



INTERNATIONAL ENERGY AGENCY

South East Asia gas study



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FOREWORD

The IEA's *World Energy Outlook* (1998) projects that under the business-as-usual scenario, world energy demand will grow by 65% from 1995 to 2020 and CO₂ emissions will increase by 70% during the same period. Increase in energy demand in OECD-Pacific, China and East Asia represents more than 40% of incremental energy demand during this period.

Asia will have to depend increasingly on oil imports from outside the region, particularly from the Middle East, in order to meet this increase in energy needs. The greater use of gas, much of which could be produced in the region, will therefore play an increasingly significant role in improving energy security. It will also contribute to environmental protection. This will, of course, contribute to the global realisation of both these objectives.

As a supplement to the IEA's *Asia Gas Study* (1996), this study describes the current situation and future challenges in the gas sectors of the Philippines, Vietnam and Myanmar, which are promoting gas production and use. The Secretariat would like to place on record its gratitude for the invaluable information it received from the governments of these countries, and from private and public corporations that are developing gas projects in the countries.

This study is published under my authority as Executive Director and does not necessarily reflect the views or policies of the IEA Member Countries.

Robert Priddle
Executive Director

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EXECUTIVE SUMMARY

The gas shares of total primary energy supply have to date been lower in Asia than in Europe and North America: more than 20% in Europe and North America and less than 10% in Asia.

Some Asian countries, however, do have high gas shares, notably Indonesia, Malaysia and Brunei. In addition to catering for domestic use, these countries have exported LNG (liquefied natural gas) to Japan, Korea and Chinese Taipei over the past 30 years.

But international pipeline gas trade is still at the preliminary stage in the region. There are still only a few international pipelines, including those projected to be built and Asia is clearly different from Europe and North America in this regard. And now additional Asian countries such as the Philippines, Vietnam and Myanmar are promoting gas production and use. Gas will play an increasingly important role in the region in the next century.

This report identifies the current situation and the future challenges of gas development in these countries. These objectives were met through meetings with government officials and project developers in each country.

In the Philippines, the Malampaya gas development project is in progress. A 504-km pipeline is planned to transport gas from the offshore Malampaya field to Luzon Island. Gas is scheduled to be available for use in power plants that have a total capacity of 2,700 MW in 2002. This project should meet 20 to 30% of the country's electricity needs for at least the next twenty years.

Several onshore and offshore gas fields have been exploited in Vietnam to date, including the Tien Hai C (onshore: near Hanoi) and the Bach Ho gas fields. The Nam Con Son project, which has more than a third of total gas reserves in the country, is crucial to Vietnam's gas development. In April 1999, MOUs (Memoranda of Understanding) on the Nam Con Son project were signed to determine the gas price, transportation and indexing and government guarantees, and detailed negotiations are now underway between foreign companies and Vietnamese government agencies and state enterprises.

In Myanmar, the Yadana project to export offshore gas to Thailand via pipeline was completed in 1998. However, gas supply from Myanmar to Thailand has been delayed as a result of Thailand's failure to install combined-cycle gas turbines

as planned. This delay was partly due to the economic crisis which has slowed the estimated increase in electricity demand in Thailand. The Petroleum Authority of Thailand (PTT) as the purchaser of the gas is negotiating with the project developers its liability to pay penalties under take-or-pay provisions in the contract.

Despite the short-term problems, the development of Myanmar gas projects will change Thailand's energy balance. The Yadana and Yetagun (to be completed in 2000) projects are expected to provide about 35% of incremental gas supply in Thailand by the beginning of the next century. Gas from the Yadana project was earmarked for power generation in Myanmar, but this plan has been postponed because the ASEAN's investment commitment was reduced due to economic problems.

According to the IEA's World Energy Outlook 1998, growth in energy demand in OECD Pacific, China and East Asia represents more than 40% of incremental energy demand during the period 1995 to 2020. So dependency on oil imports will continue to increase in Asia, which will have to depend further on the Middle East as its main source of oil. This trend is probably one of the greatest potential causes for instability in Asia's energy supplies.

Therefore, the further use of gas, much of which is produced inside the region, is expected to play an increasingly important role in improved energy security and, as an added-value, environmental protection of the region. The World Energy Outlook 1998 projects an annual average rate of an increase in gas demand of 5.5% in East Asia from 1995 to 2020 and 6.5% in China during the same period.

With this study, a follow-up to the Asia Gas Study (IEA, 1996), the Agency's review of the Asian gas sector is complete. However, the Agency should continue to monitor the progress of the gas sector in Asian countries in order to further our understanding of regional and global energy security.

PHILIPPINES

1. ECONOMY

Corazon Aquino was elected president in 1986 of the democratic regime that followed the “constitutional authoritarianism” of Ferdinand Marcos’ dictatorship. When she came to office, the Philippines was suffering from huge economic turmoil. Mrs. Aquino began restructuring the national economy by establishing the “Medium-Term Philippine Development Plan 1987-1992” which covered liberalisation of imports, tax reform, introduction of foreign capital for industrial development, public investment for agriculture and education, and reform of governmental financial institutions. The Foreign Investment Act, established in 1991, allowed 100% foreign equity ownership, except in certain sectors that were specifically restricted to 25-40% (ownership is restricted to 40% in exploitation, development and use of natural resources) or banned altogether (e.g., mass media and private security agencies).

Although the economy recovered in the late 1980s, it deteriorated in the 1990s due to factors such as drought, a major earthquake, eruption of a volcano and a shortage of electricity. Fidel Ramos, who succeeded Mrs. Aquino in 1992, continued implementing plans to restructure and liberalise the national economy. Annual GDP growth rate increased from 0.3% in 1992 to 2.1% in 1993 and 4.4% in 1994.

In 1992, the government prepared the “Medium-Term Philippine Development Plan 1993-1998”, under which:

- GDP was to increase from a rate of 3.4-4.4% in 1994 to 8.1-9.8% in 1998. Per capita GNP was to increase from US\$ 838 in 1993 to US\$ 1,165-1,262 in 1998;
- Investment was to rise from 24.5% of GNP in 1994 to 29.5% by 1998, mainly fuelled by the private sector;
- Total energy demand was projected to grow at an average annual rate of about 8.0%, reaching 203.15 million barrels of fuel oil equivalent (MMBFOE) in 1998, with power consumption increasing at an average rate of 10.6% annually;
- The share of imported energy was to be reduced from 71.7% in 1992 to 60.08% in 1998;
- Daily brownouts would be eliminated by 1996 with the installation of 7,479 MW of additional generating capacity; and

- The share of oil in power generation was to be reduced from 54.3% to 42.19% in 1998.

The government restructured the Department of Energy (DOE) in 1992 and passed the Electricity Crisis Act (Republic Act 7648) in 1993 with the aim of reducing shortfalls in electricity supply. The Electricity Crisis Act allowed the President, through the National Power Corporation, to enter into negotiated contracts with the private sector for the construction of power infrastructure. Build-Operate-Transfer (BOT) contracts were successfully introduced and encouraged the private sector to invest in more power plants. The first Philippine Independent Power Producer (IPP) project was commissioned in January 1991. These reforms led to economic growth in the country. The growth rate of GDP was 4.4% in 1994, 4.7% in 1995 and 5.9% in 1996.

But then the Asian economic crisis in 1997 hit the Philippines and the annual GDP growth rate fell from 5.2% in 1997 to -0.5% in 1998. The crisis is expected to bottom out in 1999 and the Asian Development Bank (ADB) predicts that the GDP growth in the Philippines will be 2.4% in 1999 and 4.0% in 2000.

Figure 1 Map of the Philippines



Table 1 Energy Indicators

	1971	1975	1980	1985	1990	1992	1994	1997
Energy Production (Mtoe)	6.31	7.10	10.67	14.95	15.90	16.61	17.08	16.62
Net Imports (Mtoe)	8.67	9.96	11.47	7.90	12.53	14.06	15.19	20.92
Total Primary Energy Supply (Mtoe)	14.61	17.24	21.21	22.88	28.29	29.94	33.06	38.25
Net Oil Imports (Mtoe)	8.73	9.95	11.26	7.23	11.74	13.63	14.56	18.72
Oil Supply (Mtoe)	8.36	10.13	10.84	7.69	11.93	13.32	15.61	19.45
Electricity Consumption (TWh)	8.69	12.99	17.70	19.02	22.02	21.78	25.73	33.22
GDP (bill. 90 US\$ using exch. rates)	22.2	27.9	37.5	35.2	44.3	44.2	47.1	54.9
GDP (bill. 90 US\$ using PPPs)	68.2	85.7	115.0	107.9	135.9	135.6	144.6	168.4
Population (millions)	38.7	43.1	48.3	54.7	62.6	65.6	68.7	73.5
Energy Production/TPES	0.43	0.41	0.50	0.65	0.56	0.55	0.52	0.43
Net Oil Imp./GDP (toe / 000 90 US\$)	0.39	0.36	0.30	0.21	0.26	0.31	0.31	0.34
TPES/GDP (toe / 000 90 US\$)	0.66	0.62	0.57	0.65	0.64	0.68	0.70	0.70
TPES/GDP (toe / 000 90 US\$ PPP)	0.21	0.20	0.18	0.21	0.21	0.22	0.23	0.23
TPES/Population (toe / capita)	0.38	0.40	0.44	0.42	0.45	0.46	0.48	0.52
Oil Supply/GDP (toe / 000 90 US\$)	0.38	0.36	0.29	0.22	0.27	0.30	0.33	0.35
Oil Supply/Population (toe / capita)	0.22	0.24	0.22	0.14	0.19	0.20	0.23	0.26
Elect. cons./GDP (kWh / 90 US\$)	0.39	0.46	0.47	0.54	0.50	0.49	0.55	0.61
Elect. cons./Pop. (kWh / capita)	225	301	366	348	352	332	375	452

Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

2. ENERGY SUPPLY AND DEMAND

Total Primary Energy Supply (TPES) increased by an annual average rate of 7.1% from 1987 to 1997. Supply of crude oil and petroleum products rose at an annual average rate of 7.8% during this period. Almost all the crude oil used is imported. Coal production has decreased since 1994 and imports of coal have increased. Geothermal and solar energy showed a steady increase with an annual average rate of 4.8% during this period. Geothermal and solar energy's share of TPES (except for combustible renewables & waste) was 21.6% in 1997.

Total Final Consumption (TFC) increased by an annual average rate of 8.0% from 1987 to 1997. During this period, the annual average increase rate was 9.5% in the industry sector and 7.9% in the transport sector. Consumption of petroleum products rose from 5.496 Mtoe in 1987 to 12.385 Mtoe in 1997.

Deregulation in the oil industry

In 1997, the Philippines Supreme Court overruled the oil industry deregulation legislation because the law's provisions on tariff differentials, inventories and predatory pricing inhibited competition and were deemed unconstitutional. Following this ruling, the Congress prepared a new deregulation law (Republic Act No. 8479)

which came into effect on February 12, 1998. Since then the downstream oil industry has been deregulated. While the old law offered a 4% tariff differential between imports of crude oil and refined products, the new law imposes a uniform 3% tariff on all petroleum products. The law also removes the requirement for all companies to maintain a minimum inventory of 40 days. Additionally, refining companies are required to sell at least 10% of their shares to the public within three years and to list them on the Philippine Stock Exchange.

This deregulation process was divided into two phases:

Phase 1 (five months): The transition period during which the government established an automatic pricing mechanism to enable the domestic price of petroleum products to match the international market price. During this period, a subsidy fund was permitted.

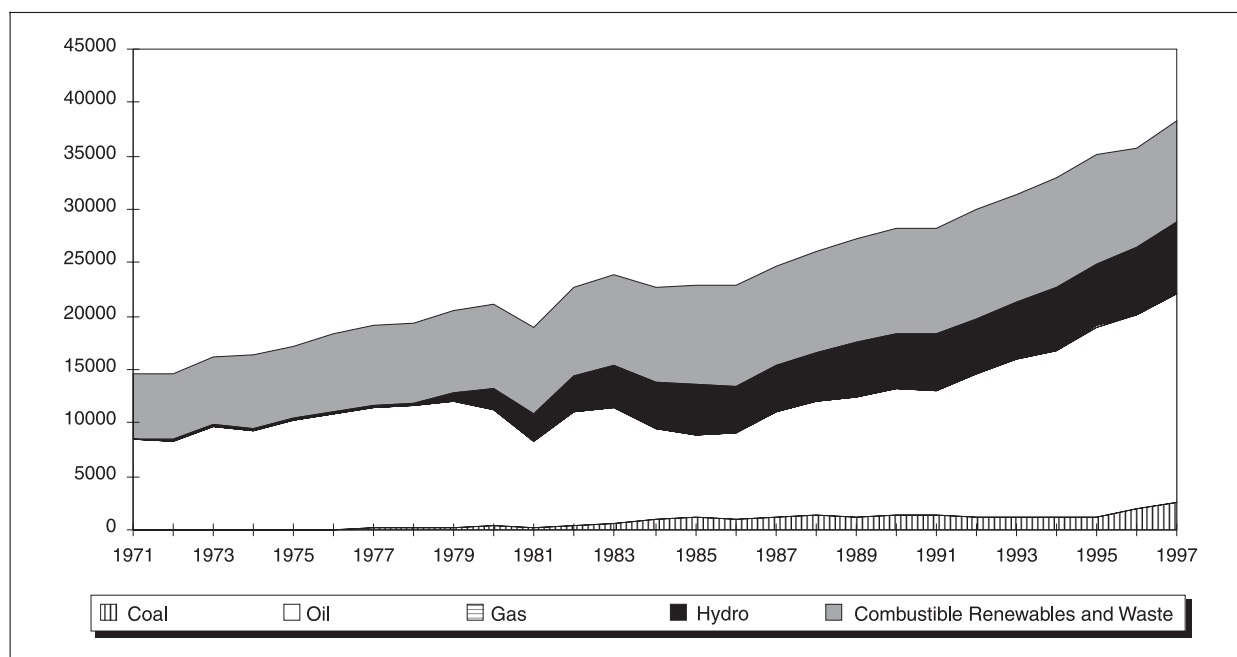
Phase 2 (as from July 13, 1998): The government will no longer intervene in the setting of retail prices of petroleum products. Prices will be determined by market forces. The DOE is expected to continue to monitor the activities of industry to ensure the protection and safety of customers.

The DOE's deregulation programme has attracted further investment, notably in the storage, LPG refilling and petroleum product retailing sectors.

The government is expected to encourage competition under a regime of fair prices and an adequate and secure supply of cleaner petroleum products.

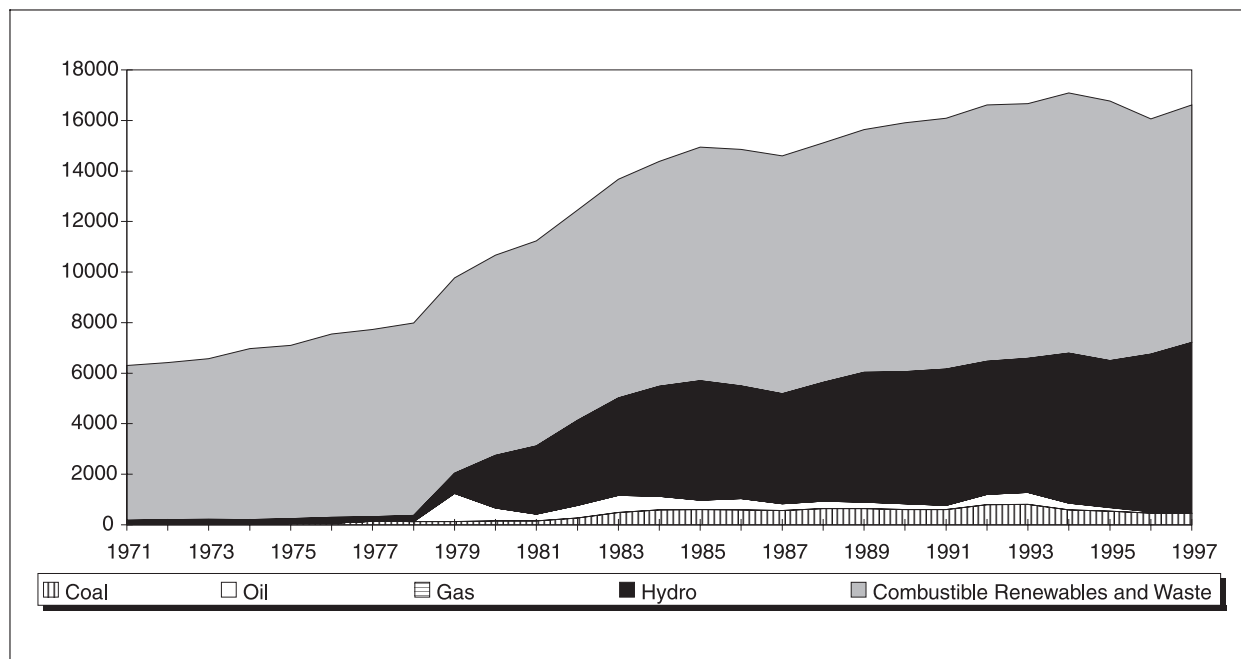
Figure 2

Total Primary Energy Supply
(Thousand tonnes of oil equivalent)



