Appendix D

Model Manual

For

Energy Supply / Demand Balance Model

In The Philippines

CONTENTS

1. Requisites for the Model Development

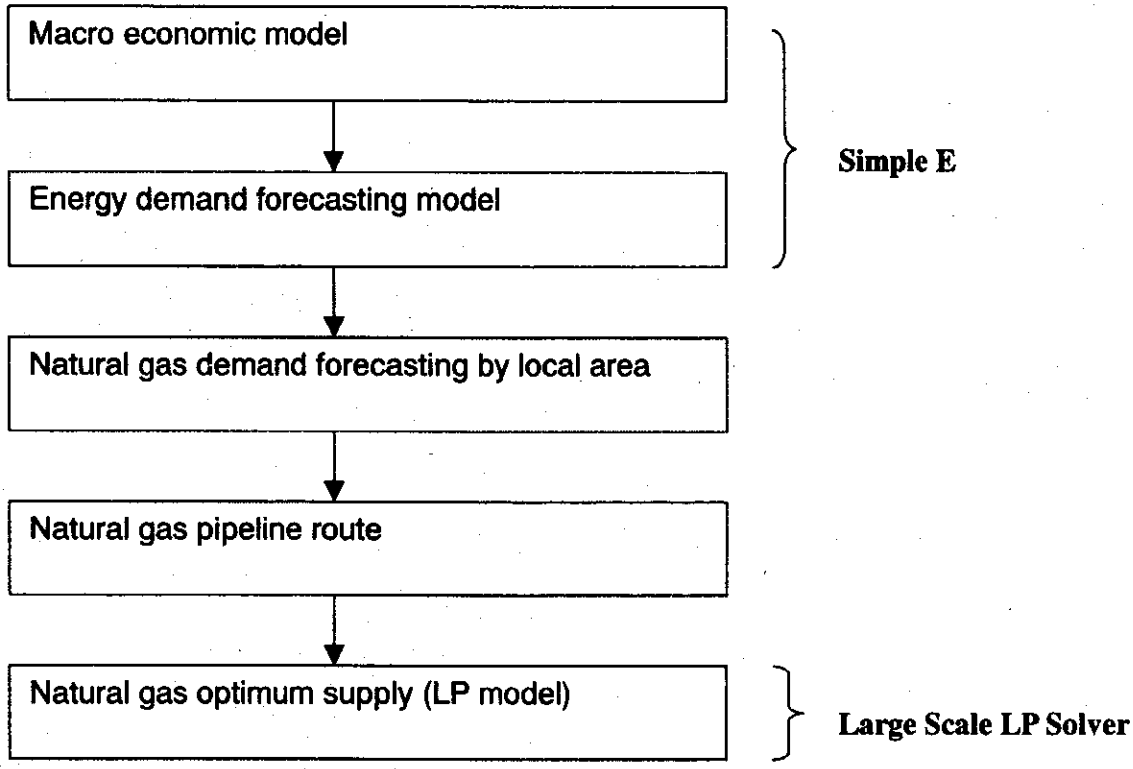
1.1 Given conditions for model development

(1) The model is designed for Philippines long-term energy plan (up to 2025) and Natural gas supply planning.

(2) The model is designed in a linkage with the macro economy, energy demand, and natural gas supply and demand balance.

(3) Model development environment is under personal computers, EXCEL and its Add-In software. (Simple E., Large scale LP)

1.2 Structure of the Model



2. Macro Economic Model

Structure flow chart of the macro economic model

1. Population	Population Labor force Unemployment rate
2. GDP	GDP by economic sector
3. Wage	Wage & Growth Rate of wage
4. GDE	Private consumption Government consumption Gross capital formation Stocks Import Export
5. Prices & deflator	CPI WPI GDP deflator
6. Nominal data	GDP GDE Nominal wage

2.1 Population and Labor

(1) Population forecast (exogenous)

Future population in Philippines is forecasted by the growth rate of population. The growth rate of population in the future is assumed from 2.0% in 2001 to 1.5% in 2025.

Population = Population in the previous year * Growth rate of population

(2) Population over 15 years old (exogenous)

This is the population which can be incorporated into the labor force of over 15 years old in the total population. It is obtained by multiplying the total population by the share of the population 15 years old or more in the total population. The share of population 15 years old or more is assumed as 65% in this model based on past trend.

Population 15 years old or more = Population * 65%

(3) Labor force (exogenous)

Of the productive-age population (Population over 15 years old) those who are willing

and able to work are defined as the labor force. The labor force also represents the sum total of the students + workers + unemployment. Of the labor force, those who worked for longer than an hour in a surveyed period fall in the category of workers, while those who failed to work for longer than an hour in the surveyed period are in the category of the wholly unemployed. Therefore, it should be noted that the category of workers include many workers of underemployment. With the proposed model, this item is obtained by inputting each year's growth rates of the population.
No. of labor force = Labor force in the previous year * Growth rate of population

(4) Labor force population rate

The share of labor force in the productive-age population is called labor factor working population rate (which stands at around 70% in Japan). A rising school enrollment rate often noted in the developing countries, leads to a falling labor force working population rate. In the developing countries, the labor force working population rate is generally keep flat or slightly downward.
Labor force population rate = No. of labor force/Population 15 years old or more

(5) Number of households (exogenous)

A rising income, popularly noted in the developing countries, generally brings about a growing number of nuclear families and, therefore, the number of households outgrows faster than the population growth. Average family size in Philippines is around five persons per household.
No. of households = Population/Average family size (5)

(6) Number of workers (exogenous)

As already mentioned, the workers are defined as those who worked for longer than an hour during a surveyed period, while those who were not able to work even for an hour fall in the wholly jobless category. With part-time workers included, the so-called workers include not a few workers of underemployment. The highly promising industries have a sharply growing number of workers. In the developing countries, the number of workers is on the decline in the primary industry, on the sharp rise in the secondary industry, and on the increase in the tertiary industry. With the proposed model, this item is obtained by inputting each year's growth rates of workers by industry. In this model, the categorized industries and the growth rate of workers are as follows.

G.R. of workers in agriculture : 1%
G.R. of workers in mining & manufacturing : 2%
G.R. of workers in construction : 3%
G.R. of workers in transportation & communications : 4-3%
G.R. of workers in Trading & commercial : 2%
G.R. of workers in Banking & service 2%
G.R. of workers in public sector & others : 3-2%

G.R. is growth rate.

No. of workers in each sector = No. of workers in the previous year * Growth rate

(7) Employment rate

The developing countries are secured when their employment rate stays under 100% and over 90%. The condition of employment where this rate falls below 90% should have some problems.

Employment rate = No. of workers/Labor force

(8) Unemployment rate

Unemployment rate = 1 – Employment rate

2.2 Gross Domestic Product (GDP)

(1) GDP by sector

In this model, GDP by sector is forecasted by exogenous variables, namely the growth rate of GDP each sector is given in the model based on the economic planning in Philippines. Energy demand depends on the growth rate of GDP. If the GDP projection could not achieve, energy demand in the future will go down. Formula of GDP each sector is as follow.

GDP = GDP in the previous year * growth rate (exogenous)

(2) GDP by industry

Industry consists of the primary, secondary, and tertiary industries. Formulas of the GDP each industry are as follows.

Primary industry GDP = GDP of Agriculture, Fishery, Forestry

Secondary industry GDP = Mining, Manufacturing, Energy GDP + Construction GDP

Tertiary industry GDP = Transportation, Communication GDP + Trading, commercial GDP + Banking, Service GDP + Public, Others GDP

(3) Labor productivity by sector (added value/number of workers)

The elements which help increase labor productivity include 1) to raise capital

accumulation, 2) to accelerate technological advance, and 3) to shift the labor force to the more productive sectors.

Labor productivity of agriculture, fishery, & forestry = Added value / number of workers of agriculture, fishery, & forestry Labor productivity of mining & manufacturing = Added value / number of workers of mining & manufacturing Labor productivity of construction = Added value / number of workers of construction Labor productivity of transportation & communication = Added value / number of workers of transportation & communication Labor productivity of trading & commercials = Added value / number of workers of trading & commercials Labor productivity of Banking & service = Added value / number of workers of Banking & service Labor productivity of public sector & others = Added value / number of workers of public sector & others All-industry average labor productivity = GDP / total number of workers

(4) Growth rate of labor productivity

Industry-by-industry growth rates of labor productivity become the same one in the long run. It is because the labor force shifts from the poorly-productive industry to highly-productive industries. The shift continues until the industry-by-industry incomes come to be balanced well. At last, an equilibrium is gained when the growth rates of the poorly-productive and highly-productive industries become same to each other. This is expressed as follows: the growth rate = the growth rate of labor force + the growth rate of labor productivity. (Japan's labor force went up 0.8%, and labor productivity up 3.2%, when the Japanese economy grew by 4.0%.)

When running the proposed model, industry-by-industry growth rates of labor productivity should be same ones in the long run by making the balance between the growth of output values (or added values) by industry and the growth of the number of workers by industry. With this point particularly respected, the growth rates of population, labor force, workers, and industry-by-industry added values need to be externally determined.

Growth rate of labor productivity = Current year's labor productivity/previous year's labor productivity

2.3 Distributed National Income and Wage

(1) Labor share of GDP (exogenous)

Generally the labor share of GDP is 70-80%. The remainder is reaped by capital. Because the labor's relative share is rather constant, it appears not necessary to vary the figure dramatically in the proposed model. In the model, the labor share of GDP is assumed as 72%.

(2) Labor distribution of GDP

The labor distribution of GDP provides the basic data to calculate the savings rate, the growth rate of wage, etc. This is obtained by multiplying GDP by the labor share of GDP.

Labor distribution of GDP = GDP * Labor share of GDP (72%)

(3) Capital distribution of GDP

The capital distribution of GDP is obtained by subtracting the labor distribution of GDP from total GDP, and provides the basic data to calculate the amounts of investment, fixed capital formation, etc.

Capital distribution of GDP = Total GDP – Labor distribution of GDP

(4) Wage per capita

No serious inflation can be caused when labor productivity grows at an identical pace to the growth of wage. Inflation is inevitable if the wage growth outpaces the labor productivity growth. The short-term growth rates of labor productivity of different industries naturally result in wage differentials among them. If all industries are urged to raise their wages by the same margin as the national average of labor productivity growth, a feeble inflation should start first from the industry with the poorest labor productivity. Given below is the mechanism to determine per capita wage in the long run;

Growth rate of real wage = Growth rate of labor distribution share
+ Growth rate of labor productivity

Growth rate of labor productivity = GDP growth rate
– Growth rate of workers in number

Growth rate of nominal wage = Growth rate of real wage + Inflation rate

(5) Savings propensity (= GDP * savings rate)

The savings propensity provides the basic data to calculate investments. The savings

rate is an exogenous variable. Regardless of countries, it remains rather constant (staying at around 30% in Japan). In this model, savings propensity in Philippines is assumed as 19% based on the past trend.

(6) Consuming propensity (Labor distribution of GDP – savings propensity)

With the proposed model, the consuming propensity is obtained by subtracting the savings propensity from labor distribution of GDP.

2.4 Government finance

(1) Rates of taxes for government revenue

Government revenue consists of taxes and custom duties. In this model, the rates of taxes and import duty are set up as follows based on the past trend in Philippines.

Average income tax rate: 3.5%

Average corporation tax rate: 11.5%

Average import duty: 7%

Other tax rate: 10%

(2) Government revenue by expression

Originally, the Government fiscal revenue should be calculated by adding up the income tax, corporate tax, business tax, property tax, tariffs, indirect taxes, liquor tax, gas oil tax, royalty, inheritance tax, etc. Simply for convenience, it is obtained here with the expression below;

Government fiscal revenue = Labor distribution of GDP * Income tax rate
+ Capital distribution of GDP * corporate tax rate
+ Import amount * Import duty
+ Total GDP * other taxes rate

(3) Government revenue

Actual government revenue in the past was a little different from the above formula. This model is forecasting government revenue in the future using the growth rate that is obtained by the above formula.

Government revenue = Government revenue in the previous year * Growth rate

(4) Government expenditure (definition equation)

Major items of the Government expenditure include the general and special accounts of

the national government, the ordinary account and project account (water service, transportation) of governmental organizations, governmental corporations and local governments, and income accounts. The government expenditure remains rather constant. Generally the government expenditure is forecast by setting reasonable assumptions. With the proposed model, the Government expenditure is assumed to grow at the same as the Government revenue.

2.5 Gross Domestic Expenditure

(1) Private consumption expenditure

This item occupies more than 70% of GDP and is on the constant rise. The greatest factors that affect the private consumption expenditure are the population and per capita disposable income. The disposable income depends on individual income, and the individual income depends on the number of employees and their wage. With the proposed forecasting, this is estimated with following expression;

Private consumption = Private consumption in the previous year * (No. of households * Wage index)/(No. of households in the previous year * Wage index in the previous year)

(2) Government consumption expenditure (definition equation)

The government expenditure is divided into the government consumption and the government fixed capital formation. Most of the government consumption is shared by personnel-expenses of public servers. With the proposed forecasting, the government consumption is estimated with following expression;

Government consumption = Government consumption in the previous year
* Growth rate of government revenue

(3) Gross fixed capital formation (definition equation)

The gross fixed capital formation is the other item of the government and private investment. It is calculated as the balance remaining after the government consumption that is given higher priorities. However, because some countries can raise ample funds to finance treasury investments and loans on top of the fiscal revenue, "Fiscal revenue – government consumption" is not always equal to the government fixed capital formation.

Gross fixed capital formation = Gross fixed capital formation in the previous year * (Savings propensity + Government revenue – Government consumption)/ (Savings propensity + Government revenue – Government consumption) in the previous year

(4) Imports

In a trade-based country, imports increase in proportion to the growth of industrial output. In case of Philippines, the imports are increasing in proportion to consumer's activity. Therefore, the proposed model employs the private consumption expenditure and the gross fixed formation as the determinants of the imports.

Imports = Imports in the previous year * (Gross fixed formation + Private consumption)/(Gross fixed formation + Private consumption) in the previous year

(5) Exports (definition equation)

On the assumption that domestic industrial structure is kept in a certain shape, exports depend on specific conditions to the importing countries. Namely, the determinants of the exports are the growth of world trade, GDP growth of the importing countries, etc. Given that Philippines has to finance its long-term imports with export revenues, following assumption is taken this time; the growth rate of exports = the growth rate of imports. This means the exchange rate could be hit severely if there is a gap between the exports and imports, or without the well-balanced international payments. In other words, the international balance of payments should be always kept well-balanced.

Exports = Exports in the previous year * Growth rate of imports

2.6 Commodity Price and Deflator

(1) U.S. consumer price index (exogenous: U.S. consumer price index)

The U.S. consumer price index is taken as the world's average inflation rate. Excluding some particular periods, the U.S. consumer price index has been decoupled little from the world's inflation rate announced by the World Bank, etc. Besides, it is easier to obtain the data on the U.S. consumer price index than those on the world's average inflation rate. Many organizations forecast CPI of the U.S. as well. In this model, the growth rate of US consumer price index is assumed as 1-3% in High Case and 0.5-2.5% in Low Case from 2000 to 2025.

US CPI = US CPI in the previous year * Growth rate of US CPI

(2) Exchange rate (regression equation)

Exchange rate to US has a relationship among international balance of payment. Generally, when imports exceed exports, a currency (Pesos) becomes weak. With the proposed model, the exchange rate is obtained by regression analysis as follow.

Exchange rate = a + b * Exchange rate in the previous year * (Imports/Exports)

(3) Wholesale price index (regression equation)

Along with upgrading of industry, the capital cost outstrips the labor cost in share. (During the 1970s in Japan, manufactured goods involved 60% of the labor cost, and 40% of the capital cost.) Upgrading of industry tends to widen decoupling of WPI from the wage increases. With the proposed model, Wholesale price index (WPI) is forecast by using the expression below.

WPI = a + b * WPI in the previous year + c * (Wage index/labor productivity + USA CPI * exchange rate)

(4) Consumer price index (regression equation)

Generally the consumer price index (CPI) rises at a faster pace than WPI. CPI tends to keep rising at the same pace as in the past, and is very vulnerable to the wage increases. With the proposed model, CPI is forecast by using the expression below.

CPI = a + b * WPI + c * (Wage index/Labor productivity)

(5) Deflators by economic sector (definition equation)

The economic sector-specific deflator is necessary for calculating real value from nominal value or nominal value from real value. The growth rate of economic sector-specific deflator has following relations, which reflect productivity differentials.

Rate of primary industry's commodity price rises

>Rate of tertiary industry's commodity price rises

>Rate of secondary industry's commodity price rises

Given these relations, as well as the characters of CPI and WPI, following expressions can be given to estimate economic sector deflators.

Primary industry's deflator = 1.0 * CPI + 0.0 * WPI

Secondary industry's deflator = 0.2 * CPI + 0.8 * WPI

Tertiary industry's deflator = 0.8 * CPI + 0.2 * WPI

(6) GDP deflator (definition equation)

GDP deflator can be obtained by using the expression below.

GDP deflator = (Primary industry's added value * Primary deflator
+ Secondary industry's added value * Secondary deflator
+ Tertiary industry's added value * Tertiary deflator)/GDP

(7) International energy prices (exogenous)

Following international energy prices (FOB basis) are collected and employed as exogenous variables.

Crude oil price = Exogenous

Coal price = Exogenous

Natural gas price = Exogenous

2.7 Calculation of Nominal Values

(1) Nominal GDP

Nominal GDP is obtained by multiplying real GDP item by the deflator of the relevant industry of the three.

Nominal GDP of agriculture, fishery, & forestry
= Real GDP of agriculture, fishery & forestry * Primary industry's deflator
Nominal GDP of mining & manufacturing
= Real GDP of mining & manufacturing * secondary industry's deflator
Nominal GDP of construction
= Real GDP of construction * secondary industry's deflator
Nominal GDP of transportation & communication
= Real GDP of transportation & communication * tertiary industry's deflator
Nominal GDP of trading & commercial
= Real GDP of trading & commercial * tertiary industry's deflator
Nominal GDP of banking & service
= Real GDP of banking & service * tertiary industry's deflator
Nominal GDP of public sector & others
= Real GDP of public sector & others * tertiary industry's deflator

(2) Nominal wage index (definition equation)

The nominal wage index is obtained from the growth rate of the wage in real terms and the inflation rate.

Nominal wage index = Wage index in the previous year
* (1+growth rate of real wage + growth rate of GDP deflator)

(3) Nominal government finance (definition equation)

Nominal government finance is obtained from the growth rate of government finance in real terms and the inflation rate.

Nominal government revenue = real government revenue * GDP deflator
Nominal government expenditure = real government expenditure
* GDP deflator

(4) Nominal gross domestic expenditure (definition equation)

Nominal gross domestic expenditure (GDE) is obtained from the GDE growth rate in real terms and the inflation rate.

