

SOCIALIST REPUBLIC OF VIETNAM

Independence - Freedom - Happiness

PUBLIC INVESTMENT PROGRAM

1996 - 2000

(Approved by the Prime Minister, Decision No. 2920/QĐ-QP on 18 June, 1996)

Hanoi, June 1996

Chapter VI

ENERGY

A. Electricity

The Recent Energy Development Situation

1. . Before 1995, three distinct regional systems supplied electricity in Viet Nam, each of them controlled by a power company which managed generation, transmission and distribution in the region. The three companies came directly under the control of the Ministry of Energy.

TABLE VI.1 - GEOGRAPHICAL LOCATION OF THE POWER COMPANIES AND INSTALLED CAPACITY

	Region	Population (m)	Main centers	Installed Capacity	Low demand
PC1	North	34	Hanoi, Hai Phong	2,000 MW	1,000 MW
PC2	South	24	HCMC, Mekong Delta	1,200 MW	800 MW
PC3	Center	10	Da Nang, Hue	250 MW	200 MW

2. Since early 1995, the energy sector has been reorganized with the creation of one large-scale corporation. Electricity of Viet Nam (EVN) has been established, which has taken over the functions previously exercised by Power Companies 1, 2, 3, and also manages the local utilities of the large cities, service providers and equipment manufacturing. EVN comes under the supervision of the Government through the Ministry of Industry which remains responsible for overall supervision and regulation, and for policy-making and strategy-setting for the sector.

3. Total electricity production in 1995 is estimated to have been at 14.5 bn. Kwh. (about 3 bn. Kwh. more than consumption, because of transmission and distribution losses). Average growth for 5 years 1991-95 was 10.8 % p.a. In 1994, the increase was 15.1 % and in 1995 it is estimated to be 18 %.

4. Over the last fifteen years Viet Nam has seen a very rapid growth in electricity demand: between 1991 and 1995 consumption increased at an average 11.2% p.a., much faster than GDP growth at around 8.2%, a relationship which normally happens at an early stage of development. Industry is the largest consumer of electricity, with an estimated annual consumption of 4.5 bn Kwh in 1995. Households and public consume almost as much as industry (4.3 bn. Kwh.), and growth in household and public electricity demand over 1991-1995 (at 11.6 % p.a.) was nearly double the rate of growth of sales to industry. However, it should be noted that many households carry out

productive activities (e.g. handicrafts, cottage industries, commercial services) on the family premises, making it difficult to separate domestic consumption from use for productive activities.

Objectives and Targets: 1996 - 2000

5. The priorities for the coming five years are to:
 - (a) rehabilitate and expand existing power generation capacity, with particular attention to some of the older and least efficient thermopower plants;
 - (b) complete projects and put them into operation to increase generation capacity, to respond to the projected more than doubling in demand by 2000; and
 - (c) to integrate all the districts in the country into the national grid.

6. Based on the macroeconomic growth projections, forecasts for electricity demand indicate that overall electricity production will need to grow to 30 bn Kwh between now and year 2000, which is two times higher than that of the year 1995. The sectoral breakdown of the estimated growth in electricity consumption is presented in the table below.

TABLE VI.2 - ESTIMATED ELECTRICITY CONSUMPTION BY SECTOR
(bn. kwh)

	1995	2000
Industry	4.500	10.92 - 12.20
Agriculture	0.765	1.00 - 1.15
Trade/commerce	0.900	2.30 - 2.52
Households & public consumption	4.275	8.70 - 8.80
Other	0.900	4.98 - 5.50
TOTAL	11.340	27.9 - 30.0
	(not including losses)	

7. In order to meet the growth in electricity demand estimated for 1996-2000, an increase in generating capacity of 4,000 MW will be required. The investment programs required to generate that increase are as follows:

List of Projects and the Timetable for the Construction of New Power Generation Capacity

- Ba Ria Gas-Turbine Thermo Power Plant: an additional generator F6 (with a capacity of 37.5 MW) will be completed by the 1996 dry season. Two other generators with a capacity of 57 MW each will be operating by the end of 1998. This project is funded by a World Bank loan.
- Phu My Gas Turbine Thermo plant 1, 2 and 3, with a total capacity of 1,800 MW of which:
 - Phu My 1 with capacity of 600 MW will be completed by the end of 1999. This project is being funded by Japanese ODA.
 - Phu My 2. Phase 1: one generator with a capacity of 200 MW will be completed by the end of 1996;
 - Phu My 2, Phase 2: an additional 200 MW will come on stream by the end of 1996; the remaining 200 MW will start to operate by the last quarter of 1998. The funds for phase 1 are provided by the World Bank. Phase 2 funding has still to be arranged, and could be either under a BOT or joint venture arrangement.
 - Phu My 3: has a planned capacity of 600 MW, of which 200 MW will be put into operation in the last quarter of 2000 and full capacity will be put into operation by the end of 2004. This project may be funded under a BOT scheme or a joint-venture arrangement.
- River Hinh Hydro plant (70 MW): In the fourth quarter of 1998, a turbine will come on stream; in the last quarter 1999 the full capacity will be operational. Funds to purchase equipment are being made available through ADB, domestic or foreign countries' credits.
- Pha Lai Thermo Plant 2 (600 MW): in the fourth quarter of 1998 one generator (200 MW) will come on stream; in the second quarter of 2000, the remaining two generators (capacity 200 MW each) will start operating. This project is funded by Japanese ODA.
- Ham Thuan - Da Mi Hydro Plant (472 MW): total capacity will come on stream by fourth quarter 2000. This project is funded by the Japanese ODA.
- Yaly Hydro plant (720 MW): in the fourth quarter 1999 one generator of 180 MW will be put into operation, in the second quarter 2000 a second generator with a capacity of 180 MW will come on stream, and the remaining generators will be put into operation in the second quarter 2001. The funds are to be provided partly by domestic credit institutions, partly from depreciation and revenues generated from electricity tariff increases.

