JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

ELECTRICITY OF VIETNAM
THE SOCIALIST REPUBLIC OF VIETNAM

FEASIBILITY STUDY
ON
DONG NAI NO.3 AND NO.4 COMBINED HYDROPOWER PROJECT
IN
THE MIDDLE REACHES OF THE DONG NAI RIVER
IN
THE SOCIALIST REPUBLIC OF VIETNAM

FINAL REPORT

VOLUME II
MAIN REPORT

MARCH 2000

NIPPON KOEI CO., LTD.
TOKYO ELECTRIC POWER SERVICES CO., LTD.

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Composition of the Final Report

Volume I : Executive Summary

Volume II : Main Report

Volume III-1: Supporting Report

Appendix A : Geological Investigation

Volume III-2: Supporting Report

Appendix B : Topographic Survey

Appendix C : Hydrological Investigation

Appendix D : Environmental Survey

Appendix E : Examination of Project Layout Plan

Appendix F : Data Related to Power Transmission System and Explanation of EGEAS

Currency Exchange Rates Adopted for the Study

US$1.00 = VND 13,870

VND 1.00= ¥ 0.008219

(in March 1999)

PREFACE

In response to a request from the Government of the Socialist Republic of Vietnam, the Government of Japan decided to conduct the Feasibility Study on Dong Nai No.3 and No.4 Combined Hydropower Project in the Middle Reaches of the Dong Nai River in the Socialist Republic of Vietnam, and entrusted the Study to Japan International Cooperation Agency (JICA).

JICA sent a study team, led by Mr. Katsuyoshi Wada of Nippon Koei Co., Ltd. and organized by Nippon Koei Co., Ltd. and Tokyo Electric Power Services Co., Ltd., to the Socialist Republic of Vietnam five times form January 1999 to February 2000.

The team held discussions with the officials concerned of the Government of the Socialist Republic of Vietnam, and related field surveys. After returning to Japan, the team conducted further studies and compiled the final results in this report.

I hope this report will contribute to the promotion of the plan and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Socialist Republic of Vietnam for their close cooperation throughout the Study.

March 2000

Kimio Fujita
President
Japan International Cooperation Agency

March 2000

Mr. Kimio Fujita
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Sir,

Letter of Transmittal

We have the pleasure of submitting to you herewith the Final Report for Feasibility Study on the Dong Nai No.3 and No.4 Combined Hydropower Project in the Middle Reaches of the Dong Nai River in the Socialist Republic of Vietnam.

The main objective of the Feasibility Study is to formulate the optimum development plan of the Dong Nai No.3 and No.4 Combined Hydropower Project which is planned to be built on the Dong Nai River about 180 km northeast of Ho Chi Minh City in linear distance. To attain the purpose, the Study Team performed the survey, investigation and studies on concerned disciplines during the period from December 1998 to March 2000. In conclusion, the Feasibility Study proposed to construct the two dams, 108.5 m high Dong Nai No.3 dam and 96 m high Dong No.4 dam, to generate a peak power of 510 MW and annual energy of 1,579 GWh in total.

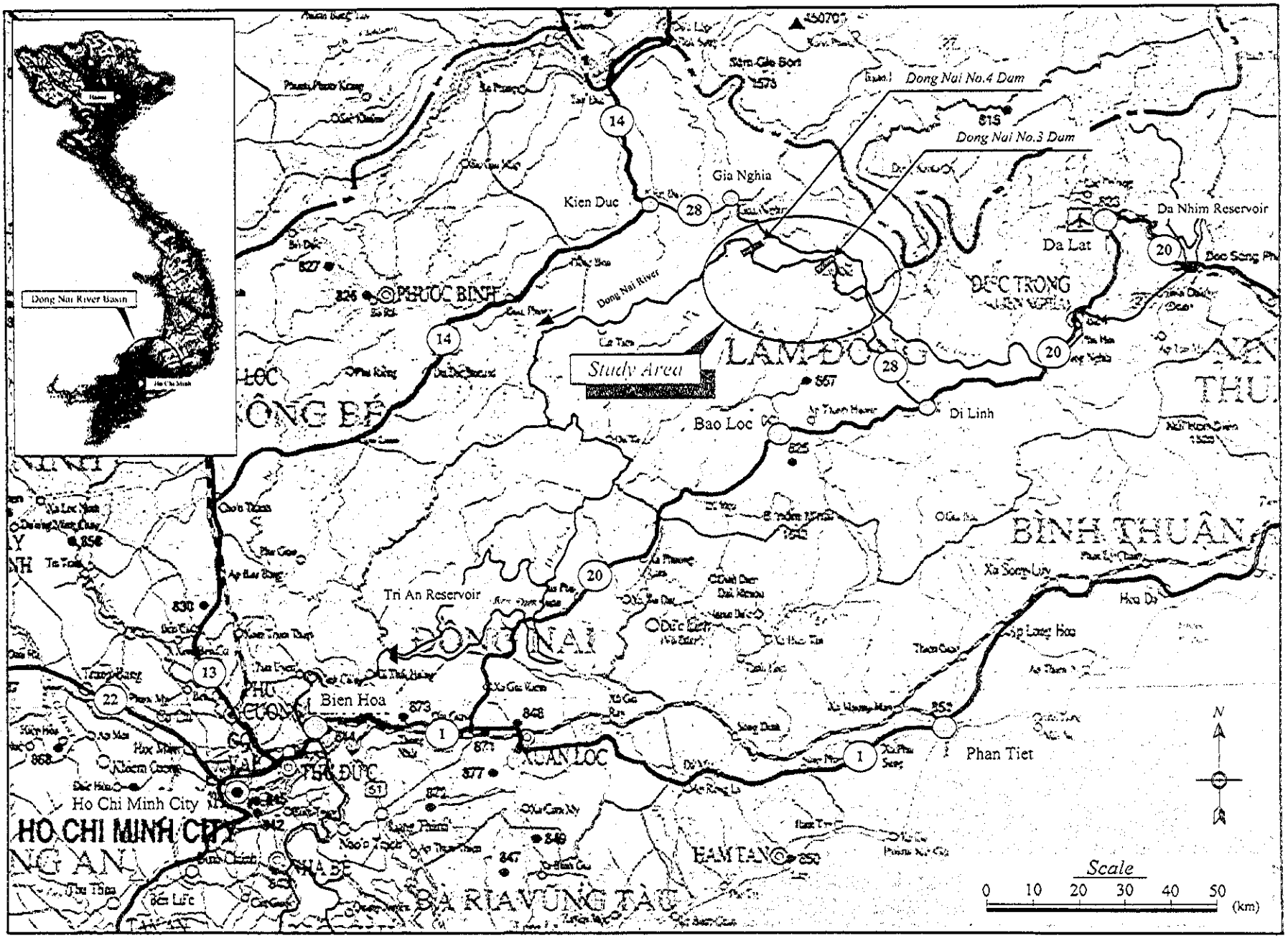
The Report consists of four (4) Volumes, Main Report, Executive Summary and two (2) Supporting Reports. The Main Report covers all the investigation and study results including field investigation and results, plan formulation, environmental impact assessment and resettlement action plan, cost estimates and project evaluation. The Executive Summary presents main outputs of the Study. The Supporting Reports give additional and supporting information and data to the Main Report.

We would like to express our grateful acknowledgement to the personnel of your Agency, your Branch Office in Vietnam, and the Embassy of Japan in Vietnam, and also to officials and individuals of the Government of the Socialist Republic of Vietnam for their assistance and advice extended to the Study Team. We sincerely hope that the results of this Study would contribute to the national and regional development of the country.

