Chapter 13

Business Plans for the Master Plan

13. Business Plans for the Master Plan

In the Master Plan, we examine the possibility that PGN expand pipeline networks and develop the residential market. To carry out the expansion of business, it will be necessary for PGN to introduce various measures. This chapter proposes the relevant business plans. In Section 13.1, we suggest to modify the tariff structure to be based on the costs and to introduce the two-part tariff structure to make the recovery of the costs more stable. In Section 13.2, we recommend to improve the business organization to cope with the large increase of residential customers. Section 13.3 will mention some measures to promote gas sales in each market. Section 13.4 emphasizes the necessity to reinforce the contractor's work capability and to reinforce the action system against pipeline incidents. In Section 13.5, we propose training programs for human resource development including contractors to promote gas sales and to reinforce piping works. We recommend in Section 13.6 that PGN establish new marketing offices in the regions near customers considering the increase and the density of the customers. Section 13.7 points out technical problems to realize the Master Plan.

13.1 Gas Tariff Systems

Energy prices should not be distorted from economics as the signal of the market, and at the same time, energy pricing have to be consistent with national energy policies. In case of Indonesia, gas pricing policies are expected to give incentives to energy customers to promote energy conversion from oil to natural gas by keeping price advantages of natural gas against other fuels. At the same time, gas tariff structure has to be cost-based to make it possible to develop the gas pipeline network as national and urban infrastructures. Thus, a right price should be in between a minimum cost-based price and a maximum netback value that can compete with other fuels.

Natural gas is expected as a major energy in the residential sector, not only in the industrial sector. Though PGN changed its status from Perum to Persero in May 1996, the business may be expanding more to public domain. PGN will be required of more supply stability and management stability as a public utility.

To realize such stability in management, gas tariff should be designed on cost basis in principle. A basic idea is that "A cost causer should be the cost payer." Fig. 13-1-1 shows a theoretical flow of cost based allocation as an example. Distribution costs are classified into 3 categories. The gas purchasing cost is allocated in proportion to gas sales volume between general tariff and contract tariff. The pipeline cost should be allocated in proportion to gas flow per hour. Then, the customer service cost should be allocated in proportion to number of customers.

Table 13-1-1 shows the composition of demand characteristics by tariff categories based on the current situation. Currently, the difference between general and contract tariff is just about 10 to 20%. However, the distribution cost to general tariff customers can be several times higher than that of contract tariff. It is necessary to think some measures

to protect low income households from the standpoint of affordability, but a review of the tariff rebalance is needed from the cost allocation approach.

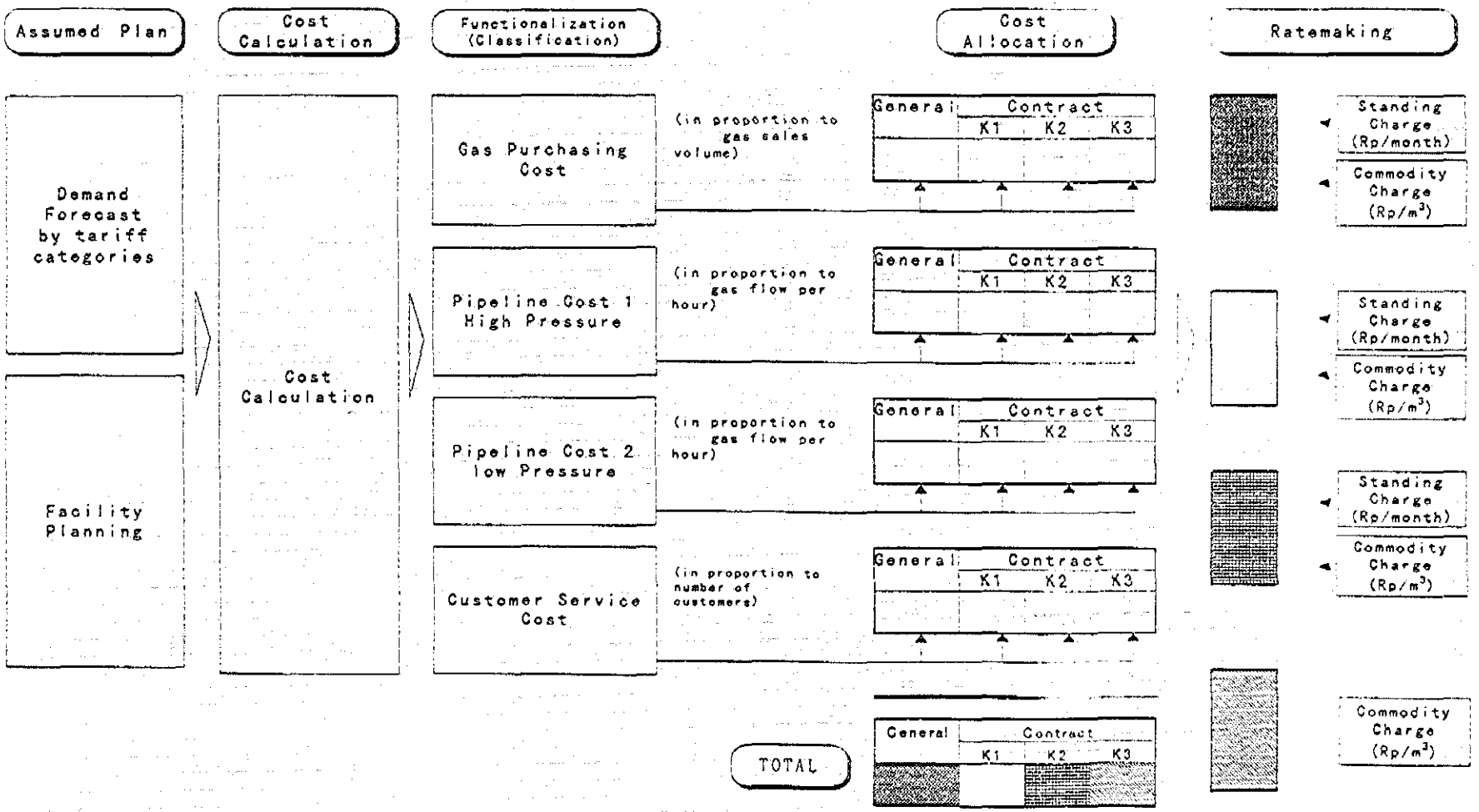
Table 13-1-1 Composition of Cost Allocation Factors by Tariff Categories

	General	Contract			Total
		K1	K2	K3	
Gas sales volume	0.4%	16.2%	65.4%	18.0%	100.0%
Number of customers	96.1%	3.5%	0.4%	0.0%	100.0%
Gas flow per hour	2.6%	15.8%	64.0%	17.6%	100.0%

source: JICA Team

To realize more stable recovery of cost through tariff revenue, the introduction of two part tariff may be considered. The two part tariff is composed of standing charge and commodity charge. According to an economic theory, standing charge and commodity charge should collect the fixed cost and variable cost respectively. However, in reality, the range covered by the standing charge has to be limited considering the affordability of small scale customers.

Fig.13-1-1 BASIC FLOW OF COST ALLOCATION AND RATEMAKING



13.2 Organization and Employee Plan

13.2.1 Organization Plan

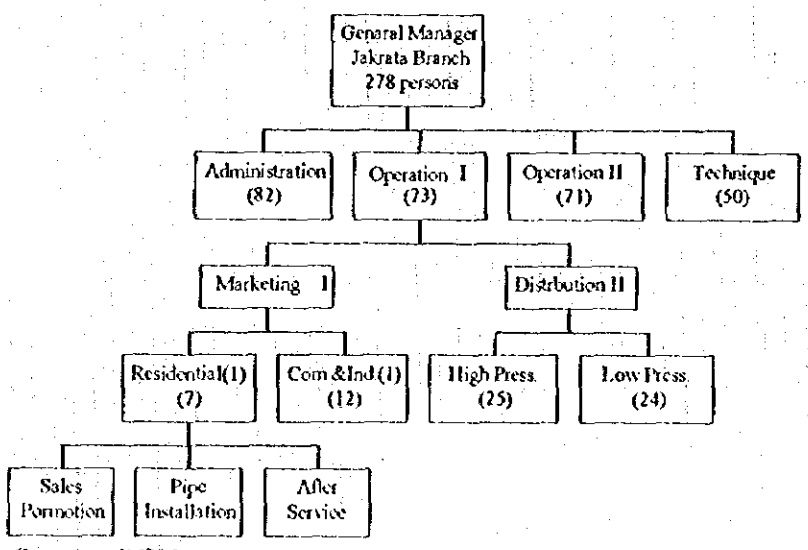
(1) Additional functions for residential and commercial marketing

Current marketing organization of PGN is oriented to industrial customers. In order to promote gas sale to residential and commercial market, restructuring of organization, strengthening of ability to make strategic plans to sell gas, and additional employees may be necessary.

Marketing activities for residential customers are different from those for commercial and industrial customers. Fig. 13-2-1 shows the current organization of Jakarta Branch. Marketing activities for residential customers are done by residential groups under Operation Sections. However, to respond to increasing residential customers more than twenty thousand per year, independent sections and additional work force for them may be necessary for registration, meter reading and tariff collection. Also new offices near customer residences, as well as introducing office automation systems and setting up information network among offices may be required.

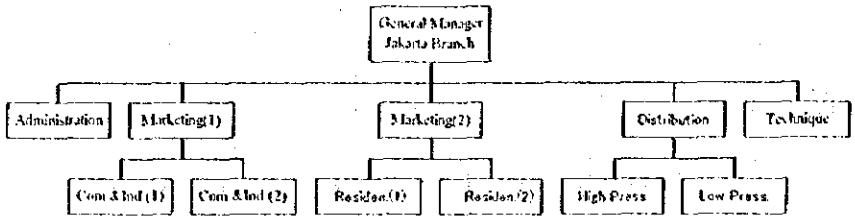
Fig. 13-2-2 suggests an example of new organization. The benefit of this organization is that managers of residential marketing sections are able to modify their sections in response to rapidly increasing customers in number without influence of commercial and industrial sections.

