

The EC - ASEAN Business Facilitator

National Energy Policy Review

Vietnam



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COGEN 3

Proven, Clean & Efficient Biomass, Coal, Gas Cogeneration

The objective of COGEN 3 is to promote the use of proven, clean and efficient cogeneration using biomass, coal or gas as fuel. This is achieved through partnership between ASEAN industries and European equipment suppliers.

The programme is co-ordinated in ASEAN by the Asian Institute of Technology (AIT), Bangkok, Thailand and in Europe by Carl Bro International, Sweden. COGEN 3 started its operation in January 2002 and will continue until December 2004.

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List of Abbreviations

ADB	Asian Development Bank
BOT	Build, Operate and Transfer
BOO	Build, Own and Operate
BTO	Build, Transfer and Operate
BT	Build and Transfer
DONG	Vietnam currency
DSM	Demand Side Management
est.	estimation
EF	Electricite de France
EU	European Union
FMFA	French Ministry of Foreign Affairs
EVN	Electricity of Vietnam
GDP	Gross Domestic Products
GEF	Global Environment Facility
GHG	Green House Gases
LPG	Liquefied Petroleum Gas
IPP	Independent Power Producers
MW	Megawatt
MWh	Megawatt-hour
MOSTE	Ministry of Science and Technology
MOI	Ministry of Industry
MTPY	Metric ton per year
NEDO	New Energy and Industrial Technology Development Organisation
NGO	non-government organisations
PPA	Purchase Power Agreement
SME	Small and Medium Enterprise
SPP	Small Power Producers

List of energy units

BOE	Barrel of Oil Equivalent
Kcal/kg	kilo Calories per KG
MT	Mega tonnes
MW	Mega Watt
TSCF	Trillion standard cubic feet
GW	Giga Watt
GWh	Giga Watt-Hour
kV	Kilo Volt
kWh	Kilo Watt-Hour

Executive Summary

In Vietnam, it is estimated that by year 2010, there will still be 3 million rural households which will lack access to electricity services and will have to depend heavily on alternate options like expensive batteries or candles. Vietnam is endowed with abundant renewable energy resources like hydro and biomass which includes rice husk and bagasse. Rice and sugarcane sectors have been growing rapidly over the last few years and are potential biomass fuel resources for cogeneration and could become one of the best options for distributed energy systems in Vietnam.

Although per capita consumption of electricity in Vietnam is among the lowest in Southeast Asia, demand has been on the rise for the past several years, straining the country's generating capacity. As an emerging market, Vietnam has experienced rapid commercial growth, mass migration to major cities, and rising living standards, all of which have contributed to the country's growing demand for electricity.

Vietnam has had Cogeneration systems for a few decades now and many of the older installations (believed to be 30 to 40 years old) are no more operational. There are cogeneration systems which are also a part of the IPPs including some of which are standalone private generators which have been supplying steam and power for a few decades in the sugar and the rice mills. Its worth mentioning here that the first cogeneration system installed in a commercial sector was at the CORA supermarket in Dongnai province, in which two generation-diesel units, capacity of each one of 1200KW and two cooling central systems of thermal capacity of 1000KW (French technology) have been installed and have been operational since 1998.

Some of the main barriers for implementing successful cogeneration projects which have been identified as be lack of commercial business models, lack of any successful demonstration projects in the recent years, lack of Government support to promote energy efficient technologies and also subsidies for the same, lack of financing channels for such projects due to lack of information available and lack of accessibility to information on benefits of cogeneration.

The Government of Vietnam has no clear demarcation on energy efficient and renewable energy policies and also on agencies and programs administering energy related functions. There is no Ministry identified as yet for administering and supporting Energy Department. All the institutional bodies and agencies which are responsible for energy related activities come under the responsibility of the Ministry of Science and Technology.

Except for the restructuring of the state monopoly of electricity industry EVN, not many activities are foreseen in the energy direction though some policies have been drawn up to address energy related issues like use of fuels and so on. Any policy on cogeneration is yet to be formulated and policies and legislation on renewable energy resources are in the draft stage and some of them are waiting for approval form the Government.

1. Introduction

Vietnam is one of the densely populated countries in the Southeast Asian region. In 1998 GDP average growth rate reached 5.76% and in 1999 it slowed down to 4.77%. The growth rate is slowly increasing as a rate of 5.8% in 2000 and 6.5% in 2001. Year 2003 recorded a growth of 6.8%.

Table 1.1: Economic Figures – compared to other ASEAN countries.

