Republic of the Philippines
Department of Energy

Final Report
on
the Data Collection Survey
on
Utilization of Clean Alternative Energy
in the Republic of the Philippines
(Executive Summary)

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BatMan 1 Proposed Pipeline and Facilities Overview

Photos of Project Sites

IRIJAN natural gas fired power plant
Existing Malampaya OGP Facility

Gas Pipeline Route Section 1

Gas Pipeline Route Section 2

Gas Pipeline Route Section 3

LNG Terminal Candidate Site

Industrial Park in Laguna

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List of Abbreviated Terms
(Alphabetical Order)

BIR	Bureau of Internal Revenue
CBR	Cost Benefit Ratio
DOE	Department of Energy
DPWH	Department of Public Works and Highways
ECA	Environmentally Critical Area
ECC	Environmental Compliance Certificate
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EIS	Environmental Impact Statement
EPC	Engineering Procurement and Construction
FERC	US Federal Energy Regulatory Commission
IROW	Infrastructure Right of Way
JICA	Japan International Cooperation Agency
LNG	Liquefied Natural Gas MMS
NECA	Non-Environmentally Critical Area
NEDA	National Economic Development Authority
NPV	Net Present Value
O&M	Operation and Maintenance
PIP	Public Investment Program
PNOC	Philippine National Oil Company
PPP	Public-Private Partnership
ROW	Right of Way
SCF	Standard Conversion Factor

Chapter 1 Introduction

1.1 Background

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

Natural gas utilization in the Philippines has been widespread since the start of commercial operation of Camago-Malampaya gas field in 2002. The gas is transported by offshore pipelines (maximum capacity: 650MMcf/d) and supplied to three power plants (Ilijan, Santa Rita and San Lorenzo. Total: 2,700 MW).

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

1.2 Objective

Following the previously-conducted study, Department of Energy (DOE), with utilization of PPP in mind, is now engaged in the development of natural gas-related infrastructure facilities. They are planning a Batangas-Manila pipeline project as a top-priority project. In the project, to construct about 100km pipeline from Batangas to Sucat, Metro Manila and to supply gas to the power plant in Sucat in which conversion to gas-fired power generation is planned and the surrounding area. In addition, the possibility of its extension to Quirino Highway has also been considered in view of demand in the transportation sector. The project is positioned as one of high-priority projects of natural gas-related facilities in the future. In prospect of gas depletion in Camago-Malampaya gas field and the possibility of import LNG supply to three power plants in Batangas, the necessity of LNG plants in Batangas has also been put under review.

Based on the above-mentioned projects since the conduct of JICA M/P (2002) and in view of the current status, the Study will be conducted for the purposes of collecting information required for the realization of future natural gas projects in a manner that would contribute policy promotion of the Philippine government.

1.3 Study Area

The study covers all the areas of the Philippines. (The BatMan 1 and LNG terminal projects are located at the Luzon island.)

1.4 Scope of the Study

(1) To review the precondition at the time of conducting JICA M/P (2002)
- (a)To compare the energy policy at the time of conducting JICA M/P (2002) and the current energy policy
- (b)To position increase of utilization of natural gas
- (c)To identify focused investigation items

(2) To verify the current status of potential natural gas demand
- (a)To investigate natural gas demand in Luzon
- (b)To investigate natural gas demand in Visayas and Mindanao

(3) To review the validity of natural gas-related facilities projects proposed in JICA M/P (2002)
- (a)To review the validity of pipeline planning
- (b)To verify the current status of other projects

(4) To collect information on natural gas-related facilities projects since the conduct of JICA M/P (2002)

(5) To evaluate priorities of natural gas-related facilities projects

(6) To collect information on regulations and systems regarding environmental and social considerations associated with construction of natural gas-related facilities
- (a)To verify the status of environmental permit approval for pipeline planning
- (b)To collect information on environmental permit required for construction of LNG plant.

(7) To consider construction and business schemes for promotion of natural gas-related facilities projects
- (a)To consider business schemes regarding pipeline projects
- (b)To consider business schemes regarding LNG plant

(8)To verify the current status of bidding system of natural gas-related projects
- (a)To verify the current status of bidding system for private enterprises and assignment of roles between the private and public sectors
- (b)To verify items such as TOR of expected consultants

(9)To prepare a draft of proposal on improvement of policies and systems in natural gas sector
- (a)To prepare a draft of proposal on pipeline projects
- (b)To prepare a draft of proposal on LNG plant projects
- (c)To prepare a draft of proposal on other natural gas-related projects

(10)To report to the Philippines government on contents of the study

1.5 Main Findings

1.5.1 BatMan 1

The Study confirmed that the BatMan 1 project would be feasible from the viewpoints of land acquisition, technical and environmental aspects for the segment from Batangas to Sucat.
The financial analysis showed that the private sector development would have a financial

challenge compared with the development by public sector due to the gas supply shortage during the first few years after the commissioning. The analysis also confirmed that so-called ownership-operation separation model, where the asset-holding and asset-operation are managed by two separate entities, could be effectively applicable for the project. The Study therefore proposed the PPP development, in which the infrastructure development and the facility operation would be conducted by the public sector and the private sector, respectively.

1.5.2 LNG Terminal

The Study found the possibilities of the LNG terminal development in several potential sites around the Batangas area while the additional examinations would be required for the environmental and social considerations as well as the land acquisition. Since the LNG terminal would expect the solid revenue basis from the beginning of the operation, the facility could be developed and operated by the private sector with the appropriate tariff setting. Thus the Study proposed to conduct the feasibility study with the idea of the development by the private sector. In addition, the task and schedule for the action plans were suggested to the Department of Energy in order to expedite the project development.

Chapter 2 Natural Gas Utilization Policy and Regulatory Framework

2.1 Current Situation of Natural Gas Production and Consumption

2.1.1 Primary Energy Composition and Position of Natural Gas

In the Philippines, the large part of the primary energy is imported. Improvement of the self-sufficiency ratio of energy has been put at the core of energy policy since the former Arroyo administration. Total primary energy supply in 2009 was 39.5 MTOE and its self-sufficiency ratio was 59.2%. The share of natural gas in the total primary energy was 7.8% (2008), which is the lowest level in the ASEAN countries except for Laos. Natural gas is an important energy resource in the sense that its utilization is required to be promoted early toward the realization of low carbon society. It is expected that natural gas utilization will be promoted actively in the future.

2.1.2 Natural Gas Production and Consumption

As for natural gas production, the total amount is produced by the Malampaya gas field which started production in 2001. The gas production as of 2010 is 130 bcf.

Natural gas consumption as of 2010 is 120 bcf, and nearly 100% of it is consumed by the power plants in Ilijan, Sta.Rita and San Lorenzo which are located in Batangas area. At present, some of the amount is used for the Shell Refinery, while a small portion of the demand is used for CNG buses plying the routes in Manila-Batangas- Calamba.

2.2 Outline of the Current Energy Policy

2.2.1 PEP 2009-2030 and Energy Policy of the Aquino Administration

The Philippine Energy Plan (PEP) announced by DOE each year focuses on plans and programs in energy sector. The future of energy development, which is an important issue for the prosperity of the Philippines, is a major consideration for the PEP. The latest PEP, “the PEP 2009-2030” was announced in April 2010 (before the start of the Aquino administration).

The comprehensive goal of the PEP 2009-2030 is “Ensuring the best energy choices for a better quality of life”. The PEP indicates the changes required for the current energy sector for the future energy outlook. The PEP 2009-2030 is based on the following three policies;

- Ensure energy security
- Pursue effective implementation of energy sector reforms
- Implement social mobilization and cross-sector monitoring mechanisms

2.2.2 PEP and Natural Gas-related Measures

As for upstream, especially natural gas development, it is emphasized that the exploration in South China Sea area should be promoted. However, as the targets toward 2030 show, it is assumed Malampaya gas field will continuously play a major role in natural gas production.

As for CNG as alternative energy, it aims at encouraging diffusion in transportation sector (CNG bus). According to the DOE, the target for CNG bus numbers are 2,500 in 2020 (of which 1,884 in Luzon), 10,000 in 2030 (of which 7,535 in Luzon). However, when it is converted to natural gas demand, it will be 0.006 bcf in 2020 (of which 0.0046 bcf in Luzon) and 0.24 bcf in 2030 (of which 0.18 bcf in Luzon) which are small quantity.

In electricity sector, the plan of natural gas-fired thermal plant should be noted. The PEP refers to Combined Cycle Gas Turbine (300MW, 2011) and San Gabriel Power Plant

(550MW, 2013). The electric power development plans including Combined Cycle Gas Turbine and San Gabriel Power Plant are shown in (4).

In natural gas downstream sector, several measures are being planned. Especially with regard to infrastructure development, to formulate a master plan of natural gas which is currently implemented by JICA is positioned as the highest-priority measure. In addition, to conduct FS of LNG terminals and to develop natural gas infrastructure in Visayas and Mindanao are also included in the PEP. According to hearing from DOE, in Visayas, Cebu Island is a candidate for LNG terminal.

2.2.3 Natural Gas-related Infrastructure Projects

Specific infrastructure development projects are shown in the table below. According to DOE, BatMan 1 pipeline from Batangas to Manila is positioned as the highest-priority project. DOE gives higher priority to LNG terminal in Batangas area than LNG terminal in Bataan Peninsular. The reasons might be as follows: 1) Although the Malampaya gas field is expected to be a source for BatMan 1 pipeline, there is a concern about depletion of the Malampaya gas field in the future and a new LNG terminal is expected to serve alternative function of natural gas supply. 2) As the price of natural gas of Malampaya gas field (retail price of natural gas based on the price formula of Malampaya gas field) is relatively higher, natural gas price decline is expected by competition between LNG as a new supply source with Malampaya gas field.

Infrastructure Development

Critical Gas Infrastructure Project	Target Year
Batangas-Manila (BatMan 1) pipeline	
Zone 1: Batangas-Binan	2013
Zone 2: Binan-Rosario/Robin	2014
Zone 3: Bian-Sucat	2015
CNG Refilling Stations in Metro Manila	2010-2015
Bataan-Manila (BatMan 2) Pipeline	2016
LNG Hub Terminal in Pagbilao Quezon	2013
LNG Terminal in Bataan	2015
Pipelines to Subic and Clark	2017
Sucat-Fort Bonifacio Pipeline	2017
Bataan-Cavite (BatCave) Pipeline	2020
Metro Manila Gas Loop/EDSA-Taft Loop	2020

Note:
PNOC to undertake front-end engineering and design (FEED), engineering procurement and construction (EPC) and permitting.
Funding will be handled by the private sector while the gas supply will be shared between PNOC and private sector
Source: Philippine Energy Plan 2009-2030

2.2.4 Power Development Plan 2010-2030

Electricity demand is viewed as a key to forecast natural gas demand. As of 2010, 97% of natural gas consumption is consumed by natural gas-fired power plants. (They are Ilijan combined cycle plant, Sta.Rita combined cycle plant and San Lorenzo combined cycle plant in Batangas area using natural gas from Malampaya gas field). In the future, it is expected

that there will be new construction of natural gas-fired power plants and fuel conversion along the BatMan 1 pipeline and around the LNG bases. The trends of power development make an impact on FS of BatMan 1 pipeline and LNG bases. Hereinafter, future prospects of power development based on "Power Development Plan 2010-2030" will be described.

In Luzon there are 23 new power plants projects conducted by private companies. If these new power plants are constructed as scheduled, the total capacity in 2020 will increase by 5208.3MW compared to the capacity in 2010. The table below shows the forecast for power supply and demand in case the new combined cycle power plants are constructed.

Forecast for Power Supply and Demand in Luzon

(MW)

	① Required additional capacity	② Committed capacity	③ Existing capacity	④ Required reserve margin	⑤Peak demand	⑥ Required capacity	⑦non-committee project	⑧Existing capacity (in case if non-committee projects are completed as scheduled)	⑨Required additional capacity (in case if non-committee projects are completed as scheduled)
2010			10,197	1,825	7,799	9,624		10197	
2011		75	10,272	1,847	7,895	9,742		10272	
2012		34	10,347	1,932	8,257	10,190		10347	
2013	276	620	10,381	2,021	8,636	10,657	295.8	10,381	276
2014	145		11,001	2,114	9,033	11,146	238.5	11,297	-150
2015	657		11,001	2,211	9,447	11,658	980	11,535	123
2016	1,192		11,001	2,312	9,881	12,193	1050	12,515	-322
2017	1,752		11,001	2,418	10,335	12,753	1240	13,565	-812
2018	2,337		11,001	2,529	10,809	13,338	600	14,805	-1,467
2019	2,949		11,001	2,645	11,305	13,950	0	15,405	-1,455
2020	3,590		11,001	2,767	11,824	14,591	150	15,405	-815
2021	4,260		11,001	2,894	12,367	15,261	700	15,555	-295
2022	4,960		11,001	3,027	12,934	15,961	0	16,255	-294
2023	5,693		11,001	3,166	13,528	16,694	0	16,255	438
2024	6,459		11,001	3,311	14,149	17,460	700	16,255	1,205
2025	7,260		11,001	3,463	14,798	18,261	0	16,955	1,306
2026	8,098		11,001	3,622	15,478	19,099	0	16,955	2,144
2027	8,975		11,001	3,788	16,188	19,976	0	16,955	3,021
2028	9,892		11,001	3,962	16,931	20,893	0	16,955	3,938
2029	10,851		11,001	4,144	17,708	21,852	0	16,955	4,897
2030	11,854		11,001	4,334	18,521	22,855	0	16,955	5,900

↑
shortfall : in black
(surplus : in red)

Note) ⑨Required additional capacity is calculated by the following method.
⑨= (⑥in the reference year (=④+⑤) － ⑧in the reference year (=⑦+⑧in the previous fiscal year)

Source) modified by MRI using 2010-2030PDP
(growth rate : 4.59%
reserve margin(23.4%) is the same condition as PDP)

2.2.5 Current Trend of Other Donors (World Bank)

The World Bank proposed solutions for the Philippines and Vietnam utilizing mid-scale LNG. In the Philippines, the construction of onshore and offshore LNG terminals in Limay in Bataan Peninsular is under consideration. The World Bank pointed out that the development of smaller LNG carriers is needed for mid-scale market such as the Philippines and FSRU/FSU has drawn more attention with the intention of accelerating the realization of projects. As for the natural gas by LNG terminal in Limay proposed by the World Bank, it is assumed to be consumed in a natural gas power plant which is expected to be constructed in neighboring area.

2.3 Outline of the Existing Regulatory Framework

2.3.1 Legislation and Existing Laws including Presidential Decree

Natural gas utilization in the Philippines has started in the twenty-first century and gas regulatory framework has not been fully institutionalized yet. The existing gas related regulations are included in the following oil related laws. However, regarding the Natural Gas Act intended for national control of gas development and quantitative expansion, its deliberation in Congress has been held up for many years.

2.3.2 Gas Related Regulations

The Study identified the related ministerial ordinances, guidelines, official views and regulations. In particular, the Circular No.2002-08-005 (hereinafter called "Circular") provides the basis for natural gas transportation, distribution, and supply related businesses.

2.3.3 Considerations on Circular No.2002-08-005

Circular No.2002-08-005 (hereinafter called "Circular") provides the basis for natural gas sector. However, the situation surrounding natural gas sector is different than before and DOE recognized the need to revise Circular.

(1) The position of Circular in pipeline related laws and regulations and its confines.

In the Philippines, Circular No.2002-08-005 is positioned as the main regulation for business related activities specifically focused on pipeline operations and supply of natural gas.

(2) Response to introduction of LNG and CNG

It appears that DOE recognized the need to revise related laws including Circular along with the introduction of new technologies such as LNG terminals and CNG refueling stations. The key points will be whether to define association with LNG terminal and CNG refueling stations in the case of pipeline, and if so, how to define it.