Yours sincerely,

和田勝義

Katsuyoshi Wada
Team Leader
Feasibility Study
on
Dong Nai No.3 and No.4 Combined Hydropower Project



Location Map of Dong Nai No.3 and No.4 Combined Hydropower Project

MAIN FEATURES OF DONG NAI NO.3 PROJECT

1. Dam and Reservoir

1.1 Hydrology

• Catchment Area (C.A.)	2,441 km^2*
• Basin Average Rainfall	1,950 mm
• Annual Mean Discharge	75.20 m^3/sec

Note: *; excludes C.A. of existing Dran Dam (Da Nhim HPP) and C.A. of on-going Dai Ninh HPP Project

1.2 Reservoir

• Full Supply Level (FSL)	El.590 m
• Minimum Operation Level (MOL)	El.560 m
• Flood Water Level for PMF	El.596.8 m
• Gross Storage Capacity	1,856 million m^3
• Effective Storage Capacity	1,248 million m^3
• Reservoir Surface Area at FSL	56 km^2

1.3 Dam

• Type	Concrete Face Rockfill Dam (CFRD)
• Crest Elevation	El.597.5 m
• Crest Length	470 m
• Crest Width	10 m
• Height above Riverbed	108.5 m
• Upstream Embankment Slope	1:1.4
• Downstream Embankment Slope	1:1.5
• Total Embankment Volume	4.73 million m^3

1.4 Spillway

• Design Flood (1,000-year probable flood)	7,240 m^3/sec
• Check Flood (Probable Maximum Flood)	12,480 m^3/sec
• Type	Gated Weir and Open Chuteway with Flip Bucket
• Gated Weir Portion	
- Crest Elevation	El.574 m
- Crest Width	52 m
- Gate	15 m wide ×16 m high ×3 gates (radial gates)
• Chuteway Portion	
- Width	52 m
- Length	158.3 m
• Energy Dissipation	Flip Bucket type

1.5 River Diversion

(1) General

• Design Flood (20-year probable flood)	2,590 m^3/sec
• Check Flood (30-year probable flood)	2,800 m^3/sec

(2) Main Coffer Dam	
• Type	Rockfill Dam
• Crest Elevation	El.519 m
• Embankment Volume	0.38 million m^3
(3) Diversion Tunnel	
• Type	Concrete Lined Circular Tunnel
• Number of Tunnel	2
• Diameter	11.5 m
• Length	780 m and 980 m

2. Hydropower Generating Facilities

2.1 Intake	
• Inlet Dimension	15.1 m width ×17.0 m high ×1 no
• Sill Elevation	El.543 m
• Gate	8.4 m width ×8.4 m high ×1 gate
2.2 Headrace Tunnel	
• Type	Concrete Lined Circular Tunnel
• Number of Tunnel	1
• Diameter	8.4 m
• Length	6,960 m
2.3 Surge Tank	
• Type	Restricted Orifice type
• Shaft	
- Diameter	20.9 m
- Height	85 m
• Diameter of Orifice	3.5 m
• Upper Surging Water Level	El.615.0 m
• Lower Surging Water Level	El.540.7 m
2.4 Penstock	
• Type	Inclined/Horizontal Pressure Tunnel, Steel Lined
• Upper Portion (before branch)	
- Number of Tunnel	1
- Diameter	6.5 m
- Length	226 m
• Lower Portion (after branch)	
- Number of Branch	2
- Diameter	4.6 m
- Length	55 m
2.5 Powerhouse	
• Type	Outdoor type
• Building Dimension	25.2 m width × 63 m long
• Overhead Travel Crane	165 ton × 2 no

2.6 Generating Equipment

(1) Turbine	
• Type	Vertical Shaft Francis type
• Number of Units	2
• Rated Output	126 MW
• Rated Speed	200 rpm
(2) Generator	
• Type	Semi-umbrella type
• Number of Units	2
• Rated Capacity	137 MVA
• Frequency	50 Hz
• Power factor	0.9
(3) Main Transformer	
• Type	3-phase, Outdoor-type
• Number of Units	2
• Voltage Ratio	16.5 kV / 500 kV
• Capacity	140 MVA

2.7 Transmission Line and Switchyard

(1) Transmission Line	
• Length	12 km
• Number of Circuits	Double Circuit
• Voltage	500 kV
• Conductor	ACSR 330mm^2×4
(2) Switchyard	
• Site Dimension	150 m width × 170 m long
• Number of Circuit Breaker	5

3. Power and Energy

3.1 Discharge	
• Firm Discharge	66.6 m^3/sec
• Maximum Plant Discharge	213.1 m^3/sec
3.2 Head	
• Maximum Gross Head	150 m
• Rated Effective Head	130 m
3.3 Power and Energy Outputs	
• Installed Capacity	240 MW
• Firm Capacity	83 MW
• Dependable Capacity	218 MW
• Annual Energy	
- Primary	636 GWh
- Secondary	100 GWh
- Total	736 GWh

MAIN FEATURES OF DONG NAI NO.4 PROJECT

1. Dam and Reservoir

1.1 Hydrology

• Catchment Area (C.A.)	149 km^2*
• Basin Average Rainfall	2,657 mm
• Average Runoff	6.54 m^3/sec

Note: *; Residual C.A. between Dong Nai No.3 and No.4 dam sites

1.2 Reservoir

• Full Supply Level (FSL)	El.440 m
• Minimum Operating Level (MOL)	El.430 m
• Flood Water Level for PMF	El.447.1 m
• Gross Storage Capacity	124 million m^3
• Effective Storage Capacity	37 million m^3
• Reservoir Surface Area at FSL	4 km^2

1.3 Dam

• Type	Rockfill Dam with Center Earth Core
• Crest Elevation	El.448.5 m
• Crest Length	240 m
• Crest Width	10 m
• Height above riverbed	96 m
• Upstream Embankment Slope	1:2.2
• Downstream Embankment Slope	1:1.8
• Embankment Volume	2.2 million m^3

1.4 Spillway

• Design Flood (1,000-year probable flood)	6,430 m^3/sec*
• Check Flood (Probable Maximum Flood)	9,960 m^3/sec*

Note: *; Flood for Dong Nai No.4 = (Flood from the residual C.A. mentioned above)+ (Regulated outflow from Dong Nai No.3 dam/spillway)

• Type	Gated Weir and Open Chuteway with Flip Bucket
• Gated Weir Portion	
- Crest Elevation	El.424 m
- Crest Width	52 m
- Gate	15 m wide ×16 m high ×3 gates (radial gates)
• Chuteway Portion	
- Width	52 m
- Length	106.6 m
• Energy Dissipation	Flip Bucket type

1.5 River Diversion

(1) General

• Design Flood (20-year probable flood)	2,630 m^3/sec*
• Check Flood (30-year probable flood)	2,850 m^3/sec*

Note: *: Flood for Dong Nai No.4 = (Flood from the residual C.A. mentioned above)+ (Regulated outflow from Dong Nai No.3 dam/spillway)

(2) Main Coffer Dam

• Type	Rockfill Dam
• Crest Elevation	El.395 m
• Embankment Volume	391,000 m^3

(3) Diversion Tunnel

• Type	Concrete Lined Circular Tunnel
• Number of Tunnel	2
• Diameter	10.9 m
• Length	690 m and 800 m

2. Hydropower Generating Facilities

2.1 Intake

• Inlet Dimension	15.7 m width ×17.0 m high ×1 no
• Sill Elevation	El.413 m
• Gate	8.6 m width ×8.6 m high ×1 gate

2.2 Headrace Tunnel

• Type	Concrete Lined Circular Tunnel
• Number of Tunnel	1
• Diameter	8.6 m
• Length	5,320 m

2.3 Surge Tank

• Type	Restricted Orifice type
• Shaft	
- Diameter	17 m
- Height	69 m
• Diameter of Orifice	3.5 m
• Upper Surging Water Level	El.466.7 m
• Lower Surging Water Level	El.409.1 m

2.4 Penstock

• Type	Inclined/Horizontal Pressure Tunnel, Steel Lined
• Upper Portion (before branch)	
- Number of Tunnel	1
- Diameter	6.7 m
- Length	377 m
• Lower Portion (after branch)	

- Number of Branch	3
- Diameter	3.9 m
- Length	57 m
2.5 Powerhouse	
• Type	Outdoor type
• Building Dimension	24 m width × 78 m long
• Overhead Travel Crane	250 ton × 1 no
2.6 Generating Equipment	
(1) Turbine	
• Type	Vertical Shaft Francis type
• Number of Units	3
• Rated Output	94 MW
• Rated Speed	214 rpm
(2) Generator	
• Type	Semi-umbrella type
• Number of Units	3
• Rated Capacity	101 MVA
• Frequency	50 Hz
• Power factor	0.9
(3) Main Transformer	
• Type	3-phase, Outdoor type
• Number of Units	3
• Voltage Ratio	16.5 kV / 500 kV
• Capacity	110 MVA
2.7 Transmission Line and Switchyard	
(1) Transmission Line	
• Length	13 km
• Number of Circuits	Double Circuit
• Voltage	500 kV
• Conductor	ACSR330mm^2 × 4
(2) Switchyard	
• Site Dimension	150 m width × 200 m long
• Number of Circuit Breaker	6