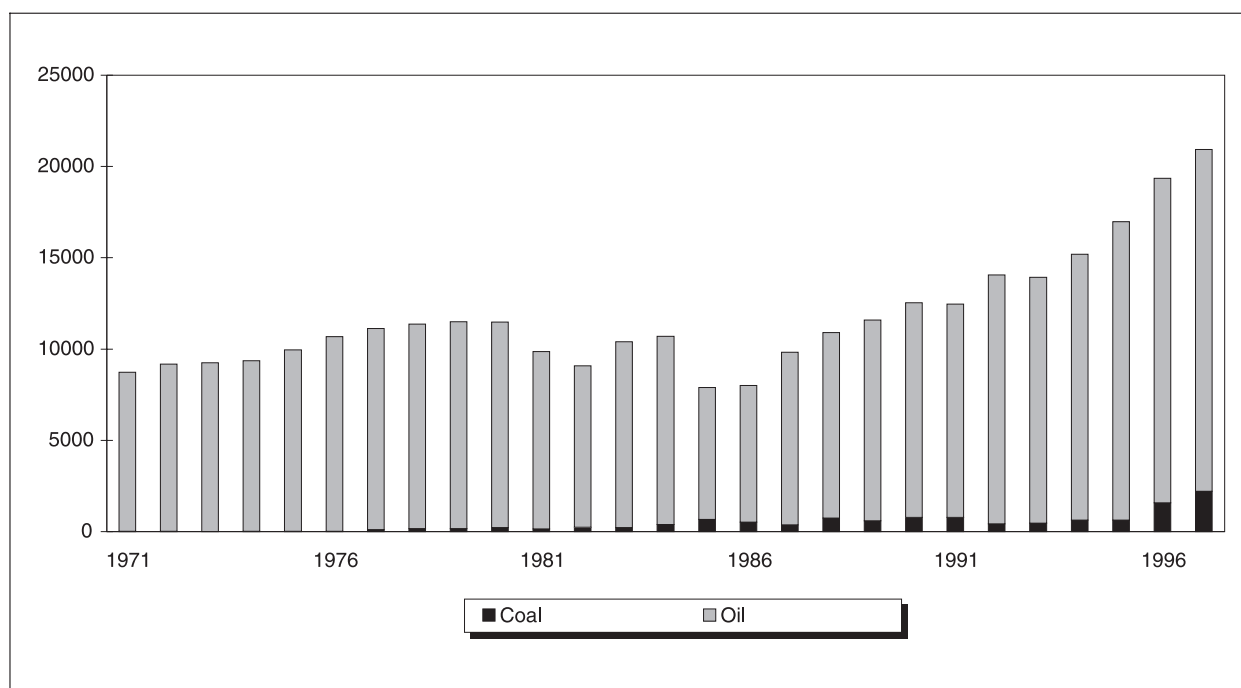
Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

Figure 3 Indigenous Production of Energy
(Thousand tonnes of oil equivalent)



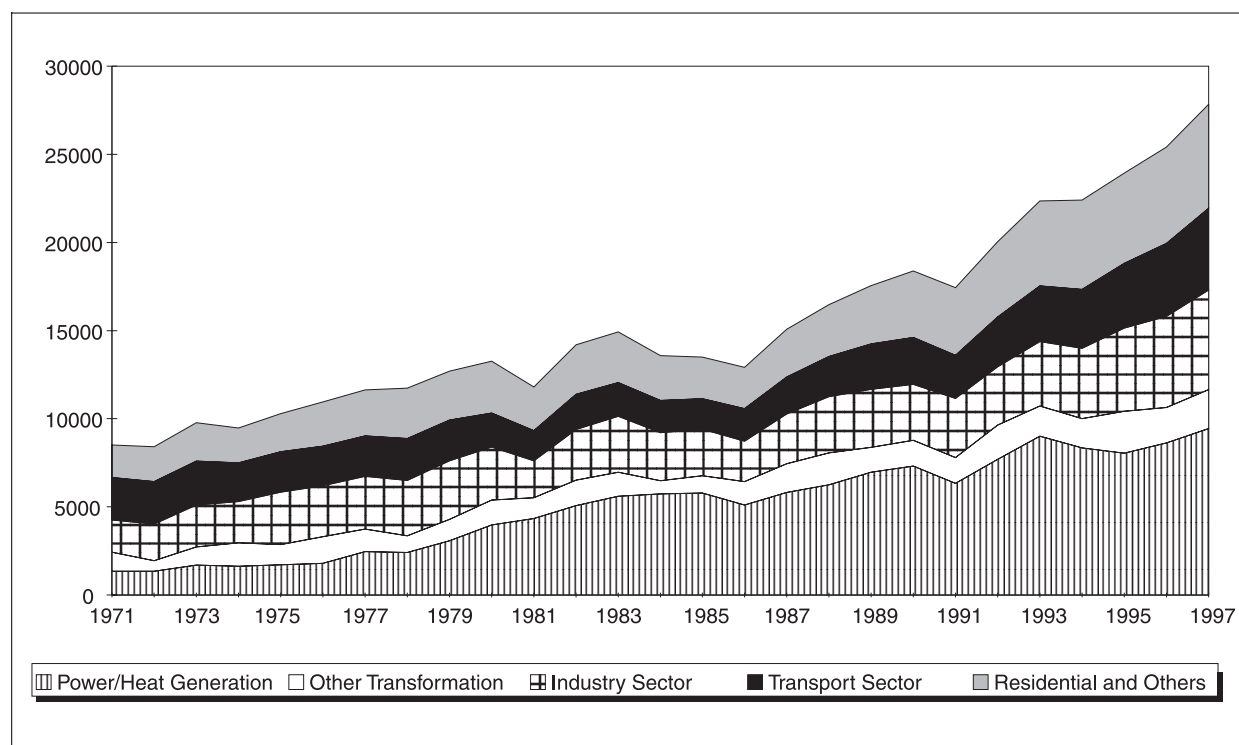
Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

Figure 4 Total Net Imports of Energy
(Thousand tonnes of oil equivalent)



Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

Figure 5 Total Energy Consumption by Sector
(Thousand tonnes of oil equivalent)



Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

Note: Does not include combustible renewables and waste.

DOE's energy supply and demand outlook

The DOE prepared the energy supply and demand outlook for the period 1998 to 2035 in four following scenarios using the following key parameters:

	Annual GDP Increase (%)	Annual Population Increase (%)	Crude Oil Price (US\$/barrel)
1996-2005	7.2	2.0	22.2
2005-2015	7.2	1.6	24.6
2015-2025	6.3	1.2	27.3
2025-2035	6.3	0.9	30.2

Baseline Scenario

This scenario provides two cases. Case 1 projects the results of sectoral plans and programmes based on the most realistic estimates of the economic availability and use of the various energy options. Case 2 considers the option of switching coal to LNG. Coal substitution by LNG in power generation is expected to begin in 2012 in order to meet the expected power demand of 3,000 MW.

Pole-Vaulting Scenario

This scenario encompasses the implementation of the pole-vaulting strategy in the energy sector; namely establishing the Philippines as a net energy exporter in the long term. Plans under this scenario focus on the full-scale contribution of ocean, solar and wind as sources of energy to meet the energy requirements of the country's growing economy.

ASEAN Gas Pipeline Scenario

This scenario involves the imports of natural gas through the Trans-ASEAN gas pipeline. The pipeline will transport natural gas to fuel 7,600 MW of baseload power plant capacity, which will replace coal-fired plants. This option will start in 2015 with an initial capacity of 1,800 MW and is projected to reach 7,600 MW capacity by 2018.

Table 2 Projected Energy Mix
(Million barrels of fuel oil equivalent, Baseline Scenario (Case 1))

	1998	2000	2005	2010	2015	2020	2025	2030	2035
I. Indigenous Energy	104.37	123.17	169.28	204.24	279.67	352.56	413.76	511.94	633.26
Oil	0.33	14.44	10.72	5.56	2.70	1.01	0.00	0.00	0.00
Gas	0.07	0.12	21.70	24.05	62.13	79.37	81.61	127.83	188.19
Coal	3.07	4.56	11.26	19.09	28.04	39.33	49.59	54.39	55.97
Hydro	9.87	10.12	16.10	20.92	30.77	44.86	53.33	61.36	70.87
Geothermal	19.52	18.43	22.34	32.41	37.73	42.84	47.74	56.12	66.75
Other	71.52	75.49	87.16	102.22	118.32	145.14	181.48	212.24	251.49
II. Imported Energy	133.90	151.59	209.00	322.01	420.89	572.94	774.13	1 039.82	1 426.58
Oil	116.29	119.69	160.69	254.55	336.35	436.31	547.66	709.75	946.05
Coal	17.61	31.91	48.31	67.46	84.54	136.63	220.34	311.67	456.00
Nuclear	0.00	0.00	0.00	0.00	0.00	0.00	6.13	18.40	24.53
Total Energy	238.27	274.76	378.27	526.26	700.56	925.50	1 187.89	1 551.75	2 059.84

Source: Department of Energy "Philippine Energy Plan 1998-2035".

Table 3 Natural Gas Demand Outlook
(Million barrels of fuel oil equivalent)

Baseline Scenario (Case 1)							
	2005	2010	2015	2020	2025	2030	2035
Power	21.29	23.64	56.55	71.18	69.48	109.71	160.91
Industry	0.41	0.41	2.64	4.24	6.84	11.01	17.73
Residential/Commercial	0	0	1.74	2.38	3.26	4.47	6.12
Transportation	0	0	1.21	1.57	2.04	2.64	3.43
Total	21.70	24.05	62.13	79.37	81.61	127.83	188.19
Baseline Scenario (Case 2)							
	2005	2010	2015	2020	2025	2030	2035
Power							
NG	21.29	23.64	45.58	60.21	69.48	109.71	160.91
LNG	0	0	21.94	43.88	87.77	149.94	245.02
Industry	0.41	0.41	2.64	4.24	6.84	11.01	17.73
Residential/Commercial	0	0	1.74	2.38	3.26	4.47	6.12
Transportation	0	0	1.21	1.57	2.04	2.64	3.43
Total	21.70	24.05	73.10	112.28	169.38	277.77	433.21
Pole-Vaulting Scenario							
	2005	2010	2015	2020	2025	2030	2035
Power	21.29	23.64	56.55	71.18	69.48	109.71	160.91
Industry	0.41	0.41	2.64	4.24	6.84	11.01	17.73
Residential/Commercial	0	0	1.74	2.38	3.26	4.47	6.12
Transportation	0	0	1.21	1.57	2.04	2.64	3.43
Total	21.70	24.05	62.13	79.37	81.61	127.83	188.19
ASEAN Gas Pipeline Scenario							
	2005	2010	2015	2020	2025	2030	2035
Power							
Local	21.29	23.64	49.23	63.86	69.48	109.71	160.91
Imported	0	0	13.17	55.59	55.59	55.59	55.59
Industry	0.41	0.41	2.64	4.24	6.84	11.01	17.73
Residential/Commercial	0	0	1.74	2.38	3.26	4.47	6.12
Transportation	0	0	1.21	1.57	2.04	2.64	3.43
Total	21.70	24.05	67.98	127.64	137.20	183.42	243.78
ASEAN Electricity Grid Interconnection Scenario							
	2005	2010	2015	2020	2025	2030	2035
Power	21.29	23.64	49.23	60.21	69.48	109.71	160.91
Industry	0.41	0.41	2.64	4.24	6.84	11.01	17.73
Residential/Commercial	0	0	1.74	2.38	3.26	4.47	6.12
Transportation	0	0	1.21	1.57	2.04	2.64	3.43
Total	21.70	24.05	54.81	68.40	81.61	127.83	188.19

Source: Department of Energy "Philippine Energy Plan 1998-2035".

ASEAN Electricity Grid Interconnection Scenario

This scenario simulates the impact of importing electricity through the ASEAN Electricity Grid. 8,443 GWh of electricity will be imported by 2015, rising to 42,215 GWh by 2019. Under this scenario, no additional power plants will be installed, and capital investments will be switched to much-needed energy infrastructure projects, such as exploration and development of indigenous energy sources, research, development and commercialisation of new and renewable energy systems, construction of downstream distribution facilities in strategic areas, and the expansion and rehabilitation of distribution lines.

Under Case 1 of the Baseline scenario, the aggregated natural gas demand for 2002-2025 will reach 1,162.9 MMBFOE, less than the Philippine Energy Plan 1996-2025's projections of 1,565 MMBFOE. The DOE attributes this decrease to more optimistic demand targets in the previous plan based on a higher economic growth outlook and on lower prospects of indigenous natural gas supply.

3. CURRENT STATUS AND FUTURE VISION OF THE GAS SECTOR

Organisational structure **Department of Energy:**

The Department of Energy, which was restructured in 1992 through Republic Act 7638, is mandated to ensure the country's continuous and affordable energy supply with due consideration to environmental concerns by formulating clear policies and response plans and programmes.

The national energy policies are as follows:

- Increase energy self-sufficiency through continuous exploration, development and exploitation of indigenous energy sources;
- Diversify sources of both local and imported energy while ensuring a balance between cost and security;
- Pursue large-scale use of new and renewable sources of energy;
- Provide a reliable and efficient supply of electricity and petroleum products, the two forms of energy most widely used by the different sectors;
- Promote judicious conservation and efficient use of energy;
- Promote the adoption of environmentally-friendly energy systems;

- Encourage greater private sector investment and participation in all energy activities;
- Integrate social and environmental concerns in the planning and implementation of energy programmes and projects; and
- Develop an Energy Information System (EIS) for planning and decision-making processes.

Strategies to support these goals include:

- Intensify exploration and development of indigenous energy sources;
- Increase incentives for private sector investment and participation in all energy activities through the passage of pending energy bills in both Houses;
- Undertake environmental management and community relations activities;
- Pursue privatisation of energy companies;
- Intensify implementation of Demand-Side Management (DSM) and Integrated Resource Planning (IRP) by electric utilities;
- Promote use of natural gas in power generation;
- Restructure the power sector to promote efficiency and accountability;
- Rationalise electricity prices to encourage efficiency in generation, transmission, distribution and use of electricity by end-users;
- Implement long-run marginal cost (LRMC)-based electricity tariffs;
- Diversify energy sources for power generation; and
- Increase the use of natural gas in various sectors.

In addition, the DOE published the following policy guidelines on natural gas development and use in its circular No. 95-06-006 in 1995:

Section 1: The government shall promote the role of natural gas in the energy mix of the country by creating conditions for the Philippine gas industry that economically serve a broader variety of users, including efficient gas-fired power plants, industrial, commercial and residential customers.

Section 2: The Malampaya/Camago gas field shall serve as the foundation for the Philippine gas industry by planning and developing it to supply efficient gas-fired power plants starting year 2001.

Section 3: The Philippine gas industry shall be consistent with the government's overall policy of encouraging private sector participation and reducing the direct involvement of government in the ownership of assets and facilities. The role of government will be confined to that of policy direction and regulation, unless government involvement is demonstrated to provide substantial reduction in the cost of natural gas and economic benefit to the people.

Section 4: Government regulation of the development and operation of the Philippine gas industry facilities shall be structured to facilitate the safe operation and growth of the industry while ensuring equitable non-discriminatory access to all industry participants.

Philippine National Oil Company:

The Philippine National Oil Company (PNOC), which was established in 1973, is responsible for developing the country's indigenous geothermal, coal, natural gas and oil resources and domestic supply of petroleum products. Its subsidiary, PNOC Exploration Corporation (PNOC EC), develops domestic and overseas oil and gas exploration, supply base operations and power generation.

Before the downstream deregulation law came into effect in February 1998, the oil industry in the Philippines was dominated by three companies: Petron, Pilipinas Shell Petroleum and Caltex. Petron is 40% owned by the government. Deregulation allows new players to sell petroleum products in the Philippines, and encourages pricing that reflects international market prices.

National Power Corporation:

The National Power Corporation (NPC) has been the main power generator in the country since 1978.

Executive Order 215 (1987) allowed private companies to construct and operate generating facilities. By the end of 1996, IPPs accounted for 24% of the country's generating capacity. IPP plants are obliged to sell their power to NPC and transmission is undertaken solely by the NPC.

There are 145 investor- and municipal-owned electric utilities and cooperatives that distribute electricity in their service areas.

Energy Regulatory Board:

The Energy Regulatory Board (ERB) was created in 1987 as part of the government's reorganisation programme. The ERB has the authority to fix and regulate both electricity rates and cost adjustments charged by the NPC, private and public utilities and rural electric cooperatives. The Board is also responsible for fixing and regulating the rate schedule of prices of piped gas to be charged by duly

franchised gas companies that distribute gas via underground pipes. It also sets the prices of coal and other energy resources. Following deregulation in the downstream oil sector, the ERB's responsibility is likely to become more focussed on the electricity industry.

Production

The Oil Exploration and Development Act was passed in 1972 to encourage the discovery and development of the country's indigenous petroleum resources.

All energy resources belong to the State which controls their licensing, exploration, development, exploitation and use. A contractor enters into a service contract with the government (Department of Energy) to produce gas, such as Malampaya project. Computation of the government's share under a petroleum service contract is as follows:

Gross Proceeds	100%
(Less:) Filipino Participation Incentive Allowance (which may be given to the contractor with Filipino participation)	7.50%
(Less:) Cost Recovery (70% of gross proceeds or actual expenses whichever is lower)	70%
Net Proceeds	22.50%
Government's Share	13.50%
(Less:) Income Tax:	4.43%
Share of Department of Energy	9.07%
(Less:) Share of Local Government Unit: 40%	3.63%
Net Share of Department of Energy	5.44%

Source: Department of Energy.

Notes: This formula is subject to change every year.

As to net proceeds, the contractor's share is 40%, or 9% of the gross, and the government's share is 60%, or 13.5% of the gross.

A service contract is valid for a maximum of ten years for exploration and 40 years for production and development. Contract area sizes are 50,000 to 750,000 hectares for onshore and 80,000 to 1,500,000 hectares for offshore. Working capital requirements are US\$ one million for operators and US\$ 0.5 million for consortium members. The contractor is exempt from all taxes except income taxes.

The DOE is examining the possibility of new incentives for smaller scale exploration, but is not seeking any tax holiday.

