuclear power, renewable energy, etc. As a result, the total data entry cells of the Vietnamese energy database are reduced to 1,372 (28×49=1,372).

2) Function and Operation of Database

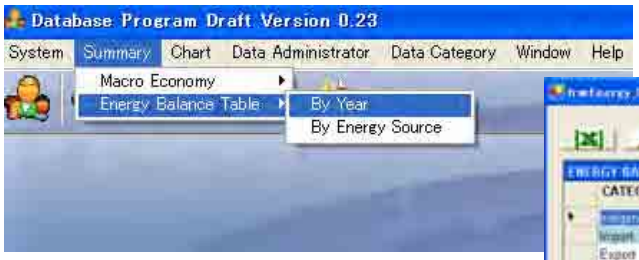
The Vietnamese database program is developed considering easy data handling. Functions and operations of the database program are as follows.

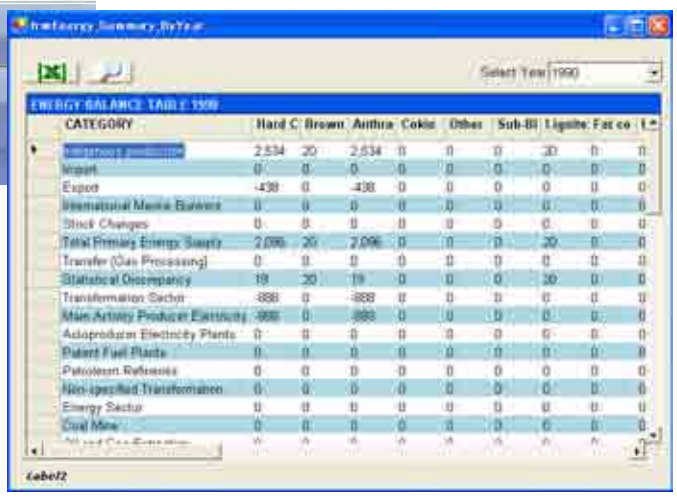
Macro Economy Data

Click Summary and select Macro Economy Table.

Then, time-series macro economy data will be displayed.

Energy Balance Table by Year





Click Summary and select Energy Balance Table by Year.

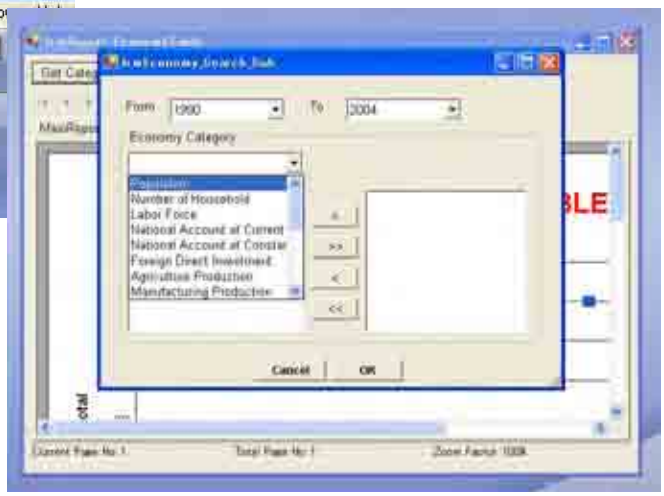
Then, energy balance table by year will be displayed.

Energy Balance Table by Source

Click Summary and select Energy Balance Table by Energy Source.

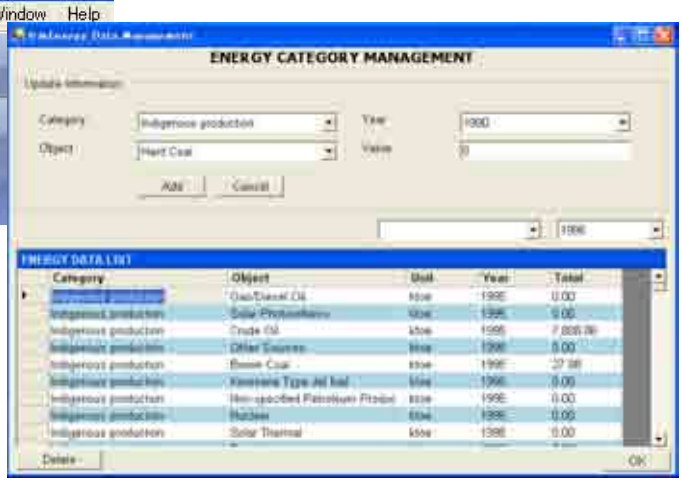
Then, energy balance table by source will be displayed.

Graph Generation



Pie chart and line chart can be created from the Chart menu.

Data Update



Click Data Administrator and select Data Management.
Then, you can update the data.

Adding Data Items

Click Data Category and select Category, Item, Field, or Source.
Then, you can add new item(s).

2.2 HECS and Its Issues

2.2.1 HECS

The Household Energy Consumption Survey (HECS) is periodically conducted to obtain the fuel consumption patterns in the residential sector, undertaken by DOE with cooperation of the National Statistic Office (NSO). The survey is implemented in an interview style for sampled households. Table 2.2-1 shows the overview of three HECS conducted in 1984, 1995 and 2004. In the latest 2004 HECS, the number of the sample data was increased and certain consumption categories were added to obtain specific consumption characteristics of energy use such as transport expenditure.