Fig. 13-2-1 Current Organization of Jakarta Branch



Source: PGN

Fig. 13-2-2 Suggested Organization



Source: PGN modified by JICA Team

(2) Strengthening gas pipeline construction and indoor piping capability

In order to accommodate the increase of twenty thousand new customers per year additional PE pipeline construction by another 200 km per year is expected. Furthermore, additional indoor piping by twenty thousand new customers per year is also expected. Work force for supervising pipeline construction and indoor piping is necessary too. New qualified contractors and plumbers are also necessary. PGN will be able to establish a contractors' group to control emergency situations including accidental gas leaks.

(3) Safety management for residential and commercial customers

PGN has more than thirty thousand residential and commercial customers, and it has accumulation of gas safety technology and standards. However, in line with a social trend, customers' demand for safety will increase year by year. The number of customers in high-rise buildings is also expected to increase. While gas safety in homes should be a responsibility of customers based on education by PGN, some personnel for safety patrol, safety campaign and customer safety management may be required.

13.2.2 Employee Plans

In order to make an employee plan in this Master Plan, the work capability rates and

Table 13-2-1 Productivity Ratios

Employee		Ratios
Staff in Branch Office		a person / 4 persons(field worker)
Worker in Branch Office		2.5 persons / a person (staff in branch)
Sales Promotion		264 housing / a person / Year
Meter Reading		1932 housing / a person / year
Billing/ Collecting		986 housing / a person / year
Maintenance	High Press.	6 km / a person
	Med. & Low Press.	3 km / a person
	Meter	548 meters / a person

Source: PGN

ratios which are based on the current status of PGN shown in Table 13-2-1, are applied as a starting point.

The Team's projection of marginal cumulative number of employees starting from 1997 until 2020 is shown in Table 13-2-2, which is based on the assumption that the productivity rises up to two times per decade, with Base Demand Case in Case1 to 4.

Table 13-2-2 Marginal Cumulative Number of Employees Assumed

Employee		1997	1998	1999	2000	2005	2010	2015	2020
Administrative Staff		16	35	62	81	102	82	57	34
Administrative Workers		36	76	126	154	137	78	38	16
Sales Promotion		21	36	61	61	42	29	21	0
Meter Reading		0	4	9	19	49	61	64	61
Billing		0	5	14	28	75	92	93	85
Maintenance	High-Med. Press. Pipe	9	17	23	29	31	29	27	28
	Low Press. Pipe	28	75	152	223	430	496	487	417
	Meter	10	26	56	82	155	181	176	152
Total		120	274	503	677	1,021	1,048	963	793

Source: JICA Team

According to the Table 13-2-2 the cumulative number of employees assumed is 793 in the final year (2020), in which the cumulative number of newly developed customers between 1997 and 2020 will be about 440 thousand. Therefore, the number of newly developed customers per employee will be 550 (=440,000/793), which is almost the same number with that of a current Singapore gas company (Power Gas), which is shown in Table 13-2-3.

Table 13-2-3 Customers/Employee Ratio of the World Gas Companies

	Company Name	Country	Year	No. Customer	No employee	Cust./Emp.
1	**Hong Kong&China Gas**	**Hong Kong**	**95**	**1,106,506**	**2,476**	**447**
2	**Shin Chang Natural Gas**	**Taiwan**	**95**	**74,884**	**167**	**448**
3	**The Great Taipei Gas**	**Taiwan**	**95**	**313,516**	**479**	**655**
4	**Power Gas**	**Singapore**	**95**	**316,780**	**477**	**664**
	Average					**554**

In 2020 PGN will have many residential and commercial customers and become a similar gas distribution company to one in Singapore.

The assumption that the productivity rises up to two times per decade, is equivalent that the productivity of PGN in 2020 will be the same one of the current gas company in Singapore.

13.3 Gas Sales Promotion Techniques

13.3.1 Techniques for Residential Market

(1) Basic Concept

The key to a successful development of the residential market is to quickly acquire a large number of customers near the new distribution grids, because sales amount of gas is comparatively small compared to other sectors. Gas will be readily competitive in the market even if the gas rate (tariff) is increased to a level that assures recovery of investment since that level will not be higher than the prices of LPG. But this possible success assumes that number of customers acquired and the gas sales per meter will be realized as planned. It is expected that when a pipeline grid is installed, many customers near the grid will be registered as customers. Attaining a high level of number of customers, however, will still be crucial for the feasibility.

Attention should be paid all the time to nearby potential residential customers when major pipelines mainly for larger customers in the commercial and industrial sectors are planned or implemented for further expansion of gas sales. Especially many target commercial customers may induce residential customers surrounding them once pipelines are installed and marginal costs for such residential customers are comparatively small.

In the development of about 50 residential estates that are taking off as stated in Chapter 9, among others, the residential market should be jointly developed together with the commercial markets for effective gas sales expansion.

(2) Incentives for Promoting Fuel Conversion

The number of existing LPG customers is tremendous. Therefore, PGN will have to deploy efficient and strategic sales activity so as to induce the LPG customers to decide on fuel conversion from LPG to urban gas. For the existing customers, approaching the organizations of the communities is an effective way compared with visiting each household for gas sales. As possible measures for promotion of urban gas demand, PGN will have to offer them such services as re-sale, take-over of their existing LPG cylinders and, in addition, adjustment and conditioning of necessary appliances at free charge which must be done for fuel conversion to urban gas, in order to reduce their burden of additional cost incurred by in-house pipe work.

(3) Points of Appeal to Customers

Bearing in mind that the main competitor is LPG, marketers should appeal to customers:

- Lower running cost
- more safety
- convenience
- cleanliness

The market activity should establish an environment in advance for customers to be readily connected to gas when pipelines come.

(4) Maintaining Safety Standards

PGN will be handling the increase of tens of thousands of customers in a year; i.e., mass number of customers requiring strict safety in implementation. Maintaining the safety is crucial for competitiveness with LPG, for maintaining customers and for sustainable development.

It is thus necessary to establish the guidelines for pipe construction quality, improved safety examination system and maintaining safe day-to-day work. The customer service activities should include safety check for customers in addition to meter reading, etc.

(5) Cultivating New Uses of Gas

With the increase of income levels and knowledge of new life styles and new use of gas like hot water showers, further increase of gas sales can be expected in the future. Hot showers are already installed in certain high income residences. Furthermore, it is recommended to appeal the effectiveness (e.g., comfort, healthy merit, etc.) of hot water to potential customers for development of new gas demand.

Kitchen utensils may also be more diversified from the current simple gas cookers, involving additional gas demand. Market developers should be kept abreast with the knowledge of new type of gas use and appliances, demanding for systematic education.

13.3.2 Techniques for Commercial Market

(1) Cooking Market

a. Targeting Gas Demand for Commercial Cooking

Gas demand for commercial cooking will be put under such an environment that gas is readily accepted due to its superiority in economic and convenience. In most cases, existing LPG users will convert LPG to urban gas when pipelines are installed. On the other hand, new gas pipelines are installed aiming mainly at industrial demand, gas air conditioning and steam generation in newly built commercial buildings. Therefore, when gas pipelines are newly installed, sales activity must be deployed so as to secure at least cooking demand from the existing buildings located along the gas pipelines.

b. Diversity of Appliances and Safety in Marketing

Unlike residential cooking , commercial cooking uses a variety of gas appliances as seen in various restaurants such as Chinese, Western, Japanese, Indonesian, etc. Thus, it is necessary and important for sales people to keep a list of commercial kitchen appliances in order to review and improve "Safety Check Points" as well as to acquire the knowledge on products.

Upon the visiting survey we could see some Chinese restaurants still using kerosene or LPG due to its high thermal output despite that they have already introduced urban gas. Herein it should be noted that urban gas can output thermal energy equivalent to kerosene and LPG by resetting the house regulators in current use. In this connection, the sales personnel are required to acquire the knowledge relating to modification of the related equipment and appliances for full understanding of customers' needs and problems in use of urban gas as well.

c. Effective Approach to Chain Restaurants

As known, new style chain restaurants such as McDonalds, KFC, Pizza Hut, Hoka-Hoka Bento, etc. have increased rapidly. For successful gas sale to these restaurants, safety, convenience and economic merit of urban gas should be propagated to their headquarters' division which has the power to decide on purchase of equipment and, in addition, necessary activities should be deployed to get the information on future store deployment (expansion) from such restaurants. The activities should be deployed toward a goal of standardizing "Once gas pipelines are installed in the street, gas appliances are there."

(2) Gas Demand for Steam Generation, Air Conditioning and Power Generation

a. Building-up a Formation for Gas System Installation

Market development for boilers, air conditioners and co-generators should promote not individual appliance sales but installing gas systems. Two sales policies can be derived from this as follows:

- The first point is that it is difficult to develop the market only by appealing the superiority of urban gas. An important thing is to have the performance of total gas system understood by customers. For this purpose, it is indispensable to educate sales engineers who are familiar with the total gas system. They are required to have the ability to present an efficient system building-up and comparative evaluation of its economic merit against other competing systems. For the purpose, the headquarters is required to establish a training system, while each branch is required to have several sales engineers (specialists).