Figure 6 Map of Proposed Gas Pipelines



San Antonio onshore gas field:

PNOC EC has produced natural gas from the San Antonio gas onshore field (Luzon Island: north of Manila) since 1994.

Natural Gas Production from San Antonio Onshore Field
(Unit: million standard cubic feet)

1994	1995	1996	1997
233.607	225.198	380.797	203.208

Source: Department of Energy.

All the gas produced from this field has been used to fuel a 3.25 MW power plant in Echague, Isabela (north of Luzon Island), which generates electricity to some 10,000 households in three neighbouring towns.

One million cubic feet (MCF) of natural gas is produced per day and the remaining reserves are estimated to be 3.5 billion cubic feet (BCF). The PNOC EC puts the remaining production life of the San Antonio gas field at 11 years.

Malampaya gas development project:

The Camago-Malampaya gas field is located in deep water northwest of Palawan Island. Occidental Petroleum discovered the Camago offshore gas field in 1989. Shell Philippines Exploration BV concluded a joint venture agreement with Occidental Philippines Inc., in 1990, and the consortium discovered the Malampaya oil and gas field adjacent to the Camago field in 1992. In September 1998, Shell Philippines Exploration BV acquired a 100% interest in this project following the global Shell-Occidental asset swap and operates the field. The DOE believes this field has at least 2.5 trillion cubic feet (TCF) of recoverable gas reserves.

In January 1998, Shell Philippines Exploration BV and Occidental Philippines Inc., concluded gas supply agreements with First Gas Holdings and National Power Corporation for the Santa Rita power plant and the Ilijan power plant. A gas supply agreement for the 500 MW San Lorenzo (Calabarzon) plant was concluded with First Gas Holdings in April 1998.

First Gas Holdings (Share: British Gas – 40%, First Philippines Holdings – 60%) is planning to use gas for a 1,000 MW gas-combined power generation plant in Santa Rita (7 km from Batangas in Luzon Island) from 2002. The construction of this plant should be completed in 1999 and condensate will be supplied by Enron until 2002. The San Lorenzo Plant, First Holding's second gas power plant in the Philippines, will be built next to the Santa Rita plant.

Under the gas sales agreement Santa Rita will be supplied from January 2002 until December 2023. Supply of gas to San Lorenzo is valid from July 2002 to

June 2023. According to the DOE, the agreed initial price is US\$ 4.076/GJ (US\$ 4.30/MMBTU) – to be reduced gradually during the contract period.

NPC has signed an Energy Conversion Agreement (ECA) with the Korea Electric Power Corporation (KEPCO) for a 1,200 MW gas-fired power plant in Ilijan (15 km from Batangas in Luzon Island). This plant is to be constructed by the KEPCO under a BOT scheme and should begin operations by 2002.

Supply of gas to Ilijan under the gas sales agreement with the NPC is valid from January 2002 to December 2021. According to the DOE, the agreed initial price is US\$ 4.029/GJ (US\$ 4.25/MMBTU) and will be reduced gradually during the contract period.

According to the DOE, 400 to 450 MMCF/D of gas will be supplied through these agreements. The government's revenue from these service contracts is expected to be US\$ 8.1 billion, while the total cost of this project is estimated at US\$ 4.8 billion. If a sufficient volume of gas is not supplied, the buyer or the power plant owners can purchase an alternative fuel; the cost to be borne by Shell Philippines Exploration BV.

A 504-km offshore pipeline is planned by Shell Philippines Exploration BV to transport gas to Batangas. PNOEC would like to join this venture for future third party access and the possibility of transporting gas from other fields.

The pipeline route between Batangas and Santa Rita will be chosen in 1999 and the choice of offshore or onshore depends on the pipeline constructor.

The DOE estimates the Philippine's proved gas reserves to be 3.4 to 5.4 TCF. PNOEC and other exploration companies plan to drill from 1999 onwards.

Future use of natural gas

Indigenous Gas Production Projections
(Unit: billion cubic feet)

1998	2000	2005	2010	2015	2020	2025
0.37	0.64	128.39	127.75	395.41	518.29	475.10

Source: Department of Energy "Philippine Energy Plan 1998-2035".

Under the Plan, 57,852 MW of generation capacity will be added between 1998 and 2025, of which 12,200 MW will be fuelled by gas (990 MW by 2000, 1,710 MW by 2005, 4,500 MW by 2015, 2,000 MW by 2020 and 3,000 MW by 2025). The Plan also states that 22,000 MW will be fuelled by indigenous natural gas by 2035 and that imported LNG may possibly replace up to 9,650 MW of imported coal to fuel baseload facilities during the same period. The share of gas-fired power generation will represent 29% in 2015, 26% in 2020 and 19% in 2025.

While plans to generate a total of 2,700 MW from gas-fired power plants are in progress, there are no firm plans to build other power plants. A 620 MW nuclear power plant in Bataan was almost completed during the presidency of Mr. Marcos, but never went into operations. The Shell Philippines Exploration BV and Occidental Philippines Inc., joint venture had considered converting it to a gas-fired power plant, but no firm decision was reached.

Future gas production totals are still uncertain. If indigenous gas production is lower than expected, imports of LNG could be an option.

Transmission and distribution

Manila Gas Corporation supplied manufactured gas (gas produced from LPG and naphtha) to local customers until 1991. This company now sells LPG in cylinders. New capital is necessary to upgrade this existing gas distribution network for future gas distribution. Manila Gas Corporation is contemplating a partial privatisation.

Despite the precarious future of gas, the DOE described the following plans for gas use in its *Energy Plan 1996-2025*:

Luzon Island:

- Construction of main onshore pipeline from the landing point of the offshore Camago-Malampaya pipeline in Batangas to Sucat, Metro Manila
- Development of gas distribution networks by 2010 (to serve 400,000 consumers or 50% of the total commercial and residential consumers in Metro Manila and the provinces of Batangas, Cavite and Laguna)
- Use of natural gas by the transport sector by 2010
- Construction of an LNG receiving facility by 2010, if deemed necessary.

Mindanao Island:

- Establishment of a gas distribution network in towns along the pipeline from Zamboanga City to Cagayan de Oro by 2020.

Equitable non-discriminatory access to all industry participants is provided for in Section 4 of the policy guideline on natural gas development and utilisation. (Please see page 22.)

Price regulation

As noted previously, the ERB shall fix and regulate the rate of schedule or prices of piped gas to be charged by duly franchised gas companies that distribute gas by means of an underground pipe system.

Tax

Although Republic Act No. 8184 (an act restructuring the excise tax), 1996, sets the tax rate of locally extracted natural gas and LNG at 2% and the 1997 Executive Order No. 461 set the rate of duty on imported LNG at 10%, these taxes have never been applied.

4. CHALLENGES

Financial requirement

In its Energy Plan 1998-2035, the DOE estimates that US\$ 21 billion will be required for oil and gas resource development during this period 1998 to 2025. The total capital investment in the energy sector is estimated at US\$ 156 billion, 64.0% of which is to come from foreign investors. In view of the current Asian economic situation, it could be a major challenge to attract investments — at least in the short-term.

The Plan also forecasts a strong rise in gas demand after 2010. Under the Baseline Scenario (Case 1), it will increase from 24.05 MMBFOE in 2010 to 62.13 MMBFOE in 2015 and 79.37 MMBFOE in 2020. (Please see Table 3.) How much more gas will be produced after the current Malampaya project is completed will depend greatly on foreign investment. It is quite important for the government to develop measures to further attract foreign investment, which will also affect future LNG imports. While the DOE expects that 9,500 MW of gas-fired power plants will be added during this period, an additional 9,000 MW of gas-fired power plants could be added if gas (or imported LNG) prices are more advantageous than coal.

Development of electricity market

In the Philippines, the electricity sector will remain the principal customer for gas in the years to come. The government has to play an important role in developing policies that encourage the liberalisation of the electricity market in order to achieve sustainable economic growth. It is fortuitous that the Philippine's economic situation is expected to be recovered by 2002, when Malampaya gas will come on line for power generation.

Conclusion

The Malampaya project is expected to meet 20 to 30% of the country's electricity needs for at least the next twenty years. The Philippines was not hit by the current economic crisis as severely as other ASEAN countries, such as Indonesia and Thailand. Pending gas sales and purchase agreements on this project were not affected by the economic crisis and the Asian Development Bank predicts a positive economic growth for 1999 and beyond.

Although potential production capacity is not yet certain, natural gas development will improve energy security in the Philippines by decreasing its dependence on imports. This will also lead to further environmental protection by reducing dependency on oil and coal.

Since the use of gas looks likely to grow in the Philippines, interest in projects for gas pipeline networks linking ASEAN countries will increase. Ultimately such networks will increase the use of gas in the region.

VIETNAM

1. ECONOMY

In 1976, when the two Vietnams were reunified as the Socialist Republic of Vietnam, the government implemented the second five-year plan (1976-80), imposing on the south the Soviet-style central planning model. This model described as “the bureaucratic centralised state subsidy system”, led to further decreases in productivity. Following the withdrawal of foreign aid — in the wake of Vietnam’s invasion of Cambodia — per capita output fell by 2% per year between 1976 and 1980.

Reformed policies, such as Directive No. 100 of the Central Committee Secretariat and Decree No. 25-CP, were introduced in 1981. Under the Directive, farming households were allowed to sell agricultural products in excess of their production quotas in the free market, generally at higher prices than regulated ones. These reforms proved insufficient because, while acknowledging the importance of the free market, they attempted to set clear limits on its scope. As a result, inflation rose to 487% in 1986 and the trade deficit continued to increase.

The clear failure of these reforms was the incentive to implement more comprehensive ones. The sixth Communist Party Congress of December 1986 adopted a policy of *doi moi* (renovation programme). At that time, Vietnam was suffering from a high rate of inflation, a decrease in aid from the former Soviet Union and communist countries in central and eastern Europe, a huge financial deficit, and stagnant production caused by inefficient state enterprises. The Congress identified the following central factors as the source of economic problems: discrimination against the non-socialist elements of society such as the collective and private sectors; inefficient central allocation to the state sector; and the favoured position of heavy industry.

A reform package was introduced in 1988 aimed to stimulate production, control inflation and transform the centrally-planned economy to one based on market mechanisms. The key elements were as follows:

- reorganising agriculture on the basis of the household rather than the collective;
- giving state enterprises greater autonomy in decision-making;
- abolishing almost all subsidies and price controls;

- establishing tax and expenditure reforms to reduce the budget deficit;
- lifting restrictions on trade;
- devaluating the *dong* (local currency);
- encouraging the development of the private sector; and
- revising the foreign investment law to encourage further direct investment.

Figure 1 Map of Vietnam



Table 1 Energy Indicators

	1971	1975	1980	1985	1990	1992	1994	1997
Energy Production (Mtoe)	14.03	16.35	18.05	19.75	24.68	28.64	31.54	43.53
Net Imports (Mtoe)	5.69	2.84	1.55	1.63	-0.23	-2.95	-3.61	-4.22
Total Primary Energy Supply (Mtoe)	19.71	19.19	19.35	21.38	24.45	25.69	27.93	39.31
Net Oil Imports (Mtoe)	5.90	3.14	1.86	1.92	0.14	-2.31	-2.59	-2.10
Oil Supply (Mtoe)	5.90	3.14	1.86	1.92	2.89	3.29	4.43	7.77
Electricity Consumption (TWh)	1.79	1.89	2.93	4.14	6.61	7.36	9.59	15.77
GDP (bill. 90 US\$ using exch. rates)	..	..	..	5.1	6.5	7.5	8.8	11.4
GDP (bill. 90 US\$ using PPPs)	..	..	..	52.4	66.2	76.2	89.7	116.9
Population (millions)	43.7	48.0	53.7	58.9	66.2	69.4	72.5	76.7
Energy Production/TPES	0.71	0.85	0.93	0.92	1.01	1.11	1.13	1.11
Net Oil Imp./GDP (toe/000 90 US\$)	..	..	..	0.37	0.02	-0.31	-0.30	-0.18
TPES/GDP (toe / 000 90 US\$)	..	..	..	4.17	3.78	3.45	3.19	3.44
TPES/GDP (toe / 000 90 US\$ PPP)	..	..	..	0.41	0.37	0.34	0.31	0.34
TPES/Population (toe / capita)	0.45	0.40	0.36	0.36	0.37	0.37	0.39	0.51
Oil Supply/GDP (toe / 000 90 US\$)	..	..	..	0.37	0.45	0.44	0.51	0.68
Oil Supply/Population (toe / capita)	0.14	0.07	0.03	0.03	0.04	0.05	0.06	0.10
Elect. cons./GDP (kWh / 90 US\$)	..	..	..	0.81	1.02	0.99	1.09	1.38
Elect. cons./Pop. (kWh / capita)	41	39	55	70	100	106	132	206

Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

Together with Vietnam's withdrawal from Cambodia in 1989, the reform package led to tremendous achievements. The agricultural sector grew by 5.9% in 1988 and 6.4% in 1989. Inflation fell from 308% in 1988 to 35% in 1989. The boom in agriculture and service sectors offset the industrial stagnation caused by the abolition of state subsidies. The *doi moi* was identified as Vietnam's national policy in its revised constitution of 1992. Vietnam began to follow "market socialism".

The seventh Communist Party Congress of 1991 adopted an economic programme called the "Socio-Economic Stabilisation and Development Strategy to the Year 2000". Under the programme, GDP was projected to grow at 8% per year from 1992 to 2000, on the assumption that the investment ratio would double. The industrial sector recorded an average annual growth rate of 13.3% between 1991 and 1995; this was one of the driving forces behind Vietnam's high economic growth. GDP increased by an average of 8.2% per year from 1991 to 1995. In 1995, Vietnam joined the ASEAN and normalised diplomatic relations with the United States. It joined the AFTA (ASEAN Free Trade Area) in 1996, and has

normalised diplomatic relations with European countries. In addition, Vietnam joined the APEC in 1998 and has applied for the WTO.

In 1996, the government established the 1996-2000 five-year plan for socio-economic development. The key objectives are as follows:

- to achieve an average annual economic growth rate of 9-10% by 2000 and to double 1990's per capita GDP by 2000;
- to develop agriculture, forestry and fishery at an average annual rate of 4.5-5%; to develop various industries with emphasis on processing, consumer and export goods industries; to select and build a number of heavy industry establishments (oil and gas, coal, cement, mechanical engineering, electronics, steel, fertilisers and chemicals) as well as some defence industry establishments;
- to increase industrial output by an annual average rate of 14-15%;
- to increase exports by an annual average of 28%;
- to increase imports by an annual average of 24%, targeting raw and other materials, as well as various types of technological equipment to meet the needs of industrialisation and modernisation; and
- to attract and spend effectively some US\$ seven billion from Official Development Assistance (ODA) and US\$ 13-15 billion (1995 price) from foreign direct investment. (Foreign direct investment should be channeled towards those fields, products and services that have advanced technology and a high export ratio. For sectors that do not require large capital investment or high technology, and which generate quick returns, ways to mobilise capital should be sought. Effective policies and measures need to be implemented to target those areas, which have a good potential but are still in a difficult position.)

Those objectives particularly relevant to the energy sector are as follows:

- *to increase prospects for exploration and exploitation of oil and gas in order to reach an output of some 16 million tonnes of crude oil and 130.6-141.3 billion cubic feet of gas by the year 2000; to diversify forms of joint ventures; to raise the capacity of the national oil and gas industry in exploration, exploitation, processing and services; to draw up a master plan for the use of natural and associated gas; to complete the two gas pipeline projects so that 158.9-176.6 billion cubic feet/year may be available; to build Vietnam's first oil refinery (6.5 million tonnes/year); to prepare for the construction of a second oil refinery (or the expansion of the first) and of a petrochemical plant; and*
- *to rapidly increase power supply; to complete construction underway and start new construction of major power plants, so as to provide an additional capacity of*

about 2,500-3,000 MW over the next five years and another 1,000-1,500 MW after the year 2000; to raise power output to approximately 30 billion kWh in 2000; to rehabilitate and add to the network of transformer stations and the electricity grid; to apply strong and effective policies and measures to ensure rational and economical power consumption.

Reforms of state enterprises, which were less efficient and profitable than private enterprises, have been developed with the “*doi moi*” policy. Production targets were abolished and subsidies were largely reduced by the government. This led to the bankruptcy or merger of about 6,000 state enterprises which resulted in the loss of a million jobs. (The number of state enterprises decreased from about 12,000 in 1990 to 6,310 in 1995.) The government gave state enterprises more freedom to establish production and management plans and set prices of products and employees’ wages.

In 1995, the State Enterprise Law was passed with the aim of reforming state enterprises. However, these reforms were not a tremendous success. The profitability of state enterprises has fallen and nearly half lost money in 1997, compared to 22% in 1996. Despite the relatively strong performance of privatised firms, only 14 state enterprises have been privatised so far. The government plans to privatise 150 firms over the years to come, but this challenge seems difficult. Key industries with growth potential — such as cement, oil, steel and electricity — are, and will continue to be, dominated by state enterprises. Small state enterprises will continue to have difficulty in getting bank credit, and will become progressively less unprofitable in the years to come, while many are likely to be merged or closed. The worsening performance of the state enterprises has led many donors including the World Bank to call for major reforms of the sector, such as eliminating the advantages enjoyed by state enterprises, enabling private firms to compete on equal terms. Many donors are also calling for the privatisation of a number of existing state enterprises.

Foreign direct investment is unlikely to recover in the next few years. About two-thirds of investments came from Asian countries such as Korea and Thailand, which are now suffering an economic crisis. It will take several years before these countries recover enough to invest in Vietnam. At the same time, the weakened *rupiah* (Indonesia) and *baht* (Thailand) have made these two countries more competitive than Vietnam in terms of exports to foreign markets, so the government must offer real incentives to make Vietnam attractive to foreign investors.

