Ministry of Energy and Mineral Resources
The Republic of Indonesia

THE STUDY ON OPTIMAL ELECTRIC POWER DEVELOPMENT IN JAVA-MADURA-BALI IN THE REPUBLIC OF INDONESIA

FINAL REPORT

December 2008

JAPAN INTERNATIONAL COOPERATION AGENCY

NEWJEC INC.
THE KANSAI ELECTRIC POWER CO., INC.

PREFACE

In response to a request from the Government of Republic of Indonesia, the Government of Japan decided to conduct the Study on the Optimal Electric Power Development in Java-Madura-Bali in the Republic of Indonesia, and the study was implemented by the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team, headed by Mr. Satoshi YAMAOKA of NEWJEC Inc., and organized by NEWJEC Inc. and The KANSAI Electric Power Co., Inc. four times from January 2008 to December 2008.

The Study Team held discussions with the counterparts concerned of the Government of Indonesia and State-owned Electric Power Company, PT. PLN (Persero), and conducted field surveys at the study area.

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

Finally, I wish to express my sincere appreciation to the counterparts concerned of the Government of Republic of Indonesia and PT. PLN (Persero) for their close cooperation throughout the Study.

December 2008

Seiichi NAGATSUKA
Vice President
Japan International Cooperation Agency

December 2008

Seiichi NAGATSUKA
Vice President
Japan International Cooperation Agency
Tokyo, Japan

LETTER OF TRANSMITTAL

We are pleased to submit to you the report of "the Study on the Optimal Electric Power Development in Java-Madura-Bali in the Republic of Indonesia". This Study was implemented by NEWJEC Inc. and The Kansai Electric Power Co., Inc. from January 2008 to December 2008 based on the contract with your Agency.

This report presents the optimal power development plan to be proposed with comprehensive assessment of supply stability, reliability, economy and environment, based on current policies and plan, on various power sources and facility, and transmission line system. In addition, power source development, transmission line system, environmental measures and also investment promotion schemes for the power sector are proposed in order to realize the plans.

We trust that utilization of our proposal will much contribute to sustainable development in the electric power sector, which will contribute to the improvement of the public welfare in Java-Madura-Bali as well, and recommend that the Government of the Republic of Indonesia prioritize the implementation of our proposal by applying results of technology transfer in the Study.

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and the Ministry of Economy, Trade and Industry. We are also wish to express our sincere gratitude to Ministry of Energy and Mineral Resources, PT PLN (Persero), and other authorities concerned for the close cooperation and assistance extended to us throughout the Study.

Very truly yours,

Satoshi YAMAOKA
Team Leader,
The Study on the Optimal Electric Power
Development in Java-Madura-Bali
in the Republic of Indonesia

Abbreviation Table

Abbreviation	Full Description in English (Indonesian)
AC	Alternating Current
ACB	Air Blast Circuit Breaker
ACE	ASEAN Center for Energy
ADB	Asian Development Bank
AFC	Automatic Frequency Control
AH	Air Heater
AI	Annual Inspection
AMDAL	Environmental Impact Assessment
ANDAL	Environmental Impact Statement
AVR	Automatic Voltage Regulator
BAKOREN	Badan Koordinasi Energi Nasional (National Energy Coordination Committee)
BAPEDALDA	Badan Pengendalian Dampak Lingkungan Daerah (Regional Environmental Management Authority)
BAPETEN	Badan Pengawas Tenaga Nuklir (Nuclear Energy Regulatory Agency)
BAPPENAS	National Development Planning Agency (Badan Perencanaan Pembanguanan Nasional)
BATAN	Badan Tenaga Atom National (National Atomic Energy Agency)
BCFD	Billion Cubic Feet per Day
BEMS	Building and Energy Management System
BFP	Boiler Feed Water Pump
BLK	Block
BOD	Biochemica1 Oxygen Demand
BOP	Balance of Plant
BP	British Petroleum (BPS-Statics Indonesia)
BPMIGAS	Badan Pelaksana Kegiatan Usaha Hulu Minyak Dan Gas Bumi (Executive Agency for Upstream Oil and Gas Business Activity)
BPPT	Agency for the Assessment and Application of Technology
BPS	Badan Pusat Statistik
CB	Circuit Breaker
CBM	Coal Bed Methane
CDF	Computer Fluid Dynamics
CDM	Clean Development Mechanism
CFL	Compact Fluorescent Lamp
CNG	Compressed Natural Gas
COD	Chemical Oxygen Demand
CRT	Cathode Ray Tube
CWP	Circulating Water Pump
DAS	Data Acquisition System
DC	Direct Current
DCS	Distributed Contro1 System
DGEED	Directorate General of Electricity and Energy Development
DGEEU	Directorate General of Electricity and Energy Utilization
DNA	Designated National Authority
DSM	Demand Side Management
DSS	Daily Start and Stop

Abbreviation	Full Description in English (Indonesian)
DEN	Dewan Energi Nasional
De-NOx	De-nitrification
De-SOx	De-sulfurization
DO	Dissolved Oxygen
DSM	Demand Side Management
ECR	Economica1 Continuous Rating
EE’C	Energy Efficiency and Conservation
EIA/AMDAL	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
ESCO	Energy Service Company
EPC	Engineering Procurement Construction
FGD	Flue Gas Desulfurization
FIRR	Financial Internal Rate of Return
FOH	Forced Outage Hours
FOH (L)	Forced Outage Hours caused by power grid system
FOH(D)	Forced Outage Hours caused by power station
FW	Feed Water
GEF	Global Environment Facility
GF	Governor Free
GHG	Greenhouse Gas
GI	General Inspection
GIB	Gas Insulated Busbar
GIS	Gas Insulated Switchgear
GOV	Governor
GT	Gas Turbine
HHV	Higher Heating Value
HP	High Pressure
HRSG	Heat Recovery Steam Generator
HSD	High Speed Diesel Oil
HV	High Voltage
HVAC	Heating Ventilation Air Conditioning
IAEA	International Atomic Energy Agency
I & C	Instrumentation and Control
IDO	Intermediate Diesel Oil
IEA	International Energy Agency
IEC	International Electrotechnical Commission
IGCC	Integrated Gasification Combined Cycle
IP	Intermediate Pressure
IPB	Isolated Phase Bus
IPP	Independent Power Producer
JBIC	Japan Bank for International Cooperation
JCC	Java Control Center
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
KA-ANDAL	Term of Reference for Environmental Impact Assessment

Abbreviation	Full Description in English (Indonesian)
KEN	National Energy Policy
LFC	Load Frequency Control
LHV	Lower Heating Value
LNG	Liquefied Natural Gas
LOLP	Loss of Load Probability
LP	Low Pressure
LRC	Low Rank Coal
LV	Low Voltage
MCR	Maximum Continuous Rating
MEMR	Ministry of Energy and Mineral Resources
METI	Ministry of Economy, Trade and Industry
MFO	Marine Fuel Oil
MHI	Mitsubishi Heavy Industries
MIGAS	Directorate General of Oil and Gas
MO	Major Overhaul
MOC	Ministry of Communications
MOE	Ministry of Environment (=KLH)
MOFo	Ministry of Forestry
MOH	Maintenance Outage Hours
MOI	Ministry of Industry
MOPS	Means of Platts Singapore
MS	Main Steam
NG	Natural Gas
ODA	Official Development Assistance
O&M	Operation and Maintenance
P3B	Penyaluran Dan Pusat Pengatur Beban Jawa Bali (Jawa Bali Transmission and Load Dispatching Center)
P3B UBOS	Penyaluran Dan Pusat Pengatur Beban Jawa Bali Unit Bidang Operasi Sistem (Jawa Bali Transmission and Load Dispatching Center)
PGN	PT Perusahaan Gas Negara (Indonesia Gas Corporation)
PJB	PT Java Bali Power Company
PLN	Perusahaan Umum Listrik Negara Persero (Indonesia Electricity Corporation)
PLTA	Hydro Power Plant
PLTD	Diesel Power Plant
PLTG	Gas Turbine Power Plant
PLTGU	Combined Cycle Power Plant
PLTM	Small Hydro Power Plant
PLTMH	Micro Hydro Power Plant
PLTP	Geothermal Power Plant
PLTU	Steam Power Plant
POH	Planned Outage Hours
ONAF	Oil Natural Air Forced
ONAN	Oil Natural Air Natural
RCC	Regional Control Center
REC	Regional Electricity Company

Abbreviation	Full Description in English (Indonesian)
RH	Re-heater
RIKEN	Rencana Induk Konservasi Energi National (National Energy Conservation Plan)
RKL / UKL	Environmental Management Plan
RLA	Remaining Life Assessment
RPL / UPL	Environmental Monitoring Plan
RSH	Reserve Shutdown Hours
Rp.	Indonesian monetary unit (1 US$ = 9,000 Rp. in 2007 (Provisionoal))
PPA	Power Purchase Agreement
RIKEN	Runcana Induk Konsetvasi Energi National (National Energy Conservation Plan)
RUEN	Rencana Umum Energi National (National Enegy General Plan)
RUKD	Rencana Umum Ketenagalistrikan. Daerah (General Plan for Regional Electricity)
RUKN	Rencana Umum Ketenagalistrikan National (National Electricity General Plan)
RUPTL	Rencana Usaha Penyediaan Tenaga Listrik (Electrical Power Supply Business Plan)
SCADA	Supervisory Control and Data Acquisition
SH	Super Heater
SEDF	Social Electricity Development Fund
SH	Service Hours
ST	Steam Turbine
TDL	TARIF DASAR LISTRIK (Basic Tariff of Electricity)
TIT	Turbine Inlet Temperature
TOR	Terms of Reference
UBP	Unit Busnis Pembangkitan (Generation Business Unit)
UFR	Under Frequency Relay
USAID	U.S. Agency for international Development
VAT	Value Added Tax
WASP	Wien Automatic System Planning
WB	World Bank
WSS	Weekly Start and Stop
WW	Water Wall

Unit Table

Abbreviation	Unit
bbl	Barrel (1 bbl = 159 litter)
BCM	Billion Cubic Meter
BCT	Billion Cubic Feet
BOE	Barrels of Oil Equivalent
BSCF	10^9 Standard Cubic feet
BTU	British Thermal Unit (=0.251996 kcal)
dBA	Decibe1 Measured on the A Scale
DWT	Dead Weight Tonnage
GWh	Gigawatt-hour
Hz	Hertz
kJ	Kilo Joule
kV	Kilovolt
kW	Kilowatt
kWh	Kilowatt-hour (1 kWh = 860 kcal) (1 kcal = 3.968 BTU)
MMCF	10^6 Cubic Feet (MM = 10^6)
MMBTU	10^6 British Thermal Unit (MM = 10^6)
MMSCF	10^6 Standard Cubic Feet (MM = 10^6)
MMSCFD	Million Standard Cubic Feet per Day
MMSTB	Million Stock Tank Barrel
MPa	Mega Pascal
MVA	Mega-volt-ampere
MW	Megawatt
MWh	Megawatt-hour
Nm^3	Normal Cubic Meter
pH	Potential of Hydrogen
ppb	Percent per Billion
ppm	Percent per Million
psi	Pound per Square Inch
rpm	Revolution per Minute
SBM	Setara Barrel Minyak (=BOE)
SCF	Standard Cubic Feet
STB	Stock Tank Barrel
TCF	Trillion Cubic Feet
TOE	Tons of Oil Equivalent (=10^7kcal)
VA	Volt-ampere

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1. PREFACE (BACKGROUND AND OBJECTIVES)

1.1. Background

The national medium-term plan from 2004 to 2009 in Indonesia proclaims that the stable supply of electricity is one of fundamental issues that contribute to the improvement of public security and social welfare in addition to development of economy, society and politics. The overall national electricity plan (hereinafter referred to as "RUKN") states importance of formulating stable energy supply system and securing energy sources.

Java-Madura-Bali (hereinafter referred to as "Jamali") region is a center of politics, economy and industry in Indonesia. The population in Jamali region is 133 million, about 60% of Indonesian total population as of 2006. The installed capacity of power plants owned and contracted by PLN is 24,846 MW in total and by type of power plant, steam plants take up 33.0 % of the total, followed by combined cycle 28.3%, hydro 14.2%, diesel 11.8%, gas turbine 7.5% and geothermal 1.6%.

The total energy production including IPP was 123,370 GWh in 2005, of which 79.5% was generated by PLN and 20.5% by IPP. PLN's energy production was 101,282 GWh of which 87% came from fossil fuel and 13% from other renewable energy, hydro and geothermal.

The electricity power capacity in Jamali region is 16,355 MW as of 2005, 73% of total capacity 22,515 MW in Indonesia. Capacity expansion has not been catching up with the growth of demand. Many outages have occurred due to load control. The annual demand growth rate is assumed at 7% in Jamali region and this rate continuing for another 10 years requires extra capacity of about 1,500 MW every year. The present situation urges the power sector in Indonesia to make the best effort to increase reliable power sources.

In response to soaring world oil prices since 2005, the Ministry of Energy and Mineral Resources (herein after referred to as "MEMR") decided to take an acceleration program for the construction of new coal thermal power plants and set a target of the ratio of coal power plants to be raised from 42% (2006) to 71% (2010) in RUKN. Meanwhile, MEMR began to take specific actions to start a nuclear power operation plant by 2017 for stable power supply. In consideration of these situations, MEMR and PLN are required to update current power development plans immediately.

The previous JICA study in 2002 established the optimal power development plan and power system development plan which focused mainly on short term measures. Drastic economic and social changes since then bring about the need of revision to these plans. The construction of the southern high voltage transmission line, 500 kV from Paiton to Depok was completed in 2006. In addition, the electricity generated in southern Sumatra is now scheduled to be transmitted to Java by DC interconnection by 2012.

To cope with the problem of insufficient power capacity, MEMR and PLN requested JICA's support to develop the twenty-year power development plan for Jamali region. JICA executed the project formation study in August 2007 and the S/W was signed between both governments. The main study was publicly announced in November 2007 and a consortium of NEWJEC Inc. and The KANSAI Electric Power Co., Inc. was selected as a consultant through a proposal evaluation process in December 2007. This study was started in January 2008 and is scheduled to be completed in December 2008.

The objectives of this study are:

1) To formulate the power development plan in Jamali region for 20 year period from 2009 to 2028; and
2) To transfer relevant knowledge and technologies to Indonesian counterpart.

The power development plan will incorporate current policies and past studies on various power sources and facility such as coal, natural gas, hydro, geothermal and nuclear and transmission line system. It will be optimized with comprehensive assessment of supply stability, reliability, economy and environment.

1.2. Objectives

(1) Optimal Power Development Planning in Java-Madura-Bali for the period from 2009 to 2028
(2) Technical transfers of the planning skills to the Ministry of Energy and Mineral Resources (MEMR) and the state-owned power company (PLN)

1.3. Flow of Overall Study

The study is comprised of the following three stages.

First Stage : Preparatory Work

The JICA Study Team elucidated the goals and framework of this study and carried out the following items as a basic study for formulating a development plan.

(1) Checking and conferring with counterparts concerning the framework of this study and the nature of the ways in which it is implemented

(2) Gathering and analyzing information about policies, the legal system, organizations, the amount of primary energy

(3) Review of existing demand forecast, existing power plant, power development plans, system plans, system operation and fast track program.

<u>Second Stage : Study of the Optimal Scenarios</u>

The JICA Study Team Studied following items.

(1) Demand Forecast
   1) Review of the Existing Power Demand Forecast
   2) Review of the Economic Development Policies, Economic Growth Forecast and Regional Development Plans
   3) Evaluation of the Possibility of Application of DSM and Energy Saving Measures
   4) Update of Power Demand Forecast

(2) Setting Up of Power Development Scenarios
   1) Evaluation of Primary Energy Potentials
   2) Evaluation of Existing Plans for Power Development Projects
   3) Evaluation of Methodology of Development Plan of Transmission and Substation including Java-Sumatra Interconnection
   4) Strategic Environmental Assessment
   5) Setting Up of Alternative Scenarios for Power Development and Identification of Optimal Scenario
   6) Estimation of Financial Requirements to realize the Optimal power Development Plan

<u>Third Stage : Proposal of Optimal Power Development Plan</u>

The JICA Study Team presented an optimal power development plan based on the investigations and results of evaluations from the previous stages. The Study Team also studied and presented "estimation of financial requirements and recommendation on the promotional measure for private sector investment" and "potential environmental impacts associated with each type of electricity generation and possible measures to prevent/reduce/ mitigate these impacts".

(1) Optimal power source development plan
(2) Optimal power system development plan
(3) Finance and involvement of private sector
(4) Environmental and social consideration
(5) Improvement of system operation

The flow chart for all the study work is on the following page.

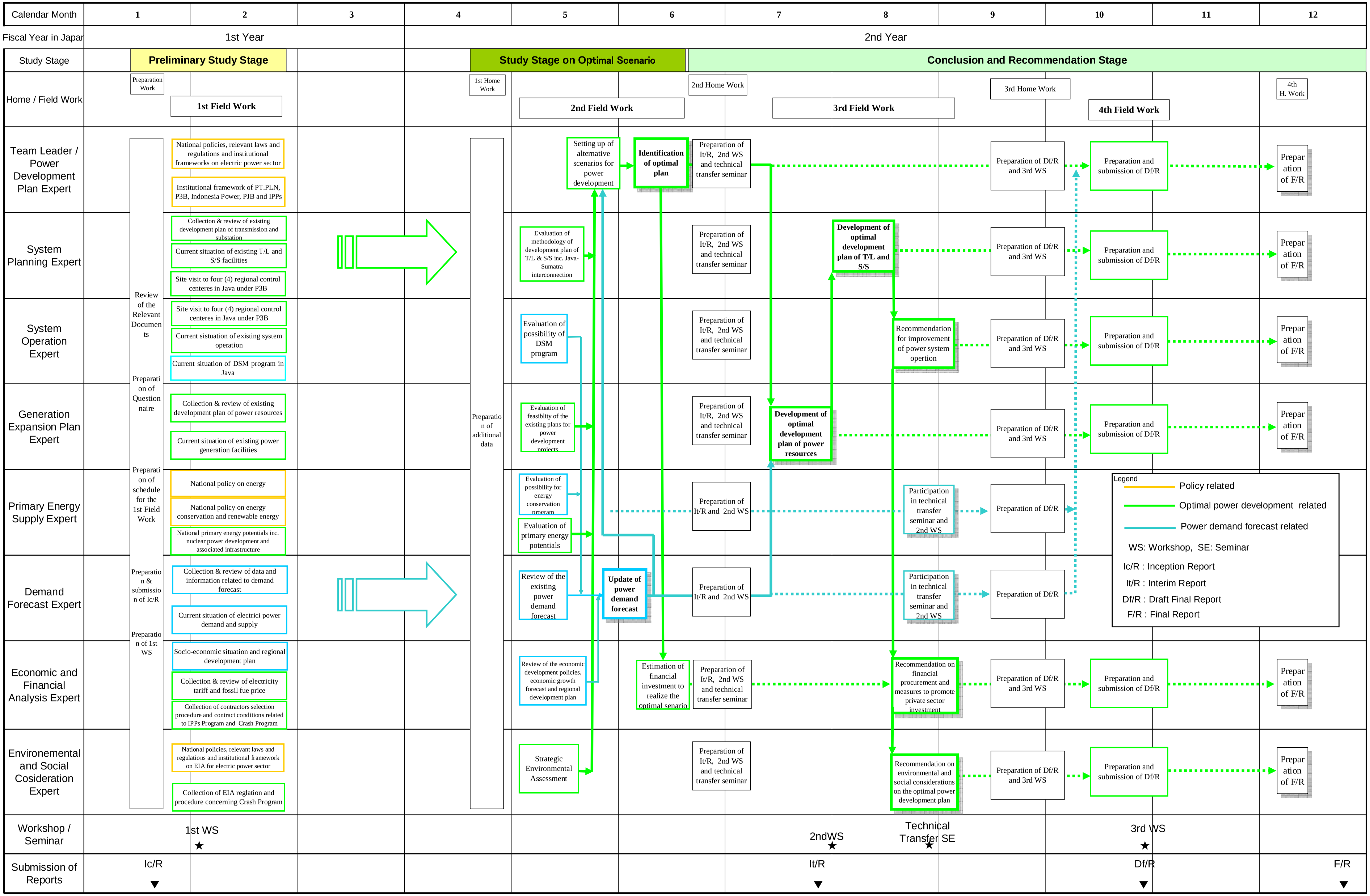


Fig. 1.3-1 General Flow Chart for the Study on Optimal Electric Power Development in Java-Madura-Bali in the Republic of Indonesia

1.4. Workshop and Technology Transfer Seminar

(1) Workshop

The workshops were held three times during the course of this study to share the subjects and issues of the study with related parties, and to build common recognition and understanding regarding the power development plan. Invitations were sent to a variety of organizations, i.e., MEMR, PLN, P3B JB, Indonesia Power, PJB, and IPP, etc.

The outline of each workshop is shown in Table 1.4-1. The content of the workshop are detailed in Attachment-1.

Table 1.4-1 Workshops

1st Workshop		
1. Place:	Jakarta	
2. Date:	One day in the course of the 1st Field Work	
3. Attendants :	MEMR, PLN, IP, PJB, P3B, JICA Indonesia Office	
4. Content :	♦ Explanation and discussion on Ic/R (General Approach and Methodology) ♦ Explanation of cooperative work planning with counterpart team	
2nd Workshop		
1. Place:	Surabaya	
2. Date:	One day in the course of 3rd Field Work	
3. Attendants:	MEMR, PLN, IP, PJB, P3B, JICA Indonesia Office	
4. Content:	♦ Explanation and discussion on It/R (Optimal power development scenario, Power demand forecast)	
3rd Workshop		
1. Place:	Jakarta	
2. Date:	One days in the course of 4th Field Work	
3. Attendants:	MEMR, PLN, IP, PJB, P3B, Japan Embassy, JICA Indonesia Office	
4. Content:	♦ Explanation and discussion on Df/R	

(2) Technology Transfer Seminar

The technology transfer was conducted in accordance with the requests from the counterpart as follows. Contents of the seminar had been determined through discussion with counterpart in the first trip. Technology transfer seminar was held out at PJB Head Office in Surabaya following the 2nd workshop.

1) Design of transmission and substation including insulation, lightning and pollution for improving reliability

2) Method of voltage control and system protection

3) Advanced and efficient technologies on transmission and substation facility management including maintenance technology

These contents of the seminar are arranged in connection with the topics in "5.5 Measures for the Improvement of System Operation" of this report.

The outline of the technology transfer seminar is shown in Table 1.4-2. The detailed report of the seminar is attached to this report, as Attachment-2.

Table 1.4-2 Contents of Technology Transfer Seminar

3rd Workshop	
1. Place:	Surabaya
2. Date:	2 days in the course of 3rd Field Work
3. Attendants:	PLN, IP, PJB, P3B, JICA Indonesia Office
4. Content:	♦ Design of transmission and substation including insulation, lightning and pollution for improving reliability ♦ Method of voltage control and system protection ♦ Advanced and efficient technologies on transmission and substation facilities including maintenance technology

1.5. Counterpart Team and Study Team

(1) Counterpart Team

1) MEMR

Department	Counterperson (2008.1-2008.4)	Position etc	NEW Counterperson (2008.4-)
General	Ir. Emy Perdanahari, M.Sc	Director of Electricity Program Supervision	No change
General	Mr. Benhur PL. Tobing	Deputy Director of Electricity Supplying	No change
Demand Forecast	Mr. Titovianto Widyantoro	Training Center staff	No change
Environment	Ms. Nini	Head of the Section of Power Plant Environmental Protection	No change
General of Mineral, Coal & Geothermal	Ms. Lidya Hardiani, M.Si	Head of Investment Development Section	No change
Oil & Gas Preparatory Program	Mr. J.Widjonarko	Deputy Director of Oil & Gas Preparatory Program	No change
- ditto -	Mr. Gusti S Sidemen	Head of Oil and Gas Development Section	No change
Energy Conservation	Mr. Indarti	Head of Energy Conservation	No change
Electricity Price and Subsidy	Mr. T. Gultom	Deputy Director of Electricity Price and Subsidy	No change
New Renewable Energy & Energy Conservation	Dr.Ir.Dadan Kusdiana	Deputy Director of Rural Energy	No change

2) PLN

Department	Counterperson (-2008.4)	Position etc	NEW Counterperson (2008.4-)
Director	Mr. Herman Darnel (- 2008.4)	Director	Mr. Bambang Praptono (2008.4 -)
Deputy Director	Mr. Bambang Hermawanto (- 2008.4)	Deputy Director for Planning System	Dr.Djoko Prasetijo (2008.4 -)
System Planning	Mr. Indra Tiahya (-2008.7)	Manager of System planning in Jawa-Bali	Mr. Monstar Panjaitan (2008.7-)
System Planning (P3B)	Mr. Susanto	P3B System planning manager	No change
System Operation(P3B)	Mr. Nur Pamudji (- 2008.4)	P3B Operation manager	Mr. Krisna Simbaputra (2008.4 -)
System Planning	Mr. Erwin Mirza		No change
- ditto -	Mr. Abdurachman Afiff		No change
- ditto -	Mr. Pudji Widodo	Assistant Deputy Director of Coal Energy	No change
P3B region Jakarta & Banten	Mr. Sunoto	RCC1 Deputy manager	No change
- ditto -	Mr.Kosasih	RCC1	Mr.Edi Purwanto
P3B region Jawa Barat	Mr. Iyan	RCC2 Deputy Manager System	No change
P3B region Jawa tengah & DIY	Mr. Zainal	RCC3 Deputy Manager Operation	No change
P3B Region Jawa Timur & Bali	Mr. Choirul	RCC4 Deputy Manager Operation	No change
Demand forecasts	Mr. Putu Karmiata	System planning staff	No change
Generation Expansion Planning	Mr. Ikbal Nur	Generation Expansion Planning	Mr. Budi Chaeruddin (2008.8-)
10,000 MW Fast Track Project	Mr. M. Dalyono	Project Coordinator, Coal Fired Steam Power Plant 10,000 MW Fast Track Project	No change
IPP Contract Management	Mr. Nasri Sebayang (- 2008.4)	Duputy Director of Strategic IPP	Mr. Binarto (2008.4 -)
Primary Energy	Mr. Hartoyo Atmowiyoto	Assistant Deputy Director of Gas Energy	No change
Environment and Safety, Directorate of Generation and Primary Energy	Dr. Francisca Kolondam (2008.7 -)	Assistant Deputy Director for Environment	Ms. Assistia Semiawan (2008.7 -) (Deputy Director for Environment)

(2) JICA Study Team

Area of Expertise	Name	Area of Expertise	Name
Team Leader/ Power Development Plan	YAMAOKA Satoshi	Primary Energy Supply	NAKAJIMA Yasufumi
System Planning	TANAKA Yukao	Power Demand Forecast	YAMADA Hiroaki
System Operation	KOYAMA Yasushi	Economic and Financial Analysis	NISHIDA Masaru
Transmission Engineer	MARUOKA Yoshio	Environmental and Social Considerations	OHWADA Takashi
Substation Engineer	MANABE Kazuhiro	Coordinator	MATSUNO Toshihiro
Generation Expansion Plan	MATSUDA Yasuharu		

2. CURRENT CONDITIONS IN JAMALI AND INDONESIA

2.1 Electricity Related Laws and Regulations, Policy and Organization

2.1.1 Electricity Related Laws and Regulations

(1) Law Hierarchy

The law hierarchy is defined in the constitution and Law No.10/2004 (refer to Tables 2.1-1 and 2.1-2). The laws and regulations are presented in order of higher authority from the top in Table 2.1-3.[1,2]

Table 2.1-1 Laws and Regulations defined in the Constitution

Description	Authorized body		Reasons in the constitution
Law	Article 5, paragraph 1 and Article 20, paragraph 1	President and parliament	President has the right to submit a bill. Parliament assumes the power to establish laws.
Government Regulation	Article 5, paragraph 2	President	President establishes government regulations to implement laws.
Presidential Decree	Article 4, paragraph 1	President	President administers the government in accordance with the constitution.

