CHAPTER 7

POWER SECTOR REFORM AND FINANCIAL ANALYSIS

Chapter 7 Power Sector Reform and Financial Analysis

7.1 Sector Reform

7.1.1 Power Sector Reform Update

(1) Objectives of Power Sector Reform

In the first place, it is not questioned that the power sector reform is not the policy end, but the policy means.

There are a couple of higher objectives. One is promotion of private capital participation in power generation. The other is EVN's management efficiency improvement for security of future funding for development investment to meet insatiate power demand. In addition, efficiency improvement in unprofitable operation like rural electrification is considered to diminishing financial losses and thus to improvement of EVN's future financial position. Therefore, the progress of the reform, in theory, promotes construction of non-commercial power generation such as multi-purposed hydropower and stand-by thermal power generation and of power transmission/distribution grids, and reduces future net repayment of ODA and commercial loans.

In addition, as an ultimate policy objective, there exists stable power supply, which is essential to economic growth. There are also marketization of Vietnam's economy as a whole, state-owned enterprises reform, and socio-economic pressure, which altogether complicate the power sector reform development. We draw correlations between agenda set in the aforementioned power policy statement of the Government and higher objectives in the Figure below.

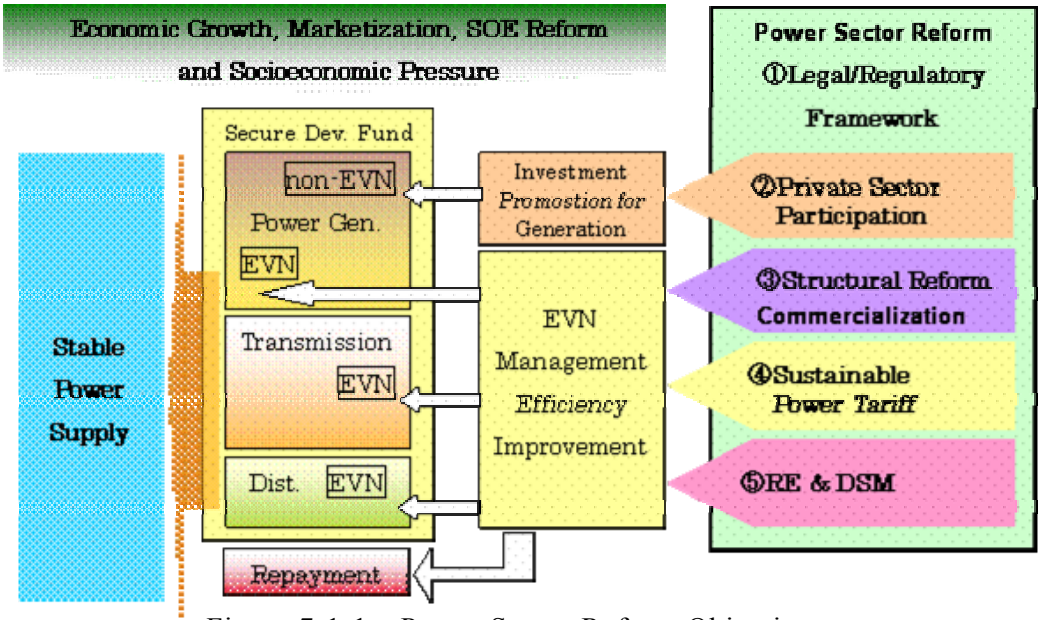


Figure 7-1-1 Power Sector Reform Objectives

(2) The Prime Minister's Decision on Vietnam Power Sector Development Strategy period 2004-1010 and orientation for the period up to 2020（176/2004/QD-TTg）

On 5th of October 2004, the Prime Minister's issued his decision on the power sector development strategy. His decision outlined specific requirements to gradually develop a competitive power market. The key contents of the decision are as follows;

The Prime Minister's Decision on Vietnam Power Sector Development Strategy

- Viewpoint of development
- Development objectives
- Development strategies
  - Strategies for power generation development
  - Strategies on power transmission and distribution network development
  - Strategies on development of electricity in rural and mountainous areas.
  - Financing and capital mobilizing strategies
  - Strategies on science and technological development
  - Orientation of telecommunications and information technology development
  - Orientation of electro-mechanic development
  - Strategies on development of power-engineering consulting
  - Strategies on power construction and installation development
  - Strategies on manpower development
  - Strategies on the development of power market
- Solutions
  - Institution and mechanism
  - Investment development
  - Financing and financial mobilization
  - Science and technology
  - Manpower

(3) Electricity Law（Law 28/2004/QH11）

The National Assembly finally passed the Electricity Law on December, 3rd 2004. The Law will come into effect on July, 1st 2005. It is stated that under the principle of publicity, equality, and fair competition, the power sector will be built and developed with limited governmental interference. A Regulatory Authority (RA) is to be established, which is responsible for developing a regulatory framework and to implement regulatory activities. Since the submission of the first draft, the law has been revised more than twenty times. The final contents of the Electricity Law are as follows;

Table 7-1-1 Contents of the Electricity Law

Chapter	Title
Chapter 1	General Provisions
Chapter 2	Power Development Planning and Investment
Chapter 3	Electricity Saving in Power Generation, Transmission, Distribution and Usage
Chapter 4	Power Market
Section 1	Principles, Subjects, Modes and Contents of Power Market

Chapter		Title
	Section 2	Electricity Purchase & Sale, and Electricity Supply Service through the Time-Bound Agreements
	Section 3	Electricity Tariff
Chapter 5		Electricity Activity License
Chapter 6		Rights and Obligations of Electricity Units and Consumers
Chapter 7		Protection of Electrical Equipment, Electricity Works and Power Safety
Chapter 8		Electricity of Rural, Mountainous Areas, and Islands

(4) Competition Law (Law No.28/2004/QH11)

The same day the Electricity Law was passed, the National Assembly passed the Competition Law. The law defines activities that restrict market competition, activities for unfair competition, and disputes resolutions regarding competition. The law recognizes there are discriminatory terms and conditions for different business partners on the same kind of transactions and activities that restrict competition in the market by taking advantage of the dominant status. The power suppliers are asked to operate their business according to the restrictions imposed by the Competition Law in addition to regulations defined by the Electricity Law. The Competition Law will take effective on July, 1st 2005. The executing authorities are the Competition Administration Department and the Competition Committee under the Ministry of Trade. The contents of the law are shown in Table 7-1-2.

Table 7-1-2 Contents of the Completion Law

Item	Title
Chapter 1	General regulation（Article 1～Article 7）
Chapter 2	Competition restrict behavior（Article 8～Article 38）
Chapter 3	Unfair competition behavior（Article 39～Article48）
Chapter 4	Competitive administration department and competitive council(Article49～Article 55)
Chapter 5	Inspection and violation incident processing（Article56～Article121）
Chapter 6	Execution stipulation（Article 122～Article123）

(5) PM's Decision on Restructuring of EVN up to 2005 (Decision 12/2005/QD-TTg)

In January 2005, the decision was made more or less on the context of the Government's state-owned enterprise reform policy and not in line with power sector reform policy. However, some components that assist sector reform, such as integration the four power transmission companies into one entity. The contents of the PM Decision are as follows;

the Prime Minister issued a decision on the approval of EVN's organizational restructuring plan for the end of 2005

Restructuring and Renovation of EVN up to the year 2005

- Converting to independent accounting subsidiaries to equitize the following dependent accounting subsidiaries:
  - Thac Mo HPP
  - Uong Bi TPP
  - Ninh Binh TPP
  - Ba Ria TPP
  - Da Nhim – Ham Thuan – Da Mi HPP
  - Thac Ba HPP
  - Pha Lai TPP
- Converting to One Member Limited Liability Companies to the following dependent accounting subsidiaries:
  - Thu Duc TPP
  - Phu My TPP
- Equitizing the following subsidiaries where the state holds minority of shares
  - Power Construction Company (PC1)
  - Glass Insulator Enterprise (PC1)
  - Electro-Mechanical Enterprise (PC3)
  - Transport Enterprise (PC3)
  - Power Engineering Center (HPC)
  - Electrical Equipment Repair Workshop （Hai Phong PC）

The management board of EVN shall be responsible for:

- Directing the restructuring in accordance with the content and approved schedule.
- Completing the Vietnam Power Group Establishment Project and submitting it to Prime Minister for approval in the first quarter of 2005
- Developing a plan for the Power Telecom Company to operate under the parent company – daughter company model in accordance with the regulation of the law
- Reorganizing the 4 existing Power Transmission Companies into the Power Transmission Company to be submitted for approval by Prime Minister in the fourth quarter of 2005
- Developing a plan for the Power Finance Company to be submitted for approval by the Prime Minister in 2005

(6) Commitment toward the Electricity Law enactment (July 2005)

1) Electricity Law Decree

Before enforcement of the Electricity Law in July 2005, a decree on providing detailed regulations and guidelines for implementation of a number of articles contained in the Electricity Law will be signed and promulgated the by Prime Minister. The MOI has finished drafting and awaits approval. Under the Electricity Law, there is one decree. Detailed regulations and rules such as power tariff setting process, network codes and rural electrification funding, will be discussed and drafted by RA after its establishment. According to the March 2005 draft, the decree consists of 35 articles. The contents of the decree are as follows.

Table7-1-3 Contents of the Decree on Electricity Law

Article 1	Scope of application
Article 2	Construction and operation of large-sized and significant power plants
Article 3	Responsibilities for construction of power stations
Article 4	Demand-side Management
Article 5	Responsibilities for power demand management
Article 6	Electricity efficiency in transmission and distribution
Article 7	Power purchase contract for residential use
Article 8	Term Contract violation
Article 9	Power quality assurance
Article 10	Power measurement
Article 11	Power meter record
Article 12	Meter Protection by Purchasers
Article 13	Testing of electricity meters subject to claims
Article 14	Payment condition
Article 15	Retail price
Article 16	Retail price Frame Poll
Article 17	Accredit valid days and decision-making
Article 18	Retail price announcement
Article 19	Conditions for granting power operation licenses
Article 20	Content of electricity licenses
Article 21	Validity of electricity licenses
Article 22	Revision, supplement to Electricity license
Article 23	Order and procedure for revision and supplement of electricity licenses
Article 24	Withdrawal of electricity licenses
Article 25	Right to visit areas under authority of electricity purchaser
Article 26	Regulation on safety of electrical equipment and work
Article 27	Safety in electrical generation, transmission and distribution
Article 28	Responsibility for safety assurance of organizations and individuals using electricity in production
Article 29	Responsibility for electrical safety management
Article 30	Conditions for connecting electrical facilities with national network
Article 31	Support for electrical activities
Article 32	Issuance of electricity licenses to individuals and organizations involving in electrical activities.
Article 33	State management in electrical activities and usage
Article 34	Effect of implementation
Article 35	Responsibility for implementation

2) Establishment of Regulatory Agency（RA）

Prime Minister Decision on Establishment of Regulatory Agency was issued on 19th of October 2005 (285/2005/ND-CP), MOI set up RA under the Ministry. The full-time staff members increased from 6 to about 30, and the RA started its regulatory activities. The contents of the decision are as follows.

Table7-1-4 Contents of the Prime Minister Decision on RA

Article 1	Establishment, position and functions
Article 2	Tasks and authorities
1.	To formulate National Electric Power Development Master Plan
2.	To set up electricity retail tariff
3.	To submit the Minister for promulgation of the related regulations
4.	To appraise modes of financial supports for realizing projects on DSM and Energy Saving, the results of selecting investors for new power generation source
5.	To appraise new grant, revision, amendment and revocation of electricity activity license
6.	To check for the realization of Rules on power market, electricity activity, PPA, etc.
7.	To implement items which related retail tariff, price frame and various fees
8.	To realize the duties related to management of Power demand and supply
9.	To regulate competitive activities
10.	To make projects on establishment and development of power market
11.	To cooperate internationally in regulating electricity and developing power market
12.	To research and apply scientific and technological breakthroughs
13.	To organize for providing training and developing human resource
14.	To make annual report
15.	To spend allocated national budget, income of fees for granting license
16.	To suspend and propose for dealing with electricity units and parties
17.	To have connections with related State agencies
18.	To request electricity units to provide documents and information
19.	To administer organizations, apparatus and adopted personnel
Article 3	Apparatus and personnel of Authority
Article 4	Effect of implementation
Article 5	Responsibility for implementation

7.1.2 EVN's Efforts for Sector and Market Restructuring

(1) EVN Internal Pool Market

Albeit under the guidance of MOI, EVN considers its commitment to the set up of its internal power pool market as a bottom-up approach to a coming competitive market. The main objective of introduction of the internal market is to instill a sense of participation in power pool market to power generation units. Those units will be split out of EVN legally and in terms of accounting in the future.

Out of EVN-owned power plants (fourteen independent accounting units), eight units participate in the EVN power market. Participating units are shown in Table 7-1-5.

Table 7-1-5 EVN Power Plants

	Name of PP	Type	MW	Future Ownership	Participation	Reasons
1	Hoax Binh	HPP	1,920	EVN	×	Multi-purposed
2	Thac Ba	HPP	120	JSC	○	—
3	Tri An	HPP	420	EVN	×	Multi-purposed
4	Da Nhim – Ham Thuan – Da Mi	HPP	167	JSC	○	—
5	Thac Mo	HPP	150	JSC	○	
6	Italy	HPP	720	EVN	×	Multi-purposed
7	Pha Lai 1, 2	TPP/Coal	1,040	JSC	○	—
8	Uong Bi	TPP/Coal	105	JSC	○	—
9	Ninh Binh	TPP/Coal	100	JSC	○	—
10	Thu Duc	Oil/Gas	165/126	OMC	×	High-cost operation
11	Can Though	Oil/Gas	35/150	OMC	×	High-cost operation
12	Ba Ria	Oil/Gas	399	JSC	○	—
13	Phu My 1, 2-1, 4	Oil/Gas	2,410	OMC	○	—

*EVN：Remaining as an EVN independent unit
JSC：Majority of shares held by EVN holds majority share
OMC: 100% shares held by EVN

The internal pool market is named the “Viet pool” interim market. Tran Grid Co., an Australian consultant has been assisting the EVN in developing the market scheme. The Viet pool is a day-ahead market, in which, by 10 AM of a day ahead of real transactions, market participants bid prices for time slots divided by one hour through transaction software. Based on a demand forecast for the next day, an operation schedule of outside power plants for the next day is submitted one day earlier, and based on offers from the bidder; the Power Market Department of EVN formulates an operational schedule for the next day and chooses the bid winners. The results become open to participants on the internal web site by 3 PM. Regarding the forecasted maximum power demand, power plants with the lowest bidding price in turn are dispatched to the extent the final power plant reaches maximum demand. The offer of the final power plant becomes the market price.

Actually, energy is traded and there is no capacity element in the Viet pool. In addition, there is no spot transaction. On the day of operation, generation output is adjusted alongside the real power demand. Discrepancies between the plan and real operation are adjusted not by bid price but by market price.

(2) Equalization and Initial Public Offering (IPO)

EVN proceeds with a process of equalization of internal units, following the direction of the SOE reform of the Government. There are two kinds of equalization modalities. One is to equitize an internal business unit and form a limited liability company whose 100% equity share is retained by EVN, the One Member Limited Liability Company (OMC). The other is to equitize an internal business unit and to sell off a part of the equity to the public in the market. Through the initial public offering (IPO) of the equity share, the entity becomes a joint stock company, JSC. If EVN keeps a majority of the equity share of a JSC, then the EVN exerts the authority to control the company by nominating three management board members out of three to five seats for the JSC. This is the case of a majority JSC. If EVN relinquishes a majority of the equity of a JSC, it may lose a full control of the company. The EVN appoints only one management board member for a minority JSC. This is the case of a minority JSC.

EVN Organization, Personnel and Training Department (OPTD) plans an overall equalization policy, specifying what units to be equalized in what modes of equalization, OMC, majority JSC or minority JSC. So far 15 units have become Discs through IPO, generating revenues of 1 billion VND (66,667 USD). The results of IPO of EVN's units are shown in Figure 7-1-6.

Table 7-1-6 EVN IPO Results

	Year	Name of JSC	Equity share (%)		
			State	Employee	Other
1	1999	Electro-mechanical JSC, HCMC PC	42	Nil	58
2		Power Construction, Installation JSC, PC2	42	34	24
3	2002	Son Han Power JSC, PC3	30	35	35
4		Power Hotel JSC, PC3	30	11.9	58.1
5	2004	Construction, Installation, & Telecom JSC	30	11.9	58.1
6		Power Transportation & Services	51	46.39	2.61
7		Electric Engineering Material JSC	51	41	8
8		Hai Phong Construction & Installation JSC	28.83	71.17	Nil
9		Glass Insulator JSC	Nil	100	Nil
10	2005	Electro-mechanical Logistics JSC	51	46.1	2.9
11		Electro-mechanical JSC	51	44	5
12		Electrical Equipment Manufacturing JSC	51	45.29	3.71
13		Vinh Son – Song Hinh HPP JSC	60	5	35
14		Khanh Hoa Power JSC	51	36	13
15		Electro-mechanical Thu Duc JSC	N/A	N/A	N/A

Source: EVN

EVN reckons that the objectives of IPO are to raise capital and to secure managerial efficiency improvement for equitized entity. In the case of an IPO company, 60% of the equity share is assigned to the EVN, 5% to the employees of the company, and 35% of the equity share is sold off through a bidding process in the Hanoi Stock Exchange. The capital payment from new shareholders goes to a special reserve fund in EVN and will be saved to future capital investment in the future. However, the expected total revenues from IPO are 10 billion VND (666,667USD), which are not large enough to cover the majority of the capital investment requirements in the future.

Equitized entities, such as OMCs and JSCs, are obliged to submit periodical reports monthly, quarterly and annually, and their efforts for managerial efficiency improvement will be closely monitored by the EVN. The EVN seems to consider that entities that became JSCs and OMCs in 2004 have shown some degree of efficiency gains so far.

A plan for 2005 and 2006 is shown in the Table 10 below. Under regional power companies (PC1, 2, 3) there are 60 provincial power companies. Half will be equitized into JSCs, and the rest will be equitized in 2007.

Table 7-1-7 EVN Equitization Plan (JSC) in 2005-06

	2005	2006
Power Plant	Pha Lai TPP Thac Ba HPP Thac Mo HPP Uong Bi TPP Ba Ria TPP Ninh Binh TPP Da Nhim – Ham Thuan – Da Mi	
Power Company	PC Nam Dinh (PC1) PC Thanh Hoa (PC1) PC Thai Binh (PC1) PC Hoa Binh (PC1) PC Thai Nguyen (PC1) PC Ha Tinh (PC1) PC Kien Giang (PC2) PC Tien Giang (PC2) PC Tay Ninh (PC2) PC Dong Thap (PC3) PC Binh Dinh (PC3) PC Gia Lai (PC3) PC Quang Tri (PC3)	PC Bac Giang (PC 1) PC Ha Nam (PC 1) PC Hung Yen (PC 1) PC Phu Tho (PC 1) PC Vinh Phuc (PC 1) PC Tuyen Quang (PC 1) PC Yen Bai (PC 1) PC An Giang (PC2) PC Lam Đong (PC2) PC Soc Trang (PC2) PC Ben Tre (PC2) PC Binh Thuan (PC2) PC Ca Mau (PC2) PC Quang Ngai (PC3) PC Quang Binh (PC3) PC Phu Yen (PC3)
Non Power Company	Power Construction Co. (PC1) Glass Insulator Co. (PC1) Electro-Mechanical Co. (PC3) Electro-Mechanical Co. (Thu Duc) Transport Co. (PC3) Power Engineering Center (PC Hanoi)	PECC 1 PECC 2 PECC 3 PECC 4 IT Center Power Engineering Center (PC 1) Power Engineering Center (PC 2) Power Engineering Center (PC 3) PECC HCMC

Source: EVN

It is speculated that EVN is keen on equitzed provincial power companies because EVN wants to create environment in which it can smoothly adjust the tariff to a sustainable level. In raising it tariff, EVN as a monopoly has so far been challenged by those who enjoy a cheep power tariff. However, after the IPO new shareholders may be concerned with management issues in the equitized PPCs and they will recognize that the current tariff level is politically subsidized and needs adjusting. EVN envisages that in the end of the day, they will tolerate the tariff adjustment.

For equitization, the World Bank (WB) implements a technical assistance program. Now EVN is selecting a consultant for the TA (to commence in September 2005). The contents of the TA are mainly to assist the EVN in improving the equitization process, to establish corporate governance in new JSC, and to issue corporate bonds and securities.

Important units to EVN are to become OMCs. In 2005, Phu My TPP (Phu My 1, 2-1, and 4),

Can Tho TPP and Thu Duc TPP become OMCs. In 2006, the four existing power transmission companies (PTC 1, 2, 3, and 4) will be integrated into one power transmission company and then become an OMC. Power companies that supply power to large cities such as PC Hanoi, PC HCMC, PC Hai Phong, and PC Dong Nai, will become OMCs in 2006.

(3) Corporate Restructuring

EVN is planning to become a holding company. Under the Government polity, SOEs in major economic sectors are required to form economic groups, to strengthen their management, and to finally become profitable and strong corporations.

In July 2005, EVN will submit a proposal for establishment of the Vietnam Power Group to the Prime Minister. A new organizational arrangement plan in the second draft of the proposal is shown in the Figure 7-1-8. The proposal will not necessarily be approved by the Prime Minister as it is, taking into account previous experience. Some modifications will be made to the initial proposal.

According to the draft proposal, EVN will become a holding corporation that retains equity share of OMCs, majority JSCs, and minority JSC. EVN Holding will also retain 100% equity share of PC Holding, to which PC 1, 2, and 3 belong, and of Power Telecom Holding, which may have several telecom related companies. PCs supplying power with large cities will become OMCs. For TPP, Phu My, Thu Duc, and Can Tho will become OMCs. And an integrated transmission entity will be formed as OMC as well, remaining under EVN Holding for time being. Power Financial Company will be newly created as OMC. Equity share for other business units will be partly sold off to the public in the market.

Table 7-1-8 Vietnam Power Corporation

EVN Holding －Head Office Functions －Multi-purposed Hydro Power Plants (Hoa Binh, Ialy, & Tri An) －NLDC －Power Project Management Board －Institute of Energy, Training Functions －Power Hospital		
OMC Equity Share 100%	**Majority JSC Equity Share 50%+**	**Minority JSC Equity Share Below 50%**
－PC1 Holding OMC －PC2 Holding OMC －PC3 Holding OMC －PC OMCs (HPC, PCMCMC, PC Hai Phong, PC Dong Nai, PC Ninh Binh, & PC Hai Duon) －TPP OMCs (Phu My, Thu Duc, & Can Tho) －Integrated PTC OMC －Financial Company －Power Telecom Holding	－JSC TPP (Ninh Binh, Pha Lai, Uong Bi, Ba Ria, Hai Phong, Quang Nihn) －JSC HPP (Tac Ba, Song Hinh- Vin Song, Tac Mo, Danim-Ham Tuan-Dami) －PECC (PECC 1,2,3, &4) －ITJSC －Electro-mechanical Companies (3)	－Power Construction JSC －Power JSC Bank －Se San 3A JSC －Ha Long Cement JSC －Other JSCs

7.1.3 Issues and Countermeasures on Power Sector Restructuring

(1) Power Sector's Objectives (missions)

The most important objective of the Power Sector is to secure **the stable and economical power supply** for the socio-economic development in Vietnam. Power sector reform is one of measures for fulfilling the above objective. The relation between Ends and Means for stable & economical power supply is shown in Figure. 7-1-2.

When power sector reform is carried out, effects by the reform should be fully considered, otherwise, the reform will fail.

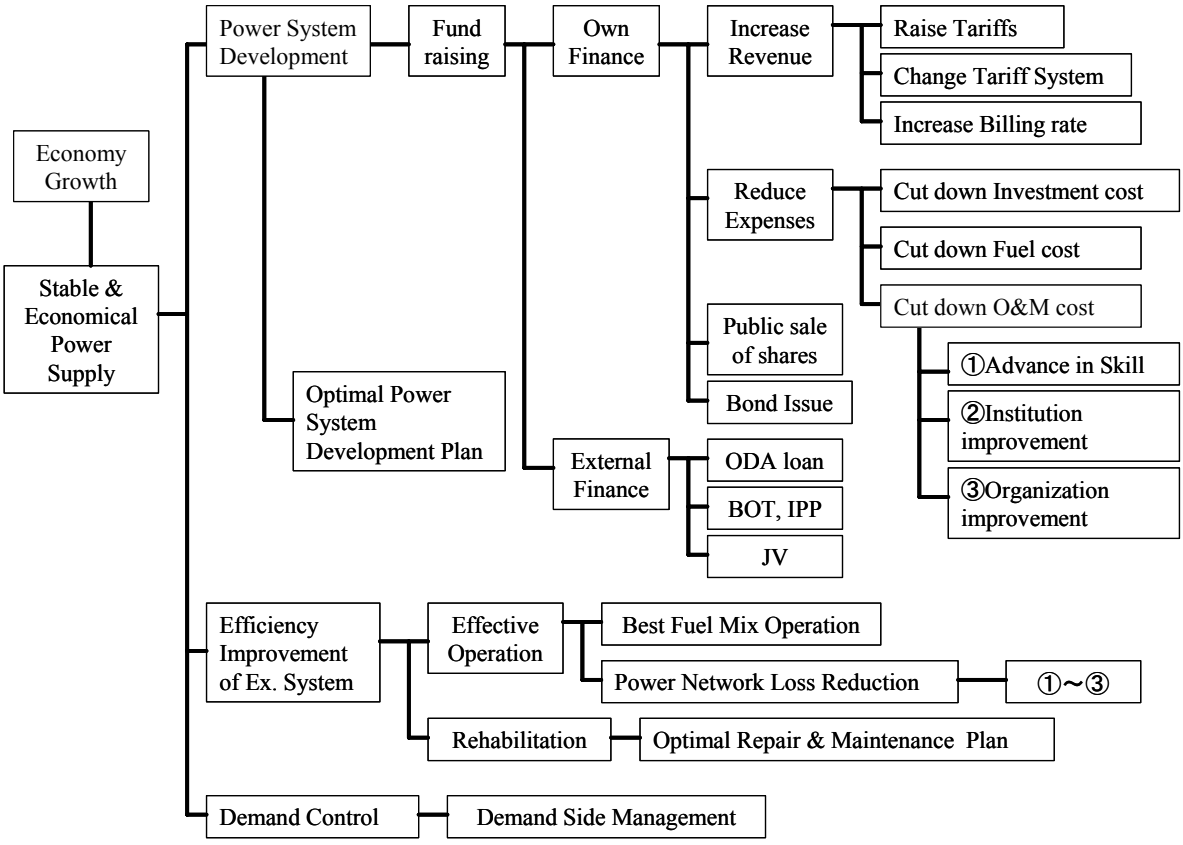


Figure. 7-1-2 Relation between Ends and Means for Stable & Economical Power Supply

(2) Privatization (Equitizaton)

a. Purpose of Privatization (Denationalization)

Privatization (Denationalization) has following advantages:

- A private company has potential for share sell-offs and issuing of bonds, in short, a private company can finance investment cost,
- A private company has an incentive for effective management and to yield profits, and
- Privatization by foreign direct investment can mobilize private resources and introduce flexible management through infusion of know-how, such as construction and fund management.

b. Impediments of Privatization

The key difficulties for the privatization of power sector assets can be summarized as follows:

- EVN and affiliated companies must remain under state-ownership. This leaves the Government the controlling vote over the management of the EVN group companies, and
- Electricity tariff system is uniform across the country.