Countries	Purchasing power parity (PPP) \$	Real GDP Growth %		Per Capita PPP \$	GDP per Sector		
		2003	2004		Agriculture %	Industry %	Services %
Cambodia	18 billion	5.0	5.5	1500	50	15	35
Indonesia	663 billion	3.5	4.0	3100	17	41	42
Malaysia	210 billion	4.2	5.1	9300	12	40	48
Philippines	356 billion	4.0	4.5	4200	15	31	54
Singapore	105 billion	2.2	4.2	24000	Negl	33	67
Thailand	429 billion	5.75	5.5 to 6.5	6900	11	40	49
Vietnam	168 billion	6.9	7.1	2100	25	35	40

Sources: - Asian Development Bank
 - World Bank Yearly Report for Year 2002 and
 - The Bank of Thailand.

Vietnam has significant energy resources including hydropower, coal, oil and gas. With the noticeable steady increase in the GDP growth every year and the corresponding increase in the demand for energy, the Government of Vietnam has given high priority to the development of the energy sector with projects like thermal power plants using fossil fuels (mainly coal, gas) and hydropower plants.

In 1999 and 2000, Vietnam had a total electric generating capacity of 5.0 and 6.85 GW respectively. In 1999 hydropower accounted for roughly 52% and in 2000 it was 47.9% of electricity generation, while thermal power accounted for about 48% and 52.1% respectively. By the end of 2002, Vietnam had a total electric generating installed capacity of 8860 MW, of which Independent Power Producers (IPPs) accounted for roughly 7%.

With the rapid GDP growth and industrialisation in Vietnam after the 1997 Asian Economic crisis, the Vietnamese Government has come up with policies on effective management of the energy sector. Especially in the Power development Master Plan for the period of 2001-2010, 2003, prepared by the Department of Energy, Ministry of Industry, the focus has been on decentralising the existing power industry and also to privatise the generators and the transmission units which are a state-monopoly now. More emphasis now being laid on the IPPs to provide the much needed power in the next few years, a cogeneration option seems to be one the best.

2. General Overview of the Energy Sector

In the past ten years, economy of Vietnam grew at a fast pace recording an average growth rate of over 7% per year. In order to meet the energy demand of this growing national economy in general and electricity demand in particular, the Vietnam Government has responded by promoting new projects with international financing and co-operation.

By the end of 2002, Vietnam had an installed power capacity of 8700MW and generated 35.79TWh, at an average growth rate of over 13%/year, in 2002 year by 16.9%.

Vietnam's energy industry is regulated by the monopoly providers of the industry. In the oil and gas sector, PetroVietnam has a full monopoly on upstream activities and is an exceptionally strong player in the downstream area too. Thus it has a substantial role in any kind of work in the energy service sector. Foreign companies and foreign investors in the IPPs, within the industry will have to work with in co-operation with PetroVietnam.

2.1. Energy Statistics and Data

The commercial energy production has been rapidly increasing as with the GDP growth, especially the electricity and oil & gas production has seen a big growth rate. It is as illustrated in the Table 2.1. Vietnam has around 600 mill.m³ of proven oil reserve and more discoveries have since been made and further discoveries are also likely. Most of the Vietnam oil reserve remains unexploited. The country also has 554 bill.m³ of proven reserve of natural gas. The use of natural gas has been limited in Vietnam.

Table 2.1: Commercial Primary Energy Production, Year 1990-2000.

Year Types	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Coal (mt)	4.64	4.32	5.31	5.74	6.37	8.16	9.74	11.3	11.4	9.39	10.85
Oil (mt)	2.70	3.90	5.50	6.30	7.07	7.67	8.80	10.1	12.6	15.2	16.27
Gas (Bill. M ³)	-	-	-	-	-	0.18	0.27	0.53	0.83	1.40	2.50
Hydro (TWh)	5.37	6.32	7.23	7.97	9.25	10.6	12.0	11.7	11.1	13.8	14.68

Source: - Annual Report 2002, EVN 2003

Vietnam is a net importer of fossil fuels except for coal. Table 2.2 contains total of these product imported and exported up to year 2000.

Table 2.2: Fossil Fuels Imported and Exported – up to Year 2000. (in mTOE)

Year Product	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Oil product Import	-3.11	-2.90	-3.09	-4.22	-4.73	-5.08	-5.93	-6.52	-7.19	-7.40	-8.75
Oil export ¹	2.80	4.06	5.50	6.31	7.07	8.16	9.46	10.7	13.3	14.9	15.4
Coal export	0.44	0.66	0.71	1.03	1.21	1.57	2.07	1.99	1.64	1.83	2.11
Balance	+0.1	+1.8	+3.1	+3.1	+3.5	+4.6	+5.6	+6.2	+7.8	+9.3	+8.7

Source: - Annual Report 2002, EVN 2003

¹ Crude Oil and Oil Products.