Nominal private consumption
= Real private consumption * GDP deflator
Nominal government consumption
= Real government consumption * GDP deflator
Nominal gross fixed formation
= Real gross fixed formation * GDP deflator
Nominal exports = Real exports * GDP deflator
Nominal imports = Real imports * GDP deflator
Nominal stocks = Real stocks * GDP deflator

(5) GDP per capita (definition equation)

Per capita GDP (in peso) = Nominal GDP/population
Per capita GDP (in US$) = Nominal GDP * Exchange rate/population

3. Energy demand forecasting model

3.1 Structure of energy demand forecasting model

1. Energy prices	Retail prices from international energy prices
2. Energy demand for agriculture sector	Forecasting fossil energy demand Forecasting electricity demand
3. Energy demand for Industry sector	Forecasting fossil energy demand Forecasting electricity demand
4. Energy demand for Residential sector	Forecasting fossil energy demand Forecasting electricity demand
5. Energy demand for Commercial sector	Forecasting fossil energy demand Forecasting electricity demand
6. Energy demand for transportation sector	Forecasting gasoline demand Forecasting diesel demand Forecasting other energy demand
7. Final energy demand	Final energy demand by energy source
8. Energy transformer sector	Power generation sector Petroleum products sector Natural gas sector Coal sector
9. Total energy demand	Final energy demand Energy consumption in transformer sector Total energy demand (excluding export)

3.2 Energy Conversion Coefficients

It is required to grasp the total of energy demand by use, in order to make energy demand forecast. To this end, energy conversion coefficients are necessary.

Energy	TOE
Crude oil	1.0000TOE/1000t
Gasoline	1.0275TOE/1000t
Aviation gasoline	1.0459TOE/1000t
Jet Fuel	1.0183TOE/1000t
Naphtha	1.0550TOE/1000t
Kerosene	1.0183TOE/1000t
Diesel	1.0000TOE/1000t
Fuel oil	0.9633TOE/1000t
LPG	1.1101TOE/1000t
Natural gas	1.2041TOE/1000t
Coal	0.6422TOE/1000t
Coke	0.7339TOE/1000t
Firewood & Others	0.2752TOE/1000t
Electricity	0.0789TOE/GWh

3.3 Energy Prices

All energy prices referred to here are the currently prevailing market prices. Accordingly, in order to obtain price elasticity, it is needed first to obtain the relative price to CPI and/or WPI.

(1) Energy import price (definition formula)

The import price is defined as CIF prices. With the proposed model, the import energy prices are determined by using the expressions below.

Crude oil import price = Crude oil price ($) * Exchange rate

Coal import price = Coal price ($) * Exchange rate

(2) Energy prices (definition equation)

The energy prices are formed by international energy prices. With the proposed model, The retail energy prices are selected as the energy prices. Their future prices are computed by the following expressions.

Crude oil	G.R. of Crude oil * Price elasticity to Inflation(0.45)
Gasoline	G.R. of Crude oil price
Kerosene	G.R. of Crude oil price
Diesel	G.R. of Crude oil price
Fuel oil	G.R. of Crude oil price
LPG	G.R. of Crude oil price
Natural gas	G.R. of Natural gas * Price elasticity to Inflation(0.45)
Coal	G.R. of Coal * Price elasticity to Inflation(0.45)
Electricity	Regression Crude oil, Natural gas, and Coal price

3.4 Energy Demand for Agriculture

(1) Energy-saving coefficients (exogenous: the rate of energy-saving)

With the proposed model, first of all, energy demand before conservation is forecasted. After that, energy demand involving energy conservation is forecasted by multiplying the energy demand before conservation by energy-saving coefficients. Accordingly, energy-saving coefficients must be prepared. The rate of energy-saving coefficient should be specified in terms of negative percentage (%).

Energy-saving coefficient = energy-saving coefficient in the previous year * the growth rate of energy-saving

(2) Energy demand forecast (definition and regression equation)

With the proposed model, the agricultural energy demand is forecast by dividing into two; fossil energy and electricity. Then, fossil energy demand is further divided by source. The below equations are the expression which is obtained by analysis for the agricultural fossil fuel and electricity demands:

Before conservation

Fossil fuel of agriculture = Fossil fuel of agriculture in the previous year * GDP growth rate of agriculture

Electricity of agriculture = a + b * (Electricity of agriculture in the previous year * GDP growth rate of agriculture)

After conservation

Fossil fuel demand after conservation
= Fossil fuel demand before conservation * Energy-saving coefficient

Electricity demand after conservation
= Electricity demand before conservation * Energy-saving coefficient

(3) Shares in energy demand by energy source mix (exogenous: shares in demand mix)
After obtained as described the above, the total fossil energy demand must be distributed among individual sources. With the proposed model, it is distributed in proportion to the shares held by individual sources in total demand, which are given as the exogenous variables.

(4) Distribution of fossil energy demand (definition equation)
Fossil energy demand by source is calculated from use-by-use demands and the shares of individual energy sources as expressed below.

Energy demand used in Agricultural sector
= Fossil energy demand in Agricultural after conservation
* Energy demand share

3.5 Energy demand for Industry

(1) Energy-saving coefficient (exogenous: the rate of energy-saving)
Same as 3.4 (1).

(2) Energy demand forecast
With the proposed model, the industry energy demand is forecasted by dividing into two; fossil energy and electricity. Then, the fossil fuel demand is further divided by source. Given below are the expressions used in forecasting the industry fossil energy and electricity demands;

Before conservation

Fossil fuel of industry = Fossil energy in industry in the previous year * GDP growth rate of industry····· (definition equation)

Electricity demand of industry = Electricity demand in industry in the previous year * GDP growth rate of industry ····· (definition equation)

After conservation

Fossil fuel demand after conservation

= Fossil fuel demand before conservation * Energy-saving coefficient

Electricity demand after conservation

= Electricity demand before conservation * Energy-saving coefficient

(3) Shares in demand by energy source mix (exogenous: shares in demand mix)

After obtained as described above, the total fossil energy demand must further be divided among individual sources. With the proposed model, it is distributed in proportion to the shares of individual sources in the total demand, which are given as exogenous variables.

(4) Distribution of fossil energy demand (definition equation)

Source-by-source energy demand is calculated from use-by-use demands and the shares of individual sources in the energy demand as expressed below.

Energy demand used in industry

= Total fossil energy demand in industry * Energy demand share

3.6 Energy Demand for Residential use

(1) Energy-saving coefficient (exogenous: the rate of energy-saving)

Same as 3.4 (1).

(2) Energy demand forecast

Residential energy is forecasted by two ways; fossil energy and electricity. Then, the forecast result for fossil energy demand is allocated among individual energy sources. Presented below are the expressions used in forecasting the fossil energy and electricity demands for the residential sector.

Before conservation

Fossil fuel demand in residential = Fossil energy in residential in the previous year * Growth rate of private consumption ····· (definition equation)

Electricity in residential = Electricity in residential in the previous year * GDP growth

rate····· (definition equation)

After conservation

Fossil fuel demand after conservation
= Fossil fuel demand before conservation * Energy-saving coefficient

Electricity demand after conservation
= Electricity demand before conservation * Energy-saving coefficient

(3) Shares in demand by energy source mix (exogenous: shares in demand mix)
After obtained as described the above, the total fossil energy demand must be allocated by source. With the proposed model, it is allocated in proportion to the shares of individual sources in the energy demand, which are given as exogenous variables.

(4) Distribution of fossil energy demand (definition equation)
Source-by-source energy demands are calculated from the use-by-use demand and the shares of individual sources in the demand mix as expressed below.

Energy demand used in residential
= Total fossil energy demand in residential * Energy demand share

3.7 Energy Demand for Commercial use

(1) Energy-saving coefficient (exogenous: the rate of energy-saving)
Same as 3.4 (1).

(2) Energy demand forecast
Commercial energy is forecasted by two ways; fossil energy and electricity. Then, the forecast result for fossil energy demand is allocated among individual energy sources. Presented below are the expressions used in forecasting the fossil energy and electricity demands for the commercial sector.

Before conservation

Fossil fuel demand in commercial = Fossil energy in commercial in the previous year *

GDP Growth rate of commercial ····· (definition equation)

Electricity in commercial = Electricity of commercial in the previous year * GDP Growth rate of commercial ····· (definition equation)

After conservation

Fossil fuel demand after conservation
= Fossil fuel demand before conservation * Energy-saving coefficient

Electricity demand after conservation
= Electricity demand before conservation * Energy-saving coefficient

(3) Shares in demand by energy source mix (exogenous: shares in demand mix)
After obtained as described the above, the total fossil energy demand must be allocated by source. With the proposed model, it is allocated in proportion to the shares of individual sources in the energy demand, which are given as exogenous variables.

(4) Distribution of fossil energy demand (definition equation)
Source-by-source energy demands are calculated from the use-by-use demand and the shares of individual sources in the demand mix as expressed below.

Energy demand used in commercial
= Total fossil energy demand in commercial * Energy demand share

3.8 Energy Demand for Transportation sector

(1) Statistics on the stocks (exogenous: the growth rate of stocks)
[Number of gasoline cars registered]
The number of gasoline cars registered can be grasped by taking the number of households * ownership and per capita GDP as the explanatory variables. However, because they could not produce a statistically significant regression expression, the growth rate of the stocks is employed as an exogenous variable.

[Number of diesel cars registered]
Because diesel cars are popular as commercial and distribution vehicles, the number of diesel cars registered can be grasped by taking GDP, etc. as the explanatory variables.

However, because they did not produce a statistically significant regression expression, the growth rate of the stocks is employed as an exogenous variable.

(2) Energy demand by transportation mode (regression equation)

Presented below are the expressions used in energy demand forecasts by transportation mode.

Gasoline demand for vehicles before conservation

= a + b * No. of gasoline vehicles + c * (Gasoline price/CPI)

Diesel demand for vehicles before conservation

= a + b * No. of diesel vehicles + c * (Diesel price/WPI)

Energy demand for vessels

= Energy demand for vessels in the previous year * GDP growth rate

Energy demand for airplanes

= Energy demand for airplanes in the previous year * GDP growth rate

(3) Motor fuel demand by type of vehicle (definition equation)

The proposed model is designed to forecast motor fuel demand by multiplying pre-conservation motor gasoline demand, as well as pre-conservation motor diesel demand, by energy-saving coefficients.

Motor gasoline demand = Motor gasoline demand before conservation

* Energy-saving rate

Motor diesel demand = Motor diesel demand before conservation

* Energy-saving rate

(4) Marine transport fuel demand (definition equation)

The marine transport fuel demand is forecasted with the expressions below by taking the fuel consumption share.

Diesel consumption for marine = Energy demand for marine

* Diesel consumption share for marine

Fuel consumption for marine = Energy demand for marine
* Fuel consumption share for marine

(5) Airplane fuel demand (definition equation)

The airplane fuel demand is forecasted with the expressions below by taking the fuel consumption share.

Jet consumption for airplane = Energy demand for airplane
* Jet consumption share for airplane

Aviation gasoline consumption for airplane = Energy demand for airplane
* Aviation gasoline consumption share for airplane

3.9 Final Consumption

Final consumption is the sum total of source-by-source energy demands by sector, including agriculture, mining, manufacturing, residential, commercial, and transportation. Crude oil is not specified as a final consumption, because it is the feedstock of petroleum products. Coal and natural gas for power generation are not included in the final consumption, either.

3.10 Transformer Sector

(1) Conversion factors from primary energy to secondary energy

[Generating efficiencies by fuel]

Listed below are the fuels used in electric power generation in Philippines, as well as their energy intensity.

Diesel generating efficiency	0.213	1000t/GWh
Fuel oil generating efficiency	0.216	1000t/GWh
Natural gas generating efficiency	0.210	1000t/GWh
Coal generating efficiency	0.339	1000t/GWh

[Conversion factors of petroleum products]

Listed below is yield of petroleum products from crude oil in refinery in Philippines.

LPG	0.099
Gasoline	0.190
Aviation gasoline	0.001
Jet Fuel	0.054
Naphtha	0.017
Kerosene	0.039
Diesel	0.354
Fuel oil	0.257

(2) Electricity sector (Definition equation)

Items	Detail item	Procedure
Electricity Demand	Final demand Others (non-specific use)	Endogenous Electricity demand * (Others in the previous year and the year before previous)/(Electricity demand in the previous year and the year before previous)
Consumption of in-plant use and loss	In-plant use & loss rate In-plant use & loss Total power generation	Exogenous Total generation - Total demand Total demand/(1 - Rate of in-plant use & loss)
Power generation by energy type	Hydro & Geothermal Other type energy Fossil energy	Exogenous Exogenous Total generation - Hydro & Geothermal generation - Other generation
Generation mix (%)	Diesel Fuel oil Natural gas Coal	Exogenous Exogenous Exogenous Exogenous
Required energy for power plant	Diesel Fuel oil Natural gas Coal	Power generation from fossil energy * Generation mix * Energy intensity

(3) Oil refinery sector (Definition equation)

Items	Detail items	Procedure
Petroleum products Demand	Gasoline	Final consumption of Gasoline
	Aviation gasoline	Final consumption of Aviation gasoline
	Jet	Final consumption of Jet
	Naphtha	Final consumption of Naphtha
	Kerosene	Final consumption of Kerosene
	Diesel	Final consumption of diesel + Diesel consumption of power
	Fuel oil	Final consumption of Fuel oil + Fuel oil consumption of power
	LPG	Final consumption of LPG
In plant consumption	Diesel	Total petroleum demand * (In-plant diesel consumption in the previous year and the year before previous)/(Total petroleum demand in the previous year and the year before previous)
	Fuel oil	Ditto
Total of petroleum Products demand	Gasoline	Final demand of Gasoline
	Aviation gasoline	Final demand of Aviation gasoline
	Jet	Final demand of Jet
	Naphtha	Final demand of Naphtha
	Kerosene	Final demand of Kerosene
	Diesel	Final demand of diesel + In-plant consumption
	Fuel	Final demand of Fuel oil + In-plant consumption
	LPG	Final demand of LPG

(5)Natural gas sector(definition equation)

Items	Detail items	Procedure
Total natural gas demand		Final consumption + Consumption for power

(6) Coal sector(definition equation)

Items	Detail items	Procedure
Total coal demand		Final consumption + Consumption for power + Self consumption
Self consumption		Total coal consumption * (Self consumption in the previous year and the year before previous)/(Total coal consumption in the previous year and the year before previous)

3.11 Total energy demand

(1) Energy demand of energy transformer sector(definition equation)

There are energy demand of energy transformer sector in the following table. The total demand of energy is the summation of energy demand of energy transformer sector and final demand.

Energies	Consumption of energy transfomer sector
Gasoline	0
Aviation gasoline	0
Jet	0
Naphtha	0
Kerosene	0
Diesel	Power plant and oil refinery plant
Fuel oil	Power plant and oil refinery plant
LPG	0
Natural gas	Power plant
Coal	Power plant and coal mine
Firewood & Others	0
Electricity	Oil refinery plant and Power plant, and Others

(2) Total energy demand by source (definition equation)

Total energy demand by source are summation of final demand and energy demand in transfomer sector.

Energies	Total energy demand
Gasoline	Final demand
Aviation gasoline	Final demand
Jet	Final demand
Naphtha	Final demand
Kerosene	Final demand
Diesel	Final demand + Consumption in transformer sector
Fuel oil	Final demand + Consumption in transformer sector
LPG	Final demand
Natural gas	Final demand + Consumption in transformer sector
Coal	Final demand + Consumption in transformer sector
Firewood & Others	Final demand
Electricity	Final demand + Consumption in transformer sector

(3) Primary energy demand by source (definition equation)

Primary energy demand by source are picked up from the total energy demand table as follows; However, as petroleum products include import

Crude oil has to be estimated from petroleum products after subtracted their import.

Energies	Total energy demand
Imported oil products	Final consumption of each petroleum products * (Imported petroleum products in the previous year/ Final consumption of each petroleum products in the previous year)
Domestic oil products	Total demand of oil products - Total imported oil products
Crude oil	a + b * (Total petroleum products consumption – Total imported petroleum consumption) ··· (regressoion)
Natural Gas	Total energy demand of natural gas
Coal	Total energy demand of coal
Electricity from Hydro & Geo	Exogenous variable

3.12 Energy demand forecast by physical unit

The energy demand in the proposed model are indicated with KTOE. In PHS sheet, the energies are shown themselves by physical unit which converted from kTOE. In the right columns of PHS sheet, some type of growth rate of energy demand are attached.

4. Natural Gas Demand and Supply Model

The natural gas demand and supply model consists of three sheets, LDF, DIN, and LPM. The LDF sheet is natural gas demand data sheet. The DIN sheet is cost data sheet. The LPM sheet is LP model sheet.

4.1 Natural gas demand in target area

Natural gas demand in industry, residential, commercial, transport, and power sectors from 2000 to 2025 are input in the sheet. These input data are exogenous variables.

	Unit	2000	2001	2002	-------	2024	2025
Tabangao	mmcfd						
Lipa City	mmcfd						
Santo Tomas	mmcfd						
Cabuyao	mmcfd						
Carmona	mmcfd						
Alabang	mmcfd						
Sucat	mmcfd						
Bacoor	mmcfd						
Pasay	mmcfd						
Manila	mmcfd						
North NCR	mmcfd						
Santa Rita	mmcfd						
San Fernando	mmcfd						
Clark	mmcfd						
Palapala	mmcfd						
Tanza	mmcfd						
Limay	mmcfd						
Orion	mmcfd						
Dinalupihan	mmcfd						
Morong	mmcfd						
Subic	mmcfd						
Cebu	mmcfd						
Davao	mmcfd						

4.2 Pileline costs

The DIN sheet is cost data sheet. Investment cost and operation & maintenance cost are input in the sheet. According to natural gas demand, optimum pipeline network is designed. There are four cases for pipeline network in the study. Pipeline investment costs in case 2 are as follows. PL-Length, PL-Size, and PL-Unit cost are exogenous variables.

PL-Operation

C	D	E	F	G	H	I	J
PL-Start	PL-End	PL-Length	PL-Size	PL-Unit cost	Distribution area	Distribution cost	Investment
		km	inch	$/m	km2	1000$/km2	Million $
Tabangao	Lipa City	28	16	350.0			9.8
Lipa City	Santo Tomas	22	16	350.0	44.0	0.44	26.9
Santo Tomas	Cabuyao	15	16	350.0	30.0	0.44	18.4
Cabuyao	Carmona	9	16	350.0	36.0	0.44	18.9
Carmona	Palapala	14.5	6	150.0			2.2
Carmona	Alabang	11	12	650.0	75.9	0.87	73.5
Alabang	Sucat	5	12	600.0			3.0
Alabang	Bacoor	10	12	600.0			6.0
Bacoor	Pasay	10	12	600.0	175.6	0.87	159.5
Pasay	North NCR	24	12	600.0	267.1	0.87	247.9
North NCR	Santa Rita	25	12	450.0	25.0	0.44	22.2
Santa Rita	San Fernando	28	12	450.0	28.0	0.44	24.8
San Fernando	Clark	20	6	150.0	40.0	0.44	20.5
Limay	North NCR	38	12	480.0			18.2
Limay	Orion	16.3	6	150.0	16.0	0.44	9.4
Orion	Dinalupihan	25	6	150.0		0.44	3.8
Dinalupihan	Subic	25	6	200.0	3.0	0.41	6.2
Tabangao	Cebu	770	16	562.0	80.0	0.57	478.0
Cebu	Davao	580	16	562.0	107.0	0.71	402.3

You should input not only investment data such as pipeline length and pipeline unit investment cost, but also pipeline operation in the column of PL-Operation. You input "1" in the cell each year if you suppose to supply gas.

In the column of PL-Capacity from H32 to H53, the pipeline capacity or upper limit of gas supplying is input. In this model, "250 (mmcfd)" was temporarily input.

In the column of PL-Investment, annual expenditure of pipeline investment was expressed. Annual expenditure of pipeline investment is calculated as the amount of principal and interest, which will be equally paid for 20 years at 12% of interest rate. Formula of annual expenditure is as follows.