Table 2.2-1 Overview of Past HECS

Year	1998	1995	2004
Number of Estimated Households	11,183,000	12,821,000	16,973,000
Number of Sampling Households	5,082	6,429	21,961

In this section, to confirm the accuracy of the HECS results and consistency with other statistical survey, the 2004 HECS is compared with the 2004 Energy Balance Table for the Philippines prepared by International Energy Agency (IEA), which shows the residential sector energy consumption estimated from supply-side data (see Table 2.2-2). In Electricity, LPG, Kerosene and Petroleum Products, the differences in the toe-based consumption between the HECS and the IEA Energy Balance Table are 29%, 27%, 27% and 55%, respectively; these may be deemed being meaningful ranges for comparison, although these numbers are not small. This indicates that the 2004 HECS provides relatively reliable statistics. In the contrary, there is a big difference in the biomass residue consumption maybe due to unclear conversion calculations to the toe figures.

Table 2.2-2 Comparison between 2004 HECS and IEA Energy Balance

Type of Fuel		2004 HECS		2004 Energy Balance (Residential Sector)	Difference (%)
			(ktoe)	(ktoe)	
Electricity		22,379,486MWh	1925	1369	-29%
LPG		872,000t	1046	764	-27%
Kerosene		474,000kl	416	304	-27%
Petroleum Products	Gasoline(Transportation-purpose)	2,121,000kl	1753	1181	-55%
	Diesel(Transportation-purpose)	970,000kl	885		
Biomass Residue		1,351,000t	270	3438	1172%

Source: The 2004 HECS and IEA 2004 Energy Database for Philippines

2.2.2 Issues on HECS

(1) Data Set and Continuity

In the 2004 HECS, several important factors affecting the fuel consumption, such as household income, number of household members and electrical appliance ages, were properly included in the interview items. In addition, the 2004 HECS has added specific demand categories, like transport expenditure, aiming to

analyze demand patterns in more detail. However, the number of the total data collected in the three HECS are still small for calculating the energy consumption trend and for identifying extraordinary data, such as climatic effects on consumption. Thus, it is recommended to conduct an annual survey continuously, or if it is difficult in terms of survey costs, the combination of the detail survey in several years and the annual brief survey for limited important factors that are consisting the basic trends.

(2) Analyzing Regional Characteristics

The sample data in the 2004 HECS were collected from 17 regions universally, while, in the stage of analysis, there were only few comments made on the detail regional demand patterns. Analysis on the outcome of the HECS may be utilized in considering energy saving policies for households. In the same manner, it is useful to utilize the HECS to clarify regional characteristics of the energy consumption in formulating energy policies.

(3) Collaboration with the Other Statistical Survey

There are two types of methods for demand estimation; one approach is a direct demand survey like the HECS and the other is a supply-data-based estimation. In general, in formulating the national level demand figure, the calculation via supply data is preferred due to its wider coverage, easiness in implementation and cost efficiency. In the contrary, as a demand side survey may be able to approach the primary information source directly, it is suitable to conduct more detail research on consumption patterns responding to characteristics of consumers. These interview surveys may be conducted jointly with other social surveys to better utilize the governmental resources. For example, if additional items are added in the HECS about the daily characteristics of the power demand, it could reveal the daily load curve of the household sector which could be utilized for electric power station planning.

2.3 Energy Demand and Supply Models

2.3.1 Characteristics of DOE's Energy Demand Forecasting Model

To date, the PEP has presented the energy demand forecast of the Philippines for the next 10 years. The model formulae for the future energy demand forecast are made mainly by regression analysis and EPPB (Energy Policy and Planning Bureau) is using "Simple.E" as the main regression analysis tool. The electricity demand forecast is being conducted by EPIMB (Electric Power Industry and Management Bureau), and EPPB applies the figures from EPIMB as the outlook of electricity demand in the PEP. Of course, common assumptions are applied by EPPB and EPIMB for their analyses regarding fundamental factors for forecast such as GDP growth rate, population growth rate, foreign exchange rate, etc., using outlooks of NEDA (National Economic and Development Authority), BSP (Central Bank of Philippines), and NSO (National Statistics Office). The energy demand forecast by EPPB is divided into five sectors, namely, residential, transport, industrial, commercial, and agriculture, as shown in Table 2.3-1.

Table 2.3-1 Sectors and Fuels by EPPB Model

Residential	Transport	Industrial	Commercial	Agriculture
LPG	Gasoline	LPG	LPG	Gasoline
Kerosene	Diesel	Kerosene	Kerosene	Diesel Oil
Biomass	Aviation Fuel	Fuel Oil	Fuel Oil	Kerosene
	Fuel Oil	Diesel Oil	Diesel Oil	Fuel Oil
	Natural Gas	Coal	Biomass	
		Biomass		

Source: DOE

The model formulae and variables used for the energy demand forecasting model of DOE are as follows.