2.4 Review of JICA M/P (2002) and Necessity of Development of Natural Gas Infrastructure

2.4.1 Review of JICA M/P (2002)

JICA conducted "A Master Plan Study on the Development of the Natural Gas Industry in the Republic of Philippines" in 2002 (hereinafter called "JICA M/P (2002)"). In this section, we summarize and review JICA M/P (2002) based on the development and utilization of natural gas and the development of natural gas infrastructure since 2002.

2.4.2 Necessity of Development of Natural Gas Infrastructure

In the Philippines, it is expected to promote natural gas utilization actively. For this end, development of several pipelines, LNG terminals and CNG refueling stations are being planned. Among them, DOE positioned BatMan 1 pipeline from Batangas to NCR and LNG terminal which is scheduled to be constructed around Batangas as the highest-priority projects.

Response to environmental issues is an important issue of energy policy in the Philippines. To promote natural gas shift toward the realization of a low-carbon society, it is important to promote the introduction of fuel conversion, cogeneration and communal central air-conditioning in industrial and business sectors, as well as development of natural gas fired power plants and acceleration of fuel conversion of the existing power plants in electricity sector. In addition, it is also important to promote the introduction of CNG bus by developing pipelines and CNG refilling station to connect pipelines.

Chapter 3 Confirmation of Basic Information on Regulation and System for Environmental and Social Considerations

3.1 Regulation and System for Environmental and Social Considerations relevant to This Project

3.1.1 Environment Impact Assessment (EIA)

(1) Outline

In the Philippines, all projects are required to submit necessary documents and acquire Environmental Compliance Certificate (ECC) or Certificate of Non-Coverage (CNC) from the final approver (Chief of Environmental Management Bureau etc.). By Philippines Environmental Impact Statement System (PEISS), projects are categorized into 5 groups as described in the table below.

Category classification by Philippines Environmental Impact Statement System

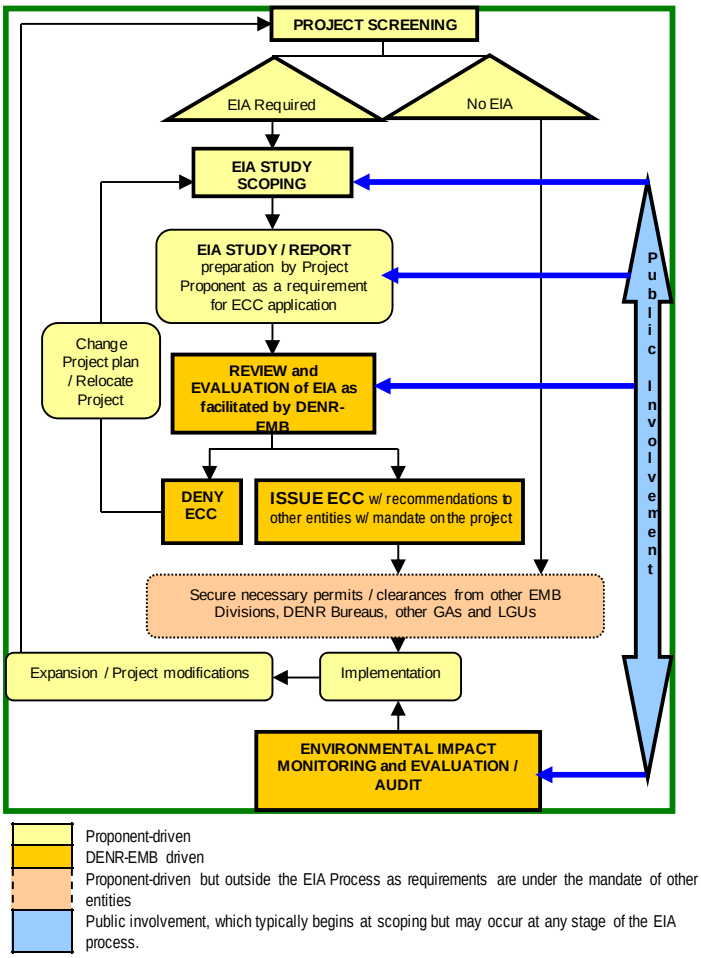
Group	Kinds of businesses and location implemented
I	All Environmentally Critical Projects (ECP)（regardless of locations implemented）
II	Non-Environmentally Critical Projects (NECP) in Environmentally Critical Areas (ECA)
III	NECP in Non-Environmentally Critical Areas (NECA）
IV	Co-located Projects (Several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

Source：Revised Procedural Manual for DAO 2003-30（2008）

(2) Flowchart of EIA Process

Summary flowchart of EIA process is shown in the figure below. Previously, the term for gaining approval after submission of EIS was 60 business days. However, it was shortened to 20 business days by Memorandum Circular (Jan.29 2010) of DENR.

Summary Flowchart of EIA Process



Source: Revised Procedural Manual for DENR Administrative Order No. 30 Series of 2003 (2008)

3) ECC Acquisition Procedure

ECC acquisition procedure after the EIS submission is outlined below. According to DOE, after the selection of project proponents, the proponents conduct EIA.

a. Scoping
b. Preparation of EIS
c. Evaluation of EIS

4) Outline for EIS

The EIS consists of the chapters including Project Description, Analysis of Key Environmental Impacts, Environmental Ecological Risk Assessment and Impact Management Plan.

5) Comparison of JICA Guidelines for Environmental and Social Considerations and the Philippine EIA Related Laws

The comparison of JICA Guidelines for Environmental and Social Considerations (April,2010) and the Philippine EIA related laws was made in the Study. There is not much difference in the legal system.

3.1.2 Land Acquisition and Resettlement

(1) Outline

An Act to Facilitate the Acquisition of Right-of-Way or Repubic Act (RA)No.8974(2000) provides the legal basis for land acquisition and resettlement.

In the Philippines each project implementing agency conducts independently land acquisition and resettlement, because there is no governmental agency specializing in land acquisition and resettlement. In addition to Department of Public Works and Highways (DPWH), the main agencies conducting land acquisition are as follows. DPWH is the only organization that specified the procedures for land acquisition and resettlement. The agencies except for DPWH conduct land acquisition and resettlement in accordance with the procedures of DPWH and guidelines of financing institutions.

- National Housing Authority (NHA)
- National Power Corporation (NAPOCOR)
- Transmission Corporation (TRANSCO)
- National Irrigation Administration(NIA)
- Department of Agrarian Reform (DAR)

(2) Details of Major Laws Relevant to Land Acquisition and Involuntary Resettlement

Some of the details of major laws relevant to land acquisition and involuntary resettlement are summarized as follows:

1) "An Act to Facilitate the Acquisition of Right-of-Way, 2000"

The policy and measures to facilitate the acquisition of right-of-way for public purpose are stipulated in the document of "An Act to Facilitate the Acquisition of Right-of-Way, 2000" as explained below:

- Project operator should first of all confirm with the land owner regarding his (her) intention of whether to convey the land or not.

- On the occasion that the land owner refuse to convey the land, the project operator should offer the amount of compensation worked out based on the Zonal Value [1]decided by the Bureau of Internal Revenue (BIR) so as to start negotiation with the land owner.

- If the land owner refuse to accept the offer based on BIR terms, the project operator should negotiate with the land owner by offering the amount of compensation based on the price not higher than the appropriate market rate. The project operator can ask a government or private financial institution to figure out the appropriate market rate. The period of negotiation can be possibly prolonged to a maximum extent of 15 days.

- If the land owner still does not agree with the amount offered, the project operator should apply to the Court for arbitrament. The Court should work out the amount of compensation within 60 days for the project operator to pay the land owner so as to settle the deal.

2) "Infrastructure Right-of-Way (IROW) Procedural Manual (2003)"

The IROW Procedural Manual formulated by DPWH in 2003 consists of the following items regarding the procedure of land acquisition for public purpose:

- Implementation of the Percellary Survey and Formulation of the Report

[1]Zonal Value is calculated based on the past record of land selling prices, which is different from the meaning of Replacement Cost defined by the World Bank in its OP4.12.

- Preparation of Land Acquisition Plan and Resettlement Action Plan（LAPRAP）

3) Laws Relevant to the Issue of Resettlement of Squatters
The treatment regarding squatters is required to follow the stipulations by Act No. 7279.

4) Title Holders of Compensation
Under the IROW Procedural Manual (2003), the determination of the title holders of compensation, that is Project Affected Persons (PAPs), and improvements shall be based on the cutoff date, which is the start of the census of PAPs and tagging for improvements.

3.1.3 Indigenous peoples

(1) Definition of Indigenous People and Its Distribution in the Philippines
The Philippines is said to be the only country in Asia which clearly recognizes the existence of "indigenous people"[2]. In the Philippines, "The Indigenous Peoples Rights Act of 1997" specifies indigenous peoples(IPs) and indigenous cultural communities(ICCs) (Article 3-h in Section 2 in Chapter 2) .

There is no exact statistics of population distribution of IPs. National Commision on Indigenous Peoples (NCIP) estimates the IPs population as 14,183,809. 62.6% lives in Mindanao, 35.9% lives in Luzon and 1.4% lives in Visayas. It is calculated by NCIP based on an unofficial statistics and IPs account for more than 20 % of the entire population.

(2) Considerations for Indigenous People in Issues of Land Acquisition and Resettlement
With respect to its relations with this project, the issue of indigenous people consideration in terms of land acquisition and involuntary resettlement mentioned above is of particular importance. In this regard, the "Land Acquisition, Resettlement, Recovery and Indigenous People Policy"（LARRIP Policy; 3rd edition, 2007）gives explanation of the required procedures regarding projects having potential impact on indigenous people. Here, it is made a prerequisite during the stage of project formulation to go all out to prevent the project from impacting the indigenous people especially in the case where there is the possibility of involuntary resettlement. Regarding those projects with evidently negative impact on indigenous people as identified by social assessment, the preparation of an Indigenous Peoples Action Plan (IPAP）is compulsory.

3.2 Environmental and Social Considerations Regarding the Pipeline Project

3.2.1 Current State of EIS Preparation and ECC Acquisition

So far, EIS regarding this project has not been prepared, and ECC has not been acquired. As the tasks of the next step, it is necessary to organize the basic data needed for the drafting of EIS, followed by the formulation of EIS and the acquisition of ECC.

(1) Environmental Checklist in JICA Guidelines for Environmental and Social Considerations

In the JICA JICA Guidelines for Environmental and Social Considerations pipeline is distributed into Category A. When utilizing yen loans in pipeline projects, it is required to receive advice on support and confirmation of environmental and social considerations from Advisory Council of Environmental and Social Considerations.

(2) Draft of the Scoping Document

[2] Raja Devasish Roy of Minority Rights Group International (MRG), "Traditional Customary Laws and Indigenous Peoples in Asia" (2005)

It is needed to consider measures for pollution control under construction and impact on the social environment.

3.2.2 Current Status of ROW and Land Acquisition

(1) Provision on ROW

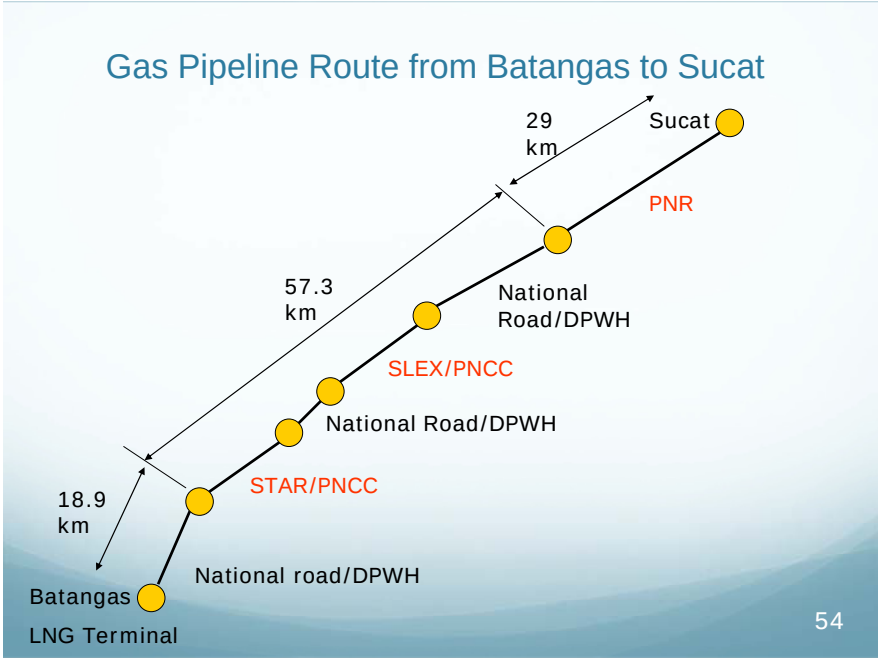
ROW is for 5 m from the middle of the pipeline to right and left (10m in width) based on the Philippine legal provision.

(2) Acquirer of ROW

The project proponent is required to acquire

(3) Current status of ROW and Land Acquisition

As shown in the Figure below, ROW is distributed into the categories of National Road(under the jurisdiction of DPWH), STAR SLEX(under the jurisdiction of PNCC) and PNG(under the jurisdiction of PNC). Land acquisition and involuntary resettlement are not required(see the Table below).



Source: Formulated by JICA study team

Pipeline Route

ROW, Land Acquisition, Involuntary Resettlement

Route		ROW	Land Acquisition	Involuntary Resettlement
Sucat	PNR	Negotiate with PNR		Need to move illegal people in PNR railway
	National Road	Negotiate with DPWH		
	SLEX	Negotiate with PNCC	Not required	No Involuntary Resettlement In other area
	National Road	Negotiate with DPWH		
	STAR	Granted to STAR by PNCC		
	National Road	Negotiate with DPWH		

Source : Formulated by JICA study team

3.2.3 Scale and Compensations of Resettlement

The requirements for the required land are verified in the study.
There is no need for land acquisition and resettlement. However, it is required to pay the ROW

3.2.4 Indigenous Peoples

There is not any need to take measures for indigenous peoples concerning pipeline construction.

3.3 Environmental and Social Considerations Regarding LNG Terminal Construction

3.3.1 Selection of Candidate LNG Terminal Sites

(1) The Process of Candidate LNG Terminal Site Selection

The Study Team has so far made four trips to the Batangas Province to look for suitable LNG terminal sites. Based on information obtained from these field trips and result of comparison among all the candidate sites visited, the site of Batangas Baseport in Batangas City is considered as the most suitable site for LNG terminal construction. Meanwhile, the site in Barangay Simlong of the same Batangas City and the site of an energy supply base owned by PNOC in Bauan Municipality are regarded as comparatively suitable sites for the project.

3.3.2 Environmental Checklist in JICA Guidelines for Environmental and Social Considerations

Focusing on the Batangas Baseport as the most promising candidate site for LNG terminal construction, verification based on JICA's Environmental Checklist was conducted.