Annual Expenditure = Total Investment * Capital Recovery Factor (CRF)

$CRF = i/(1-(1+i)^{-n})$ i: interest rate, n: repayment period

There is the column of Land Investment in this sheet. However, we don't have any data about land cost. Therefore, there is no data in this column now.

In the column of PL-Accum. Investment, annual expenditure of pipeline investment from start point (Tabangao) to each point was expressed. The way of calculation of the

column of Accum. Land is same as the PL-Accum. Investment.

In the column of PL-Operation Cost, annual operation and maintenance (OM) costs was expressed. Annual OM costs depend on the length of pipeline for transmission pipeline and the distribution area for distribution pipeline. OM costs were estimated based on the experience of gas distribution company in Japan. We used US$35,000/km for transmission pipeline and US$30,000/km^2 for distribution pipeline as OM costs in the model. Calculation of PL-Accum. Operation Cost is same way of PL-Accum. Investment.

Formulas of PL-Tcost and PL-Accum. Tcost are as follows.

PL-Tcost = PL-Investment + Land + PL-Operation Cost
PL-Accum. Tcost = PL-Accum. Investment + Accum. Land + PL-Accum. Operation Cost

4.3 Linear Programming Model

4.3.1 Contents of data in the LPM sheet

The LPM sheet consists of 11 columns such as demand, supply, cost, price, profit, etc. (refer to Figure 4.3.1) The model seeks optimum solution for natural gas supply system using Linear Programming (LP) Model. Variable is natural gas supply. Objective is maximum profit.

Main Columns in the LPM Sheet

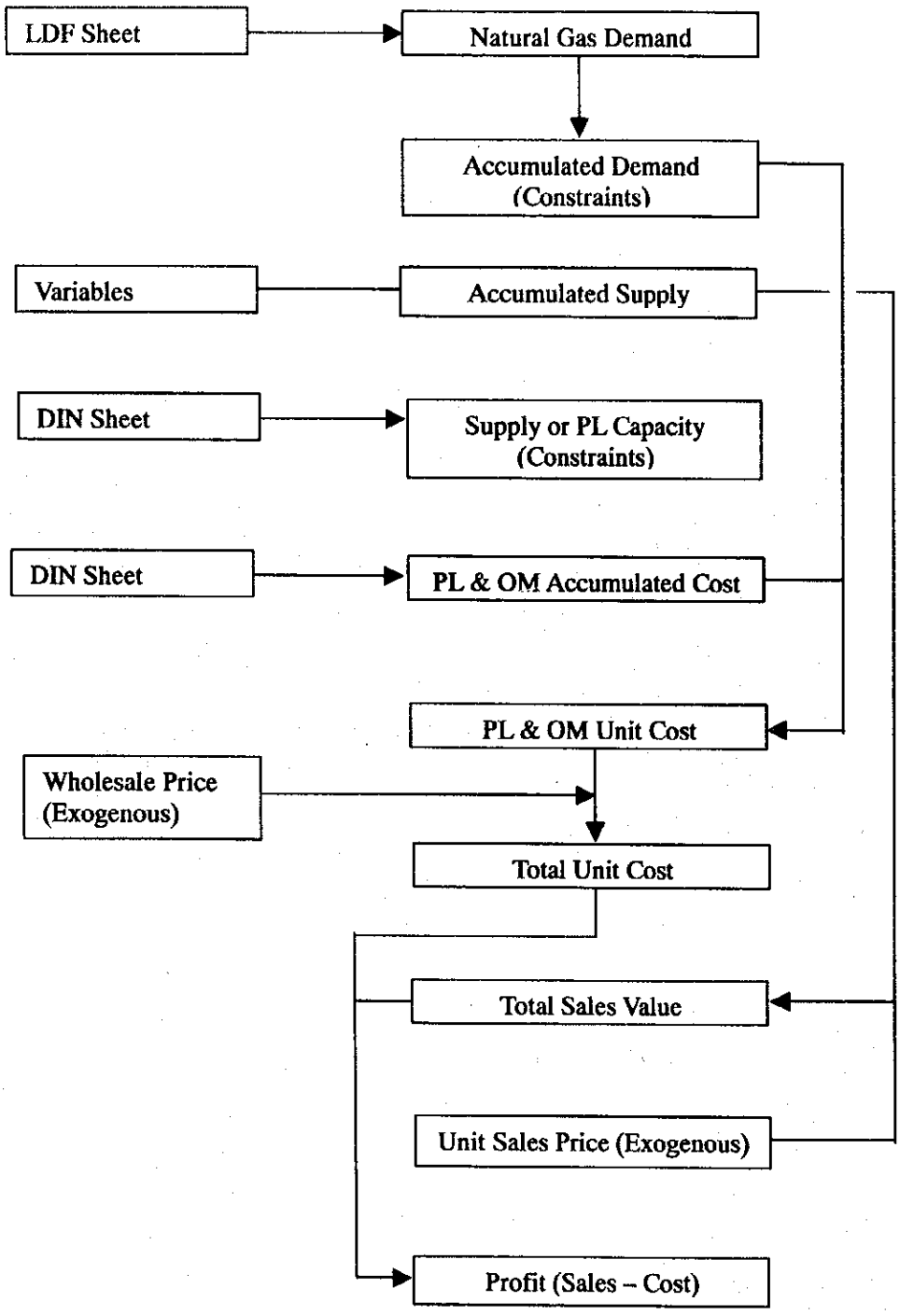


Figure 4.3.1 Flow Chart of LPM Sheet

(1) Natural gas demand

Natural gas demand in the future is exogenous variables. We estimated regional gas demand from population, regional GDP, and so on. These figures come from the LDF sheet.

(2) Accumulated gas demand

Basically, there are three routes for natural gas supplying, Tabangao – NCR, Tabangao – Bataan penunsula via Manila gulf, and Tabangao – Davao via Cebu. The starting point of accumulated gas demand is Tabangao. This column is used for constraints (Supply can not exceed demand).

(3) Accumulated gas supply

This column is variables. It is not necessary to put in any data. Solver finds optimum figures for the model.

(4) Supply and/or Pipeline capacity

This column is for constraints. When natural gas is produced from fields, production ceiling is needed, and also capacity limits of pipeline are settled as the upper limits. If supply exceeds these capacity, this constraint controls the amount of gas supply. These figures come from the DIN sheet.

(5) Pipeline and OM accumulated cost

This figure expresses annual pipeline investment and operation & maintenance cost from Tabangao to each point. These figures come from the DIN sheet.

(6) Pipeline and OM unit cost

The unit cost is obtained by divided the accumulated cost by the accumulated demand.

(7) Total unit cost

Total unit cost is obtained by adding pipeline and OM unit cost and natural gas wholesale unit price. In the model, natural gas wholesale unit price is exogenous.

(8) Sales value

Sales value is obtained by multiplying the accumulated gas supply by the gas sales price. Gas sales price is exogenous.

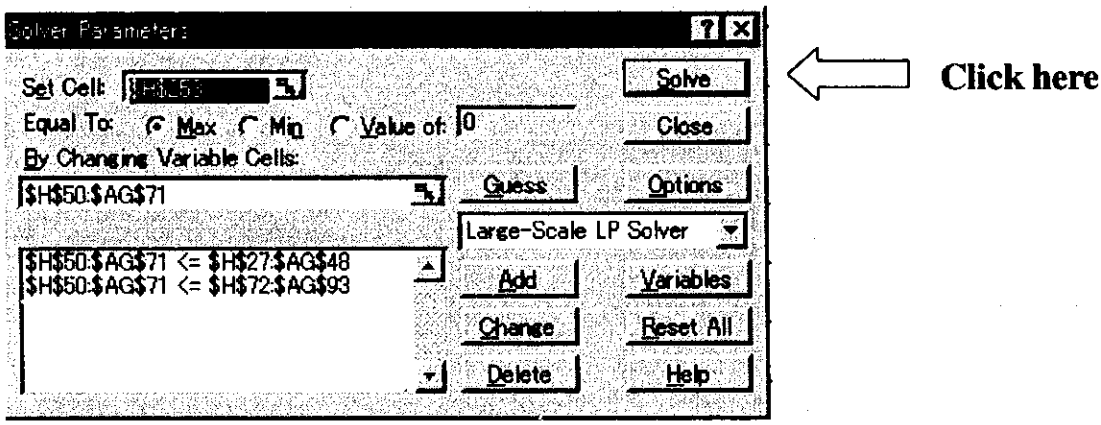
(9) Profit

Total profit is obtained by subtracting the cost from the sales as follow.

Total profit = Total sales value – Total cost

4.3.2 Solver command

The model is operated by using solver command in Excel. You can find solver command in tool menu. When you click solver command, the below screen comes out. When you change input data and want to recalculate the model, click "solve" button.

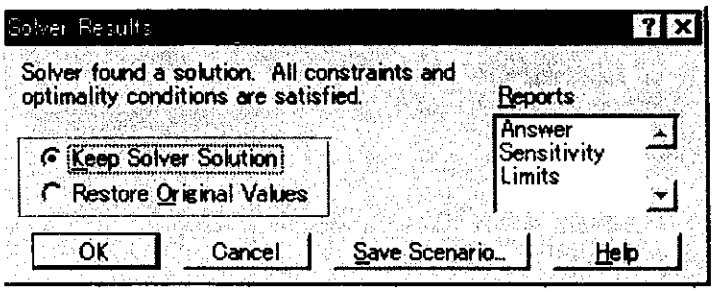


There are two constraints in the model as follows.

Accumulated gas supply <= Accumulated gas demand

Accumulated gas supply <= Supply and/or Pipeline capacity

After the solver calculated, the below message appears in the screen if all constraints and condition are satisfied.



4.3.3 Evaluation of the solution

The LPM sheet of Case 2 from line 200 to line 219 shows the results of calculation. In this example, net present value of the profit from Tabangao to North NCR is maximum (see column AL). Even if the pipeline from Tabangao to Santo Tomas was constructed, the model cannot supply natural gas until 2011 because the demand from Tabangao to Santo Tomas is small and they don't have any profit. This model says that to construct pipeline from Tabangao to North NCR brings maximum profit.

Appendix E

Model Manual for Economic / Financial Analysis

CONTENTS

1. The purposes and specification of the model

1.1 The purposes

The model calculates economic financial statements for natural gas industry sectors planned by the JICA study team. And LNG, pipeline and gas-fired power generation sectors (Power sector) are defined as the targeted sectors in the project. The following table described the outline of the sectors.

Table 1.1 The outline of the sectors

Sectors	Contents
LNG sector	1) It is a sector that re-gasifies LNG imported and sell the natural gas to pipeline and gas-fired power sectors. 2) It is considered that LNG plants are located in Batangas area and/or Bataan peninsula. The LNG plants are assumed to belong to a LNG sector in the model.
Pipeline sector	1) It is the sector that transports the natural gas using pipeline from Batangas area to the northern area of Manila via NCR. And the gas is consumed in power stations and non-power sectors (Industry, commercial and residential users). 2) Non-power sector cannot use natural gas without pipelines. And installation of the pipeline is a political matter in the model.
Power sector	1) In the Philippines, gas-fired power generation will start in 2001. However the model targets the gas-fired power generation to start beyond the year of 2006. It means that the power plants started from 2001 to 2006 are not included in the model. 2) It is defined that the power generated in the gas-fired power plants is sold to power distribution companies.

1.2 The structure of the model

The model is created on MS-EXCEL sheet and it takes over several kinds of data from macroeconomic model and other blocks. The following figures described " The relation of the models in the project".

The economic financial model posted in the last one in the study. And many kinds of data are gathered from the other models and discussion papers. The following figures show the relation of models in the study.

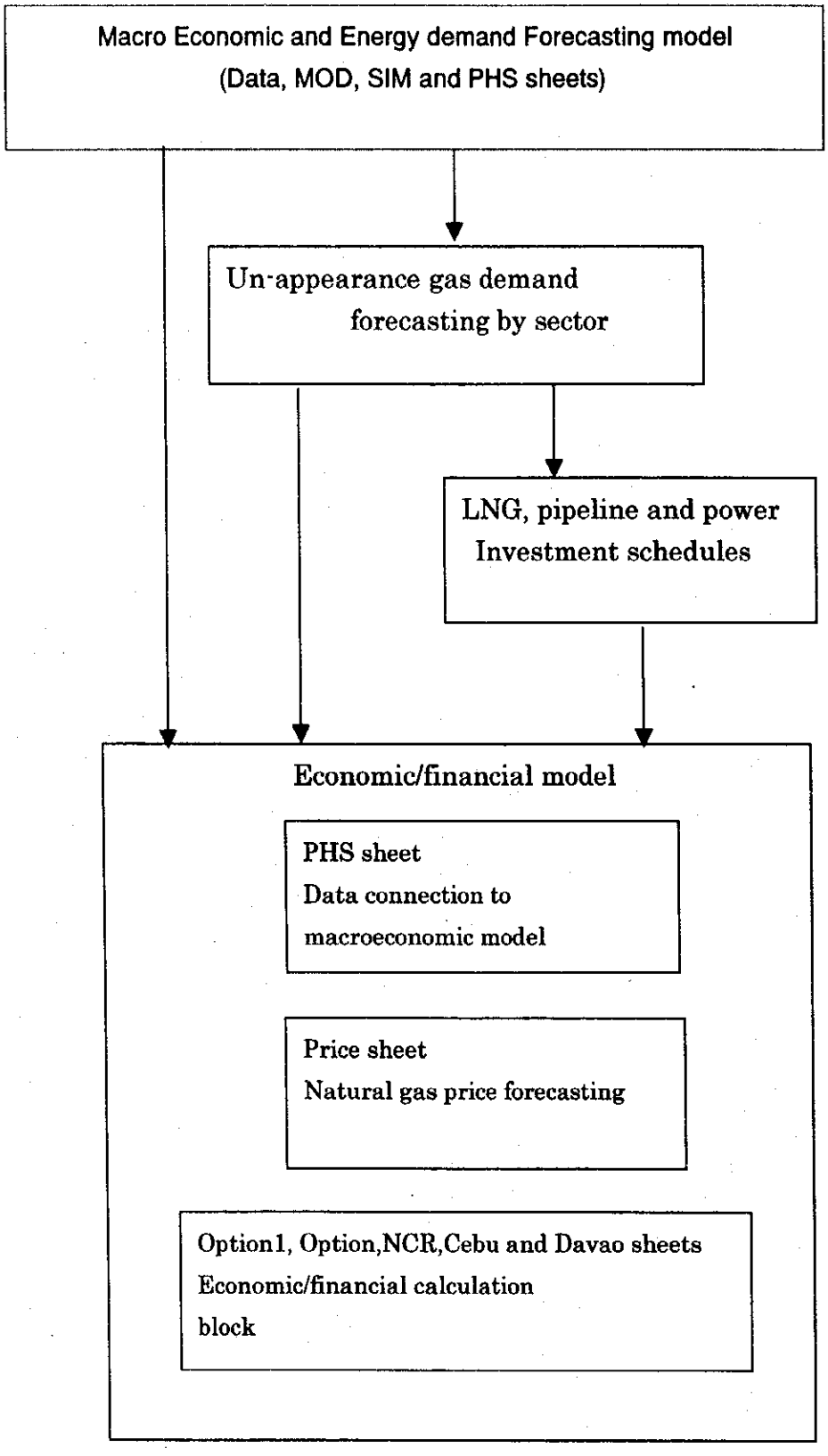


Figure 1.2 Economic financial model structure

1.3 Computer environment

The model is operated on MS-EXCEL (Upper version of Office 97). The following software and computer resources are required for the model.

Table 1.3 Computer Environment

Software & Resources	Contents
MS-EXCEL	Office97 and Office 2000
Disk	7MB for a model
Memory	More than 64K

The model consists of the following three kinds of sheets. PHS sheet receives forecasted data from macroeconomic model. The Price sheet calculates natural gas prices, petroleum products prices, and power tariffs. The option sheet (Option1, Option2, Cebu, and Davao sheets) calculates economic financial statements.

PHS sheet

PHS sheet is the same formula to PHS sheet in macroeconomic forecasting model.
You should copy PHS sheet from macro economic forecasting model when the macroeconomic model is changed.
By using this sheet, the data in macroeconomic model are taken over to the Price sheet and the option sheet.

Price sheet

Crude oil and LNG cif price, which are exogenous variables, are described in the sheet.
Petroleum products prices by sector are also estimated in the sheet
Camago/Malampaya natural gas prices are estimated in the sheet.
Natural gas prices by sector are estimated in the sheet
Natural gas unit costs by sector are described in the sheet.

Option sheet (Option1, Option2, Cebu, and Davao sheets)

Economic indicators are described
Energy demand and supply balance are described
Natural gas prices are determined
Economic financial statements of LNG, pipeline and gas-fired power generation sectors are calculated.

2. PHS sheet

2.1 The purposes

By using PHS sheet, you can take over macroeconomic data from the macro economic model. PHS sheet is the same formula to PHS sheet in the macroeconomic forecasting model. You should copy PHS sheet from macroeconomic forecasting model when the model is changed.

2.2 Data copy

Step1) "Copy" all data in PHS sheet of macroeconomic model.

Select range =G3:BC501

Step2) "Paste" all data in PHS sheet of the economic financial model

Set cursor in G3

Click "Edit"

Select "Paste special "

Select "Text"

By doing this operation, only text data in PHS sheet of macroeconomic model are copied to PHS sheet of the economic financial model.

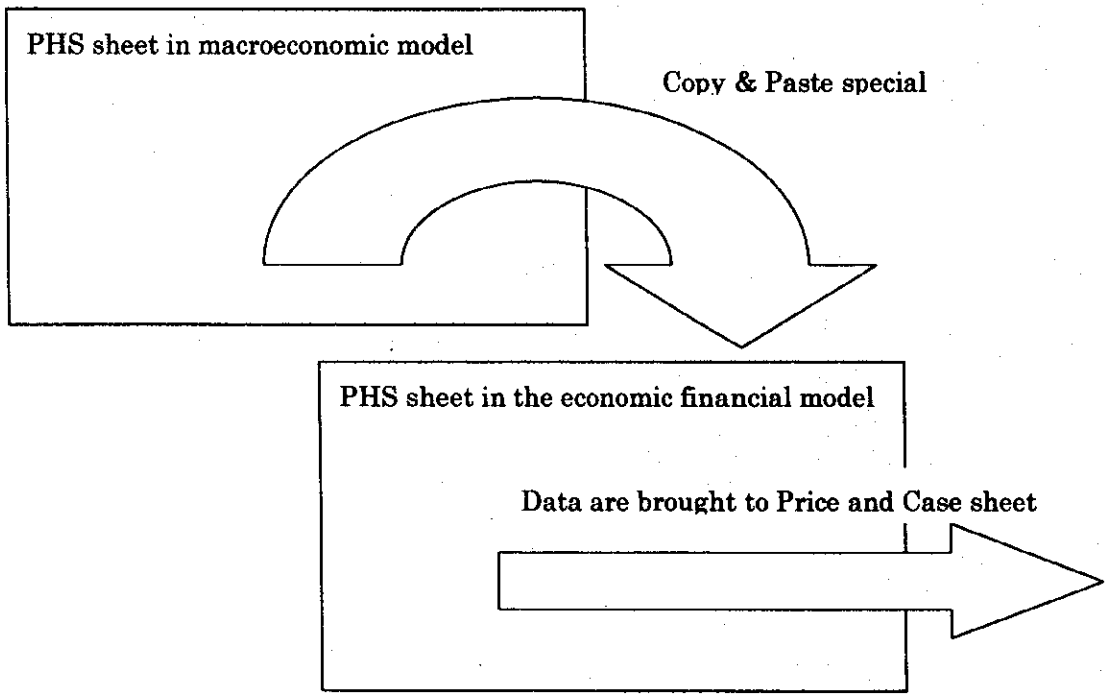


Figure 2.1 PHS sheet handling

2.3 Required data

The data that are required from the macroeconomic model are as the following tables. The data are forecasted in the macroeconomic model.