[Residential]

R = LPG + Ker + Bio + Elc

Where:

R = Total demand for residential sector

LPG = Demand for LPG (OLS, f{t})

Ker = Demand for kerosene (OLS, f{t})

Bio = Biofuel based on 2004 HECS results

Elc = Demand for electricity (DDP approach)

[Transport]

T = GSL + IFO + AVF + ADO + Elc + CNG + BioF

Where:

T = Total demand for transport sector

GSL = Demand for gasoline (OLS, f{GVA, no. of motor vehicles using GSL})

IFO = Demand for fuel oil (OLS, linear trend)

AVF = Demand for aviation fuel (OLS, linear trend)

ADO = Demand for diesel oil (OLS, f{GVA, no. of motor vehicles using ADO})

Elc = Demand for electricity based on historical consumption at existing train lines

CNG = Demand for CNG (calculated based on expected no. of CNG buses)

BioF = Calculated based on the diesel oil demand (1% of bio-diesel) and gasoline demand (5% ethanol blend)

[Industry]

I = LPG + Ker + IFO + IDO + Lig + Bio + Elc

Where:

I = Total demand for industrial sector

LPG = Demand for LPG (Energy intensity approach, f{GVA})

Ker = Demand for kerosene (Energy intensity approach, f{GVA})

IFO = Demand for fuel oil (Energy intensity approach, f{GVA})

IDO = Demand for diesel oil (Energy intensity approach, f{GVA})

Lig = Demand for coal (OLS, f{cement production})

Bio = Demand for biomass (agriwaste, fuelwood, bagasse) (OLS, f{t})

Elc = Demand for electricity (based on DDP)

[Commercial]

C = LPG + Ker + IFO + IDO + Bio + Elc

Where:

C = Total demand for commercial sector

LPG = Demand for LPG (Energy intensity approach, f{GVA})

Ker = Demand for kerosene (Energy intensity approach, f{GVA})

IFO = Demand for fuel oil (Energy intensity approach, f{GVA})

IDO = Demand for diesel oil (Energy intensity approach, f{GVA})

Bio = Demand for biomass (agriwaste, fuelwood, charcoal, bagasse) (OLS, f{t})

Elc = Demand for electricity (based on DDP approach)

[Agriculture]

A = GSL + Ker + IFO + IDO + Sol + Elc

Where:

A = Total demand for agriculture sector

GSL = Demand for gasoline (OLS, linear trend)

Ker = Demand for kerosene (OLS, linear trend)

IFO = Demand for fuel oil (OLS, linear trend)

IDO = Demand for diesel oil (OLS, linear trend)

Sol = Demand for solar energy (based on ANEC inventory)

Elc = Demand for electricity (based on DDP approach)

(Note) OLS: Ordinary Least Squares, HECS: Household Energy Consumption Survey, DDP: Distribution Development Plan, GVA: Gross Value Added, CNG: Compressed Natural Gas

2.3.2 Issues of Energy Demand Forecasting Model of DOE

(1) Credibility of Past Data

For an energy demand forecasting formula using a regression analysis, correlation between the energy demand and explanatory variables is very important. If it is deemed that there is no meaningful correlation between the energy demand and explanatory variables as a result of regression analysis, we cannot use such a formula. For example, we can consider the energy statistics on the agriculture sector from 1988 to 2005, which are divided into four regions, North Luzon, South Luzon, Visayas and Mindanao. Though the GDP growth rates in the agriculture sector of the same period was stable, energy demand showed great variances as shown in Figure 2.3-1. Energy demand statistics of the agriculture sector frequently cast problems on credibility in many countries as well as in the Philippines. Although it is

needed to check the data from its collecting and processing stage to grasp the energy demand exactly, we leave it as the next challenge due to the big work volume. .