8. As is apparent from the above list, new natural gas thermo power plants account for a large proportion of the new projects. Hydro power remains the dominant form for generation but coal and gas power plant will increase their share in the short term, essentially to meet power needs in the interim, until other new planned capacity comes on stream. The new capacity coming into operation will be broadly divided as follows:

Table VI.3 - Composition of New Generating Capacity

	Increase in estimated production of the year 2000 compared to 1995 (bn Kwh)	% of total production 1995	% of total production 2000
Hydro	3.355	69.6	44.5
Thermo (natural gas)	9.859	6.8	36.0
Thermo (coal)	3.331	15.7	18.6
Other (Diesel, Fuel oil)	(0.917)	7.9	0.9
TOTAL	15.608	100.0	100.0

9. The following summary table shows the contribution of the various types of generators to total electricity production once all the new projects become operational:

TABLE VI.4 - CONTRIBUTION OF DIFFERENT GENERATOR AND
PRIMARY ENERGY SOURCES (BN. KWH)

	1995	2000
Total Production capacity	14.500	30.000
of which:		
1. Hydro (total)	10.098	13.453
Old hydro plants	10.098	10.996
New plants		2.475
2. Thermo	3.289	5.725
Coal-fired	2.289	5.600
Oil fired	1.000	0.125
3. Phu My 1,2,3 and generator F6 of Ba Ria Plant		8.421
4. Gas turbine (existing plants)	0.982	2.320
5. Diesel	0.131	0.089

10. Total production capacity of newly constructed plants is 4000mw. Construction of some of these plants will only be completed after the year 2000 and as a result they cannot come into full capacity operation by the year 2000.

11. The power stations involved in the rehabilitation program in 1996 are listed in the table below.

TABLE VI.5 - REHABILITATION AND IMPROVEMENT
OF EXISTING POWER STATIONS

Pha Lai	440 mw
Uong Bi	153 mw
Ninh Binh	110 mw

12. Investment in new plants will increase total generating capacity by 80 % in five years. Taking into account the rehabilitation program for the old power stations, total effective generating capacity in the country will more than double over the same period. Capital expenditure will also be made to expand and rehabilitate the national grid and existing distribution networks.

13. In addition to the list of projects for completion before year 2000, work on the following is planned to commence in the end of the five-year plan to meet the energy requirements beyond the year 2000:

Son La Hydro	3,600 mw
Play Krong Hydro	120 mw
Ban Mai Hydro	350 mw
Dai Ninh Hydro	300 mw
Quang Ninh Thermo (expansion)	600 mw

There are also a number of projects still subject to preparation work as follows:

Se San Hydro	220 mw
Dong Nai 4 Hydro	200 mw
Thuong Kon Tum Hydro	260 mw

Power Transmission Network

14. A large amount of capital expenditure (estimated at around 5,700 bn VND) was absorbed by the recently completed 500 kv North-South transmission line. At present 84.7 % of districts and 54.7 % of communes are interconnected. During 1996-2000, the transmission and the distribution networks will be further expanded and rehabilitated, to handle the increase in the volume of production. The transmission network includes 6427 km. of high-voltage transmission lines and

power sub-stations of 110 and 220 kv., for a total capacity of 15,712 mva. The medium-voltage transmission lines cover 34,212 kms. and the low-voltage 24,437 kms.. Sub-stations with a total capacity of 7,020 mva. service the medium- and low-voltage lines.

15. Investments to upgrade and add transmission lines where capacity is insufficient, in the industrial growth areas such as those along Highway 51, HCMC-Song Be-Bien Hoa-Ba ria-Vung Tau, Xuan Mai-Ha Noi-Noi bai, Hai Phong-Quang- Ninh, along Highway 5, Da nang -Dung Quat, will receive high priority.

16. The transmission network to densely populated rural areas and supply of electricity to the island communities will be expanded. By the year 2000, it is intended that 100% of provinces and districts and 80% of communes will be connected to the national grid.

17. In order to meet these targets over the next five years, total capital expenditure in the power sector will amount to 58,238 bn VND of which 34,138 will go to construction of power generation. The rest will be used in the upgrading and expansion of the transmission network.

TABLE VI.6 - INVESTMENT REQUIREMENTS OF THE ELECTRICITY SECTOR (billion VND)

	Constant 1995 Prices	
	1996	1996 - 2000
Network	2,940	23,500
Power Generation	4,930	42,000
Other	50	600
Total	7,920	66,900

Capital Inadequacy and Insufficient Tariff Levels

18. The power sector faces many difficulties, but a critical constraint on the growth of the sector is the supply of capital for construction of plant and distribution. Electricity tariffs are insufficient to generate the domestic resources required to support the required investment expenditure. Pricing and financial mechanisms and policies have been amended. The power companies will mobilize more resources to meet their investment and operating requirements, and put them on a more autonomous financial footing, while at the same time ensuring the supervision by the Government.

