# Chapter 18

# Feasibility Study - Bekasi

## 18. Feasibility Study - Bumi Bekasi Baru

### 18.1 Area Background

Bumi Bekasi Baru is a large residential estate developed for middle and low income families by Perum Perumnas and located 4 km southeast from the old city of Bekasi and about 30 km from downtown Jakarta. This feasibility study area consists of 2 parts : Area I and II as shown in Fig. 18-1-1 indicating area and the number of houses is about 7,700.

House construction of Area I has already finished and more than 90% of houses are occupied. Area II is now under construction and people are beginning to live in the northern part of Area II. Within Area II, there are some parts which remain still unprocured. Those parts are excluded from the feasibility study since we do not have any prospect when houses will be built there. PGN's existing high pressure main is located about 0.5 km north of Bumi Bekasi Baru.

### 18.2 Estimated Demand for Urban Gas

Table 18-2-1 shows our demand projection which is used in the feasibility study.

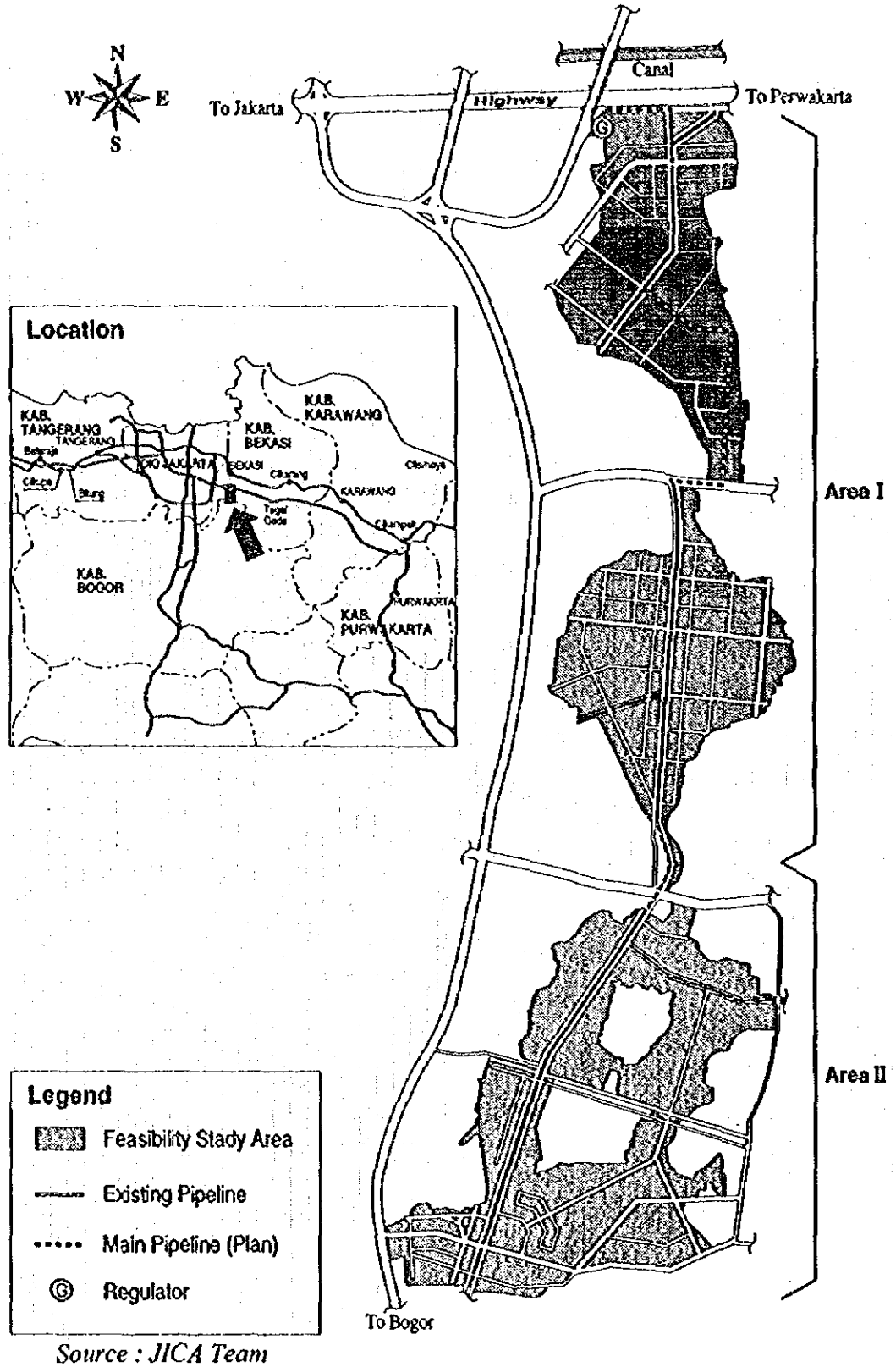
**Table 18-2-1 Gas Demand in Bumi Bekasi Baru for Feasibility Study**

| Year | 1997 | | 1998 | | 1999 | |
|---|---|---|---|---|---|---|
| | 1st half | 2nd half | 1st half | 2nd half | 1st half | 2nd half |
| No. of Customers | | 1,650 | 3,300 | 5,520 | 7,740 | 7,740 |
| Unit Consumption ($m^3$/y) | 331 | 331 | 334.6 | 334.6 | 338.1 | 338.1 |
| Gas Demand (1000 $m^3$/y) | 100 | | 1,200 | | 2,400 | |

| Year | 2000 | 2005 | 2010 | 2020 |
|---|---|---|---|---|
| No. of Customers | 7,740 | 7,740 | 7,740 | 7,740 |
| Unit Consumption ($m^3$/y) | 344.4 | 353.3 | 366.7 | 389 |
| Gas Demand (1000 $m^3$/y) | 2,700 | 2,700 | 2,800 | 3,000 |

*Source : JICA Team*

Fig. 18-1-1 Outline of Bekasi Feasibility Study Area

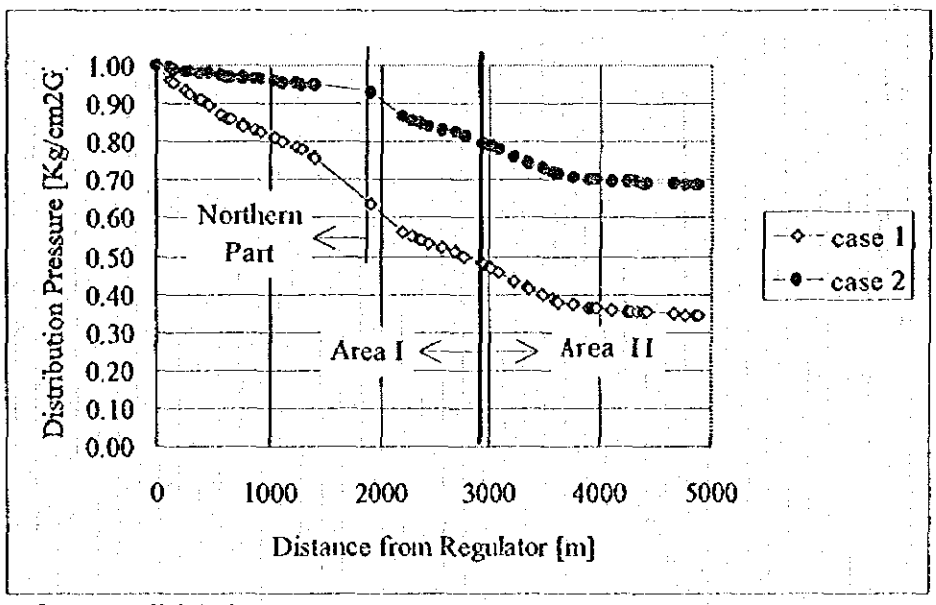



*Source : JICA Team*

## 18.3 Proposed Distribution Network

Since the existing main pipeline is located at the north of the feasibility study area, we decided to install a regulator which reduces gas pressure from 10 bar to 1 bar at the northern edge of the feasibility study area. Also we decided to install a distribution main pipeline from the regulator to the southern edge of the feasibility study area so that the pipeline conveys gas down to Area II. As for the diameter of this main pipeline, we found two alternative cases, one is the case that all sections of the pipeline have 125 mm diameter (Case 1), and the other is the case that sections in the northern half of Area I have 180 mm diameter and the remaining sections 125 mm (Case 2). We conducted the network analysis for both Case 1 and Case 2 and the results are shown in Fig. 18-3-1.

**Fig. 18-3-1 Distribution Pressure along Main Pipeline**




*Source : JICA Team*

As shown in Fig. 18-3-1, the pressure at the terminal point in Case 1 is much lower than that in Case 2. We understand that Case 1 is a kind of the maximum capacity design and gives us an economical grid design. On the other hand, Case 2 has about 55% capacity surplus. Therefore, if we target to develop not only the feasibility study area but also neighboring estates, it is recommended to choose Case 2. Table 18-3-1 shows the length and cost of pipelines.

**Table 18-3-1 Pipeline Necessary in Bekasi F/S Area (Case 1)**

| Diameter (mm) | Length (m) | | | Cost (MM Rp.-) | | |
|---|---|---|---|---|---|---|
| | Area I | Area II | Total | Area I | Area II | Total |
| PE 32 | 13,136 | 25,264 | 38,400 | 315 | 606 | 922 |
| PE 63 | 13,740 | 10,976 | 24,716 | 1,154 | 922 | 2,076 |
| PE 90 | 0 | 0 | 0 | 0 | 0 | 0 |
| PE 125 | 2,918 | 1,864 | 4,782 | 397 | 254 | 650 |
| PE 180 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 29,794 | 38,104 | 67,898 | 1,866 | 1,782 | 3,648 |
| Steel 100 | 48 | 56 | 104 | 7 | 8 | 15 |
| Steel 150 | 24 | 68 | 92 | 4 | 13 | 17 |
| Steel 200 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 72 | 124 | 196 | 12 | 21 | 32 |
| All Total | 29,866 | 38,228 | 68,094 | 1,878 | 1,803 | 3,681 |

*Source : JICA Team*

## 18.4 Gas Supply

Gas will be supplied from an existing high pressure pipeline. The availability of gas is confirmed in the Master Plan making and we assume no problem in the supply. In order to convey gas from the existing pipeline to the feasibility study area, the extension of high pressure pipeline which crosses a canal and a highway is necessary. The cost of the pipeline is about US$ 346,500.

## 18.5 Economic and Financial Assessment-Bekasi

### 18.5.1 Assumptions

We made projections for each case of the Master Plan, from case 1 to case 5.

We assume higher labor efficiency compared to that of PGN now, which is used in the master plan.

The next table shows plans of the project. Detailed plans are shown in Appendices O.