- The second point is that a simple change of equipment for heat source conversion is difficult and, in many cases, this conversion is subjected to modification of existing building structures. In other words, the initial cost incurred by introduction of a gas system in existing building is high and, therefore, the target of sales activity should be narrowed to new buildings. In that case, it is important that sales activity should be deployed at an early stage of construction plan so that the gas equipment system is built in a building structure. For this purpose, it is indispensable to keep continued good relationship with project developers, design consultants, constructors, and equipment suppliers and, in addition, to promote the activity for collecting relevant information. It is recommended to hold presentation meetings, exhibition, etc., to disseminate information of gas systems for application to boilers, air conditioners, co-generators, etc., several times a year. One more efficient sales method is to deploy joint sales activity with equipment manufacturers and distributors/agents and to have the meeting for exchange of sales information.

b. Recognizing the Importance of Maintenance especially for Absorption Chillers

Several units of gas absorption chillers were introduced and installed in the past. But all of them are currently sleeping. Why? One possible reason is maintenance failure. Maintenance is indispensable for such gas absorption chillers. To make such equipment fruitful, PGN is required to review and improve the current maintenance systems, under close tie-up relationship with the equipment manufacturers and service contractors. As an idea, we recommend PGN to newly set up "air conditioning charge" for secure execution of the maintenance by PGN and manufacturers, and to add the periodic

maintenance charge to the regular gas charge.

c. System Development

The units of boilers, air conditioners, and power generators are well commercialized products and, therefore, technical development effort should be toward to collecting such data as to lead to system development and sales tools. In that sense, installing a model system of "Co-generator + gas air conditioning equipment" in the headquarters' building will bring good public relations effect and, in addition, the model system will be effectively utilized for acquiring sales engineering technique and for getting sales support tools such as collection of operation data, etc.

d. Strategic Pipeline Installation

Similarly to the gas development for residential sector, development of commercial gas market greatly demands for gas pipeline availability. Since new buildings are mainly targeted in the commercial sector in comparison to existing houses targeted in the residential market, pipeline planning is more difficult, but more affects sales result. Many buildings are currently being constructed at an extra work speed in DKI . As prescribed in Chapter 9, they are concentrated in the zone of "Golden Triangle". For success in this zone, gas pipelines should be installed by advance planning along the main streets in DKI (subsidiary to subway construction work). Furthermore, gas pipeline work should be performed in relation with large regional development, with careful attention to the progress of the development.

13.3.3 Techniques for Industrial Market

(1) Introducing Consultant Type Sales Activity

Deployment of the sales activity to the field of industrial heating equipment, wherein PGN shares almost all of total gas sales, is already successful. Now the industrial sector is a seller's market, as proven by the existence of a "Waiting List". However, such sales attitude as to wait for application is considered as too passive, from the viewpoint of remarkable sales expansion of urban gas. Rather consulting sales activities are desired to meet customer's need and to develop new type of gas use. In this view, sales personnel will have to be trained so as to acquire "required sales mind" and "sense of engineering" to develop new market.

(2) Cultivating New Markets

For developing new gas demand, advancing into new fields (chilling, power generation,

etc.) other than heating application will be required in the future. By this approach, investment in pipelines can be utilized effectively toward a goal of maximizing gas development volume per customer. For example, it is desired to promote the introduction of gas equipment systems such as gas absorption chillers, as heat source units for chilled process water and space cooling, and "gas boiler + steam absorption chiller", etc. Also, introductory promotion of co-generation equipment which leads to realization of stable supply of electric power for manufacturing and extensive energy savings will greatly contribute to further sales of urban gas. Furthermore, such co-generation equipment enables to build up various systems which use waste heat effectively from power generators, as process steam, and, in addition, to use waste heat in cascade by driving steam absorption systems. As prescribed in "Commercial Market", sales personnel engaged in sales activity of these systems will be required to have the knowledge of equipment a little different from the knowledge that special engineers in charge of production equipment have. Therefore, in a short-period view, it is one of promotion ideas to educate special sales engineers specializing in "air conditioning + co-generation" so that they can act as a sales engineer for development of both commercial and industrial gas markets, and to strengthen the sales activity in the fields of electric power and air conditioning.

(3) Strategic Sales Activity for New Industrial Estates

Many new industrial estates are being promoted in West Java where industrial production activities are remarkably growing. Even from the viewpoint of strategic investment in gas pipelines, it will be effective to organize a special team specializing in this field where tremendous demand is prospected. Deployment of sales activity at the early stage of construction will facilitate built-in introduction of air conditioning and co-generation systems and this will lead to remarkable sales expansion of urban gas. Based on good relation with the developers of the industrial estates and on the close information exchange, the distribution pipelines could be installed in the estates not to miss the timing for the users in the estates. For the purpose, the friendly relationship with a developer within the industrial area should be built up and, based on this good relationship, the pipeline should be installed in due time under closely exchanged information so the area customers can use urban gas as wanted, without delay.

13.4 Pipeline Construction Management

13.4.1 Reinforcement of PE Pipeline Construction Companies' Work Capability

The present PE pipeline work capability of 17contractors in the service area of PGN Jakarta Branch is approximately 40 km per year altogether, as detailed in Section 12. This capability may have to be widely reinforced up to 200 km per year to cope with this Master Plan in the future. Jointing PE pipes is automated for simple work using a special controller, but pretreatment of pipe section surfaces before joint fusing is difficult to automate and, in addition, it may greatly affect work quality. When the PE pipe was introduced to Bogor Branch for the first time, PGN experienced gas leak from many pipe joints after joint work, due to inadequate pretreatment of pipe surface before fusing.

Table 13-4-1 No. of Pipe Construction Companies in Jakarta Branch

Construction	Class	Number
Steel Pipe	A	9
PE Pipe	A	9
	B	8

Source: PGN, 1996

In addition, it is practically impossible to conduct nondestructive inspection on the installed PE pipes in the field to check the quality of joint work. Due to these reasons strict work control at work site is indispensable. It is not the best way, viewed from the efficiency, that a supervisor of the gas company always stays at work site to check work performance. Therefore the work control by construction company at its responsibility is adopted world wide.

The preconditions for adoption of this work control system are to review and improve work order specifications, work personnel qualification and certification system including training , the code of responsibility against accidents, etc. Though PGN already adopts the work personnel qualification and certification system, the system itself relating to pipeline work will have to be reviewed from the viewpoint of newly distributing urban gas into several hundred thousand of unspecified customers (users) which are difficult to directly control.

Furthermore, this Master Plan has decided to adopt 32 mm PE pipes, which are currently used only for service pipes, as distribution pipes in order to save the cost of distribution piping work within residential areas. The distribution and service pipeline work contractor have only fusion machines available for pipes of 63 mm and over and, in addition, they will have to educate and train their work personnel because they have no experience in the piping work as mentioned above.

13.4.2 Protection of Gas Pipes from Damage by Third Party Construction Work

A number of medium pressure (approx. 1 bar) 32 mm PE pipelines are to be installed to distribute urban gas for civil use under this Master Plan. This means that the pipelines installed have high risk of being damaged by third party works such as water work, electric work, etc., after completion of the gas pipeline work. To protect the pipelines from such a risk of damage, it is important to maintain and control the information on the buried pipelines and to share the relevant information with utilities and companies. Utilization of the Map System(a computer graphic pipeline management system) on DKI level is already started, but more effective use of it is difficult under the current condition in which the information input speed can not follow. Therefore PGN will have to purchase its original map system while transferring its relevant data to DKI's Map System in its view field and to supply other construction companies with the latest information of the buried pipelines to thereby protect the installed pipelines from damage by third parties. The mapping software relating to creation of buried pipelines were developed by gas companies in the world and are already commercially available, which PGN will be able to introduce at a reasonable price.

13.4.3 Optimization of Gas Meter

The result of load survey revealed that maximum gas consumption per hour at general family was 0.8 m^3/hr. The minimum capacity of gas meters currently used by PGN is 2.5 m^3/hr , which is too large meter. Our intention is to review the current gas meters and to adopt a cheaper meter because the investment for gas meters shares a great portion of the total investment required for gas spread into families.

13.4.4 Reinforcement of the Current Action System against Pipeline Trouble or Accident

It is forecast that gas leak accidents become more frequent in proportion to the number of increasing customers. A gas accident does not occur continuously at constant time interval. It occurs suddenly. It is more realistic to flexibly take countermeasures against accidents by construction company's employees who acquired the knowledge of "How To Take Actions Flexibly " than to organize a special counteraction team within PGN. For the purpose, it is necessary to build up both the personnel training system and the accident countermeasure system.

13.4.5 Setting up the Unit Price of In-house Service Pipe Work

Currently the in-house service pipe work is quoted by individual work companies

(contractors) and PGN concludes the contract with customers regarding the pipe work. This is the current transaction flow. To improve this, however, PGN personnel in charge of business development should prepare and utilize " Quoted Unit Price List for In-house Service Pipe Work" so that sales personnel can quote in-house pipe work by themselves. Because doing so will make the quotation service more efficient.

13.5 Human Resource Development

In order to strengthen the organization to cope with increasing number of customers by twenty thousand per year, together with standardization and documentation, training and education are necessary for both new and existing employees.

13.5.1. Desired Training Items

(1) Training and education for gas safety

1) Preparing for Standards

First, relevant safety standards have to established, e.g.:

- Standards of installing gas appliances and equipment including piping for natural gas and ducting flue gas
- Standards of piping for high rise buildings

Industrial gas users are mostly energy experts. However the commercial and residential users, who are expected to increase, have very poor knowledge of gas appliances and safe usage of gas. According to the load survey of residential gas users, continuous gas usage for a long time is popular. For wooden made houses which have a lot of open space, there should normally be no danger of CO poisoning by flue gas. However for the tightly sealed concrete houses in the urban area which are potential gas users, not only gas leakage prevention but also complete ventilation is important.

2) Dissemination of the standards

3) Training and education based on the standards

(2) Training on market promotion

- Acquiring basic technology of strategic appliances
- Accumulation of marketing know-how including gas cooling and cogeneration

Currently technologies of gas cooling systems and cogeneration systems are only known by a few experts. This is because urban gas has not yet been recognized as a public utility yet and gas appliances such as gas cooling and cogeneration are very sophisticated. PGN is expected to make effort to popularize urban gas and to raise its value through various gas applications. Implementation will require advance training:

1) Increasing programs for appliance knowledge
Programs for gas appliances are desired as gas appliances will become more sophisticated, and most modern appliances are with IC chip.

2) Cooperation with appliance manufacturers
Cooperation with gas appliance manufacturers is expected in training programs. This will be done by inviting instructors and sending trainees to manufacturers. Such cooperation is beneficial for both parties.

3) Increasing the number of qualified sales engineers
Sales engineers are expected to have knowledge of gas appliances, and the ability to design basic energy systems, to calculate and evaluate economic data between gas and other energies, and to act as energy consultants to advise potential customers.