(3) Unbundling (Demonopolization)

a. Purpose of Unbundling (Demonopolization)

The aims of unbundling are as follows:

- To reduce electricity price by introducing competition to the benefit of the end user, and
- To vitalize the economy by introducing competition and abolition of government regulation.

b. Issues and countermeasures on Unbundling

- Concern over the decline of supply reserve capacity

In Vietnam, supply capability is relatively short at present. Therefore, if liberalization is implemented while locus of supply responsibility is vague, the shortage of supply capability will worsen and there is a risk that a stable power supply could not be maintained.

Once competition to the wholesale market is introduced, generation companies pursue efficiency and quit maintaining surplus facilities and invest in supply capability for peak time, whose profitability is low (because the rate of use is low, it does not help to set a high selling price in order to keep profitability.) This creates a tendency for supply reserve power to decline.

In order to maintain a sufficient power supply capability, the following measures will be taken,

- ✓ By making the locus of supply responsibility clear, to develop generation facilities under the lead of the supply responsibility organization. (although it is un-liberalizing in part, assignment to generation companies or development of generation facilities by state owned generation companies)
- ✓ To provide investment incentives, such as a preferential treatment measures in the taxation system
- ✓ The system which imposes a duty to reserve power generation capacity corresponding to self demand to retail companies and introduction of the power generation capacity market. (However, in this case, there is a risk averting new comers to the retail supply sub sector.)
- ✓ Introduction of a market that secures appropriate supply capability (ancillary market).

- Volatility of market price

Due to the fall of reserve capacity, the market price of electricity has the tendency to become easily influenced by climatic conditions, such as intense heat and drought, and to fluctuate sharply.

Moreover, it is said that the mandated pool power exchange market is easily influenced by the controlling market power and if there is a player who has a large amount of control power, the market price may be controlled by this player.

In order to prevent large changes in market price, the following measures are taken,

- ✓ Procurement both by long-term bilateral contracts and by markets, not to rely on only procurement by market. (Especially in Vietnam, the ratio of hydropower generation is high and the shortage of supply capability would occur in the time of water shortage, so there is a risk of extreme price jumps and it is preferable to avoid procuring power only from the market.)
- ✓ Regulation of the share of the generation market. (However, due to certain characteristics of electricity, such as storage inability, low price elasticity, and long construction periods, it is recognized that electricity is weak for the controlling market power.)

- Concern over the shortage of transmission capacity, and transmission line congestion

If the responsibility of transmission line expansion and securing funds for transmission line investment is not clarified, in the long run, transmission line capacity runs short and transmission line congestion tends to occur as a result. Especially in Vietnam there are some points currently causing the transmission congestion. By implementing sufficient investment, transmission congestion can be alleviated. However, regarding region to region transmission lines, since the profit and loss of each market participant by the addition of transmission capacity cannot be specified, the problem of how to bear transmission investment remains.

In order to solve transmission congestion, the following measures are taken,

- ✓ By making the location of responsibility to expand transmission lines clear, to implement transmission lines development over the long-term. A transmission company is preferable as the responsible organization of expanding transmission lines.
- ✓ To set the appropriate transmission tariffs as a means of obtaining investment in transmission lines and to make all users share the burden equally

c. Current difficulties of Unbundling

The key difficulties for the unbundling of power sector assets can be summarized as follows:

- Generation subsector

Generation companies have been established by plant. In this case, wholesale competition can NOT work, because generation costs differ and distances from power demand centers and fuel production areas differ.

- Distribution and sales subsector

  Distribution companies by region have been established. However, Vietnam policy is to maintain uniform tariffs across all distribution companies in the whole country even though distribution costs differ and the customer mix differs. The transfer prices between EVN (Single Buyer) and the distribution companies are set respectively to balance differences in costs of the distribution companies.

d. Equitization and Unbundling

At present, the Vietnam government is enhancing operational efficiency and commercialization of power industry through horizontal unbundling into generation, transmission and distribution subsectors and conversion into independent accounting units, and also aiming at reduction of the electricity prices through introduction of the principle of market mechanism to each subsector. In order to achieve that, it is essential that the above-mentioned key difficulties for the privatization should be settled.

However, principle of market mechanism can NOT work in either whole sale or retail under the current unbundling method as above-described. In the case of the horizontal unbundling system, the Regulatory Agency has to bear a lot of functions, obligations and responsibilities. Moreover, it is vital to clear the locus of responsibility of power supply.

Meanwhile, as for the power industry with close relationships of technology between ups and downs subsectors -generation, transmission, and distribution-, integrated system can avoid unprofitable overlaps and save costs for building manpower & development plan and cash plan in view of the optimization of the whole power system. As its background, there are advantages that necessary information regarding operation and plan can be gathered as inside information without external trade and utilized easily, in addition, risks for uncertainties can be shared in house as economies of scale of integrated system with G,T&D.

Therefore, after liberalizing the power sector in Japan, the integrated system of G,T&D by 9 power companies has been maintained. In this case, an administrative body is needed to supervise adequacy of electricity rate from the viewpoints of socio-economic development and fair price competition between power companies or subsectors based on the market mechanism. Since the power companies bear the responsibility of power supply, they make their power supply plans and secure the required reserve capacity.

Conceptual diagram of different types of Power Sector Reform are shown in Figure. 7-1-3.

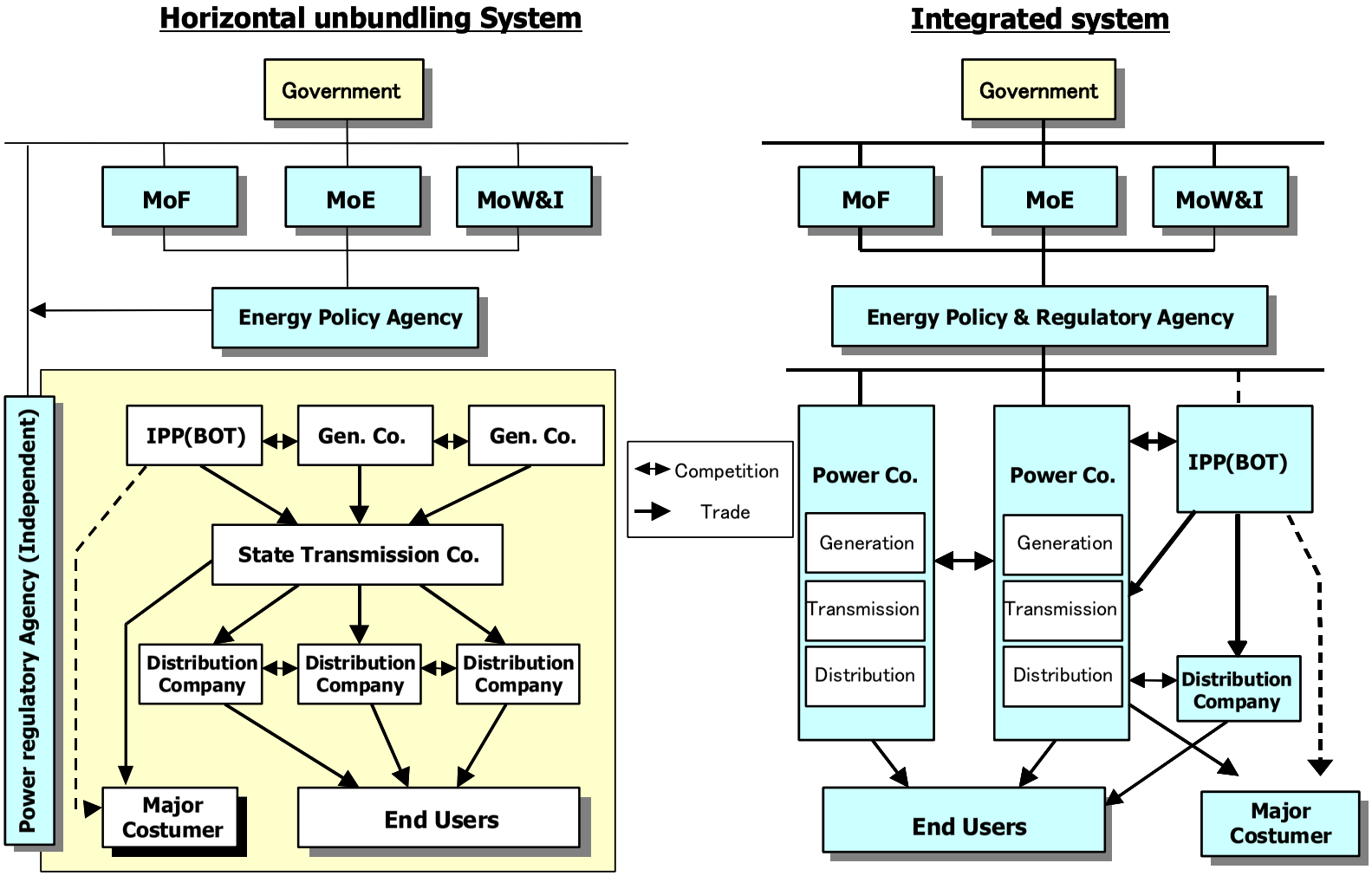


Figure. 7-1-3 Conceptual Diagram of Different Types of Power Sector Reform

7.1.4 Electricity Tariff System

It is forecasted that the growth rate of power demand in Vietnam will be more than 15%, therefore it is estimated that the huge investment is required to develop the power generation and network facilities to meet the growing power demand. And such high growth of power demand results in early exhaustion of primary energy resources in Vietnam.

Therefore, as advocated in the energy policy draft, it is indispensable to control the power demand (DSM). And it is recommended to introduce time-of-day and seasonal tariff system as a series of DSM, and to introduce two-part pricing for setting rational tariffs with reflecting the difference of load factor (the way of use) .

(1) Building norms for setting the electricity tariffs

The norms and rules for setting electricity tariffs have not been built yet. Electricity tariff should be determined so as to maintain the soundness of power utilities' operation and the development of socio-economy, based on the least cost development plan and efficiency improvement plan of energy sector industry.

(2) Introduction of time-of-day and seasonal tariff system

The amount of development of power facilities can be reduced by curbing a peak demand, and the load factor of power facility can be improved by moderating seasonal fluctuation of power demand. Accordingly these measures or Demand Side Management (DSM) are very useful for improving operation of the power industry.

Introduction of time-of-day and seasonal tariff system can be of assistance for the demand control and can give consumers incentive for curbing power demand. Although the time-of-day tariff system has been applied to the industry sector, it is recommended to introduce it to the commercial and households sector.

(3) Introduction of the two-part pricing

At present EVN applies basically the single pricing based on the energy charge. However, it is recommended to introduce a two-part pricing, since that has many advantages over the single pricing as explained in the BOX-3. In the case of introduction of a two-part pricing, it is required to analyze the operation cost of each power facility and divide it into the fix cost and the variable cost.

BOX-1 Two-part pricing

Kinds of tariff systems

1. Single pricing based on Energy charge - Vietnam, Laos, Cambodia, etc.
2. Two-part pricing based on Energy charge and Service charge
   - Thailand, Malaysia, Japan, etc.

Comparison of advantages and disadvantages of each system

<Single pricing based on Energy charge>

Advantage: Relatively easy to calculate relatively.

Disadvantage: Difficult to recover invested capital when the amount of electric energy consumption (kWh) is relatively little or nearly zero.

<Two-part pricing based on Energy charge and Service charge>

Advantages:

- *Easy to recover invested capital even if the amount of Energy consumption (kWh) is relatively little or nearly zero.*
- *Easy to set rational tariffs with reflecting the difference of load factor, even if load factor (the way of use) changes.*

7.2 Long Term Investment Plan

7.2.1 Investment Plan based on the Original Development Plan by IE

The JICA Team projected and calculated the investment by EVN and the running costs of EVN during 2005 – 2025 based on the the Original Development Plan by IE. The assumptions, method and results of calculation are as described below.

(1) Investment Statement of the Whole Country : Table 7-2-1 (refer to Appendix 7-1(1) –(2) in detail）

Investments by EVN in each year were estimated based on the power system development plan of IE, using unit construction costs of TPPs & NPP stated by IE.

Construction unit cost (USD/kW)

Capacity	Oil	Gas	GFCC	GT	Coal	Nuclear
200	914	1031		400	1294	
250	849	961		400		
300	800	900			1170	
400	727	819				
500	746	833			1089	
600			660		1089	
720			660			
1000					980	1700

Note : Conventional hydropower (<30MW) : 1,7340 USD/kW

Source : Institute of Energy

(2) Generation Statement of the Whole Country : Table 7-2-2

Generation energy of each power plant is estimated from the simulation by the PDPATII to meet the power demand forecasted (Base case).

(3) Operation and Maintenance Costs Statement of EVN : Table 7-2-3 (refer to Appendix 7-2(1)-(2) in detail）

Operation and maintenance costs of EVN's power plants and power grids were calculated using unit O&M cost of the PPs and the power grids stated by IE as shown below.

O & M cost for each type of TPP (Unit: USD/kW/year)

Capacity	Oil	Gas	GFCC	GT	Coal	Nuclear
200	25.3			19.8		
250	23.5	19.2		19.3		
300	22.1	18.0			33.9	
400	20.0	16.4			33.6	
500	20.6	16.7			33.3	
600			29.7			
720			29.7			
1000					30.0	59.8

O&M Hydropower

>30MW	0.5%	of Investment cost	:	0.01 (USD/kW)
-30MW	1.0%	of Investment cost	:	0.02 (USD/kW)

Source : Institute of Energy

(4) Fuel price

Fuel prices are assumed as shown in the table below. The transportation cost of coal from the North to the South is assumed as 7US$/ton as stated by Vinacoal.

Fuel Prices

Fuel Type	Unit	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
FO	USD/ton	217.2	219.4	221.6	223.8	226.0	228.2	230.6	232.9	235.2	237.5	239.9	242.3	244.8	247.2	249.6	252.1	254.7	257.3	259.8	262.4	265.0
DO	USD/ton	398.2	402.1	406.2	410.3	414.3	418.5	422.6	426.9	431.2	435.5	439.9	444.3	448.7	453.2	457.8	462.3	466.9	471.6	476.3	481.1	485.9
Coal (Dom.)	USD/ton	21.8	22.2	22.7	23.1	23.6	24.1	24.6	25.1	25.6	26.1	26.6	27.1	27.7	28.2	28.8	29.7	30.5	31.5	32.4	33.4	34.4
North(CIF)	USD/ton	24.4	24.8	25.2	25.7	26.1	26.6	27.1	27.6	28.1	28.6	29.1	29.6	30.1	30.7	31.2	31.8	32.7	33.5	34.5	35.4	36.4
South(CIF)	USD/ton	28.5	29.0	29.3	29.8	30.2	30.7	31.2	31.7	32.2	32.7	33.2	33.7	34.2	34.8	35.3	35.9	36.1	37.0	37.9	38.8	39.8
Coal (Imp.)	USD/ton											51.7	52.7	53.8	54.8	55.9	57.1	58.2	59.3	60.5	61.7	63.0
Gas	USD/mmBTU	3.14	3.20	3.26	3.33	3.40	3.46	3.53	3.60	3.68	3.75	3.82	3.90	3.98	4.06	4.14	4.22	4.31	4.39	4.48	4.57	4.66
Nuclear	¢/10^3kcal													0.119	0.120	0.120	0.121	0.121	0.122	0.123	0.123	0.124

Source : Institute of Energy, Vinacoal and Petrovietnam estimates

(5) Fuel cost statement of EVN : Table 7-2-4

Fuel cost by owner of power plant is calculated by the PDPATII.

(6) Power purchase statement of EVN : Table 7-2-5 (refer to Appendix 7-3 in detail)

Power purchase prices of every kind of power source as of the year 2005 are assumed, for example, HPP's (including import) 4.0 ¢ /kWh, coal TPP（≦200MW） 5.0 ¢ /kWh, coal TPP （≧300MW） 4.0 ¢ /kWh, Diesel TPP 10.0 ¢ /kWh, GTCC's 4.2 ¢ /kWh and imports from China, Laos, Cambodia 4.0 ¢ /kWh. The escalation of each fuel price was also taken into account.

Table 7-2-6 shows power purchase price of each type of power project.

Table 7-2-1 Investment Statement Based on the PDP 6th (Base Case of IE)

Power Plants		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
North	EVN(PP)	185.3	261.0	375.8	633.1	1272.1	1667.8	1904.3	1827.1	1739.7	1590.4	1205.4	1310.7	1536.4	1706.1	1727.5	1812.0	1833.4	1844.6	1928.8	1714.7	1226.1	626.3	130.7
	IPP	182.5	271.4	427.2	527.4	577.5	454.7	231.5	99.3	33.5	78.7	113.6	131.6	114.7	63.0	54.0	63.0	63.0	36.0	36.0	27.0	0.0	0.0	0.0
	JV	0.0	5.9	272.0	538.2	620.1	491.4	160.9	17.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Imp	132.2	139.3	147.3	126.0	95.4	79.6	85.7	210.6	345.3	456.5	508.5	495.7	355.0	173.9	53.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	500.0	677.5	1222.3	1824.6	2565.1	2693.5	2382.3	2154.6	2118.5	2125.6	1827.5	1938.0	2006.1	1942.9	1835.1	1875.0	1896.3	1880.5	1964.7	1741.7	1226.1	626.3	130.7
C&S	EVN(PP)	587.8	790.9	908.0	1013.3	1023.1	935.5	945.3	986.1	1113.3	1217.0	1440.3	1727.2	2092.2	2559.0	2970.6	3120.7	3435.3	3657.2	3949.1	3390.3	2086.2	869.8	1.9
	IPP	461.7	433.8	468.7	483.7	364.9	178.2	98.9	73.4	81.8	91.9	88.9	67.3	70.9	91.1	70.9	81.0	70.9	40.5	30.4	0.0	0.0	0.0	0.0
	JV	11.9	58.6	84.9	105.2	121.1	202.3	203.7	134.6	79.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Imp	2.9	36.6	54.1	70.2	174.3	252.1	426.9	508.1	613.4	594.4	432.2	326.4	106.5	22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	1064.3	1319.9	1515.7	1672.5	1683.4	1568.2	1674.7	1702.3	1887.7	1903.4	1961.4	2121.0	2269.6	2672.6	3041.5	3201.7	3506.1	3697.7	3979.5	3390.3	2086.2	869.8	1.9
Whole	EVN(PP)	773.1	1051.9	1283.8	1646.4	2295.3	2603.4	2849.6	2813.2	2853.0	2807.4	2645.7	3037.9	3628.6	4265.1	4698.2	4932.7	5268.6	5501.8	5877.8	5105.0	3312.3	1496.0	132.5
	IPP	644.2	705.2	896.0	1011.1	942.4	632.9	330.4	172.8	115.3	170.7	202.5	198.9	185.6	154.1	124.8	144.0	133.8	76.5	66.4	27.0	0.0	0.0	0.0
	JV	11.9	64.4	356.9	643.4	741.2	693.7	364.5	152.2	79.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Imp	135.1	175.9	201.4	196.2	269.6	331.7	512.6	718.8	958.7	1050.9	940.6	822.2	461.5	196.4	53.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	1564.3	1997.4	2738.0	3497.1	4248.5	4261.6	4057.1	3856.9	4006.2	4029.0	3788.8	4059.0	4275.7	4615.6	4876.6	5076.6	5402.5	5578.3	5944.2	5132.0	3312.3	1496.0	132.5

Power Grids	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
500kV Trans. Line & Substation	267.0	279.0	272.0	125.9	125.9	125.9	125.9	125.9	125.9	125.9	125.9	125.9	125.9	256.7	256.7	256.7	256.7	256.7	300.0	300.0	300.0	300.0	300.0
500kV Trans. Line & Substation	170.0	186.0	182.0	154.0	154.0	154.0	154.0	154.0	200.0	200.0	200.0	300.0	300.0	300.0	400	400	400	500	500	500	600	600	600
110kV Trans. Line & Substation	242.0	280.0	320.0	167.0	131.0	148.0	167.0	138.0	200.0	200.0	200.0	300.0	300.0	300.0	400	400	400	500	500	500	600	600	600
Distribution System	247.0	258.0	268.0	325.0	255.0	288.0	326.0	269.0	400.0	400.0	400.0	600.0	600.0	600.0	800	800	800	1,000	1,000	1,000	1,200	1,200	1,200
Subtotal	926	1,003	1,042	772	666	716	773	687	926	926	926	1,326	1,326	1,457	1,857	1,857	1,857	2,257	2,300	2,300	2,700	2,700	2,700

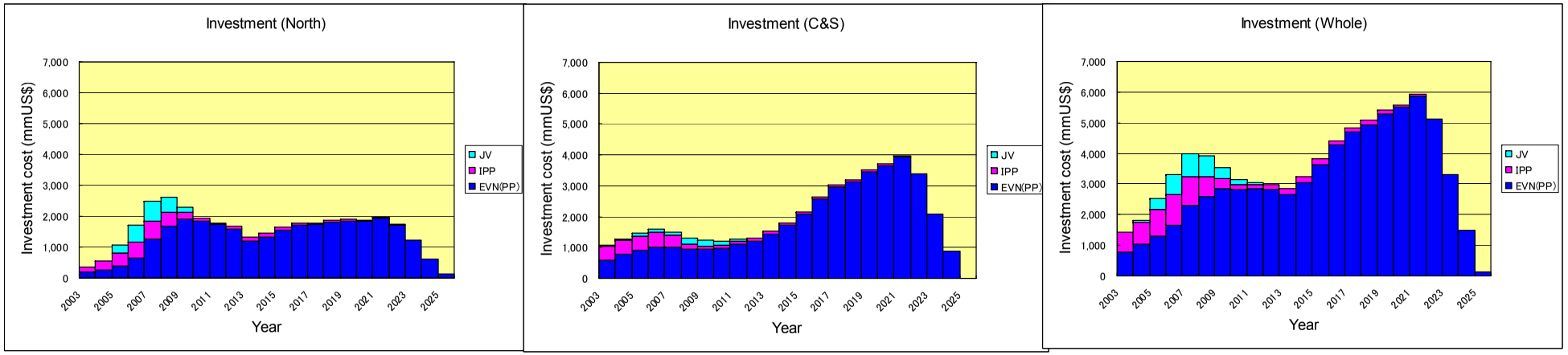


Table 7-2-2 Generation Statement Based on the PDP 6th (Base Case of IE)

Unit : GWh

REGION	Norm\Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
NORTH	DEMAND	19,680	21,842	24,233	26,915	29,923	33,339	36,114	39,130	42,408	45,972	49,787	53,333	57,132	61,208	65,652	65,653	65,654	65,655	65,656	65,657	65,658
	Power Generation	17,210	20,570	22,841	25,531	35,348	42,221	52,094	59,198	64,883	70,764	77,561	85,404	100,195	108,100	115,818	124,591	134,117	145,982	156,309	166,631	179,886
	Hydro + Import	*9,044*	*9,410*	*10,384*	*12,120*	*14,380*	*11,998*	*20,057*	*24,737*	*27,641*	*30,712*	*33,522*	*37,949*	*46,696*	*47,681*	*47,536*	*47,791*	*47,666*	*47,515*	*48,133*	*47,987*	*47,955*
	THERMAL	*8,166*	*11,160*	*12,457*	*13,411*	*20,969*	*30,224*	*32,037*	*34,461*	*37,242*	*40,052*	*44,038*	*47,455*	*53,499*	*60,419*	*68,282*	*76,801*	*86,451*	*98,467*	*108,176*	*118,644*	*131,930*
CENTRE	DEMAND	5,642	6,391	7,250	8,237	9,373	10,686	11,631	12,669	13,802	15,041	16,394	17,599	18,915	20,330	21,877	21,878	21,879	21,880	21,881	21,882	21,883
	Power Generation	4,303	4,299	5,660	8,467	11,337	16,661	18,537	20,173	24,053	25,775	28,533	28,831	29,225	29,225	29,225	29,619	29,619	30,145	30,145	30,013	30,013
	Hydro + Import	*4,303*	*4,299*	*5,660*	*8,467*	*11,337*	*16,661*	*18,537*	*20,173*	*24,053*	*25,775*	*28,533*	*28,831*	*29,225*	*29,225*	*29,225*	*29,619*	*29,619*	*30,145*	*30,145*	*30,013*	*30,013*
SOUTH	DEMAND	26,272	29,376	32,838	36,763	41,171	46,185	50,196	54,574	59,338	64,595	70,207	75,334	80,882	86,842	93,345	93,346	93,347	93,348	93,349	93,350	93,351
	Power Generation	33,118	40,122	47,811	57,293	59,458	60,911	59,989	65,553	71,396	83,144	88,734	97,323	101,919	114,745	128,055	142,798	157,492	170,972	189,395	207,812	224,543
	Hydro + Import	*5,335*	*5,389*	*5,932*	*7,367*	*8,318*	*9,483*	*9,483*	*10,256*	*10,559*	*10,559*	*13,105*	*14,709*	*15,356*	*15,137*	*15,011*	*14,886*	*14,636*	*14,605*	*14,511*	*14,386*	*14,240*
	THERMAL	*27,782*	*34,732*	*41,879*	*49,927*	*51,141*	*51,428*	*50,506*	*55,297*	*60,837*	*72,585*	*75,629*	*82,614*	*81,891*	*92,600*	*100,779*	*106,888*	*114,824*	*127,167*	*135,756*	*147,290*	*154,240*
	NEWCLEAR	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*4,672*	*7,008*	*12,264*	*21,024*	*28,032*	*29,200*	*39,128*	*46,136*	*56,064*
Total power generation		**54,630**	**64,991**	**76,312**	**91,292**	**106,144**	**119,794**	**130,620**	**144,924**	**160,333**	**179,683**	**194,827**	**211,557**	**231,338**	**252,070**	**273,098**	**297,008**	**321,228**	**347,099**	**375,848**	**404,456**	**434,442**

Table 7-2-3 Operation & Maintenance Cost Statement of EVN Based on the PDP 6th (Base Case of IE)

Unit : million USD

Type/Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Hydro	38	38	41	52	63	73	93	108	123	129	132	135	138	142	144	147	151	153	156	159	161
Coal Fired	42	48	52	52	58	89	117	135	152	167	186	247	287	357	445	537	621	746	861	978	1,098
FO Fired	16	18	28	40	44	49	40	40	40	40	40	40	40	35	35	35	35	35	35	35	35
Gas	77	86	86	86	90	94	102	113	148	217	274	287	317	338	338	338	338	354	360	360	360
Nuclear	0	0	0	0	0	0	0	0	0	0	0	0	40	60	105	179	239	249	334	394	478
Powr grids	90	101	113	126	142	159	178	199	223	250	280	313	351	393	440	493	552	618	692	775	868
Total O & M Cost	263	291	321	357	396	464	529	596	685	803	912	1,022	1,173	1,325	1,508	1,729	1,937	2,156	2,438	2,701	3,001

Table 7-2-4 Fuel Cost Statement of EVN Based on the PDP 6th (Base Case of IE)