**Table 18-5-1 Plans for Bekasi**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (Gas Demand) | | | | | | | | | |
| | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
| Residential | (1000m3) | 137 | 1,152 | 2,429 | 2,666 | 2,735 | 2,838 | 2,928 | 3,011 |
| (Number of Customers) | | | | | | | | | |
| | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
| Residential | | 1,650 | 5,520 | 7,740 | 7,740 | 7,740 | 7,740 | 7,740 | 7,740 |
| (Sales Volume per Customer) | | | | | | | | | |
| | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
| Residential | (1000m3) | 0.08 | 0.21 | 0.31 | 0.34 | 0.35 | 0.37 | 0.38 | 0.39 |
| (Investment Plan) | | | | | | | | | |
| | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
| Transmission pipeline | (km) | 0.3 | | | | | | | |
| Distribution pipeline | (km) | 29.9 | 38.2 | | | | | | |
| Cumulative distribution pipeline | (km) | 29.9 | 68.1 | 68.1 | 68.1 | 68.1 | 68.1 | 68.1 | 68.1 |
| Cumulative A governor | (units) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Cumulative B governor | (units) | 2 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| SP/customer | (1000Rp) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| HR+meter/customer | (1000Rp) | 126 | 126 | 126 | 126 | 126 | 126 | 126 | 126 |
| *Transmission pipeline* | *(mil Rp)* | *814* | | | | | | | |
| Distribution pipeline | (mil Rp) | 1,878 | 1,803 | | | | | | |
| Total SP | (mil Rp) | 165 | 387 | 222 | 0 | 0 | 0 | 0 | 0 |
| Total HR+meter | (1000$) | 88 | 207 | 119 | 0 | 0 | 0 | 0 | 0 |
| | (mil Rp) | 208 | 498 | 280 | 0 | 0 | 0 | 0 | 0 |
| A governor | (1000$) | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | (mil Rp) | 119 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B governor | (1000$) | 50 | 100 | 50 | 0 | 0 | 0 | 0 | 0 |
| | (mil Rp) | 117 | 235 | 117 | 0 | 0 | 0 | 0 | 0 |
| Total investment (PGN) | (mil Rp) | 3,302 | 2,913 | 519 | 0 | 0 | 0 | 0 | 0 |
| (Number of Workers) | | | | | | | | | |
| | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
| *Administrative staff (except safety)* | (persons) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Administrative workers (except safety) | (persons) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Administrative staff (for safety) | (persons) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Administrative workers (for safety)* | (persons) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sales | (persons) | 5 | 3 | 1 | 1 | 1 | 1 | 1 | 0 |
| Meter reading | (persons) | 1 | 3 | 4 | 4 | 3 | 2 | 2 | 1 |
| Collecting | (persons) | 2 | 5 | 7 | 6 | 5 | 3 | 3 | 2 |
| Low pressure (safety) | (persons) | 4 | 9 | 8 | 8 | 5 | 4 | 2 | 2 |
| Meter administration | (persons) | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Total | (persons) | 15 | 23 | 23 | 22 | 17 | 13 | 11 | 8 |

*Sources:JICA team, Appendices O*

### 18.5.2 Results of Projections-Bekasi

The next tables are the summary of case 5 of Bekasi feasibility study. The first cash flow is for the separate utility, the second is economic analysis, and the third is for PGN. Detailed analyses for each case are in Appendices O.

**Table 18-5-2 Results for Case 5**

(Financial Feasibility Analysis)

| | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| Gas sales | (mil Rp) | 109 | 922 | 1,943 | 2,133 | 2,188 | 2,271 | 2,342 | 2,409 |
| Gas material cost | (mil Rp) | 45 | 380 | 802 | 880 | 902 | 937 | 966 | 994 |
| Gross profit | (mil Rp) | 64 | 541 | 1,142 | 1,253 | 1,285 | 1,334 | 1,376 | 1,415 |
| Property tax | (mil Rp) | 2 | 4 | 4 | 4 | 2 | 1 | 1 | 0 |
| Labor cost | (mil Rp) | 149 | 179 | 188 | 179 | 159 | 129 | 129 | 100 |
| Administrative expenses | (mil Rp) | 45 | 54 | 57 | 54 | 48 | 39 | 39 | 30 |
| Maintenance & other expenses | (mil Rp) | 47 | 106 | 118 | 118 | 118 | 118 | 118 | 118 |
| Total investment | (mil Rp) | 2,368 | 2,913 | 619 | 0 | 0 | 0 | 0 | 0 |
| Before tax cash flow | (mil Rp) | -2,548 | -2,713 | 155 | 899 | 959 | 1,047 | 1,089 | 1,167 |
| IRR of before tax cash flow | | 15% | | | | | | | |
| NPV as of 10% | (mil Rp) | 1,971 | | | | | | | |
| NPV as of 15% | (mil Rp) | -138 | | | | | | | |

(Social Benefit & Loss Analyses of Bekasi Project)

| | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| Social benefit for residential customers | (Rp/m3) | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Total social benefit from gas sales | (mil Rp) | 109 | 922 | 1,943 | 2,133 | 2,188 | 2,271 | 2,342 | 2,409 |
| Social loss for gas supplied | (Rp/m3) | 167 | 167 | 167 | 167 | 186 | 217 | 242 | 267 |
| Total social loss from gas supplied | (mil Rp) | 23 | 192 | 406 | 445 | 509 | 616 | 709 | 804 |
| Gross social benefit | (mil Rp) | 86 | 729 | 1,538 | 1,687 | 1,679 | 1,655 | 1,634 | 1,605 |
| | | | | | | | | | |
| Total investment | (mil Rp) | 3,302 | 2,913 | 619 | 0 | 0 | 0 | 0 | 0 |
| LPG bottle repurchase | (mil Rp) | 330 | 774 | 444 | 0 | 0 | 0 | 0 | 0 |
| In house pipeline installation | (mil Rp) | 660 | 1,548 | 888 | 0 | 0 | 0 | 0 | 0 |
| Imported facilities (included) | (mil Rp) | 444 | 723 | 397 | 0 | 0 | 0 | 0 | 0 |
| Imported tax | (mil Rp) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Net social loss for facilities | (mil Rp) | 3,632 | 3,687 | 1,063 | 0 | 0 | 0 | 0 | 0 |
| Labor cost | (mil Rp) | 214 | 325 | 318 | 308 | 240 | 194 | 162 | 132 |
| Income tax (included) | (mil Rp) | 23 | 34 | 33 | 32 | 26 | 21 | 18 | 15 |
| Administrative expenses | (mil Rp) | 64 | 97 | 95 | 93 | 72 | 58 | 49 | 40 |
| Maintenance & other expenses | (mil Rp) | 66 | 124 | 137 | 137 | 137 | 137 | 137 | 137 |
| Value tax (included) | (mil Rp) | 13 | 22 | 23 | 23 | 21 | 19 | 19 | 18 |
| | | | | | | | | | |
| Net social benefit | (mil Rp) | -3,853 | -3,449 | -19 | 1,205 | 1,277 | 1,306 | 1,324 | 1,329 |
| EIRR | | 13% | | | | | | | |
| NPV as of 10% | (mil Rp) | 1,917 | | | | | | | |
| NPV as of 15% | (mil Rp) | -715 | | | | | | | |

(Financial feasibility of PGN in Separate Utility Case)

| | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| Gas sales | (mil Rp) | 45 | 380 | 802 | 880 | 902 | 937 | 966 | 994 |
| Gas material cost | (Rp/m3) | 162 | 168 | 174 | 183 | 212 | 230 | 252 | 277 |
| Gas material cost | (mil Rp) | 22 | 193 | 424 | 487 | 579 | 654 | 738 | 834 |
| Gross profit | (mil Rp) | 23 | 187 | 378 | 393 | 323 | 282 | 228 | 160 |
| Property tax | (mil Rp) | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Labor cost | (mil Rp) | 65 | 146 | 130 | 130 | 81 | 65 | 32 | 32 |
| Administrative expenses | (mil Rp) | 19 | 44 | 39 | 39 | 24 | 19 | 10 | 10 |
| Maintenance & other expenses | (mil Rp) | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| Investment | (mil Rp) | 933 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Net cash flow | (mil Rp) | -1,014 | -22 | 190 | 206 | 199 | 179 | 167 | 99 |
| IRR of the cash flow | | 15% | | | | | | | |
| NPV as of 10% | (mil Rp) | 407 | | | | | | | |
| NPV as of 15% | (mil Rp) | 9 | | | | | | | |

*Sources:JICA team, Appendices O*

The next table shows FIRR and NPV as of 10% discount rate, and NPV as of 15% discount rate for each case. In case 5, results are for the separate utility. Downside contingency when sales volume decreases by 2% and investment costs rise by 10% has is

shown. Cases when in house pipeline installation cost would be paid by the gas utilities have also been done. Results of economic analyses are shown at the bottom of the table.

Consecutively we show financial feasibility of PGN in case 5 and the equity return for the separate utility in case we consider financing of the separate utility.

**Table 18-5-3 Results of Projections-Bekasi**

(%,mil Rp)

| | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 |
|---|---|---|---|---|---|
| FIRR | ---------- | 7.3% | ---------- | 13.6% | 14.5% |
| NPV(10%) | ---------- | -1,722 | ---------- | 1,489 | 1,971 |
| NPV(15%) | ---------- | -3,383 | ---------- | -376 | -138 |
| (Downside contingency) | | | | | |
| FIRR | ---------- | 6.1% | ---------- | 12.2% | 12.4% |
| NPV(10%) | ---------- | -2,586 | ---------- | 945 | 1,134 |
| NPV(15%) | ---------- | -4,108 | ---------- | -801 | -829 |
| (Analysis with in house pipeline installation) | | | | | |
| FIRR | ---------- | 5.7% | ---------- | 10.4% | 11.4% |
| NPV(10%) | ---------- | -2,995 | ---------- | 216 | 698 |
| NPV(15%) | ---------- | -4,548 | ---------- | -1,540 | -1,302 |
| (Downside contingency with in house pipeline installation) | | | | | |
| FIRR | ---------- | 4.7% | ---------- | 9.4% | 9.7% |
| NPV(10%) | ---------- | -3,859 | ---------- | -329 | -140 |
| NPV(15%) | ---------- | -5,272 | ---------- | -1,965 | -1,993 |
| (Economic Analysis) | | | | | |
| EIRR | 11.4% | 11.4% | 11.4% | 11.4% | 13.3% |
| NSB(10%) | 832 | 832 | 832 | 832 | 1,917 |
| NSB(15%) | -1,513 | -1,513 | -1,513 | -1,513 | -715 |

**[Financial Feasibility of PGN, in Case 5]**

Assumptions: PGN will invest only in transmission pipeline to Bekasi
PGN will supply gas to separate utility at 330 Rp/m3
PGN will be in charge of safety maintenance of pipelines but will not be paid for their labor cost

Financial feasibility for PGN can be examined by FIRR. Investment for PGN here is marginal, so we do not suppose any financing constraints for PGN in this case.

Results:

FIRR=15.2%

NPV(10%)=403

NPV(15%)=9

**[Equity Return of Separate Utility]**

Assumptions:Total equity invested 2,000 mil Rp

Total equity invested /Total facility investment=33.9%

Interest rate for cash deposits=5%

Interest rate for long term and short term debt=10%

Results:

IRR of equity=12.4%

*(Source:JICA Team, Appendices O, Bekasi)*

### 18.5.3 Assessment

In case 4, PGN would be financially feasible. It would be the only realistic case in financial sense except case 5.

In case 5, the separate utility and PGN are both financially feasible.

Economic analysis is showing this project is economically feasible at 10% discount rate level but not feasible at 15% discount rate level.

Equity investment would bear 12.4% IRR with the investment of 2000 mil Rp, which is 33.4% of total facility investment.

# Chapter 19

# Feasibility Study - BSD (Bumi Serpong Damai)

## 19. Feasibility Study--BSD (Bumi Serpong Damai)

### 19.1. Area Background

BSD (Bumi Serpong Damai) is the area where land improvement of approximately 6,000 ha is currently being promoted by PT. BSD (land developing company) in the west to Jakarta and the south to Tangerang. This Master Plan includes construction of residences amounting to approximately 123 thousand houses, commercial facilities, office buildings, a university, hospitals, hotels, high technology industrial zone, etc.

