

TABLE 16 LPG PRODUCTION IN 1986

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LPG Product lb-Mols/Hr	Molecular Weight lb	(1)x(2) LPG Weight lb/Hr	(3)-2.20462 LPG Weight Kg/Hr	(4)x24x10 ³ LPG Weight t/D	(5)x365x10 ³ LPG Weight 10 ³ t/Y	Specific Quantity 60°F/60°F	(6)÷(7) LPG Volume 10 ³ Kl/y
ETHANE	30.068	962.2	436.4	10.47	3.82	0.374	10.21
PROPANE	44.094	30,173.5	13,686.5	328.48	119.90	0.508	236.02
BUTANE (ISO+N)	58.120	17,191.9	7,798.1	187.15	68.31	0.584	116.97
PENTANE (ISO+N)	72.146	923.5	418.9	10.05	3.67	0.631	5.82
HEXANE	86.172	8.6	3.9	0.09	0.03	0.664	0.05
TOTAL		49,259.7	22,343.8	536.24	195.73		369.07

TABLE 17 LPG PRODUCTION IN 1987

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LPG Product lb-Mols/Hr	Molecular Weight lb	(1)x(2) LPG Weight lb/Hr	(3)÷2.20462 LPG Weight Kg/Hr	(4)x24÷10 ³ LPG Weight t/D	(5)x365÷10 ³ LPG Weight 10 ³ t/Y	Specific Quantity 60°F/60°F 60°F/60°F	(6)÷(7) LPG Volume 10 ³ Kl/Y
ETHANE	30.068	1,142.6	518.3	12.44	4.54	0.374	12.14
PROPANE	44.094	35,799.9	16,238.6	389.73	142.25	0.508	280.02
BUTANE (ISO+N)	58.120	20,342.0	9,227.0	221.45	80.83	0.584	138.41
PENTANE (ISO+N)	72.146	1,096.6	497.4	11.94	4.36	0.631	6.91
HEXANE	86.172	8.6	3.9	0.09	0.03	0.664	0.05
TOTAL		58,389.7	26,485.2	635.65	232.01		437.53

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for ensuring transparency and accountability in financial operations. This section also highlights the role of internal controls in preventing fraud and errors.

2. The second part of the document focuses on the implementation of robust risk management strategies. It outlines various risk assessment techniques and provides guidance on how to identify, measure, and mitigate potential risks. The text stresses the need for a proactive approach to risk management to protect the organization's assets and reputation.

3. The third part of the document addresses the importance of effective communication and reporting. It discusses the need for clear and concise communication channels and the role of regular reporting in keeping stakeholders informed. This section also touches upon the importance of maintaining accurate financial statements and providing timely updates to investors and other interested parties.

4. The fourth part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for ensuring transparency and accountability in financial operations. This section also highlights the role of internal controls in preventing fraud and errors.

5. The fifth part of the document focuses on the implementation of robust risk management strategies. It outlines various risk assessment techniques and provides guidance on how to identify, measure, and mitigate potential risks. The text stresses the need for a proactive approach to risk management to protect the organization's assets and reputation.

6. The sixth part of the document addresses the importance of effective communication and reporting. It discusses the need for clear and concise communication channels and the role of regular reporting in keeping stakeholders informed. This section also touches upon the importance of maintaining accurate financial statements and providing timely updates to investors and other interested parties.

7. The seventh part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for ensuring transparency and accountability in financial operations. This section also highlights the role of internal controls in preventing fraud and errors.

8. The eighth part of the document focuses on the implementation of robust risk management strategies. It outlines various risk assessment techniques and provides guidance on how to identify, measure, and mitigate potential risks. The text stresses the need for a proactive approach to risk management to protect the organization's assets and reputation.

9. The ninth part of the document addresses the importance of effective communication and reporting. It discusses the need for clear and concise communication channels and the role of regular reporting in keeping stakeholders informed. This section also touches upon the importance of maintaining accurate financial statements and providing timely updates to investors and other interested parties.

10. The tenth part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for ensuring transparency and accountability in financial operations. This section also highlights the role of internal controls in preventing fraud and errors.

TABLE 18 LPG PRODUCTION IN 1988

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	LPG Product lb-Mols/Hr	Molecular Weight lb	(1)x(2) LPG Weight lb/Hr	(3)+2.20462 LPG Weight Kg/Hr	(4)x24÷10 ³ LPG Weight t/D	(5)x365÷10 ³ LPG Weight 10 ³ t/Y	Specific Quantity 60°F/60°F 60°F/60°F	LPG Volume 10 ³ Kl/Y
ETHANE	43.7	30.068	1,314.0	596.0	14.30	5.22	0.374	13.96
PROPANE	946.6	44.094	41,739.4	18,932.7	454.38	165.85	0.508	326.48
BUTANE (ISO+N)	407.0	58.120	23,654.8	10,729.6	257.51	93.99	0.584	160.94
PENTANE (ISO+N)	17.6	72.146	1,269.8	576.0	13.82	5.04	0.631	7.99
HEXANE	0.1	86.172	8.6	3.9	0.09	0.03	0.664	0.05
TOTAL	1,415.0		67,986.6	30,838.2	740.10	270.13		509.42

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for transparency and accountability, particularly in financial reporting and auditing.

2. The second part of the document outlines the various methods and techniques used to collect and analyze data. This includes both qualitative and quantitative approaches, as well as the use of statistical tools and software to process large volumes of information.

3. The third part of the document focuses on the interpretation and presentation of the collected data. It discusses how to identify trends, patterns, and anomalies, and how to communicate these findings effectively to stakeholders through reports, presentations, and visual aids.

4. The fourth part of the document addresses the ethical considerations and challenges associated with data collection and analysis. It highlights the need for privacy, confidentiality, and integrity, and provides guidance on how to navigate these issues responsibly.

5. The fifth part of the document concludes with a summary of the key points and offers recommendations for future research and practice. It encourages ongoing learning and adaptation to new technologies and methodologies in the field.

TABLE 19 LPG PRODUCTION IN 1989

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	LPG Product lb-Mols/Hr	Molecular Weight lb	(1)x(2) LPG Weight lb/Hr	(3)÷2.20462 LPG Weight Kg/Hr	(4)x24÷10 ³ LPG Weight t/D	(5)x365÷10 ³ LPG Weight 10 ³ t/Y	Specific Quantity 60°F/60°F 60°F/60°F	LPG Volume 10 ³ Kl/Y
ETHANE	50.2	30.068	1,509.4	684.7	16.43	6.00	0.374	16.04
PROPANE	1,087.4	44.094	47,947.8	21,748.8	521.97	190.52	0.508	375.04
BUTANE (ISO+N)	457.2	58.120	27,153.7	12,316.7	295.60	107.89	0.584	184.74
PENTANE (ISO+N)	20.1	72.146	1,450.1	657.8	15.79	5.76	0.631	9.13
HEXANE	0.1	86.172	8.6	3.9	0.09	0.03	0.664	0.05
TOTAL	1,625.0		78,069.6	35,411.9	849.88	310.20		585.00

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TABLE 20. LPG PRODUCTION IN 1990

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	LPG Product lb-Mols/Hr	Molecular Weight lb	(1)x(2) LPG Weight lb/Hr	(3)÷2.20462 LPG Weight Kg/Hr	(4)x24÷10 ³ LPG Weight t/D	(5)x365÷10 ³ LPG Weight 10 ³ t/Y	Specific Quantity 60°F/60°F 60°F/60°F	(6)÷(7) LPG Volume 10 ³ Kl/Y
ETHANE	57.0	30.068	1,713.9	777.4	18.66	6.81	0.374	18.21
PROPANE	1,234.9	44.094	54,451.7	24,698.9	592.56	216.28	0.508	425.75
BUTANE (ISO+N)	530.2	58.120	30,815.2	13,977.6	335.46	122.44	0.584	209.66
PENTANE (ISO+N)	22.7	72.146	1,637.7	742.8	17.83	6.51	0.631	10.32
HEXANE	0.1	86.172	8.6	3.9	0.09	0.03	0.664	0.05
TOTAL	1,844.9		88,627.1	40,200.6	964.60	352.07		663.99

TABLE 21 REQUIREMENT OF EACH PRODUCT AND TOTAL CRUDE OIL THRU-PUT (EXISTING, EXPANSION AND/OR NEW)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
LPG 10 ³ Kl/y	% of (1) on Crude (25)	Benzine 10 ³ Kl/y	% of (3) on Crude (23)	Jet Fuel 10 ³ Kl/y	% of (5) on Crude (23)	Kerosene 10 ³ Kl/y	% of (7) on Crude (23)	Diesol Oil 10 ³ Kl/y	% of (9) on Crude (23)	Fuel Oil (Incl. N.G.) 10 ³ Kl/y	N.G. Equi. Fuel Oil 10 ³ Kl/y	(11)-(12) Fuel Oil (Excl. N.G.) 10 ³ Kl/y	% of (13) on Crude (23)	Lube 10 ³ Kl/y
Production 240		2,117		752		280		2,797		2,828				
Demand														
292	2.1	2,625	19.1	916	6.6	342	2.5	4,392	31.9	4,223			30.6	12
317	2.1	2,843	19.0	992	6.6	371	2.5	4,757	31.8	4,574			30.6	15
356	2.1	3,200	19.0	1,116	6.6	417	2.5	5,354	31.7	5,149			30.5	18
396	2.2	3,559	20.3	1,241	7.1	464	2.6	5,954	33.9	5,726	1,189	4,537	25.3	21
444	2.4	3,986	21.2	1,390	7.4	520	2.8	6,669	35.5	6,413	2,141	4,272	22.8	24
464	2.4	4,163	21.5	1,452	7.5	543	2.8	6,966	36.1	6,699	2,529	4,170	21.5	27
479	2.5	4,297	22.6	1,499	7.7	560	3.0	7,189	37.9	6,913	3,578	3,335	17.6	30
523	2.5	4,692	22.1	1,637	7.7	612	2.9	7,851	37.1	7,549	3,527	4,022	19.5	34
571	2.5	5,131	22.4	1,790	7.8	669	2.9	8,585	37.5	8,256	4,106	4,150	18.1	38
620	2.5	5,567	22.0	1,942	7.7	726	2.9	9,315	36.9	8,958	4,038	4,920	19.5	42
644	2.5	5,961	22.3	2,079	7.8	777	2.9	9,975	37.3	9,592	4,634	4,958	18.5	46
706	2.5	6,339	22.0	2,211	7.7	825	2.9	10,606	36.9	10,199	4,577	5,622	15.5	50
749	2.4	6,723	21.8	2,345	7.6	877	2.9	11,250	36.4	10,818	4,506	6,312	20.4	54
808	2.4	7,257	21.5	2,531	7.5	946	2.8	12,143	36.0	11,677	4,506	7,171	21.3	58
868	2.4	7,799	21.3	2,720	7.4	1,017	2.8	13,049	35.6	12,548	4,506	8,042	22.0	62
933	2.4	8,374	21.1	2,921	7.4	1,092	2.7	14,011	35.3	13,473	4,506	8,967	22.6	66
1,003	2.4	9,002	21.0	3,140	7.3	1,174	2.7	15,063	35.1	14,484	4,506	9,978	23.2	70
1,077	2.3	9,671	20.8	3,373	7.3	1,261	2.7	16,183	34.8	15,561	4,506	11,055	23.8	74
1,156	2.3	10,382	20.6	3,621	7.2	1,354	2.7	17,372	34.6	16,705	4,506	12,199	24.3	78
1,232	2.3	11,060	20.5	3,858	7.2	1,442	2.7	18,507	34.3	17,796	4,506	13,290	24.7	82
1,311	2.3	11,774	20.4	4,107	7.1	1,535	2.7	19,701	34.2	18,945	4,506	14,439	25.0	86
1,395	2.3	12,528	20.3	4,370	7.1	1,633	2.6	20,963	34.0	20,158	4,506	15,652	25.4	90
1,483	2.2	13,321	20.2	4,646	7.1	1,737	2.6	22,289	33.9	21,433	4,506	16,927	25.7	94

Note: *1 Unfinished products is only including in 1977.
 *2 The crude oil thru-put of 3 existing refineries, this is conceived the maximum capacity of existing 3 refineries.
 *3 (25) minus *2 (1,840 B/SD), it is the capacity of the new refinery.

TABLE 21 REQUIREMENT OF EACH PRODUCT AND TOTAL CRUDE OIL THRU-PUT (EXISTING, EXPANSION AND/OR NEW REFINERY) AND EXPANSION AND/OR NEW REFINERY CRUDE OIL THRU-PUT

(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)*1	(21)	(22)
Kerosene 10 ³ kl/y	% of (7) on Crude (23)	Diesol Oil 10 ³ kl/y	% of (9) on Crude (23)	Fuel Oil (Incl. N.G.) 10 ³ kl/y	N.G. Equi. Fuel Oil 10 ³ kl/y	(11)-(12) Fuel Oil (Excl. N.G.) 10 ³ kl/y	% of (13) on Crude (23)	Lube Oil 10 ³ kl/y	% of (15) on Crude (23)	Bitumen 10 ³ kl/y	% of (17) on Crude (23)	Petroleum Product Total 10 ³ kl/y	Loss and Own Fuel % on Products	Loss and Own Fuel 10 ³ kl/y	% of (22) on Crude (23)
280		2,797		2,828						156	1.6	9,170	9.5	488	5.0
342	2.5	4,392	31.9	4,223			30.6	128	0.9	205	1.5	13,123	5.0	656	4.0
371	2.5	4,757	31.8	4,574			30.6	152	1.0	236	1.6	14,242	5.0	712	4.0
417	2.5	5,354	31.7	5,149			30.5	187	1.1	281	1.7	16,060	5.0	803	4.8
464	2.6	5,954	33.9	5,726	1,189	4,537	25.3	225	1.3	347	2.0	15,723	5.0	836	4.8
520	2.8	6,669	35.5	6,413	2,141	4,272	22.8	291	1.5	388	2.1	17,960	4.5	808	4.3
543	2.8	6,966	36.1	6,695	2,529	4,170	21.5	325	1.7	406	2.1	18,489	4.5	832	4.3
560	3.0	7,182	37.9	6,913	3,578	3,335	17.6	377	2.0	419	2.2	18,155	4.5	817	4.3
612	2.9	7,851	37.1	7,549	3,527	4,022	19.5	457	2.2	457	2.2	20,251	4.5	911	4.3
669	2.9	8,585	37.5	8,256	4,106	4,150	18.1	500	2.2	500	2.2	21,896	4.5	985	4.4
726	2.9	9,315	36.9	8,958	4,033	4,920	19.5	543	2.1	543	2.1	24,174	4.5	1,088	4.3
777	2.9	9,975	37.3	9,592	4,034	4,958	18.5	581	2.2	581	2.2	25,576	4.5	1,151	4.3
825	2.9	10,606	36.9	10,122	4,577	5,622	19.5	618	2.1	618	2.1	27,546	4.5	1,240	4.3
877	2.9	11,250	36.4	10,818	4,506	6,312	20.4	655	2.1	655	2.1	29,566	4.5	1,330	4.3
946	2.8	12,143	36.0	11,677	4,506	7,171	21.3	707	2.1	707	2.1	32,270	4.5	1,452	4.3
1,017	2.8	13,049	35.6	12,548	4,506	8,042	22.0	760	2.1	760	2.1	35,015	4.5	1,576	4.3
1,092	2.7	14,011	35.3	13,473	4,506	8,967	22.6	816	2.1	816	2.1	37,930	4.5	1,707	4.3
1,174	2.7	15,063	35.1	14,484	4,506	9,978	23.2	877	2.0	877	2.0	41,114	4.5	1,850	4.3
1,261	2.7	16,183	34.8	15,561	4,506	11,055	23.8	943	2.0	943	2.0	44,506	4.5	2,003	4.3
1,354	2.7	17,372	34.6	16,705	4,506	12,199	24.3	1,011	2.0	1,011	2.0	48,106	4.5	2,165	4.3
1,442	2.7	18,507	34.3	17,796	4,506	13,290	24.7	1,078	2.0	1,078	2.0	51,545	4.5	2,320	4.3
1,535	2.7	19,701	34.2	18,945	4,506	14,439	25.0	1,147	2.0	1,147	2.0	55,161	4.5	2,482	4.3
1,633	2.6	20,963	34.0	20,158	4,506	15,652	25.4	1,221	2.0	1,221	2.0	58,983	4.5	2,654	4.3
1,737	2.6	22,289	33.9	21,433	4,506	16,927	25.7	1,298	2.0	1,298	2.0	62,999	4.5	2,835	4.3

*1 is conceivable the maximum capacity of existing 3 refineries.

