② The Network in the Starting Year (2013) in the Phase 2

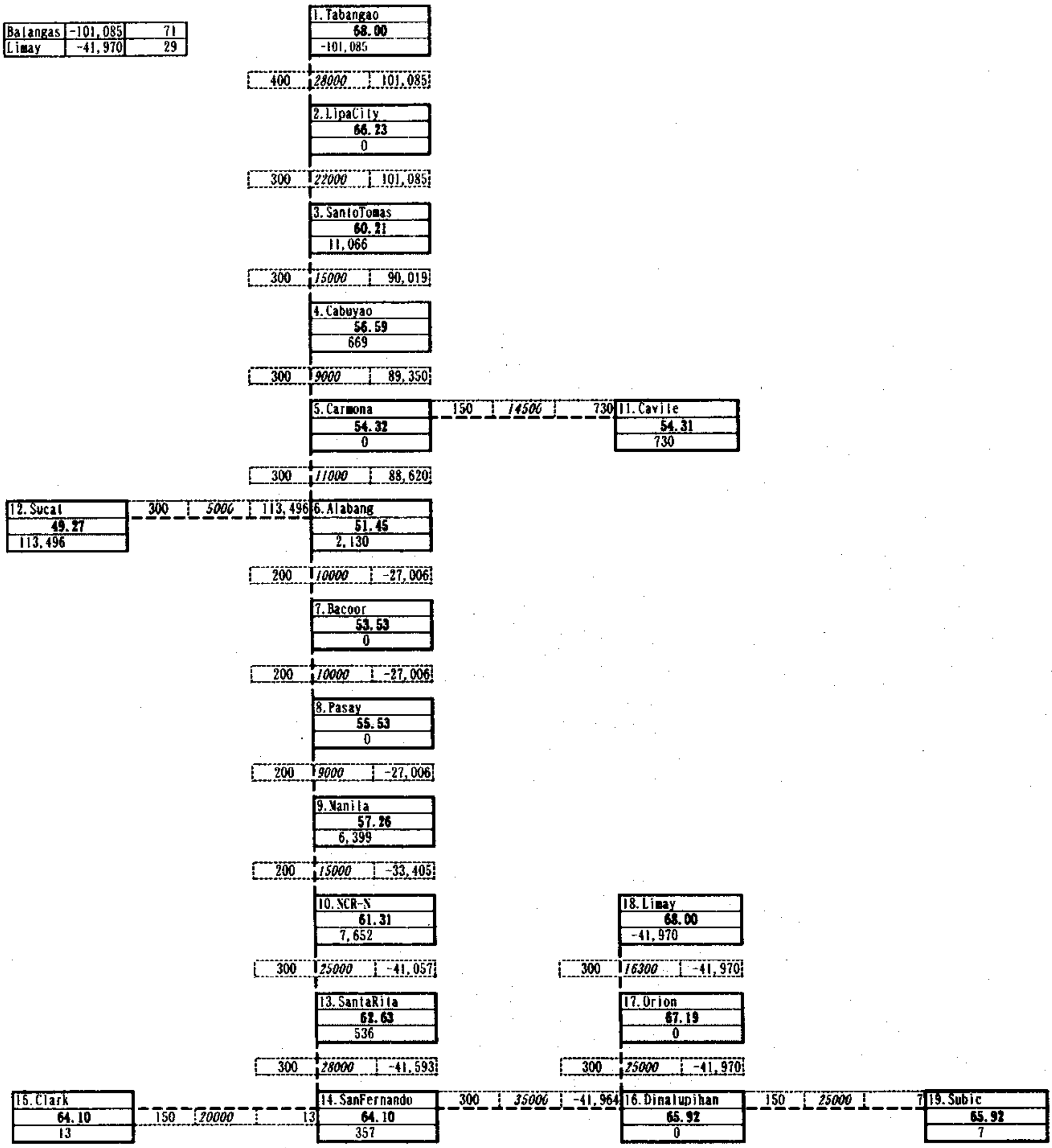

Figure 5-3-7 Pipeline Network (Option 1/ Low Case in 2013)

③ The Network in the Final Year (2025)

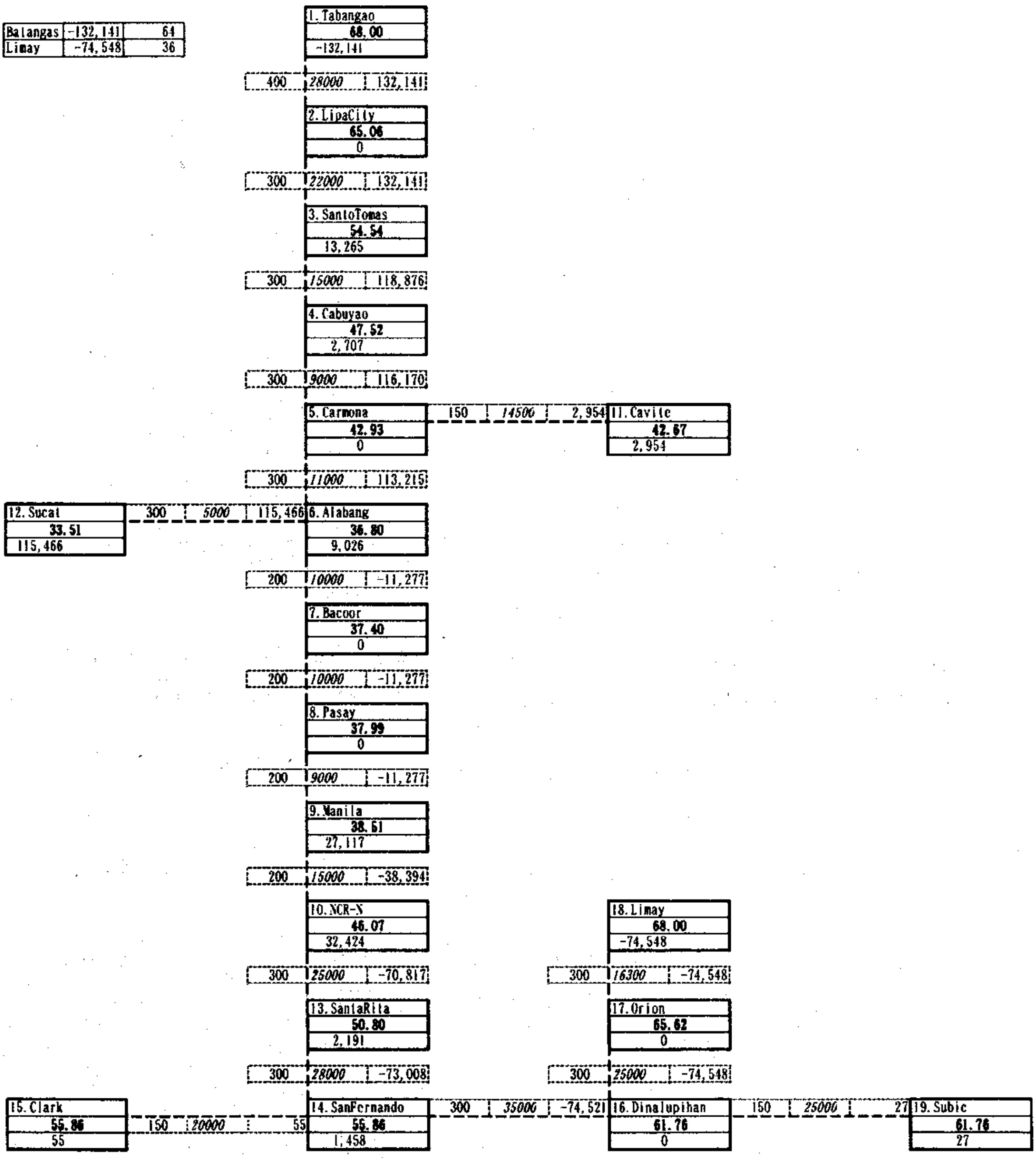

Figure 5-3-8 Pipeline Network (Option 1/ Low Case in 2025)

(2) Area L – Option 2

The LNG terminal constructed in Area L-3 will be connected to the landing terminal for domestic natural gas in Area L-2 through a transmission pipeline across Manila Bay.

Gas will be supplied to Areas L-1 and L-2 first, and finally to Area L-3.

Phase 1	Priority will be given to Areas L-1 and L-2. Domestic gas will be transported from the landing terminal for domestic gas in the Batangas area.
Phase 2	By the year when the capacity of the transportation pipeline in the above-mentioned section reaches its limit, a new transmission pipeline will be constructed undersea across Manila Bay to connect the LNG terminal in Area L-3 and the Phase 1 transmission pipeline.
Phase 3	Another new pipeline will be extended from the northern NCR and the LNG terminal, and supply gas to Area L-3.

Thereby, a double-source and two-terminal system for domestic and imported natural gas will be established and ensure stable gas supply (Figures 5-3-9 and 5-3-10).

The undersea pipeline to be constructed in the Phase 2 will be able to flexibly respond to the increase of gas demand in Areas L-1 and L-2 by enlarging the diameter of the undersea pipeline. So, it will be important to fix the demand forecast when planning the pipeline.

The pipelines in the Phase 3 can be laid at any year until the target year after the Phase 2. Therefore, the pipelines can flexibly support the increase of gas demand in Area L-3.

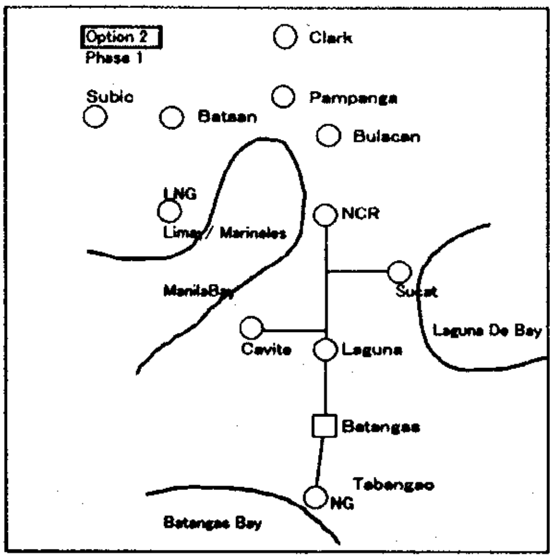

Figure 5-3-9 Area L – Option 2 (Phase 1)
(2006 to 2015)—High Case
(2006 to 2012)—Low Case

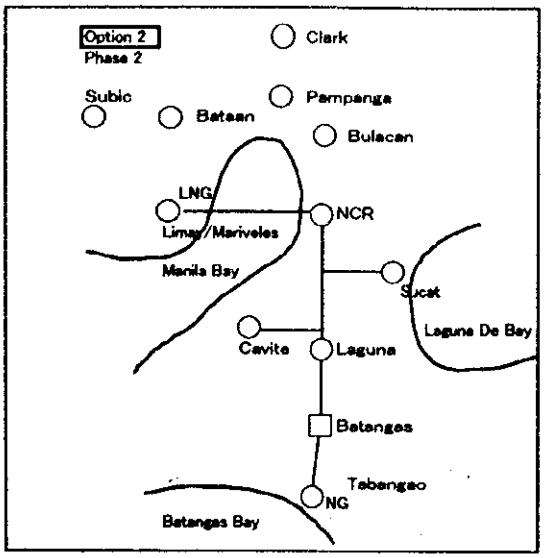

Figure 5-3-10 Area L – Option 2 (Phase 2)
(2016 to 2020)··· High Case
(2013 to 2020)··· Low Case

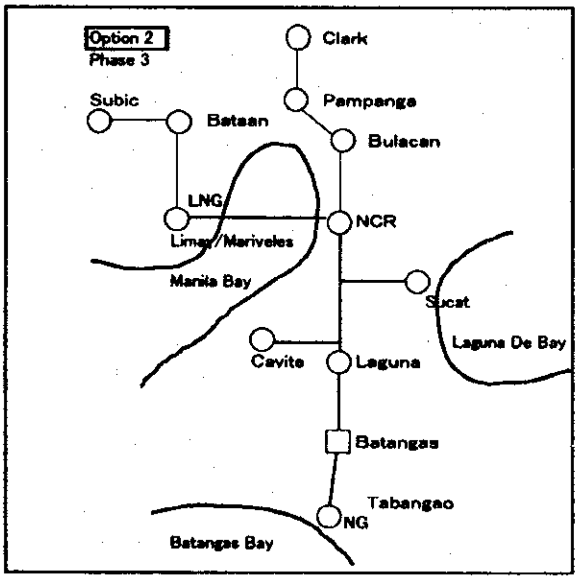

Figure 5-3-11 Area L – Option 2 (Phase 3)
(2021 to 2025)··· High Case, Low Case

The peak-hourly gas flow rate at each supply point obtained from the two demand forecast cases is shown in Table 5-3-5.

Table 5-3-5 Peak-hourly Gas Flow Rate in Area L -Option 2 (Nm^3/h)

No	Point	Demand Case	2006	2010	2015	2020	2025
3	Santo Tomas (Batangas)	High	396	7,619	14,213	17,095	20,172
		Low	277	6,477	11,276	11,994	13,265
4	Cabuyao (Laguna)	High	367	1,483	3,585	6,257	9,108
		Low	257	425	863	1,529	2,707
6	Alabang (NCR-S)	High	1,104	4,801	11,902	21,022	30,892
		Low	763	1,327	2,776	5,002	9,026
9	Manila (NCR-C)	High	3,317	14,423	35,757	63,157	92,811
		Low	2,293	3,987	8,339	15,029	27,117
10	NCR-N (NCR-N)	High	3,966	17,246	42,755	75,518	110,976
		Low	2,742	4,767	9,971	17,970	32,424
11	Cavite (Cavite)	High	401	1,619	3,913	6,830	9,942
		Low	280	463	943	1,669	2,954
12	Sucat (Rizal)	High	355	114,284	116,316	118,899	121,655
		Low	248	410	113,685	114,328	115,466
13	Santa Rita (Bulacan)	High	-----	-----	-----	-----	7,334
		Low	-----	-----	-----	-----	2,191
14	San Fernando (Pampanga)	High	-----	-----	-----	-----	4,880
		Low	-----	-----	-----	-----	1,458
15	Clark (Bataan)	High	-----	-----	-----	-----	184
		Low	-----	-----	-----	-----	55
18	Limay/Mariveles (Bataan)	High	-----	-----	-----	1,066	1,560
		Low	-----	-----	148	262	466
19	Subic (Bataan)	High	-----	-----	-----	-----	92
		Low	-----	-----	-----	-----	27

The result of a pipeline network analysis using the two scenarios are shown in Figures 5-3-12 to 5-3-15 (High Case) and in Figures 5-3-16 to 5-3-19 (Low Case).

1) High Case

①The Network in the Final Year (2015) in the Phase 1

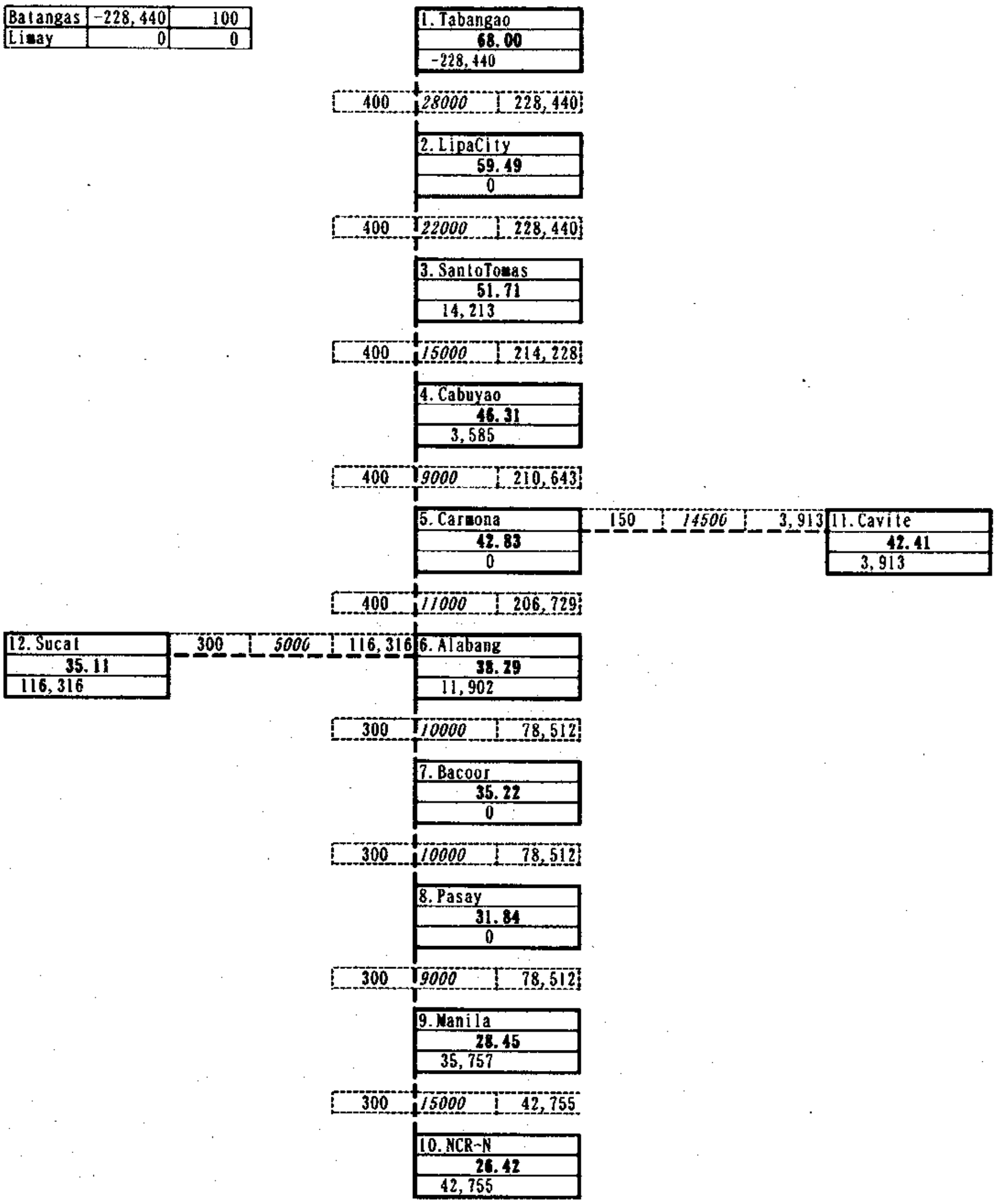

Figure 5-3-12 Pipeline Network (Option 2 / High Case in 2015)

② The Network in the Starting Year (2016) in the Phase 2

Batangas	-144,365	59
Limay	-99,089	41

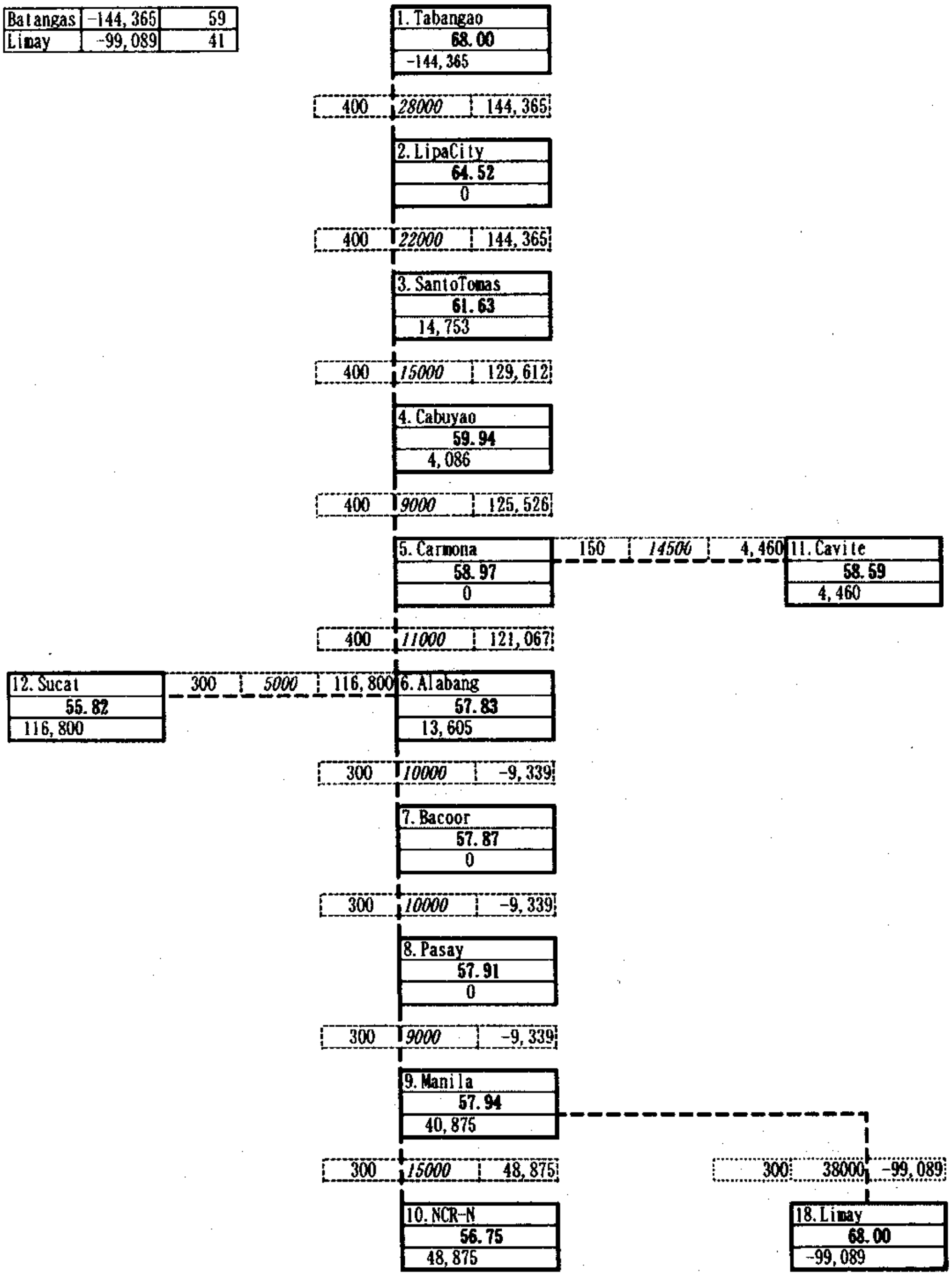

Figure 5-3-13 Pipeline Network (Option 2 / High Case in 2016)