#### 19.1.1 Area Layout

Fig.19-1-1 shows BSD's total land utilization plan. As shown, the area is further divided into two areas by Ci Sadane River along the east side of the central part of the area. Taking into consideration this topographic feature, the development schedule in the master plan is divided into first period and second period schedules respectively by each divided area.

#### 19.1.2. Prediction of Population and Household/Buildings in the Area

Construction of housing lots was started in 1989. Table 19-1-1 shows the population and number of residences planned in the future.

**Table 19-1-1 Estimated Population in the BSD Acquired Area**

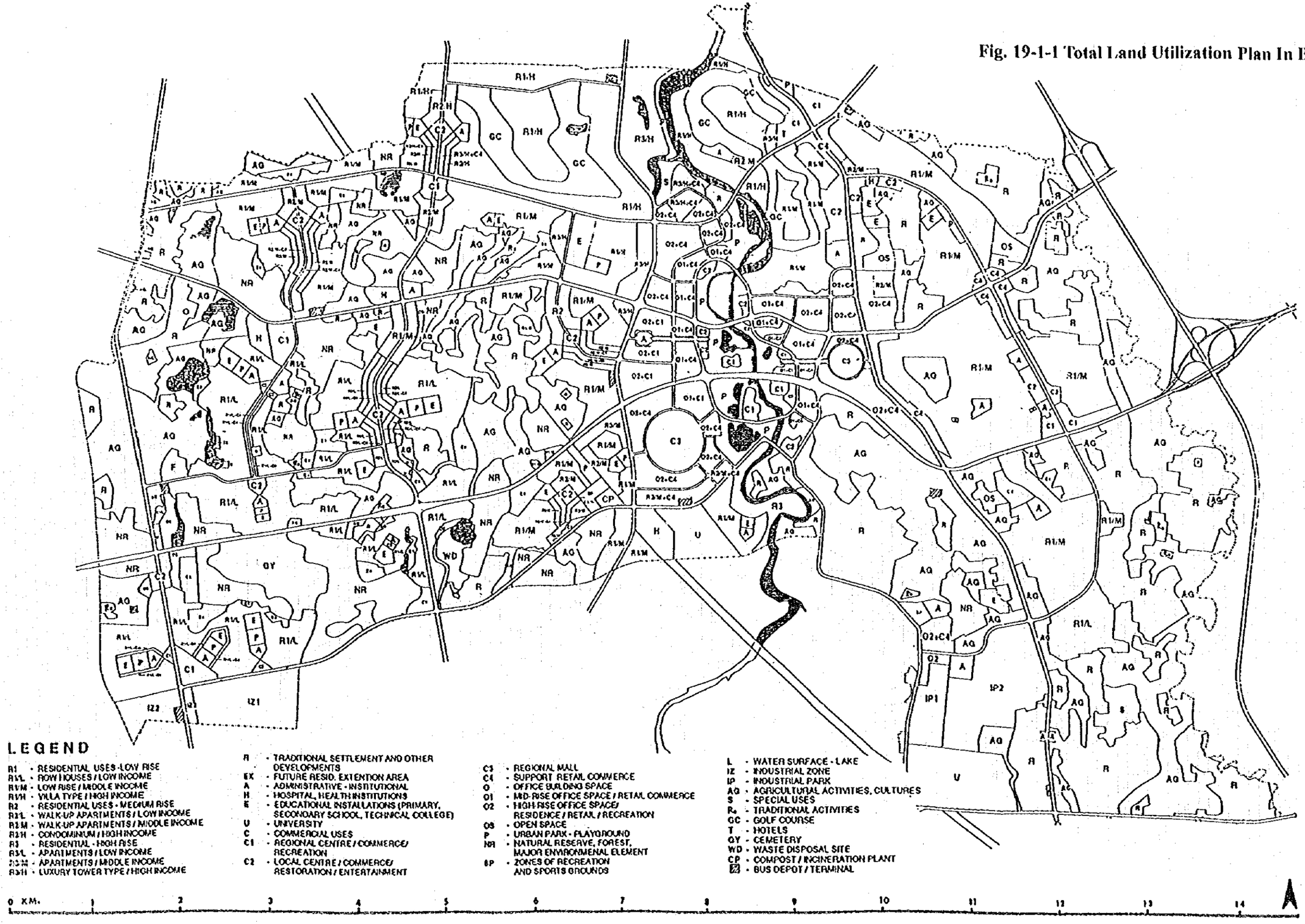
| | 1995 | 2000 | 2005 | 2010 | 2015 |
|---|---|---|---|---|---|
| BSD Acquired Area Housing Unit ※ | 10.7 | 27.5 | 55.0 | 95.0 | 123.0 |
| Average Family Size in BSD Acquired Area | 4.8 | 4.5 | 4.2 | 4.0 | 4.0 |
| BSD Acquired Area Population ※ | 46.2 | 123.7 | 231.0 | 380.0 | 492.0 |

*Source: Master Plan of PT.BSD* ※unit thousand

#### 19.1.3. Scope of the Feasibility Study

The first-period work zone under the BSD Master Plan has been defined as the zone of this feasibility study. Further, even within this area our zone includes only quarters where construction projects are estimated to be completed by 2010, and other quarters are considered out of the scope of this feasibility study unless they have a great effect on the design of city gas supply network.

Fig. 19-1-1 Total Land Utilization Plan In BSD




Source: Final Master Plan Report for Bumi Serpong Damai New City by PT BSD

## 19.2 Estimated Demand for Urban Gas

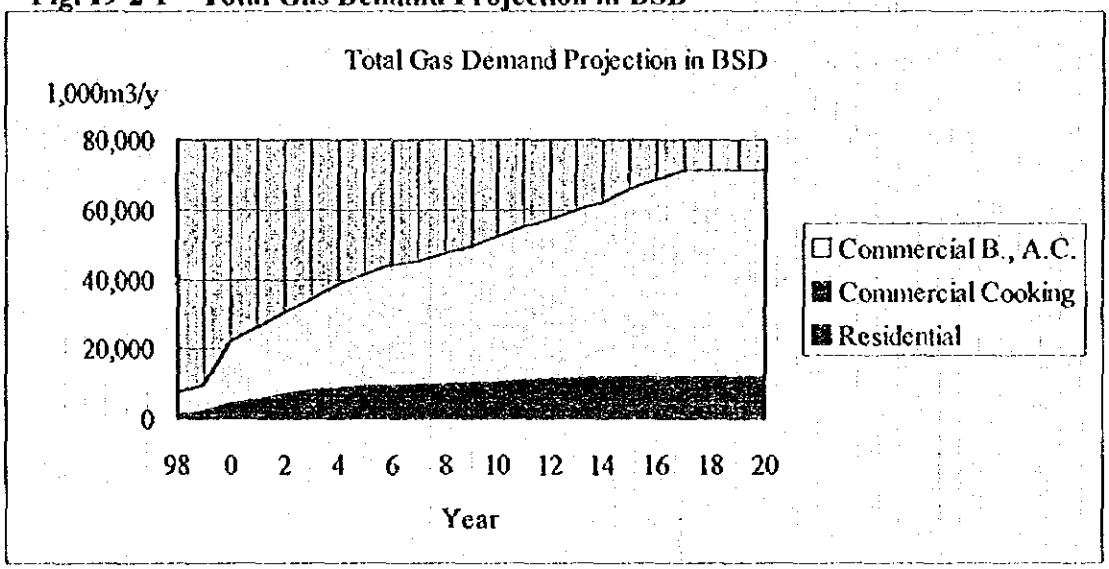
The total gas demand projection in BSD is summarized in chronological order based on information about the construction schedule obtained from PT. BSD, and is shown below:

**Table 19-2-1 Total Demand Projection in BSD**

| Gas Market Developme | Year | | 1998 | 2000 | 2005 | 2010 | 2015 | 2020 |
|---|---|---|---|---|---|---|---|---|
| | Residential | | 126,000 | 1,121,550 | 96,000 | 0 | 0 | 0 |
| | Commercial | Cooking | 921,475 | 1,384,531 | 305,405 | 401,674 | 113,453 | 0 |
| | | Boiler & A.C | 6,747,121 | 10,305,008 | 2,572,326 | 2,695,734 | 3,425,588 | 0 |
| | Total | m3/y | 7,794,596 | 12,811,090 | 2,973,731 | 3,097,408 | 3,539,041 | 0 |
| Cumulative Gas Deman | Year | | 1998 | 2000 | 2005 | 2010 | 2015 | 2020 |
| | Residential | | 126,000 | 1,800,050 | 4,932,100 | 5,028,100 | 5,028,100 | 5,028,100 |
| | Commercial | Cooking | 921,475 | 2,670,298 | 4,273,115 | 5,560,629 | 6,908,411 | 6,908,411 |
| | | Boiler & A.C | 6,747,121 | 17,976,554 | 32,336,566 | 41,832,709 | 53,678,016 | 59,086,595 |
| | Total | m3/y | 7,794,596 | 22,446,902 | 41,541,781 | 52,421,438 | 65,614,527 | 71,023,106 |

*Source: JICA Team*

**Fig. 19-2-1 Total Gas Demand Projection in BSD**




*Source: JICA Team*

## 19.3 District Cooling Business

### 19.3.1 Applicable Area

The key to success in a district cooling business is whether the thermal energy load density is high enough or not, we consider the feasibility of this business in the 2nd business zone which is composed of medium- and high-storied buildings.

### 19.3.2 Projection of Energy Load

The forecast integrated cooling load in the applicable area is approximately 63,000RT in office buildings and 14,000RT in shopping centers, approximately 78,000RT in total.

**Table 19-3-1 Composition of Cooling Load**

| Type of Business | Floor Area 1,000m2 | Capacity of Air Conditioner Centralized RT | Decentralized RT | Total RT |
|---|---|---|---|---|
| Office | 1,881 | 30,000 | 33,500 | 63,500 |
| Shopping | 405 | 11,000 | 3,500 | 14,500 |
| Total | 2,286 | 41,000 | 37,000 | 78,000 |

*Source: JICA Team*

### 19.3.3 Cases to Be Studied

The feasibility of a district cooling business will be examined by economic comparison of introduction of "area cooling system using urban gas as energy source" with installation of air conditioners in individual buildings.

The table below shows the feasibility study cases.

**Table 19-3-2 Cases to Be Studied**

| | District Cooling System | | | | Independent Air Conditioning System | | | |
|---|---|---|---|---|---|---|---|---|
| | Case-A | | Case-B | | C-Case | | D-Case | |
| | Conventional Type | | Cogene Type | | Gas/Elec. Air Con. Type | | Elec. Air Con Type | |
| Office | Steam Abs. | 82,000RT | Gas Turbine | 40,000kW | Abs Chiller | 25,500RT | Elec.Chiller | 30,000RT |
| | Boiler | 394Ton/h | Steam Abs | 82,000RT | GHP | 0RT | EHP | 33,500RT |
| | | | Boiler | 334Ton/h | | | | |
| | | | | | Elec.Chiller | 4,500RT | | |
| | | | | | EHP | 33,500RT | | |
| Shopping | | | | | Abs Chiller | 10,500RT | Elec.Chiller | 11,000RT |
| | | | | | GHP | 1,500RT | EHP | 3,500RT |
| | | | | | Elec.Chiller | 500RT | | |
| | | | | | EHP | 2,000RT | | |

*Source: JICA Team*

### 19.3.4 Study Method

The feasibility study judges the potentiality of the district cooling business, assuming that the thermal charge to customers is equal to total energy cost of "fuel cost + equipment depreciation + maintenance cost + personnel cost (operators) + machine room rental charge", and comparing to the independent cooling systems.