OIL THRU-PUT (EXISTING, EXPANSION AND/OR NEW REFINERY) AND EXPANSION AND/OR NEW REFINERY CRUDE OIL THRU-PUT

ATTACH. 21

(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)*1	(21)	(22)	(23)	(24)	(25)	(26)
N.G. Equi. Fuel Oil 10 ³ kl/y	(11)-(12) Fuel Oil (Excl. N.G.) 10 ³ kl/y	% of (13) on Crude (23)	Lube Oil 10 ³ kl/y	% of (13) on Crude (23)	Bitumen 10 ³ kl/y	% of (17) on Crude (23)	Petroleum Product Total 10 ³ kl/y	Loss and Own Fuel % on Products	Loss and Own Fuel 10 ³ kl/y	% of (21) on Crude (23)	Total Crude Oil Thru-put 10 ³ kl/y	Total %	(23) = 330x6.3 Crude Oil Thru-put B/SD	Expan. and/or New Ref. Crude Oil Thru-put B/SD
					156	1.6	9,170	9.5	488	5.1	9,658			184,000*2
		30.6	128	0.9	205	1.5	13,123	5.0	656	4.8	13,779	100	263,000	
		30.6	152	1.0	236	1.6	14,242	5.0	712	4.8	14,954	100	285,000	
		30.5	187	1.1	281	1.7	16,060	5.0	803	4.8	16,863	100	322,000	
1.189	4,537	25.3	225	1.3	347	2.0	15,723	5.0	836	4.8	17,559	100	335,000	151,000*3
2,141	4,272	22.8	291	1.5	388	2.1	17,960	4.5	808	4.3	18,768	100	358,000	174,000
2,523	4,170	21.6	325	1.7	406	2.1	18,489	4.5	832	4.3	19,321	100	369,000	185,000
3,578	3,335	17.6	377	2.0	419	2.2	18,155	4.5	817	4.3	18,972	100	362,000	178,000
3,527	4,022	19.5	457	2.2	457	2.2	20,251	4.5	911	4.3	21,162	100	404,000	220,000
4,106	4,150	18.1	500	2.2	500	2.2	21,896	4.5	985	4.4	22,881	100	437,000	253,000
4,038	4,920	19.5	543	2.1	543	2.1	24,174	4.5	1,088	4.3	25,262	100	482,000	298,000
4,034	4,958	18.5	581	2.2	581	2.2	25,576	4.5	1,151	4.3	26,727	100	510,000	326,000
4,577	5,622	19.5	618	2.1	618	2.1	27,546	4.5	1,240	4.3	28,786	100	550,000	366,000
4,506	6,312	20.4	655	2.1	655	2.1	29,566	4.5	1,330	4.3	30,896	100	590,000	406,000
4,506	7,171	21.3	707	2.1	707	2.1	32,270	4.5	1,452	4.3	33,722	100	644,000	460,000
4,506	8,042	22.0	760	2.1	760	2.1	35,015	4.5	1,576	4.3	36,591	100	699,000	515,000
4,506	8,967	22.6	816	2.1	816	2.1	37,930	4.5	1,707	4.3	39,637	100	757,000	573,000
4,506	9,978	23.2	877	2.0	877	2.0	41,114	4.5	1,850	4.3	42,964	100	820,000	636,000
4,506	11,055	23.8	943	2.0	943	2.0	44,506	4.5	2,003	4.3	46,509	100	888,000	704,000
4,506	12,199	24.3	1,011	2.0	1,011	2.0	48,106	4.5	2,165	4.3	50,271	100	960,000	776,000
4,506	13,290	24.7	1,078	2.0	1,078	2.0	51,545	4.5	2,320	4.3	53,865	100	1,028,000	844,000
4,506	14,439	25.0	1,147	2.0	1,147	2.0	55,161	4.5	2,482	4.3	57,643	100	1,100,000	916,000
4,506	15,652	25.4	1,221	2.0	1,221	2.0	58,983	4.5	2,654	4.3	61,637	100	1,177,000	993,000
4,506	16,927	25.7	1,298	2.0	1,298	2.0	62,999	4.5	2,835	4.3	65,834	100	1,257,000	1,073,000

TABLE 22 REQUIREMENT OF EACH PRODUCT AND TOTAL CRUDE OIL THRU-PUT FOR EXPANSION AN

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
LPG Demand -1977's Capacity 10 ³ kl/y	% of (1) on Crude (22)	Benzine Demand-1977's Capacity 10 ³ kl/y	% of (3) on Crude (22)	Jet Fuel Demand-1977's Capacity 10 ³ kl/y	% of (5) on Crude (22)	Kerosene Demand-1977's Capacity 10 ³ kl/y	% of (7) on Crude (22)	Diesel Oil Demand-1977's Demand 10 ³ kl/y	% of (9) on Crude (22)	Fuel Oil (Incl.N.G.Dem. -1977's Dem. 10 ³ kl/y	Natural Gas (Equivalent) 10 ³ kl/y	(11)-(12) Fuel Oil (Incl. N.G.) 10 ³ kl/y	% of (13) on Crude (22)	Lu
77														
78	52	508		164		62		1,595		1,395				
79	77	726		240		91		1,960		1,746				
80	115	1,063		364		137		2,557		2,321				
81	156	1,442	18.4	439	6.2	184	2.3	3,157	40.2	2,898	1,189	1,709	21.8	
82	204	1,869	20.5	638	7.0	240	2.6	3,872	42.4	3,585	2,141	1,444	15.8	
83	224	2,046	21.1	700	7.2	263	2.7	4,169	43.0	3,871	2,529	1,342	13.9	
84	239	2,180	23.4	747	8.0	280	3.0	4,392	47.0	4,085	3,578	507	5.4	
85	283	2,575	22.3	885	7.7	332	2.9	5,054	43.9	4,721	3,527	1,194	10.4	
86	331	3,014	22.8	1,038	7.8	389	2.9	5,788	43.8	5,428	4,106	1,322	10.0	
87	380	3,450	22.1	1,190	7.6	446	2.9	6,518	41.8	6,130	4,038	2,092	13.4	
88	424	3,844	22.5	1,327	7.8	497	2.9	7,178	42.1	6,764	4,634	2,130	12.5	
89	466	4,222	22.1	1,459	7.6	546	2.9	7,809	40.9	7,371	4,577	2,794	14.6	
90	500	4,606	21.7	1,593	7.5	597	2.8	8,453	39.9	7,990	4,506	3,484	16.4	
91	568	5,140	21.4	1,779	7.4	666	2.8	9,346	38.9	8,849	4,506	4,343	18.1	
92	628	5,582	21.1	1,968	7.3	737	2.8	10,252	38.2	9,720	4,506	5,214	19.4	
93	693	6,257	20.9	2,169	7.3	812	2.7	11,214	37.5	10,645	4,506	6,139	20.6	
94	763	6,835	20.7	2,388	7.2	894	2.7	12,266	36.9	11,656	4,506	7,150	21.5	
95	837	7,554	20.6	2,621	7.1	981	2.7	13,386	36.4	12,733	4,506	8,227	22.4	
96	916	8,265	20.4	2,869	7.1	1,074	2.7	14,575	36.0	13,877	4,506	9,371	23.1	1
97	992	8,943	20.3	3,106	7.1	1,162	2.6	15,710	35.7	14,968	4,506	10,462	23.7	1
98	1,071	9,657	20.2	3,355	7.0	1,255	2.6	16,904	35.4	16,117	4,506	11,611	24.3	1
99	1,155	10,411	20.1	3,618	7.0	1,353	2.6	18,166	35.1	17,330	4,506	12,824	24.8	1
100	1,243	11,204	20.0	3,894	7.0	1,457	2.6	19,492	34.8	18,505	4,506	14,099	25.2	1

H PRODUCT AND TOTAL CRUDE OIL THRU-PUT FOR EXPANSION AND/OR NEW REFINERY

ATTACH. 22

(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Fuel Oil (Incl. N.G. Dem. -1977's Dem. 10 ³ kl/y	Natural Gas (Equivalent) 10 ³ kl/y	(11)-(12) Fuel Oil (Incl. N.G.) 10 ³ kl/y	% of (13) on Crude (22)	Lube Oil 10 ³ kl/y	% of (15) on Crude (22)	Bitumen Demand-1977's Production 10 ³ kl/y	% of (17) on Crude (22)	Petroleum Product Total 10 ³ kl/y	Loss and Own Fuel 10 ³ kl/y	% of (20) on Crude (22) 10 ³ kl/y	Crude Oil Thru-put 10 ³ kl/y	% of (22) on Crude (22)	Crude Oil Thru-put (22)÷330x6.3 B/SD
1,395				123		49			158				
1,746				152		80			203				
2,321				187		125			276				
2,898	1,189	1,709	21.8	225	2.9	191	2.4	7,553	298	3.8	7,851	100	150,000
3,585	2,141	1,444	15.8	291	3.2	232	2.5	8,790	347	3.8	9,137	100	174,000
3,871	2,529	1,342	13.9	325	3.4	250	2.6	9,319	368	3.8	9,687	100	185,000
4,085	3,578	507	5.4	377	4.0	263	2.8	8,985	355	3.8	9,340	100	178,000
4,721	3,527	1,194	10.4	457	4.8	301	2.6	11,081	438	3.8	11,519	100	220,000
5,428	4,106	1,322	10.0	500	3.3	344	2.6	12,726	503	3.8	13,229	100	253,000
6,130	4,038	2,092	13.4	543	3.5	387	2.5	15,006	593	3.8	15,599	100	298,000
6,764	4,634	2,130	12.5	581	3.4	425	2.5	16,406	648	3.8	17,054	100	326,000
7,371	4,577	2,794	14.6	618	3.2	462	2.4	18,376	726	3.8	19,102	100	365,000
7,990	4,506	3,484	16.4	655	3.1	499	2.4	20,396	806	3.8	21,202	100	405,000
8,849	4,506	4,343	18.1	707	2.9	551	2.3	23,100	912	3.8	24,012	100	458,000
9,720	4,506	5,214	19.4	760	2.8	604	2.3	25,845	1,021	3.8	26,866	100	513,000
10,645	4,506	6,139	20.6	816	2.7	650	2.2	28,760	1,136	3.8	29,896	100	571,000
11,656	4,506	7,150	21.5	877	2.7	721	2.2	31,944	1,262	3.8	33,206	100	634,000
12,733	4,506	8,227	22.4	943	2.6	787	2.1	35,336	1,396	3.8	36,732	100	701,000
13,877	4,506	9,371	23.1	1,011	2.5	855	2.1	38,936	1,538	3.8	40,474	100	773,000
14,968	4,506	10,462	23.7	1,078	2.4	922	2.1	42,375	1,674	3.8	44,049	100	841,000
16,117	4,506	11,611	24.3	1,147	2.4	991	2.1	45,991	1,817	3.8	47,808	100	913,000
17,330	4,506	12,824	24.8	1,221	2.3	1,065	2.1	49,813	1,968	3.8	51,781	100	989,000
18,505	4,506	14,099	25.2	1,298	2.3	1,142	2.1	53,829	2,126	3.8	55,955	100	1,068,000

TABLE 23 EXAMPLE OF CONSTRUCTION SCHEDULE FOR EACH REFINERY (UNIT : BPSD)

	CASE-1								CASE-2						
	A Exist. (63,000)	B Exist. (74,500)	C Exist. (46,500)	NO.1 New (-)	No.2 New (-)	No.3 New (-)	Total (184,000)		A Exist. (63,000)	B Exist. (74,500)	C Exist. (46,500)	No.1 New (-)	No.2 New (-)	No.3 New (-)	Total (184,000)
1983	45,000 (108,000)	65,000 (139,500)	35,000 (81,500)	90,000 (90,000)	0	0	235,000 (419,000)	1983	45,000 (108,000)	65,000 (139,500)	35,000 (81,500)	90,000 (90,000)	0	0	235,000 (419,000)
84								84							
85				(2)			50,000 (469,000)	85				(2')			100,000 (519,000)
86				50,000 (140,000)			50,000 (519,000)	86				100,000 (190,000)			
87				50,000 (190,000)				87							
88				50,000 (240,000)			50,000 (569,000)	88				125,000 (315,000)			125,000 (644,000)
89								89							
1990					(5) 75,000 (75,000)		75,000 (644,000)	1990							
91					(6) 75,000 (150,000)		75,000 (719,000)	91				(4') 150,000 (150,000)			150,000 (794,000)
92								92							
93					(7) 75,000 (225,000)		75,000 (794,000)	93							
94					(8) 75,000 (300,000)		75,000 (869,000)	94				(5') 150,000 (300,000)			150,000 (944,000)
95						(9) 75,000 (75,000)	75,000 (944,000)	95						(6')	
96						(10) 95,000 (150,000)	75,000 (1,019,000)	96						(6') 150,000 (300,000)	150,000 (1,094,000)
97						(11) 75,000 (225,000)	75,000 (1,094,000)	97						(7')	
98						(12) 75,000 (300,000)	75,000 (1,169,000)	98						(7') 150,000 (300,000)	150,000 (1,244,000)
99		(13) 75,000 (214,500)					75,000 (1,244,000)	99							
2000			(14) 75,000 (156,500)				75,000 (1,319,000)	2000		(8') 150,000 (289,500)					150,000 (1,394,000)