Results of Verification by JICA's Environmental Checklist

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
Permits and Explanation	EIA and Environmental Permits	(a)Have EIA reports been already prepared in official process?	Activities relevant to the all the items on the left column have not yet started.
		(b)Have EIA reports been approved by authorities of the host country's government?	
		(c)Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?	
		(d)In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	
	Explanation to the Local Stakeholders	(a)Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders?	The 1st seminar on information disclosure of the project was held on Dec. 1, 2011, targeting business circle of gas pipeline, energy and power generation, government officials and mass media people, but not including local residents.
		(b)Have the comment from the stakeholders (such as local residents) been reflected to the project design?	
	Examination of Alternatives	(a)Have alternative plans of the project been examined with social and environmental considerations?	The most promising candidate site and two standby candidate sites are decided.
Pollution Control	Air Quality	(a) Do air pollutants, such as sulfur oxides (SOx), nitrogen oxides (NOx), and soot and dust emitted from ships, vehicles and project equipments comply with the country's emission standards? Are any mitigating measures taken?	Yes. The specific measures will be considered in the study of the next phase.
	Water Quality	a) Do effluents from the project facilities comply with the country's effluent and environmental standards?	Yes.
		(b) Do effluents from the ships and other project equipments comply with the country's effluent and environmental standards?	Yes.
		(c) Does the project prepare any measures to prevent leakages of oils and toxicants?	The specific measures will be considered in the study of the next phase.
		(d) Does the project cause any alterations in coastal lines and disappearance/appearance of surface water to change water temperature or quality by decrease of water exchange or changes in flow regimes?	This issue is to be verified in the study of the next phase.
		(e) Does the project prepare any measures to prevent polluting surface, sea or underground water by the penetration from reclaimed lands?	The specific measures will be considered in the study of the next phase.
	Wastes	(a) Are wastes generated from the ships and other project facilities properly treated and disposed of in accordance with the country's regulations?	Yes.

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		(b) Is offshore dumping of dredged soil properly disposed in accordance with the country's regulations?	Yes.
		(c) Does the project prepare any measures to avoid dumping or discharge toxicants?	The specific measures will be considered in the study of the next phase.
	Noise and Vibration	(a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards?	Yes.
	Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	This issue is to be verified in the study of the next phase.
	Odor	(a) Are there any odor sources? Are adequate odor control measures taken?	This issue is to be verified in the study of the next phase.
	Sediment	(a) Are adequate measures taken to prevent contamination of sediments by discharges or dumping of hazardous materials from the ships and related facilities?	The specific measures will be considered in the study of the next phase.
Natural Environment	Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	The project site will not be located in any protected area designated by the country's laws or international treaties and conventions
	Ecosystem	a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?	The project site on shore will not encompass any primeval forests, tropical rain forests, and other ecologically valuable habitats. As for the possibility of existence of mangrove or coral reef in the surrounding marine area, it needs to be verified in the study of the next phase.
		(b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?	No.
		(c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?	Mitigation measures will be taken in the case that such impacts are anticipated.
		(d) Is there a possibility that the project will adversely affect aquatic organisms? Are adequate measures taken to reduce negative impacts on aquatic organisms?	This issue is to be verified in the study of the next phase.
		(e) Is there a possibility that the project will adversely affect vegetation or wildlife of coastal zones? If any negative impacts are anticipated, are adequate measures taken to reduce the impacts on vegetation and wildlife?	This issue is to be verified in the study of the next phase.
	Hydrology	(a) Do the project facilities affect adversely flow regimes, waves, tides, currents of rivers and etc if the project facilities are constructed on/by the seas?	This issue is to be verified in the study of the next phase.
	Topography and Geology	(a) Does the project require any large scale changes of topographic/ geographic features or cause disappearance of the natural seashore?	This issue is to be verified in the study of the next phase.

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
Social Environment	Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?	Involuntary resettlement will not happen in the case of LNG terminal construction on the site of Batangas Baseport, which is chosen as the most promising candidate site. However, with regard to the construction work needed to connect the terminal to the gas pipeline, the possibility of involuntary resettlement needs to be verified. In the case that such possibility be identified, the following measures will be taken: - Conduct consultation meeting with affected people. - Formulate resettlement plan including compensation with full replacement costs in market price and restoration of livelihoods and living standards. - Prepare the compensation policies in document. - Pay particular attention to vulnerable groups or people in the resettlement plan formulation. -Obtain agreements with the affected people prior to resettlement. - Pay the compensations prior to the resettlement. - Establish a highly capable organization to properly implement the resettlement. - Develop plan to monitor the impacts of resettlement. - Establish grievance redress mechanism
		(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?	
		(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?	
		(d) Are the compensations going to be paid prior to the resettlement?	
		(e) Are the compensation policies prepared in document?	
		(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?	
		(g) Are agreements with the affected people obtained prior to resettlement?	
		(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	
		(i) Are any plans developed to monitor the impacts of resettlement?	
		(j) Is the grievance redress mechanism established?	
	Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	This issue is to be verified in the study of the next phase.
		(b) Is there a possibility that changes in water uses (including fisheries and recreational uses) in the surrounding areas due to project will adversely affect the livelihoods of inhabitants?	This issue is to be verified in the study of the next phase.
		(c) Is there a possibility that port and harbor facilities will adversely affect the existing water traffic and road traffic in the surrounding areas?	This issue is to be verified in the study of the next phase.
		(d) Is there a possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are considerations given to public health, if necessary?	There is no possibility for this kind of effect to happen as a result of the implementation of this project.
	Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	There is no heritage of any kind existing in Batangas Baseport, the most promising candidate site for this project.

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
	Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	This issue is to be verified in the study of the next phase, and mitigation measures will be taken in the case that such effect are anticipated
	Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?	This issue of whether the implementation of this project will have impacts on the culture and lifestyle of Bajau people is to be verified in the study of the next phase, and mitigation measures will be taken in the case that such impacts are anticipated.
		(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	
	Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?	The Labor Code of the Philippines (Presidential Decree No.442)will be followed.
		(b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?	Safety measures for individuals involved in the project will be taken.
		(c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?	Measures including formulating a safety and health program, and conducting safety training for workers will be taken.
		(d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	Appropriate measures should be taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents. Specifically, this item should be stipulated in the document of employment conditions.
Others	Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	Impacts during construction such as pollution, adverse effect on natural environment and social environment are foreseeable, and mitigation measures will be taken by complying with the laws and regulations of the Philippines.
		(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?	
		(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	
	Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?	Monitoring program for the environmental items that are considered to have potential impacts will be developed and implemented according to the EIA system of the Philippines.
		(b) Are the items, methods and frequencies of the monitoring program regarded appropriate?	The items, methods and frequencies of the monitoring program, the monitoring framework, and the monitoring report system will be decided according to the stipulation of EIA regulations of the Philippines.
		(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?	
		(d) Are any regulatory requirements pertaining to the monitoring report	

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
		system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	
Note	Note on Using Environmental Checklist	(a) Where necessary, impacts on groundwater hydrology (groundwater level drawdown and salinization) that may be caused by alteration of topography, such as land reclamation and canal excavation should be considered, and impacts, such as land subsidence that may be caused by groundwater uses should be considered. If significant impacts are anticipated, adequate mitigation measures should be taken.	Regarding the site of Batangas Baseport, reclamation is unnecessary thanks to the spacious available land, but the construction of a jetty is needed. Therefore, the possible impacts of the construction work of the jetty on the groundwater hydrology will need to be verified in the study of the next phase.
		(b) If necessary, the impacts on transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	Yes.

Source: JICA Study Team

3.3.3 Current Status of ROW and Land Acquisition

The site of LNG terminal is envisioned as the public land under the jurisdiction of the Batangas Port Authority. So long as the land can be acquired through open bidding, it is possible to use it for a long time by way of leasing, though the leasing contract will need to be renewed every seven years. Accordingly, efforts in obtaining additional ROW and land are unnecessary.

3.3.4 Scale and Compensations of Resettlement

The LNG terminal component is not expected to cause any involuntary resettlement, but it needs to make sure whether resettlement will happen or not when the installation work is required to connect the LNG terminal with the pipeline afterwards.

3.3.5 Indigenous Peoples

As was mentioned in (2) of 3.3.1, there are tribes of indigenous people known as Bajau living in the coastal areas of the Batangas Bay, and though it is almost impossible for the implementation of this project to violate their interest on shore, it still needs to be clarified whether the marine component of the LNG terminal, i.e. the jetty and the ship berth and so on, will overlap with the area where the Bajau people have their fishing ground, and whether the project will have negative effect on their livelihood or not.

3.4 CO_2 Emission Reduction Effect Expected to Be Brought by the Proposed Project

It can be expected that part of the environmental improvement effect to be brought by the implementation of this project will be reflected in the effect of CO2 emission reduction. In this section, the CO2 emission reduction effect to be brought by the implementation of this project are estimated focusing on the electric power sector and industrial sector of Luzon Region which is assumed to be the area to benefit from this project . The estimation covers the period from the year of 2017 when the pipeline installation work is to be completed to the year of 2030 which is the final year of demand forecast conducted in this study. The result

estimation shows that the total CO2 emission reduction including both the electric power sector and the industrial sector is expected to attain 14.5gt.

CO_2 Reduction Effect on the Electric Power Sector of Luzon Region with the Implementation of This Project

Item		Unit	Total	Coal	Oil	NG	Others
Pre-conditions	Generation mix	%	100.0	17.7	7.4	17.0	57.9
	Generating efficiency	%	-	40	55	55	-
Demand of NG and expected CO_2 emission (2017-2030)	Annual demand for NG（2017-21)	$MMNm^3$	123				
	Annual demand for NG（2022-24)	$MMNm^3$	697	-	-	-	-
	Annual demand for NG（2025-30)	$MMNm^3$	1395	-	-	-	-
	Heat value per unit volume of NG	$kcal/m^3$	11,000	-	-	-	-
	Annual heat value of NG（2017-21)	gcal	1,353,000	-	-	-	-
	Annual heat value of NG（2022-24)	gcal	7,667,000	-	-	-	-
	Annual heat value of NG（2025-30)	gcal	15,345,000	-	-	-	-
	Conversion factor for NG to CO_2	$kt\text{-}CO_2/gcal$	0.20675	-	-	-	-
	Annual emission of CO_2 by NG （2017-21)	$kt\text{-}CO_2$	279,733	-	-	-	-
	Annual emission of CO_2 by NG （2022-24)	$kt\text{-}CO_2$	1,585,152	-	-	-	-
	Annual emission of CO_2 by NG （2025-30)	$kt\text{-}CO_2$	3,172,579	-	-	-	-
	Total emission of CO_2 by NG (2017-30)	$kt\text{-}CO_2$	25,189,593	-	-	-	-
Total CO_2 reduction with LNG (2017-2030)	Annual heat value of fuels to be replaced by LNG (2017-21)	gcal	-	329,286	100,122	230,010	-
	Annual heat value of fuels to be replaced by LNG (2022-24)	gcal	-	1,865,956	567,358	1,303,390	-
	Annual heat value of fuels to be replaced by LNG (2025-30)	gcal	-	3,734,589	1,135,530	2,608,650	-
	CO_2 conversion factor by fuel type	$kt\text{-}CO_2/gcal$	-	0.37927	0.29992	0.20675	-
	Annual CO_2 emission by fuel type (2017-21)	$kt\text{-}CO_2$	-	124,888	30,029	47,555	-
	Annual CO_2 emission by fuel type (2022-24)	$kt\text{-}CO_2$	-	707,701	170,162	269,476	-
	Annual CO_2 emission by fuel type (2025-30)	$kt\text{-}CO_2$	-	1,416,418	340,568	539,338	-
	Annual CO_2 reduction with LNG (2017-21)	$kt\text{-}CO_2$	84,704	-	-	-	-
	Annual CO_2 reduction with LNG (2022-24)	$kt\text{-}CO_2$	479,990	-	-	-	-
	Annual CO_2 reduction with LNG (2025-30)	$kt\text{-}CO_2$	960,669	-	-	-	-
	Total CO_2 reduction with LNG (2017-30)	$kt\text{-}CO_2$	7,627,502	-	-	-	-

Source：1. Generation mix: DOE “Power Development Program (2004-2013)” (projected value for 2013)
2. Heat value per unit volume of natural gas: Heat value per unit volume of imported LNG
3. Heat value per unit volume of coal: Heat value per unit volume of imported fuel coal
4. Conversion factors for natural gas to CO_2 and for coal to CO_2:
“The Energy Data and Modeling Center, IEEJ, “Handbook of Energy & Economic Statistics in Japan 2011”

CO_2 Reduction Effect on the Industrial Sector of Luzon Region in 2030 with the Implementation of This Project

Item		Unit	Total	Light Oil	Kerosene	Heavy Oil	LPG
Share of existing energy consumption by fuel type	Annual energy consumption	-	-	(ℓ)	(ℓ)	(ℓ)	(kg)
				536,023	1,871	1,162,588	57,269
	Heat value per unit volume	kcal/ℓ(kg)	-	9,006	8,767	10,009	12,136
	Total annual heat value	gcal	17,175	4,827	16	11,636	695
	Energy mix	%	100.0	28.1	0.1	67.8	4.0
CO_2 emission resulted from the consumption of natural gas in 2030	NG demand in 2010	$MMNm^3$	240	–	–	–	–
	NG demand in 2030	$MMNm^3$	960	–	–	–	–
	Annual growth rate of NG (2010-30)	%	7.2	–	–	–	–
	Total NG demand (2021-30)	$MMNm^3$	7,168	–	–	–	–
	Heat value per unit volume of NG	$kcal/m^3$	11,000	–	–	–	–
	Total heat value of NG (2021-30)	gcal	78,848,000	–	–	–	–
	Conversion factor for NG to CO_2	$kt-CO_2/gcal$	0.20675	–	–	–	–
	Total CO_2 emission (2021-30) (A)	$kt-CO_2$	16,301,824	–	–	–	–
CO_2 emission to be reduced by using LNG in 2030	Heat value of fuels to be replaced by NG (2021-30)	gcal	78,848,000	22,161,778	75,303	53,420,230	3,190,688
	CO_2 conversion factor by fuel type	$kt-CO_2/gcal$	–	0.28748	0.28411	0.29992	0.24758
	Total CO_2 emission (2021-30) (B)	$kt-CO_2$	23,204,208	6,371,068	21,394	16,021,795	789,951
	Total CO_2 emission reduction (B-A)	$kt-CO_2$	6,902,384	–	–	–	–

Source: 1. Heat value per unit volume of natural gas: Heat value per unit volume of imported LNG
2. Conversion factors for natural gas to CO_2, heat value per unit volume and CO_2 conversion factor of the other fuel types:
"The Energy Data and Modeling Center, IEEJ, "Handbook of Energy & Economic Statistics in Japan 2011"

Chapter 4 Natural Gas Demand

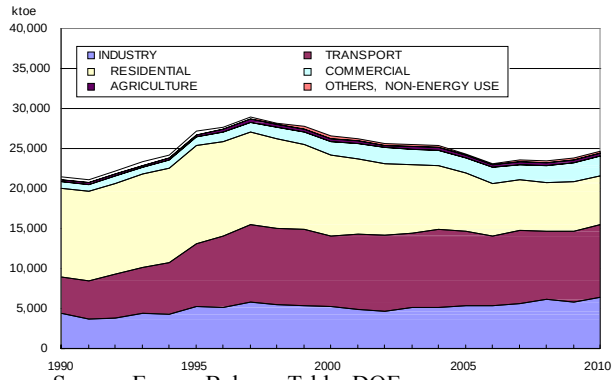
4.1 Review of JICA M/P (2002)

4.1.1 Energy Policy

The accelerated development of indigenous energy was one of the most important energy policy directions in the Philippines, mainly because it was importing nearly 60% of primary energy consumption from foreign countries in 1999. Thus, it was expected that natural gas, commercial reserves of which have been proved in the sea off the Palawan Island, would be one of promising energy sources for solving the problem of developing indigenous energy, and it would open the door for a large scale utilization of natural gas.

4.1.2 Energy Demand

In the master plan in 2002, it was forecasted that the annual growth rate of energy demand would increase at around 5% based on the past trend. However, actual energy demand from 2000 to 2010 decreased even though the average GDP growth rate increased at 4.8%. The share of natural gas supply to total primary energy supply, however, increased to 5.1% in 2004 and 8.1% in 2009. The dependency of the imported energy reduced to 45.8 in 2004 and 40.5% in 2009. The cause is that biomass rapidly decreased in this period. The growth rate of energy excluding biomass remains at 0.5%. Looking at energy demand by sector, annual growth rate of residential sector was minus 5% and other sectors were flat. It is considered that industry structure changed from heavy industry to light industry.