Further, sensitivity of business feasibility is analyzed considering the parameters of "demand fixation period" which greatly affect the success of a district cooling business. And we also analyzed business feasibility taking into account the premium values of district cooling systems as 1.1 or 1.2 times over independent systems.

### 19.3.5 Calculation of Initial Cost

Table below shows the calculated initial cost in each case:

**Table 19-3-3 Comparison of Initial Costs (1,000 Rp)**

| | District Cooling System | | | | Independent Air Conditioning System | | | |
|---|---|---|---|---|---|---|---|---|
| | Case-A | | Case-B | | Case-C | | Case-D | |
| | Conventional Type | | Cogene Type | | Gas/Elec. Air Con. Type | | Elec. Air Con Type | |
| Major Appliances | S.Abs | 167,492 | Power Gen. | 34,893 | Abs | 137,170 | Chiller | 119,113 |
| | Boiler | 14,833 | S.Abs | 167,492 | GHP | 9,479 | EHP | 103,716 |
| | | | Boiler | 12,826 | Chiller | 14,527 | | |
| | | | | | EHP | 109,908 | | |
| Piping, Wiring Pumps, C.T. etc. | | 204,254 | | 220,697 | | 143,825 | | 174,761 |
| District Piplines of Chilled Water | | 57,504 | | 57,504 | | 0 | | 0 |
| Total | | 444,083 | | 493412 | | 414909 | | 397,590 |

*Source: JICA Team*

Note Engineering cost, civil works cost and insurance are included.

### 19.3.6 Calculation of Energy Cost

Table 19-3-4 summarizes the costs and expenses for each item.

**Table 19-3-4 Composition of Energy Cost by Case (Million Rp/Year)**

| | Case-A | Case-B | Case-C | Case-D |
|---|---|---|---|---|
| Utility Cost | 45,167 | 37,131 | 48,794 | 53,095 |
| Maintenance Cost | 11,597 | 13,077 | 16,596 | 15,904 |
| Personel Cost | 358 | 358 | 1,960 | 1,960 |
| Rental Fee for Spac | 7,715 | 8,266 | 9,435 | 9,435 |
| General Expences | 2,413 | 2,512 | 2,390 | 2,355 |
| Depreciation | 26,645 | 29,605 | 24,895 | 23,855 |
| Total | 93,895 | 90,948 | 104,070 | 106,604 |

*Source: JICA Team*

### 19.3.7 Feasibility Evaluation of District Cooling Business

We calculated the sensitivity in IRR by the difference in the thermal charges, and the results are compared below.

**Table 19-3-5 IRR in Conventional District Cooling Business**

| Coeficient of Thermal Charge | Thermal Charge (Price) | Demand Build-up (year) | | | |
|---|---|---|---|---|---|
| | Rp/Mcal | 1 | 2 | 5 | 10 |
| 1.00 | 198.81 | 5.38 | 4.66 | 2.84 | 0.41 |
| 1.10 | 218.69 | 8.58 | 7.63 | 5.39 | 2.61 |
| 1.20 | 238.57 | 11.50 | 10.31 | 7.62 | 4.48 |

*Source: JICA Team*

**Table 19-3-6 IRR in Co-generation Type District Cooling Business**

| Coeficient of Thermal Charge | Thermal Charge (Price) | Demand Build-up (year) | | | |
|---|---|---|---|---|---|
| | Rp/Mcal | 1 | 2 | 5 | 10 |
| 1.00 | 198.81 | 6.07 | 5.30 | 3.41 | 0.92 |
| 1.10 | 218.69 | 8.90 | 7.93 | 5.65 | 2.84 |
| 1.20 | 238.57 | 11.52 | 10.33 | 7.64 | 4.51 |

*Source: JICA Team*

From the above, district cooling is economically feasible with the IRR higher than 10% only in four cases that the market development is completed in only two years and thermal price of 20% higher level is charged to the customers.

Relatively, co-generation type is superior to conventional type due to the energy conservation effect on the economics. The district cooling business will be feasible with co-generation.

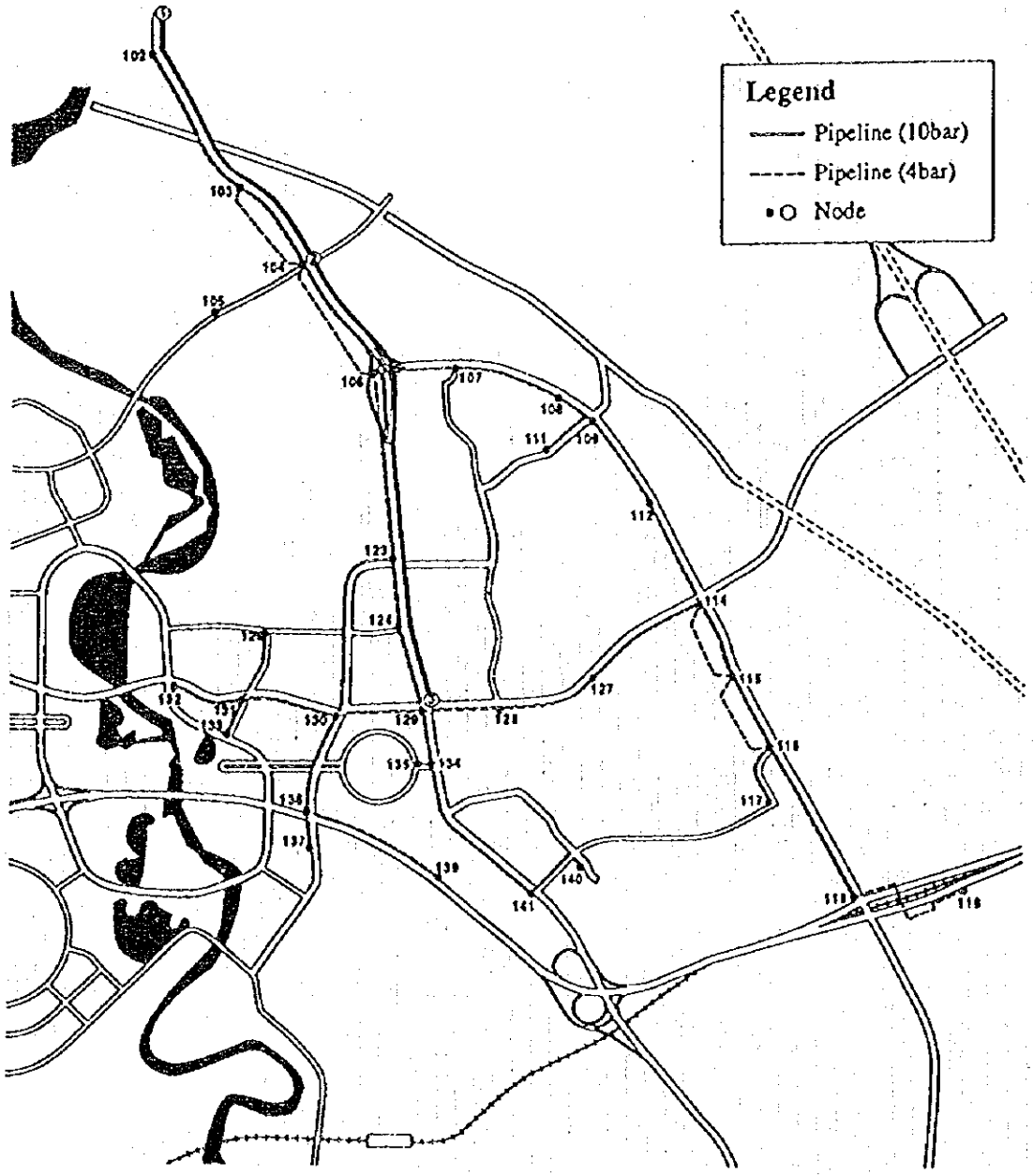
The district cooling business may not be feasible in other cases, but by reducing the construction, operation and personnel costs, and with higher levels of energy conservation, some cases may become feasible.

## 19.4 Proposed Distribution Network

### 19.4.1 Method of Grid Designing for BSD

The grid design of pipelines in the area is conducted in the following steps:
(1) Area zoning and load estimation
(2) Selection of roads where pipelines are necessary
(3) Measurement of pipe length and drawing of network diagram
(4) Pipeline load assignment
(5) Network analysis and decision of pipe diameter

Fig. 19-4-1 Network Diagram for BSD F/S Area



### 19.4.2 Results of Designing

Since the development in BSD proceeding step by step, we made a pipeline extension plan which consists of 4 phases. Table 19-4-1 shows the length and cost of pipeline necessary in each phase.

**Table 19-4-1 Length and Cost of Pipeline Necessary in BSD F/S Area**

( Length [km], Cost [million Rp- ])

| Classification | Material | Phase | I | II | III | IV | Total |
|---|---|---|---|---|---|---|---|
| Main Pipes to Plots | Steel | Length | 4.6 | 9.4 | 2.8 | 5.6 | 22.3 |
| | | Cost | 822 | 1,710 | 398 | 0 | 2,929 |
| | P.E. | Length | 1.7 | 0.0 | 0.3 | 0.3 | 2.2 |
| | | Cost | 180 | 0 | 25 | 21 | 227 |
| | Total | Length | 6.3 | 9.4 | 3.1 | 5.8 | 24.5 |
| | | Cost | 1,002 | 1,710 | 423 | 21 | 3,156 |
| Distribution Pipes in Residential Plots | Steel | Length | 0 | 0 | 0 | 0 | 0 |
| | | Cost | 0 | 0 | 0 | 0 | 0 |
| | P.E. | Length | 22.8 | 0 | 128.4 | 0 | 151.2 |
| | | Cost | 1,351 | 0 | 7,608 | 0 | 8,959 |
| | Total | Length | 22.8 | 0 | 128.4 | 0 | 151.2 |
| | | Cost | 1,351 | 0 | 7,608 | 0 | 8,959 |
| Total | | Length | 29.1 | 9.4 | 131.5 | 5.8 | 175.7 |
| | | Cost | 2,353 | 1,710 | 8,031 | 21 | 12,115 |

*Source : JICA Team*

### 19.5 Gas Supply

The gas consumed in the BSD feasibility study area is directly supplied from PGN's Serpong Offtake Station as the station is located at the edge of the area. The availability of gas is checked in the Master Plan chapters and we assume no problem in the supply of gas to the area.

## 19.6 Economic and Financial Assessment-BSD

### 19.6.1 Assumptions

The next table shows plans for BSD. (Air conditioning demand will be developed 100%, case 1 to 4) Detailed plans for each case are shown in Appendices O.