3. Power and Energy

3.1 Discharge	
• Firm Discharge	69.9 m^3/sec
• Maximum Plant Discharge	223.7 m^3/sec
3.2 Head	
• Maximum Gross Head	150 m
• Rated Effective Head	138m
3.3 Power and Energy Outputs	
• Installed Capacity	270 MW

- Firm Capacity 89 MW
- Dependable Capacity 256 MW
- Annual Energy
  - Primary 721 GWh
  - Secondary 120 GWh
  - Total 841 GWh

Estimated Total Project Cost for Dong Nai No.3 and No.4 Combined Hydropower Project

Estimated Total Project Cost (1)

(Unit: million US$)

Description	FC	LC	Total
I. Base Cost	368.4	270.4	638.8
Construction Cost	333.4	219.6	553.0
Engineering Service	31.1	10.4	41.5
Administration	0.0	3.9	3.9
Land compensation and resettlement	3.9	6.7	10.6
Tax	0.0	29.8	29.8
II. Contingency	55.0	43.3	98.3
Price contingency	26.0	17.9	43.9
Physical contingency	29.0	25.4	54.4
Total Project Cost	423.4	313.7	737.1

Estimated Total Project Cost (2)

(Unit: million US$)

Description	No.3	No.4	Total
I. Base Cost	343.9	294.9	638.8
Construction Cost	293.4	259.6	553.0
Engineering Service	22.0	19.5	41.5
Administration	2.1	1.8	3.9
Land compensation and resettlement	10.6	0.0	10.6
Tax	15.8	14.0	29.8
II. Contingency	52.6	45.7	98.3
Price contingency	22.6	21.3	43.9
Physical contingency	30.0	24.4	54.4
Total Project Cost	396.5	340.6	737.1

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FINAL REPORT

VOLUME II

MAIN REPORT

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Abbreviations

1. Organization

ADB	: Asian Development Bank
DSI	: Development Strategy Institute
CTNP Office	: Cat Tien National Park Office
EPRI	: Electric Power Research Institute
EVN	: Electricity of Vietnam
IBRD	: International Bank for Reconstruction and Development
IOE	: Institute of Energy
JICA	: Japan International Cooperation Agency
MoARD	: Ministry of Agriculture and Rural Development
MPI	: Ministry of Planning and Investment
PC	: Power Company
PECC2	: Power Engineering and Consulting Company No.2
WB	: World Bank (International Bank for Reconstruction and Development)
WWF	: World Wide Fund for Nature

2. Water Level of Reservoir and Tailrace

FSL	: Full Supply level
MOL	: Minimum Operation Level
RWL	: Rated Water Level
FWL	: Flood Water Level
TWL	: Tail Water level

3. Chemical Element

pH	: pH value
BOD	: Biochemical oxygen demand
DO	: Dissolved oxygen

4. Unit

MW	: mega-watt	km	: kilometer
kW	: kilowatt	km^2	: square kilometer
MWh	: mega-watt hour	ha	: hectare
kWh	: kilo-watt hour	$mile^2$	: square mile
GWh	: giga-watt	m^3	: cubic meter
GWh/yr	: giga-watt per year	m^3/year	: cubic meter per year
kV	: kilovolt	m^3/sec	: cubic meter per second
MVA	: mega-volt ampere	$m^3/sec/km^2$	: cubic meter per second per square kilometer
mm	: millimeter	$feet^3/sec/miles^2$	: cubic feet per second per square mile
mm/day	: millimeter per day	g	: gram
mm/year	: millimeter per year	mg/l	: milligram per liter
m	: meter		
m/s or m/sec	: meter per second		
m/sec^2	: meter per square second		

5. Currency

VND	: Vietnamese Dong
US$	: US Dollar
USc or US ¢	: US Cent

6. Others

AC	: Alternating Current
ASEAN	: Association of Southeast Asian Nations
C.A.	: Catchment Area
C-Cycle	: Combined Cycle
CPI	: Consumer Price Index
DP	: Dynamic Programming
EGEAS	: Electric Generation Expansion Analysis System
EIA	: Environmental Impact Assessment
EIRR	: Economic Internal Rate of Return
FC	: Foreign Currency
FDI	: Foreign Direct Investment
F.M.	: Finess Modulus
FIRR	: Financial Internal Rate of Return
GDP	: Gross Domestic Products
GNP	: Gross National Products
GRDP	: Gross Regional Domestic Products
HCM	: Ho Chi Minh
HCMC	: Ho Chi Minh City
HPP	: Hydropower Project
ICB	: International Competitive Bid
IPP	: Independent Power Producer
LC	: Local Currency
LCB	: Local Competitive Bid
LOLP	: Loss of Load Probability
LRMC	: Long Run Marginal Cost
MDD	: Maximum Dry Density
MIT	: Massachusetts Institute of Technology
ODA	: Official Development Aid
OMC	: Optimum Moisture Content
PMP	: Probable Maximum Precipitation
RAC	: Resettlement Action Committee
RAP	: Resettlement Action Plan
ROE	: Return on Equity
SGS	: Streamflow Gauging Station
SME	: Small and Medium Enterprises
SRMC	: Short-Run Marginal Cost
VAT	: Value Added Tax
WASP	: Wien Automatic System Planning Package

CHAPTER 1 INTRODUCTION

1.1 The Project

The socialist Republic of Vietnam has an area of about 332,000 km^2 and population of approximately 78 million in 1998. The whole nation is broadly divided into three areas of North, Central and South areas. The Project site is located about 260 km northeast of Ho Chi Minh City via the National Roads No.13, No.14 and No.28.

Since the year 1986, the Government of Vietnam has been carrying out drastic political, commercial and social reforms under the banner of "Doi Moi" (which means renovation in Vietnamese), generating highly active economic activities.

It may be particularly noted that Vietnam economy had made its substantial shifting from the centrally planned economy to the market-oriented economy after 1992. In the course of such shifting the Government of Vietnam admitted the basic principles such as introduction of market-economy, official recognition of private property right, authorization of private entrepreneurship, private land tenure system and joint venture with foreign firms.

Further after 1994 when an economic embargo imposed on Vietnam by USA was lifted, the foreign direct investment from surrounding Asian countries and the official development aid (ODA) of OECD countries started to flow into Vietnam.

As a result, GDP growth during the period from 1992 to 1997 was remarkable, attaining a high annual average GDP growth rate of 9.8% for five years.

Although adverse effects from the Asian Economic Crisis that rose in the mid-1997 were unavoidable even in Vietnam to some extent, the Sixth Five-year Plan for Socio-economic Development of Vietnam for the period of 1996-2000 was already attained in and before 1998 on some of the targets such as the per-capita GDP target, the population target and the food production target set for 2000.

However, the target of electricity supply set at 30,000 GWh in 2000 in the Plan was not attained yet with the power supply at 20,850 GWh in 1998.

Electrical power demand has increased steadily for these ten years from 5,661 GWh in 1989 to 9,198 GWh in 1994 and 17,739 GWh in 1998. The average annual growth rate of total demand during 1993-1998 was as high as 17.2%.

Further power generation and peak load forecast for future development are in the order of 68,000 GWh in 2010 and 105,000 GWh in 2015, and 11,000 MW in 2010 and 17,000 MW in 2015, although thegrowth rate had to be assumed to be far smaller than experienced so far.

Under such circumstances EVN has pursued long-term power source development plans. Among various candidate development plans, the Dong Nai No.3 and No.4 Combined Hydropower Project was identified as an attractive development plan through such studies as the JICA master plan study in 1996 and the pre-feasibility study by EVN in 1998 to meet the deficiency of electric power that was foreseen to take place before 2010.

After a series of arrangements made between the Government of Japan and the

Government of the Socialist Republic of Vietnam, this Feasibility Study started in December 1998 and the field investigations were carried out five times to date to ensure the previous studies and work out the optimum development plan.

The Project has now been formulated for the optimum development by incorporating the results of the studies/investigations done so far as well as comments from parties concerned including EVN.

1.2 Objectives of the Study

The Study aims at formulating the optimum development plan of the Project by assessing it from the technical, economic, financial and environmental aspects. Further, the Study aims at finding the most suitable timing of commissioning the optimized development plan, to make various arrangements required for putting the Project into execution.