(million US$)

		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
North	EVN	192	271	277	302	347	319	342	377	411	557	681	828	958	1,041	1,286	1,571	1,860	2,179	2,515	2,887
	IPP	0	0	0	17	22	16	14	15	16	21	14	16	25	38	45	31	40	47	48	54
	JV	0	0	0	39	31	8	2	0	4	11	7	2	12	65	73	94	98	100	104	108
	Subtotal	**192**	**271**	**277**	**357**	**400**	**343**	**358**	**392**	**431**	**589**	**702**	**846**	**995**	**1,145**	**1,405**	**1,696**	**1,998**	**2,326**	**2,667**	**3,049**
C &S	EVN	507	765	570	410	399	561	643	776	1,061	1,171	1,439	1,643	2,005	2,212	2,386	2,663	3,095	3,437	3,841	4,254
	IPP	220	231	410	426	432	456	464	467	494	494	519	529	505	539	521	528	537	540	549	563
	JV	0	0	0	0	0	21	112	110	119	119	110	103	100	100	88	88	84	74	66	64
	Subtotal	**727**	**995**	**980**	**836**	**831**	**1,038**	**1,219**	**1,353**	**1,674**	**1,784**	**2,067**	**2,275**	**2,610**	**2,851**	**2,995**	**3,278**	**3,717**	**4,050**	**4,456**	**4,881**
Whole	EVN	699	1,036	847	712	746	880	986	1,153	1,472	1,728	2,119	2,471	2,963	3,253	3,672	4,234	4,955	5,616	6,356	7,141
	IPP	220	231	410	443	454	472	478	482	509	515	533	545	530	577	566	559	577	586	597	617
	JV	0	0	0	39	31	28	114	110	123	130	117	105	112	165	161	182	182	174	170	172
	Total	**919**	**1,267**	**1,257**	**1,193**	**1,231**	**1,381**	**1,577**	**1,745**	**2,105**	**2,373**	**2,769**	**3,121**	**3,605**	**3,996**	**4,400**	**4,975**	**5,714**	**6,376**	**7,123**	**7,930**

Table 7-2-5 Power Purchase Statement of EVN Based on the PDP 6th (Base Case of IE)

Unit : million USD

Type/Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Hydro	17	33	62	108	192	325	348	358	358	377	380	380	412	412	412	443	443	464	496	491	491
Coal	81	115	124	172	564	735	738	741	716	719	721	724	726	729	759	729	731	734	736	739	742
Gas	401	405	464	741	835	844	876	1,004	1,014	1,024	1,034	1,045	1,025	1,051	1,061	1,072	1,082	1,093	1,104	1,115	1,126
Oil	64	65	66	66	67	68	68	69	70	70	71	72	0	0	0	0	0	0	0	0	0
Import	19	32	64	65	113	165	179	190	337	381	703	927	1,062	1,121	1,128	1,137	1,148	1,158	1,167	1,179	1,190
Total Cost	**582**	**649**	**780**	**1,152**	**1,771**	**2,137**	**2,209**	**2,361**	**2,495**	**2,571**	**2,910**	**3,148**	**3,225**	**3,312**	**3,360**	**3,380**	**3,405**	**3,449**	**3,503**	**3,523**	**3,549**

Table 7-2-6 Power Purchase Prices

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Hydro IPP (Domestic)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Coal IPP (<200MW)	5.03	5.05	5.06	5.08	5.09	5.11	5.12	5.14	5.15	5.17	5.18	5.20	5.21	5.23	5.25	5.26	5.28	5.29	5.31	5.32	5.34
Coal IPP (>300MW)	4.02	4.04	4.05	4.06	4.07	4.08	4.10	4.11	4.12	4.13	4.15	4.16	4.17	4.18	4.20	4.21	4.22	4.23	4.25	4.26	4.27
Coal IPP (South)	4.04	4.06	4.08	4.10	4.12	4.14	4.16	4.18	4.20	4.23	4.25	4.27	4.29	4.31	4.33	4.35	4.38	4.40	4.42	4.44	4.46
Coal IPP (Imp. coal)											4.50	4.52	4.55	4.57	4.59	4.61	4.64	4.66	4.68	4.71	4.73
Gas IPP,BOT	4.24	4.28	4.33	4.37	4.41	4.46	4.50	4.55	4.59	4.64	4.69	4.73	4.78	4.83	4.88	4.92	4.97	5.02	5.07	5.12	5.18
Import from China	4.0	4.04	4.08	4.12	4.16	4.20	4.25	4.29	4.33	4.37	4.42	4.46	4.51	4.55	4.60	4.64	4.69	4.74	4.78	4.83	4.88
Import from Laos	4.0	4.04	4.08	4.12	4.16	4.20	4.25	4.29	4.33	4.37	4.42	4.46	4.51	4.55	4.60	4.64	4.69	4.74	4.78	4.83	4.88
Import from Cambodia	4.0	4.04	4.08	4.12	4.16	4.20	4.25	4.29	4.33	4.37	4.42	4.46	4.51	4.55	4.60	4.64	4.69	4.74	4.78	4.83	4.88
Hiep Phuoc (IPP)	6.12	6.18	6.24	6.31	6.37	6.43	6.50	6.56	6.63	6.69	6.76	6.83	6.90	6.97	7.04	7.11	7.18	7.25	7.32	7.39	7.47
VeDan-Amata-BouBon	10.20	10.30	10.41	10.51	10.62	10.72	10.83	10.94	11.05	11.16	11.27	11.38	11.49	11.61	11.73	11.84	11.96	12.08	12.20	12.32	12.45
Diesel	10.20	10.30	10.41	10.51	10.62	10.72	10.83	10.94	11.05	11.16	11.27	11.38	11.49	11.61	11.73	11.84	11.96	12.08	12.20	12.32	12.45
Formosa 1	6.12	6.18	6.24	6.31	6.37	6.43	6.50	6.56	6.63	6.69	6.76	6.83	6.90	6.97	7.04	7.11	7.18	7.25	7.32	7.39	7.47

7.2.2 Evaluations of Investment Plan and Running Cost Projections

Investment plan and running cost of EVN are shown in Figure. 7-2-1 and Figure 7-2-2 respectively.

The main features of the investment plan and the running cost projections are described as follows:

a. Investment ; the investment from 2007 to 2011 is rather high because many large hydropower plants, especially Son La are developed intensively up to 2015. Therefore, investment from 2007 is over 3 billion US$. After 2014, investment will need to increase 600 million US$ every year.

b. O&M costs ; O&M cost will increase gradually in accordance with the increase in the amount of power facilities.

c. Fuel costs ; since many large hydropower plants, especially Son La are developed intensively up to 2015 and the shares of power imports and IPP power plants (BOT) increase, the fuel costs do not increase until 2013.

d. Power purchase costs ; power purchase costs will increase up to2013 in line with the increase of power imports and power plant development by IPPs.

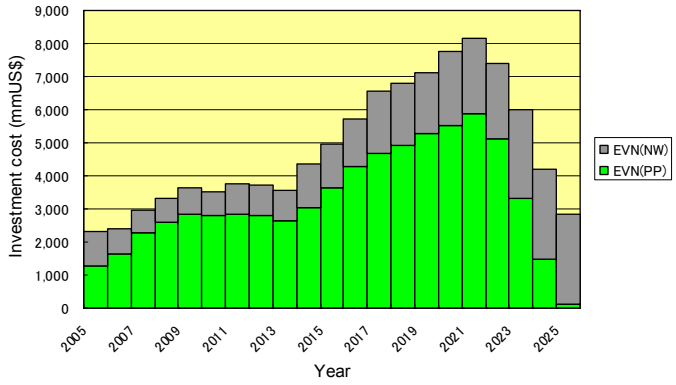


Figure 7-2-1 Investments of EVN

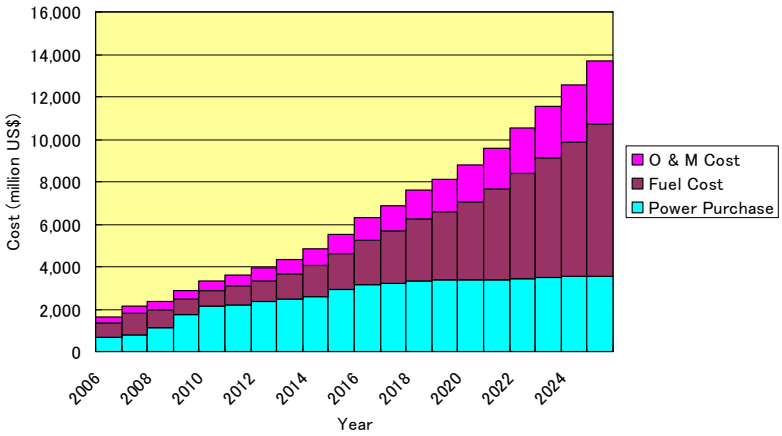


Figure 7-2-2 Running Cost of EVN and Power Purchase

7.3 Financial Projection of EVN

7.3.1 EVN Reorganization

The current EVN affiliated units as of the end of 2003 are as follows.

15 independent accounting entities

8 Power Companies (PC)
1 Power Telecommunication Company
1 Electrical Equipment Manufacturing Company
4 Power Engineering Consulting Companies
1 Duc Mechanical and Engineering Company

26 Dependent accounting entities…

14 Power Stations
4 Power Transmission Companies
2 Support Units

6 Administration Units

14 Construction/Project Management Units

Subsidiaries and joint ventures controlled by EVN (over 50% voting power)

The regulatory body will study the future EVN organizational structure in comparison with the current one in accordance with the newly established electricity law. For example, specific studies will be made for each of 14 current power plants as to what they should be (shift to independent accounting entities, shift to equities company, shift to limited company and other).

The Study Team calculates the financial projection while taking the influence of reorganization of EVN into consideration as much as possible through coordination with EVN financial staff.

7.3.2 Financing Environment (ODA, commercial borrowings)

(1) International Donor Institutions

The major donor institutions such as WB, ADB, and JBIC will continue their assistance to the power sector in Vietnam. It is assumed that ODA loans are used for some projects in EVN financial projections. Similar assumptions are made in the study as well.

(2) Issue of Bonds

As the bond market develops, major governmental corporations such as EVN may issue bonds.

Additionally, there are also plans for a government guarantee system regarding bonds issued by governmental corporations for nationally important projects. Thus, bonds are expected to be a main method for governmental corporations to raise funds.

As stated above, funds may be raised by issuing bonds, but it is not considered in the study projection, as it is not so different from borrowing.

(3) Initial Public Offering (IPO)

Funds may be raised from the stock market by IPO of EVN itself or its affiliate companies after the reorganization of EVN in relation to the power sector reform. However, it is still difficult to judge the feasibility and stock market value at present. We calculate the financial projection while taking the influence of IPO into consideration as far as possible by coordination with EVN financial staff.

7.3.3 Financial Projections

The financial projections have been conducted according to the following steps.

(1) Projected Period

Twenty years from 2005 to 2025.

(2) Prepared Statements

Financial analysis is manifested in the following 3 forms.

- Income Statement
- Balance Sheet
- Cash Flow Statement

(3) Projected Units

6th Master Plan would show financial analysis for production and business activities of the following EVN group

- Independent accounting units
- Dependent accounting units
- Project management units

(4) Projected Cases

Two cases are assumed for financial projections.

- Case 1：Based on the investment and funding plan to avoid the cash crises
- Case 2：With Revised Financing Conditions

7.3.4 Assumptions of Financial Projections

(1) Case 1

a. Revenue assumption

i) Foreign Currency

1$= 15,800VND

ii) Electricity tariff (Average sales price)

As shown in the following schedule.

	2005	2006	2007	2008	2009	2010	2011
1.Sales Price (VND)	782	885	885	948	948	1002	1002
2.Sales Price (¢)	4.95	5.60	5.90	6.00	6.00	6.34 (*)	6.34

	2012	2013	2014	2015	2016	2017	2018
1.Sales Price	1002	1002	1002	1002	1002	1002	1002
2.Sales Price (¢)	6.34	6.34	6.34	6.34	6.34	6.34	6.34

	2019	2020	2021	2022	2023	2024	2025
1.Sales Price	1002	1002	1002	1002	1002	1002	1002
2.Sales Price (¢)	6.34	6.34	6.34	6.34	6.34	6.34	6.34

（*） 7 ¢ （without VAT 6.3 ¢ ）

iii) Annual Electricity Sales Volume

As shown in the following schedule

(Unit: GWh)

	2005	2006	2007	2008	2009	2010	2011
Sales Volume	45682	53586	62749	73353	84848	97111	109124

	2012	2013	2014	2015	2016	2017	2018
Sales Volume	121699	135054	149407	164960	181010	197867	216351

	2019	2020	2021	2022	2023	2024	2025
Sales Volume	236102	257261	279109	302523	327843	353931	381160

b. Cost assumption

i) Fuel cost

Adopted data calculated by the Study Team.

(Unit: billion VND)

	2005	2006	2007	2008	2009	2010	2011
Fuel Cost	9053	8750	8759	7107	5177	4898	6102

	2012	2013	2014	2015	2016	2017	2018
Fuel Cost	7344	8380	11455	14761	19061	21298	27273

	2019	2020	2021	2022	2023	2024	2025
Fuel Cost	31383	36726	43090	49450	58530	69242	79170

ii) Power purchasing cost

Adopted data calculated by the Study Team.

(Unit: billion VND)

	2005	2006	2007	2008	2009	2010	2011
Power Purchasing Cost	8316	15049	25830	31361	39535	46960	47761

	2012	2013	2014	2015	2016	2017	2018
Power Purchasing Cost	49794	52243	57505	62420	64733	67738	72777

	2019	2020	2021	2022	2023	2024	2025
Power Purchasing Cost	77226	81676	83261	84071	84303	84326	84380

iii) Salaries

Average salary is estimated to increase by 7% every year.

iv) Depreciation

Annual depreciation of current fixed assets is calculated using depreciation years based on past actual results.

The assets, which will be completed in 2005 and after, are depreciated based on the useful life as follows.

Plants	Rates	
Hydropower	6.5%	Approximately 15 years
Thermal power	8.5%	Approximately 12 years
Gas turbine	9.0%	Approximately 11 years
Nuclear	5.0%	Approximately 20 years
Transmission Facilities	8.5%	Approximately 12 years
Distribution Facilities	10.0%	Approximately 10 years
Current Asset	10.0%	Approximately 10 years

Interest during construction (IDC), which will be included in fixed assets after completion, is calculated as follows.

- IDC on power plants : 14-year depreciation based on useful life of hydropower and thermal power plants.
- IDC on transmission and distribution facilities : 12-year depreciation.

Actual depreciation cost of fixed assets : Straight-line method

v) Interest Expense

Interest expense incurred on borrowings during construction is included in fixed assets. Interest expense incurred after completion is expensed every year.

vi) Corporate Income tax

Taxable income is equal to net income before tax deducting income appropriated to capital investment, according to EVN financial projections. Tax rate is 28%.

c. Cash flow assumption

i) Fund allocation

Allocated funds among the projects included in the long-term investment plan according to the fund sources and financing conditions assumed in EVN financial projections.

The balance of borrowings and repayment schedule of projects are as follows. The future investment that cannot be allocated to specific fund is calculated by the "International Fund" temporarily.

	Duration	Grace Period	Interest Rates
Loan from the Government	8	4	2.4%
WB	20	5	6.9%
OECF	25	5	2.2%
NDF	15	5	3.0%
JBIC	25	5	2.2%
ECA	13	3	6.0%
International Loan	13	3	7.0%
Long Term Local Loan	10	2	8.0%
Short Term Local Loan	1	1	13.0%
Existing Loan	15	1	1.0%

(2) Case 2

It is assumed that investment cost will decrease two-thirds by 2011.

7.3.5 Financial Projection Results

(1) Case 1

a. Prospective income statement

(Unit: bill VND)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
I Revenue	**35422**	**35723**	**47413**	**55533**	**69539**	**80436**	**97305**	**109342**	**121942**	**135324**	**149706**	**165290**	**181372**	**198263**	**216784**	**236574**	**257776**	**279667**	**303128**	**328499**	**354639**	**381922**
1. Sales of Electricity(bill dong)	31267	35723	47413	55533	69539	80436	97305	109342	121942	135324	149706	165290	181372	198263	216784	236574	257776	279667	303128	328499	354639	381922
Output (GWh)	39696	45682	53586	62749	73353	84848	97111	109124	121699	135054	149407	164960	181010	197867	216351	236102	257261	279109	302523	327843	353931	381160
Selling price (dong/kWh)	788	782	885	885	948	948	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002
2.Other Income (bill dong)	4155																					
Ⅱ. Expenses (bill dong)	**31794**	**34633**	**43863**	**59217**	**71370**	**83515**	**96527**	**104888**	**115961**	**129969**	**147437**	**163325**	**180349**	**199794**	**225257**	**242009**	**256501**	**273397**	**302500**	**328920**	**347416**	**363691**
Material	1055	1342	1574	1843	2155	2493	2853	3206	3575	3967	4389	4846	5318	5813	6356	6936	7558	8199	8887	9631	10397	11197
Major repairs	1494	1700	1775	2210	2894	3650	4435	4001	4511	5040	5611	6248	6838	7480	8150	8880	9673	10574	11493	12418	13283	14080
Salaries	2064	2270	2429	2599	2781	2976	3184	3407	3645	3900	4173	4465	4778	5112	5470	5853	6263	6701	7171	7672	8210	8784
Depreciation	8026	8817	10511	13138	16087	19433	23473	27032	29786	33886	38846	41233	45438	51063	58020	61806	64339	69242	77496	84796	87862	88573
Electricity purchase	4285	8316	15049	25830	31361	39535	46960	47761	49794	52243	57505	62420	64733	67738	72777	77226	81676	83261	84071	84303	84326	84380
Fuel cost	7168	9053	8750	8759	7107	5177	4898	6102	7344	8380	11455	14761	19061	21298	27273	31383	36726	43090	49450	58530	69242	79170
Interest expense	1276	1974	2551	4438	6492	8382	10448	12250	13171	15488	17511	18324	20045	24173	28633	28777	28100	29745	36444	40536	39611	38017
Natural resource tax	236	238	325	369	498	564	710	894	1043	1259	1261	1409	1517	1649	1629	1638	1627	1634	1762	1823	1847	1915
Management cost	674	656	770	901	1053	1218	1395	1567	1748	1939	2146	2369	2599	2841	3107	3390	3694	4008	4344	4708	5082	5474
Social fund	63	68	73	78	83	89	96	102	109	117	125	134	143	153	164	176	188	201	215	230	246	264
Operating expense reduction from EPPs	0	0	-306	-1114	-1116	-1129	-1290	-1089	-1062	-997	-949	-793	-729	-619	-602	-607	-595	-697	-918	-1046	-1097	-1171
Others	5453	199	363	165	1973	1127	-634	-345	2296	4745	5364	7909	10609	13092	14281	16551	17253	17439	22085	25318	28407	33008
Ⅲ. Income from IPPs, JVs, EPPs	**0**	**17**	**109**	**191**	**274**	**553**	**1051**	**1398**	**1398**	**1398**	**1398**	**1398**	**1398**	**1398**	**1398**	**1398**	**1398**	**951**	**0**	**0**	**0**	**0**
Ⅳ. Net income before tax	**3627**	**1090**	**3550**	**-3684**	**-1831**	**-3079**	**778**	**4454**	**5981**	**5355**	**2269**	**1965**	**1023**	**-1531**	**-8473**	**-5435**	**1275**	**6270**	**628**	**-421**	**7223**	**18231**
Ⅴ. Income tax	**296**	**305**	**994**	**0**	**0**	**0**	**218**	**1247**	**1675**	**1499**	**635**	**550**	**286**	**0**	**0**	**0**	**357**	**1756**	**176**	**0**	**2022**	**5105**
Ⅵ. Capital cost	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Ⅶ. Net Income after Tax	**3331**	**785**	**2556**	**-3684**	**-1831**	**-3079**	**560**	**3207**	**4307**	**3856**	**1634**	**1415**	**737**	**-1531**	**-8473**	**-5435**	**918**	**4515**	**452**	**-421**	**5200**	**13127**

b. Prospective Balance Sheet

(Unit: bill VND)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
I. Assets	**98440**	**123196**	**163892**	**200734**	**236326**	**270180**	**298003**	**324809**	**353816**	**385963**	**406354**	**432248**	**455652**	**478678**	**495215**	**522476**	**552329**	**577048**	**585757**	**580081**	**554291**	**496276**
1. Working fixed assets	74237	94461	129523	166811	203033	238226	265759	291680	318982	348731	368894	391904	413400	435368	456701	484964	512565	535740	544773	539707	516186	463989
a. Original fixed asset	112059	136004	166202	203539	241437	291899	339882	375757	411925	502509	520324	567817	618972	756775	821481	839306	890120	983173	1179332	1220578	1298126	1312802
b. Accumulated Depreciation	55994	64811	75322	88460	104547	123980	147453	174485	204271	238157	277003	318236	363674	414737	472757	534563	598902	668144	745640	830436	918298	1006871
Depreciation Assets(Net)	56065	71193	90880	115079	136890	167919	192429	201272	207654	264352	243321	249581	255298	342038	348724	304743	291218	315029	433692	390142	379828	305931
c. Work-in-progress	12704	17800	33175	46264	60675	64839	67862	84940	105860	78911	120105	136855	152634	87862	102509	174753	215879	215243	105613	144097	130890	152590
d. Other non-current Assets	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468
2. Current asset	24203	28735	34369	33923	33293	31954	32243	33129	34835	37233	37460	40345	42252	43310	38514	37512	39764	41308	40985	40374	38105	32287
e. Cash	12232	21468	25646	23668	21187	17900	15700	14979	14854	15399	13515	14183	13732	12826	5647	2365	2175	1232	-1623	-5060	-10202	-18770
f. Inventories	3777	1094	1084	1172	1171	1161	1295	1309	1514	1706	2077	2480	2956	3271	3903	4391	4995	5706	6420	7361	8427	9414
g. Receivables	7396	5374	6840	8285	10137	12095	14450	16043	17668	19330	21071	22885	24767	26415	28166	29958	31795	33572	35390	37275	39083	40846
h. Others	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798
II. Liabilities	**98440**	**123196**	**163892**	**200734**	**236326**	**270180**	**298002**	**324808**	**353816**	**385963**	**406353**	**432248**	**455652**	**478678**	**495214**	**522476**	**552328**	**577048**	**585757**	**580081**	**554291**	**496275**
3. Shares	40541	41099	44034	41259	40255	38020	39080	41115	44079	46574	47065	47489	47710	46179	37705	32271	32546	34934	35069	34648	37276	46894
i. Fund from the Government	40951	41274	42515	43425	44252	45095	45988	45988	45988	45988	45988	45988	45988	45988	45988	45988	45988	45988	45988	45988	45988	45988
j. Accumulated profit	-410	-174	1519	-2165	-3997	-7076	-6908	-4873	-1908	587	1077	1501	1722	191	-8282	-13717	-13442	-11054	-10918	-11340	-8712	906
4. Liablitities	57898	82096	119857	159474	196070	232160	258922	283694	309736	339389	359289	384759	407942	432499	457509	490205	519783	542114	550688	545433	517015	449382
k. Long term debt	45309	64975	97102	133481	168875	203225	229698	253584	277921	305175	324848	347433	368709	390677	412010	440273	467599	488386	497283	492217	466068	404253
l. Other liabilities	**6446**	10978	16612	19850	21052	22792	23081	23967	25672	28071	28298	31183	33090	35679	39356	43790	46041	47585	47262	47073	44804	38986
- Fuel cost + Elec. purchase	**2038**	3091	4235	6156	6846	7957	9229	9586	10169	10789	12273	13736	14913	15846	17806	19329	21072	22487	23763	25420	27331	29107
- Basic construction	**4408**	7887	12376	13694	14206	14835	13852	14381	15504	17282	16025	17447	18178	19834	21550	24460	24969	25098	23499	21653	17473	9879
m. Others	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**

c. Prospective Cashflow Statement

(Unit: bill VND)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
I. Operating Activities	**11679**	**20262**	**18934**	**15598**	**20099**	**24528**	**31889**	**40595**	**45797**	**52414**	**54964**	**60650**	**65253**	**74331**	**79474**	**87301**	**92524**	**100432**	**111220**	**121896**	**124959**	**127639**
1. Net Income before Tax	3627	1090	3550	-3684	-1831	-3079	778	4454	5981	5355	2269	1965	1023	-1531	-8473	-5435	1275	6270	628	-421	7223	18231
2. Depreciation	8026	8817	10511	13138	16087	19433	23473	27032	29786	33886	38846	41233	45438	51063	58020	61806	64339	69242	77496	84796	87862	88573
3. Interest expence	1276	1974	2551	4438	6492	8382	10448	12250	13171	15488	17511	18324	20045	24173	28633	28777	28100	29745	36444	40536	39611	38017
4. Capital cost Paid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5. Income tax paid	-296	-305	-994	0	0	0	-218	-1247	-1675	-1499	-635	-550	-286	0	0	0	-357	-1756	-176	0	-2022	-5105
6.Contingency Fund paid	-333	-79	-256	0	0	0	-56	-321	-431	-386	-163	-141	-74	0	0	0	-92	-451	-45	0	-520	-1313
7. Allowance fund paid	-516	-471	-607	0	0	0	-336	-852	-911	-975	-980	-849	-442	0	0	0	-551	-1675	-271	0	-2052	-2196
8.Other Fund paid	-1913	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9. Current capital change	1807	9236	4178	1706	-649	-208	-2200	-721	-125	545	-1884	668	-451	625	1294	2153	-190	-943	-2856	-3015	-5142	-8568
II. Investment Activities	**-16232**	**-29041**	**-45573**	**-50426**	**-52308**	**-54626**	**-51007**	**-52953**	**-57088**	**-63635**	**-59009**	**-64243**	**-66934**	**-73032**	**-79353**	**-90069**	**-91940**	**-92417**	**-86528**	**-79730**	**-64341**	**-36375**
10. Investing activities	-16232	-29041	-45573	-50426	-52308	-54626	-51007	-52953	-57088	-63635	-59009	-64243	-66934	-73032	-79353	-90069	-91940	-92417	-86528	-79730	-64341	-36375
- Generation		-11875	-22971	-26204	-26674	-28606	-27669	-33843	-37681	-43534	-37581	-40186	-38670	-44048	-50013	-60334	-62456	-61626	-53940	-46605	-31832	-9143
- Transmision, Distribution		-16780	-21238	-21190	-22707	-24543	-23142	-19110	-19406	-20101	-21428	-24057	-28264	-28983	-29339	-29734	-29485	-30791	-32588	-33126	-32509	-27233
- Others		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- JVs		-386	-1364	-3032	-2927	-1476	-195	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ⅲ. Financing Activities	3930	18015	30818	32850	29729	26811	16917	11636	11166	11766	2161	4261	1230	-2205	-7300	-514	-774	-8958	-27547	-45602	-65760	-99832
11. Borrowings	8265	22069	38030	44350	51894	56423	53821	56496	62371	71298	70101	80048	83699	88478	90695	106853	117525	118634	107314	97925	81223	41807
12. Debt repayment	-4587	-4377	-8454	-12409	-22992	-30456	-37796	-44859	-51205	-59532	-67940	-75787	-82469	-90682	-97996	-107367	-118299	-127591	-134861	-143527	-146983	-141639
- Principal and IDC repayment	-3311	-2403	-5902	-7971	-16500	-22074	-27348	-32609	-38034	-44044	-50428	-57462	-62424	-66509	-69362	-78591	-90199	-97846	-98417	-102990	-107372	-103622
- Interest Paid	-1276	-1974	-2551	-4438	-6492	-8382	-10448	-12250	-13171	-15488	-17511	-18324	-20045	-24173	-28633	-28777	-28100	-29745	-36444	-40536	-39611	-38017
13.Fund from Gov. , Other	252	323	1242	909	827	844	892	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IV. Balance	**-623**	**9236**	**4178**	**-1979**	**-2481**	**-3287**	**-2200**	**-721**	**-125**	**545**	**-1884**	**668**	**-451**	**-906**	**-7179**	**-3281**	**-190**	**-943**	**-2856**	**-3437**	**-5142**	**-8568**
IV. Cash and cash equivalent-Opening balance	**12855**	**12232**	**21468**	**25646**	**23668**	**21187**	**17900**	**15700**	**14979**	**14854**	**15399**	**13515**	**14183**	**13732**	**12826**	**5647**	**2365**	**2175**	**1232**	**-1623**	**-5060**	**-10202**
V. Cash and cash equivalent-Closing balance	**12232**	**21468**	**25646**	**23668**	**21187**	**17900**	**15700**	**14979**	**14854**	**15399**	**13515**	**14183**	**13732**	**12826**	**5647**	**2365**	**2175**	**1232**	**-1623**	**-5060**	**-10202**	**-18770**