### Table 19-6-1 Plans for BSD

| (Gas Demand) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
| Residential | | (1000m3) | 0 | 126 | 679 | 1,800 | 4,932 | 5,028 | 5,028 | 5,028 |
| Commercial | (cooking) | (1000m3) | 0 | 921 | 1,286 | 2,670 | 4,273 | 5,561 | 6,908 | 6,908 |
| | (AC) 100% | (1000m3) | 0 | 6,747 | 7,672 | 17,977 | 32,337 | 41,833 | 53,678 | 59,087 |
| Gas demand Total | | (1000m3) | 0 | 7,795 | 9,636 | 22,447 | 41,542 | 52,421 | 65,615 | 71,023 |
| AC demand with 100% contingency | | (1000m3) | 0 | 6,747 | 7,672 | 17,977 | 32,337 | 41,833 | 53,678 | 59,087 |
| (Number of Customers) | | | | | | | | | | |
| | | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
| Residential | | (units) | 0 | 212 | 1,142 | 4,017 | 12,431 | 12,592 | 12,592 | 12,592 |
| Commercial | (cooking) | (units) | 0 | 13 | 17 | 46 | 91 | 161 | 240 | 240 |
| | (AC) | (units) | 0 | 7 | 8 | 22 | 43 | 73 | 108 | 112 |
| Gas demand Total | | (units) | 0 | 232 | 1,166 | 4,084 | 12,565 | 12,826 | 12,941 | 12,945 |
| (Sales Volume per Customer) | | | | | | | | | | |
| | | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
| Residential | | (1000m3) | 0 | 0.59 | 0.59 | 0.45 | 0.40 | 0.40 | 0.40 | 0.40 |
| Commercial | (cooking) | (1000m3) | 0 | 69.62 | 76.24 | 57.54 | 47.06 | 34.52 | 28.73 | 28.73 |
| | (AC) | (1000m3) | 0 | 945.74 | 976.88 | 833.41 | 747.08 | 573.92 | 496.58 | 525.37 |
| Gas demand Total | | (1000m3) | 0 | 33.54 | 8.26 | 5.50 | 3.31 | 4.09 | 5.07 | 5.49 |
| (Investment Plan) | | | | | | | | | | |
| | | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
| Cumulative main pipeline length (10bar) | | (km) | 1.6 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 | 4.1 |
| Cumulative main pipeline length (1bar) | | (km) | 4.7 | 11.6 | 11.6 | 11.6 | 14.7 | 20.5 | 20.5 | 20.5 |
| Cumulative distribution pipeline length | | (km) | 22.8 | 22.8 | 22.8 | 22.8 | 151.2 | 151.2 | 151.2 | 151.2 |
| Cumulative offtaker | | (units) | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 3 |
| Cumulative A governor | | (units) | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| Cumulative B governor | | (units) | 1 | 2 | 5 | 7 | 13 | 13 | 13 | 13 |
| Total investment (PGN) | | (mil Rp) | 2,723 | 2,002 | 1,120 | 733 | 87 | 165 | 29 | 0 |
| (Number of Workers) | | | | | | | | | | |
| | | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
| Administrative staff (Except Safety) | | (persons) | 1 | 2 | 4 | 5 | 4 | 2 | 1 | 1 |
| Administrative workers (Except Safety) | | (persons) | 3 | 5 | 9 | 10 | 6 | 2 | 1 | 1 |
| Administrative staff (for Safety) | | (persons) | 2 | 2 | 1 | 1 | 5 | 2 | 1 | 0 |
| Administrative workers (for Safety) | | (persons) | 4 | 4 | 2 | 1 | 6 | 1 | 0 | 0 |
| Sales | | (persons) | 1 | 4 | 9 | 7 | 1 | 1 | 1 | 0 |
| Meter reading | | (persons) | | 1 | 1 | 3 | 5 | 4 | 3 | 2 |
| Collecting | | (persons) | | 1 | 2 | 4 | 8 | 6 | 4 | 3 |
| High-medium pressure (Safety) | | (persons) | 0 | 2 | 2 | 1 | 1 | 1 | 1 | 0 |
| Low pressure (Safety) | | (persons) | 10 | 9 | 8 | 8 | 38 | 27 | 19 | 13 |
| Meter administration | | (persons) | 1 | 2 | 7 | 10 | 13 | 9 | 7 | 1 |
| Total | | (persons) | 22 | 32 | 45 | 50 | 87 | 55 | 38 | 21 |

*Sources:JICA team, Appendices O*

### 19.6.2. Results of Projections-BSD

The next tables are the summary of case 5 of BSD feasibility study. First cash flow is for separate utility, the second is economic analysis, and the third is for PGN. Detailed analyses for each case are in Appendices O.

## Table 19-6-2 Financial Analyses and Economic Analyses

(Financial Feasibility Analysis)

| | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| Gas sales | (mil Rp) | 0 | 3,065 | 4,103 | 9,509 | 18,035 | 22,276 | 27,263 | 29,048 |
| Gas material cost | (mil Rp) | 0 | 2,455 | 3,035 | 7,071 | 13,086 | 16,513 | 20,669 | 22,372 |
| Gross profit | (mil Rp) | 0 | 609 | 1,068 | 2,438 | 4,950 | 5,763 | 6,594 | 6,676 |
| Property tax | (mil Rp) | 2 | 3 | 4 | 4 | 7 | 5 | 3 | 2 |
| Labor cost | (mil Rp) | 100 | 229 | 479 | 568 | 528 | 318 | 208 | 120 |
| Administrative expenses | (mil Rp) | 30 | 69 | 144 | 177 | 158 | 95 | 62 | 36 |
| Maintenance & other expenses | (mil Rp) | 48 | 78 | 101 | 116 | 320 | 355 | 367 | 368 |
| Total investment | (mil Rp) | 2,381 | 1,542 | 1,120 | 733 | 87 | 165 | 29 | 0 |
| Before tax cash flow | (mil Rp) | -2,561 | -1,313 | -779 | 820 | 3,850 | 4,825 | 5,924 | 6,150 |
| IRR of before tax cash flow | | 22.7% | | | | | | | |
| NPV as of 10% | (mil Rp) | 13,786 | | | | | | | |
| NPV as of 15% | (mil Rp) | 5,263 | | | | | | | |

(Social Benefit & Loss Analyses of BSD Project)

| | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| Social benefit for residential customers | (Rp/m3) | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Social benefit for commercial cooking | (Rp/m3) | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 |
| Social benefit for commercial AC | (Rp/m3) | 528 | 528 | 528 | 528 | 528 | 528 | 528 | 528 |
| Total social benefit from gas sales | (MMRp) | 0 | 4,400 | 5,622 | 13,068 | 24,436 | 30,559 | 37,891 | 40,747 |
| Social loss for gas supplied | (Rp/m3) | 167 | 167 | 167 | 167 | 166 | 217 | 242 | 267 |
| Total social loss from gas supplied | (mil Rp) | 0 | 1,302 | 1,609 | 3,749 | 7,727 | 11,375 | 15,879 | 18,963 |
| Gross social benefit | (mil Rp) | 0 | 3,099 | 4,013 | 9,319 | 16,711 | 19,183 | 22,012 | 21,784 |
| | | | | | | | | | |
| Total investment | (mil Rp) | 2,723 | 2,002 | 1,120 | 733 | 87 | 165 | 29 | 0 |
| LPG bottle repurchase (residential) | (mil Rp) | 42 | 186 | 575 | 483 | 32 | 0 | 0 | 0 |
| In house pipeline installation (residential) | (mil Rp) | 85 | 372 | 1,150 | 966 | 65 | 0 | 0 | 0 |
| LPG bottle repurchase (commercial) | (mil Rp) | 3 | 1 | 6 | 1 | 1 | 4 | 0 | 0 |
| In house pipeline installation (cooking) | (mil Rp) | 47 | 13 | 104 | 23 | 17 | 63 | 0 | 0 |
| In house pipeline installation (AC) | (mil Rp) | 95 | 10 | 183 | 45 | 32 | 99 | 29 | 0 |
| Turbo chiller | (1000$) | 7,216 | 727 | 13,874 | 3,440 | 2,468 | 7,494 | 2,211 | 0 |
| | (mil Rp) | 16,958 | 1,709 | 32,605 | 8,085 | 5,799 | 17,610 | 5,195 | 0 |
| Absorption chiller | (1000$) | 7,735 | 779 | 14,872 | 3,688 | 2,645 | 8,033 | 2,370 | 0 |
| | (mil Rp) | 18,178 | 1,832 | 34,950 | 8,667 | 6,218 | 18,877 | 5,569 | 0 |
| Imported facilities (included) | (mil Rp) | 1,555 | 320 | 3,150 | 1,067 | 483 | 1,416 | 400 | 0 |
| Imported tax | (mil Rp) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Net social loss for facilities | (mil Rp) | 3,987 | 2,137 | 3,564 | 1,337 | 519 | 1,491 | 403 | 0 |
| | | | | | | | | | |
| Labor cost | (mil Rp) | 495 | 641 | 757 | 834 | 1,677 | 956 | 616 | 330 |
| Income tax (included) | (mil Rp) | 56 | 73 | 87 | 98 | 188 | 103 | 64 | 34 |
| Administrative expenses | (mil Rp) | 148 | 192 | 227 | 250 | 503 | 287 | 185 | 99 |
| Maintenance & other expenses | (mil Rp) | 54 | 95 | 117 | 132 | 349 | 396 | 408 | 420 |
| Value tax (included) | (mil Rp) | 20 | 29 | 34 | 38 | 85 | 68 | 59 | 52 |
| | | | | | | | | | |
| Net social benefit | (mil Rp) | -4,609 | 136 | -530 | 6,902 | 13,934 | 16,224 | 20,524 | 21,020 |
| EIRR | | 55.9% | | | | | | | |
| NPV as of 10% | (mil Rp) | 75,527 | | | | | | | |
| NPV as of 15% | (mil Rp) | 41,634 | | | | | | | |

(Financial Feasibility of PGN in Separate Utility Case)

| | | 1997 | 1998 | 1999 | 2000 | 2005 | 2010 | 2015 | 2020 |
|---|---|---|---|---|---|---|---|---|---|
| Gas sales price | (Rp/m3) | 315 | 315 | 315 | 315 | 315 | 315 | 315 | 315 |
| Gas purchase price | (Rp/m3) | 162 | 168 | 174 | 183 | 212 | 230 | 252 | 277 |
| Total gas sales | (mil Rp) | 0 | 2,455 | 3,035 | 7,071 | 13,086 | 16,513 | 20,669 | 22,372 |
| Total gas purchased | (mil Rp) | 0 | 1,309 | 1,681 | 4,102 | 8,802 | 12,082 | 16,535 | 19,673 |
| Gross profit | (mil Rp) | 0 | 1,147 | 1,355 | 2,969 | 4,283 | 4,431 | 4,134 | 2,699 |
| | | | | | | | | | |
| Offtaker | (mil Rp) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| A governor | (mil Rp) | 119 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Main pipeline (10bar) | (mil Rp) | 223 | 460 | 0 | 0 | 0 | 0 | 0 | 0 |
| Labor expenses Salaries | (mil Rp) | 359 | 374 | 253 | 224 | 1,045 | 580 | 371 | 192 |
| Pensions | (mil Rp) | 36 | 37 | 25 | 22 | 104 | 58 | 37 | 19 |
| Total | (mil Rp) | 395 | 411 | 279 | 245 | 1,149 | 638 | 408 | 211 |
| Administrative expenses | (mil Rp) | 118 | 123 | 84 | 74 | 345 | 191 | 122 | 63 |
| Maintenance & other expenses | (mil Rp) | 2 | 2 | 2 | 2 | 16 | 27 | 27 | 39 |
| Net cash flow | (mil Rp) | -858 | 150 | 990 | 2,647 | 2,773 | 3,574 | 3,576 | 2,386 |
| FIRR | | 94.7% | | | | | | | |
| NPV as of 10% | (mil Rp) | 16,836 | | | | | | | |
| NPV as of 15% | (mil Rp) | 10,127 | | | | | | | |

*Sources:JICA team, Appendices O*

The next tables shows FIRR, NPV as of 10% discount rate, and NPV as of 15% discount rate for each case. In case 5, results are for the separate utility. Downside contingency when sales volume decreases by 2% and investment costs rise by 10% has been shown. Cases when in house pipeline installation cost would be paid by the gas utilities have also

been done. Results of economic analyses are shown at the bottom of the table. We conducted the same analyses when air conditioning demand development is 50%.