Table 2.3: Commercial Primary Energy Production, Year 1992-2002.

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Coal (Mt)	5.31	5.74	6.37	8.35	9.74	11.3	11.6	9.6	11.6	13.0	15
Oil (Mt)	5.50	6.30	7.07	7.67	8.80	10.1	12.6	15.2	16.3	16.8	16.6
Gas (Bill m ³)	-	-	-	0.18	0.27	0.53	0.83	1.20	1.35	1.40	1.70
Hydro (TWh)	7.23	7.97	9.25	10.6	12.0	11.7	11.1	13.8	14.7	18.2	18.2

Source: - Annual Report 2002, EVN 2003

The total final energy consumption from year 1990 to 2000 is given in the table 2.5. The energy consumption is growing at a rate of 11.5% annually.

Table 2.4: Consumption and Structure of Commercial Electricity (TWh).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Industry	2.84	3.07	3.2	3.48	3.94	4.62	5.5	6.16	6.78	7.57	9.09
Agriculture	0.59	0.81	0.97	1.11	1.36	1.52	1.87	2.08	2.19	0.57	0.43
Service	2.7	2.64	2.7	3.15	3.9	4.95	5.89	6.93	8.59	11.24	12.71
Transport.	0.05	0.05	0.06	0.06	0.08	0.1	0.11	0.13	0.16	0.16	0.17
Total	6.18	6.57	6.93	7.8	9.28	11.19	13.37	15.3	17.72	19.54	22.40

Source: - Annual Report 2002, EVN 2003

Table 2.5: Per Capita Indicators.

Indicators	1990	1995	1999	2000
Primary energy consumption (KgOE/cap.)	83.2	116.3	169.8	232.3
Final energy consumption (KgOE/cap.)	63.1	98.7	144.0	174.5
Electricity production (kWh/cap.)	132.5	203.3	307.6	343.6
Electricity consumption (kWh/cap.)	94.2	155.6	255.1	288.3

All indicators per capita are much lower than the world average.

Source: The Ministry of Industry.

Based on a survey of hydro-potential of 87 rivers in Vietnam territory, the theoretical hydro-potential is estimated as high as 308TWh annually with capacity of 70,000MW. Explored hydro-potential is evaluated based on the study data of 363 places with capacities more than 10MW. It reaches the figure of 72 TWh annually and 17,566 MW capacities. This study has been conducted by the Research Centre of Energy and Environment- VUSTA-Social Republic of Vietnam. Hydro stations are to be considered as small and micro if their capacity is less than 10MW. Their potential is not large but they play an important role in the remote areas. The potential of small and micro hydro is shown in the table 2.6.

Table 2.6: Small and Micro Hydro Generators- Potential

	Number of stations	Capacity
Small hydro	3000	1500-2000MW
Micro hydro	1,000,000	100MW
Total out put		2TWh

Biomass is the most important energy resource for rural area, as 80% of the population still relies on it as an important fuel source. It is used mainly for cooking which has led to an intensive deforestation. Its share in 2000 energy balance was 45%.

Biogas estimation is based mainly on the methane coming from enteric fermentation manure and agricultural waste. In the averaged methane content of 55-60% and heat content of 4800-5100 kcal/m³, the potential energy available is estimated as 924.6 millm³/year or 0.444 mTOE/year. The real utilisation is only 9-14 mill m³/year, and forms only 10-15% of the potential.

2.2. The Electricity Supply Industry

Vietnam's power sector is under the administration of Ministry of Industry. Electricity of Vietnam (EVN) is a state-owned utility established in 1995. It is engaged in generation, transmission and distribution of electricity in the whole country. It could be said that the electricity market in Vietnam is a state-owned monopoly.

In 2001, the total installed capacity of Vietnam reached 8,478 MW, of which 7,878 MW are operated and owned by EVN and the balance of 600 MW are owned by the IPPs. Hydropower accounted for 48.6 percent, coal and oil 13.4 percent, gas turbine and diesel 30.8 percent, and the balance of 7.2 percent came from IPPs with mixed use of fuels.

EVN is the single utility for Vietnam and does allow some private sector distributors of power in the rural areas. These are generally farmer cooperatives or rich individuals who can invest in electricity poles and cables to distribute power from central sub-stations in the rural areas.