FIG.1 TOTAL THROUGH-PUT,
EXPANSION AND/OR NEW REFINERY
CONSTRUCTION SCHEDULE 1983~2000

UNIT: 10³ BPSD

BPSD
1,300

1,200

1,100

1,000

900

800

700

600

500

400

300

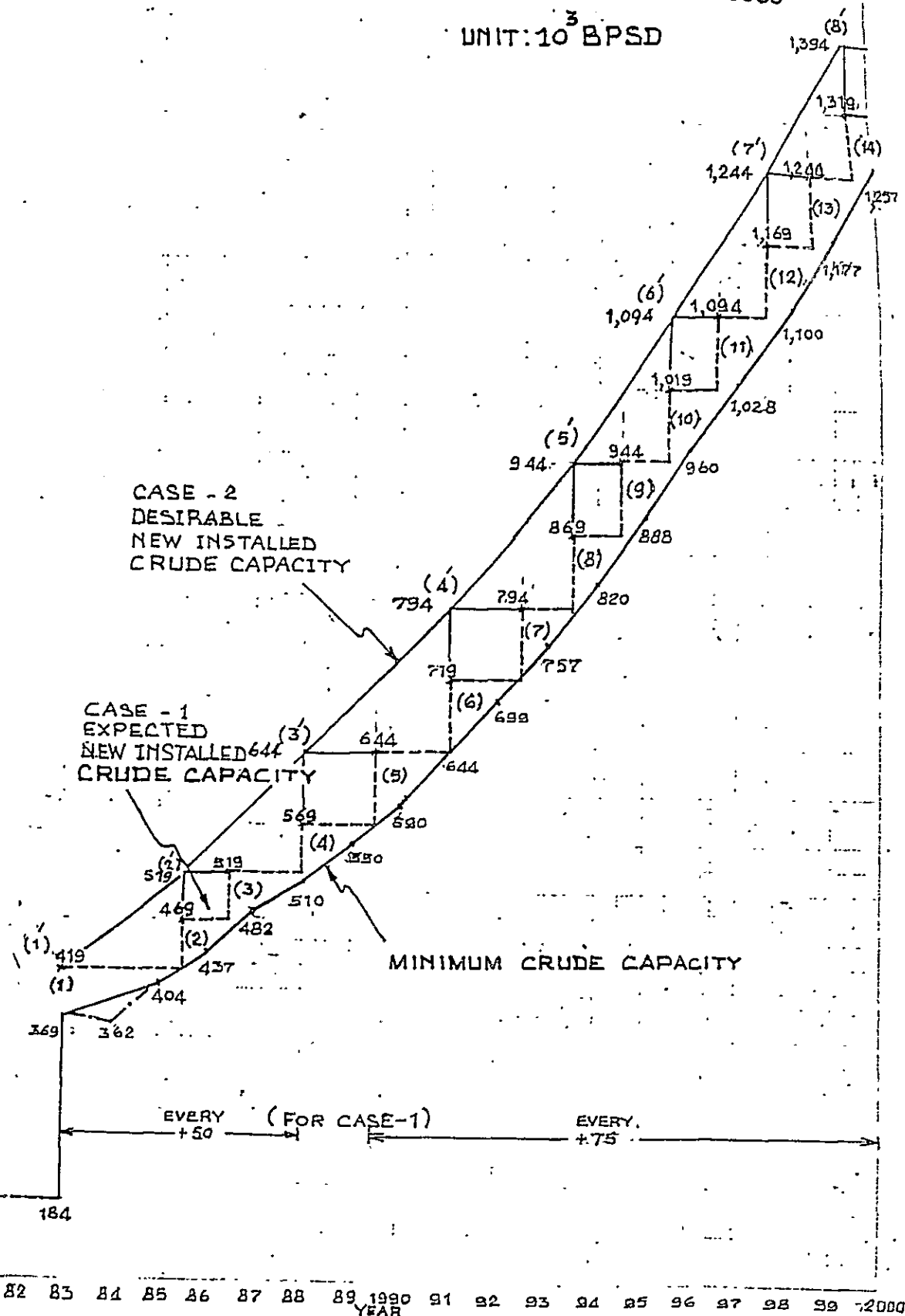
200

100

CASE - 2
DESIRABLE
NEW INSTALLED
CRUDE CAPACITY

CASE - 1
EXPECTED
NEW INSTALLED
CRUDE CAPACITY

MINIMUM CRUDE CAPACITY



EVERY +50 (FOR CASE-1)

EVERY +75

81 82 83 84 85 86 87 88 89 1990 91 92 93 94 95 96 97 98 99 2000
YEAR

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for consistent data collection procedures and the use of advanced analytical techniques to derive meaningful insights from the data.

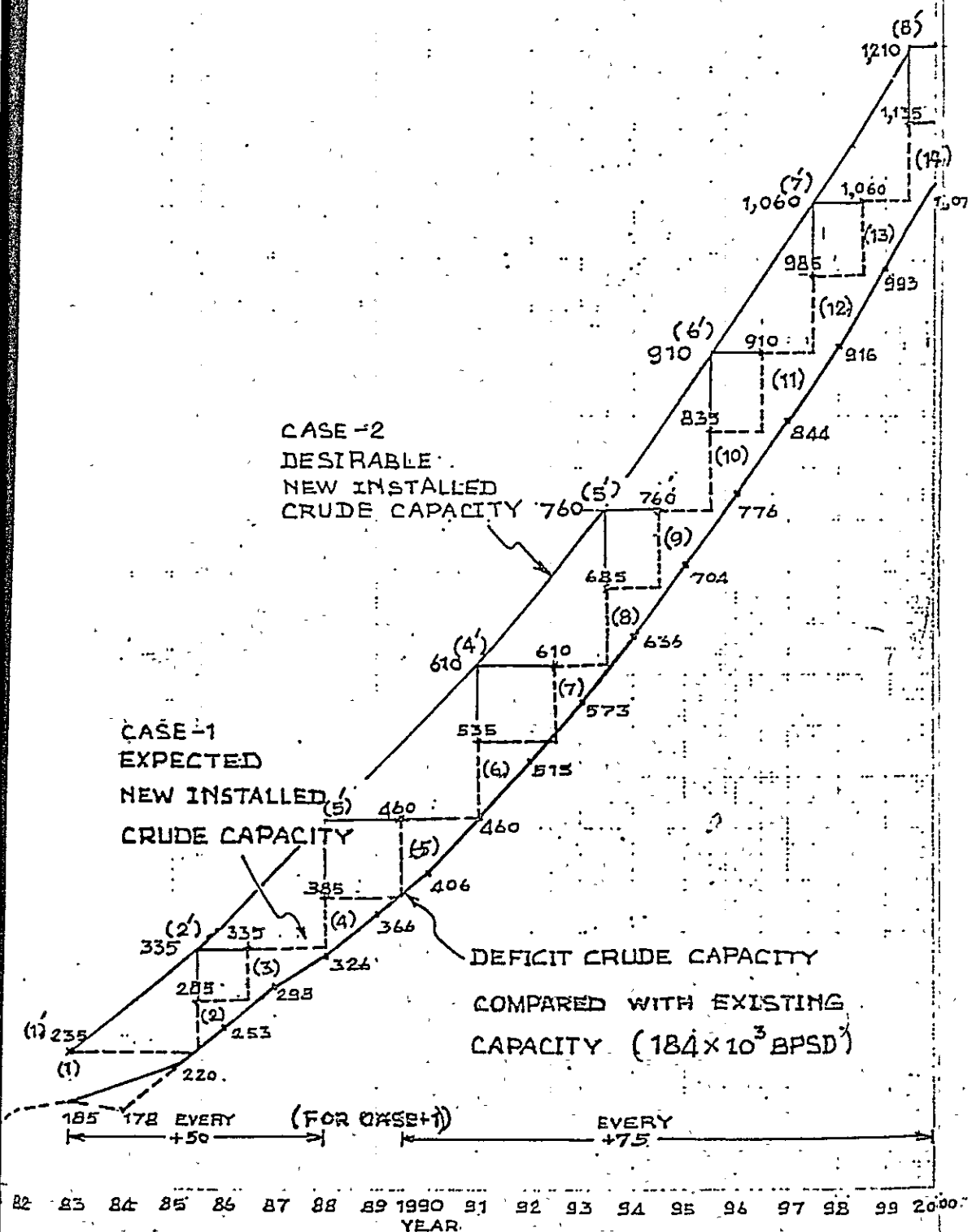
3. The third part of the document focuses on the implementation of data-driven decision-making processes. It provides a detailed overview of the steps involved in identifying key performance indicators (KPIs) and using data to inform strategic decisions.

4. The fourth part of the document discusses the challenges and risks associated with data management and analysis. It addresses issues such as data quality, privacy concerns, and the potential for bias in data analysis.

5. The fifth part of the document provides a summary of the key findings and recommendations. It emphasizes the importance of ongoing monitoring and evaluation of data-driven processes to ensure their effectiveness and relevance over time.

FIG. 2 NEW INSTALLATION FROM 1983,
EXPANSION AND/OR NEW REFINERY
CONSTRUCTION SCHEDULE 1983~2000

UNIT : 10^3 BPSD





JICA

9
(23)
July 16, 1979.

Mr. Tammachart Sirivadhanakul,
Director of Regulatory Division,
National Energy Administration.

Dear Mr. Tammachart,

Re: NATURAL GAS DEMAND FORECAST

I present you the report of "NATURAL GAS DEMAND FORECAST"
by your request.

This report is revision of "NATURAL GAS DEMAND FORECAST OF
THE INDUSTRY (FUEL AND RAW MATERIAL) on July 20, 1978.

About 1 year past, the natural gas production schedule,
natural gas characterization, natural gas requirement, new project
have been clear, so I revised the former report.

But there are still many unknown factors, so natural gas
forecast should be revised every a half year or several months.
I recommend you as follows :-

I NATURAL GAS BALANCE AND USAGE

(1) For EGAT

The potential natural gas consumption of South Bangkok and
Bang Pakong Power Station is 720 MMscf/D. Sales natural gas will be
546 MMscf/D in 1990.

Initial stage of natural gas production, wholesales natural
gas should be consumed by NGOT.

(2) New Project

At present, Thai Government takes up soda ash and integrated
flat steel project. The project will consume natural gas not only
fuel but raw material or reductant, so these are valuable usage of
natural gas.



Soda ash project will be scheduled to commence the production in 1982 or 1983, but may be in 1984, and integrated flat steel project will be commenced in 1985.

Sales natural gas for projects is 17 - 20% on total sales natural gas (for new project 104 MMscf/D and sales natural gas 546 MMscf/D in 1991).

(3) Existing Industry

Fuel oil firing boiler of the existing industry must be modified to natural gas firing boiler or newly natural gas firing boiler must be replaced.

The cost of modification is 50% of new fuel oil boiler and the price of new fuel oil firing boiler is 15 - 20% higher than fuel oil boiler. So, natural gas price must be reduced for depreciation, interest, insurance and others of high price or modification cost (reduction price of natural gas is very small, such as 0.0354 - 0.108 \$/1,000 scf), and bounty and dangerous allowance must be considered by NGOT. Total reduction of sales natural gas price might be 3 - 5%. Its sales natural gas price is 1.98 \$/1,000 scf, reduction is 0.06 \$ - 0.10 \$/1,000 scf (natural gas price for existing industry is 1.92 - 1.88 \$/1,000 scf).

Other hand, natural gas firing of existing industry is very small.

Anyhow, modification of existing industry boiler might be wait till natural gas production will be going up.

(4) LPG Production

LPG production from the refineries is enough for domestic requirement. So, LPG from natural gas could be export and LPG utilization must be developed such as motor fuel.

LPG production from natural gas should be studied.

(5) Petrochemicals

More profitable usage must be developed, such as industry which uses natural gas raw material. The industry is so-called

petrochemical industry, therefore methane derivative industry and ethylene industry should be developed.

Ethane in Siam Gulf natural gas enough quantity to produce ethylene.

Ethylene production will be 242,000 T/Y in 1985 and 301,800 T/Y in 1990.

Ethylene production of one ethylene center is 300,000 T/Y.

Ethylene price from ethane is very cheaper than ethylene from naphtha or heavier fractions. So, in near future, Thailand might install ethylene plant and ethylene chemicals plants. When ethylene plant is installed, aromatics (benzene, toluene and xylenes) plant must be installed.

(6) LPG

Natural gas production is not enough for LNG production to export.

II NGOT must guarantee term of natural gas supply

NGOT must guarantee the term of natural gas supply to every natural gas user.

III Bang Pakong Power Station

Nobody can imagine the energy situation for 20 years hence, but if the electric power station still use fuel oil, Bang Pakong Power Station is far from the refineries, or if coal is used for thermal plant, Bang Pakong Power Station must have coal storage and ash dumping area, and coal import facilities.

IV Natural gas production is increased from 150 to 200 MMscf/D

NGOT is concerning that natural gas production in 1981 will be changed from 150 to 200 MMscf/D and in 1982 from 300 to 350 MMscf/D. My 5 cases study, there is no problem for 50 MMscf/D production increase. Natural gas production increase is preferable for crude oil shortage.

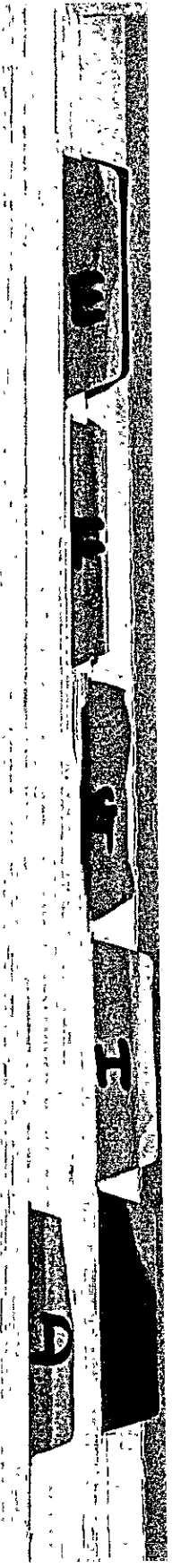


I recommend you that natural gas will be used for EGAT and the new project, not used for the existing industry till natural gas reserves will be confirmed more than 30 years production, and natural gas production will be more than 700 MMscf/D.

I appreciated if it would be useful for you

Sincerely yours,

y. Kawase



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I FOREWORD

I reported "NATURAL GAS DEMAND FORECAST OF THE INDUSTRY (FUEL AND RAW MATERIAL) on July 20, 1978.