The outcomes from the Study have been compiled to be acceptable to the international lending agencies for financial arrangement to implement the Project as well as various requirements of the Government of Vietnam.

One of the main objectives of the Study is to achieve transfer of technology to and training of the counterpart personnel of the Government of Vietnam in the course of the Study.

1.3 The Study Stages and Schedule

The study is conducted in three stages, namely, Preliminary Investigation Stage, Detailed Investigation Stage and Feasibility-Grade Design stage, with phases of home preparatory work, five field investigations and two home office works during the period of approximately 16 months from mid-December 1998 to late March 2000. The overall work schedule is summarized below:

Study Stages and Reports

Study Stage	Work Period	Report Submitted
Home Preparatory Work	December 1998	Inception Report
First Field Investigation	January - March 1999	Progress Report No.1
Second Field Investigation	May - July 1999	Progress Report No.2
Third Field Investigation	August - September 1999	
First Home Office Work	October - November 1999	
Fourth Field Investigation	December 1999	Interim Report
Second Home Office Work	January - February 2000	
Fifth Field Investigation	February 2000	Draft Final Report

1.4 Structure of Final Report

This Final Report presents the results of all the investigation and studies carried out by the JICA Study Team from December 1998 to February 2000 comprising the following volumes:

Volume I	:	Executive Summary
Volume II	:	Main Report
Volume III-1	:	Supporting Report

Appendix-A : Geological Investigation

Volume III-2 : Supporting Report

Appendix-B : Topographic Survey
Appendix-C : Hydrological Investigation
Appendix-D : Environmental Survey
Appendix-E : Examination of Optimum Project Layout Plan
Appendix-F : Data Related to Power Transmission System and Explanation of EGEAS

Volume I summarizes the contents of Volume II, while Volume III-1 and Volume III-2 supports the contents of Volume II.

Volume II deals with full details of the study results and consists of eleven Chapters.

Chapter 1 presents background, purpose and outline of the Feasibility Study. Chapter 2 shows general status of national and regional socio-economic conditions, and socio-economic projection. Chapter 3 describes natural conditions of the Study area such as topography, meteorology and hydrology, geology and natural construction materials. Chapter 4 gives the results of the environmental assessment and management plans, and resettlement plan in the inundation area. Chapter 5 states results of surveys and studies of the existing power development situations and the power demand forecast. Chapter 6 explains the plan formulation to work out the optimum development plan and the examination of optimum commissioning year of the project. Chapter 7 gives the result of the feasibility-grade design for the civil structures and the hydro-electrical and mechanical equipment. Chapter 8 discusses construction plan and cost estimate of the project. Chapter 9 details economic and financial analyses. Chapter 10 briefs the status of the Transfer of Knowledge. Chapter 11 recommends investigations and surveys required for the detailed design stage of the Project.

1.5 Acknowledgement

During the course of the Study, the JICA Study Team has been given a lot of helpful assistance and advice by the EVN personnel and its counterpart personnel. In addition, the JICA Study Team highly appreciate the elaborated efforts of the counterpart personnel and all other local staff who participated in the field investigation works, that had to be performed under very severe climatic conditions during the Second and Third Field Investigations, as compared with those in the normal climatic years. The JICA Study Team wishes to express grateful acknowledgement to all the concerned personnel of EVN and sincerely expresses many thanks to all of them.

CHAPTER 2 SOCIO-ECONOMIC SITUATION

2.1 Present Conditions of Socio-Economy

2.1.1 Geographical Features

The Socialist Republic of Vietnam extends north and south along the east coast of the Indochina Peninsular. The total land area encompasses about 332,000 square kilometers. It is surrounded by the ocean; by the Gulf of Tongking to the east, by the Sea to the southeast and by the Gulf of Siam to the south. Vietnam is bordered by the Yunnam Province of the People's Republic of China to the north. The Annam Mountains walls Vietnam from Cambodia and Laos to the west. This geography is often likened to a cowl-staff hanging at its both ends two baskets of the Red River Delta and Mekong River Delta, Vietnam's two biggest granaries.

The whole nation is broadly divided into eight (8) regions that are sorted out into three areas, North, Central and South areas, as shown in Figure 2.1. The North area includes the Red River Delta, Northeast, Northwest and North Central Regions; the Central area includes Central Coast and Central Highlands Regions; the South area includes Southeast and Mekong Delta Regions. These Regions are further divided into 57 Provinces and four (4) Centrally Administered Cities as shown in Figure 2.1. The Communes, Towns and Wards constitute the smallest administrative units.

The Dong Nai River Basin lies in the Central Highlands Region and Southeast Region. There are four (4) Provinces in the upstream basin of the existing Tri An Reservoir situated about 220 km downstream of Dong Nai No.4 dam site. These are the Lam Dong Province and Dac Lac Province within the Central Highlands Region, and the Binh Phuoc Province and Dong Nai Province within the North East South Region as shown in Figure 2.2. The uppermost basin of the Dong Nai mainstream is situated in the Lam Dong Province. In the middle reach of the Dong Nai mainstream, the river course flows down along the western fringe of the Lam Dong Province, which conforms to the provincial boundaries. The Dong Nai mainstream which originates in an eastern part of the Lam Dong Province flows down to the west as a whole, forming a boundary between the Lam Dong Province and Dac Lac Province in the middle reach where the Dong Nai No.3 and No.4 dam sites are located. At the nearby location of Cat Tien, it starts meandering largely to change the flow direction from west to east. In the large meandering portion, the river course forms a boundary of the Lam Dong province with the Binh Phuoc Province and Dong Nai Province in the downstream direction. Thereafter, it changes the flow direction almost to the south to join the existing Tri An reservoir.

2.1.2 Administrative Structure

The Socialist Republic of Vietnam is divided into eight (8) regions mainly based on their geographical conditions, which are further administratively divided into sixty-one (61) provinces. Names of those provinces are listed in Table 2.1 together with the number of administrative units. The stratum administrative structure is depicted in Figure 2.3. As shown in the figure, the administrative stratum is structured by four (4) levels:

1) Central level,
2) Provincial level: Provinces and 4 Centrally Administered Cities,
3) District level: Urban Districts, Rural Districts, Cities and Towns and
4) Commune level: Communes, Wards and Towns.

The four (4) Centrally Administered Cities are Hanoi, Hai Phong, Danang and Ho Chi Minh.

The "region" concept is not firmly established in Vietnam. As presented in Table 2.1, the whole 61 Provinces and Cities are grouped in eight (8) regions which are further bundled into three areas of North, Central and South as shown below.

North:	1) Red River Delta Region
	2) Northeast Region
	3) Northwest Region
	4) North Central Region
Central:	5) Central Coast Region
	6) Central Highlands Region
South:	7) Southeast Region
	8) Mekong River Delta Region

However, there are no regional offices of Government. Statistics at a provincial level are currently aggregated to a regional level but there is substantially no planning at a regional level.

2.1.3 Population and Labor Force

The historical population trend in Vietnam is presented in Table 2.2. The latest population in 1998 amounts to 78 million, which was the second largest in Southeast Asia following Indonesia. Out of the total population, a majority of 78% peoples are living in rural villages and the remaining 22% are living in urban areas in 1998. The growth rate of the total population is decreasing for these two decades and reached 1.8% per year in 1997 which was the target to be attained in 2000 in the sixth Five-year National Development Plan for 1996-2000. This success in population control can be attributed to the Government's effort represented by the "two-children" policy, which encouraged people to reduce the family size.

The population concentration into urban areas is clearly observed in these two decades. The annual growth rate of urban population has increased from 1.28% in 1975-1985 to 2.52% in 1985-1995 and further to 4.11% in 1995-1998. While that of rural population has been decreasing to 1.27% in 1995-1998 that was less than the national average.

The population distribution in the whole nation is shown below according to the preliminary result of the population census conducted in April 1999.

Population Distribution by Region in 1999

	Region	Population (in 10^3)	Share %
North	1) Red River Delta	14,800	19.4%
	2) Northeast	10,861	14.2%
	3) Northwest	2,228	2.9%
	4) North Central	10,007	13.1%
Central	5) Central Coast	6,526	8.6%
	6) Central Highland	3,062	4.0%
South	7) Southeast	12,709	16.7%
	8) Mekong River Delta	16,132	21.1%
Nation Total		76,325	100.0

The concentration of population into three Regions of Mekong River Delta, Red River Delta and Southeast is eminent. About 57% of population of the whole nation is living in these three regions. It is to be noted that this is the "preliminary" result of the population census 1999 and some adjustment will be done before getting the final figures. According to this result, the total population is less than the one estimated in 1998.