(Projection Results)

d. Income statement item

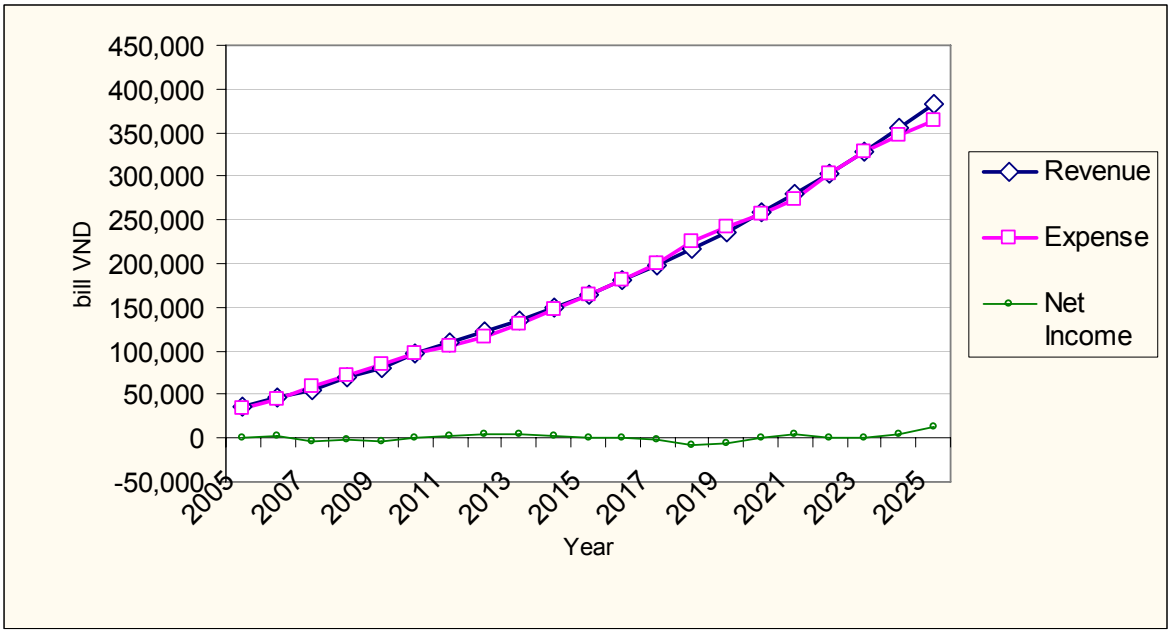


Figure 7-3-1 Revenue, Expense and Net Income

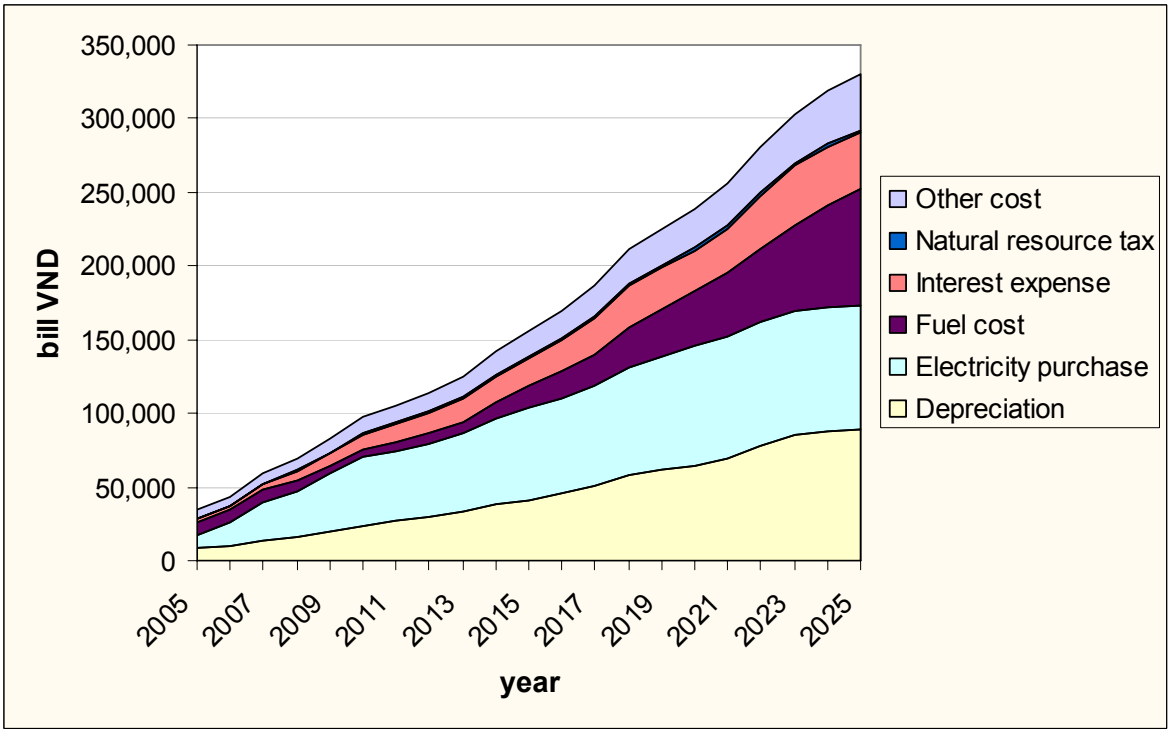


Figure 7-3-2 Cost Transition

- Income as well as expense increase at the same level, while net income is steady at the zero level.
- From the cost aspect, power purchase and fuel cost will significantly increase, and in 2025, the respective amounts will become 10.1 and 8.7 times of those in 2005. Compared to electricity sales, which will be multiplied by 10.8 times in 20 years, depreciation expense will be multiplied by 4.4 times, and interest expense by 6.2 times.

e. Cashflow statement item

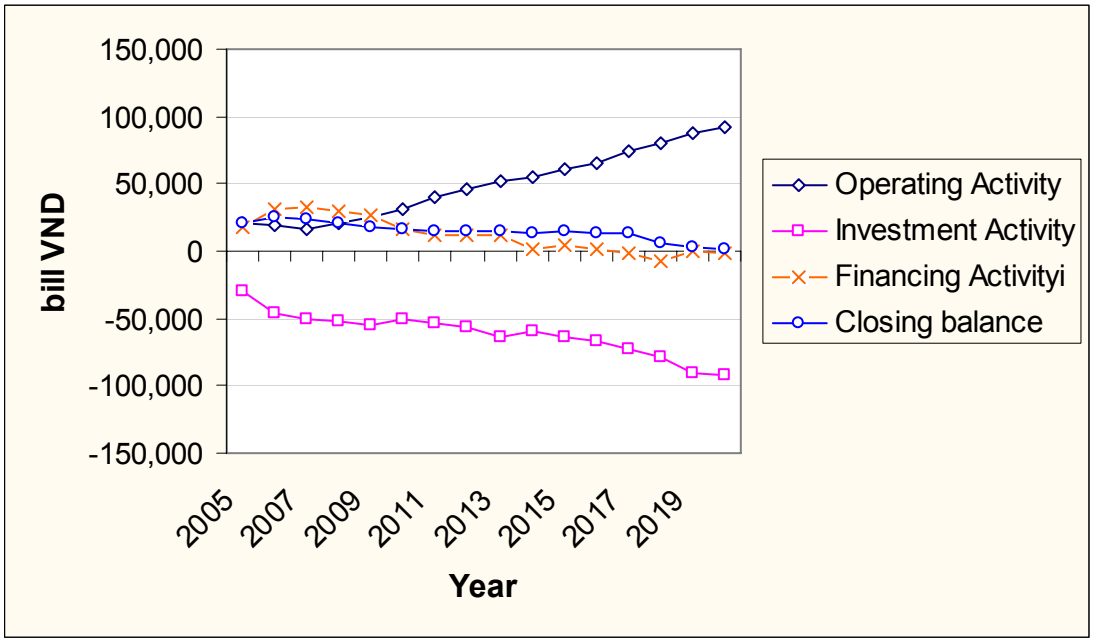


Figure 7-3-3 Cashflow of Each Activity

Table 7-3-1 Fluctuation of Borrowing (Committed Loan and Uncommitted Loan)

(Unit: bill VND)

	2005	2006	2007	2008	2009	2010	2011
1.Commitment loan	6217	14124	15935	15269	16716	12181	10883
2.Uncommited loan	15864	23951	27430	34875	36660	39077	44505
Total loan	22069	38030	44350	51894	56423	53821	56496

	2012	2013	2014	2015	2016	2017	2018
1.Commitment loan	8315	6876	292	292	252	0	0
2.Uncommited loan	57487	67938	69444	78796	83447	88478	90695
Total loan	62371	71298	70101	80048	83699	88478	90695

	2019	2020	2021	2022	2023	2024	2025
1.Commitment loan	0	0	0	0	0	0	0
2.Uncommited loan	106853	117525	118634	107314	97925	81223	41807
Total loan	106853	117525	118634	107314	97925	81223	41807

- In Case 1, we simulated the funding plan to avoid the cash crises. As a result, heavy borrowing will be needed. Especially, uncommitted loan will become an important factor to avoid cash crises. Uncommitted loan after 2011 might be committed in the future. On the other hand, uncommitted loan from 2005 to 2010 will be difficult to commit in the near future. That is to say, the amounts of uncommitted loan correspond to the amount of money shortage.
- To avoid cash crises, there should be some method to decrease investment cost especially from 2005 to 2010.
- Repayment of loan will rapidly increase after 2015, however sales of electricity will also gradually increase. As a result, cashflow will remain sound.

(2) Case 2 Analysis results

a. Prospective Income Statement

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
I Revenue	**35422**	**35723**	**47413**	**55533**	**69539**	**80436**	**97305**	**109342**	**121942**	**135324**	**149706**	**165290**	**181372**	**198263**	**216784**	**236574**	**257776**	**279667**	**303128**	**328499**	**354639**	**381922**
1. Sales of Electricity(bill dong)	31267	35723	47413	55533	69539	80436	97305	109342	121942	135324	149706	165290	181372	198263	216784	236574	257776	279667	303128	328499	354639	381922
Output (GWh)	39696	45682	53586	62749	73353	84848	97111	109124	121699	135054	149407	164960	181010	197867	216351	236102	257261	279109	302523	327843	353931	381160
Selling price (dong/kWh)	788	782	885	885	948	948	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002	1002
2.Other Income (bill dong)	4155																					
II. Expenses (bill dong)	**31794**	**34633**	**43863**	**59217**	**71370**	**83515**	**96527**	**104888**	**115961**	**129969**	**147437**	**163325**	**180349**	**199794**	**225257**	**242009**	**256501**	**273397**	**302500**	**328920**	**347416**	**363691**
Material	1055	1342	1574	1843	2155	2493	2853	3206	3575	3967	4389	4846	5318	5813	6356	6936	7558	8199	8887	9631	10397	11197
Major repairs	1494	1700	1775	2148	2646	3148	3636	3265	3612	3951	4299	4709	5161	5646	6057	6530	7090	7708	8393	9136	9792	10241
Salaries	2064	2270	2429	2599	2781	2976	3184	3407	3645	3900	4173	4465	4778	5112	5470	5853	6263	6701	7171	7672	8210	8784
Depreciation	8026	8817	10511	13138	16087	19433	23473	27032	29786	33886	38846	41233	45438	51063	58020	61806	64339	69242	77496	84796	87862	88573
Electricity purchase	4285	8316	15049	25830	31361	39535	46960	47761	49794	52243	57505	62420	64733	67738	72777	77226	81676	83261	84071	84303	84326	84380
Fuel cost	7168	9053	8750	8759	7107	5177	4898	6102	7344	8380	11455	14761	19061	21298	27273	31383	36726	43090	49450	58530	69242	79170
Interest expense	1276	1589	2200	2752	3458	4282	4916	5654	6730	8545	9441	9251	10411	14143	18063	18310	18797	21901	30412	34017	32754	30692
Natural resource tax	236	238	325	369	498	564	710	894	1043	1259	1261	1409	1517	1649	1629	1638	1627	1634	1762	1823	1847	1915
Management cost	674	656	770	901	1053	1218	1395	1567	1748	1939	2146	2369	2599	2841	3107	3390	3694	4008	4344	4708	5082	5474
Social fund	63	68	73	78	83	89	96	102	109	117	125	134	143	153	164	176	188	201	215	230	246	264
Operating expense reduction from EPPs	0	0	-306	-1114	-1116	-1129	-1290	-1089	-1062	-997	-949	-793	-729	-619	-602	-607	-595	-697	-918	-1046	-1097	-1171
Others	5453	583	714	1912	5255	5730	5697	6987	9637	12778	14746	18521	21919	24957	26944	29368	29139	28149	31216	35119	38755	44172
III. Income from IPPs, JVs, EPPs	**0**	**17**	**109**	**191**	**274**	**553**	**1051**	**1310**	**1398**	**1398**	**1398**	**1398**	**1398**	**1398**	**1398**	**1398**	**1398**	**951**	**0**	**0**	**0**	**0**
IV. Net income before tax	**3627**	**1090**	**3550**	**-3684**	**-1831**	**-3079**	**778**	**4454**	**5981**	**5355**	**2269**	**1965**	**1023**	**-1531**	**-8473**	**-5435**	**1275**	**6270**	**628**	**-421**	**7223**	**18231**
V. Income tax	**296**	**305**	**994**	**0**	**0**	**0**	**218**	**1247**	**1675**	**1499**	**635**	**550**	**286**	**0**	**0**	**0**	**357**	**1756**	**176**	**0**	**2022**	**5105**
VI. Capital cost	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
VII. Net Income after Tax	**3331**	**785**	**2556**	**-3684**	**-1831**	**-3079**	**560**	**3207**	**4307**	**3856**	**1634**	**1415**	**737**	**-1531**	**-8473**	**-5435**	**918**	**4515**	**452**	**-421**	**5200**	**13127**

b. Prospective Balance Sheet

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
I. Assets	**98440**	**107397**	**121619**	**129076**	**133410**	**135143**	**136180**	**131948**	**140933**	**150262**	**159312**	**168917**	**163682**	**161003**	**154875**	**152539**	**160250**	**168311**	**155307**	**111005**	**49754**	**-609**
1. Working fixed assets	74237	82037	93625	102791	108424	111823	111501	107063	112136	119192	125590	132850	128460	124685	122695	122701	126854	131921	120010	80095	16939	-65359
a. Original fixed asset	112059	134173	166202	203539	241437	291899	339882	375757	411925	502509	520324	567817	618972	756775	821481	839306	890120	983173	1179332	1220578	1298126	911258
b. Accumulated Depreciation	55994	64811	75322	88460	104547	123980	147453	174485	204271	238157	277003	318236	363674	414737	472757	534563	598902	668144	745640	830436	918298	1006871
Depreciation Assets(Net)	56065	69362	90880	115079	136890	167919	192429	201272	207654	264352	243321	249581	255298	342038	348724	304743	291218	315029	433692	390142	379828	-95613
c. Work-in-progress	12704	7207	-2723	-17756	-33934	-61564	-86396	-99677	-100986	-150628	-123199	-122199	-132306	-222821	-231497	-187510	-169832	-188576	-319150	-315515	-368357	24786
d. Other non-current Assets	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468	5468
2. Current asset	24203	25361	27994	26285	24986	23320	24678	24884	28798	31070	33722	36067	35222	36319	32180	29838	33396	36390	35297	30910	32814	64750
e. Cash	12232	18094	19271	16042	12930	9366	8295	6882	8997	9454	10039	10213	7037	6201	-268	-4838	-3676	-3112	-6691	-13868	-14795	14460
f. Inventories	3777	1094	1084	1160	1121	1061	1135	1161	1334	1488	1814	2172	2621	2904	3484	3921	4478	5132	5799	6705	7729	8646
g. Receivables	7396	5374	6840	8285	10137	12095	14450	16043	17668	19330	21071	22885	24767	26415	28166	29958	31795	33572	35390	37275	39083	40846
h. Others	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798	798
II. Liabilities	**98440**	**107397**	**121619**	**129075**	**133410**	**135143**	**136179**	**131947**	**140933**	**150262**	**159311**	**168917**	**163682**	**161003**	**154874**	**152539**	**160249**	**168311**	**155307**	**111005**	**49753**	**-609**
3. Shares	40541	41099	44692	42350	41879	40527	42186	44853	48449	51592	52082	52507	52728	51196	42723	37288	37564	39951	40087	39666	42294	51912
i. Fund from the Government	40951	41274	43173	44516	45876	47602	49094	49726	50358	51005	51005	51005	51005	51005	51005	51005	51005	51005	51005	51005	51005	51005
j. Accumulated profit	-410	-174	1519	-2165	-3997	-7076	-6908	-4873	-1908	587	1077	1501	1722	191	-8282	-13717	-13442	-11054	-10918	-11340	-8712	906
4. Liablitities	57898	66297	76927	86725	91531	94616	93993	87095	92484	98670	107229	116410	110954	109807	112151	115250	122686	128359	115220	71339	7460	-52521
k. Long term debt	45309	52550	60547	68369	72643	74315	72334	65229	66705	70619	76526	83362	78751	74976	72986	72992	76870	79549	67503	27587	-32724	-89475
l. Other liabilities	**6446**	7604	10237	12213	12745	14158	15516	15722	19636	21908	24560	26905	26060	28688	33022	36116	39673	42667	41574	37609	34040	30811
- Fuel cost + Elec. purchase	**2038**	3091	4235	6156	6846	7957	9229	9586	10169	10789	12273	13736	14913	15846	17806	19329	21072	22487	23763	25420	27331	29107
- Basic construction	**4408**	4513	6002	6057	5899	6201	6287	6136	9467	11119	12287	13169	11148	12842	15216	16787	18601	20180	17811	12188	6710	1704
m. Others	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**	**6143**

c. Prospective Cash Flow Statement

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
I. Operating Activities	**11679**	**16503**	**15582**	**12661**	**16432**	**20152**	**27486**	**33308**	**41596**	**45383**	**49362**	**51083**	**52894**	**64370**	**69614**	**75546**	**84573**	**94095**	**104465**	**111637**	**116844**	**122974**
1. Net Income before Tax	3627	1090	3550	-3684	-1831	-3079	778	4454	5981	5355	2269	1965	1023	-1531	-8473	-5435	1275	6270	628	-421	7223	18231
2. Depreciation	8026	8817	10511	13138	16087	19433	23473	27032	29786	33886	38846	41233	45438	51063	58020	61806	64339	69242	77496	84796	87862	88573
3. Interest expence	1276	1589	2200	2752	3458	4282	4916	5654	6730	8545	9441	9251	10411	14143	18063	18310	18797	21901	30412	34017	32754	30692
4. Capital cost Paid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5. Income tax paid	-296	-305	-994	0	0	0	-218	-1247	-1675	-1499	-635	-550	-286	0	0	0	-357	-1756	-176	0	-2022	-5105
6.Contingency Fund paid	-333	-79	-256	0	0	0	-56	-321	-431	-386	-163	-141	-74	0	0	0	-92	-451	-45	0	-520	-1313
7. Allowance fund paid	-516	-471	-607	0	0	0	-336	-852	-911	-975	-980	-849	-442	0	0	0	-551	-1675	-271	0	-2052	-2196
8.Other Fund paid	-1913	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9. Current capital change	1807	5862	1178	455	-1282	-484	-1071	-1413	2115	457	585	174	-3176	696	2004	865	1162	564	-3579	-6756	-6400	-5910
II. Investment Activities	**-16232**	**-16617**	**-22100**	**-22303**	**-21721**	**-22832**	**-23151**	**-22594**	**-34858**	**-40942**	**-45244**	**-48493**	**-41048**	**-47288**	**-56030**	**-61812**	**-68492**	**-74309**	**-65585**	**-44881**	**-24706**	**-6275**
10. Investing activities	-16232	-16617	-22100	-22303	-21721	-22832	-23151	-22594	-34858	-40942	-45244	-48493	-41048	-47288	-56030	-61812	-68492	-74309	-65585	-44881	-24706	-6275
- Generation		-7992	-15460	-16898	-17161	-19675	-20760	-20858	-31805	-37827	-43109	-46433	-38473	-45243	-52921	-58823	-67153	-74309	-65585	-44881	-24706	-6275
- Transmision, Distribution		-8367	-5730	-3472	-2710	-2229	-2012	-1725	-3053	-3116	-2135	-2059	-2575	-2045	-3110	-2989	-1339	0	0	0	0	0
- Others		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- JVs		-257	-909	-1933	-1849	-927	-379	-11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ⅲ. Financing Activities	3930	5975	7696	6413	2176	-883	-5406	-12127	-4622	-3983	-3533	-2416	-15022	-17918	-20053	-18304	-14919	-19222	-42459	-73933	-93065	-87444
11. Borrowings	8265	12963	16946	19253	19595	20391	19701	18421	28989	34134	40848	48837	39727	41072	42342	50600	60525	59082	42620	18483	0	0
12. Debt repayment	-4587	-7311	-11150	-14182	-18780	-23001	-26599	-31180	-34243	-38765	-44382	-51253	-54749	-58989	-62395	-68904	-75443	-78304	-85079	-92416	-93065	-87444
- Principal and IDC repayment	-3311	-5722	-8950	-11430	-15322	-18718	-21683	-25526	-27513	-30220	-34941	-42002	-44338	-44847	-44332	-50594	-56647	-56403	-54667	-58399	-60311	-56751
- Interest Paid	-1276	-1589	-2200	-2752	-3458	-4282	-4916	-5654	-6730	-8545	-9441	-9251	-10411	-14143	-18063	-18310	-18797	-21901	-30412	-34017	-32754	-30692
13.Fund from Gov. , Other	252	323	1900	1342	1360	1727	1491	632	632	648	0	0	0	0	0	0	0	0	0	0	0	0
IV. Balance	**-623**	**5862**	**1178**	**-3229**	**-3113**	**-3563**	**-1071**	**-1413**	**2115**	**457**	**585**	**174**	**-3176**	**-836**	**-6470**	**-4570**	**1162**	**564**	**-3579**	**-7177**	**-927**	**29255**
IV. Cash and cash equivalent-Opening balance	**12855**	**12232**	**18094**	**19271**	**16042**	**12930**	**9366**	**8295**	**6882**	**8997**	**9454**	**10039**	**10213**	**7037**	**6201**	**-268**	**-4838**	**-3676**	**-3112**	**-6691**	**-13868**	**-14795**
V. Cash and cash equivalent-Closing balance	**12232**	**18094**	**19271**	**16042**	**12930**	**9366**	**8295**	**6882**	**8997**	**9454**	**10039**	**10213**	**7037**	**6201**	**-268**	**-4838**	**-3676**	**-3112**	**-6691**	**-13868**	**-14795**	**14460**