2. FOREIGN INVESTMENT

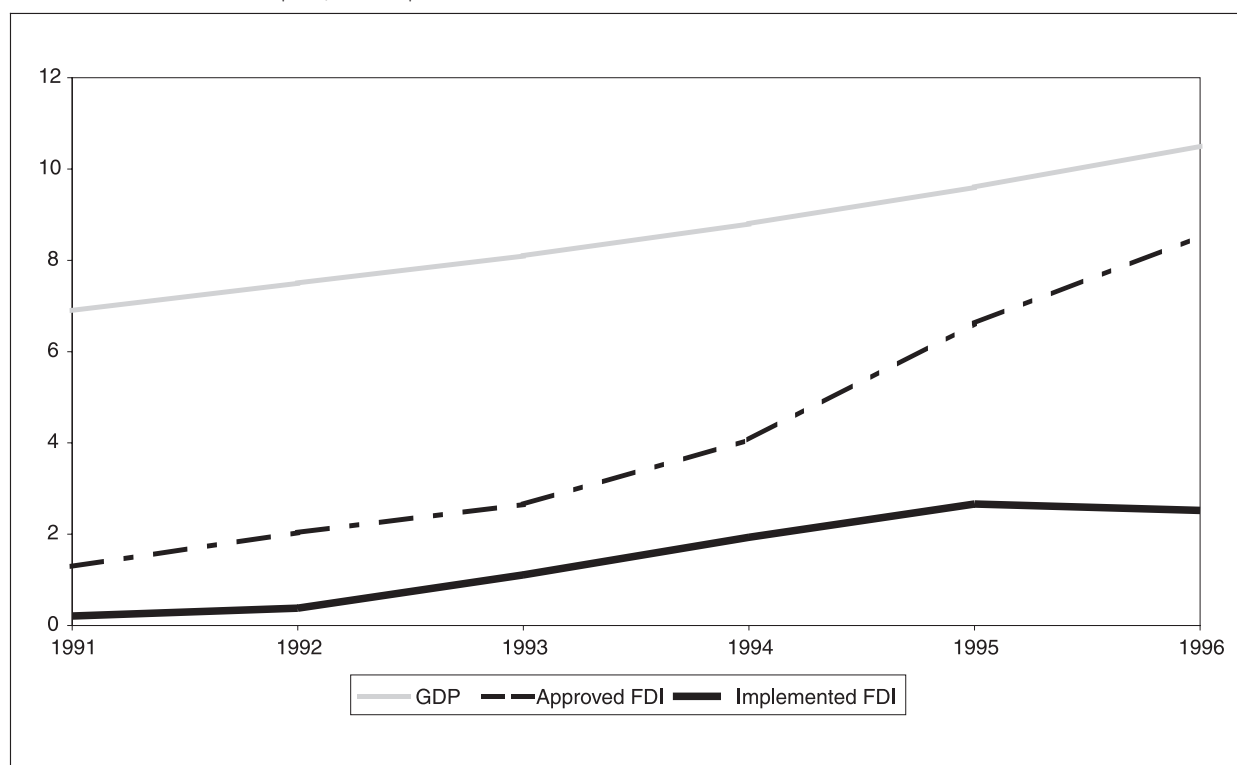
Foreign direct investment has increased at an annual average rate of over 50% since the Foreign Investment Law was passed in 1987. Approved foreign direct investments increased rapidly, from 149 cases (US\$ 1,294 million) in 1991 to 336

cases (US\$ 4,453 million) in 1997. From 1988 to 1997, 2,320 investments totalling some US\$ 31,232 million, were approved. The oil and gas share (US\$ 1,640 million, from 1988 to June 1998) was about 5%. The Foreign Investment Law was revised in 1996 at the request of foreign companies. The key elements of these changes are as follows:

- Article 3 – The government encourages foreign investors to invest in:
 - production of exports;
 - farming and processing of agricultural produce, forestry and aquaculture;
 - advanced technology and modern techniques;
 - environment protection;
 - research and development;
 - labour intensive activities, processing of raw materials and efficient use of natural resources in Vietnam; and
 - construction of infrastructure facilities and major industrial production units.
- Article 3 – Private Vietnamese companies are allowed to co-operate with foreign investors, subject to conditions stipulated by the government;
- Foreign companies or individuals may conduct business in Vietnam under the following circumstances:
 - a business co-operation contract (Article 5);
 - a joint venture contract (Article 6) (Usually the minimum share of foreign partners is 30%: Article 16);
 - an enterprise with 100% foreign owned capital (Article 15); and
 - Build-Operate-Transfer (BOT).
- Article 17 – The duration of an undertaking with foreign owned capital and the duration of a business co-operation contract must be stated in the investment licence for each project in accordance with government regulations, but shall not exceed 50 years;
- Article 21 – Capital and other lawful assets of foreign investors shall not be requisitioned or expropriated by administrative measures, and enterprises with foreign owned capital shall not be nationalised; and
- Article 38 – Enterprises with foreign owned capital and foreign parties to business co-operation contracts shall be subject to profit tax at a rate of 25% on the profits earned; where investment is encouraged, the rate shall be 20% on the profits earned. Where the investment satisfies many investment promotion criteria, the rate shall be 15%. Where the investment is especially encouraged, the rate shall be 10%. *For investments in the oil and gas industry and a number of other*

rare and precious resources, the rate of profits tax shall be set in accordance with the provisions of the Petroleum Law (Please see page 44.) and other relevant legislation.

Figure 2 GDP, Approved and Implemented FDI
(US\$ billion)



Sources: GDP: IEA Estimates; FDI: Ministry of Planning and Investment, Vietnam.

The capital contribution of a foreign party or foreign parties shall be agreed by the joint venture parties but shall not be less than 30% of the legal capital of the joint venture enterprise. (Article 18 of the Governmental 12/CP Decree details the implementation of the law on foreign investment in Vietnam.)

With respect to projects for the construction of infrastructure or the production of essential import substitutes and some major projects, the State Bank assures that enterprises with foreign-owned capital and foreign parties with business contracts shall be permitted to convert Vietnamese currency into foreign currency in order to meet their reasonable requirements in strict compliance with the regulations on foreign exchange control of Vietnam. (Article 72 of the Governmental 12/CP Decree details the implementation of the law on foreign investment in Vietnam.)

In order to encourage foreign organisations and individuals to invest in capital and technology, the Decree on BOT contracts and its regulations was promulgated in November 1993.

The key points are as follows:

- Article 3 of Regulations – A BOT company shall be subject to the following taxes and tax rates:
 - profits tax at a rate of 10% on all profits; exemption from profits tax rate for a period of four years, commencing from the first profit-making year of the business, and a 50% profits tax reduction for a further period of four successive years;
 - withholding tax at a rate of 5% on all profits remitted abroad; and
 - the most preferential turnover tax rate and/or possible exemption from, or reduction of, turnover tax depending on each specific project and as decided by the Prime Minister.

- Article 7 of Regulations – The Government shall give preferential treatment to a BOT company in respect of its right to use land, roads, and other supporting public facilities in order for the BOT company to implement the project on the basis of the BOT contract; and

- Article 7 of Regulations – The right to use land for the implementation of the project shall be exempted from payment of rent.

In Vietnam, BOT projects are still in the early phases. Projects to build an international port and a water supply system are in progress, and power generation plants are being planned through BOT contracts. (Please see *Nam Con Son project*, page 49. The Decree on BOT contracts is currently being revised with a view to attract further foreign investment.)

Following the government decree on measures for encouragement and guarantee of foreign direct investment promulgated in January 1998, investment projects which are encouraged by the government shall be exempted from profits tax for four years and shall be granted a 50% reduction of profits tax for a further four years. (Article 7) The decree also defines exploration and processing of oil and gas as an investment in the form of a joint venture or a business cooperation contract. (Appendix III of the Decree)

3. ENERGY SUPPLY AND DEMAND

Total Primary Energy Supply (TPES) increased by an annual average rate of 11.3% from 1987 to 1997. Oil production has increased remarkably since the Foreign Investment Law enabled foreign investors to develop oil fields, and Vietnam has been a net exporter of energy since 1991. This has contributed to national fiscal balancing. Since the country has no oil refineries, all crude oil is exported and

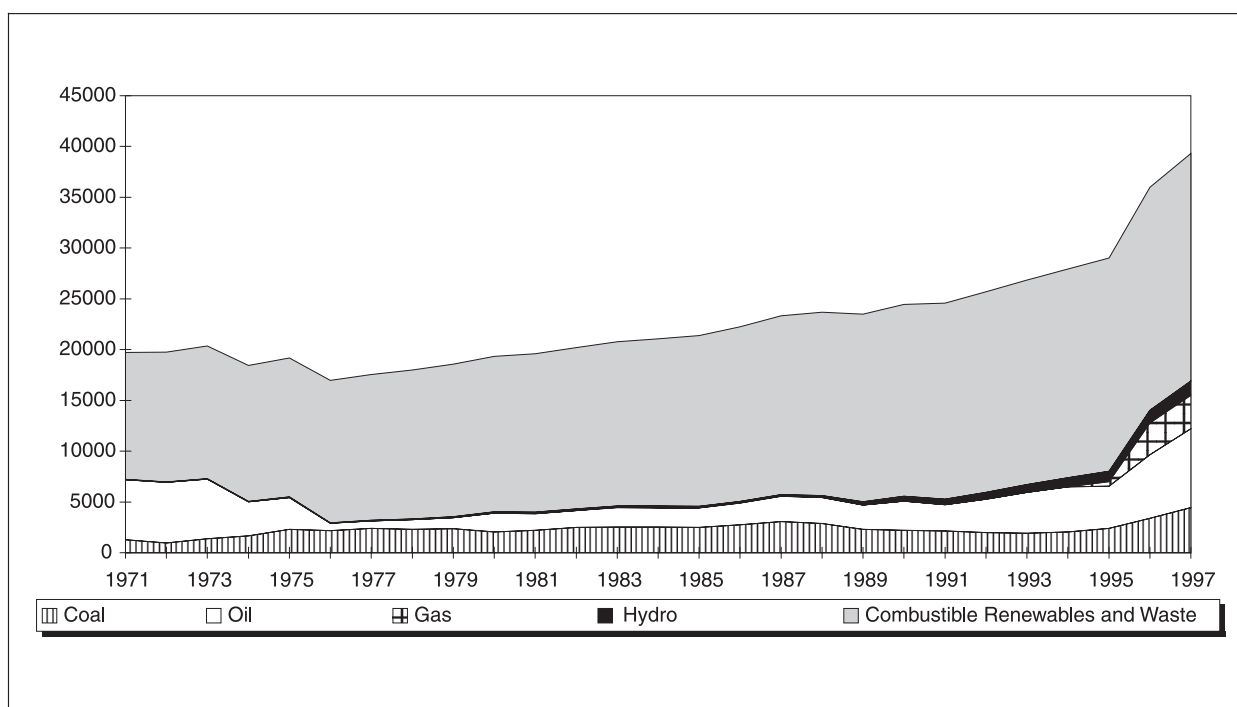
petroleum products are imported for domestic use. However, per capita TPES was 0.51 tonnes of oil equivalent (toe) in 1997, still the lowest level in the world.

During this period, hydro power generation has shown an annual average increase rate — 28.0% from 1987 to 1997, thanks in part to active foreign direct investment. The Hoa Binh hydro power station began operations in 1992 and its present capacity is 1,920 MW. Power generation in general increased by an annual average of 12.8% from 1991 to 1997. (In 1994, the total installed capacity of the Vietnamese power system was 4,484 MW, of which hydro power was 2,824 MW and thermal power 1,661 MW. According to Electricity of Vietnam (a state-owned electricity company), total installed capacity was about 5,000 MW in 1998.)

Coal production and exports have increased since 1990 as a direct result of foreign investment and technology.

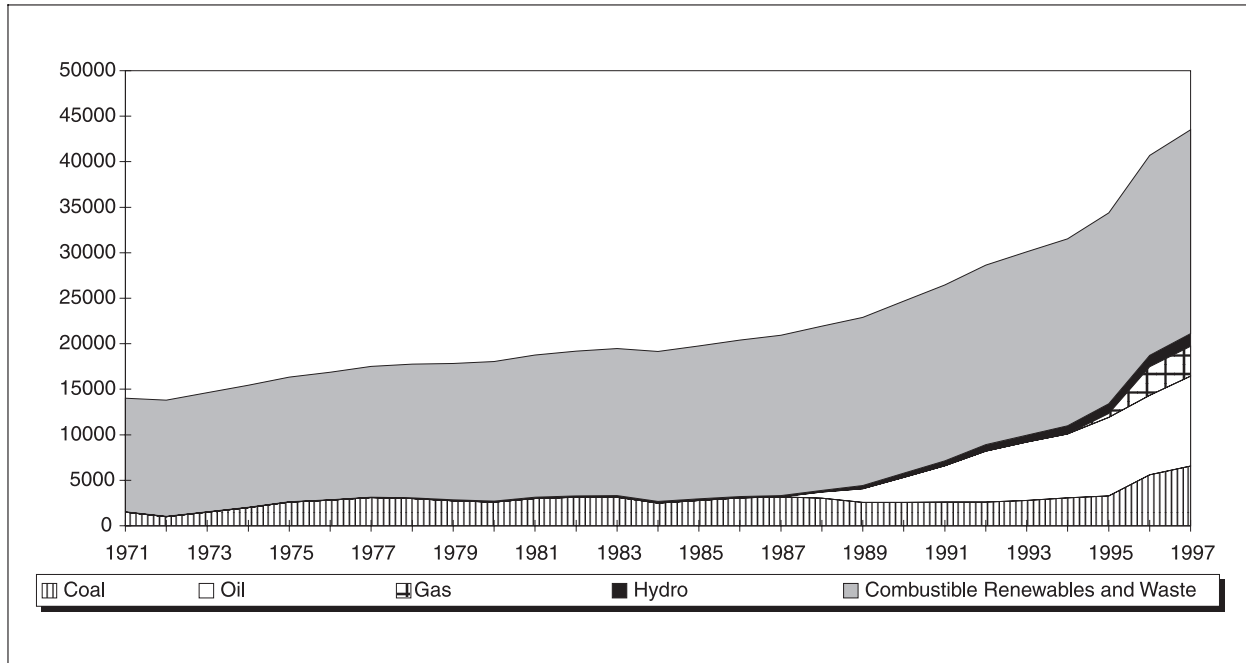
Total Final Consumption (TFC) increased by an annual average rate of 12.5% from 1987 to 1997. During this period, the annual average increase rate was 12.4% in the industry sector and 20.5% in the transport sector. Consumption of petroleum products increased from 2.153 Mtoe in 1987 to 7.183 Mtoe in 1997.

Figure 3 Total Primary Energy Supply
(Thousand tonnes of oil equivalent)



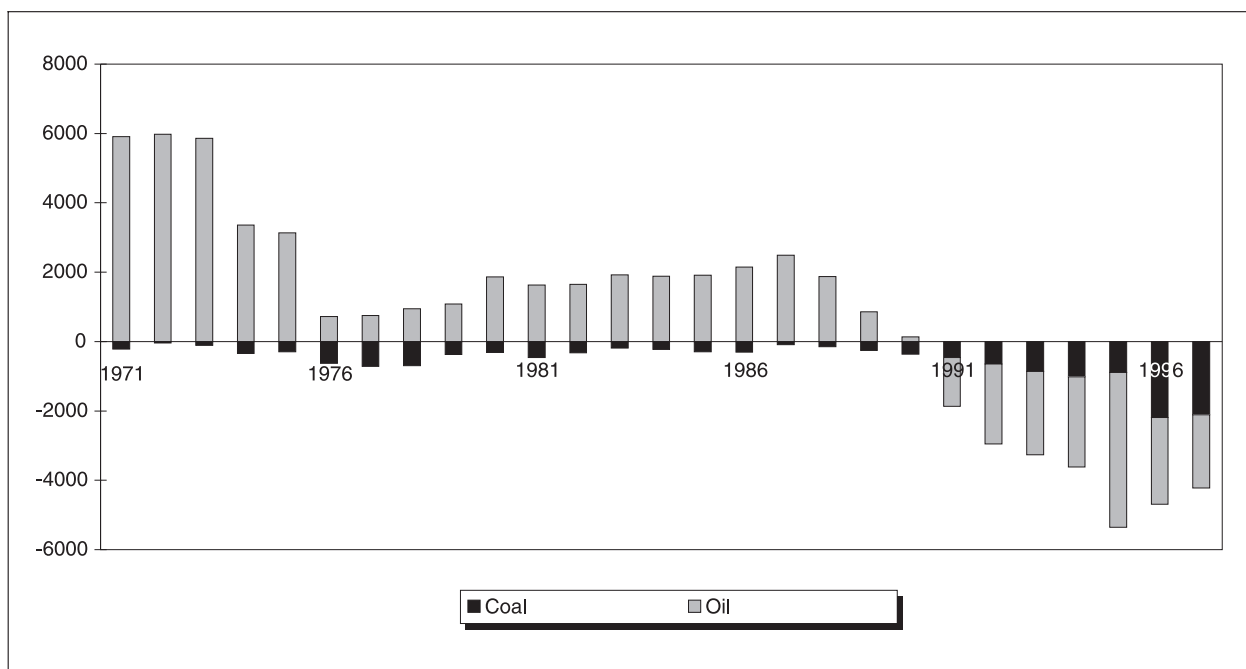
Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

Figure 4 Indigenous Production of Energy
(Thousand tonnes of oil equivalent)