③ The Network in the Starting Year (2021) in the Phase 3

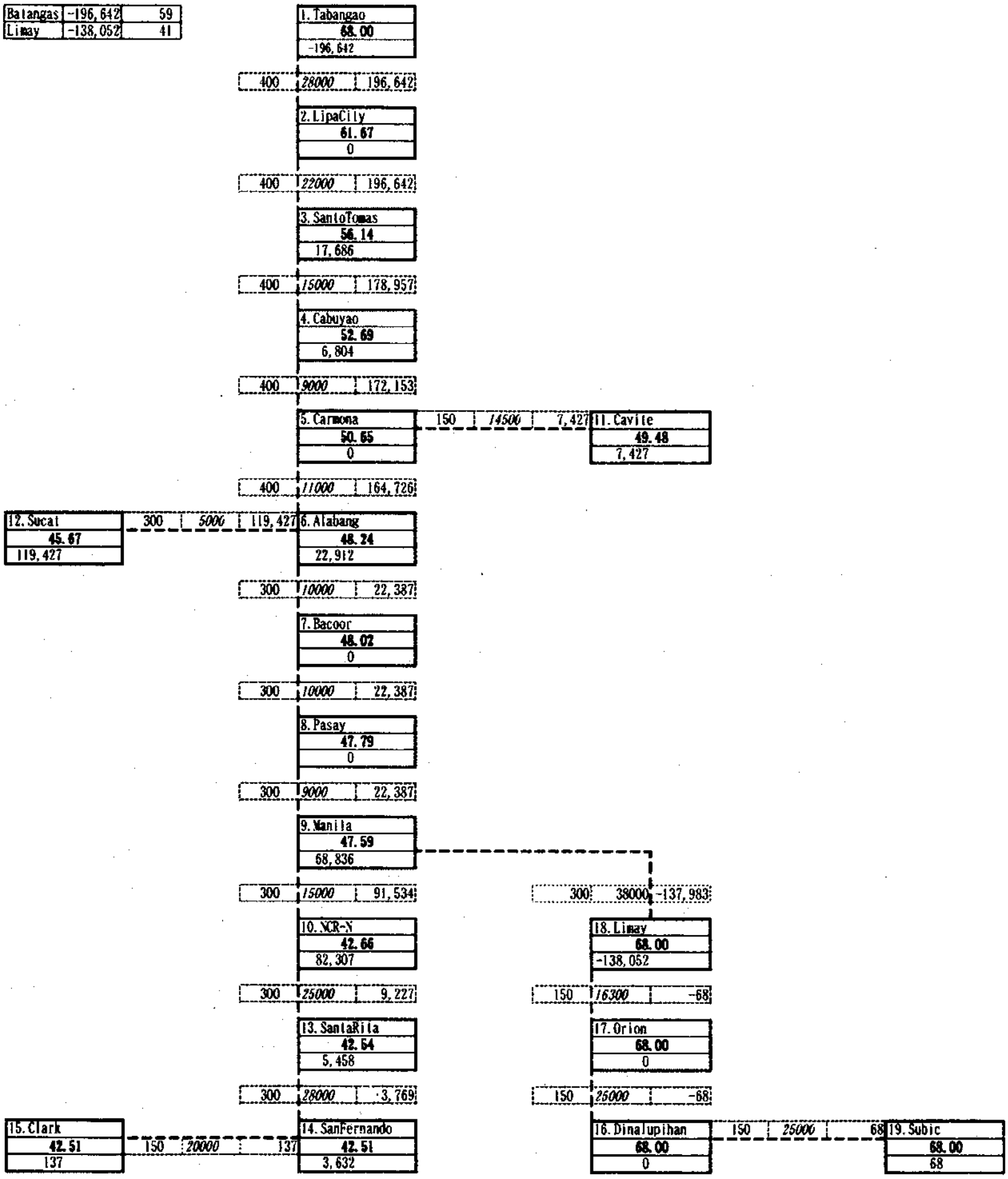

Figure 5-3-14 Pipeline Network (Option 2 / High Case in 2021)

④ The Network in the Final Year (2025)

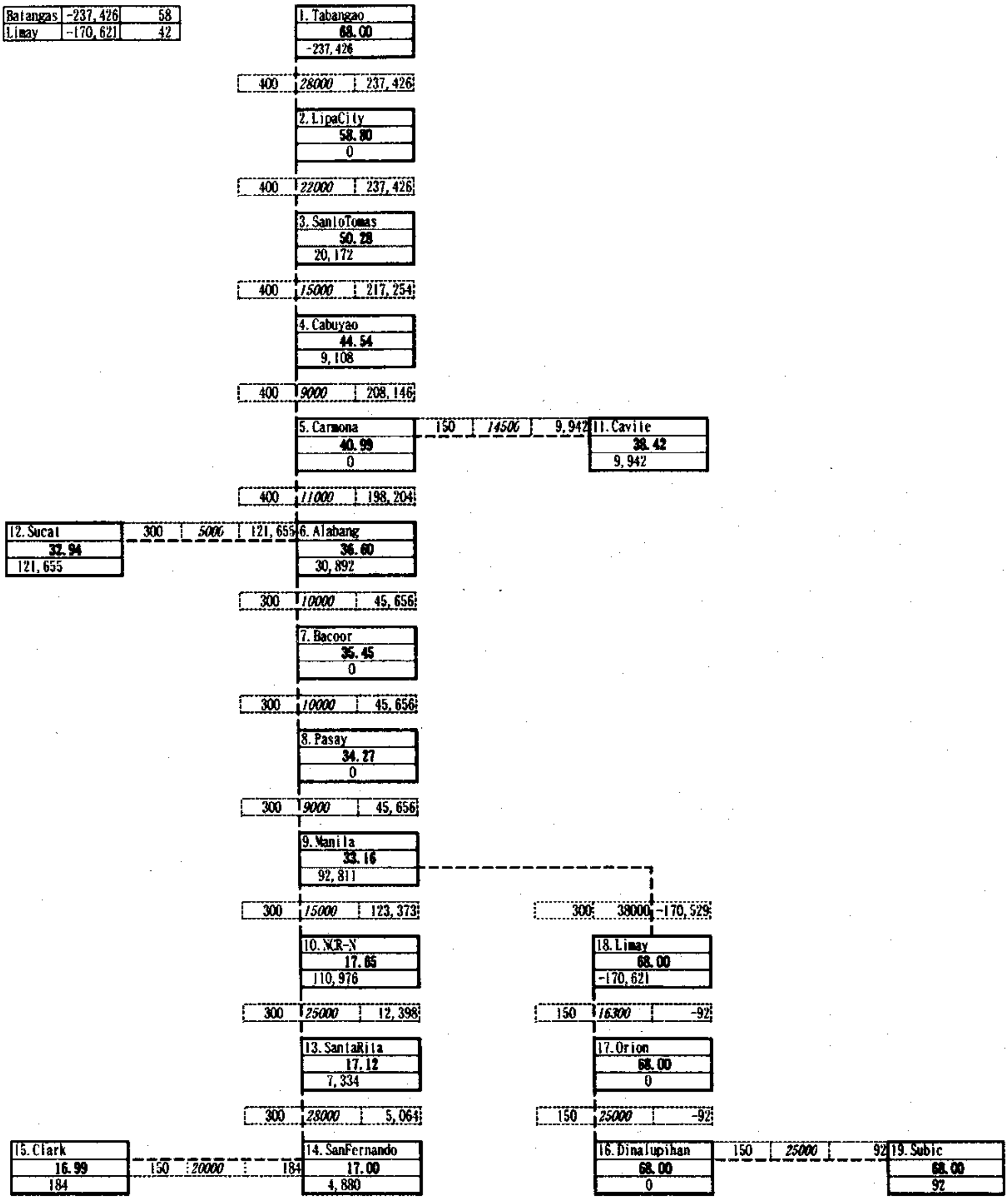

Figure 5-3-15 Pipeline Network (Option 2 / High Case in 2025)

2) Low Case

①The Network in the Final Year (2012) in the Phase 1

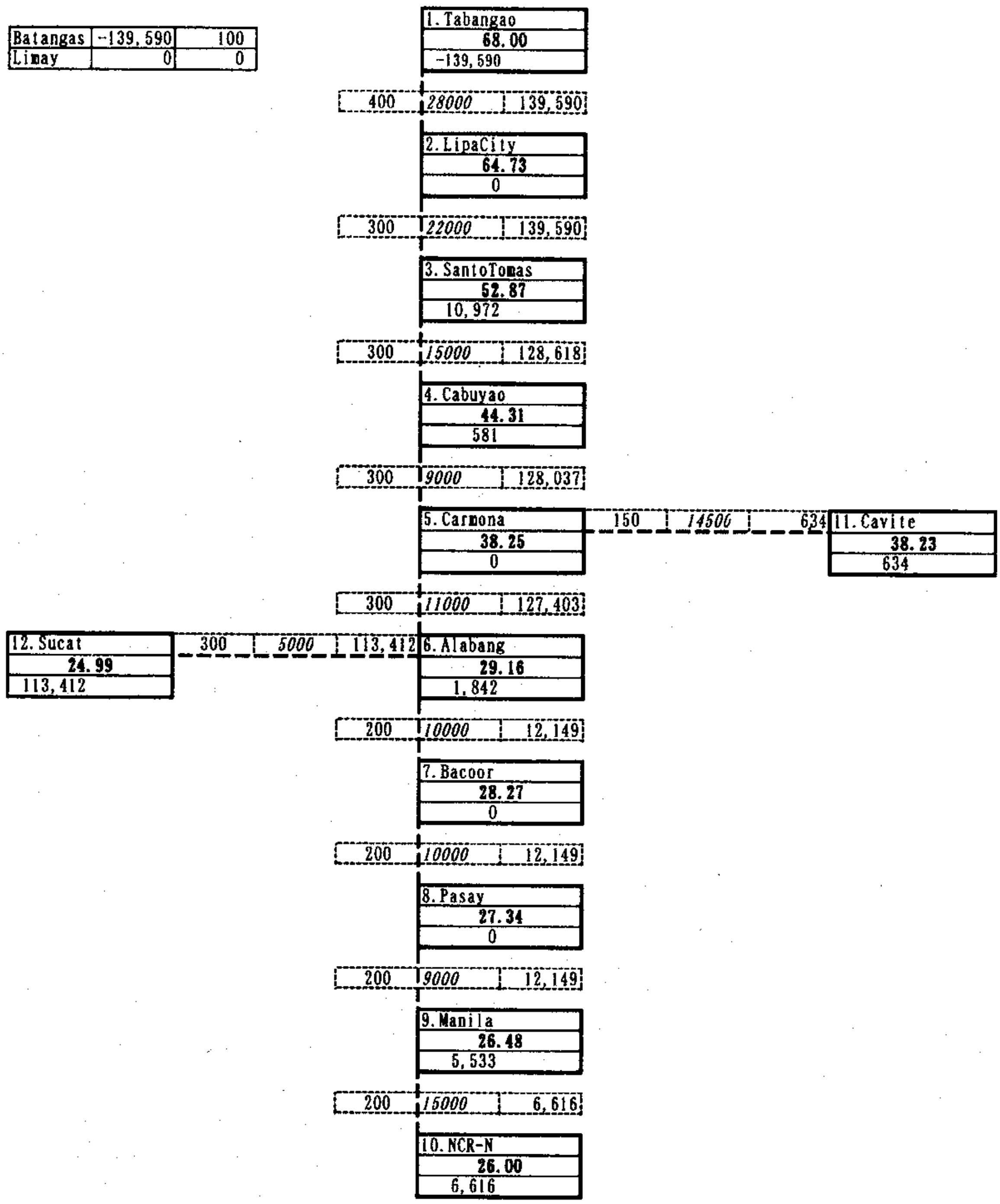

Figure 5-3-16 Pipeline Network (Option 2 / Low Case in 2012)

② The Network in the Starting Year (2013) in the Phase 2

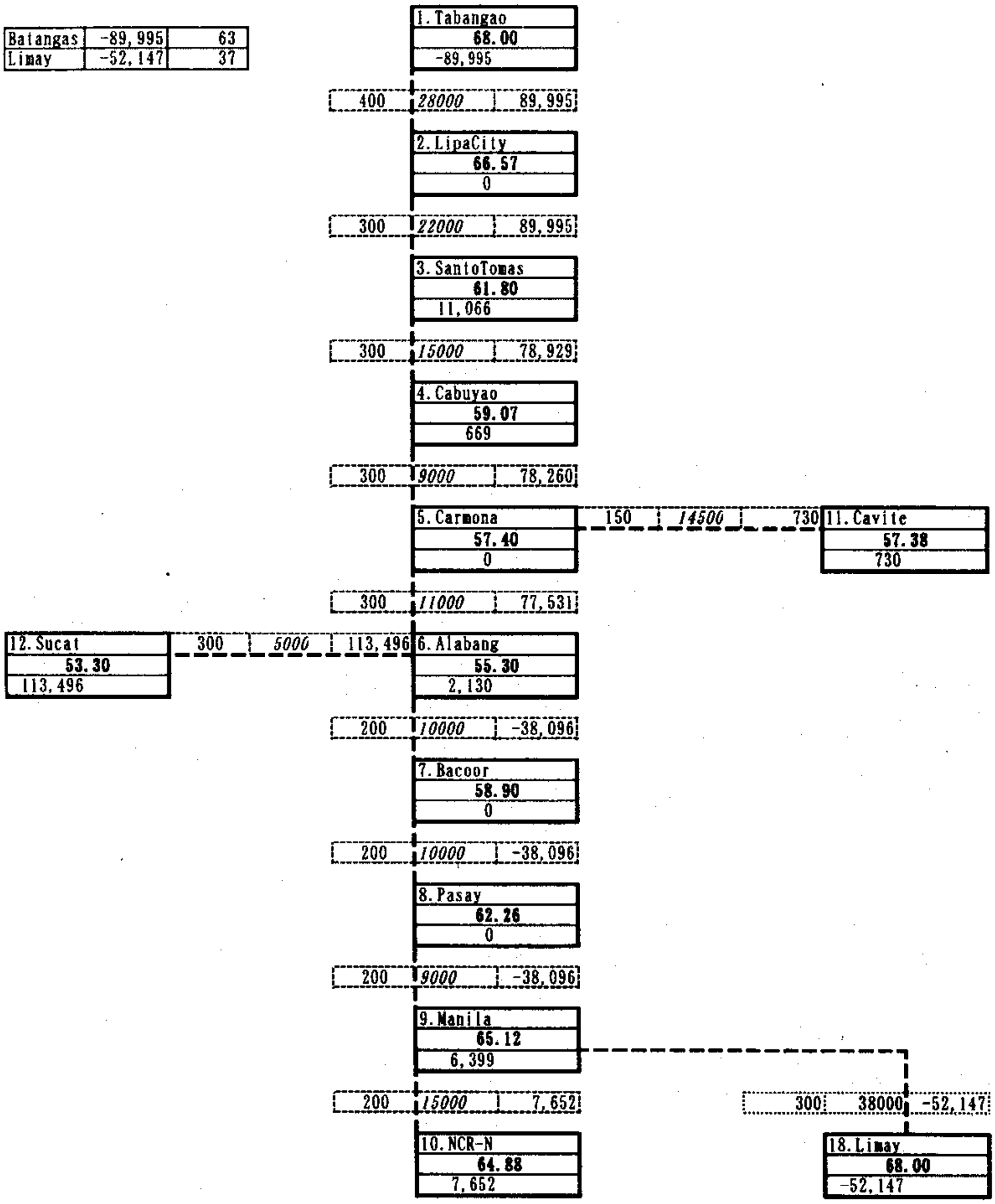

Figure 5-3-17 Pipeline Network (Option 2 / Low Case in 2013)

③ The Network in the Starting Year (2021) in the Phase 3

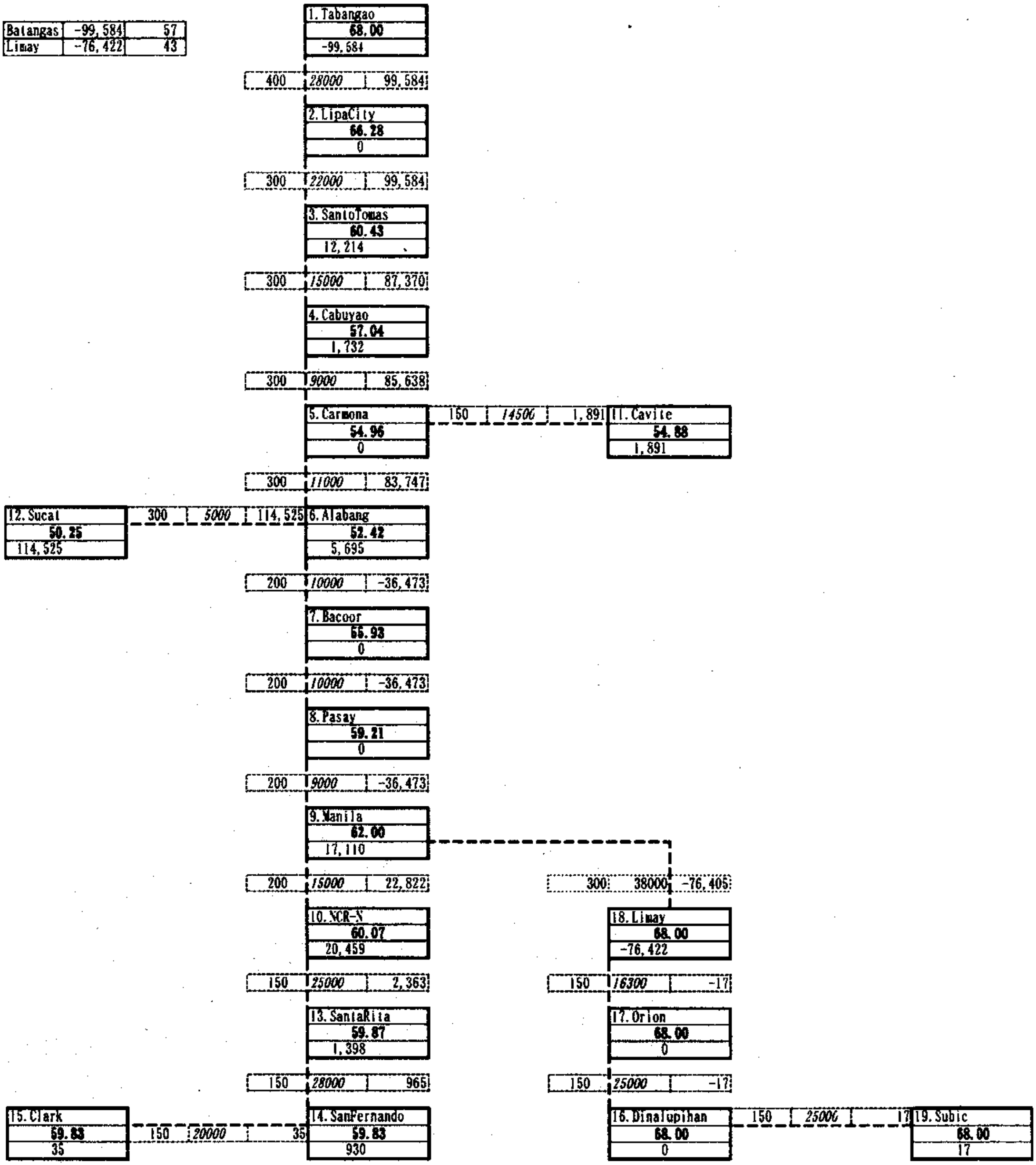

Figure 5-3-18 Pipeline Network (Option 2 / Low Case in 2021)

④ The Network in the Final Year (2025)