Private sector power producers (mostly foreign invested companies) are beginning to enter the market for power generation. To date though, independent power producers (IPPs) have had to struggle enormously with EVN to negotiate power purchase agreements (PPAs) that make financial sense. Until these IPPs can move forward, there will likely be few new projects in the energy service sector for power generation. From a market structure perspective, the core functions of generation and transmission are integrated and under direct management of EVN headquarters. This core unit sells electricity in bulk to seven regional independent distribution companies.

Electricity production increases up to 2.7 times during 10 years. It is shown in Table 2.7.

Table 2.7: Electricity Production. (TWh)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Generation	8.69	9.21	9.70	10.6	12.2	14.6	16.9	19.1	21.6	23.5	26.7

Source: - Annual Report 2002, EVN 2003

2.3. The Electricity Tariff rates and Fuel Prices:

Table 2.8: Electricity Tariff - Current unit Price and Tariff Structure

Customer	Voltage	Peak time (18h - 22h)	Normal time (4h - 18h)	Lowload time (22h - 4h)
I. Industry sector	> 110kV	1325	785	425
	20 kV - 110kV	1370	815	445
	6kV - 20kV	1430	860	480
	< 6kV	1480	895	505
II. Water mgmnt for agriculture Production	> 6kV	950	600	240
	< 6kV	1000	630	250
III. Public lighting	> 6kV	860	860	860
	< 6kV	895	895	895

IV. Clean water supply	> 6kV	1350	795	425
	< 6kV	1420	835	445
V. Public service	> 6kV	780	780	780
	< 6kV	820	820	820
VI. State offices	> 6kV	885	885	885
	< 6kV	920	920	920
VI. Service business	> 6kV	2.190	1.350	790
	< 6kV	2.300	1.410	815

Note: Validated from 20/09/2002 and Tariffs in VND/kWh / Source: - Annual Report 2002, EVN 2003

Table 2.9: Foreigners, Institution & Enterprise owned by Foreigners & Joint-Ventures

Customers	Voltage	Peaktime (18h - 22h)	Normal time (4h - 18h)	Lowload (22h -4h)
I. Industry sector	>110 kV	1.410	830	440
	20 - 110kV	1.510	890	480
	6 - 20 kV	1.600	950	520
	< 6kV	1.710	1.020	560
II. Service – Commercial	>20 kV	2.110	1.260	690
	6 - 20 kV	2.360	1.400	760
	< 6 kV	2.550	1.530	850
III. House hold	> 20 kV	1.200	1.200	1.200
	6 -20 kV	1.330	1.330	1.330
	< 6kV	1.470	1.470	1.470

Note: Validated from 20/09/2002 and Tariffs in VND/kWh.

Source: - Annual Report 2002, EVN 2003

2.4. The Energy Forecast up to year 2010²

The GDP of Vietnam is projected to increase by at least 2 folds based on 2000 GDP figure. The average GDP growth rate is about 7% per annum. Electricity demand is forecasted to grow at an average yearly growth of 10 to 12 percent to reach around 70,000 GWh in 2010 and 1000,000 Gwh in 2015.

Table 2.10: Electricity Generation 1995 – 2015:

Electricity Generation (in GWh)						
Year	Coal	Natural Gas	Diesel	Fuel Oil	Hvdro	Total
1996	2376.3	1434.3	223.6	902.5	12008.3	16946.0
1997	3324.7	2919.5	214.3	1016.5	11676.7	19151.5
1998	3479.7	4597.5	359.2	2136.6	11092.2	21665.2
1999	2914.8	4274.2	225.7	2369.7	13774.1	23558.5
2000	3257.0	3600.0	-	3579.0	15564.0	26000.0
2005	8245.0	16004.0	-	728.0	19114.0	44191.0
2010	14605.0	27160.0	-	749.0	27687.0	70451.0
2015	13951.0	40814.0	-	-	53788.5	109453.0

Source: - Annual Report 2002, EVN 2003

² Power Sector Reform in Vietnam - Nguyen Quang Dung- Director General, Department of Industry, Ministry of Planning and Investment, Social Republic of Vietnam

According to the Revised Power Development Master Plan of Vietnam for the period 2001-2010 approved by the Prime Minister in March 2003, the load demand has been forecasted at 48.5 to 53 billion kWh for the year 2005 and 88 to 93 billion kWh for the year 2010. This means the average load growth rate is around 15% annually for the period 2001-2010.