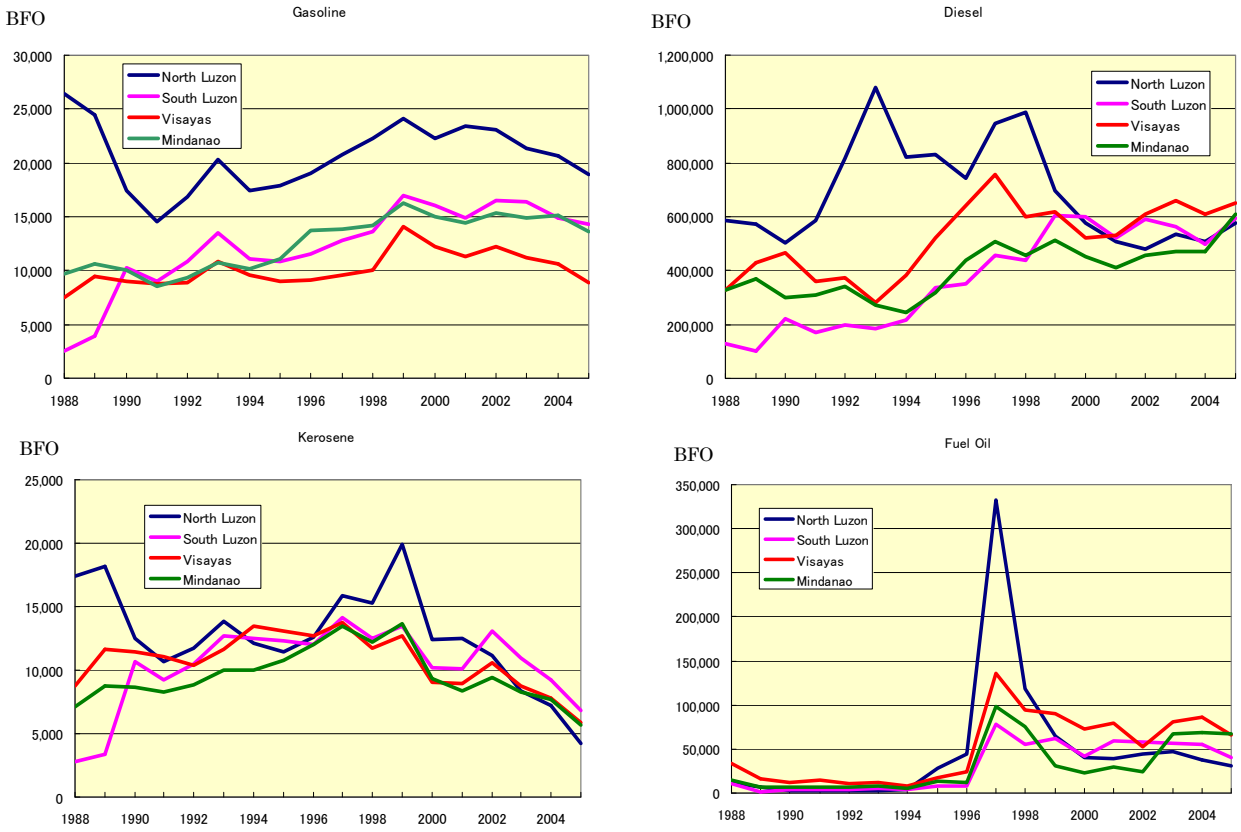


Figure 2.3-1 Trend of Energy Demand in Agriculture Sector

(2) Price Impact

In its energy demand forecasting model, EPPB uses time trend, GDP, number of vehicles, etc. as explanatory variables of the model formulae, but the price variables are not considered. In general, it is difficult to find the true price elasticity statistically in developing countries, because the government is often controlling energy prices lower than the natural market prices. Today, the world crude oil price is soaring rapidly and every energy prices are following the trend of the crude oil price. Under the circumstance, it is essential to consider and incorporate the price impact in the energy demand forecasting model to be developed in this study.

(3) Energy Demand Forecast by regions

EPPB is estimating energy demand by region; the country is divided into four or fifteen regions as the case may be. Should sufficient and stable data be available, it may be desirable to adopt the procedure estimating the energy demand by regions and summing them up into the whole country energy demand. However, this is often not the case. In case regional data is not sufficient, we may adopt a method where the whole country energy demand is estimated first and then divided to each region applying factors such as the regional GDP, population, floor space, and so on. In this study, we decided to formulate the nationwide comprehensive energy forecast due to the difficulty of collecting accurate regional energy and

economic data at this time.

(4) Electricity Demand

At present, EPPB is using the figures from EPIMB as outlook of electricity demand in PEP. However, considering elements such as energy shift from fossil fuels to electricity, fuel consumption in power plants, the role of the power sector providing the anchor demand for developing natural gas and/or renewable energies, and energy best mix considering the efficient co-generation system, etc., it is desirable to have an integrated model rather than a separated model. In this study, we established the comprehensive model including all the energy sources.

(5) Past Time Series Data

In the past, energy demand outlook of the PEP has been prepared for the next ten years. However, the presidential request is made this time to prepare an energy outlook for 20 years in next PEP2008 Update. At present, DOE has compiled the past energy data from 1990 (partly-1988) to 2006, the coverage of which would not be adequate from the viewpoint of meaningful statistical analysis to estimate energy demand for the next 20 years. Another factor is, for example, that the natural gas demand has arisen only from 2002 when production from the Malampaya gas field started. It is not possible to examine the potential natural gas demand trend for the preceding period since no natural gas option had existed then in the Philippines.

If past time series data is not sufficient for estimating future energy demand, we have to construct estimation formulas for energy demand forecast applying several assumptions. Since our future should not be a simple copy of the past, while respecting the result of regression analyses, we need to incorporate into our model those factors such as structural changes of the society and technical innovations in an appropriate manner.

(6) Consideration for Energy Conservation

As the world concern is rising on the global warming today, it is necessary to consider the effects of promoting energy conservation into the model. In the contemporary world, energy efficiencies of electric appliances such as air conditioner, refrigerator and etc. are being improved day by day. We observe really big differences between the existing social stock and new appliances on sale in terms of energy efficiency. Substantial energy conservation can be promoted just replacing the equipments. Should energy conservation policy be promoted in a country, additional effects will be expected through accelerated technology development, higher concern on energy efficiency at selection and/or use of new appliances.

It is impossible to explain such future tendency of the energy efficiency simply applying the past energy trends. Therefore, we need to conduct various studies on the energy conservation in order to install a mechanism in the demand forecasting model to consider its effects. As appliances, equipments and buildings to use energy will be used for 5-15 years or more, replacement of the existing stock takes time and thus the energy conservation process proceeds cumulatively with time. We need to take note of these points in the model building.

2.3.3 Supply/Demand Optimization Model

(1) Need of Supply and Demand Optimization Model

For preparation of the PEP, it is necessary and useful to provide quantitative information on the energy balance, which is logically correct, consistent and optimized. As energy goes through various processing facilities before reaching the final user, it is almost impossible to obtain the optimized information with consistent long-term balance over various energies by simply using table calculation software such as Excel spread sheet. To this end, we need a supply and demand optimization model (hereinafter called as the "S&D Model"), which applies optimization theories.