But recently, the natural gas production is changed from 500 MMscf/D to 700 MMscf/D, the composition of sales natural gas is cleared, the pipeline route is decided that NGOT has no schedule to lay the pipeline to Saraburi of cement industrial area.

So, I recalculate the natural gas demand forecast more accuracy than the old report.

The main recalculation is the natural gas consumption for EGAT.

Natural gas will be utilized for EGAT, new project and existing industry.

EGAT is the main natural gas user, new project is used natural gas as raw material or reduction agent, so there are no problems at all. The problem is for existing industry, it must modified from fuel oil to natural gas. The modification has very small merit, and natural gas price for existing industry should be cheaper than fuel oil on calorific value. And the point is natural gas life, if it is less than 25 years, Thai Government could not recommend to use natural gas to existing industry.

I present the report, but there is still much unknown factor, so natural gas utilization schedule shall be revised many times.

II NATURAL GAS HEATING VALUE

In old report, natural gas heating value was 1,000 BTU/scf as net heating value.

In this report, I calculate the sales natural gas heating value from Fluor Ocean Services International Inc.'s report. Average net heating value is 864 BTU/scf which is shown in TABLE-1 (ATTACH.1).

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for consistent data collection procedures and the use of advanced analytical techniques to derive meaningful insights from the data.

3. The third part of the document focuses on the role of technology in data management and analysis. It discusses how modern software solutions can streamline data collection, storage, and processing, thereby improving efficiency and accuracy.

4. The fourth part of the document addresses the challenges associated with data management, such as data quality, security, and privacy. It provides strategies to mitigate these risks and ensure that the data remains reliable and secure throughout its lifecycle.

5. The fifth part of the document concludes by summarizing the key findings and recommendations. It stresses the importance of ongoing monitoring and evaluation to ensure that the data management processes remain effective and aligned with the organization's goals.

And EGAT assumed two heating value, one is 1,000 BTU/scf and other is 900 BTU/scf.

III NATURAL GAS FOR EXISTING INDUSTRY

NGOT has no schedule to lay a pipeline to Saraburi of cement industrial area.

Natural gas consumption of existing industry except cement industry is shown in TABLE-2 (ATTACH.2).

IV INTEGRATED FLAT STEEL PROJECT

Production flow is shown in FIG.1 (ATTACH.3), and natural gas consumption is shown in TABLE-3 (ATTACH.4).

In the planning, electricity will be bought from EGAT.

Natural Gas Consumption will be as follows :-

	1985	1990
MMscf/D	50	75 (1,000 BTU/scf)
"	57.87	86.81 (964 BTU/scf)

V SODA ASH PROJECT

Soda ash production would be commenced in 1982 or 1983, and production and natural gas consumption schedule is shown in TABLE-4 (ATTACH.4).

Natural gas consumption for soda ash project is 17.63×10^6 scf/D (946 BTU/scf) including ammonia production and electric generation.

In this calculation, soda ash manufacturing will be commenced from 1984, and expansion is not concerned.

VI TOTAL NATURAL GAS BALANCE OF EXISTING INDUSTRY, NEW PROJECT AND EGAT

TABLE-6 (ATTACH.6) is shown total natural gas balance of existing

industry, new project and EGAT.

- Sales Natural Gas : Fluor's report (TABLE-5).
(Production)
- Consumption Existing : My report on July 20, 1978 (TABLE-2)
Industry (Origin is SOFREGAZ INTERIM REPORT).
- New Project : TABLE-3 and 4.

4 cases are made in TABLE-6 (ATTACH.6).

(1) CASE-1 sales natural gas 100% for EGAT

Sales natural gas is not supplied to the existing industry and the new project, in other words, the wholesales natural gas is utilized for electricity generation.

(2) CASE-2 0 - 70% (70% max.) of potential existing industry natural gas is supplied. After the year of 1988, natural gas of each year is 70% on potential existing industry natural gas consumption.

And the new project is 100% on potential of its natural gas consumption. The rest of natural gas is for EGAT.

(3) CASE-3 0 - 50% (50 max.) of potential existing industry natural gas is supplied. After the year of 1986, natural gas consumption of each year is 50% on potential existing industry natural gas consumption.

And the new project is 100% on potential of its natural gas consumption. The rest of natural gas is for EGAT.

(4) CASE-4 No natural gas for existing industry.

And the new project is 100% on potential of its natural gas consumption. The rest of natural gas is for EGAT.

The reason of 10% increase every year for conversion to natural firing boiler of the existing industry is that old boiler can not modified to natural gas firing boiler, a life of boiler is

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for transparency and accountability, particularly in the context of public administration and government operations. The text highlights that without reliable records, it becomes difficult to track the flow of funds, resources, and information, which can lead to inefficiencies and potential misuse.

2. The second part of the document addresses the challenges associated with data collection and analysis. It notes that while modern technology offers powerful tools for data management, the quality and consistency of the data itself can be a significant barrier. The document suggests that standardized protocols and regular audits are necessary to ensure that the data being collected is both accurate and relevant to the tasks at hand.

3. The third part of the document focuses on the role of communication in organizational success. It argues that clear and consistent communication is vital for ensuring that all team members are aligned with the organization's goals and objectives. The text stresses the importance of both internal communication, such as team meetings and reports, and external communication, such as public relations and stakeholder engagement.

4. The fourth part of the document discusses the importance of continuous learning and professional development. It suggests that in a rapidly changing environment, individuals and organizations must stay current in their knowledge and skills. This can be achieved through a variety of means, including formal education, workshops, and on-the-job training. The document encourages a culture of lifelong learning where individuals are encouraged to seek out new opportunities for growth and development.

5. The fifth and final part of the document concludes by reiterating the key points discussed throughout the text. It emphasizes that success is not achieved through a single strategy but through a combination of effective record-keeping, data management, communication, and continuous learning. The document ends with a call to action, urging all stakeholders to take responsibility for their own contributions to the organization's overall success.

already passed over several years, so it lost money to the investment of modification.

If the existing industry is modified much fuel oil firing boilers to natural gas boilers, natural gas firing electric power plants of Bang Pakong Power Station should be changed from natural gas to diesel and fuel oil within 10 years.

VII NGOT NATURAL GAS PRODUCTION AND DEMAND FORECAST (MADE BY NGOT)

NGOT made schedule of LPG and natural gas production and the demand forecast of natural gas for EGAT, the existing industry and the new industry (new project). NGOT disclosed these data which are shown in TABLE-7 (ATTACH.7).

Comparison of TABLE-6 (ATTACH.6) TOTAL NATURAL GAS BALANCE which is based on SOFREGAZ INTERIM REPORT and Fluor's report, and TABLE-7 (ATTACH.7) QUANTITY OF NATURAL GAS PRODUCTION OF NGOT COMPARING WITH THE DEMAND FORECAST, and TABLE-10 (ATTACH.9) is shown in TABLE-8 (ATTACH.8).

EGAT investigated his own natural gas demand forecast, and NGOT was reported natural gas, LPG and remain of natural gas (sales natural gas) production and natural gas demand forecast of the existing industry and the new project. But I could not know how NGOT and EGAT calculate natural gas volume, so I will calculate it which based on Fluor's report.

VIII EGAT NATURAL GAS CONSUMPTION SCHEDULE (MADE BY EGAT)

TABLE-9 (ATTACH.9) is shown the capacity of each plant of EGAT and the modification schedule of South Bangkok thermal plant and new installation of Bang Pakong.

TABLE-10 (ATTACH.9) is shown the forecast demand of natural gas on electricity generation of EGAT during 1981 - 1985. In this table, natural gas heating value is assumed as 900 BTU/scf and 1,000 BTU/scf.

In TABLE-7 (ATTACH.7), natural gas demand forecast of EGAT

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for ensuring transparency and accountability in financial reporting.

2. The second part of the document outlines the various methods and techniques used to collect and analyze data. It highlights the need for a systematic approach to data collection and the importance of using reliable sources of information.

3. The third part of the document focuses on the analysis and interpretation of the collected data. It discusses the various statistical and analytical tools used to identify trends, patterns, and relationships within the data.

4. The fourth part of the document discusses the implications of the findings and the need for further research. It emphasizes that the results of the study should be used to inform decision-making and to guide the development of policies and programs.

5. The fifth part of the document provides a summary of the key findings and conclusions of the study. It highlights the main points of the research and the implications for future research and practice.

is shown, but demand forecast in 1981 is 181.8 scf/D and TABLE-10 (ATTACH.9) in 1981 is 162.9 scf/D, another demand forecast is same.

Both natural gas demands of EGAT are over the remain of natural gas (the sales natural gas), these may be only a requirement of EGAT.

IX HEAT EFFICIENCY OF ELECTRIC GENERATOR USING NATURAL GAS

According to TABLE-10 (ATTACH.9) which is estimated by EGAT, I calculated heat efficiency of South Bangkok dual plant, Bang Pakong combined cycle plant and thermal plant.

<u>Power Station</u>	<u>Heat Efficiency</u>
South Bangkok	
Dual No.1 - No.5	36.426 % TABLE-11 (ATTACH.10)
Bang Pakong	
Combined Cycle No.1 - No.2	41.237 % TABLE-12 (ATTACH.11)
Thermal No.1 - No.2	38.234 % TABLE-13 (ATTACH.12)

Heat efficiency of combined cycle plant is 41.237%, it seems too low, but I suppose that EGAT is concerned time factor.

X SALES CONTRACT BETWEEN NGOT AND UNION

The sales contract between NGOT and Union is as follows :-

1. Natural gas heating value

Natural gas heating value is 950 - 1,150 BTU/scf in gross heating value.

2. Natural gas price

Natural gas price is 1.04¢/MM BTU at date of negotiation.

3. Exploration period

Exploration period is 8 years and can be extended for 4 years.

Union, Texas-Pacific and Union-MOECO were already extended for 4 years.

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4. Termination of production period

Termination period is 30 years production and can be extended for 10 years but the extension is NGOT's option. Production period is commenced from next day of the end of exploration period.

Union extended for 4 years on April, 1977, so Union's production period will be commenced from April, 1982.

5. Yearly contract quantity

Yearly contract quantity is that daily contract quantity multiples for 365 days.

NGOT can reduce to 50% and increase to 125% of yearly contract quantity. Union has duty to supply for 125% but not whole year, only several months per year.

When NGOT does not receive yearly contract quantity, NGOT must pay yearly contract quantity, but NGOT can receive natural gas of shortage in the next year or several years later without fee.

6. Daily contract quantity

Daily contract quantity of next week is made on every Friday.

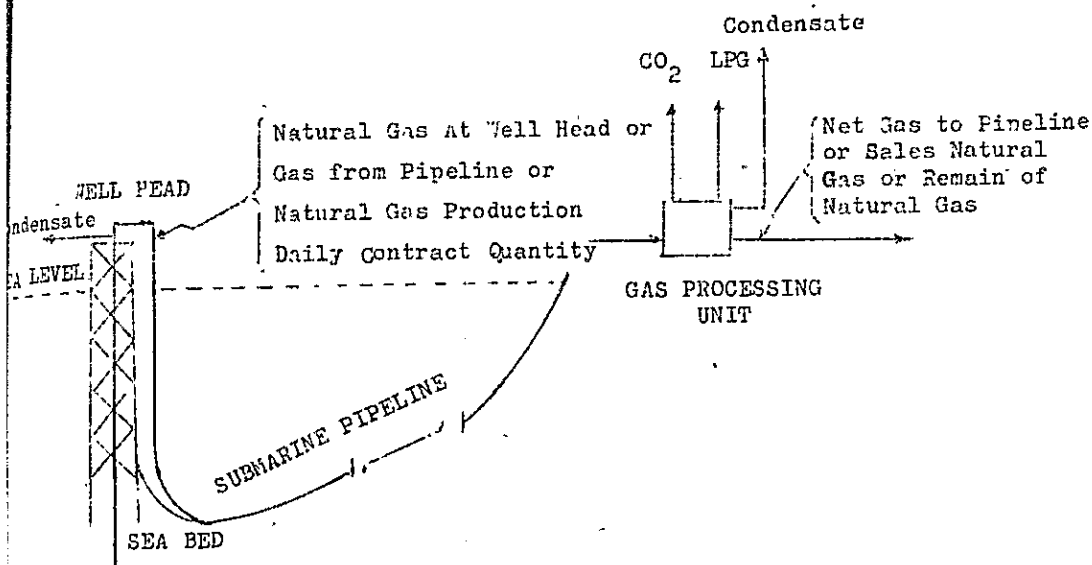
NGOT can change daily contract quantity as follows :-

within \pm 10%	before	6 hours, NGOT must notice to Union.
within \pm 25%	before	12 hours, NGOT must notice to Union.
more than \pm 25%	before	24 hours, NGOT must notice to Union.

But NGOT can not make less than 50% of daily contract quantity.

7. Release from responsibility of NGOT

When NGOT can not receive 50% of daily contract quantity according to irresistible force, NGOT is exempted from the responsibility.



XI NATURAL GAS BALANCE FOR EGAT

XI.1 Wholesales natural gas to EGAT (Made by NGOT) (CASE-1)

NGOT natural gas demand forecast of TABLE-7 (ATTACH.7) and TABLE-10 (ATTACH.9) are almost over the remain of natural gas (the sales natural gas). So, I calculate as following conditions :-

No allocation to the existing industry.

No allocation to the new industry (new project).

This means that the whole remain of natural gas (sales natural gas) is allocated to EGAT.

Sales natural gas (net gas to pipeline) is come from TABLE-5 (ATTACH.5). Natural gas consumption of each unit at Bang Pakong and South Bangkok is come from TABLE-10 (ATTACH.9), but the natural gas consumption was calculated by 900 BTU/scf of heating value, so I correct to 864 BTU/scf of heating value (net heating value of low heating value).

The result is shown in TABLE-14 (ATTACH.13).

- (1) Wholesales natural gas can be consumed by electric generation.
- (2) Natural gas demand of South Bangkok Power Station is very big

Handwritten text, possibly bleed-through from the reverse side of the page. The text is extremely faint and illegible due to low contrast and blurring. It appears to be organized into several lines or paragraphs, but the specific content cannot be discerned.

except the year of 1981 and 1982. So number of boiler which is converted from fuel oil firing to natural gas firing must be reduced after the year of 1983.

(3) EGAT can be consumed natural gas (382 MMscf/D) for Bang Pakong electric power station as long as natural gas production.

(4) Natural gas reserves of Union is 1.5 trillion and Texas-Pacific is 3.5 trillion (it is said that reserves of Texas-Pacific is 0.4-4.5 trillion), if so, natural gas life is about 20 years consuming as 700 MMscf/D. Depreciation year of the set of electric generator is 20 years, but life of electric generator set is 25 years.

(5) Nobody can imagine the energy situation for 20 years hence, but if the electric power station still uses fuel oil, Bang Pakong Power Station is far from the refinery.