(3) Measures for increasing piping works

- Qualifying polyethylene pipe laying work
- Qualifying indoor piping
- Training for Contractors

1) Qualifying polyethylene pipe laying work
Polyethylene pipe laying work will increase as gas is distributed to commercial and residential customers. Quality of fusion joint is strongly influenced by pre- treatment of surface of PE pipe. PGN already has a qualified contractor system. Review and upgrading of this system is expected to strengthen the PE work capability.

2) Qualifying indoor piping
The majority of gas accidents occur in houses. Systems to maintain safety standards to prevent these accidents are expected to be incorporated in the programs. Training house pipe plumbers and contractors is expected to be strengthened.

3) Training for Contractors
Training programs for not only employees but also contractors, including pipeline constructors and repair personnel, will be desired, because the quality of gas work is crucial. To maintain their skill level, periodical follow-up training is also important.

(4) Organizational integrity toward productivity improvement

The economic and financial analysis in the Study assumes that the productivity of the organization will increase with time in the future. This may not be accomplished without certain measures included in the training programs.

Larger organizations of which PGN will be one in the future, require organizational strength with integrity for conducting larger businesses, as well as individual strength. Larger work involves more staff people and more failures, unless more in quantity and more fine tuned adjustment among staffs is made. More systematic work rules have to be established and an organization has to motivate its employees to observe the rules toward higher performance.

This will be achieved not by hardships on the side of employees but by appropriately addressing the work rules, work ethic, good practice, necessity of transparency, mutual communication and integrity, and thus by changing organizational customs.

It is expected that senior employees will perform good practices which are in turn addressed to younger employees through training courses, effectively enhancing the organizational integrity and reliability attracting customers and domestic and foreign trade partners.

13.5.2 Voluntary Education Courses

An allowance system for certain voluntary education courses, if existing in Indonesia, will be favorable for encouraging employees and improving morale. The rate of allowance to the total may not be 100% but 50% or less than 50%. It is more favorable if some incentives to progress are added. For example, a student getting an allowance has to improve his /her study level. If not, the allowance is canceled.

13.5.3Training Center for Employees and Contractors

1) Suggested Gas Utilization Technology Training Center
In order to promote gas sale by utilizing relatively new technologies such as gas absorption chillers, PGN is expected to make an effort to train sales engineers at a technology training center. The center will be equipped with facilities, instruments and gas appliances to train salesmen/women how to sell such gas appliances, some of which are very sophisticated.

For example, gas absorption chillers seem to have a great potential market in Indonesia. However, they are not well known by potential customers. PGN salespeople are expected to approach and let the customers know how economical they are and how to operate and maintain them. PGN already has a training center in each operation site. However, they are equipped with only class rooms and some language labs. More practical facilities which are equipped with test field and equipment, are also expected.

2) Facility for Qualifying and Training Piping Contractors
In order to maintain the quality of pipeline construction and maintenance work, reviewing qualification systems for such as plumbers of polyethylene piping, and

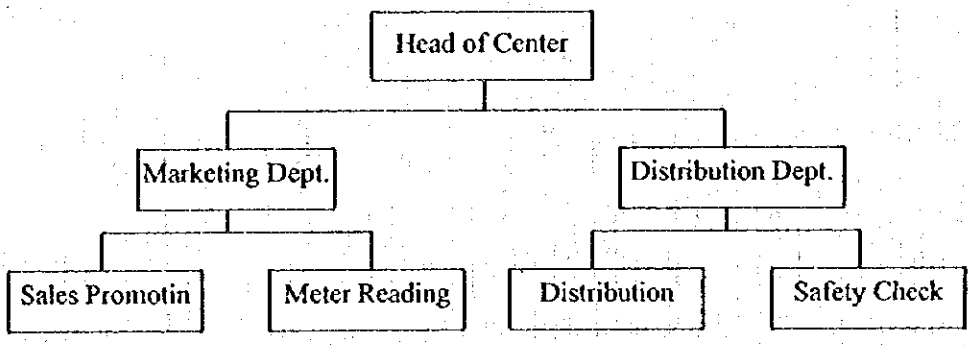
periodical and continuous training is important. Facilities for that purpose are also expected.

However, it seems uneconomical to build these facilities separately. One of the solutions may be to build a comprehensive facility to fulfill these functions and to share the facilities, instruments and equipment.

13.6 Business Facility Plans

According to the Mater Plan, the number of customers of PGN will increase drastically because PGN newly develops residential market. Currently, Jakarta Branch locates central Jakarta area and is in charge of broad area. When PGN develops new customers, we recommend that PGN establish new marketing center effectively in each region considering the increase and the density of the customers. New marketing center is expected to have a function of appliance sales, safety check, meter reading, bill collecting. The function of current branch may be restricted to the control of regional marketing center and administrative affairs. It is expected for the marketing center to contribute the improvement of service standards of PGN because it is possible to cope with customer needs much more quickly both marketing and safety aspects. At the same time, rationalization of PGN operation can be expected because moving time from branch to customers can be shortend. Also, facilities related to automobile and telecommunication have to be maintained.

Fig. 13-6-1 Function of Marketing Center



In the early step of market penetration of natural gas in the residential market, the customers needs may be relatively simple. Therefore, the major function of marketing center is to cope with customer requests. In the next stage of market development, however, customers' needs may become much more complicated. Then, marketing center should have more sophisticated function. PGN has to create database of all customers utilizing computer network. The database should contain customer information about appliance, billing, record of trouble. To make use of customer information in the database, network facility has to be provided in each markeiting center.

13.7 Other Technical Matters for Implementation

13.7.1 Conversion of Gas Appliances from LPG to Urban Gas

LPG is rapidly spreading as a fuel for residences in the Jakarta area. This Master Plan targets existing residential areas from the viewpoint of promoting early return from the investment in the urban gas pipelines. LPG is the competitive fuel for cooking. PGN began conversion from manufactured gas into natural gas about 20 years ago and, therefore, it has the experience in converting gas appliances to the specifications for natural gas application. At that time, however, the conversion from manufactured gas (4,200 kcal/m^3) to natural gas (8,800 kcal/m^3)was not so serious because the customers could adjust the combustion rate by a valve of the gas appliances. On the other hand, it is forecast that the conversion from LPG to natural gas incurs a large change in gas input and, as a result, could cause complains from customers due to input shortage if adjustment of the appliances delays.

Table13-7-1Number of Households Using Gas Cookers by Brand Name, 1994

Name of Maker	Total	Cities			
		Jakarta	Surabaya	Bandung	Semarang
Rinai	187	26	43	44	46
Hitachi	111	23	24	25	32
Sanyo	74	16	7	14	19
Corina	30	5	10	8	5
Arison	11	4	1	3	3
Compro	7	4	1	0	2
National	26	4	6	2	7
Fhisher	23	3	0	13	5
Madena	11	3	5	1	2
Paloma	8	2	0	5	1
Saporo	7	1	2	0	2
Others	45	23	17	23	17
Total	582	114	116	138	141

Source:GIC No.130-4th June 1995 (thousands of households)

The work system for smooth conversion of the gas appliances to the specifications for natural gas must be built up so as to ensure adjustment of the gas appliances in good time with supply of natural gas. Supply of relevant information and cooperation from and by manufacturers of gas appliances are indispensable to build up such a conversion work system. We had an opportunity to exchange the related information with a manufacturer of appliances who appears to have the highest share in the field of gas appliances in Jakarta.

Judging from the information, gas appliances in general require replacement of nozzles for conversion to natural gas, but the personnel in charge will be able to acquire necessary skill for the replacement by participating in several days' education and training course. Furthermore, other appliances, e.g., hot water heater, etc. could be modified more efficiently by the manufacturer than by the gas company. Table 13-7-1 shows the market shares of gas appliances in recent years. It is necessary to have full advance discussion to these appliance manufacturers. A document in appendix describes the adjustment specification for major appliances and expenses incurred by the adjustment.

13.7.2 Improvement of Standards for Installation of Gas Equipment and Gas Appliances

It is forecast that residential spaces which mostly have been of open-style will be modified into more airtight spaces in Indonesia in order to spread cooling system and to upgrade cooling efficiency with further improvement of the living standards. Furthermore, medium- and high-storied residences currently under construction in Jakarta City will be of more airtight structure due to great difference of building style from a single house. As a result, the environment of gas consumption will change from open style to high airtight style and this change is forecast to result in higher risk of explosion accidents which are caused by gas leak and of flue gas accidents . Under such a trend, the "standard for installation of gas equipment within medium- and high-storied buildings " and the " standard for installation of gas appliances at high airtight residences" must be improved in order to prevent recurrence of such accidents and to minimize damages even if any of them occurred.

(1)Standard for installation of gas equipment within medium-and high-storied buildings

In this Master Plan we recommend a medium pressure house regulator system as the gas distribution, but this system is subjected to leading of medium-pressure pipes into medium- and high-storied residences, and such residences may be more influenced by gas leak. To minimize such an adverse influence, supply of low pressure gas into each building must be considered. In addition, the standard for installation of gas equipment must reviewed and improved, considering shaking of building structures which results from earthquake. The Team explained the " Gas safety systems in Japan" throughout the period of local survey, but direct application of the Japanese standards to building structures in Indonesia will cause over-specification of equipment due to difference in the concept of earthquake resistance, etc. The original standards suitable to Indonesia will be needed.

(2)Standard for installation of gas appliances at tall airtight residences

The result of the load survey revealed that urban gas was used at many families for a long time (3 to 4 hours in a day). Supply of fresh air or complete ventilation is indispensable to use urban gas in good condition in a house. Although installation of a ventilation fan is not an absolute requirement for gas service and exhaust, a ventilation port ($10cm^2$/1000kcal/hr, Japan case) will have to be provided for smooth natural ventilation So it will be important in the future to establish the standard for installation and to deploy public relation activity into construction companies for promoting installation of ventilation ports. It will be an urgent subject for spread of city gas to families to create these standards that match the living situations of Indonesia.