Source: Energy Balance Table, DOE

Trend of Final Energy Consumption by sector

4.1.3 Energy Prices

In 2002, it was assumed that crude oil price in 2010 is US$30/bbl and LNG price is US$5/MMBtu. However, actually, both fuel prices became three times compared with past assumption. It is also indicated that price gap between petroleum products and LNG becomes three times. This shows that LNG becomes more competitive than petroleum products.

4.2 Current Situation of Gas Supply and Demand

Camago-Malampaya gas field that started commercial operation from 2002 is supplying natural gas to industry sector, transport sector, and three power stations such as Ilijan, Sta. Rita, and San Lorenzo at Batangas. Most natural gas is consumed by power stations. Natural gas consumption for industry and transport sectors is less than 2% of total consumption only.

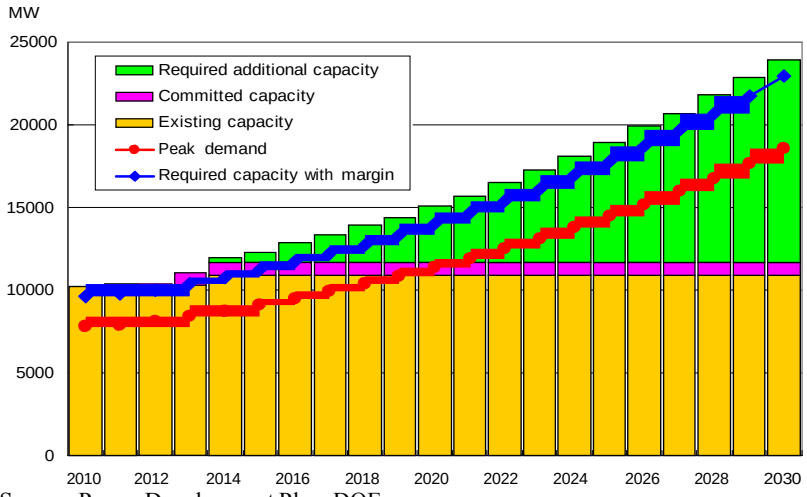
4.3 International Trends of LNG Price

LNG price in Japan (JLC) gradually increases along with crude oil price and reaches US$16/MMBtu as of July 2011. JLC remains at a low level than JCC. JLC price will become a price indicator as imported LNG price in Philippines at present. The JLC price is applicable only for Asian LNG market which makes its pricing mechanism different from Europe and USA. In the future, Philippines will not limit sourcing its supply of LNG in Asia but also consider other supply sources such as Russia, Australia and Canada which has a different pricing mechanism against the Asian LNG market.

4.4 Gas Demand for Power Sector

4.4.1 Power Supply and Demand up to 2030

According to Power Development Plan (PDP2010-2030), electricity demand in Luzon will increase at 4.59% annual. Total plant capacity and peak demand in 2010 were 10,197 MW and 7,799 MW respectively. Some power plants are committed from 2011 to 2013. Additional potential gas demand for power sector will arise after 2014. Luzon is required additional capacity with 12,300 MW until 2030 according with increasing power demand. Required reserve margin is set at 23.4% of peak demand.



Source: Power Development Plan, DOE

Power Supply and Demand Forecast in Luzon

4.4.2 Power Plant Projects by Private Company in Luzon

There are 23 power plant projects by private company in Luzon, of which the gas-fired power plants are Energy World CCGT with 300 MW (Pagbilao) and First Gen San Gabriel with 550 MW (Batangas). Energy World CCGT will consume LNG and First Gen's San Gabriel will consume indigenous natural gas. All projects except Energy World CCGT are not started to construct yet. Therefore, planed operating year will be delayed. NA means that planned operating year is not available.

4.4.3 Examination of Gas–fired Power Plant

As for examination of thermal power plants, gas-fired power plant is only examined because of energy policy (energy diversification) of the Government of Philippines.

According to information from DOE, Sucat Power Plant (850 MW) and Malaya Power Plant (650 MW) are candidate gas conversion power plants. At present, both power plants do not generate. These power plants were oil-fired power plants and thermal efficiency was low at 35% compared with combined cycle power plant. In this section, it is weighed gas conversion of existing power plant against new combined cycle power plant from the economic point of view.

4.4.4 Gas Demand for Gas-fired Power Plant

If the power plant projects by private company came off new combined cycle power plant will be required after 2020 according with increasing electricity demand. One unit of combined cycle power plant assumes 350 MW (gas turbine: 300 MW, steam turbine: 50 MW) as standard. Two units start operation in 2022 and another two units start operation in 2025. Total capacity of combined cycle power plant is assumed at 1,400 MW.

Natural gas consumption for new combined cycle power plant reaches 99,504 Nm^3/h (84 MMcf/d) in 2022 and 199,008 Nm^3/h (168 MMcf/d) after 2025 under assumptions such as thermal efficiency at 55%, plant factor at 80%, and natural gas heat rate at 11,000 $kcal/Nm^3$. This demand accounts for 26% of Camago-Malampaya gas supply capacity (650 MMcf/d).

4.4.5 Gas Demand Potential for Power Sector in Visayas and Mindanao

Gas demand potential for power sector depends on the power development plan. According to PDP 2010-2030, there is no plan for gas-fired power plant.
However, according to information from DOE, there is a 1 MW gas fired power plant that will operate soon in the province of Cebu.

4.5 Gas Demand for Industry Sector

Gas demand for industry sector will be estimated by sample survey for industry parks along BatMan 1 gas pipeline. Number of sample survey reached 73 factories. Total number of factories in Laguna and Batangas are estimated about 700 from the area of industry parks and the number of sample survey accounts for about 10% of total factories. At present, factories are consuming petroleum products as fuel.

4.5.1 Industry Park along Gas Pipeline

According to DOE, there are 16 industry parks along planned gas pipeline. These areas belong to Batangas province and Laguna province in Calabarzon region. Other provinces in Calabarzon region are Cavite Rizal and Quezon provinces.

However, according to web-site of PEZA (Philippine Economic Zone Authority), there are 28 industry parks along the planned gas pipeline (Batangas and Laguna provinces). If gas supply area is expanded to Cavite province, the number of industry parks increases to 37 parks.

4.5.2 Energy Consumption of Industry Park

Energy consumption of industry parks will be estimated by sample survey as mentioned before.

(1) Number of Factories in Industry Parks

The total number of operating industry parks are 246, proclaimed industry parks are 99, and developing industry parks are 216. Total number of approved industry parks reaches 561. There are many IT industries, followed by manufacturing, agro-industry, tourism. PEZA discloses lists of locators (factories) in industry park. But this list shows not only operating locators but also proclaimed locators. Therefore, in this report, number of operating locators is estimated from site area.

(2) Fuel Consumption for Factory

The Study identified the fuel consumption for factories base on the sample survey.

(3) Potential of Gas Demand along Gas Pipeline

The number of locators (factories) and gas demand potential for 73 locators (1.26 million Nm^3/month) were assumed. Based on these assumptions, potential of gas demand along gas pipeline are as follows.

Number of factories:	1,143 factories
Average gas consumption/73 locators:	1.26 million Nm^3/month (1,750 Nm^3/h, 61,800 cf/h)
Potential of gas demand :	27,400 Nm^3/h（0.968 MMcf/h、23.23 MMcf/d）
	1,143 locators/73 locators × 1,750 Nm^3/h＝ 27,400 Nm^3/h

The potential demand is equivalent to 190 MW of combined cycle power plant.

4.5.3 Gas Demand Potential in Visayas and Mindanao

(1) Regional GDP

Philippines are divided by 16 regions and each region has economic statistics. Cebu-Mactan belongs to Region 7 (Central Visayas) and South Mindanao belongs to Region 11 (Davao Region). According to the breakdown of regional GDP in 2009, regional GDP for industry sector in Region 7 accounts for 6.6% of total GDP and that in Region 11 is 5.2%.

(2) Gas Demand Potential in Cebu-Mactan and South Mindanao

Energy demand for industry sector will increase from 1,453 ktoe in 2010 to 3,888 ktoe in 2030 at 5% of annual growth rate. When energy demand is allocated by regional GDP, energy demand for industry sector in Cebu-Mactan in 2030 is 826 ktoe and that in South Mindanao is 651 ktoe. Of which, if 9.2% of energy demand can convert to natural gas in the same way of Luzon's estimation, natural gas demand in Cebu-Mactan reaches 69 $MMNm^3$/year (6.7 MMcfd) and that in South Mindanao is 54 $MMNm^3$/year (5.3 MMcfd). These figures are smaller than 2002 Master Plan Study, by 15% in Cebu-Mactan and 30% in South Mindanao.

4.6 Gas Demand for Commercial Sector

There is no gas demand for commercial sector in Philippines. The Philippines is expecting gas demand in commercial sector by introducing heat pump and co-generation system for building. In this section, typical co-generation system in Japan is introduced and gas demand potential for commercial sector will be examined.

4.6.1 Current Situation of Natural Gas Demand for Commercial Building in Japan

Co-generation system provides electricity and steam by using gas as fuel. Generated electricity and steam are provided to office building that has 40 stories and 150,000 m^2 of total floor space. This system consists of 2 units of gas turbine engine, 1,100 kW generator, and waste heat boiler. Steam from waste heat boiler is sent to absorption chiller and is converted to cooling water as air conditioning. Total efficiency of the system is 70-75% (thermal efficiency is 20-25% and boiler efficiency is 50%).

4.6.2 Current Situation of Energy Demand for Commercial Building in Philippines

There is no heating demand for building in Philippine because it is warm all year round. Only cooling demand is needed. The system that is introduced here, is supplying cooling water to large shopping mall (5 stories and 178,000 m^2 of total floor space, of which 99,000 m^2 is for air conditioning floor space) by electric chillers. This system consists of 6 units of electric chiller (827 RT: Refrigeration Ton) and one unit of electric chiller (415 RT). Usually, three electric chillers (827 RT) is running. Energy for air condition is only electricity and they

don't use petroleum products. Estimated electricity consumption for air conditioning is about 800,000 kWh/month.

4.6.3 Estimation of Gas Demand for Commercial Building in Philippines

The gas demand potential for one shopping mall has about 3 million Nm^3/year in case of gas fired-absorption chiller and about 5 million Nm^3/year in case of co-generation system. As for potential of gas demand for commercial sector in 2030, it is assumed at 70 million Nm3/year. This is equivalent to 20% of LPG demand in 2030.

4.7 Gas Demand for Transport Sector

In Philippines, CNG buses are operating between Batangas and Laguna as pilot project. At present, there are 61 CNG buses in Philippines and average gas consumption is 1.67-2.0 km/Nm^3 according to information from DOE. There are two gas filling stations, mother station in Batangas and daughter station in Laguna. As for capacity of filling station, mother station is available to fill up gas for 200 buses per day. On the other hand, daughter station can fill up gas for 50 buses per day. Actually, 26 buses are filled up a day. Average filling volume per one bus is 112.9 kg. Price of CNG is PHP18.38/kg. But this price is temporary price for pilot project. After pilot project, this price will be reviewed.

4.8 Gas Demand in Luzon

The table below shows gas demand outlook in Luzon up to 2030 based on the assumptions from section 4.4 to 4.7 in this report. Gas demand will increase from 119,869 MMcf in 2010 to 227,990 MMcf in 2030. It is assumed that gas demand for new combined cycle power plant will increase from 2022 as mentioned in section 4.4 and gas demand for industry sector will rise from 2016 when gas pipeline will be completed. Gas demand for transport sector will also rise from 2016 and increase according with the target of DOE. Gas demand for commercial sector is assumed at 0 because of economic aspect.

Gas Demand Outlook in Luzon up to 2030

（MMcf）

Year	Consumption				
	Power	Industry	Transport	Commercial	Total
2001	4,840	-	-	-	4,840
2002	54,329	-	-	-	54,329
2003	84,241	-	-	-	84,241
2004	81,097	-	-	-	81,097
2005	106,997	252	-	-	107,249
2006	99,199	2,193	-	-	101,392
2007	117,792	3,316	-	-	121,107
2008	123,604	2,932	15	-	126,550
2009	125,058	3,019	18	-	128,095
2010	116,809	3,044	16	-	119,869
2011	122,000	3,000	20	-	125,020
2012	122,000	3,000	20	-	125,020
2013	122,000	3,000	20	-	125,020
2014	122,000	3,000	20	-	125,020
2015	122,000	3,000	20	-	125,020
2016	122,000	3,000	20	-	125,020
2017	122,000	19,549	3,111	-	144,660
2018	122,000	20,887	3,517	-	146,404
2019	122,000	22,225	3,923	-	148,148
2020	122,000	23,563	4,331	1,236	151,130
2021	122,000	24,902	5,197	1,360	153,458
2022	146,626	26,240	6,063	1,483	180,412
2023	146,626	27,578	6,929	1,607	182,740
2024	146,626	28,916	7,795	1,730	185,068
2025	171,252	30,255	8,661	1,854	212,022
2026	171,252	31,593	10,393	1,978	215,216
2027	171,252	32,931	12,125	2,101	218,409
2028	171,252	34,269	13,857	2,225	221,603
2029	171,252	35,608	15,589	2,348	224,797
2030	171,252	36,946	17,320	2,472	227,990

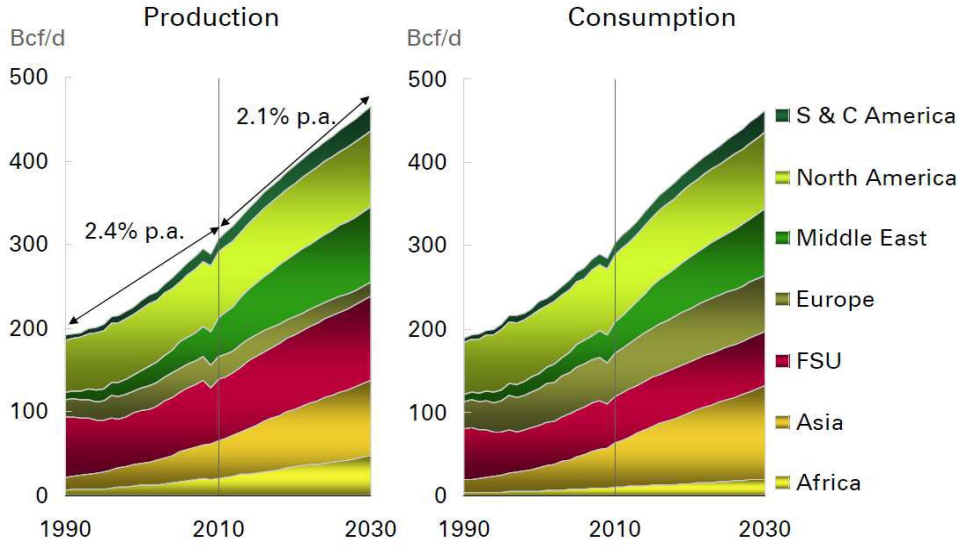
Source: Formulated by JICA study team

Chapter 5 LNG Supply-Demand System

5.1 Global LNG Production and Consumption

5.1.1 Global LNG Production and Consumption

Natural gas production grows in every region except Europe, where decline rates at mature fields are likely to reverse the gains since 1975.