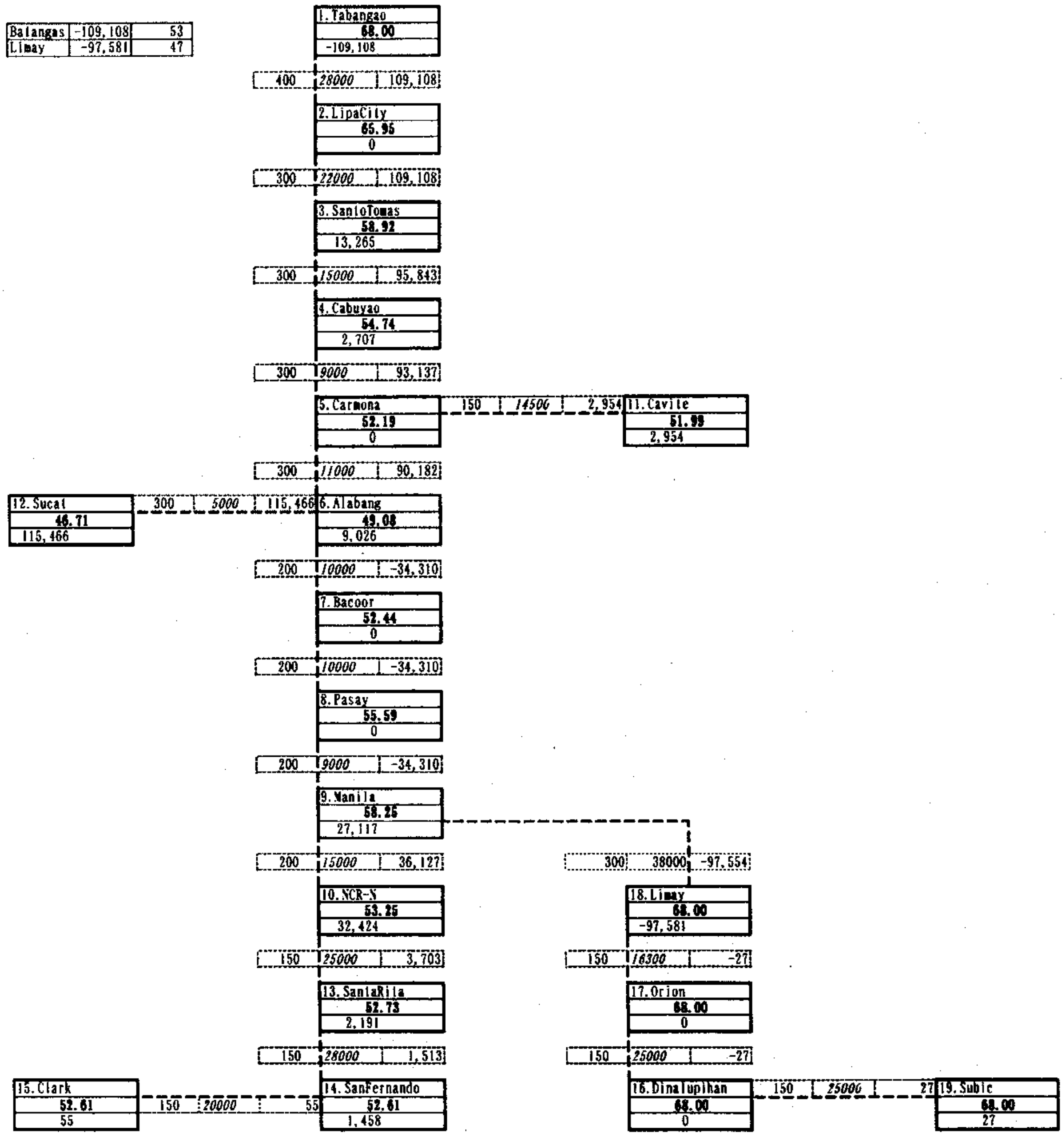

Figure 5-3-19 Pipeline Network (Option 2 / Low Case in 2025)

(3) Areas C-M and D

The peak-hourly gas flow rate in each area obtained from the two demand forecast cases is shown in Table 5-3-6.

Three natural gas source cases are studied using the following demand figures.

Table 5-3-6 Peak-hourly Gas Flow Rate in Areas C-M and Area D (Nm^3/h)

Area	Demand	2020	2025	2030	2035
Area C-M	High Case	47,097	107,948	107,948	107,948
	Low Case	39,903	98,141	98,141	98,141
Area D	High Case	45,658	105,903	105,903	105,903
	Low Case	39,555	97,542	97,542	97,542

1) Using Camago/Malampaya Domestic Gas

Gas will be supplied through a national pipeline from the Camago/Malampaya domestic gas-landing terminal in the Batangas area to Areas C-M and D. The route is shown in Figure 5-3-20.

The route crosses a shallow ocean area and extends to Davao via Cebu Island, Iligan and Cagayan de Oro in Mindanao Island. Routes to Mindoro Island intersect the Camago/Malampaya submarine pipeline. Therefore, none of these routes is adopted.

As a result of a pipeline network analysis premised on the condition that the total length is 1,400 km and the maximum demand is 102 mmscfd, it is concluded the diameter of the transmission pipeline can be 16 inches.

It is such a long-distance transmission pipeline that careful planning is required to decide the diameter of the pipeline in consideration of possible new demand or a change in the demand in Areas C-M and D.

2) Construction LNG Terminal

Gas will be supplied directly to the supply area through a high-pressure distribution pipeline from the LNG terminals near Cebu and Davao.

The supply point cannot be forecasted now. Therefore, the network analysis has not been studied.

3) Using Trans-ASEAN Pipeline

In the Second Trans-ASEAN Gas Pipeline Forum (2001), which was held in the Philippines, a route to Luzon Island via Malaysia and Parawan Island was advocated. This route crosses the shallow ocean area and is considered to be feasible (See Figure 5-3-21).

On condition that a landing terminal of the Trans-ASEAN pipeline will be in the Batangas area, gas will be supplied to Areas C-M and D through the national pipeline studied in 1) above.

As a result of the analysis, provided that the total length of the pipeline is 1,500 km and the demand is 411 mmscfd, the transmission pipeline network can be established with a booster station installed at the middle of the pipeline route.

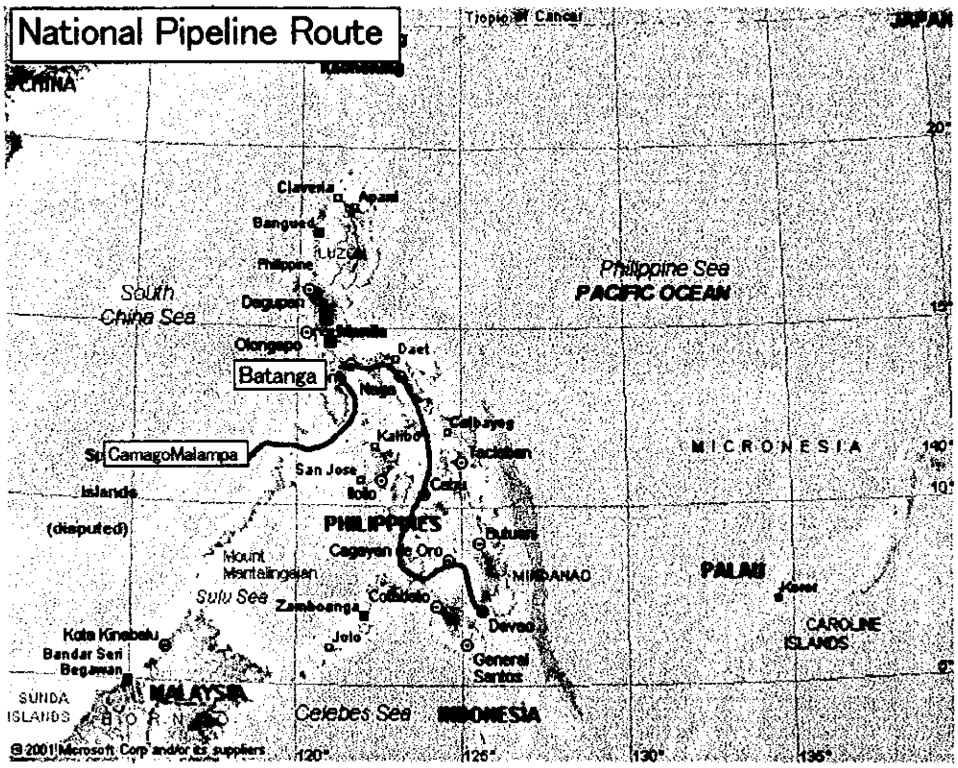

Figure 5-3-20 National Pipeline Route

3) Using Trans-ASEAN Pipeline

In the Second Trans-ASEAN Gas Pipeline Forum (2001), which was held in the Philippines, a route to Luzon Island via Malaysia and Parawan Island was advocated. This route crosses the shallow ocean area and is considered to be feasible (See Figure 5-3-21).

On condition that a landing terminal of the Trans-ASEAN pipeline will be in the Batangas area, gas will be supplied to Areas C-M and D through the national pipeline studied in 1) above.

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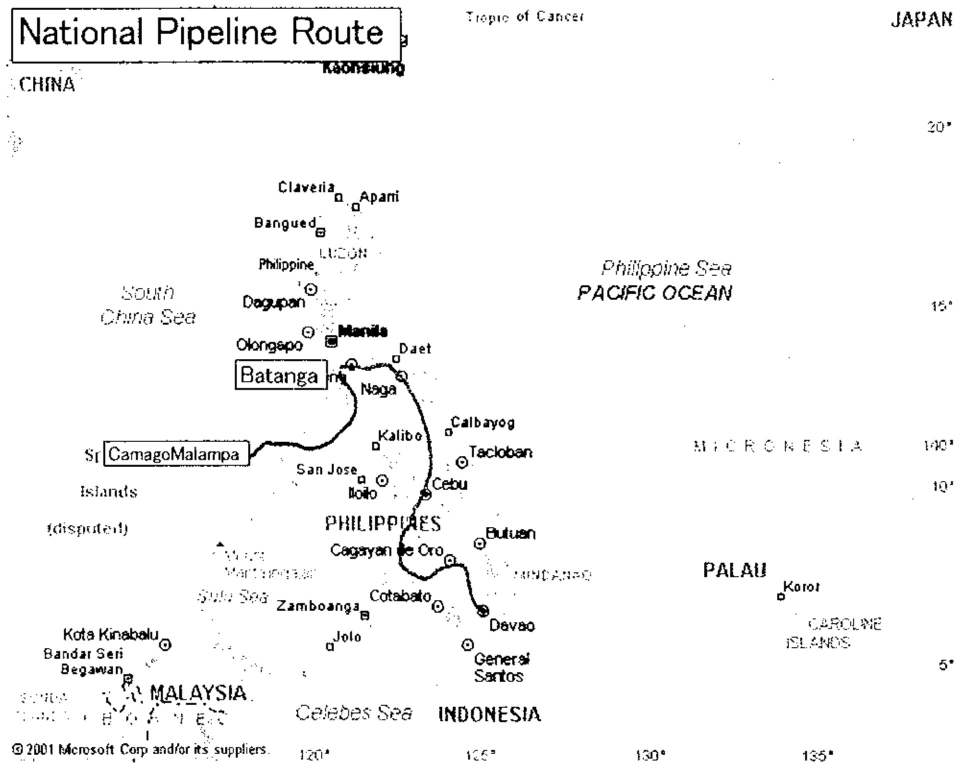

Figure 5-3-20 National Pipeline Route

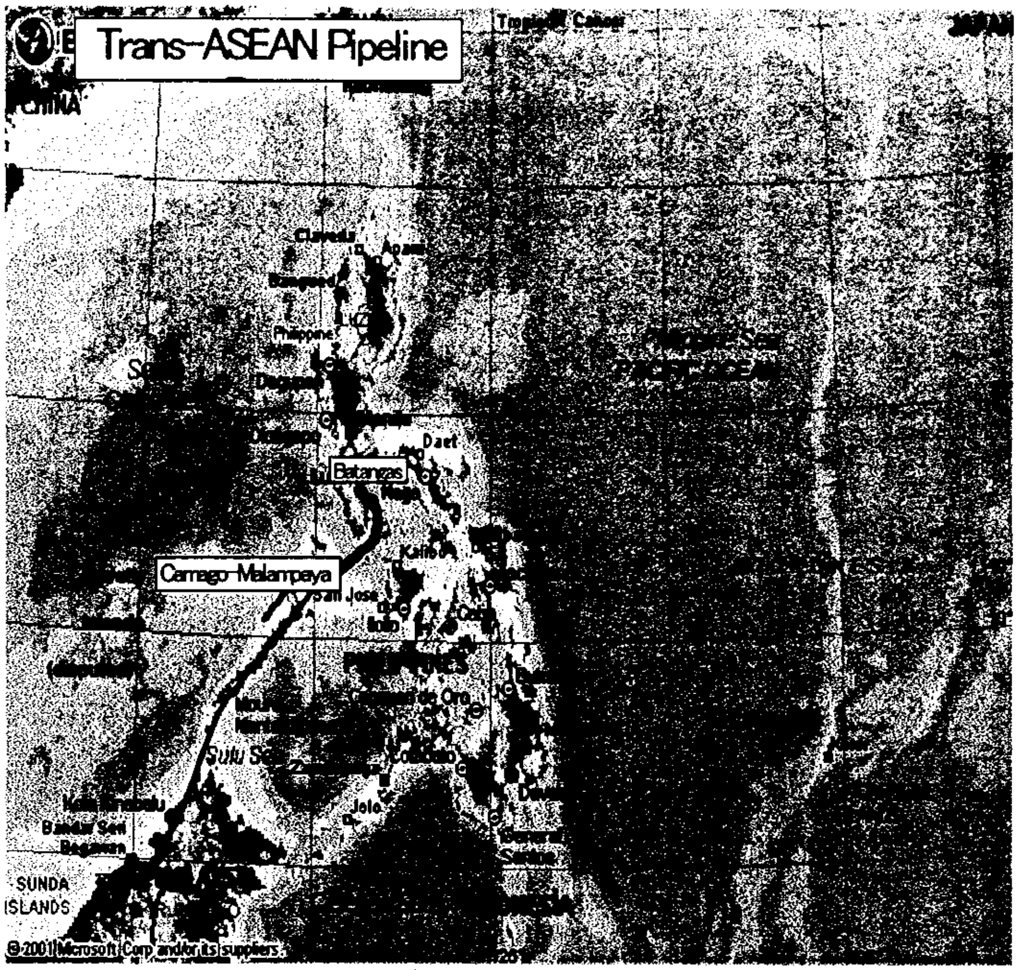

Figure 5-3-21 Trans-ASEAN Pipeline Route

5-3-7 Estimating Construction Costs

(1) Construction Costs of Transmission Pipeline

1) Construction Costs in Area L

The construction cost in Area L is estimated as shown in Table 5-3-6, which is based on actual data overseas and the F/S result of a part of the route.

Table 5-3-7 Unit Construction Costs of Transmission Pipelines

Pipeline dia. (inch)	Urban-area type (US$/m)	Standard type (US$/m)	Open Field type (US$/m)
24	950	700	450
20	800	600	400
16	650	500	350
12	600	450	300
6	200	150	100

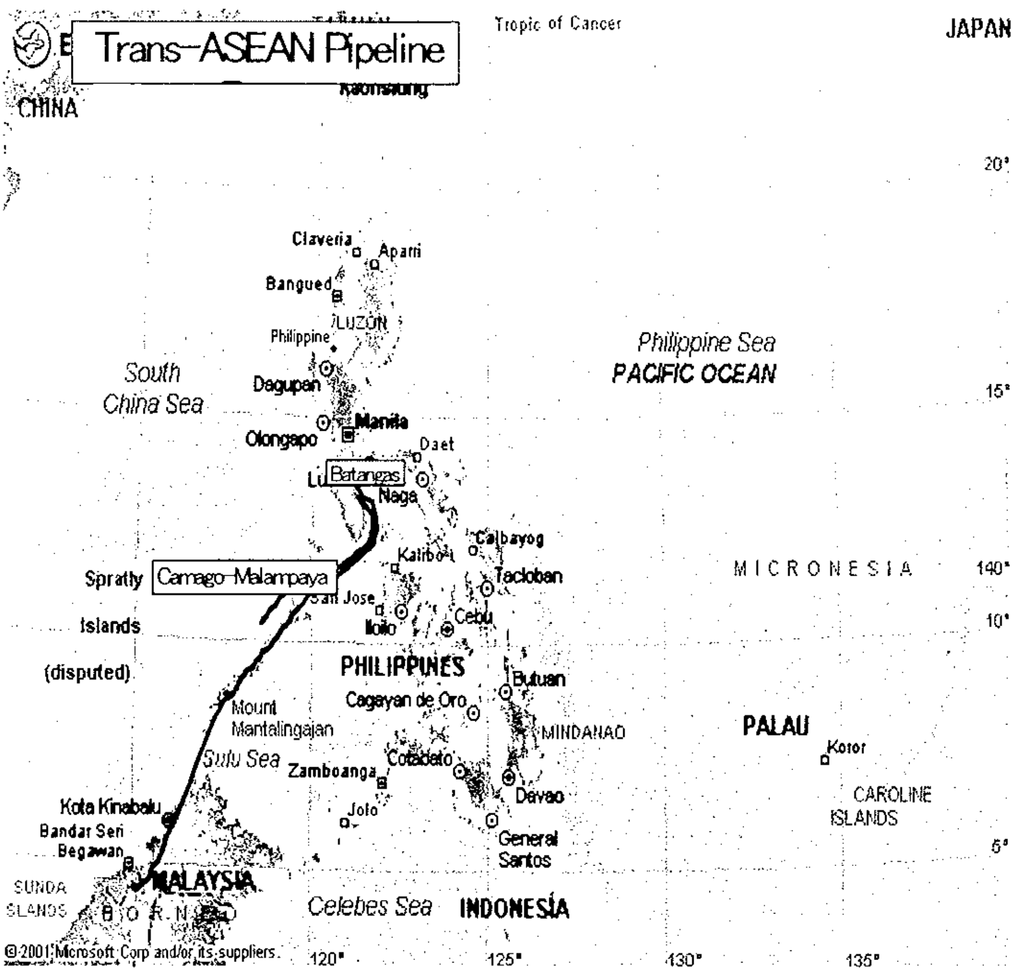

Figure 5-3-21 Trans-ASEAN Pipeline Route

5-3-7 Estimating Construction Costs

(1) Construction Costs of Transmission Pipeline

1) Construction Costs in Area L

The construction cost in Area L is estimated as shown in Table 5-3-6, which is based on actual data overseas and the F/S result of a part of the route.

Table 5-3-7 Unit Construction Costs of Transmission Pipelines

Pipeline dia. (inch)	Urban-area type (US$/m)	Standard type (US$/m)	Open Field type (US$/m)
24	950	700	450
20	800	600	400
16	650	500	350
12	600	450	300
6	200	150	100

2) Construction Costs in Other Areas

Construction costs for the National Pipeline and ASEAN Pipeline are estimated, on condition that standard land pipelines (US$25/inch-m), submarine pipelines (US$40/inch-m), and under-deep sea pipelines (US$80/inch-m) are used.

(2) Construction Costs of Distribution Pipeline

The study is based on the macro-demand estimations and no distribution points have been determined concretely. Therefore, based on the actual facilities of distribution system in Japan, the amount of facilities required per 1 km^2 is estimated to calculate the distribution pipeline network system cost as shown in Table 5-3-8.

Table 5-3-8 Main Distribution Facilities per 1 km^2

Item (pressure)	Installation	Unit	Quantity
Main (high)	Pipe	meter	500
	Valve	unit	1.1
	Governor	unit	0.1
Main (medium)	Pipe	meter	1,000
	Valve	unit	5
	Governor	unit	0.1
Main (low)	Pipe	meter	3,000
	Valve	unit	60
Branch line (low)	Pipe	meter	6,000
Service line (low)	Pipe	meter	2,000

(3) Construction Costs in Each Case

The construction costs of the transmission pipeline are calculated for each pipeline diameter based on the unit costs described in (1) above.

The construction cost of the distribution pipeline is based on the supply area as described in (2) above.

1) Construction Cost in Area L

Table 5-3-9 Construction Costs in Each Case

Option No	Demand Case	Construction cost of transmission pipeline (Million US$)	Construction cost of distribution pipeline (Million US$)			Total (Million US$)
			Area L-1	Area L-2	Area L-3	
Option 1	High	136	453	48	49	687
	Low	126	133	14	15	288
Option 2	High	121	453	48	49	671
	Low	100	133	14	15	262

2) Construction Costs in Area C-M and Area D

Table 5-3-10 Construction Costs Classified by Supply Gas Source

Supply source	Construction cost of transmission pipeline (Million US$)	Construction cost of distribution pipeline (Million US$)		Total (Million US$)
		Area C-M (80 km²)	Area D (107 km²)	
Domestic natural gas	655	45	76	776
LNG	624	45	76	745
Trans-ASEAN Pipeline gas	3,886	45	76	4,007

Note: The construction cost of the transmission pipeline for the LNG case is the construction cost of the LNG terminals.

When supplying gas to Areas C-M and D, the most economical case is the LNG case. Therefore, the analysis in Chapter 6 focuses on the LNG case.