Table2.2 The required data for the economic financial analysis

Data	Unit
USA-CPI	1985=100
Exchange rate	Peso/US$
Crude oil price	$/bbl
LNG price	$/1000cf
Gasoline(Regular)	Peso/liter
Kerosene	Peso/liter
Diesel	Peso/liter
Fuel oil	Peso/liter
LPG	Peso/liter
Electricity (Average)	Peso/Kwh
Electricity(Residential)	Peso/Kwh
Electricity(Commercial)	Peso/Kwh
Electricity(Industrial)	Peso/Kwh

Table2.3 The required data for analyzing the effects to the Philippine economy

Data	Unit
Number of Labor Force	1000p
Number of workers	1000p
Government revenue	Million pesos
Private consumption	Milion pesos
Government consumption	Milion pesos
Gross fixed formation	Milion pesos
Export	Milion pesos
Import	Milion pesos
Stocks	Milion pesos
Gross Domestic Expenditure	Milion pesos

3. Price sheet

3.1 The purposes

In the Price sheet, we can calculate several kinds of natural gas prices and unit cost. The prices forecasted in the macroeconomic model are brought by the PHS sheet.

3.2 Economic indicators as exogenous variables

The crude oil price imported to the Philippines, the LNG cif price imported to the Philippines, and economic indicators of exchange rate and CPI in USA forecasted in macroeconomic model are shown in the sheet.

The crude oil price (exogenous variable) is the average import price in the Philippines, and its future values are estimated by IEA information.

The LNG price (exogenous variable: cif in the Philippines) is estimated under the assumption that the Philippines will import LNG from Australia in future. Its future values are forecasted by changes of international crude oil prices.

The exchange rate data between peso and US$ are estimated using the future export and import balance of the Philippines.

Exchange rate = f(Import value / Export value)

CPI-US (exogenous variable) is 1.0-3.0% up year by year. The industrial goods in US have an elastic value at 0.6 to CPI-US. When CPI-US is 3% up, therefore, the industrial goods indicator is 1.8% up.

Table 3.1 Economic indicators prepared for the economic financial analysis

Types	Data	Comments	UNit
Economic indicators	Crude oil		$/bbl
	LNG	Net calory value	$/1000cf
	Exchange rate		Peso/ $
	CPI in USA		1985=100

3.3 Camago/Malampaya natural gas prices

The natural gas pricing formula of Camago/Malampaya has been agreed between the gas supply company (Shell) and its users (NPC: National Petroleum Company and FGH: First Gas Holdings). The natural gas prices are important indicators for forecasting the future prices of domestic natural gas delivered to other users.

The following table shows the components of Camago/Malampaya natural gas prices that we have estimated for our study using the following expressions.

Camago/Malampaya natural gas price formula for NPC

Base price *(0.53*US-CPI increase rate

+0.075* Singapore marin bunker spot price

+0.075*Singapore products spot price

+0.075*Dubai crude oil spot price

+0.075*Oman crude oil spot price

+0.17)

Camago/Malampaya natural gas price formula for FGH

Base price *(0.43*US-CPI increase rate

+0.15* Singapore marine bunker spot price

+0.10* Singapore oil products spot price

+0.075*Dubai crude oil spot price

+0.075*Oman crude oil spot price

+0.17)

Table 3.2 Camago/Malampaya natural gas prices estimated

Types	Data	Comments	UNit	2001	2002	2003	2004	2005	2010	2015
Values in 1995	USCPI	1995=100	1995=100	141.6	141.6	141.6	141.6	141.6	141.6	141.6
	MSFO	Marin bunker spc	$/MT	103.97	103.97	103.97	103.97	103.97	103.97	103.97
	Gasoil	Oil products spot	$/bbl	21.60	21.60	21.60	21.60	21.60	21.60	21.60
	Dubai oil	Crude oil spot pri	$/bbl	16.10	16.10	16.10	16.10	16.10	16.10	16.10
	Oman oil	Crude oil spot pri	$/bbl	16.10	16.10	16.10	16.10	16.10	16.10	16.10
	NCV	MJ/kg	MJ/kg	45.70	45.70	45.70	45.70	45.70	45.70	45.70
	GCV	MJ/kg	MJ/kg	50.64	50.64	50.64	50.64	50.64	50.64	50.64
	USCPI	1995=100	1995=100	159.2	160.8	162.4	164.0	165.6	187.4	212.0
	MSFO	Marin bunker spc	$/MT	148.47	123.20	143.09	143.67	157.37	193.54	204.79
	Gasoil	Oilproducts spot	$/bbl	24.73	20.52	23.83	23.93	26.21	32.24	34.11
	Dubai oil	Crude oil spot pri	$/bbl	22.85	18.96	22.02	22.11	24.22	29.78	31.51
	Oman oil	Crude oil spot pri	$/bbl	22.85	18.96	22.02	22.11	24.22	29.78	31.51
	NCV	MJ/kg	MJ/kg	45.70	45.70	45.70	45.70	45.70	45.70	45.70
	GCV	MJ/kg	MJ/kg	50.64	50.64	50.64	50.64	50.64	50.64	50.64
NPC formula	Base price		$/GJ	4.029	4.029	4.029	4.029	3.934	3.744	3.555
	Base price	Net calory value	$/MMBtu	4.251	4.251	4.251	4.251	4.150	3.950	3.751
	GJ / mmBtu		1.055							
	NPC-NG prices		$/MMBtu	4.979	4.711	4.968	5.000	5.063	5.531	5.713
	NCV mmBtu / 1000scf		1.010							
	NPC-NG prices		$/1000scf	5.029	4.758	5.017	5.050	5.114	5.586	5.770
FGH formula	Base price		$/GJ	4.076	4.076	4.076	4.076	3.981	3.791	3.602
	Base price	Net calory value	$/MMBtu	4.300	4.300	4.300	4.300	4.200	4.000	3.800
	GJ / mmBtu		1.055							
	FGH-NG prices		$/MMBtu	5.138	4.762	5.095	5.126	5.237	5.779	5.931
	NCV mmBtu / 1000scf		1.010							
	FGH-NG prices		$/1000scf	5.189	4.810	5.146	5.177	5.289	5.837	5.990

3.4 Petroleum products prices

The petroleum products prices are forecasted in the macroeconomic model. In the economic financial analysis, the petroleum products prices are compared with natural gas prices for

analyzing natural gas cost competitiveness.

Gasoline, kerosene, diesel, LPG, and fuel oil prices are shown in the following tables. The original prices are shown with Peso/litter. They are converted to other price units such as $/1000cf and $/mmBtu.

The natural gas price in the table is the average natural gas price of National Petroleum Company and First Gas Holdings.

The petroleum products prices by end-use sector are estimated with some spread from average petroleum products prices of the above. The sizes of the spreads are estimated by actual spread in the past data.

The petroleum products prices by end-use sector are used when we estimate the future natural gas prices by end-use sector.

Table3.3 Estimation of Petroleum products prices

Types	Data	omment	UNit	2001	2002	2003	2004	2005
DOE prices	Crude oil		Peso / kg	9.5	8.3	9.9	10.1	11.2
	Gasoline(Regular)		Peso / litter	15.4	14.2	17.0	17.3	19.1
	Kerosene		Peso / litter	12.0	11.1	13.2	13.4	14.8
	Diesel		Peso / litter	12.4	11.4	13.7	13.9	15.4
	Fuel oil		Peso / kg	10.6	9.7	11.6	11.8	13.1
	LPG		Peso / litter	11.9	11.0	13.2	13.4	14.8
Peso / 1000cf p	Crude oil		Peso / 1000cf	293.2	255.7	305.2	310.8	343.0
	Gasoline(Regular)		Peso / 1000cf	543.4	501.7	598.9	609.8	673.0
	Kerosene		Peso / 1000cf	422.9	390.4	466.1	474.6	523.7
	Diesel		Peso / 1000cf	437.8	404.2	482.5	491.3	542.2
	Fuel oil		Peso / 1000cf	342.6	316.3	377.6	384.5	424.4
	LPG		Peso / 1000cf	421.4	389.1	464.5	472.9	521.9
	C/Malampaya-NG		Peso / 1000cf	269.3	265.0	289.1	294.9	302.1
$ / 1000cf price	Crude oil		$ / 1000cf	5.553	4.608	5.360	5.384	5.900
	Gasoline(Regular)		$ / 1000cf	10.292	9.041	10.516	10.563	11.576
	Kerosene		$ / 1000cf	8.010	7.036	8.184	8.221	9.008
	Diesel		$ / 1000cf	8.291	7.284	8.472	8.510	9.325
	Fuel oil		$ / 1000cf	6.490	5.701	6.631	6.661	7.299
	LPG		$ / 1000cf	7.982	7.012	8.156	8.192	8.977
	C/Malampaya-NG		$ / 1000cf	5.100	4.776	5.076	5.108	5.197
Peso / MMBTU	Crude oil		Peso / MMBT	221.0	192.7	230.1	234.3	258.5
	Gasoline(Regular)		Peso / MMBT	466.5	430.7	514.2	523.5	577.8
	Kerosene		Peso / MMBT	337.3	311.4	371.7	378.5	417.7
	Diesel		Peso / MMBT	338.6	312.6	373.2	380.0	419.4
	Fuel oil		Peso / MMBT	248.8	229.7	274.2	279.2	308.2
	LPG		Peso / MMBT	452.2	417.5	498.4	507.5	560.1
	C/Malampaya-NG		Peso / MMBT	266.6	262.4	286.2	292.0	299.2
$ / MMBTU pric	Crude oil		$ / MMBTU	4.186	3.473	4.040	4.058	4.447
	Gasoline(Regular)		$ / MMBTU	8.836	7.762	9.029	9.069	9.938
	Kerosene		$ / MMBTU	6.388	5.612	6.527	6.556	7.185
	Diesel		$ / MMBTU	6.413	5.634	6.553	6.582	7.213
	Fuel oil		$ / MMBTU	4.713	4.140	4.815	4.837	5.301
	LPG		$ / MMBTU	8.565	7.524	8.752	8.791	9.633
	C/Malampaya-NG		$ / MMBTU	5.049	4.729	5.025	5.058	5.145

Table3.4 The petroleum products prices by consumption sector

Types	Data	omment	UNit	2001	2002	2003	2004	2005
Diesel	Industry		Peso / litter	12.40	11.45	13.67	13.92	15.36
	Commercial		Peso / litter	12.48	11.53	13.75	14.00	15.44
	Transport		Peso / litter	12.48	11.53	13.75	14.00	15.44
Fuel oil	Industry		Peso / litter	10.55	9.74	11.63	11.84	13.07
Kerosene	Average		Peso / litter	11.98	11.06	13.20	13.44	14.84
LPG	Industry		Peso / litter	11.94	11.02	13.16	13.40	14.79
	Commercial		Peso / litter	12.73	11.81	13.95	14.19	15.58
	Residential		Peso / litter	13.23	12.31	14.45	14.69	16.08
Gasoline	Average		Peso / litter	15.39	14.21	16.97	17.28	19.06
Electricity	Average		Peso /kWh	5.56	5.83	6.04	5.89	5.97
	Residential		Peso / kWh	5.89	6.17	6.40	6.53	6.63
	Commercial		Peso / kWh	5.52	5.79	6.00	6.11	6.20
	Industrial		Peso/ kWh	5.26	5.52	5.72	5.04	5.07

3.5 Natural gas prices by end-use sector

In advanced countries utilizing natural gas, it is normal the natural gas prices are different by end-use sector. We defined the natural gas prices for industry, commercial, residential, and transportation sectors under the consideration.

The natural gas prices for end-use sectors should be defined with maintaining the cost competitiveness to the conventional energies including petroleum products.

For defining the natural gas prices for end-use sectors, we studied the petroleum products prices in current market in the Philippines, and defined the current natural gas prices.

Table3.5 The natural gas prices by end-use sector

Prices	Sectors	Comments	UNit			2001	2002	2003
NG sales prices	Industry	Gross calory valu	$/MMBtu	0.75		6.86	6.89	6.92
	Commercial	Gross calory valu	$/MMBtu	0.90		8.23	8.27	8.31
	Residential	Gross calory valu	$/MMBtu	1.00	8.15	9.15	9.19	9.23
	Transportation	Gross calory valu	$/MMBtu	0.83		7.59	7.63	7.66
	(Prices for Sucat p	Gross calory valu	$/MMBtu	0.72		6.59	6.62	6.65
NG sales prices	Industry		$/1000scf			7.72	7.75	7.79
	Commercial		$/1000scf			9.26	9.30	9.35
	Residential		$/1000scf			10.29	10.34	10.38
	Transportation		$/1000scf			8.54	8.58	8.62
	(Prices for Sucat power)		$/1000scf			7.41	7.44	7.48
NG sales volume	Industry		mmcfd			0.3	0.3	0.3
	Commercial		mmcfd			13.9	13.9	13.9
	Residential		mmcfd			32.7	32.7	32.7
	Transportation		mmcfd			0.0	0.0	0.0
	Total		mmcfd			47.0	47.0	47.0
NG sales price	Average		$/1000scf			9.97	10.01	10.06

The initial prices for the natural gas are the following values, and the increase rates of the

natural gas prices for end-use sectors are the same rate as the average natural gas prices in the Philippines.

3.6 FIRR & EIRR and natural gas prices/cost

This is summary table of the economic/financial model in the Option1and Option2 sheets.

FIRR, DCR, EIRR, natural gas prices, and natural gas process cost in the economic/financial model are shown in the table as important indicators for analyzing the economic/financial statements.

FIRR, DCR and EIRR are shown by sector (LNG, pipeline and power). And each natural gas prices and natural gas process cost are shown from 1) to 6).

1) NG cost at Batangas
2) LNG import cost
3) Natural gas price and its cost to power and pipeline sectors from LNG sector
4) Power price and its cost to Power distributors from power sector
5) Natural gas price and its cost to Sucat from pipeline sector
6) Natural gas price and its cost to non-power users from pipeline sector

Table3.6 The natural gas prices by supply sector

Option1	FIRR		1) NG cost at Batangas	$/1000scf
	LNG(%)	12.0%		
	Pipeline(%)	9.2%	2) LNG import cost	$/1000scf
	Power(%)	0.0%		
	DCR		3) LNG price to power and pipeline	$/1000scf
	LNG	1.1	(LNG cost)	
	Pipeline	0.8		
	Power	0.5	4) Power price to power distributors	$/kWh
			(Power cost)	
	EIRR		5) Pipeline gas price to Sucat	$/1000scf
	LNG(%)	18.0%		
	Pipeline(%)	14.4%		
	Power(%)	16.5%	6) Pipeline gas price to non power user	$/1000scf
			(Pipeline cost)	

3.7 Shadow Exchange Rate

Shadow exchange rates are used in the economic analysis. In the Philippines, the difference between shadow exchange rates and market exchange rates between Pesos and US$ was within 1% from 1995 to 1999. This means that the Philippine Pesos' shadow exchange rates almost equal to the market exchange rates. The shadow exchange rate (SER) is calculated by the following expressions.

SER = (Export total + Import total + Import tax value – Export subsidy value)
/ (Export total + Import total + Import)

In calculating the shadow exchange rate, we assumed 3% to the export total for export subsidy rate and 5% to the import total for import tax rate in the Philippines.

Table 3.7 Shadow exchange rate of the Philippine Pesos

Items		Unit	1995	1996	1997	1998	1999	Average
Market exchange rate		Peso/US$	25.7	26.2	29.5	40.9	39.1	32.3
Export	Exports in total	Billion peso	448.4	538.2	744.2	1,206.4	1,369.9	861.4
	Electric equipment	Billion peso	190.5	261.9	384.3	700.9	827.6	473.1
	Machinery & transportation	Billion peso	19.0	33.9	79.2	135.6	193.5	92.3
	Textile & garment	Billion peso	78.2	76.9	88.3	119.3	106.0	93.7
	Bananas, Mangoes, Coffee & Fish	Billion peso	22.3	18.9	19.9	28.8	26.8	23.4
	Total	Billion peso	310.1	391.7	571.7	984.7	1,154.0	682.4
Export subsidry rate	Electric equipment	%	3.0	3.0	3.0	3.0	3.0	3.0
(Tax reduction)	Machinery & transportation	%	3.0	3.0	3.0	3.0	3.0	3.0
	Textile & garment	%	3.0	3.0	3.0	3.0	3.0	3.0
	Bananas, Mangoes, Coffee & Fish	%	3.0	3.0	3.0	3.0	3.0	3.0
	Average	%	0.0	0.0	0.0	0.0	0.0	0.0
Export subsidy	Electric equipment	Billion peso	5.7	7.9	11.5	21.0	24.8	14.2
	Machinery & transportation	Billion peso	0.6	1.0	2.4	4.1	5.8	2.8
	Textile & garment	Billion peso	2.3	2.3	2.6	3.6	3.2	2.8
	Bananas, Mangoes, Coffee & Fish	Billion peso	0.7	0.6	0.6	0.9	0.8	0.7
	Total of subsidary	Billion peso	9.3	11.7	17.2	29.5	34.6	20.5
Import(FOB)	Imports in total	Billion peso	682.0	849.6	1,060.0	1,213.1	1,202.0	1,001.3
	Electrical machines	Billion peso	97.7	128.4	200.6	294.5	281.5	200.5
	Machines	Billion peso	113.1	157.2	162.3	175.9	152.5	152.2
	Base metal	Billion peso	25.7	36.7	41.3	46.2	55.6	41.1
	Mineral fuels	Billion peso	64.3	78.6	88.5	90.0	97.8	83.8
	Total	Billion peso	300.7	400.9	492.7	606.5	587.4	477.6
Import tax rate	Electrical machines	%	5.7	5.7	5.7	5.7	5.7	5.7
	Machines	%	5.8	5.8	5.8	5.8	5.8	5.8
	Base metal	%	8.0	8.0	8.0	8.0	8.0	8.0
	Mineral fuels	%	5.4	5.4	5.4	5.4	5.4	5.4
	Average	%						
Import tax	F	Million peso	5.5	7.3	11.4	16.7	15.9	11.4
	G	Million peso	6.6	9.1	9.4	10.2	8.9	8.8
	H	Million peso	2.0	2.9	3.3	3.7	4.4	3.3
	I	Million peso	3.5	4.2	4.8	4.8	5.3	4.5
	Total	Million peso	17.6	23.5	28.8	35.4	34.5	28.0
Shadow Exchange Coefficient			1.0	1.0	1.0	1.0	1.0	1.0
Shadow Exchange Rate		Peso/US$	25.9	26.4	29.7	41.0	39.1	32.4

3.8 Account table for gas utility promotion program

For prompting NGV, gas co-generation, and gas air-conditioner, the Philippine government requires several kinds of tax credits and natural gas price credit. The following table shows the accounts of the expenditure of the tax credit and government income from Camago/Malampaya natural gas royalty.

(1) NGV promotion policies

We prepare the following three policy measures for promoting NGV in the Philippines.