Based on this master plan, to meet high growth rate of power demand, reliable supply of electricity as well as enough reserved capacity for power system in cases of maintenance and faults, there will be a number of new power plant to be put into operation.

Among the new 62 power plants as projected in the Master Plan, EVN itself would invest in 29 generation projects (6912 MW), 3 joint venture projects (2623 MW), a number of new substations and lines. Other state corporations are likely to invest in 30 generating projects (3661 MW). A transmission network expansion should be simultaneously implemented to support the generation expansion plans. In accordance with this, there will be 15 substations (8550 MVA) and 2326 km of lines to be constructed at 500 kV, 85 substations (15628 MVA) and 5064 km of lines at 220 kV.

2.5. Key Players in the Cogeneration Market

Till recent there has been no comprehensive study to estimate the cogeneration potential in Vietnam. The preliminary estimations can be found in the relevant documents of EVN, Vietnam Petrol, Vinacoal, and conservation project sponsored by MOSTE in period of 1996-2000. Also the boilers survey sponsored by MOST and NEDO in 1998 and the project of National strategy study on CDM coordinated by Hydro meteorological service of Vietnam in 2001-2002 also throw some light into the existing cogeneration installations and the potentials in the near future.

One of the findings from these studies has been that there are a big number of intensive energy (electric and thermal) consumers and have power and thermal loads adequate enough for implementing a cogeneration system. Energy consumers with average daily electricity of more than 500KW and average annual thermal demand of more than 500TOE fall in to the category of potential cogeneration customers.

Table 2.11: Cogeneration Potential (MW)

	Existing (MW)	Potential (to 2010)(MW)
Sugar sector	123	20
Paper sector	185	300
Cement sector	2.5	20
Textile, fibres	-	200
Wood processing	-	5
Chemical	-	600
Other	-	15
Total	310.5	1160

Source: - Annual Report 2002, EVN 2003
 - Draft of power sector development strategy in Vietnam, MOI, 2003
 - Power development Master Plan for the period of 2001-2010, 2003

Some Cogeneration Installations in Vietnam:

1. The Viettri power plant was built in 1960. It had cogeneration system which included coal fired boilers and the extraction condensing steam turbines (Russian technology) to supply electrical and thermal energy for Vietnam industry zone. This cogeneration system fell out of operation when it was destroyed in the Vietnam War.

2. The Vandien sugar factory was equipped with a boiler using bagasse as fuel and a backpressure steam turbine (Polish technology) to supply electricity and steam for sugar production (1960). This cogeneration system too, fell out of operation when it was destroyed in the Vietnam War.
3. In 1980 the BaiBang paper factory has built boilers using coal and wastes as fuel and extraction steam turbines (Swedish technology). It has electrical capacity of 130MW and is still in good working conditions.
4. An-Anh sugar factory (NgheAn province) has installed boilers firing bagasse and steam turbine (British technology). It is in operation since 2000.
5. The Cogido paper factory was built in 1959 boilers using waste and oil as fuel. Its cogeneration system consisted of backpressure steam turbine with electrical capacity of 9100 KW and currently is out of operation now.
6. Bourbon sugar factory in TayNinh province has equipped by two boilers and two backpressure steam turbines with electric capacity of 2 x 12MW, in started its operation in 1998 (French technology).
7. Hatien II cement factory has installed HRSG using residual heat from cement kiln and steam turbine with capacity of 3MW (Japanese technology) and came in to operation by 1999.