Production and Consumption of Natural Gas

Source: BP statistics, January 2011

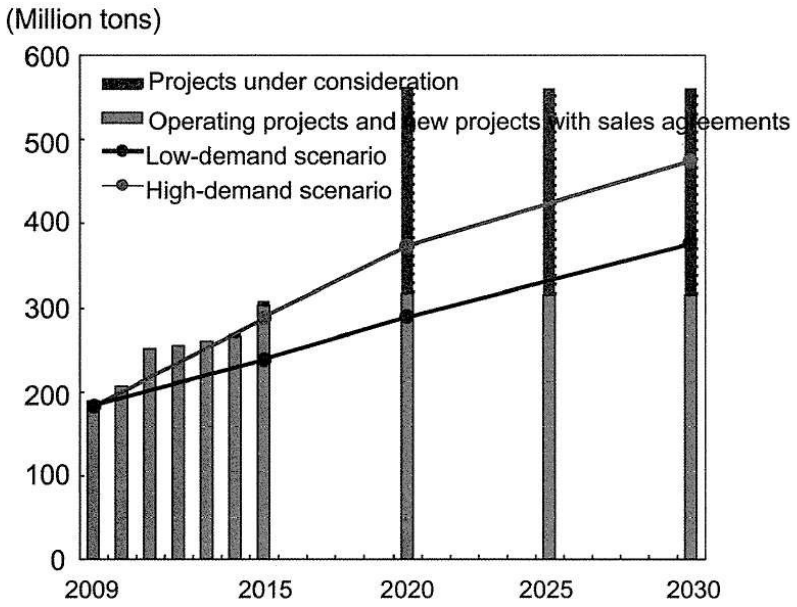
5.1.2 LNG Exports and Imports

LNG supply is projected to grow 4.4% p.a. to 2030, more than twice as fast as total global gas production (2.1% p.a.). Its share in global gas supply increases from 9% in 2010 to 15% in 2030.

LNG imports increased mainly in Asia and Europe, while export increased in the Middle East. LNG industry of Indonesia, Malaysia, and Brunei had a little change from 1990 and the share of LNG supply of these countries are getting small. On the other hand, the shares of Qatar and Australia are growing.

5.1.3 Global LNG Supply-Demand Balance (Long-term)

Enough supply potential up to 2030, as far as projects under consideration will start up without any problem.



Global LNG Supply-Demand Balance

Source: IEEJ

5.1.4 LNG Plant in Qatar and Australia

The table below describes the outlines of LNG projects in Qatar and Australia.

LNG Projects in Qatar and Australia

Country	Plant	Capacity（10 thousand ton/year）
Qatar	Qatargas（Train 1-3）	970
	Qatargas Ⅱ（Train 4）	780
	Qatargas Ⅱ（Train 5）	780
	Qatargas 3	780
	Qatargas 4	780
	Rasgas（Train1-2）	660
	Rasgas Ⅱ Ⅲ	2970
Australia	Prelude	350
	Wheatstone	860
	Australian Pacific	1400
	Southern Cross, etc	70-130

Source: Formulated by JICA study team

5.1.5 Scenario of Gas Supply

It is said that the reserves of Camago-Malampaya gas field is 2.7 Tcf and accumulated gas production up to 2010 reaches about 1 Tcf. Therefore, R/P ratio of the gas field is only 15 years without new additional reserves.

Chapter 6 BatMan 1 Pipeline Plan

6.1 Natural Gas Supply Volume/Location

With assumptions based on the Chapter 4 Natural Gas Demand Estimates, supply volumes and supply location for natural gas using the BatMan 1 gas pipeline is examined.

6.1.1 Supply Volume/Location of Natural Gas to Thermal Power Stations

In the case that the new power station is constructed in Calamba, we project two possible cases. The first case once again assumes a 700MW double-sequence, based on the 350MW single-sequence combined cycle (300MW gas turbine, 50MW steam turbine) at the Sucat facility. The second case includes demand from the Malaya power station (650MW), in total 1400MW.

6.1.2 Supply Volume/Location of Natural Gas to Industrial Parks

It is assumed that four supply points, located in Santo Tomas, Cabuyao, Carmona, and Alabang will each receive an equal amount (one quarter) of the 1.94MMcf/h (55,000Nm^3/h) supply volume.

6.1.3 Supply Volume/Location of Natural Gas Targeted to the Commercial Sector

As noted in the Section 4.6 Gas Demand for Commercial Sector, we are projecting future demand 70million Nm^3/year, but natural gas will not be a source of HVAC based on a present LNG price (16 - 17USD/MMBtu). We however take into consideration that the elicitation of shale gas price-reduction, we are projecting the peak natural gas supply volume 0.35MMcf/h (10,000Nm^3/h) for future gas demand. Our plans assume the use of business facilities surrounding Quirino highway as supply sites.

6.1.4 Supply Volume/Location of Natural Gas to the Transport Sector

As noted in Section 4.7 Gas Demand for Transport Sector, we are anticipating use of natural gas filling stations along the Quirino highway as supply sites. The natural gas supply volume as conditions of the pipeline design is shown in the table below.

Natural gas supply volume in 2030

	Power Station Calamba / Sucat	Industrial Area 4 Areas	Commercial and CGV (Quirino)	Total
Case 1	5.89 MMcf/h	7.76 MMcf/h	2.65 MMcf/h	16.3 MMcf/h
	167,000 Nm^3/h	220,000 Nm^3/h	75,290 Nm^3/h	462,290 Nm^3/h
	36.12%	47.59%	16.29%	100%
Case 2	3.51 MMcf/h	7.76 MMcf/h	2.65 MMcf/h	13.92 MMcf/h
	99,273 Nm^3/h	220,000 Nm^3/h	75,290 Nm^3/h	394,563 Nm^3/h
	25.16%	55.76%	19.08%	100%
Case 3	3.51 MMcf/h	7.76 MMcf/h	2.65 MMcf/h	13.92 MMcf/h
	99,273 Nm^3/h	220,000 Nm^3/h	75,290 Nm^3/h	394,563 Nm^3/h
	25.16%	55.76%	19.08%	100%
Case 4	7.02 MMcf/h	7.76 MMcf/h	2.65 MMcf/h	17.43 MMcf/h
	198,545 Nm^3/h	220,000 Nm^3/h	75,290 Nm^3/h	493,835 Nm^3/h
	40.20%	44.55%	15.25%	100%

Source: Formulated by JICA study team

6.2 Gas Pipeline Route

6.2.1 Overview

The gas pipeline route runs roughly 105.2km between a new LNG receiving plant in Batangas and Sucat power station. The route was selected based on assumptions of both the case of reusing the Sucat power station, and newly establishing a power station in Calamba.

6.2.2 Characteristics and Tasks Faced at Each Section of the Route

The route layouts for the three sections are analyzed and described in the report.

6.2.3 Land Required for Gas Pipeline Maintenance

While DOE is presently attending to the obtaining of ROW for the pipeline, and its operation and maintenance, only the 42km stretch along the South Tagalog Arterial Road (STAR) has been acquired. For the purpose of as the pipeline, block valve stations, and cathodic protection stations operation and maintenance, a 4m service track running parallel to the buried pipeline is required. Therefore, including the pipeline space, a 6m-wide land is required In the case of access being possible via existing nearby roads however, this width limit does not apply.

6.3 Gas Pipeline Design Overview

6.3.1 Pipeline Transport Capacity Specifications

(1) Applicable Criteria

International standards such as ANSI, ISO, etc. are applied to the BatMan pipeline design.

(2) Natural gas composition, specific gravity, and design temperature

Natural gas specific gravity will make a major impact on a gas flow volume calculations for the pipeline. We applied 0.65 as a natural gas specific gravity with safe margin even an exact gas specific gravity is 0.647 in accordance with a composition of natural gas from Malampaya. We applied 35° Celsius.

(3) Pipe Materials

Line pipe with high strength and toughness shall be applied for gas pipeline. API 5L X X-80 has higher strength than API 5L X-65, we however applied the X-65 to the gas pipeline due to a reason that the X-65 has better weldability than the X-80. External coating is polyethylene coating and internal is epoxy coating. Induction bends, tee and other fittings are to be same specification as aforementioned.

(4) Location Class

Location class in accordance with ANSI/ASME B31.8 is important criterion to determine a buried depth, and distance between each valve station.

(5) Depth of Buried Pipeline

A depth of buried pipeline is specified by ANSI/ASME.

6.3.2 Gas Pipeline Flow Condition

The maximum gas flow from Tabangao gas plant is 650MMscf/d. At the present time in 2011, total energy usage from thermal power plants surrounding Batangas city are 2,700MW (324MMscf/d), allowing for a potential usable gas volume from Malampaya for the pipeline is 326MMcf/d.

6.3.3 Flow Analysis

One of the most critical point in a pipeline design is the determination of pipe diameter based on long term gas supply plans. The basis for such determination is flow analysis, of which outlet pressure, supply volume, supply pressure, and supply distance are critical variables.

(1) Flow Analysis Conditions
The conditions for the flow analysis have been established.

(2) Flow Analysis Points (actual position)
Flow analysis points, namely the locations at which flow and pressure are confirmed, have been set the industrial areas, power station, and Quirino highway: Lipa City, Santo Tomas, Calamba, Cabuyao, Carmona, Alabang, Sucat, and Quirino, 8 points in total. The supply volume 7.76MMcf/h (220,000Nm^3/h) for the said industrial areas based on assumed natural gas demand in 2030 will be evenly divided into Santo Tomas, Cabuyao, Carmona, and Alabang, i.e. 1.94MMcf/h (55,000Nm^3/h) respectively.

6.3.4 Flow Analysis Results
The flow analysis is conducted in the Study.

6.3.5 Pipe Wall Thickness Calculation
(1) Designed Pressure and Class Location
The designed pressure and class locations for each section are set in the Study.

(2) Pipe Wall Thickness Computations
The minimum pipe wall thickness for each section is calculated based on the ANSI/ASME B31.8.

6.3.6 Comparison of pipeline diameter between JICA M/P(2002) and 2011
As of JICA M/P(2002), the pipeline diameter of the main pipeline was 16 inch, however that figure has at the present increased to 24 inch.

6.4 Related Pipeline Facilities

6.4.1 Pipeline Block Valve Stations
ANSI/ASME B31.8 specifies a distance between each Block valve station on a gas pipeline.

6.4.2 Metering Station
Metering stations on the pipeline are installed at the Batangas gas plant and each power station. Metering stations will be installed at each user in the industrial areas, however they are not to be included in the present investigation.

6.4.3 SCADA system
The pipeline and or facilities installed above ground shall be isolated to continue the cathodic protection effectiveness. An operation states of the cathodic protection system shall be recorded and controlled by an SCADA system.

6.5 Consideration of project implementation

6.5.1 Construction Costs

(1)Cost estimate conditions and its Structure

The conditions have been established to calculate the cost estimation.

(2) Costs Estimated and Calculation Method

1)Pipeline Material Costs

Cost estimates for materials such as polyethylene-coated line pipe, induction bends, and fittings are based on quotes obtained through Nippon Steel Engineering, procurement department. For purposes of cost estimation for this Study,assumed that materials are to be procured from Japan.

2)Valve Stations and Other Related Facilities Costs

Cost estimates for materials and construction for valve stations, metering stations, SCADA and cathodic protection systems are based on actual costs from similar projects undertaken in the past both domestically and abroad by Nippon Steel Engineering. For purposes of cost estimation, it is assumed that the materials are to be procured from overseas except SCADA system, which is to be procured from Japan.

3)Construction Costs

For all related costs to pipeline and its facilities construction, such as labor, machinery, consummable, material stockyards, shipping, residence, and personnel transportation costs, a request for a quotation was issued to a local construction company. Thus construction costs have been estimated based on the local company's quotation into consideration alongside the similar past project data provided by Nippon Steel Engineering.

4)Engineering and Management Costs

Engineering and management costs, including construction planning and management, quality control, and safety control associated with the execution of detailed pipeline design and construction are computed as an actual percentage of these costs to total costs experienced on similar past projects performed by Nippon Steel Engineering.

5)Contingency Costs

Contingency costs are not included but only a base cost has been estimated.

6)Incentive

The present cost estimation does not include any incentive.

(3)Estimate Results

As pipe diameter and wall thickness vary according to each case, cost estimations are on a per-case basis. The results are listed in table below.

	Currency Rate: JPY/USD= 85	Section 1 18.9km		Section 2 57.3km		Section 3 28.5km		Total	
Case 1	Joint number	1,663 jts		5,042 jts		2,552 jts		9,258 jts	
	Distance	18.9 km		57.3 km		29.0 km		105.2 km	
	inch-m	453,600 inch-m		1,375,200 inch-m		696,000 inch-m		2,524,800 inch-m	
	Grand total (x 1,000 JPY | USD)	JPY	USD	JPY	USD	JPY	USD	JPY	USD
		3,408,030	40,094	7,231,073	85,071	4,581,325	53,898	**15,220,427**	**179,064**
	Cost / inch-m (JPY | USD)	7,513	88.39	5,258	61.86	6,582	77.44	**6,028**	**70.92**
Case 2	Joint number	1,663 jts		5,042 jts		2,552 jts		9,258 jts	
	Distance	18.9 km		57.3 km		29.0 km		105.2 km	
	inch-m	453,600 inch-m		1,375,200 inch-m		504,000 inch-m		2,332,800 inch-m	
	Grand total (x 1,000 JPY | USD)	JPY	USD	JPY	USD	JPY	USD	JPY	USD
		3,408,030	40,094	7,072,153	83,202	3,150,049	36,643	**13,630,231**	**159,939**
	Cost / inch-m (JPY | USD)	7,513	88.39	5,143	60.50	6,250	72.70	**5,843**	**68.56**
Case 3	Joint number	1,663 jts		5,042 jts		2,552 jts		9,258 jts	
	Distance	18.9 km		57.3 km		29.0 km		105.2 km	
	inch-m	453,600 inch-m		1,375,200 inch-m		408,000 inch-m		2,236,800 inch-m	
	Grand total (x 1,000 JPY | USD)	JPY	USD	JPY	USD	JPY	USD	JPY	USD
		3,407,737	40,091	7,287,943	85,741	2,513,429	29,570	**13,209,109**	**155,401**
	Cost / inch-m (JPY | USD)	7,513	88.38	5,300	62.35	6,160	72.47	**5,905**	**69.47**
Case 4	Joint number	1,663 jts		5,042 jts		2,552 jts		9,258 jts	
	Distance	18.9 km		57.3 km		29.0 km		105.2 km	
	inch-m	453,600 inch-m		1,375,200 inch-m		504,000 inch-m		2,332,800 inch-m	
	Grand total (x 1,000 JPY | USD)	JPY	USD	JPY	USD	JPY	USD	JPY	USD
		3,408,030	40,094	7,291,159	85,778	3,026,633	35,607	**13,725,821**	**161,480**
	Cost / inch-m (JPY | USD)	7,513	88.39	5,302	62.38	6,005	70.65	**5,884**	**69.22**

Source: Formulated by JICA study team

(4)Procurement Detail of Primary Items

Procurement detail of primary items are listed.

(5)Construction Cost Comparisons to JICA M/P (2002)

When compared with JICA M/P (2002) construction costs, inch-meter unit prices in 2011 come in around 2 times higher USD basis. Main causes of the difference are that costs of human resources, line pipe, materials, and logistic has soared. Also, as the result of the current study, expected daily progress in the section 1, Batangas urban area, is poor.

(6)Recommended Case from Pipeline Construction View Point

From pipeline construction view point, the case 4 is recommended due to the reason that the ratio of Construction Cost to Natural Gas Supply Volume is lower, i.e. Natural Gas Supply Capacity is the highest and it has flexibility to meet future increased gas demand. Ratio of construction cost to natural gas supply volume is shown in the table below.

Ratio construction cost to natural gas supply volume

	a: Total Cost (USD)	b: Gas Flow Volume (scf/h)	**a / b**
Case 1	179,063,851	16,300,000	**10.99**
Case 2	159,939,471	13,920,000	**11.49**
Case 3	155,401,277	13,920,000	**11.16**
Case 4	161,480,246	17,430,000	**9.26**

Source: Formulated by JICA study team

6.5.2 Construction Schedule

(1) Prerequisite Conditions

The conditions have been established to estimate the construction schedule.