Table 2.1-2 Law No.10/2004 on Government Regulations

Article 1
(3) Law is established by the parliament under the consent of the president.
(5) Government regulations are established by the president to implement the laws.

Article 7
(1) Kinds of laws and their hierarchy are described as follows:
a. Constitutions, 1945
b. Act, Government Regulation/Peraturan in Lieu of Act
c. Government Regulation/Peraturan
d. Presidential Regulation/Peraturan
e. Regional Regulation/Peraturan

1 JICA, Energy conservation and efficiency conservation in RI Progress Report, February 2008 P. 2-42/43 (Japanese)
2 JICA, Approaches to overall technical cooperation for the energy sector in Indonesia (Project Study), March 2006 (Japanese)

Table 2.1-3 Hierarchy of Laws and Regulations in Indonesia

1.	1945 Constitution (UUD 1945)
2.	People's Consultative Assembly Resolution (Ketetapan MPR)
3.	Law (Undang Undang)
4.	Government Regulation Substituting a Law (PP Pengganti UU/Perupu)
5.	Government Regulation (Peraturan Pemerintah / PP)
6.	Presidential Decree (Keputusan Presiden/Keppres) Presidential Regulation (Peraturan Presiden)
7.	Presidential Instruction (Instruksi Presiden/Inpres)
8.	Ministerial Decree (Keputusan Menteri/KepMen)
9.	Regional Regulation (Peraturan Daerah/Perda)

(2) Outline of Electricity related Laws and Regulations

Main laws and regulations related to electricity and energy in Indonesia are presented in Tables 2.1-4 and 2.1-5. Amendment of Electricity Laws was enacted, but the amendment was judged unconstitutional and abolished in December 2004. The basic electricity law reverted to the Law No.15/1985. Various energy-related laws and regulations have been established to meet difficult energy situation recently. Laws and presidential decrees concerning national energy policy were established which were followed by the presidential instructions and ministerial decrees concerning, for example, energy conservation and use of bio fuel.

A series of the government regulations on electricity supply and utilization came into effect to follow up the new energy related laws and regulations. Furthermore, government regulations became effective for renewable energy and geothermal, and ministerial decree for IPP acceleration. Some presidential decrees were also established to promote coal thermal power plants development for urgent power supply for base load.

The details of each laws and regulations are described in the following sections of electricity and energy policy.

Table 2.1-4 Main Laws and Regulations of Power and Energy in Indonesia

No.	Regulation	Law	Government Regulation	Presidential Degree	Presidential Instruction	Ministerial Decree
(1) Electricity						
1.	Undang-undang No.15 Tahun 1985 Tentang Ketenagalistrikan	✓				
2.	Peraturan Pemerintah No 10 TAHUN 1989 Tentang Penyediaan dan Pemanfaatan Tenaga Listrik		✓			
3.	Peraturan Pemerintah No.3 Tahun 2005 Tentang Perubahan Atas Peraturan Pemerintah No 10 1989 Tentang Penyediaan Dan Pemanfaatan Tenaga Listrik		✓			
4.	Peraturan Pemerintah No.26 Tahun 2006 Tentang Perubahan Kedua Atas Peraturan Pemerintah No.10 Tahun 1989 Tentang Penyediaan Dan Pemanfaatan Tenaga Listrik		✓			
5.	Peraturan Presiden RI No.71 Tahun 2006 Tentang Penugasan Kepada PT Perusahaan Listrik Negara (Persero) Untuk Melakukanÿ Percepatan Pembangunan Pembangkit Tenaga Listrik Yang Menggunakan Batubara			✓		
6.	Peraturan Presiden RI No.72 Tahun 2006 Tentang Tim Koordinasi Percepatan Pembangunan Pembangkit Tenaga Listrik			✓		
7.	Peraturan Presiden RI No.86 Tahun 2006 Tentang Pemberian Jaminan Pemerintah Untuk Percepatan Pembangunan Pembangkit Listrik Yang Menggunakan Batubara			✓		
8.	Permen ESDM No. 0010 Tahun 2005 Tentang Tata Cara Perizinan Usaha Ketenagalistrikan Untuk Lintas Provinsi Atau Yang Terhubung Dengan Jaringan Transmisi Nasional					✓
9.	Permen ESDM Nomor 0009 Tahun 2005 Tentang Prosedur Pembelian Tenaga Listrik Dan/Atau Sewa Menyewa Jaringan Dalam Usaha Penyediaan Tenaga Listrik Untuk Kepentingan Umum					✓
10.	Permen ESDM No. 001 Tahun 2006 tentang Prosedur Pembelian Tenaga Listrik dan/atau Sewa Menyewa Jaringan Dalam Usaha Penyediaan Tenaga Listrik Untuk Kepentingan Umum					✓
11.	Permen ESDM Nomor 004 Tahun 2007 Tentang Perubahan Atas Peraturan Menteri Energi dan Sumber Daya Mineral Nomor 001 Tahun 2006 Tentang Prosedur Pembelian Tenaga Listrik dan Atau Sewa Menyewa Jaringan Dalam Usaha Penyediaan Tenaga Listrik Untuk Kepentingan Umum					✓
12.	Peraturan Menteri ESDM NO. 044 Tahun 2006 Tentang Pembelian Tenaga Listrik dalam Rangka Percepatan Diversifikasi Energi untuk Pembangkit Tenaga Listrik ke Batubara Melalui Pemilihan Langsung					✓
13.	Peraturan Menteri Energi dan Sumber Daya Mineral No.479-12/43/600.2/ 2005 tanggal 18 Mei 2005 tentang Penetapan Kondisi Krisis Penyediaan Tenaga Listrik					✓
14.	Kepmen ESDM No.1122K/30/MEM/2002 tentang Pedoman Pengusahaan Pembangkit Tenaga Listrik Skala Kecil Tersebar					✓
15.	PERATURAN MENTERI ESDM NO. 02 TAHUN 2006 Tentang Pengusahaan Pembangkit Listrik Tenaga Energi Terbarukan Skala Menengah					✓
(2) Energy						
16.	Undang Undang Nomor 30 tahun 2007 Tentang Energi	✓				
17.	Peraturan Presiden RI No.5 Tahun 2006 Tentang Kebijakan Energi Nasional			✓		
18.	Instruksi Presiden RI No.1 Tahun 2006 Tentang Penyediaan dan Pemanfaatan Bahan Bakar Nabati (Biofuel) Sebagai Bahan Bakar Lain				✓	
19.	Instruksi Presiden RI No.10 Tahun 2005 Tentang Penghematan Energi				✓	
20.	Permen ESDM No. 0031 Tahun 2005 tentang Tata Cara Pelaksanaan Penghematan Energi					✓
(3) Geothermal						
21.	Undang-Undang No.27 Tahun 2003 Tentang Panas Bumi	✓				
22.	Peraturan Pemerintah No.59 Tahun 2007 Tentang Kegiatan Usaha Panas Bumi		✓			
23.	Peraturan Menteri ESDM No.14 Tahun 2008 Tentang Harga Patokan Penjualan Tenaga Listrik dari Pembangkit Listrik Tenaga Panas Bumi					✓
(4) Investment						
24.	Undang Undang Nomor 25 tahun 2007 Tentang Penanaman Modal	✓				
25	Peraturan Presiden Republik Indonesia Nomor 76 Tahun 2007 Tentang Kriteria Dan Persyaratan Penyusunan Bidang Usaha Yang Tertutup Dan Bidang Usaha Yang Terbuka Dengan Persyaratan Di Bidang Penanaman Modal			✓		
26	Peraturan Presiden Republik Indonesia Nomor 77 Tahun 2007 Tentang Daftar Bidang Usaha Yang Tertutup Dan Bidang Usaha Yang Terbuka Dengan Persyaratan Di Bidang Penanaman Modal			✓		

Table 2.1-5 (1/2) Framework of Laws and Regulations

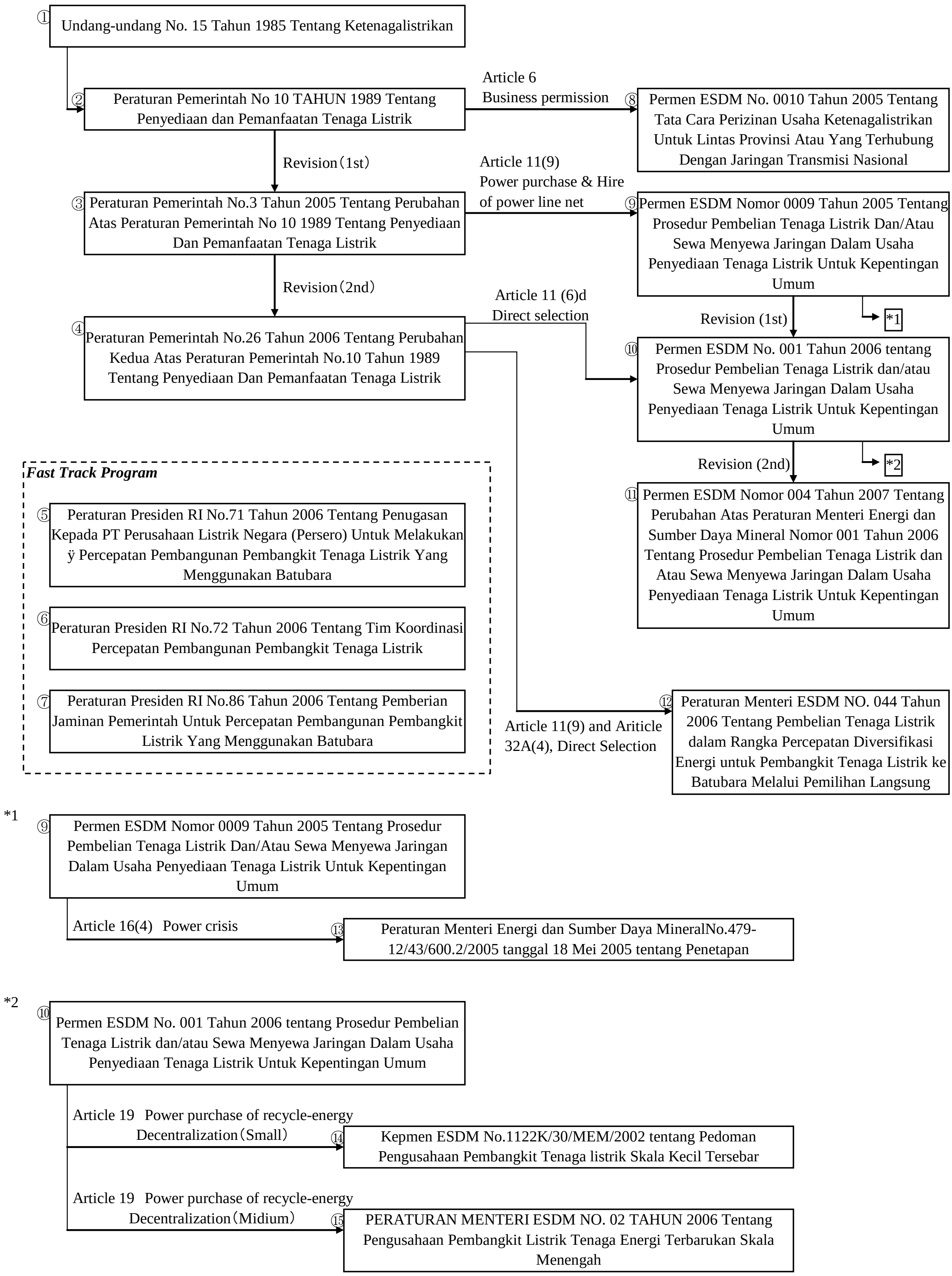


Table 2.1-5 (2/2) Framework of Laws and Regulations

- ⑯ Undang Undang Nomor 30 tahun 2007 Tentang Energi
  - Article 17 National Energy Policy → ⑰ Peraturan Presiden RI No.5 Tahun 2006 Tentang Kebijakan Energi Nasional
  - Article 1 Biofuel → ⑱ Instruksi Presiden RI No.1 Tahun 2006 Tentang Penyediaan dan Pemanfaatan Bahan Bakar Nabati (Biofuel) Sebagai Bahan Bakar Lain
  - Section 3 Energy conservation Article 25 → ⑲ Instruksi Presiden RI No.10 Tahun 2005 Tentang Penghematan Energi
    - Article 4 Energy conservation → ⑳ Permen ESDM No. 0031 Tahun 2005 tentang Tata Cara Pelaksanaan Penghematan Energi
- 21 Undang-Undang No.27 Tahun 2003 Tentang Panas Bumi
  - 22 Peraturan Pemerintah No.59 Tahun 2007 Tentang Kegiatan Usaha Panas Bumi
    - Article 20- → 23 Peraturan Menteri ESDM No.14 Tahun 2008 Tentang Harga Patokan Penjualan Tenaga Listrik dari Pembangkit Listrik Tenaga Panas Bumi
- 24 Undang Undang Nomor 25 tahun 2007 Tentang Penanaman Modal
  - 25 Peraturan Presiden Republik Indonesia Nomor 76 Tahun 2007 Tentang Kriteria Dan Persyaratan Penyusunan Bidang Usaha Yang Tertutup Dan Bidang Usaha Yang Terbuka Dengan Persyaratan Di Bidang Penanaman Modal
  - 26 Peraturan Presiden Republik Indonesia Nomor 77 Tahun 2007 Tentang Daftar Bidang Usaha Yang Tertutup Dan Bidang Usaha Yang Terbuka Dengan Persyaratan Di Bidang Penanaman Modal

2.1.2 History of Electricity Policy

(1) Restructuring of Electricity Sector[3]

The government has consistently been expanding access to an affordable and reliable electricity supply as a vital element of its strategy for rapid economic growth and equitable social development. The government established PLN in 1950 as a national electricity utility responsible for electric generation and distribution throughout the country. In response to the persistent power deficit, Law No.25/1985 allowed private enterprises and cooperatives to participate in the electricity business as complement to PLN in areas where PLN cannot supply power. In addition, as public fund had been chronically insufficient to expand the capacity to meet the increasing demand, the government, through Presidential Decree No.37/1992, allowed the private sector to participate in power generation projects as Independent Power Producers.

The present policy for the use of primary energy focuses on increasing utilization of non-oil energy sources. Accordingly, coal and gas have been increasingly utilized. Abundance of coal supply has rapidly led to an increased number of coal steam power plants, while the production and supply of gas have not been implemented according to the prescribed schedules, which causes delays of gas use in power generation and disruptions of power development planning. In contrast, permission process in geothermal development located in protected forests hinders its expansion. Priority is actually given to the exploitation of renewable energy such as hydropower. However remoteness of hydropower sites, need for large areas to be acquired, and high initial costs are obstacles to hydro development. Efforts are being made to exploit hydropower of micro-scale for rural areas distant from PLN's power grids or fuel oil distribution networks.

In order to create a competitive market and to improve efficiency of the power sector, the government initiated a power sector restructuring program. Power Sector Restructuring Policy was released in August 1998 and its implementation plan in December 1998. Unbundling and privatization of PLN was the prime target of the restructuring. In Java-Bali system, the transmission and distribution networks are well organized and the capacity is large enough to create commercial business opportunities, compared to the other islands. To facilitate competition there, three functions; generation, transmission and distribution were to be separated and multiple players to enter the fields of generation and distribution. In 1994, PLN was converted from public corporation to state-owned company (Persero) of which 100% of stocks is owned by the government. In 1995, PLN's generation assets and their operation organizations in Jamali region were unbundled into two power generation companies; PT Indonesian Power and PT PJB.

[3] JICA/Chubu Electric Power Co., Inc. Study on the optimal electric power development and operation in Indonesia, August 2002

(2) Establishment and Abolishment of Electricity Law No.20/2002

To facilitate the new power policy aiming at liberalization of the power sector, a new law was called for to replace the existing Law No. 15/1985. Electricity Bill was submitted to the Parliament in February 2001 and Law No.20/2002 was established in September 2002.

The key points of the Law are:

1) PLN lose its monopoly over the country's power industry.

2) The private sector will be allowed to do business in power generation and retailing, as well as with PLN.

3) The government will control power transmission lines and distribution networks, and charge producers a fee to use them.

4) All power producers will sell power to the public through competitive bidding. Producers which offer the lowest price will be allowed primary access to the government-owned network.

Under the Law No.20/2002, the central government is responsible for making general power policy, such as power demand forecast, generation planning, transmission network planning, investment and finance planning, subsidies, and renewable energy utilization, etc. The local government is responsible for local power sector planning, such as local demand forecast, primary energy studies, and transmission plan considering regional development plans.

Electricity generation business will be left to market competition. A regulatory body will be established to oversee and regulate the market. This organization is to ensure fair competition, efficient power supply, adequate investment environment, and to protect the interests of the society. The Social Electricity Development Fund (SEDF), to be set up as an independent entity, will allocate subsidies to low-income segments of the society, underdeveloped areas and to rural electrification projects. After the enactment of the Law, there will be a seven (7) year transition period:

1) Within a year after the enactment, an executive body for SEDF will be established;
2) Within two years, an independent regulating body will be established;
3) Within three years, a single buyer market will be established; and
4) Within seven years, a fully competitive market will be established.

In Java-Bali system, unbundling PLN and its privatization were to be executed step by step. First, Strategy Business Units would be established inside PLN to prepare for unbundling. Next, the distribution and generation departments would be separated from PLN. A Single Buyer System would be introduced where PLN buys power from generation companies and IPPs and sells it to distribution companies. Finally, a Multiple Buyer/Multiple Seller (MSMB) framework for a completely competitive market would be formed. The new system aimed at drastic revolution on free market basis.

The development of rural electricity would be conducted to achieve the goal of electrifying all rural areas; either by expanding the existing networks or installing independent systems such as solar power for households (Solar Home System). At present, PKUK (PLN) has a significant role in implementing the rural electricity programs by expanding the networks. The cooperatives also have a role in implementing this program, but smaller scale than PLN. Almost all the financing for the PKUK (PLN) program comes from the state budget and PLN's rural electrification projects are regarded as government projects.

Outside Java, the power sector consists of a number of small systems and sometimes isolated power systems. The costs are high and the electrification ratio is low. Therefore power business is too difficult to be profitable in these areas and government support is still needed. In these areas a Rural Electricity Company (REC) would be established, directly owned by the government. This would allow the restructuring if at a slow pace.

Before establishing the Law in September 2002, the power development should follow RUKN. But after the Law establishment, each provincial government is responsible to produce a provincial power development plan (RUKD) and RUKN would integrate all RUKDs into a national plan. However, as some transmission networks and power plants are inter-provincial, a power development plan must be made for a whole network first, based on which provincial plans are to be formulated. Naturally, provincial governments were inexperienced in power development planning. As a result, planning process was completely stuck at provincial level.

On 15th December, 2004, the Constitutional Court ruled that the Law No.20/2002 is unconstitutional, because the law violated a constitutional stipulation that "important means of production" should be kept under state control. Only exception to this rule was those contracts signed while the Law was effective, which should be honored until they expire. The fact that local government could not meet their new responsibility under the new Law may have affected the court decision. At present the Law No.15/1985 has been reinstated, which confirmed the following principles:

- Power tariff is determined by the parliament, not by market mechanism.
- PLN, as PKUK, is the sole provider of electricity.
- Power development plan (RUKN) is formulated by the central government.

In the midst of debate over the new Law, institutional provisions for private participation to the electricity market were delayed and the role of local governments became unclear. The government submitted to the House of Representatives a new electricity bill to replace the old Law No.15/1985. It can take several years for draft bills submitted to the parliament in Indonesia to be made into laws. Meanwhile, decentralization of administrative authorities is under way and new electricity law should adapt to decentralization law established in 2001. The revision is to transfer the power to set the electricity tariff from central to local governments, as well as the responsibility of bearing the subsidy payment. This new bill is still being discussed in the parliament.[4]

(3) Policy of IPP Promotion

The government has from time to time provided regulations to facilitate IPP (government regulation/ministerial decree). Persisting power shortage in Indonesia has been in the background for trading companies or foreign power utility companies to invest in the field. Foreign investors' concerns in investing in the power sector in Indonesia are mostly concentrated in clear provisions of support facilities that guarantee payment from the offtaker, PLN, for the investors to obtain project financing, such as a government comfort letter.

New Investment Law (Law No.25/2007) adopted a principle of "no discrimination due to nationality" which assures the same treatment to foreign investors making investment in Indonesia as domestic investors. However, so-called Negative List remains in place, which limits the proportion of foreign capital investing in the power sector to 95%, including the cases of IPP (Presidential Decree No.76 and No.77/2007). More than 5% of local capital should be involved in a venture. All the generated power is sold to PLN by IPP and its direct marketing is not allowed (Government Regulation No.20/1994, Presidential Decree No.96/2000).

Some regulations have been established to facilitate IPP; power purchase for public power supply enterprise or procedure of leasehold transmission, MEMR Ministerial Decree No. 001/2006 and its amendment, MEMR Ministerial Decree No.004/2007. These regulations state general procedure, bidding and negotiation of PPA on PLN's power purchase or leasehold transmission.

Direct appointment of a private operator without competitive bidding is allowed in some cases:

a. power purchase from plants of renewable energy such as mini/micro hydro, geothermal, biomass, wind and solar, and marginal gas, mine-mouth coal, and other local production energy,
b. purchase of surplus energy,
c. power supply under critical conditions at the independent local power system,
d. additional capacity at power plant center managed by publicly authorized power enterprise such as cooperative association, public company, private, civil group and people.

[4] The Jakarta Post, Government to share cost of power subsidies with regions, 13 June 2008.

2.1.3 Nuclear Policy[5]

Nuclear power development has been on the political agenda for some time in Indonesia. Start of a nuclear plant operation in 2017 is indicated in the Law No.17/2007. Presidential decree (or ministerial decree) is supposedly under preparation at the moment and the government is ready to demonstrate the state will to develop nuclear power and form a study team to start nuclear power project. The study team members will be selected from MEMR, BATAN, BAPETEN, and PLN. MEMR is in charge of overall power development plan which includes nuclear power development. BATAN (National Nuclear Energy Agency of Indonesia) has been stipulated as non department government institution which is directly reporting to the President. BATAN is led by a Chairman and its programme is coordinated by the Ministry for Research and Technology. Its mission is to realize reliable and safe nuclear science and technology and to actuate and accelerate the pursuit of welfare through nuclear power development.

BAPETEN founded in year 1998 by Nuclear Energy Act No.10/1997, is a national authority responsible for the utilization of nuclear energy, including control of a nuclear power plant by the Nuclear Power Plant (NPP) programme. BAPETEN has to prepare appropriate regulations, licensing system, inspection system and human resources for regulators in order to protect health and safety of working personnel, members of public and to protect environment.

Basic nuclear law in Indonesia is Law No.10/1997 on Nuclear Energy. Under this law, there are specific regulations provided. The regulations may be formulated in Governmental Regulations, Presidential Regulations or BAPETEN Chairman Regulations, depending on the appropriateness of the level. The main regulations relating to the NPP program are, for example:

1. Governmental regulation (GR) No.43/2006 on Nuclear Reactor Licensing,
2. GR No.63/2006 on Safety and Health towards the Utilization of Ionizing Radiation (under revision).
3. GR No. 134/2000 on Tariff for Nuclear Licensing; exc.

GR No.43/2006 stipulates that the licensing of nuclear reactor, including NPP, is generally conducted in multi steps:

1) Sitting,
2) Construction,
3) Commissioning,
4) Operation, and
5) Decommissioning.

[5] JICA, Update of transmission line development plan in Java-Bali, project formation study, November 2007

The site selection, capacity building and public acceptance should be assured before nuclear power development. IAEA issued appraisal report for FS carried out by a consultant, NEWJEC. The location was selected near Jepara in Muria peninsula as the most prospective site in F/S, however, there are some inhabitants near the site opposing the development plan.

According to the road map of nuclear power development, a consultant will be hired in 2008 to analyze the past study results (not yet done as of December 1, 2008). They will produce a site appraisal report and the site selected will be evaluated. A preliminary safety appraisal report will be produced thereafter and construction permission will be given. The construction will start in 2010/2011 and the permission on commercial operation plan will be given in 2015/16. The first unit will start commercial operation in 2016/17, the second one in 2017/18 and the third and fourth ones between 2023 to 2025. Generation capacity of single unit will be 1,000 MW each.

Technical cooperation has been offered by Japan, Korea, Canada, US and Russia and Japan and Korea have already started some preparatory programs. Japanese and Indonesian governments signed the cooperation agreement on 22nd November 2007 on the framework of nuclear power development. JETRO, as the main executing body of Japanese side, has started activities. Korean Electricity Power Company received 15 members of Indonesian personnel at a capacity building program

There is a campaign against nuclear power development at present, which may affect the presidential election in 2009. Therefore, the president will not supposedly sign, before the election, the presidential decree to establish the study team. The study team may be formed after the election, which will start a period of 10 years needed before a commercial operation of the first generating unit, according to the road map. The first unit, therefore, will not start its operation before 2018.

2.1.4 Organization of Power Enterprise

Power enterprise and organization are defined in laws. Power supply enterprise is an enterprise that is in charge of generation, transmission and distribution. The authorized holder of electricity business (PKUK) is a state owned company, PLN which is mandated by the government to provide electricity services to the nation. . The approved holder of electric business (PIUKU) is any public body that has been given an approval for doing the business. The other enterprises are local government owned companies (public companies), the private and local independent organizations. The Minister of Energy and Mineral Resources is the minister oversees the power sector. The General Director of Directorate General of Electricity and Energy Utilization (DGEEU) of MEMR, ***Ir. J. Purwono, MS.E.E*** is the general director in the administration having mission and responsibility for the power sector.

MEMR had assumed all government responsibility over the power sector until recently. Policy-making is now the responsibility of Directorate General of Electricity and Energy Utilization in MEMR. The role of supervising PLN has been transferred to the Ministry of State of State-owned Enterprises. Power development planning is managed by the section of Electricity Supplying Program in Electricity Program Supervision Department under DGEEU.

Figs.2.1-1 (1/2) and (2/2) show the organization chart of MEMR. In 1992, the government granted opportunities for private companies to take part in electricity business. In line with that policy, in 1994 the status of PLN was changed from a state-enterprise to a state owned company again (Persero). PLN, during this structural change, remained as the authorized holder of electric business (PKUK) with an obligation of providing electric power for public needs[6].