3. Energy Sector Legislation Framework

The Existing Institutional System of Energy Sector

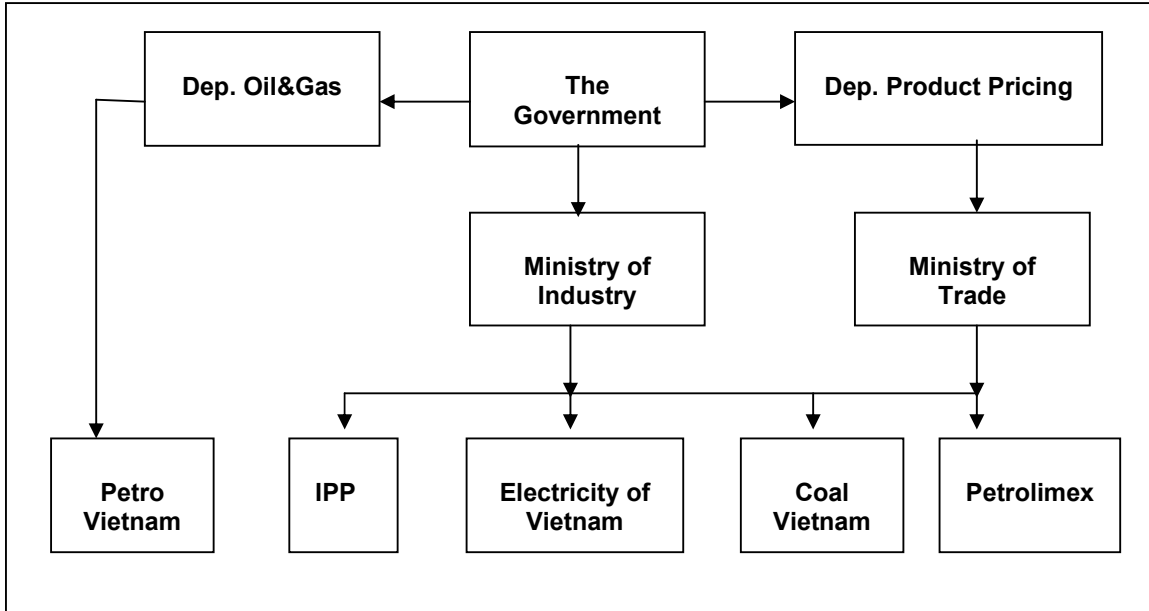


Figure 3.1: Existing Institutional System of Energy Sector

Table 3.1: Policy Making Institutions Responsible For Energy Related Activities In Vietnam:

THE INDUSTRY SECTOR AND THE ENERGY SECTOR	
The Policy Maker and The economic and technical regulatory functions related activities.	
<i>Institution</i>	<i>Area of Jurisdiction</i>
<p>The Ministry of Industry (MOI)</p> <p>Departments under MOI:</p> <ul style="list-style-type: none"> - Legislation Department - Product Quality & Technology Management Department - International Cooperation Department - Planning & Investment Department 	<ul style="list-style-type: none"> - To perform the function of sate administration of industrial sector, including mechanical engineering, metallurgy, electronics, informatics, chemicals, geology, mineral resources, and mines (including coal, oil and gas and gemstone), electricity and consumer goods industry nationwide. - To submit draft laws, ordinances, legal documents associated with industries administered by the Ministry to the Government. - To submit national strategies, plans and projects for industrial development the Government , and give direction and guidance on the implementation after they are approved by the Government
THE ENVIRONMENT SECTOR	
<p>The Ministry of Science and Technology (MOSTE), The Ministry of Industry(MOI) and The Ministry of Planning and Investment(MPI) are responsible for the policies, regulations, legislations and other related activities.</p>	

3.1. Liberalisation of the Electricity and Gas Market

Activities in electricity sector are regulated by the Government decree on electricity activities and consumption. Private companies can participate in electricity generation and distribution only but are subject to the conditions as below:

- License issued by MOI if generation capacity is bigger than 10MW and also in case of generation for self use.
- In the case of connection to grid, beside the license there is a need to obtain additional purchase contracts with the EVN.
- Investment modes as BOT, BOO, BTO, BT are encouraged.
- The price to sell to grid is not fixed, depends on negotiation with EVN case by case.
- Investment into electricity for rural areas is encouraged by tax policy and financing.

3.2. Legislation and Programs Promoting Cogeneration

In 1996-2000, Vietnam carried out the National Science Technology program on Strategy and Policy for Sustainable Energy Development for Period of 2001- 2020. Main target of this program is to create scientific bases for National Energy Policy. Based on these results Draft of National Energy policy was prepared and submitted to Government.

Some contents related to cogeneration are outlined in this Draft as follows:

- In the context of policy for power development there are articles of priority of using combined cycle, clean coal technologies for cogeneration.
- In the context of policy for energy conservation, cogeneration system is considered as appropriate measure for energy conservation and environment protection.

Till date, Vietnam does not have a separate program, legislation or national policy promoting cogeneration.

3.3. Legislation and Programs Promoting Energy Efficiency

The National Project in the period of 1996-2000 was set up for formulating the energy policy and it was submitted to the government and the document has still not yet endorsed by the Government.