The labor force statistics is shown by kind of economic activities in Table 2.3. The total labor force in 1997 numbered 37 million, which corresponded to 48.2% of the total population. The annual average growth rate was 3.5% in 1996 and 3.4% in 1997. Due to the slowing down of the population growth rate, the growth rate of the labor force is anticipated to decrease consequently in the future. In order to maintain sustained economic growth, an effort to raise productivity in every field of economic activities will be required.

As shown in the table, agriculture and forestry provide the largest share of labor force of 67.1% in 1997 though it is gradually decreasing recently. Manufacturing is the second largest source of labor force with 8.9% of the total. Although it is increasing in number, the share of manufacturing in the total labor force is slightly decreasing every year. Education/training, construction and transport/communication provide a substantial number of job opportunities following the big two sectors of agriculture and manufacturing.

2.1.4 GDP and Economic Structure

The Government of Vietnam declared an economic renewal program called "Doi Moi" in Vietnamese in 1986. However, being affected by the collapse of the Soviet Russia in 1989, Vietnam economy could start its substantial shifting from the centrally planned economy to the market-oriented economy only after 1992. The new constitution so called "Doi Moi Constitution" was promulgated in 1992 and basic principles for economic activities such as introduction of market-economy, official recognition of private property right, authorization of private entrepreneurship, private land tenure system and approval of joint venture with foreign firms were publicly admitted. In 1994, an economic embargo imposed on Vietnam by the USA was lifted. The foreign direct investment (FDI) from surrounding Asian countries and the official development aid

(ODA) of OECD countries started to flow into Vietnam thereafter.

Table 2.4 shows a continuous economic development after Doi Moi. Especially GDP growth during the period from 1992 to 1997 was remarkable. Annual average GDP growth for these five years reached as high as 9.8%. The table also compares the sector structure of the economy in 1985 and 1998. It shows the drastic decrease in agriculture sector from 44% of the total GDP in 1985 to 24% of the total GDP in 1998. While the same share of industry has increased from 22% of the total GDP in 1985 to 31% of the total GDP in 1998.

The recent high economic growth of Vietnam economy can mainly be attributed to the following:

a) Open-market policy after the declaration of Doi Moi program.
b) Inflow of FDI and ODA
c) Remarkable growth of export: annual average growth of export reached 32 % for seven years of 1990-1997 (see Table 2.11).
d) Increase in agricultural production: Vietnam has changed from food-deficit position to the world's second largest rice export country.
e) High rate of investment in GDP: (see Table 2.5)
f) High rate of domestic savings rate: (see Table 2.5)

Table 2.5 shows the national accounts in percentage of GDP. The percentage total of consumption and investment exceeds 100% every year. This was balanced by excessive imports of goods and services over exports, which led to the habitual deficit in current account balance of the international balance of payment (see Table 2.14). In other words, owing to the current deficit in the international balance of payment, the high rate of domestic investment has been realized. Meanwhile, the gross national savings have been maintained at a comparatively high level of nearly 17% to GDP these years. This is also considered to have contributed to the high economic growth of Vietnam. However, the balance of the domestic saving ratio and the domestic investment ratio had to be actually financed by FDI and ODA (see Table 2.14).

2.1.5 Infrastructure

Table 2.6 compares several infrastructure indicators of Vietnam, Thailand, Philippines and the low-income group in 1980 and 1995. In spite of rapid improvement, infrastructure needs in Vietnam still remain considerable. Vietnam's existing infrastructure lags behind Thailand and Philippines in all the available indicators shown in the table. In addition, Vietnam is less equipped, as compared with low-income group average, in such aspects of infrastructure as electricity consumption per-capita, commercial energy use and access to safe water - percentage of population with access. Vietnam exceeds the average low-income countries only in such fields of infrastructure as paved roads - percentage to total roads, telephone main lines per population and air passengers carried per population.

Investment to infrastructure for respective sector is being implemented as shown below:

Public Investment Plan 1996-2000 (VND billion-1995 price)

	1996-1998 Investment	Actual	1999-2000 Investment	Planned
Public Investment	114,000		100,000	
Infrastructure	72,050	100 %	59,550	100 %
· Transport & Water	33,750	47 %	19,250	32 %
· Irrigation	6,700	9 %	10,800	18 %
· Energy	31,600	44 %	15,600	26 %
· Posts & Telecoms	0	0 %	13,900	23 %

The transport and water sector and the energy sector have been prioritized in the past and the posts and telecommunications sector is being focussed on lately.

2.1.6 Household Income and Expenditure

Table 2.7 shows statistics by region of monthly per-capita income based on the annual household surveys. From this table, income imbalance by region can be observed. Comparing each region with an index with the national average equal to 100, the three regions of Southeast, Central Highlands and Mekong River Delta exceed the national average. Among these three regions, Southeast Region exceeds the national average most by 67% in 1996. While the lowest regions include Northeast, Northwest and North Central Regions. In addition, the growth rates of household income in these lowest income regions were also lowest, which aggravated the income disparity among regions.

The statistics of household expenditure was available only for 1994 that are compiled in Table 2.8. The Engel's coefficient (the share of expenditure for foods in total expenditure) ranges from 59% (Central Highlands Region) to as high as 70% (Northeast and Northwest Regions). Reflecting the income disparity, household expenditure was also large in such regions as Southeast, Central Highlands and Mekong River Delta. The savings ratio (the balance of income and expenditure) was computed and it was found that the household saving ratio ranges from 12% (Northeast and Northwest and Red River Delta Regions) to 19% (Central Highlands Region). The comparatively high level of living standard in Central Highlands is attributable to its coffee plantation for exports.

2.1.7 Consumer Price

Table 2.9 shows price indices in Vietnam for the period of 1993-1998. The merchandise export price index has been rising while that of import has been lowering. Consequently the terms of trade have been improved in these several years. The consumer price index and GDP deflator have been stable for these years. Having experienced a hyperinflation in the latter half of the 1980's, with some 400% increase in consumer price in 1988, the Government of Vietnam is sensitive to inflation. The Government has taken such measures as tight money policy, money supply control and devaluation of official exchange rate to avoid inflation in the past.

Table 2.10 compiles average retail prices of selected goods and services for the period of 1995-1998. Broadly speaking, the price of daily-necessities is being stable except sea shrimp, dried sea fish and tea that which are considered expensive foods to general people.

It is to be noted that the success in rice production increase in Vietnam has brought the stability of the price of rice, which contributed to prevent inflation through suppressing daily-living cost.

2.1.8 External Trade

Tables 2.11 to 2.13 contain statistics related to exports and imports. First, merchandise exports by commodity are presented in Table 2.11. Exports of Vietnam recorded US$ 9 billion corresponding to 46% of GDP in 1997 (cf. Table 2.5). Average growth rate of exports for the period of 1990-1997 was 32% per year (Table 2.11). The high economic growth in 1990's can be naturally attributed to this remarkable increase in exports. When examined by commodity, the largest one was handicrafts and light industrial goods - especially textile and garments - with the share of 33% to the total exports, followed by agriculture and forestry products of 20% and petroleum of 16% in 1997.

Table 2.12 shows statistics of major imports by commodity. Imports of Vietnam recorded US$ 10 billion corresponding to 54% of GDP in 1997 (cf. Table 2.5). Average growth rate of imports for the period of 1990-1997 was 36% per year (Table 2.12). Although the import statistics for 1996 and 1997 in the table failed to provide some substantial figures, it can be observed from this table that major import commodity includes machinery, equipment, spare parts, petroleum and fertilizers. As a whole, capital goods import including machinery, steel and equipment had increased rapidly after lifting the embargo of the USA in 1994.

Table 2.13 clarifies major countries that Vietnam is exporting to and importing from. As for the export destination in 1997, 66% of the total exports of Vietnam were forwarded to Asian countries among which Japan occupied the largest share of 18%, followed by Singapore (13%) and Taiwan (9 %). As for the import origin to Vietnam in 1997, 78% of the total imports of Vietnam originated from Asian countries among which Singapore occupied the largest share of 18% followed by Republic of Korea (14%), Japan (13%) and Taiwan (13%).