5-3-8 Distribution Plan of Natural Gas

It is necessary to clarify the cost of investment on construction, maintenance expenses, personnel expenses, and the amount of existing gas demand each year for the economic analysis in Chapter 6. Therefore, based on the results of the study, three supply options are prepared for Area L, and the supply plan of distribution pipelines for Areas C-M and D is prepared. In addition, two scenarios are considered in each area (i.e., the Gas Use Scenario and the Gas Promotion Scenario).

(1) Area L with High Case

1) Option 1 (Table 5-3-11)

2) Option 2 (Table 5-3-12)

(2) Area L with Low Case

1) Option 1 (Table 5-3-13)

2) Option 2 (Table 5-3-14)

(3) Area C-M

1) High Case (Table 5-3-15)

2) Low Case (Table 5-3-16)

(4) Area D

1) High Case (Table 5-3-17)

2) Low Case (Table 5-3-18)

Table 5-3-11 Gas Distribution Plan in Area L in High Case / Option 1

Luzon Area																											(million$)	
Case 1(High)			Unit		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Potential demand	NCR	Industrial use	mmscfd		0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6
		Commercial use	mmscfd		0.1	0.1	0.1	0.9	1.6	2.6	3.6	4.9	6.3	7.7	9.1	10.6	12.2	13.9	15.6	17.5	19.5	21.6	23.8	26.0	28.3	30.7	33.3	35.9
		Residential use	mmscfd		1.4	2.1	2.2	2.7	3.2	4.4	5.8	10.2	14.7	19.2	23.8	28.6	33.5	38.5	44.2	50.1	56.2	62.4	68.7	74.9	81.1	87.4	93.8	100.1
	Batangas—Cavit	Industrial use	mmscfd		0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4
		Commercial use	mmscfd		0.0	0.0	0.0	0.1	0.2	0.3	0.4	0.6	0.8	0.9	1.1	1.3	1.4	1.6	1.9	2.1	2.3	2.5	2.8	3.1	3.3	3.6	3.9	4.2
		Residential use	mmscfd		0.2	0.3	0.3	0.4	0.4	0.6	0.7	1.3	1.8	2.3	2.9	3.4	4.0	4.6	5.3	6.0	6.7	7.4	8.1	8.8	9.5	10.3	11.0	11.7
	Bulacan—Bataan	Industrial use	mmscfd		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2
		Commercial use	mmscfd		0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.4	1.5	1.6	1.7	1.9	2.0
		Residential use	mmscfd		0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.6	0.8	1.1	1.4	1.6	1.9	2.2	2.5	2.9	3.2	3.6	3.9	4.3	4.6	5.0	5.3	5.7
	Power generation	(Sucat, FPIP)	mmscfd		0.0	0.0	0.0	0.0	0.0	0.0	39.1	74.5	74.5	74.5	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2
	Total potential demand		mmscfd		2.1	2.8	3.0	4.6	5.9	8.6	50.7	92.8	99.8	106.8	116.7	124.1	131.8	139.7	148.7	157.9	167.4	177.3	187.5	197.3	207.4	217.8	228.4	239.0
	Potential supply area		km2						628.6	628.6	628.6	628.6	628.6	628.6	628.6	628.6	628.6	628.6	740.9	740.9	740.9	740.9	740.9	740.9	740.9	740.9	740.9	740.9
Existing demand	NCR	Industrial use	mmscfd		0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6
		Commercial use	mmscfd		0.0	0.0	0.0	0.0	0.6	1.0	1.6	2.5	3.5	4.6	5.9	7.4	9.1	11.1	13.3	15.8	18.5	21.6	23.8	26.0	28.3	30.7	33.3	35.9
		Residential use	mmscfd		0.0	0.0	0.0	0.0	0.5	0.8	1.4	2.9	4.8	7.1	9.9	13.1	16.9	21.2	26.3	32.1	38.5	45.5	53.3	61.4	70.2	79.5	89.6	100.1
	Batangas—Cavit	Industrial use	mmscfd		0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4
		Commercial use	mmscfd		0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.6	0.9	1.1	1.3	1.4	1.6	1.9	2.1	2.3	2.5	2.8	3.1	3.3	3.6	3.9	4.2
		Residential use	mmscfd		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	1.3	2.1	3.0	4.1	5.3	6.0	6.7	7.4	8.1	8.8	9.5	10.3	11.0	11.7
	Bulacan—Bataan	Industrial use	mmscfd		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2
		Commercial use	mmscfd		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.0	1.1	1.2	1.4	1.5	1.6	1.7	1.9	2.0
		Residential use	mmscfd		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.3	1.9	2.7	3.5	4.3	4.6	5.0	5.3	5.7
	Power generation	(Sucat, FPIP)	mmscfd		0.0	0.0	0.0	0.0	0.0	0.0	39.1	74.5	74.5	74.5	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2
	Total existing demand		mmscfd		0.0	0.0	0.0	0.0	1.1	2.1	42.5	80.4	84.0	88.2	95.9	101.7	108.4	116.1	126.4	136.5	147.5	159.5	171.6	183.9	196.5	209.9	224.2	239.0
	Existing supply area		km2		0.0	0.0	0.0	0.0	75.2	98.5	121.9	145.2	185.1	224.9	264.7	304.6	344.4	384.2	452.3	492.5	532.6	572.8	613.0	647.6	670.9	694.2	717.6	740.9
Transmission PL	Construction of trunk line	Phase I		84.6	0	0	32.3	32.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(High pressure)	(Tabangao-NCR)	(mm$)				50%	50%																				
		Phase II		71.4	0	0	0	0	0	0	0	0	0	0	0	0	35.7	35.7	0	0	0	0	0	0	0	0	0	0
		(NCR-Bataan)	(mm$)										0%	0%	0%		50%	50%										
		Phase III		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			(mm$)																									
Distribution PL	Construction of local			89.3	0.0	0.0	10.4	10.4	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(NCR)	trunk line		(mm$)				15%	15%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%										
	(high-pressure)				0%	0%	0%	0%	37%	44%	51%	58%	65%	72%	79%	86%	93%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Construction of local			49.6	0.0	0.0	7.4	7.4	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0	0	0	0	0	0
	supply line		(mm$)				15%	15%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%						
	(middle-pressure)				0%	0%	0%	0%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%	100%	100%	100%	100%	100%	100%
	Construction of supply line			334.3	0.0	0.0	16.7	16.7	15.0	15.0	15.0	15.0	15.0	15.0	15.0	-15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
	(Low-pressure)		(mm$)				5.0%	5.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
518.62	Supply area			518.62					75.2	98.5	121.9	145.2	168.6	191.9	215.2	238.6	261.9	285.2	308.6	331.9	355.3	378.6	401.9	425.3	448.6	471.9	495.3	518.6
	(Low-pressure supply area)		(km2)						14.5%	19.0%	23.5%	28.0%	32.5%	37.0%	41.5%	46.0%	50.5%	55.0%	59.5%	64.0%	68.5%	73.0%	77.5%	82.0%	86.5%	91.0%	95.5%	100.0%
Distribution PL	Construction of local			7.4	0.0	0.0	0.0	3.7	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Batangas to	trunk line		(mm$)				0.0%	50.0%	50.0%																			
	(high-pressure)				0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Cavite)	Construction of local			5.3	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	supply line		(mm$)				0.0%	0.0%	0.0%	20.0%	20.0%	20.0%	20.0%	20.0%														
	(middle-pressure)				0.0%	0.0%	0.0%	0.0%	0.0%	20.0%	40.0%	60.0%	80.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	Construction of supply line			35.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	5.3	5.3	5.3	5.3	5.3	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(Low-pressure)		(mm$)				0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	10.0%									
110	Supply area			110	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.5	33.0	49.5	66.0	82.5	99.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0
	(Low-pressure supply area)		(km2)		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.0%	30.0%	45.0%	60.0%	75.0%	90.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Distribution PL	Construction of local			7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Bulacan to	trunk line		(mm$)											0.0%	0.0%	0.0%		50.0%	50.0%									
	(high-pressure)				0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Pampanga to	Construction of local			5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	1.9	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bataan)	supply line		(mm$)											0.0%	0.0%	0.0%	0.0%	35.0%	35.0%	30.0%								
	(middle-pressure)				0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	70%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Construction of supply line			38.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	5.4	5.4	5.4	5.4	5.4	3.6	0.0	0.0	0.0	0.0
	(Low-pressure)		(mm$)											0.0%	0.0%	0.0%	0.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	10.0%				
112.3	Supply area			112.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	33.7	50.5	67.4	84.2	101.1	112.3	112.3	112.3	112.3	112.3
	(Low-pressure supply area)		(km2)		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	30.0%	45.0%	60.0%	75.0%	90.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Construction fee total (mm$)		Transmission		136.0	0.0	0.0	32.3	32.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.7	35.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Distribution		550.3	0.0	0.0	34.5	38.2	26.0	23.4	23.4	23.4	28.7	28.7	27.7	27.7	27.7	38.8	32.1	24.6	23.0	23.0	20.5	18.7	15.0	15.0	15.0	15.0
		Total		686.3	0.0	0.0	66.8	70.5	26.0	23.4	23.4	23.4	28.7	28.7	27.7	27.7	63.4	74.5	32.1	24.6	23.0	23.0	20.5	18.7	15.0	15.0	15.0	15.0
Maintenance fee	Transmission PL	Maintenance fee(mm$)		35					5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3
(mm$)	($35/m)	Maintenance Length(m)	($/m)						148,500	148,500	148,500	148,500	148,500	148,500	148,500	148,500	148,500	148,500	322,800	322,800	322,800	322,800	322,800	322,800	322,800	322,800	322,800	322,800
	Distribution PL	Maintenance fee(mm$)		30000	0.0	0.0	0.0	0.0	2.3	3.0	3.7	4.4	5.6	6.7	7.9	9.1	10.3	11.5	13.6	14.8	16.0	17.2	18.4	19.4	20.1	20.8	21.5	22.2
	($30000/km2)	Maintenance area(km2)	($/km2)		0.0	0.0	0.0	0.0	75.2	98.5	121.9	145.2	185.1	224.9	264.7	304.6	344.4	384.2	452.3	492.5	532.6	572.8	613.0	647.6	670.9	694.2	717.6	740.9
Maintenance Operation Personnel	Head Quarter	Personnel (1.6 persons/km2)		1.6	0	0	120	120	120	158	195	232	296	360	424	487	551	615	724	788	852	917	981	1,036	1,073	1,111	1,148	1,185
	Transmission	Personnel (0.5 person/km)		0.5	0	0	74	74	74	74	74	74	74	74	74	74	74	74	161	161	161	161	161	161	161	161	161	161
	Distribution	Personnel (0.6 person/km2)		0.6	0	0	45	45	45	59	73	87	111	135	159	183	207	231	271	295	320	344	368	389	403	417	431	445
	Total				0	0	239	239	240	291	342	394	481	569	657	744	832	920	1,156	1,245	1,333	1,422	1,510	1,586	1,637	1,689	1,740	1,791

Table 5-3-12 Gas Distribution Plan in Area L in High Case / Option 2

(million$)

Luzon Area / Case 2(High)			Unit	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Potential demand	NCR	Industrial use	mmscfd	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6
		Commercial use	mmscfd	0.1	0.1	0.1	0.9	1.6	2.6	3.5	4.9	6.3	7.7	9.1	10.6	12.2	13.9	15.6	17.5	19.5	21.6	23.8	26.0	28.3	30.7	33.3	35.9
		Residential use	mmscfd	1.4	2.1	2.2	2.7	3.2	4.4	5.8	10.2	14.7	19.2	23.8	28.6	33.5	38.5	44.2	50.1	56.2	62.4	68.7	74.9	81.1	87.4	93.8	100.1
	Batangas—Cavite	Industrial use	mmscfd	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4
		Commercial use	mmscfd	0.0	0.0	0.0	0.1	0.2	0.3	0.4	0.6	0.8	0.9	1.1	1.3	1.4	1.6	1.9	2.1	2.3	2.5	2.8	3.1	3.3	3.6	3.9	4.2
		Residential use	mmscfd	0.2	0.3	0.3	0.4	0.4	0.6	0.7	1.3	1.8	2.3	2.9	3.4	4.0	4.6	5.3	6.0	6.7	7.4	8.1	8.8	9.5	10.3	11.0	11.7
	Bulacan—Bataan	Industrial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2
		Commercial use	mmscfd	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.4	1.5	1.6	1.7	1.9	2.0
		Residential use	mmscfd	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.6	0.8	1.1	1.4	1.6	1.9	2.2	2.5	2.9	3.2	3.6	3.9	4.3	4.6	5.0	5.3	5.7
	Power generation	(Sucat, FP1P)	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	39.1	74.5	74.5	74.5	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2
	Total potential demand		mmscfd	2.1	2.8	3.0	4.6	5.9	8.6	50.7	92.8	99.8	106.8	116.7	124.1	131.8	139.7	148.7	157.9	167.4	177.3	187.5	197.3	207.4	217.8	228.4	239.0
	Potential supply area		km2					628.62	628.62	628.62	628.62	628.62	628.62	628.62	628.62	628.62	628.62	740.92	740.92	740.92	740.92	740.92	740.92	740.92	740.92	740.92	740.92
Existing demand	NCR	Industrial use	mmscfd	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6
		Commercial use	mmscfd	0.0	0.0	0.0	0.0	0.6	1.0	1.8	2.5	3.5	4.6	5.9	7.4	9.1	11.1	13.3	15.8	18.5	21.6	23.8	26.0	28.3	30.7	33.3	35.9
		Residential use	mmscfd	0.0	0.0	0.0	0.0	0.5	0.8	1.4	2.9	4.8	7.1	9.9	13.1	16.9	21.2	26.3	32.1	38.5	45.5	53.3	61.4	70.2	79.5	89.6	100.1
	Batangas—Cavite	Industrial use	mmscfd	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4
		Commercial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.6	0.9	1.1	1.3	1.4	1.6	1.9	2.1	2.3	2.5	2.8	3.1	3.3	3.6	3.9	4.2
		Residential use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	1.3	2.1	3.0	4.1	5.3	6.0	6.7	7.4	8.1	8.8	9.5	10.3	11.0	11.7
	Bulacan—Bataan	Industrial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2
		Commercial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.6	1.7	1.9	2.0
		Residential use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	2.1	3.0	4.0	5.7
	Power generation	(Sucat, FP1P)	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	39.1	74.5	74.5	74.5	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2
	Total existing demand		mmscfd	0.0	0.0	0.0	0.0	1.1	2.1	42.5	90.4	84.0	88.2	95.9	101.7	108.4	116.1	124.9	134.1	144.3	155.5	166.6	180.4	194.0	207.9	222.8	239.0
	Existing supply area		km2	0.0	0.0	0.0	0.0	75.2	98.5	121.9	145.2	185.1	224.9	264.7	304.6	344.4	384.2	418.6	441.9	465.3	488.6	511.9	569.0	609.1	649.3	689.5	740.9
Transmission PL	Construction of trunk line (High pressure)	Phase I (Batangas-NCR)	64.6 (mm$)	0	0	32.3	32.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
						50%	50%																				
		Phase II (NCR-Bataan)	18.2 (mm$)	0	0	0	0	0	0	0	0	0	0	0	0	0	18.2	0	0	0	0	0	0	0	0	0	0
														0%			100%	0%									
		Phase III	38 (mm$)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	19	0	0	0	0
																	0%	0%				50%	50%				
Distribution PL (NCR)	Construction of local trunk line (high-pressure)		69.3 (mm$)	0.0	0.0	10.4	10.4	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
						15%	15%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%										
				0%	0%	0%	0%	37%	44%	51%	58%	65%	72%	79%	86%	93%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Construction of local supply line (middle-pressure)		49.6 (mm$)	0	0	7.4	7.4	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0	0	0	0	0	0
						15%	15%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%						
				0%	0%	0%	0%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%	100%	100%	100%	100%	100%	100%
	Construction of supply line (Low-pressure)		334.3 (mm$)	0.0	0.0	16.7	16.7	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
						5.0%	5.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
518.62	Supply area (Low-pressure supply area)		(km2)					75.2	98.5	121.9	145.2	168.6	191.9	215.2	238.6	261.9	285.2	308.6	331.9	355.3	378.6	401.9	425.3	448.6	471.9	495.3	518.6
								14.5%	19.0%	23.5%	28.0%	32.5%	37.0%	41.5%	46.0%	50.5%	55.0%	59.5%	64.0%	68.5%	73.0%	77.5%	82.0%	86.5%	91.0%	95.5%	100.0%
Distribution PL (Batangas to Cavite)	Construction of local trunk line (high-pressure)		7.4 (mm$)	0.0	0.0	0.0	3.7	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
						0.0%	50.0%	50.0%																			
				0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	Construction of local supply line (middle-pressure)		5.3 (mm$)	0.0	0.0	0.0	0.0	0.0	1.1	1.1	1.1	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
						0.0%	0.0%	0.0%	20.0%	20.0%	20.0%	20.0%	20.0%														
				0.0%	0.0%	0.0%	0.0%	0.0%	20.0%	40.0%	60.0%	80.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	Construction of supply line (Low-pressure)		35.5 (mm$)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	5.3	5.3	5.3	5.3	5.3	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
						0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	10.0%									
110	Supply area (Low-pressure supply area)		(km2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.5	33.0	49.5	66.0	82.5	99.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0	110.0
				0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.0%	30.0%	45.0%	60.0%	75.0%	90.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Distribution PL (Bulacan to Pampanga to Bataan)	Construction of local trunk line (high-pressure)		7.5 (mm$)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	3.8	0.0	0.0	0.0	0.0
																	0.0%	0.0%				50.0%	50.0%				
				0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%	100%	100%	100%
	Construction of local supply line (middle-pressure)		5.4 (mm$)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	1.9	1.6	0.0	0.0	0.0
																	0.0%	0.0%	0.0%			35.0%	35.0%	30.0%			
				0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	70%	100%	100%	100%	100%
	Construction of supply line (Low-pressure)		36.2 (mm$)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	5.4	5.4	5.4	5.4	9.0
																	0.0%	0.0%	0.0%	0.0%	0.0%	15.0%	15.0%	15.0%	15.0%	15.0%	25.0%
112.3	Supply area (Low-pressure supply area)		(km2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.7	50.5	67.4	84.2	112.3
				0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	30.0%	45.0%	60.0%	75.0%	100.0%
Construction fee	Total (mm$)	Transmission	120.8	0.0	0.0	32.3	32.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.2	0.0	0.0	0.0	0.0	19.0	19.0	0.0	0.0	0.0	0.0
		Distribution	550.3	0.0	0.0	34.5	38.2	26.0	23.4	23.4	23.4	28.7	28.7	27.7	27.7	27.7	27.7	21.1	17.5	17.5	17.5	26.1	26.1	22.1	20.5	20.5	24.1
		Total	671.1	0.0	0.0	66.8	70.5	26.0	23.4	23.4	23.4	28.7	28.7	27.7	27.7	27.7	45.9	21.1	17.5	17.5	17.5	45.1	45.1	22.1	20.5	20.5	24.1
Maintenance fee (mm$)	Transmission PL ($35/m)	Maintenance fee(mm$)	35					5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	6.5	6.5	6.5	6.5	6.5	11.4	11.4	11.4	11.4	11.4
		Maintenance Length(m)	($/m)					148,500	148,500	148,500	148,500	148,500	148,500	148,500	148,500	148,500	148,500	186,500	186,500	186,500	186,500	186,500	325,800	325,800	325,800	325,800	325,800
	Distribution PL ($30000/km2)	Maintenance fee(mm$)	30000	0.0	0.0	0.0	0.0	2.3	3.0	3.7	4.4	5.6	6.7	7.9	9.1	10.3	11.5	12.6	13.3	14.0	14.7	15.4	17.1	18.3	19.5	20.7	22.2
		Maintenance area(km2)	($/km2)	0.0	0.0	0.0	0.0	75.2	98.5	121.9	145.2	185.1	224.9	264.7	304.6	344.4	394.2	418.6	441.9	465.3	488.6	511.9	569.0	609.1	649.3	689.5	740.9
Maintenance Operation Personnel	Head Quarter	Personnel (1.6 persons/km2)	1.6	0	0	120	120	120	158	195	232	296	360	424	487	551	615	670	707	744	782	819	910	975	1,039	1,103	1,185
	Transmission	Personnel (0.5 person/km)	0.5	0	0	74	74	74	74	74	74	74	74	74	74	74	74	93	93	93	93	93	163	163	163	163	163
	Distribution	Personnel (0.6 person/km2)	0.6	0	0	45	45	45	59	73	87	111	135	159	183	207	231	251	265	279	293	307	341	365	390	414	445
	Total		(persons)	0	0	239	239	240	291	342	394	481	569	657	744	832	920	1,014	1,065	1,117	1,168	1,219	1,415	1,503	1,591	1,680	1,793

Table 5-3-13 Gas Distribution Plan in Area L in Low Case / Option 1

(million$)