In place of an existing legislation on energy efficiency, there are many programmes being supported by the World bodies like the World Bank, to lay foundation work to assist the Vietnamese Government to promote National policies on Energy Management and Efficiency. Some such efforts are:

1. Energy Efficiency Programs:
A national wide program coordinated by the MOSTE. This Project is assisted by organisations from Japan, Netherlands and Germany. Programme supports several projects like Energy Saving in Small and Medium Sized enterprises.
2. DSM Project:
This project is coordinated by the MOI and supported by the MOSTE, The Ministry of Construction and the EVN. Funded by the World Bank, the project is in Phase II and in preparation of building up a demonstration project on commercial energy saving.
3. Energy-Efficient Public Lighting:
This project is coordinated by the National Centre for Natural Science and Technology and sponsored by the GEF. The first phase was finished in this year as PDFB. The phase II is in the

process of preparation. The aim of phase II is the realisation of efficient public lighting system in some big cities as a full scale demonstration project. GHGs abatement is also a subject of project. Presently a Governmental decree on Energy Saving and Efficiency is being drafted.

3.4. Legislation and Programs Promoting Biomass

Biomass is a major component of noncommercial energy in Vietnam. It has more than 50% share in national energy balance in the past and will continue in the same status in the future (until 2020). It is the main energy source in the rural area where 70-80% of the population still use it mostly for heating and cooking. It shares about 98% of energy consumption in this area. To tackle use of biomass as a fuel efficiently, some of the suggestions from the studies conducted are:

- Rural energy development must be integrated into other development programmes such as poverty elimination, education and cultural development, health care, new life style, protection from natural disasters.
- Encourage the use of commercial energy such as coal, gas, oil and support the use of renewable energy by financing, subsidising and provide similar financial assistance.
- Rational and efficient use and production of biomass resources by agriculture and forestry by-product processing into fuel, by special forestation for woods, by switching from wood to other fuel in ceramic, brick, lime production.

3.5. Legislation and Programs Promoting Natural Gas

By the Oil and Gas Law, the legislation concerning energy production by governmental and private companies is highlighted as below:

- Government encourages Vietnamese, foreign organisations and individual persons to invest into oil & gas sectors. The stakeholders are entitled to protection of their capital, properties and other legal rights. Some of the conditions to be met by these investors are:

All legal bodies including private companies shall:

- Apply only modern technology.
 - Fulfill commitments on environment protection.
 - Buy insurance
- All legal bodies including private companies can: install, operate, maintain, use facilities, routes, pipelines, storage for their activities.
 - All legal bodies including private companies, investing in the Oil and Gas sector businesses in Vietnam are required to enter contracts with the PETROVIETNAM, the government representative through a bidding process. Normal contract term is less than 25 years including the exploration period of less than 5 years.

3.6. Legislation and Programs Promoting Coal

Energy production by all companies in coal sector is regulated by the Mineral law. This law encourages all investors, including private companies to invest into coal sector activities such as investigation, exploration, mining and processing but does not provide the ownership of the mines being explored or area invested, to anybody.

The License terms under this law for the investors are:

- 12 months for investigation
- 24 months for exploration.
- less than 30 years for exploitation.

4. Conclusions

Energy resources of Vietnam are highly diversified, but are still not fully explored. In the last ten years, energy consumption increased and has caused the present energy system capacity to develop to meet the demand.

As of now, Energy technology application and efficient management are still on limited. The Government of Vietnam as a result is drafting polices to incorporate a development strategy for the energy sector with focus on the electricity industry. With these policies in place, it is expected to create good opportunities for energy advanced technology, including cogeneration.

Cogeneration technology was introduced into Vietnam early, but has seen no significant development owing largely due to the economic impairment during the Vietnamese War and the subsequent lower investment in this sector.

With no policies promoting cogeneration technology in Vietnam and the lack of awareness of the industry stakeholders, it is suggested that capacity building activities to promote and educate the stakeholders are of immediate importance.

Cogeneration potential in Vietnam industries is estimated to be relatively large. There is a need of a proper strategy and a roadmap for the realisation of that potential.

The Vietnamese energy sector legislation framework is rather weak. A fundamental change in the existing policies involving a better approach to effectuate the energy efficiency cause is much required in Vietnam. Unless this is done, little can be expected in the direction of increasing cogeneration capacity.

5. Sources and Links to Information

1. <http://www.eia.doe.gov/> -The Energy Information Administration, US Department of Energy.
2. <http://www.aseanenergy.org/> - The ASEAN Energy Centre, Jakarta.
3. <http://www.dei.gov.vn> – Vietnam’s Economy and Policy Information website.
4. CIA – The Worldfact book 2002
5. <http://www.odci.gov/cia/publications/factbook/geos/vn.html>
6. Asian Development Outlook 2003 - Asian Development Bank
7. Vietnam Country Report – First Quarter, November 2002
8. <http://www.fao.org/> - FOOD AND AGRICULTURE ORGANISATION OF THE UNITED NATIONS
9. http://asemconnectvietnam.gov.vn/vn_ministries/ministry_detail.aspx?id=71 – The Vietnam Trade Information centre.
10. <http://www.most.gov.vn/> - Website of the Ministry Of science and Technology
11. <http://www.mpi.gov.vn/gioithieu.asp?Lang=2&mabai=3> - Website of the Ministry of Planning and Investment.