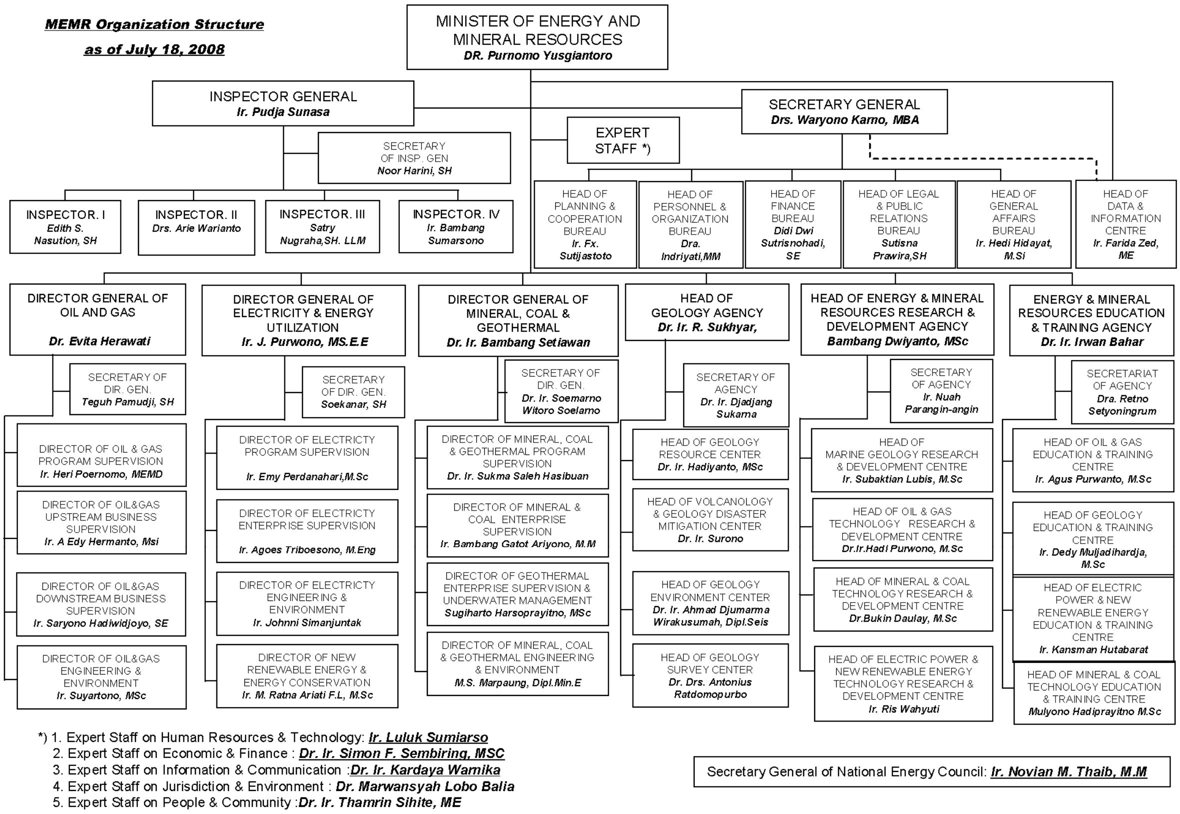


Fig.2.1-1 (1/2) MEMR Organization

[6] PLN Annual Report 2006

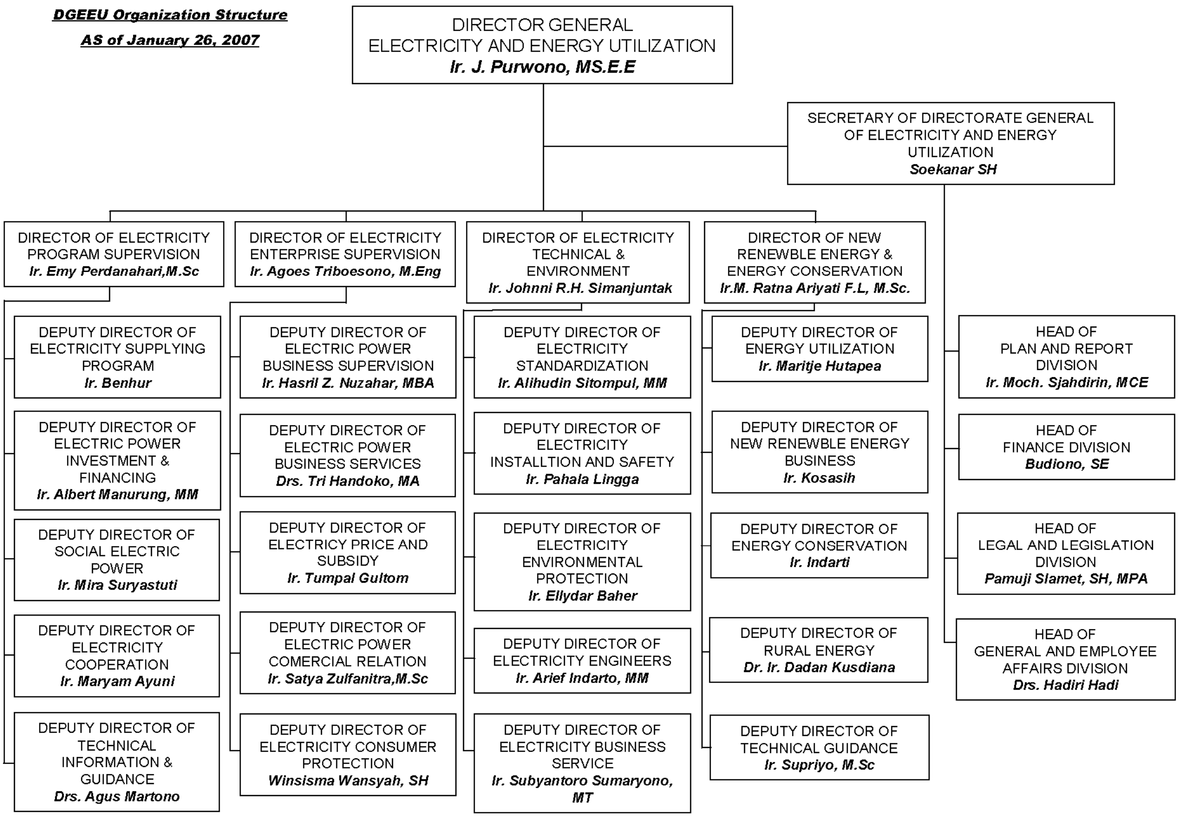


Fig.2.1-1 (2/2) MEMR Organization

2.2. Energy Policies and Domestic Primary Energy Resources

2.2.1 Main Energy Policies

Energy policies announced by the government are as follows:

- National Energy Policy 2003-2020 (KEN, March 2004)
- National Energy Management Blueprint (2005-25)
- Presidential decree on national energy policy (No.5/2006)
- Energy Law (No. 30/2007, established on August 10, 2007)

The National Energy Policy was formulated particularly to ensure a sustainable supply for national energy security and an efficient consumption of energy. This National Energy Policy supersedes the 1998 General Policy on Energy. It is formulated in cooperation with stakeholders in the energy sector. In addition, the National Energy Policy was used as a term of reference in drafting an Energy Law.

The vision set out in the policy is to guarantee energy supply in the national interests. Three missions are stated;

1) Guaranteeing a domestic energy supply:
   - To provide access to domestic and international sources of energy to ensure that the energy supply is secured.
   - To establish a management of energy that ensures a balance between demand and supply, and a balance between domestic consumption and export.
   - To maximize the use of sources of new energy and renewable energy sources, thereby increasing their roles in the national energy supply and improving environmental quality.
   - To develop a funding scheme to increase domestic and foreign investments.

2) Increasing the added values of energy sources
   - To manage and develop sources of energy, domestic and imported, as fuel, industrial raw materials and export commodities with priority on those with the largest multiplier effects.
   - To optimize the utilization of non-exportable energy sources to fulfill domestic needs for energy and to export secondary energy produced.

3) Managing sustainable sources of energy in an ethical and sustainable manner, focusing on conservation of environment
   - To optimally develop energy resources and transformation process
   - To increase the implementation of responsible and consistent environmental management including using environmentally friendly technology in energy supply process.

- To utilize energy efficiently in all sectors to promote a sustainable development.
- To apply a principle of good governance in managing energy

Numerical target is stated as follows:

- Achievement of a 90% electrification ratio by year 2020 with increased investments in building power plants, transmission and distribution grid in the light of the fact that power plant development is a capital intensive activity.
- Increased energy share of renewable energy, with the exception of large-scale-hydro, to at least 5% in year 2020. The renewable energy expected to fulfill the target is geothermal, biomass and micro/mini hydro power plants.
- A 1% per year reduction in energy intensity.

National Energy Management Blueprint (2005-25) is established as the same concept with the National Energy Policy. More data on energy consumption, and strategy and specific action programs described in the document are as follows.

In the energy use in Indonesia energy resources potential is large enough (Table 2.2-1) but its availability to the nation is limited. The energy balance and final energy consumption are shown in Figs.2.2-1 and 2.2-2. The ratio of oil fuel consumption is 63% in 2003 on final energy basis. The export of energy resources and oil fuel import is found rather dominant. The record of fossil fuel in 2006 is as follows:

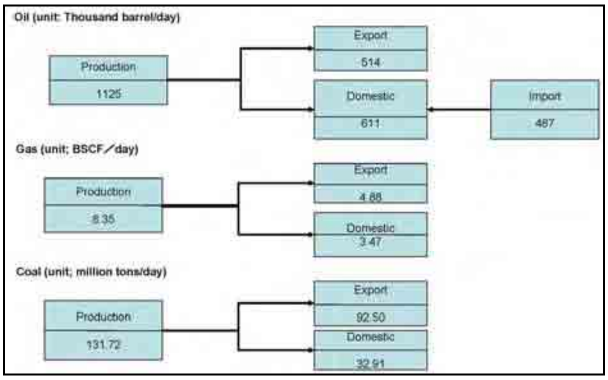
- Oil export 514,000 bbl/day, Domestic consumption 611,000 bbl/day, import 487,000 bbl/day
- Gas export 4.72 BCF/day, Domestic consumption 3.67 BCF/day
- Coal export 135.6 million ton/year, Domestic consumption 51.1 million ton/year

Table 2.2-1 Energy Resources Potential in Indonesia (2004)

Fossil Fuel	Resources	Reserve (Proven + Possible)	Production (Annual)	CAD/PROD (W/O New Mine) year
oil	86.9 Billion Barrel	9.0 Billion Barrel	500million barrel	18
Gas	384.7 TSCF	188 TSCF	3.0 TSCF	62
Coal	57 Billion tons	19.3 Billon Barrel	130 Million Barrel	147

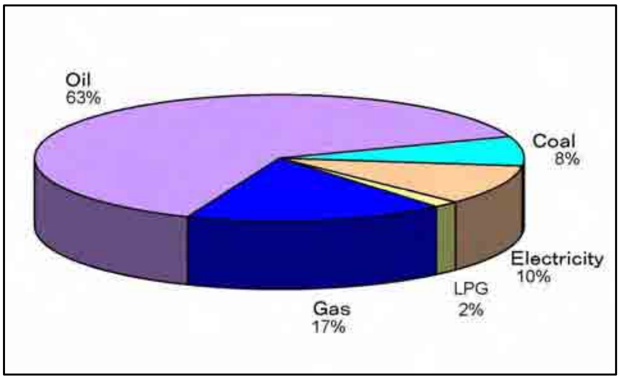
Non-Fossil Fuel	Resources	Converted	Utilized	Installed capacity
Hydro	845 Million BOE	75.67 GW	6,851.00 GWh	4,200.00 MW
GeoThermal	219 Million BOE	27.00 GW	2,593.50 GWh	800.00 MW
Micro/Mini Hydro	458.75 MW	458.75 MW		84.00 MW
Biomass		49.81 GW		302.40 MW
Solar		4.80 kWh/m²/Day		8.00 MW
Wind		9.29 GW		0.50 MW
Nuclear	24.112 Ton* 3 GW 11 years			

Source; Blueprint PEM (Pengelolaan Energi Nasional; National Energy Management) 2005



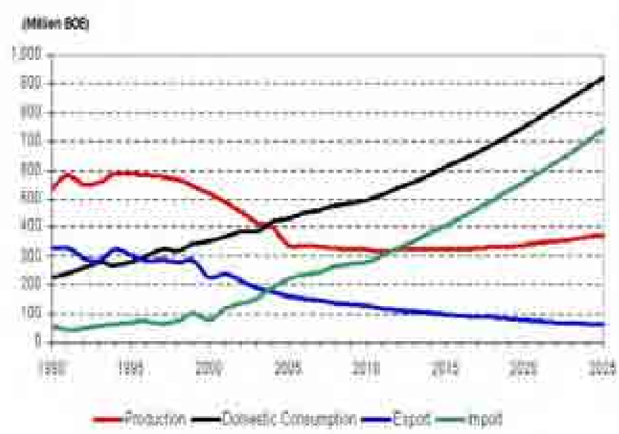
Source; Blueprint PEM 2005

Fig.2.2-1 Energy Balance



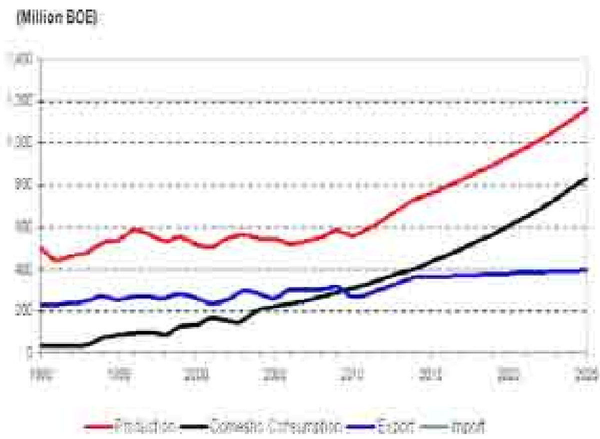
Source; Blueprint PEM 2005

Fig.2.2-2 Final Energy Consumption (2003)



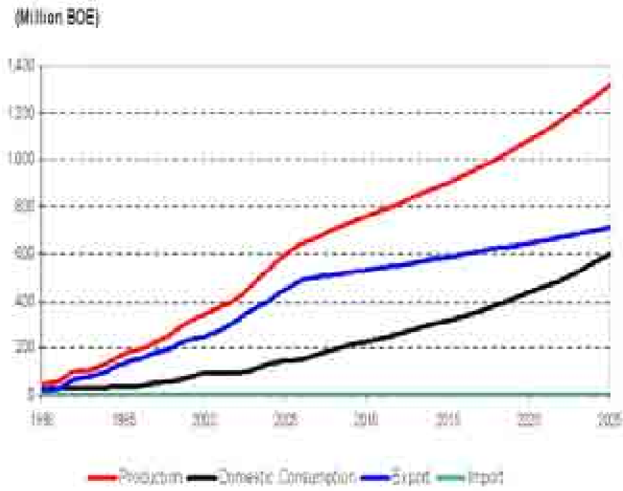
Source; Energy Outlook 2006

Fig.2.2-3 Crude Oil Balance



Source; Energy Outlook 2006

Fig.2.2-4 Natural Gas Balance



Source; Energy Outlook 2006

Fig.2.2-5 Coal Balance

The export prices of gas and coal are higher than those in domestic markets and the domestic demand and purchase capability for gas and coal is not high enough. Tax exemption and subsidies are not introduced to promote domestic consumption.

Some target is stated as follows:

1) Minimum energy use per person is 10 SBM (RIKEN)[7], electrification rate is 95 % (RUKN) in 2025

2) Domestic stable energy supply should be realized:

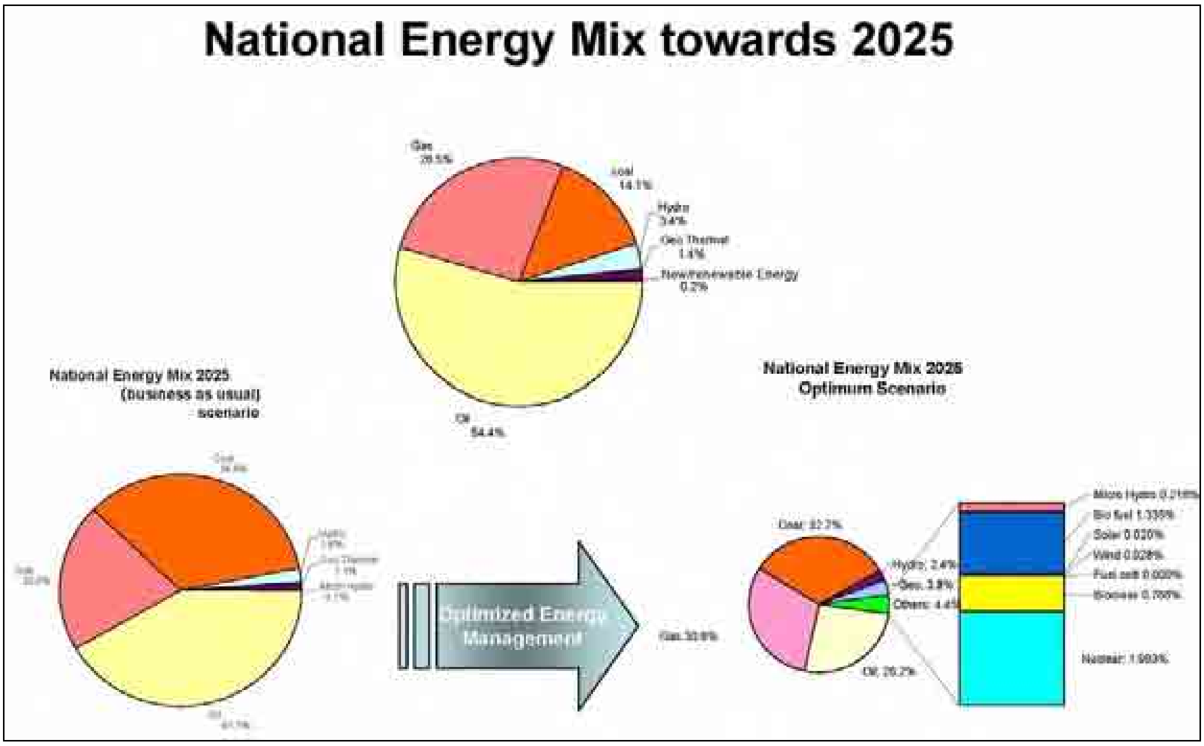
♦ Energy elasticity less than 1 in 2025

♦ Best energy mixture realization
- Proportion of oil is down to 26.2 %
- Proportion of gas is up to 30.6 %
- Proportion of coal is up to 32.7 %
  (Low rank coal use, Coal liquefaction, Briquette)
- Proportion of geothermal is up to 3.8 %
- Proportion of other renewable energy is up to 4.4 %

♦ Gradual decrease of export leads to domestic fuel use increase

Fig.2.2-6 shows the optimal scenario of national energy mix in 2025.

[7] SBM : Setara Barrel Minyak
RIKEN : Runcana Induk konsetvasi Energi National



Source; Blueprint PEM 2005

Fig.2.2-6 National Energy Mix towards 2025

These targets are established for national long term energy use. As one primary energy covers several sectors, action plan is needed to set up numerical target in each sector, industry, transportation, commercial and households, or in each program. Total 16 programs are proposed and alternative energy development is one of the programs as shown in Table 2.2-2.

Table 2.2-2 Alternative Energy Development Programs

	Electric Generation	Transportation	Industrial	Residential/commercial
Kind of Energy	Coal	Gas	Gas	Electricity
	Gas	Electricity	Coal	LPG
	Geothermal	Bio Fuel	Natural Gas Hydrate	Briquette
	Hydro	Coal Liquefaction	Biomass	Town Gas
	Micro Hydro	GTL (*Gas to Liquid*)		Bio Gas
	DME	Hydrogen, Fuel Cell		Solar
	Solar	Natural Gas Hydrate		Fuel Cell
	Wind			Natural Gas Hydrate
	Energy In Situ			
	Nuclear			
	Bio Diesel			

To implement the energy policy, the Presidential decree No.5/2006 was introduced following National Energy Policy 2003. The decree states both energy supply and utilization. The supply side emphasizes assuring domestic energy supply, the optimal energy production and energy efficiency. The utilization side refers to an increase of energy utilization efficiency. The following target is described:

1) Energy Elasticity is less than 1.0 in 2025.

2) The Optimal Energy Mixture should be established by 2025, national energy consumption comprising each energy resource should be balanced as follows:
   - Oil fuel is less than 20%
   - Gas is more than 30%
   - Coal is more than 33%
   - Bio fuel is more than 5%
   - Geothermal is more than 5%
   - Other New and Renewable energy, such as bio-mass, nuclear, hydro, solar and wind power is more than 5%
   - Liquefied coal is more than 2%

The National Energy Management Blueprint set up oil use target as 26.2% in 2025, while the Presidential decree prescribed the target of oil use should be less than 20%. The price variability of oil, gas and coal in the international market affect the balance of trading, import and export amount. Stable domestic fuel provision for the power sector calls for the action to secure the fuel and trading efforts of government and PLN, and incentives for increasing production and suitable arrangement of infrastructure are also required.

The Parliament established "Energy Law (No. 30 established on August 10, 2007)". This is the one that aims at such overall prescriptions as to solve the various problems, from the energy development to application, the difference between energy supply and consumption, limitation on alternate energy development, inefficient energy utilization, environmental impact due to energy management. However, a specific numerical target is not prescribed.

As for the Energy Law No.30/2007, the main contents are the followings:

1) Control and regulation of energy resources shall be done by the government
2) Giving priority in that the domestic demands for energy are filled
3) Government subsidies to low-income population
4) Maximizing the utilization of domestic resources
5) National Energy Policy (KEN)
6) Establishment of Nation Energy Council 1(Dewan Energi Nasional: DEN)
7) Establishment of Nation Energy General Plan (RUEN)
8) Establishment of General Local Energy Program
9) Accommodating and giving incentive by the government to the supply/application of New/Renewable Energy
10) Energy conservation is the whole responsibility of the government and the nations
11) Accommodating Give convenience incentive to the manufacturers of energy conservation devices by the government

12) Give un-convenience and disincentive to the energy consumer that do not carry out energy conservation by the government

Furthermore there is a plan to establish the National Energy Council (Dewan Energi Nasional) headed by the President, in place of the National Energy Committee (BAKOREN). The Council has not been established so far. As the National Energy Council must be established within 6 months from the enactment of Energy Low (in Article 33), the Government Decree, Ministers Act (i.e. Energy Conservation Act) etc. that will prescribe the detail are scheduled to be established by the end of2008.

2.2.2 Primary Energy Policy

The demand for primary energy is showing constant growth and the demand for petroleum occupies a half or more of the total. Petroleum, gas, coal are the important energy resources that support the economy of Indonesia. These resources have been developed following a rapid economic growth, but the growth of gas production is too slow and Indonesia became a net petroleum importing country after the petroleum export import balance was reversed in 2004.

As explained in previous section, converting energy use to coal and gas that have possibilities of production increases from now, and utilizing renewable energy are promoted in order to reduce petroleum consumption. The importance will be attached to the development of coal as a main domestic source of primary energy, because of its abundance and potential to be exploited most among primary energy resources found in the country. It is expected that the rise of recent crude oil price expedite the development of the oil, gas and coal fields. Further, some measures to give incentives to investors, the preferential treatment of tax to deep sea exploitation and a transfer of coal mining authorization to the local governments, etc., are gradually advanced by the government.

Regarding the high rank coal and LNG that are directed to exportation, investment in the development may increase according to the fuel price rise in the international market. However, low rank coal and gas from small scale gas fields that can not be traded in international market due to their quality or difficulty in transportation would be distributed only in domestic market. It is quite possible that the development of these resources does not catch up with the demand, if there is no acceleration measure taken by the government. Although the coal to be used by power plants in Fast Track Program is low rank coal, specific policy measure to secure the stable supply to be provided to mining and infrastructure are not sufficient at this moment.

A Product Sharing Contract (PSC) is prescribed for production of petroleum, gas and coal. In addition to this, there is a Domestic Market Obligation (DMO) applicable only to petroleum.

An incentive to foreign investors will be larger with higher PSC rate, but the income to the Indonesian government will be smaller. In the reverse case, there is also a dilemma that the incentive drops and production does not increase. There is a difficulty in manipulating production by policy measures.
The following is the contents of present PSC for each kind of primary energy.

【Product Sharing Contract】

1) Gas

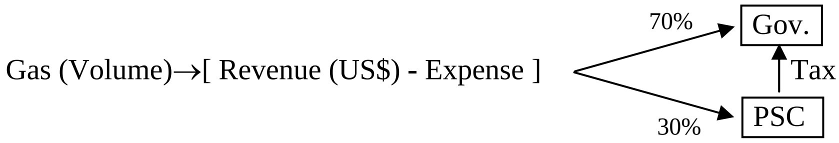
   a) Allocation (domestic and export) of produced gas is determined by the Government (MEMR-MIGAS)

   b) Gas is sold at international market price

   c) Profit = A - B (A = Revenue, B = Expense)

   d) Profit (after tax) is shared by Gov. = 70% and PSC = 30% (PSC; gas developer)

   e) PSC is subject to taxes on his operation



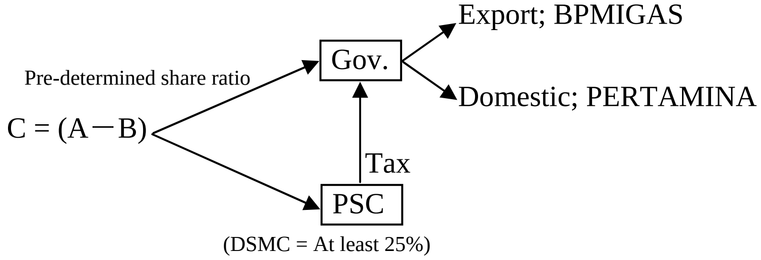
2) Crude Oil

   a) Produced crude oil is measure by volume basis (bbl). (Specific product amount)
   Expense (capital recovery, operation, variable and fixed cost, etc.) is converted to equivalent volume of oil (bbl) at current crude oil price in Indonesia. Then produced amount is calculated by subtracting the expense.

   b) The above is divided by the pre-determined ratios (the ratios vary according to the easiness of exploitation), normally Gov. = Approx. 85%, PSC = Approx. 15%

   c) PSC sells has share in the market and is subject to taxes on his operation. PSC is obliged to sell at least 25% of his share in Indonesian markets. (DMO; Domestic Market Obligation)

   d) Government sells her share to domestic and international markets.
   International sales are undertaken by BPMIGAS and domestic use crude oil is sold in domestic market after processed in PERTAMINA's Refineries.
   A = Production (BBL), B = Expense (Converted to BBL)



3) Coal

- The developer sells his product in the market. Net revenue is calculated by subtracting sum of miner costs, such as the market fee, etc., from gross revenue (FOB base).
- In usual case the government takes 13.5% of net revenue and remaining 86.5% is taken by the developer. (The share ratios vary case by case according to such factors as easiness of mining of the coal field, coal quality, infrastructure at the mine, etc.)
- 20% of the Government's share is allocated to provincial government/regional government.

4) Geothermal

- "Share Development" was amended largely by the Law No. 27/2003. Presidential Decree No.49/1991 was and is applicable to Kamojan, Lahendo, Sibayak geothermal plants of Pertamina, Chevlon's Drajat, Star Energy's, Bali Energy, and Geodipa's Pabsk. The rules are applicable by approved development zone basis. Therefore, older regulation is applied to a newly developed plant in a zone already approved under previous rules.
- Previous regulation stipulates that the Central Government takes 34% of the NOI (Net Operating Income, a return on sales that is calculated by subtracting operating cost, depreciation cost, interest payment, etc.) and remaining 67% is taken by the developer. In the case that the NOI is negative, the quota of the government becomes nil.
- New regulation (in Article 30) stipulates the duties of the developer as follows.
  - The developer shall pay 2.5% of electricity charges he pays to PLN, or of electricity sales as the Royalty.[8]
  - All the (central government) taxes are payable. There are possible tax reductions or exemptions case by case, under policy measures for development promotion, with the consent of the Ministry of Finance.
  - All the (local governments) taxes are payable.