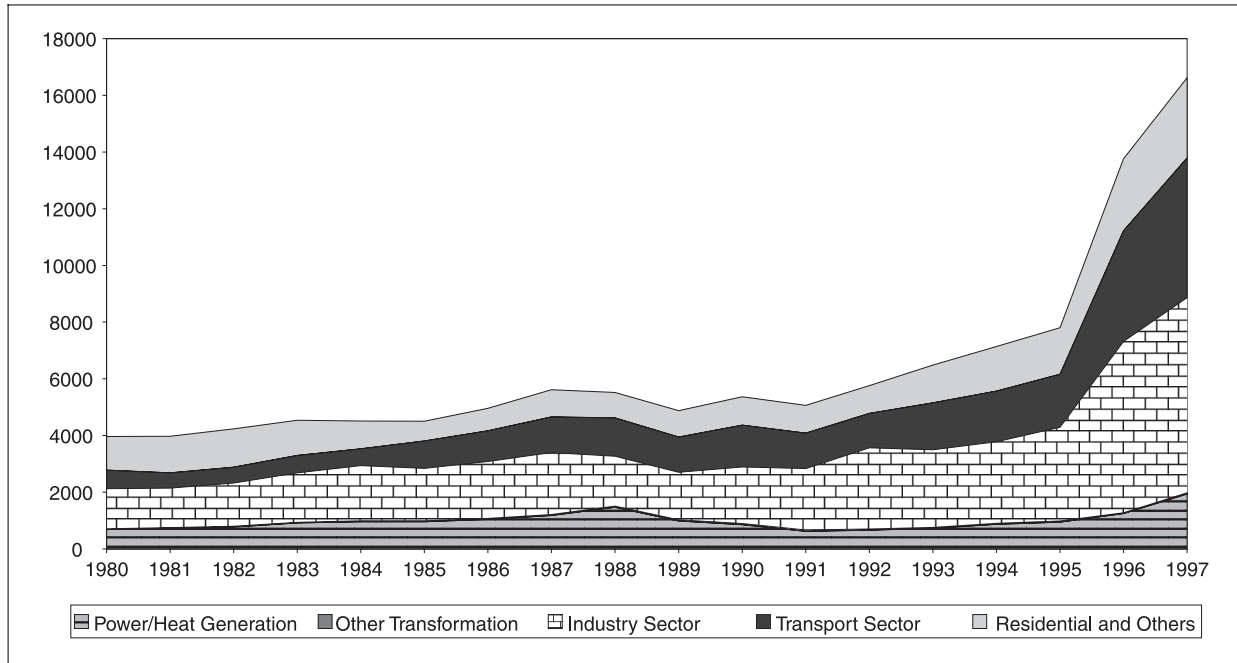
Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

Figure 5 Total Net Imports of Energy
(Thousand tonnes of oil equivalent)



Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

Figure 6 Total Energy Consumption by Sector
(Thousand tonnes of oil equivalent)



Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

Note: Does not include combustible renewables and waste.

According to 1995 forecasts made by the Vietnamese Institute of Energy, from 1993 to 2010 shares of coal are expected to decrease and gas to play an increasingly significant role. This is due to the further development of offshore gas fields and pipelines, which will promote gas-fired power generation. Throughout this projection period to 2010, Vietnam is expected to be self-sufficient in energy.

Following continued economic growth, energy consumption in the industry sector is expected to increase. A rapid rise in the number of automobiles will augment the share of energy consumption by the transport sector.

Energy demand is expected to continue increasing steadily in Vietnam, especially in the southern part of the country, so it is important for Vietnam to continue its efforts to develop its own energy resources to meet increasing needs.

The updated review by the Institute of Energy is scheduled to be published in 1999.

Table 2 Primary Energy Supply Outlook
(Thousand tonnes of oil equivalent)

	1993		2000				2010					
			Base Case		High Case		Base Case		High Case A		High Case B	
Total Primary Energy Supply	6,649		13,458		15,376		34,613		42,696		43,155	
Coal	1,916	28.8%	3,318	24.7%	3,912	25.4%	4,843	14.0%	5,800	13.6%	8,799	20.4%
Crude Oil & Petroleum Products	4,062	61.1%	6,774	50.3%	7,791	50.7%	19,623	56.7%	25,770	60.4%	26,044	60.4%
Gas	0	0.0%	2,013	15.0%	2,303	15.0%	6,906	20.0%	7,773	18.2%	4,811	11.1%
Hydro	671	10.1%	1,353	10.1%	1,370	8.9%	3,241	9.4%	3,353	7.9%	3,501	8.1%

Sources: Institute of Energy, Vietnam (1995), Institute of Energy Economics, Japan (1997).

Table 3 Energy Consumption Outlook
(Thousand tonnes of oil equivalent)

	1993		2000				2010					
			Base Case		High Case		Base Case		High Case A		High Case B	
Coal	1,616	28.1%	2,300	20.3%	2,500	19.3%	3,560	12.0%	3,850	10.4%	3,850	10.4%
Petroleum Products	3,456	60.1%	6,590	58.1%	7,604	58.7%	19,378	65.4%	25,499	69.1%	25,499	69.1%
Gas	0	0.0%	670	5.9%	912	7.0%	1,503	5.1%	1,847	5.0%	1,847	5.0%
Electricity	676	11.8%	1,790	15.8%	1,941	15.0%	5,185	17.5%	5,704	15.5%	5,704	15.5%
Total Final Consumption	5,748		11,351		12,957		29,627		36,899		36,899	
Industry Sector	2,955	51.4%	6,433	56.7%	7,277	56.2%	17,849	60.2%	23,020	62.4%	23,020	62.4%
Residential and Commercial Sector	1,339	23.3%	2,320	20.4%	2,649	20.4%	4,613	15.6%	5,029	13.6%	5,029	13.6%
Transport Sector	1,086	18.9%	2,173	19.1%	2,550	19.7%	6,463	21.8%	8,056	21.8%	8,056	21.8%
Agriculture Sector	368	6.4%	425	3.7%	481	3.7%	702	2.4%	794	2.2%	794	2.2%

Sources: Institute of Energy, Vietnam (1995), Institute of Energy Economics, Japan (1997).

4. CURRENT STATUS AND FUTURE VISION OF THE GAS SECTOR

Organisational structure **Ministry of Planning and Investment:**

The Ministry of Planning and Investment is responsible for approving and managing foreign investments.

Ministry of Industry:

In November 1995, the Ministry of Energy, the Ministry of Heavy Industry and the Ministry of Light Industry were merged into one entity: the Ministry of Industry. The objectives of this new Ministry are:

- to establish energy security progressively (desirable for social and economic development) by diversifying domestic energy resource development and utilisation;
- to gradually reduce the differences in social and economic development and energy supply between urban and rural areas;
- to attract foreign investment and to increase oil and gas production;
- to increase oil and coal exports;
- to promote the use of natural gas, coal and hydro power domestically in order to minimise oil imports;
- to expand power generation capacity;
- to encourage the production, use and eventual export of LPG so that it will become one of the key industries in Vietnam;
- to develop new and renewable energy and nuclear energy;
- to facilitate the efficient use of energy resources through DSM (Demand-Side Management);
- to introduce market-based price setting mechanism; and
- to minimise damage to the environment caused by energy related projects.

PETROVIETNAM:

PETROVIETNAM (Vietnam Oil and Gas Corporation) was established in 1975. It is a state-owned enterprise under the direct control of Prime Minister's Office. PETROVIETNAM handles the following operations, either in its own capacity or through its subsidiaries, affiliates and joint ventures:

- petroleum exploration, production, research, processing, storage, transportation and services;
- import and export of petroleum and its material and equipment;
- import and export of petrochemical products;
- sales and distribution of petroleum and petrochemical products;
- survey, engineering, construction, lease and repairing of floating structures and facilities for civil and petroleum uses;
- consultant services in engineering and construction of floating structures for civil and petroleum uses;
- petroleum insurance and reinsurance; and
- personnel training and supply for the petroleum industry.

About 11,000 employees work for PETROVIETNAM, of which 400 are employed at its headquarters in Hanoi.

Electricity of Vietnam:

In 1995, the state-run Electricity of Vietnam (EVN) was established under the control of the Ministry of Industry following the reorganisation of three regional power companies which covered generation, transmission and distribution in Vietnam. At present, the EVN supervises four transmission companies (north, central, Da Nang and Ho Chi Minh City) and five distribution companies (north, central, south, Hanoi and Ho Chi Minh City). 7,000 employees work for the EVN, of which 200 work at its headquarters in Hanoi.

Institute of Energy:

The Institute of Energy is a research institute under the aegis of the EVN. The Institute published the "*Vietnam Energy Review*" in 1995. An updated review is scheduled to be published in 1999.

Production

Tien Hai C onshore gas field in northern Vietnam (50 km east of Hanoi) was Vietnam's first gas field. It began production in 1981 and initial reserves were estimated at 46 billion cubic feet (BCF).

The gas from this field was used by the Tien Hai power plant (capacity of 35 MW) until 1994. This power plant is not currently operating due to the insufficient volume of gas production. The gas production is estimated to be only 700 million cubic feet (MCF) per year and is used for industrial needs such as the production of brick, cement, ceramic and glass.

Anzoil concluded an MOU (Memorandum of Understanding) with the EVN confirming that the EVN will purchase gas from Hanoi Basin in 1997. If sufficient gas reserves are confirmed, Anzoil could provide gas initially to the Tien Hai power plant, bringing it back into operation, and eventually to other, new gas-fired power stations.

With a view to regulate petroleum (crude oil, natural gas and hydrocarbons) exploration and production activities, the government established the Petroleum Law in 1993 and Decree No. 84/CP was prepared in 1996 to regulate details of the Law's implementation.

The key elements of the Petroleum Law and Decree No. 84/CP are as follows:

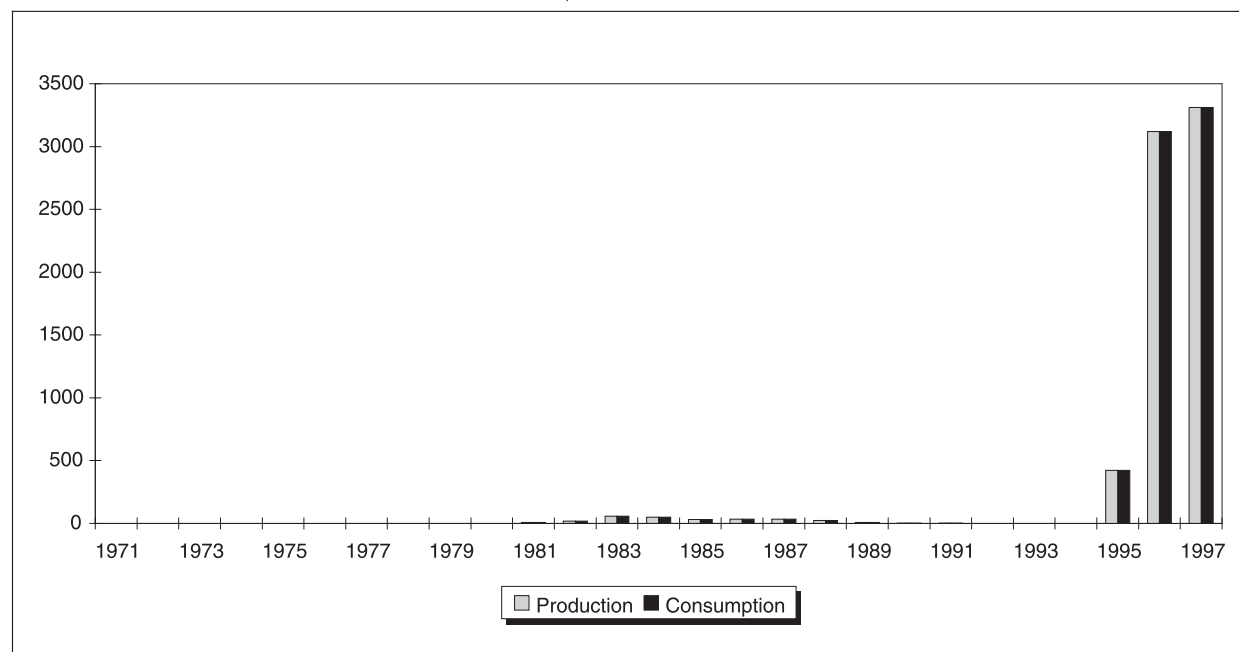
- Article 1 – All petroleum existing in the territory of Vietnam is the property of the Vietnamese people under the sole management of the State of Vietnam;
- Article 5 – An organisation or an individual conducting petroleum operations shall have a plan for environmental protection, take all measures to prevent pollution, promptly eliminate sources of pollution, and be responsible for remedying all consequences of pollution;
- Article 8 – The exploration acreage covered by a petroleum contract shall be determined based upon the blocks determined by the Government of Vietnam;
- Article 14 – The Vietnam Oil and Gas Corporation (PETROVIETNAM) conducts petroleum operations and enters into petroleum contracts with organisations and individuals for the petroleum operations;
- Article 15 – A petroleum contract may be entered into in the form of a production sharing contract, joint venture agreement or other type of contract;
- Article 16 – An organisation or an individual wishing to enter into a petroleum contract shall be subject to the bidding or other procedures stipulated by the government;

- Article 23 of the Decree – With the permission of the Vietnamese government, PETROVIETNAM may enter into a petroleum contract on a selective or bilateral negotiation basis;
- Article 17 – The duration of a petroleum contract for natural gas shall not exceed 30 years, during which the exploration period shall not exceed seven years;
- Article 18 – An exploration acreage under a petroleum contract shall not cover more than two blocks in general;
- Article 25 – PETROVIETNAM shall have the right to participate in the capital investment. Its share of investment, term of participation, reimbursement of expenses incurred by a contractor shall be in accordance with international practices of the petroleum industry;
- Article 28 – Foreign organisations and individuals shall have the right to transfer abroad their recovered capital investment and profits obtained during petroleum operations in accordance with the provisions of the Foreign Investment Law;

Figure 7 Map of Gas Pipelines (current and proposed)



Figure 8 Natural Gas Production and Consumption
(Thousand tonnes of oil equivalent)



Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

Note: Data not available for 1992-1994.

- Article 32 – The rate of royalties for natural gas shall range from 0 to 10%;

Production (cubic feet/day)	Onshore and 200m or less of water depth	More than 200m of water depth
Less than 177 million	0%	0%
177 to 353 million	5%	3%
More than 353 million	10%	6%

Source: Article 44 of the Decree.

- Article 47 of the Decree – The price for calculating royalties on natural gas is the price at the point of delivery (the point accepted by PETROVIETNAM where natural gas is transferred from an oil tanker or other storage facilities to a receiving tanker or other receiving facilities, such as pipelines);
- Article 33 – An organisation or individual conducting petroleum exploration and production shall pay a profit tax at a rate of 50% of taxable profit during the taxable period;
- Article 52 of the Decree – The total taxable profit consists of the total revenue less the value of royalty, the amount of money paid for other taxes and fees

other than the profit tax, and other lawful expenses recoverable during the taxable period; and

- Article 35 – An organisation or individual conducting petroleum operations shall pay export and import taxes, rental for use of land or real estate tax and other taxes and fees stipulated by Vietnamese law.

Following the implementation of the Petroleum Law, 30 production sharing contracts have been concluded to date in the oil and gas sector; of which 17 are still valid.

Bach Ho (White Tiger) project:

Natural gas production projects were designed in the Bach Ho (White Tiger) oil field in the early 1990s. Prior to that more than 35 billion cubic feet (BCF) of gas flared per year. Offshore and onshore pipelines (127 km) and onshore distribution facilities were constructed by Hyundai, and some minimum offshore gas processing equipment was set up by VietSovPetro (a joint venture between PETROVIETNAM and the former Soviet Union's state oil company, which has been the only joint venture in Vietnam's petroleum sector). Gas distribution to the Ba Ria (120 km from Ho Chi Minh City) power generation plant (with the capacity of 271.8 MW) began in May 1995. PETROVIETNAM paid for pipelines using export credits and other loans. A 55 MW power plant will be added at a cost of US\$ 50 million in 1999.

In 1997, the Phu My 2-1 power generation plant (288 MW) was built and a central compression platform was added later. The Phu My 2-1 Extension (288 MW) is set to begin operations in 1999. At present about 106 million cubic feet (MCF) of gas is produced per day. The total investment amounts to US\$ 400 million.

In 1997 NKK Corporation (Japan) and Samsung Engineering (Korea) won an eight billion Yen (US\$ 60 million) contract with PETROVIETNAM to build a natural gas separation plant. This plant, with 150 MMCFD processing capacity will separate gas from Bach Ho field into propane, butane and condensate. After separation, methane gas will be used to fuel a power plant. This separation plant, which is expected to be completed in 1999, will produce 330,000 tons of LPG for domestic use and exports per year. (At present LPG, whose consumption increases 10-15% per year is imported from Malaysia and Indonesia.)

When the Phu My 2-1 power generation plant is extended, it will be impossible for both Ba Ria and Phu My 2-1 power plants to use gas from Bach Ho field because of insufficient volume of production. The Ba Ria plant will have to switch to diesel.

Nam Con Son project:

The Nam Con Son project has been designated one of the country's top five priority projects by the government. Since their discovery in 1993, large gas fields in Block 06.1 have been developed by BP and Statoil (40%), and the Oil and Natural Gas Corporation of India (ONGC: 55%) and PETROVIETNAM (5%) through a production sharing contract. PETROVIETNAM is considering increasing its share to 15% in this project. Recoverable reserves are estimated at two TCF (non-associated gas). Exploration in the basin has yielded several discoveries, of which the largest are Lan Tay and Lan Do. MOUs were signed to settle gas price, transportation and indexation and government guarantees in April 1999. Detailed negotiations are being developed between foreign companies and Vietnamese government agencies and state enterprises. This upstream project is estimated to cost US\$ 500 million. The development of this project will also affect many projects in other sectors.