(2) Situation of S&D model in Philippine

DOE is using modeling tools such as LEAP, Simple.E, MARKAL, MESSAGE and etc. according to individual purposes. But LEAP is not meant as an optimization modeling software. Simple.E is a useful tool for forecasting work, but does not function for optimization. Thus, neither LEAP nor Simple.E is usable for S&D modeling. On the other hand, MARKAL is widely used in various countries and research institutes worldwide for optimization modeling. DOE has used MARKAL twice for two individual projects in the past. According to an interview with the staff engaged, MARKAL was used for these projects, but it has not been used since then in the regular jobs like preparation of the PEP as the data preparation and operation is complicated in using MARKAL. For example, it requires peculiar data sets that are very difficult to obtain in a usual research, such as technical specification of air-conditioning machines by type. MARKAL requires such detail data in various aspects. Furthermore it is not easy to understand its content such as the calculation logics, which is not very transparent, so that only a limited number of staff would be able to handle MARKAL. Function of MESSAGE is same as MARKAL and the seminar on MESSAGE was held at DOE in August 2008. But this is not the model which EPPB can use as the method for the ordinary work like establishing of the PEP. Under the circumstance, DOE is not using the supply/demand optimization method in aggregating the sectoral study results.

(3) Selection of tool for S&D model

In view of the current status at DOE as above, the JICA team agreed with the Counterpart that the team will construct an S&D Model for use in formulation of the PEP as shown in Figure 2.3-2. The model shall assure the consistency among sectors and work with good operation maneuverability. As MARKAL owned by the Counterpart uses GAMS as its engine (modeling software), and in view of the experiences of the JICA team expert in model building in Vietnam and elsewhere, it is agreed that GAMS shall be used as the tool for the S&D Model.

The basic theory used in building the S&D model is Linear Programming (LP), which enables to obtain the optimized solution applying the LP theory after preparation of the energy flows and various constraints in linear equations and giving the objective function for optimization, such as total profit maximum or total cost minimum for a long term. GAMS is a good software tool for building an LP model. In this study, we used Excel as the input-output tool since many DOE staffs are familiar with handling Excel.

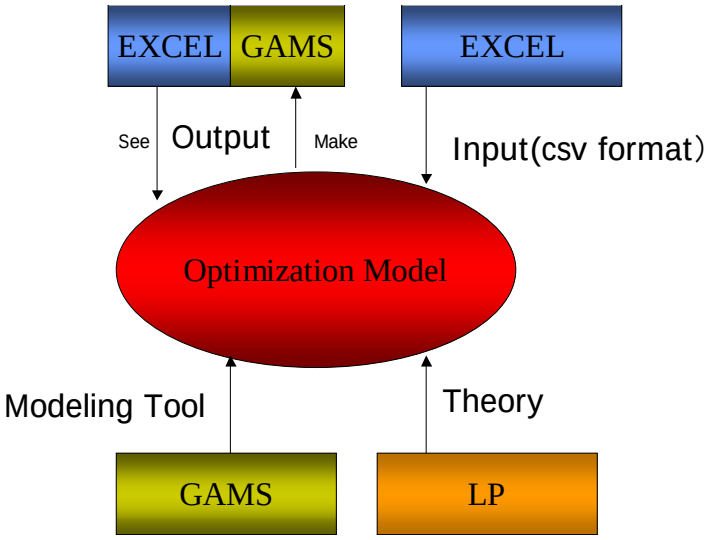


Figure 2.3-2 Tools of Supply & Demand Model

(4) Style of the Supply & Demand model.

Building a model for support of preparing the PEP while capacity development is required, it is desirable to make a transparent and simple model and limit its function to the specified purposes so that as many people as possible can handle it. However, regarding the purpose to avail the model for many people, we cannot exclude a case that the usage would be confined to those who have certain background as it relates to a peculiar theme and method in pursuing the optimization of supply and demand balance. The JICA team has tried to design the model in line with the routine data processing procedure currently adopted at DOE, as experts are familiar with, so that so many staff as possible could operate the model. To this end, the technical transfer was done as follows.

As the first step, a technical transfer seminar on LP theory and handling of GAMS was conducted for many DOE stuffs. After then, the JICA team constructed the model and made the technical transfer on the detailed contents of the model and operational method for the selected experts among the DOE stuff.

(5) Issues to be decided on designing S&D model

Major check points in building the S&D Model are those issues as shown below. Decisions on them were made in view of the two points, firstly whether the study purpose could be achieved or not and secondly whether the necessary data could be obtained or not.

1) Required functions of the S&D model

For example

a. To incorporate important energy policies and/or foreign factors.

b. To show various indices as criteria for policy selection

c. To create various outputs such as time series tables, energy balance tables at specified years and etc.

2) Building one country model

Important issues to be considered are

a. The energy transportation among regions

b. Locations of the transformation facilities (oil refinery, power plant, etc)

c. Availability of collecting energy and economic regional data

d. Number of regions

3) Deciding the electric power development Plan in this Model

Should the optimum power development plan and fuel allocation be decided in this model or be calculated by another model and the result should be input as exogenous data? A full scale power allocation model is complex in order to consider measures to accommodate the peak demand and other complicated issues. On the other hand, it is questionable if the individual optimization result of the power sector would necessarily mean the optimization of the whole system. We decided to integrate the power sector as a part of integral model handling in this model, because our objective is to assist for formulating the PEP to simplify modeling.