(6) EGAT has the budget for modification of No.4 and No.5 plant but not for No.1 - No.3 plant.

XI.2 Wholesales natural gas to EGAT (Made by me) (CASE-2)

Natural gas consumption of No.1, No.2 combined cycle and No.1, No.2 thermal unit at Bang Pakong Power Station are come from TABLE-12 (ATTACH.11) and TABLE-13 (ATTACH.13).

These consumptions are as same as EGAT's calculation in TABLE-10 (ATTACH.9) but corrected heating value.

Natural gas consumption of No.1 - No.5 thermal units of South Bangkok Power Station are calculated individually, and its natural gas demand was shown in TABLE-11 (ATTACH.10).

The result is shown in TABLE-15 (ATTACH.14)

(1) Wholesales natural gas will be consumed by electric generator at South Bangkok and Bang Pakong, and no natural gas for new project and existing industry.

(2) Maximum consumption of EGAT in 1988 and in 1982 (in case of 250 MMscf/D natural gas production in 1981) are a little bit smaller than wholesales natural gas.

Conversion from fuel oil firing to natural gas firing is expensive, so it is not economical for only 1 or 2 years using natural gas, conversion of South Bangkok No.4 and No.5 (each 300 MW) is lost much money. Thus in 1988, daily contract quantity of natural gas should be less than Fluor's report.

In case of 200 MMscf/D natural gas production, the year of 1982 is same situation of the year of 1988 in case of 150 MMscf/D natural gas production.

(3) If wholesales natural gas is supplied only to EGAT, Bang Pakong natural gas firing units could be used as long as natural gas production.

XI.3 Supply to EGAT and 100% new project (CASE-3)

In CASE-3, sales natural gas is supplied to EGAT and the new project, but it is not supplied to the existing industry.

100% of the new projects means :-

Natural gas demand of the new projects (integrated flat steel and soda ash project) supplied 100% on potential of its natural gas demand by NGOT.

The result is shown in TABLE-16 (ATTACH.15).

(1) In case of 200 MMscf/D production in 1984, maximum consumption in 1982 is a little bit smaller than natural gas for EGAT. So, in 1982, the daily contract quantity should be less than Fluor's schedule.

(2) CASE-3 is the best case, because Bang Pakong total capacity is 382 MMscf/D from the year of 1984, and natural gas for EGAT is 442 MMscf/D after 1990. So, if the new project is not expanded, Bang Pakong units could be used natural gas as long as its production.

XI.4 Supply to EGAT, 0 - 50% existing industry and 100% new project (CASE-4)

0 - 50% on potential existing industry natural gas demand means :-

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for transparency and accountability, particularly in financial reporting and compliance with regulatory requirements. The text notes that incomplete or inconsistent records can lead to significant legal and financial consequences for the organization.

2. The second section focuses on the role of internal controls in preventing fraud and errors. It outlines key components of a robust internal control system, including segregation of duties, authorization procedures, and regular monitoring and review. The document stresses that these controls are not just administrative tasks but critical safeguards that protect the organization's assets and ensure the integrity of its operations.

3. The third part of the document addresses the challenges of data management in the digital age. It highlights the need for secure storage, access controls, and data backup procedures to protect sensitive information from cyber threats and data loss. The text also discusses the importance of data accuracy and the implications of data breaches for the organization's reputation and legal standing.

4. The final section discusses the importance of regular audits and reviews. It explains that audits are not just for compliance but also for identifying areas for improvement and ensuring that the organization's processes are efficient and effective. The document encourages a proactive approach to auditing, where potential issues are identified and addressed before they become major problems.

in 1981 modification and testing of natural gas firing boiler of existing industry, so natural gas demand is zero.

in 1982 10%
 going up 10% on potential existing industry natural gas demand every year.

in 1986 50%

in 1991 50%

Natural gas demand of existing industry is not 100% on potential of its natural demand. The reason was described in VI (page 3).

The result is shown in TABLE-17 (ATTACH.16).

(1) In CASE-4, from the year of 1990, NGOT could not supply enough natural gas to EGAT. Demand of Bang Pakong plants will be 382 MMscf/D of sales natural gas, but natural gas for EGAT will be 377 - 375 MMscf/D after 1990.

CASE-4 is big problem, Bang Pakong plants must be changed to fuel oil firing or coal firing after 1990.

(2) If NGOT supplies a lot of natural gas to existing industry, Bang Pakong plants must be changed to fuel oil firing within 10 years.

(3) If NGOT supplies natural gas enough for Bang Pakong plants, he must supply less than 45% on potential existing industry natural gas demand. But another problem is occurred.

For instance, some company will replace fuel oil firing to natural gas firing in 1990, and few years later, he wants to expand his factory, he should use fuel oil for expansion, thus the company uses natural gas and fuel oil.

XI.5 Supply to EGAT, 0 - 70% existing industry and 100% new project (CASE-5)

0 - 70% on potential existing industry natural gas demand means:-

in 1981 modification and testing of natural gas firing boiler of existing industry, so natural gas demand is zero.

in 1982 10%
going up 10% on potential existing industry natural gas demand every year.

in 1988 70%

in 1991 70%

Others are same as XI.4.

The result is shown in TABLE-18 (ATTACH.17).

1. In CASE-5, in 1987 and from the year of 1990, NGOT could not supply enough natural gas to EGAT.

So, Bang Pakong Power Plant can not run 100%, it is about 92%.

These status is same as XI.4.

XII NATURAL GAS RESERVES AND PRODUCTION AND LIFE

Expected natural gas recoverable reserves and production is very important to planning for natural gas delivery otherwise natural gas utilization.

Natural gas production will be commenced in Autumn of 1981. Natural gas is estimated that Union 1.5 trillion scf and Texas-Pacific 0 - 4.5 trillion (it is said 3.5 trillion scf). So, total reserves is 5.0 trillion scf.

$1.5 \text{ trillion scf} \div 250 \text{ MMscf/D} \div 365 \text{ days} = 16.4 \text{ years}$

Union said that he will produce natural gas for 20 years.

$3.5 \text{ trillion scf} \div 450 \text{ MMscf/D} \div 365 \text{ days} = 21.3 \text{ years}$

or $4.5 \text{ trillion scf} \div 450 \text{ MMscf/D} \div 365 \text{ days} = 27.4 \text{ years}$

But, Union - MOECO (No.10 and No.11 Concession) is now carrying exploratory drilling, and Bangkok Post newspaper said



Mitsui and Union oil estimate the well would bring daily commercial production of 2.125 million cubic meters, it is about 80 MMscf/D.

Union, Texas-Pacific and Union-MOECO have another structures which are not yet carried exploratory drilling in their concession. So, in future more natural gas reserves would be discovered, and natural gas life might be assumed more than 50 years.

Mining license (concession) shall be terminated 30 years after finished the exploration period.

TABLE-19 (ATTACH.18) shows natural gas reserves and production (daily contract quantity). When reserves are estimated as 5 trillion scf, 700 MMscf/D production (daily contract quantity) can be continued for 20 years. When reserves are estimated as 10 trillion scf, 1,400 MMscf/D production (daily contract quantity) can be continued for 20 years, and 900 MMscf/D production (daily contract quantity) can be continued for 30 years.

But, each company who has the concession and each structure will not start commercial production at the same time.

	Start
Union	autumn 1981
Texas-Pacific	1982
Other (company and structure)	later than 1983 (?)
⋮	"
⋮	"

Timeline diagram showing production periods:

- Union: Production period starting in autumn 1981.
- Texas-Pacific: Production period starting in 1982.
- Other (company and structure) (?): Production period starting later than 1983.
- Other (company and structure) (?): Production period starting later than 1983.
- more than 50 years: Production period starting later than 1983.

So, natural gas production from Siam Gulf is not only 20 years but more than 50 years, and natural gas production will be bigger than natural gas production schedule of TABLE-5 (ATTACH.5).

Natural gas requirement should be larger than natural gas production, if the production is over the requirement, natural gas should be flared. So that, when sales agreement is signed, it must be carefully to avoid over agreement.

(1) The most safty and economical way is that natural gas is supplied to EGAT and new project, natural gas consumption should be larger than its production.

Natural gas expected demand for EGAT is as follows :-

			MMscf/D
Bang Pakong Combined Cycle	No.1		55
"	No.2		55
Thermal	No.1		136
"	No.2		136
Sub Total			382
South Bangkok	Thermal	No.1	52
"	"	No.2	52
"	"	No.3	78
Dual	No.4		78
	No.5		78
Sub Total			338
Grand Total			720
Minimum Demand			
Bang Pakong			382 MMscf/D
Maximum Demand			
Bang Pakong + South Bangkok			720 MMscf/D

Sales natural gas volume is about 91.0% of natural gas at well head (daily contract quantity) in 1981, and 79.3% in 1999, because CO₂ is eliminated and LPG is produced. Maximum natural gas for EGAT is as follows :-

$$720 \text{ MMscf/D} \div 91.0\% = 791 \text{ MMscf/D}$$

$$720 \text{ MMscf/D} \div 79.3\% = 908 \text{ MMscf/D}$$

(sales natural gas) (natural gas at well head)

When sales natural gas consumption of the new project is same as TABLE-6 (ATTACH.6), total natural gas consumption is as follows :-

	FOR NEW PROJECT		FOR EGAT		TOTAL		Production *
	MMscf/D	+	MMscf/D	=	MMscf/D	(1)	Sales Natural Gas
							MMscf/D
in 1981	0	+	720	=	720	(1)	134
in 1984	17.63	+	720	=	737.63	(2)	445
in 1985	75.50	+	720	=	795.50	(3)	434
in 1990	104.44	+	720	=	824.44	(5)	546

Note: * at present schedule (TABLE-5, ATTACH.5).

$$720 \text{ MMscf/D} \div 91.0\% = 791 \text{ MMscf/D}$$

$$737.63 \text{ " } \div 90.5\% = 815 \text{ "}$$

$$795.50 \text{ " } \div 88.3\% = 901 \text{ "}$$

$$824.44 \text{ " } \div 79.3\% = 1,040 \text{ "}$$

So, note (A) of TABLE-19 (ATTACH.18) is a limit for sales natural gas (900 MMscf/D natural gas production at well head).

The above mentioned calculation is EGAT maximum and 100% new project TABLE-6 (ATTACH.6), this is similar to CASE-3 (TABLE-16, ATTACH.15). At present schedule natural gas production at well head is 700 MMscf/D, but the above expected natural gas production at well head is 1,040 MMscf/D.

XIII FUEL OIL FIRING BOILER IS RENEWED OR MODIFIED TO NATURAL GAS FIRING BOILER

In America, many boils of electric generator are using natural gas, and also it is using as raw material of petrochemicals

and household usage.

In Japan, natural gas production is very small.

Boiler operating number in Japan, in 1979 is as follows :-

Oil Firing Boiler	114,456
Gas Firing Boiler*	4,434
Coal Firing Boiler	944
Others	3,177
Total	123,011

Note: * Most of them are town gas firing small boiler.

Merit and demerit of fuel oil firing and natural gas firing.

	Fuel Oil Firing Boiler	Natural Gas Firing Boiler New or Modification
Cost		New: 15 - 20% up of fuel oil boiler. Modification: 50% of new fuel oil boiler.
Heat Efficiency		Same as fuel oil boiler.
Smoke Tube	Every two months	Need not. So, operation ratio is big.
Air Pollution	SO _x and NO _x are much.	Very small
Others		Almost same

The above mentioned table, natural gas firing boiler has merits of smoke tube cleaning and air pollution, but price of new boiler or modification cost of old boiler is very high.

So, natural gas price must be lower than fuel oil by calorific value. The depreciation of high price or modification cost, and

insurance and interest must be minus from fuel oil price on calorific value. And also a bounty and dangerous allowance for using natural gas must be paid by NGOT.

XIII.1 Natural gas price for new boiler of existing industry

The price of new natural gas firing boiler was estimated by Mr. M. Heya, Ishikawajima-Harima Heavy Industries Co., Ltd. He estimated the price of natural gas firing boiler as 15 - 20% up to the price of fuel oil firing boiler. I calculate 20% which is including interest and insurance for price up and others

TABLE-20 DEPRECIATION FOR 20% PRICE UP OF NEW NATURAL GAS FIRING BOILER

Boiler Capacity T/H	1	3	5	10
Fuel Oil Firing Boiler \$	21,250	31,500	45,000	65,000
Natural Gas Firing Boiler (up 20%) \$	25,500	37,800	54,000	78,000
Different \$	4,250	6,300	9,000	13,000
Depreciation, interest, insurance and others				
20 years * \$/D	0.58	0.86	1.23	1.78
10 years * \$/D	1.16	1.73	2.47	3.56
5 years * \$/D	2.33	3.45	4.93	7.12

Note: * Depreciation years

Natural gas consumption of small natural gas firing boiler is as follows :-

Conditions of steam (These are assumed because they are different for each)

Steam Pressure 17 Kg/cm² - G
 18 Kg/cm² - A (256 psia)

Super Heated 500 °F (steam temperature)

Boiler Feed Water 30°C (86°F)

From Steam Table

Psia	500 °F
240	1,264.6 BTU/lb
<u>256</u>	<u>1,262.84</u> BTU/lb
260	1,262.4 BTU/lb

$$1,262.84 \text{ BTU/lb} \div 0.4563 \text{ Kg/lb} = 2,767.57 \text{ BTU/Kg}$$

$$= 2,767.57 \times 10^3 \text{ BTU/T}$$

$$2,767.57 \times 10^3 \text{ BTU/T} \div 905 \text{ BTU/scf}^* = 3.06 \times 10^3 \text{ scf/T}$$

Note: * 1,000 BTU/scf gross = 905 BTU/scf net

$$3.06 \times 10^3 \text{ scf/T} \div 85\% \text{ (efficiency)} = 3.6 \times 10^3 \text{ scf/T}$$

TABLE-21 NATURAL GAS CONSUMPTION OF NEW NATURAL GAS FIRING BOILER

Boiler Capacity T/H	Mscf/T/H	Mscf/T/D	\$/D ^{*1}	\$/D ^{*2}
1 T/H	3.6	86.4	138.24	171
3 T/H	10.8	259.2	414.72	513
5 T/H	18.0	432.0	691.20	855
10 T/H	36.0	864.0	1,382.40	1,711

Note: *1 Sales natural gas cost (NGOT COST)
 1.6 \$/MM BTU = 1.6 \$/1,000 scf (assume)

*2 Sales natural gas price equivalent 600" Fuel Oil
 1.98 \$/MM BTU = 1.98 \$/1,000 scf (assume)
 (see TABLE-22 Note: *3)

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for transparency and accountability, particularly in the context of public administration and financial management. The text notes that without reliable records, it is difficult to track expenditures, assess performance, and identify areas for improvement.