Table 2.14 contains international balance of payment for the period of 1990-1997. In parallel with the rapid economic growth in the first half of 1990's, the trade balance deficit has increased. However, the deficit had been offset by the inflow of foreign direct investment mainly from surrounding Asian countries and official development aid from OECD countries.

2.1.9 Public Finance for Development

The Government's budgetary operation is summarized in Table 2.15 for the period of 1990-1997. Total expenditure including capital expenditure exceeds total revenue and consequently the budget deficit is observed every year. This has been financed by both foreign loans and domestic loans as shown in the table. Grants from foreign Governments are included in Government's revenue. The current expenditure occupied 71% of the total expenditure in 1997 and the capital expenditure occupied 26%. The budget deficit was 3% of the total expenditure in 1997.

The breakdown of the Government's capital expenditure by sector is shown in Table 2.16.

When the trend is analyzed, it shows that the priority of the capital expenditure has been shifted from industry and construction to transport and communication and further to education and health sectors recently. From the accumulated capital expenditure, major sectors of capital expenditure are identified to be three sectors comprising transport and communication, education and health and industry and construction in order of accumulated amount. These three sectors correspond to 62% of total capital expenditure in the period of 1990-1997.

2.2 Economic Development Plan

2.2.1 National Development Plan

Although having been affected much by the Asian Economic Crisis of the mid-1997, the Sixth Five-year Plan for Socio-economic Development of Vietnam for the period of 1996-2000 is still underway. The new Five-year Plan for the period of 2001-2005 is under preparation and scheduled to be approved by the Government in November 1999.

The information obtained about the new Five-year Plan included that the growth target of GDP was set at 7.2% per year that was far below that in the previous Plan and that the rural development will be given priority among other sectors.

The Sixth Five-year Plan for 1996-2000 designated those five years as an important phase to accelerate industrialization and modernization of the country and to develop the multi-sector economy operating along the market mechanism. Major targets were set as arranged below together with the progress by 1998:

Economic growth targeted in the Sixth Five-year Plan for 1996-2000:

	Total GDP	Sector		
		Agriculture	Industry	Services
Target annual growth	9-10 % p.a.	4.5-5.0 % p.a.	14.0-15.0 % p.a.	12.0-13.0 % p.a.
Actual by 1998	10.0 % p.a.	4.1 % p.a.	11.7 % p.a.	12.2 % p.a.
Target sector share	-	19-20 %	34-35 %	45-46 %
Actual in 1998	-	22.7 %	30.1 %	47.2 %

Actual achievement in 1998 was computed by the Study Team as shown above. As far as total GDP is concerned, the high growth in 1995 and 1996 with more than 12% in the respective year was attributed to the attainment of the target. Despite the industrial sector's damage caused by the Asian Crisis, a favorable growth in both the service sector and agricultural sector had brought a good achievement in these three years of 1996-1998 as a whole. When the GDP share by each sector is observed, the decreasing trend of agriculture sector was rather slower than expected in the Plan. While the industrial sector share did not increase as expected in the Plan mainly due to the Asian Crisis.

The per capita GDP was targeted to reach a level of two times that in 1990 though the value in 1990 was not presented in the Plan. Actual realization was computed by the Study Team as US$ 348 per capita at current price level which is to be compared with US$ 123 per capita estimated also by the Study Team for 1990. Then, it can be said that the per capita GDP target set for 2000 in the Plan was easily attained in 1998 already (cf. Table 2.18).

The target for Consumer Price Index (CPI) was set at a level less than 10% per annum in the Plan. When the price change is measured by GDP deflator that was 508.9 in 1995 and 603.8 in 1998 based on the index with 1989 price level =100, average annual increase was calculated at 5.9% per year. The planned target for CPI was also attained.

The population target of 1.8 % per year increase rate in 2000 was already reached in 1997. The food production target of 30 million tons in 2000 was also attained in 1997 (30.561 million tons). However, the target of electricity supply set at 30,000 GWh in 2000 in the Plan was not attained yet with the power supply at 20,850 GWh in 1998.

Some more details of targets stipulated in the Sixth Five-year National Development Plan for the period of 1996-2000 are summarized in Table 2.17.

2.2.2 Regional Development Plan

As stated in Section 2.1.2 Administrative Structure, the regional concept is not established yet in Vietnam. Regional Development Plan is actually compiled by planning agencies for each Five-year plan period. However, they are not so consistent, with each lacking a definite criteria for regional planning that it is not appropriate, according to the information of planning agencies, to take up in such a report. Such being the case, only an outline of regions is presented here by describing the regional development plan for 1999. According to an informed source, JICA Study on regional development master plan which is now underway in Central Vietnam will provide a standard criteria for regional planning in Vietnam. The brief description of 1999 Regional Development Plan in each region is as follows:

a) The Red River Delta Region is one of the two major granaries of Vietnam. The growth in agricultural production was set at 4.4% in 1999 while that in industrial production at 11.6%.

b) Regions in the Central area were demanded by the National Assembly to channel investment into the upgrading and building of irrigation systems. Tasks urgently required in this area comprise the speeding up of shifting plant and animal structure and extension of afforestation acreage in upward areas. Central Vietnam is also planned to efficiently specialize in farming of industrial crops like sugarcane, rubber, coffee, cacao, etc. As for industrial production, the processing and rural industries should be intensified with offshore fishing projects given great attention. This area is also required to develop westwards to reclaim 1.5 million hectares of deserted land and bare hills and exploit 50,000 coastal hectares to farm aqua-products.

c) The Southeast Region plays an important role in the development of national economy with its potential of industrial growth. The region's average growth rate is higher than the other regions of the country, accounting for 52% of the country's industrial production, more than 50% of the export and import turnover, and more than 57% of the national budget revenues.

d) The region comprising HCM City- Binh Duong-Ba Ria- Vung Tau is stressed by the Government to develop into the economic center of the South with its potential in infrastructure and other special advantages. The top priority will be placed on oil exploitation industry, energy, fertilizer, steel, building materials, electronics, garments, etc. in the strategy of regional development.

e) The Mekong River Delta region is powerful in agricultural production and processing of agro-products for export. The agricultural growth is planned in 1999 at least 4.6% with a food output of 15.5-16.6 million tons. The industrial production is planned to increase 10%, services sector 8%, import and export turnover 9.1% and employment creation for 160,000 people.

2.3 Impact of East Asian Economic Crisis

Economy of Vietnam has not fully integrated into global financial markets and its capital account is tightly controlled. Therefore, it was initially anticipated that Vietnam's economy would not be affected by the Asian economic crisis that began in mid 1997. Actually, economic growth reached 9.3% in 1997, inflation remained low at 5%, exports grew at more than 20% and FDI inflows increased more than 40%. All these indices showed a reasonable healthy pace compared with other Asian countries. As the crisis has deepened, however, the growth has slowed down significantly.

Although the currencies of Thailand, Indonesia, the Philippines, Malaysia and Korea have depreciated substantially since July 1997, Vietnam's exchange rate has appreciated over the same period. This has adversely affected the relative price competitiveness of Vietnam against other Asian economies. Economic growth in Asia has slowed dramatically and domestic demand has decreased in the major economies of Asia. As a result, export demand of Vietnam lowered. This trend has affected Vietnam much, since a significant portion of total export from Vietnam went to Asian countries with 72%, for example, in 1996.

Foreign investment has been an important source of rapid economic growth of Vietnam in 1990's. The Asian countries have been the largest investors in Vietnam. As of the end of 1997, the share of Asian countries was reported to be 68% in the total un-disbursed FDI ("Vietnam- Rising to the Challenge" WB, December 1998). In 1998, FDI inflows have dropped sharply; in the first six months, FDI inflows totaled only US$ 1.0 billion compared to US$ 1.7 billion in 1997. The primary reason has been the sharp decline of economic activity in Asian economies as a result of the crisis.

Recovery from the current recession will depend to a large extent on the economic recovery of other surrounding Asian countries. Fortunately for Vietnam, Asian economies have been gradually improving in these several months. Apart from external conditions that are given to Vietnam, there may be many challenges that Vietnam has to struggle with. Among others, an intensive rural development is deemed to be the urgent and highest priority. Nearly 80% of the total population is living in rural areas with insufficient working opportunities. The effective utilization of these untapped human resources in villages will be realized through rural industrialization, for example introducing small and medium enterprises (SME) and foreign direct investment (FDI) into rural areas. This will need incentive measures attractive to SME and FDI including regulation improvements of land tenure and others. The rural electrification program is to be encouraged for rural industries as well. Meanwhile, the vitalization of rural areas will lead to a solution to the income disparity between urban and rural, which is emerging, an important problem of Vietnam recently.