(Projection Results)

d. Income Statement Item

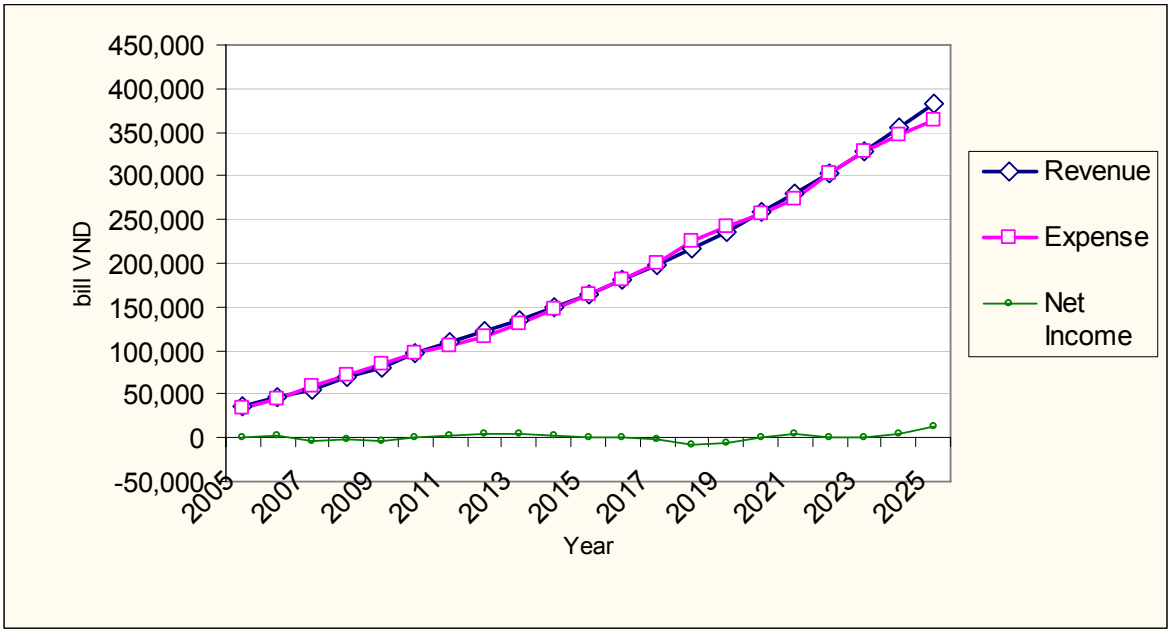


Figure 7-3-4 Revenue, Cost and Net Income

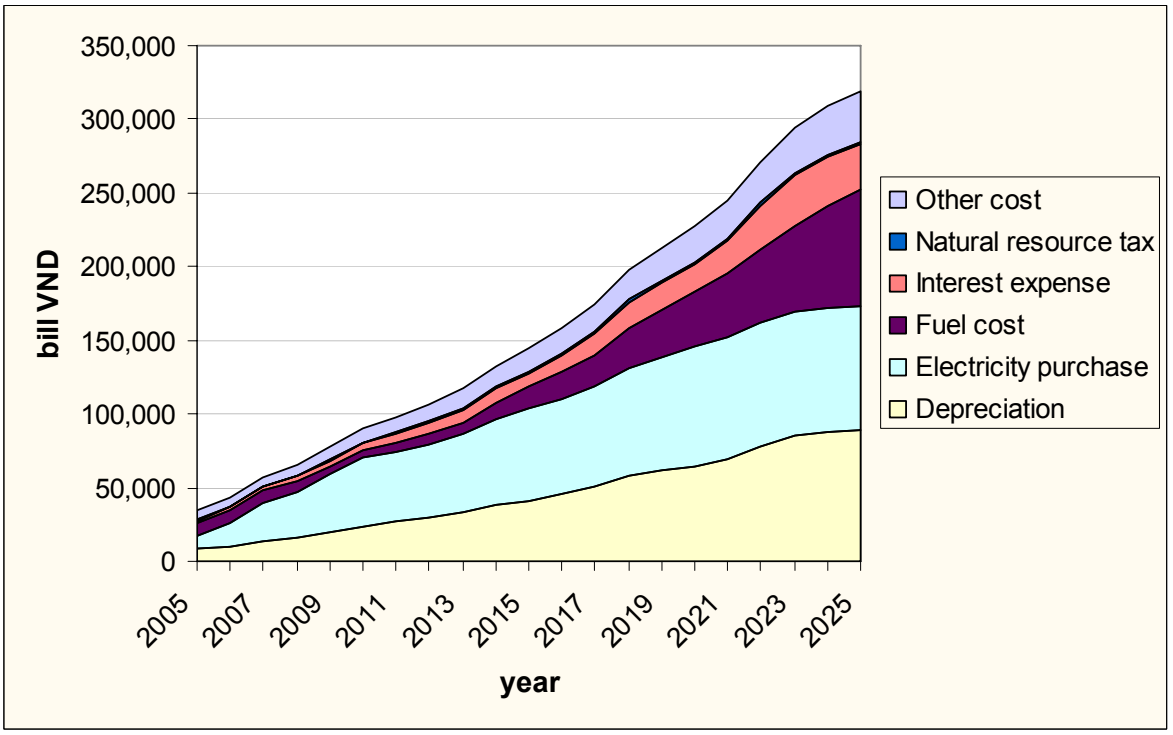


Figure 7-3-5 Cost Transition

e. Cashflow Statement Item

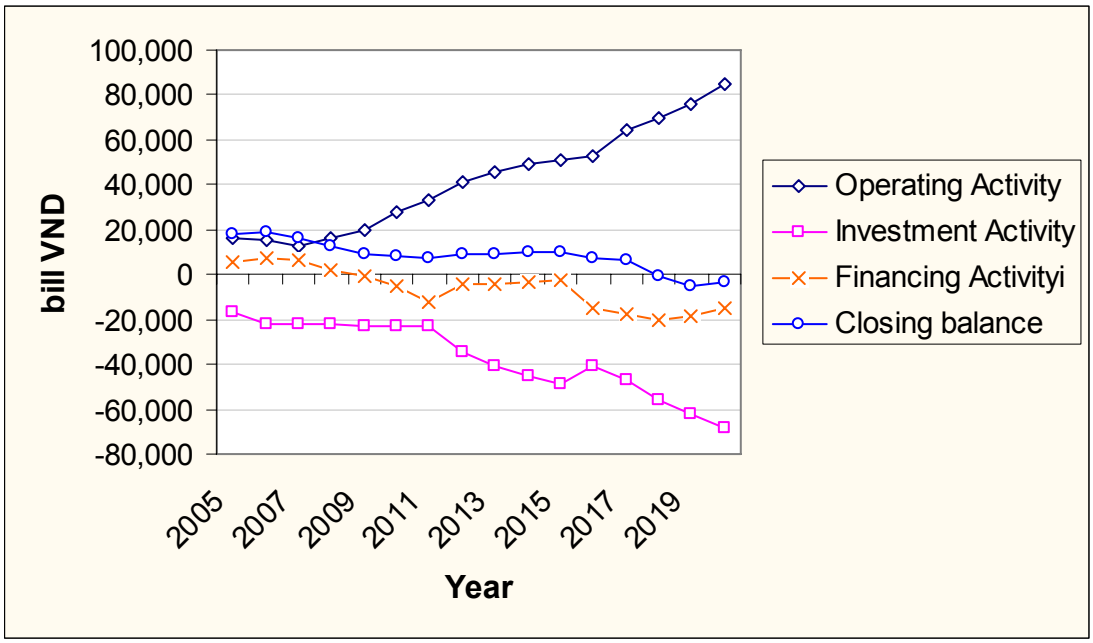


Figure 7-3-6 Cashflow of Each Activity

Table 7-3-2 Transition of Borrowing (Committed Loan and Uncommitted Loan)

(Unit: bill VND)

	2005	2006	2007	2008	2009	2010	2011
1.Commited loan	6217	14124	15935	15269	16716	12181	10883
2.Uncommited loan	6746	2822	3318	4327	3675	7520	7539
Total loan	12963	16946	19253	19595	20391	19701	18421

	2012	2013	2014	2015	2016	2017	2018
1.Commited loan	8315	6876	292	292	252	0	0
2.Uncommited loan	20674	27258	40557	48545	39475	41072	42342
Total loan	28989	34134	40848	48837	39727	41072	42342

	2019	2020	2021	2022	2023	2024	2025
1.Commited loan	0	0	0	0	0	0	0
2.Uncommited loan	50600	60525	59082	42620	18483	0	0
Total loan	50600	60525	59082	42620	18483	0	0

- Compared to Case 1, uncommitted loan will decrease and cashflow will be improved.
- As a result, the decrease of investment cost by 2011 will have a good effect in cashflow items.

7.3.6 Conclusion

The analysis results are as follows.

- Cashflow balance will be negative until 2009, therefore, the investment plan of the project should be scaled back.
- The major reason for the cash shortage is the substantial amount of annual repayments of borrowings and a large amount of investment.

CHAPTER 8

ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

Chapter 8 Environmental and Social Considerations

8.1 Strategic Environmental Assessment: SEA

8.1.1 SEA in General

Strategic Environmental Assessment (SEA) is environmental assessment targeting the three 'P's of Policy, Plan and Program.

SEA has two significances as follows,

- ✓ Environmental Consideration should be integrated into decision making when a project, which would have a major impact on the environment, is planned / executed.
- ✓ To make up for the limit of Environmental Assessment at the project executing stage. (Report of the Strategic Environment Assessment Research Committee)

SEA will be carried out in an earlier stage with wider environment conservation treatment than EIA.

- To analyze multiple schemes for its location
- To put restrictions on the planning of management programs, on the planning / execution of lower plans / projects
- To assess the accumulative big impact caused by small-scale projects none of which is targeted by EIA.
- To assess the accumulated impact of multiple projects concentrated into certain narrow areas.
- To assess the total impact of the network (emission amount of CO2 gas, variations in air pollution conditions).

8.1.2 SEA in the Study on National Power Development Plan in Vietnam

Abstract flow of the Strategic Environment Assessment (SEA), for the PDP 6th is shown in Figure 8-1-1.

SEA should be executed comprehensively by integrating the following three aspects: 'Policy', 'Plan' and 'Program'.

In particular, Vietnam is a long country stretching 1,500km from north to south (between Ha Noi and Ho Chi Minh City), and there are three different types of electric power sources dividing the country into three regions, i.e. the North (mainly hydro-power and thermal-power), the Center (mainly hydro-power) and the South (gas thermal power).

Furthermore, different types of power generation can have big differences in the environmental impact.

On the other hand, as stated in Chapter 3, the power demand in the country is increasing rapidly in line with the growth of its industry and advance in the quality of life, causing a lack of power supply; thus, improvement of power supply has become an urgent matter.

Environmental and Social Considerations Expert of the Study Team has therefore decided that it is appropriate to execute SEA dividing the country into the above mentioned three areas.

The power development policy and the long-term development plan (up to 2025) of the Vietnam Government are very important for balancing the power supply and demand in power development.

From the viewpoint of SEA, it is very important not only to balance the environmental quality and grades inside the area, and between the North, Central and South regions, but also to balance the accumulative impact thereof these regions.

SEA in the Study on National Power Development Plan is carried out in line with the procedure indicated in Figure 8-1-1.

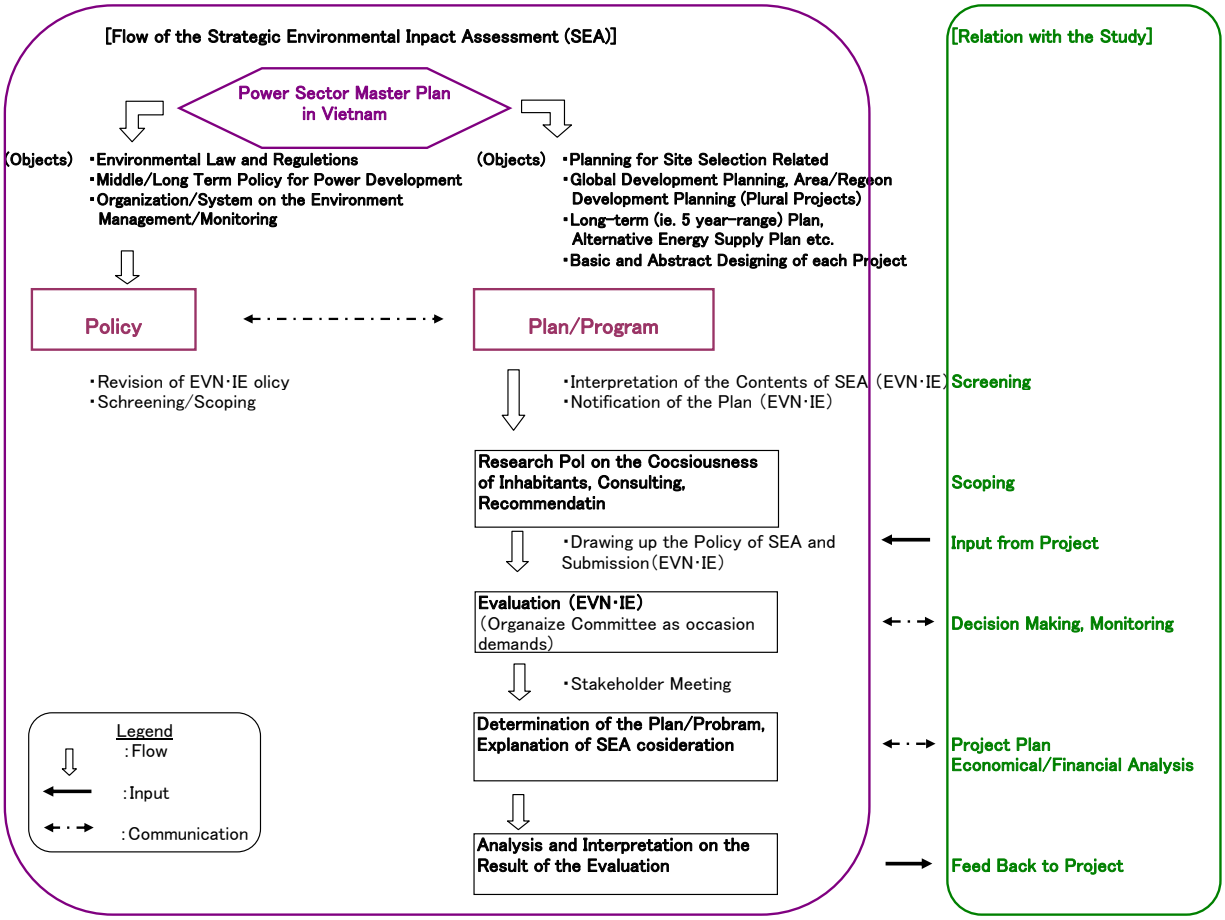


Figure 8-1-1 Relation between "the Study on National Power Development Plan" and SEA

8.2 Environmental Considerations in the Japanese ODA

8.2.1 Environmental and Social Considerations Guideline of JICA

JICA completed "JAPAN INTERNATIONAL COOPERATION AGENCY GUIDELINES FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS (herein after referred to as 'JICA's E & SC GL') April 2004" revising the previous Guideline for environmental and social considerations in April 2004.

This JICA's E & SC GL is composed of three parts: I. BASIC MATTERS, II. Process of Environmental and Social Considerations and III. Procedure of Environmental and Social Considerations.

The concept, objectives and basic policy are as follows.

(1) Concept

Japan's Official Development Assistance (ODA) Charter states the following in its opening: "In formulating and implementing assistance policies, Japan will take steps to assure fairness. This should be achieved by giving considerations to the conditions of the socially vulnerable and the gap between the rich and the poor as well as the gaps among various regions in developing countries. Furthermore, great attention will be paid with respect to factors such as environmental and social impacts on developing countries when implementing ODA."

In addition, the GL prescribes that the inclusion of environmental and social costs in development costs, and the social and institutional framework to make it possible to internalize environmental and social costs in development costs, are crucial for sustainable development.

Additionally, the GL prescribes as the Government statement that the internalization and the institutional framework are requirements for measures of environmental and social considerations, democratic decision-making is indispensable for environmental and social considerations, and, in order to achieve an appropriate decision-making process, it is important to ensure stakeholder participation, information transparency, accountability and efficiency in addition to respect for human rights.

In this context, with respect to human rights and in view of the principles of democratic governance, the measures for environmental and social considerations are implemented by ensuring a wide range of meaningful stakeholder participation and transparency of decision-making as well as by working for information disclosure and by ensuring efficiency.

(2) Objectives

The objectives of the Guidelines are to encourage the recipient governments to take appropriate considerations of environmental and social factors as well as to ensure that JICA's

support for and examination of environmental and social considerations are conducted accordingly.

(3) Basic Policy

JICA's E & SC GL states seven particularly important items in the basic policy as follows,

- A wide range of impacts to be addressed are covered
- Measures for environmental and social considerations are implemented at an early stage
- Follow-up activities are carried out after cooperation projects are terminated
- JICA is responsible for accountability when implementing cooperation projects
- JICA asks stakeholders for their participation
- JICA discloses information
- JICA enhances organizational capacity.

8.2.2 JBIC Guidelines for Environmental and Social Considerations Confirmation

JBIC (Japan Bank of International Cooperation) established "Guideline for Environmental and Social Considerations Confirmation (April, 2002) (hereinafter referred to as 'JBIC's E & S GL')".

JBIC's E & S GL is composed of two parts.

(1) The First Part

The First part is composed of basic items such as basic policy, objectives, basic considerations, confirmation procedure, information disclosure, reflection for decision making / finance contract, to secure execution / observance, application and amendment etc.

a. Basic Policy:

The basic policy of JBIC Environmental and Social Considerations GL is nearly the same as JICA's E & SC GL; however, it also screens and reviews the Environmental and Social Considerations for satisfying financing conditions.

Furthermore, it is stated that a borrower must carry out monitoring and work by taking account of Environmental and Social Considerations.

b. Objectives / Positioning:

The objectives and positioning are to urge to appropriate environmental and social considerations to be made in line with the JBIC Environmental and Social Considerations GL and to endeavor to keep transparency / predictability / accountability indicating required conditions of finance aimed project with the viewpoint of environment.

c. Basic Considerations:

There are stated responsibility body, confirmation of environmental and social considerations by JBIC, necessary information for confirming environmental and social consideration standards to confirm appropriateness and reflection to decision making.

d. Confirmation Procedure for Environmental and Social Considerations:

There are stated Screening, Categorization, Environmental review for each category and Monitoring.

e. Information Disclosure of JBIC Environmental and Social Considerations Related:

f. Reflection in Decision Making, Finance Contract etc.:

g. To Secure Execution / Observance of the GL:

h. Application and Amendment of GL:

(2) The Second Part

After a brief explanation, there is an introduction to the concrete assessment procedure based on the environmental and social considerations with Report format, Screening items, Checklist, Monitoring items, etc. are stated.

Following twenty-one (21) sectors are listed as environmentally fragile sectors.

・Mining, ・Petroleum / Natural Gas Development, ・Pipe Line, ・Steel Works, ・Non-ferrous Metal Refining, ・Petro-chemical, ・Oil Refining, ・Terminal of Oil / Gas / Chemical Material, ・Paper and Pulp, ・Production and Transportation of Hazardous / Poisonous Materials, ・Thermal Power Generation, Hydro-power Generation / Dam / Storage, ・Transportation / Transmission / Distribution of Electric Power, ・Road / Rail Road / Bridge, ・Airport, ・Port, ・Sewage / Waste Water Treatment, ・Agriculture, ・Forestry / Plantation, ・Tourism.

The checklists for twenty six (26) sectors include the following five (5) additional sectors.

They are; Water Supply, Irrigation, ・Fishery / Aquaculture, ・Infrastructure, ・Chemical Industry and ・Other Industry.

8.3 Method and Study Results of Initial Stage Environmental Study

8.3.1 Method of the Study

The survey and the study were carried out in line with the following steps;

(1) Policy Aspect

① Compilation of laws, regulations and standards related to socio-environment assessment.
Collecting laws, regulations and standards related to socio-environment assessment with C/P, MONRE MARD etc.

② Investigation on the relation between Power Development Policy of Vietnam and Socio-environmental Considerations.

The power development plan in Vietnam optimized by the experts of power development plan, power demand forecast and energy policy putting the viewpoint on the energy security and economics, is reviewed and suggested in view of environmental and social consideration aspects.

(2) Planning Aspect and Programming Aspect

③ Study of the SEA checkpoints and drawing up the checklist.

Based on JICA's E & SC GL (Dam, River / Sand Control etc.) and study results at home, the environmental and social considerations expert prepares draft SEA checkpoints and checklist (refer to Appendix 8-1), explains them to the C/P and local consultant, amends and collects data and Initial stage Environmental Study on the PDP 6th (hereinafter referred to as 'IES') concerning all the power development candidate sites putting weight on the 12 items which the pre-study mission evaluated as category 'B'.

IES will be carried out on the following items based on the executing method and its checklist.

a. Socio-environmental Items

- Minorities / Indigenous people, weakness / gender, involuntary resettlement
- World Heritage, cultural assets
- Scenery
- Life (agriculture, water utilization / water rights)
- Others (isolation and / or splitting)

b. Natural Environmental Items

- Ecology flora and fauna, biodiversity)

- Migration
- Topography, geography
- National Park, reserved areas
- Costal zone
- Hydrological situation
- Meteorology, climate change / global warming

c. Pollution Items

- Air pollution
- Water pollution
- Soil contamination
- Noise
- Vibration
- Land subsidence
- Bad smell
- Solid waste / hazardous waste

On the other hand, following 12 (twelve) items were categorized as "B";

- Involuntary resettlement,
- Land use and utilization of local resources,
- The poor, Indigenous and minority people,
- Cultural heritage,
- Water usage or water rights and rights of common,
- Topography and geological features,
- Hydrological situation,
- Costal zone,
- Flora, fauna and biodiversity,
- Global warming,
- Air pollution
- Water Pollution

④ Examination and selection of execution method of SEA

Environmental study and evaluation on each hydropower plant will be carried out in accordance with the evaluation standard of screening and scoping checklist shown in JICA's E & SC GL (Dam, River / Sand Control etc.).

Based on the IES result of each candidate site, SEA is executed including cases of developing multiple power plants in the same area after discussion with C/P considering the necessity of analysis from the perspective of social and natural environments.

(3) Policy Aspect, Planning Aspect and Programming Aspect

⑤ Evaluation for the environmental and social consideration aspects of the candidate power generation plants.

Based on the IES results of item '②', screening is reviewed and general comparative assessment of the environment related to each site is executed taking into consideration the government long term policy, cooperation and balance between areas. The results are used to optimize the power generation development plan.

In concrete terms, a local consultant is selected, and then IES on the listed power development candidate sites (refer to Appendix 8-2) is executed by a selected consultant.

The study is carried out on the listed power development candidate sites and additional candidate sites, which would be nominated by power generation and network development plan WG on the way of execution of their study.

8.3.2 Study Result of IES

(1) Collection and Analysis of the Environment Related Data

a. Information relating Energy Policy

The Environmental and Social Considerations WG obtained and studied National Energy Policy. The result was reflected in the Policy aspect in the SEA study.

b. Information relating to the Environment

The Environmental and Social Considerations WG confirmed and collected the data which are related to the environmental and social considerations law and regulations, visiting and discussing with MONRE / EIA, inquiring the state of existence and method of acquisition.

Mainly, there is the Environmental Protection Law which went into effect on January 10th, 1994. Under this law, regulations on the waste water, emission gas and solid waste were implemented.

Regarding EIAs, Circular No. 490/1998/TT-BKHCNMT dated 29/4/1998 of the Ministry of Science, Technology and Environment that provides guidelines on making and evaluating the EIA reports with regard to investment projects was issued.

Regarding investment project, the investor should prepare environmental impact assessment report in order to receive environmental license, and submit them to MONRE and be evaluated by Government Decree No. 175/CP for environmental protection.

Meanwhile, Decision No. 04/2003/QD-BTNMT dated 21/8/2003 of the Ministry of Natural Resources and Environment, prescribes the organization and activities of the EIA Report Appraisal Committee.

As a result of the investigation on the collected data and hearings from counter personnel related the environmental and social considerations group of the Study Team could not find any regulations documents which indicate necessity of applying EIA to the master plan.

Regarding the foreign investment, there is a simple provision for environmental impact assessment by Circular No. 490/1998/TT-BKHCNMT

Projects are divided into following two categories by the result of the evaluation.

- Category I：Projects which cause environmental impact widely and larger
- Category II：Projects which have smaller environmental impact

In case of category I, investor should prepare Environmental Impact Assessment (EIA) report, and have to be evaluated by administration organization.

In case of category II, investors only need to form simple Registration for Securing Environmental Standards and submit them to MOSTE / NEA, DOSTE. Then the process is completed.

Figure 8-3-1shows the procedure.

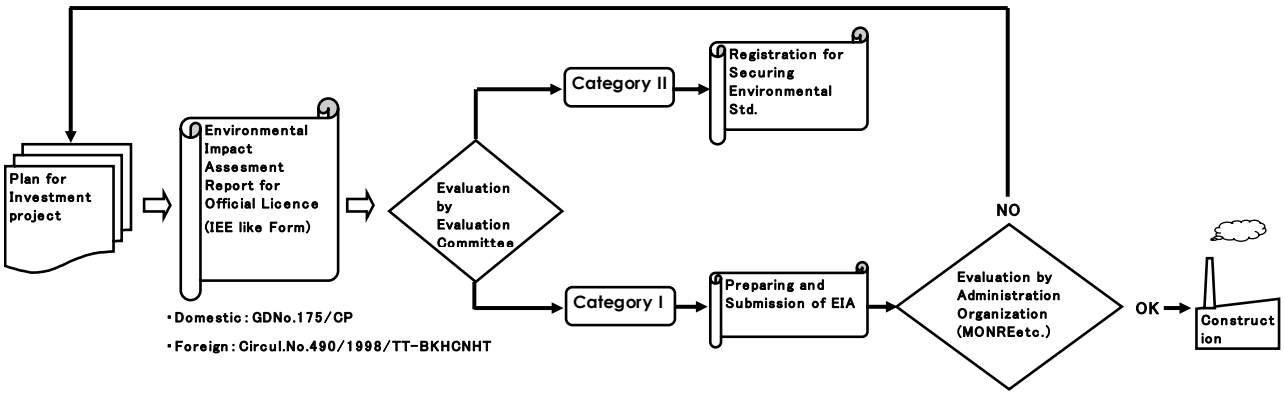


Figure 8-3-1 Procedure of EIA for Developing Project in Vietnam

The Environmental Protection Law was enforced in January, 1994 as environmental related law and regulations.

There are regulations for water and discharge water TCVN5945-1995, for air TCVN5939-1995 and for solid waste Decision No. 155/1999/QD-TTG (Hazardous waste Management Regulation).

Table 8-3-1, 8-3-2 and 8-3-3 show regulations for the Surface Water, Discharge Water and Air in comparison with Japanese standards.

The Vietnamese standards for environment and emission have looser part and tighter part in comparison with Japanese and European standards. However, they can be said to be rather severe standards and carefully formed, taking into consideration social and environmental, economic conditions and technical level of the Vietnam.

Table 8-3-1Regulation for Surface Water

Parameters	Unit	TCVN-5942-1995 (B)	Japanese Std.	Notes
pH	—	5.5 - 9	6.5 - 8.5	
Temperature	℃	—	—	
DO	mg/L	≧2	> 7 - 2	in Japan, categorized by water utilization（grade 1to 3 for drinking, grade 1 to 3 for industrial use)
BOD5	mg/L	< 25	< 1 - 10	- ditto -
COD	mg/L	< 35	< 1 - 8	- ditto -
SS	mg/L	80	< 25 -100	- ditto -
N-NO3	mg/L	15	—	
N-NO2	mg/L	0.05	—	
N-NH3	mg/L	1	—	
Total-N	mg/L	—	< 0.1 - 0.005	in Japan, categorized by water utilization（grade 1to 3 for drinking, grade 1 to 3 for industrial use)
Fe	mg/L	2	—	
Pb	mg/L	0.1	0.01	
Zn	mg/L	2	—	
Mn	mg/L	0.8	—	
Oil and Grease	mg/L	0.3	—	
Detergent	mg/L	0.5	—	
Organic-P	mg/L	—	ND	
Coliform	MPN/100mL	10,000	< 50 - 1,000	in Japan, categorized by water utilization（grade 1to 3 for drinking, grade 1 to 3 for industrial use)
Cd & Cd compound	mg/L	—	0.01	
CN ncompound	mg/L	—	ND	
Cr6+	mg/L	—	0.05	
As & As compound	mg/L	—	0.01	
Hg & Hg compound	mg/L	—	0.0005	
Alkyl Hg compound		—	ND	
PCB		—	0.03	
Organic chloride composition		—	0.03～1	dipending to the composition of TCE, TTC etc.
T-N		—	0.1～1.0	
T-P		—	0.005-0.1	

Table 8-3-2Regulation for Discharge Water

Parameters	Unit	TCVN-6984-2001 Q>200, F2	TCVN-5942-1995 (B)	Japanese Std.	Notes
pH	—	6 - 8.5	5.5 - 9	5.8 - 8.6	
Temperature	℃		40	—	
SS	mg/L	90	100	200	
BOD5	mg/L	40	50	160	
COD	mg/L	80	100	160	
Total-Porganic					
	mg/L	0.8	0.5	—	
Total-P					
	mg/L	8	—	—	
N-NH3	mg/L	—	1	—	
Total-N	mg/L	—	60	< 0.1 - 0.005	
S2-	mg/L	—	0.5		
Mn	mg/L	—	1	10	Mn2+ in the Vietnam regulation
Fe	mg/L	4	5	10	
Pb	mg/L	—	0.5	0.1	
Cu	mg/L	—	1	3	Cu2+ in the Vietnam regulation
Cr3+	mg/L	—	1	2	
Cr6+	mg/L	—	0.1		
Cl	mg/L	800	—	—	
Sn	mg/L	—	1		
Zn	mg/L	—	2		Zn2+ in the Vietnam regulation
Hg2+	mg/L	—	0.005		
Ni	mg/L	—	1		Ni2+ in the Vietnam regulation
Mineral Oil and Grease	mg/L	10	1	—	
Normal Hexananimal	mg/L	—	—	5	
Normal Hexanmineral	mg/L	—	—	30	
Phenol	mg/L	—	—	5	
Coliform	MPN/100mL	5,000	10,000	3,000	
CN ncompound	mg/L		—	ND	
Cr6+	mg/L	—	0.1	0.5	
Cd	mg/L		—	0.1	Cd2+ in the Vietnam regulation
As & As compound	mg/L	0.08	0.1	0.1	As3+ in the Vietnam regulation
Hg & Hg compound	mg/L		—	0.005	Hg2+ in the Vietnam regulation
Alkyl Hg compound			—	ND	
PCB			—	ND	
Organic chloride composition			—	*	*:Each compound is shown in the other table
T-N	mg/L	—	60	1	There are various categories as for human health, for drinking water, for natural environmental protection etc in Japan.
T-P	mg/L	6	6	0.09	

Table 8-3-3 Standard for Air Quarity

Parameters	Unit	TCVN-5937-1995 TCVN5938-1995	Japanese Std.	Notes
Dust	mg/m3	4	0.1(0.2)	SPM in Japan, 1day average of 1hour value (1hour value)
CO	mg/m3	20	10(20)	ppm in Japan, 1day average of 1hour value (1hour value)
SO2	mg/m3	5	0.04(0.1)	ppm in Japan, 1day average of 1hour value (1hour value)
NO2	mg/m3	5	0.04-0.06	ppm in Japan, 1day average of 1hour value (1hour value)
THC	mg/m3	－	0.20-0.31ppmC	Average of am 6:00～9:00 corresponding to 0.06ppm of OX
H2S	mg/m3	10	－	
NO	mg/m3	10	－	
NH3	mg/m3	17	－	
CH4	mg/m3	－	－	
Photochemical Oxidant （OX）			0.06	ppm innJapan, 1 hr value

Furthermore, there are regulations of Benzene, Tri-chloro-ethylene, Tetra-chloro-ethylene, Di-chrolo-methane and Dioxin group in Japan.

c. Law and Regulations regarding Social Considerations

The Environmental and Social Considerations WG could not find out any descriptions of law and regulation regarding social considerations form collected the data and hearing from counterparts.