(2) Schedule Overview and Basis

As a result of schedule calculation for Engineering, Procurement, Construction and Commissioning, the total pipe-laying period is expected to be 2.1 years. Main items' duration is as follows:

1) Engineering: 0.5 years
2) Procurement: 1.5 years (conducted simultaneously)
3) Construction (pipeline installation): 1.1 years
4) Construction (pipeline inspection and completion): 0.2 years
5) Commissioning: 0.1 years

Chapter 7 LNG Receiving Terminal

7.1 Design Conditions for LNG Receiving Terminal

7.1.1 Type of LNG Re-gasification Terminal

LNG receiving terminal has two types, which are onshore plant and offshore plant.

Comparison between Onshore Plant and Offshore Plant

	Onshore Plant	Offshore Plant (Floating Storage Unloading Re-gasification : FRSU)
Capital expenditure	Relatively High (It depends on the situation of harbor and installation site.)	Relatively Low
Operational expenditure	Same between onshore and offshore	Same between onshore and offshore
Construction period	Long due to the long EPC period of LNG storage tank	Short in case of a used carrier's remodeling
Operational Flexibility	High flexibility No restriction of available LNG carrier	Many restrictions such as gas send-out pattern and unloading timing
Reliability of gas send-out	High Reliability (Large amount of LNG storage volume)	Low reliability due to the small amount of LNG storage volume
Expansion ability	Infinite in case of no restriction of land and harbor	Possibility of the additional install of FSRU in case of no restriction of harbor

Source: Formulated by JICA study team

If LNG re-gas Terminal has to be installed and started up in a short term, it is seemed to be better that an offshore plant which is a remodeling type of a used LNG carrier is applied to it. However when it can be installed and started up in a long term, an onshore plant should be applied to LNG re-gas terminal due to the high reliability of gas send-out. And then the capacity of LNG re-gas terminal should be expanded according to the increase of gas demand. From the point of long-term view, an onshore plant should be applied and studied in this feasibility study due to the high reliability and expansion ability.

7.1.2 Location of the LNG Receiving Terminal

(1) Harmony with/ Acceptance by Local Community

How to maintain local environment after accepting the siting of an LNG receiving terminal will be important for secure operation. This requires the confidence of local residents regarding safety, protecting preferred local distinctions such as natural landscape and monuments, and maintaining the everyday lives of the residents. It is preferred not just to maintain them but to improve them when introducing terminals.

(2) Proximity to Transmission and Use

The location of an LNG terminal should accommodate easy connection to gas transmission, and eventual distribution and end use. Furthermore, utilities supply situation such as power, industrial water, and drinking water is one of the selection criteria.

(3) Easy Reception of LNG Ships

The size of generally used LNG ships is up to 266,000 m^3. It is necessary to select a port to allow this scale ships docked securely and safely by checking the data of meteorological, oceanographic seismic, and soil.

(4) Supply Security

When two or more geographically separate markets or distribution areas are conceived, and thus two or more terminals are planned, such terminals should be located in a certain distance from each other to accommodate a good gas network balance to raise security, and thus eventual economies.

(5) Sea water/ Port Conditions

If the concentration of copper ions or suspended matter in seawater is high, it is neccessary to take action on the vaporizer design. If there is a big river near the receiving terminal, the frequency of dredging will increase. These factors increase construction costs.

7.1.3 Volume of Imported LNG

The table below shows the volume of LNG that would need to be imported based on the natural gas supply and demand forecast. When the terminal starts operation in 2020, the required LNG imports would be about 0.7 million ton, and the required LNG imports would be about 2.5 million ton in 2030.

Required LNG Imports (thousand /year)

Year	Power	Industry	Transport	Total
2020	0	556	102	658
2021	0	588	123	710
2022	581	619	143	1,343
2023	581	651	164	1,395
2024	1,163	682	184	2,029
2025	1,163	714	204	2,081
2026	1,163	746	245	2,153
2027	1,163	777	286	2,226
2028	1,163	809	327	2,298
2029	1,163	840	368	2,371
2030	1,163	872	409	2,443

Source: Formulated by JICA study team

7.1.4 LNG Vessel

LNG vessels were generally about 125,000 m^3 - 153,000 m^3 capacity. Becoming large in recent years, Q-Flex type (216,000 m^3) in 2007, and the Q-Max type in 2008 (266,000 m^3) were built.

7.2 Main Facilities and Equipments of LNG Receiving Terminal

7.2.1 LNG Receiving Facilities

(1) Passage and Anchorage

The passage width shall be 172.5m and the turning basin shall be 690m in diameter (circle). The depths of the passage and the anchorage shall both be 14m.

(2) Jetty

Pier alignment shall be determined based on passage, turning basin, capacity of LNG carrier, frequency of arrival and leaving of carriers, operability of carriers, installation plans for send-

out pipelines, and meteorological and ocean meteorological conditions. In this study, a pier shall be extended 300m up to a 14m deep position to minimize dredging work, and shall be of the dolphin type.

(3) Unloading Arms

The 16-inch x 60-feet unloading arm, which is the main type used in Japan, shall be adopted. This one is of the rotary counterweighted marine arm-suspended type, wherein the pressure retaining members and suspension members are isolated from each other so that thermal stress does not act on the pressure members. Furthermore, all of the arms shall be provided with an emergency release system and automatic disconnect hydraulic couplers

(4) Unloading Pipeline

Two lines with 750mm diameter shall be installed so as to allow gas receiving at a rate of 11,000m^3-LNG/h. Installation of two pipelines permits gas receiving operation even when one line cannot be operated for some reason.

7.2.2 LNG Tanks

(1) Type

According to the recent trend of LNG storage construction, the above-ground type PC tank (integral type of outer container and PC dike) is the main steam tank and is adopted in this study. The above ground PC tank has 2 types which are full-containment type and suspension deck type. The full-containment type is better seismic performance than the suspension deck type, so it is adopted in Japana and Taiwan. However, suspension deck type is cheaper than full-containment type. Suspension deck type is world standard because of its price, so in this study, we adopted the suspension deck type.

(2) Calculation of Required Number of Storages

The required reserve at an LNG terminal is calculated using the following equation: Required reserve = Storage + Seasonal differentials + LNG for receiving + LNG Vessel Capacity

Based on the analysis, in 2030, three 180,000 kl LNG storages should be deployed. If we assume, with the same calculation as in 2020, two 180,000 kl LNG storages are also needed.

(3) LNG Pumps

Operating rate of the power plants is calculated at 80%, but we estimate the maximum amount of send-out rate using the data which all power plants are running

7.2.3 LNG Vaporizers

(1) Types of LNG Vaporizer

The type of vaporizers will be submerged-type LNG vaporiser (hereinafter abbreviated as SMV).

(2) Calculating Required Numbers

The capacities of LNG vaporizers are determined to be four based on the analysis.

7.2.4 BOG (boil-off gas) Treatment Facilities

(1) BOG Generation

The rate of BOG generation with unloading operation would be 15.5t/h and without unloading operation 5.5t/h in 2020.

(2) BOG Reliquefaction Facilities
The capacity of the BogG reliquefaction facilities is calculated.

(3) Types of BOG Compressor
The Study adopts the reciprocating type with the good operability and low power cost.

(4) BOG Compressors and Reliquefaction Facilities Installation Plan
The capacity and the installation plan were studied on the BOG compressors and reliquefaction facilities.

7.2.5 Seawater Facilities
(1) Required Seawater Volume

The analysis finds the volume of seawater required for one vaporizer to be 5,250 $m^3/h \cdot$unit.

(2) Seawater Pumps and Seawater Lines
Seawater pumps for vaporizers are with 7,000 m^3/h of capacity and 30 m of lift with two back-ups, booster pumps for disaster control are centrifugal types with 3,000 m^3/h of capacity and 80 m of lift with one back-up.

7.2.6 Gas Send-out Facilities
(1) Odorizers
The Gas Utility Industry Law in Japan requires that "the concentration of city gas must be at a level that is detectable when diluted in the atmosphere at a volume of 1/1,000." Ten mg/Nm^3 of a mixture of DMS (dimethyl sulphide) and TBM (tertiary butyl mercaptan), which Osaka Gas uses, will be employed as an odorizer.

(2) Measurement and Quality Control
The send-out pipe is equipped with measuring instruments and quality control devices.
The orifice meter and the delta meter can be used to measure the volume of gas, and the calorimeter, the specific weight meter, and the analyzers including gas chromatography can be used to control quality.

7.2.7 Utility Facilities
A list of the required utility facilities is provided in the report.

7.2.8 Electrical Equipment
(1) Basic Design Concept
The Study needs to consider the below factors in the design of equipment.

(2) Power Demand
The integration of electric power for gas manufacture/supply and maintenance is examined.

(3) Outline of Equipment
The outline of equipment was shown.

7.2.9 Control and Supervision Systems
(1) Design Policy

This LNG terminal has the responsibility to maintain a stable gas send-out capability according to varying gas demand for town gas consumption, electric power generation, and NGV vehicles. The conditions for designing the process control and supervision system were discussed.

(2) System Composition.
To realize stable, reliable, and efficient management of latest LNG terminal, several systems will be required, and all system information shall be integrated.

(3) Design Concept
The design concept has been studied from the aspects of system segregation and integration, the redundancy and reliability, the automatic operation, and the maintenance.

7.2.10 Main facilities and Layout
The layout and specifications for the main facilities are shown.

7.3 Project execution study

7.3.1 Terminal cost
Total terminal cost from inhouse database is shown in the table below. Others include civil & Buildings, Jetty, Electrical/Instrumentation etc. Site preparation cost is not included.

LNG Terminal Cost

(million USD)

Required LNG imports (million t /y)	250
LNG storage tanks	320
Mechanical & Piping	185
Others	105
Engineering	30
Total	640

Source: Formulated by JICA study team

7.3.2 Operating Organization and Operating and Maintenance Costs
(1) Operating Organization
The Study estimated the operating and maintenance manpower needed for terminal, based on data for LNG terminals under operation.

(2) Operation and Maintenance Costs
Operation and Maintenance costs were calculated based on the actual data for LNG terminals in operation.

7.3.3 Organization
The sample organization for the project is proposed with about 30-40 staff.

7.3.4 Procurement
The potential vendor/subcontractor list is provided.

7.3.5 Project Schedule

The Study prepared the overall project schedule for this project.

7.4 LNG Cold Energy Utilization

7.4.1 What is LNG Cold Energy Utilization

LNG has cold energy of about 200kcal/kg. The cold energy depends on its composition and pressure. The composition also varies according to the production places of the LNG. Also the pressure depends on the pipeline pressure of the area. The LNG cold energy is usually thrown away to the sea in order to vaporize LNG.

7.4.2 Example of LNG Cold Energy Utilization

(1) Air Separation & Liquefaction Plant

Air separation & liquefaction plant produces "liquefied nitrogen", "liquefied oxygen" and "liquefied argon", utilizing the temperature difference of each gas boiling point. And the produced liquid is supplied to the factories such as steel plant, petrochemical plant and refinery plant.

(2) Cryogenic Power Generation with LNG Cold Energy

The cryogenic power generation plant can generate electrical power, utilizing temperature difference between LNG and sea water. The Study described the process flow of the cryogenic power generation.

(3) Refrigerated Warehouse

The Study designed the refrigerated warehouse.

7.4.3 Track records in Japan

The Study showed the track records in Japan.

7.4.4 Advantage of LNG Cold Energy Utilization

1) Reduction of influence of cold sea water which is heat-exchanged with LNG and spread to sea---Reduction of influence of sea creature
2)Environmental friendly system ---Reduction effect of CO_2 emission (Reduction of electricity consumption)
3) Employment promotion by new industry generation by LNG cold energy utilization.

Chapter 8 Project Scheme

8.1 Current Regulation

According to the current BOT law, companies constructing and operating the infrastructures in the Philippines may obtain financing from foreign and/or domestic sources and/or engage the services of a foreign and/or Filipino contractor: provided, that, in case an infrastructure or a development facility's operation requires a public utility franchise, the facility operator must be a Filipino or if a corporation, it must be duly registered with the Securities and Exchange Commission and owned up to at least sixty percent (60%) by Filipinos. The requirement applies to not only the owner of assets but also to the operation and maintenance entity, even in the case of operation separation model. This requirement by the BOT law is applicable to gas pipeline business as it is deemed to be social infrastructure defined in the law.

8.2 Pipeline

8.2.1 Proposed Scheme

As for the pipeline business ownership and management structure, three project model options are considered; Model 0: conventional BOT model, Model 1: the Integrated Execution Organization Model, and Model 2: the Operation and Maintenance Separation Model.

Two financing options are considered for Models 1 and 2. One is an option of obtaining a concessional loan at a preferable condition (low interest rate with long grace period and long repayment duration). Another is an option of capital procurement in commercial market, by issuing 10 year maturity term bonds. Models 1 and 2 are therefore further separated into two s each, suffixed with “A” for concessional loan financing, and “B” for bond financing. Altogether, five patterns are considered (the table below).

Proposed Project Model Patterns and Their Cost of Capital

Model Name	Model 0	Model 1A	Model 1B	Model 2A	Model 2B
Project model	Model 0 (Conventional BOT)	Model 1 (Integrated Execution)		Model 2 (O&M Separation)	
	[Model 0]	[Model 1A]	[Model 1B]	[Model 2A]	[Model 2B]
Finance	Market Procurement	Concessional Loan	Market Procurement	Concessional Loan	Market Procurement
Initial Investment			USD 154 million		
Annual O&M cost	USD 6.1 million	USD 7.7 million		USD 6.1 million (For O&M company)	
Amount of Equity	USD 150 million	USD 43 million	USD 82 million	USD 38 million (For asset holding company)	USD 77 million (For asset holding company)
Expected Yield for Equity		20%		20% (For asset holding company)	
Amount of Debt	USD 138 million	USD 138 million		USD 138 million (For asset holding company)	
- of which is Concessional Loan (Interest) [repayment]	None	USD 138 million (0.2%) [40 years]	None	USD 138 million (0.2%) [40 years]	None
- of which is market procured (Interest) [maturity]	USD 138 million (16%) [refinanced every 10 years]	None	USD 138 million (6%) [refinanced every 10 years]	None	USD 138 million (6%) [refinanced every 10 years]
Weighted Average Interest Rate of Debt	16%	0.2%	6.0%	0.2% (For asset holding company)	6% (For asset holding company)
WACC: Weighted Average Cost of Capital	16%	4.9%	10%	4.4% (for asset holding company)	9.9% (for asset holding company)

Source: Formulated by JICA study team

8.2.2 Scheme Comparison through Financial Analysis

Models are compared from the viewpoint of difference in required wheeling charges as well as their viability. Advantages and disadvantages for each of the project models and financing patterns are compared as follows:

(1) Gas Transmission (Wheeling) Charge

Revenue expected for each Model will be dependent on the amount of gas transported and the unit tariff for the transmission by the pipeline. As natural gas is to be supplied to an unspecified number of customers, the gas transmission (wheeling) charges are likely to be regulated by the Energy Regulatory Commission (ERC). However, ERC is yet to establish a method for regulating the

wheeling charges of natural gas pipelines. In conducting the analysis the revenue from providing the pipeline business service, the wheeling charge was considered and treated as a variable based on the current situation where regulatory mechanism for gas transmission service is not existent. The wheeling charges for each of the project models were set so as to realize the FIRR of approximately 2 percentage points above WACC, to ensure financially sustainable operation of the business.

The assumed setting is a type of cost recovery scheme, which allows the operating entity to recover from wheeling charge revenue, the operating expense (OPEX) and the capital expenditure (CAPEX), to meet the weighted average cost of capital (WACC). Additional profit to cover the business risks will also be required. The assumption in this analysis, therefore, allows the operator to conduct a financially sustainable business at a given cost and profit.