2. The second part of the document outlines the various methods and tools used for data collection and analysis. It mentions the use of surveys, interviews, and focus groups to gather qualitative data, as well as the application of statistical software and data visualization techniques to analyze quantitative data. The author highlights the importance of choosing appropriate methods based on the research objectives and the nature of the data being collected.

3. The third part of the document addresses the challenges and limitations of data collection and analysis. It discusses issues such as data quality, bias, and the potential for misinterpretation of results. The text suggests ways to mitigate these challenges, such as using multiple data sources, conducting pilot studies, and involving stakeholders in the data collection process. It also emphasizes the need for clear communication and documentation of the data collection and analysis process.

4. The fourth part of the document provides a summary of the key findings and conclusions. It reiterates the importance of accurate record-keeping and the use of appropriate data collection and analysis methods. The author concludes that while there are challenges, the benefits of a well-structured data collection and analysis process far outweigh the costs. The text encourages further research and innovation in this field to improve the quality and reliability of data collection and analysis.

Natural gas price for the new natural gas boiler is as follows:-

TABLE-22 DISCOUNT OF SALES NATURAL GAS PRICE FOR DEPRECIATION OF PRICE UP OF NEW NATURAL GAS FIRING BOILER

Boiler Capacity T/H	1	3	5	10
Natural Gas Consumption *1 Mscf/T/D	86.4	259.2	432.0	864.0
Depreciation 20 years \$*2/D	0.58	0.86	1.23	1.78
\$/1,000 scf	0.0067 (0.34%)*3	0.0033 (0.17%)	0.0028 (0.14%)	0.0021 (0.11%)
10 years \$/D	1.16	1.73	2.47	3.56
\$/1,000scf	0.0134 (0.68%)	0.0068 (0.35%)	0.0057 (0.29%)	0.0041 (0.21%)
5 years \$/D	2.33	3.45	4.93	7.12
\$/1,000 scf	0.0270 (1.36%)	0.0133 (0.63%)	0.0114 (0.58%)	0.0082 (0.41%)

Note: *1 from TABLE-21

*2 from TABLE-20

*3 600" Fuel oil

Retail Price as March 10, 1978

$$1.66 \text{ B/lit} = 1,660 \text{ B/Kl}$$

$$= 81.37 \text{ $/Kl} \quad 20.40 \text{ B/\$}$$

$$\text{L.F.O.} = 9,371 \text{ Kcal/lit} \div 0.252 \text{ Kcal/BTU} = 37,186.5 \text{ BTU/lit}$$

$$\therefore 1 \text{ BTU} = 0.2520 \text{ Kcal} = 37.2 \text{ MBTU/lit}$$

$$= 37.2 \text{ MMBTU/Kl}$$

$$37.2 \text{ MM BTU/Kl} = 81.37 \text{ $/Kl}$$

$$\frac{81.37 \text{ $/Kl}}{37.2 \text{ MMBTU/Kl}} \times 905 \text{ BTU/scf} = 1.98 \text{ $/1,000 scf}$$

\(\therefore\) 905 BTU/scf — sales natural gas

$$\frac{0.0067 \text{ $/1,000 scf}}{1.98 \text{ $/1,000 scf}} \times 100 = 0.34\%$$

Discount of sales natural gas price for depreciation, interest, insurance and others must be calculated every boiler, But, in case of new natural gas firing boiler, discount rate might be applied for 20 years depreciation.

XIII.2 Natural gas price for modified boiler of existing industry

Mr. M. Heya estimated the modification cost is about 50% of new fuel oil firing boiler. I calculate 52.2%, 2.5% is interest, insurance and others for 50% modification cost.

TABLE-23 DEPRECIATION FOR MODIFICATION COST

Boiler Capacity T/H	1	3	5	10
Fuel Oil Firing Boiler \$	21,250	31,500	45,000	65,000
Modification Cost 52.5% \$	11,156	16,538	23,625	34,125
Depreciation				
20 years \$/D	1.53	2.27	3.24	4.67
10 years \$/D	3.06	4.53	6.47	9.35
5 years \$/D	6.11	9.06	12.95	18.70



TABLE-24 DISCOUNT OF SALES NATURAL GAS PRICE FOR DEPRECIATION OF MODIFICATION COST

Boiler Capacity
T/H

Natural Gas

Consumption Mscf/D*1	26.4	..	432.0	364.0
----------------------	------	----	-------	-------

Depreciation, interest
insurance and others

20 years \$/D*2	1.53	2.27	3.24	4.67
-----------------	------	------	------	------

\$/1,000 scf	0.0177 (0.89%)	0.0 (0. %)	0.0075 (0.38%)	0.0054 (0.27%)
--------------	-------------------	---------------	-------------------	-------------------

10 years \$/D	3.06	4.53	6.47	9.35
---------------	------	------	------	------

\$/1,000 scf	0.0354 (1.79%)	0.0 (. %)	0.0150 (0.76%)	0.0108 (0.55%)
--------------	-------------------	--------------	-------------------	-------------------

5 years \$/D	6.11	9.06	12.95	18.70
--------------	------	------	-------	-------

\$/1,000 scf	0.0707 (3.57%)	0.0 (. %)	0.0300 (1.52%)	0.0216 (1.09%)
--------------	-------------------	--------------	-------------------	-------------------

Note: *1 from TABLE-21
*2 from TABLE-23
*3 see TABLE-22 *3

Discount of sales natural gas price for depreciation, interest, insurance and others must be calculated every boiler. But, in case of modification of fuel oil firing boiler, modified natural gas firing boiler must be used more than 10 years.

XIII.3 NGOT guarantees supply sales natural gas to existing industry

When natural gas is used for boiler of existing industry, natural price must be estimated every boiler.



For new natural gas firing boiler, NGOT must guarantee more than 20 years natural gas supply. And for modified gas firing boiler, NGOT must guarantee to supply natural gas for certain period which is requested by user. The certain period must be 10 - 20 years.

XIV.4 Insitive usage system

NGOT must encourage the existing industry to use natural gas for boiler, and NGOT might pay dangerous allowance.

Sales Natural Gas Price \$/1,000 scf	Bounty	
	%	\$/1,000 scf
1.98	20	0.396
	15	0.297
	10	0.198
	5	0.099
	3	0.059
	2	0.040
	1	0.020

Note: bounty 20% - sales natural gas price is 1.584 \$/1,000 scf - less than 1.6 \$/1,000 scf.

So, NGOT can discount 19%. If bounty and dangerous allowance is 3% and discount for depreciation and others of modification cost is 1.79% (see TABLE-24, 10 years depreciation, 1 ton/hr boiler), total is 4.79% on sales natural gas 1.98 \$/1,000 scf, it is 1.89 \$/1,000 scf. And if bounty and dangerous allowance is same as the above and discount for depreciation and others of new natural gas firing boiler cost up is 0.11% (see TABLE-22, 20 years depreciation, 10 ton/hr boiler), total is 3.11% on sales natural gas price 1.98 \$/1,000 scf, it is 1.92 \$/1,000 scf. So, minimum discount price of sales natural gas is 1.89 \$/1,000 scf and maximum of it is 1.92 \$/1,000 scf.

Bounty and allowance can not decided theoretically. NGOT must determine by his consideration, but it is needed to persuade the existing industry to agree upon pricing.

I suppose, bounty and allowance has to be minimum 3% and maximum 5%, because if less than 3%, there is no merit for existing

industry and if more than 5%, existing industry who can not use natural gas make a complaint. Too high bounty is not fare for whole existing industry.

XV VALUABLE USAGE OF NATURAL GAS

Natural gas production from Siam Gulf will make big contribution to Thai economy.

EGAT and existing industry

Natural gas production will be commenced in autumn 1981, and it could be saved crude oil 10% - 15% (7% in the year of 2000) on crude oil throughput as natural gas 700 MMscf/D production at well head.

As far as the natural gas is used by EGAT (electricity) and the existing industry (steam), it is only saving crude oil not valuable usage.

New project

Thai Government is planning new project to use natural gas as raw material or reduction agent, it is more valuable usage. The new projects are integrated flat steel project and soda ash project, and these projects are carried the feasibility study by JICA and not through JICA fertilizer project is concerned.

LPG production

LPG is manufacture in maximum rate and LPG can be export to Japan.

Ethylene production (Petrochemical)

In natural gas, ethane (C_2H_6) fraction is very much contained.

TABLE-25 ETHYLENE PRODUCTION FROM ETHANE IN NATURAL GAS

		in 1985	in 1990
C ₂ H ₆	10 ³ lb/D	2,773.3	3,458.4
	(%) ^{*1}	(10.4)	(11.0)
	T/D	1,260.6	1,572
C ₂ H ₄	T/D ^{*2}	807	1,006
	T/Y	242,000	301,800

Note: *1 % on net gas to pipeline

*2 Ethane recovery from natural gas is 80% on natural gas, and ethylene yield from ethane is 8% on ethane.

Ethylene production of 242,000 T/Y and 301,800 T/Y are economical size, and the ethylene cost is very cheaper than ethylene cost from naphtha or heavier fractions. So, in near future, Thailand might install ethylene plant, and manufacture polyethylene, polyvinylchloride, polystyrene and other many ethylene petrochemicals. When ethylene plant is installed, aromatics (benzene, toluene and xylene) plant must be installed.

LNG production

Natural gas production is not enough for LNG production to export.

XV CONCLUSION

XV .1 Natural gas production (life)

At present natural gas production schedule is 700 MMscf/D, and it is said that the life will be 25 years.

But, (1) recently Union-MOECO confirmed natural gas reserves and expected natural gas production is about 80 MMscf/D (2) Union, Texas-Pacific and Union-MOECO have several structures which are not yet carried exploratory drilling in their concession. So, the life of natural gas production is expected more than 50 years, optimistic

people said life of Thai natural gas production life may be about 100 years.

XV .2 Natural gas utilization

Natural gas utilizations are (1) electric generation (for EGAT) (2) new project (integrated flat steel and soda ash project) in future, fertilizer project (3) existing industry (4) LPG production (5) petrochemicals.

(1) Electric generation (for EGAT)

Minimum natural gas consumption

Bang Pakong Power Station will be install for natural gas utilization, so it can not use fuel oil.

Bang Pakong power plant

o Combined Cycle Power	240 MW x 2 = 480 MW
Natural Gas Consumption	55 MMscf/ x 2 = 110 MMscf/D
o Thermal plants Power	550 MW x 2 = 1,100 MW
Natural Gas Consumption	136 MMscf/D x 2 = 272 MMscf/D
Total	
Power	2,080 MW
Natural Gas Consumption	382 MMscf/D

Maximum natural gas consumption

Natural gas consumption of South Bangkok and Pang Pakong power plants.

South Bangkok

	MW	MMscf/D
No.1	200	52
No.2	200	52
No.3	300	78
No.4	300	78
No.5	300	78
Total	1,300	338

Lang Pakong and South Bangkok total

MM	MMscf/D
3,380	720

Sales natural gas production is 134.16 MMscf/D in 1981 and 546.35 MMscf/D after 1990.

(2) New project

Soda ash project is ASEAN Project, and JICA is carrying feasibility study. It will be commenced the production in 1982 or 1983, actually may be in 1984.

Integrated flat steel project which JICA is carrying feasibility study will be commenced the production in 1985.

Fertilizer project is studying by some Japanese group. It will be commenced the production several years later.

(3) Existing industry

When existing industry uses natural gas instead of fuel oil, he must rebuild from fuel oil firing boiler to natural gas firing boiler or modify from fuel oil firing boiler to natural gas firing boiler

New natural gas boiler price is 15 - 20% higher than new fuel oil firing boiler, and modification cost is 50% of new fuel oil firing boiler. So, NGOT must reduce the natural gas price for compensation, interest, insurance and others of price up of new boiler or modification cost, moreover pay bounty and dangerous allowance.

If natural gas firing boiler has big merit for instance, heat efficiency is high, natural gas price reduction is not necessary, but some demerit.

(4) LPG

LPG production from the refineries will be enough for domestic requirement. So, LPG from natural gas could be export.

In the other hand, LPG utilization must be developed such as motor car fuel.



(5) Ethylene petrochemicals

Ethane in Siam Gulf natural gas is enough quantity to produce ethylene economically. In near future, ethylene plant and associated plants will be installed.

XVI COMMENTS

(1) At the present time, natural gas might be used for EGAT and new project. Natural gas firing boiler is not attractive for existing industry.

(2) When natural gas production is increased, and natural gas production life is long, then natural gas might be used for existing industry.

(3) More profitable usage must be developed, such as industry which uses natural gas as raw material. The industry is so-called petrochemical industry, therefore, methane derivative industry and ethylene industry should be developed.

end.

ATTACH.1

TABLE-1 EACH YEAR AND AVERAGE, HEATING VALUE OF SALES NATURAL GAS
(CALCULATED FROM FLUOR'S REPORT)

Unit: BTU/scf

	H.V. Net	H.V. Gross		H.V. Net	H.V. Gross
1981	946*	1,044*	1986	854	944
1982	856	945	1987	863	955
1983	876	964	1988	855	947
1984	858	947	1989	868	959
1985	867	959	1990	880	977

Average H.V. Net 864 BTU/scf
H.V. Gross 955 BTU/scf

Note: * In 1981, only Union will produce natural gas, so it is not included in average.

TABLE-2

NATURAL GAS CONSUMPTION OF EXISTING INDUSTRY EXCEPT CEMENT INDUSTRY

Unit: MMscf/D

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Source*
Construction Material (except cement)	7.43	7.68	7.95	8.27	8.59	8.86	9.13	9.39	9.68	9.97	page 8
Iron and Steel Mill	5.48	5.48	5.48	5.48	5.48	5.48	5.48	5.48	5.48	5.48	page 10
Chemical and Fertilizer	8.82	9.34	9.84	10.60	11.29	11.97	11.72	13.51	14.35	15.15	page 13
Sythetic Fiber	4.82	5.07	5.32	5.59	5.67	5.73	5.78	5.84	5.88	5.95	page 14
Yarn and Fabric	2.47	2.60	2.74	2.85	2.96	3.10	3.21	3.34	3.48	3.62	page 14
Pulp and Paper	13.15	14.79	19.73	20.55	21.10	21.92	22.74	23.29	24.11	24.93	page 16
Glass	14.11	14.65	15.32	15.81	16.25	18.25	18.74	19.10	19.64	20.16	page 18
Tire	2.47	2.74	3.01	3.28	3.56	3.84	4.11	4.38	4.93	5.21	page 19
Food & Beverage	16.98	17.80	18.64	19.72	20.54	21.36	22.20	23.02	23.84	24.96	
Total (Potential) 1,000 BTU/scf**	75.73	80.15	88.03	92.15	95.44	100.51	103.11	107.35	111.40	115.43	
864 BTU/scf***	87.65	92.77	101.89	106.66	110.46	116.33	119.34	124.25	128.94	133.60	

Note: * Source—NATURAL GAS DEMAND FORECAST OF THE INDUSTRY (FUEL RAW MATERIAL), July 20, 1978. (My report)

** Net Heating Value of my report on July 20, 1978.

*** Net heating value of the sales natural gas in this report.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is essential for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for consistent data collection procedures and the use of advanced analytical techniques to derive meaningful insights from the data.