It has been reported that the government would like to purchase gas for US\$ 1.75/MMBTU at the offshore platform, while the developers would like to sell it for US\$ 2.00/MMBTU or higher. Indexation of prices and take-or-pay provisions are also to be discussed.

FINA and Unocal are also exploiting offshore gas fields near the national border of Thailand and Malaysia. The result of the negotiations on the Nam Con Son project will affect these businesses.

A 400-km, 24-inch pipeline developed by a consortium of PETROVIETNAM (38%), BP (24.8%), Mobil (12.4%), Statoil (12.4%) (in addition, 12.4% share of ex-BHP held by BP/Statoil) will transport offshore gas in Nam Con Son to the southern port Vung Tau, and then on Phu My (70 km from Ho Chi Minh City). Gas is expected to begin flowing by 2001 at an initial volume of 176.6-211.9 BCF per year. The Ministry of Planning and Investment estimates that this pipeline project will cost about US\$ 300 million. PETROVIETNAM intends to assume operations five years after operations begin in order to maintain control, especially since the pipeline will probably transport gas from other fields. The government might also introduce a tariff system for this pipeline.

This project will include the construction of integrated power and urea plants. The power plant (Phu My-3) with a capacity of 650-700 MW will be built on a BOT basis by BHP (40%), BP (32.3%), Statoil (16.2%) and Tomen/Mitsui (11.5%). The urea plant will be developed through a joint venture of Agrium (27%), Vinachem (20%), Tomen/Mitsui (14.3%), BP (14%), Statoil (11.2%), PETROVIETNAM (5%), Vigecam (5%) and BHP (3.5%). The power plant is projected to begin operations in 2000 and the fertiliser plant should begin producing 2,400 tons of urea per day in 2001.

It should be noted that the rate of profits tax is 10 or 15% in the gas pipeline project according to the Foreign Investment Law, while it is 50% in petroleum exploration and production under the Petroleum Law.

The following gas-fired power plants are also being planned:

- Phu My 1: a 1,090 MW combined-cycle gas turbine costing US\$ 400 million that will be funded 85% by Japanese ODA and 15% by EVN (projected to begin operations in 2000);
- Phu My 2-2: a 450 MW plant (converting later to 700 MW), to be constructed on a BOT basis;

In January 1999, a consortium of Tokyo Electric Power Company (TEPCO), Electricité de France (EDF), Alstom and Sumitomo Corporation was selected as the first preferred bidder by the Vietnamese Authorities to negotiate for the Phu My 2-2 project. The electricity generated by the power plant will be purchased and distributed by EVN and is scheduled to begin operations by 2001; and

- Phu My 4, a 600-900 MW plant, will be built on a BOT basis as an expansion of Phu My 2-1.

The total capacity of Phu My power plants is put at 2,500 MW in 2000 and 3,000 MW in 2002. The future opportunities for Vietnam's BOT power plants projects will depend on the success of these Phu My power plants. Among others, currency convertibility will be a key issue.

PETROVIETNAM prepared a gas master plan in 1995 with financial support from the U.K. government. The plan is used as a reference document although it has not been approved by the Vietnamese government.

According to the plan, PETROVIETNAM's view on gas supply potential is as follows: (Unit: trillion cubic feet)

	Proved	Potential
Red River Basin		
<i>Low CO₂</i>	0.2-0.4	1.0- 2.0
<i>High CO₂</i>	4.5-6.5	13.0-17.0
Mekong Basin	1.5-2.5	3.0- 5.0
Nam Con Son Basin	5.0-7.0	19.0-25.0
Malay-Tho Chu Basin	0.5-1.5	3.0- 5.0
Other Basins		20.0-25.0
Total	12.0-18.0	59.0-79.0

The plan also presented the following gas demand outlook: (Unit: billion cubic feet per year)

	2000	2005	2010
North Vietnam	0-88.3	141.3-176.6	211.9-247.2
Central Vietnam	0-17.7	17.7-35.3	35.3-53.0
South Vietnam	141.3-211.9	211.9-353.1	317.8-459.1
Total	141.3-317.8	370.8-565.0	565.0-759.3

In 1997, 19,151 GWh of electricity was generated, of which 919 was gas-fired. EVN estimates that electricity output will increase to around 30,000 GWh in 2000, 53,000 GWh in 2005 and 88,000 GWh in 2010. Capacity is estimated to be 8,000 MW in 2000 and 15,000 MW in 2010. (The Institute of Energy is currently preparing a "Master Plan on Electricity" which covers 2000 to 2020.)

Pricing

At present, gas from the Bach Ho field is being sold by PETROVIETNAM to EVN onshore for US\$ 2.50/MMBTU. However, this price is different from the market price because this is a sale between state-owned companies. EVN proposes that the price be reduced to US\$ 2.00/MMBTU. However, the Ministry of Industry believes that the gas price for energy should be US\$ 2.50/MMBTU, while US\$1.00-1.50/MMBTU is reasonable price at which to produce urea and methanol.

Although EVN raised electricity tariffs in April 1997 to reflect actual costs, they are still subsidised. EVN is planning to increase the current tariff from US 5.5 cents/ kWh to 6 to 7 US cents/kWh (on the average) by 2000.

5. CHALLENGES

Administrative procedures

Administrative procedures in Vietnam are generally lengthy. In order to attract more foreign investment, it is important for authorities to take sufficient measures to establish more transparent and efficient administrative procedures and legal frameworks. These measures will also contribute to developments of BOT projects in the electricity sector.

The government decree regulating the implementation of the petroleum law states that it is desirable for the government to establish "State Management Authorities" as independent regulatory bodies for petroleum contracts. These authorities could expand their activities to other core aspects of regulations in the gas sector.

High tax rate

The rate of tax imposed on the profit earned by petroleum exploration and production is 50% under the Petroleum Law, although the government reduced it to 32% in November 1998 for those cases qualifying for a reduction (e.g., deeper areas). This tax could make Vietnam less attractive than other countries in the region in terms of foreign investment. The rate should be adjusted to make petroleum exploration and production more competitive.

In July 1998, Prime Minister Phan Van Khai had meetings in Hanoi and Hochi Minh City with representatives of oil and gas companies to discuss Vietnam's regulatory framework in energy development. To improve transparency and attract foreign investment, the government should make an effort to have this type of exchange regularly.

National energy and gas master plan

As stated earlier, PETROVIETNAM's gas master plan has not been approved yet and is currently used only as a reference document.

The Institute of Energy of Vietnam is responsible for updating a master plan in the electricity sector.

Vietnam must prepare a more extensive energy and gas master plan to state its view of the future of the gas sector more clearly.

Power development plan

Vietnam's power generation capacity at the end of 1997 was 4,936 MW. According to the Vietnam Energy Review prepared by the Institute of Energy in 1995, the capacity was expected to increase by 10,297 MW during the period 1998 to 2010.

As a result of the current Asian economic situation, however, this plan has had to be reviewed carefully. In the northern region, it is important to balance hydro and gas-fired power generation with future gas supply in the region. One of the difficulties Vietnam faces is that hydro power generation costs are relatively cheap because power plants were constructed with aid from the Former Soviet Union. This has made it more difficult to balance the costs between gas and hydro power generation. But in the southern region, whether FINA and Unocal will develop their own projects will depend on whether there will be gas demand beyond gas supply from the Nam Con Son project.

At present EVN contracts annually with PETROVIETNAM for energy supply source procurement. In order to develop a longer-term power development plan, it should conclude longer-term contracts.

Pricing

The current electricity tariff should be reviewed in order to better reflect costs. Subsidies should be removed, which would in turn help to attract foreign investment. The same is true for the gas sector.

International cooperation

Vietnam joined the APEC in the fall of 1998. Both Vietnam and other APEC Members would benefit from information exchanges and cooperative programmes in the energy sector. One possible means of such exchange is through the APEC Energy Working Group.

Conclusion

So far Vietnam has not been so severely affected by the Asian economic crisis. According to the Asian Development Bank, Vietnam's economic growth rate was 4.0% in 1998 and is expected to be 3.7% in 1999 and 4.5% in 2000. Energy demand is also expected to increase steadily.

Gas, which accounted for 19.6% of the primary energy supply in 1997, will play an increasingly important role in Vietnam for further energy supply diversification and environmental protection.

In view of these facts, the current negotiations on the Nam Con Son project are crucial to Vietnam's gas development. It is estimated that the Nam Con Son project holds more than a third of Vietnam's total gas reserves. The development of this project will facilitate gas-fired power generation (mainly in the southern part), which will lead to further industry development. As one of the top five priority projects in Vietnam, this will also have an impact on various projects in other sectors.

Gas development in Vietnam will improve energy security in the region, despite the fact that most of its gas is expected to be used for domestic consumption.

The government should make administrative procedures more open and transparent and encourage electricity development in order to attract further foreign investment. (The government is planning several measures to improve the investment environment for foreign companies. These include reductions in telephone bills and electricity rates for foreign companies in Vietnam, which have been higher than those for local people. These new rates will come into force in 1999.)

MYANMAR

1. ECONOMY

In March 1962, Ne Win replaced the civilian government with a military-run Revolutionary Council. Under the new regime, the Burma Socialist Programme Party (BSPP) developed the “Burmese Way to Socialism” — a mixture of Buddhism, Marxism and nationalism of which the central elements were economic self-sufficiency and a non-aligned foreign policy. Foreign-owned companies were nationalised.

By 1977 it became clear that the economy was stagnating as the result of these policies. In spite of the subsequent resumption of international aid and borrowing, the economy nearly collapsed in the absence of far-reaching reforms. Myanmar recorded a negative economic growth from 1986 to 1988, and was designated a “least-developed nation” by the United Nations in 1987. In October 1987, a nationwide movement calling for democracy and economic growth began in the form of student demonstrations in Yangon, followed by nationwide protests against the government. Ne Win resigned as chairman of the BSPP in July 1988.

The military seized power amidst continuing demonstrations and the calling of a general strike. All state organs were replaced by the State Law and Order Restoration Council (SLORC). The SLORC dropped the central policies of the “Burmese Way to Socialism” and introduced a package of reforms, which included the expansion of the private sector in foreign trade in order to stimulate the private sector and encourage foreign investment, especially in the energy sector. The enactment of the Foreign Investment Law and the creation of the Foreign Investment Commission led to further exploration of gas fields. Of the US\$ six billion of approved foreign investment made since then, US\$ two billion has been allocated to the oil and gas sectors. On an expenditure basis, fixed investment has been the fastest growing component of GDP in real terms.

Average annual growth from 1992 to 1997 was 6.2%. GDP increased by 4.1% in 1997. The government estimates an annual economic growth rate of 6% from 1996 to 2000. In addition, 42 state-owned enterprises (SOEs), two farms and 72 cinemas should be privatised through sales of SOEs or the lease of SOEs’ units to private investors. The oil and gas industry will remain nationalised. 44 SOEs dominate the national economy, while very few joint ventures and private companies have developed businesses in Myanmar yet.

Figure 1 Map of Myanmar



On 15 November 1997, the SLORC was replaced by the State Peace and Development Council (SPDC). Two ministries (electricity and military affairs) were added to the cabinet and many ministers were replaced in a wide-ranging reshuffle. New cabinet ministers were required to give up their military posts.

Table 1 Energy Indicators

	1971	1975	1980	1985	1990	1992	1994	1997
Energy Production (Mtoe)	7.34	8.13	9.51	10.67	10.94	11.19	11.78	12.25
Net Imports (Mtoe)	0.41	0.14	0.07	0.10	0.01	0.18	0.40	0.95
Total Primary Energy Supply (Mtoe)	7.91	8.38	9.43	10.57	10.79	11.08	11.96	13.01
Net Oil Imports (Mtoe)	0.28	-0.01	-0.07	-0.01	-0.02	0.17	0.39	0.95
Oil Supply (Mtoe)	1.32	1.07	1.35	1.25	0.73	0.74	1.05	1.31
Electricity Consumption (TWh)	0.55	0.77	1.16	1.60	1.82	1.88	2.34	2.72
GDP (bill. 90 US\$ using exch. rates)	13.9	15.5	21.1	26.7	24.0	26.1	29.8	35.2
GDP (bill. 90 US\$ using PPPs)	48.8	54.3	73.9	93.5	83.9	91.4	104.2	123.3
Population (millions)	27.8	30.4	33.8	37.5	40.5	41.4	42.4	43.9
Energy Production/TPES	0.93	0.97	1.01	1.01	1.01	1.01	0.98	0.94
Net Oil Imp./GDP (toe/000 90 US\$)	0.02	-0.00	-0.00	-0.00	-0.00	0.01	0.01	0.03
TPES/GDP (toe/000 90 US\$)	0.57	0.54	0.45	0.40	0.45	0.42	0.40	0.37
TPES/GDP (toe/000 90 US\$ PPP)	0.16	0.15	0.13	0.11	0.13	0.12	0.11	0.11
TPES/Population (toe/capita)	0.28	0.28	0.28	0.28	0.27	0.27	0.28	0.30
Oil Supply/GDP (toe/000 90 US\$)	0.09	0.07	0.06	0.05	0.03	0.03	0.04	0.04
Oil Supply/Population (toe/capita)	0.05	0.04	0.04	0.03	0.02	0.02	0.02	0.03
Elect. cons./GDP (kWh/90 US\$)	0.04	0.05	0.06	0.06	0.08	0.07	0.08	0.08
Elect. cons./Pop. (kWh/capita)	20	25	34	42	45	45	55	62

Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

2. ENERGY SUPPLY AND DEMAND

From 1991 to 1997 Total Primary Energy Supply (TPES) increased by an annual average rate of 7.6%. During this same period, indigenous production of natural gas and imports of petroleum products increased. Per capita TPES was 0.30 tonnes of oil equivalent (toe) in 1997 — the lowest level in the world. There have been fuel shortages in Myanmar, especially in the residential sector.

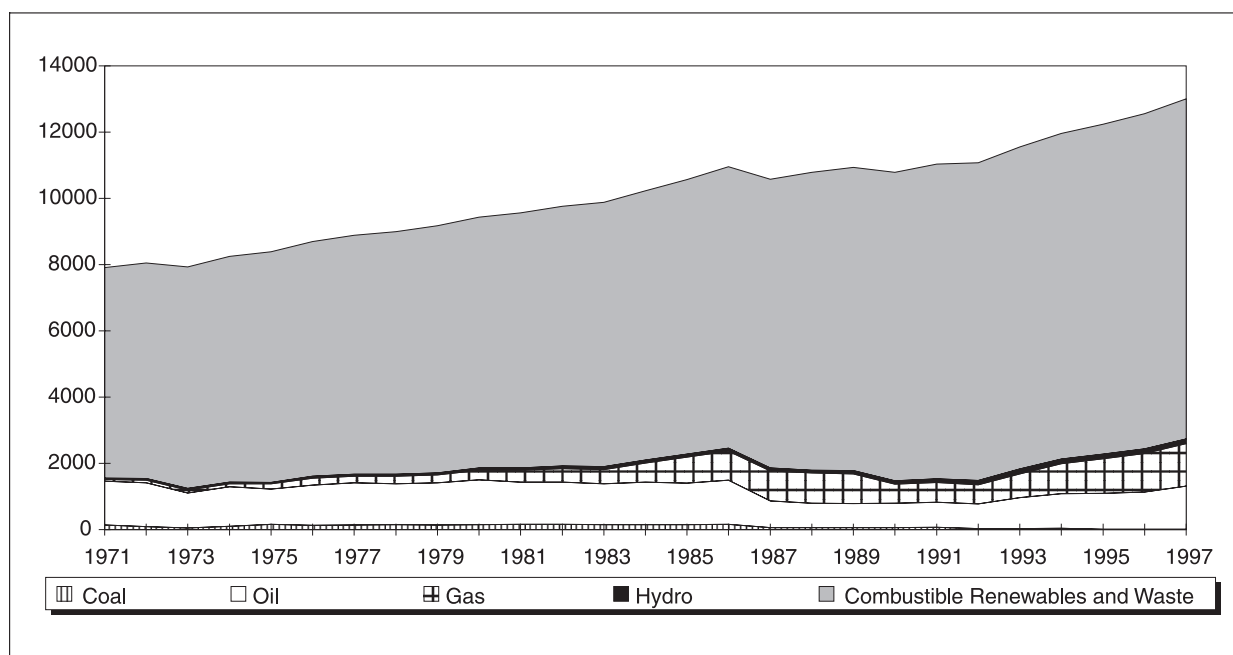
Total Final Consumption (TFC) increased by an annual average rate of 6.4% from 1991 to 1997. During this period, the annual average increase rate was 11.8% in the transport sector. Gas demand increased for electricity generation, but decreased for industry.

Ensuring a sufficient supply of electricity is a challenge in Myanmar. Blackouts occur frequently due to the lack of water and gas resources for power generation, and the deteriorated state of hydro power stations.

The government is preparing an energy master plan to secure a stable supply of oil and gas.