4) CO_2 emission as an indicator for environmental issues

There are some indicators for evaluating environmental issues. In this study, we selected CO_2 emission volume that is paid attention most now, as indicator for environmental issues.

5) Energy types and the analysis period

The same classification of energy items and the analysis period should be used in both the demand forecasting model and the supply optimization model. This is because the S&D model should satisfy the energy demand estimated by the demand forecasting model; the forecasting period should also be same, or from 2006 to 2030.

6) Total energy cost as the objective function for optimization

In general, the total cost (minimum) or the total profit (maximum) for the whole analysis period is adopted as the objective function. In this study, the objective function is set minimization of total energy cost based on the general ideas.

7) Energy transformation facilities built in model

In general, transformation facilities such as oil refineries, power plants, coal processing plants and gas processing units are incorporated. According to the energy situation in the Philippines, three transformation facilities like oil refinery, power station and gas processing plant were incorporated in this study, or two refineries, eight kinds of power stations such as coal, gas, fuel oil, diesel, nuclear, geothermal, hydro and renewable energy and one gas processing plant.

8) Output sheet

The design of the output sheet may be decided according to the required information to be shown out of the calculation result. As a general example, an energy balance table is popular among energy experts. In the model for Vietnam, a summary sheet of the major information by sector is compiled in an Excel spread sheet in addition to the energy balance table.

(6) Block flow diagram of Supply & Demand model

The block flow diagram including the demand forecasting model is shown in Figure 2.3-3. The S&D Model decides the optimized balance on production, import, export, transformation of energy and their transportation optimizing the objective function and satisfying the demand estimated by the demand

forecasting model. The following chart shows the input/output relations only.

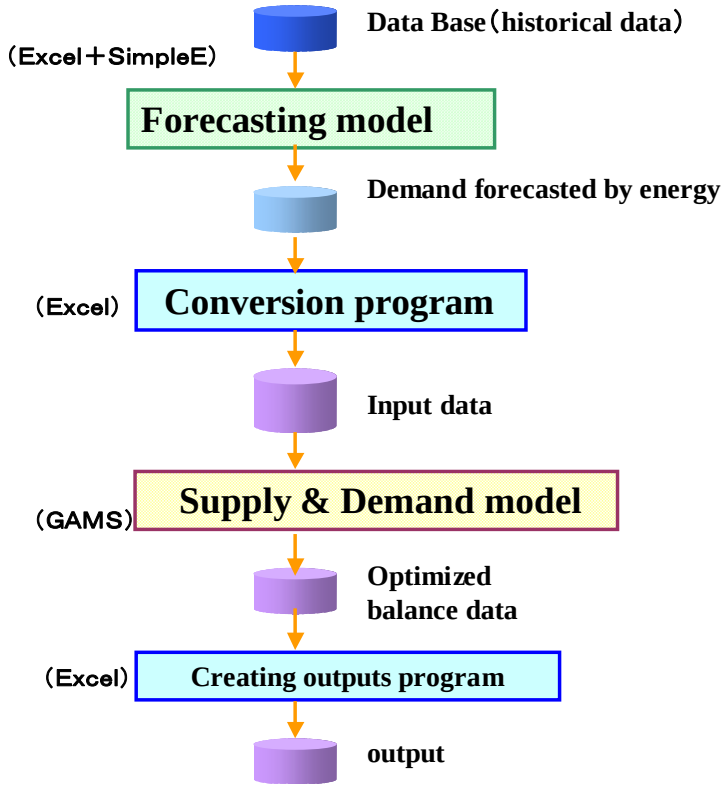


Figure 2.3-3 Block Flow Diagram

(7) Technical transfer

A seminar on the theory of Linear Programming and GAMS was conducted for a week during the second survey mission. Then, the technical transfer on the detailed contents and operational method was held for the experts in the DOE stuffs.

2.4 Survey of Energy Demand

In this study, energy demand survey was conducted by a local consultant. To select an appropriate local consultant, we invited candidate consultants and explained the terms of reference for the survey to three consultants, Social Weather Stations, Innogy Solution Inc., and AC Nielsen Philippines, at Department of Energy (DOE) on 19 September 2007. Two consultants, Social Weather Stations, and Innogy Solution Inc., submitted their proposals on 2 October 2007 and they were evaluated together with DOE. After due evaluation, Innogy Solution Inc. was selected as the contractor and the contract was awarded on October 5, 2007.

2.4.1 Objective of the Survey

The objective of the energy demand survey is to collect necessary data and information for estimating

energy demand by sector such as industry, commercial, and transport. These data and information should be collected from relevant organizations, energy supply companies, energy consuming industries, public organizations and so on by questionnaire sheets and interview survey. The energy consumers were divided into sub-sectors such as Industry, Transport, and Commercial. The above data and information are intended for use as the Database for setting up energy balance tables, forecasting energy demand, optimizing energy supply and examining energy policy options for compilation of the Philippine Energy Plan.

2.4.2 Scope of the Work

The followings are key items of the energy demand survey.