(2) Comparison of the Project Models

First, wheeling charges are set so that the FIRR becomes approximately 2 percentage points above WACC for each of the project models. Models 2A and 1A, taking advantage of the preferential concessional loan, offer the lowest wheeling charge of 0.017 USD/Nm^3 and 0.018 USD/Nm^3 respectively. Wheeling charges in Models 2B and 1B, procuring debt from the market, will be 0.011 USD/Nm^3 higher than the concessional loan patterns, at 0.028 USD/Nm^3 and 0.029 USD/Nm^3 respectively. Conventional BOT model is seen to require more than twice the wheeling charge compared with the concessional loan patterns, at 0.047 USD/Nm^3.

Wheeling Charge to meet the Equity Return requirement

Model Name	[Model 0]	[Model 1A]	[Model 1B]	[Model 2A]	[Model 2B]
Business Model	Conventional BOT	Model 1 （Integrated Type）		Model 2 （Separation）	
Finance	Market Procurement	Concessional Loan	Market Procurement	Concessional Loan	Market Procurement
Wheeling Charges [USD/Nm^3]	0.047	0.018	0.029	0.017	0.028
WACC	16%	6.0%	11%	5.4% (For asset holding company)	10% (For asset holding company)
Financial IRR (=FIRR)	19%	8.4%	13%	7.2% (for asset holding company) 8.4% (for project overall)	12% (for asset holding company) 13% (for project overall)

Source: Formulated by JICA study team

The Sensitivity analysis was carried out by moving the wheeling charges between 0.017 USD/Nm^3 and 0.047 USD/Nm^3. The result shows that the Models 1A and 2A will benefit due to their low WACC. Model 2A will be financially viable in any wheeling charge settings within the moving zone. Model 1A will become marginal when the wheeling charge is set at 0.017 USD/Nm^3.

FIRR Comparison under Referential Wheeling Charges

Model Name	Model 0	Model 1A	Model 1B	Model 2A	Model 2B
Business Model	Conventional BOT	Model 1（Integrated Type）		Model 2（Separation）	
Finance	Market Procurement	Concessional Loan	Market Procurement	Concessional Loan	Market Procurement
Wheeling Charge = 0.047 [USD/Nm^3]	FIRR = 19% WACC = 16%	FIRR = 18% WACC = 4.8%	FIRR = 18% WACC = 10%	18% (for asset holding company) 19% (for project overall) WACC = 4.4%	18% (for asset holding company) 19% (for project overall) WACC = 10%
Wheeling Charge = 0.029 [USD/Nm^3]	FIRR = 13% WACC = 16% NOT VIABLE	FIRR = 13% WACC = 5.5%	FIRR = 13% WACC = 11%	13% (for asset holding company) 13% (for project overall) WACC = 5.1%	13% (for asset holding company) 14% (for project overall) WACC = 10%
Wheeling Charge = 0.028 [USD/Nm^3]	FIRR = 13% WACC = 16% NOT VIABLE	FIRR = 13% WACC = 5.6%	FIRR = 13% WACC = 11%	12% (for asset holding company) 13% (for project overall) WACC = 5.1%	12% (for asset holding company) 13% (for project overall) WACC = 10%
Wheeling Charge = 0.018 [USD/Nm^3]	FIRR = 8.9% WACC = 17% NOT VIABLE	FIRR = 8.4% WACC = 6.0%	FIRR = 8.5% WACC = 11% NOT VIABLE	8.8% (for asset holding company) 7.2% (for project overall) WACC = 5.4%	8.4% (for asset holding company) 9.2% (for project overall) WACC = 11% NOT VIABLE
Wheeling Charge = 0.017 [USD/Nm^3]	FIRR = 8.9% WACC = 17% NOT VIABLE	FIRR = 7.9% WACC = 6.0% MARGINAL	FIRR = 8.0% WACC = 11% NOT VIABLE	8.4% (for asset holding company) 7.2% (for project overall) WACC = 5.4%	7.8% (for asset holding company) 8.7% (for project overall) WACC = 11% NOT VIABLE

Source: Formulated by JICA study team

(3) Model Comparison Summary

Comparison results show that the use of concessional loans, as in Models 1A and 2A are financially advantageous, being able to offer the lowest wheeling charge for the gas customers. Models 1B and 2B, taking advantage of governmental creditworthiness enabling capital procurement at low cost also is seen to be financially effective, being able to offer the wheeling charge only 0.011 USD/Nm^3, or 70 to 80% higher than the concessional loan models. Conventional BOT resulted in the wheeling charge becoming significantly higher, at 280% of the concessional loan models.

Further, comparison of Model 1 and 2 shows that outsourcing of O&M, to realize more efficient operation through competition, will bring about financial advantage to the project. Although the impact of Separation might be minimal for lowering the wheeling charge, profitability in terms of project financial IRR differs significantly compared with the integrated model, under the same wheeling charge.

8.3 LNG Regasification Terminal

8.3.1 Proposed financing Scheme and Financial Analysis

Considering that the LNG regasification terminal is a stand-alone facility from financial viewpoint, the revenue of the project is deemed to be from regasification charge. The charge was set at 0.07 USD/Nm^3, to have the FIRR calculated at 12%, which is approximately 2 percentage points above the weighted average cost of capital (WACC).

The result of the financial analysis for the LNG regasification terminal proposed in this study shows that the project will be financially viable under the condition that the capital can be procured at average interest rate of 9.7%, and that the charge for regasification can be charged at 0.07 USD/Nm^3. Fluctuation in costs (initial investment costs and O&M costs) as well as in gas demand will be the factors which may either underpin or hinder the financial viability of the project which is demonstrated from the analysis.

Financial Analysis Results for LNG Regasification Terminal

	Financial Analysis Results
Regasification charge	0.07 USD/Nm^3 (USD 205 million for 2,931 million Nm^3 of regasification from 10th year of operation onwards)
WACC	9.7%
Financial IRR (=FIRR)	12%

Source: Formulated by JICA study team

8.4 Economic Analysis

8.4.1 Benefits

Benefits other than the revenue gained through business should also be included in the calculation. Among various benefits that will be brought about by making natural gas available to the society, one of the most significant and quantifiable benefit will be the cost reduction compared with the use of fuel oil. As mentioned in Chapter 4 of this report, the current unit cost of fuel oil in the Philippines is calculated as 2.2 times the unit cost of nationally available natural gas, or 1.3 times the unit cost of imported natural gas. Although the fuel cost saved by energy consumers will not be collected by the gas business entities, it is the economic advantage for the society that can be directly quantified. The benefit is calculated by multiplying the unit cost difference between natural gas and fuel oil, and by the amount of gas provided through the pipeline.

8.4.2 Costs

Costs for the project were calculated as the sum of investment and O&M costs for both the regasification terminal and the pipeline. Tax levies were deducted and internal transactions (e.g. lease paid by the operator to the asset holding company) were balanced out to ensure the accuracy of the calculation. Standard conversion factor (SCF) to adjust the local portion of the costs to international costs was set at 0.95 (All costs excluding material, engineering and management costs were considered as the local costs).

Result of the economic analysis shows that the economic internal rate of return is 31%, which is well above the social discount rate of 16% (The social discount rate of 16% is the commonly employed rate for evaluation of public works in the Philippines). Net present value (NPV) of the project at social discount rate was calculated as USD 1,576 million, with the cost benefit ratio (CBR) of 2.7. The result, by showing that the investment in the project will bring about the benefit worth 2.7 times the investment amount, implies that the project is robustly worthwhile being conducted.

Economic Analysis and Sensitivity Analysis Results

	Referential condition (Specification = Case 4) (Project Model = 2A)	Project cost [+20%]	Commercial Revenue [-20%]	Initial Investment [+20%] and Commercial Revenue [-20%]
Economic IRR (=EIRR)	31%	28%	31%	27%
Net present value (=NPV) at Social Discount Rate	USD 1,576 million	USD 1,388 million	USD 1,463 million	USD 1,275 million
Cost Benefit Ratio (=CBR) at Social Discount Rate	2.7	2.2	2.6	2.1

Source: Formulated by JICA study team

Sensitivity analysis was conducted under various cost and revenue conditions. First the EIRR under the assumption that the project cost will incur at 120% of the referential condition resulted in 29%. This is a figure to show the robustness of the project despite of the cost increase. Another case in which the revenue declines 80% of what can be gained in referential condition also shows that the EIRR will not change significantly. The third case, in which the cost increases by 20% while the revenue declines at 20% simultaneously, shows that the project is still well economically viable.

Chapter 9 Implementation of BatMan 1 Pipeline Project

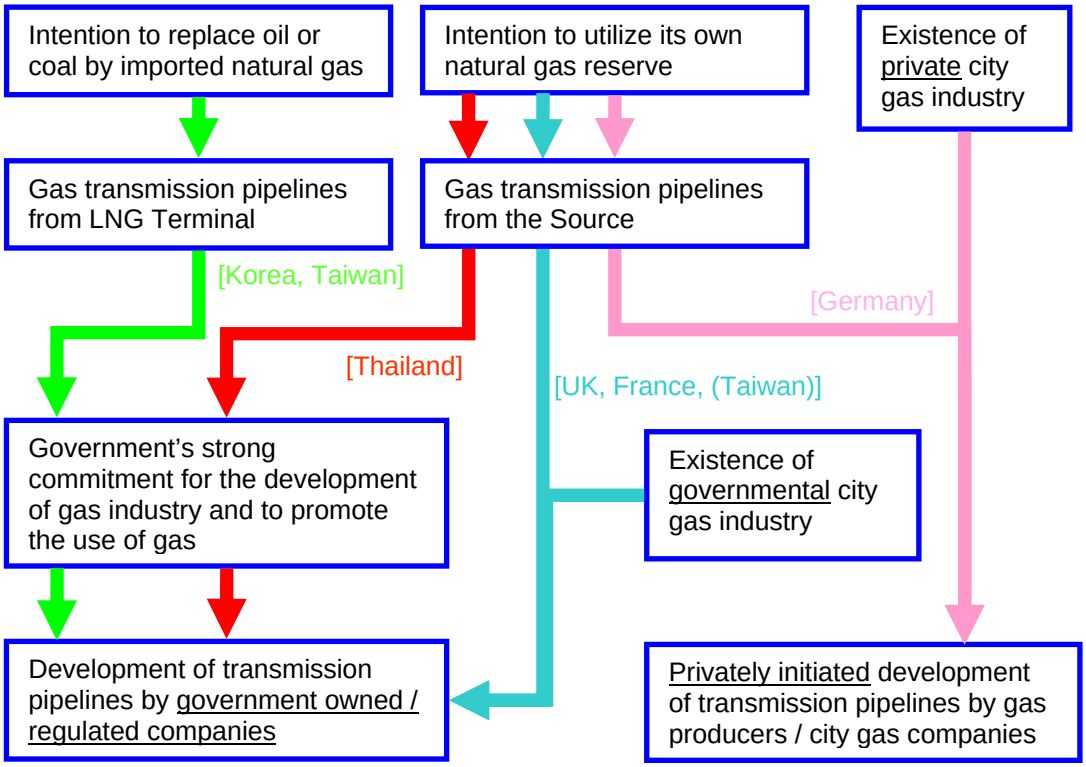
9.1 Development of a Physical Link between Sources and Offtakers

A value chain of gas industry, starting from the source (whether imported or from its own well) intermediated by transmission line and aggregators, down to the end users, will have to be structured. The existence of a value chain will facilitate private companies to enter into the business by lowering the hurdles to overcome supply and demand risks. BatMan 1 gas transmission pipeline can become an assurance for the distribution businesses in Greater Manila and its periphery area on supply. Companies will be encouraged to embark on distribution businesses once the gas supply will be secured.

9.2 Project Implementing Entity

9.2.1 Government's Initiatives in the Cases Overseas

Examples of pipeline development in some of the other implies that whether it is the government or the private who implement the project is broadly relevant with the intention behind the necessity of the project and maturity of the gas industry. Intentions may be categorized into two cases: one is the intention to replace oil or coal by imported gas, while another is the intention to enhance the utilization of its natural gas reserve. Maturity can be categorized by existence of city gas companies. The logic of the development initiative of natural gas transmission pipelines can be visualized as in the following flow chart.



Analysis of Gas Transmission Pipeline Initiatives

Source: Formulated by JICA study team

9.2.2 Government's Role as the Market Regulator

Market regulation to avoid certain business entity being advantageous due to linkage with the other segment should therefore be enforced to allow for fair competition within each of the value chain segment. Open and fair access for all stakeholders in need for pipeline usage will have to be ensured. European Directive and US Federal Energy Regulatory Commission (FERC) Order are examples of such open and fair access requirements for the pipelines under public utility.[3] [4]

Further, with the case of the European Directive, a principle of "unbundling" of the business activities in each of the value chain sector is stipulated to be enforced. The unbundling requirement is introduced with the aim to avoid conflict of interest among the business entities in different value chain segments, by ensuring independence among the entities.

9.2.3 Government's Role to Ensure Low Tariff for the Users

BatMan 1 project, with the aim to promote the development of a gas industry from its infancy, will have to be conducted by lowest capital cost available, i.e. public finance. Financing by government budget backed by concessional loan(s) will be the realistic and appropriate option, followed by governmental bonds.

Given the non-negligible difference in expected wheeling charge between public and private financing options, BatMan 1 project, with the aim to promote the growth of a gas industry, will desirably be financed through public finance, backed by concessional loan.

9.2.4 Option for the Philippines: Government Owned, Government Financed

Three topics, namely: examples in other countries, importance of proper market regulation, and requirements for low capital cost, all indicated the necessity for the government to implement this BatMan 1 project. The common conclusions from three topics discussed are all derived from a common goal: to promote the growth of gas industry in the Philippines.

9.3 Project Model to Encourage Participation of the Private Sector

9.3.1 Major Tasks and their Allocation

Tasks or functions, which will be required in an infrastructure development project, will broadly be the following five tasks: designing constructing, financing, owning and operating. Operation may further be broken down to management, technical maintenance & repairs, marketing.