In the case of each project which will be implemented based on the EIA approved by evaluation organization of MONRE, various committees such as 'Involuntary Resettlement Management Committee' are organized, and DONRE, sub-organization of MONRE, manages each area and takes part in as a member including monitoring.

(2) Execution of the Site Investigations and Analysis

a. First Site Investigation

The Environmental and Social Considerations WG carried out the first site investigation and obtained the following environmental information of two thermal plant sites and one hydro power plant.

The environmental expert of the selected consultant together with experts of the Study Team and C/P carried out the site investigation and grasped status of environment.

- Pha Lai coal power plant (existing)
- Uong Bi coal power plant (existing) and expansion plant (under construction)
- Song La hydro power plant (under construction)

The Pha Lai coal thermal power plant (existing) has already done an EIA and The Pha Lai and the Uong Bi TPP submit monitoring reports every year (two times a year; Pha Lai, one time a year; Uong Bi). These plants operate fairly well paying attention to environmental considerations. However, DONRE of Hai Duong Province raises the following concerns.

① Deforestation and impact on the ecological system affected by SO_2 of emission gas even using high quality coal.

② Impact of waste water on the river, since this is released after only settling treatment (Alkali water).

Song La Discreet and Construction Office of Song La Hydro Power Plant prepared various committees (steering, approval, management, compensation and committees of village scale) related to resettlement and has managed and controlled them. In particular, the Construction Office of the Song La Hydropower Plant manages to control the following items.

① Large-scale involuntary resettlement, more than 18,000 households, is required, and it has a large impact on both the site and resettled area.

② The expected resettled people consist of 95.3% Indigenous minorities (Thai [83.1%], La Ha [5.9%] and Khang, Kho Mu and H'mong [6.3%]), and 80 % of their livelihood is agriculture. 50 % of them are extremely poor. There are some cases that they changed their kind of agricultural production (from corn to tea).

③ The ethnic minority to be resettled want to move to similar circumstances. However, it is not clear that the representatives fully understood the wishes of these people.

④ The stakeholder meeting was not held excusing low education level of Indigenous minority people.

The big environmental and social impacts by the Song La Hydropower Plant development are the involuntary resettlement and ecological changes.

At the moment, the resettlement problem is not actualized since all the expected resettlers have not moved. It would be very difficult to monitor and control / operation after finishing resettlement.

In case the inquiry is not solved when all the data are obtained, an additional survey would be necessary.

b. Second Site Investigation

The Environmental and Social Considerations WG visited two Hydro Power Plants in the Central region and two Thermal Power Plants, one is already operating and the other is in the planning stage, in the southern region as the second site survey.

The environmental expert of local consultant went together with experts of the Team and C/P personnel as same as the first site survey and carried out observation on the issues of environmental aspect.

Before executing site survey on each site, the Team visited DONRE and grasped actual state of condition.

- Song Bung 2 ,Dak Mi 4 hydro power plant (planned), and New village for the involuntarily resettled people from A Vuong hydropower plant
- Phu-My power plant (existing),
- O Mon #3, #4 gas thermal power plants (planned)

i) Central Area

As for the result of discussion with DONRE of Quang Nam Province and visit result for resettling area of Song Bung 2 and Dak Mi 4 residents, the following issues of environmental and social considerations are listed up.

① A Vuong is under construction, as roads, resident areas and agricultural land are being prepared for resettlers. A Representative of DONRE explained that there was not any problem on the resettlement, however the representative did not know much about the compensation nor negotiation process. The Team was given the impression that there were not enough considerations for residents.

② According to the hearing on the residents of Dak Mi, there was information about the project by F/S consultant, however there was not any official explanation. Residents and stakeholders seemed not to be informed sufficientlly.

③ The residents who have to move seem to accept resettlement as an unavoidable issue, and show their interest in the compensations (alternative land, compensation fee).

④ There are mainly low trees and bushes in the submergible area of Son Bong 2 and Dak Mi 4. Tropical forests are protected as Nature Areas, and Conservation Areas out of the construction zone. However, an EIA should be carried out along the river, as it has been done in the Vu Gia-Thu Bon river basin, with particular attention paid to tree cutting, and altering water route.

⑤ Considerable environmental impacts of hydro power plant in the Central and Southern areas are involuntary resettlement and ecology, the same as with Son La HPP site.

ii) Southern Area

As a result of discussion with DONRE of Ba Ria-Vung Tau Province, and Can Tho province, and the result of site observation on the Phu-My TPP and O Mon TPP (Under operation, Preparing), the following information was obtained as the Environmental and Social Considerations in terms of thermal power plant.

① Both the Phu My Thermal Power Plant (under operation) and O Mon Thermal Power Plant (under preparation) did EIAs, and submit an environmental monitoring report to MONRE twice a year.

② DONRE of Ba Ria-Vung province installed a monitoring center and submits monitoring data to the MONRE; however they do not have feedback from this information. DONRE recognizes that the problem was a lack of the database.

③ DONRE are anxious about influences of warm discharge water.
The emission gas is tightly controlled as stated by the DONRE representative; however the data is submitted to MONRE directly and DONRE does not have the relevant data. Environment management and monitoring system are problems.

④ The number of involuntary resettlements in the O Mon #3 and #4 areas was 254 households (all were farmers) and all of them had been resettled. The resettlement area was selected by the inhabitants themselves, and it was agreed to compensate all of the costs. The inhabitants were satisfied without any discontent (all of them are satisfied).

(3) Analysis of the Initial stage Environmental Study (IES)

IES was executed on the 65 candidate sites, where concrete location is specified, in the 96 candidate sites, original 71 candidate sites and additional 26 candidate sites.

Specified candidate sites of 37 hydro power plants (HPP) , 26 thermal power plants (TPP) and two nuclear power plants (NPP) and were studied based on the checklist which is indicated in the section “8-3-1 Method of IES”, attached in Appendix 8-1, by the local consultant.

The IES results are shown in Appendix 8-2 and 8-3, Summary Table TPP and Summary Table HPP.

The study results were evaluated by following formula.

$$E_I = \sum_{i=1}^{m} (V_i)_l W_i \qquad (8.3.1)$$

In which: E_I : environmental impact

$(V_i)_l$: quality value of the category “i” environmental parameter of the project ‘l’

W_i : weight of the category “i” factor

m : sum of factors

The evaluation is executed putting a quality value score of 4 to **a** (considerable serious environmental impact), 2 to **b** (less environmental impact) and 1 to **c** (non environmental impact) as factor (Vi).

Then, importance levels 3, 2 and 1 were weighted to each environmental item depending on the importance level (Wi). After that, each weight was multiplied by each point ((Vi)i*Wi).

Moreover, these evaluations are carried out separating construction phase and operation phase, and finally summarizing the result of each item for evaluation.

There were some candidate sites, which had been already decided to be developed or had already done EIA, and these were omitted from the study targets. 46 (forty six) candidate sites were therefore evaluated

As a result of evaluation which had been done by local consultant, E_I numbers are shown in Appendix 8-4 and 8-5 separating to TPPs and HPPs.

Ranking of smaller impact is shown in Table 8-3-1.

Table 8-3-4 Priority Selection of Power Plants Based on Natural/Social Environmental Criteria

Projects/Plants	Priority order
Thermal Power plants	
Amata Bien Hoa CCGT	1
South CCGT Thermal Power Plant	2
O Mon No 2 Thermal Power Plant	3
Nhon Trach No3 Thermal Power Plant	4
Nhon Trach No 4 Thermal Power Plant	5
Nhon Trach No1 Thermal Power Plant	6
Nhon Trach No 2 Thermal Power Plant	7
Son Dong Thermal Power Plant	8
O Mon No 4 Thermal Power Plant	9
Quang Ninh Thermal Power Plant	10
O Mon No 3 Thermal Power Plant	11
Mong Duong Thermal Power Plant	12
Nghi Son Thermal Power Plant	13
Hai Phong Thermal Power Plant	14
Hydro Power plants	
New PSPP No3 JS6	1
Dakmi No4 Hydropower Plant	2
EA Krong Hnang Hydropower Plant	3
Chu Linh – Coc San Hydropower Plant	4
Nho Que No3 Hydropower Plant	5
Sesan No4 Hydropower Plant	6
Nho Que No1 Hydropower Plant	7
Nho Que No2 Hydropower Plant	8
Dakrtih Hydropower Plant	9
Song Tranh No2 Hydropower Plant	10
Dambri Hydropower Plant	11
Nam Chien Hydropower Station	12
New PSPP No 1 JN	13
Bao Lac Hydropower Plant	14
A Sap Hydropower Plant	15
Bac Me Hydropower Plant	16
New PSPP No 2 JN5	17
Hua Na Hydropower Plant	18
Bung 4 River Hydropower Plant	19
Serepok 3 Hydropower Plant	20
Dakmi No 1. Hydropower Plant	21
Bac Quang Hydropower Plant	22
Ankhe Kanak Hydropower Plant	23
Bung 2 River Hydropower Plant	24
Ban Muc Hydropower Plant	25
Huoi Quang Hydropower Station	26
Hydropower Plant Buon Tua Srah	27
Lai Chau Hydropower Plant	28
Ban Uon Hydropower Plant	29
Pa Vinh Hydropower Plant	30
Nuclear power plants	
Hoa Tam Nuclear power plant	1
Phuoc Dinh Nuclear power plant	2

As a result of reviewing the checklist, the 18 highest ranking candidate sites, which have smaller impact, are HPPs; middle rank of 19 to 29 are mix of HPPs and TPPs, and TPPs concentrate in the lowest rank under 30.

The two nuclear candidate sites were ranked very low at the last and 4th from the bottom.

TPPs have bigger influences than HPPs, by evaluating each candidate site based on the IES result from the view point of environmental and social considerations.

It is undeniable that the strategic environmental and social considerations tends to undigested because of the SEA was applied to PDP 6th for the first time. However, in the case of preparing the power development plan which covers whole country of Vietnam, the plan should be built based on the strategic way of thinking, taking into consideration IES results.

Meanwhile, IES of this time was carried out mainly in the office. When developing each candidate site, IEE and EIA should, therefore, be executed carefully focusing on the conditions of each site.

8.4 Interpretation of IES Results and SEA

8.4.1 PDP 6th from the Viewpoint of Environmental and Social Considerations

As shown in Figure 8-4-1, power generation in 2005 was around 11,000 MW, and 7 times of that, around 79GW will be developed by 2025 according to the PDP 6th and the 42.5% will be developed in the North, 57.5% in the Central and South.

Figure 8-4-2 shows the Best Mix of Power Development in the PDP 6th. The composition rate by power source is planned to change from now to the year of 2025 as follows;

- Hydro-power (incl. PSPP) : from 37 % to 23 %
- Coal Thermal Power: from 13 % to 43 %
- Gas Thermal Power: from 38 % to 18 %
- Nuclear Power: from 0% to 9 %
- New and Renewable Energy (less than 30MW of small HPP, Wind, Bio-mass, Solar Energy): to 1 %

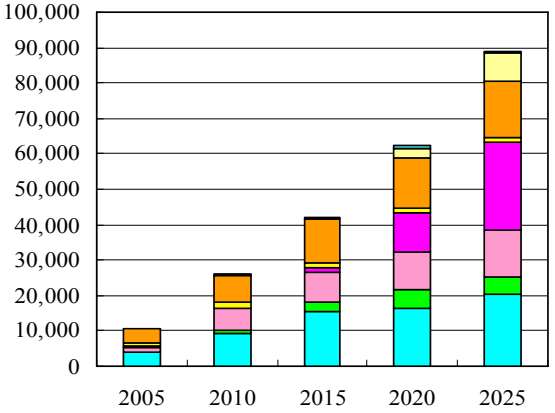


Figure 8-4-1 Installed Capacity by Power Source in the PDP 6th

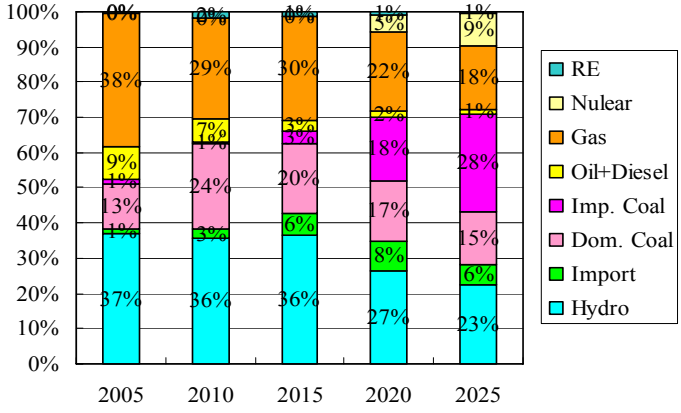


Figure 8-4-2 Installed Capacity Composition in the PDP 6th

Namely, installed capacity and composition rate of coal thermal plants will expand largely in the both the North and the Center & South.

On the other hand, development potential of HPP is estimated as 300 TWh of generation energy theoretically (180 TWh in the North, 78 TWh in the Center and 44 TWh in the South), and 82 TWh (20.6 GW of Capacity (17.6 GW of big and middle scale hydropower plants)) is estimated as feasible development potential. According to the PDP 6th, conventional hydropower of 16 GW is planned to develop by 2017. This means that there is a little room for further conventional hydro-power development.

8.4.2 SEA on PDP 6th

(1) Policy

The concept of the National Energy Policy of Ministry of Industry is summarized below.

① To develop energy resources and to keep energy security with protection of natural resources and environment.
② To change the energy sector to competitive energy market.
③ To propel export / import of energy resources.
④ To promote international cooperation and introduce foreign investment.
⑤ To develop energy along international environmental standard.
⑥ To accelerate introduction of new energy / renewable energy.
⑦ To minimize energy consumption elasticity.
⑧ To enforce power network.
⑨ To commence national storage of oil.
⑩ To introduce nuclear power plants and increase the share of nuclear power generation.

The most important points are "① Energy security and natural resources and environment conservation" first, "④ Promotion of international cooperation", "⑥ Introduction of new and renewable energy", "⑦ Minimization of energy consumption elasticity" and "⑩ Increase of share of nuclear power generation".

(2) Plan

The plan of PDP 6th is to develop around 78 GW electric power supply to meet the demand of Base Case by the year 2025.

(3) Program

The program of the PDP 6th is to develop 16 GW of HPP, 5 GW of import, 48 GW of TPP (36.5 GW of coal TPP [including 25 GW of imported coal TPP], 12 GW of Gas), 8 GW of nuclear power, and 0.6 GW of renewable energy between 2006 and 2025.

Abstract concept is shown in Figure 8-4-1 PDP 6th and SEA, Environmental and Social Considerations.

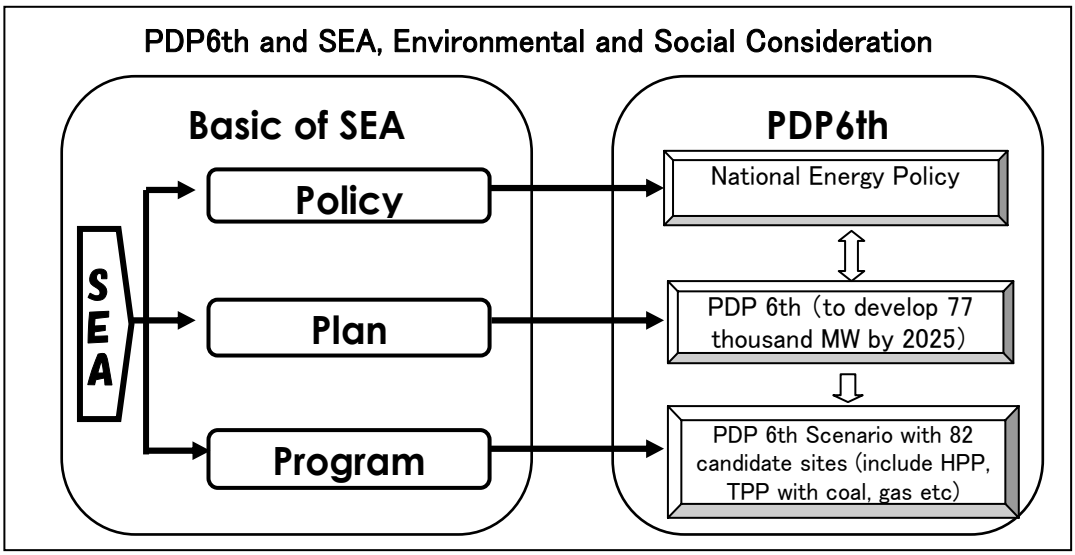


Figure 8-4-3 PDP 6th and SEA, Environmental and Social Considerations

PDP 6th scenario has the following characteristics compared to the National Energy Policy.

- ✓ All new coal thermal power plant in the South after 2016 is planned to generate with imported coal（③ To Promote energy resources import / export）
- ✓ Import hydropower electricity will increase after 2013（④ To accelerate international cooperation）
- ✓ To introduce 1000 MW * 8 nuclear power plants（⑩ to introduce nuclear power）

At the same time,

- ✓ ⑥ Introduction of New / Renewable energy is also reflected in the development scenario

According to the IES results, items which have strong impact on the socio-environment are Minorities, Involuntary Resettlement and Agriculture, and each of them is related with Involuntary Resettlement.

Items which have strong impact on the environmental issues are Air Quality and Climate Change – Global Warming.

Two alternatives are prepared as SEA of the PDP 6th selecting the biggest influence on each of social aspect and environmental aspect.

Alternative I is the lowest impact on the social aspect and alternative II is the lowest impact on the environmental aspect.

Thus, three ideas, the lowest cost scenario, alternative I and alternative II, are discussed.

8.4.3 Alternative Study

(1) Study for Involuntary Resettlement

The number of involuntary resettlement households in the candidate sites of TPP are 0 to 280 (mostly less than 5 households) and on the other hand, in the candidate sites of HPP, there are 0 to 3,000 households (mostly less than 500 households). Larger numbers of households are in the HPP sites and most of them are minorities.

The results of the study on the involuntary resettlement are shown in Table 8-4-1.

Table 8-4-1 Distribution of Households in Candidate Sites for HPP

Number of Households	>2,000	>1,000	>500	<= 500	ND	Total
Candidate Sites	1	5	4	16	6	32

The relation between the number of households and the power generation capacity is shown in Figure 8-4-4.

Figure 8-4-4 indicates that the top 4 (four) candidate sites account for 55% (around 6,800 households) and total generation capacity of those top four sites is around 17% (935 MW) of total capacity.

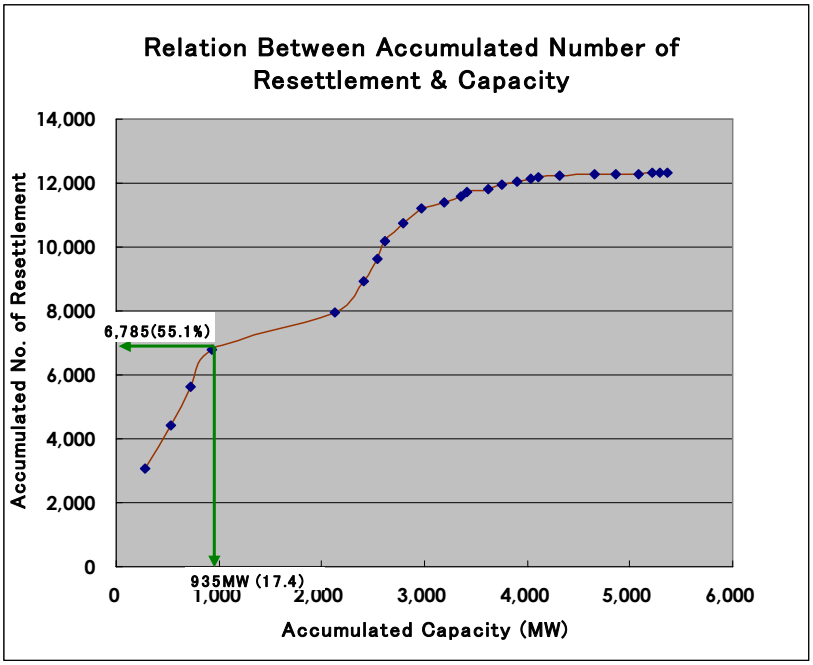


Figure 8-4-4. Relation between No. of Resettled Households & Accumulated Capacity

Here, the cost for involuntary resettlement is VND 545milion / household （=VND 10,294.915 billion / 18,897 households） as an example. Namely, US$ 34,500 / household were

applied. The ratio of the cost for involuntary resettlement in the total construction cost is 40%, in this case showing the highest rate of all cases.

One of the reasons is that the developer should compensate minorities who tend to require land, where the soil quality and other conditions for agriculture are similar to the area where they used to live, and better houses near to the alternative land.

This example has the highest number of involuntary resettlements. As for the study result, most candidate sites should prepare for less than 500 households of involuntary resettlement. In this case, the rate of the cost will be 5 to 10 % of total construction cost which is around 1/5 of the example.

Involuntary resettlement in case of construction of TPP, the rate of the cost seems to be lower because the main inhabitants are ordinary farmers and the migration issue is easy to solve by compensating a reasonable amount of money without preparing land and houses. (They look for appropriate and favorite land and build houses by themselves).

(2) Study on Air Quality, Climate Change – Global Warming

Coal thermal power plants release sulfur dioxide (SO_2) in the emission gas by burning sulfur (S)-containing coal and solid waste as fly ash. This is an origin of environmental pollution. SO_2 content in the emission gas is reduced by selecting more suitable raw materials, installing of SO_2 gas treatment / sulfuric acid production system, etc. Solid waste is generally reduced to be reused as raw material for cement. However, the reduction of carbon dioxide (CO_2), which is generated by combustion and has a greenhouse effect causing global warming, is quite costly to treat and large-scale equipment generates a huge amount of solid waste (in the case of the calcite absorbing method, calcium carbonate [$CaCO_3$]) and is therefore impracticable.

Namely, CO_2 generation is a cause of global warming (climate change) and is more serious than environmental pollution caused by SO_2 or solid waste.

Amount of CO_2 generation of each type of power unit per kWh is shown in Table 8-4-2 and Fig 8-4-5.

Table 8-4-2 Unit Amount of CO_2 Generation of Each Type (g/kWh)

Coal TPP	975	(=887+88)
Oil TPP	742	(=704+38)
LNG TPP	608	(=478+130)
LNG-combined cycle PP	519	(407+111)
Solar energy	53	
Wind energy	29	
Nuclear Generation	22	
Geothermal energy	15	
Middle and small scale HPP	11	

Source: HP of Ministry of Environment in Japan

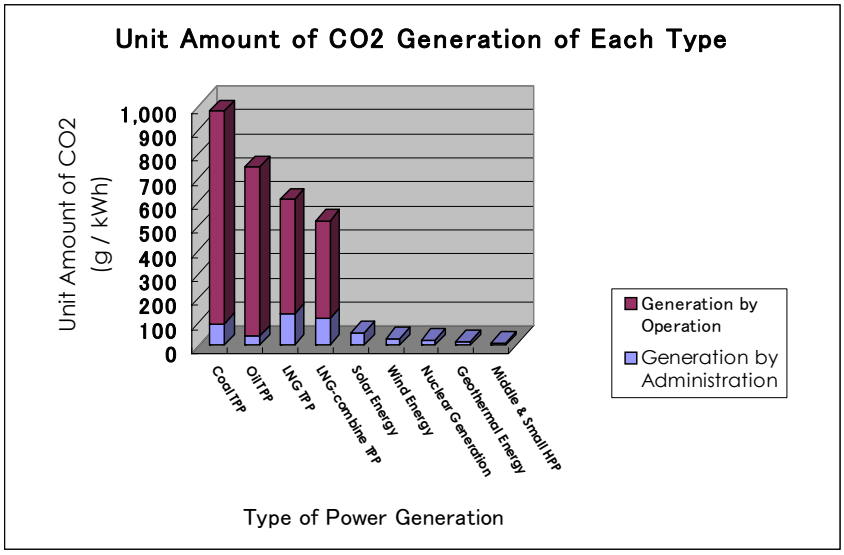


Figure 8-4-5 Unit Amount of CO2 Generation of Each Power Generation Type

CO_2 emission amount in case of the plant capacity 1,000MW, yearly operation rate 70% is estimated by following formula.

CO_2 emission amount = (unit amount [g/kWh]) * 1000 MW * 24 hr * 365 days/ year * 70 %
= 6 million tons / year

Furthermore, generation of CO_2 lasts for the entire lifetime of operation.

Amount of CO_2 generation by TPP (millions tons) is therefore larger than loss of CO_2 absorption capacity caused by HPP (hundreds thousand tons).

With that, let's try to apply CO_2 emission right trade based on the Kyoto mechanism (CDM).

CO2 emission price will be decided by the market mechanism, and generally trade seems to be done at the price of US$ 5/t-CO_2 at present (2005). However, they say the price will rise up to US$ 10 by 2010.

CO_2 estimation price is difficult to predict because of differences in each county's policy. However, when the carbon credit price of US$ 10/t-CO_2 is applied income of carbon credit trade is equivalent to US$ 60 million each year for CO_2 emission of 6 million tons / year generated by 1,000MW coal TPP.