Private filling station investment credit program (50% tax credit for the investment)

Public filling station investment program (100% tax credit for the investment)

Natural gas price discount program (50% discount for natural gas price)

Table3.8 NGV promoting policy measure program

Equipment	Classification	Items	Unit			
NGV incentive program	Filling station investment Credit pr	NO. of filling station	sets			
		(accumulative)	sets			
		Filling station unit cost	1000 $			
		Filling station cost	1000 $			
		Credit value	1000$	50	% to filling station cost	
	Public filling station	No. of filling station	sets			
		(accumulative)	sets			
		Filling station unit cost	1000 $			
		Filling station cost	1000 $			
		Credit value	1000 $	100	% to filling station cost	
	NG price discount Credit program	NO.of vehicles	1000 vehicles			
		(Vehicles per day)	vehicles			
		NG consumption per vehicle	Nm3/vehicle/one tir	30	Nm3/vehicle/one time	
		NG price	$ /1000cf			
			$/Nm3			
		NG consumption value	mmcfd			
		NG consumption value	1000 $			
		Credit value	1000 $	50	% to NG consumption value	
	Credit total					

(2) Gas co-generation promotion

We prepare the following two policy measures for promoting gas co-generation in the Philippines.

Tax credit for investment of commercial use co-generation qualified

Tax credit for investment of public use co-generation qualified

Table3.9 Gas co-generation incentive program

Equipment	Classification	Items	Unit			
Gas co-generation	Commercial use co-generation	No. of co-generation	sets			
investment tax credit	qualified	Co-generation unit cost	1000$ / set			
		Investment value	1000 $			
		Credit value	1000 $	20	% Assistance to investment value	
	Public use co-generation	No. of co-generation	sets			
	qualified	Co-generation unit cost	1000$ / set			
		Investment total	1000 $			
		Credit value	1000 $	30	% Assistance to investment value	
	Credit total					

(3) Gas air-conditioner promotion

We prepare the following two policy measures for promoting gas air-conditions in the Philippines.

Tax credit for investment of commercial use co-generation qualified

Tax credit for investment of public use co-generation qualified

Table3.10 Gas air-conditioner incentive program

Equipment	Classification	Items	Unit			
Gas air-conditioning	Commercial use air-conditions	No. of air-conditioning	sets			
investment tax credit	qualified	Air-condition unit cost	1000$ / set			
		Investment value	1000 $			
		Credit value	1000 $	20	% to investment value	
	Public use air-conditions	No. of air-conditioning	sets			
		Air-condition unit cost	1000$ / set			
		Investment total	1000 $			
		Credit value	1000 $	30	% to investment value	
	Credit total		1000 $			

(4) Gas conversion promotion

We prepare the following three policy measures for promoting gas conversion in the Philippines.

Tax credit for investment of industrial use gas-conversion qualified

Tax credit for investment of commercial use gas-conversion qualified

Tax credit for investment of residential use gas-conversion qualified

Table3.11 Gas conversion incentive program

Equipment	Classification	Items	Unit			
Gas conversion	Industrial use gas conversion	No. of gas-conversion	sets			
investment tax credit			Same accumulated			
		Gas conversion unit cost	1000$ / set			
		Investment value	1000 $			
		Credit value	1000 $	20	% to investment value	
	Commercial use gas conversion	No. of gas-conversion	sets			
			Same accumulated			
		Gas conversion unit cost	1000$ / set			
		Investment value	1000 $			
		Credit value	1000 $	30	% to investment value & Corporate tax 32	
	Residential use gas-conversion	No. of gas-conversion	sets			
			Same accumulated			
		Gas conversion unit cost	1000$ / set			
		Investment total	1000 $			
		Credit value	1000 $	40	% to investment value & Corporate tax 32	
	Credit total					

(5) Credit value and credit rates to Camago/Malampaya natural gas royalty

We assume C/M natural gas royalty for the fund resources of the above tax credit and natural gas discount. Therefore, we calculate the credit values and the ratios between the value and C/M natural gas royalty income in the following table.

NGV credit value and rate to C/M natural gas royalty

Gas co-generation credit value and rates to C/M natural gas royalty

Gas air-conditioner credit value and rates to C/M natural gas royalty

Gas conversion credit value and rates to C/M natural gas royalty

Table3.12 Credit value and credit rates to C/M natural gas royalty

	Types	Data	Comments	2002	2003	2004	2005	2006
Credit total	NGV credit total		1000 $					2,658
	(Ratio to Royalty)		%					(3.13)
	Gas cogene credit total		1000 $					2,200
	(Ratio to Royalty)		%					(2.59)
	Gas air-con credit total		1000 $					1,540
	(Ratio to Royalty)		%					(1.81)
	Gas conversion credit total		1000 $					172
	(Ratio to Royalty)		%					(0.20)
	Credit Grand Total		1000 $					6,570
	(Ratio to Royalty)		%					(7.73)
C/M natural gas	Net National Government reve		Million $	71.9	89.8	88.3	86.5	85.0
Royalty Income	Local government revenue		Million $	47.9	59.9	58.9	57.7	56.7
	Income tax from Gas prifit		Million $	54.8	58.4	67.3	65.9	64.8
	Total Government revenue		Million $	174.6	208.1	214.5	210.1	206.4

4. Option sheet

4.1 The purposes

We call Option1, Option2, Cebu and Davao sheets as "Option sheet". Target sectors in the economic/financial analysis of the project are LNG supply, gas pipeline, and gas-fired power generation. Then we set the three sectors and prepared financial statements and some policy variables, which are shown in the following table. The policy variables are set in the model for directing the control of gas flows, which starts with natural gas production and/or importation, is followed by gas transportation by pipeline, and finally ends with natural gas consumption in the power generation sector and non-power users, which belong to the industry, commercial, transportation, or residential sectors.

Table 4.1 Setting policy variables for the sectors

Sectors	Contents
LNG sector	1) This sector regasifies imported LNG and sells the natural gas to pipeline and gas-fired power sectors. 2) We defined that domestic natural gas price is given for the sectors and LNG price imported can be change politically as exogenous variables. 3) It is considered that LNG plants are located in Batangas area and/or Bataan peninsula. The LNG plants are assumed to belong to a LNG sector in the model.
Pipeline sector	1) This sector transports the natural gas using a pipeline from Batangas area to the northern area of Manila via NCR. The gas is consumed in power stations and non-power sectors (Industry, commercial and residential users). 2) Non-power sector cannot use natural gas without a pipeline. Installation of the pipeline, as well as decision on the natural gas price for users are political variables in the model.
Power sector	1) In the Philippines, gas-fired power generation will start in 2001. However, the model targets the gas fired power generation to start beyond the year of 2006. It means the power plants that started from 2001 to 2006 are not included in the model. 2) It is defined that the power generated in the gas-fired power plants is sold to power distribution companies. Then the sales price from the generation sector to distribution companies is lower than the retail power tariff.

(Note 1) Camago/Malampaya natural gas price is calculated in line with the natural gas price agreement of the related companies. outside the model.

(Note 2) Power sector in the model has a power transmission block to calculate the transmission cost.

4.2 Economy block

There are two indicators in the block. The data are brought from "Price" sheet. And CPI-US indicators with two different basic years are prepared. One is "1985=100", another is "2001=100". The inflation rate of the US construction indicator is calculated by "CPI-US inflation rate * 0.6". The 0.6 is elastic value of industrial products price index in USA to CPI-USA.

Construction inflation index = Construction inflation index $_{-1}$*(1+CPI inflation rate * 0.6)

Table 4.2 Economic indictors used in economic/financial model

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
Economic co	CPI of USA		1985=100		165.5	165.5	165.5	165.5	165.5
			2001=100		105.0	105.0	105.0	105.0	105.0
	Construction inflation		2001=100	0.6	103.0	103.0	103.0	103.0	103.0

4.3 Financial condition block

(1) Currency

We use US$, not the Philippine Peso, for the currency unit in the model, because the US$ has been comparatively stable in recent years and is usually used for economic/ financial analyses in projects other than natural gas in the Philippines.

(2) Project Life and Base Year

We set the year at 2001, when domestic natural gas is to be supplied from Camago / Malampaya, as the starting year of gas-related projects. The year (2001) is also set to be the base year for the present value method, and the final year of the project is 2025. Therefore, the project calculation term is from 2001 to 2025.

The first investment for constructing pipelines will be made in 2006. Accordingly, the project life is around 20 years (from 2006 to 2025). We target all investments in the analysis, which will be made from 2001 and 2025, although we do not target additional investments beyond 2026, because the effects of the investments will not appear within the project life.

Table 4.3 Base year and project life

Items	Year	Term
Base year	2001 (Present value)	
Calculation term	2001 -- 2025	25 years
Project life	Starting year -- 2025	20 years

(3) Depreciation

Depreciation for the sectors is calculated by the straight-line depreciation method, and the residual values (scrap value) of installed machines and equipment in all sectors are determined to be 10% of acquisition value. The depreciation term is 20 years for each sector.

a. LNG sector

We define that the depreciation term of LNG related facilities is 20 years, although concrete houses and buildings are usually depreciated over 20 to 30 years. The fact that re-gasification plants and gas storage tanks are depreciated for 10 to 20 years is one of the main reasons.

Additional investments are often made in the sector, and many assets remain un-depreciated at the end of the term if the depreciation term is as long as 20 years. This is another reason we set the term to be 20 years.

b. Pipeline sector

We define that the term for the pipeline sector is 20 years. Usually, the depreciation term is from 20 to 25 years for the pipeline sector. By defining the term to be 20 years, the end of the depreciation term is in agreement with the end of the calculation term of the model, because we assume investments on pipelines will start five years after the base year.

c. Power generation sector

We define the depreciation term for the power sector to be 20 years. The breakdown of investments in the power sector is not available for the analysis, while the depreciation term for machines and equipment except housing and civil works for the sector is usually 10 to 20 years.

d. Amortization term of L.T. L. interest in pre-operation term

We define that the amortization term for pre-operation assets is 10 years. The amortization term is applied to all target sectors. Usually, the term actually applied is five years in corporate financial statements. In the analysis, however, the term of 10 years is adopted, because the sectors have a huge amount of pre-operation assets (accordingly, a large amount of interest), therefore, they cannot enjoy a very high profit.

Table 4.4 Depreciation and amortization term

Items	Sectors & assets	Term
Depreciation Term	LNG	20
	Pipeline	20
	Power	20
Amortization Term	Pre-operation assets	10

(4) Short-Term Loan

When a project needs working capital and/or others short-term loans (S.T. L.) can be supplied by domestic banks. We set the interest rate of S.T. L. at 7%, referring to the rates shown in the following table, in addition to actual interest rates recorded in Meralco's accounting report.

The estimated nominal rate of S.T.L. is 15%, and the effective interest rate of S.T.L. is 7.0%, as shown in the table. This means that the project has to pay an interest rate of 15% to domestic banks for a short-term loan on a Peso basis. However, the project will have to pay an interest rate of around 7% (effective interest rate) for loans from U.S. banks.

Table 4.5 Interest rates of short-term loans in the Philippines

	Manila Reference rates (Deposit rate)	Bank Average Lending Rates (A) (Int. rate of S.T.L)	CPI For the whole Country (B)	Effective interest rate of S.T.L. (A)-(B)
1994	11.6	15.0	8.3	6.7
1995	10.0	14.6	8.0	6.6
1996	11.7	14.8	9.0	5.8
1997	13.1	16.2	5.9	10.3
1998	15.4	16.0	9.8	6.2
1999	15.4	16.0	6.7	9.3
Average	12.9	15.4	7.9	7.5
Estimated value	12.0	15.0 (Nominal rate)	8.0	7.0 (Effective rate)

(Note) Manila Reference rates: Promissory notes and time deposit transactions

(Sources)Philippine Statistical Year Book

(5) Long-term Loan

a. Financing by long-term loans

We assume that 75% of the required capital will be financed by long-term loans and that all of the loans will come from foreign countries. As a result, a withholding tax of 10% on the interest of L.T. L. will be levied for the long-term loans, except international development bank loans.

b. Repayment term of L.T. L.

The repayment terms and grace periods of the international development agencies are shown in the following table. Referring to these, we assume that the repayment term of long-term loans is 10–30 years. However, the 10 years, the period in which the principal of a long-term loan need not be paid("grace period"), is exclusive of the repayment term.

Table 4.6 Repayment term and grace period

International Development Agencies	Repayment term	Grace period
World Bank	15 - 20	5
International Finance Corporation	3 - 13	Max 8
Asia Development Bank	10 - 30	3 – 7
Japan Bank for International Cooperation	10 - 30	Case by case
(Foreign commercial bank)	(5-10)	(Case by case)

(Sources) Referred to the homepage of each facility

c. Interest rate of long-term loan

According to "The Philippine Statistical Yearbook 2000", the interest rate of long-term loan is 18%(The term of a long-term loan is usually one year in the Philippines), which is shown in the following table. This means that the rate of domestic L.T.L. is "Interest rate of short-term loan + 3%(spread)."

Table 4.7 Long-term loans in the Philippines

Long-term loan	Items	Contents
Long-term loan in local banks	Repayment term for Local L.T.L.	1 year
	Nominal Interest rate of Local L.T.L.	18.0%

It is difficult for a project to have long-term loans with a repayment term of more than one year from domestic banks in the Philippines. In this case, the project needs to have long-term loans from foreign or international development facilities.

The interest rates of international development facilities are shown in the following table. Project finance is usually a combination of financing from several banking institutions, including commercial banks and international development facilities. Therefore, the interest rate of long-term loans can be calculated as their average.

Table 4.8 Long-term loans in the Philippines

Agencies	Interest rate	As of
World Bank	6.4%	Jan-Jun 98
International Finance Corporation	Market rate	
Asia Development Bank	6.0 - 6.8%	As of April 98
Japan Bank for International Cooperation	1.3 - 2.0%	As of June 200 1
(Foreign commercial bank)	(7 %)	

(Sources) Referred to the homepage of each facility

The interest rates of L.T.L. in the following table are set in the model. It is assumed that the project takes out long-term loans from foreign commercial banks, International development facilities A (IDF-A), and International development facilities B (IDF-B).

Table 4.9 Shares of L.T.L. and interest rates in the model

Agencies	Shares of loan	Interest rate	Repayment term	Grace
Foreign bank	25%	7.7%	10 years	Nothing
IDF-A	25%	2.0%	20 years	10 years
IDF-B	25%	7.0%	20 years	10 years

(Note 1) The remain(25% fund) comes from own capital.
(Note 2) The average interest rate of L.T.L. is 4.5%

(6) Labor Cost

There are several kinds of labor cost for building and maintaining the project. Table 6-2-9 below shows the income statistics of the Philippines.

a. Labor cost of operators

Operators work, for instance, to construct gas refining plants and pipelines, as well as maintain gas-fired power plants and LNG terminals. They are required to have the capabilities and the technologies necessary for the operation, which are equivalent to high-school graduate level. Labor cost of an operator is estimated to be 100,000 Pesos / year ($2000) in 2001. They also need employee benefits and welfare facilities. It is considered that labor cost including employee benefits and welfare facility cost is 120,000 peso ($2,400).

b. Salaries of administrators and engineers

Administrators and engineers work for gas production facilities and in corporate administrations. They are required to have capabilities equivalent to a college and university graduate level. Salaries of administrators and engineers are estimated to be 300,000 Pesos / year ($6,000) in 2001.

Table 4.10 Household income in urban areas in 1997

Income class	Number of families (1,000 households)	Average (Pesos / year)
Under 10,000	8.1	7,612
10,000 – 19,999	82.9	15,971
20,000 – 29,999	181.3	25,578
30,000 – 39,999	297.1	35,099
40,000 – 49,999	367.3	45,024
50,000 – 59,999	372.9	54,921
60,000 – 79,999	816.4	70,039
80,000 – 99,999	715.3	89,772
100,000 – 149,000	1348.8	122,950
150,000 – 249,000	1391.2	192,049
250,000 – 499,000	870.7	332,043
500,000 – over	298.7	1,022,447

(Sources) Philippine Statistical Yearbook

(7) Maintenance, Sales, and Factory Expenses and Others

Maintenance cost (factory expenses, spare parts, and utilities) is defined to be 1% to 5% of investment value. The costs of utilities, which LNG and pipeline related facilities use, are included in the maintenance costs. Sales and administration costs are assumed to be 5% of sales value in the LNG, pipeline and power sectors, respectively. We assume that the insurance cost of each sector is 1% of acquisition value of fixed assets.

Table 4.11 Maintenance, sales, administration, and insurance costs

Fixed cost items	%	Multiplicand
Maintenance cost: LNG	1.0	% of acquisition value of assets
Pipeline	1.0	Same as above
Power	5.0	Same as above
Sales cost, administration cost	5.0	% of sales value
Insurance cost	1.0	% of acquisition value of assets

(8) Tax Rate

Taxes related to the LNG, pipeline, and power sectors are shown in the following table.

Table 4.12 Tax rates related to the project

Tax items	%	Multiplicand
VAT tax	10.0	% of "sales value – variable cost"
Real property tax	2.0	% of assessment value in NCR
	1.0	% of assessment value in Provinces
Business tax (Local tax)	0.5	% of sales value
Corporate tax	32.0	% of before tax profit
Customs tax	3.0	% of crude oil
	3.0	% of imported petroleum products price
	3.0	% of LNG (from 2003)
Withholding tax	10.0	% of interest rate

(Sources) The Tax reform act of 1997 in Philippines

In the economic analysis, all kinds of tax values are dealt with as income for the Philippine government.

Table 4.13 Financial condition block

Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
LNG interest rate	Commercial L.T.L	R-term, %	10	7.7%	7.7%	7.7%	7.7%	7.7%
		G-term	0					
	Develop. L.T.L	R-term, %	20	4.5%	4.5%	4.5%	4.5%	4.5%
		G-term	10					
Pipeline interest rate	Commercial L.T.L	R-term, %	10	7.7%	7.7%	7.7%	7.7%	7.7%
		G-term	0					
	Develop. L.T.L	R-term, %	20	4.5%	4.5%	4.5%	4.5%	4.5%
		G-term	10					
Power interest rate	Commercial L.T.L	R-term, %	10	7.7%	7.7%	7.7%	7.7%	7.7%
		G-term	0					
	Develop. L.T.L	R-term, %	20	4.5%	4.5%	4.5%	4.5%	4.5%
		G-term	10					
Short term loan		%		7.0%	7.0%	7.0%	7.0%	7.0%
Discounting	Rate	%	12.0%					
	Discounting factor	%		0.567	0.507	0.452	0.404	0.361

Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
Taxes	Value added tax	%		10.0%	10.0%	10.0%	10.0%	10.0%
	Asset tax	%		1.0%	1.0%	1.0%	1.0%	1.0%
	Business tax	%		0.5%	0.5%	0.5%	0.5%	0.5%
	Corporate tax	%		32.0%	32.0%	32.0%	32.0%	32.0%
Customs	Import LNG	%		3.0%	3.0%	3.0%	3.0%	3.0%
	Import plant	%		5.0%	5.0%	5.0%	5.0%	5.0%
	Import other materials	%		5.0%	5.0%	5.0%	5.0%	5.0%
Wage	Wages unit cost	US$/person		2,560	2,624	2,689	2,757	2,826
Other cost	Sales cost & administration	%		5.0%	5.0%	5.0%	5.0%	5.0%
	Insurance	%		1.0%	1.0%	1.0%	1.0%	1.0%
Depreciation term	LNG	years	20					
	Pipeline	years	20					
	Power	years	20					
Working capital	LNG	months		3.0	3.0	3.0	3.0	3.0
	Pipeline	months		3.0	3.0	3.0	3.0	3.0
	Power	months		3.0	3.0	3.0	3.0	3.0
	Total	months		3.0	3.0	3.0	3.0	3.0

4.4 Energy balance block

Supply and demand balance for natural gas are described in the block, the demand are separated to power sector and non-power sector. The gas demand to the power is also separated to direct-supply demand and indirect- supply demand. And the indirect-supply demand for power sector use the pipeline. The gas demand to non-power sector is also supplied through pipeline.