As developing renewable energy requires large amount of investment cost, then some treatments, such as exemption of import tax, reduction of various kinds of taxes for the power generating equipments, and relief of obligation of electric power purchase from small/medium size power producers, should be arranged to promote the power generation business using renewable energy. These policy measures are under examination by the government now.

[8] Hearing from Memr DGMCG

2.3. Economic and Social Status and Development Plans in Jamali Region

2.3.1 Economic Status of Republic of Indonesia

(1) Outline of Economic Status

In Indonesia, having endured Asian Economic Crisis in 1997 and the collapse of Suharto Regime in 1998 and its aftermath, direct presidential election was held for the first time in its history in 2004, the economy has been stabilized and steadily expanding since. During this period, there were some external disturbances experienced, such as a terrorist attack in Bali in 2002, bombing of Australian Embassy in Jakarta in 2003, Sumatra earthquake and tsunami disaster (a.k.a. Indian Ocean Earthquake, Great Sumatra-Andaman earthquake, or Asian Tsunami) in 2004, and Central Java earth quake in 2006. Among them, Sumatra earthquake and tsunami disaster was particularly serious, and there are recovery and reconstruction efforts still being made in Aceh and surrounding areas in North Sumatra.

In national economic management, financial restructuring has been the focus of efforts since Asian Economic Crisis. Particularly, external debts have been targeted, taking policy of banning long-term debt except government bonds, to reduce the debts by US$ 1 - 2 billion a year. The efforts were paid off, and external debt was reduced from 100% to 45% of gross domestic products in 2005. Reimbursement of external debt account for 25% of national government budget, and outstanding amount is planned to be reduced to 31.8% of GDP by 2009.

Meanwhile, development investment has not recovered to the pre-crisis level where foreign direct investment targeted the development of natural resources such as oil, gas and minerals. Before the crisis, development investment accounted for 10% of GDP or US$ 10 billion equivalent (among which US$ 2 billion was private), which has not been reached yet. The balance of foreign direct investment turned positive in 2005, still hovering around US$ 3 billion, and remaining at the lowest level among South East Asian countries. Investment in public sector is inadequate, constraining potentials of economic development including shortage in electricity. Year 2005 saw the so-called Infra Summit where private sectors were encouraged to invest in infrastructure development. Some of IPP projects currently in process are originated in this Summit.

Delegation of authorities to local governments are being advanced, which has proven to be unsuccessful. Administrative capacity of local governments is not quite up to the required level and resource and its distribution are rather inflexible. Own resource of a local government is earmarked by up to 85% for personnel and administrative expenses, leaving very small room to forward any development efforts of his own envisage.

In the private sector, fuel price subsidies were revised drastically in 2005 to reduce the deficit of central government. Retail prices of oil were raised by 29% in March, further 126% in

October, which resulted in immediate jump of consumer price level by 18%. To curb the impact of such drastic price changes particularly on low income segments of society, the government provided so-called "programs for fuel subsidy reduction".

Aside from the shortages of infrastructure, lack of skill and inflexibility of labour market, short comings in investment environment, and inefficiency of financial sector are said to be the weakness of Indonesian economy.

Recovery of economy after the crisis is mostly attributable to ever increasing private consumption. Therefore, basis for future economic development has been in short supply.

Asian Development Outlook 2008 (ADB) predicts that the economy has expanded at 6.3% per annum in 2007, reaching at its highest level since the crisis. On the demand side, this expansion is largely thanks to private consumption, private investment and external trade. On the supply side, service sector has been performing pretty well, while communication grew rapidly with mobile phone and internet expanding at 40 - 50% per annum. In manufacturing sector, machinery, food, rubber, and paper showed rapid expansion, while textile, oil refinery and LPG were lagging behind. The decline of textile industry reveals losing competitiveness in labour-intensive industries. Agriculture, although boosted by international price rise of agro products, was expanding slowly. Mining and minerals grew only by 2%, largely accountable to the price hike in oil and gas in world, showing the chronicle lack of investment.

Price levels have been stabilized after the record high inflation of 18.4% in 2005. Inflation level was between 5 - 7% within the range of Bank of Indonesia target.

In May 2008, domestic oil prices were revised and raised by 28.7% on average, for the first time since 2005, to ease the burden of subsidy on the central government exploding due to the skyrocketing oil prices in recent years. The central government has been trying very hard to stabilize the consumer markets, particularly for food, by reducing the import tax on food and providing subsidies to domestic products. However, external pressure on commodity prices will possibly be an impetus to anticipated inflation eventually.

(2) Population

National population is estimated at 222 million in 2006, has been increasing at around 1.5% per annum, down from over 2% in 1970s through 80s. Jamali region's share of population has been decreasing from 71% in 1971 to 60% presently.

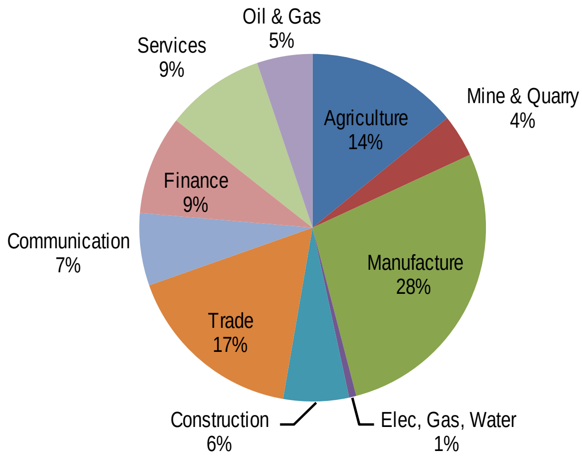
Table 2.3-1 Population of the Republic and Jamali Region

year	1971	1980	1990	1995	2000	2006
National (million)	119.2	147.5	179.4	194.8	206.3	222.2
Ratio of Jamali Region	65.6%	63.6%	61.5%	60.4%	60.3%	60.1%

Source : BPS Statistics

(3) Production

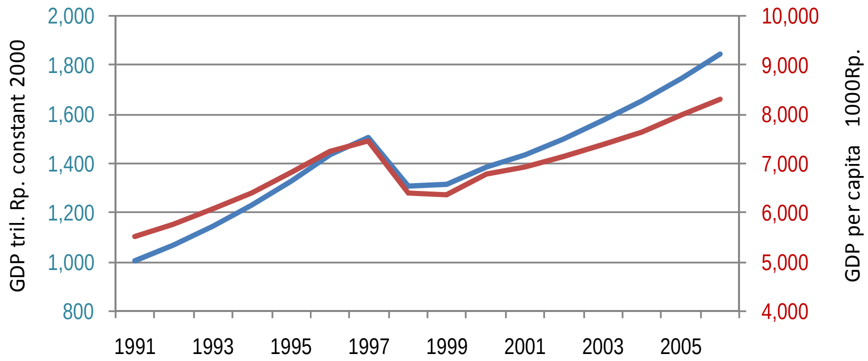
Gross Domestic Products (GDP) in 2006 was Rp. 1,850 trillion and its industrial composition is as shown in the figure in the right. Largest industry is manufacturing, 28% of total, followed by trade 17%, agriculture 14%, finance and services, both 9%.



Source : produced by JICA team using BPS Statistics

Fig.2.3-1 Industrial Composition of GDP of the Republic

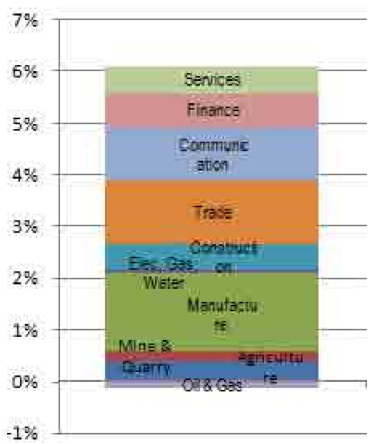
Growth of real GDP has been stable after the economic crisis in 1997, showing 4% on average after year 2000 which has been accelerating to 6% for the last few years. Per Capita GDP shows a little lower growth. It was relatively recent, in 2004, that per capita GDP exceeded the before-crisis level.



Source : produced by JICA team using BPS Statistics

Fig.2.3-2 Real GDP and per Capita GDP of the Republic

Contribution to GDP growth of industries is shown in the figure on the right (2003-2006 average). It is manufacturing that contributed to the growth most, proving that it is the power house of Indonesian economy. It is followed by trade and communication, while investment-lacking oil and gas sector shows negative contribution.

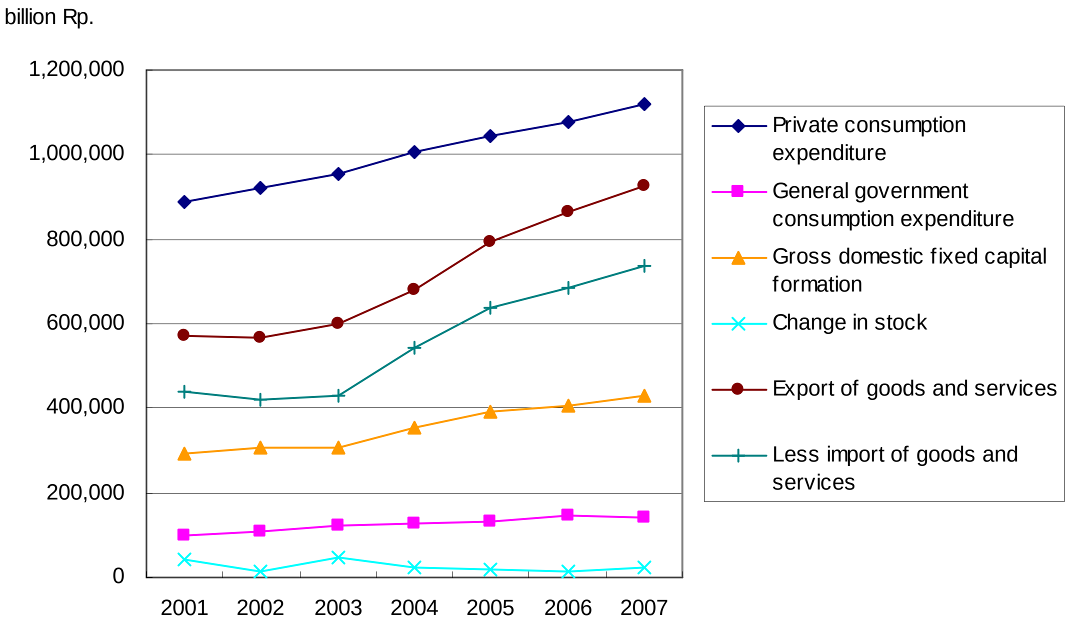


Source : produced by JICA team using BPS Statistics

Fig.2.3-3 Industry Contribution to GDP

(4) Consumption

On demand side, private consumption, external trade (export) have been growing faster. Gross domestic capital formation has been stagnant since economic crisis, but show a slight recovery after year 2004.



Source : produced by JICA team using BPS Statistics

Fig.2.3-4 Growth of Demand Side

To sustain economic development in the long run, it is important to have a good infrastructure and economic capital. As mentioned above, gross domestic fixed capital formation has shown the growth in real terms just recently. In terms of its share to GDP, it has stayed at 20% level, has not quite recovered yet to the pre-crisis level of 30% of GDP.

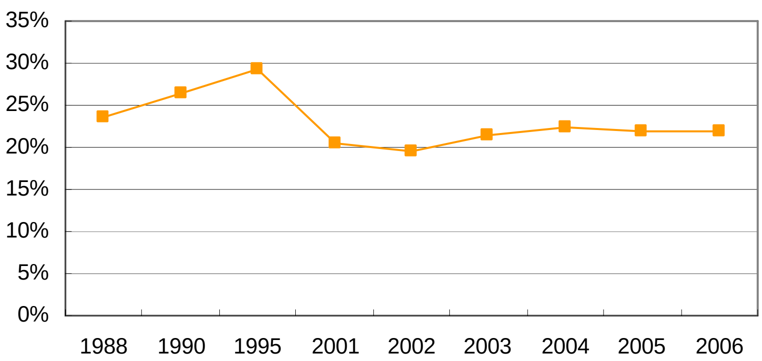


Fig. 2.3-5 Share of Fixed Capital Formation to GDP

2.3.2 Social and Economic Status and Development Plans of Jamali Region

(1) Development Plans of Jamali Region

Long term national development Plan 2005-2025 (Law No.17/2007) states that regional development in the Republic has problems as follows.

- Large cities in Jamali region are still growing and excessively congested, while those in outside islands are lagging behind or even shrinking.
- Urban sprawl in large cities and formation of conurbation are uncontrolled.
- Population is flowing out of rural areas to urban areas.
- The balance between large cities and small ones have reached to levels where there are negative effects arising from it.
- Destruction of natural environment in areas surrounding large cities is observed.
- Agricultural areas surrounding large cities have been transformed into residential or industrial areas.
- Degradation of urban living environment due to pollution is observed in large cities.
- Uncontrolled inflow of population into large cities has been causing socio-economic problems among city dwellers and lowering standard of public services in large cities.
- Areas left behind are experiencing difficulties in attracting investment from outside that creates employment and in providing basic public services at decent levels.

From these observations, the plan envisages that "it is necessary to check the unregulated expansion of urban areas, and to restore the balance between the cities in various sizes." and that "to attain this, it is crucial to create jobs in areas outside Java, and reduce the outflow of population." Industrial policy is in line with this regional development policy, stating that "it is important to develop and nurture small to middle scale industries, which are competitive in both domestic and international markets, in areas outside Jamali, to make the economy in these areas healthy." In particular, the second five-year period of the plan, 2010 - 2014, it is targeted to build areas that will be the core of development outside Jamali, to attain balanced development of the nation.

As for regional development policy, JICA team also interviewed Directorate of Regional Development, BAPPENAS, and was shown the policy on the same line:
"as for national development, too much concentration of population and industries in Jamali region has to be avoided. The government is trying to direct the investment outside Jamali to Kalimantan and Sulawesi, now that Sumatera has already seen large inflow of capital and resulting development. It is hoped, in view of balanced development, that more capital goes to Iriyan Jaya. But the resources there are not yet adequate to attract outside investment."

Aforementioned Directorate of Regional Development provided JICA team with special planning of the republic as shown in the next pages. It is obvious, from the figures, that it is transportation infrastructure between large cities that is the chief concern of the development efforts.

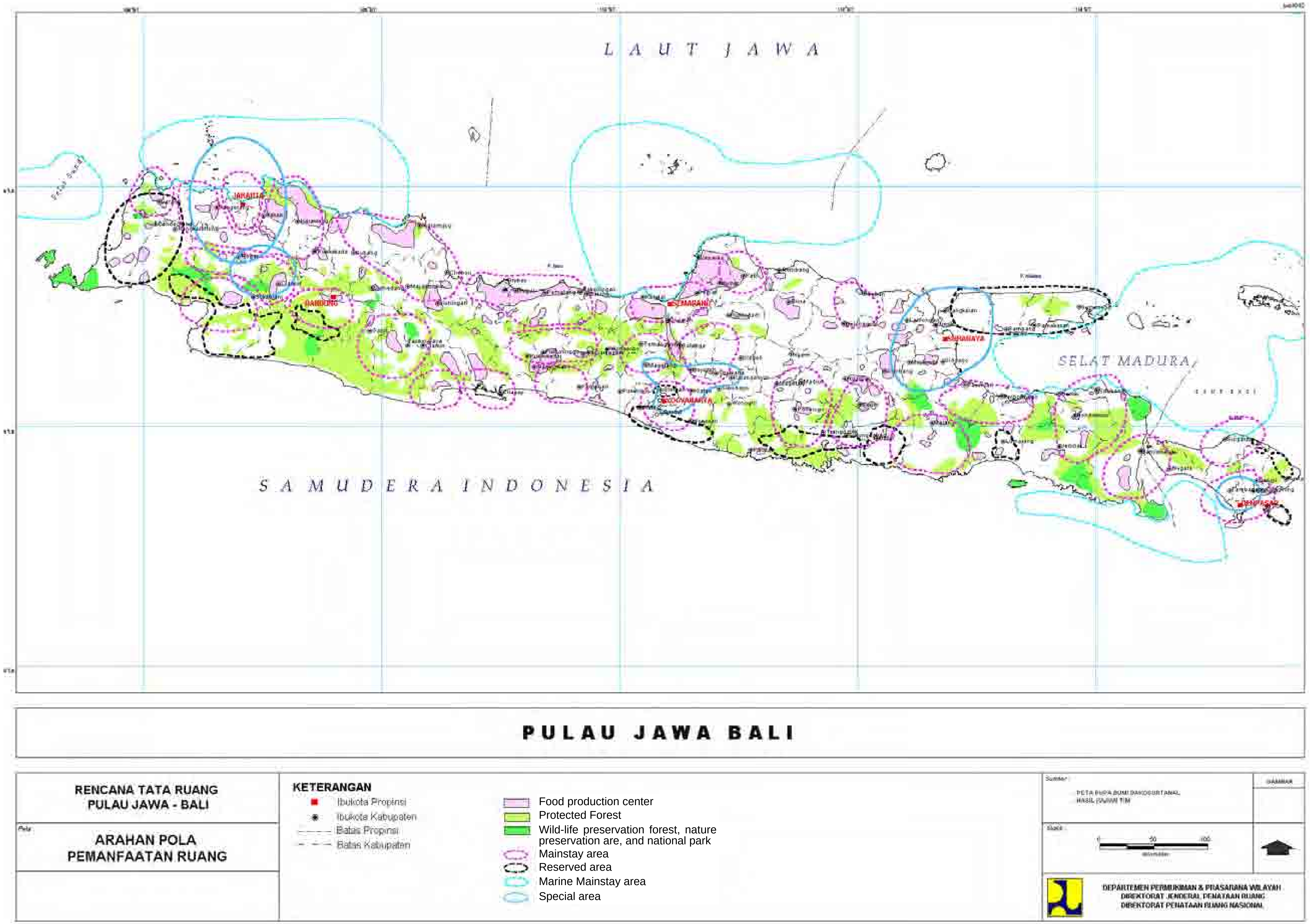


Fig.2.3-6 Spatial Development Plan of Jamali Region

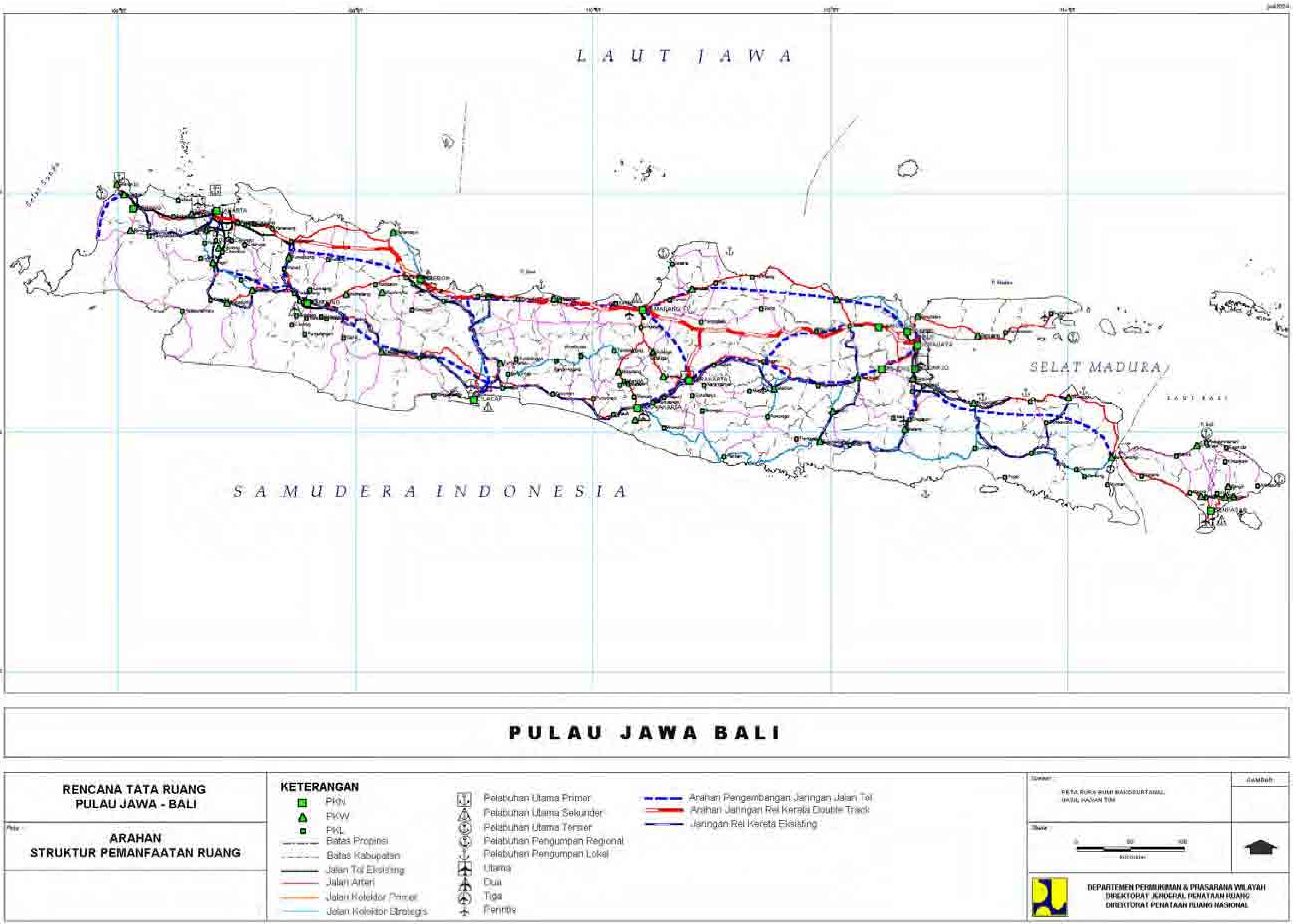


Fig.2.3-7 Spatial Structure of Jamali Region

(2) Social and Economic Status of Jamali Region

Jamali region encompasses administrative areas of DKI Jakarta, DI Yogyakarta, West Java Province (propince), Banten Province, Central Java Province, East Java Province and Bali Province. In this study, considering business unit of PLN, the whole region is separated into five sub regions, i.e., Jakarta Sub-region (DKI Jakarta and Tangerang City from Banten Province), West Java Sub-region (West Java and Banten Provinces except Tangerang City), Central Java Sub-region (Central Java Province and DI Yogyakarta), East Java Sub-region (East Java Province) and Bali Sub-region (Bali Province). It should be noted, however, that for the statistics shown below, Tangerang City is included in Banten Province, therefore, in West Java Sub-region.

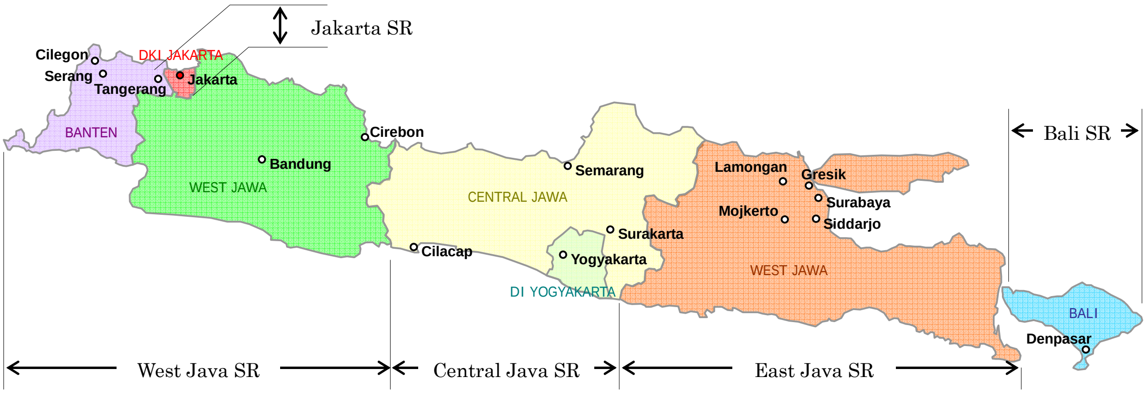


Fig. 2.3-8 Five Sub-regions of Jamali Region

Population of Jamali Region as a whole is 133 million in 2006, that is 60% of national population, while GDP of the region (GRDP) is 61% of national GDP, only slightly larger in proportion. Meanwhile, manufacturing, trade and finance sectors are larger in proportion than national GDP, revealing the fact that these sectors are concentrated in Jamali Region.

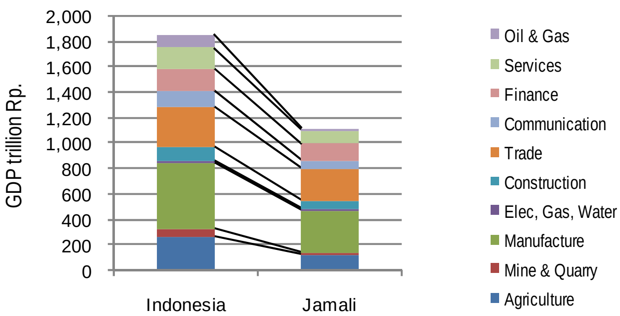


Fig.2.3-9 Comparison of GDP Structure

The figure below compares structures of GRDP in five sub-regions.

In Jakarta, financial sector is particularly prominent. Besides, trade, services are larger than in other sub-regions, while manufacturing is less than 20% and agriculture, mining and quarries and oil and gas are negligible. In West Java sub-region, manufacturing is as large as 50% of total regional production showing that the region is the center of manufacturing in the Republic.

Mining and quarrying, and oil and gas are small but present, each taking a few percent of regional production. Central Java is characterized by rather large agriculture sector, which is 20% of regional production, as much as in Bali. East Java is similar to Central Java except that there is no oil and gas output and that trade is larger. Bali sub-region has smallest manufacturing sector, largest agriculture, trade and services sectors among five sub-regions.

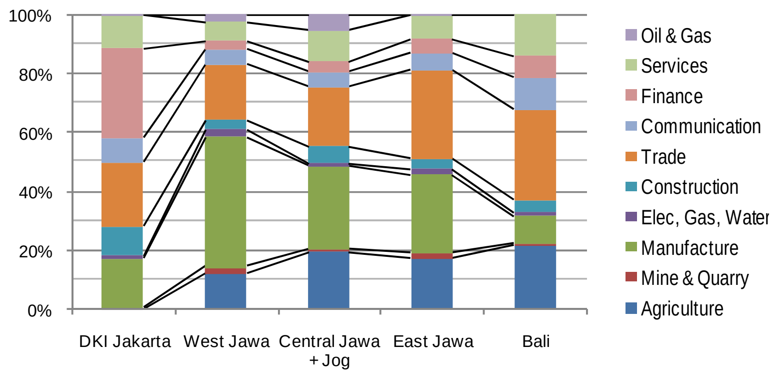


Fig.2.3-10 Comparison of GDP Structure within Jamali

Population in Jamali Region has been increasing. Among five sub-regions, West Java is growing fastest at more than 2% per annum

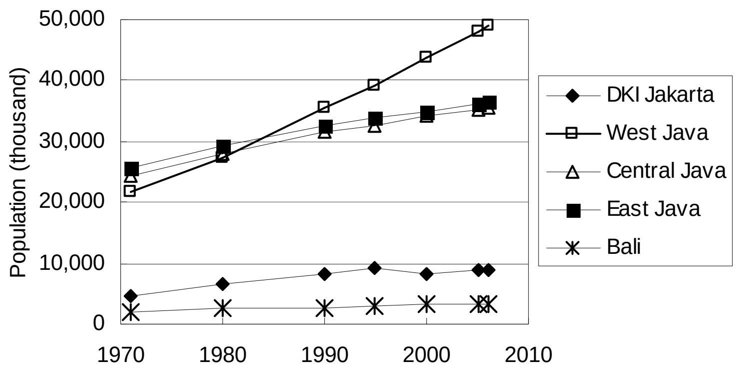


Fig.2.3-11 Growth of Population

Table 2.3-2 Population and Migration

Sub-region	Population (2000)	Migration (1995)
Jakarta	8,389,443	1,782,099
West Java	43,828,317	1,723,484
Central Java	34,351,208	-4,856,278
East Java	34,783,640	-2,070,394
Bali	3,151,162	-72,247

Although it is not shown in the figure or table, Banten Province is growing much faster at 3% per annum. Jakarta's population growth is slowest at 0.17%. Table 2.3-2 shows life time migration of the population which reveals that Central Java and East Java experienced large outflow of population in the past.