19. Current tariffs involve an average charge of VND 550 per Kwh., reflecting adjustments made in August 1994, but that is still inadequate to cover operating costs and capital depreciation at the levels required. This situation is only temporary, as adequate policies should be implemented to overcome this problem. It is expected that the tariff level will be increased gradually by about VND 50-60 per Kwh p.a. and reach VND 770 per kwh (equivalent to 7 US cents) in 1999, which will allow the power companies to fund their operating requirements including new capital expenditure, meet their financial obligations and contribute to the state budget.

Energy Efficiency, Energy Intensity and Conservation

20. Although the amount and rate of electricity consumption will increase rapidly, Vietnam still has considerable domestic energy supply potential, there is no merit in using resources inefficiently, which would result in premature exhaustion of natural resources and environmental stress. Serious attention will be given both to supply efficiency and to energy demand management. On the supply side, considerable improvements in energy efficiency are expected from the rehabilitation of the old thermo power plants. Improvements in efficiency in generating electricity will come from the gradual phasing in of generators of thermo power plants over the coming five years. Finally, improvements in the transmission and distribution systems will reduce losses, which are now very high by international standards.

21. Being a late-comer to industrialization, Vietnam has many comparative advantages to conserve energy by using fuel efficient technologies, particularly in those many manufacturing investments involving acquisition of new production technology and equipment. Appropriate policies will need to be put into place that encourage the adoption of energy saving solutions and to discourage energy-intensive, energy inefficient choices.

POWER

An indicative list of projects targetted for investment (in VND billion)

Project Name	Location	Estimated Capacity	Construct Period	Total Cost	ODA	Donor	GVN Amount	Spent thru 31/12/95	Needed 96-2000	Remarks	
Generation											
Y-A-Ly Hydropower Plant	Gia Lai	720 mw	1994-2000	6256.0			6256.0	1244.0	5012.0		
Ham Thuan Da Mi Hydropower Plant	Binh Thuan	450 mw	1996-2000	7370.0	6560.0	Japan	810.0		7370.0		
Pha Lai 2 Thermo Power Plant	Hai Hung	600 mw	1996-2000	10780.0	9163.0	Japan	1617.0		10780.0		
Hinh River Hydropower Plant	Phu Yen	66 mw	1995-1998	1144.0	561.0	Sweden	583.0	220.0	924.0		
Dai Ninh Hydropower Plant	Binh Thuan	300 mw	1996-2000	4851.0	1925.0	World Bank	2926.0		4851.0	Including State Credit	
Small Power Plants in Northern Districts		10 w	1996-1998	25.3	22.0	China	3.3		25.3		
Phu My I Thermopower Plant	Ba Ria/Vung Tau	600-660mw	1996-1998	9713.0	9570.0	Japan	143.0	9.0	9704.0		
Phu My II - Phase I		430 mw	1996-1997	2486.0	2282.0	World Bank	204.0	10.0	2476.0		
Expansion of Elec. Power Plant F6	Ba Ria	37.5 mw	1996	127.0			127.0		127.0		
Thermo-Elec. Power Plant in Can Tho		75 mw	1996	275.0	136.7		275.0		275.0		
Transmission											
Rehabilitation of Transmission Network In Ha Noi, Hai Phong and Nam Dinh			1996-1998	1034.0	880.0	ADB	154.0		1034.0		
Upgrading Central Vietnam/HCMC Transmission Capacity			1996-1998	2134.0	1815.0	WB	319.0		2134.0		
Improvement of Hue Transmission Network			1996-1997	66.0	55.0	France	11.0		66.0		
Feasibility Study for Hydro Power Plant	Nghe An	400 mw	1996-1999	39.6	33.0	France	6.6		39.6		
Total: Power Sector					46340.5	33035.7		13441.5	1483.0	44857.5	

MINISTRY OF INDUSTRY - ELECTRICITY OF VIETNAM

**POWER DEVELOPMENT PROGRAM
IN VIETNAM**

**The Presentation on the 11th Meeting of the
ASEAN Power Utilities/Authorities Co-Operation
Project No3 Interconnection**

Country paper

Ha noi, Vietnam

POWER DEVELOPMENT PROGRAM IN VIETNAM

1. Current status of Electric Power System

1.1 Generation Facilities

In 1998 the total installed capacity of power stations in the country was 5111MW with available capacity 4690 MW, from which 56% hydropower, 23% thermal power, and 21% gas-turbine & diesel. Electric Power generation was around 21700 GWh, of which hydropower generation recorded around 11100 GWh accounting for 51%, thermal generation was about 5600 GWh (of which 3500 GWh coal-fired and 1300 GWh FO-fired), accounting for 26% and gas turbine and diesel generation was about 5000 GWh (of which 3400 GWh gas-fired), accounting for 23% (Fig-1).

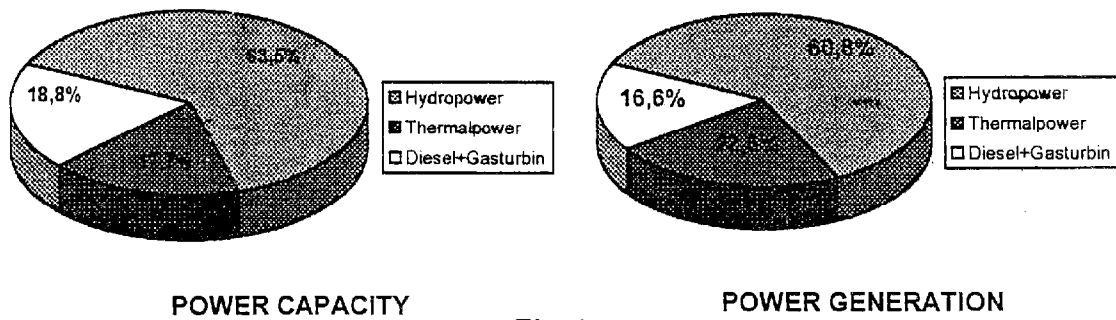


Fig-1

Record of peak power demand and energy generation in period 1990-1998 is as follows (Fig -2).