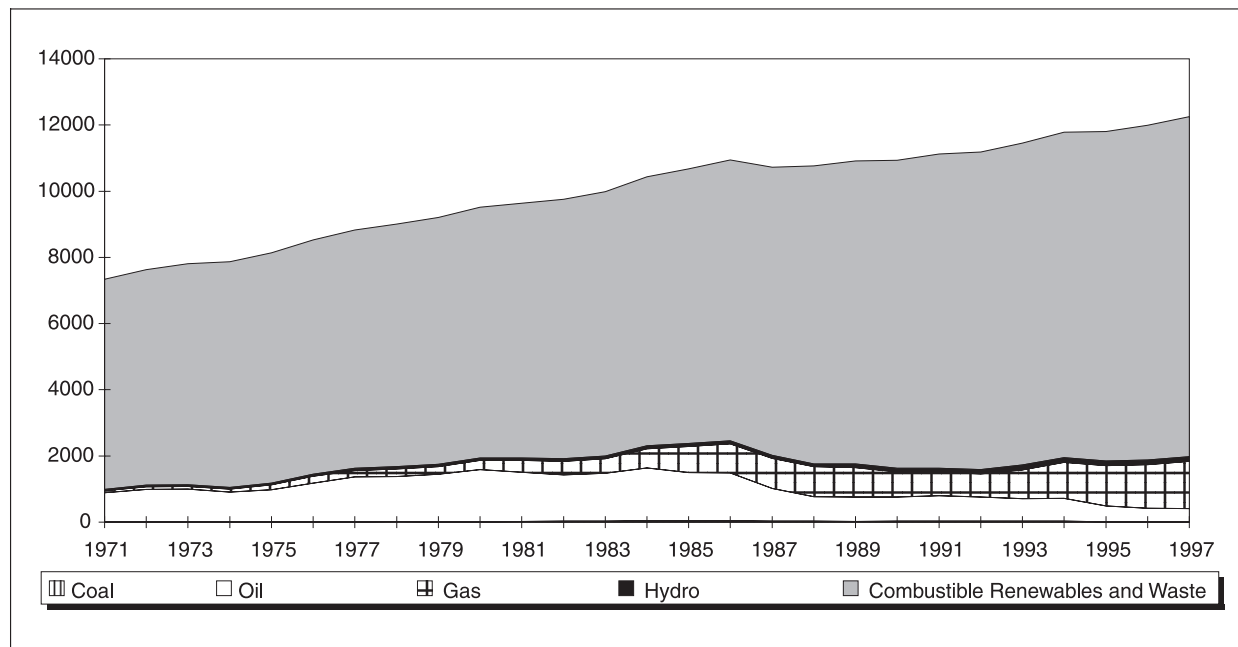
The Ministry of Energy forecasts that gas demand will increase at an annual average rate of 25% from 1995 to 2000 and 9% from 2000 to 2010. Since crude oil production is falling, gas production — notably from offshore fields — will play an increasingly significant role in the years to come.

Figure 2 Total Primary Energy Supply
(Thousand tonnes of oil equivalent)



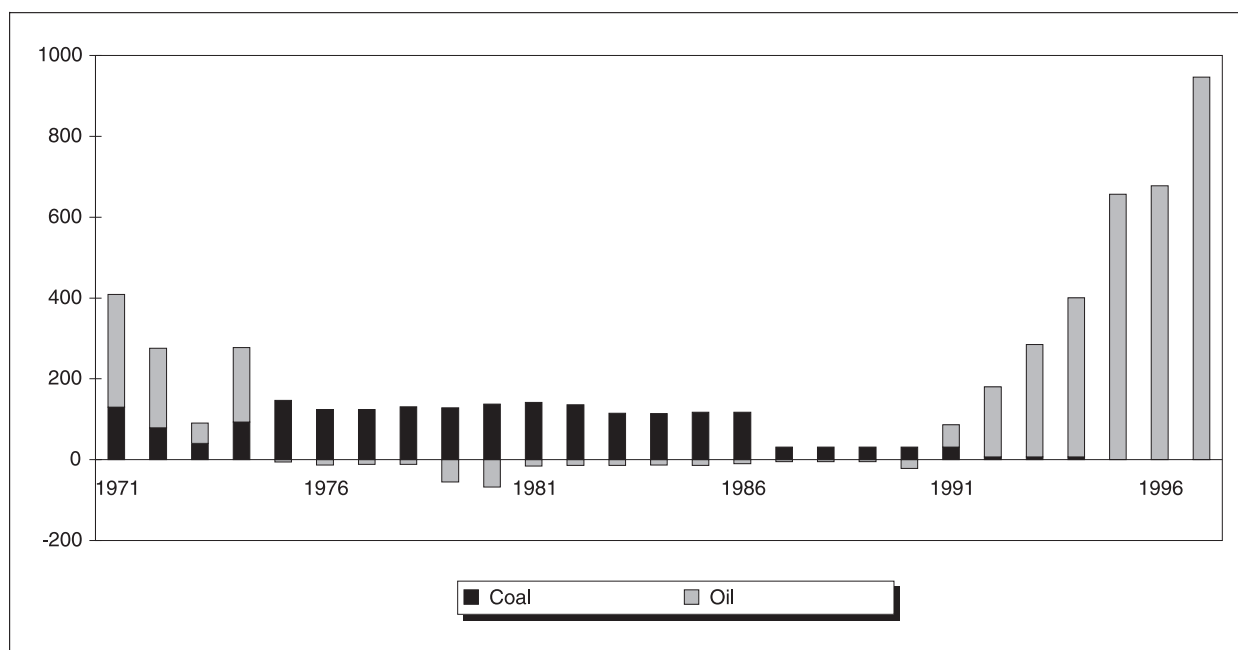
Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

Figure 3 Indigenous Production of Energy
(Thousand tonnes of oil equivalent)



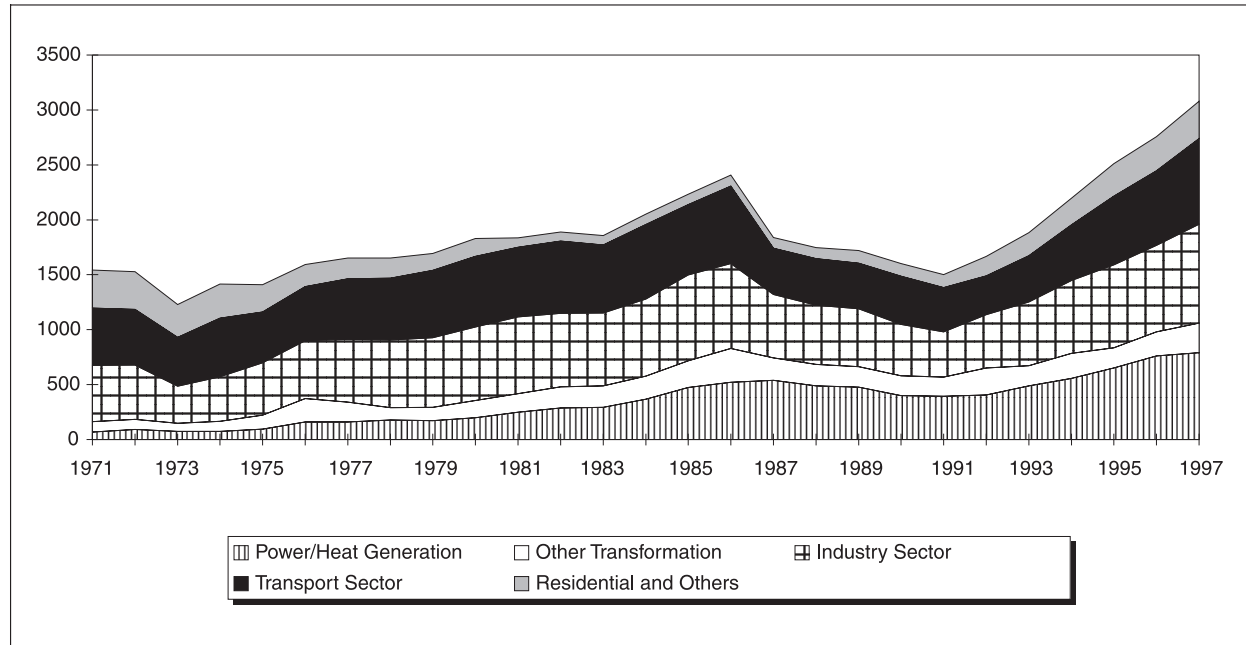
Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

Figure 4 Total Net Imports of Energy
(Thousand tonnes of oil equivalent)



Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

Figure 5 Total Energy Consumption by Sector
(Thousand tonnes of oil equivalent)



Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.
Note: Does not include combustible renewables and waste.

3. CURRENT STATUS AND FUTURE VISION OF THE GAS SECTOR

Organisational structure Ministry of Energy:

The Ministry of Energy is responsible for general energy policy in Myanmar. There are three state-owned enterprises under the supervision of the Energy Planning Department of the Ministry:

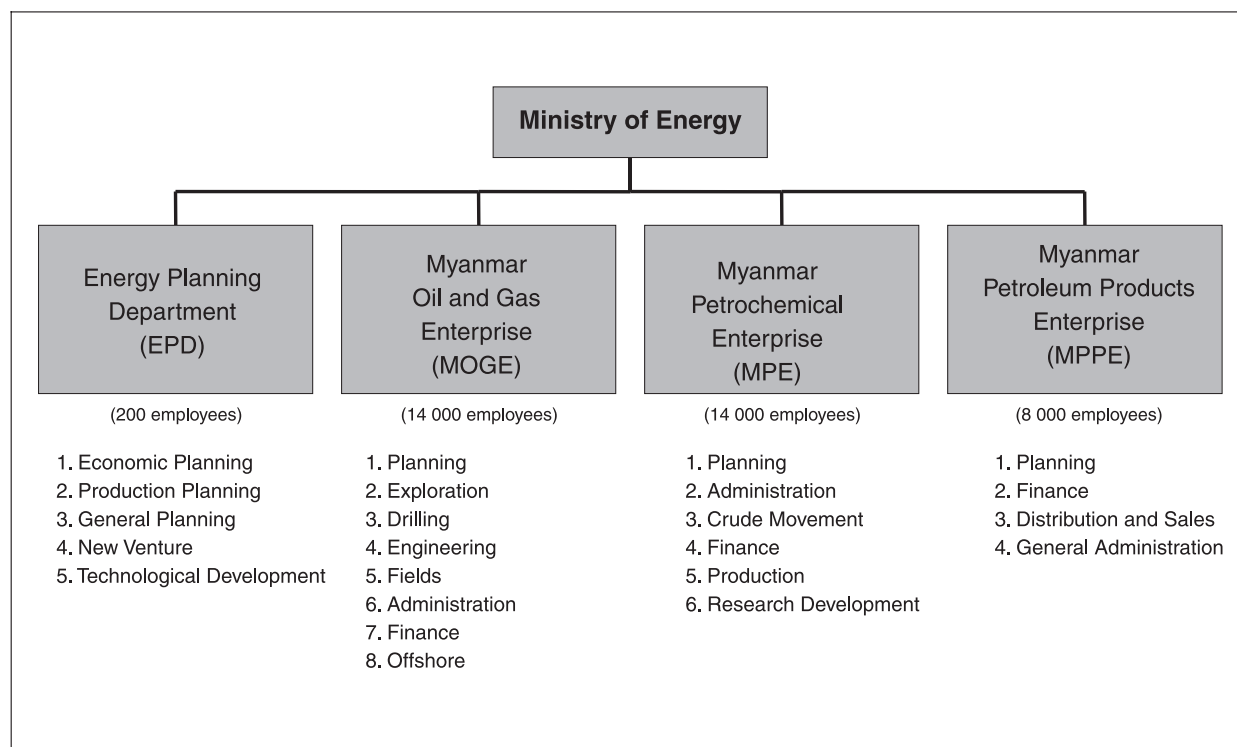
- Myanmar Oil and Gas Enterprise (MOGE)
- Myanmar Petrochemical Enterprise (MPE)
- Myanmar Petroleum Products Enterprise (MPPE)

In November 1997, the Myanmar Electric Power Enterprise (MEPE) separated from the Ministry of Energy and became a separate ministry: the Ministry of Electric Power in an effort to improve organisation. No independent regulatory body has been set up.

The Ministry of Energy has formulated an energy policy whose main points are:

- to maintain the status of energy independence;
- to employ hydroelectric power as one vital source of energy sufficiency;
- to generate and distribute more electricity for economic development;
- to conserve fossil fuel reserves to ensure national energy security;
- to promote the efficient use of energy and emphasise energy conservation; and
- to prevent deforestation caused by excess use of fuelwood and charcoal.

Figure 6 Organisation in the Energy Sector



**Foreign
Investment
Law**

The government promulgated the Foreign Investment Law in 1988, whose principle aims are as follows:

- promotion and expansion of exports;
- exploration of natural resources, which would require heavy investment;
- acquisition of advanced technology;
- support and provide assistance to production and services involving large capital;
- increase employment opportunities;
- develop energy efficient projects; and
- continued regional development.

The Foreign Investment Commission was formed later in the same year to approve foreign investment.

Under Articles 5 and 6, foreign companies can create businesses in Myanmar under one of the following conditions:

- with 100% foreign capital;
- as a joint venture;
- in a production sharing contract;
- as a branch of a foreign company; and
- as a representative office.

Article 21 of the Foreign Investment Law provides several tax incentives including:

- exemption from income tax for a period up to three consecutive years after the start of production (in cases where it is beneficial for the State, exemption or relief from income tax can be further extended) subject to approval of the Foreign Investment Commission;
- exemption or relief from income tax on profits if they are kept in a reserve fund and they are reinvested within one year after the reserve is opened;
- the right to accelerate depreciation (at the rate of 25%) for machinery, equipment, building or other capital assets used in the business at the rate fixed by the Foreign Investment Commission;

- if the goods produced by any enterprise are exported, relief from income tax on up to 50% of the profits accrued from the said export;
- the right of an investor to pay income tax on behalf of foreign employees and the right to deduct such payments from the assessable income;
- the right of an investor to pay income tax on the income of foreign employees at the rates applicable to the citizens residing within the country;
- the right to deduct from the assessable income, such expenses incurred in respect of research and development relating to the enterprise which are actually required and are carried out within the State;
- the right to carry forward and offset losses up to three consecutive years from the year the loss is sustained;
- an exemption or relief from customs duties or other internal taxes, or both, on imported machinery equipment, instruments, machinery components, spare parts and materials used, that are actually required during the period of construction; and
- an exemption or relief from customs duties or other internal taxes, or both, on raw materials imported for the first three years' commercial production following the completion of construction.

The Law guarantees that foreign investments shall not be nationalised. The government also guarantees an investor of foreign capital, the rights he is entitled to in the foreign currency in which such investment was made after the termination of the contract. Net profits after deducting all taxes and the prescribed funds from the annual profits received by the person who has brought in foreign capital shall be transferable abroad in the relevant foreign currency. (Articles 22, 23 and 26).

Table 2 Approved Foreign Direct Investment

Fiscal Year (April-March)	1991	1992	1993	1994	1995	1996	1997	Total
(Total)								
Cases	4	23	27	36	39	78	46	253
Investments (US\$ million)	6	104	377	1 352	668	2 814	555	5 876
(Oil and Gas Sector)								
Cases	0	7	2	3	1	10	11	34
Investments (US\$ million)	-	45	20	1 040	15	700	165	1 985

Source: Ministry of National Planning and Economic Development.

Note: Figures for 1997 are from April to December.

Production

Myanmar Oil and Gas Enterprise:

Myanmar Oil and Gas Enterprise (MOGE) is responsible for the exploration and production of oil and gas.

To date, natural gas has been produced from around ten onshore gas fields. Output totalled 175 million cubic feet/day (MMCF/D) in 1998. The gas field with the largest production is Apyauk, located northwest of Yangon. This field was discovered by Shell in 1991 and MOGE took it over in 1993. Its production share is estimated to be about 70%. Nevertheless, gas production from onshore fields including Apyauk is expected to decline over the years to come.

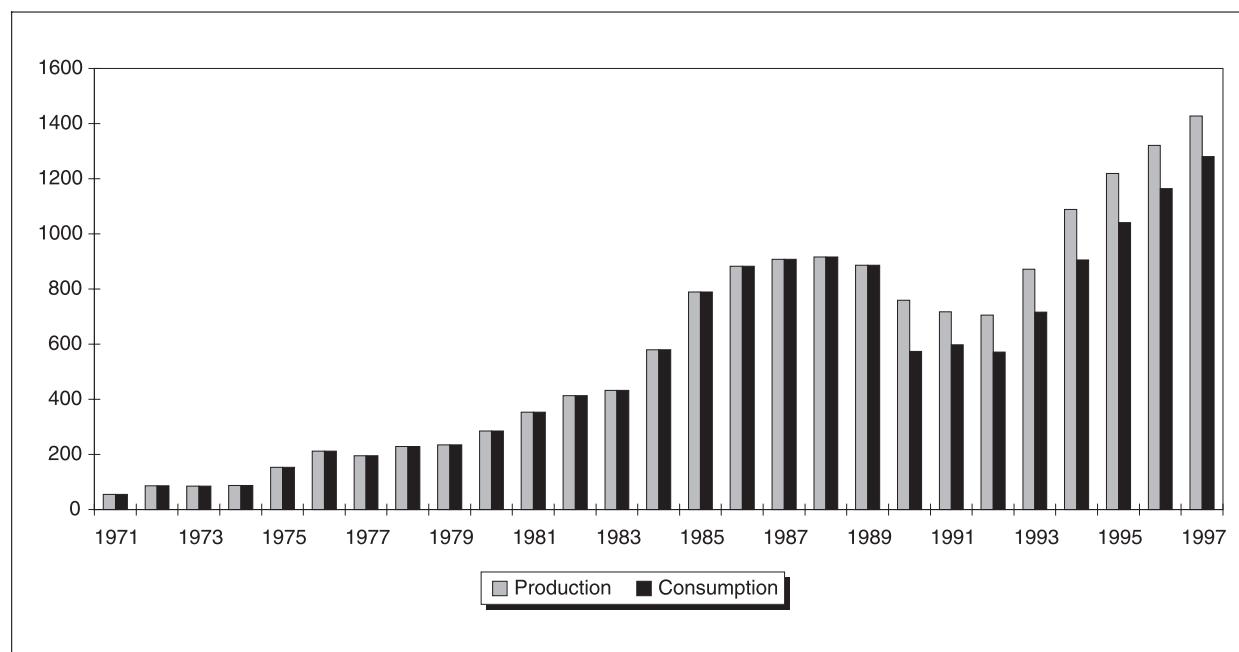
Following the Foreign Investment Law, gas exploration has been developed through the following schemes:

- Production Sharing Contracts (PSCs): At present there are seven PSCs for onshore oil and gas fields and 11 PSCs for offshore ones. In principle, PSCs are valid for twenty years (with the possibility of extensions) with shares of government and contractors at 60% and 40%, respectively;
- Improved Oil Recovery Contracts (IORs): IORs are used for increasing production in existing oil and gas fields. At present there are three IORs for onshore oil and gas fields. IORs are valid for twenty years (with the possibility of extensions) with shares of government and contractors at 65% and 35%, respectively;
- Performance Compensation Contracts (PCCs): PCCs are applied to engineering service companies. At present there are two PCCs for onshore oil and gas fields. PCCs are valid for nine years (with the possibility of extensions) with shares of government and contractors at 65% and 35%; and
- Reactivation of Suspended Fields (RSF): RSF is applied when a foreign contractor succeeds MOGE. The shares are split evenly 50%/50% between government and contractors.