2.4 Socio-Economic Projection

2.4.1 General

A socio-economic projection up to the year 2015 was conducted for the limited purpose of providing a macro-framework for the electric power demand projection stated in Chapter 5. Such being the case, this projection includes neither in-depth studies on population trend, GDP potentials, employment nor productivity of each economic sector. Most of the projected macro indices were primarily those projections made by the Government of Vietnam and/or World Bank where data and information on Vietnam are accumulated. The projection result of GDP and population is compiled in Table 2.18 and those of sector GDP in Table 2.19.

2.4.2 Projection of GDP and Population

The GDP forecast made by the Development Strategy Institute (DSI) of the Ministry of Planning and Investment (MPI) was adopted for the years of 1999 and 2000. Thereafter, the GDP forecast incorporated in the Power Development Master Plan Phase V prepared by the Institute of Energy (IOE) in Hanoi in August 1999 was adopted up to the year 2015. The latter forecast of GDP was also prepared by DSI for IOE. Accordingly the growth rate of GDP shown below was adopted in this report:

	1999	2000	2001-2005	2006-2010	2011-2020
GDP growth rate	5.0 % p.a.	6.0 % p.a.	7.2 % p.a.	7.2 % p.a.	6.5 % p.a.

Regarding population projection, the fact that Vietnam had attained the target of 1.8% population increase set for the year 2000 three years earlier in 1997 was taken into consideration. While, an analysis of the relationship between population growth and per capita GDP in Indonesia and Thailand shows that when the per capita GDP rises to a level of US$ 1,000, the population increase slows down below the level of 1.5 - 1.7%. Based on these two factors, the population growth of 1.3% was assumed in 2010 when the per capita GDP of Vietnam is projected to exceed US$ 1,000 and 1.2 % in 2015 when the per capita GDP will reach an order of US$ 1,700. Actually, it took only 5 years for Vietnam to reduce the population growth rate of 0.6% from 2.4% in 1992 to 1.8% in 1997. Therefore, it is deemed rather slow to assume 18 years from 1997 to 2015 for Vietnam to reduce the same 0.6% population growth rate. The decreasing trend of population projected in this report may be still conservative. According to this projection, the Vietnamese population will reach nearly 100 million in the year 2015.

The consequent per capita GDP in 2015 was projected at US$ 1,744 at current price level which is approaching the per capita GNP level of "middle income" group (US$ 1,890 in 1997) defined by World Bank.

2.4.3 Projection of Sector GDP

The GDP projected as stated above was broken down into each economic sector on the basis of various information collected and assumptions made by the Study Team. This was done for the purpose of facilitating the power demand forecast made in Chapter 5 in

this report. The projected sector GDP is presented in Table 2.19. Method of the projection is stated below.

(1) Structure of the Projection

Based on the historical data, forecasts were made first for the year 2015 in terms of either GDP sector share, employment structure, or labor force participation rate. The projection for the years 2000, 2005 and 2010 were made by the method of interpolation thereafter.

(2) Sector Share of GDP

The structure of GDP in 2015 was assumed for each sector as shown below.

- Agriculture : 10%
- Industry and construction : 45%
- Services : 45%

In determining these shares, historical data (1996) of Asian countries in terms of GDP share and per capita GDP were examined. It was observed that, as per capita GDP increases, agricultural sector share reduces and industrial sector share increases. At the same time, the decreasing trend of the agricultural sector share and the increasing trend of the industrial sector share in recent Vietnam were also taken into consideration.

(3) Labor Force Participation Rate

The rate of labor force to the total population (labor force participation rate) in 2015 was assumed at 55% taking into account the historical trend in Vietnam and other Asian countries.

(4) Employment Structure

In parallel with the decreasing trend of the agricultural sector share in GDP, the employment share of agriculture sector decreases. The employment share of the industrial sector, though the rate is not so large, increases as its GDP share increases.

Taking into consideration these historical trends in Vietnam, the employment structure in 2015 was assumed as shown below:

Sectoral Share of Employment

Sector	Sector Share
Agriculture sector:	60%
Industry and construction:	15%
Services:	25%

Based on these assumptions, the sector GDP values for the year 2015 were projected for each sector. The sector GDP projection for each year including years of 2000, 2005 and 2010 was made by the method of interpolation through connecting the 2015 values and the historical 1998 values.

(5) Result of Projection of Sector GDP

The projected sector GDP is tabulated in Table 2.19 together with the historical sector

GDP. The following can be pointed out from this table:

a) Due to the declining growth rate projection of the total GDP, the consequent growth rate of each sector GDP is projected to decrease. A large decrease is projected for the industrial sector from the historical growth of 13.3% per annum for the period of 1990-1998 to 9.3% per annum for the period of 1998-2015. For the agriculture sector, the same growth rate is projected to increase from 1.6% to 1.8%. This increasing growth in agriculture sector, even though it is a slight increase, coincides with the long-term strategy of rural development conceived in the coming Five-year Development Plan of the Government.

b) As for employment by sector, though the employment increases in terms of number, its growth rate is projected to decrease slightly from 1.5% per annum to 1.4% per annum in the agricultural sector. Therefore, the agriculture sector needs to raise its productivity.

c) Productivity of each sector was also computed for the purpose of examining the consistency of the projection of GDP by sector. As stated already, agriculture is required to raise its productivity. Since the productivity in the industrial sector is already high enough, it will grow rather slowly compared to that in the preceding high growth period, though the expected growth of more than 5% per year will not be so easy to attain. Meanwhile, all the projected result of productivity is deemed to be within a reasonable range.