Chapter 14

Economic and Financial Projections of the Master Plan

14. Economic and Financial Projections of the Master Plan

14.1 Alternatives for Smaller Market Viability

14.1.1 Five Pricing and Business Alternatives

In defining the Master Plan and Feasibility Studies, we find that it is not always financially feasible to develop a new market in the residential sector if PGN keeps its tariff structure to remain at the current status. On the other hand, there are many points to support residential use of urban gas which are summarized as follows:

1) Since many people are switching to LPG from kerosene in the residential sector, the economic price of urban gas can be measured from the price of LPG. We find it as 800rp/m3 in gas price terms, which can compete with LPG and will make it feasible to develop the residential market.
2) Because LPG has some safety problems, more developers seem to hope that gas will be distributed to residences.
3) The price of gas for existing residential customers of PGN is well below the actual cost. PGN has been trying to modify the price structure to make it closer to a condition which fairly reflects the cost. A fair price to the residential sector will give the gas distributor and transmitter an incentive to develop new markets in that sector.

We assume 5 alternative cases of gas pricing directions and business sponsors in developing new markets in the master plan and feasibility studies to find a feasible case to distribute gas to residences as shown in the following table.

Table 14-1-1 Alternative Cases for Pricing & Business Unit

	Gas price	Investment	Operation
Case 1	Keep current price level	PGN	PGN
Case 2	Raise gas price gradually to an equivalence to competitive fuels	PGN	PGN
Case 3	Keep current price level	Government	PGN
Case 4	Raise gas price gradually to an equivalence to competitive fuels	Government	PGN
Case 5	Raise gas price immediately to equivalence to competitive fuels	third party (e.g.,a subsidiary)	third party (e.g., a subsidiary)

Sources:JICA team

In Case 1, we assume the government keep a rigid gas pricing policy and give no support to initial investment for distribution pipelines. Therefore, the feasibility may be tough.

In Case 2, we assume the government approves a gradual increase of a gas tariff to

800Rp/m^3 in the residential sector in ten years which is equivalent to that of LPG. Even in that case, it may be hard to get feasibility of the project in such areas as Bekasi, where gas users are only residential.

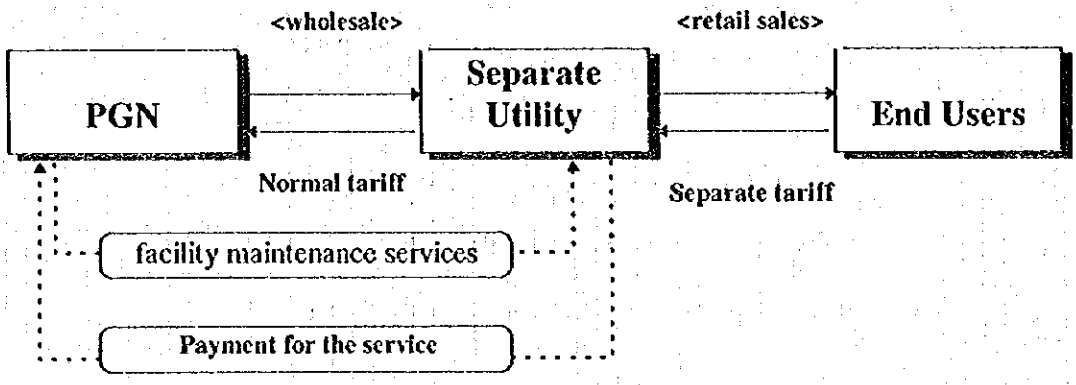
In Cases 3 and 4, we assume that residential distribution pipeline investment is borne by government as an urban infrastructure. In the case of Bekasi, it seems realistic to adopt this method as the developer is a governmental body, Perum Perumnas. Actually, we find an example in the water business that initial investment is covered by government.

In Case 5, a separate utility established for commercial and residential sectors distributes gas. We assume immediate increase of gas tariff in commercial cooking and residential use up to 800Rp/m3, which competes with LPG.

14.1.2 Separate Utility Entity Concept

The separate utility entity concept is summarized in the figure below:

Fig 14-1-1 Separate Utility Entity Concept



Source:JICA team

For the financial projection, we assume PGN will invest in transmission lines, offtakers and meter stations, high pressure mains and "A" regulators. PGN will invest in those facilities strategically to meet future regional demand.

A separate utility will invest in regional mid or low pressure mains after "A" regulators and distribution lines together with "B" regulators.

The separate utility, in case 5, will be in charge of meter reading and billing/collections but the facility maintenance work for safe distribution of gas will be contracted to PGN. Such work requires special skills and experiences so that it would be realistic for PGN to be in charge of them. The separate utility should pay for those jobs to PGN to give them

incentives for the work, but in the projection we assumed labor costs for the facility maintenance service for the safe gas distribution is included in the PGN tariff charged to the separate utility.

We assume the separate utility will be in charge of rather simple jobs like meter reading, billing and collecting. We assume as labor costs for separate utilities two thirds of the average salary level of PGN. Because of this assumption, the overall economic IRRs of this total system are slightly higher than in Cases 1 to 4.

14.2 Assumptions for the Master Plan

14.2.1 Assumptions

We conducted the economic and financial assessment of the Master Plan in each Pricing and Business case based on each demand projection. In Case 5, the feasibility of a separate utility entity in the Master Plan as a whole is also conducted. Basic assumptions are as follows:

1) We conduct these in real terms, fixing the exchange rate between Dollar and Rupiah remaining unchanged at 2,350 Rp/$. Projections are conducted in Rupiah.

2) Projections are conducted on the incremental basis starting from 1997.

3) Necessary workforce is on the incremental basis. In that process we assume labor productivity to be doubled in 10 years, while initial labor productivity in 1996 is at the current level of PGN. This will be possible because the educational level of Indonesia is going up, and new office equipment is being installed. This increase in labor efficiency is generally assumed, and we are not doing detail analyses to enhance labor efficiency.

4) Personnel expenses are estimated based on the average salary level of PGN now. We also estimate pension expenses to be 10% of the salary. Salary includes bonuses, which are being paid from after tax profits now in PGN. Labor cost of separate utility entities are set at two third of the current average salary level of PGN. Pension plans are not assumed for the workforce. Those assumptions make economic feasibility of Case 5 slightly different from other cases.

5) Administrative expenses are estimated to be 30% of the total salary expenses.

6) Maintenance and other expenses are set at the level of 2% of cumulative total investment in this master plan.

7) An economic price of gas for residential customers is set at 800Rp/m3, which is equivalent to the price of LPG, as of gas including bottling charges. This is because we assume LPG users to be the main competitor.

8) Selling the right of an LPG bottle is counted as a social benefit and in-house pipeline installations are counted as a social cost in the residential sector. The price and cost of the bottle are estimated at 200,000Rp and 400,000Rp respectively per customer.

9) In the financial projection, the difference in the cost of LPG bottle to be avoided and the installation of indoor pipelines is thus 200,000Rp per residential customer, which may discourage residential customers to accept urban gas. In that case the gas utility may need to pay for it even if the indoor pipes are owned by the customer. Financial assessment is also made for such a case.

10) An economic price of gas for commercial cooking is also supposed to be the level of LPG. LPG bottle selling is counted as a social benefit and in house pipeline installations are counted as a social cost. In Case 5, a financial feasibility analysis for a sub-case when those costs are substantially paid by the separate utility was conducted together with the residential sector.

11) Economic prices for commercial air conditioning are taken from the price of electricity. The difference of the initial investment cost of air-conditioning facilities between turbo chillers which use electricity and absorption chillers which use natural gas is counted in social benefit and loss account.

12) Economic price of gas for the industrial users is estimated from the price level of a basket of competing fuels, such as IO, FO, and Kerosene. Components of the basket are those of the current share of each fuels used in the Jakarta Branch area. The transportation cost to refill competing fuels is included in this price. The difference between initial facility investments to use such energies like IO tank or in house pipeline installations are counted in the social benefit and loss account.

13) The financial cost of gas which is the cost of gas PGN needs to pay to purchase

gas is estimated in such a way; i.e., until 2000: costs are calculated on the contract between Pertamina and PGN; from 2000: we suppose incremental demand will be supplied with gas from South Sumatra, whose cost will be 260Rp/m3 in real terms; from year 2011: we simply set a cost of gas/m3 as 10Rp higher than that of the economic cost that we estimated.

14) For Case 5, we estimated financial projections of such separate utilities as a whole in this Master Plan in each demand case. Here we assume separate utilities will invest in all the gas facilities after "A" regulators, distribution mains from "A" regulators to "B" regulators, "B" regulators, distribution pipes, and service pipes to customers.

15) In each case, downside contingency (sensitivity) analysis with 2% sales volume and 10% of facility investment has been done.

16) In Base Case demand and High Case demand, the second transmission line is supposed to be constructed before 2020 in the course of demand increase. In Base Case, we assume the transmission pipe construction begins in 2016 and completed in four years. In High Case demand, it will begin in 2013 and be completed in four years.

17) A sensitivity analysis for a case of the labor efficiency to double in twenty years is done only in Case 2 .

14.2.2 Investment Plan

The table blow is the investment plan of master plan in each demand case.