Luzon Area / Case I (Low)			Unit	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Potential demand	NCR	Industrial use	mmscfd	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.9	0.9
		Commercial use	mmscfd	0.1	0.4	0.4	0.3	0.7	1.1	1.4	1.8	2.2	2.9	3.6	4.4	5.3	6.2	7.3	8.5	9.8	11.2	12.7	14.3	15.9	17.7	19.6	21.6
		Residential use	mmscfd	2.0	2.2	2.3	2.3	2.5	2.7	3.0	3.2	3.5	3.9	4.3	4.7	5.2	5.7	6.2	6.8	7.3	8.0	8.0	10.4	12.0	13.8	15.7	17.7
	Batanbas—Cavit	Industrial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3
		Commercial use	mmscfd	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.9	1.0	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5
		Residential use	mmscfd	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.3	1.4	1.6	1.9	2.1
	Bulacan—Bataan	Industrial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Commercial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.1	1.2
		Residential use	mmscfd	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.7	0.8	0.9	1.0
	Power generation	(Sucat, F.P.I.P)	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	3.5	3.5	3.5	6.5	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2
	Total potential demand		mmscfd	2.7	3.3	3.3	3.4	4.1	4.8	9.0	9.8	10.5	14.8	80.9	86.5	90.1	91.9	93.8	95.9	98.1	100.7	103.0	107.2	111.1	115.3	119.8	124.0
	Potential supply area		km2					184.2	184.2	184.2	184.2	184.2	184.2	217.8	217.8	217.8	217.8	217.8	217.8	217.8	217.8	217.8	217.8	217.8	217.8	217.8	217.8
Existing demand	NCR	Industrial use	mmscfd	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.9	0.9
		Commercial use	mmscfd	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.9	1.2	1.7	2.3	3.1	4.0	5.0	6.2	7.7	9.3	11.2	12.7	14.3	15.9	17.7	19.6	21.6
		Residential use	mmscfd	0.0	0.0	0.0	0.0	0.4	0.5	0.7	0.9	1.1	1.4	1.8	2.2	2.6	3.1	3.7	4.3	5.0	5.9	6.9	8.5	10.4	12.5	15.0	17.7
	Batanbas—Cavit	Industrial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3
		Commercial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.9	1.0	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5
		Residential use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.5	0.6	0.8	0.8	0.9	1.0	1.1	1.3	1.4	1.6	1.9	2.1
	Bulacan—Bataan	Industrial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Commercial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.1	1.2
		Residential use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.8	0.9	1.0
	Power generation	(Sucat, F.P.I.P)	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	3.5	3.5	3.5	6.5	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2
	Total existing demand		mmscfd	0.0	0.0	0.0	0.0	0.7	1.1	5.1	5.6	6.3	10.4	82.3	84.0	85.8	87.8	90.1	92.6	95.3	98.5	101.5	105.3	109.5	114.0	119.1	124.6
	Existing supply area		km2	0.0	0.0	0.0	0.0	22.0	28.8	35.6	42.4	54.2	65.9	77.6	99.4	116.1	132.9	148.0	159.8	170.0	176.8	183.6	190.5	197.3	204.1	210.9	217.8
Transmission PL	Construction of trunk line	Phase I	59.6	0	0	29.8	29.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(High pressure)	(Batangas-NCR)	(mm$)			50%	50%																				
		Phase II	66.2	0	0	0	0	0	0	0	0	0	33.1	33.1	0	0	0	0	0	0	0	0	0	0	0	0	0
		(NCR-Bataan)	(mm$)									0%	50%	50%													
		Phase III	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			(mm$)																						
Distribution PL	Construction of local		20.3	0.0	0.0	3.0	3.0	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(NCR)	trunk line		(mm$)			15%	15%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%										
	(high-pressure)			0%	0%	0%	0%	37%	44%	51%	58%	65%	72%	79%	86%	93%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Construction of local		14.5	0	0	2.2	2.2	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0	0	0	0	0	0
	supply line		(mm$)			15%	15%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%						
	(middle-pressure)			0%	0%	0%	0%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%	100%	100%	100%	100%	100%	100%
	Construction of supply line		97.7	0.0	0.0	4.9	4.9	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
	(Low- pressure)		(mm$)			5.0%	5.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
151.6	Supply area							22.0	28.8	35.6	42.4	49.3	56.1	62.9	69.7	76.5	83.4	90.2	97.0	103.8	110.6	117.5	124.3	131.1	137.9	144.7	151.6
	(Low-pressure supply area)		(km2)					14.5%	19.0%	23.5%	28.0%	32.5%	37.0%	41.5%	46.0%	50.5%	55.0%	59.5%	64.0%	68.5%	73.0%	77.5%	82.0%	86.5%	91.0%	95.5%	100.0%
Distribution PL	Construction of local		2.2	0.0	0.0	0.0	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Batangas to	trunk line		(mm$)			0.0%	50.0%	50.0%																			
	(high-pressure)			0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Cavite)	Construction of local		1.6	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	supply line		(mm$)			0.0%	0.0%	0.0%	20.0%	20.0%	20.0%	20.0%	20.0%														
	(middle-pressure)			0.0%	0.0%	0.0%	0.0%	0.0%	20.0%	40.0%	60.0%	80.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	Construction of supply line		10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.6	1.6	1.6	1.6	1.6	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(Low- pressure)		(mm$)			0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	10.0%									
32.7	Supply area			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	9.8	14.7	19.6	24.5	29.4	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7
	(Low-pressure supply area)		(km2)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.0%	30.0%	45.0%	60.0%	75.0%	90.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Distribution PL	Construction of local		2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Bulacan to	trunk line		(mm$)										0.0%	50.0%	50.0%												
	(high-pressure)			0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Pampanga to	Construction of local		1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bataan)	supply line		(mm$)										0.0%	35.0%	35.0%	30.0%											
	(middle-pressure)			0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	70%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Construction of supply line		10.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.6	1.6	1.6	1.6	1.6	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(Low- pressure)		(mm$)										0.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	10.0%							
33.5	Supply area			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.1	15.1	20.1	25.1	30.2	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5
	(Low-pressure supply area)		(km2)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	30.0%	45.0%	60.0%	75.0%	90.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Construction fee total (mm$)		Transmission	125.8	0.0	0.0	29.8	29.8	0.0	0.0	0.0	0.0	0.0	33.1	33.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Distribution	161.4	0.0	0.0	10.1	11.2	7.6	6.9	6.9	6.9	8.4	8.4	11.4	11.4	10.2	9.7	7.8	6.7	6.2	5.1	4.4	4.4	4.4	4.4	4.4	4.4
		Total	287.2	0.0	0.0	39.9	41.0	7.6	6.9	6.9	6.9	8.4	41.5	44.5	11.4	10.2	9.7	7.8	6.7	6.2	5.1	4.4	4.4	4.4	4.4	4.4	4.4
Maintenance fee	Transmission PL	Maintenance fee(mm$)	35					5.2	5.2	5.2	5.2	5.2	5.2	5.2	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3
(mm$)	($35/m)	Maintenance Length(m)	($/m)					148,500	148,500	148,500	148,500	148,500	148,500	148,500	322,800	322,800	322,800	322,800	322,800	322,800	322,800	322,800	322,800	322,800	322,800	322,800	322,800
	Distribution PL	Maintenance fee(mm$)	30000	0.0	0.0	0.0	0.0	0.7	0.9	1.1	1.3	1.6	2.0	2.3	3.0	3.5	4.0	4.4	4.8	5.1	5.3	5.5	5.7	5.9	6.1	6.3	6.5
	($30000/km2)	Maintenance area(km2)	($/km2)	0.0	0.0	0.0	0.0	22.0	28.8	35.6	42.4	54.2	65.9	77.6	99.4	116.1	132.9	148.0	159.8	170.0	176.8	183.6	190.5	197.3	204.1	210.9	217.8
Maintenance	Head Quarter	Personnel	1.6	0	0	120	120	35	46	57	68	87	105	124	159	186	213	237	256	272	283	294	305	316	327	337	348
Operation		(1.6 persons/km2)																									
Personnel	Transmission	Personnel	0.5	0	0	74	74	74	74	74	74	74	74	74	161	161	161	161	161	161	161	161	161	161	161	161	161
		(0.5 person/km)																									
	Distribution	Personnel	0.6	0	0	45	45	13	17	21	25	32	40	47	60	70	80	89	96	102	106	110	114	118	122	127	131
		(0.6 person/km2)																									
	Total			0	0	239	239	123	138	153	168	193	219	245	380	417	454	487	513	535	550	565	580	595	610	625	640

Table 5-3-14 Gas Distribution Plan in Area L in Low Case / Option 2

Luzon Area (million$)

Case 2(Low)			Unit	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Potential demand	NCR	Industrial use	mmscfd	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.5	0.7	0.8	0.8	0.9	0.9
		Commercial use	mmscfd	0.1	0.4	0.4	0.3	0.7	1.1	1.4	1.8	2.2	2.9	3.6	4.4	5.3	6.2	7.3	8.5	9.8	11.2	12.7	14.3	15.9	17.7	19.6	21.6
		Residential use	mmscfd	2.0	2.2	2.3	2.3	2.5	2.7	3.0	3.2	3.5	3.9	4.3	4.7	5.2	5.7	6.2	6.8	7.3	8.0	8.9	10.4	12.0	13.8	15.7	17.7
	Batangas—Cavite	Industrial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3
		Commercial use	mmscfd	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.7	0.9	1.0	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5
		Residential use	mmscfd	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.3	1.4	1.6	1.9	2.1
	Bulacan—Bataan	Industrial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Commercial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.1	1.2
		Residential use	mmscfd	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.7	0.8	0.9	1.0
	Power generation	(Sucat, F.P.I.P)	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	3.5	3.5	3.5	6.5	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2
	Total potential demand		mmscfd	2.7	3.3	3.3	3.4	4.1	4.6	9.0	9.8	10.5	14.8	86.9	88.5	90.1	91.9	93.8	95.9	98.1	100.7	103.6	107.2	111.1	115.3	119.8	124.0
	Potential supply area		km2					184.2	184.2	184.2	184.2	184.2	184.2	184.2	184.2	184.2	184.2	184.2	184.2	184.2	184.2	217.8	217.8	217.8	217.8	217.8	217.8
Existing demand	NCR	Industrial use	mmscfd	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.9	0.9
		Commercial use	mmscfd	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.9	1.2	1.7	2.3	3.1	4.0	5.0	6.2	7.7	9.3	11.2	12.7	14.3	15.9	17.7	19.6	21.6
		Residential use	mmscfd	0.0	0.0	0.0	0.0	0.4	0.5	0.7	0.9	1.1	1.4	1.8	2.2	2.6	3.1	3.7	4.3	5.0	5.9	6.9	8.5	10.4	12.5	15.0	17.7
	Batangas—Cavit	Industrial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3
		Commercial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.9	1.0	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.5
		Residential use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.5	0.6	0.8	0.8	0.9	1.0	1.1	1.3	1.4	1.6	1.9	2.1
	Bulacan—Bataan	Industrial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
		Commercial use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.9	1.0	1.1	1.2
		Residential use	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.5	0.7	1.0
	Power generation	(Sucat, F.P.I.P)	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	3.5	3.5	3.5	6.5	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2
	Total existing demand		mmscfd	0.0	0.0	0.0	0.0	0.7	1.1	5.1	5.6	6.3	10.4	82.3	83.7	85.3	87.2	89.3	91.7	94.3	97.3	100.2	104.6	109.1	113.7	118.9	124.6
	Existing supply area		km2	0.0	0.0	0.0	0.0	22.0	28.6	35.6	42.4	54.2	65.9	77.6	89.3	101.0	112.8	122.8	129.7	136.5	143.3	150.1	167.0	178.9	190.7	202.6	217.8
Transmission PL	Construction of trunk line	Phase I	59.6	0	0	29.8	29.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(High pressure)	(Tabangao-NCR)	(mm$)			50%	50%																				
		Phase II	18.2	0	0	0	0	0	0	0	0	0	0	18.2	0	0	0	0	0	0	0	0	0	0	0	0	0
		(NCR-Bataan)	(mm$)										0%	100%				0%									
		Phase III	22.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11.05	11.05	0	0	0	0	0
			(mm$)														0%	0%			50%	50%	0%				
Distribution PL (NCR)	Construction of local trunk line		20.3	0.0	0.0	3.0	3.0	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			(mm$)			15%	15%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%										
	(high-pressure)			0%	0%	0%	0%	37%	44%	51%	58%	65%	72%	79%	86%	93%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Construction of local supply line		14.5	0.0	0.0	2.2	2.2	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.0	0	0	0	0	0
			(mm$)			15%	15%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%						
	(middle-pressure)			0%	0%	0%	0%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%	100%	100%	100%	100%	100%	100%
	Construction of supply line		97.7	0.0	0.0	4.9	4.9	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
	(Low- pressure)		(mm$)			5.0%	5.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%
151.6	Supply area							22.0	28.6	35.6	42.4	49.3	56.1	62.9	69.7	76.5	83.4	90.2	97.0	103.8	110.6	117.5	124.3	131.1	137.9	144.7	151.6
	(Low-pressure supply area)		(km2)					14.5%	19.0%	23.5%	28.0%	32.5%	37.0%	41.5%	46.0%	50.5%	55.0%	59.5%	64.0%	68.5%	73.0%	77.5%	82.0%	86.5%	91.0%	95.5%	100.0%
Distribution PL (Batangas to Cavite)	Construction of local trunk line		2.2	0.0	0.0	0.0	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			(mm$)			0.0%	50.0%	50.0%																			
	(high-pressure)			0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	Construction of local supply line		1.6	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			(mm$)			0.0%	0.0%	0.0%	20.0%	20.0%	20.0%	20.0%	20.0%														
	(middle-pressure)			0.0%	0.0%	0.0%	0.0%	0.0%	20.0%	40.0%	60.0%	80.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	Construction of supply line		10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.6	1.6	1.6	1.6	1.6	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(Low- pressure)		(mm$)			0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	10.0%									
32.7	Supply area			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	9.8	14.7	19.6	24.5	29.4	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7
	(Low-pressure supply area)		(km2)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.0%	30.0%	45.0%	60.0%	75.0%	90.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Distribution PL (Bulacan to Pampanga to Bataan)	Construction of local trunk line		2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1	0.0	0.0	0.0	0.0
			(mm$)														0.0%	0.0%				50.0%	50.0%				
	(high-pressure)			0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%	100%	100%	100%
	Construction of local supply line		1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.5	0.0	0.0	0.0
			(mm$)														0.0%	0.0%	0.0%			35.0%	35.0%	30.0%			
	(middle-pressure)			0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	70%	100%	100%	100%	100%
	Construction of supply line		10.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.6	1.6	1.6	1.6	2.7
	(Low- pressure)		(mm$)														0.0%	0.0%	0.0%	0.0%	0.0%	15.0%	15.0%	15.0%	15.0%	15.0%	25.0%
33.5	Supply area			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.1	15.1	20.1	25.1	33.5
	(Low-pressure supply area)		(km2)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	30.0%	45.0%	60.0%	75.0%	100.0%
Construction fee total(mm$)		Transmission	99.9	0.0	0.0	29.8	29.8	0.0	0.0	0.0	0.0	0.0	0.0	18.2	0.0	0.0	0.0	0.0	0.0	0.0	11.1	11.1	0.0	0.0	0.0	0.0	0.0
		Distribution	161.4	0.0	0.0	10.1	11.2	7.6	6.9	6.9	6.9	8.4	8.4	8.1	8.1	8.1	8.1	6.2	5.1	5.1	5.1	7.7	7.7	6.5	6.0	6.0	7.1
		Total	261.3	0.0	0.0	39.9	41.0	7.6	6.9	6.9	6.9	8.4	8.4	26.3	8.1	8.1	8.1	6.2	5.1	5.1	16.2	18.7	7.7	6.5	6.0	6.0	7.1
Maintenance fee (mm$)	Transmission PL	Maintenance fee(mm$)	35					5.2	5.2	5.2	5.2	5.2	5.2	5.2	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	11.4	11.4	11.4	11.4	11.4
	($35/m)	Maintenance Length(m)	($/m)					148,500	148,500	148,500	148,500	148,500	148,500	148,500	186,500	186,500	186,500	186,500	186,500	186,500	186,500	186,500	325,800	325,800	325,800	325,800	325,800
	Distribution PL	Maintenance fee(mm$)	30000	0.0	0.0	0.0	0.0	0.7	0.9	1.1	1.3	1.6	2.0	2.3	2.7	3.0	3.4	3.7	3.9	4.1	4.3	4.5	5.0	5.4	5.7	6.1	6.5
	($30000/km2)	Maintenance area(km2)	($/km2)	0.0	0.0	0.0	0.0	22.0	28.8	35.6	42.4	54.2	65.9	77.6	89.3	101.0	112.8	122.8	129.7	136.5	143.3	150.1	167.0	178.9	190.7	202.6	217.8
Maintenance Operation Personnel	Head Quarter	Personnel (1.6 persons/km2)	1.6	0	0	120	120	35	46	57	68	87	105	124	143	162	180	197	207	218	229	240	267	286	305	324	348
	Transmission	Personnel (0.5 person/km)	0.5	0	0	74	74	74	74	74	74	74	74	74	93	93	93	93	93	93	93	93	163	163	163	163	163
	Distribution	Personnel (0.6 person/km2)	0.6	0	0	45	45	13	17	21	25	32	40	47	54	61	68	74	78	82	86	90	100	107	114	122	131
	Total		(persons)	0	0	239	239	123	138	153	168	193	219	245	290	316	341	364	379	394	409	424	530	556	582	609	642

Table 5-3-15 Gas Distribution Plan in Area C-M in the High Case

(million$)

Cebu (High)			Unit.etc.	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Potential Demand		Industrial	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
		Commercial	mmscfd	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.6	0.8	1.1	1.4	1.6	1.9	2.2	2.5	2.9	3.2
		Residential	mmscfd	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1
	Power Generation		mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total Potential Demand		mmscfd	0.1	0.1	0.2	0.2	0.3	0.4	0.6	0.9	1.2	1.6	1.9	2.3	2.7	3.0	3.5	3.9	4.4
	Potential Supply Area		km2																	
Existing Demand		Industrial	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Commercial	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Residential	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Power Generation		mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total Existing Demand		mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Existing Supply Area		km2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Transmission PL (High-Pressure)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution PL Construction Fee	Distribution PL (High-Pressure)		15.7		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9
																			25%	25%
				0%	0%	0%	0%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Distribution PL (Middle-Pressure)		3.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7648
																				20%
				0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Distribution PL (Low-Pressure)		25.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6
																				10.0%
80	Supply Area							0	0	0	0	0	0	0	0	0	0	0	0	0
								0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Maintenance Fee (mm$)	Transmission PL ($35/m)	Fee	35					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Length	0					0												
	Distribution PL ($30000/km2)	Fee	30000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Area	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maintenance Operation Personel	Head Quarter	Personal (1.6人/km2)	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Transmission	Personal (0.5P/km)	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Distribution	Personal (0.5P/km2)	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totel				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cebu (High)			Unit.etc.	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Potential Demand		Industrial	mmscfd	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Commercial	mmscfd	3.5	3.9	4.3	4.6	5.0	5.3	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7
		Residential	mmscfd	1.2	1.4	1.5	1.6	1.7	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Power Generation		mmscfd	22.7	22.7	21.7	21.4	21.1	50.8	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7
	Total Potential Demand		mmscfd	27.6	28.1	27.6	27.7	27.9	58.1	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6
	Potential Supply Area		km2	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Existing Demand		Industrial	mmscfd	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Commercial	mmscfd	1.4	2.3	3.4	4.6	5.0	5.3	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7
		Residential	mmscfd	0.2	0.3	0.4	0.6	0.7	0.8	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
	Power Generation		mmscfd	22.7	22.7	21.7	21.4	21.1	50.8	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7
	Total Existing Demand		mmscfd	24.4	25.5	25.7	26.7	26.9	57.1	57.5	57.6	57.7	57.8	57.9	58.0	58.1	58.2	58.3	58.4	58.6
	Existing Supply Area		km2	16.0	20.0	24.0	28.0	32.0	36.0	40.0	44.0	48.0	52.0	56.0	60.0	64.0	68.0	72.0	76.0	80.0
	Transmission PL (High-Pressure)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution PL Construction Fee	Distribution PL (High-Pressure)		15.7	3.1	3.1	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				20%	20%	10%														
				70%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Distribution PL (Middle-Pressure)		3.8	0.7648	0.7648	0.7648	0.7648	0	0	0	0	0	0	0	0	0	0	0	0	0
				20%	20%	20%	20%													
				40%	60%	80%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Distribution PL (Low-Pressure)		25.8	2.6	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
				10.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
80	Supply Area			16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
				20.0%	25.0%	30.0%	35.0%	40.0%	45.0%	50.0%	55.0%	60.0%	65.0%	70.0%	75.0%	80.0%	85.0%	90.0%	95.0%	100.0%
Maintenance Fee (mm$)	Transmission PL ($35/m)	Fee	35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Length	0																	
	Distribution PL ($30000/km2)	Fee	30000	0.5	0.6	0.7	0.8	1.0	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.0	2.2	2.3	2.4
		Area	80	16.0	20.0	24.0	28.0	32.0	36.0	40.0	44.0	48.0	52.0	56.0	60.0	64.0	68.0	72.0	76.0	80.0
Maintenance Operation Personel	Head Quarter	Personal (1.6人/km2)	1.5	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
	Transmission	Personal (0.5P/km)	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Distribution	Personal (0.5P/km2)	0.5	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
Totel				32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160