In the section below, economic characteristics and development plan of each sub-region are reviewed.

1) Jakarta Sub-region

Jakarta sub-region includes DKI Jakarta with Pelau Serib and Tangerang City. It has developed

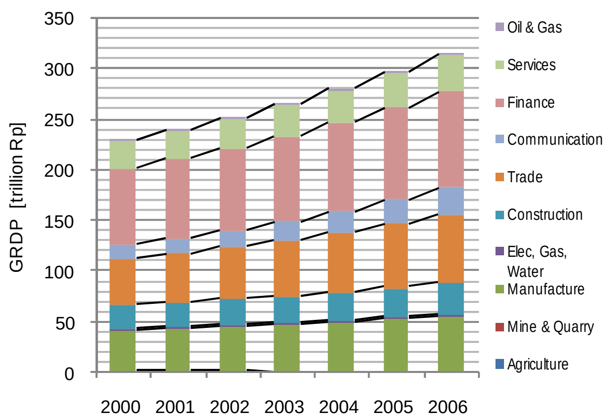


Fig. 2.3-12 GDP Structure of Jakarta

into a megalopolis called "Jabodetabek" encompassing surrounding cities, Bogor, Depok, Tangerang and Bekasi.

As the capital of the republic, it is a center of Indonesian economy. Financial sector is concentrated here, and manufacturing and trade sectors are larger than in other sub-regions. Construction, which is also large, consists of mostly by private sector projects for residences, offices and commercial buildings.

Average real GRDP growth in 2002 - 2006 period is 5.7% per annum, which is the highest among Jamali sub-regions.

National regional development plan (Rencana Tata Ruang: RTR) describes the direction of the development of the region as follows.

- To be a core of growth of the nation and to be a gateway to the world, Jakarta must function with strong linkages with surrounding large cities.
- To check uncontrolled expansion of urban areas (urban sprawl), an absorption zone should be set up surrounding developed areas.
- Residential area developments, including large Bumi Serpong Damai as well as smaller Karawaci, Cikarang and Bintaro, must be provided with mass transit services.
- Transportation capacity in Jakarta and surrounding cities must be enlarged. Transportation network connecting the capital and other large cities must be improved in terms of quality of services. A ring road should be developed to increase the efficiency of physical transport.
- Urban environment must be improved.
- Flood protection must be upgraded.

2) West Java Sub-region

Regional center cities (PKW) Cilegon, Serang, and those included in "Jabodetabek" Bogor and Depok, Tangerang, and Bekasi, and old city with academic concentration Bandung are within West Java sub-region. Population is largest in Jamali, 49 million.

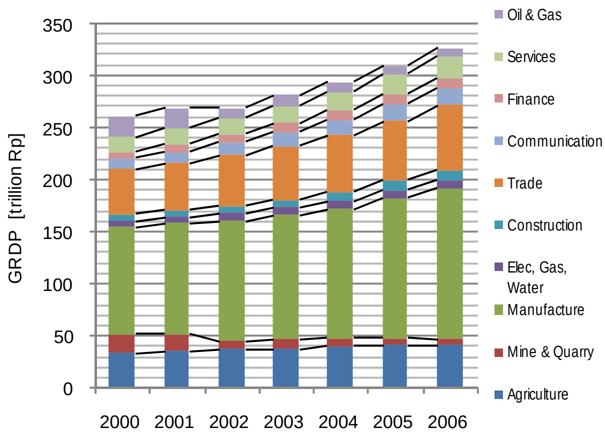


Fig.2.3-13 GDP Structure of West Java

Main industry of the region is manufacturing which takes up about half of regional production. Average real GRDP growth in 2002 - 2006 period is 5.3% per annum, half of which is attributable to the growth of manufacturing. Next largest industry is trade which is also growing in proportion. Agriculture takes up 12% of regional production in 2006, whose share has been decreasing however, as the sector's growth has been stagnant.

RTR describes the direction of regional development as follows.

- Distribution center, Port of Bojanegara, and transportation hubs, Port of Arjuna and Panggung Airport, and road transportation in Serang, must be improved.
- Provincial capital and satellite cities must be linked with better transportation.
- Urban sprawl along trunk roads connecting large cities must be controlled.
- Railway network must be expanded. Trans-Java trunk road should be connected to southern areas of the region.
- Road network passing through Serang as a core city connecting Sumatra and Java Islands must be improved.
- Agriculture, plantation, fisheries and agro-process industries around Cilegon must be promoted.
- Development of distribution function in Cimahi and agro-process industries in Soreang must be promoted. Manufacturing in Bandung should be gradually relocated to Soreang area.
- Maintenance of irrigation network and development of food production center employing advanced method.
- Increase the number of fishery ports and improvement of related facilities.
- Reduction of agricultural loss due to flooding.

3) Central Java Sub-region

PKW Semarang, Surakarta, Cilacap, DI Yogyakarta are among large cities in Central Java. Central Java Earthquake occurred in May 2006 brought extensive damages, both human and economic, in the areas near around Yogyakarta. In terms of economic structure, Central Java bears average features of Jamali region, with balanced output from agriculture, manufacturing and trade sectors. These sectors are the main contributors to the economic development of the sub-region at its growth rate 5.1% per annum. In particular, expansion of output in agriculture sector is at highest level in Jamali.

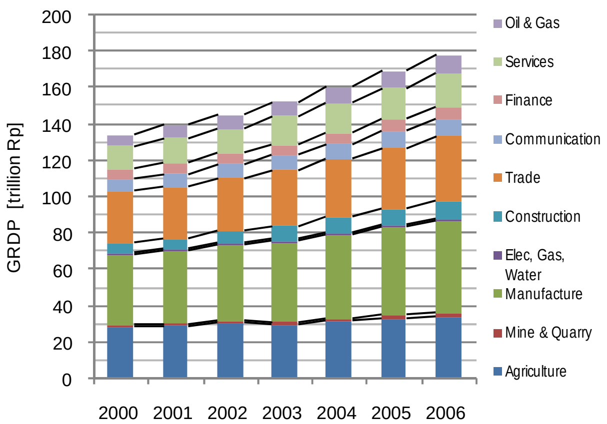


Fig. 2.3-14 GDP Structure of Central Java

RTR describes the direction of the development of the region as follows.

- Strengthening of linkages with other sub-regions using transport infrastructure such as

Central Artery Road, Southern Artery Road, railways, Tunggul Wulung and Adi Sumarmo Airports, Intan Cape Port.

- Enhancement of core development functions of manufacturing and agriculture sectors.
- Promotion of Fishery and its processing industries through the development of infrastructure including improvement of fishery ports.
- Checking urban sprawl, and controlled southbound expansion of Yogyakarta urban areas
- Controlling flood through enhancement of ground water retention and securing run-off functions in and around large cities.
- Controlling landslides to minimize the damages to residential and farming areas.
- Development of tourism potential of Semarang City, and marine tourism in southern coast including Cilacap.
- Other common objectives such as reinforcement of transportation with other large cities, and improvement of urban environment, urban transport, etc.

4) East Java

Gerbangkertosusila (GKS), a conglomerate of industrial cities of Gresik, Bangkalan, Mojkerto, Surabaya and Lamongan, all located near Madura Straight, is the center of economic activities of this sub-region. Main industries are manufacturing and trade, while the latter, distribution, hotels and restaurants in particular has been expanding rapidly, contribute to the development of this sub-region at above 5.6% per annum. Agriculture has been steadily increasing at around 3% per annum, while forestry has halved its output in the last few years.

RTR describes the development directions as follows.

- Controlling sprawl of GKS in south-west direction, and protection of farm lands.
- Expansion of output of rice crop and horticulture, maintenance of irrigation networks and advanced paddy fields, and securing food output for local consumption.
- Environmental protection and flood control in enhancement of urban functions of large cities.
- Other common objectives such as reinforcement of transportation with other large cities, and improvement of urban environment, urban transport, etc.

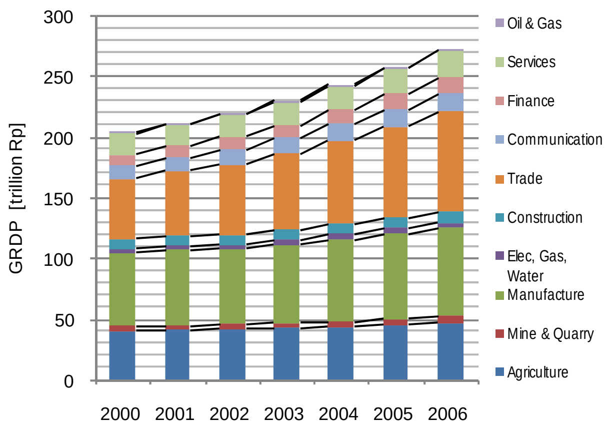


Fig. 2.3-15 GDP Structure of East Java

5) Bali Sub-region

Located to the east of Java Island, Bali is an island famous for its tourist attraction and its main industry is agriculture and trade. Most production activities beside agriculture are centered in Denpasar. The region experienced terrorist bombing act in 2003, which apparently reduced the number of inbound tourists, regional production has been steady and has not shown a sign of depression as shown in the figure on the right. Still, growth rate of GRDP is 4.8% for 2002 - 2006 period, lowest among Jamali sub-regions.

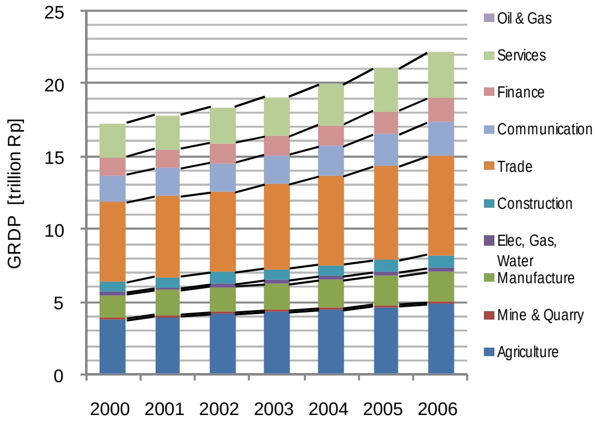


Fig. 2.3-16 GDP Structure of Bali

RTR shows following development subjects.

- Continuation of tourism development mainly in Denpasar, and pushing up public services to international level.
- Improvement of functions of tourism and services industries.
- Improvement of transportation with other areas, particularly eastern islands of the country.
- Countermeasures to earthquakes and tsunamis.
- Other common objectives such as reinforcement of transportation between large cities, and improvement of urban environment, etc.

As discussed above, development policies regarding Jamali region are mostly concerned, not about developing new large industrial bases, but about improving transport infrastructures and services in and between large cities, raising the levels of disaster prevention and preparedness, and alleviating negative impacts of urban development (urban sprawl and environmental degradation), in order to improve the efficiency and to fully exploit the potential of existing industries.

2.4. Electricity Industry in Java-Madura-Bali

2.4.1 Power related Organization of PLN, P3B, Indonesia Power, PJB and IPP

The organization of PLN was restructured significantly from March to April 2008. The previous restructuring took place in 2003, five years ago. The latest organization of PLN is shown in Fig.2.4-1.

The new organization consists of main six (6) departments: planning and technology, strategic construction, Java-Bali- Madura, outside Java-Madura-Bali, human resources and general affair, and finance. The planning and technology department is in charge of power generation equipment, power system, IPP, information technology and general technology, and contact to JICA, and also the process of loan agreement of construction projects funded by JBIC and other donors. The strategic construction department is in charge of consultant selection, and procurement and supervision for construction. The responsibility for operation and maintenance after construction depend on the location of projects, and Jamali area is managed by Java-Bali-Madura department and outside Jamali is done by outside Java-Madura-Bali department.

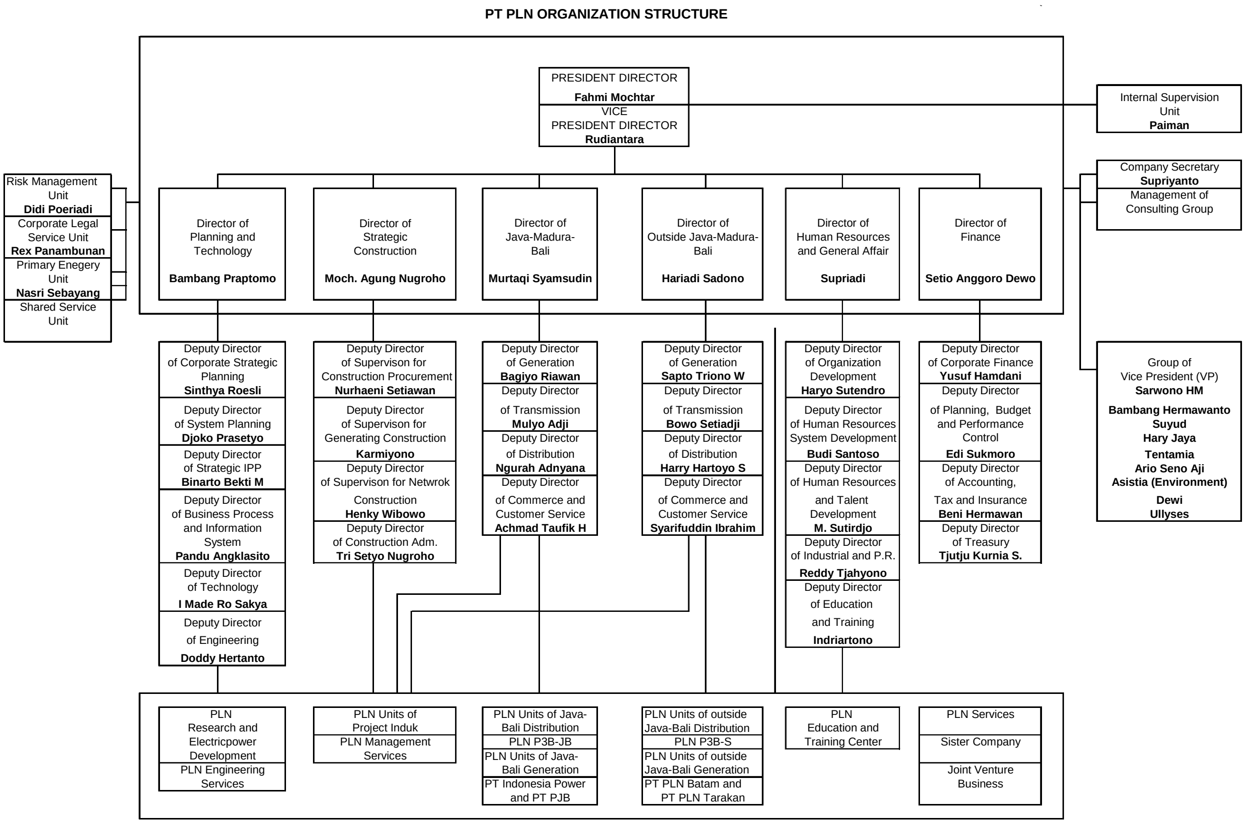


Fig.2.4-1 PLN Organization

The previous organization consisted of five (5) departments: generation and primary energy, transmission and distribution, commercial and customer service, human resources, and finance. Consultant selection was managed by the commercial and customer service, system plan and transmission and substation study done by the transmission and distribution, and detail design and operation and maintenance for power plants done by the generation and primary energy, respectively.

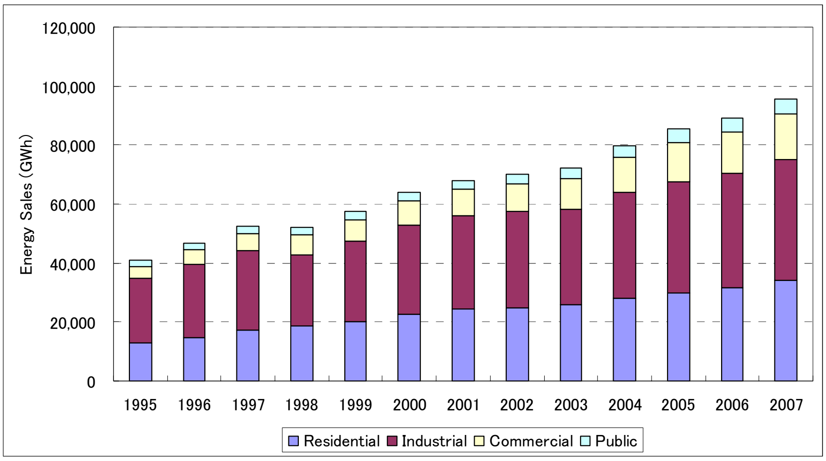
Risk management, company regulations and fuel procurement are managed by organizations under the president director or the vice-president director. Some members named vice president (VP) are in charge of special missions directed by directors or managers. In the former organization, fuel procurement was managed by the generation and primary energy.

P3B is a system planning and operation center, and a part of internal organization of PLN. P3B manages overall national system plan, and daily and long-term power operation. Transmission system of 500 kV is managed by P3B and the lower system of 150 kV is managed by each local control center: RCC1 (Jakarta), RCC2 (Bandung), RCC3 (Semarang), and RCC4 (Surabaya). RCC1 manages the area of Banten province and Jakarta province, RCC2 does West Java province, RCC3 does Central Java province, and RCC4 does East Java province and Bali province for operation and maintenance. All the organization of P3B was previously under the control of transmission and distribution department. The system planning center is now managed by the planning and technology department. The operation and maintenance are managed based on the location of plants, Jamali area is managed by the Jamali department and outside Jamali is by the outside Jamali department. The organization structure is more divided than the previous one in terms of the operation of the overall system..

PT. Indonesia Power and PT. PJB are subsidiary companies of PLN. PT. Indonesia Power operates in the filed of electric power plants and other related businesses. Generated power is sold to PLN. The company was established on October 3, 1995 bearing the name of PT. PJB I and on September 1, 2000 it was changed to PT. Indonesia Power. PT. PJB operates in the filed of electric power plants and other related businesses. The generated power is sold to PLN. The company was established on October 3, 1995 bearing the name of PT PJB II and on September 1, 2000 it was changed to PT PJB.

2.4.2 Demand and Supply

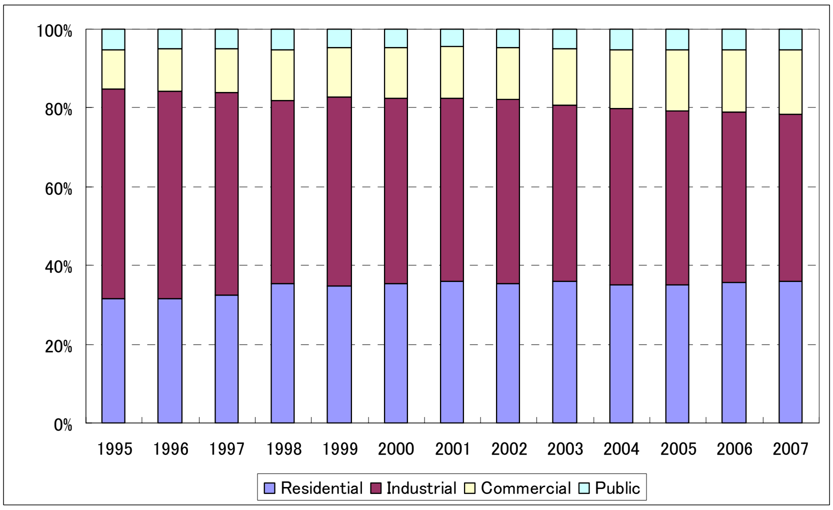
In Jamali region, electricity demand has been increasing in recent years reflecting social and economic growth. Fig.2.4-2 shows transition of energy sales in Jamali region. Although the growth of energy sales once recorded slowdown due to the economic crisis in 1997, steady growth has been recorded in recent years. The annual average energy growth rate from 2003 to 2007 was around 6.5%, and energy sales in 2007 reached 95,624 GWh.



Source : PLN

Fig.2.4-2 Energy Sales

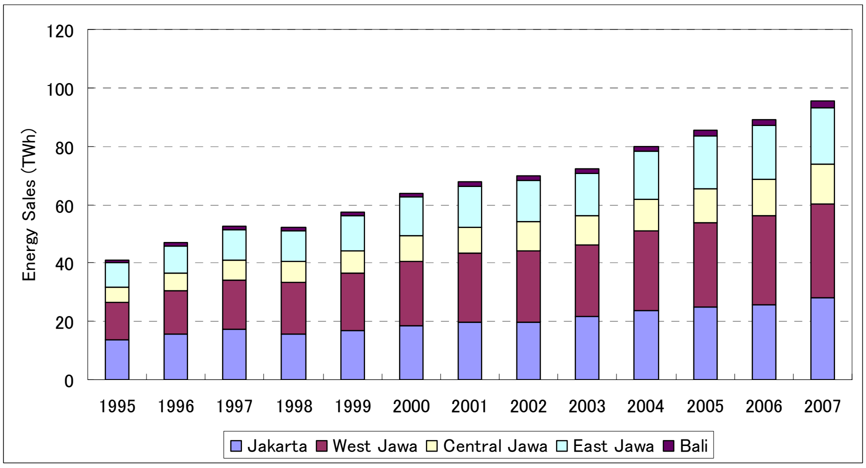
Fig.2.4-3 shows the ratio of energy sales by sector. In Indonesia, power demand is classified into residential, industrial, commercial and public sectors. The proportion of each sector in 2007 is 35.9% for residential, 42.6% for commercial, 16.2% for industrial and 5.4% for public respectively. In recent years, the proportion of industrial demand has been decreasing, while the ratio of commercial demand has been increasing.



Source : PLN

Fig.2.4-3 Ratio of Energy Sales by Sector

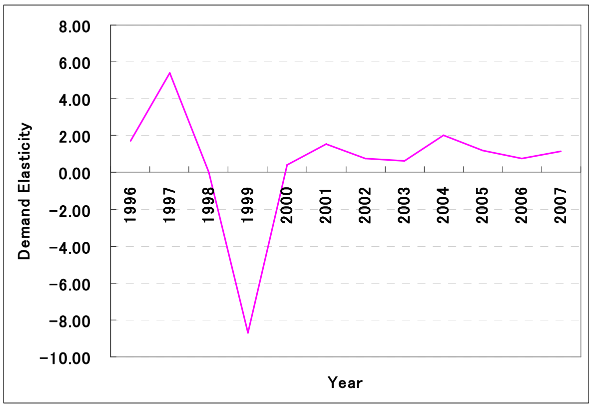
Fig. 2.4-4 shows energy sales classified by region. As of 2007, the ranking of energy sales, in order from highest to lowest, is West Java, Jakarta, East Java, Central Java, and Bali. The annual energy growth rate is around 6% in each region.



Source : PLN

Fig.2.4-4 Energy Sales by Region

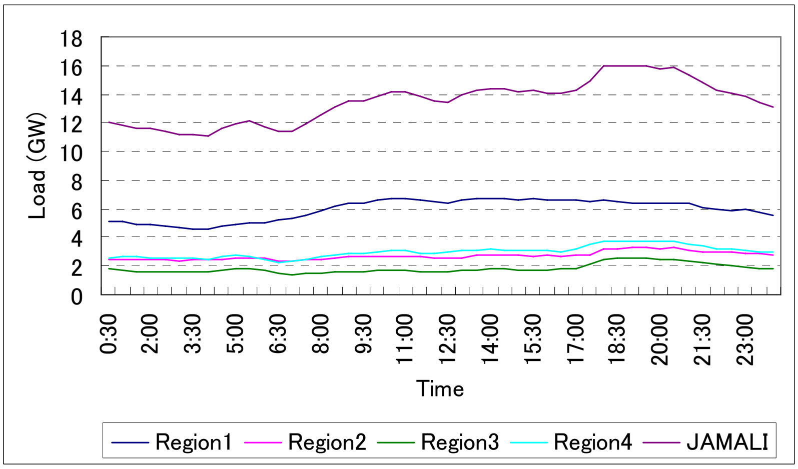
Demand elasticity, which indicates the ratio of energy growth to GDP growth, is shown in Fig 2.4-5. Elasticity changes significantly around the economic crisis in 1997, and there are discrepancy between energy growth and GDP growth. After year 2000, elasticity remains steadily within the range from 0.5 to 2.0.



Source : PLN

Fig.2.4-5 Demand Elasticity

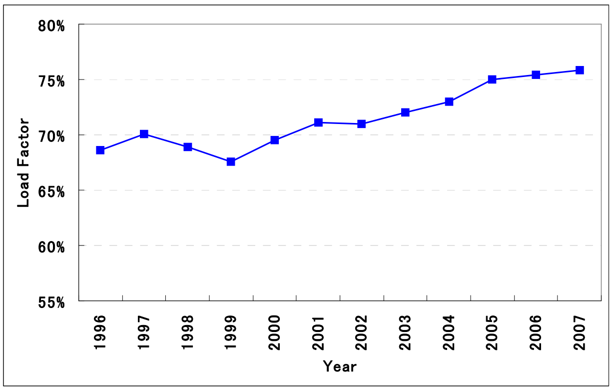
Fig.2.4-6 illustrates the example of daily load curve for whole Jamali and each region. In Region 1 including Jakarta, peak load is recorded in daytime. As for whole Jamali, peak load is recorded at night. However, the demand in daytime has been increasing recently, and the peak time will shift from night to daytime in the near future.



Source : PLN

Fig.2.4-6 Daily Load Curve in Each Region

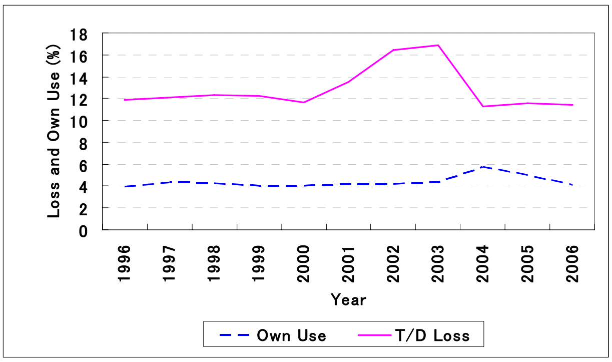
Transition of load factor is shown in Fig.2.4-7. The ratio of load factor has been increasing slightly, and stays around 75%. In the past, the load in night such as for lighting was dominant. However, the load in daytime such as for air conditioners and factories has been increasing, and the difference between night load and daytime load is getting smaller.