Table 14-2-1 Investment Plan

(Base Case)

	2000	2005	2010	2015	2020
Cumulative industrial transmission (km)	144.5	144.5	144.5	144.5	275.0
Cumulative residential & commercial transmission(km)	40.0	90.0	140.0	190.0	230.0
Cumulative industrial distribution (km)	8.4	19.5	40.1	80.3	140.4
Cumulative commercial distribution (km)	40.0	90.0	140.0	190.0	230.0
Cumulative residential distribution (km)	580.0	1,580.0	2,580.0	3,580.0	4,341.2
Cumulative offtakers (units)	23	58	119	233	398
Cumulative A regulators (units)	5	15	25	35	43
Cumulative B regulators (units)	58	158	257	358	434
Cumulative meter residential (units)	58,000	158,000	257,999	358,001	434,122
Cumulative meter cooking (units)	126	645	1457	2,572	3,755
Cumulative meter AC (units)	57	321	725	1,275	1,854
Cumulative meter industrial (units)	112	261	538	1,077	1,884

(High Case)

	2000	2005	2010	2015	2020
Cumulative industrial transmission (km)	144.5	144.5	144.5	242.4	275.0
Cumulative residential & commercial transmission(km)	40.0	90.0	140.0	190.0	230.0
Cumulative industrial distribution (km)	10.5	23.9	51.0	123.8	253.6
Cumulative commercial distribution (km)	40.0	90.0	140.0	190.0	230.0
Cumulative residential distribution (km)	580.0	1,580.0	2,580.0	3,580.0	4,380.0
Cumulative offtakers (units)	28	69	148	346	691
Cumulative A regulators (units)	5	15	25	35	43
Cumulative B regulators (units)	58	157	257	357	438
Cumulative meter residential (units)	58,001	157,999	257,999	358,000	438,000
Cumulative meter cooking (units)	127	656	1,500	2,719	4,089
Cumulative meter AC (units)	57	326	747	1,347	2,017
Cumulative meter industrial (units)	140	321	685	1,661	3,402

(Low Case)

	2000	2005	2010	2015	2020
Cumulative industrial transmission (km)	144.5	144.5	144.5	144.5	144.5
Cumulative residential & commercial transmission(km)	40.0	90.0	140.0	190.0	230.0
Cumulative industrial distribution (km)	6.3	15.8	29.1	46.7	69.3
Cumulative commercial distribution (km)	40.0	90.0	140.0	190.0	230.0
Cumulative residential distribution (km)	560.0	1,580.0	2,580.0	3,294.5	3,852.3
Cumulative offtakers (units)	18	48	90	145	213
Cumulative A regulators (units)	5	15	25	32	38
Cumulative B regulators (units)	55	158	258	329	385
Cumulative meter residential (units)	55,998	158,000	258,001	329,447	385,227
Cumulative meter cooking (units)	126	632	1,408	2,415	3,421
Cumulative meter AC (units)	57	314	701	1,198	1,691
Cumulative meter industrial (units)	84	212	390	627	929

Sources:JICA team, Appendices O, Master plan

Industrial transmission pipeline length reflects conditions stated in **14.2.1** 16).

Residential and commercial transmission lines are those which transmit gas from high pressure mains to gas supplying areas. Those are assumed to be installed 10 km annually.

Distribution lines are those which will be installed in gas supplying ares after A regulators or B regulators. Length of industrial distributions are assumed from the amount of space of planned industrial estate. Commercial distribution lines are assumed to be installed 10 km annually. Residential distribution lines are assumed to be installed 10m per customer.

Offtakers are stations to extract gas from high pressure mains and will be increased in accordance with total demand increase.

A regulators are installed per 10 of B regulators. B regulators are installed per 1000 residential customers.

14.2.3 Additional Workers for the Master Plan

We also assumed additional workers for master plan. In the estimation we used current labor efficiency of PGN, and assumed the efficiency will be doubled in 10 years. Detailed discussions of this assumptions are in **13.2**. Figures are shown in the following table below.

Table 14-2-2 Additional Workers for the Master Plan

(Base Case)

(persons)

	2000	2005	2010	2015	2020
Staffs	81	102	82	57	34
Administrative workers	154	137	78	38	16
Workers	442	782	888	868	743
Total	677	1,021	1,048	963	793

(High Case)

(persons)

	2000	2005	2010	2015	2020
Staffs	82	102	82	57	35
Administrative workers	154	137	78	38	17
Workers	442	783	890	879	759
Total	678	1,022	1,050	974	811

(Low Case)

(persons)

	2000	2005	2010	2015	2020
Staffs	79	103	82	52	30
Administrative workers	150	137	78	35	14
Workers	429	786	886	795	654
Total	658	1,026	1,046	882	698

Sources:JICA team, Appendices O

14.3 Results and Assessment of the Master Plan

14.3.1 FIRR and NPV of a Project

In assessing financial analysis, we see FIRR (financial internal rate of return) derived from financial cash flow. FIRR is the discount rate to make NPV (net present value) of financial cash flow zero. Here we assume C i as cash flow at year i. NPV is derived as follows assuming discount rate equal r.

$$NPV = \sum_{i=1}^{n} \frac{Ci}{(1+r)^i}$$

NPV is the current value of a cash flow with a certain discount rate, which represents time value or return of cash flow. If we know the fair return of the project, discounting cash flow with that discount rate, we get the NPV of the project. If NPV$\geqq$0, then we can decide we should start the project.

We can see the viability of the project by seeing FIRR. If FIRR$\geqq$fair return, then we can decide we should start the project.

The next table shows the cash flow analyses of master plan in base demand case, case 1. Detailed figures are shown in Appendices O. For case 5, we conducted financial analyses both of separate utility and PGN. For case 2, we conducted additional analysis when labor efficiency will be doubled in 20 years.

Table 14-3-1 Financial Analysis

(Base Case, Case1)

				1997	2000	2005	2010	2015	2020	resid 2021
Sales	Residential		(mil Rp)	1,023	6,216	21,159	37,216	54,049	71,056	
	Commercial	Cooking	(mil Rp)	1,553	2,351	5,547	10,837	17,946	27,561	
	Commercial	Boiler+AC	(mil Rp)	2,807	6,943	34,172	78,194	136,810	215,519	
	Commercial	Total	(mil Rp)	4,360	9,294	39,719	89,031	154,756	243,080	
	Industrial		(mil Rp)	302,529	409,377	624,383	991,840	1,725,147	2,953,312	
Total			(mil Rp)	307,913	424,948	685,261	1,118,087	1,933,952	3,267,448	
Gas material cost			(mil Rp)	158,550	245,724	457,618	811,051	1,535,106	2,854,275	
Gross profit			(mil Rp)	149,363	179,224	227,643	307,036	398,845	413,173	
Gross profit (incremental:MMRp)			(mil Rp)	0	29,861	78,280	157,673	249,483	263,810	1,589,217
Property Tax			(mil Rp)	33	138	164	192	233	354	
Labor cost (incremental)		Staffs	(mil Rp)	1,183	6,211	7,789	6,254	4,323	2,615	
		Workers	(mil Rp)	1,540	8,779	13,553	14,244	13,366	11,193	
		Pensions	(mil Rp)	272	1,499	2,134	2,050	1,769	1,381	
		Total	(mil Rp)	2,995	16,489	23,477	22,548	19,458	15,188	91,496
Administrative expenses			(mil Rp)	898	4,947	7,043	6,764	5,837	4,557	27,449
Maintenance & other expenses			(mil Rp)	747	3,741	6,463	9,606	13,571	20,953	126,224
Total investment			(mil Rp)	37,356	54,087	28,756	30,743	34,363	-200	
Before tax cash flow		(financial)	(mil Rp)	-42,029	-49,541	12,377	87,820	176,020	222,958	1,344,048
IRR of before tax cash flow				16.6%						
NPV as of 10%		(financial)	(mil Rp)	259,105						
NPV as of 15%		(financial)	(mil Rp)	35,681						

Sources:JICA team, Appendices O

The Resid 2021 represents the residual value of the cash flow at 2021. We derived it with the assumption of no additional investment and no demand increase and same cash flow as 2020 after 2021. We assumed the same cash flow will continue forever. Residual value at the year will be derived as follows by using FIRR.

$$\text{Residual value at 2021} = \frac{\text{Annual cash flow}}{\text{FIRR}}$$

It is important to count the residual value of the project in seeing financial or economic feasibility of the master plan because the facilities invested in close to 2020 will not yield enough cash flows or social benefits (stated in the next) if we do not count the cash flow after 2020, thus we may underestimate the value of the project.

14.3.2 EIRR and NSB of a Project

As for the economic analysis of the project, we see EIRR (economic internal rate of return) instead of FIRR and NSB (Net social benefit) instead of NPV. In doing that we first calculate annual social benefit instead of cash flow.

The objective of economic analysis is to see whether the project have benefit for Indonesia. It could be that a project has positive net social benefit although it is not

financially feasible. As an example we show in the next table social benefit and loss analysis of base case of master plan (from case 1 to 4). Detailed analyses for each case are shown in Appendices O.

Table 14-3-2 Social Benefit and Loss Analyses (Base Case, Case 1 to 4)