- Preparation of a draft distribution list containing 3,000 respondents
- Preparation of questionnaire sheets for questionnaire survey
- Distribution and collection of questionnaire sheets
- Validation of filled-up questionnaire
- Preparation of the survey report

The expected number of respondents (filled-up questionnaires) is shown in Table 2.4-1. Considering the possible recovery ratio to obtain at least 2,000 sheets, Contractor was asked to release at least 3,000 survey questionnaires. The questionnaire survey shall cover Industry, Commercial, Transport, Public and Agriculture sectors; where 60 percent shall come from Luzon, 20 percent from Visayas, and 20 percent from Mindanao. Thanks to diligent efforts of the contractor and support of DOE, more than 3,300 sheets were recovered as explained later.

Table 2.4-1 Distribution List of Questionnaire Survey

Sector	Expected number of Filled-up Questionnaires	Number of Released Survey Questionnaires
Industry	671	1007
Agriculture and agro-industry	158	238
Commercial/Service	664	997
Transport	259	389
Public services	266	400
Total	2,018	3,031

Source: Innogy Solution Inc.

2.4.3 Work Schedule

The contract for this survey was divided into two parts, the first contract and the second contract as the work extend for two fiscal years. The first contract for survey and draft report was executed from October 2007 to February 2008. The second contract for final report was executed from the beginning of May to the end of May 2008. Table 2.4-2 shows the schedule in detail.

Table 2.4-2 Work Schedule

	2007						2008	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Preparation of Draft Distribution List	■							
Preparation, Validation, and Finalization of the Survey	■	■						
Conduct of Survey		■	■	■				
Data Validation and Analysis		■	■	■				
Report Preparation and Presentation					■			
Submission of Draft Final Report					■			
2nd Contract for Final Report								■
Submission of Draft Report								■

2.4.4 Questionnaire Sheets

Questionnaire sheets for the energy demand survey were finalized in the first joint study through discussions with DOE. The sheets were designed to obtain the unit energy intensity collecting such figures as production in the industrial sector, floor space in the commercial sector, driving distance and freight amount carried in the transportation sector, etc. Also, we have simplified the questionnaire sheets as much as possible to improve the recovery ratio.

2.4.5 Survey Results

(1) Characteristics of Collected Data Set

A total of 3,372 accomplished survey forms were collected, where the data have been compiled into an Excel database. As the characteristics of collected data set, Figure 2.4-1 shows the number of respondents categorized by area and sector. Regarding its geographical distribution, 66% of respondents came from Luzon, 19% from Visayas, and 15% from Mindanao, which by and large respond to the targeted figures of 60%, 20 and 20% respectively as mentioned in Section 2.4.2. As to the proportion of four sectors, the commercial sector gained the largest portion of all respondents, followed by industrial, public and transportation sectors. Although the numbers of the distributed questionnaires of the commercial and industrial sectors were almost same as mentioned in Table 2.4-1, the response rate of the industrial sector was lower than others. The reason of the low response rate was that the factories would not like to disclose their operational information and answer lengthy survey questionnaires according to the Innogy implementing the survey. Thus, if the same type of survey is executed in the future, it is recommended establishing a legally bind to submit energy consumption. Also, questionnaire sheets should be simplified to select the survey items.

When original data was converted into the Excel database, some errors were generated, such as lack of detailed information in retrieved sheets, incompatibilities of responded energy consumption units, typing mistakes, and so on. To utilize these incomplete data, we processed not only simple validation, but also estimation and complements by typical market figures in the Philippines.

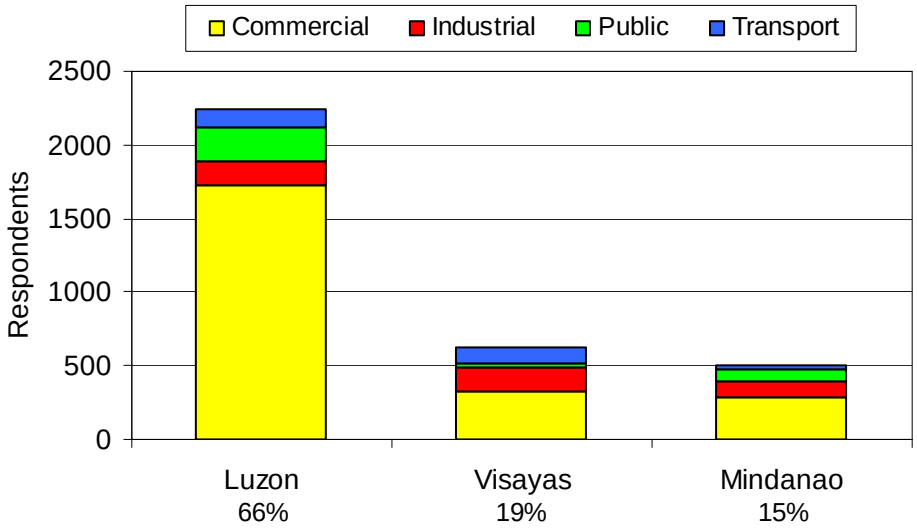


Figure 2.4-1 Respondents by Sector and Area

(2) Characteristics of energy consumption in Transportation Sector

As one of the application of the survey results, the energy consumption characteristics of transportation sector are explained. Table 2.4-3 shows the average fuel efficiencies and daily operation distances by transportation modes and fuel types. We tried to grasp these figures that were scanty and unreliable. Calculated fuel efficiencies in the table were reasonable in comparison with ones of new sales cars and the records in other countries. Also, results such that small-sized vehicles, like tricycles, showed better efficiency than large-sized ones, such as buses, are deemed natural. The estimated energy efficiencies are applied to calculate micro-level demand estimation in transportation sector to combine the forecasts of transportation modal share transition in the future.