ANNEXES

Annex 1 - General Information of Vietnam:

Vietnam is located at the South-East Asia. The land area occupies 329,241 km². The sea area consists of large area of territorial water and thousands of small islands with 3260 km of coastline. Vietnam possesses a monsoon tropical climate with plentiful heat, high humidity, and is affected by many typhoons and tropical cyclones.

The agricultural land covers 7.3 million hectares. Forestland is about 19 million hectares (in 1994), in which only 9.3 million hectares had good forest coverage. The population of Vietnam in 1994 was 70.8 millions and in 1999 were 76.6 millions inhabitants with growth rate ranged from 1.4% to 1.6% annually. Vietnam is an agricultural country with 70 – 80% of the population living in rural areas.

Vietnam industry is still not developed yet, the equipment is backward and power consumption per unit of product is high. Commercial power supply level is low in comparison with other countries (only about 0.12TOE/capita). The energy resources potentials are diversified and have not been explored enough. The technologies in energy production and utilisation are still obsolete, with low efficiencies and high consumption rates.

The economy has high growth rates, and GDP has increased by twofold in the last 10 years. Hyper inflation was controllable and liquidated. Vietnam has succeeded in maintaining high growth rates with good macroeconomics performance during the past few years. This development has inevitably required increased demand in energy as it is a driving force for all social and economic activities.

During 1991-1997, Vietnam's unprecedented economic growth remarkably stabilised macroeconomic balance. The gross domestic product (GDP) per capita in 1996 was as high as about US\$265. Throughout the 1991-1996 period, GDP rose by 53% with an average rate of 8.8 percent annually, showing an accelerating growth rate over the years. The high growth of GDP has resulted from the rapid growth in most Vietnamese economic sectors and industries, especially agriculture and industrial production. But Vietnam's growth is now slowing down because of the financial crisis in East Asia, and because of its own inertia in implementing structural and policy reforms. In 1998 GDP average growth rate reached 5.76% and in 1999 it slowed down to 4.77%. Presently the growth rate has the sign of rehabilitation, it was 5.8% in 2000 and 6.5% in 2001. It is expected that 2002 growth rate can reach 7.2%.

Table ANNEX 1: Economical development

Year Indicators	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Pop (mill. per.)	65.6	66.9	68.2	69.5	70.8	72.0	73.2	74.3	75.5	76.6	77.7
GDP(Bill.US\$)	14.0	14.9	16.1	17.5	19.0	20.8	22.7	24.6	26.0	27.3	29.0
Growth rate (%)	5.1	6.0	8.6	8.1	8.8	9.5	9.3	8.2	5.8	4.8	6.8
GDP/Cap. (US\$/Cap.)	213	223	236	252	268	289	310	331	344	356	379

Remark: The 1995 US\$.

ANNEX 2: Vietnam general data of year 2000.

Population	77.6 million
Urban population	18.8 million
Territory	329.000 km ²
Number of adminis. units	61 provinces and cities
GDP	29.0 Billion USD
GDP growth rate	6.79%
Inflation	0.5%
Exchange rate	15,000 VND/USD
Coal production	11.6 million tones
Coal export	3.25 million tones
Crude oil production	16.3 mill. Tones
Oil export	15.4 mill.tones
Petroleum products import	8.7 mill. Tones
Electricity production	26.7 bill.MWh
Output of paddy	32.5 mill. Tons
- Rice export	3.47 mill.tones

Annex 3: List of Existing and future IPP's in Vietnam

Name	Type of power plant	Year in operation	Total capacity MW	Type of fuel
HiepPhuoc- South of VN	Diesel	1997	375	DO
BinhDuong- South of VN	Diesel	1996	8	DO
Amata- South of VN	Diesel	1997	12	DO
Nomura- North of VN	Diesel	1997	50	DO
Vedan- South of VN	Diesel	1998	72	DO
BaiBang paper- North of VN	Thermal power	1980	130	Waste + coal
Bourbonsugar- North of VN	Thermal power	1996	20	Biomass
NaDuong	Thermal power	2004	100	Coal
CaoNgan	Thermal power	2005	100	Coal
40 small power plants	Hydro	30% in operation 70% planned	1300	Water