		1997	2000	2005	2010	2015	2020	resid 2021
Social benefit for residential customers	(Rp/m3)	800	800	800	800	800	800	
Social benefit for commercial cooking	(Rp/m3)	800	800	800	800	800	800	
Social benefit for commercial AC	(Rp/m3)	528	528	528	528	528	528	
Social benefit for industrial customers	(Rp/m3)	308	308	308	308	308	308	
Social benefit for residential customers	(mil Rp)	2,213	13,511	45,150	80,467	116,862	153,634	
Social benefit for commercial cooking	(mil Rp)	3,765	5,700	13,447	26,271	43,506	66,815	
Social benefit for commercial AC	(mil Rp)	4,491	11,108	54,676	125,111	218,896	344,830	
Social Benefit for commercial total	(mil Rp)	8,256	16,808	68,122	151,382	262,402	411,645	
Social benefit for industrial customers	(mil Rp)	295,807	400,280	610,508	969,799	1,686,810	2,887,683	
Total social benefit from gas sales	(mil Rp)	306,275	430,659	724,380	1,201,648	2,066,074	3,452,962	
Social loss for gas supplied	(Rp/m3)	167	167	186	217	242	267	
Total social loss from gas supplied	(mil Rp)	163,057	224,571	401,707	763,639	1,474,190	2,751,233	
Gross social benefit	(mil Rp)	143,218	206,088	322,673	438,009	591,885	701,729	
Incremental gross social benefit	(mil Rp)	0	62,869	179,454	294,791	448,666	558,511	1,633,072
Total Investment	(mil Rp)	37,356	54,087	28,756	30,743	34,363	-200	
LPG bottle repurchase (residential)	(mil Rp)	1,186	4,244	4,114	4,000	4,000		
In house pipeline installation (residential)	(mil Rp)	2,371	8,488	8,229	8,000	8,000		
LPG bottle repurchase (cooking)	(mil Rp)	5	9	27	37	50		
In house pipeline installation (cooking)	(mil Rp)	94	164	475	649	891		
In house pipeline installation (AC)	(mil Rp)	94	344	897	1,211	1,647		
Turbo chiller	(1000$)	7,124	26,138	68,195	92,038	125,229		
	(mil Rp)	16,740	61,424	160,258	216,290	294,289		
Absorption chiller	(1000$)	7,636	28,018	73,101	98,659	134,238		
	(mil Rp)	17,945	65,843	171,786	231,849	315,460		
FO tank installation	(mil Rp)	1,141	2,532	2,262	3,395	4,593		
In house pipeline (industrial)	(mil Rp)	326	724	646	970	1,312		
Imported facilites (included)	(mil Rp)	3,937	12,631	20,387	26,665	35,487	0	
Imported tax	(mil Rp)	0	0	0	0	0	0	
Net social loss for facilities	(mil Rp)	39,114	61,440	44,128	49,101	58,741	-200	
Labor cost (incremental) Staffs	(mil Rp)	1,183	6,211	7,789	6,254	4,323	2,615	0
Workers	(mil Rp)	1,540	8,779	13,553	14,244	13,366	11,193	0
Pensions	(mil Rp)	272	1,499	2,134	2,050	1,769	1,381	0
Total	(mil Rp)	2,995	16,489	23,477	22,548	19,458	15,188	44,410
Income tax (included)	(mil Rp)	331	1,810	2,524	2,362	1,985	1,512	4,420
Administrative expenses	(mil Rp)	898	4,947	7,043	6,764	5,837	4,557	13,323
Maintenance & other Expenses	(mil Rp)	747	3,741	6,463	9,605	13,571	20,953	61,266
Value tax (included)	(mil Rp)	150	790	1,228	1,488	1,764	2,319	6,781
Net social benefit	(mil Rp)	-43,273	-21,148	102,095	210,022	354,809	521,843	1,525,273
EIRR		34.2%						
NSB as of 10%	(mil Rp)	970,601						
NSB as of 15%	(mil Rp)	435,187						

Sources:JICA team, Appendices O

Per m3 social benefit of gas for each demand sector are conducted from competitive energy.

For imported gas facilities, there is no import tax. If import tax had existed, it would have been counted as social benefit in this analysis. Income tax for salaries (10% for workers and 15% for staffs) and value tax for administrative expenses and maintenance and other expenses (10% of each expenses) are counted as social benefit.

14.3.3 Fair Financial Returns

In this financial projections we assume that the required financial internal rate of return or "FIRR" of total investment on the before tax basis and in real terms should be from 10% to 15% for a criterion of feasibility. This means that the average tariff per m3 of gas should be determined at a level at which the total investment would produce a return of 10% to 15% in the project period in real terms.

We assume the fair rate of return of the project will be from 10% to 15%, based on the fact that:

Interest rate of Rupiah now is about 20%, and the inflation rate is about 8%, resulting in the real interest rate of Rupiah from 10% to 15%

1) Long term interest rate of US Dollar is about 6%, and inflation gap between Indonesia and US is about 5%.
2) Long term interest rate of Yen is about 3%, and inflation gap between Indonesia and Japan is about 8%.
3) The above b and c would result in those capital funded in Dollar or Yen requiring from 10% to 15% FIRR on a project in which we set an exchange rate between Rupiah and Dollar unchanged during the project periods
4)

Minimum requirement for EIRR could be considered in accordance with fair return for FIRR.

14.3.4 Results of the Master Plan

The tables below shows results from projections of the Master Plan in each case. First three sections shows results of each demand case in five pricing and business alternative (case 1 to 5). Fourth section shows financial analysis of separate utility in case 5 in each demand case. Fifth section shows Case 2 analysis with labor efficiency doubled in 20 years.

Table 14-3-3 Results of the Master Plan

(%,mil Rp)

	Case 1	Case 2	Case 3	Case 4	Case 5
1) Base case demand projections					
FIRR	16.6%	20.7%	19.5%	24.0%	27.0%
NPV(10%)	259,105	456,244	326,238	523,084	432,524
NPV(15%)	35,681	136,540	88,928	189,690	175,268
(Downside contingency analysis)					
FIRR	13.3%	17.5%	16.1%	20.6%	22.8%
NPV(10%)	125,346	321,918	199,668	396,590	315,861
NPV(15%)	-38,289	61,664	20,429	120,498	112,860
(With in house pipeline installation)					
FIRR	15.7%	19.6%	18.4%	22.6%	25.0%
NPV(10%)	234,677	432,354	301,011	498,826	406,958
NPV(15%)	16,150	117,186	69,134	170,216	155,363
(Downside contingency with in house pipeline installation)					
FIRR	12.5%	16.6%	15.0%	19.5%	21.1%
NPV(10%)	101,086	297,379	175,019	371,238	289,529
NPV(15%)	-57,764	42,097	826	100,664	92,703
(Economic analysis)					
EIRR	34.2%	34.2%	34.2%	34.2%	36.0%
NSB(10%)	970,601	970,601	970,601	970,601	996,676
NSB(15%)	435,187	435,187	435,187	435,187	455,103

14.3.4 Results of the Master Plan

The tables below shows results from projections of the Master Plan in each case. First three sections shows results of each demand case in five pricing and business alternative (case 1 to 5). Fourth section shows financial analysis of separate utility in case 5 in each demand case. Fifth section shows Case 2 analysis with labor efficiency doubled in 20 years.

Table 14-3-3 Results of the Master Plan

(%,mil Rp)

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NPV(10%)	101,086	297,379	175,019	371,238	289,529
NPV(15%)	-57,764	42,097	826	100,664	92,703
(Economic analysis)					
EIRR	34.2%	34.2%	34.2%	34.2%	36.0%
NSB(10%)	970,601	970,601	970,601	970,601	996,676
NSB(15%)	435,187	435,187	435,187	435,187	455,103

Table 14-3-3 Results of the Master Plan (Continue)

	Case 1	Case 2	Case 3	Case 4	Case 5
2) High case demand projections					
FIRR	21.2%	24.5%	24.3%	27.8%	31.5%
NPV(10%)	574,686	769,704	633,940	830,235	727,665
NPV(15%)	172,684	273,632	223,361	324,729	305,569
(Downside contingency analysis)					
FIRR	17.9%	21.2%	20.7%	24.3%	27.4%
NPV(10%)	400,115	593,559	468,263	662,301	570,842
NPV(15%)	80,235	179,930	136,947	236,837	224,914
(With in house pipeline installation)					
FIRR	20.3%	23.4%	23.0%	26.5%	29.7%
NPV(10%)	552,290	748,092	612,581	807,818	704,426
NPV(15%)	153,814	255,020	204,832	305,852	286,421
(Downside contingency with in house pipeline installation)					
FIRR	17.1%	20.3%	19.7%	23.1%	25.5%
NPV(10%)	377,556	570,836	445,143	639,777	548,514
NPV(15%)	61,311	160,952	117,839	217,925	206,067
(Economic analysis)					
EIRR	40.2%	40.2%	40.2%	40.2%	42.0%
NSB(10%)	1,353,508	1,353,508	1,353,508	1,353,508	1,378,804
NSB(15%)	622,282	622,282	622,282	622,282	642,015
3) Low case demand projections					
FIRR	10.4%	16.1%	13.3%	19.2%	20.8%
NPV(10%)	8,837	203,656	78,171	272,378	194,685
NPV(15%)	-77,793	20,803	-24,719	73,675	63,871
(Downside contingency analysis)					
FIRR	6.2%	13.1%	9.1%	16.1%	16.5%
NPV(10%)	-95,308	101,758	-19,267	177,882	107,422
NPV(15%)	-137,353	-38,707	-79,056	19,618	15,646
(With in house pipeline installation)					
FIRR	9.5%	15.1%	12.1%	17.9%	18.6%
NPV(10%)	-15,971	178,826	52,475	247,155	167,831
NPV(15%)	-97,117	1,471	-44,336	54,215	43,873
(Downside contingency with in house pipeline installation)					
FIRR	5.6%	12.2%	8.0%	15.0%	14.6%
NPV(10%)	-120,779	77,006	-45,269	152,184	79,390
NPV(15%)	-156,895	-58,013	-98,773	0	-4,739
(Economic analysis)					
EIRR	28.1%	28.1%	28.1%	28.1%	29.5%
NSB(10%)	653,777	653,777	653,777	653,777	680,837
NSB(15%)	272,395	272,395	272,395	272,395	292,281

Table 14-3-3 Results of the Master Plan (Continue)

	Case 1	Case 2	Case 3	Case 4	Case 5
2) High case demand projections					
FIRR	21.2%	24.5%	24.3%	27.8%	31.5%
NPV(10%)	574,686	769,704	633,940	830,235	727,665
NPV(15%)	172,684	273,632	223,361	324,729	305,569
(Downside contingency analysis)					
FIRR	17.9%	21.2%	20.7%	24.3%	27.4%
NPV(10%)	400,115	593,559	468,263	662,301	570,842
NPV(15%)	80,235	179,930	136,947	236,837	224,914
(With in house pipeline installation)					
FIRR	20.3%	23.4%	23.0%	26.5%	29.7%
NPV(10%)	552,290	748,092	612,581	807,818	704,426
NPV(15%)	153,814	255,020	204,832	305,852	286,421
(Downside contingency with in house pipeline installation)					
FIRR	17.1%	20.3%	19.7%	23.1%	25.5%
NPV(10%)	377,556	570,836	445,143	639,777	548,514
NPV(15%)	61,311	160,952	117,839	217,925	206,067
(Economic analysis)					
EIRR	40.2%	40.2%	40.2%	40.2%	42.0%
NSB(10%)	1,353,508	1,353,508	1,353,508	1,353,508	1,378,804
NSB(15%)	622,282	622,282	622,282	622,282	642,015
3) Low case demand projections					
FIRR	10.4%	16.1%	13.3%	19.2%	20.8%
NPV(10%)	8,837	203,656	78,171	272,378	194,685
NPV(15%)	-77,793	20,803	-24,719	73,675	63,871
(Downside contingency analysis)					
FIRR	6.2%	13.1%	9.1%	16.1%	16.5%
NPV(10%)	-95,308	101,758	-19,267	177,882	107,422
NPV(15%)	-137,353	-38,707	-79,056	19,618	15,646
(With in house pipeline installation)					
FIRR	9.5%	15.1%	12.1%	17.9%	18.6%
NPV(10%)	-15,971	178,826	52,475	247,155	167,831
NPV(15%)	-97,117	1,471	-44,336	54,215	43,873
(Downside contingency with in house pipeline installation)					
FIRR	5.6%	12.2%	8.0%	15.0%	14.6%
NPV(10%)	-120,779	77,006	-45,269	152,184	79,390
NPV(15%)	-156,895	-58,013	-98,773	0	-4,739
(Economic analysis)					
EIRR	28.1%	28.1%	28.1%	28.1%	29.5%
NSB(10%)	653,777	653,777	653,777	653,777	680,837
NSB(15%)	272,395	272,395	272,395	272,395	292,281