Source : PLN

Fig.2.4-7 Load Factor

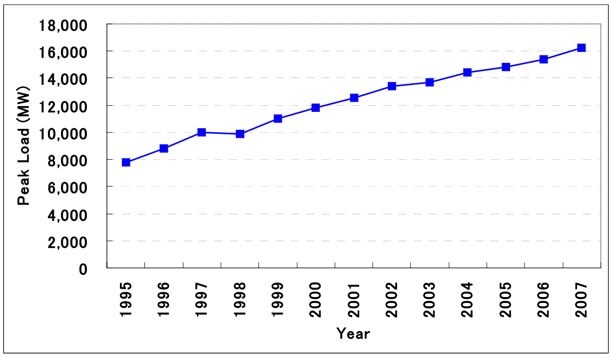
Fig.2.4-8 shows the proportion of own use and transmission/distribution loss. Own use remains around 4%. As for transmission/distribution loss, although there was volatile swing, it remains around 11% and has a trend of declining slightly.



Source : PLN Statistics

Fig.2.4-8 Own Use and Transmission/ Distribution Loss

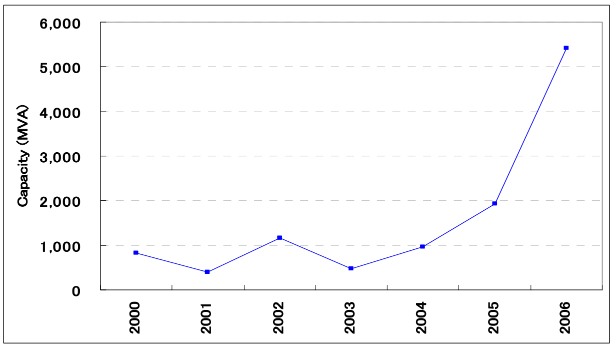
Transition of the peak load in recent years is shown in Fig.2.4-9. The annual growth rate was more than 10% before the economic crisis, but it slackened after year 2000. The amount of peak load in 2007 was 16,251 MW.



Source : PLN

Fig.2.4-9 Peak Load

In recent years, PLN declined new customers who applied for connection and supply of electricity, due to shortage of supply. These waiting customers are managed as "Waiting List", and trend of them is shown in Fig.2.4-10. The total capacity of all waiting customers in "Waiting List" reached around 5,500 MVA in 2006.



Source : PLN Statistics

Fig.2.4-10 Waiting List

2.4.3 Existing Power Generation Facilities

Table 2.4-1 shows an overview of the existing power generation facilities in Jamali System. PLTP Drajat with installed capacity of 110 MW × 1 unit (IPP) was put into operation in June 2007.

Total installed capacity for 2007 in Jamali System is 22,421 MW, 82% by PLN and 18% by IPP, while rated capacity is 20,309 MW, about 10% less than the installed capacity. Gross production in 2006 was 104,775 GWh, 76% by PLN and the remaining 24% by IPP.

As of year 2006, energy generation by coal occupies 43 % of the total PLN energy production, which has increased by 5% from the previous year, while installed capacity of PLTU has increased its share by 3% from the previous year.

Operation performance of the existing power plants is shown in Appendix-5.

Table 2.4-1 Brief of Existing Power Generation Facilities in Jamali

Year	Installed Capacity		Rated Capacity		Total for Jamali	
	PLN	Out of PLN	PLN	Out of PLN	Installed Capacity	Rated Capacity
	MW	MW	MW	MW	MW	MW
Year 2005	16,356	N.A	14,225	N.A	N.A	N.A
Year 2006	18,416	3,895	16,990	3,837	22,311	20,827
**Year 2007	18,416	4,005	16,362	3,947	22,421	20,309

Year	Energy Production by Type of Fuel						PLN Total Production
	HSD	MFO	Coal	Natural Gas	Geothermal	Hydro	
	GWh	GWh	GWh	GWh	GWh	GWh	GWh
Year 2005	18,880	7,133.0	29,439	12,902	2,870	6,247	77,471
Year 2006	16,575	7,717.0	34,526	13,434	2,975	4,682	79,909

Year	Energy Production Share by Type of Fuel						PLN Total Production
	HSD	MFO	Coal	Natural Gas	Geothermal	Hydro	
	%	%	%	%	%	%	%
Year 2005	24.4%	9.2%	38.0%	16.7%	3.7%	8.1%	100.0%
Year 2006	20.7%	9.7%	43.2%	16.8%	3.7%	5.9%	100.0%

Year	Installed Capacity (MW)						PLN Total Installed
	Steam	Gas Turbine	Combined C.	Geothermal	Diesel	Hydro	
	PLTU	PLTG	PLTGU	PLTP	PLTD	PLTA	MW
Year 2005	6,000	2,065.0	5,403	375	103	2,409	16,355
Year 2006	7,320	2,065.0	6,143	375	103	2,409	18,415

Year	Energy Production Share by Type of Fuel (%)						PLN Total Installed
	Steam	Gas Turbine	Combined C.	Geothermal	Diesel	Hydro	
	PLTU	PLTG	PLTGU	375	PLTD	PLTA	%
Year 2005	36.7%	12.6%	33.0%	2.3%	0.6%	14.7%	100.0%
Year 2006	39.8%	11.2%	33.4%	2.0%	0.6%	13.1%	100.0%

Note: * (75.65) is quoted from "Evaluasi Operasi System Jawa Bali 2007", P3B
** Source "Evaluasi Operasi System Jawa Bali 2007", P3B
Source : PLN Statistics 2005, 2006

2.4.4 Existing Power Development Plan

Table 2.4-2 shows the current power development plans listed in RUPTL 2006 and 2007. As of February 6, 2008, five (5) projects have already started their commercial operation.

(1) Fast Track Program (6,900 MW) in Jamali

The fast track program with total installed capacity of 6,900 MW of coal-fired thermal plants in Jamali is expected to start its commercial operation during 2009 and 2010. Fig.2.4-11 shows locations of ten (10) coal-fired power plants under the fast track program.

Table 2.4-2(1) shows the progress of the Fast Track Program as of February 2008 and Table 2.4-2 (2) shows the latest progress as of November 2008. According to the latest information, eight (8) out of ten (10) projects are under construction. However, concerning the three (3) projects out of eight (8) projects, their progress are slow because progress payments to EPC contractors have not been done except the advance payment. The remaining two (2) projects have not yet started the construction and their commercial operations are expected to start in 2011 or 2012.

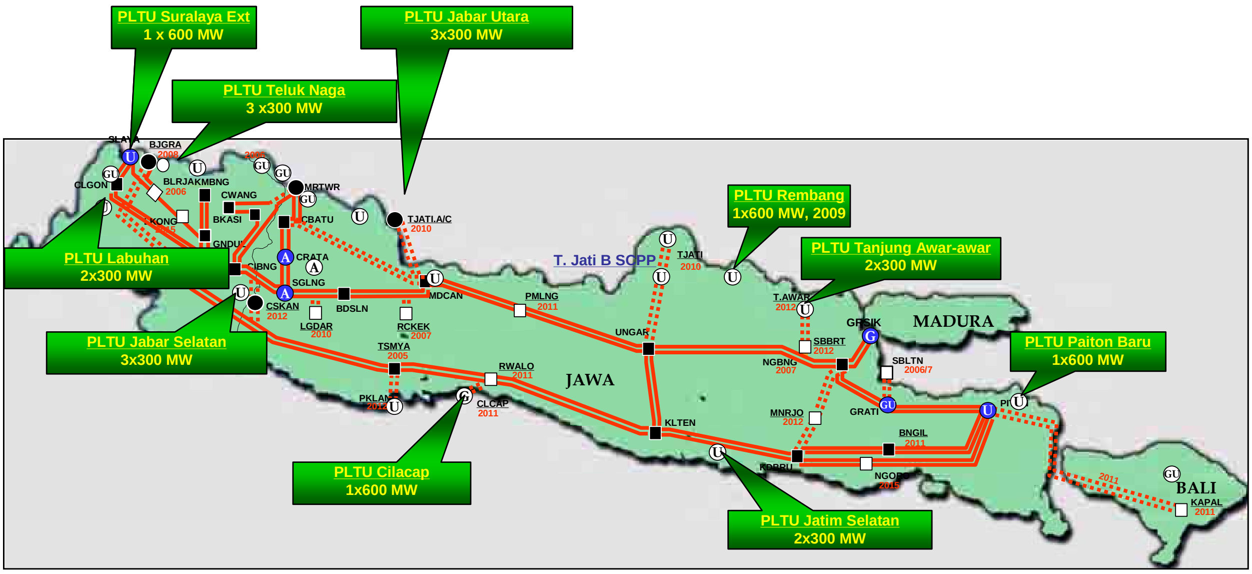


Fig.2.4-11 Location of Fast Track Program (6,900 MW) in Jamali

Table 2.4-2 (1) Existing Power Development Plans (as of February 6, 2008)

S.N	Power Plant/Project Name	Generation Type (PLTU, PLTG, PLTP, PLTGU, PLTA, PLTD, PLTN)	Installed capacity: U.Capacity MW	Installed capacity: Nos. of unit	Installed capacity: Total Capacity MW	Owner (IP, PJB, PLN, IPP)	Fuel (HSD, MFO, NG, Coal)	Location (WJ, CJ, EJ, Bali, Madura)	Expected Operation Year (of the 1st unit)	Financial Procurement: Already prepared	Financial Procurement: on-going	Financial Procurement: not yet planned	Financial Source (if already prepared)	Total Investment Amount (L/C and/or F/C): Local Currency Billion Rp.	Total Investment Amount: Foreign Currency Million USD	Construction and Land Acquisition: Already const. started	Already secured	on-going	Planned but not yet started	Not yet planned	EIA: Already finished	EIA: on-going	EIA: Not yet started	Approval of BAPEDALDA/Government: Already approved	on-going	Not yet submitted	RUPTL: Nov. 2006 (2006~10)	RUPTL: May 2006 (2006~16)	RUPTL: Aug. 2007 (2007~16)	Remark
Already Completed / Canceled Projects																														
1	Cilegon	PLTGU	740	1	740	PLN	NG	Banten	Op.2005																		■	■		Already start the operation in 2005
2	Tanjung Jati-B	PLTU	660	2	1,320	PLN	Coal	C.J	Op.2006																		■	■		Lease Project / Already start the operation in 2006
3	Cilacap	PLTU	300	2	600	IPP	Coal	W.J	Op.2006																		■	■		Already start the operation in 2006
5	Darajat #3	PLTP	110	1	110	IPP	Geo	W.J	Op.2007																		■	■	■	Already start the operation in 2007
4	Kamojang #4	PLTP	60	1	60	IPP	Geo	W.J	Op.2008																		■	■	■	Already start the operation in February 2008
5	~~Pemaron~~	PLTGU				PLN		Bali	Cancelled																		■	■		Canceled due to environmental restriction
On-going and Commited Projects (PLN & IPP)																														
6	Muara Karang	PLTGU	750	1	750	PLN	NG	Banten	2011				JBIC															■	■	
7	Muara Tawar	PLTGU	225	1	225	PLN	NG	Banten	2011				JBIC															■	■	
9	Tanjung Priok Extension	PLTGU	750	1	750	PLN	NG	Banten	2012				JBIC															■	■	
10	Suralaya Baru	PLTU	600	1	600	PLN	Coal	Banten	2009	APLN			China Exim Bank $330.8 Million	951	368	O					O			O			■	■	■	PLN signed a loan agreement on Jan. 30, 2008 (Jakata Post)
11	Labuhan	PLTU	300	2	600	PLN	Coal	Banten	2009	APLN			Bank Central Asia	1,538	373	O					O			O			■	■	■	International finace source has not yet prepared.
12	Teluk Naga	PLTU	300	3	900	PLN	Coal	Banten	2010	APLN				2,079	602	O					O			O			■	■	■	
13	Jabar Selatan/ Pelabuhan Baru	PLTU	300	3	900	PLN	Coal	W.J	2010	APLN				2,426	624	O					O			O			■	■	■	
14	Jabar Utara/ Indramayu	PLTU	300	3	900	PLN	Coal	WJ	2009	APLN			B. MANDIR, B. BNI, B.CA /	1,647	766	O					O			O			■	■	■	Syndicate of Banks consisting of Bank Mandir, Bank Negara Indonesia and Bank Central Asia
15	Rembang	PLTU	300	2	600	PLN	Coal	C.J	2009	APLN			B. MANDIR, B. BNI, B. CA /	2,474	339	O					O			O			■	■	■	Syndicate of Banks consisting of Bank Mandir, Bank Negara Indonesia and Bank Central Asia
16	Jatim Selatan/Pacitan	PLTU	300	2	600	PLN	Coal	E.J	2010	APLN				1,354	393	O					O			O			■	■	■	
17	Paiton Baru	PLTU	600	1	600	PLN	Coal	E.J	2009	APLN			China Exim Bank $284.0 Million	777	428	O					O			O			■	■	■	PLN signed a loan agreement on Jan. 30, 2008 (Jakata Post)
18	Tanjung Jati Baru /Cilacap	PLTU	600	1	600	PLN	Coal	C.J	2010	APLN							Bidding procurement					O					■	■	■	Under selection of EPC Contractor (Expected date of completion of EPC Contractor is the end of March
19	T Awar-awar	PLTU	300	2	600	PLN	Coal	E.J	2010	APLN							Bidding procurement				O						■	■	■	Under selection of EPC Contractor (Expected date of completion of EPC Contractor is the end of February
20	Patuha # 1, 2, & 3	PLTP	60	3	180	IPP	Geo	W.J	2010			O					O						O				■	■	■	Looking for investors
21	Wayang Windu #2	PLTP	110	1	110	IPP	Geo	W.J	2009	O			Sumitomo Shoji (Japan)			O					O						■	■	■	On schedule
22	Dieng #2 & 3	PLTP	60	2	120	IPP	Geo	C.J	2010			O															■	■	■	Looking for investors
23	Bali Utara / Celukanbawang	PLTU	130	3	390	IPP	Coal	Bali	2009	O						O					O						■	■	■	Behind schedule, year of commercial operation might be 2010.
24	Bedugul	PLTP	10	1	10	IPP	Geo	Bali	2010			O					O					O					■	■	■	Looking for investors, Ministry of Forest has not yet approved because the site locates in the National Park.
25	Cirebon ~~(Eks Cilegon)~~	PLTU	600	1	600	IPP	Coal	W.J	2010		O		JBIC and Korean Exim					O				O					■	■	■	Financial close is expected to be the mid of 2008.
PLN Planning Projects																														
26	Upper Cisokan	PLTA	500	2	1,000	PLN		W.J	2013		O		WB/JBIC					O				O						■	■	
27	LNG-1 (Bojanegara)	PLTGU			1,500	PLN	LNG	Banten	2014			O					O				O							■	■	EIA was already prepared in 2002 ~ 2003. However, due to postpone of the project, EIA regires to be re-
28	Kamojang #5	PLTP	60	1	60	PLN	Geo	W.J	2012																				■	
29	PLTU Baru																											■	■	
IPP Planning Projects																														
30	Cikarang Ext.	PLTGU	150	1	150	IPP	NG	W.J	2010			O					O						O					■		Still under negotiation with the original owner
31	Anyer	PLTU	300	1	300	IPP	Coal	W.J	2009			O					O						O					■	■	
32	Pasuruan	PLTGU	500	1	500	IPP	NG	E.J	2011			O								O			O					■		
33	Madura	PLTU	100	2	200	IPP	Coal	E.J	2011			O								O			O					■	■	
34	Tj. Jati A	PLTU	300	2	600	IPP	Coal	W.J	2014			O						O					O					■	■	Under negotiation with Developer
35	~~Tj. Jati C~~																											■		Tj. Jati C is closed out due to adaption of Financial Lease for Tj. Jati B # 1 & #2
36	~~Tj. Jati B3~~																											■		Tj. Jati B3 is the same project with Tj. Jati -B Ext.
37	Bali Timur	PLTU	100	2	200	IPP	Coal	Bali	2011			O								O			O					■	■	Bidding Procurement (selection of Developer) will start in March 2008
38	PLTU Jawa Tengah	PLTU	600	2	1,200	IPP	Coal	C.J	2014																				■	
39	Cikarang Listrindo	PLTG	150	1	150	IPP	NG	W.J	2012																				■	
40	Rajamandala	PLTA	47	1	47	IPP		W.J	2011																				■	
41	Mulut Tambang	PLTU			2,400	IPP		Sumatera	2012			O								O			O					■	■	The owner is changed from PLN to IPP in RUPTL Aug. 2007.
Potential Projects																														
42	LNG-2				2,250	PLN/IPP	LNG	Banten	2015								O											■		
43	Cilacap Ext. (III)	PLTU	600	1	600	IPP	Coal	W.J	2011			O							O				O					■	■	
44	Paiton Block III - IV	PLTU	800	1	800	IPP	Coal	E.J	2011			O					O						O					■	■	
45	Tanjung Jati-B Ext.	PLTU	660	2	1,320	IPP	Coal	C.J	2011	O			JBIC				O				O			O				■	■	
46	PLTGU Baru																											■		
47	PLTN		900 or 1,000			PLN			2018/19			O										O						■		EIA is almost finished but not yet submitted for approval.
Planning Projects by MEMR (Note: The Following projects are not listed in RUPTL.)																														
48	Telaga Ngebel	PLTP			120	IPP	Geo	E.J	2012			O								O			O							MEMR Projects announced by ESDM website saying "Government Ready to Tender 6 Geothermal Working Areas (Sep. 13, 2007). Provincial governments have already prepared Auction Committee and under preparation of Tender Documents. Tender Documents are expected be sold within this year. However, regional governments (smaller unit than the provincial government) have not yet prepared Auction Committee
49	Gunung Ungaran	PLTP			50	IPP	Geo	C.J	2012			O								O			O							
50	Gunung Tampomas	PLTP			50	IPP	Geo	W.J	2012			O								O			O							
51	Cisolok-Cisukarame	PLTP			45	IPP	Geo	W.J	2012			O								O			O							

Note in table: **APLN** means Already Prepared for PLN Portion.

Note in table (Planning Projects by MEMR, Not yet planned): Working Area does not specify the development site. The development site is to be determined by IPP

Source : PLN Project and Crash Program (PLN system Planning Division), IPP Project (PLN Primary Enrgy Division), Crash Program (PLN Coal Fired Steam Power Plant 10,000 MW Fast Track Project)
Planning projects by MEMR are informed by Investment Development Section (Geothermal and Coal) in MEMR.

Table 2.4-2(2) Latest Progress of the Fast Track Program

(As of November 06, 2008)

S.N	Power Plant/Project Name	Expected Operation Year (of the 1st unit)	Financial Procurement			Progress of Construction
			PLN Advance Payment	Foreign Bankers	Local Bankers	
Fast Track Program (6,900 MW Crash Program in Jamali)						
10	Suralaya Baru	2009	Already Paid	Finance Close (China Exim Bank)	Finance Close	Under construction
11	Labuhan	2009	Already Paid	No Foreign Bankers	Finance Close (Bank Central Asia)	Under construction
12	Teluk Naga	2010	Already Paid	Under negotiation with Bank of China (Interest and Government concerned)	Determination of loan amount by foreign bankers first, then negotiation with local bankers.	Under construction but progress is slow due to the progress payment is covered by Advance Payment.
13	Jabar Selatan/ Pelabuhan Baru	2010	Already Paid	Looking for foreign bankers	Determination of loan amount by foreign bankers first, then negotiation with local bankers.	Under construction but progress is slow due to the progress payment is covered by Advance Payment.
14	Jabar Utara/ Indramayu	2009	Already Paid	Finance Close (Bank of China)	Finance Close (B. MANDIR, B. BNI, B.CA)	Under construction
15	Rembang	2009	Already Paid	Finance Close (Barclays Bank)	Finance Close (B. MANDIR, B. BNI, B. CA)	Under construction
16	Jatim Selatan/Pacitan	2010	Already Paid	Under negotiation with China Exim Bank (waiting signing and governments approval)	Determination of loan amount by foreign bankers first, then negotiation with local bankers.	Under construction but progress is slow due to the progress payment is covered by Advance Payment.
17	Paiton Baru	2009	Already Paid	Finance Close (China Exim Bank)	Finance Close	Under construction
18	Tanjung Jati Baru /Cilacap	2011/12	Not yet	Looking for foreign bankers	Not yet proceeded	Not yet start construction due to waiting for the official approval for EPC Contract
19	T Awar-awar	2011/12	Not yet	Looking for foreign bankers	Not yet proceeded	Not yet start construction due to waiting for the official approval for EPC Contract

Source: PLN

(2) Geothermal (PLTP) Development

Drajat unit 3 (110 MW, IPP) and Kamojang unit 4 (60 MW, IPP) were put into operation in June 2007 and February 2008, respectively.

Four (4) geothermal power plants are already committed or under construction, and will start their commercial operations in 2009 and 2010. However, two (2) out of 4 projects are still looking for investors. All future geothermal power development will be implemented by IPP. Apart from RUPTL, MEMR is planning under its own initiative[1] to develop four (4) geothermal power plants of 265 MW in total capacity in Jamali, with expected commercial operation in and after 2012[2].

MEMR issued the ministerial decree in 2008 to accelerate development of the geothermal energy. Under this decree, price per kWh of electricity by geothermal plants above 55 MW is set at 80 % of the average production cost of conventional fuel-fired power generation. For power plants between 10 to 55 MW, electricity is priced at its 85%.

To see whether this decree will promote development of 55 MW geothermal power plants, geothermal and conventional thermal generation costs are compared in Table 2.4-3, using 2006 data. As shown in the table, 85% of the average production cost of conventional fuel-fired

[1] System Planning Section of PLN has not been informed by MEMR as of Feb. 6, 2008.
[2] According to the Jakarta Post of June 7, 2006, Tampomas (50 MW), Cisolok Sukarame (45 MW) and Tangkuban Perahu (220 MW) have been bided and their operation are expected in 2011.

power generation in Jamali is lower than the production cost of geothermal power generation in 2006, while 85% of the average production cost conventional fuel-fired power generation in outside of Jamali is much higher than the production cost of geothermal power generation in 2006. The new decree seems to provide an incentive in outside of Jamali rather than in Jamali region.

Table 2.4-3 Cost Comparison between PLTP Production Cost and 85% Cost

Plant Type	PLN Generation cost in 2006 for Whole Indonesia (Rp/kWh)						PLN Production (GWh)		Generation Cost (Million Rp)	
	Fuel	Maintenance	Depreciation	Salary	Others	Total	Jamali	Out of Jamali	Jamali	Out of Jamali
PLTA	9	17	95	17	5	143	4,682	4,076	670,369	583,602
PLTU	314	18	50	5	2	389	42,964	4,801	16,733,189	1,869,845
PLTD	1,429	99	60	35	8	1,631	123	5,928	200,656	9,670,643
PLTG	1,791	119	77	10	2	1,999	3,471	1,560	6,939,015	3,118,658
PLTGU	808	34	42	3	3	889	25,691	5,227	22,847,777	4,648,528
PLTP	506	8	53	11	3	580	2,976	166	1,725,306	96,237
						Total	79,907	21,758	49,116,312	19,987,513
							Average Total Production Cost (Rp/kWh)		615	919
							85 % of total Generation Cost (Rp/kWh)		**523**	**781**
							85 % of Thermal Generation Cost except PLTP (Rp/kWh)		**550**	**937**

Source : PLN Statistics 2006, Table 23 & Table 38

(3) Combined Cycle Thermal Power Plant (PLTGU) Development

Development of combined cycle thermal power plants by IPP, such as Cikarang Extension (150 MW) and Pasuruan (500 MW), has been eliminated from the latest development plan (RUPTL in 2007). Future development plan of combined cycle thermal power plants is only by LNG-fired PLTGU (Bojanegara, 2 × 750 MW, PLN) except for the on-going projects under JBIC Loan.

(4) Hydropower (PLTA) Development

Due to the limited potential sites for hydroelectric power development in Jamali, especially for reservoir-type hydroelectric power development, only Upper Cisokan Pumped Storage Power Plant (2 × 500 MW) with expected commercial operation from 2013, is planned. If PLN wishes to start its commercial operation as originally schedule, its construction needs to start in 2008, as the main work construction of Upper Cisokan Power Plant is expected to take about 5 years. However, its finance source has not been fixed though World Bank and other international financial institutions show their intention to provide funding. Considering the progress of financial arrangement, its commercial operation seems to delay for 2 years (2015).

Apart from PLN's development plan, multipurpose Jatigede Dam (installed capacity 2 × 55 MW) is under construction by PU, with expected commercial operation in 2015. Concerning IPP development, 47 MW Rajamandala run-of-river type power plant in the downstream of Saguling Dam is under construction, and it is expected to be completed in 2012, one year after its scheduled year of completion in 2011 described in RUPTL, due to slow progress.

(5) Nuclear Power (PLTN) Development

A program of developing PLTN is still active although it is not mentioned in the latest plan (RUPTL 2007). The Indonesia Government has not fixed its location yet.

2.4.5 Power System Reinforcement Plan

The overall power system reinforcement plan in Indonesia is divided into two parts, one for Java-Madura-Bali and the other for the remaining areas, and they are carried out separately. This power reinforcement plan is conducted for ten year period and the result is incorporated in RUPTL. The plan is revised annually.

(1) Current Situation of Java-Madura-Bali System

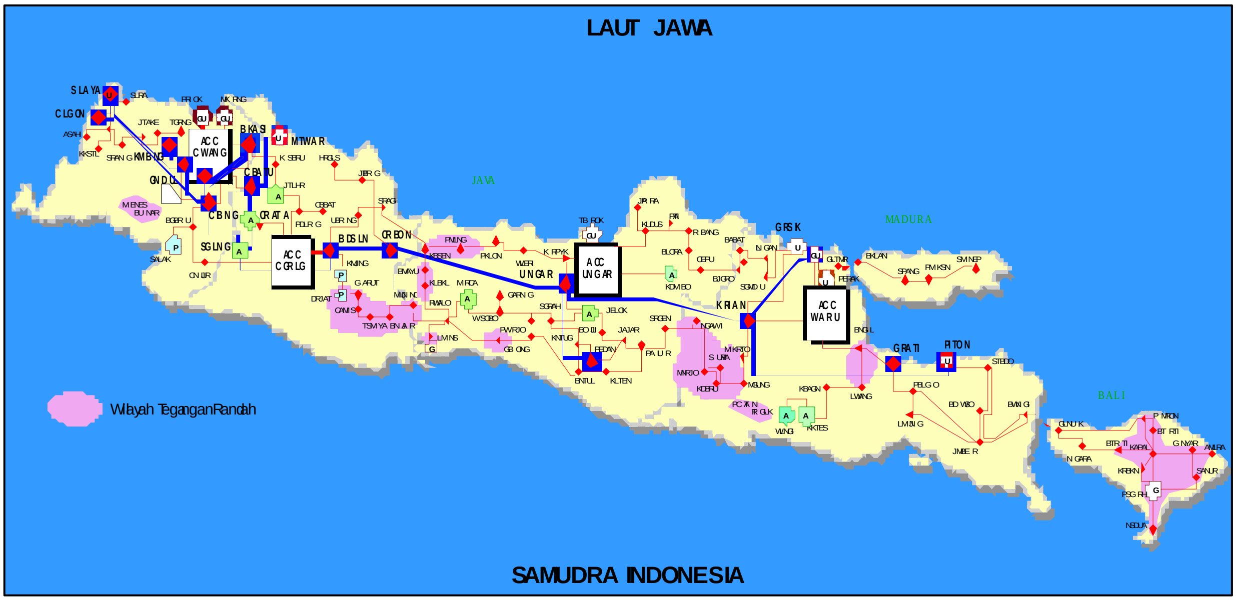
The present major power transmission system in Java Island is a 500 kV system covering all areas of the island.