Consecutively we show financial feasibility of PGN in case 5 and the equity return for separate utility when we consider financing of the separate utility.

**Table 19-6-3 Results of Financial and Economic Projections-BSD**

(%, mil Rp)

| | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 |
|---|---|---|---|---|---|
| (100% Air conditioning development demand) | | | | | |
| FIRR | 10.3% | 17.4% | 38.0% | 52.5% | 22.7% |
| NPV(10%) | 304 | 10,203 | 11,701 | 21,600 | 13,786 |
| NPV(15%) | -3,611 | 2,126 | 5,887 | 11,623 | 5,263 |
| (Downside contingency analysis)32% | | | | | |
| FIRR | 7.6% | 14.7% | 32.1% | 46.7% | 18.8% |
| NPV(10%) | -2,969 | 6,733 | 9,566 | 19,267 | 10,110 |
| NPV(15%) | -5,884 | -262 | 4,561 | 10,183 | 2,770 |
| (In house pipeline installation) | | | | | |
| FIRR | 8.9% | 15.8% | 28.3% | 41.1% | 19.7% |
| NPV(10%) | -1,376 | 8,524 | 10,022 | 19,921 | 11,765 |
| NPV(15%) | -5,010 | 727 | 4,487 | 10,224 | 3,613 |
| (Downside contingency with in house pipeline installation) | | | | | |
| FIRR | 6.4% | 13.3% | 24.1% | 36.8% | 16.4% |
| NPV(10%) | -4,648 | 5,053 | 7,887 | 17,588 | 8,088 |
| NPV(15%) | -7,284 | -1,661 | 3,162 | 8,784 | 1,120 |
| (Economic Analysis) | | | | | |
| EIRR | 52.2% | 52.2% | 52.2% | 52.2% | 55.9% |
| NSB(10%) | 72,634 | 72,634 | 72,634 | 72,634 | 75,527 |
| NSB(15%) | 39,538 | 39,538 | 39,538 | 39,538 | 41,634 |

been done. Results of economic analyses are shown at the bottom of the table. We conducted the same analyses when air conditioning demand development is 50%.

Consecutively we show financial feasibility of PGN in case 5 and the equity return for separate utility when we consider financing of the separate utility.

**Table 19-6-3 Results of Financial and Economic Projections-BSD**

(%, mil Rp)

| | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 |
|---|---|---|---|---|---|
| **(100% Air conditioning development demand)** | | | | | |
| FIRR | 10.3% | 17.4% | 38.0% | 52.5% | 22.7% |
| NPV(10%) | 304 | 10,203 | 11,701 | 21,600 | 13,786 |
| NPV(15%) | -3,611 | 2,126 | 5,887 | 11,623 | 5,263 |
| (Downside contingency analysis)32% | | | | | |
| FIRR | 7.6% | 14.7% | 32.1% | 46.7% | 18.8% |
| NPV(10%) | -2,969 | 6,733 | 9,566 | 19,267 | 10,110 |
| NPV(15%) | -5,884 | -262 | 4,561 | 10,183 | 2,770 |
| (In house pipeline installation) | | | | | |
| FIRR | 8.9% | 15.8% | 28.3% | 41.1% | 19.7% |
| NPV(10%) | -1,376 | 8,524 | 10,022 | 19,921 | 11,765 |
| NPV(15%) | -5,010 | 727 | 4,487 | 10,224 | 3,613 |
| (Downside contingency with in house pipeline installation) | | | | | |
| FIRR | 6.4% | 13.3% | 24.1% | 36.8% | 16.4% |
| NPV(10%) | -4,648 | 5,053 | 7,887 | 17,588 | 8,088 |
| NPV(15%) | -7,284 | -1,661 | 3,162 | 8,784 | 1,120 |
| (Economic Analysis) | | | | | |
| EIRR | 52.2% | 52.2% | 52.2% | 52.2% | 55.9% |
| NSB(10%) | 72,634 | 72,634 | 72,634 | 72,634 | 75,527 |
| NSB(15%) | 39,538 | 39,538 | 39,538 | 39,538 | 41,634 |

Table 19-6-3 (Continued)

| | | | | | |
|---|---|---|---|---|---|
| (50% Air conditioning development demand) | | | | | |
| FIRR | ---------- | 8.6% | 8.5% | 24.1% | 21.2% |
| NPV(10%) | ---------- | -1,932 | -777 | 9,122 | 12,027 |
| NPV(15%) | ---------- | -5,640 | -2,111 | 3,626 | 4,204 |
| (Downside contingency analysis) | | | | | |
| FIRR | ---------- | 6.7% | 5.8% | 21.6% | 18.0% |
| NPV(10%) | ---------- | -4,594 | -2,138 | 7,563 | 9,125 |
| NPV(15%) | ---------- | -7,539 | -2,970 | 2,652 | 2,177 |
| (In house pipeline installation) | | | | | |
| FIRR | ---------- | 7.5% | 6.0% | 19.7% | 18.4% |
| NPV(10%) | ---------- | -3,612 | -2,457 | 7,443 | 10,006 |
| NPV(15%) | ---------- | -7,040 | -3,510 | 2,227 | 2,555 |
| (Downside contingency with in house pipeline installation) | | | | | |
| FIRR | ---------- | 5.8% | 3.7% | 17.6% | 15.7% |
| NPV(10%) | ---------- | -6,274 | -3,818 | 5,884 | 7,103 |
| NPV(15%) | ---------- | -8,939 | -4,370 | 1,252 | 527 |
| (Economic Analysis) | | | | | |
| EIRR | 30.1% | 30.1% | 30.1% | 30.1% | 32.9% |
| NSB(10%) | 35,207 | 35,207 | 35,207 | 35,207 | 38,099 |
| NSB(15%) | 16,480 | 16,480 | 16,480 | 16,480 | 18,575 |

**[Financial Feasibility of PGN, in Case 5]**

Assumptions:

- PGN will invest in off-take and meter stations, high pressure mainlines, and "A" regulators.
- PGN will whole-sell gas to the separate utility at 315 Rp/m3.
- PGN will be in charge of safety maintenance of pipelines but will not be paid for their labor cost.
- Financial feasibility for PGN can be considered with FIRR. Investment for PGN here is marginal, so that we do not suppose any financing restrictions for PGN in this case.

Results:

| [100% Air Conditioning Demand] | [50% Air Conditioning Demand] |
|---|---|
| FIRR=94.7% | FIRR=40.6% |
| NPV(10%)=16,886 | NPV(10%)=6,509 |
| NPV(15%)=10,127 | NPV(15%)=3,419 |

Table 19-6-3 (Continued)

| (50% Air conditioning development demand) | | | | | |
|---|---|---|---|---|---|
| FIRR | ---------- | 8.6% | 8.5% | 24.1% | 21.2% |
| NPV(10%) | ---------- | -1,932 | -777 | 9,122 | 12,027 |
| NPV(15%) | ---------- | -5,640 | -2,111 | 3,626 | 4,204 |
| (Downside contingency analysis) | | | | | |
| FIRR | ---------- | 6.7% | 5.8% | 21.6% | 18.0% |
| NPV(10%) | ---------- | -4,594 | -2,138 | 7,563 | 9,125 |
| NPV(15%) | ---------- | -7,539 | -2,970 | 2,652 | 2,177 |
| (In house pipeline installation) | | | | | |
| FIRR | ---------- | 7.5% | 6.0% | 19.7% | 18.4% |
| NPV(10%) | ---------- | -3,612 | -2,457 | 7,443 | 10,006 |
| NPV(15%) | ---------- | -7,040 | -3,510 | 2,227 | 2,555 |
| (Downside contingency with in house pipeline installation) | | | | | |
| FIRR | ---------- | 5.8% | 3.7% | 17.6% | 15.7% |
| NPV(10%) | ---------- | -6,274 | -3,818 | 5,884 | 7,103 |
| NPV(15%) | ---------- | -8,939 | -4,370 | 1,252 | 527 |
| (Economic Analysis) | | | | | |
| EIRR | 30.1% | 30.1% | 30.1% | 30.1% | 32.9% |
| NSB(10%) | 35,207 | 35,207 | 35,207 | 35,207 | 38,099 |
| NSB(15%) | 16,480 | 16,480 | 16,480 | 16,480 | 18,575 |

**[Financial Feasibility of PGN, in Case 5]**

Assumptions:

- PGN will invest in off-take and meter stations, high pressure mainlines, and "A" regulators.
- PGN will whole-sell gas to the separate utility at 315 Rp/m3.
- PGN will be in charge of safety maintenance of pipelines but will not be paid for their labor cost.
- Financial feasibility for PGN can be considered with FIRR. Investment for PGN here is marginal, so that we do not suppose any financing restrictions for PGN in this case.

Results:

| [100% Air Conditioning Demand] | [50% Air Conditioning Demand] |
|---|---|
| FIRR=94.7% | FIRR=40.6% |
| NPV(10%)=16,886 | NPV(10%)=6,509 |
| NPV(15%)=10,127 | NPV(15%)=3,419 |

**[Equity Return of Separate Utility]**

[100% Air Conditioning Demand]

Assumptions:

- Total equity invested 3,000 mil Rp
- Total equity invested /Total facility investment=16.3 %
- Interest rate for cash deposits=5.0%
- Interest rate for long term and short term debt=10.0%

Results: IRR of equity=18.4%

[50% Air Conditioning Demand]

Assumptions:

- Total equity invested: 3,000 mil Rp
- Total equity invested /Total facility investment=16.3%
- Interest rate for cash deposit=5.0%
- Interest rate for long term and short term debt=10.0%

Results: IRR of equity=18.0%

*(Source: JICA Team; Appendices O, BSD)*

### 19.6.3. Assessment

From the results of the financial projections, when we see its sensitivity analysis case of 50% air conditioning demand development, only Cases 4 and 5 are feasible.

In Case 4, PGN will be too profitable in the 100% air conditioning demand development case to be realistic.

In Case 5, the viability of the separate utility does not change so much between these two cases. In both demand cases, PGN is quite profitable in Case 5.

Economic feasibility is rather high in both demand cases.

As an example of equity investment in Case 5, we get IRR of 18.4% or 18.0%, for the 100 % AC demand case or 50% AC demand case with 16.3% equity of total investment of this project which is 3,000 mil Rp.

# PART IV

# CONCLSION AND RECOMMENDATION

# Chapter 20

# Conclusions

# PART IV CONCLUSIONS AND RECOMMENDATIONS

## 20. Conclusions

### 20.1 Energy and Economic Situation and Policies

(1) *Affordability:* The economic growth of the Jakarta area has been significant with the current average GRP per capita being about US $ 3,000, a level perceived as sufficient to afford urban gas infrastructure. GRP per capita in other major metropolitan areas where gas is available is also growing fast and approaching the US $ 1,000 line. Perspective urban gas infrastructure in those areas will be worth consideration, too.