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Peak demand (MW)	1660	1850	2005	2141	2408	2774	3177	3582	3875
Energy generation (GWh)	8678	9152	9654	10665	12284	14636	16960	19151	21654
Growth rate (%)	-	5.5	5.5	10.5	15.2	19.1	15.9	12.9	13.1

The average energy consumption growth rate in period 1991-1998 was 12.2%, while the GDP growth rate was 8.2% resulting the elasticity coefficient of about 1.5.

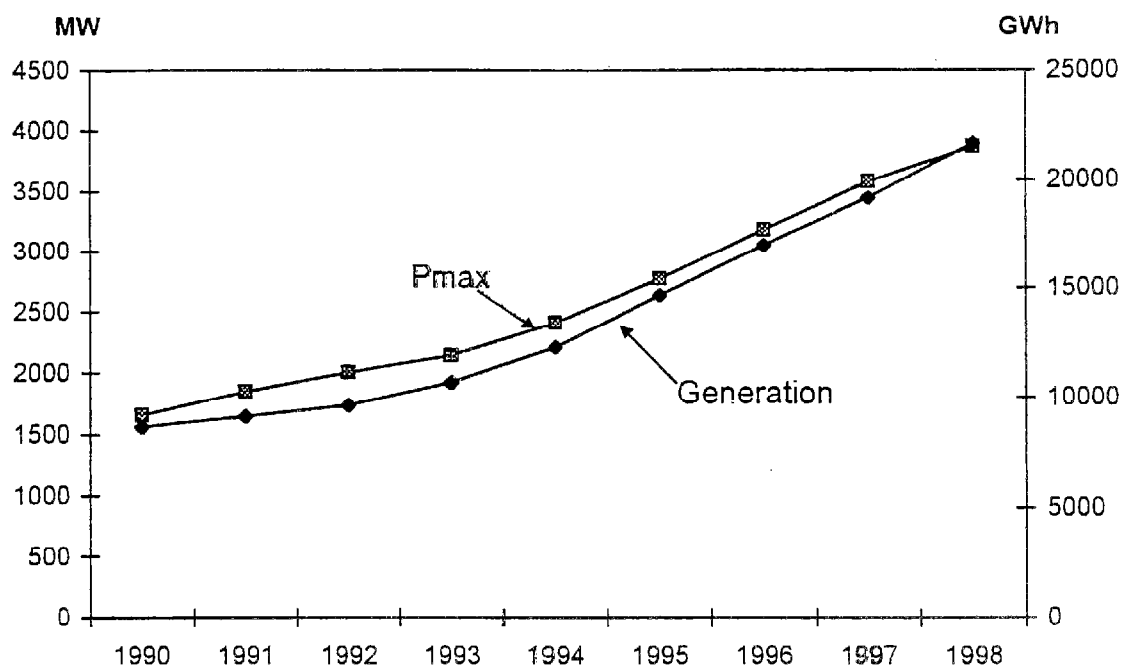


Fig-2

Existing installed capacity of power stations in the country is as follows:

Power stations	Capacity (MW)
I- Hydraulic	2854
1. Hoa Binh	1920
2. Thac Ba	108
3. Da Nhim	160
4. Tri An	400
5. Thac Mo	150
6. Vinh Son	66
7. Small stations	50
II- Thermal	1098
1. Pha Lai (coal)	440

2. Uong Bi (coal)	110
3. Ninh Binh (coal)	100
4. Thu Duc (oil)	165
5. Can Tho (oil)	33
6. Hiep Phuoc IPP (oil)	250
III- Gas Turbine	762
1. Ba Ria	271
2. Phu My2-1	288
3. Thu Duc	128
4. Can Tho	75
IV- Diesel	397
Total	5111

1.2 Transmission and distribution Facilities

The existing transmission systems of Vietnam has been formulated based on the Soviet Standard. The major transmission line system voltage is 220kV and 110kV. 220kV is applied for major transmission systems and 110kV for secondary systems.