Table 5-3-16 Gas Distribution Plan in Area C-M in the Low Case

(million$)

Cebu (Low)			Unit.etc.	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Potential Demand		Industrial	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Commercial	mmscfd	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4
		Residential	mmscfd	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.6
	Power Generation		mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total Potential Demand		mmscfd	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.5	0.6	0.6	0.7	0.8	0.9	1.0
	Potential Supply Area		km2																	
Existing Demand		Industrial	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Commercial	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Residential	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Power Generation		mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total Existing Demand		mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Existing Supply Area		km2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Transmission PL (High-Pressure)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution PL Construction Fee	Distribution PL (High-Pressure)		15.7		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.9
																			25%	25%
				0%	0%	0%	0%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Distribution PL (Middle-Pressure)		3.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7648
																				20%
				0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Distribution PL (Low-Pressure)		25.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6
																				10.0%
80	Supply Area							0	0	0	0	0	0	0	0	0	0	0	0	0
								0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Maintenance Fee (mm$)	Transmission PL ($35/m)	Fee	35					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Length	0					0												
	Distribution PL ($30000/km2)	Fee	30000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Area	80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maintenance Operation Personal	Head Quarter	Personal (1.6人/km2)	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Transmission	Personal (0.5P/km)	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Distribution	Personal (0.5P/km2)	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cebu (Low)			Unit.etc.	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Potential Demand		Industrial	mmscfd	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Commercial	mmscfd	0.5	0.5	0.6	0.7	0.8	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
		Residential	mmscfd	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	Power Generation		mmscfd	0.0	25.1	23.8	22.6	22.1	53.6	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9
	Total Potential Demand		mmscfd	1.1	26.4	25.3	24.2	23.9	55.6	54.2	54.2	54.2	54.2	54.2	54.2	54.2	54.2	54.2	54.2	54.2
	Potential Supply Area		km2	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Existing Demand		Industrial	mmscfd	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Commercial	mmscfd	0.2	0.3	0.5	0.7	0.8	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
		Residential	mmscfd	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.8	0.9	0.9	1.0	1.0	1.1	1.2	1.2
	Power Generation		mmscfd	0.0	25.1	23.8	22.6	22.1	53.6	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9
	Total Existing Demand		mmscfd	0.3	25.7	24.6	23.6	23.3	55.0	53.6	53.7	53.8	53.8	53.9	53.9	54.0	54.1	54.1	54.2	54.2
	Existing Supply Area		km2	16.0	20.0	24.0	28.0	32.0	36.0	40.0	44.0	48.0	52.0	56.0	60.0	64.0	68.0	72.0	76.0	80.0
	Transmission PL (High-Pressure)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution PL Construction Fee	Distribution PL (High-Pressure)		15.7	3.1	3.1	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				20%	20%	10%														
				70%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Distribution PL (Middle-Pressure)		3.8	0.7648	0.7648	0.7648	0.7648	0	0	0	0	0	0	0	0	0	0	0	0	0
				20%	20%	20%	20%													
				40%	60%	80%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Distribution PL (Low-Pressure)		25.8	2.6	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
				10.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
80	Supply Area			16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
				20.0%	25.0%	30.0%	35.0%	40.0%	45.0%	50.0%	55.0%	60.0%	65.0%	70.0%	75.0%	80.0%	85.0%	90.0%	95.0%	100.0%
Maintenance Fee (mm$)	Transmission PL ($35/m)	Fee	35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Length	0																	
	Distribution PL ($30000/km2)	Fee	30000	0.5	0.6	0.7	0.8	1.0	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.0	2.2	2.3	2.4
		Area	80	16.0	20.0	24.0	28.0	32.0	36.0	40.0	44.0	48.0	52.0	56.0	60.0	64.0	68.0	72.0	76.0	80.0
Maintenance Operation Personal	Head Quarter	Personal (1.6人/km2)	1.5	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
	Transmission	Personal (0.5P/km)	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Distribution	Personal (0.5P/km2)	0.5	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
Total				32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160

Table 5-3-17 Gas Distribution Plan in Area D in the High Case

(million$)

Davao (High)			Unit etc.	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Potential Demand		Industrial	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
		Commercial	mmscfd	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.5	0.7	0.9	1.1	1.4	1.6	1.8	2.1	2.4	2.7
		Residential	mmscfd	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.9
	Power Generation		mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total Potential Demand		mmscfd	0.1	0.1	0.1	0.2	0.2	0.3	0.5	0.7	1.0	1.3	1.6	1.9	2.2	2.6	2.9	3.3	3.7
	Potential Supply Area		km2																	
Existing Demand		Industrial	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Commercial	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Residential	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Power Generation		mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total Existing Demand		mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Existing Supply Area		km2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Distribution PL Construction Fee	Transmission PL (High-Pressure)		18.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.7163	4.7163
																			25%	25%
	Distribution PL (High-Pressure)		17.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	1.8
																			10%	10%
				0%	0%	0%	0%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Distribution PL (Middle-Pressure)		5.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5115
																				10%
				0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Distribution PL (Low-Pressure)		34.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4
																				10.0%
80	Supply Area							0	0	0	0	0	0	0	0	0	0	0	0	0
								0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Maintenance Fee (mm$)	Transmission PL ($35/m)	Fee	35					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Length	49000					0												
	Distribution PL ($30000/km2)	Fee	30000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Area		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maintenance Operation Personal	Head Quarter	Personal (1.8人/km2)	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Transmission	Personal (0.5P/km)	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Distribution	Personal (0.6P/km2)	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Davao (High)			Unit etc.	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Potential Demand		Industrial	mmscfd	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Commercial	mmscfd	3.0	3.3	3.6	3.9	4.2	4.5	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
		Residential	mmscfd	1.0	1.1	1.3	1.4	1.5	1.6	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
	Power Generation		mmscfd	22.7	22.7	21.7	21.4	21.1	50.8	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7
	Total Potential Demand		mmscfd	26.8	27.3	26.7	26.8	26.9	57.0	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4
	Potential Supply Area		km2	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107
Existing Demand		Industrial	mmscfd	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Commercial	mmscfd	0.6	1.0	1.4	2.0	2.5	3.2	3.9	4.4	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
		Residential	mmscfd	0.2	0.3	0.4	0.5	0.6	0.7	0.9	1.0	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.7
	Power Generation		mmscfd	22.7	22.7	21.7	21.4	21.1	50.8	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7
	Total Existing Demand		mmscfd	23.6	24.0	23.6	23.9	24.3	54.8	55.5	56.1	56.7	56.8	56.9	57.0	57.0	57.1	57.2	57.3	57.4
	Existing Supply Area		km2	16.0	20.0	24.0	28.0	32.0	36.0	40.0	44.0	48.0	52.0	56.0	60.0	64.0	68.0	72.0	76.0	80.0
Distribution PL Construction Fee	Transmission PL (High-Pressure)		18.9	3.773	3.773	1.8865	0	0	0	0	0	0	0	0	0	0	0	0	0	0
				20%	20%	10%														
	Distribution PL (High-Pressure)		17.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				10%	10%	10%	10%	10%	10%	10%	10%									
				30%	40%	50%	60%	70%	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Distribution PL (Middle-Pressure)		5.1	0.5115	0.5115	0.5115	0.5115	0.5115	0.5115	0.5115	0.511469	0.511469	0	0	0	0	0	0	0	0
				10%	10%	10%	10%	10%	10%	10%	10%	10%								
				20%	30%	40%	50%	60%	70%	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Distribution PL (Low-Pressure)		34.5	3.4	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
				10.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
80	Supply Area			16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
				20.0%	25.0%	30.0%	35.0%	40.0%	45.0%	50.0%	55.0%	60.0%	65.0%	70.0%	75.0%	80.0%	85.0%	90.0%	95.0%	100.0%
Maintenance Fee (mm$)	Transmission PL ($35/m)	Fee	35	1.2	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
		Length	49000	34300	49000	49000	49000	49000	49000	49000	49000	49000	49000	49000	49000	49000	49000	49000	49000	49000
	Distribution PL ($30000/km2)	Fee	30000	0.5	0.6	0.7	0.8	1.0	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.0	2.2	2.3	2.4
		Area		16.0	20.0	24.0	28.0	32.0	36.0	40.0	44.0	48.0	52.0	56.0	60.0	64.0	68.0	72.0	76.0	80.0
Maintenance Operation Personal	Head Quarter	Personal (1.8人/km2)	1.5	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
	Transmission	Personal (0.5P/km)	0.5	17	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	Distribution	Personal (0.6P/km2)	0.5	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
Total				49	65	73	81	89	97	105	113	121	129	137	145	153	161	169	177	185

Table 5-3-18 Gas Distribution Plan in Area D in the Low Case

(million$)

Davao (Low)			Unit etc.	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Potential Demand		Industrial	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Commercial	mmscfd	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4
		Residential	mmscfd	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5
	Power Generation		mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total Potential Demand		mmscfd	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.9
	Potential Supply Area		km2																	
Existing Demand		Industrial	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Commercial	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Residential	mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Power Generation		mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total Existing Demand		mmscfd	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Existing Supply Area		km2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Distribution PL Construction Fee	Transmission PL (High-Pressure)		18.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.7163	4.7163
																			25%	25%
	Distribution PL (High-Pressure)		17.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	1.8
																			10%	10%
				0%	0%	0%	0%		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Distribution PL (Middle-Pressure)		5.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5115
																				10%
				0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Distribution PL (Low-Pressure)		34.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4
																				10.0%
80	Supply Area							0	0	0	0	0	0	0	0	0	0	0	0	0
								0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Maintenance Fee (mm$)	Transmission PL ($35/m)	Fee	35					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Length	49000					0												
	Distribution PL ($30000/km2)	Fee	30000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Area		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maintenance Operation Personal	Head Quarter	Personal (1.6人/km2)	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Transmission	Personal (0.5P/km)	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Distribution	Personal (0.6P/km2)	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Davao (Low)			Unit etc.	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Potential Demand		Industrial	mmscfd	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Commercial	mmscfd	0.4	0.4	0.5	0.6	0.7	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
		Residential	mmscfd	0.5	0.6	0.7	0.8	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Power Generation		mmscfd	0.0	25.1	23.8	22.6	22.1	53.6	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9
	Total Potential Demand		mmscfd	1.0	26.2	25.0	24.0	23.7	55.3	53.9	53.9	53.9	53.9	53.9	53.9	53.9	53.9	53.9	53.9	53.9
	Potential Supply Area		km2	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107
Existing Demand		Industrial	mmscfd	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Commercial	mmscfd	0.1	0.1	0.2	0.3	0.4	0.5	0.7	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
		Residential	mmscfd	0.1	0.2	0.2	0.3	0.3	0.4	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0
	Power Generation		mmscfd	0.0	25.1	23.8	22.6	22.1	53.6	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9	51.9
	Total Existing Demand		mmscfd	0.2	25.4	24.2	23.1	22.9	54.6	53.2	53.3	53.5	53.5	53.6	53.6	53.7	53.7	53.8	53.9	53.9
	Existing Supply Area		km2	16.0	20.0	24.0	28.0	32.0	36.0	40.0	44.0	48.0	52.0	56.0	60.0	64.0	68.0	72.0	76.0	80.0
Distribution PL Construction Fee	Transmission PL (High-Pressure)		18.9	3.773	3.773	1.8865	0	0	0	0	0	0	0	0	0	0	0	0	0	0
				20%	20%	10%														
	Distribution PL (High-Pressure)		17.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				10%	10%	10%	10%	10%	10%	10%	10%									
				30%	40%	50%	60%	70%	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Distribution PL (Middle-Pressure)		5.1	0.5115	0.5115	0.5115	0.5115	0.5115	0.5115	0.5115	0.511469	0.511469	0	0	0	0	0	0	0	0
				10%	10%	10%	10%	10%	10%	10%	10%	10%								
				20%	30%	40%	50%	60%	70%	80%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Distribution PL (Low-Pressure)		34.5	3.4	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
				10.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
80	Supply Area			16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
				20.0%	25.0%	30.0%	35.0%	40.0%	45.0%	50.0%	55.0%	60.0%	65.0%	70.0%	75.0%	80.0%	85.0%	90.0%	95.0%	100.0%
Maintenance Fee (mm$)	Transmission PL ($35/m)	Fee	35	1.2	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
		Length	49000	34300	49000	49000	49000	49000	49000	49000	49000	49000	49000	49000	49000	49000	49000	49000	49000	49000
	Distribution PL ($30000/km2)	Fee	30000	0.5	0.6	0.7	0.8	1.0	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.0	2.2	2.3	2.4
		Area		16.0	20.0	24.0	28.0	32.0	36.0	40.0	44.0	48.0	52.0	56.0	60.0	64.0	68.0	72.0	76.0	80.0
Maintenance Operation Personal	Head Quarter	Personal (1.6人/km2)	1.5	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
	Transmission	Personal (0.5P/km)	0.5	17	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	Distribution	Personal (0.6P/km2)	0.5	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
Total				49	65	73	81	89	97	105	113	121	129	137	145	153	161	169	177	185

5-4 Study on LNG Receiving Terminal

5-4-1 Conditions for a LNG Receiving Terminal

The following conditions will be considered for receiving terminals:

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

- Proximity to Transmission and Use
  The location of an LNG terminal should accommodate easy connection to gas transmission, and eventual distribution and end use.

- Easy Reception of LNG Ships
  The size of generally used LNG ships is 130,000 to 140,000 m^3. Ships of this scale should be easily accepted and operated safely and securely in the seaport to accommodate the terminal.

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

5-4-2 Volume of LNG on the Basis of Gas Demand

The volume of LNG that would need to be imported based on the forecast of natural gas supply and demand is shown in Tables 5-4-1, 5-4-2, 5-4-3 and 5-4-4.

Table 5-4-1 Required LNG imports for Area L (High Case) (Million t /year)

		2009	2013	2017	2021	2025
Option 1	L-2	0.00	0.34	1.25	2.48	3.52
	L-3	0.26	1.22	1.89	2.95	4.42
Option 2	L-2	0.00	0.34	1.24	2.47	3.52
	L-3	0.26	1.22	1.88	2.93	4.42

Table 5-4-2 Required LNG imports for Area L (Low Case) (Million t /year)

		2013	2017	2021	2025
Option 1	L-2	0.00	0.61	1.65	2.54
	L-3	0.30	1.22	2.48	3.31
Option 2	L-2	0.00	0.61	1.65	2.54
	L-3	0.30	1.21	2.48	3.31

Table 5-4-3 Required LNG imports for Area C-M and D (High Case) (Million t /year)

	2019	2022	2025
Area C-M	0.23	0.23	0.49
Area D	0.22	0.22	0.48

Table 5-4-4 Required LNG imports for Area C-M and D (Low Case) (Million t /year)

	2020	2024	2025
Area C-M	0.22	0.20	0.45
Area D	0.22	0.20	0.45

In comparison of Option 1 with Option 2 in Area L, required LNG imports are almost the same in both the High and Low Cases. In the High Case, the volume of LNG that would need to be supplied to Area L-2 and Area L-3 in 2025 would reach 3.5 million tons and 4.4 million tons annually, respectively. In the Low Case, demand would be 2.5 million tons for Area L-2 and 3.3 million tons for Area L-3, respectively.

On the other hand, Area C-M and D would need approximately 500,000 tons each.

Thus, we base our projections for the size of the LNG terminal on 4 million t/y for Area L-2 and 5 million t/y for Area L-3 in the High Case, and on 3 million tons for Area L-2 and 4 million tons for Area L-3 in the Low Case.

Areas C-M and D would need one million t/y.

The LNG volume for each Case would be applicable in the Gas Promotion Scenario.

5-4-3 LNG Tanker and Receiving Facilities

(1) Conditions of LNG Tanker

The specifications of LNG carriers for this study are shown below

LNG Capacity:	130,000kl
Length of ship:	290m
Length between perpendiculars:	276m
Beam:	48m
Loaded draft:	11.8m
Loaded displacement:	98,800t

(2) Passage and Anchorage

The passage width shall be 300m and the turning basin shall be 600m in diameter (circle). The depths of the passage and the anchorage shall both be 14m.

(3) Jetty

Pier alignment shall be determined based on passage, turning basin, capacity of LNG carrier, frequency of arrival and leaving of carriers, operability of carriers, installation plans for send-out pipelines, and meteorological and ocean meteorological conditions. In this study, a pier shall be extended 300m up to a 14m deep position to minimize dredging work, and shall be of the dolphin type.

(4) Unloading Arms

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

(5) Unloading Pipeline

Two lines with 750mm diameter shall be installed so as to allow gas receiving to be completed from a 130,000kl LNG ship in 12 hours. Installation of two pipelines permits gas receiving within 24 hours, even when one line cannot be operated for some reason.

5-4-4 LNG Tanks

(1) Type

The typical types and respective features of LNG tanks in world use are shown in Appendix. According to the recent trend of LNG tank construction, the aboveground type PC tank (integral type of outer container and PC dike) is the mainstream tank and is adopted in this study.

(2) Calculation of Required Number of Tanks

The required reserve at an LNG terminal is calculated using the following equation:

Required reserve = Storage + Seasonal differentials + LNG for receiving

Although the quantity maintained in storage may vary depending on the importance to consumers of a continuous supply for power and gas, and our assessment of the risks present in the LNG chain, for the purposes of this report we assume a storage amount equal to seven days average daily send-out. Accordingly, if we assume an annual handling volume of five million tons, storage would be:

$$5 \text{ million t/y} \div 0.4565 \text{ t/m}^3 \div 365 \text{ d/y} \times 7 \text{ days} = 210{,}000 \text{ kl} \cdots\cdots\cdots (1)$$

Considering the climate in the Philippines, we may disregard seasonal differentials.

We assume the amount received to be equivalent to the capacity of two LNG vessels. For greater transportation efficiency, a large LNG vessel (130,000 kl) is presumed. Accordingly, the required amount for storage for receiving would be:

$$130{,}000 \text{ kl} \times 2 = 260{,}000 \text{ kl} \cdots\cdots\cdots (2)$$

In this case, the annual frequency of arrivals would be:

$$5 \text{ million t/y} \div 0.4565 \text{ t/m}^3 \div 130{,}000 \text{ kl} = 84 \text{ vessels/y},$$

and the interval of arrivals,

$$365 \text{ d/y} \div 84 \text{ vessels/y} = 4.3 \text{ d/vessel}.$$

Thus, the requisite LNG in storage is

(1) + (2) = 470,000 kl

If we assume a 140,000 kl tank with a dead capacity of 5%, the number of tanks required would be four, according to the following equation:

470,000 kl/(140,000 ×0.95) = 3.53

(3) Tank Construction Plan

Following the same computation procedure as for (2), the annual construction plan is drawn up for an LNG terminal to be established in Area L for the High Case and Low Case. The number of tanks required would be two, three and four respectively for the nominal LNG handling weight 1.6, three and four million tons per annum, assuming a 140,000 kl tank. Therefore, the tank construction plan for Area L-2 in the High Case can be made by dividing the term up to 2025 into three phases based upon the amount of LNG import as follows.

Table. 5-4-5 Construction plan for LNG storage tank (High Case; Area L-2)

Year	2013～2019	2020～2023	2024～2025
Imported LNG (Million t/year)	0.34～1.37	1.98～2.85	3.31～3.52
Nominal annual LNG quantity (million t/year)	1.6	3	4
Required storage capacity (thousand kl)	265	390	430
Number of 140,000kl tanks	2	3	4

For Area L-3 in the High Case, the tank construction plan can be made by dividing the term up to 2025 into four phases.

Table. 5-4-6 Construction plan for LNG storage tank (High Case; Area L-3)

Year	2009～2016	2017～2021	2022～2024	2025
Imported LNG (Million t/year)	0.26～1.30	1.89～2.95	3.51～3.67	4.42
Nominal annual LNG quantity (million t/year)	1.6	3	4	5
Required storage capacity (thousand kl)	265	390	430	480
Number of 140,000kl tanks	2	3	4	4

For Area L-2 in the Low Case, a terminal with a nominal handling capability of 1.6 million t/y and three million t/y would be constructed by dividing the term from 2017 to 2025 into two phases.

Table. 5-4-7 Construction plan for LNG storage tank (Low Case; Area L-2)

Year	2017～2020	2021～2025
Imported LNG (Million t/year)	0.61～1.31	1.65～2.54
Nominal annual LNG quantity (million t/year)	1.6	3
Required storage capacity (thousand kl)	265	390
Number of 140,000kl tanks	2	3

For Area L-3 in the Low Case, a terminal with a nominal handling capability of 1.6, three and four million t/y would be constructed by dividing the term from 2013 to 2025 into three phases.

Table 5-4-8 Construction plan for LNG storage tank (Low Case; Area L-3)

Year	2013～2018	2019～2023	2024～2025
Imported LNG (Million t/year)	0.30～1.60	1.76～2.72	3.20～3.31
Nominal annual LNG quantity (million t/year)	1.6	3	4
Required storage capacity (thousand kl)	265	390	430
Number of 140,000kl tanks	2	3	4

The following are tank construction plans for Areas C-M and D.