(2) *Gas Priority for Urban Use:* Urban gas priority is good to be built into the national energy policy at least in high growth metropolitan areas like Jakarta. Looking into the country's energy resource base available to domestic use and assuming abundance of natural gas in a long-term perspective, the gas could be best used for urban energy infrastructure. This is because a modern urban area requires a streamlined energy distribution contributing to better traffic conditions, better environment, more convenience, safety and higher energy efficiency, and the direct use of gas can meet such requirement. Other energy resources are better used by larger customers and in more rural areas.

(3) *Competition with LPG:* Gas networks can well compete with LPG at economic price levels. Since urban gas can be available only through pipeline systems that require large up-front costs. Economics has to be carefully examined in view of affordability by people and competition with LPG. The use of LPG is rapidly growing in suburban areas and it is also a clean energy suitable for household use with care. Due to its safety and the nature of the distribution system, however, it is more suitable for rural areas. Gas is preferred in urban areas.

(4) *Regulation and Policy:* There is almost no transparent framework yet to regulate urban gas distribution. Gas prices are set by the Government after discussions among PGN, Pertamina, MIGAS and political parties. By policy, the national one price system is applied so that the distributed gas has the same price throughout the nation if the use of gas is in a same category. While the constitution stipulates that gas and oil be marketed by a sate-owned company, but whether or not it governs the delivery to the end use is unclear. GOI well recognizes this situation and the need to formulate a streamlined framework as a prerequisite in inviting investors, it is drafting one with the help of ADB and WB.

With recognition that economic prices work best in a market economy, it is desired that as long as the pricing is reasonable in view of affordability, the efficiency cost and competitiveness and price changes be approved smoothly under the transparent

regulatory rules. Also in view of large up-front investment required, more a favorable tariff like a two part tariff system is desired to be employed for smaller customers.

While PGN is authorized as the sole gas distributor to smaller customers, some variations, like setting up a separate company for limited gas distribution, better be approved especially when one price policy rule is too rigid, a different system is economically justified and residents select such a different system.

(5) *Importance of Market Development*: While when it is a mandate to develop the domestic use of natural gas, more attention is usually paid to upstream development, it should be recognized that market development is equally important. When only large industries are a target such burden is small, but as the gas is to be used by a smaller but more abundant number of customers, large development effort and more intricate plans are necessary. Upstream and downstream have to be developed in parallel.

## 20.2 Assessment of Master Plan

(1) *Overall*: The Team concludes from the analysis of the Master Plan that the gas distribution to smaller customers is economically feasible and beneficial on the national economic basis. This is judged mainly from the overall EIRR and NPV over the calculation period from 1997 and 2020. The IRR and the NPV values of cash flows are shown in Table 20-1.

**Table20-1 Economic Result of M/P**

| | IRR (%/y) | NPV (mil.Rp) |
|---|---|---|
| Base case | 34.2 | 970,601 |
| High case | 40.2 | 1,353,508 |
| Low case | 28.1 | 653,777 |

*Source: JICA Team 1997*

We set gas prices at a level competitive with alternative energies in calculating IRR rather than directly determining the economic gas distribution cost in each market sector. There is complexity of the gas market that includes residential, commercial, industrial and new technology sub-sectors which all use the same distribution network. Instead, the residential gas distribution cost is exemplified in a feasibility study that follows later.

The feasibility is expected if:

- The price is set at a cost recoverable price, and
- is still at a level competitive with LPG,
- financing is available,
- all the effort to cut the cost
- large market as gas cooling is sought together.

(2) *Gas Purchase Price:* Before discussing gas sales prices, the gas purchase price was set to gradually increase from the current price of 167 Rp/m3 in 1996 to 268 Rp/m3 in 2020 in real terms reflecting the future gas coming from farther gas fields.

(3) *Residential:* The residential gas price was set at 800 Rp/m3 in real terms in the above economic analysis. This is a level still low enough to compete with LPG and to recover the investment; thus deemed as an economic price. The difference between the purchase price and 800 Rp/m3 represents the distribution cost which is based on efficient operations.

The set price of 800 Rp/m3 is far higher the current residential gas price but has to be realized for the independent feasibility of residential gas distribution. This level is both economically competitive and affordable by many potential customers.

A quick increase of the residential gas price to a level of 800 Rp/m3 is desired since a case of gradual increase in ten years proved not enough rate of return for inviting private sector investors.

(4) *Separate Entity:* How to virtually raise the price is a political or corporate theme and we have proposed a concept of "separate entity distribution operation". In this concept PGN sells gas to a separate distribution entity, PGN's subsidiary or a third party company, at a wholesale price and the rest of the work of gas distribution is handled by such an entity which charges an 800 Rp/m3 level price to residential customers in a designated area. This is because PGN is currently required by the Government to apply a unique gas price to residential customers in the country regardless of the region and actual cost differences, and it is presumed that a separate company may be allowed to apply a different but economically reasonable price to customers A similar scheme is already applied to apartment buildings, where a landowner charges a price to end customers, though the price is different from such a high level. To maintain the safety and common gas distribution standards, PGN may still act as a contractor for physical operations and patrols, not really feeling the loss of a market. The estate operator may be rewarded with certain economic return, keeping privileges and attractiveness of the property. By this scheme, the final price to the customer could be divided into a distribution charge and a gas price, the latter of which is still in line with the PGN gas tariff.

(5) *Financial Analysis:* Whether to adopt the separate entity concept and how quickly to raise the price for residential customers affects the economics of the whole Master Plan mildly because of inherent cross subsidy from more lucrative industrial sectors. The situation is shown in Table 20-2. Since the portion of residential gas market in the whole PGN operations is small, less economical element is well absorbed, except in the combined cases of current gas prices and low demand. This can work as a back-stop element to PGN for venturing into new market sectors, but it is never desirable that the residential gas market damage the financial picture of other sectors when PGN requires a large investment in transmission lines. Thus an arrangement for self sustainability of the residential gas operation is necessary.

**Table 20-2 Financial Analysis on the Master Plan**

| | Scenario | | Base | | High | | Low | |
|---|---|---|---|---|---|---|---|---|
| | | | IRR %/y | NPV milRp | IRR %/y | NPV milRp | IRR %/y | NPV milRp |
| 1 | Managed by separate utility. Gas purchased at 315, sold at 800 | PGN side | 27.0 | 432,524 | 31.5 | 727,665 | 20.8 | 191,685 |
| | | Sep. U. | 17.5 | 120,337 | 17.9 | 130,910 | 17.0 | 106,697 |
| 2 | PGN operates. Price up in ten years | | 20.7 | 456,241 | 24.5 | 769,701 | 16.1 | 203,656 |
| 3 | PGN operates. No price hike | | 16.6 | 259,165 | 21.2 | 574,686 | 10.4 | 8,837 |

*Source: JICA Team 1997*

(6) *Commercial Air-conditioning:* Gas absorption air-conditioning is mostly feasible in commercial facilities at the current gas and electric prices if the pipelines are located close to the customer facilities. The estimated pay-back is 3 to 4 years. Assuming the electric prices will be raised in the future reflecting the clearly more expensive generation costs, absorption chillers will be feasible in the future, too.

(7) *Cogeneration:* High efficiency cogeneration may have some difficulty in attracting investors, who generally want a quick property investment return, due to high capital expenditure and generally low energy prices as well as insufficient amount of heat demand depending on facilities. Pay-back is 5 to 6 years and the IRR may be in the range of 10 to 13 %/y in a 15 year project period. It is still economical to an investor with enough financial capability and long-term perspective of property investment. It is worth consideration to hotels and hospitals in urban areas. The gas cogeneration is challenged by another cogeneration using low priced oil products without environmental restriction in urban areas.

(8) *NGV:* A NGV is simply beneficial for environment in urban areas as long as economics allows it and the policy of the government to spread CNG for taxis, buses and other fleet are appreciated if the price of a conversion kit is maintained at the current level and safety is ensured. There are still barriers of land prices in installing CNG filling stations in urban areas and so the economics are difficult to generalize. Certain density of the number of stations are required for NGVs to take off in a self sustaining market. It may be worth certain cross-subsidy in a transition period.

(9) *Industrial market:* There is a large potential in industrial gas markets in many industrial estates being developed in the east of Jakarta as well as in Serang. Uncertainty is also large in estimating the potential gas demand since many estates are in very early stages of development. The Team, nevertheless dared to approximate the potential. There are recently challenges from low cost oil products, so PGN should feel competition and think in advance for possible demand areas. The Team appreciates that PGN well knows the industrial gas sector from abundant experiences.

(10) *Environmental and societal effect:* The Team conducted a detail environmental assessment for the Master Plan projections. As gas is good only, it is essentially to assess how good natural gas is in urban areas. Gas considerably decreases SOx and NOx in urban areas by replacing oil for factories as well as greenhouse gases effective globally. Gas absorption chillers decreases ozone depleting CFCs. The gas is safer than LPG which has recently caused many large explosion incidents as well as more convenient. It is felt by people as having a premium value which, though, changes with income levels and hard to quantitatively determine.

## 20.3 Conclusions from Feasibility Studies

**Table 20-3Financial Results of Feasibility Studies**

| No. | Scenario | | Bekasi | | BSD | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 100% Progress | | 50% Progress | |
| | | | IRR %/y | NPV mil Rp | IRR %/y | NPV mil Rp | IRR %/y | NPV mil Rp |
| 1 | Operated by separate utility. Gas sold at 800 Rp, purchased at 315 Rp/m3 | PGN | 15.2 | 403 | 94.7 | 16,886 | 40.6 | 6,509 |
| | | S. Ut. | 14.5 | 1,971 | 22.7 | 13,786 | 21.2 | 12,027 |
| 2 | PGN operates. Up to 800 Rp in 10 yrs. | | 7.3 | -1,722 | 17.4 | 10,203 | 8.6 | -1,932 |
| 3 | PGN operates. Price remains w/o hike. | | | -7,824 | 10.3 | 304 | | -11,832 |
| 4 | PGN operates. Gov. help pipes; no price hike. | | | -4,613 | 38.0 | 11,701 | 8.5 | -777 |
| 5 | PGN operates. Gov. help pipes; To 800 in 10 yrs. | | 13.6 | 1,489 | 52.5 | 21,600 | 24.1 | 9,122 |

*Source: JICA Team*

(1) The Team has confirmed the economic feasibility of gas distribution to smaller customers under certain conditions in two estates: Perum Perumnas Bumi Bekasi Baru and Bumi Serpong Damai. The former is almost purely residential and the latter is the combination of large commercial center and residential estates. Another distinction is that the former is a government sponsored estate while the latter is very large and purely a private sector estate. Table 20-3 shows the results.

(2) *Bumi Bekasi*: The results on Bumi Bekasi Baru shows a typical genuine residential gas distribution which has proved rather tough economics. It is economically feasible if:

- the gas price is raised to 800 Rp/m3 from the beginning, and
- the operation cost is kept minimum by only a limited number of staff and workers.

(3) *Separate entity*: Assuming the difficulty in raising the gas price directly by PGN, the Team considers the case of a "separate entity" is the only possibility, in which a gas bill to a customer is broken down into a gas charge and distribution service charge.

PGN has enough return by whole-selling the gas to a separate gas distributor at 315 Rp/m3 applying the current K2 tariff in line with the size of the demand from Bekasi.

Based on our financial analysis on PGN's profitability, PGN will even be able to give a discount in the whole-sale price to such an entity or establish a new and lower tariff table, attracting more customers in the estate.