The gas demand area is Luson, Cebu/Mactan, and Davao area. The most of the gas demand is in Luson area.

The natural gas is supplied from Camago/Malampaya natural gas stations and LNG stations.

We enter the demand / supply data in the energy balance block. The economic/ financial statements are calculated using the energy balance data.

Table 4.14 Energy balance block

Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
Power supply	Power from gas	GWh		2054	2147	4386	8221	10351
Gas supply to Power	DNG for Batangas & Bataan po	mmcfd		36	38	38	38	75
	DNG for Sucat & Auto-pro pov	mmcfd		0	0	39	74	74
	LNG for Batanagas & Bataan p	mmcfd		0	0	0	32	32
	LNG for Sucat & Auto-pro pow	mmcfd		0	0	0	0	0
	Total	mmcfd		36	38	77	144	181
Gas supply to Non-powe	DNG for non power(by pipelin	mmcfd		0	0	0	0	0
	LNG for non power (by pipelin	mmcfd		6	9	12	16	21
	Total	mmcfd	1,298	6	9	12	16	21
Gas supply to All sectors	DNG	mmcfd	506	36	38	77	112	149
	LNG	mmcfd	857	6	9	12	47	52
	Total	mmcfd	1,363	42	46	89	159	201
Gas cost	DNG(Expense at Batanagas)	1000US$	1,079,971	69,166	75,910	153,789	235,695	311,174
	LNG(Import cost)	1000US$	1,961,100	12,063	17,410	23,927	95,688	106,685
	Total	1000US$	3,041,070	81,229	93,320	177,715	331,383	417,859

4.5 Pricing block

In pricing block, the prices used in the economic financial model are set. The profit, FIRR, DCR, EIRR and so on of all sectors (LNG, pipeline, and power sectors) are controlled by the prices. The following prices and the unit cost are set in the block.

C/M natural gas price with the agreement

➔ National Petroleum Corporate and First gas holdings

LNG cif

➔ Assumed The LNG comes from Australia

LNG import duty

➔ 10% until 2002, 3% from 2003

LNG import cost

➔ LNG cif + LNG import duty

Natural gas sales price from LNG sector to pipeline and power sector

➔ LNG import cost + Re-gasification cost

Natural gas sales price from pipeline sector to power and non-power

➔ Gas cost (weighted average of C/M gas & LNG gas) + Pipeline cost

Power sales price from power sector to Power-distributors

➔ Natural gas cost + gas-fired power generation fixed cost

Table 4.15 Natural gas pricing block

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
NG cost	DNG cost	C/M pricing agreement	$/mmBtu		5.23	5.49	5.44	5.71	5.66
		C/M pricing agreement	$/1000scf		5.28	5.54	5.50	5.77	5.71
		Batangas sales prices	$/1000scf		5.28	5.54	5.50	5.77	5.71
	LNG cost	LNG cif	$/mmBtu		4.62	4.67	4.73	4.78	4.83
		LNG cif	$/1000scf		5.20	5.26	5.32	5.38	5.44
		LNG imort duty	%		3.0%	3.0%	3.0%	3.0%	3.0%
		LNG import cost	$/1000scf		5.36	5.42	5.48	5.54	5.60
Sales prices	LNG sales price	to pipeline and power	$/1000scf	36.0%	7.29	7.37	7.45	7.53	7.62
		(LNG unit cost)	$/1000scf		22.29	17.32	14.30	8.29	8.15
		LNG FIRR	%	13.8%					
	DNG sales price	to pipeline & power	$/1000scf	0.0%	5.28	5.54	5.50	5.77	5.71
	Pipeline gas price	to power	$/1000scf	0.0%	7.63	7.72	7.80	7.89	7.98
		(NG unit cost)	$/1000scf		10.12	9.36	7.79	7.73	7.81
	Pipeline gas price	to non-power	$ / 1000scf	0.0%	10.23	10.34	10.46	10.57	10.69
		(NG unit cost)	$/1000scf		17.25	15.58	8.19	7.77	7.90
		Pipeline FIRR	%	11.4%					
	Power sales price	to Power-distributos	$/KWh	-23.0%	0.060	0.061	0.061	0.062	0.063
		(Power unit cost)	$/kWh		0.059	0.064	0.071	0.072	0.072
		Power FIRR	%	0.0%					

4.6 LNG sector

(1) Capital plan

The LNG plants are built in Batangas and Bataan area in Option1 and Option2. Then, the LNG **investment values** in Batangas are set in the upper line of the investment data area. And ones in Bataan are set in the lower line of the investment data area. The data are affected

by the inflation rate.

The **operation costs** include assets tax, insurance, maintenance cost and manpower cost are calculated. Then we have to set the asset tax rate, insurance rate, and maintenance cost rate to acquisition asset values, and manpower for calculating the manpower cost.

Depreciation cost is calculated in the block. For the calculation, assets to be depreciated, depreciation term, and scrap value rate of the assets are prepared. As the results of the calculation, accumulative depreciation and booked assets are calculated.

Repayment of the long-term-loan is calculated in the block. For the calculation, long-term loans from commercial banks and international development facilities, repayment term, grace term of L.T.L. and own capital are prepared. Repayment of commercial bank's L.T.L and international development facility's L.T.L. are calculated separately.

Interest payables & Amortization of L.T.L. is calculated. The interest payable of L.T.L. in pre-operation term is depreciated as amortization. The interest payable of L.T.L. in operation term is accounted as one of operation cost.

Table 4.16 Capital plan block for LNG sector

Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
Investment	Plant cost(Batangas)	1000 US$						
	Plant cost(Limay)	1000 US$						
	Total	1000 US$		0	0	0	0	0
	(Acquisition assets)	1000 US$		335,722	335,722	335,722	335,722	335,722
Operating cost conditio	Assets tax	%		1.0%	1.0%	1.0%	1.0%	1.0%
	Insurance	%		1.0%	1.0%	1.0%	1.0%	1.0%
	Maintenance cost	%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
	Man power	person		100	100	100	100	100
Operating cost	Asset tax	1000 US$		3,357	3,357	3,357	3,357	3,357
	Insurance	1000 US$		3,357	3,357	3,357	3,357	3,357
	Maintenance cost	1000 US$		3,357	3,357	3,357	3,357	3,357
	Wages	1000 US$		278	287	295	304	313
	Total	1000 US$		10,350	10,358	10,367	10,376	10,385
Depreciation	Assets to be depreciated	1000 US$	15%	285,364	0	0	0	0
	Accumulative sssets to be d	1000 US$		285,364	285,364	285,364	285,364	285,364
	Booked value of the assets	1000 US$		321,454	307,186	242,559	228,291	214,023
	Accumulative depreciation	1000 US$		14,268	28,536	42,805	57,073	71,341
	Annual depreciation	1000 US$	20	14,268	14,268	14,268	14,268	14,268
Loan	Own capital	1000 US$	25%	0	0	0	0	0
	LTL of Commercial	1000 US$	25%	0	0	0	0	0
	LTL of Develop.	1000 US$	50%	0	0	0	0	0
	Total repayment	1000 US$		8,393	8,393	8,393	8,393	8,393
	Total balance			243,399	235,006	226,612	218,219	209,826
	Repay commercial	1000 US$		8,393	8,393	8,393	8,393	8,393
	Balance	1000 US$		75,537	67,144	58,751	50,358	41,965
	Repay development	1000 US$		0	0	0	0	0
	Balance	1000 US$		167,861	167,861	167,861	167,861	167,861
Interest & Amortization	Interest of L.T.L.		2,006	13,370	12,724	12,078	11,431	10,785
	Assets for amoprtization			0	0	0	0	0
	Amortization		10	646	646	646	646	646

(2) Income statements

In the income statements of LNG sector, **sales value** of LNG sector includes that to the both power and non-power sectors (Industry, commercial, transportation, and residential).

Variable costs include import LNG cost of LNG sector and the natural gas cost which is supplied from Camago/Malampaya gas fields.

Production fixed costs include depreciation cost, property tax, insurance cost, maintenance cost, and labor cost.

Among **non-operating expenses**, we can also account for sales cost, administration cost, business tax, value added tax, long-term and short-term loans, and pre-operation amortization.

Table 4.17 Income statements of LNG sector

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
Income State	Sales	LNG sales value			146,759	153,352	158,758	292,372	389,057
		(Sales volume)	mmcf		(21,414)	(22,377)	(23,165)	(42,662)	(56,770)
		(Sales price)	$/1000cf		(6.9)	(6.9)	(6.9)	(6.9)	(6.9)
	Variable cost	LNG import cost	1000US$		104,903	109,615	113,480	208,986	278,096
	Fixed cost	Depreciation	1000US$		14,268	14,268	14,268	29,321	29,321
		Assets tax	1000US$		3,357	3,357	3,357	6,899	6,899
		Insurance	1000US$		3,357	3,357	3,357	6,899	6,899
		Maintenance cost	1000US$		3,357	3,357	3,357	6,899	6,899
		Wages	1000US$		278	287	295	608	626
		Total	1000US$		24,618	24,626	24,635	50,626	50,644
	Supply cost	Direct supply cost	1000US$		129,521	134,242	138,115	259,612	328,741
		Gross profit on sales	1000US$		17,238	19,110	20,643	32,760	60,316
	Non-operating exp	Sales cost & administrati	1000US$		7,338	7,668	7,938	14,619	19,453
		Business tax	1000US$		734	767	794	1,462	1,945
		Value added tax	1000US$		3,850	4,038	4,192	7,649	10,406
		Interest of L.T.L	1000US$		13,370	12,724	26,865	25,537	24,208
		Interest of S.T.L	1000US$		2,568	2,684	2,778	5,117	6,808
		Amortization			646	646	646	646	646
		Total	1000US$		28,506	28,526	43,213	55,028	63,468
	Profit before tax	Full cost	1000US$		158,027	162,768	181,328	314,640	392,208
		(Unit cost)	$/1000cf		(7.4)	(7.3)	(7.8)	(7.4)	(6.9)
		Profit before tax	1000US$		-11,268	-9,416	-22,570	-22,269	-3,151
	Profit after tax	Corporate tax	1000US$		0	0	0	0	0
		Profit after tax	1000US$		-11,268	-9,416	-22,570	-22,269	-3,151
		Dividend	1000US$	15.0%	0	0	0	0	0
		Retained earnings	1000US$		0	0	0	0	0
		(Accumulatice)	1000US$		0	0	0	0	0
	price & cost	Sales price	$/1000cf	8.646	6.853	6.853	6.853	6.853	6.853
		Full cost	$/1000cf	7.792	7.379	7.274	7.828	7.375	6.909
		Gasification cost	$/1000cf		2.481	2.375	2.929	2.477	2.010
	ROA	Cash on hand	1000US$		0	0	0	0	0
		Acc. Receivable	1000US$		36690	38338	39690	73093	97264
		Booked value of the asse	1000US$		321454	307186	242559	514291	484970
		total	1000US$		358144	345524	282249	587384	582234
		ROA	%	6.2	-3.1	-2.7	-8.0	-3.8	-0.5

Finally we can calculate profit **before tax and after tax**. Current profit after tax in LNG sector is delivered to shareholders with a dividend rate of 15% when the profit is greater than

the total dividend value. Although an accumulative deficit remained in the current year, the dividend is delivered under previous conditions.

Sales prices, unit cost, gasification unit cost, and ROA of the LNG sector in the targeted years are calculated in the income statement. The average sales price and the average unit cost in all years are also calculated by present value method.

(3) Cash flow

The cash flow table of LNG sector is calculated in the following formula.

Capital sources include LNG sales, equity, long-term loans and short-term loans. And the summation of long-term loans and equity equals capital investments for the each sector.

Capital applications include investments, working capitals, direct operating costs, indirect operating costs. Direct operating costs consist of fuel cost, asset tax, insurance fee, maintenance cost, and wages. Indirect operating costs consist of sales cost and administration, business tax, VAT, interest payable, repayment of L.T.L., and dividend.

Short-term loans is prepared only for working capital. When there is a capital shortage in the cash flow, the shortfall is fulfilled by short-term loans from banks. But interest payable for the short-term loans is not taken into account in the model.

Table 4.18 Cash flow block of the LNG sector

Items 1	Items 2	Item 3	Unit	2006	2007	2008	2009	2010
Cash flow	Sources	Cash in total	1000 US$	183,448	155,000	337,199	325,775	413,228
		(+) LNG sales value	1000 US$	146,759	153,352	158,758	292,372	389,057
		(+) Equipty	1000 US$	0	0	88,545	0	0
		(+) Long Term Loan	1000 US$	0	0	88,545	0	0
		(+) Short term loan for	1000 US$	36,690	1,648	1,352	33,403	24,171
	Application	Investment	1000 US$	0	0	354,179	0	0
		Working capital	1000 US$	36,690	1,648	1,352	33,403	24,171
		(Accumulatice W/C)	1000 US$	36,690	38,338	39,690	73,093	97,264
		Direct operating cost	1000 US$	115,252	119,974	123,847	230,291	299,420
		(+) Fuel cost	1000 US$	104,903	109,615	113,480	208,986	278,096
		(+) Assets tax	1000 US$	3,357	3,357	3,357	6,899	6,899
		(+) Insurance	1000 US$	3,357	3,357	3,357	6,899	6,899
		(+) Maintenance cost	1000 US$	3,357	3,357	3,357	6,899	6,899
		(+) Wages	1000 US$	278	287	295	608	626
		Indirect operating cost	1000 US$	36,253	36,273	50,960	71,630	80,069
		(+) Sales cost & admini	1000 US$	7,338	7,668	7,938	14,619	19,453
		(+) Business tax	1000 US$	734	767	794	1,462	1,945
		(+)Value added tax	1000 US$	3,850	4,038	4,192	7,649	10,406
		(+) Coporate tax	1000 US$	0	0	0	0	0
		(+) Interest of L.T.L.	1000 US$	13,370	12,724	26,865	25,537	24,208
		(+) Interest of S.T.L.	1000 US$	2,568	2,684	2,778	5,117	6,808
		(+) Repayment of L.T.L	1000 US$	8,393	8,393	8,393	17,248	17,248
		(+) Dividend	1000 US$	0	0	0	0	0
		Cash out total	1000 US$	188,195	157,895	530,337	335,324	403,660
	Cash surplus	Cash surplus a year	1000 US$	-4,747	-2,895	-193,138	-9,549	9,568
		Accumulative	1000 US$	-172,608	-175,503	-368,640	-378,190	-368,621

(4) FIRR Calculation

FIRR (Financial internal rate of return) is calculated by the method shown in the following

table.

Investment and working capital fund are summed up as **Capex** (Capital cost accounts). All working capital is returned to the income category at the end of calculation term.

As **Opex** (Operation cost accounts), LNG import costs are summed up for the LNG sector. In addition, other costs for all sectors, including property tax, insurance fee, maintenance cost, labor cost, sales and administration cost, business tax, value added tax, and corporate tax are summed up.

Sales revenues are LNG sector's natural gas sales to pipeline and power sectors. And **benefit** of the sector is expressed as the follows;

Benefit = Sales revenue – Capex – Opex

FIRR is calculated by the following expressions

FIRR=IRR(Xm : Xn、0)　Xm: the starting year , Xn : the final year

Table 4.19　FIRR calculation block

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
FIRR	Capex	Investment	1000 US$		0	0	354,179	0	0
		Working capital for gas users	1000 US$		36,690	1,648	1,352	33,403	24,171
		Total	1000 US$		36,690	1,648	355,531	33,403	24,171
	Opex	LNG import cost	1000 US$		104,903	109,615	113,480	208,986	278,096
		Assets tax	1000 US$		3,357	3,357	3,357	6,899	6,899
		Insurance	1000 US$		3,357	3,357	3,357	6,899	6,899
		Maintenance cost	1000 US$		3,357	3,357	3,357	6,899	6,899
		Wages	1000 US$		278	287	295	608	626
		Sales cost & administration	1000 US$		7,338	7,668	7,938	14,619	19,453
		Business tax	1000 US$		734	767	794	1,462	1,945
		Value added tax	1000 US$		3,850	4,038	4,192	7,649	10,406
		Coporate tax	1000 US$		0	0	0	0	0
		Total	1000 US$		127,174	132,446	136,770	254,020	331,224
	Income	LNG sales amount	1000 US$		146,759	153,352	158,758	292,372	389,057
	Benefit	Cash flow	1000 US$		-17,105	19,258	-333,543	4,948	33,662
		FIRR	%	12.0%					

(5) DCR Calculation

DCR (Debt coverage ratio) is calculated as shown in the following Table 4.20. The total principal loan contains long-term and short-term loans.

Table 4.20 DCR (Debt Coverage Ratio) table

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
DCR	Income	Sales	1000 US$		146,759	153,352	158,758	292,372	389,057
		Equity	1000 US$		0	0	88,545	0	0
		Long term loan	1000 US$		0	0	88,545	0	0
		Short term loan for W/C	1000 US$		36,690	1,648	1,352	33,403	24,171
		Total	1000 US$		183,448	155,000	337,199	325,775	413,228
	Expenditure	Opex	1000 US$		127,174	132,446	136,770	254,020	331,224
		Interest	1000 US$		15,938	15,408	29,643	30,653	31,017
		Equipment	1000 US$		0	0	354,179	0	0
		Working capital			36,690	1,648	1,352	33,403	24,171
		Repayment	1000 US$		8,393	8,393	8,393	17,248	17,248
		Total	1000 US$		188,195	157,895	530,337	335,324	403,660
	Capital surplus		1000 US$		-4,747	-2,895	-193,138	-9,549	9,568
	Capability o	Capital surplus(PV)	1000 US$	30,934	-2,693	-1,466	-87,366	-3,857	3,450
		Interest(PV)	1000 US$	154,504	9,044	7,806	13,409	12,380	11,185
		Repayment(PV)	1000 US$	89,869	4,762	4,252	3,797	6,966	6,220
		Total(PV)	1000 US$	275,308	11,113	10,592	-70,160	15,489	20,855
	Principal loan(PV)		1000 US$	246,486	20,819	835	40,665	13,491	8,716
	DCR			1.1					

The **capability of repayment** is shown by the summation of capital surplus, interest payable, and repayment of long-term loans.

The capability of repayment= capital surplus + interest payable + repayment of L.T.L.

DCR means repayment capability (It is the present value) divided by the **total principal loans** (It is the present value).

$$DCR = \frac{\text{Capability for loan repayment}}{\text{Total principal loan}}$$

(6) EIRR Calculation

EIRR (Economic internal rate of return) is calculated as shown in the following Table 4-21.

Capex in EIRR is calculated from capex of FIRR. Capex in FIRR is assumed that 60% of the investment is for importing machines and materials, on which are levied 5% customs. In the EIRR analysis, all taxes and customs are treated as income to the government. Therefore, 5% customs on imported machines and materials should be eliminated from the cost items of investment in LNG sector.

Investment (FIRR)= Equipment investment (FIRR)+ Working capital (FIRR)

Investment (EIRR)= Equipment investment (FIRR)*(0.6*0.95+0.4)+ Working capital(FIRR)

0.6: 60% of equipment investment is levied by customs tax

0.95: Decreased by 5% customs tax rate

0.4: 40% of equipment investment are procured in domestic markets.

In the same way, the **withholding tax** of 10% for foreign loan is eliminated from the cost items of LNG sector.