Table 5-4-9 Construction plan for LNG storage tank (High Case; Areas C-M & D)

Area	C-M	D
Year	2019～2025	2019～2025
Imported LNG (million t/year)	0.23～0.49	0.22～0.48
Nominal annual LNG quantity (million t/year)	1	1
Required storage capacity (thousand kl)	310	310
Number of 140,000kl tanks	2	2

Table 5-4-10 Construction plan for LNG storage tank (Low Case; Areas C-M & D)

Area	C-M	D
Year	2020～2025	2020～2025
Imported LNG (million t/year)	0.22～0.45	0.22～0.45
Nominal annual LNG quantity (million t/year)	1	1
Required storage capacity (thousand kl)	310	310
Number of 140,000kl tanks	2	2

(4) LNG Pumps

The number of LNG pumps to be established is determined by the number of tanks. If we assume the primary (1ry) pump has a capacity of 170 t/h, the transfer pump capacity 150 t/h, and the secondary (2ry) pump capacity 150 t/h, the number of pumps required in a terminal for Area L in High Case would be (See Table 5-4-11 and 5-4-12):

Table 5-4-11 LNG pump installation plan (High Case; Area L-2)

Year	2013～2019	2020～2023	2024～2025
Imported LNG (million t/year)	0.34～1.37	1.98～2.85	3.31～3.52
Nominal annual LNG quantity (million t/year)	1.6	3	4
Number of primary pumps	4(2)	6(2)	7(2)
Number of transfer pumps	3(1)	3(1)	3(1)
Number of secondary pumps	4(2)	6(2)	7(2)

(Note) Numbers in parentheses show the number of back-up pumps.

Table 5-4-12 LNG pump installation plan (High Case; Area L-3)

Year	2009~2016	2017~2021	2022~2024	2025
Imported LNG (million t/year)	0.26~1.30	1.89~2.95	3.51~3.67	4.42
Nominal annual LNG quantity (million t/year)	1.6	3	4	5
Number of primary pumps	4(2)	6(2)	7(2)	8(2)
Number of transfer pumps	3(1)	3(1)	3(1)	3(1)
Number of secondary pumps	4(2)	6(2)	7(2)	8(2)

(Note) Numbers in parentheses show the number of back-up pumps.

LNG pumps installation plan for Area L in the Low Case, is shown in the following tables.

Table 5-4-13 LNG pumps installation plan (Low Case; Area L-2)

Year	2017~2020	2021~2025
Imported LNG (million t/year)	0.61~1.31	1.65~2.54
Nominal annual LNG quantity (million t/year)	1.6	3
Number of primary pumps	4(2)	6(2)
Number of transfer pumps	2(1)	2(1)
Number of secondary pumps	4(2)	6(2)

Table 5-4-14 LNG pump installation plan (Low Case; Area L-3)

Year	2013~2018	2019~2023	2024~2025
Imported LNG (million t/year)	0.30~1.60	1.76~2.72	3.20~3.31
Nominal annual LNG quantity (million t/year)	1.6	3	4
Number of primary pumps	4(2)	6(2)	7(2)
Number of transfer pumps	3(1)	3(1)	3(1)
Number of secondary pumps	4(2)	6(2)	7(2)

If we assume the primary (1ry) pump has a capacity of 85 t/h, the transfer pump capacity is 85 t/h, and the secondary (2ry) pump capacity is 65 t/h, the number of pumps required in a terminal for Area C-M and D would be (See Table 5-4-15 and 5-4-16):

Table 5-4-15 LNG pump installation plan (High Case; Areas C-M & D)

Area	Area C-M	Area D
Year	2019~2025	2019~2025
Imported LNG (million t/year)	0.23~0.49	0.22~0.48
Nominal annual LNG quantity (million t/year)	1	1
Number of primary pumps	4(2)	4(2)
Number of transfer pumps	3(1)	3(1)
Number of secondary pumps	4(2)	4(2)

(Note) Numbers in parentheses show the number of back-up pumps.

Table 5-4-16 LNG pump installation plan (Low Case; Areas C-M & D)

Area	Area C-M	Area D
Year	2020~2025	2020~2025
Imported LNG (million t/year)	0.22~0.45	0.22~0.45
Nominal annual LNG quantity (million t/year)	1	1
Number of primary pumps	4(2)	4(2)
Number of transfer pumps	3(1)	3(1)
Number of secondary pumps	4(2)	4(2)

(Note) Numbers in parentheses show the number of back-up pumps.

5-4-5 LNG Vaporizers

(1) Types of LNG Vaporizer

A vaporizer uses seawater as an LNG heating source, because LNG terminals are mostly constructed along seashores. An open rack-type LNG vaporizer (hereinafter abbreviated as ORV) and a shell & tube-type LNG vaporizer (hereinafter abbreviated as STV) are currently available as LNG vaporizers using seawater as the LNG heating source. In addition, a submerged-type LNG vaporizer (hereinafter abbreviated as SMV) is also available, which recycles the heat that results from LNG combustion. Generally, either ORV or STV is employed considering running costs. On the other hand, the SMV is adopted as a countermeasure against peak gas demand.

This study adopts the ORV, which is adopted worldwide, taking comprehensive consideration of operability, maintainability, and cost.

(2) Calculating Required Numbers

The capacities of LNG vaporizers are determined by the maximum send-out rate per hour. Gas is sent out for power generation and other purposes. For 2025, we are assuming a ratio of power generation demand to non-power generation demand of 82.1% to 17.9%. For power generation demand, if we assume a power generation capacity in 2025 of 4.3 million kW, and power generation efficiency of 50% (based on a high heating value),

4.30 million kW × 860 kcal/kWh ÷ 0.5 ÷ 13,000 kcal/kg (HHV) ÷ 1,000
= 569 t/h – (3)

To calculate the peak ratio (maximum send-out per hour against daily send-out), assuming 5 million tons are handled annually, the daily average demand for power generation in 2025 would be:

5 million t/y × 0.821 ÷ 365 d/y = 11,200 t/d

Accordingly, the peak ratio is:

569 t/h ÷ 11,200 t/d × 100 = 5.1%.

Because the percentage for non-power generation is 17.9%, daily average demand for non-power generation for an annual amount of 5 million tons would be:

5 million t/y × 0.179 ÷ 365 d/y = 2,450 t/d

If we assume a peak ratio of 7.8% (based on similar data in Southeast Asia) and an allowance factor in Japan of 1.2:

2,450 t/d × 0.078 × 1.2 = 230 t/h – (4)
The maximum output is (3) + (4) = 799 t/h.

Using ORV (open rack vaporizer) with a send-out capacity of 150 t/h, the number of vaporizers required would be:

799 t/h ÷ 150 t/h·unit = 5.3, or 6.
If we were to use one back-up vaporizer, the number would increase to 7.

(3) Vaporizer Installation Plan

Following the same procedure as for (2) above, we have come up with a vaporizer installation plan for Area L in the High Case until 2025. The results are shown in Table 5-4-17 and 5-4-18.

Table 5-4-17 LNG vaporizers installation plan (High Case; Area L-2)

Year		2013～2019	2020～2023	2024～2025
Imported LNG (million t/year)		0.34～1.37	1.98～2.85	3.31～3.52
Nominal annual LNG quantity (million t/year)		1.6	3	4
Required amount of vaporization (t/h)	Power	159	371	477
	Non-power	72	108	143
	Total	231	479	620
Number of 150t/h vaporizers*1		3	5	6

*1 Including one back-up unit

Table 5-4-18 LNG vaporizers installation plan (High Case; Area L-3)

Year		2009～2016	2017～2021	2022～2024	2025
Imported LNG (million t/year)		0.26～1.30	1.89～2.95	3.51～3.67	4.42
Nominal annual LNG quantity (million t/year)		1.6	3	4	5
Required amount of vaporization (t/h)	Power	159	358	464	569
	Non-power	68	133	200	230
	Total	227	491	664	799
Number of 150t/h vaporizers*1		3	5	6	7

*1 Including one back-up unit

Plans for Area L in the Low Case are shown below.

Table 5-4-19 LNG vaporizers installation plan (Low Case; Area L-2)

Year		2017～2020	2021～2025
Imported LNG (million t/year)		0.61～1.31	1.65～2.54
Nominal annual LNG quantity (million t/year)		1.6	3
Required amount of vaporization (t/h)	Power	159	371
	Non-power	18	38
	Total	177	409
Number of 150t/h vaporizers*1		3	4

*1 Including one back-up unit

Table 5-4-20 LNG vaporizers installation plan (Low Case; Area L-3)

Year		2013~2018	2019~2023	2024~2025
Imported LNG (million t/year)		0.30~1.60	1.76~2.72	3.20~3.31
Nominal annual LNG quantity (million t/year)		1.6	3	4
Required amount of vaporization (t/h)	Power	212	371	477
	Non-power	15	43	65
	Total	227	414	542
Number of 150t/h vaporizers*1		3	4	5

*1 Including one back-up unit

Plans for Areas C-M and D are shown below.

Table 5-4-21 LNG vaporizers installation plan (High Case; Areas C-M & D)

Area		Area C-M	Area D
Year		2019~2025	2019~2025
Imported LNG (million t/year)		0.23~0.49	0.22~0.48
Nominal annual LNG quantity (million t/year)		1	1
Required amount of vaporization (t/h)	Power	67	67
	Non-power	35	36
	Total	102	103
Number of 60t/h vaporizers*1		3	3

*1 Including one back-up unit

Table 5-4-22 LNG vaporizers installation plan (Low Case; Areas C-M & D)

Area		Area C-M	Area D
Year		2020~2025	2020~2025
Imported LNG (million t/year)		0.22~0.45	0.22~0.45
Nominal annual LNG quantity (million t/year)		1	1
Required amount of vaporization (t/h)	Power	67	67
	Non-power	10	10
	Total	77	77
Number of 60t/h vaporizers*1		3	3

*1 Including one back-up unit

5-4-6 BOG (boil-off gas) Treatment Facilities

(1) BOG Generation

Factors influencing BOG generation include:

1) BOG due to spontaneous heat input to LNG tanks and pipes;

2) BOG due to heat loss of rotating equipment including LNG pumps;

3) BOG when unloading from an LNG tanker; and,

4) BOG from unloading arms.

Because (1) above is permanently generated, the following is assumed.

1.5 t/h·tank unit + 5 t/h (piping)

BOG generated when unloading tanks is assumed to be 40 t/h, based on past data on 130,000 kl tankers. Accordingly, BOG generation based on a tank installation plan in Area L for the High Case is shown in Table 5-4-23 and 5-4-24.

Table 5-4-23 BOG generation (High Case; Area L-2)

Year		2013~2019	2020~2024	2024~2025
Imported LNG (million t/year)		0.34~1.37	1.98~2.85	3.31~3.52
Nominal annual LNG quantity (million t/year)		1.6	3	4
Number of tanks		2	3	4
BOG generation (t/h)	At holding	8	9.5	11
	At receiving	46.5	48.0	49.5

Table 5-4-24 BOG generation (High Case; Area L-3)

Year		2009~2016	2017~2021	2022~2024	2025
Imported LNG (million t/year)		0.26~1.30	1.89~2.95	3.51~3.67	4.42
Nominal annual LNG quantity (million t/year)		1.6	3	4	5
Number of tanks		2	3	4	4
BOG generation (t/h)	At holding	8	9.5	11	11
	At receiving	46.5	48.0	49.5	49.5

BOG generation based on a tank installation plan in Area L for the Low Case is shown in Table 5-4-25 and 5-4-26

Table 5-4-25 BOG generation (Low Case; Area L-2)

Year		2017～2020	2021～2025
Imported LNG (million t/year)		0.61～1.31	1.65～2.54
Nominal annual LNG quantity (million t/year)		1.6	3
Number of tanks		2	3
BOG generation (t/h)	At holding	8	9.5
	At receiving	46.5	48.0

Table 5-4-26 BOG generation (Low Case; Area L-3)

Year		2013～2018	2019～2023	2024～2025
Imported LNG (million t/year)		0.30～1.60	1.76～2.72	3.20～3.31
Nominal annual LNG quantity (million t/year)		1.6	3	4
Number of tanks		2	3	4
BOG generation (t/h)	At holding	8	9.5	11
	At receiving	46.5	48.0	49.5

BOG generation for Areas C-M and D are shown below

Table 5-4-27 BOG generation (High Case; Areas C-M & D)

Area		Area C-M	Area D
Year		2019～2025	2019～2025
Imported LNG (million t/year)		0.23～0.49	0.22～0.48
Nominal annual LNG quantity (million t/year)		1	1
Number of tanks		2	2
BOG generation (t/h)	At holding	8.0	8.0
	At receiving	46.5	46.5

Table 5-4-28 BOG generation (Low Case; Areas C-M & D)

Area		Area C-M	Area D
Year		2019～2025	2019～2025
Imported LNG (million t/year)		0.23～0.49	0.22～0.48
Nominal annual LNG quantity (million t/year)		1	1
Number of tanks		2	2
BOG generation (t/h)	At holding	8.0	8.0
	At receiving	46.5	46.5

(2) BOG Reliquefaction Facilities

When there is sufficient LNG send-out to meet needs, BOG may be reliquefied by mixing it with LNG. Suppose BOG is reliquefied using the base amount (50% of the peak) of fuel LNG for power generation. Table 5-4-29 and 5-4-30 show the amount of BOG that could be reliquefied in Area L of the High Case, assuming seven tons of LNG is needed to reliquefy one ton of BOG.

Table 5-4-29 BOG reliquefaction (High Case; Area L-2)

Year	2013~2019	2020~2023	2024~2025
Imported LNG (Million t/year)	0.34~1.37	1.98~2.85	3.31~3.52
Nominal annual LNG quantity (million t/year)	1.6	3	4
Minimum send-out rate (t/h)	20~80	119~186	225~239
Available BOG reliquefied(t/h)	2.8~11.4	17.0~26.5	32.2~34.1

Table 5-4-30 BOG reliquefaction (High Case; Area L-3)

Year	2009~2016	2017~2021	2022~2024	2025
Imported LNG (million t/year)	0.26~1.30	1.89~2.95	3.51~3.67	4.42
Nominal annual LNG quantity (million t/year)	1.6	3	4	5
Minimum send-out rate (t/h)	20~80	119~179	219~232	285
Available BOG reliquefied(t/h)	2.8~11.4	17.0~25.6	31.2~33.1	40.6

Table 5-4-31 and 5-4-32 show the amount of BOG that could be reliquefied in Area L of the Low Case.

Table 5-4-31 BOG reliquefaction (Low Case; Area L-2)

Year	2017~2020	2021~2025
Imported LNG (Million t/year)	0.61~1.31	1.65~2.54
Nominal annual LNG quantity (million t/year)	1.6	3
Minimum send-out rate (t/h)	40~80	106~186
Available BOG reliquefied(t/h)	5.7~11.4	15.1~26.5

Table 5-4-32 BOG reliquefaction (Low Case; Area L-3)

Year	2013~2018	2019~2023	2024~2025
Imported LNG (Million t/year)	0.30~1.60	1.76~2.72	3.20~3.31
Nominal annual LNG quantity (million t/year)	1.6	3	4
Minimum send-out rate (t/h)	20~106	106~186	225~239
Available BOG reliquefied(t/h)	2.8~15.1	17.0~25.6	32.2~34.1

Similarly, Table 5-4-33 and 5-4-34 show the amount of BOG that could be reliquefied in Areas C-M and Area D.

Table 5-4-33 BOG reliquefaction (High Case; Areas C-M & D)

	Area C-M		Area D	
Year	'19～'23	'24～'25	'19～'23	'24～'25
Imported LNG (million t/year)	0.23	0.49	0.22	0.48
Nominal annual LNG quantity (million t/year)	1	1	1	1
Minimum send-out rate (t/h)	13	34	13	34
Available BOG reliquefied (t/h)	1.9	4.8	1.9	4.8

Table 5-4-34 BOG reliquefaction (Low Case; Areas C-M & D)

	Area C-M		Area D	
Year	'20～'23	'24～'25	'20～'23	'24～'25
Imported LNG (million t/year)	0.22	0.45	0.22	0.45
Nominal annual LNG quantity (million t/year)	1	1	1	1
Minimum send-out rate (t/h)	13	34	13	34
Available BOG reliquefied (t/h)	1.9	4.8	1.9	4.8

(3) Types of BOG Compressor

A reciprocal compressor and a centrifugal compressor are generally used in LNG receiving terminals. These two types of compressor are compared in Appendix. The operability of the reciprocating compressor is better than the centrifugal compressor for both start-stop and cool down performance. On the other hand, the centrifugal compressor is excellent in terms of maintainability and is more compact than the reciprocating compressor. From the comparative results, this study adopts the reciprocating type with the good operability and low power cost.

(4) BOG Compressors and Reliquefaction Facilities Installation Plan

1) Area L

Assuming a capacity of 15 t/h for a BOG compressor capable of raising the atmospheric pressure to 0.8 MPa, the number of compressors required would be

When nominal annual LNG quantity is 1,600,000 t/year,

46.5/15 = 3.1 (Two LNG tanks)

When nominal annual LNG quantity is 5,000,000 t/year,

49.5/15 = 3.3 (Four LNG tanks)

Thus, if we include one backup compressor, five compressors are required in both the High Case and Low Case.

A booster is used to raise the pressure of BOG that cannot be reliquefied to 0.8 MPa. Assuming a booster capacity of 15 t/h, the number of compressors required would be:

When nominal annual LNG quantity is 1,600,000 t/year,

(46.5 t/h – 2.8 t/h)÷15 t/h·unit = 2.9

Accordingly, if we include one back-up compressor, four booster compressors are required in High Case or Low Case.

2) Area C-M, Area D

If we assume the capacity of a BOG compressor that can raise atmospheric pressure to 0.8 MPa to be 15 t/h, the number of compressors required would be 46.5/15 = 4 (3.1), or 5, including one back-up compressor. The number of compressors required would be:

(46.5 t/h – 1.9 t/h) ÷ 15 t/h·unit = 2.97, or four with one back-up compressor.

A summary of the above can be found in Table 5-4-35 and 5-4-36.

Table 5-4-35 BOG treatment facilities (Areas L-2 & L-3)

Case	High Case		Low Case	
Area	L-2	L-3	L-2	L-3
Year	2013～2025	2009～2023	2017～2025	2013～2025
Number of BOG compressor units	5	5	5	5
Number of booster units	4	4	4	4
BOG reliquefaciton capacity (t/h)	Max 34.1	Max 40.6	Max 26.5	Max 34.1

Table 5-4-36 BOG treatment facilities (Areas C-M & D)

Area	Area C-M	Area D
Year	2019~2023	2019~2023
Number of BOG compressor units	5	5
Number of booster units	4	4
BOG reliquefaciton capacity (t/h)	Max 4.8	Max 4.8

5-4-7 Seawater Facilities

(1) Required Seawater Volume

Seawater facilities supply water drawn from the sea to a vaporizer and a disaster control facility. Supply capacity depends upon the number of vaporizers. Assuming the design seawater temperature to be 10℃, the required seawater volume for an open rack vaporizer (our plan) would be 35t/t-LNG.

Accordingly, the volume of seawater required for one vaporizer would be

$$150\ t/h \times 35 = 5{,}250\ m^3/h\cdot unit.$$

Table 5-4-37 and 5-4-38 indicate the volume of seawater required for vaporizers, together with that for the seawater electrolyte and the disaster-control facility, in Areas L-2 and L-3 in the High Case. The volume for disaster-control is based on a disaster affecting one tank.

Table 5-4-37 Required sea water volume for vaporizers and chlorinator equipment (High Case; Area L-2)

Year	2013~2019	2020~2023	2024~2025
Imported LNG (million t/year)	0.34~1.37	1.98~2.85	3.31~3.52
Nominal annual LNG quantity (million t/year)	1.6	3	4
Number of vaporizer units	2	4	5
Number of LNG storage tanks	2	3	4
Sea water volume for vaporizers (m^3/h)	10,500	21,000	26,250
Sea water volume for chlorinator equipment(m^3/h)	80	130	150
Sea water for disaster prevention (m^3/h)	4,400	5,000	5,400

Table 5-4-38 Required seawater volume for vaporizers and chlorinator equipment

(High Case; Area L-3)

Year	2009～2016	2017～2021	2022～2024	2025
Imported LNG (million t/year)	0.26～1.30	1.89～2.95	3.51～3.67	4.42
Nominal annual LNG quantity (million t/year)	1.6	3	4	5
Number of vaporizer units	2	4	5	6
Number of LNG storage tanks	2	3	4	4
Sea water volume for vaporizers (m^3/h)	10,500	21,000	26,250	31,500
Sea water volume for chlorinator equipment(m^3/h)	80	130	150	180
Sea water for disaster prevention (m^3/h)	4,400	5,000	5,400	5,400

Table 5-4-39 and 5-4-40 indicate the volume of seawater required for vaporizers, together with that for the seawater electrolyte and the disaster-control facility, in Areas L-2 and L-3 in the Low Case.