Table 2.1 Number of Administrative Units and Population by Province

Region / Province	Cities under provinces	Urban districts	Town	Rural districts	Precinct	Towns under provinces	Communes	Total population in 1994	Urban population	Rural population
Whole Country	**15**	**33**	**62**	**490**	**951**	**530**	**8,850**	**72,510**	**14,139**	**57,326**
Red River Delta	**1**	**11**	**9**	**69**	**210**	**77**	**1,670**			
1 Ha Noi		7		5	102	8	118	2,194	1,151	1,044
2 Hai Phong		4	1	8	50	9	157	1,615	540	1,076
3 Ha Tay			2	12	10	14	300	2,257	173	2,084
4 Hai Duong			1	11	6	13	244	2,709	141	2,568
5 Hung Yen			1	6	6	6	148	n.a.	n.a.	n.a.
6 Ha Nam			1	5	4	6	104	2,640	303	2,337
7 Nam Dinh	1			9	15	9	201	n.a.	n.a.	n.a.
8 Thai Binh			1	7	6	7	272	1,789	104	1,686
9 Ninh Binh			2	6	11	5	126	861	77	785
Northeast	**3**	**0**	**16**	**98**	**117**	**117**	**2,107**			
10 Ha Giang			1	9	4	5	175	535	48	488
11 Cao Bang			1	10	4	6	177	645	65	573
12 Lao Cai			2	8	9	10	161	552	73	479
13 Bac Kan			1	5	4	6	112	n.a.	n.a.	n.a.
14 Lang Son			1	10	5	14	206	690	90	600
15 Tuyen Quang			1	5	3	8	134	645	64	581
16 Yen Bai			2	7	11	8	159	652	116	536
17 Thai Nguyen	1		1	7	20	13	144	n.a.	n.a.	n.a.
18 Phu Tho	1		1	8	11	10	249	n.a.	n.a.	n.a.
19 Vinh Phuc			1	5	4	8	136	2,249	164	2,085
20 Bac Giang			1	9	5	14	205	n.a.	n.a.	n.a.
21 Bac Ninh			1	5	5	3	115	n.a.	n.a.	n.a.
22 Quang Ninh	1		2	10	32	12	134	900	388	512
Northwest	**0**	**0**	**4**	**26**	**14**	**30**	**515**			
23 Lai Chau			2	8	6	8	140	521	74	446
24 Son La			1	9	2	10	181	802	103	699
25 Hoa Binh			1	9	6	12	194	729	118	612
North Central	**3**	**0**	**8**	**70**	**83**	**78**	**1,625**			
26 Thanh Hoa	1		2	24	18	30	578	3,382	320	3,062
27 Nghe An	1		1	17	18	16	429	2,743	225	2,518
28 Ha Tinh			2	8	10	12	240	1,309	75	1,234
29 Quang Binh			1	6	8	5	135	762	89	673
30 Quang Tri			2	7	9	8	119	535	89	446
31 Thua Thien-Hue	1			8	20	7	124	995	257	739
Central Coast	**2**	**5**	**4**	**49**	**84**	**43**	**680**			
32 Da Nang		5		2	33		14	1,953	603	1,349
33 Quang Nam			2	12	10	12	189	n.a.	n.a.	n.a.
34 Quang Ngai			1	12	6	9	159	1,179	102	1,077
35 Binh Dinh	1			10	12	10	127	1,407	251	1,156
36 Phu Yen			1	6	6	6	86	731	136	595
37 Khanh Hoa	1			7	17	6	105	947	536	591
Central Highlands	**1**	**0**	**2**	**34**	**23**	**31**	**378**			
38 Kon Tum			1	6	4	6	66	256	56	200
39 Gia Lai			1	11	6	11	144	763	171	593
40 Dak Lak	1			17	13	14	168	1,211	202	1,009
Southeast	**3**	**17**	**6**	**54**	**319**	**52**	**683**			
41 T.P. Ho Chi Minh		17		5	237	4	62	4,392	3,252	1,140
42 Lam Dong	1		1	9	18	11	99	769	259	510
43 Ninh Thuan			1	3	9	2	43	459	106	353
44 Binh Phuoc				5		7	62	n.a.	n.a.	n.a.
45 Tay Ninh			1	8	3	5	78	888	105	783
46 Binh Duong			1	3	3	7	67	n.a.	n.a.	n.a.
47 Dong Nai	1			8	23	7	133	1,813	455	1,358
48 Binh Thuan			1	8	10	4	96	882	208	674
49 Ba Ria-Vung Tau	1		1	5	16	5	43	671	225	446
Mekong River Delta	**2**	**0**	**13**	**90**	**101**	**102**	**1,192**			
50 Long An			1	13	5	15	162	1,252	158	1,094
51 Dong Thap			2	9	10	9	120	1,491	236	1,254
52 An Giang			2	9	7	11	120	1,971	366	1,605
53 Tien Giang	1		1	7	12	7	144	1,656	201	1,455
54 Vinh Long			1	6	7	6	94	1,062	145	917
55 Ben Tre			1	7	8	7	143	1,330	98	1,233
56 Kien Giang			1	11	7	11	90	1,360	285	1,074
57 Can Tho	1			6	15	6	73	1,817	353	1,464
58 Tra Vinh			1	7	7	9	72	958	59	900
59 Soc Trang			1	6	10	7	81	1,197	196	1,002
60 Bac Lieu			1	3	5	6	37	n.a.	n.a.	n.a.
61 Ca Mau			1	6	8	8	56	n.a.	n.a.	n.a.

Note: (1) Unit for population: thousand persons
(2) Population data do not add to grand total, due to possible exclusion of military forces.
(3) The 1994 population of some provinces are not known due to changes of administrative division.
(4) "n.a." means that the data are not available.

Source: (1) Administrative unit: "Statistical Yearbook 1998" General Statistical Office, Socialist Republic of Vietnam
(2) Population by province: "Vietnam-Rising to the Challenge" World Bank, December 1998

Table 2.2 Historical Trend of Population in Vietnam

(Unit of population : 1000 persons)

	Total Population	Growth Rate of Population	Urban	% to Total	Rural	% to Total
1975	48,030					
1976	49,160	2.35%	10,127	20.6%	39,033	79.4%
1977	50,237	2.19%	10,116	20.1%	40,114	79.8%
1978	51,337	2.19%	10,105	19.7%	41,226	80.3%
1979 (Census)	52,462	2.19%	10,094	19.2%	42,368	80.8%
1980	53,630	2.23%	10,295	19.2%	43,335	80.8%
1981	54,824	2.23%	10,499	19.2%	44,324	80.8%
1982	56,045	2.23%	10,708	19.1%	45,336	80.9%
1983	57,292	2.22%	10,921	19.1%	46,371	80.9%
1984	58,568	2.23%	11,138	19.0%	47,429	81.0%
1985	59,872	2.23%	11,360	19.0%	48,512	81.0%
1986	61,109	2.07%	11,817	19.3%	49,292	80.7%
1987	62,452	2.20%	12,271	19.6%	50,181	80.4%
1988	63,727	2.04%	12,662	19.9%	51,065	80.1%
1989 (Census)	64,774	1.64%	12,919	19.9%	50,801	78.4%
1990	66,233.0	2.25%	13,281.0	20.1%	51,908.0	78.4%
1991	67,774.0	2.33%	13,619.0	20.1%	53,111.0	78.4%
1992	69,405.2	2.41%	13,285.0	19.1%	55,075.0	79.4%
1993	71,025.6	2.33%	13,663.0	19.2%	56,317.8	79.3%
1994	72,509.5	2.09%	14,139.3	19.5%	57,325.5	79.1%
1995	73,962.4	2.00%	14,575.4	19.7%	58,342.3	78.9%
1996	75,355.2	1.88%	15,085.5	20.0%	59,224.9	78.6%
1997	76,714.5	1.80%	15,725.5	20.5%	59,939.4	78.1%
1998 (preliminary)	78,059.1	1.75%	16,445.2	21.1%	60,601.2	77.6%
Growth rate :						
75-85	2.23%		1.28%		2.45%	
85-95	2.14%		2.52%		1.86%	
95-98	1.81%		4.11%		1.27%	

Source: (1) "Statistical Yearbook 1998"
(2) "Vietnam-Rising to the Challenge" WB, December 1998 for the data of 1975-1989

Note: Urban and rural population does not add up the total population due to army population.

Table 2.3 Labor Force by Kind of Economic Activities

	1995		1996		1997	
	(x 1000)	(%)	(x 1000)	(%)	(x 1000)	(%)
Agriculture & Forestry	23,521.0	68.0%	24,152.8	67.5%	24,813.8	67.1%
Fishing	600.7	1.7%	622.5	1.7%	629.6	1.7%
(Sub Total: Primary Industry)	24,121.7	69.7%	24,775.3	69.2%	25,443.4	68.8%
Mining & Quarrying	207.4	0.6%	211.8	0.6%	210.5	0.6%
Manufacturing	3,227.2	9.3%	3,288.8	9.2%	3,292.5	8.9%
Construction	995.6	2.9%	975.1	2.7%	976.5	2.6%
(Sub Total: Secondary Industry)	4,430.2	12.8%	4,475.7	12.5%	4,479.5	12.1%
Electricity, Gas & Water Supply	152.2	0.4%	152.8	0.4%	153.0	0.4%
Wholesale & Retail Trade, Repair Works	1,887.6	5.5%	2,158.6	6.0%	2,671.7	7.2%
Hotels & Restaurants	506.7	1.5%	518.3	1.4%	518.5	1.4%
Transport & Communication	781.0	2.3%	855.6	2.4%	856.0	2.3%
Bank and Securities	126.4	0.4%	125.3	0.4%	125.9	0.3%
Science & Technology	38.4	0.1%	39.2	0.1%	40.7	0.1%
Real Estate & Rental	55.3	0.2%	76.0	0.2%	76.6	0.2%
Government, Defense & Social Security	392.5	1.1%	409.4	1.1%	410.6	1.1%
Education & Training	973.4	2.8%	994.3	2.8%	998.8	2.7%
Health & Social Work	279.2	0.8%	293.0	0.8%	296.0	0.8%
Recreation, Culture & Sports	94.0	0.3%	95.8	0.3%	96.2	0.3%
Party & Organization	97.3	0.3%	98.7	0.3%	99.9	0.3%
Community & Social Activities	571.5	1.7%	593.2	1.7%	595.3	1.6%
Private Business	76.7	0.2%	124.3	0.3%	125.4	0.3%
Others including NGO	5.5	0.0%	6.4	0.0%	6.7	0.0%
(Sub Total: Tertiary Industry)	6,037.7	17.5%	6,540.9	18.3%	7,071.3	19.1%
Total	34,589.6	100.0%	35,791.9	100.0%	36,994.2	100.0%
Annual Average Growth	-		3.5%		3.4%	

Source: "Statistical Yearbook 1998" General Statistical Office