The service lifetime of the thermal power plant is said to be 25 years.

On the other hand, the unit construction cost of hydro power plant is limited to a maximum US$ 1,700 / kW from viewpoint of economical efficiency.

In case that Discount Rate of 10% is applied, the net present value of the carbon credit would be approximately US$ 511 / kW by following formula. Therefore, the limit construction unit cost of hydro power plant may increase up to US$ 2,211 / kW (1,700 +511).

$$PVn = FVn / (1+r)^n$$

R : discount rate n : term (year)

FVn : estimated value in the 'n'th year

PVn : present value of estimated value in the 'n'th year

The introduction of a carbon credit idea provides an additional 30% (= 511 / 1,700) "allowance" for unit construction cost of hydropower plants.

(3) Study on Alternatives

Comparison of the level of influences between social aspects and environmental aspects is not easy. The Study Team recommends two alternatives, one of social aspects and the other of environmental aspects, as follows.

- **Alternative I : Replace the highest 4 ranks of HPP candidate sites, which require large scale involuntary resettlement, with other HPPs with less involuntary resettlement and / or imported HPP energy.**

The top four candidate sites of HPP, which require large-scale involuntary resettlement, are shown in Table 8-3-4.

All 4 sites are located in the North region, and total plant capacity is 935MW.

Table 8-4-3 Top 4 HPP Candidate Sites Which Would Have Large Scale Involuntary Resettlement

	No. of Household	Location	MW	Observation
Bac Me	3,067	N	280	
Ban Uon	1,338	N	250	
Hua Na	1,200	N	195	The largest number of estimation (800 - 1200)
Nam Chien	1,180	N	210	
Total	6,785		935	

By introducing CDM, limit construction cost may have 30% more allowance as 511 US$ / kW. With this alternative, involuntary resettlement of nearly 7 thousand households would be disengaged by replacing these HPP developments with other domestic HPP and/or import hydropower.

It can be said that maximum US$ 2.4 million (=$34,500*7,000) of resettlement cost would not be needed to prepare avoiding destruction of 24 thousand households lives which is more than 55 % of necessary total involuntary resettlement households.

- **Alternative II：Replace import coal TPP to HPP and / or Renewable Energy**

New coal thermal power plants developed after 2022 in the North are planned to use imported coal. On the other hand, in the Center and South, coal thermal power plants with imported caol will be put into operation since 2016 and its total capacity will drastically increase. Thermal power using imported coal is planned in the PDP 6 th scenario as 10,600MW in the North and 14,250MW in the Central and South, for a total of 24,250MW.

This alternative is the plan to replace imported coal thermal power plants with hydro power plants and or renewable power plants in view of energy security and reduction of CO_2 emission (contribution for the protection of global warming).

As mentioned in section 8-4-1, according to the PDP 6th, almost all feasible hydropower potential will be developed by 2017.

It is better to develop more hydropower plant sites and to accelerate the development of renewable energy to postpone development of thermal-power taking into consideration the limit construction unit cost as 2,211 US$ / kW (30% higher than usual) as discussed in the section of ‘Air Contamination’ before.

8.4.4 PDP 6th with SEA

The best mix of the PDP 6th was shown as Figure 8-4-2 in the clause 8-4-1, again showed as Figure 8-4-6 for comparison.

The best mix of the PDP 6th was reviewed as shown in the Figure 8-4-7, as the result of reexamination on the power development taking into consideration the proposed alternative of SEA.

Although the renewable energy was planned to develop 600MW by 2025 in the PDP 6th first plan. Then, 1,900 MW (1,400 MW of hydropower, 500 MW of wind power) of new candidate sites were added and the composition ratio increased from 1 % to 3 %. Along with this, composition ratio of coal thermal generation decreased from 43 % to 41 %.

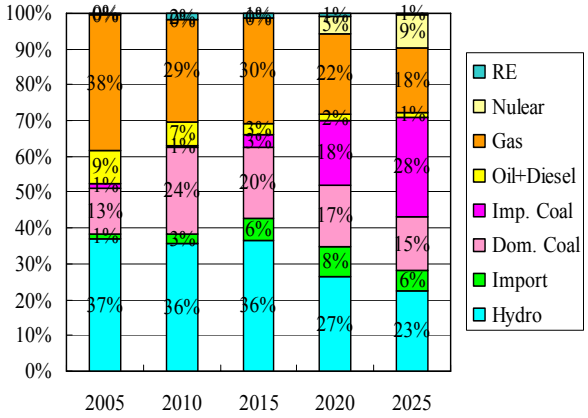


Figure 8-4-6 Installed Capacity Composition in the PDP 6th

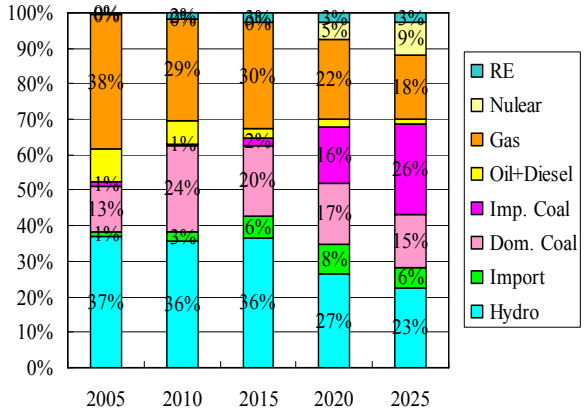


Figure 8-4-7 Installed Capacity Composition with Consideration of SEA Result

The alternative I is not reflected in the PDP 6th at the stage of the draft final report, however, IE staff recognize this and it is expected that candidate sites which require less number of involuntary resettlement households are developed preferentially according to the recommendation of alternative I .

In the study on the master plan, it is also necessary that wide ranged power supply network connecting multiple power plants be revised.

It was observed in the IES results of each candidate site that protected areas were avoided as much as possible in view of environmental considerations. However, in the PDP 6th construction of country wide power supply network should be planned, taking eight times of power supply capacity into consideration. Accordingly, considerations from the viewpoint of SEA are also necessary when conducting concrete studies on the power network.

This time, environmental and social considerations study was carried out with counterpart personnel to prepare the PDP 6th master plan, complying with the JICA's Environmental and Social Considerations Gude-lines.

It is expected that this experience can be the first step to do more strategic environmental and social considerations and more effective SEA will be introduced in the following master plan study .

8.5 Mitigation of Negative Environmental Impacts

8.5.1 Environmental Negative Impacts Caused by Power System Development

(1) Hydro Power Plant Development Plan

(a) Construction Stage

[Direct Impact]

- Involuntary resettlement (tentative)
- Deforestation (tentative)
- Water temperature increase (sustainable)
- Topography / geography (sustainable)

[Indirect Impact]

- Biodiversity (tentative)

We have to focus on the involuntary resettlement of minorities who live in the mountains and live with agriculture, in case of hydropower plant development.

Namely, preparation of land that has similar qualities, distribution of living space, acknowledgement of inhabitants' opinions, condition of migration, compensation method for different life styles, etc.

(b) Operation Stage

[Direct Impact]

- t increase (sustainable)
- Topography / geography (sustainable)

[Indirect Impact]

- Aquatic ecology (sustainable)

(2) Coal thermal Power Plant Development Plan

(a) Construction Stage

[Direct Impact]

- Air pollution (suspended solids etc.) (sustainable)
- Noise and vibration (sustainable)

(b) Operation Stage

[Direct Impact]

- Air Pollution (SO_2 gas, NOx, suspended solid etc.) (sustainable)
- Water Pollution (alkali waste, SS, hazardous materials) (sustainable)
- Water Temperature Increase (sustainable)

・Impact on coastal zones (water pollution) (sustainable)

[Indirect Impact]

・Climate change by CO_2 emission (sustainable)

・Solid waste (fly ash): quantity and quality (sustainable)

・Deforestation and impact on ecology (caused by air pollution / acid rain) (sustainable)

In particular, focus on the relation between the quality and impurity of domestic and imported coal, and quality of emission gas.

(3) Gas TPP Development Plan

(a) Construction Stage

[Direct Impact]

・Water temperature increase (sustainable)

・Noise and vibration (sustainable)

(b) Operation Stage

[Direct Impact]

・ Water temperature increase (sustainable)

[Indirect Impact]

・ Climate change by CO_2 emission (sustainable)

Gas thermal power plants generate very few air pollution impurities like as SO_2 and solid waste, compared to coal power plants.

A negative impact of gas TPP development is climate change.

(4) Nuclear PP Development Plan

(a) Construction Stage

[Direct Impact]

・Air pollution (suspended solids etc.) (sustainable)

・Noise and vibration (sustainable)

(b) Operation Stage

[Direct Impact]

・ Water temperature increase (sustainable)

・ Radioactive waste (solid waste) (intermittent)

[Indirect Impact]

・ Psychological impact on neighboring residents (sustainable)

In particular, psychological fear for radio isotope influences in case of accidents is very large.

The point of environmental and social considerations in nuclear power plant development is how to treat the radioactive waste (solid waste).

(5) Power Network Development Plan

(a) Construction Stage

[Direct Impact]

・Air pollution (suspended solids etc.) (sustainable)

・Noise and vibration (sustainable)

(b) Operation Stage

[Direct Impact]

・ Influences on the scenery (sustainable)

[Indirect Impact]

・Pollution by bird droppings (sustainable)

・Psychological Impact on neighboring residents (sustainable)

[Others]

・Electrocution accidents Scattering of broken insulators

Following general items will occur in the operation stage.

- Solid waste (construction material, waste material)
- Noise (operation of construction equipments, transportation equipments)
- Vibration (operation of construction equipments, transportation equipments along road)

8.5.2 Mitigation of Environmental Negative Impacts

Vietnam is long country stretching 1,800km from north to south. Mountain range runs along the western area where the border to neighboring countries is, and there are four distinct seasons even in the semi-tropical zone. The topography is complex, made up of mountain ranges with tropical rain forests, a delta area and a coastal zone. Various flora and fauna with biodiversity occur in all areas of the country.

Careful study should therefore be needed for executing development of each power candidate site. This includes treatment of indigenous minority people.

Also, Vietnam is a prominent tourist country, having tourist resorts in the coastal zone such as Ha Long bay in the northern area, Da Nang in the central area and Nha Trang and Vung Tau in the southern area. Furthermore, it has long coast-line around 2,000 km from north to south and obtains abundant marine products. It is very important to maintain the water quality of the costal zone.

Environmental and social impacts of each type of power generation are explained.

The mitigation method for each environmental and social impact is discussed as follows.

[Mitigation of Environment related Impact]

As shown in the Item 8.3.2, standard values of SO2, NO2 and Dust are 5 mg / m3, 5 mg / m3 and 4 mg / m3 respectively according to the regulation for atmosphere in the Vietnam (TCVN-5937, 5938-1995).

There should be applied severe emission gas treatment on each development site to achieve these environmental regulations.

The Study Team, therefore, recommends introducing following emission gas treatment systems, which are utilizing in the advanced countries including Japan.

(1) Mitigation and reduction of air pollution (SO_2 gas, NO_2, SS etc)

Generally, air pollution is caused by emission of polluted complex gases, which arises by oxidation reaction in the combustion stage. The density varies depending on the components of raw material and exhaust gas treatment method.

a. Thermal power plant

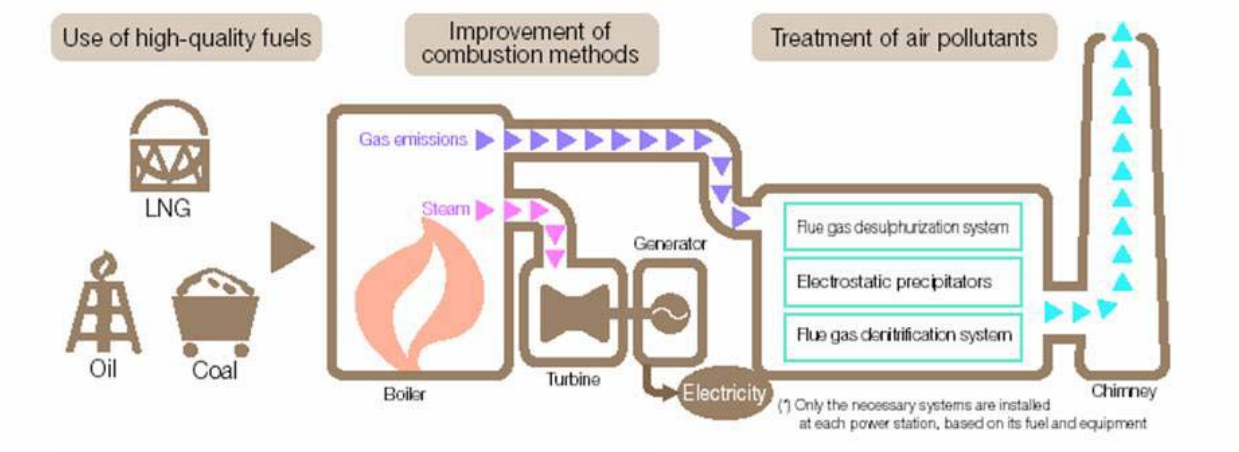
The quality of raw coal is different in each country or area, but sulfur (S) is very common air pollutant. Mercury (Hg), Arsenic (As), Cadmium (Cd), Chromium (Cr) etc. are also polluting materials that are included in very small amounts as emission pollutants of coal thermal power plants.

Some kinds of coal contain radio isotropic materials such as uranium and / or thorium.

Because the coal which is produced in the North of Vietnam is considerably high quality anthracite and contains very few toxic heavy metals and isotope materials, density of pollution materials in the emission gas which pass through dust collector and de-sulfurization system are improved as much as negligible.

Fuel gas contains little pollution materials, especially sulfur, in fuel gas and dust are not emitted from the gas thermal power. Treatment of NOx is only required.

A general emission gas treatment method is shown in Figure 8-5-1.



Source : Tokyo Electric Power Company Homepage

Figure 8-5-1 Air Pollution Mitigation Method for Thermal Power Plants

Namely, after combustion gas is used for steam generation, it is cleaned by passing thorough de-nitrogen process, dust collection process and de-sulfurization process, and then discharged into the air.

1) De-nitrofication Method

There are two types of Oxide nitrogen (NOx). One is Thermal NOx, which is generated by oxidizing reaction of nitrogen and oxygen in the air, and the other is fuel NOx, which is generated by the oxidizing reaction of nitrogen contained (around 0.7 to 2.2 weight %) in the raw coal.

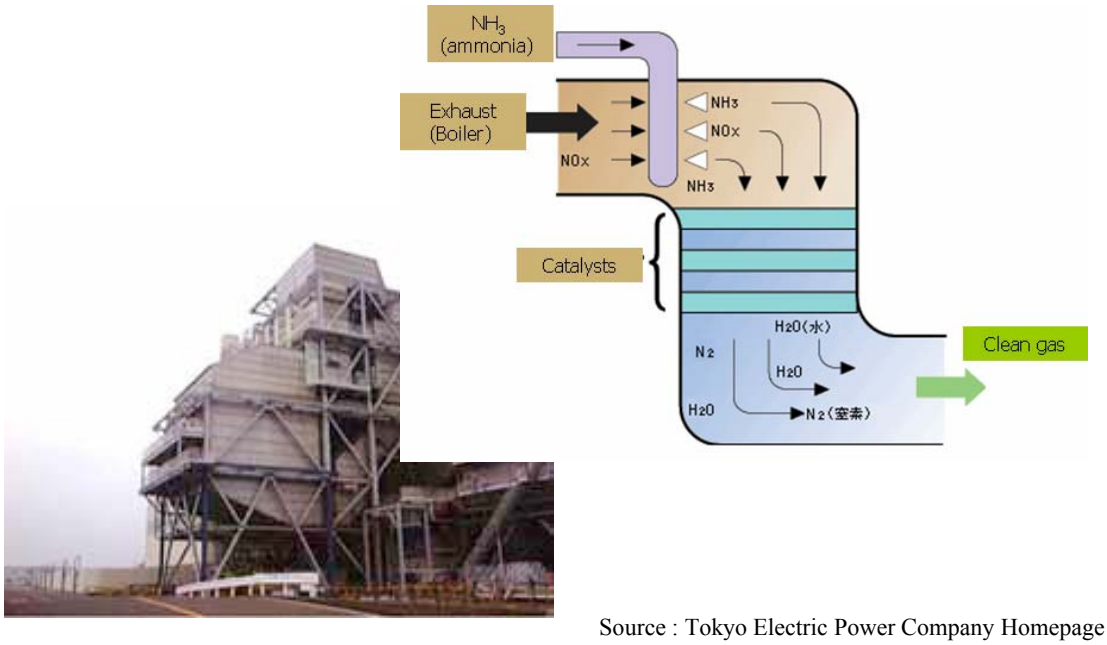
The former is generated less when the combustion temperature is lower, and there is less oxygen content in the combustion zone and shorter retention period in the higher temperature zone. Namely, NO_2 is reduced by good combustion control (operation control).

The lower N content is in the raw coal, the less the latter is generated. That is, one should select high quality coal, or eliminate N beforehand by hydrogen addition method etc. or replace the combustion material.

Main part of NOx consists of NO, which has low reaction ability and is difficult to eliminate, and NO_2 content is small.

Various kinds of de-nitrofication methods of exhaust gas have been studied. The recent main method is contact-de-oxidization method with ammonium.

$$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_20$$



Source : Tokyo Electric Power Company Homepage

Figure 8-5-2 Emission Gas De-nitrification System (for Treatment of NOx)

The following method is also used.

$$2NO + ClO_2 + H_2O \rightarrow NO_2 + HCl + HNO_3$$

2) Dust Collection

Generally, the dust size of coal thermal plants is considerably large (13 to 40 micro- meter of central value diameter (dP50)) and easy to collect.

The following dust collection methods are popular.

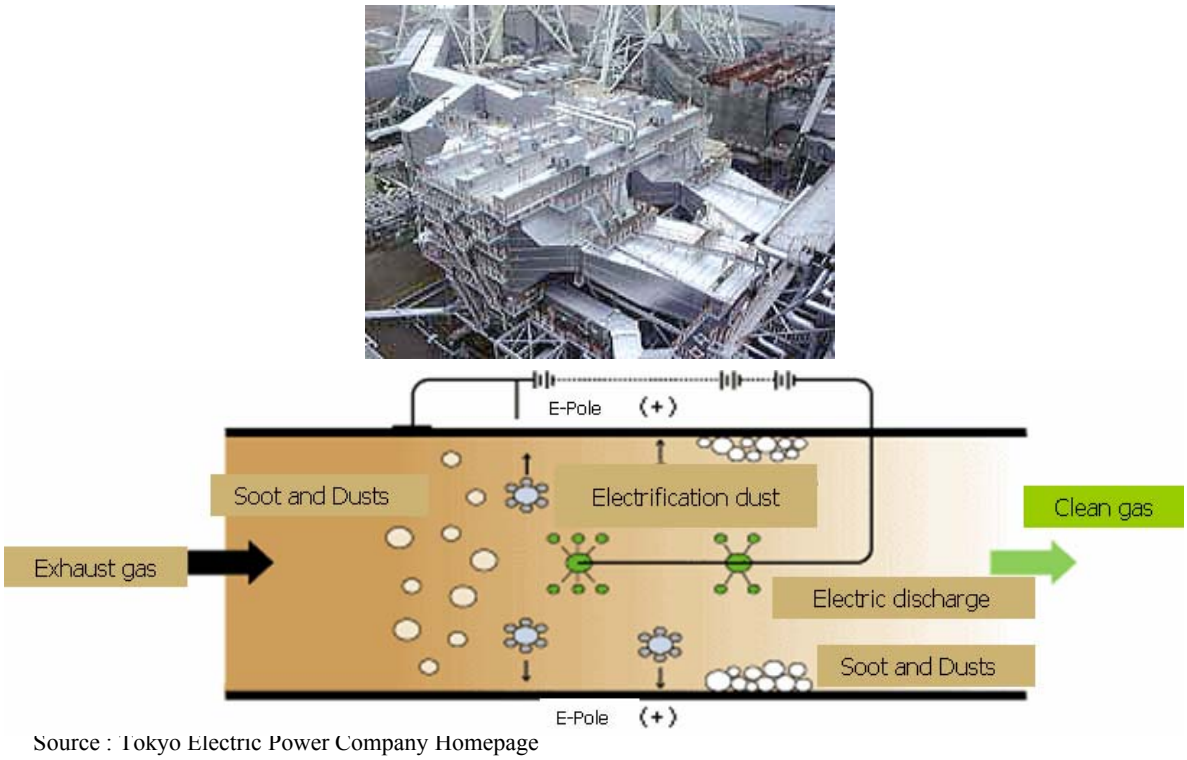
- Physical method (gravity, inertia power, centrifuge power, diffusion power)
- Electric method (electric power)
- Others (sonic wave etc.)

Combined system of those methods results in higher efficiency for dust collection. The main stream is to combine cyclone, which uses centrifuge power; filter, which uses diffusion power; and an electric dust collector, which uses electric power.

Components of boiler dust by combustion of micro powder coal are shown in Table 8-5-1.

Table 8-5-1 Components of Boiler Dust by Combustion of Powdered Coal

Element / Raw Material		SiO_2	Al_2O3	Fe_2O_3	CaO	MgO	H_2O	SO_3	Ig.Loss
Powder Coal	A	62.1	25.5	3.5	5.7	1.1	0.2	0.7	0.5
	B	54.3	26.3	5.3	5.9	1.6	0.3	0.6	2.4



Source : Tokyo Electric Power Company Homepage

Figure 8-5-3 Electric Dust Collector System (for Dust Treatment)

3) De-Sulfurization Method

Generally, coal contains 0.3 to 2.6 weight % of sulfur (S), but the rate varies considerably at each production area.

This 'S' is oxidized by combustion, changing it into SO_2 and mixing it into the emission gas.

De-sulfurization is classified into two methods, namely the wet method and the dry method. The wet method is the main method at the moment.

- Wet method

- Absorption method with hydroxide soda （NaOH） or sodium sulfite (Na_2SO_3)
- Absorption method with ammonia (NH_4OH)
- Absorption method with calcium carbonate ($CaCO_3$) or cal ($Ca(OH)_2$) slurry
- Absorption method with magnesium hydroxide ($Mg(OH)_2$) slurry
- Absorption with alkali sulfuric aluminum liquid (<1-x>Al2(SO_4)$_3$・xAl_2O_3)
- Absorption with oxidation

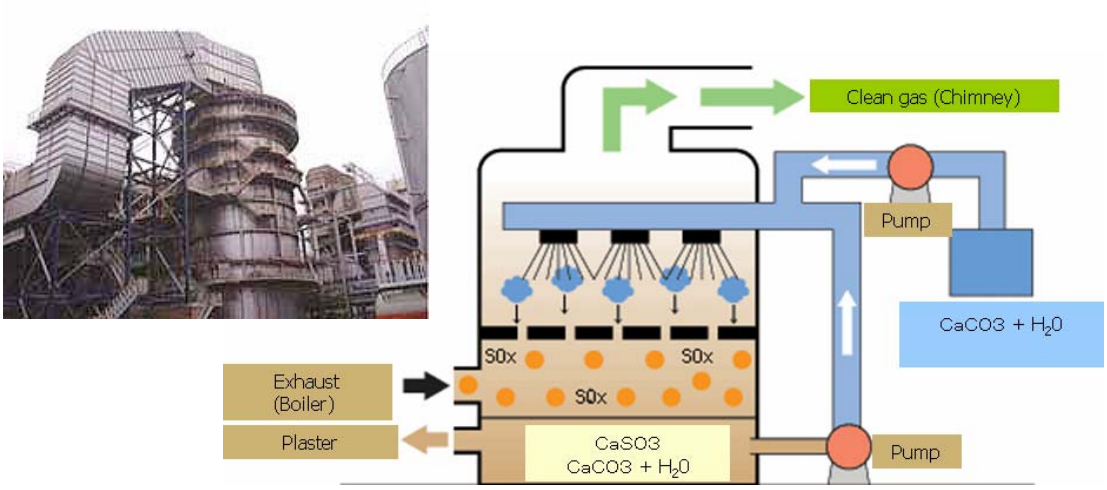
- Dry method

- Adsorption with activated carbon
- Stabilization with heated calcite

Almost all of the toxic elements contained in small amounts in the emission gas are also recovered as they pass through the treatment system mentioned above without dispersing.

On the other hand, huge amounts of solids remain in combustion, so called "fly ash" in case of coal thermal power plant and treatment of this "fly ash" is also problem.

Part of the fly ash is utilized as material for cement, while the rest is stock-piled.



Source : Tokyo Electric Power Company Homepage

Figure 8-5-4 Desulphurization System for Emission Gas (for Treatment of SOx)

b. Reduction of CO_2 gas emission

Thermal power plants generate carbon dioxide (CO_2) from the carbon (C) contained in the raw material. There is a theoretical CO_2 reduction method that is, absorption by alkali liquid, but CO_2 is generated in huge (cf. Table 8-4-8) and the alkali liquid absorption method create a very large amount of solid according to the CO_2 amount. These generated solid (Calcium Hydro-oxide: $Ca(OH)_2$ etc.) have to be held in piling waste dams at high cost. This is not realistic.

It is better to reduce CO_2 generation by selecting an appropriate power generation type, which has less CO_2 per unit power. (Refer to Table 8-5-2)

Table 8-5-2 CO_2 Generation per Calorific Value

	Coal (Anthracite)	Diesel Oil	Natural Gas	LPG	Note
Calorific Value	8,000 (kcal/kg)	11,500 (kcal/kg)	12,000 (kcal/m3)	24,500 (kcal/m3)	
CO2 generation (kg-CO_2/kg or m3)	3.3 (kg-CO_2/kg)	3.1 (kg-CO_2/kg)	2.63 (kg-CO_2/m3)	3.04 (kg-CO_2/m3)	
CO2 generation (g- CO_2/kcal)	0.41	0.27	0.22	0.12	

(2) Mitigation and reduction of water pollution (Alkaline waste, SS, Toxic impurities)

Mitigation and reduction of water pollution caused by power development must be examined by separating two stages, the construction stage and the operation stage.

a. Construction Stage

- Suspended Solids (SS)

Soil, sand and dust caused by construction pour into nearby rivers and lakes, polluting the water.

The countermeasures to protect against water pollution are as follows.

- To install SS settling equipment such as settling ponds for treating all the water collected from each yard.
- To settle the dust (shower, use of wet reagent etc.)
- To prepare by-passes, banks for protecting river and lake from inflow of soil and sand during construction in the river or lake.
- To manage blast control and blasted rock and sand control paying attention to water pollution prevention.

- Oil

There is high possibility that lubricant and oil leaked from construction machines and transportation equipments flow in rivers and lakes.

- An oil separation system should be installed before settling system for SS (simple oil fence etc.).

- Toxic heavy metals

Sometimes, heavy metal minerals which exist underground come out on the surface by blasting and are oxidized by humid air and / or rain causing acid water including toxic heavy metal ions such as arsenic (As) ion.

Originally this was said to be natural pollutions, however, since it occurs in line with construction, it can be said to be artificial pollution.