Opex in EIRR is defined by subtracting property tax, business tax, withholding tax, value added tax, and corporate tax from Opex in FIRR.

Opex in EIRR = Opex in FIRR – (property tax + business tax + withholding tax + value added tax +corporate tax)

Income (Sales revenues) is gas sales value to the pipeline sector and the power sector.

Income in LNG sector = gas sales value to the pipeline sector + gas sales value to the power sector

Benefit of the sectors is expressed as "Income – Capex – Opex".

EIRR is calculated by "=IRR（Xm：Xn、0）"

Xm: the starting year of the cash flow, Xn: the ending year of the cash flow

Table 4.21 EIRR table of LNG sector

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
EIRR	Capex	Investment	1000 US$		0	0	0	0	0
		- Import duty to 60% of Investi	1000 US$	60%	0	0	0	0	0
		Working capital for gas users	1000 US$		4,101	1,818	2,216	24,399	3,739
		Total	1000 US$		4,101	1,818	2,216	24,399	3,739
	Opex	Opex	1000 US$		22,940	28,886	36,132	115,851	128,073
		- LNG import duty	1000 US$	100%	-362	-522	-718	-2,871	-3,201
		- Asset tax	1000 US$	100%	-3,202	-3,202	-3,202	-3,202	-3,202
		- Business tax	1000 US$	100%	-82	-118	-163	-651	-725
		- Value added tax	1000 US$	100%	-114	-307	-541	-3,125	-3,520
		- Corporate tax	1000 US$	100%	0	0	0	0	0
		Total	1000 US$		19,181	24,737	31,508	106,003	117,425
	Income	LNG sales value	1000 US$		16,406	23,678	32,540	130,136	145,092
		- Others	1000 US$	0%	0	0	0	0	0
		Total	1000 US$		16,406	23,678	32,540	130,136	145,092
	Benefit	Cash flow	1000 US$		-6,877	-2,878	-1,184	-266	23,928
		EIRR	%	20.1%					

4.7 Pipeline sector

(1) Capital plan

The pipeline is built from Batangas to NCR and the northern area of NCR in Option1. And an offshore pipeline is built in Option2. In the every options, **investment for transmission** of

the pipeline is set in the upper line of the investment data area. And **investment for distribution** of the pipeline is set in the lower line of the investment data area. The data are affected by the inflation rate at 1.8%.

The **operation costs** include assets tax, insurance fee, maintenance cost and manpower cost are calculated. Then we have to set the assets tax rate, insurance rate, and maintenance cost rate to acquisition asset value, and manpower for calculating the manpower cost.

Depreciation cost of the pipeline is calculated in the block. For the calculation, assets to be depreciated, depreciation term, and scrap value rate of the assets are prepared. And accumulative assets to be depreciated and booked value of the assets are calculated for the analysis.

Repayment of the long-term-loan is calculated in the block. For the calculation, long-term loans from commercial banks and international development facilities, repayment term, grace term and own capital are prepared. Repayment of commercial bank's L.T.L and international development facility's L.T.L. are calculated separately.

Interest payable & amortization of L.T.L. is calculated. The interest payable of L.T.L. in pre-operation term is depreciated as amortization. The interest payable of L.T.L. in operation term is accounted as one of operation cost.

Table 4.22 Capital plan block for pipeline sector

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
Capital plan	Investment	Gas Transmission	1000 US$						
		Gas distribution cost	1000 US$	501,400	26,075	23,435	23,435	23,435	28,760
		Total	1000 US$		27,107	24,727	25,098	25,475	31,732
		(Acquisition assets)	1000 US$		150,048	177,154	201,882	226,980	252,455
	Operating cost condition	Assets tax	%		1.0%	1.0%	1.0%	1.0%	1.0%
		Insurance	%		1.0%	1.0%	1.0%	1.0%	1.0%
		Maintenance cost	%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
		Man power	person		119	133	147	161	185
	Operating cost	Asset tax	1000 US$		1,500	1,772	2,019	2,270	2,525
		Insurance	1000 US$		1,500	1,772	2,019	2,270	2,525
		Maintenance cost	1000 US$		3,001	3,543	4,038	4,540	5,049
		Wages	1000 US$		305	349	395	444	523
		Total	1000 US$		6,307	7,435	8,471	9,523	10,621
	Depreciation	Assets to be depreciated	1000 US$	15.0%	127,541	23,041	21,018	21,334	21,654
		Accumulative assets to be dep	1000 US$		127,541	150,581	171,600	192,933	214,587
		Booked value of the assets	1000 US$		143571	163248	179396	194947	209693
		Accumulative depreciation	1000 US$		6377	13906	22486	32133	42862
		Annual depreciation	1000 US$	20	6377	7529	8580	9647	10729
	Loan&Repayment	Own capital	1000 US$	25%	6,777	6,182	6,275	6,369	7,933
		LTL commercial	1000 US$	25%	6,777	6,182	6,275	6,369	7,933
		LTL development	1000 US$	50%	13,553	12,364	12,549	12,737	15,866
		Total repayment	1000 US$		3,751	4,429	5,047	5,675	6,311
		Total balance	1000 US$		129,115	143,231	157,008	170,440	187,928
		Repay commercial	1000 US$		3,751	4,429	5,047	5,675	6,311
		Balance	1000 US$		40,537	42,290	43,518	44,212	45,834
		Repay development	1000 US$		0	0	0	0	0
		Balance	1000 US$		88,577	100,941	113,490	126,228	142,094
	Interest & Amortization	Interest of L.T.L		2,006	7,107	7,799	8,458	9,085	9,923
		Assets for amoprtization			0	0	0	0	0
		Amortization		10	626	626	626	626	626

(2) Income statements

In the income statements of pipeline sector, **sales value** of the pipeline sector includes that of the power and non-power sectors (Industry, commercial, transportation, and residential).

Variable costs include natural gas cost from LNG sector and Camago/Malampaya to the pipeline sector.

Production fixed costs include depreciation cost, property tax, insurance cost, maintenance cost, and labor cost.

Among **non-operating expenses**, we can also account for sales cost, administration cost, business tax, value added tax, interest payable of long-term and short-term loans, and pre-operation amortization.

. Table 4.23 Income statements of pipeline sector

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
Income Statat	Sales	Sucat power station	1000US$		0	0	111,424	214,494	216,907
		Small lot users	1000US$		23,039	33,240	45,671	60,507	80,098
		Total	1000US$		23,039	33,240	157,095	275,001	297,005
		(Sales volume)	1000scf		(2,252)	(3,214)	(18,649)	(32,910)	(34,681)
		(Sales price)	$/1000scf		(10.2)	(10.3)	(8.4)	(8.4)	(8.6)
	Variable cost	NG cost at Batangas	1000US$		0	0	78,519	156,755	155,341
		LNG cost	1000US$		16,406	23,678	32,540	43,121	57,098
		Total	1000US$		16,406	23,678	111,059	199,876	212,439
	Fixed cost	Depreciation	1000US$		6,377	7,529	8,580	9,647	10,729
		Assets tax	1000US$		1,500	1,772	2,019	2,270	2,525
		Insurance	1000US$		1,500	1,772	2,019	2,270	2,525
		Maintenance cost	1000US$		3,001	3,543	4,038	4,540	5,049
		Wages	1000US$		305	349	395	444	523
		Total	1000US$		12,684	14,964	17,051	19,170	21,350
	Supply cost	Direct supply cost	1000US$		29,089	38,642	128,109	219,046	233,789
		Gross profit on sales	1000US$		-6,051	-5,402	28,985	55,955	63,216
	Non-operating expenses	Sales cost & administration	1000US$		1,152	1,662	7,855	13,750	14,850
		Business tax	1000US$		115	166	785	1,375	1,485
		Value added tax	1000US$		363	602	4,200	7,059	7,952
		Interest of L.T.L	1000US$		7,107	7,799	8,458	9,085	9,923
		Interest of S.T.L	1000US$		403	582	2,749	4,813	5,198
		Amortization	1000US$		626	626	626	626	626
		Total	1000US$		9,767	11,437	24,674	36,707	40,034
	Profit before tax	Full cost	1000US$		38,857	50,079	152,783	255,753	273,823
		(Unit cost)	$/1000scf		(17.3)	(15.6)	(8.2)	(7.8)	(7.9)
		Profit before tax	1000US$		-15,818	-16,839	4,312	19,248	23,182
	Profit after tax	Corporate tax	1000US$		0	0	0	0	0
		Profit after tax	1000US$		-15,818	-16,839	4,312	19,248	23,182
		Dividend	1000US$	15.0%	0	0	0	9,467	10,657
		Retained earnings	1000US$		0	0	4,312	9,781	12,525
		(Accumulation)	1000US$		0	0	4,312	14,093	26,617
	price & cost	Sales price	$/1000scf	9.806	10.231	10.342	8.424	8.356	8.564
		Full cost	$/1000scf	9.005	17.255	15.581	8.192	7.771	7.895
		Transmission cost	$/1000scf		2.833	1.988	0.344	0.196	0.187
		Distribution cost	$/1000scf		2.799	2.668	0.571	0.387	0.429
	ROA	Cash on hand	1000US$		0	0	4312	14093	26617
		Acc. Receivable	1000US$		5760	8310	39274	66750	74251
		Booked value of the assets	1000US$		143671	163248	179396	194847	209593
		total	1000US$		149430	171558	222981	277691	310462
		ROA	%	5.1	-10.6	-9.8	1.9	6.9	7.5

Finally we can calculate **profit before tax and after tax**. Current profit after tax is delivered to shareholders with a dividend rate of 15% when the profit is greater than the total dividend value. Although an accumulative deficit remained in the current year, the dividend is delivered under previous conditions.

Sales prices, unit cost, pipeline unit cost, and ROA of the pipeline sector in the targeted years are calculated in the income statement. The average sales price and the average unit cost in all years are also calculated by present value method

(3) Cash flow

In the following formula, the cash flow tables of pipeline sector are calculated.

Capital sources include pipeline sales, equity, long-term loans and short-term loans. And the summation of long-term loans and equity equals capital investments for pipeline sector.

Capital applications include investment, working capital, direct operating cost, indirect operating cost. And direct operating costs consist of fuel cost, asset tax, insurance fee, maintenance cost, and wages. Indirect operating costs consist of sales cost and administration, business tax, VAT, interest payable, repayment of L.T.L., and dividend.

We are assumed that short-term is applied only for working capital. When there is a capital shortage in the cash flow, the capital shortfall is fulfilled by short-term loans from banks. But interest payable for the short-term loans is not taken into account in the model.

Table 4.24 Cash flow block of the LNG sector

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
Cash flow	Sources	Cash in total	1000 US$		42,382	48,154	200,807	317,216	318,372
		(+) NG sales value for sm	1000 US$		23,039	33,240	157,095	275,001	297,005
		(+) Equity	1000 US$		6,777	6,182	6,275	6,369	7,933
		(+) Long Term Loan	1000 US$		6,777	6,182	6,275	6,369	7,933
		(+) Short term loan for W/	1000 US$		5,760	2,550	30,964	29,477	5,501
	Application	Investment	1000 US$		27,107	24,727	25,098	25,475	31,732
		Working capital	1000 US$		5,760	2,550	30,964	29,477	5,501
		(Accumulate W/C)	1000 US$		5,760	8,310	39,274	68,750	74,251
		Direct operating cost	1000 US$		22,712	31,113	119,529	208,399	223,060
		(+) Fuel cost	1000 US$		16,406	23,678	111,059	199,876	212,439
		(+) Assets tax	1000 US$		1,500	1,772	2,019	2,270	2,525
		(+) Insurance	1000 US$		1,500	1,772	2,019	2,270	2,525
		(+) Maintenance cost	1000 US$		3,001	3,543	4,038	4,540	5,049
		(+) Wages	1000 US$		305	349	395	444	523
		Indirect operating cost	1000 US$		12,892	15,239	29,094	51,222	56,376
		(+) Sales cost & administ	1000 US$		1,152	1,662	7,855	13,750	14,850
		(+) Business tax	1000 US$		115	166	785	1,375	1,485
		(+)Value added tax	1000 US$		363	602	4,200	7,059	7,952
		(+) Coporate tax	1000 US$		0	0	0	0	0
		(+) Interest of L.T.L.	1000 US$		7,107	7,799	8,458	9,085	9,923
		(+) Interest of S.T.L.	1000 US$		403	582	2,749	4,813	5,198
		(+) Repayment of L.T.L.	1000 US$		3,751	4,429	5,047	5,675	6,311
		(+) Dividend	1000 US$		0	0	0	9,467	10,657
		Cash out total	1000 US$		68,470	73,630	204,686	315,573	316,669
					218,518	292,148	496,834	812,407	1,129,076
	Cash surplus	Cash surplus a year	1000 US$		-26,119	-25,476	-4,078	1,642	1,703
		Accumulative	1000 US$		-101,143	-126,619	-130,697	-129,055	-127,352

(4) FIRR Calculation

FIRR (Financial internal rate of return) is calculated by the method shown in the following table.

Investment and working capital fund are summed up as **Capex** (Capital cost accounts). All working capital is returned to the income category at the end of calculation term.

As **Opex** (Operation cost accounts), natural gas costs are summed up for the pipeline sector. In addition, other costs including property tax, insurance fee, maintenance cost, labor cost, sales and administration cost, business tax, value added tax, and corporate tax are summed up.

Sales revenues are pipeline sector's natural gas sales to power and non-power sectors. **Benefit** of the pipeline sector is expressed as "Sales revenue – Capex – Opex".

FIRR is calculated by "=IRR(Xm : Xn、0)" in EXCEL functions.

Xm: the starting year of the cash flow, Xn : the final year of the cash flow

Table 4.25 FIRR calculation block

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
FIRR	Capex	Investment	1000 US$		27,107	24,727	25,098	25,475	31,732
		Working capital for gas user	1000 US$		5,760	2,550	30,964	29,477	5,501
		Total			32,866	27,278	56,062	54,952	37,233
	Opex	Fuel cost	1000 US$		16,406	23,678	111,059	199,876	212,439
		Assets tax	1000 US$		1,500	1,772	2,019	2,270	2,525
		Insurance	1000 US$		1,500	1,772	2,019	2,270	2,525
		Maintenance cost	1000 US$		3,001	3,543	4,038	4,540	5,049
		Wages	1000 US$		305	349	395	444	523
		Sales cost & administration	1000 US$		1,152	1,662	7,855	13,750	14,860
		Business tax	1000 US$		115	166	785	1,375	1,485
		Value added tax	1000 US$		363	602	4,200	7,059	7,952
		Coporate tax	1000 US$		0	0	0	0	0
		Total	1000 US$		24,343	33,543	132,369	231,583	247,347
	Income	NG for small lot users	1000 US$		23,039	33,240	157,095	275,001	297,005
	Benefit	Cash flow	1000 US$		-34,170	-27,581	-31,337	-11,533	12,425
		FIRR	%	11.4%					

(5) DCR Calculation

DCR (Debt coverage ratio) is calculated as shown in the following table. The **total principal loan** contains long-term and short-term loans.

The **capability of repayment** is shown by the summation of capital surplus, interest payable, and repayment of long-term loans.

Capability of repayment = capital surplus + interest payable + repayment of L.T.L.

DCR means repayment capability (it is the present value) divided by total principal loans (It

is present value). Banks and international development facilities check DCR of the project. Usually DCR is expected a value more than 1.0.

$$DCR = \frac{\text{Capability for loan repayment}}{\text{Total principal loan}}$$

. Table 4.26 Debt Coverage Ratio(DCR) table

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
DCR	Income	Sales	1000 US$		23,039	33,240	157,095	275,001	297,005
		Equity	1000 US$		6,777	6,182	6,275	6,369	7,933
		Long term loan	1000 US$		6,777	6,182	6,275	6,369	7,933
		Short term loan for W/C	1000 US$		5,760	2,550	30,964	29,477	5,501
		Total	1000 US$		42,352	48,154	200,607	317,216	318,372
	Expenditure	Opex	1000 US$		24,343	33,543	132,369	231,583	247,347
		Interest	1000 US$		7,511	8,360	11,207	13,697	15,121
		Equipment	1000 US$		27,107	24,727	25,098	25,475	31,732
		Working capital			5,760	2,550	30,964	29,477	5,501
		Repayment	1000 US$		3,751	4,429	5,047	5,675	6,311
		Total	1000 US$		68,470	73,630	204,686	306,106	306,012
	Capital surplus		1000 US$		-26,119	-25,476	-4,078	11,109	12,360
	Capability of repayment	Capital surplus(PV)	1000 US$	1,333	-14,821	-12,907	-1,845	4,467	4,457
		Interest(PV)	1000 US$	77,339	4,252	4,246	5,070	5,613	5,453
		Repayment(PV)	1000 US$	44,820	2,129	2,244	2,283	2,292	2,276
		Total(PV)	1000 US$	123,492	-8,430	-6,417	5,508	12,392	12,186
	Principal loan(PV)		1000 US$	114,324	7,113	4,424	16,845	14,477	4,844
	DCR			1.1					

(6) EIRR Calculation

EIRR (economic internal rate of return) is calculated as shown in the following table.

Capex in EIRR is calculated from capex of FIRR. The capex of FIRR is assumed that 60% of the investment is for importing machines and materials, on which are levied 5% customs. In the EIRR analysis, all taxes and customs are treated as income to the government. Therefore, 5% customs on imported machines and materials should be eliminated from the cost items of the sectors.

Investment (FIRR)= Equipment investment (FIRR)+ Working capital(FIRR)

Investment (EIRR)= Equipment investment (FIRR)*(0.6*0.95+0.4)+ Working capital(FIRR)

0.6: 60% of equipment investment is levied by customs tax

0.95: Decreased by 5% customs tax rate

0.4: 40% of equipment investment are procured in domestic markets.

In the same way, the **withholding tax** of 10% for foreign loan is eliminated from the cost items of the sectors.

Opex in EIRR is defined by subtracting property tax, business tax, withholding tax, value

added tax, and corporate tax from the opex of FIRR.

Income (Sales revenues) are natural gas sales value for power and non-power sectors.

Benefit of the pipeline sector is expressed as "Income – Capex – Opex".

EIRR of the pipeline sector is calculated by "=IRR（Xm : Xn、0）" in EXCEL functions.

Xm: the starting year of the cash flow, Xn: the ending year of the cash flow

Table 4.27 EIRR calculation of pipeline sector

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
EIRR	Capex	Gas pipeline to Luzon	1000 US$		26,705	24,290	24,581	24,876	30,885
		- Import duty to 60% of Invest	1000 US$	60%	-801	-729	-737	-746	-927
		Working capital for gas users	1000 US$		4,882	2,146	4,711	3,121	4,105
		Total	1000 US$		30,786	25,707	28,555	27,250	34,074
	Opex	Opex	1000 US$		22,514	30,867	47,556	59,168	74,034
		- Asset tax	1000 US$	100%	-1,483	-1,750	-1,993	-2,238	-2,487
		- Business tax	1000 US$	100%	-98	-141	-235	-297	-379
		- Value added tax	1000 US$	100%	-150	-292	-706	-938	-1,275
		- Corporate tax	1000 US$	100%	0	0	0	0	0
		Total	1000 US$		20,784	28,684	44,623	55,694	69,892
	Income	NG for small lot users	1000 US$		19,529	28,113	46,956	59,439	75,861
	Benefit	Cash flow	1000 US$		-32,042	-26,278	-26,221	-23,505	-28,105
		EIRR	%	12.2%					

4.8 Power sector block

(1) Capital plan

The power plants are built in Batanagas and Bataan area in Option1 and Option2. The power is supplied to NCR and other area.