In order to attract more foreign investment, the government has recently introduced an option that allows a foreign investor (for a fee) to study a block for six to nine months prior to making an investment. The government is also examining the possibility of extending the current period of two to three years from the conclusion of a production sharing contract to initial exploration.

Gas production from onshore fields is expected to decline because of insufficient reserves. (The current proved reserve is estimated to be 474 billion cubic feet.) Gas development from the two major offshore fields, Yadana and Yetagun, are increasing.

Figure 7 Natural Gas Production and Consumption
(Thousand tonnes of oil equivalent)



Source: IEA, Energy Balances of Non-OECD Countries, 1996-1997.

Yadana gas development project:

The Yadana offshore gas field is located in the Andaman Sea; 80 km south of the coast of Myanmar, about 300 km from Yangon and about 400 km west of the Thai border. Natural gas was discovered there by the Burma National Oil Company in 1982. In 1992 Total signed a production sharing contract with the MOGE and is an operator of this project. In 1995, after UNOCAL came in on the development, a 30-year sales contract including take-or-pay provisions was signed between TOTAL, UNOCAL, PTTEP (a subsidiary of the Petroleum Authority of Thailand), Myanmar Oil and Gas Enterprise (MOGE) and Petroleum Authority of Thailand (PTT) — the national oil company of Thailand to supply natural gas to a power station in Ratchaburi, southwest of Bangkok.

This project was completed in 1998, as scheduled and consists of a 649-km pipeline (346 km from the production platform to the west coast of Myanmar, 63 km from the west coast of Myanmar to the Thai border and 240 km from the border to the power station). PTT buys the gas from the Yadana consortium and resells it to the Electricity Generating Authority of Thailand (EGAT). In spite of protests by environmentalists and non-governmental organisations in Thailand

Figure 8 Map of Gas Pipelines (current and proposed)



(a 6-km section has been designed to cut through one of Thailand's few remaining areas of pristine forest) there have been no delays in the completion of the project.

Gas production was projected to be 65 million cubic feet/day (MMCF/D) in July 1998, 130 MMCF/D in August 1998, 325 MMCF/D in November 1998 and was expected to reach a plateau of 525 MMCF/D by October 1999. However, this schedule was delayed because of EGAT's failure to install six units of combined-cycle gas turbines (with a total capacity of 1,200 MW) in Ratchaburi by February 1999. According to the EGAT's most recent plan, these six units are expected to be installed by the end of 1999. By this date, the Ratchaburi power station will use almost as much natural gas as originally planned. A 20 MW plant from northern province Kamphaeng Phet has been moved to the Ratchaburi power plant as a temporary gas burner. This unit requires only around ten MMCF/D of gas. This delay is due to a smaller increase in electricity demand than had been estimated.

The Petroleum Authority of Thailand (PTT) and project developers, including TOTAL, are negotiating whether PTT should pay penalties following take-or-pay provisions in the contract. It was reported that PTT has pleaded *force majeure* and deferred its first payment of US\$ 62 million — which was due by the end of March 1999 — until negotiations are concluded. However, the EGAT does not have the same legal liability as PTT because only an MOU has been finalised between the EGAT and PTT. No legally-binding contracts have been finalised between the two organisations.

Key figures are as follows:

Proved gas reserves:	5.7 trillion cubic feet (TCF)	
Stakes in the project:	Total (Operator)	31.24%
(Blocks M5 and M6)	UNOCAL	28.26%
	PTTEP (PTT Exploration and Production)	25.5%
	MOGE	15.0%
Stakes in the project:	Total (Operator)	52.5%
(Blocks M8)	UNOCAL	47.5%
	(MOGE has an option to get a 15% share.)	
Production at plateau:	650 MMCF/D	
	(525 MMCF/D for export and 125 MMCF/D for domestic use)	
Duration of the contract:	30 years	
Base price:	US\$ 3/MMBTU	
Project cost:	US\$ 1.2 billion	
(in Myanmar only)		

Yetagun gas development project:

The Yetagun offshore gas field is also located in the Andaman Sea, 220 km south of the southern coast of Myanmar and about 170 km west of the Thai border. In 1990, Premier Oil signed the first production sharing contract of the field with MOGE. Natural gas was discovered by Premier Oil, Texaco and Nippon Oil in 1992.

In 1997, a sales contract covering at least 15 years, including take-or-pay provisions, was signed between the above consortium and PTT, to supply natural gas to the Ratchaburi power station, southwest of Bangkok beginning in January 2000. Petronas purchased Texaco's share in 1997. Natural gas will be transported to the Thailand border through a 170-km pipeline (about 100 km offshore and 70 km onshore). In Thailand, this project will share the pipeline with the Yadana project. The supply volume is projected to be 200 MMCF/D. There is also a possibility that condensate will be produced at the rate of 7000 barrels/day and that LPG will be processed for export to Thailand.

Key figures are as follows:

Proved gas reserves:	1.7 trillion cubic feet (TCF)	
Stakes in the project:	Petronas	30.0%
(Blocks M12, M13, M14	Premier Oil (Operator)	26.6%
and the pipeline company)	MOGE	15.0%
	Nippon Oil	14.2%
	PTTEP (PTT Exploration and Production)	14.2%
Stakes in the project:	Petronas	42.4%
(Block M10)	Premier Oil (Operator)	22.6%
	Nippon Oil	20.0%
	Amerada Hess	15.0%
	(MOGE has an option to get a 15% share.)	
Production:	200 MMCF/D	
Duration of the contract:	at least 15 years	
Base price:	US\$ 3.07/MMBTU	
Project cost:	US\$ 800 million	
(in Myanmar only)		

The government's revenue is expected to reach US\$ 150 to 180 million once gas production from these two projects reaches full output.

Work on laying the pipeline should be completed by the end of 1999, as originally scheduled. However, given the current economic situation in Thailand, there is still a concern whether PTT will have enough power generating capacity to use the gas from both the Yadana and Yetagun fields, which might affect the completion of the laying of the pipeline. PTT is planning to construct a 153-km gas pipeline between the Ratchaburi power plant and the Wangnoi power plant, to the north

of Bangkok. Until this line is ready in the middle of 2000, it will be difficult for PTT to use all the gas from the two fields.

In addition to these two projects, Genting Sanyen (Malaysia) has signed production sharing contracts for offshore blocks M-3 and M-4.

Transmission and distribution

Myanmar's onshore natural gas pipeline network has been developed since the 1970s as gas production from its onshore gas fields has expanded. The current network is approximately 700 miles (1120 km).

In 1997, 953 thousand TOE of gas was used for power generation and 326 thousand TOE of gas was used for industry (urea and fertiliser plants).

In 1997, total installed electricity capacity was 1,393 MW. Of total installed power capacity, the Ministry of Electric Power managed 74% (of which 53% was natural gas and 22% was hydroelectric) and the rest was managed by several ministries, including the Ministry of Defence.

The government estimates that electricity demand will continue to increase at an annual average rate of 15% over the years to come. Gas-fired power generation will have to play an increasingly significant role until hydro power plants are sufficiently developed in the foreseeable future. At present the government is planning to build a 320 MW gas-fired power plant in southern Myanmar, which would be fuelled by the Yadana gas field. The government would also like to build two additional 320 MW gas-fired power plants to satisfy increasing demand.

The Government of Myanmar signed an MOU (Memorandum of Understanding) with the Government of Thailand to sell 1,500 MW of power supply by the year 2010. While most of the electricity needs will be met through hydro, there will still be a need for some gas-fired power plants. There is also a possibility that natural gas might be exported to India, Bangladesh and Indonesia. However, it is a significant challenge for Myanmar to secure investment funds for these projects. If Myanmar does not have enough electricity capacity by the year 2010 to satisfy increased domestic needs, it will have to consider electricity imports from neighbouring countries.

Three-in-One project:

The Government of Myanmar concluded an MOU of the "Three-in-One project" with Total, UNOCAL and Mitsui & Co., Ltd., (the share is 33.3% each) in 1996 with a view to facilitate its domestic use of natural gas. This project involved the construction of a pipeline from Yadana gas field to Kyaiktaw (50 km southwest of Yangon), a gas-fired electricity power station, and an urea fertiliser plant (with an annual output of 570,000 tons).

Initial key figures were as follows:

Length of pipeline:	235 km (offshore: 195 km, onshore: 40 km)
Production at plateau:	125 MMCF/D (a part of Yadana gas development project)
Capacity of power station:	210 MW (will be 320 MW when it is combined in 2000.)
Project cost:	US\$ 900 million (pipeline: US\$ 200 million, power station: US\$ 200 million, and an urea fertiliser plant: US\$ 500 million)

When the MOU was concluded, the pipeline and the electricity power station was expected to be completed in 1999 and the fertiliser plant was projected to begin in 2002.

The project contract was supposed to be concluded in June 1998; however, it was not signed because the ASEAN's investment commitment was reduced due to economic problems. Under the developers' revised plan, a pipeline will be laid by the end of 2000, the construction of a gas-fired electricity power station has been postponed and the construction plan of an urea fertiliser plant has been suspended altogether.

Gas production from existing onshore gas fields is expected to decline in Myanmar because of their declining reserves. So production of the Three-in-One project will remain at 125 MMCF/D, and about 75 MMCF/D will be used for existing power stations. In view of the industrial development in Myanmar, 40 to 50 MMCF/D of gas will be for industrial use.

According to the latest information, the government has proposed that the pipeline should be 36 inches diameter rather than 20 inches as originally planned. In this case, the total cost would double. The project consortium disagreed with this proposal because such an increase in gas demand is not expected over the years to come.

Table 3 Generated Electricity (GWh)

	1992		1993		1994		1995		1996		1997	
Hydro	1 518	51%	1 705	50%	1 614	45%	1 624	40%	1 651	42%	1 655	39%
Gas	1 366	46%	1 402	41%	1 595	44%	1 820	45%	1 943	49%	2 039	48%
Oil	107	4%	273	8%	380	11%	611	15%	351	9%	511	12%
Coal	5	0%	5	0%	5	0%	0	0%	0	0%	0	0%
Total	2 996	100%	3 385	100%	3 594	100%	4 055	100%	3 945	100%	4 205	100%

Source: IEA.

Note: Percentages may not add due to rounding.

Pricing and taxes

The gas price:	10 <i>kyats</i> / 1000 cubic feet ¹ .
The electricity price: (Revised in March 1999)	To the government; 0.50 <i>kyats</i> /kWh
	To domestic and industrial sectors; 25 <i>kyats</i> /kWh
	To foreigners; 8 cents/kWh

The Ministry of Electric Power purchases gas from MOGE at a very cheap price with no tax. 10% of its revenues on electricity sales go to the government.

The Ministry of Electric Power would like to remove subsidies on electricity prices and bring prices up to an international level.

4. CHALLENGES

Energy security

It is important for Myanmar to increase its energy supply to meet its increasing energy needs. The Ministry of Energy expects gas demand to increase at an annual average rate of 25% from 1995 to 2000 and 9% from 2000 to 2010, respectively. The government also estimates that electricity demand will continue to increase at an annual average rate of 15% over the years to come.

Hydro power generation is likely to be reduced because of physical deterioration of facilities, so ensuring an adequate power generation capacity, especially through gas-fired power plants, is essential. Since gas production from onshore fields is declining, most of the electricity is currently produced by diesel generators. Gas development in offshore fields will play an increasingly significant role for future power generation in Myanmar.

Facilitation of foreign investment

The government has allowed foreign investors to implement Independent Power Producer (IPP) programmes since early 1994. The government should review the current framework and examine the possibility of offering further incentives to foreign investors despite the current regional economic climate.

1. An official exchange rate is US\$ 1=6.5 *kyats*, while the prevailing rate is US\$ 1=370 *kyats*.

Thailand's commitments

The Yadana and Yetagun gas development projects have been designed primarily for export to Thailand. These sales and purchases contracts were concluded before Thailand was hit by the economic crisis of 1997/1998 — when it sought long-term commitments from different gas developers to satisfy steadily increasing gas demand.

However, the Asian economic problems slowed EGAT's power expansion plans. As such, PTT could not purchase as much gas as originally contracted, which led to negotiations with project developers over whether to apply take-or-pay provisions.

EGAT says that it will increase the capacity of its Ratchaburi power station in 1999. If this happens, PTT could purchase 525 MMCF/D of gas as originally planned. However, it was reported that this plan might be further delayed. Additionally, it is uncertain whether EGAT will purchase all of Yadana and Yetagun gas when the Yetagun gas project is completed in 2000. If not, PTT will have to seek other gas uses and it will become difficult again for Myanmar to obtain expected revenues smoothly.

This will greatly affect Myanmar's economy because natural gas is expected to be a key export product from the country. If the current situation continues, Myanmar's domestic gas use project will be delayed due to lack of funds. This will seriously impact the energy security of Myanmar, which is faced with a decrease in power generation and onshore gas production.

Pricing

Electricity tariffs should be reviewed in a timely manner in order to further reflect costs by removing subsidies and thereby attract foreign investments. The same is true for the gas sector.

Establishment of an energy master plan

Myanmar needs to complete the energy master plan which it is currently drafting as soon as possible. Myanmar is encouraged to develop a variety of energy related policies, including energy modelling based on the plan.

International exchanges

The development of resources in Myanmar is playing an increasingly important role in improving regional energy security. Appropriate opportunities for information and personnel exchanges should be facilitated.

Close attention should be paid to the development of Yadana project will develop since it is the second transnational gas pipeline project to be built in Asia. A gas pipeline between Malaysia and Singapore was the first project.

At present there are several gas pipeline plans in Asia, including a Trans-ASEAN pipeline project. Facilitation of these projects will lead to improved security and

diversification of energy in the region. However, in view of Asia's diversity and current economic situation, it is more realistic to develop these plans on a step-by-step basis. The Yadana pipeline is a major step for a regional gas pipeline network although the current gas flow is much lower than originally planned.

Development of Myanmar gas projects will change Thailand's energy balance. According to the Asia Pacific Energy Research Centre (APEREC)'s outlook, the share of gas in Thailand's primary energy supply will increase from 19.0% in 1995 to 26.0% in 2010 (Business-as-usual baseline). Additionally, PTT in Thailand predicted in October 1998 that the Yadana and Yetagun projects will represent about 35% of incremental gas supply in the country.

Since long-term energy demand in Thailand is expected to increase steadily, gas development projects in Myanmar are expected to improve Thailand's energy security and diversification and contribute to the environmental protection in the country.

ABBREVIATIONS

The Philippines

DOE	Department of Energy
ERB	Energy Regulatory Board
NPC	National Power Corporation
PNOC	Philippine National Oil Company
PNOC EC	PNOC Exploration Corporation

Vietnam

EVN	Electricity of Vietnam
PETROVIETNAM	Vietnam Oil and Gas Corporation

Myanmar

BSPP	Burma Socialist Programme Party
MEPE	Myanmar Electric Power Enterprise
MOGE	Myanmar Oil and Gas Enterprise
MPE	Myanmar Petrochemical Enterprise
MPPE	Myanmar Petroleum Products Enterprise
SLORC	State Law and Order Restoration Council
SPDC	State Peace and Development Council

Other countries/ international

ADB	Asian Development Bank
AFTA	ASEAN Free Trade Area
APEC	Asia Pacific Economic Cooperation
APEREC	Asia Pacific Energy Research Centre
EDF	Electricité de France
EGAT	Electricity Generating Authority of Thailand
KEPCO	Korea Electric Power Corporation
PTT	Petroleum Authority of Thailand
PTTEP	PTT Exploration and Production
TEPCO	Tokyo Electric Power Company
WTO	World Trade Organisation

Common terms

BOT	Build-Operate-Transfer
ECA	Energy Conversion Agreement
EIS	Energy Information System
DSM	Demand-Side Management
FDI	Foreign Direct Investment
IOR	Improved Oil Recovery Contract
IPP	Independent Power Producer
LRMC	Long-Run Marginal Cost
MOU	Memorandum of Understanding
ODA	Official Development Assistance
PCC	Performance Compensation Contract
PSC	Production Sharing Contract
RSF	Reactivation of Suspended Fields
SOE	State-Owned Enterprise

Measurements

BCF	billion cubic feet
BCM	billion cubic metres
LNG	liquefied natural gas
MCF	million cubic feet
MCM	million cubic metres
MMBFOE	million barrels of fuel oil equivalent
MMBOE	million barrels of oil equivalent
MMBTU	million British thermal units
MMCF/D	million cubic feet/day
MW	megawatt
TCF	trillion cubic feet
TFC	Total Final Consumption
TPES	Total Primary Energy Supply