The 500 kV system comprises the north and south corridors that go through Java Island for about 900 km east and west, and interconnection lines that connect these 2 corridors. The system in Bali Island is connected to the Java system with 150 kV submarine cables, and the Java and Bali systems are operated integrally, which configure the Java-Bali system.

The Java-Madura-Bali system has the following main characteristics of power flow and system configuration:

- The power system is configured by long-distance northern and southern 500 kV transmission lines which are connecting Paiton P/S in the eastern and the load center in the western end of Java Island.
- A large-scale demand areas, such as Jakarta, are located in the west side.
- Many large power plants, such as Paiton P/S, are located in the east side.
- The connection between the Java and Bali systems is not so strong (150 kV submarine cable with transmission capacity of around 200 MW)
- Substantial dependence of the Bali system on power supply from the Java system

The power system has a heavy power flow from the east side to the west side, and elasticity problem seems to be the important issue in power supply.



Source : Sistem Tenaga Listrik Jamali, Jawa-Madura-Bali, PLN

Fig.2.4-12 500 kV Bulk Power Network of the Java-Madura-Bali System

(2) Plan to Reinforce Power System

Power system reinforcement is conducted by cooperation between PLN Head Office and PLN P3B on the basis of load demand forecast and the power development program. Power system analysis, which provides a basis for expansion of the power system is conducted by PLN P3B.

In accordance with the latest power reinforcement plan by PLN, transmission lines and transformers required for the trunk power system in the next decade are shown in the tables below.

1) Expansion Plan for Transmission Lines

To meet the rapidly increasing demand, trunk transmission lines are to be reinforced significantly. As for 500 kV transmission lines, the total length of 3,128 km is already in place as of 2006, substantial addition of 2,557 km is planned for the next decade.

Expansion Plan of 500 kV and 150 kV Transmission Line (km)

Transmission Lines	2006*)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
500kV	3,128	129	165	773	462	622	56	20	100	210	20
150kV	11,055	1,759	2,358	1,767	445	184	534	388	382	46	45

*) Existing as of year 2006

Source : RUPTL 2007-2016

2) Transformer

Also for the trunk transformers, additional 22,164 MVA are planned for 500/150 kV, and additional 28,530 MVA are planned for 150/70 or 20 kV. 70 kV power system is being reduced, and this voltage system should be replaced by 20 kV system to simplify the system voltage level in future.

Expansion Plan of 500 kV and 150 kV Transformers (MVA)

Transformers	2006*)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
500/150kV	15,500	1,832	2,832	1,500	4,000	1,500	2,000	1,500	1,500	3,000	2,500
150/70kV	3,579	480	220	100	-	180	100	30	-	-	-
150/20kV	24,470	5,220	4,470	2,700	3,090	2,160	2,610	2,010	2,430	1,860	870

*) Existing as of 2006

Source : RUPTL 2007-2016

3) New Trunk Substations

To respond to the increase of demand in certain areas, installation of new substations are planned to provide basis to satisfy electric demand in these areas. New trunk substations, as many as twelve 500 kV substations and eleven 150 kV substations are planned for the next decade as shown in the table below.

Expansion Plan of 500 kV and 150 kV Substation (Number)

Substations	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
500kV	1	3	-	3	-	1	1	-	2	2
150kV	21	16	17	11	6	12	11	14	2	1

Source : RUPTL 2007-2016

4) Criteria for Power System Planning

As for the criteria for power system planning, reinforcement of power system is considered to maintain stable power supply with existing equipments even when one of them is forced to be out of service. Purpose of power system planning is to mainly consider the results of analysis of so called N-1 rule, to maintain quality of the power supply within certain levels, such as 500 kV ±5%. Currently, transient stability of the systems is not evaluated, and no criterion is adapted.

From now on, it is recommended to establish and apply criteria to evaluate transient stability gradually, to realize stable power supply in the near future.

(3) Outline of Major Projects

Major projects likely to affect the Java-Madura-Bali trunk power system including introduction of many coal-fired power plants, new type power plants with large capacity and Java-Sumatra interconnection, are covered in this study.

Among these major projects, following two projects are mentioned and planned in RUPTL (2007-2016). Their outlines are as follows;

1) Java-Sumatra Interconnection Project

JICA team has been informed that an interconnection is planned to send the surplus power of 3,000 MW in Sumatra to Java. This surplus power is generated by a new coal-fired power plant at mine-mouth (600 MW × 4 units) and coal-fired Musi Rawas P/S (600 MW × 2 units). 400 MW will be consumed in Sumatra; and 200 MW will be lost on the HVDC system.

According to the current plan, 1,200 MW will be transmitted in 2012, being increased to 2,400 MW in 2013 and finally 3,000 MW in 2014. However, it seems to be difficult to realize this project as scheduled as the construction would require longer period.
As one of the options to supply from Sumatra to Java, there is a plan as follows;

(a) Method of transmission
Electric power of 3,000 MW generated at the P/S at the mine-mouth and Musi Rawas P/S will be transmitted to Depok S/S in Java through Muara Enim S/S in Sumatra by DC 500 kV bipolar.

(b) Transmission line
Outlines of transmissions line in this project are shown in table below.

Transmission Lines of Java-Sumatra Interconnection

Section	Transmission	Length (km)
Mine-mouth P/S in South Sumatera to Ketapang	Overhead Line	400
Ketapang to Salira	Submarine Cable	37
Salira to Depok III	Overhead Line	250-280

Source : RUPTL (2006-2015)

Considering the final capacity of 3,000 MW, transmission lines will be designed to transmit this final capacity at the time of commencement of its operation in 2012.

(c) Converter station
AC/DC converters will be installed at Muara Enim S/S in Sumatra and Depok S/S in Java as a part of this project.

In addition, the expansion (addition of 600 MW × 2 units) of existing Keramasan P/S is planned, for example, although there is some uncertainty. Depending on the supply and demand balance in Jamali, additional 3,000 MW may be transmitted from Sumatra to Jamali system in future.

A further study is required to realize this transmission of additional 3,000 MW, in line with the power development plan in Java Island.

2) Java-Bali Interconnection Project

According to RUPTL, the total supply capacity of the existing generators and newly installed generators with transmission from Java Island will reach 874 MW in 2008 in Bali. In future, electricity demand will exceed this total supply capacity since the demand will be increasing significantly. As for the demand and supply balance in Bali, it depends largely on the supply from Java system through Java-Bali interconnection.

However, the existing interconnection line (submarine cable, 150 kV, 2 cct.) has low transmission capacity of 200 MW. In addition, there seems to be many problems with the submarine cable. There is a concern that there may affect the reliability and economic operation of Bali power system.

In order to strengthen the system interconnection, a new 500 kV transmission line will be constructed between Paiton S/S in Java and newly installed Kapal S/S in Bali by 2016.

500 kV transmission line will pass through a national park or protection forests, and the landscape has to be protected from impacts by 500 kV transmission towers. It is necessary to overcome this problem to realize this project.

A further study is required in accordance with the power development plan including repowering of the existing power plants.

2.4.6 Current Condition of System Operation

Through investigation at P3B Java central dispatching control center (JCC) and regional control centers (RCC), review of existing documents, and discussions with counterparts, current conditions of system operation in Jamali were found, and problems and probable reasons are shared with P3B.

Operational boundary of Jamali system in terms of geography and voltage are shown in Fig.2.4-13 and Fig.2.4-14 respectively. System of SCADA is shown in Fig.2.4-15. Central dispatching control center (JCC) conducts dispatching, and observes and controls 500 kV system. Regional control centers observe and control 150 kV and 70 kV system. Systems of 20 kV and below are managed by PLN distribution units. Regional control centers are separated into Region 1 (RCC1), Region 2 (RCC2), Region 3 (RCC3) and Region 4 (RCC4). Region 4 is subdivided into East Java and Bali. Replacement of SCADA has already been completed at JCC in 2006 as shown in Fig.2.4-16, and is scheduled at each control center in the near future.

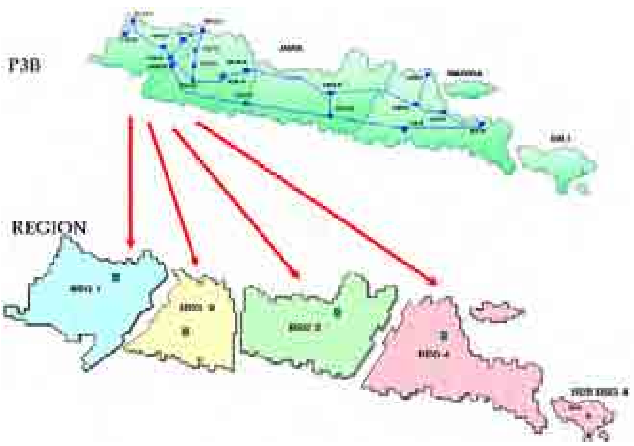


Fig.2.4-13 Regional Control Area in Jamali System

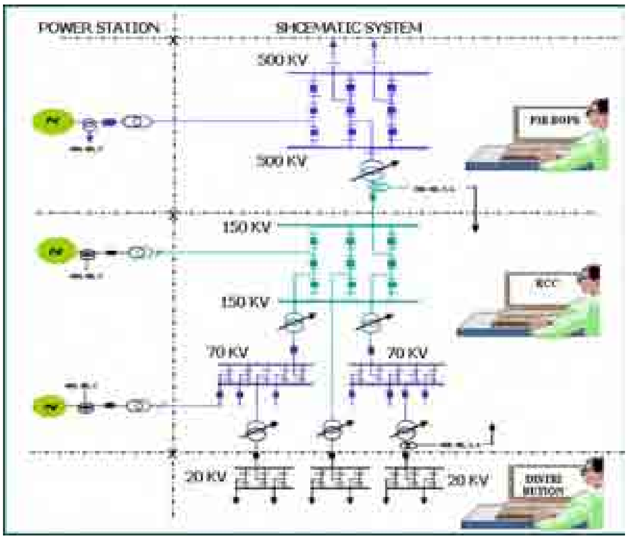


Fig.2.4-14 Hierarchy of Control System by Voltage in Jamali

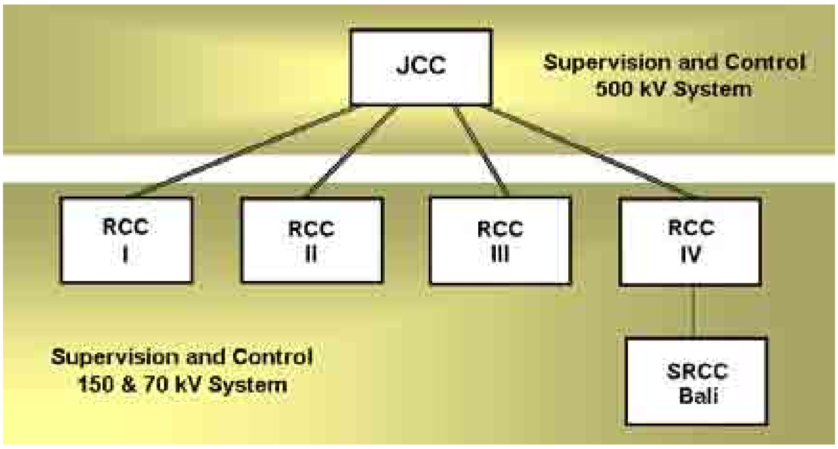


Fig.2.4-15 Structure of SCADA System in Jamali

Fig.2.4-16 New SCADA of JCC

In P3B, the following information is shared with related parties through HTML based RAPSODI (Report Application of Power System Operation & Data Integration) system which was developed by PLN itself:

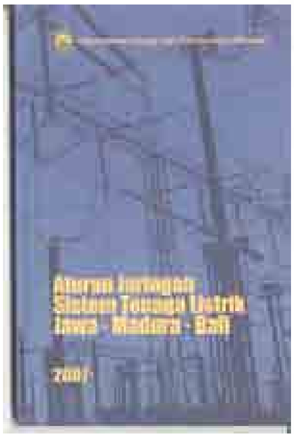
- Electronic documents such as operation reports and manuals
- Information on maintenance and outage
- Real time operation information which is linked with SCADA

To access the system, user ID and password are required, and information security is secured. Some of the information such as daily demand and supply are open to public through P3B website. (Fig.2.4-17)

Fig.2.4-17 Website of P3B

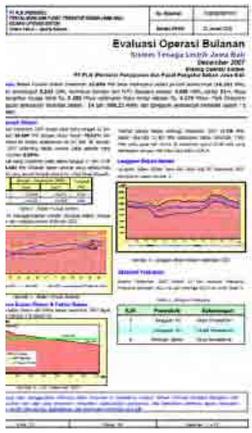
As rules on system operation, the existing grid code was reviewed by the team consists of PLN, IP, PJB and IPPs with MEMR supervision, and the revised version was issued in 2007 as a MEMR ministerial regulation.

Also, in P3B, the annual operation plan for the next year is issued every December. The report on operation record is edited and issued by P3B every month, and the annual evaluation report on operation record is also issued. (Fig.2.4-18)



Grid Code

Annual Operation Plan



Monthly Operation Report

Annual Evaluation of Operation

Fig.2.4-18 Example of Documents of PLN on System Operation

Thus, in PLN, it can be said that structure, facilities and rules for operation are well conditioned. However, problems in power quality such as in voltage and frequency exist, probably because of fundamental lack of facilities. Problems on operation can be classified into voltage, frequency, outage and loss. Current conditions analyzed in terms of these factors are described below.

(1) Voltage

1) Current Condition

According to the grid code CC2.1 (b), as shown below, standard band for voltage in normal operation is from -5% to +5% for 500 kV system, and from -10% to +5% for 150 kV and 70 kV, respectively.

CC2.1 P3B and all other system users shall make best effort in order to meet following requirements at each connecting point.

b System voltage shall be maintained within following band

Nominal Voltage	Standard
500 kV	+5%, -5%
150 kV	+5%, -10%
70 kV	+5%, -10%
20 kV	+5%, -10%

Against these standards, the number of voltage violation is quite large in recent years. Table 2.4-4 shows the record of voltage drop below the standard value in recent years. The number in the table represents cumulative number of substations with voltage drop in each year. Although violation of voltage standard was recorded many times, the problem seems to be mitigated briefly due to some factors including the completion of southern 500 kV transmission line in 2006.

Table 2.4-4 Total of Substation with Voltage Drop

	2002	2003	2004	2005	2006	2007	2008*
500 kV (S/S)	103	158	149	145	75	60	50
150 kV (S/S)	566	551	407	479	288	153	435
70 kV (S/S)	319	248	198	207	169	252	153

* Up to September, 2008 Source : PLN

The number of voltage drop in 2007 classified by voltage and area is shown in Table 2.4-5. Referring to the table, there were voltage drop in many substations, including extremely low voltage of 461 kV in 500 kV system in September. Also, there were perpetual voltage drop in 150 kV and 70 kV system.

Table 2.4-5 Record of Voltage Drop in Jamali in 2007

Month	500 kV		150 kV					70 kV				Total
	Place	Voltage (kV)	RCC1	RCC2	RCC3	RCC4	Sub-total	RCC1	RCC2	RCC4	Sub-total	
Jan	0	0	2	8	8	11	29	4	1	12	17	46
Feb	0	0	2	8	34	8	52	4	1	16	21	73
Mar	4	472	2	10	4	0	16	4	0	5	9	29
Apr	9	466	2	9	4	0	15	4	0	5	9	33
May	4	466	2	6	15	0	23	4	0	8	12	39
June	1	473	2	7	2	0	11	4	0	6	10	22
July	11	466	2	11	1	0	14	4	0	2	6	31
Aug	3	469	2	9	2	0	13	4	1	3	8	24
Sep	10	461	2	21	7	0	30	4	3	13	20	60
Oct	2	469	2	16	0	0	18	4	4	8	16	36
Nov	8	462	2	17	0	0	19	4	1	7	12	39
Dec	8	463	2	10	0	0	12	4	0	9	13	33

Source : Evaluasi Operasi Sistem Jawa Bali 2007

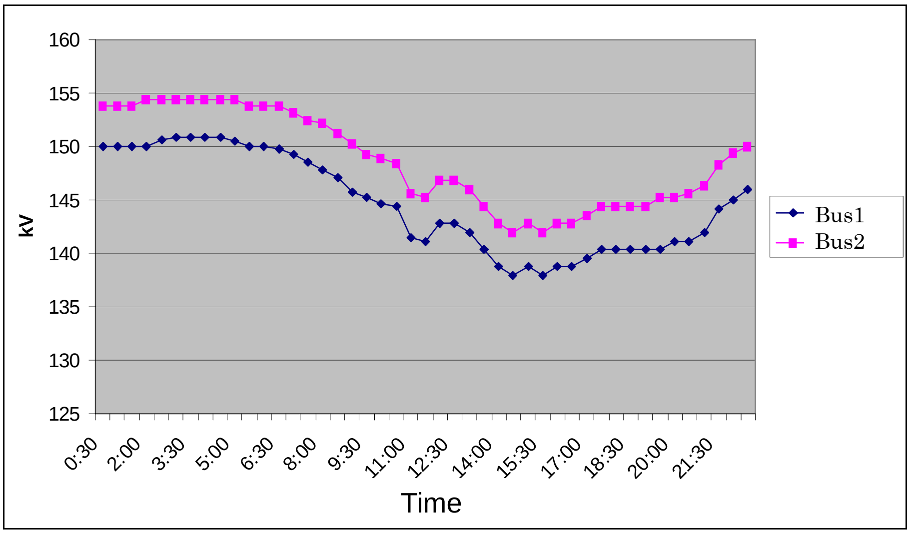
In the operation plan 2008, voltage will be kept within appropriate range in 500 kV system, while voltage drop is expected in 150 kV and 70 kV systems at peak time. The number of substations where voltage is assumed to deviate from the standard at peak time is listed in the table below. Although expected number of voltage drop is small in the operation plan 2008, voltage drop was actually recorded in many cases up to March 2008, as shown in Table 2.4-4.

Table 2.4-6 Assumed Number of Substations with Voltage Drop at Peak Time in 2008

	RCC1	RCC2	RCC3	RCC4	Total
500 kV (S/S)	0	0	0	0	0
150 kV (S/S)	1	11	0	0	12
70 kV (S/S)	4	0	-	6	10

Source : RENCANA OPERASI SISTEM TENAGA LISTRIK JAWA-BALI 2008

Fig.2.4-19 shows the record of voltage drop at a 150 kV substation in Region1 in 2007. Against standard voltage of 150 kV, although the voltage did not reach 135 kV which is -10%, a few percent of voltage drop occurred at peak time. Further voltage drop is concerned along with demand growth in future.



Source : PLN

Fig.2.4-19 Example of Voltage Drop in Region 1

Against voltage drop, capacitors are planned to be installed in Region 1. However, no specific countermeasure is planned in the other regions. In addition, many problems exist in daytime rather than night peak time, especially in the demand center, Region 1.

2) Probable Reasons

In order to maintain proper voltage, reactive power shall be supplied to the grid adequately. In general, generators, static capacitors, and line-charging capacity are considered as reactive power supply source.

In Indonesia, lack of reactive power supply source is considered to be fundamental reason for voltage problem. Normally, supply and demand balance of reactive power should be observed from long-term perspective, and reactive power equipment such as static capacitors and shunt reactors should be installed deliberately. However, in Indonesia, although supply and demand balance of active power and generation development plan are studied, installation plan considering reactive supply and demand is not studied. Therefore, it is considered that there is a shortage of reactive power supplies, and it causes problem of voltage drop.

Moreover, in order to maintain proper voltage, it is also necessary to make full use of reactive power from generators. However, they may not be fully utilized in the present state. This is probably because of shortage of functional requirement in the grid code and generators not able to follow operational orders from the central dispatching center (JCC).

As a reason of voltage drop in Region 1, increase of reactive power loss due to heavy power flow from East Java to West Java, as well as lack of reactive power source in the region, is considered. It is described in annual operation plan of P3B that the voltage of 500 kV system in Jakarta becomes lower than 475 kV when the power flow from the central to west exceeds 2,500 MW.

(2) Frequency

1) Current Condition

Frequency standard in Jamali are described in grid code CC2.1 (a) as listed below.

CC2.1 P3B and all system users shall make best effort in order to meet following requirements at each connecting point.

a Nominal frequency shall be not less than 49.5 Hz and not more than 50.5 Hz. In emergency condition or in outage, frequency may drop up to 47.5 Hz or rise up to 52.0 Hz before generators are allowed to trip.

In order to meet requirements above, current rules and conditions regarding frequency control are described below.

- Governor Free (GF) Capacity

It is provided in the grid code as follows that every generator shall principally have governor free capacity. However, there is no rule for the quantity to be secured. The total of governor free capacity can be observed online.

OC 3.3 Operation of generator governor

All generators shall operate with governor free, except for the case in which P3B permits. All generators shall fit 5% droop characteristics in order to meet with others, except for the case in which P3B permits.

In Jamali, coal-fired generators without LFC control such as Paiton 5-8, Muara Karang, Tambak Lorok and Gresik are operated with full output all the time. Therefore, they do not have governor free capacity.

- LFC Capacity

Although no rules are provided in the grid code, required LFC capacity is determined through meeting in P3B, and it is prescribed in operation plan 2008 that 5% of system capacity should be secured. LFC capacity from the set point can be observed online.

LFC capacity which is scheduled to be secured at peak time in 2008 is shown in Table 2.4-7. According to the table, only 410 MW are secured against required capacity 850 MW which is stipulated in the operation plan 2008. In addition, at the time of the study, only 30 MW of LFC generators are secured as shown in Table 2.4-8. Such condition is likely to continue for a while, and it is expected that improvement of frequency is difficult.

Table 2.4-7 Planned LFC Capacity in 2008

No.	Plant	Capacity (MW)	LFC Capacity (MW)	Notes
1	PLTU Suralaya	1800	3 × 10	Normal
2	PLTA Saguling	700	4 × 25	Normal
3	PLTA Cirata	1000	8 × 20	Normal
4	PLTGU Gresik	1030	2 × 10	Normal
5	PLTU Paiton	800	0	Out of Control
6	PLTGU Grati	300	15	Normal
7	PLTGU Muara Tawar	400	0	Not Operated
8	PLTGU Priok Baru	1100	2 × 10	Out of Control
9	PLTGU Muara Karang Baru	400	10	Normal
10	PLTGU Tambak Lorok	208	2 × 7.5	Normal
11	PLTGU Gresik Baru	500	10	Normal
12	PLTU Tanjung Jati B	1320	2 × 15	Normal
13	PLTU PEC	1290	0	Not Operated
14	PLTU Java Power	1220	0	Not Operated
15	PLTGU Cilegon	740	0	Not Operated
16	PLTU Cilacap	562	0	Not Operated
	Total		**410**	

Source : RENCANA OPERASI SISTEM TENAGA LISTRIK JAWA-BALI 2008

Table 2.4-8 Actual LFC Capacity

No	Generator	Unit	Capacity (MW)	Status (last Updated May 26, 2008)
1	SURALAYA	#6	5	Active
2	SURALAYA	#7	5	Active
3	SAGULING	#3	20	Active
4	SURALAYA	#5	5	Not Active
5	SAGULING	#1	20	Not Active
6	SAGULING	#2	20	Not Active
7	SAGULING	#4	20	Not Active
8	CIRATA	#1	20	Not Active
9	CIRATA	#2	20	Not Active
10	CIRATA	#3	20	Not Active
11	CIRATA	#4	20	Not Active
12	CIRATA	#5	20	Not Active
13	CIRATA	#6	20	Not Active
14	CIRATA	#7	20	Not Active
15	CIRATA	#8	20	Not Active
16	GRESIK	PLTGU 2	20	Not Active
17	GRESIK	PLTGU 3	15	Not Active
18	PAITON	#1		Out Of Service
19	PAITON	#2		Out Of Service
20	GRATI	PLTGU 1	20	Not Active
21	PRIOK BARAT	PLTGU 1		Out Of Service
22	PRIOK BARAT	PLTGU 2		Out Of Service
23	MUARAKARANG BARU	PLTGU 1		Out Of Service
24	GRESIK	PLTGU 1	20	Not Active
25	CILACAP	#1		Out Of Service
26	CILACAP	#2		Out Of Service
27	TAMBAKLOROK	Block 1	10	Not Active
28	TAMBAKLOROK	Block 2	10	Not Active
Total (Active)			**30**	

Source : PLN

- Reserve Margin

  Adequate reserve margin shall be secured in order to raise output from generators so as to recover frequency when generation outage occurs. Classification of reserve margin and amount to be secured in PLN are described in the grid code OC.2.0 as shown in Table 2.4-9. For spinning reserve, half of them are secured by generators and the rest by load shedding.

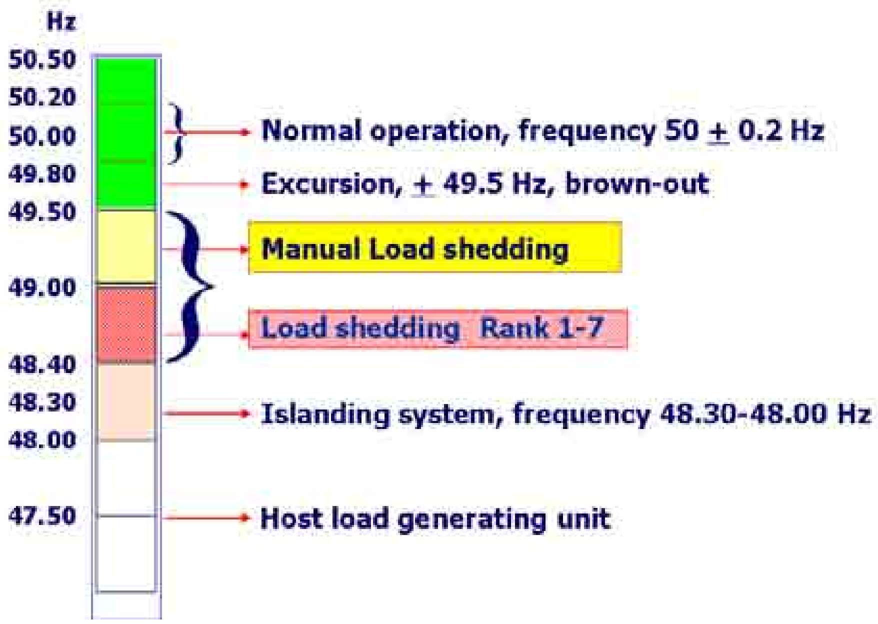
Table 2.4-9 Classification of Reserve Margin and Amount to be secured

Classification	Shall be secured within	Amount to be secured
Spinning reserve	10 minutes	Maximum unit
Spinning reserve + Cold reserve	4 hours	Maximum unit × 2
Spinning reserve + Cold reserve + Capacity reserve	2 days	Maximum unit × 2 + Margin

- Under emergency condition

  Amount of load shedding by automatic load shedding relay for emergency condition is set considering system characteristics calculated from the past records of frequency drop when generator tripped out.

  Structure of frequency control in Jamali is shown in Fig.2.4-20. The target of normal frequency control is 50 ± 0.2 Hz. Demand and supply is controlled by changing output of generators so that frequency is kept in this range. In case frequency drops below 49.5 Hz due to trip of generator and so on, load is shed manually. If frequency declines further, load is shed automatically as to the level of frequency drop. System is isolated when frequency still drops and becomes lower than 48.3 Hz.