Table 4.28 Capital plan block for the power sector

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
Captial plan	Investment	Construction unit cost	$/kW		624	633	643	652	662
	Power station (Combine	Plant capacity(Batangas & E	MW					300	300
		Plant capacity(Sucat & Auto	MW				332	300	
		(Accumulative capacity)	MW		300	300	632	1,232	1,532
		Power plant cost(Batangas	1000 US$		0	0	192,780	195,672	595,821
		Power plant cost(Sucat & A	1000 US$		0	210,191	192,780	0	0
		Total	1000 US$		0	210,191	385,561	195,672	595,821
		(Acquisition assets)	1000 US$		183,259	183,259	393,450	779,011	974,683
	Investment	Batangas & Bataan	%		5	5	5	5	5
	Power transmission	Sucat & Auto-pro	%		5	5	5	5	5
		Batangas & Bataan	1000 US$		0	0	9,639	9,784	29,791
		Sucat & Auto-pro	1000 US$		0	10,510	9,639	0	0
		Total	1000 US$		0	10,510	19,278	9,784	29,791
		(Acquisition assets)	1000 US$		9,163	9,163	19,673	38,951	48,734
Operating cos	Operating cost unit	Assets tax	%		1.0%	1.0%	1.0%	1.0%	1.0%
	Power station	Insurance	%		1.0%	1.0%	1.0%	1.0%	1.0%
		Maintenance cost	%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
		Man power	person	0.7	210	210	442	862	1,072
	Operating cost unit	Assets tax	%		1.0%	1.0%	1.0%	1.0%	1.0%
	Power transmission	Insurance	%		1.0%	1.0%	1.0%	1.0%	1.0%
		Maintenance cost	%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
		Man power	person		21	21	44	86	107
	Operating cost	Assets tax	1000 US$		1,833	1,833	3,935	7,790	9,747
	Power station	Insurance	1000 US$		1,833	1,833	3,935	7,790	9,747
		Maintenance cost	1000 US$		9,163	9,163	19,673	38,951	48,734
		Wages	1000 US$		538	551	1,190	2,377	3,030
		Total	1000 US$		13,366	13,379	28,731	56,908	71,258
	Operating cost	Assets tax	1000 US$		92	92	197	390	487
	Power transmission	Insurance	1000 US$		92	92	197	390	487
		Maintenance cost	1000 US$		458	458	984	1,948	2,437
		Wages	1000 US$		54	55	119	238	303
		Total	1000 US$		695	697	1,496	2,964	3,714
Depreciation	Depreciation	Assets to be depreciated	1000 US$	10.0%	0	0	198,630	364,355	184,910
		Accumulative assets to be d	1000 US$		173,180	173,180	371,810	736,165	921,075
		Booked value of the assets	1000 US$		175,104	166,445	368,555	736,585	895,987
		Accumulative depreciation	1000 US$		17,318	25,977	44,568	81,376	127,430
		Annual depreciation	1000 US$	20	8,659	8,659	18,591	36,808	46,054
	Loan&Repayment	Own capital	1000 US$	25%	0	55,175	101,210	51,364	156,403
		LTL commercial	1000 US$	25%	0	55,175	101,210	51,364	156,403
		LTL development	1000 US$	50%	0	110,350	202,419	102,728	312,806
		Total repayment	1000 US$		4,811	4,811	10,328	20,449	25,585
		Total balance			134,696	295,410	588,711	722,354	1,165,977
		Repay commercial	1000 US$		4,811	4,811	10,328	20,449	25,585
		Balance	1000 US$		38,484	88,849	179,731	210,645	341,463
		Repay development	1000 US$		0	0	0	0	0
		Balance	1000 US$		96,211	206,561	408,981	511,708	824,514
	Interest & Amortization	Interest of L.T.L		2005	7,293	16,137	32,243	39,247	63,396
		Assets for amoprtization			0	0	0	0	0
		Amortization		10	803	803	803	803	803

The power investment with not-use pipeline is set in the upper line of the investment data area. And **the power investment with use- pipeline** is set in the lower line of the investment data area. The data are effected by the inflation rate.

New power plants are usually in company with investment for grid networks of power transmission. Then in the power sector, we prepared **power station investment area** and power transmission investment area.

The **operation costs** include assets tax, insurance, maintenance cost and manpower cost. Then we have to set the assets tax rate, insurance rate, and maintenance cost rate to acquisition asset value, and manpower for calculating the manpower cost.

Depreciation cost is calculated in the block. For the calculation, assets to be depreciated, depreciation term, and scrap value rate of the assets are prepared. As additional information, accumulative assets to be depreciated and booked value of the assets are calculated.

Repayment of the long-term-loan is calculated in the block. For the calculation, long-term loans from commercial banks and international development facilities, repayment term, grace term and own capital are prepared. Repayment of commercial bank's L.T.L and international development facility's L.T.L. are calculated separately.

Interest & amortization of L.T.L. is calculated. The interest payable of L.T.L. in pre-operation term is depreciated as amortization. The interest payable of L.T.L. in operation term is accounted as one of operation cost.

(2) Income statements

In the income statements of power sector, **sales values** of power sector is to sell power to power distribution companies

Variable costs include natural gas cost from LNG sector and Camago/Malampaya natural gas

Production fixed costs include depreciation cost, property tax, insurance cost, maintenance cost, and labor cost.

Among **non-operating expenses**, we can also account for sales cost, administration cost, business tax, value added tax, long-term and short-term loans, and pre-operation amortization.

Finally we can calculate **profit before tax and after tax**. Current profit after tax is delivered to shareholders with a dividend rate of 15% when the profit is greater than the total dividend value. Although an accumulative deficit remained in the current year, the dividend is delivered under previous conditions.

Sales prices, unit cost, pipeline unit cost, and ROA of the power sector in the targeted years are calculated in the income statement. The average sales price and the average unit

cost in all years are also calculated by present value method

. **Table 4.29 Income statements of the power sector**

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
Income Statements		Power sales	1000US$		163,692	173,099	356,687	676,488	859,056
		(Sales volume)	GWh		(2,054)	(2,147)	(4,386)	(8,221)	(10,351)
		(Sales price)	$/kWh		(0.080)	(0.081)	(0.081)	(0.082)	(0.083)
	Variable cost	DNG cost at Batangas	1000 US$		69,166	75,910	75,270	78,939	155,833
		LNG cost at Batangas	1000 US$		0	0	0	87,015	87,994
		DNG cost at Sucat	1000 US$		0	0	111,424	214,494	216,907
		LNG cost at Sucat	1000 US$		0	0	0	0	0
		Total	1000US$		69,166	75,910	186,694	380,448	460,734
	Fixed cost	Depreciation	1000US$		8,659	8,659	18,591	36,808	46,054
		Assets tax	1000US$		1,924	1,924	4,131	8,180	10,234
		Insurance	1000US$		1,924	1,924	4,131	8,180	10,234
		Maintenance cost	1000US$		9,621	9,621	20,656	40,898	51,171
		Wages	1000US$		591	606	1,309	2,615	3,333
		Total	1000US$		22,720	22,735	48,818	96,681	121,026
	Supply cost	Direct supply cost	1000US$		91,886	98,644	235,512	477,129	581,760
		Gross profit on sales	1000US$		71,806	74,455	121,175	199,359	277,295
	Non-operating expenses	Sales cost & administration	1000US$		8,185	8,655	17,834	33,824	42,953
		Business tax	1000US$		818	865	1,783	3,382	4,295
		Value added tax	1000US$		8,491	8,757	14,934	25,514	34,715
		Interest of L.T.L	1000US$		7,293	16,137	32,243	39,247	63,396
		Interest of S.T.L	1000US$		2,865	3,029	6,242	11,839	15,033
		Amortization	1000US$		803	803	803	803	803
		Total	1000US$		28,454	38,247	73,840	114,609	161,196
	Profit before tax	Full cost	1000US$		120,341	136,891	309,352	591,738	742,956
		(Unit cost)	$/kWh		(0.059)	(0.064)	(0.071)	(0.072)	(0.072)
		Profit before tax	1000US$		43,352	36,208	47,335	84,749	116,100
	Profit after tax	Corporate tax	1000US$		13,873	11,587	15,147	27,120	37,152
		Profit after tax	1000US$		29,479	24,622	32,188	57,630	78,948
		Dividend	1000US$	15.0%	7,216	15,492	30,674	38,378	61,839
		Retained earnings	1000US$		22,263	9,130	1,514	19,252	17,109
		(Accumulatice)	1000US$		41,618	50,747	52,261	71,513	88,622
	price & cost	Sales price	$/kWh	0.091	0.080	0.081	0.081	0.082	0.083
		Full cost	$/kWh	0.078	0.059	0.064	0.071	0.072	0.072
		Fixed cost	$/kWh		0.025	0.028	0.026	0.026	0.027
	ROA	Cash on hand	1000US$		41618	50747	52261	71513	88622
		Acc. Receivable	1000US$		40923	43275	89172	169122	214764
		Booked value of the assets	1000US$		175104	166445	368555	736585	895987
		total	1000US$		257645	260468	509988	977220	1199373
		ROA	%	6.8	11.4	9.5	6.3	5.9	6.6

(3) Cash flow

In the following formula, the cash flow tables of power sector are calculated.

Capital sources include power sales, equity, long-term loans and short-term loans. And the summation of long-term loans and equity equals capital investments for the power sector.

Capital applications include investment, working capital, direct operating cost, indirect operating cost. And direct operating costs consist of fuel cost, asset tax, insurance fee, maintenance cost, and wages. Indirect operating costs consist of sales cost and administration cost, business tax, VAT, interest payable, repayment of L.T.L., and dividend.

We are assumed that short-term is applied only for working capital. When there is a capital

shortage in the cash flow, the capital shortfall is fulfilled by short-term loans from banks. But interest payable for the short-term loans is not taken into account in the model.

Table 4.30 Cash flow block of the power sector

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
Cash flow	Sources	Cash in total	1000 US$		166,126	285,801	605,003	859,168	1,217,504
		(+) Power Sales value	1000 US$		163,692	173,099	356,687	676,488	859,056
		(+) Equity	1000 US$		0	55,175	101,210	51,364	156,403
		(+) Long Term Loan	1000 US$		0	55,175	101,210	51,364	156,403
		(+) Short term loan	1000 US$		2,434	2,352	45,897	79,950	45,642
	Application	Investment	1000 US$		0	220,700	404,839	205,456	625,612
		(+) Power station	1000 US$		0	210,191	385,561	195,672	595,821
		(+) Power transmission	1000 US$		0	10,510	19,278	9,784	29,791
		Working capital	1000 US$		2,434	2,352	45,897	79,950	45,642
		(Accumulate WC)	1000 US$		40,923	43,275	89,172	169,122	214,764
		Direct operating cost	1000 US$		83,227	89,985	216,921	440,321	535,706
		(+) Fuel cost	1000 US$		69,166	75,910	186,694	380,448	460,734
		(+) Assets tax	1000 US$		1,924	1,924	4,131	8,180	10,234
		(+) Insurance	1000 US$		1,924	1,924	4,131	8,180	10,234
		(+) Maintenance cost	1000 US$		9,621	9,621	20,656	40,898	51,171
		(+) Wages	1000 US$		591	606	1,309	2,615	3,333
		Indirect operating cost	1000 US$		53,550	69,333	129,186	199,753	284,988
		(+) Sales cost & administrati	1000 US$		8,185	8,655	17,834	33,824	42,953
		(+) Business tax	1000 US$		818	865	1,783	3,382	4,295
		(+)Value added tax	1000 US$		8,491	8,757	14,934	25,514	34,715
		(+) Coporate tax	1000 US$		13,873	11,587	15,147	27,120	37,152
		(+) Interest of L.T.L.	1000 US$		7,293	16,137	32,243	39,247	63,396
		(+) Interest of S.T.L.	1000 US$		2,855	3,029	6,242	11,839	15,033
		(+) Repayment of L.T.L.	1000 US$		4,811	4,811	10,328	20,449	25,595
		(+) Dividend	1000 US$		7,216	15,492	30,674	38,378	61,839
		Cash out total	1000 US$		139,211	392,370	796,842	925,480	1,491,929
	Cash surplus	Cash surplus a year	1000 US$		26,915	-96,569	-191,839	-66,314	-274,425
		Accumulative	1000 US$		-45,290	-141,858	-333,698	-400,012	-674,437

(4) FIRR Calculation

FIRR (Financial internal rate of return) is calculated by the method shown in the following table.

Investment and working capital fund are summed up as **Capex** (Capital cost accounts). All working capital is returned to the income category at the end of calculation term.

As **Opex** (Operation cost accounts), natural gas costs are summed up for the power sector. In addition, other costs including property tax, insurance fee, maintenance cost, labor cost, sales and administration cost, business tax, value added tax, and corporate tax are summed up.

Sales revenues of the power sector is power sales to power distribution companies

Benefit of the sectors is expressed as "Sales revenue – Capex – Opex".

FIRR is calculated by "=IRR(Xm : Xn、0)" in EXCEL functions.

Xm: the starting year of the cash flow, Xn : the final year of the cash flow

Table 4.31 FIRR calculation of the power sector

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
FIRR	Capex	Power station	1000 US$		0	210,191	385,561	195,672	595,821
		Power transmission	1000 US$		0	10,510	19,278	9,784	29,791
		Working capital for power gene	1000 US$		2,434	2,352	45,897	79,980	45,642
		Total	1000 US$		2,434	223,052	450,735	285,406	671,254
	Opex	Fuel cost	1000 US$		69,166	75,910	186,694	380,448	490,734
		Assets tax	1000 US$		1,924	1,924	4,131	8,180	10,234
		Insurance	1000 US$		1,924	1,924	4,131	8,180	10,234
		Maintenance cost	1000 US$		9,621	9,621	20,656	40,898	51,171
		Wages	1000 US$		591	606	1,309	2,615	3,333
		Sales cost & administration	1000 US$		8,185	8,655	17,834	33,824	42,953
		Business tax	1000 US$		818	865	1,783	3,382	4,295
		Value added tax	1000 US$		8,481	8,757	14,934	25,514	34,715
		Coporate tax	1000 US$		13,873	11,587	15,147	27,120	37,152
		Total	1000 US$		114,593	119,849	266,620	530,162	654,821
	Income	Power sales	1000 US$		163,692	173,099	356,687	676,488	859,056
	Benefit	Cash flow	1000 US$		46,665	-169,802	-380,668	-139,080	-467,020
		FIRR	%	0.0%					

(5) DCR Calculation

DCR (Debt coverage ratio) is calculated as shown in the following table. The total principal loan contains long-term and short-term loans.

The **capability of repayment** is shown by the summation of capital surplus, interest payable, and repayment of long-term loans.

Capability of repayment = capital surplus + interest payable + repayment of L.T.L..

DCR means repayment capability (it is present value) divided by total principal loans (it is present value). Banks and International development facilities check DCR of the project. Usually DCR is expected a value more than 1.0.

$$DCR = \frac{\text{Capability for loan repayment}}{\text{Total principal loan}}$$

. Table 4.32 Debt Coverage Ratio(DCR) of the power sector

Items 1	Items 2	Item3	Unit	Value	2006	2007	2008	2009	2010
DCR	Income	Sales	1000 US$		163,692	173,099	356,687	676,488	859,056
		Equity	1000 US$		0	55,175	101,210	51,364	156,403
		Long term loan	1000 US$		0	55,175	101,210	51,364	156,403
		Short term loan	1000 US$		2,434	2,352	45,897	79,950	45,642
		Total	1000 US$		166,126	285,801	605,003	859,166	1,217,504
	Expenditure	Opex	1000 US$		114,593	119,949	266,620	530,162	654,821
		Interest	1000 US$		10,157	19,166	38,485	51,085	78,429
		Equipment	1000 US$		0	220,700	404,839	205,456	625,612
		Working capital	1000 US$		2,434	2,352	45,897	79,950	45,642
		Repayment	1000 US$		4,811	4,811	10,328	20,449	25,585
		Total	1000 US$		131,995	366,678	766,168	887,102	1,430,090
	Cpital surplus		1000 US$		34,131	-81,077	-161,166	-27,936	-212,587
	Capability of repay	Capital surplus(PV)	1000 US$	-197,275	19,367	-41,076	-72,903	-11,283	-76,661
		Interest(PV)	1000 US$	458,444	5,764	9,710	17,409	20,632	28,282
		Repayment(PV)	1000 US$	237,991	2,730	2,437	4,672	8,259	9,226
		Total(PV)	1000 US$	499,160	27,860	-28,929	-50,823	17,609	-39,152
	Principal loan(PV)		1000 US$	775,375	1,381	29,145	66,543	53,036	72,859
	DCR			0.6					

(6) EIRR Calculation

EIRR (economic internal rate of return) is calculated as shown in the following table.

Capex in EIRR is calculated from the capex in FIRR. The FIRR is assumed that 60% of the investment is for importing machines and materials, on which are levied 5% customs. In the EIRR analysis, all taxes and customs are treated as income to the government. Therefore, 5% customs on imported machines and materials should be eliminated from the cost items of the sectors.

Investment (FIRR)= Equipment investment (FIRR)+ Working capital(FIRR)

Investment (EIRR)= Equipment investment (FIRR)*(0.6*0.95+0.4)+ Working capital(FIRR)

0.6: 60% of equipment investment is levied by customs tax

0.95: Decreased by 5% customs tax rate

0.4: 40% of equipment investment are procured in domestic markets.

In the same way, the withholding tax of 10% for foreign loan is eliminated from the cost items of the sectors.

Opex in EIRR is defined by subtracting property tax, business tax, withholding tax, value added tax, and corporate tax from opex in FIRR.

Income (Sales revenues) is power sales value for power distribution companies.

Benefit of the sectors is expressed as "Income – Capex – Opex".

EIRR is calculated by "=IRR（Xm : Xn、0）" in EXCEL functions.

Xm: the starting year of the cash flow, Xn: the ending year of the cash flow

Table 4.33 EIRR calculation of the power sector

Items 1	Items 2	Item 3	Unit	Value	2006	2007	2008	2009	2010
EIRR	Capex	Power station	1000 US$		0	210,191	385,561	195,672	595,821
		- Import duty to 60% of Investi	1000 US$	60%	0	-6,306	-11,567	-5,870	-17,875
		Power transmission	1000 US$		0	10,510	19,278	9,784	29,791
		- Import duty to 60% of Investi	1000 US$	60%	0	-315	-578	-294	-894
		Working capital	1000 US$		2,434	2,352	45,897	79,950	45,642
		Total	1000 US$		2,434	216,431	438,590	279,242	652,486
	Opex	Opex	1000 US$		114,593	119,849	266,620	530,162	654,821
		- Asset tax	1000 US$	100%	-1,924	-1,924	-4,131	-8,180	-10,234
		-Business tax	1000 US$	100%	-818	-865	-1,783	-3,382	-4,295
		-Value added tax	1000 US$	100%	-8,491	-8,757	-14,934	-25,514	-34,715
		- Corporate tax	1000 US$	100%	-13,873	-11,587	-15,147	-27,120	-37,152
		Total	1000 US$		89,488	96,716	230,624	465,965	568,425
	Income	Power slaes	1000 US$		163,692	173,099	356,687	676,488	859,056
		- Others	1000 US$	0%	0	0	0	0	0
		Total	1000 US$		163,692	173,099	356,687	676,488	859,056
	Benefit	Cash flow	1000 US$		71,771	-140,048	-312,528	-68,720	-361,855
		EIRR	%	20.1%					