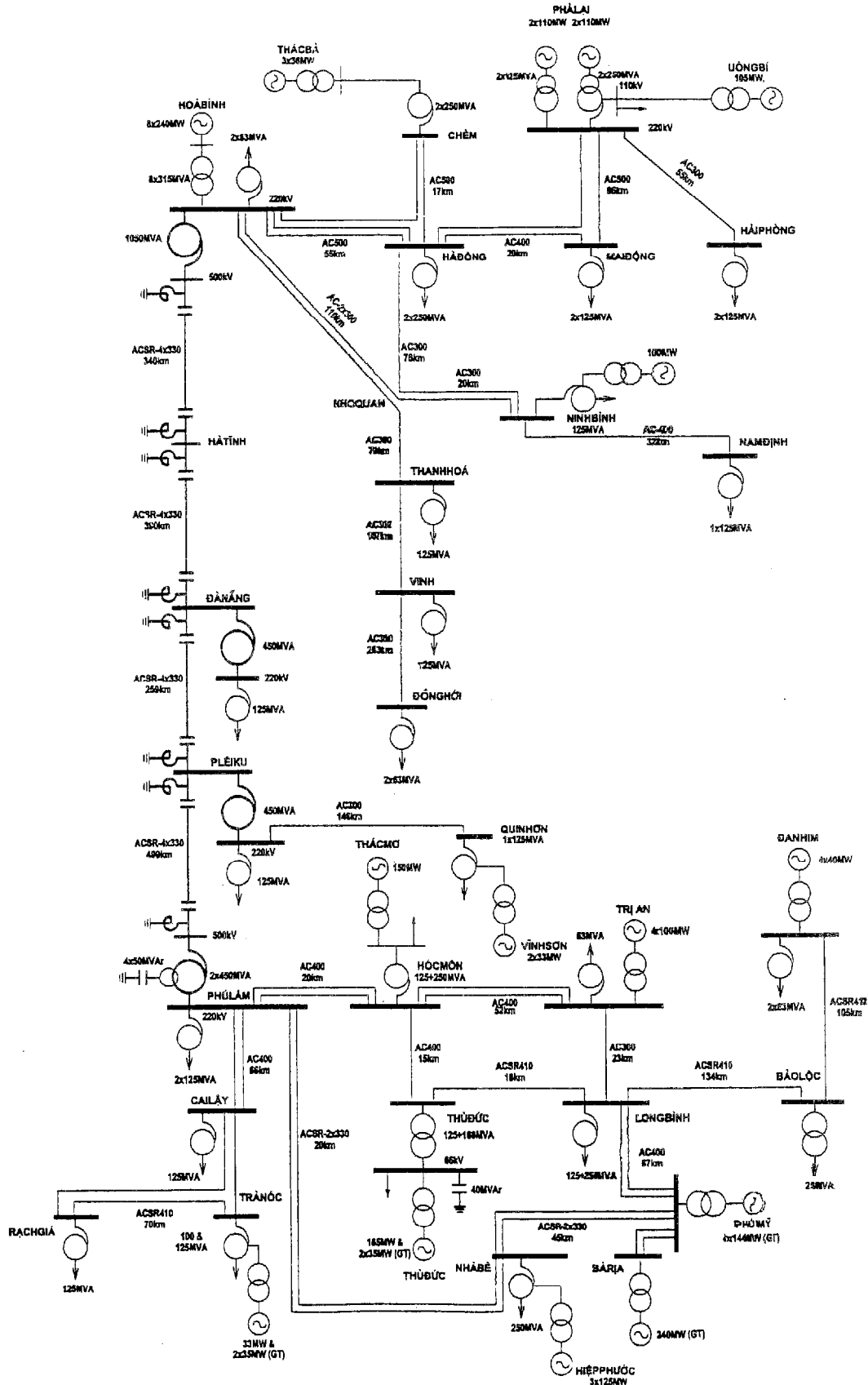
The North-South 500kV transmission system, which interconnects three region of the country (Northern, Southern and Central) was completed by the end of September 1994.

The power system diagram of generation and transmission facilities of the 500 and 220kV is shown in Figure 3.

From difference in history of development, various types of distribution system with different medium voltage classes are in operation in the country. In the Northern system the distribution network has been formulate based on medium voltage 35kV and 10kV or 6kV. In the central and southern systems, the main distribution voltage is 15kV. In 1994 Ministry of Energy decided to adopt 22kV as the future standard medium tension voltage covering the whole country.

At the present the National Power Grid has reached all of provinces, about 95% of districts and more than 75% of communes. The total amount of existing transmission and distribution network in the country is as follows:

FIG3-A : 220-500KV EXISTING ELECTRIC POWER SYSTEM OF VIET NAM



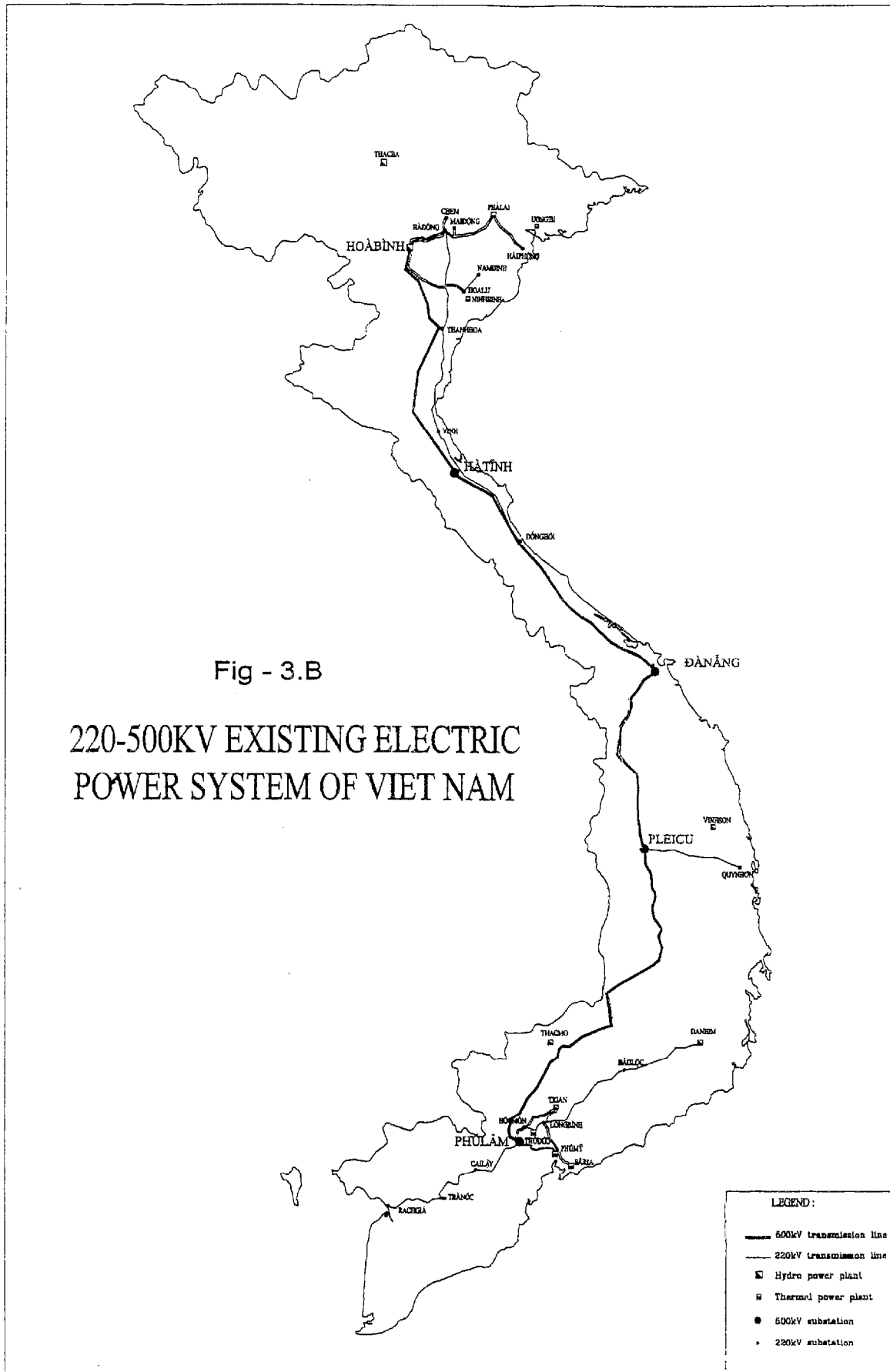


Fig - 3.B

220-500KV EXISTING ELECTRIC
POWER SYSTEM OF VIET NAM

Voltage level (kV)	Length of lines (km)	Capacity of Transformer (MVA)
500	1489	2850
220	3388	4504
66-110	7493	6283
Medium	50464	

2. Electric Power Demand Forecast

According to the newest study made by Institute of Energy the Peak Demand and Energy generation in country over coming 15 years is forecast in three cases (low, base and high) respectively economic development scenarios. Electric Generation Forecast result is as follows (Fig -4).

Year	Low case		Base case		High case	
	GWh	MW	GWh	MW	GWh	MW
1995	14,600	2,700	14,600	2,700	14,600	2,700
2000	27,000	4,800	27,500	4,900	29,550	5,300
2005	43,400	7,100	47,100	8,000	55,600	9,500
2010	71,300	10,800	75,800	12,700	89,500	15,000
Growth rate (%)	11.5	9.7	11.6	10.9	12.8	12.1

3. Power Generation Development

Analysis of the generation for the country for the period 1996 - 2010 was performed in a number of planning studies using the computer bases WASP-III model. The result of the studies provided the least cost investment plan for generation to the year 2010.

Under the Base Case of Demand Forecast, generating capacity required to be developed over 15 years is around 10,000 MW (with 11 hydropower plants of total capacity around 6,700 MW), increasing the total power capacity of the