[3] EC Directive (2009/73/EC of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC)
[4] FERC Order No. 636

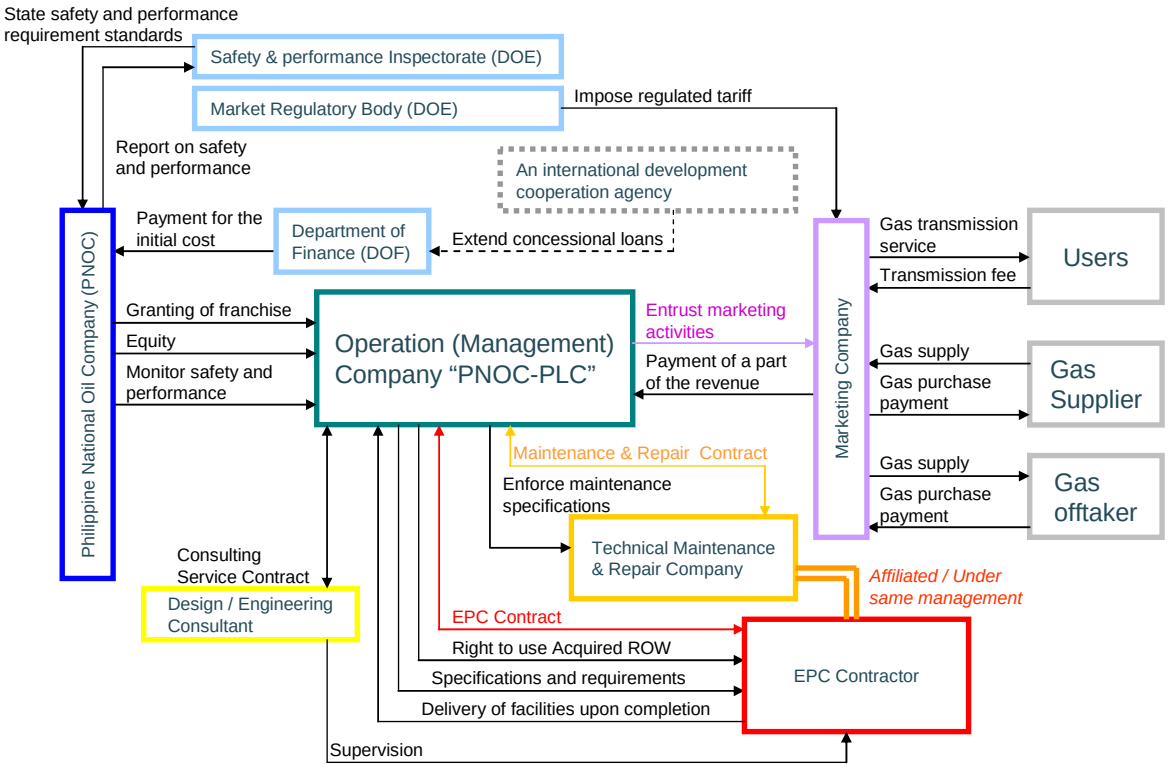
Task Allocation for Proposed Separation Project Model

Tasks	Entity who will pursue the Task	
	Proposed Separation Project Model	Conventional BOT
Designing	Engineering consultant (outsourced under service delivery contract from the management entity	Private Proponent (or its subcontracting consultants)
Building	Contractor (outsourced under EPC contract from the management entity.	Private Proponent (or its subcontractor)
Financing	Government	Private Proponent (Government, in the case of BTO)
Owning	Government	Private Proponent (Government, in the case of BTO)
Operating		
Management	Public sector management entity	Management entity = Private Proponent
Technical maintenance & repair	Subcontractor (outsourced from by the management entity), desirably the same entity as the EPC contractor to avoid interface risk.	Private Proponent (or its subcontractor)
Marketing	Private marketing company (outsourced from the management entity).	Private Proponent

Source: Formulated by JICA study team

9.3.2 A Project Model for BatMan 1 Pipeline Project

Proposed project model, based on the task allocation considered in the preceding subsection, will be a PPP model, with the combination of Build - Transfer (BT) arrangement and Outsourcing of technical maintenance and marketing tasks.



Proposed Project Model for BatMan 1

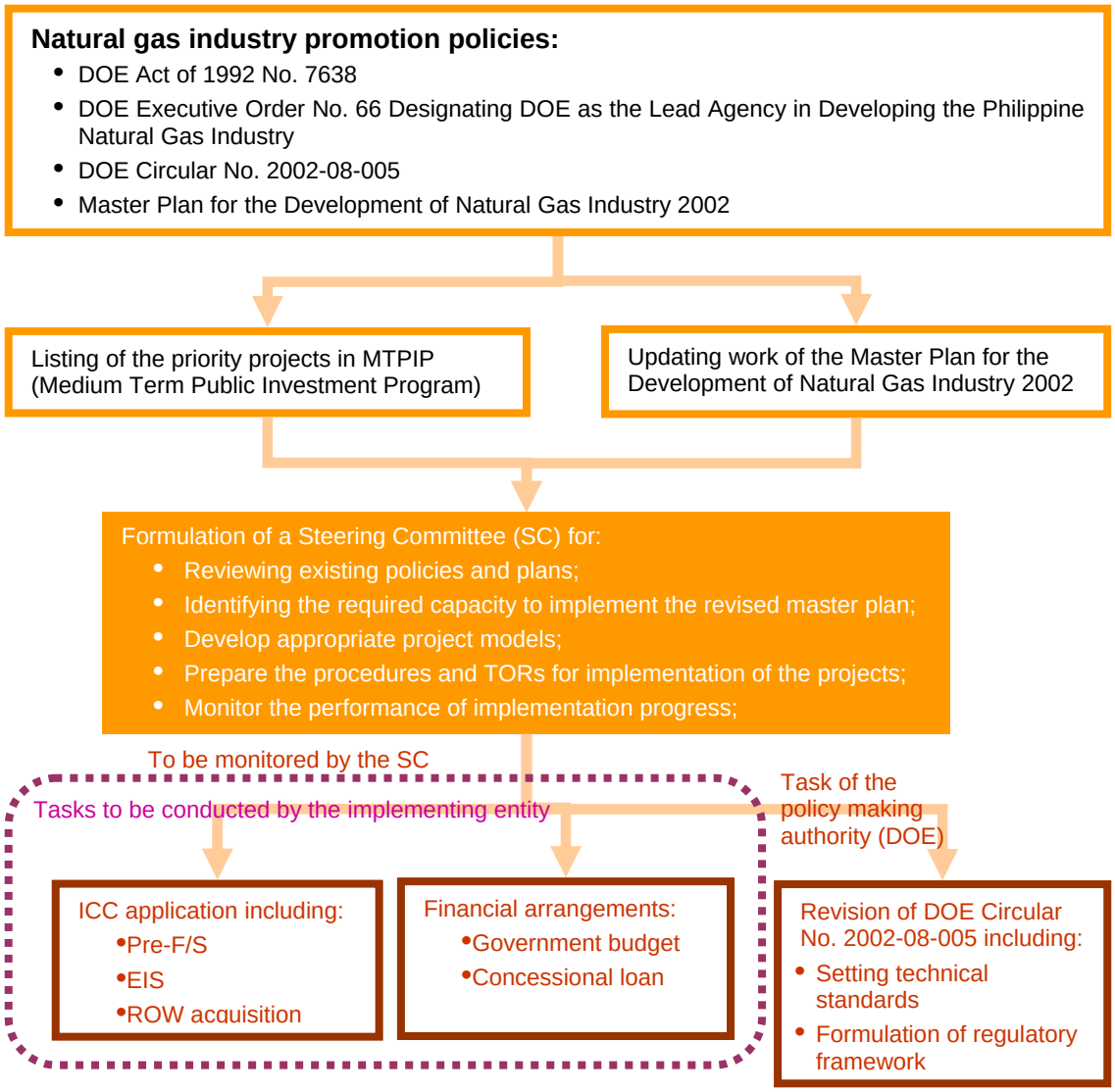
Source: Formulated by JICA study team

Chapter 10 Recommendation for Project Implementation

10.1 Basic Understanding of DOE for Project Implementation

The Study Team acknowledged that the priority projects for promotion of development of the gas industry have now been listed in the Medium Term Public Investment Program (PIP) of DOE, to be published by National Economic Development Authority (NEDA) in the first half of 2012. The list will include not only BatMan 1 pipeline project but also other projects in the supply segment as well as the end user segment.

The Study Team also acknowledged in February 2012 that, with the finalization of this study, a Steering Committee (formerly named Technical Working Group) will be established to promote the implementation of the priority projects.



Orientation for the implementation of the Master Plan Projects

Source: Formulated by JICA study team

The Study Team conducted several high-level meetings with DOE and the consultations with the stakeholders in both of the public and private sectors as well as the information and view sharing at the final presentation. The basic understanding and the agreed views on the project implementation,

which have been obtained and shared among the concerned project-related parties, are the followings:

- Considering the current development status of the Philippines, it is preferable to have the gas pipeline developed and owned by the government given the nature of the public utility infrastructure and also to promote the growth of the gas industry. Since the knowledge and experiences of the private sector will be effective for the operation (mainly marketing and maintenance), the project may be developed by applying the ownership-operation separation model;
- The formulation of the implementing organization will be carried out under coordination among the government offices, related organizations and institutions. DOE will examine the detailed procedures in the coming months;
- The project preparation and implementation will require the selection of the implementing organization, the feasibility study, and the development of institutional framework. DOE has requested the additional support to JICA on these tasks, and;
- DOE will establish a Steering Committee comprised of DOE, PNOC and PPP Center, to elaborate and consider the implementation of the proposal by the JICA study team.

Based on the above understandings and on the study findings, the project preparation will require the examinations on the project formulation such as (a) the institutional development for legal and regulatory systems, (b) project implementation scheme and finance, and (c) the procedure for project implementation. The subsequent sections discuss the tasks in detail.

10.2 Institutional Development for Legal and Regulatory Systems

The gas sector in the Philippines, still developing, has not established the technical criterion such as the safety rules and the facility standard. Since the gas projects and the facility development are expected to increase in the coming years, it is understood that the government may need to clarify the opinions on the technical matters and to develop the legal and regulatory frameworks. While the gas supply is primarily planned and implemented by the gas suppliers, the central government offices will need to study the supply security and the necessary supports for the suppliers from the viewpoints of the energy supply security and the improvement of the policy to attract industries. The action items would include the following. The schedule for the action items are also summarized at the end of this chapter.

- Review of laws and regulations on the gas sector
- Study of the current circular on the gas sector
- Study of the establishment of the regulatory commissions on the gas sector
- Study of the regulations on the approvals of the gas pricing
- Study of the standards for safety, security and inspection

10.3 Feasibility Study for Project

The Study conducted the basic design for the gas project, including the gas pipeline and the LNG terminal, based on the data available at hand at the time of the study period. Since the Study rests in the category of the pre-feasibility study, the feasibility study needs to be carried out in order to enhance the accuracy of the projections in the study. This would aim to develop the documents that can be applied to the project bidding through the design of the structures and facilities based on the basic information such as the topographical map, geological data, meteorological and oceanographic data, and seismic information. The data required for the study will include;

- Oceanographic data (water depth, wave, wind, current, tide level)
- Foundation data
- Land use and Right-of-Way data
- Information on underground structures

The report also needs to be developed based on the data required for the environmental and social impact assessment. The detailed information on the right-of-way for project development, for instance, should be compiled and presented to the project-implementing agency. It is understood that the environmental and social issues should be basically addressed by the implementing agency. It is however necessary for the central government offices to confirm the relevancy of the countermeasures by the implementing agency. The conditions in the JICA guideline also needs to be met in order to clear the loan appraisal in addition to the environmental and social considerations by the Philippines laws.

The supply source for the gas pipeline tentatively expects the utilization of the Malampaya gas supply. The detailed conditions of the transaction should be examined. The overall future gas supply scenario should also be studied as to the suppliers, amount and the purchase conditions.

10.4 Project Model Scheme and Finance

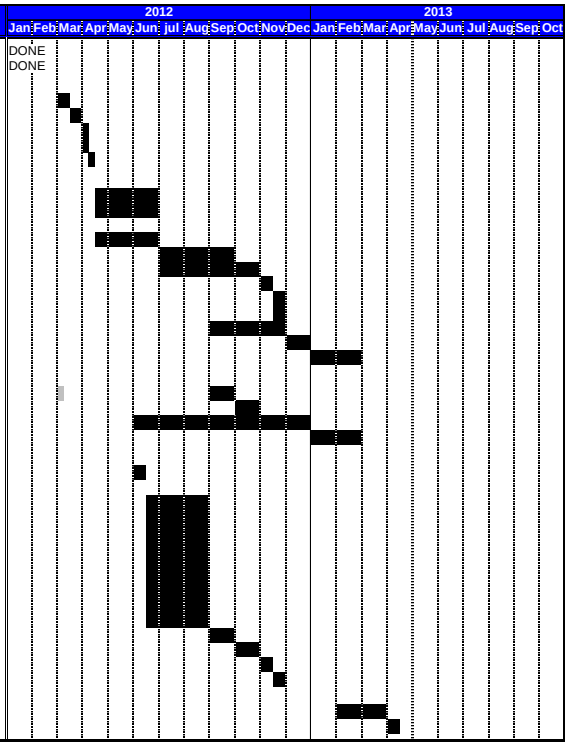
The first action would be the decision making of the implementing organization from those candidates including the institutions that carry the current franchise right. There is also a need for the government to conduct the detailed design of the public private partnership, coordinate with the relevant organizations on the funding sources and procedures, and to put together the first draft of the business scheme. Moreover it is important to share the information with the private sector and to obtain the understanding on the project implementation.

In connection with the financing for the project, it is important to confirm the required procedures for the relevant organizations if the project seeks the public finance and/or the donor funding such as JICA ODA loan. Finally, the country does not have any large-scale gas pipeline projects, there is a need to study the approval and change processes, and the conditions for approval of the wheeling charge of the pipeline projects.

10.5 Procedures for Project Implementation

The next phase of the project preparation will look into the procedures and negotiations for project implementation. These can be categorized by the relevant organizations and stakeholders into four types; (i) Procedures for project implementation within the government offices, (ii) Project preparation in DOE, (iii) Negotiation with the implementing agency, and (iv) Preparation with the financial institutions. The procedures within the government offices would be mainly with DOF and NEDA such as budgetary arrangements and funding approval. The project preparation in DOE will be the regulatory arrangements for the gas sector including the safety rules and business regulations. The negotiations with the implementing agency will include the decision on the implementing agency and the negotiation on the project promotion. Additionally, if the project seeks the borrowings from the financial institutions, the detailed discussion should be made on the funding term and conditions in parallel with the coordination with DOF and NEDA. The below table summarizes the actions for DOE.

Task	In Charge
(1) Application for Listing on MTPIP (Public Investment Program)	DOE
(2) Review and Confirmation of JICA Study	DOE
<Steering Committee>	
(1) Estsblishment of Steering Committee (SC)	DOE
(2) Identification of the Implementing Entity / Project Model	SC
(3) Stakeholder Consultation	SC
(4) Scoping of Project Preparations including ICC Application	SC
(5) Institutional Decision to Proceed with the Project	DOE
<1. NEDA ICC Approval>	
(1) Preparation of Documents to be submitted I	
F/S & Preparation of Project Profile Document	PNOC/DOE
(2) Preparation of Documents to be submitted II	
Preparation of Environmental Impact Assessment (EIA)	PNOC
Acquisition of Environmental Compliance Certificates (ECC)	PNOC
Regional Development Council (RDC) Endorsement	PNOC
Project Finance Review by DOF	PNOC
Department of Budget and Management (DBM) Certification	PNOC
Endorsement by Other Concerned Government Agency	PNOC
Pre-arrangement of ODA Financing	PNOC
Approval of NEDA ICC	NEDA
(4) Finalization of Debt-Financing Arrangement & Conclusio of Loan Agreement (L/A)	PNOC/MOF
<2. Financing Arrangements>	
(1) Submission of (Preliminary) Request	PNOC/DOF
(2) Preliminary Negotiations on Bowwoing Terms	PNOC/DOF
(3) F/S, EIA required for ODA approval	PNOC/DOE
(4) Finalization of Debt-Financing Arrangement & Conclusion of Loan Agreement (L/A)	PNOC/DOF
<3. Technical Standards & Regulatory Framework (Circular)>	
(1) Procurement of Advisory Services	DOE/PNOC
(2) Revision of Circular & Establishment of Administrative Regulation/ Technical Standard	
Review of Pipeline Technical Regulation	DOE
LNG Terminal Technical Regulation	DOE
Third Party Access	DOE
Service Provider Regulation	DOE
Pricing Regulation	DOE
Safety Regulation	DOE
Inspection and Monitoring	DOE
Public Relations	DOE
Offences and Penalty	DOE
Documentation	DOE
Public Consultation	DOE
Approval & Enforcement	DOE
(3) Establishment of Gas Transmission Regulatory Office	DOE
<Project Implementation>	
(1) Bidding Documents for EPC/Maintenance, Document Clearance	PNOC
(2) Start of Bidding Process for EPC/Maintenance	PNOC



<Assumption>

1. DOE assigns PNOC as the project implementing entity for Batman 1project.
2. Government finance backed by Concessional Loan
3. No manjor issues on eodorsement by local government and concerned government agency.
4. No major issues on project processing by stakeholders.
5. Close coordination with donor.

Actions and Timelines for Implementation of the Projects

Source: Formulated by JICA study team