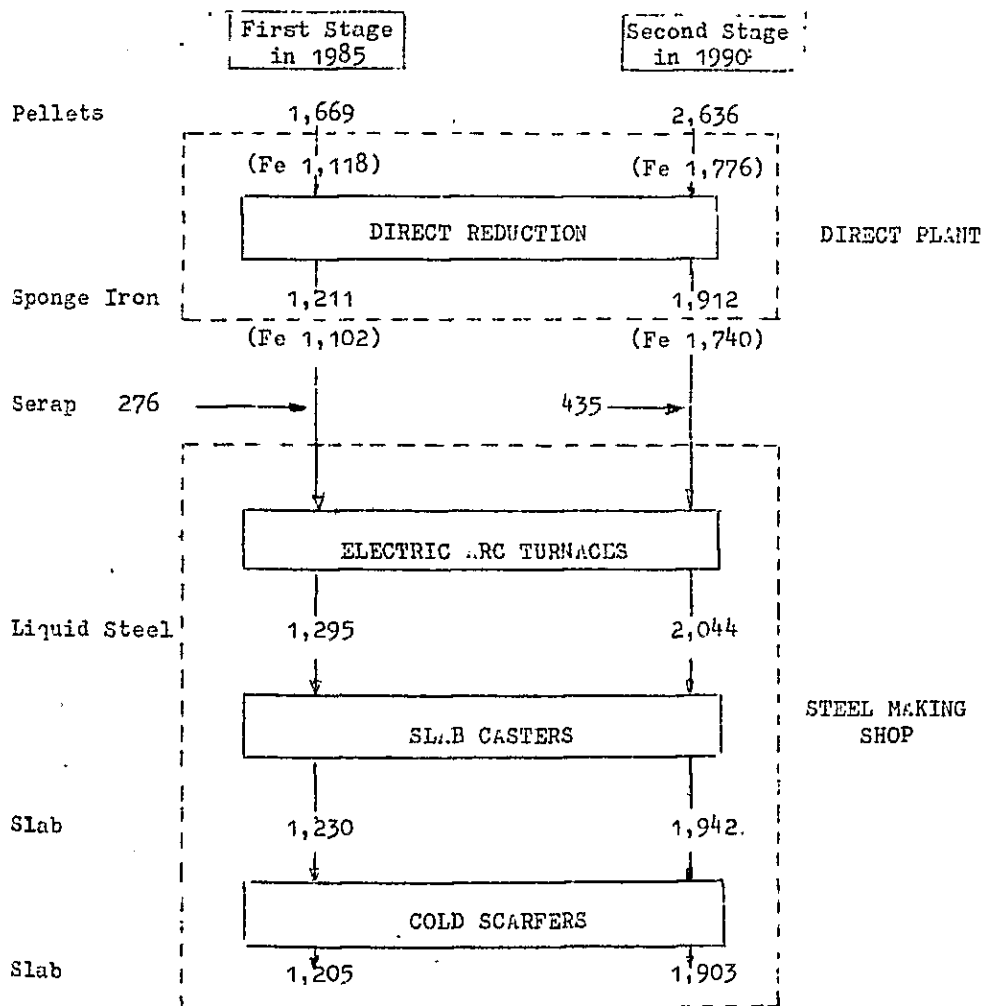
3. The third part of the document focuses on the role of technology in data management and analysis. It discusses how modern software solutions can streamline data collection, storage, and processing, thereby improving efficiency and accuracy.

4. The fourth part of the document addresses the challenges associated with data management, such as data quality, security, and privacy. It provides strategies to mitigate these risks and ensure that the organization's data remains reliable and secure.

5. The fifth part of the document concludes by summarizing the key findings and recommendations. It stresses the importance of ongoing monitoring and evaluation to ensure that the data management processes remain effective and up-to-date.

FIG.1 PRODUCTION FLOW OF INTEGRATED FLAT STEEL PLANT

Unit : 1,000 ton/year



1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part outlines the various methods and tools used to collect and analyze data. This includes both traditional manual methods and modern digital technologies, highlighting the benefits of automation and data integration.

3. The third part focuses on the challenges and risks associated with data management, such as data security, privacy concerns, and the potential for data loss or corruption. It provides strategies to mitigate these risks and ensure the integrity of the data.

4. The fourth part discusses the role of data in decision-making and strategic planning. It explains how data-driven insights can help organizations identify trends, opportunities, and areas for improvement, leading to more informed and effective decisions.

5. The fifth part addresses the importance of data governance and compliance with relevant regulations. It outlines the key principles of data governance, such as data quality, access control, and retention policies, and provides guidance on how to implement these principles in practice.

6. The sixth part concludes by summarizing the key findings and recommendations of the document. It emphasizes the need for a holistic approach to data management, one that integrates technology, processes, and people to maximize the value of data for the organization.

TABLE-3 NATURAL GAS AND ELECTRICITY CONSUMPTION
OF INTEGRATED FLAT STEEL PLANT

	1st Stage (1985)	2nd Stage (1990)	
Natural Gas MMscf/D	50 (57.87)*	75 (86.81)*	Approx. 30% is used in DR plant as reductant.
Electric Power Max. demand	KW 230,000	340,000	Approx. 65% is consumed in electric furnace.
Annual Consumption KWH	$1,500 \times 10^6$	$2,400 \times 10^6$	

Note: Based at 67% Fe in iron oxides.

* 50 MMscf/D and 75 MMscf/D may be calculated 1,000-BTU/scf,
so convert to 864 BTU/scf.

TABLE-4 SODA ASH PROJECT

Production

Soda Ash	400,000 ton/y	1,200 ton/D
Ammonium Chloride	200,000 ton/y	600 ton/D

Natural Gas Consumption 17,000 NM³/Hr
(including electric generation)

$$17,000 \text{ NM}^3/\text{Hr} \times \frac{35.315 \text{ scf}}{1 \text{ NM}^3} \times \frac{(273 + 15.55)^\circ\text{F}}{273^\circ\text{F}} = 634.6 \times 10^3 \text{ scf}/\text{Hr}$$

$$634.6 \times 10^6 \text{ scf}/\text{Hr} \times 24 \text{ Hr} = 15.23 \times 10^6 \text{ scf}/\text{D}$$

$$15.23 \times 10^6 \text{ scf}/\text{D} \times \frac{1,000 \text{ BTU}/\text{scf}}{864 \text{ BTU}/\text{scf}} = 17.63 \times 10^6 \text{ scf}/\text{D}$$

TABLE-5 NATURAL GAS PRODUCTION SCHEDULE
(FLUOR'S REPORT)

Unit:MMscf/D

	Nominal Production			(1)	(2)
	Union + Texas	=	Total	Gas from Pipeline	Net Gas to pipeline
1981	150		150	147.50	134.16
1982	150	150	300	295.01	267.01
1983	200	150	350	344.17	309.05
1984	250	250	500	491.68	444.94
1985	250	250	500	491.68	434.17
1986	250	350	600	590.01	512.88
1987	250	350	600	590.01	499.57
1988	250	450	700	688.35	578.43
1989	250	450	700	688.35	562.32
1990	250	450	700	688.35	546.35
⋮	⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮	⋮

Note : (1) Natural gas from well head
(2) Natural gas to end user

TABLE-7

QUANTITY OF NATURAL GAS PRODUCTION OF NGOT COMPARING WITH THE DEMAND FORECAST

ATTACH.7

YEAR	Natural Gas Production		Demand Forecast of Natural Gas on Heat Value 1,000 BTU/scf			TOTAL MM scf/D	LPG Demand Forecast MM Lit.	LPG ^{*4} Production from Existing Refinery MM Lit.	LPG ^{*5} Shortage MM Lit.	Project of Pipeling	
	Natural Gas At Well Head MM scf/D	Heat Value 1,000 BTU/scf MM scf/D	EGAT ^{*1} MM scf/D	Existing ^{*2} Industry MM scf/D	New ^{*3} Industry MM scf/D					LPG from Gas Plant MM Lit.	Remain of Natural Gas MM scf/D
	1978	-	-	-	-					-	-
1979	-	-	-	-	-	-	316.6	240.35	76.25	-	-
1980	-	-	-	-	-	-	356.4	240.35	116.05	-	-
1981	150	157	181.8	29.3	-	211.1	396.3	240.35	155.95	155.95	133.14
1982	300	275	229.5	32.2	-	261.7	443.9	240.35	203.55	203.55	245.65
1983	350	327	414.0	35.4	-	449.4	463.6	240.35	223.25	223.25	295.29
1984	500	459	414.0	38.9	41.61	494.51	478.5	240.35	238.15	238.15	423.50
1985	500	459	531.9	42.9	41.61	616.41	522.5	240.35	282.15	282.15	419.46
1986	600	538	531.9	45.9	41.61	619.41	571.4	240.35	331.05	331.05	489.23
1987	600	538	531.9	49.2	51.61	632.71	620.0	240.35	379.65	379.65	484.97
1988	700	616	531.9	52.6	53.36	637.86	688.2	240.35	447.85	447.85	555.82
1989	700	616	531.9	56.2	53.52	641.62	763.9	240.35	523.55	523.55	547.70
1990	700	616	531.9	60.2	53.52	645.62	847.9	240.35	607.55	607.55	485.45
1991	700	616	531.9	64.4	53.52	649.82	941.2	240.35	700.85	635.94	463.94
1992	700	616	531.9	68.8	53.52	654.22	1,044.7	240.35	804.35	635.94	463.94
1993	700	616	531.9	73.7	53.52	659.12	1,159.7	240.35	919.35	635.94	463.94
1994	700	616	531.9	78.8	53.52	664.22	1,287.2	240.35	1,046.85	635.94	463.94
1995	700	616	531.9	84.4	53.52	669.82	1,428.8	240.35	1,188.45	635.94	463.94

*1 Demand forecast of South Bangkok power plant and Bang Pakong power station (not including the demand forecast of new construction of power station at Surat-Songkhla.

(Forecast data from EGAT, January 1979).

*2 Existing industry

*3 New industry - ammonia, soda ash and sponge iron.

*4 LPG capacity in country (Production at present, not expansion).

*5 LPG produced from refinery.

TABLE-8 COMPARISON OF NGOT AND FLUOR FOR NATURAL GAS PRODUCTION AND DEMAND FORECAST

Unit : MMscf/D

	NGOT *1	EGOT *7	NGOT *1	TABLE-6 *4	NGOT *1	TABLE-6		NGOT *1		NGOT *1	TABLE-6 *4
	(1) For EGAT	(2) For EGAT	(3) For Existing Industry	(4) For Existing Industry *2	(5) For New Industry *5	(6) For New Industry *3		(7) (1)+(3)+(5)		(8) Remain of Natural Gas	(9) Sales Natural Gas *6
1981	181.8	162.9	29.3	0	-	-		211.1		133.14	134.16
1982	229.5	229.5	32.2	8.8	-	-		261.7		245.65	267.01
1983	414.0	414.0	35.4	18.6	-	-		449.4		295.29	309.05
1984	"	531.9	38.9	30.6	41.61	17.63		494.51		423.50	444.94
1985	531.9	"	42.9	42.7	"	75.5		616.41		419.46	434.17
1986	"	"	45.9	55.2	"	"		619.41		489.23	512.88
1987	"	"	49.2	58.0	51.61	"		632.71		484.97	499.57
1988	"	"	52.6	59.7	53.36	"		637.86		555.82	578.43
1989	"	"	56.2	62.1	53.52	"		641.62		547.70	562.32
1990	"	"	60.2	64.5	"	104.44		645.62		485.45	546.35
1991	"	"	64.4	66.8	"	"		649.82		463.94	"
1992	"	"	68.8		"			654.22		"	"
1993	"	"	73.7		"			659.12		"	
1994	"	"	78.7		"			664.22		"	
1995	"	"	84.8		"			669.82		"	

Note: *1 TABLE-7 (ATTACH.7), 1,000 BTU/scf

*2 Potential natural gas demand of existing industry 0 - 50%, from TABLE-6 (ATTACH.6).

*3 (864 BTU/scf) New projects are integrated flat steel and soda ash project, and they are studying by JICA, but not yet decided, from TABLE-6 (ATTACH.6).

*4 TABLE-6 (ATTACH.6).

*5 New industry - ammonia, soda ash and sponge iron, from TABLE-7 (ATTACH.7).

*6 Heating value is 864 BTU/scf, from TABLE-5 (ATTACH.5).

*7 TABLE-10 (ATTACH.9). (1,000 BTU/scf)

TABLE-9

NATURAL GAS FIRING POWER PLANT

Location	Capacity MW	Completion	
South Bangkok			
Thermal	No.1 200	Existing	} From 1981*
	No.2 200	"	
	No.3 300	"	
	No.4 300	"	
	No.5 300	"	
Bang Pakong	No.1 240	Oct. 1980	
Combined Cycle	No.2 240	April 1981	
Bang Pakong	No.1 550	July 1983	
Thermal	No.2 550	April 1984	

Note: Modification No.1 and No.2 in 1981, No.3 in 1982, No.4 and No.5 in No.4 and No.5 in 1983.

TABLE-10 FORECAST DEMAND OF NATURAL GAS ON ELECTRICITY GENERATING OF EGAT DURING 1981 - 1995 (MADE BY EGAT)

Unit : MMscf/D

	Bang Pakong				South Bangkok	Grand Total	
	Combined Cycle		Thermal		Thermal	N.G. H.V.	N.G. H.V.
	No.1	No.2	No.1	No.2	No.1-No.5	900 BTU/scf	1,000 BTU/scf
1981	53	53	-	-	75	181	162.9
82	"	"	-	-	149	255	229.5
83	"	"	131	-	223	460	414.0
84	"	"	"	131	"	591	531.9
85	"	"	"	"	"	"	"
86	"	"	"	"	"	"	"
87	"	"	"	"	"	"	"
88	"	"	"	"	"	"	"
89	"	"	"	"	"	"	"
90	"	"	"	"	"	"	"
91	"	"	"	"	"	"	"
92	"	"	"	"	"	"	"
93	"	"	"	"	"	"	"
94	"	"	"	"	"	"	"
95	"	"	"	"	"	"	"

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TABLE-11 SOUTH BANGKOK THERMAL PLANT

Thermal	Capacity MW	Potential N.G. Cons.		Factor %	N.G. Cons. MMscf/D
		F' (Mscf/H)	F" (MMscf/D)		
No.1	200	2,170	52	100	52
No.2	200	2,170	52	"	52
No.3	300	3,255*	78	"	78
No.4	300	3,255	78	"	78
No.5	300	3,255	78	"	78

Note: * $3,415 \text{ BTU/KWH} \times \frac{300 \text{ KW}}{0.36426} \div 864 \text{ BTU/scf} = 3,255 \text{ Mscf/H}$

Some of five thermal plants will be modified to dual thermal plant.