Table 14-3-3 Results of the Master Plan (Continue)

4) Financial analysis of separate utility in case 5			
	(Base case)	(High case)	(Low case)
FIRR	17.5%	17.9%	17.0%
NPV(10%)	120,337	130,940	106,697
NPV(15%)	21,495	26,094	16,495
(Downside contingency analysis)			
FIRR	16.0%	16.5%	15.6%
NPV(10%)	103,655	113,644	90,454
NPV(15%)	9,244	13,604	4,582
(With in house pipeline installation)			
FIRR	15.1%	15.5%	14.6%
NPV(10%)	95,235	105,758	82,842
NPV(15%)	856	5,390	-3,371
(Downside contingency with in house pipeline installation)			
FIRR	14.0%	14.4%	13.5%
NPV(10%)	78,184	88,463	66,680
NPV(15%)	-11,517	-7,099	-15,258
5) Case 2 with labor efficiency doubled in 20 years			
	(Base case)	(High case)	(Low case)
FIRR	17.3%	21.6%	12.0%
NPV(10%)	319,033	637,341	64,891
NPV(15%)	56,721	195,305	-58,718
(Downside contingency analysis)			
FIRR	14.2%	18.4%	8.8%
NPV(10%)	183,282	460,097	-39,045
NPV(15%)	-18,662	101,203	-118,936
(With in house pipeline installation)			
FIRR	16.5%	20.7%	11.2%
NPV(10%)	294,391	615,479	40,354
NPV(15%)	37,120	176,611	-77,953
(Downside contingency with in house pipeline installation)			
FIRR	13.5%	17.6%	8.1%
NPV(10%)	158,678	438,080	-63,225
NPV(15%)	-38,250	82,458	-138,053
(Economic Analysis)			
EIRR	31.0%	37.1%	24.7%
NSB(10%)	846,771	1,231,681	533,662
NSB(15%)	363,457	551,119	202,611

(Source: JICA Team; detail in Appendix O, Master Plan)

Table 14-3-3 Results of the Master Plan (Continue)

4) Financial analysis of separate utility in case 5			
	(Base case)	(High case)	(Low case)
FIRR	17.5%	17.9%	17.0%
NPV(10%)	120,337	130,940	106,697
NPV(15%)	21,495	26,094	16,495
(Downside contingency analysis)			
FIRR	16.0%	16.5%	15.6%
NPV(10%)	103,655	113,644	90,454
NPV(15%)	9,244	13,604	4,582
(With in house pipeline installation)			
FIRR	15.1%	15.5%	14.6%
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NPV(15%)	856	5,390	-3,371
(Downside contingency with in house pipeline installation)			
FIRR	14.0%	14.4%	13.5%
NPV(10%)	78,184	88,463	66,680
NPV(15%)	-11,517	-7,099	-15,258
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NPV(15%)	-38,250	82,458	-138,053
(Economic Analysis)			
EIRR	31.0%	37.1%	24.7%
NSB(10%)	846,771	1,231,681	533,662
NSB(15%)	363,457	551,119	202,611

(Source: JICA Team; detail in Appendix O, Master Plan)

14.3.5 Assessment of the Financial Projections

From the results of Case 1, as we see a weak financial feasibility in low demand cases, if PGN cannot raise the residential price, it will be difficult to sustain financial viability in the long term especially when demand does not increase very much.

As in an alternative of Case 1, in comparison to Case 2 or Case 3, we see PGN operation may be financially viable even in low demand cases as in Case 2, but will be slightly difficult to sustain it in Case 3. In case 3, even when distribution pipelines for residential customers will be invested by Government, if demand increase is not so much as expected like in low demand case, it will not be very viable in the long term. It is inevitable to increase the residential gas prices in the long run.

In Case 4, we see PGN will be very profitable and will exceed 15% FIRR of total investment even in a low demand case with downside contingency analysis. It might be said that Government will not necessarily invest in residential distribution pipelines if residential gas price will go up to cover its cost to supply.

In Case 5, we see high profitability of PGN and in each case FIRR will exceed 15%. While we assumed the price of 315Rp/m3 as a whole-sale to separate utilities, it might be showing that there is more room for PGN to lessen the price as their fair return of investments. Financial analyses of separate utilities as a whole show they will be financially feasible even in a low demand case with downside contingency.

Economic analyses show there are substantial social benefit for Indonesia to start developing gas demand in residential sector and commercial sector in Jakarta area in each demand case.

When we go to see Case 2 with labor efficiency doubled only in 20 years, we realize it will not be easy to sustain financial viability in a low demand case for effect of labor expenses is rather large. For PGN, it is important to accelerate their demand developnient and raise labor efficiency even when they succeed raising residential gas price.

14.3.6 Per m3 Cost Analyses

In looking at financial feasibility of gas industry, comparing sales price with per m3 cost of the projections is more generally used rather than FIRR of the projections. As an additional financial analyses of the master plan, we conducted per m3 cost analyses of each demand case.

We did it in long term marginal cost bases. That is, in using discount rate of 15%, we deprived NPV of each cost (mil Rp) in 20 years term needed to implement the master plan, gas material cost, labor cost, administrative expenses, maintenance and other expenses, property tax, and investment. Simultaneously, we deprived NPV of gas sales volume (1000m3)in 20 years term, so that we get per m3 cost of master plan in each case

in 20 years term.

We distributed NPV of each cost to each category of gas demand, residential, commercial cooking, commercial air conditioning, and industrial sectors and we get NPV cost of each sector (mil Rp). Dividing by NPV of gas sales volume of each sector, we get per m3 cost of each sector.

In distributing NPV of each cost, we distributed breakdown of investment to each demand sector and estimated additional number of workers for each demand sector.

As we need to distribute investment cost of residential distribution pipelines and labor cost of safety maintenance of them between residential sector and commercial cooking sector, we used m3 per an hour when they are using gas as the relative load factor between those demands.

Several assumptions. All governors or offtakers, including B regulator are distributed to industrial sector. High pressure transmission lines are all distributed to industrial sector. From residential sector 10 administrative staffs and regarding administrative workers are transffered to industrial sector assuming they will be in charge of negotiations with governmental bodies, which anyway PGN will be in charge of regardless of demand sectors they will be going to develop.

Next tables shows results.

Table 14-3-4 Per m3 Cost Analyses

NPV of Gas Demand

(1000m3)

	Residential	Cooking	AC	Industrial
Base case	293,727	80,070	626,449	7,241,758
High case	300,993	82,896	649,115	9,917,666
Low case	276,616	77,005	601,871	5,018,933

Distribution of NPV of Each Cost

(Base Case)

(mil Rp)

	Residential	Cooking	AC	Industrial	Total
Gas material	66,601	18,155	142,043	1,642,015	1,868,813
Labor	67,372	12,296	810	12,724	93,202
Pensions	6,737	1,230	81	1,272	9,320
Property tax	217	85	112	461	874
Administrative cost	22,233	4,058	267	4,199	30,757
Maintenance	8,280	3,232	4,265	17,621	33,398
Investment	61,891	24,156	31,883	131,710	249,639
Total	233,330	63,211	179,461	1,810,002	2,286,004
Cost per m3(Rp/m3)	794	789	286	250	277

(High Case)

(mil Rp)

	Residential	Cooking	AC	Industrial	Total
Gas material	67,988	18,724	146,621	2,243,103	2,476,436
Labor	67,166	12,406	811	13,107	93,491
Pensions	6,717	1,241	81	1,311	9,349
Property tax	215	85	112	536	948
Administrative cost	22,165	4,094	268	4,325	30,852
Maintenance	8,144	3,222	4,229	20,282	35,877
Investment	61,836	24,468	32,108	154,006	272,418
Total	234,231	64,241	184,228	2,436,671	2,919,371
Cost per m3(Rp/m3)	778	775	284	246	266

(Low Case)

(mil Rp)

	Residential	Cooking	AC	Industrial	Total
Gas material	63,228	17,602	137,574	1,149,620	1,368,023
Labor	66,923	12,157	809	10,812	90,701
Pensions	6,692	1,216	81	1,081	9,070
Property tax	211	84	113	393	800
Administrative cost	22,085	4,012	267	3,568	29,931
Maintenance	8,161	3,246	4,384	15,213	31,003
Investment	58,915	23,433	31,647	109,829	223,824
Total	226,214	61,749	174,874	1,290,516	1,753,353
Cost per m3(Rp/m3)	818	802	291	257	293

Sources: JICA team, Appendices O

From the result, we see per m3 cost of air conditioning and industrial demand sector are under sales price of each sector, 330Rp/m3 or 315Rp/m3 according to the current tariff table of PGN.

However, per m3 cost of residential sector and commercial cooking sector are about 800Rp/m3. In low case they will even exceed 800Rp/m3, which are well above current tariff level for those sectors.

Those results are showing it will be inevitable for PGN to increase sales price for residential and commercial cooking sectors in the long run.