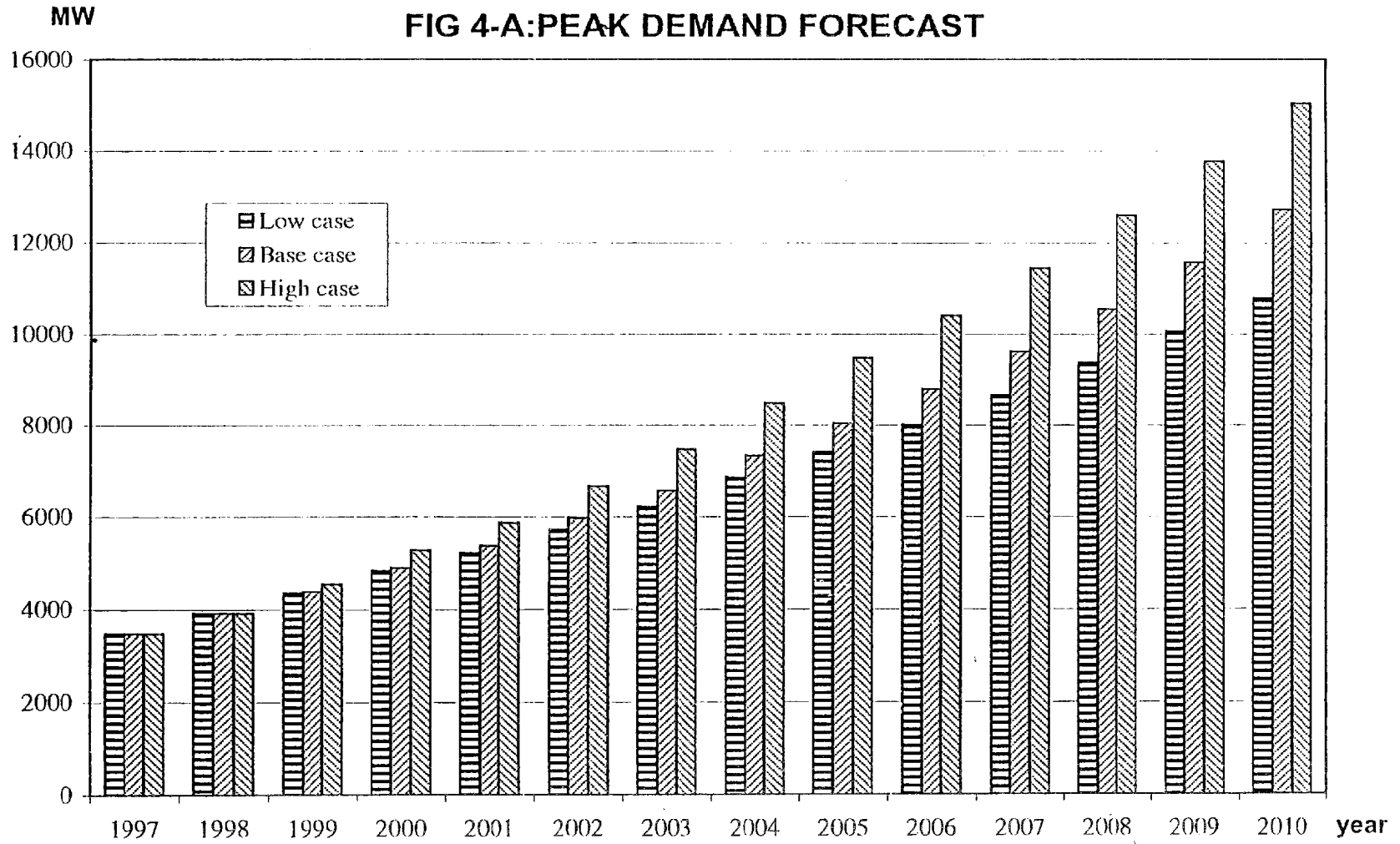
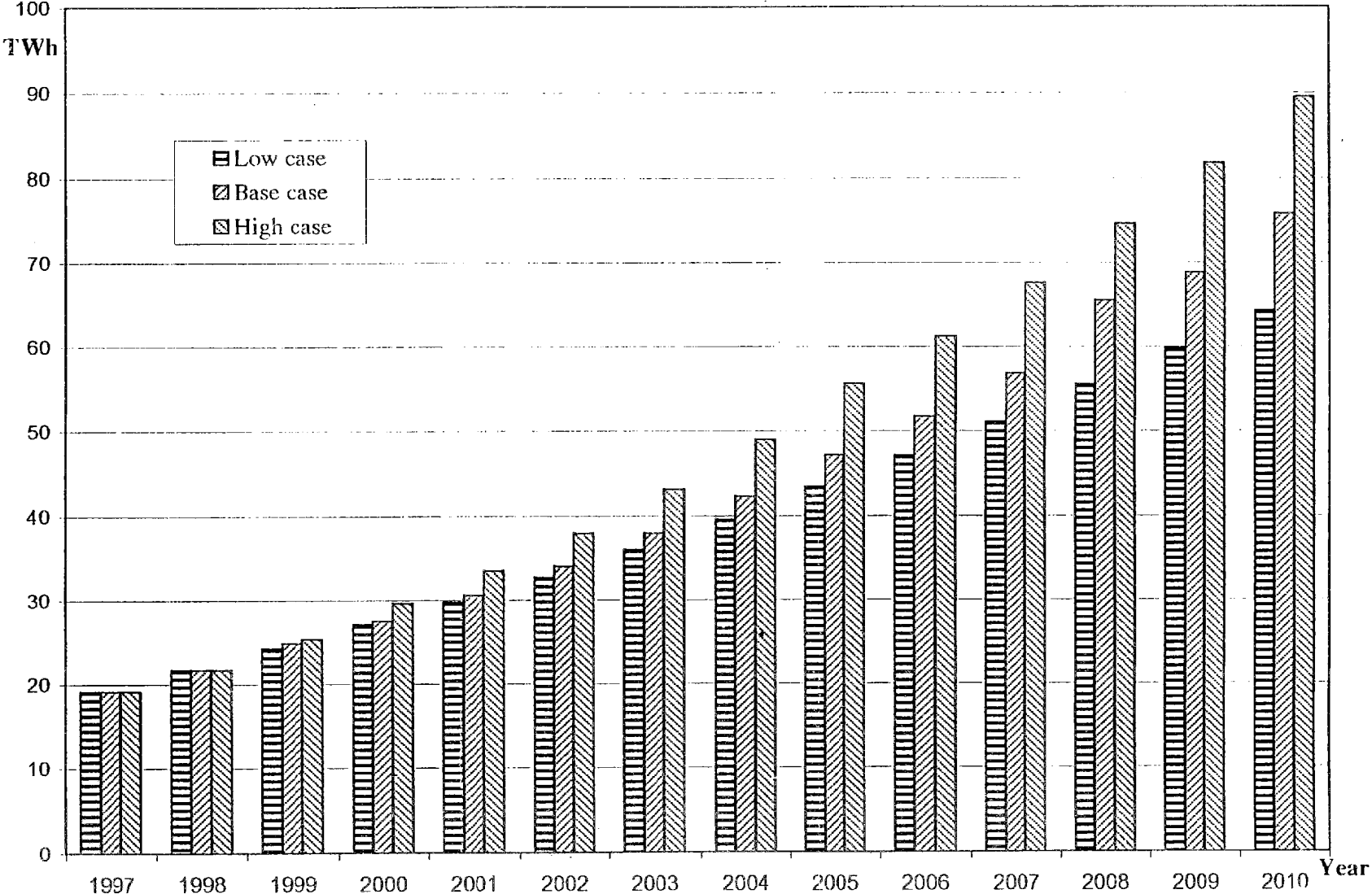


FIG.4-B: ELECTRICITY GENERATION FORECAST



whole country from more than 5,000MW at the present to 15,000 MW by 2010, of which about 50% is hydropower. Total investment requirement for power sector during 1996-2010 are estimated to be more than 23,000 millions USD, of which about 65% for generation and 35% for transmission and distribute network development.