Efficiency --- $3,415 \text{ BTU/KWH} \times \frac{300 \text{ MW}}{x} \div 900 \text{ BTU/scf} \times 24 \text{ H} = 75 \text{ MMscf/D}$

(Note: 75 MMscf/D was calculated by EGAT)

x = 36.426 %



TABLE-12 COMBINED CYCLE PLANT AT BANG PAKONG

Combined Cycle	Capacity MW	Potential N.G. Cons.		Factor %	N.G. Cons. MMscf/D	Completion Date
		F' (Mscf/H)	F'' (MMscf/D)			
No.1 (Comp. Oct. 1980)	240	2,300*	55	100	55	1980
No.2 (Comp. April 1981)	240	2,300	55	100	55	1981

Note: * $3,415 \text{ BTU/KWH} \times \frac{240 \text{ MW}}{41.237} \div 864 \text{ BTU/scf} = 2,300 \text{ Mscf/H}$

Efficiency — $3,415 \text{ BTU/KWH} \times \frac{240 \text{ MW}}{x} \div 900 \text{ BTU/scf} \times 24 \text{ H} = 53 \text{ scf/D}$

(Note: 53 scf/D was calculated by EGAT)

x = 41.237 %



TABLE-13 THERMAL PLANT AT BANG PAKONG

Thermal	Capacity MW	Potential N.G. Cons.		Factor %	N.G. Cons. MMscf/D
		F' (Mscf/H)	F" (MMscf/D)		
No.1 (Comp. July 1983)	550	5,686*	136	100	136
No.2 (Comp. Aug. 1984)	550	5,686	136	100	136

Note: * $3,415 \text{ BTU/KWH} \times \frac{550 \text{ MW}}{0.38234} - 864 \text{ BTU/scf} = 5,686 \text{ Mscf/H}$

Efficiency — $3,415 \text{ BTU/KWH} \times \frac{550 \text{ MW}}{x} \div 900 \text{ BTU/scf} \times 24 \text{ H} = 131 \text{ scf/D}$

(Note: 131 scf/D was calculated by EGAT)

$x = 38.234 \%$

TABLE-14

CASE-1 FORECAST DEMAND OF NATURAL GAS ON ELECTRICITY
GENERATING OF EGAT DURING 1981 - 1995

Unit : MMscf/D

	Bang Pakong				South Bangkok					Natural Gas Balance				
	(1) C.C. No.1	(2) C.C. No.2	(3) T. No.1	(4) T. No.2	(5) - (9)					(10) ^{*1} Max. Cons.	(11) ^{*2} Min. Cons.	(12) ^{*3} Shut-Down	(13) ^{*4} For EGAT	(14) ^{*5} For EGAT Min.
1981	55	55	0	0			78			188	133	(2)	134	101
1982	"	"	0	0			155			265	210	(7)	267	200
1983	"	"	136	0			232			478	342	(3)	309	232
1984	"	"	"	136			"			614	478	(4)	445	334
1985	"	"	"	"			"			"	"	(3)	434	326
1986	"	"	"	"			"			"	"	(4)	513	385
1987	"	"	"	"			"			"	"	(3)	500	375
1988	"	"	"	"			"			"	"	(4)	578	434
1989	"	"	"	"			"			"	"	(3)	562	422
1990	"	"	"	"			"			"	"	(4)	546	410
1991	"	"	"	"			"			"	"	(3)	"	"
1992	"	"	"	"			"			"	"	(4)	"	"
1993	"	"	"	"			"			"	"	(3)	"	"
1994	"	"	"	"			"			"	"	(4)	"	"
1995	"	"	"	"			"			"	"	(3)	"	"

Note: C.C. Combined Cycle plant

T. Thermal plant

(10)^{*1} Potential Natural gas consumption (1) + (2)+ (5) - (9)

(11)^{*2} (10) minus natural gas consumption of the biggest plant which is shut-down for maintenance. No. is shown in (12).

(12)^{*3} No. of plant which is shut-down for maintenance (the biggest plant).

(13)^{*4} Wholesales natural gas which is come from (1) of TABLE-6 (ATTACH.6).

(14)^{*5} (13) x 75% This is minimum natural gas consumption per day which is limited by contract.

TABLE-15 CASE-2 NATURAL GAS BALANCE OF EGAT (WHOLESALES NATURAL GAS IS SUPPLIED TO EGAT)
(NATURAL GAS PRODUCTION 150 OR 200 MMSCF/D IN 1981)

	Bang Pakong				South Bangkok					NATURAL GAS BALANCE FOR EGAT				
	(1) C.C. No.1	(2) C.C. No.2	(3) T. No.1	(4) T. No.2	(5) T. No.1	(6) T. No.2	(7) T. No.3	(8) T. No.4	(9) T. No.5	(10) ^{*1} Max.Cons.	(11) ^{*2} Min.Cons.	(12) ^{*3} Shut-Down	(13) ^{*4} i.or EGAT	(14) ^{*5} For EGAT Min.
150 MMscf/D 1981	55	55	-	-	52					162	107	(2)	134	101
1982	55	55	-	-	52	52	78			292	214	(7)	267	200
1983	55	55	136	-	52	-	78			376	240	(3)	309	232
1984	55	55	136	136	-	-	78			460	324	(4)	445	334
1985	55	55	136	136	-	-	78			460	324	(3)	434	326
1986	55	55	136	136	52	-	78			512	376	(4)	513	385
1987	55	55	136	136	52	-	78			512	376	(3)	500	375
1988	55	55	136	136	52	52	78			<u>564</u> **	428	(4)	<u>578</u> ***	434
1989	55	55	136	136	52	52	78			564	428	(3)	562	422
1990	55	55	136	136	52	52	78			564	428	(4)	546	410
1991	55	55	136	136	52	52	78			564	428	(3)	546	410
200 MMscf/D 1981	55	55			52	52				214	159	(2)	178	134
1982	55	55			52	52	78			<u>292</u> **	214	(7)	<u>312</u> ***	234

Note: C.C. Combined cycle plant

T. Thermal plant

(10)^{*1} Potential natural gas consumption (1) + (2) +

(11)^{*2} (10) minus natural gas consumption of the biggest plant which is shut-down for maintenance. No. is shown in (12).

(12)^{*3} No. of plant which is shut-down for maintenance (the biggest plant):

(13)^{*4} Wholesales natural gas which is come from (1) of TABLE-6 (ATTACH.6).

(14)^{*5} (13) x 75% This is minimum natural gas consumption per day, limited by contract.

** (10) is less than *** (13), so when contract is made, daily contract quantity must be less than Fluor's report.

TABLE-16 CASE-3 NATURAL GAS BALANCE FOR EGAT (ONLY SUPPLY TO NEW PROJECT)

(NATURAL GAS PRODUCTION 150 OR 200 MMSCF/D IN 1981)

Unit : MMscf/D

	Bang Pakong				South Bangkok					NATURAL GAS BALANCE FOR EGAT				
	(1) C.C.No.1	(2) C.C. No.2	(3) T. No.1	(4) T. No.2	(5) T. No.1	(6) T. No.2	(7) T. No.3	(8) T. No.4	(9) T. No.5	(10)* ¹ Max. Con	(11)* ² Min. Con	(12)* ³ Shut-Down	(13)* ⁴ For EGAT	(14)* ⁵ For EGAT Min.
150 MMscf/D														
1981	55	55	-	-	52	-	78			162	107	(2)	134	101
1982	55	55	-	-	52	52	78			292	214	(7)	267	200
1983	55	55	136	-	52	-	78			376	240	(3)	309	232
1984	55	55	136	136	-	-	78			460	324	(4)	427	320
1985	55	55	136	136	-	-	78			460	324	(3)	359	269
1986	55	55	136	136	-	-	78			460	324	(4)	437	328
1987	55	55	136	136	-	-	78			460	324	(3)	424	318
1988	55	55	136	136	52	-	78			512	376	(4)	503	377
1989	55	55	136	136	52	-	78			512	376	(3)	487	365
1990	55	55	136	136	-	-	78			460	324	(4)	442	332
1991	55	55	136	136	-	-	78			460	324	(3)	442	332
200 MMscf/D														
1981	55	55			52	52	-			214	159		179	134
1982	55	55			52	52	78			292*	214		312**	234

Note: C.C. Combined cycle plant

T. Thermal plant

(10)*¹ Potential natural gas consumption (1) + (2) +(11)*² (10) minus natural gas consumption of the biggest plant which is shut-down. No. is shown in (12).(12)*³ No. of plant which is shut-down for maintenance (the biggest plant).(13)*⁴ Wholesales natural gas which is come from (4) of TABLE-6 (ATTACH.6).(15)*⁵ (13) x 75% This is minimum natural gas consumption per day which is limited by contract.

* (10) is less than ** (13), so when contract is made, daily contract quantity must be less than Fluor's report.

TABLE-17 CASE-4 NATURAL GAS BALANCE FOR EGAT (SUPPLY 50% MAX. OF EXISTING INDUSTRY AND 100% OF NEW PROJECT)
(NATURAL GAS PRODUCTION 150 OR 200 MMSCF/D IN 1981)

Unit : MMscf/D

	Bang Pakong				South Bangkok					NATURAL GAS BALANCE FOR EGAT				
	(1) C.C. No.1	(2) C.C. No.2	(3) T. No.1	(4) T. No.2	(5) T. No.1	(6) T. No.2	(7) T. No.3	(8) T. No.4	(9) T. No.5	(10) ^{*1} Max. Con.	(11) ^{*2} Min. Con.	(12) ^{*3} Shut-Down	(13) ^{*4} For EGAT	(14) ^{*5} For EGAT Min.
150 MMscf/D														
1981	55	55	-	-	52					162	107	(2)	134	101
1982	55	55	-	-	52	52	78			292	214	(7)	258	194
1983	55	55	136	-	52	-	78			376	240	(3)	291	218
1984	55	55	136	136	-	-	78			460	324	(4)	397	298
1985	55	55	136	136	-	-	78			460	324	(3)	316	237
1986	55	55	136	136	-	-	78			460	324	(4)	382	187
1987	55	55	136	136	-	-	78			460	324	(3)	366	275
1988	55	55	136	136	-	-	78			460	324	(4)	443	332
1989	55	55	136	136	-	-	78			460	324	(3)	425	319
1990	55	55	136	136	-	-	78			382* (460)	← can not →		377**	283
1991	55	55	136	136	-	-	78			382* (460)	← can not →		375**	281
200 MMscf/D														
1981	55	55	-	-	52	52				214	159	(2)	179	134
1982	55	55	-	-	52	52	78	78		370	292	(7)	312	234

Note : C.C. Combined cycle plant

T. Thermal plant

(10)^{*1} Potential natural gas consumption (1) + (2) +

(11)^{*2} (10) minus natural gas consumption of the biggest plant which is shut-down for maintenance. No. is shown in (12).

(12)^{*3} No. of plant which is shut-down for maintenance (the biggest plant).

(13)^{*4} Wholesales natural gas which is come from (1) of TABLE-6 (ATTACH.6).

* (10) is bigger than ** (13) , so Bang Pakong Power Plant must use fuel oil.

TABLE-18

CASE-5 NATURAL GAS BALANCE FOR EGAT (SUPPLY 70% MAX. EXISTING INDUSTRY AND 100% NEW PROJECT)
(NATURAL GAS PRODUCTION 150 OR 200 MMSCF/D in 1981)

Unit : MMscf/D

	Bang Pakong				South Bangkok					NATURAL GAS BALANCE FOR EGAT				
	(1) C.C. No.1	(2) C.C. No.2	(3) T. No.1	(4) T. No.2	(5) T. No.1	(6) T. No.2	(7) T. No.3	(8) T. No.4	(9) T. No.5	(10)*1 Max. Con.	(11)*2 Min. Con.	(12)*3 Shut-Down	(13)*4 For EGAT	(14)*5 For EGAT Min.
150 MMscf/D														
1981	55	55	-	-	52					162	107	(2)	134	101
1982	55	55	-	-	52	52	78			292	214	(7)	258	194
1983	55	55	136	-	52	-	78			376	240	(3)	291	218
1984	55	55	136	136	-	-	78			460	324	(4)	397	298
1985	55	55	136	136	-	-	-			382	246	(3)	316	237
1986	55	55	136	136			78			460	324	(4)	382	287
1987	55	55	136	136			-			382* (460)	← can not →		354**	266
1988	55	55	136	136			78			460	324	(4)	419	314
1989	55	55	136	136			78			460	324	(3)	400	300
1990	55	55	136	136			-			382* (460)	← can not →		352**	264
1991	55	55	136	136			-			382* (460)	← can not →		348**	261
200 MMscf/D														
1981	55	55			52	52				214	159	(2)	179	134
1982	55	55			52	52	78			292*	214	(7)	303**	227

Note : C.C. Combined cycle plant

T. Thermal plant

(10)*1 Potential natural gas consumption (1) + (2) +.....

(11)*2 (10) minus natural gas consumption of the biggest plant which is shut-down for maintenance. No. is shown in (12).

(12)*3 No. of plant which is shut-down for maintenance (the biggest plant).

(13)*4 Wholesales natural gas which is come from (1) of TABLE-6 (ATTACH.6).

* (10) is bigger than ** (13), so Bang Pakong Power Plant must use fuel oil.

TABLE-19

NATURAL GAS RESERVES AND PRODUCTION

scf x 10 ¹² 10 ⁶ scf/D	3	4	5	6	7	8	9	10	11	12	13	14	15
	500	16.4	21.9	27.4	32.9	38.4	43.8	49.3	54.8	60.3	65.8	71.2	76.7
600	13.7	18.6	22.8	27.4	32.0	36.5	41.1	45.7	50.2	54.8	59.4	63.9	68.5
700	11.7	15.6	19.6	23.5	27.4	31.3	35.2	39.1	43.1	47.0	50.9	54.8	58.7
800	10.3	13.7	17.1	20.5	24.0	27.4	30.8	34.2	37.7	41.1	44.5	49.7	51.4
900 (A)	9.1	12.2	15.2	18.3	21.3	24.4	27.4	30.4	33.5	36.5	39.6	42.6	45.7
1,000 (B)	8.2	11.0	13.7	16.4	19.2	21.9	24.7	27.4	30.1	32.9	35.6	38.4	41.1
1,200	6.8	9.1	11.4	13.7	16.0	18.3	20.5	22.8	25.1	27.4	29.7	32.0	34.2
1,400	5.9	7.8	9.8	11.7	13.7	15.7	17.6	19.6	21.5	23.5	25.4	27.4	29.4

Note: 20 years reserves 30 years reserves