Table 2.4-3 Operational Characteristics of Land Transportation

Transportation Mode	Fuel Type	# of Respondents	Fuel Efficiency (km/l)	Operation Distance (km/day)
Line Operation Bus	Diesel	35	4.14	366
Chartered Bus/Cars	Diesel	7	6.25	327
	Gasoline	28	4.64	249
	LPG	15	5.65	244
Jeepney	Diesel	69	9.14	107
Tricycle	Gasoline	40	13.43	40

Source: Demand survey by Innogy Solution Inc.

(3) Energy Intensity

Table 2.4-4 presents a portion of the electric power intensities classified by sub-sector, where each sub-sector is defined by Philippines Standard Industrial Classification (PSIC). It is also noted that Table 2.4-4 is a fraction of total 78 electricity intensities and 77 fossil energy intensities in storage as Excel database. If continuous surveys are periodically carried out, a sequence of the intensities will become the valuable information on domestic energy efficiencies. In this study, however, it should be examined carefully about its accuracy in following two reasons: Firstly, the number of samples was too small in

each sub-sector. For example, the first sub-sector in Table 2.4-4, 'PSIC 90, Sewage and refuse disposal sanitation and similar activities (include HW treaters)' had only one sample. Thus, the calculated intensities in such a sector were unreliable. In addition, the inconsistencies of production units between respondents were another problem. The second sector, 'PSIC 156 Manufacture of bakery products,' had four types of production units by respondents; BAGS, kg, SACKS and PACKS. In such a case, aggregation of the data with different units is impossible, or includes large error for unification. If a survey focuses on finding out energy intensities, targets should be chosen more specifically and/or the unit of questionnaire should be strictly instructed. These improvements should be achieved through repeated surveys.

Table 2.4-4 Electric Power Intensities by Sub-sector (Portion)

PSIC	PSIC Classification	Production_unit	Production_Value	No. of Respondents	Electricity Consumption kWh/year	Intensity kWh/unit output
90	Sewage and refuse disposal sanitation and similar activities (include HW treaters)	MT	7,087	1	237822.6804	33.56
156	Manufacture of bakery products	BAGS	4,740	2	52056	10.98
		kg	10,509,257	8	85521.95804	0.01
		SACKS	1,440	1	3463.917526	2.41
		PACKS	14,400	1	31800	2.21
157	Manufacture of Sugar	bags sugar	837,428	1	387808	0.46
		kg	1,211,685	1	4638340	3.83
		L-kg raw sugar	6,454,086	2	6084792	0.94
		METRIC TONS	113,011	1	456000	4.03
		LKG	6,501,317	1	89492245	13.77
160	Manufacture of tobacco products	Cases	266,400	1	5929	0.02
181	Ready-made garments manufacturing	pcs	2,486,500	1	889152	0.36
399	Other manufacturing, n.e.c.	pcs	60,000	1	54720	0.91
		wigs	16,800	1	5172	0.31
1091	Iron ore mining	TONS	162	1	3629083	22,408.52

Source: Demand survey by Innogy Solution Inc.

2.4.6 Recommendation

Contents of the questionnaire sheet that we used in the demand survey might have been a bit lengthy as we designed the questionnaire survey to understand energy intensities of each sub-sector. Thus, there were items for respondents very difficult or not able to answer. The intention to request actual energy demand with high accuracy turned out to be harmful, persuading the respondents to guess and write in non-existing data.

Generally, offices have account ledgers and they can check payment for electricity by the book. But some offices did not keep a record of electricity consumption. Therefore, in this energy demand survey, some offices responded with energy payment amount as energy consumption. In order to figure out unit energy consumption of products, item of production volume was added into questionnaire sheet. However, it was difficult for a food processing factory to answer this question because they are producing many kinds of food products.

Even in the existing Japanese questionnaire sheets for factories, there are no production items. The questionnaire sheet asks only monthly energy consumption. When we want to know unit energy consumption of products, additional interview survey by energy specialists is necessary. Considering this result of the energy demand survey, the questionnaire sheet should be simplified to obtain meaningful results in the future energy demand survey. The followings are recommendations on the questionnaire sheet based on the above results of the demand survey.

1) As for energy consumption, it is better to design the questionnaire sheet to obtain available data in either physical quantities or amount of money, or if possible both of them.
2) In the questionnaire sheet, we requested energy consumption by usage such as lighting, air conditioner, etc. But it is very difficult to clarify energy consumption by usage with ordinary questionnaire survey. Only total energy consumption by energy should be asked in the questionnaire sheet.
3) In the questionnaire sheet, we requested number of electric appliances, their capacity, type of appliances and operation time. However, it is not appropriate to request such detail information in a large-scale questionnaire survey.
4) Likewise, it is not appropriate to request number of rooms, number of buildings, and floor space of commercial sector in a large-scale questionnaire survey.

In the demand survey, we targeted to cover energy data of all sectors at one time. However, to establish the energy demand survey with meaningful results, it would be better to classify them into several sectors such as transport, commercial and public services according to sectoral characteristics of energy consumption and rotate them every few years.