Table 5-4-39 Required seawater volumes for vaporizers and chlorinator equipment

(Low Case; Area L-2)

Year	2017～2020	2021～2025
Imported LNG (million t/year)	0.61～1.31	1.65～2.54
Nominal annual LNG quantity (million t/year)	1.6	3
Number of vaporizer units	2	3
Number of LNG storage tanks	2	3
Sea water volume for vaporizers (m^3/h)	10,500	15,750
Sea water volume for chlorinator equipment(m^3/h)	80	100
Sea water for disaster prevention (m^3/h)	4,400	5,000

Table 5-4-40 Required seawater volumes for vaporizers and chlorinator equipment (Low Case; Area L-3)

Year	2013~2018	2019~2023	2024~2025
Imported LNG (million t/year)	0.30~1.60	1.76~2.72	3.20~3.31
Nominal annual LNG quantity (million t/year)	1.6	3	4
Number of vaporizer units	3	5	6
Number of LNG storage tanks	2	3	4
Sea water volume for vaporizers (m^3/h)	10,500	15,750	21,000
Sea water volume for chlorinator equipment(m^3/h)	80	100	130
Sea water for disaster prevention (m^3/h)	4,400	5,000	5,400

For Area C-M and D, the volume of seawater required for one vaporizer would be

60 t/h × 35 = 2,100 m^3/h·unit.

Table 5-4-41 indicates the volume of seawater required for vaporizers, together with that for the seawater electrolyte and the disaster-control facility, in the High Case and the Low Case.

Table 5-4-41 Required seawater volumes for vaporizers and chlorinator equipment (Areas C-M and D)

Case	High Case		Low Case	
Area	Area C-M	Area D	Area C-M	Area D
Year	'19~'25	'19~'25	'20~'25	'20~'25
Imported LNG (million t/year)	0.49	0.48	0.45	0.45
Nominal annual LNG quantity (million t/year)	1	1	1	1
Number of vaporizer units	2	2	2	2
Number of LNG storage tanks	2	2	2	2
Sea water volume for vaporizers (m^3/h)	4,200	4,200	4,200	4,200
Sea water volume for chlorinator equipment (m^3/h)	30	30	30	30
Sea water for disaster prevention (m^3/h)	4,400	4,400	4,400	4,400

(2) Seawater Pumps and Seawater Lines

Seawater pumps for vaporizers are with 7,000 m^3/h of capacity and 30 m of lift with two back-ups, booster pumps for disaster control are centrifugal types with 3,000 m^3/h of capacity and 80 m of lift with one back up. The intake is installed where the required water depth is assured, taking into account ocean topography, currents, and waves. For greater reliability, one back up should be included for the intake and intake line. The diameter of the intake opening is based on a maximum flow of 0.2 m/s, and that of the seawater main pipe on a maximum flow of 2 m/s. Specifications of the main seawater facilities are provided in Tables 5-4-42~5-4-45.

Table 5-4-42 Seawater facilities plan (High Case; Area L-2)

Year	2013~2019	2020~2023	2024~2025
Imported LNG (Million t/year)	0.34~1.37	1.98~2.85	3.31~3.52
Nominal annual LNG quantity (million t/year)	1.6	3	4
Number of sea water pumps	4(2)	6(2)	6(2)
Number of booster pumps for disaster prevention	3(1)	3(1)	3(1)
Sea water intake end portion 10,000 ϕ	2	2	2
Sea water main pipeline 3,500 ϕ	2	2	2

(Note) Numbers in parentheses show the number of back-up pumps.

Table 5-4-43 Seawater facilities plan (High Case; Area L-3)

Year	2009~2016	2017~2021	2022~2024	2025
Imported LNG (Million t/year)	0.26~1.30	1.89~2.95	3.51~3.67	4.42
Nominal annual LNG quantity (million t/year)	1.6	3	4	5
Number of sea water pumps	4(2)	6(2)	6(2)	7(2)
Number of booster pumps for disaster prevention	3(1)	3(1)	3(1)	3(1)
Sea water intake end portion 10,000 ϕ	2	2	2	2
Sea water main pipeline 3,500 ϕ	2	2	2	2

(Note) Numbers in parentheses show the number of back-up pumps.

Table 5-4-44 Seawater facilities plan (Low Case; Area L-2)

Year	2017～2020	2021～2025
Imported LNG (Million t/year)	0.61～1.31	1.65～2.54
Nominal annual LNG quantity (million t/year)	1.6	3
Number of sea water pumps	4(2)	5(2)
Number of booster pumps for disaster prevention	3(1)	3(1)
Sea water intake end portion 10,000φ	2	2
Sea water main pipeline 3,500φ	2	2

(Note) Numbers in parentheses show the number of back-up pumps.

Table 5-4-45 Seawater facilities plan (Low Case; Area L-3)

Year	2013～2018	2019～2023	2024～2025
Imported LNG (Million t/year)	0.30～1.60	1.76～2.72	3.20～3.31
Nominal annual LNG quantity (million t/year)	1.6	3	4
Number of sea water pumps	4(2)	5(2)	6(2)
Number of booster pumps for disaster prevention	3(1)	3(1)	3(1)
Sea water intake end portion 10,000φ	2	2	2
Sea water main pipeline 3,500φ	2	2	2

(Note) Numbers in parentheses show the number of back-up pumps.

For Areas C-M and D, seawater pumps for vaporizers are with 2,200 m^3/h of capacity and 30 m of lift with two back-ups, booster pumps for disaster control are centrifugal types with 3,000 m^3/h of capacity and 80 m of lift with one backup. Seawater facilities installation plan is shown in Table 5-4-46.

Table 5-4-46 Seawater facilities plan (Areas C-M and D)

Case	High Case		Low Case	
Area	Area C-M	Area D	Area C-M	Area D
Year	'19～'25	'19～'25	'20～'25	'20～'25
Imported LNG (Million t/year)	0.49	0.48	0.45	0.45
Nominal annual LNG quantity (million t/year)	1	1	1	1
Number of sea water pumps	4(2)	4(2)	4(2)	4(2)
Number of booster pumps for disaster prevention	3(1)	3(1)	3(1)	3(1)
Sea water intake end portion 2,800φ	2	2	2	2
Sea water main pipeline 900φ	2	2	2	2

(Note) Numbers in parentheses show the number of back-up pumps.

5-4-8 Gas Sendout Facilities

(1) Odorizers

The Gas Utility Industry Law in Japan requires that "the concentration of city gas must be at a level that is detectable when diluted in the atmosphere at a volume of 1/1,000." Ten mg/Nm^3 of a mixture of DMS (Dimethyl Sulfide) and TBM (Tertiary Butyl Mercaptan), which Osaka Gas uses, will be employed as an odorizer. A facility plan assuming an odorizer tank capacity of thirty days' worth is shown in Tables 5-4-47, 5-4-48, 5-4-49, 5-4-50 and 5-4-51 (Note: Specific weight of odorant is 0.8).

Table 5-4-47 Installation of odorant facilities (High Case; Area L-2)

Year	2013～2019	2020～2023	2024～2025	2020～2025
Imported LNG (Million t/year)	0.34～1.37	1.98～2.85	3.31～3.52	4.10～6.28
Nominal annual LNG quantity (million t/year)	1.6	3	4	～6.5
Nominal LNG handling volume (million Nm^3/day)	5.3	10	13	22
Odorant (kg/day)	53	100	130	220
Capacity of odorant tank (m^3)	2.0	3.7	4.9	7.9

Table 5-4-48 Installation of odorant facilities (High Case; Area L-3)

Year	2009～2016	2017～2021	2022～2024	2025
Imported LNG (Million t/year)	0.26～1.30	1.89～2.95	3.51～3.67	4.42
Nominal annual LNG quantity (million t/year)	1.6	3	4	5
Nominal LNG handling volume (million Nm^3/day)	5.3	10	13	17
Odorant (kg/day)	53	100	130	170
Capacity of odorant tank (m^3)	2.0	3.7	4.9	6.1

Table 5-4-49 Installation of odorant facilities (Low Case; Area L-2)

Year	2017～2020	2021～2025
Imported LNG (Million t/year)	0.61～1.31	1.65～2.54
Nominal annual LNG quantity (million t/year)	1.6	3
Nominal LNG handling volume (million Nm^3/day)	5.3	10
Odorant (kg/day)	53	100
Capacity of odorant tank (m^3)	2.0	3.7

Table 5-4-50 Installation of odorant facilities (Low Case; Area L-3)

Year	2013～2018	2019～2023	2024～2025
Imported LNG (Million t/year)	0.30～1.60	1.76～2.72	3.20～3.31
Nominal annual LNG quantity (million t/year)	1.6	3	4
Nominal LNG handling volume (million Nm³/day)	5.3	10	13
Odorant (kg/day)	53	100	130
Capacity of odorant tank (m³)	2.0	3.7	4.9

Table 5-4-51 Installation of odorant facilities (Areas C-M & D)

Case	High Case		Low Case	
Area	Area C-M	Area D	Area C-M	Area D
Year	2019～2025	2019～2025	2020～2025	2020～2025
Imported LNG (million t/year)	0.49	0.48	0.45	0.45
Nominal annual LNG quantity (million t/year)	1	1	1	1
Nominal LNG handling volume (million Nm³/day)	3.3	3.3	3.3	3.3
Odorant (kg/day)	33	33	33	33
Capacity of odorant tank (m³)	1.3	1.3	1.3	1.3

(2) Measurement and Quality Control

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

5-4-9 Utility Facilities

A list of the required utility facilities is provided in Table 5-4-52.

Table 5-4-52 Utility facilities

Name of facility	Specification
Chilling water facilities	300m^3/h unit×3 units
Compressor for instrument air	1000m^3/h unit×3 units
Nitrogen facilities	20m^3/h unit×2 units
Portable water facilities	500m^3
Sewage treatment facilities	20m^3/day

5-4-10 Electrical equipment

(1) Basic Design Concept

- The capacity of the equipment must accommodate the maximum power demand.
- To manufacture and supply gas during regular maintenance periods, two systems will be necessary for key equipment (from power receiving to distribution). For reliability, the two systems will operate independently.
- If commercial power fails, back-up power needs to be secured by means of back-up power generation equipment. The capacity of this power generation equipment must be large enough to operate disaster-control facilities.
- Monitoring and control must be centralized.

(2) Power Demand

The integration of electric power for gas manufacture/supply and maintenance is shown below.

Table 5-4-53 Required electric power (High Case; Area L-2)

Year	2013～2019		2020～2023		2024～2025	
LNG 1ry pump	4	220kW×2	6	220kW×4	7	220kW×5
LNG 2ry pump	4	1,450kW×2	6	1,450kW×4	7	1,450kW×5
LNG transfer pump	3	170kW×1	3	170kW×1	3	170kW×1
Sea water pump	4	780kW×2	6	780kW×4	6	780kW×4
Sea water electrolyte equipment	2	320kW×1	2	320kW×1	2	320kW×1
BOG compressor	5	1,100kW×4	5	1,100kW×4	5	1,100kW×4
BOG booster	4	2,800kW×3	4	2,800kW×3	4	2,800kW×3
Return gas blower	2	250kW×1	2	250kW×1	2	250kW×1
Minimum basic electric power	2000kW		2000kW		2000kW	
Electric power required for plant construction	1000kW		1000kW		1000kW	
Total electric power	21210kW		26340kW		28010kW	
Required power receiving capacity	32MVA		40MVA		43MVA	

(Note) Power factor 0.8; Allowance factor 1.2

Table 5-4-54 Required electric power (High Case; Area L-3)

Year	2009～2016		2017～2021		2022～2024		2025	
LNG 1ry pump	4	220kW×2	6	220kW×4	4	220kW×2	6	220kW×4
LNG 2ry pump	4	1450kW×2	6	1450kW×4	4	1450kW×2	6	1450kW×4
LNG transfer pump	3	170kW×1	3	170kW×1	3	170kW×1	3	170kW×1
Sea water pump	4	780kW×2	6	780kW×4	4	780kW×2	6	780kW×4
Sea water electrolyte equipment	2	320kW×1	2	320kW×1	2	320kW×1	2	320kW×1
BOG compressor	5	1100kW×4	5	1100kW×4	5	1100kW×4	5	1100kW×4
BOG booster	4	2800kW×3	4	2800kW×3	4	2800kW×3	4	2800kW×3
Return gas blower	2	250kW×1	2	250kW×1	2	250kW×1	2	250kW×1
Minimum basic electric power		2000kW		2000kW		2000kW		2000kW
Electric power required for plant construction		1000kW		1000kW		1000kW		1000kW
Total electric power		21210kW		26340kW		28010kW		30620kW
Required power receiving capacity		32MVA		40MVA		43MVA		51MVA

(Note) Power factor 0.8; Allowance factor 1.2

Table 5-4-55 Required electric power (Low Case; Area L-2)

Year	2017～2020		2021～2025	
LNG 1ry pump	4	220kW×2	5	220kW×3
LNG 2ry pump	4	1450kW×2	5	1450kW×3
LNG transfer pump	3	170kW×1	3	170kW×1
Sea water pump	4	780kW×2	5	780kW×3
Sea water electrolyte equipment	2	320kW×1	2	320kW×1
BOG compressor	5	1100kW×4	5	1100kW×4
BOG booster	4	2800kW×3	4	2800kW×3
Return gas blower	2	250kW×1	2	250kW×1
Minimum basic electric power		2000kW		2000kW
Electric power required for plant construction		1000kW		1000kW
Total electric power		21210kW		23890kW
Required power receiving capacity		32MVA		36MVA

(Note) Power factor 0.8; Allowance factor 1.2

Table 5-4-56 Required electric power (Low Case; Area L-3)

Year	2013～2018		2019～2023		2024～2025	
LNG 1ry pump	4	220kW×2	5	220kW×3	6	220kW×5
LNG 2ry pump	4	1450kW×2	5	1450kW×3	6	1450kW×5
LNG transfer pump	3	170kW×1	3	170kW×1	3	170kW×1
Sea water pump	4	780kW×2	5	780kW×3	6	780kW×4
Sea water electrolyte equipment	2	320kW×1	2	320kW×1	2	320kW×1
BOG compressor	5	1100kW×4	5	1100kW×4	5	1100kW×4
BOG booster	4	2800kW×3	4	2800kW×3	4	2800kW×3
Return gas blower	2	250kW×1	2	250kW×1	2	250kW×1
Minimum basic electric power	2000kW		2000kW		2000kW	
Electric power required for plant construction	1000kW		1000kW		1000kW	
Total electric power	21210kW		23890kW		26340kW	
Required power receiving capacity	32MVA		36MVA		40MVA	

(Note) Power factor 0.8; Allowance factor 1.2

Table 5-4-57 Required electric power (High Case and Low Case; Areas C-M and D)

Year	～2025	
LNG 1ry pump	4	110kW×2
LNG 2ry pump	4	630kW×2
LNG transfer pump	6	110kW×1
Sea water pump	4	780kW×1
Sea water electrolyte equipment	2	30kW×1
BOG compressor	5	1,100kW×4
BOG booster	4	2,800kW×3
Return gas blower	2	250kW×1
Minimum basic electric power	2,000kW	
Electric power required for plant construction	1,000kW	
Total electric power	19,920kW	
Required power receiving capacity	29MVA	

(Note) Power factor 0.8; Allowance factor 1.2

Table 5-4-58 Required minimum electric power for fire prevention and extinguishing

Equipment name	Motor capacity	Number of unit	Required power	Required total power	Rash power at starting
Minimum basic electric power	1,000 kW	–	1,000 kW	1,000 kW	2,000 kW
Hi-Ex, Water pump	500 kW	1	500 kW	1,500 kW	2,000 kW
Sea water pump for vaporizer	780 kW	1	780 kW	2,280 kW	3,060 kW
Sea water pump for fire fighting	900 kW	1	900 kW	3,180 kW	4,080 kW
Sea water pump for fire-fighting	900 kW	1	900 kW	4,080 kW	4,980 kW

* "Rush power" is pre-start electric power surge (capacity of respective motor × 2).

Emergency power generation equipment: Gas turbine 5,000 kW (power factor: 0.8) × 1 unit, designed at 40℃

(3) Outline of Equipment

(Power-receiving/distribution equipment)

- Power-receiving equipment must entail two systems capable of supplying enough power to manufacture/supply gas and unload LNG while commercial power equipment is being inspected.
- Power-receiving transformers must entail two systems of equipment capable of supplying enough power to manufacture and supply gas. They must be capable of meeting an increase in power demand when unloading LNG, running the two systems together. The two systems must operate independently.
- The bus-line configuration of the distribution equipment must be capable of supplying enough power to manufacture and supply gas when one bus-line is disconnected for regular maintenance and others.
- The equipment supplies power to large motors and regional transforming equipment. Power is supplied to regional transforming equipment via two systems.

① Power-receiving equipment

Method 69 kV – 60 Hz, two lines (permanent, reserve)

Capacity 50 MVA/line (420 A)

Type GIS (gas insulation switch gear), installed outdoors

② Power-receiving/transformer

Capacity 25 MVA x 2

Type 69 kV/6.24 kV, hydraulic self-cooling, installed outdoors

Operation Operate two systems independently

③ Distribution equipment

Type Single bus line divided into four

System Metal-clad switchgear, installed indoors

Operation Operate two systems independently

(Areal transforming equipment)

- Areal transforming equipment is responsible for supplying power to small- and medium-sized motors and lighting equipment.
- The bus-line configuration of the distribution equipment must be capable of supplying enough power to manufacture and supply gas when one bus-line is disconnected for regular maintenance and others.

①Areal transforming equipment

- Metal-clad switchgear, installed indoors
- Use combination starter for high-voltage distribution equipment
- Operate two systems independently
- Transformer for distribution Power 6.24 kV/440 V, Lighting 6.24 kV/110-220 V, installed outdoors

(Building for substation room)

- The substation room must be of the enclosed type, ferro-concrete, and equipped with an air-conditioner.

(Distribution in the plant)

- Cables must be constructed in an open-pit.
- Fire-retardant CV cables must be used.

5-4-11 Control and supervision systems

(1) Design Policy

This LNG terminal has the responsibility to maintain a stable gas send-out capability according to varying gas demand for town gas consumption, electric power generation, and NGV vehicles.

The process control and supervision system must consider the following items.

- Gas send-out reliability and system and facilities redundancy in case of mal function or incident.
- Terminal management efficiency and labor reduction.
- Easy and efficiency maintenance.
- Easy and efficiency system expansion according to increment of gas demand in future and system hardware replacement almost every 15 years.
- Adoption of experienced and proven latest technology, especially the integrated information system.

So, this system is based on Distributed Control System (DCS) and Integrated Information System.

(2) System Composition.

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

Required major systems are as follows.

- Distributed Control system of LNG facilities that include high-voltage electric power supply equipments.
- Supervision computer system for process data saver and interface of office network.
- Disaster prevention facilities control and supervision system for detecting LNG and/or gas leakage, fire detection and control of fire extinguisher and/or water deluge system of LNG tanks.
- Laboratory system for unloaded or storage LNG and gas analyzer for send-out gas.
- Mooring monitoring system included for weather, tidal and wave condition monitoring.
- Unloading arm supervision system, which is closely related to arm operation.
- As an independent system, intruder supervision and alarm system for Guardhouse.
- Closed circuit television system for the entire terminal area.
- Paging system for the entire terminal area.
- Standalone system for software debugging when changing or adding programs, and training of new operators.

Note;

- This system excludes Vessel Navigation System for harbors. This kind of navigation system is assumed to be controlled and supervised by a Governmental Organization or others.

- Also exclude personnel affairs, organizational management, financial data saver, and other systems related to company management. These systems shall be realized for office automation systems.
- Abbreviations

  DCS = Distributed Control System

  SSS = Safety and Security System

  MMS = Marine Monitoring System

  PMS = unloading arm Position Monitoring System

  ESD = Emergency Shut Down system

  SCS = Supervision Computing System

(3) Design Concept

1) System segregation and integration.

(a) DCS segregate SSS (Safety and Security System), because of importance and operability in case of an accident.

(b) DCS segregate PMS (unloading arm Position Monitoring System), MMS (Marine Monitoring system), and Laboratory System, because of these particular functions.

(c) Most data from DCS, SSS, and Laboratory System are integrated in SCS (Supervision Computing System), and connected to an office network through Data server and firewall.

2) Redundancy and reliability.

(a) DCS and SSS are composed of a full back-up system. Main system and back-up system are almost the same to apply the same software to reduce software production costs.

After approximately 15 years system hardware must be replaced. This design structure makes it easy for hardware replacement without shutting down the process by applying a "Hot Cut Over" operation.

Switching over is done automatically in the case of a computer watchdog, but in other cases an operator can switchover manually according to his judgment.

(b) DCS is divided into two groups. Each group system is located in a different room independently and electric power is supplied by different systems.

Each group handles approximately half of the LNG terminal facilities to avoid all facilities being shut down at the same time due to electric power failure and/or fire.

(c) Common elements such as Data way, operator consoles, and printers have as duplex or dual structure for redundancy.

(d) To cope with simultaneous shutdown, which is mostly caused by electric power failures, computer software is basically designed to operate interactively with the operator.

5-4-12 Main facilities and Layout

Table 5-4-59 shows a list of the main facilities for each case. Figures 5-4-1, 5-4-2 and 5-4-3 show the layout of LNG receiving terminals for five million, four million and three million tons per annum.