Responsibilities should be clearly defined in such a separate entity gas operation since it is matter of fact a joint distribution operation. Our analysis assumed PGN invest in all high pressure gas mains above 3 bars, all regulators from the main and a gas meter for the whole sale gas transfer. PGN also takes care of the patrolling over low pressure lines. We assumed these be included in the wholesale price. Measure for gas leaks, if found, is a responsibility of the entity.

Safety is very important to assure the customers and for sustaining the business for long time and it is for this reason that PGN is expected to assume patrolling the low pressure pipelines since it is more experienced than a new entity which may be only financially interested in the residential gas distribution.

(4) *Responsibility of PGN:* By keeping the high pressure mains as PGN's property, PGN can expand its own service area through the estate to other larger customers, since PGN is basically given the right of a natural monopoly.

The price to existing residential gas customers will have to be gradually increased to eventually match the level at those estates. Since a tariff system more honest to the real cost levels should be recognized as a fair system, we hope it will be accepted.

PGN should be able to invest in such a separate entity, but considering the regulation by PKLN which restricts foreign investment in RI's governmental entities, PGN's share may be well restricted to a small level for quick implementation. Such consideration enables pipeline investment to be smoother.

*(5) BSD:* BSD is characterized by large commercial facilities as well as the residential sectors and the overall economics is much better than Bekasi. The same discussions as in Bekasi can go for residential part of the estate but when the separate entity handles both commercial and residential districts in the estate as is expected the performance of the entity of BSD will be more attractive due to large demand for gas from air-conditioning if properly installed. Our Study has been focused only on the eastern half of the estate divided by a river, which suggests that the study will be a good indication to the future development of the western half.

(6) *Gradual development of commercial facilities:* The prospect of a gas air conditioning market is heavily affected by the commercial facility build-up progress. Performance is best when all facilities are starting at the same time (defined as 100% Progress in Table 20-3) but such is unlikely. With a more conservative build-up progress (say, 50% in 5 years), however, the economics will be still attractive.

(7) *District cooling:* District cooling has an economic possibility in BSD because of sizable accumulation of cold heat demand in a central area of commercial facilities. A

more centralized energy system, it increases the energy efficiency, convenience, safety, smartness and privilege, and saves space in buildings. Premium values due to those factors, however, are felt differently according to the people and income levels generally. Because of higher up-front costs of the system, than for decentralized systems, the decision will rest with the land developers on whether to take long-term or short-term advantages.

### 20.4 Utility Management

*(1) Financial and market status:* While PGN has successfully expanded gas distribution to industrial customers so far, further expansion of the entity is to involve enormous investment in high pressure and long haul transmission pipelines, drastically changing its financial status. Future projects are very large compared to the size of the current PGN and large borrowings are envisaged as well as inviting equity investors. Still the Debt/Equity ratio is expected to increase. When the ratio of Cost of Goods/ Total Sales and Profit/Total Sales are decreasing these years, each new project should be very carefully examined of the feasibility and maximum efforts must be devoted to securing the market and cutting the cost by further efficient operations.

Since these projects are national dream projects which are important for the national policy to promote the domestic gas use to replace oil, the government is expected to fully support the projects, subject to PGN's own effort as the major transmission and distribution company.

A Market oriented approach will be more necessary in the future to secure the market, since without the market there will be no new pipelines and that means more efforts and expertise required. All possibilities of the market especially in the Jakarta areas will have to be explored and examined. For further expansion, a smaller customer market will have to be explored, too, with more carefulness.

*(2) Organization and human resource development:* Restructuring of organization in PGN is actively going on to adapt to new business status for the future. PGN has successfully expanded the business without any large increase in the number of employees in the last decade. Further expansion, however, may require involving more people in and out of the company with higher expertise because a more diversified gas market development is required. It will be necessary to involve and organize more outside contractors, to further develop our own human resources for higher expertise and to promote and cultivate more team-work among the employees to exploit every employee for common targets.

For the Master Plan to be implemented, additional functions will have to be added to the organization, various gas sales promotion techniques have to be learned, safety standards have to be streamlined and more system development will be necessary to handle more customers and to control gas networks more efficiently.

*(3) Gas pricing:* This Study finds that current gas price level is insufficient to target smaller customer market except for gas air-conditioning and any measures to virtually increase the price within an economically justified range. It is also desired to restructure the tariff system to adapt to the new markets mainly to more easily recover the investment costs by adopting a two-part tariff system or any other comparable system. To continuously study into the tariff system will be necessary as all gas companies in the world do to cope with the changing world.

*(4) Gas Networks:* Through detail network analyses, the Study finds many bottlenecks existing in the gas distribution networks as PGN recognizes, too. Most problems will be solved by precisely locating those problems and by small additional investment. Some problems, however, appear to exist in between PGN and Pertamina, since the high pressure transmission line and distribution network is closely linked. In this regard, close talks and cooperation with Pertamina will be desired.

To cope with expanding gas networks, more technologies will have to be introduced without too much dependence on labor force in the future. The Study finds that personnel expenses are already becoming a heavier burden in the distribution costs with the increase of a per-head income due to the economic growth and so personnel expenses.

(5) *Marketing:* Future marketing to target new smaller customer markets requires more a diversified approach to various potential customers, like, land developers, building owners, architects and gas appliance sellers. New strategies to diversified markets will have to be gradually developed to implement the Master Plan.

# Chapter 21

# Recommendations

## 21. Recommendations

### (1) Policy Level:

1) The government should recognize in its policy that the Jakarta area can already afford to have urban gas infrastructure due to its economic strength while such development has been inhibited by low gas prices.

2) The government policy is recommended to put a high priority in urban gas for a streamlined urban energy infrastructure.

3) The policy should recognize that gas can have a competitive price with that of LPG, and gas is more suitable for urban residents and LPG is an important fuel for more rural areas for the residential purpose.

4) Regulatory framework should allow the prices to be at a level to recover the justifiable costs for urban gas infrastructure. The two-part tariff system which is more appropriate in recovering the investment cost, should be considered. Efficient gas pricing based on economic costs and prices should be more easily approved in the approval process.

5) The policy makers should recognize that market development is important equally to upstream development to promote domestic gas use.

### (2) Master Plan:

1) It should be recognized that gas distribution to smaller customer market is feasible at economic prices under certain conditions including joint development of residential and commercial, and gas cooling market. Mid-income group residents can be better targeted for the residential gas market and so they can be a locomotive for building up of the gas energy infrastructure.

2) When the distribution cost in certain region is different from other region and such cost can still compete with other fuels, it is recommended to approve a mechanism to apply a different price through a separate entity establishment

3) The government is recommended to endorse the promotion of gas air-conditioning and cogeneration, when feasible, for commercial buildings and complexes.

4) NGVs are beneficial and recommended to be promoted in the urban areas. More filling stations are necessary for sustainability.

5) It is recommended to continue to watch new industrial estate development, since industrial estates in West Java are growing and early pipeline planning is better for securing the gas market.

**(3) Feasibility Studies:**

1) We recommend that a policy of gas price increase or of establishing a separate utility for gas distribution, which is granted to apply separate tariffs, be established early especially for Bekasi. While gas distribution is economically feasible in Bekasi, subject to economic gas tariff of 800 Rp/m3, any lower price may inhibit development, since it is a purely residential estate, without commercial customers.

2) BSD is highly encouraging for gas distribution to the combination of residential and commercial customers and so we recommend that an agreement among relevant organizations be reached early.

**(4) Gas Utility Management:**

1) We recommend that human resource development in strategic areas for market development be effectively promoted.

2) PGN is recommended to lead improved tariff system development to facilitate to more quickly recover the investment cost.

3) We recommend to solve the bottlenecks of gas networks for future gas expansion.

4) More cooperation between Pertamina and PGN recommended to optimize the gas network operation.

5) More technology to be introduced because the burden of personnel expense is rising as is seen in the analysis of the distribution costs in Feasibility Studies.

# Chapter 22

# Next Steps

## 22. Next Steps

### 22.1 Immediate Future:

This Study includes recommendations involving policy changes both at national and PGN levels which are a prerequisite for implementation of the Master Plan and other plans from feasibility studies. Establishing policies or a direction of policies on gas prices and PGN's policies for organizational and managerial improvement will be crucial for future steps from this Study.

All projections and analyses in this Study assume that such policy changes be made in a year of 1997 and implementation begin in 1998. A delay of a year in policy formulations means one year delay of all plans in this Study.

### 22.2 For implementation:

There are still more steps to be followed after the final report is approved until implementation, if implementation is decided.

a. Clearing government policies and regulations
b. Establish the direction for gas prices
c. Gas purchase arrangement
d. Acquiring supervising consultants
e. Establishing company policies
f. Establishing concrete rolling plans
g. Revised and finalized feasibility studies for financial institutions
h. Financing arrangement
i. Establishing work forces
j. Education and training for employees and contractors
k. Adjusting with gas appliance manufactures and sellers
l. Procurement procedures

Table 22-1 Implementation Schedule

| | First Year | | 2 | | 3 | 4 |
|---|---|---|---|---|---|---|
| | 1 st. | 2 nd. | 1 st. | 2 nd. | | |
| 1. Clearing Government Policies and Regulations | | | | | | |
| Establishing the Direction for Gas Prices | ← → | | | | | |
| Establishing Separate Company Policies | ← → | | | | | |
| 2. Gas Purchase Arrangement | ← → | | | | | |
| 3. Acquiring Supervising Consultant | ← | — | — | → | | |
| 4. Establishing Concrete Rolling Plans | ← | → | | | | |
| 5. Revised and Finalized Feasibility Studies | | ← → | | | | |
| 6. Financing Arrangement | | | ← → | | | |
| 7. Establishing Work Forces | | ← | — | — | — | → |
| 8. Procurement Procedures | | | | | | |
| Drafting Specifications for Tenders | | ← → | | | | |
| Reviewing Tenders | | | ← | → | | |
| 9. Preparation of Converting Appliances in to Natural Gas | | | | | | |
| Adjusting with Gas Appliance Manufactures | | | ← → | | | |
| 10. Detail Designing Gas Facilities | | | | ← → | | |
| 11. Education and Training for Employees and Contractors | | | ← | — → | | |
| 12. Implementation | | | | ← | — | → |

# Chapter 23

# Acknowledgment

## 23. Acknowledgment

The Team thanks all the officials who joined in, contributed to or cooperated with the Team in conducting the Study. Such officials and organizations are recorded in a list elsewhere in this report for commemoration.

## Cooperators for the Study in Indonesia

The Team thanks all the officials who cooperated with the Study, many of whom and relevant organizations are in the following list; It could not list all; regrets and apologizes if any one is dropped:

### 1. Organizations for the Study

**Steering Committee *(Chairman: Dr. Rachmat) for the Study:**
Members from BAPPENAS, Ministry of Mines and Energy (Planning Dept.), MIGAS and PGN

**Counterpart Team ** (Chairman: Mr. Ir. Rohali Sani):**
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**Working Group for the Study:**
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Note) * and **: Members of the Committee and the Team, respectively, are denoted with asterisk in the following list.

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## 6. Japanese Institutions in Indonesia

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Mr. Koji Hachiyama, Second Secretary

**JICA Indonesia Office**
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All his staff.

**The Overseas Economic Cooperation Fund of Japan**
Mr. Sachihiro Hayashi, Representative, Jakarta Office

**Japan External Trade Organization (JETRO), Jakarta Center**
Mr. Yoji Suga

**Japanese Enterprises in Indonesia:**
The Team also thanks numerous Japanese entities in Indonesia for the supply of information in the areas of:

- financing
- industrial estate development
- energy trading
- manufacturing
- air conditioning
- land development