It may be necessary to introduce a treatment method for heavy metal ions such as the coagulation sedimentation method, neutralization sedimentation method etc.

b. Operation Stage

- Alkali Water

There is chance that Alkali water, which occasionally including cyanide (CN), mixes in the discharge water form the coal stockyard in coal thermal power plant.

- Simple alkali water is easy to treat by neutralizing; however, if the liquid contains cyanide, a cyanide treatment system is necessary, as two-stage decomposition system with hypochlorite soda etc.

- Discharge water with heavy metal ions

When raw coal contains heavy metal minerals (As, Hg etc.), some of those heavy metals are volatilized into emission gas in the combustion stage and the rest are oxidized and mixed into fly ash, which is generated in huge amounts. These oxidized heavy metals are easily dissolved in water, changing the water pH low to acid.

- Heavy metal ion treatment system is necessary.

(3) Mitigation and Reduction of Solid Waste (Fly Ash)

Coal ash is generated as solid waste after combustion of coal thermal power generation.

There are two types of ash; clinker ash and fly ash. Clinker ash forms fine gravel and coarse sand size and the particle distribution is similar to that of sand. Fly ash is deposited along ducts or chimneys, or collected by dust collectors.

Raw coal consists of 92 – 95% of carbon, 2 – 5% of volatile components and 3 – 5% ash, and this ash changes to solid waste. This means that 1 ton of coal generates tens of tons of ash. Fly ash is sometimes utilized as cement material, but its consumption depends on the demand.

If there is an increase in coal thermal power plants, since all of ash generated will not be utilized for cement material, waste deposit or piling dam for stock should be prepared.

If the ash contains toxic heavy metals or radioactive components, a treatment process would be necessary.

(4) Deforestation, Reduction of CO_2 Absorption Capacity

Developing hydropower causes more deforestation than any other type of power development. It may submerge hundreds or thousands hectares forest.

Forests contribute to CO_2 absorption. While the CO_2 absorption capacity is discussed as the carbon fixing amount, there is no established theory. Calculations generally assume the values indicated in Table 8-5-3.

Table 8-5-3 CO_2 Fixing Capacity by Forest Type

	Tropical Rain Forest	Sub-tropical Rain Forest	Temperate Zone Forest	Sub arctic ace rose tree zone	Tundra ace rose tree zone
CO_2 Fixing Capacity ($t\text{-}CO_2/ha$)	100 - 150	80 - 100	60 - 80	40 - 60	<40

It is said that the carbon fixing ability of tropical rain forests is 380t-CO_2 / ha. We have to avoid development which causes deforestation as much as we can, especially because global warming is being accelerated by desertification and deforestation.

Following countermeasures should be considered

- Select the area where there are low trees and bushes avoiding big tree forest when choosing candidate sites.
- Avoid national parks, natural parks and protected areas.
- Plant trees to maintain the same value of CO_2 absorption reduction at an alternative area.

(5) Mitigation of Impact for Ecology

Impacts on the ecology caused by power development and mitigation measures are as follows. It is necessary to understand current conditions beforehand.

- Impact on the fauna by submerging
  - Select an area where there are not so many native big animals and precious species.
  - Relocate nature big animals and precious species to alternative land with the similar conditions.
- Separation and isolation caused by construction of dam, access road etc.
  - Prepare transportation method for residents
  - Prepare crossroads, tunnels, canals, etc. for animals
  - Set fish way
- Impact on aquatic biology caused by warm discharge water
  - Install buffer pond before release.
  - Install flow velocity reduction system (cascade etc.)
- Impact on the flora caused by emission gas with dust
  - Install appropriate dust collectors matching the characteristics of the dust (size distribution, elements, electrostatic etc.)
- Impact on the flora and fauna caused by acid rain include SO_2 gas
  - Select raw materials which contain less sulfur (S) (fuel conversion)
  - Set up a high efficiency de-sulfurization system
- Impact on the flora and fauna caused by chemical oxidants with NOx
  - Select raw materials which contain less nitrogen 'N' (fuel convert)
  - Introduce a combustion method which suppresses NOx generation, discussed in the item '(1) - a'
- Influence of noise and vibration on the surrounding area (including very low frequency waves)

- Grasp actual conditions beforehand
- Use low noise and vibration protection equipment in construction work
- Arrange working time to minimize impact on surrounding area (agriculture time etc.)

● Impact of dust by construction work

- Suppress dust dispersion (sprinkle, use of humid reagents etc.)
- Control working time of construction, transport.
- Pave around offices, access / transportation roads with water permeable asphalt.

(6) Protection of Water Temperature Change

Refer to item '(5)'.

(7) Mitigation of Negative Impacts on Aquatic Ecosystem

It is impossible to avoid impact completely in the construction stage. It is therefore very important to reduce impact as much as possible. The most affected objects are aquatic biology in rivers and lakes, aquatic flora of costal zones, biodiversity etc. Therefore, it is necessary to mitigate as much impact as possible by studying the impact on their respective growth and life cycles beforehand.

Refer to item '(5)'.

(8) Influences on Biodiversity

Refer to items '(5)' and '(7)'.

(9) Protection of Topography, Geography

Securing land for power development is indispensable.

Issues in line with securing land are shown below. Those are almost all environmental and social considerations items.

- Impact on residents
- Impact on the biology
- Impact on the aquatic ecosystem
- Impact on the biodiversity
- Deforestation
- Water pollution
- Variation of water temperature
- Air pollution
- Solid waste treatment

In addition, Protection of topography and geography is also important.

Generally, thermal power plant development requires reclamation of wetlands, and affects the biology of aquatic ecosystem.

This includes impacts of imported soil and sand.

In the construction of hydropower plants, there are impacts by construction of auxiliary facilities for dam construction work, forest submergence, change of bottom and dam side geology by water pressure, and change of underground water routes, quality and quantity etc...

It is important to consider that besides the influences by direct construction works, temporary access roads, waste dumps, waste disposal land-fill, and sewage treatment systems for workers also have a big impact.

When developing each candidate site, it is necessary to execute Initial Environmental Evaluation (IEE) carefully by visiting the site and an Environmental Impact Assessment (EIA) by considering the particular impact of each power generation type.

[Mitigation of Social related Impact]

(1) Involuntary Resettlement

Since power developments require securing vast tracks of land, resettlement might be required. Even in the case of securing agricultural land, resettlement might be required indirectly..

Resettlement resulting from power development is basically involuntary.

As for mitigation methods for the involuntary resettlement, following countermeasures are considerable corresponding to each stage.

- Planning Stage
  - ① Design the number of resettlement households as small as possible.
  - ② Understand enough the opinion of resettlement people (to ask them to participate from the planning stage if possible)
  - ③ Design the resettlement issues so as to link with sustainable development (to consider so that the effected households would be able to enjoy benefits which arise by development), if the resettlement could not be avoidable.
  - ④ Consider confirming to sustain actual state of quality of life in case of securing alternative land.
  - ⑤ Consider making level of life after resettlement better than before.
  - ⑥ Developer establishes necessary organizations, which arrange consensus of households and have responsibility of compensation management with local

government etc. such as resettlement committee with resettlers in order to resettle smoothly.

- Execution Stage
  - ⑦ Prepare resettled area to make quality level area better than before (livelihood, infrastructure, transportation, school, hospital etc.)
  - ⑧ Prepare and offer immigration expedience and expense.
  - ⑨ Set up organizations and begin their activities concerning management of the compensation issues and the monitoring.
  - ⑩ Developers, the Government and local government prepare the framework on the resettlement policy which contains necessity of resettlement, economical and technical reasons, contents and method of compensation.
- After Resettlement
  - ⑪ Execute monitoring by administration organization.
  - ⑫ Evaluate the resettlement and to reflect the result on the development of the other area.

It is very important to intend to make better relationship and to keep it after development for the risk-communication grasping residents' consciousness and furthering residents' participation from the planning stage.

(2) Local Economy (Employment, Livelihood etc.), Land Usage, Regional Resources Utilization, Social Asset, Social Organization (Local Decision Making Organization), Actual Social Infrastructure, Social Services

There are differences of impact (positive and negative) by case which all the households are resettled, all the households stay or mix of them. Basically, negative impact should be planned to be solved fairly and to be considered improving the quality of life of the residents including positive impact.

In particular, in the case of agriculture and or fishery are (is) base of livelihood, it is necessary to endeavor to execute preliminary survey well to understand site information enough and to bring intent of the residents into play regarding the change of water right, environmental change of the growing of agricultural products, variation of amount and zone of fishery, isolation of passing rout, destruction of community society – decision making organization and dispersion, dividing of social infrastructure.

(3) Poverty, Indigenous Peoples･Minorities, Gender, Right for Children

- Poverty･Indigenous･Minority, Gender

Indigenous・Minority are tend to form poverty layer and put their base of life in the area where infrastructure is not developed. Most women and children of poverty are engaged in hard work to get water and fuels which are life line.

When the project is developed, contents and method of compensation aiming to improve quality of life of these poverty, indigenous, minorities and gender should be considered.

- **Right of Children**

As mentioned before, there is a possibility to live poverty, indigenous, minority in the development area. And, many children of them tend to be engaged in heavy labor. When undertaking development of the project, the system which disengages children from heavy labor and can give them enough education should be considered.

Furthermore, since most construction staff and workers would come to work with their family, number of children will increase at site area. Accordingly, infrastructure for children, like school, park etc. corresponding to the numbers of households, will be needed.

(4) Cultural Heritage

It is easy to make plan to protect and conserve cultural heritage in a development area when the country recognizes necessity to conserve officially approved heritage such as World Heritage, National Park etc., however, important cultural heritages are sometimes overlooked by differences of living habits between developing countries and developed ones. Therefore, environmental and social considerations expert should discuss fully with cultural science / archeology expert of the country / the area and get knowledge related before starting the study.

It can be said that the Vietnam has the treasure house of fauna & flora rather than cultural heritage. When each candidate site is developed, countermeasure for protection and conservation of such treasure should be necessary.

(5) Infectious disease as HIV/AIDS etc.

During construction, a large number of staff and workers enter into the site and make big community. This means that there is high possibility to bring infectious disease and/or epidemics. It is necessary to take countermeasures for infectious disease and/or epidemics, preparing appropriate clinic and distribution of doctors etc.

(6) Others (Conflict of Interest in the Area, Misdistribution of Prejudice and Benefit etc.)

- **Conflict of Interest in the Area**

  The living environment of residents would change drastically by development. Influences may differ according to the residents' distribution, and the compensation which should be made so as to treat residents fairly, sometimes results unjust. Equal compensation is not always fair. In case of carrying out the Initial Environmental Evaluation etc., experts need to consider how to avoid injustice.

  In particular, the development program should be planned after understanding the site conditions such as separation and isolation by construction of water facility and access road etc.

- **Misdistribution of Prejudice and Benefit**

  There are few cases that negative impacts and/or positive impacts caused by power development are given to the residents equally. Depending on countermeasures, above-mentioned conflicts may arise in the area. It is, therefore, important to execute site survey and make much efforts to grasp the will of inhabitants, especially their real intention.

Impacts caused by power developments and their mitigation methods are stated above.

It is necessary and indispensable to introduce mitigation method and especially to reduce social impact factors, taking above-mentioned contents into considerations when developing power facilities according to PDP 6th.

8.6 Support for holding of Stake-holder Meeting (SHM)

When executing environmental and social considerations study, SHM is one of the most important means for understanding ideas and opinions of the Stake-holders and to harmonize their concept.

The 'JICA's E & SC GL' states that JICA study team assists its counterpart organization for holding a SHM.

Accordingly, the Study Team supported C/P（EVN-IE）to hold a SHM in January.

a. Date and Time：from 9:30 to 14:00, 18.Jan. 2006

b. Place：Meeting room of the MELIA Hotel

c. Participant：20 organizations, more than 40 participants

(Refer to attached Appendix 8-7 Participant List by IE)

d. Role：

(a) Chairman and coordinator: Dr. Lien (IE)

(b) Modulator: Dr. Toan (IE)

(c) Interpreter: Mr. M. ITO (JICA Study Team), H. OOKI (JICA Study Team)

e. Contents：(refer the attached Appendix 8-8: minutes of stake-holder meeting)

(a) Explanation of PDP 6th (Mr. M. ITO)

(b) Explanation of Environmental and Social Considerations - SEA in PDP 6th (Mr. H. OOKI)

(c) Result of the Initial stage Environmental Study (Local Consultant, Dr. L. L. Hai)

(d) Discussion

- Environmental Considerations Issues
- Social Considerations Issues
- PDP 6th

A few queries and several opinions were offered, and earnest but polite discussion was made.

Moreover, there was lively discussion on nuclear power and it ended with a sense that it was too early for Vietnam to introduce.

Neither of the 2 NGOs in attendance asked questions or offered opinions.

Participants seemed to have different interpretation of the PDP 6th and Environmental and Social Considerations with SEA.

Abstract of SHM is mentioned above. The SHM of this time was the first case in the study on power development plan (PDP) in Vietnam, and became start for counterparts to recognize the sense and necessity of SHM. Although there is time restriction to feed back appropriately the

opinions of this SHM to the PDP 6th preparing works, the method how reflects the sense and the opinions in the plan, should be adjusted systematically and institutionalized in order to take root SHM holding in the following PDP preparation work.

CHAPTER 9

RECOMMENDATIONS

Chapter 9 Recommendations

9.1 Power Demand Forecast & Primary Energy

1. Energy saving

Power demand elasticity to GDP continues at a high level of around 2.0. The value is extremely high when compared to in the rest of the world. The phenomenon sometimes happens in countries where economic development policies are focused on Heavy Industry Sectors. The worldwide economic trend is to pursue high economic growth and better lives suppressing energy demand in the near future. From this point of view, it is necessary that the national economic policies should include promotion of energy conservation, promotion of renewable energy utilization, development of high value added business sectors, improvement of transportation system, and relocation of capital functions.

2. Power saving

Electric power is used in all aspects of Vietnam people's lives such as electrification of their home and working places, enhancement of information and communication technology, increase of transportation facilities and so on. Especially, popularization of air-conditioners raises the growth of power demand. For curbing power demand growth, it is recommended that the Government should propagandize the efficient use of air-conditioners..

3. Short-term energy and power demand forecasting model

Future power demand cannot be decided by only GDP and power tariffs. It is changed drastically in line with industrial structure changes and people's life style improvement. In some other countries, the short-term power demand forecasting models are built up including the variables of dissemination ratios, efficiency and utilizing patterns of electric appliances, and the results of the models are used for education of power consumers. It is recommended to prepare such kinds of energy and power demand forecasting models for making more efficient and effective power consumption.

4. Diversification of Energy

According to IEA world energy outlook 2004, the world energy consumption shifts from oil and oil derivative production to natural gas, coal and renewable energies. Especially, energy conversion from conventional gasoline and diesel to ethanol and new fuels made from corn and natural gas are implemented in the world. It is recommended that the new

transportation system installing the new energies and fuels should be introduced in future.

5. Exploration and exploitation of domestic primary energy resources

From the viewpoint of energy security and stability of long-term energy supply, it is recommended that exploration and exploitation of domestic coal, gas and oil energy resources should be enhanced. Especially for realizing the least cost development of power generation, gas of 18BCM and coal of 70 million tons should be produced in 2025.

6. Preparation of Energy Master Plan

It is recommended that Energy Master Plan be prepared comprehensively in consideration with the Study of PDP 6th and the above-mentioned recommendations.

9.2 Power Generation and Network Development Plan

1. System reliability

The relations between system reliability, LOLE and reserve margin in 2015, 2020 and 2025 were calculated in the PDP6th study. The relation between LOLE and reserve margin can be utilized as a system reliability index considering power supply and demand balance throughout the year. The results indicate that, to secure the system reliability criterion LOLE 24-hour, it is necessary to have a reserve margin rate of 7 – 8% in the north system and 10% in the central & south system respectively. It is recommended that the power system development plan should be built utilizing the reserve margin considering the relation with LOLE.

2. Capacity of 500kV interconnection between the North and the South Systems

The capacity of 500kV interconnection should be considered by economic evaluation from comparison between benefits of interconnection and reinforcement costs.

There is risk that the system could be unstable especially at off peak time, if the interconnection cannot be operated securing N-1 criterion by a large power flow because the insufficient power development causes large imbalance of power supply and demand.

3. Dormancy of hydropower output in dry season

The hydropower monthly output plan was compared with actual records during 1996 to 2004 in this study and the actual outputs in dry season are 400MW lower than the plan in the north system. The reason why the available capacity in dry season becomes dormant is a shortage of water volume in reservoirs so as to operate at an available capacity during

peaking time of 4hours a day.

Accordingly, it is strongly recommended to review and update the metrological data and monthly supply capability of all hydropower plants (existing and planned) in the North. Especially, when revising monthly firm peak capacity, the required peak duration hours should be set at **7** hours.

4. Power purchase price

When power is purchased from BOT and neighboring countries, the economic analysis should be conducted by comparing between power purchasing price and marginal costs of Vietnam system taking its capacity factor (Peak, Middle or Base supplier) into consideration,. The capacity factor of BOT and power plants in neighboring countries should be examined by simulation of demand supply balancing operation by PDPAT2.

Furthermore, in the case that power purchase agreement is concluded, price system should be divided into capacity charge and energy charge in the contract.

5. Power network planning

Power network planning of Vietnam in perspective up to 2025 should be carried out in order to meet the soaring power demand of city areas taking into consideration scale-up and faraway location of power plants as well as high reliability and economy of power transmission. For this purpose, the following are recommended.

- ✓ N-1 criteria should be applied for power network planning.
- ✓ For the future Hanoi and Ho Chi Minh City system, application of large size conductors and large size transformers should be considered for economical system configuration.
- ✓ For the system configuration in Hanoi and Ho Chi Minh City, the multi-ring shaped system configuration should be targeted.
- ✓ Automatic power sources controllers should be applied such as automatic switching operation of capacitors or shunt reactors and SVC (Thyristor controlling reactive power sources) or synchronous condensers.
- ✓ The countermeasures against increases in fault current should be examined such as split operation of the system, adopting the circuit breakers with high fault breaking ability, application of high impedance transformers. Circuit breakers of 63 kA should be set out as a standard.
- ✓ If many series capacitors are installed, it would be difficult to grasp the resonance frequencies. The installation of series capacitors should be limited in such a case of north – south transmission lines.

- ✓ Higher voltage transmission lines should be considered for economical system configuration in order to reduce the number of lines when high scenario about power generation development is realized in the Center to the South.

It is recommended that technical standards or grid code should include the methodologies of power network planning described in PDP 6th to be standardized, because making the power network planning methodology transparent as much as possible would lead to strengthening of the impartially access for independent power producers and the quasi-pubic roles of power network systems.

9.3 Financial Perspective

1. Improvement of the cash flow until around 2010

In the investment plan of the sixth master plan, the amount of investment in construction has been estimated sizable since 2005 in response to the upsurge of power demand. Meanwhile, since many of the invested facilities are completed and started up in and after 2010, the revenue from power sales will not increase significantly until around 2010.

While the expenditure of investment activity exceeds 50,000 bill VND in 2007, the revenue of operating activity is no more than about 30,000 bill VND in 2010.

Thus, the cash flows until around 2010 will be in a harsh condition according to the simulation. In order to cope with this situation, it is necessary to scale down the investment plan until around 2010 or to cover the gap between the expenditure of investment activity and the revenue of operating activity by soft loan or other methods.

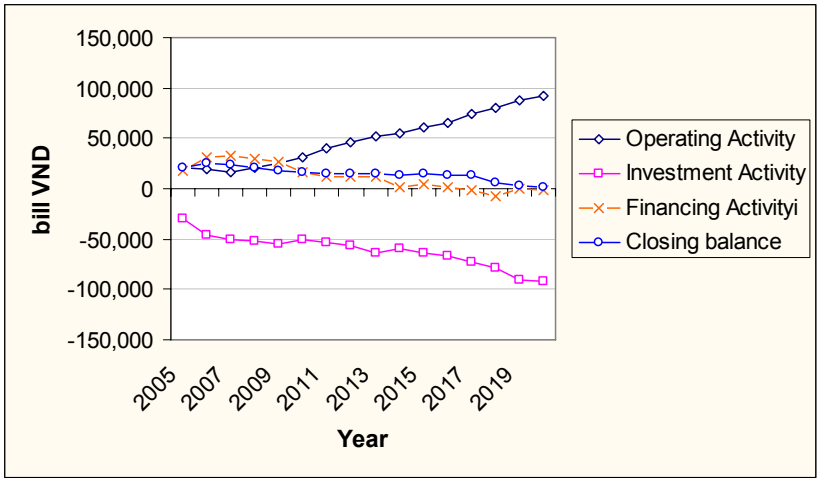


Figure 9-1-1 Cash Flow of Each Activity

2. Effect of power purchase on the financial condition

If the investment until 2010 is scaled down, the power output volume will decrease accordingly. Therefore, purchase of power from IPP and BOT should be increased for maintenance of the level of power sales before the scaling down.

The following table is a comparison of income, expense and profit (income - expense). In the simulation, the income and the expense increase to nearly the same level, which shows that further increase of power purchase cost will lead to an unfavorable balance for EVN.

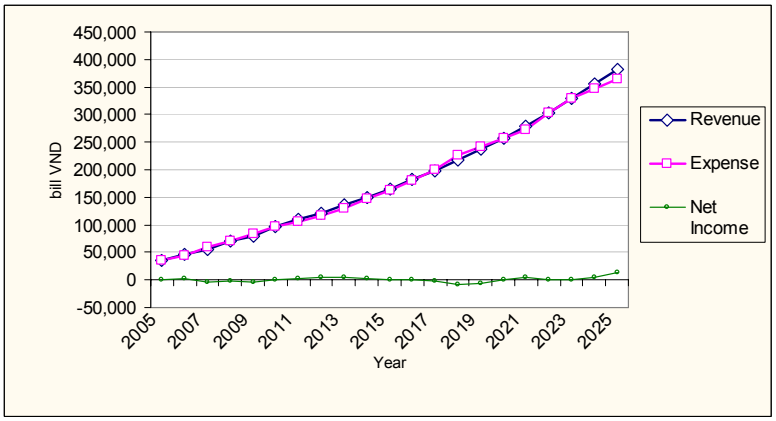


Figure 9-1-2 Revenue, Expense and Net Income

However, depreciation cost involving no cash disbursement is included in the expense. That is to say, the actual cash outlay is about (expense – depreciation cost). Furthermore, the depreciation cost will grow as the fixed assets increase. Accordingly, if we outlive the harsh condition of cash flows until around 2010, we will be able to maintain the cash flows sufficient for power purchase from IPP and BOT in reality in and after 2011.

Therefore, the use of IPP and BOT will be a key to avoid a cash crisis caused by capital investment.

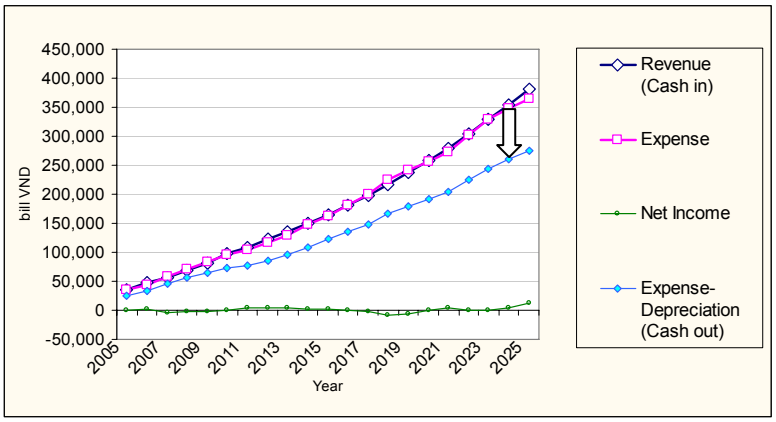


Figure 9-1-3 Revenue, Expense, Net Income and Expense-Depreciation

3. Limit of power purchase from IPP and BOT

It is essential to limit the total volume of purchase from IPP and BOT to less than 50% of the total power capacity of Vietnam so that EVN can maintain the position as a central agency of power sector in Vietnam in order to keep power market stable.

9.4 Environmental and Social Considerations

1. Result of Initial stage Environmental Study (IES) in the PDP 6th

Result of Initial stage Environmental Study (IES) in the PDP 6th showed characteristic differences between Hydro-Power Plant (HPP) and of Thermal Power Plant (TPP).

Namely, development of HPP has large impacts of social environmental issues such as involuntary resettlement and minority meanwhile development of TPP has large impacts of environmental issues such as air pollution and global warming items. Furthermore, as the result of IES, development of HPPs occupy higher rank, development of TPPs occupy lower rank, and both of HPPs and TPPs exist mixing in the middle rank (24%). As for Nuclear Power Plant (NPP), one of two candidate sites studied is seated at the lowest rank and the other was at the fourth from the bottom. NPP has serious influences on the environment such as generation of radioactive waste, transportation of nuclear fuel (fuel bar), radiation leakage caused by accident. However, from the view point of global warming / emission of CO_2 gas, it is undeniable that NPP is environmentally friendly generation system as well as wind power.

Since the study was carried out mainly in the office, there is possibility to come out another evaluation result in the IEE and/or EIA. When developing each candidate site of the middle rank group, IEE and EIA should be carried out carefully taking into consideration its specific conditions.

2. SEA in the PDP6th

In case of introducing concept of clean development mechanism (CDM), the economical construction unit cost can be raised up to 2,211 US$ / kW (+30%). Herewith, feasible development capacity of HPP can increase and the development amount of coal TPP can be reduced.

‘To develop energy resources with protection of natural resources and environment’ is stated in the ‘National energy policy’. It is, therefore, desirable that the development of coal TPPs (in particular import coal TPP which will commission in the year 2016), which have large environmental impact indicated by the result of IES, are replaced by other type

of power plants which have smaller environmental impact (i.e. new and / or renewable energy) as much as possible.

3. Alternatives

Alternative I is to replace the highest 4 ranks of HPP candidate sites, which require large scale involuntary resettlement, with other HPPs with less involuntary resettlement and/or imported HPP energy. When necessity of import power arises unavoidably, environment impact of export countries also should be considered to the utmost.

Alternative II is studied introducing the idea of emissions trading and presuming CO_2 trading price as US$10 / t-$CO_2$. However, it is considerable that the limit of economical construction unit cost will vary according to the CO_2 trading price and crude oil price.

4. Stake-Holder Meeting (SHM)

It is not easy to understand the position of SHM in the SEA.

The expert of environmental and social consideration should make efforts to make counterparts recognize the concept of SHM clearly for introducing SEA to planning of similar development project.

Moreover, there was lively discussion on nuclear power and it ended with a sense that it was too early for Vietnam to introduce.

Although there is a time restriction to feed back appropriately the opinions of this SHM to the PDP 6th preparing works, the method how reflects the sense and the opinions in the plan, should be adjusted systematically and institutionalized in order to take root holding SHM in the following PDP preparation work.

Furthermore, even when developing each candidate site, it is necessary to introduce SHM efforts as much as possible.

5. Utilization of SEA

Introduction of SEA was the first case in the study on power development plan (PDP) in Vietnam, and the experience of 3 times of W/Ss and a SHM became start for counter parts to recognize the sense and necessity of the SEA.

Hereafter, it is important to make close cooperation among concerned parties at early stage and to introduce more effective SEA.