In period 1996-2000 the power sector investment requirement is estimated around 6,000 million USD (more than 1,000 million USD per year), of which 4,000 million USD for construction of generating capacity of about 4000 MW. The most part of this investment is expected to come from international financial organizations and private investors under BOT projects. Some large projects such as Phu My combined Cycle No3 720 MW, and No 2.2 -720 MW (Gas), Quang Ninh Steam (coal) 300 MW power plant and 120 MW Diesel Station (FO) in Ba Ria have been adopted.

Proposed Power Generation Development Program in Vietnam up to 2010 is as follows:

Hydropower Plant	Installed Capacity, MW
1. Yaly	720
2. Song Hinh	70
3. Ham Thuan - Da Mi	475
4. Can Don (BOT)	72
5. Se San3	220 (295)
6. Dai Ninh	300
7. Thuong Kontum	260 (364)
8. Dai Thi	300
9. Se San4	366 (420)
10. Dong Nai 3-4	500
11. Son La	2400 - 3600 (in 2010 - 600MW, completed in 2015)
Thermal and GT combine Cycle Plant	
1. Ba Ria Steam (Gas)	110*
2. Phu My CC (Gas) EVN + BOT	3350

3. Pha Lai2 (Coal)	600
4. Na Duong (coal) BOT	100
5. Thai Nguyen (coal) BOT	100
6. Quang Ninh (Coal) BOT	300
7. O Mon (Oil-Gas)	600
8. Soc Trang (Oil-Gas) BOT	450
9. Uong Bi expansion (Coal)	300
10. Hai Phong (Coal)	600

(*). Including existing GT capacity in Ba Ria will be a CCGT total capacity of around 300 MW.

Government is also promoting development of export processing and centralized industry zones. Some of these zones have own power generation company such as Tan Thuan EPZ in Ho Chi Minh City is constructing Hiep Phuoc power station of 375 MW, NOMURA company (Japan) in Hai Phong city is constructing a diesel station of 50 MW and AMATA company (Thailand) in Bien Hoa City intend to construct 200 MW station.

Besides, at the present Vietnam is considering to import electricity from neighboring countries and first of all from LAO PDR.

Laos is believed to have 23,000 MW of hydropower potential and there are many projects of which, the prefeasibility studies have been conducted. The Lao PDR and the Thailand governments signed MOU agreeing upon the development of power projects for the purpose of exporting Electric Power to Thailand with capacity of 3700MW up to year 2006.

Vietnam has expressed interest in purchasing about 2000MW of power from Lao up to 2010 and an agreement has been signed to this effect.

The hydropower projects, which Laos intends to develop for exporting to Vietnam are as follows:

1. Nam Mo	105MW
2. Nam Theun3	237MW
3. Se Kaman3	212MW
4. Nam Kong1	240MW
5. Se Kong4	310MW

6. Se Kong5	200MW
7. Xepian-Xenamnoy	390MW
8. Sekaman1	468MW
Total	2162MW

From these projects, only the first two projects located in central Laos, the remaining ones - in southern Laos, of which Xepian-Xenamnoy and Sekaman1 may be exported to Vietnam or to Thailand, depending on negotiating process between concerning sides (EDL, EVN and EGAT). But, to our mind, this nomination has meaning only for the first constructed projects, power of which could be transmitted at 110-220kV voltage level (like power transmission from Nam Ngum and Theun Hinboun to Thailand at the present). Further (after 2005), when transmission capacity increasing in Laos will be formulated the extra high voltage (EHV) grid for receiving electricity from power stations within Laos to transmits to Thailand and Vietnam. The interconnecton between Laos and Vietnam by EHV grids may be proposed following ways:

- 220kV or 110kV lines from Nam Mo 105MW project to 220/110kV substation in Vinh city (Northern Vietnam).
- 500kV line from Ban Soc 500kV substation, receiving the power from projects in southern Laos to Pleiku 500kV substation in central Vietnam highland.
- 500kV line from Tha Khec 500kV substation, receiving the power from projects in central Laos to Ha Tinh 500kV substation in northern Vietnam.

The interconnection between Vietnam and Cambodia may be proposed by 220kV transmission line from Ho Chi Minh city to PhnomPenh and by 110kV (or medium voltage) lines from Mekong river delta (South-West area).

In the far future (after 2015), Vietnam may import electricity from Yunnan province in large amount. In this case may be proposed 500kV line from Yunnan to Soc Son 500kV substation in northern Hanoi.

By the above mentioned links Vietnam power system will be interconnected with great Mekong river subregion power grid in particular and Asean power grid in general (Fig-5).

FIG 5 : PROPOSED INTERCONNECTION IN REGION