Source : PLN

Fig.2.4-20 Structure of Frequency Control in Jamali

As mentioned above, rules for maintaining frequency quality are relatively conditioned. However, frequency deviation occurred many times in recent years as shown in Table 2.4-10.

Table 2.4-10 Number of Deviation of Standard Frequency

	2002	2003	2004	2005	2006	2007	2008*
Number of deviation	108	361	338	239	741	510	956

* As of September 2008 Source : PLN

Of the frequency deviations in 2007, the number of times where frequency exceeded 50.5 Hz was 189, which accounts for about 37%. 179 times of them were caused by load fluctuation.

On the other hand, frequency fell below 49.5 Hz 321 times, which accounts for 63% of frequency deviation. 69 times of them were caused by generator outage. In September, frequency dropped to the lowest value of the year, 48.92 Hz, because of the trip of Tanjung Jati 1st generator. In other 252 cases, generator could not catch up with load fluctuation, which implies lack of generation capability (capacity and velocity) to respond to load fluctuation.

Table 2.4-11 Generation Outage in 2007

Item	Energy of generation outage (GWh)
Forced Outage	8,959
Maintenance Outage	2,987
Forced Derating	6,553
Scheduled Derating	434
Total	18,933

Source : Evaluasi Operasi Sistem Jawa Bali 2007

Table 2.4-11 shows the record of generation outage in 2007. Generation outage is classified into Forced Outage, Maintenance Outage, Forced Derating, and Scheduled Derating. Maintenance Outage is the outage for repair that had not been scheduled at the beginning of the year. According to the table, total energy of generation outage, Energy Not Served (ENS), accounts for 18,933 GWh, which is equivalent to approximately 20% of total annual generated energy. In 2008, reservoir type hydropower plants are secured for night peak time, and load curtailment of hundreds of MW were conducted several times in daytime.

2) Probable Reasons

Major reason for frequency deviation is considered that required facilities and capacities are not secured. Probable reasons under normal and emergency conditions are listed below.

a) Frequency Control under Normal Condition

- Lack of GF capacity
  In general, small load fluctuation within few minutes is controlled through governor free of generators. However, frequency changes widely against load fluctuation when GF capacity is insufficient.

- Lack of LFC capacity

  Load fluctuation which lasts for few minutes to 10 minutes is too severe to control only with governor free generators. Load frequency control system (LFC) is generally used to change output of controlled generators, detecting frequency deviation and load fluctuation. However, increase of output cannot be attained against load fluctuation when LFC capacity is not enough.

- Insufficient capacity of generators for middle and peak load

  For proper frequency control, not only base load generators such as coal-fired plants which basically operate with constant output, but also middle and peak load generators which can follow load fluctuations, are required. However, the proportion of base load generators is quite high in Jamali system, and planned generators in the future such as in the fast track program are mainly base load type.

- Difficulty of operation order to IPP generators

  Currently, about 20% of generators are owned by IPPs. IPP generators tend to prefer constant output, and it is difficult for central dispatching control center (JCC) to order IPPs such as to change their output and so on. The share of IPPs will rise in future, and most of the planned IPP generators are base load type. Therefore, there is a concern that the system control capability becomes much lower.

- Generators with gas pipeline which is difficult to change output

  Natural gas generators which rely on gas pipeline have low ability for output control, because it is difficult to change the pressure of gas in pipelines greatly. Therefore, they have to be operated for base load and their ability to follow load fluctuation is low.

- Low ramp rate

  It is necessary to change output of generators automatically or manually when load changes. The rate of output control, namely ramp rate, is affected and restricted by boiler and mechanic system. As shown in Table 2.4-12, some generators have lower ramp rate than designed value in Jamali system. When load fluctuation is not followed by change of generator output, frequency fluctuates.

Table 2.4-12 Designed and Actual Value of Ramp Rate

No	Name	Ramping Rate (MW/mn)		
		Designed Value		Status of Actual Value
1	PLTP DRAJAT	0.55		same
2	PLTP KAMOJANG	1		same
3	PLTP SALAK	1		same
4	PLTGU MUARA TAWAR	GT	5.00	same
		3.3.1	20.00	
		2.2.1	16.00	
		1.1.1	11.00	
5	PLTGU GRESIK	GT	7.00	same
		3.3.1	25.00	
		2.2.1	16.00	
		1.1.1	11.00	
6	PLTGU MUARAKARANG	GT	5.00	same
		3.3.1	22.40	
		2.2.1	16.00	
		1.1.1	11.00	
7	PLTGU TAMBAKLOROK	2		same
8	PLTGU GRESIK 1&2	1		same
9	PLTGU GRESIK 3&4	2		same
10	PLTU MUARAKARANG 1 - 3	2		-
11	PLTU MUARAKARANG 4 & 5	3		-
12	PLTU SURALAYA 1 - 4	5		-
13	PLTU PRIOK	2		-
14	PLTU PERAK	1		-
15	PLTU PAITON 1-2	4		-
16	PLTU PAITON 5-6	10		Slower
17	PLTU PAITON 7-8	10		Slower
18	PLTU Tanjung Jati	20		Slower
19	PLTG GILITIMUR	2		-
20	PLTG MUARATAWAR	5		-
21	PLTG GRESIK	5		-
23	PLTA CIRATA	120		Faster
24	PLTA SUTAMI	22.5		Faster
25	PLTA SAGULING	12		Faster
26	PLTA MRICA	4.5		same

Source : PLN

b) Frequency control under emergency condition

For frequency control under emergency condition, system frequency characteristics shall be considered. If the designated constant is not appropriate, excessive load may be shed, or frequency may continue to decline regardless of load shedding.

Table 2.4-13 shows system frequency characteristics in PLN. In PLN, when system frequency characteristics are examined, system capacity is not considered and data is processed through root mean square (RMS). It is concerned that system frequency characteristics are not within safety margin.

Table 2.4-13 System Frequency Characteristics

Year	2002	2003	2004	2005	2006	2007
System frequency constant (MW/Hz)	569	540	543	608	613	696

Source : PLN Statistics

(3) Outage

1) Present Condition

As indexes for duration and frequency of outage per customer in one year, SAIDI (System Average Interruption Duration Index) and SAIFI (System Average Interruption Frequency Index) are often used. The general definition of SAIDI and SAIFI are as follows;

$$\text{SAIDI} = \frac{\text{Total duration of outages per year}}{\text{The number of customers}}$$

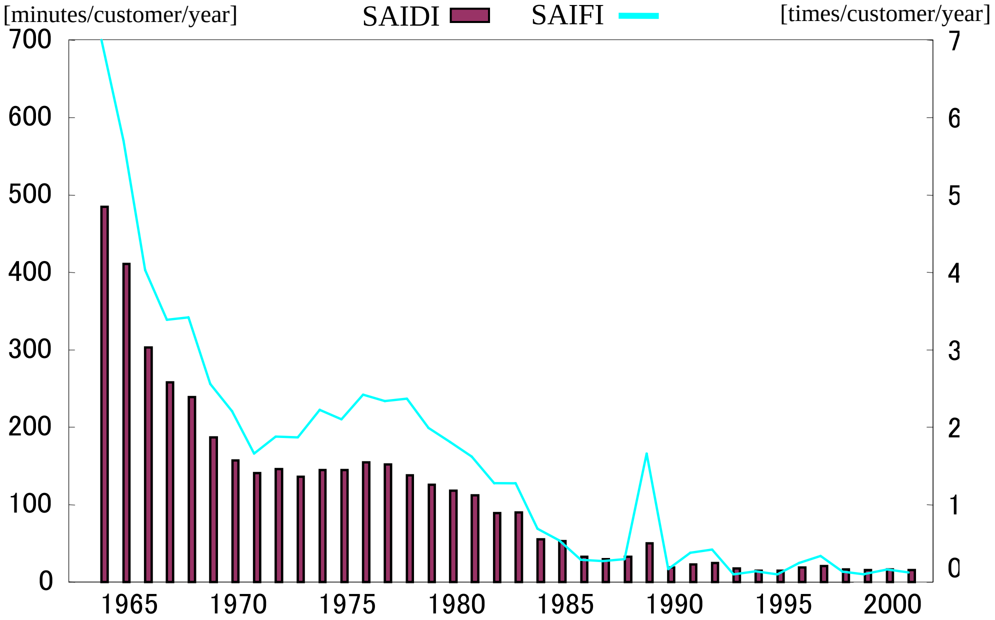
$$\text{SAIFI} = \frac{\text{Total number of outages per year}}{\text{The number of customers}}$$

Table 2.4-14 shows SAIDI and SAIFI in Java in recent years. SAIDI and SAIFI in 2006 are 164.4 (minutes/customer/year) and 4.23 (times/customer/year), respectively. It is difficult to compare simply because definition of "outage" is different in these indices, but these values in Java are high compared to the records in Japan as shown in Fig.2.4-21 and the records in other developed countries as shown in Fig.2.4-22.

Table 2.4-14 SAIDI and SAIFI in Java

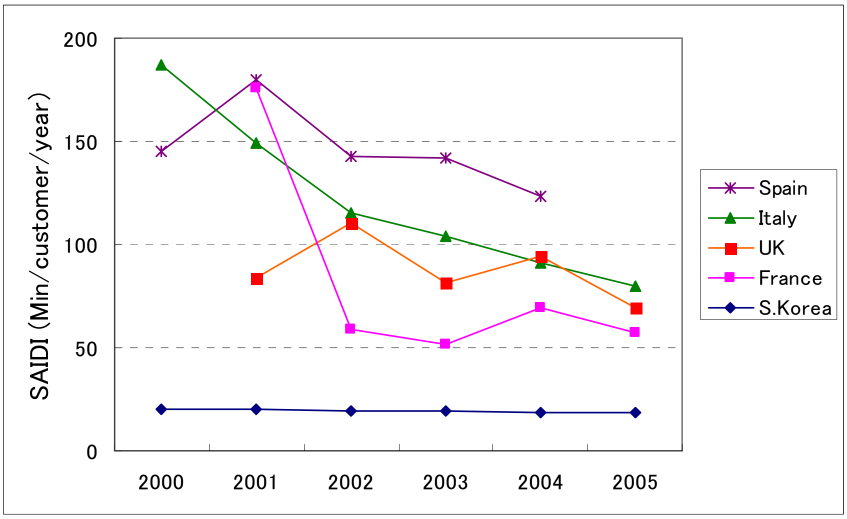
	2001	2002	2003	2004	2005	2006
SAIDI (minutes/customer/year)	510.0	499.2	322.2	250.2	224.4	164.4
SAIFI (times/customer/year)	12.24	9.26	7.90	6.67	5.88	4.23

Source : PLN Statistics



Source : The Federation of Electric Power Companies of Japan (FEPC)

Fig.2.4-21 Record of Outage in Japan



Source: Japan Electric Power Information Center (JEPIC)

Fig.2.4-22 SAIDI in Developed Countries (minutes/customer/year)

Causes of outages in recent years are shown in Table 2.4-15.

Table 2.4-15 Causes of Outages

		2002	2003	2004	2005	2006	2007	2008*2
Outage	Nature	68	48	51	54	42	28	25
	Defect of Facilities	130	136	114	113	108	95	102
	Animals	16	19	7	9	9	9	5
	Human Factor	3	4	11	3	10	3	2
	Kite	21	18	13	7	10	9	4
	Overloading	9	13	6	16	3	0	0
	Trees	3	2	3	1	1	3	0
	Relay malfunction	1	16	11	9	8	9	0
	Others	50	29	31	24	11	3	1
Total		301	285	247	236	202	159	139
Control	Load Curtailment	18	9	9	26	29	9	92
	Manual Load Shedding	19	10	10	34	19	61	146
	OLS*1	-	13	6	16	3	9	32
	Automatic load shedding	42	6	15	25	21	15	6
Total		79	38	40	101	72	94	276

*1 OLS; Load shedding system against over load *2: As of September, 2008 Source : PLN

In the table, relay malfunction is considered to be a problem of facility. Combined with defect of facilities, problems of facilities account for most of the cases of outages. Lightning is a major reason for outages in Japan, while problem exists mainly in facilities in PLN. Especially, according to the monthly operation record, outages in auxiliary equipment such as PT and CT are outstanding.

In addition, other than general outages, many outages occurred due to load control, which means that fundamental supply shortage is a problem. Table 2.4-16 shows record of load shedding and load curtailment in 2007. Supply shortage is not mitigated in 2008, and many outages due to load curtailment occurred.

Table 2.4-16 Load Shedding and Load Curtailment in 2007

Item	Region						Total
	Region 1		Region 2	Region 3	Region 4		
	Jakarta	West Java			East Java	Bali	
Automatic Load Shedding	162	50	562	135	110	100	1,120
Manual Load Shedding	11,284	1,396	2,131	198	734	57	15,800
Load Curtailment	0	0	161	1,276	464	0	1,901
Total	11,446	1,446	2,854	1,609	1,308	157	18,821

Unit : MWh   Source : Evaluasi Operasi Sistem Jawa Bali 2007

Information flow of reporting from regional control centers (RCC) to head quarter through central dispatching control center (JCC) is established when outage occurs. It is described in the grid code that countermeasures for preventing recurrence shall be studied after outages as shown below. As shown in Fig.2.4-23, information on outage such as voltage and frequency before and after outage, and operation of protection relay, are described in the outage report. Thus, it can be said that the process for reporting and setting up countermeasures after occurrence of outages are in place.

OC 11.0 Report of Event

Serious event including outages and emergencies where system operation is disturbed, or facilities failed, or load is shed or might be shed, shall be studied by P3B and other affected parties together. This study shall be sufficient so that the users understand system characteristics well and a similar event shall not occur again in the future. The results of such study on outage shall be open to all affected users.

OC 11.1 Procedure of report

The report shall be made in writing by related system users according to the seriousness and duration of the event. The report shall include detailed follow-up of the continued event and the contents which is already reported orally.

Users related to serious event shall make report immediately. The draft of the preface of the report shall be made within four hours from the occurrence. This report shall include at least the contents described in OC 11.2. The related system user shall make the final report of the event within 24 hours after the occurrence.

OC 11.2 Contents of report

Reports on serious event shall include, but are not limited to;

a. The time and date of the event
b. Outline of the event
c. Duration of the event
d. Equipment directly related to the event (including control and relays)
e. Total amount of shed load and generation (MW and MWh)
f. Scheduled recovery date and the view for countermeasures in order to avoid recurrence of similar event

OC 11.3 Investigation of serious event

a. P3B may investigate on the event and conditions for the purpose of reviewing of the validity of operation procedure or grid code in order to maintain system reliability at sufficient level.
b. All system users shall cooperate with P3B on investigation and study on the event and operation conditions by providing related records and information.
c. All system users shall provide P3B with information on the ability of each facility during and after the event and system conditions.


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Fig.2.4-23 Example of Outage Report from RCC

2) Probable Reasons

Probable reasons are described below.

- Aged deterioration

  Aged facilities are deteriorated and may cause failures. As a countermeasure, PLN makes efforts to improve technology for maintenance such as a gas analysis of transformer. In addition, shortage of spare parts for some old equipment including air circuit breaker (ACB) has been a problem. Although PLN is planning to replace them into up-to-date equipment, budget problem may not allow replacement.

- Poor performance of equipment

  Equipment may fail because of shortcomings of inherent performance and/or poor installation work at the time of installation. This would be caused by sub-standard manufacturers at installation and maintenance.

  PLN has established the standard specification (SPLN) based on IEC in order to designate specifications of equipment to be supplied. However, because specifications are only basic and so on, some suppliers deliver equipment with low quality in some cases. In the worst case, failure happened only a few days after the installation.

- Lack of support from manufacturers

  There is also a problem that enough support from manufacturer is not available after installation. In some cases, there is no response from the manufacturer, although failure occurred several times on the same equipment. In addition, it is difficult to get a support from the manufacturer where the facilities had been installed in a particular construction project and were transferred to PLN after completion.

  Besides, diversification of manufacturers of equipment is also considered to be problem. Table 2.4-17 shows the number of manufacturers classified by the number of installed transformers to PLN. There are 8 manufacturers which installed 30 transformers or over, while there are no less than 31 manufacturers which installed less than 10 transformers. As a result, it makes quick reaction to outages difficult, because there are few sharable spare parts and it is difficult to divert equipment to others. In addition, as shown in Fig 2.4-24, many equipment are installed by manufacturers abroad, which is probably one reason for the lack of support to PLN.

Table 2.4-17 Number of Manufacturers classified by Installed Transformers

Number of installed transformers	The number of manufacturers
30 units or over	8
10 units or over, less than 30	6
Less than 10	31

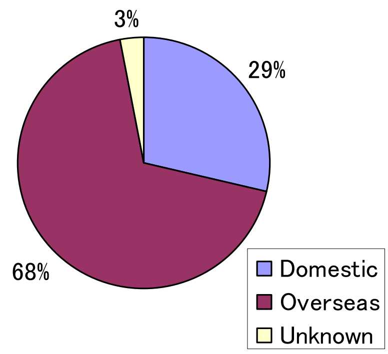


Fig 2.4-24 Ratio of Installed Transformers from Domestic and Oversea Manufacturers

- Power supply shortage

  Load curtailment cannot be avoided because of shortage of power supply against demand. Fundamental lack of generators, and outages and/or derating of existing generators are the problems.

- Method of calculation of required amount for load shedding

  System frequency characteristics shall be taken into consideration in the calculation of the amount of load shedding by automatic load shedding relay. However, system capacity is not considered in the current way of calculation and the amount of load shedding is possibly inappropriate.

- Violation of N-1 criteria

  As shown in Table 2.4-15, some of outages by load control are caused by OLS (Load shedding system against over load). OLS contributes to the increase of transmission capacity in normal condition, but when outage occurs at a transformer or transmission line, it sheds some loads by opening transformers and/or feeders in lower voltage system in order to avoid overload of sound equipment. More than 50 OLS systems have been installed in Jamali system since 2003.

  Outline of OLS is shown in Fig.2.4-25. When outage occurs at Tr1, in order to avoid overload of Tr2 in parallel, some loads are shed by opening feeders in lower voltage. Fundamentally, as described in OC1.1 of Grid Code, transmission facilities including transformers and transmission lines are supposed to be planned and installed based on N-1 criteria so as to avoid overload of equipment when any single contingency occurs in the system. However, as an unavoidable countermeasure against system outage where N-1 criteria is not met, transmission capacity is secured through avoiding overload of equipment with OLS.

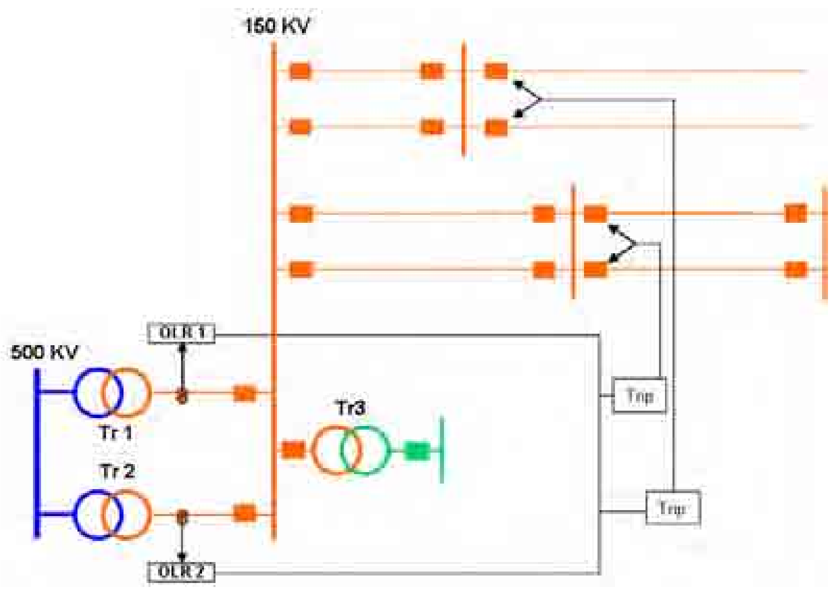


Fig.2.4-25 Outline of OLS

(3) Transmission Loss

Transmission loss ratio in recent years is shown in Table 2.4-18.

Currently, transmission loss remains around 2%, and no big issue is here. However, the problem of low voltage, which makes losses worsen, is hoped to be mitigated. When the standard voltage is raised, which is one of possible countermeasures against voltage drop problem, further reduction of loss is expected.

Table 2.4-18 Transmission Loss

	2002	2003	2004	2005	2006	2007
Transmission Loss Ratio (%)	2.55	2.42	2.31	2.22	2.11	2.17

Source : PLN

2.4.7 Electricity and Primary Energy Prices

(1) Electricity Prices

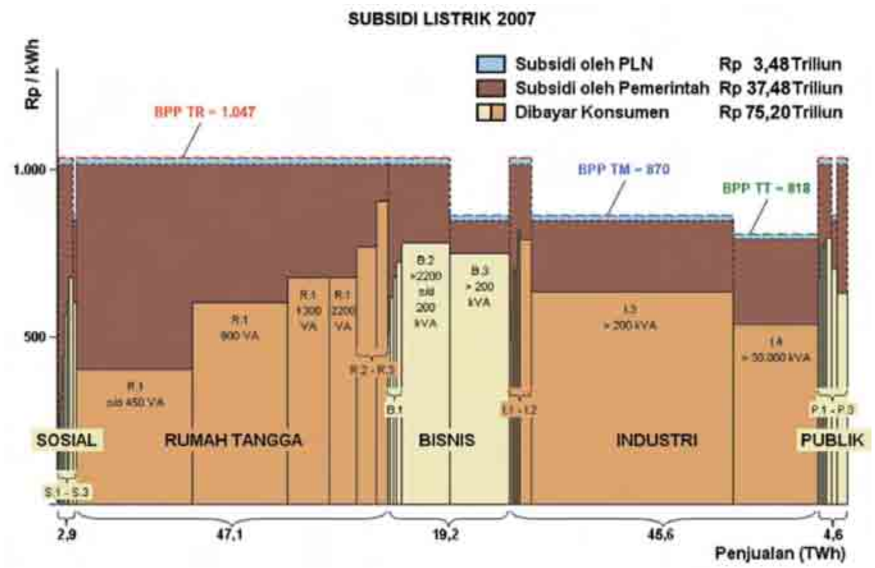
As mentioned in Chapter 2, new Electricity Law (Law No. 20/2002) has been judged unconstitutional and repealed by Supreme Court in 2004. Old Electricity Law of 1985 that is effective at this moment stipulates that electricity tariff shall be determined and enforced by Central Government. Electricity tariff applicable today is shown in what is called "TDL 2004 (Tarif Dasar Listrik: basic electricity tariff)" which has been enforced by Presidential Decree No.89/2003[1].

[1] Keputusan Presiden Republik Indonesia Nomor 89 Tahun 2002 Tentang Harga Jual Tenaga Listrik Tahun2003 Yang Disediakan Oleh Perusahaan Perseroan (PERSERO) PT Perusahaan Listrik Negara

When the abovementioned new tariff system was introduced, to mitigate excessive impact on households and business activities, PLN was given temporally subsidy on fuels it purchased, which was subsequently passed on to final consumers in the form of temporarily lowered tariff.

In this manner, currently effective electricity tariff is, as in the case of petroleum products, controlled by the government to lower-than-market-value levels. Electricity producer and distributor PLN who inevitably runs deficit by this rule, is entitle to a receipt of subsidy to fill the gap between revenues and expenses, which is assured by the law concerning state enterprises, Law No.19/2003, Article 66.

PLN's revenue and subsidies receivable by customer category for year 2007 are shown in Fig. 2.4-26 below.



Source: PLN Laporan Tahunan 2007

Fig. 2.4-26 Revenue and Subsidy of PLN 2007

Tariff levels are differentiated by customer categories. And it is shown in the figure above that the subsidies are determined by customer categories so as to fill the gaps between tariff and tariff that should have been charged if not subsidized. Subsidy amount for the year is determined in government budget formulation and is revised as the year proceeds. As there has been no revision to electricity tariff system since 2003, the gap between PLN's revenue and operation expenses has been widening, and the revenue amount increasing, mainly as a result of oil price hike in recent years.

Tariffs set out in TDL 2004 are shown in the table below. Tariffs are differentiated: residence with lowest VA value, R-1, is charged Rp. 390 for kWh, while one with largest V, R-3, Rp. 922. These differences will be decreased in the long run, according to TDL 2004 document.

Table 2.4-19 Electricity Tariff Table (TDL 2004)

Category	Contract Power	Connection(Rp/kVA/m)	Rates (Rp./kWh9
Social users (schools, hospitals, religious facilities, etc.)			
S-1/TR	220VA	-	Fixed 14,800
S-2/TR	450VA	10,000	0 – 30kWh: 123, 30–60kWh: 265, 60–kWh: 360
S-2/TR	900VA	15,000	0 – 30kWh: 200, 30–60kWh: 295, 60–kWh: 360
S-2/TR	1,300VA	25,000	0 – 30kWh: 250, 30–60kWh: 335, 60–kWh: 405
S-2/TR	2,200VA	27,000	0 – 30kWh: 250, 30–60kWh: 370, 60–kWh: 420
S-2/TR	2.2 – 200kVA	30,500	0 – 60 jam nyala: 380, 60– jam nyala:430
S-3/TM	200kVA –	29,500	WBP: K x P x 325, LWBP: P x 325
Residences			
R-1/TR	– 450VA	11,000	0 – 30kWh: 169, 30–60kWh: 360, 60–kWh: 495
R-1/TR	900VA	20,000	0 – 30kWh: 275, 30–60kWh: 445, 60–kWh: 495
R-1/TR	1,300VA	30,100	0 – 30kWh: 385, 30–60kWh: 445, 60–kWh: 495
R-1/TR	2,200VA	30,200	0 – 30kWh: 390, 30–60kWh: 445, 60–kWh: 495
R-2/TR	2.2 – 6.6kVA	30,400	560
R-3/TM	6.6kVA –	34,260	621
Commercial users			
B-1/TR	– 450VA	23,500	0 – 30kWh: 254, 30–kWh: 420
B-1/TR	900VA	26,500	0 – 30kWh: 420, 30–kWh: 465
B-1/TR	1,300VA	28,200	0 – 30kWh: 470, 30–kWh: 473
B-1/TR	2,200VA	29,200	0 – 30kWh: 480, 30–kWh: 518
B-2/TR	2.2 – 200kVA	30,000	0 – 100 jam nyala: 520, 100– jam nyala:545
B-3/TM	200kVA –	28,400	WBP: K x 452, LWBP: 452
Industrial users			
I-1/TR	– 450VA	26,000	0 – 30kWh: 160, 30–kWh: 395
I-1/TR	900VA	31,500	0 – 30kWh: 315, 30–kWh: 405
I-1/TR	1,300VA	31,800	0 – 30kWh: 450, 30–kWh: 460
I-1/TR	2,200VA	32,000	0 – 30kWh: 455, 30–kWh: 460
I-1/TR	2.2 – 14kVA	32,200	0 – 80 jam nyala: 455, 80– jam nyala: 460
I-2/TR	14 – 200kVA	32,500	WBP: K x 440, LWBP: 440
I-3/TM	200kVA –	29,500	0–350 jam nyala & WBP: Kx439, 350– jam nyala & WBP: 439, LWBP: 439
I-4/TT	30,000kVA –	27,000	434
Government users, street lamps			
P-1/TR	– 450VA	20,000	575
P-1/TR	900VA	24,600	600
P-1/TR	1,300VA	24,600	600
P-1/TR	2,200VA	24,600	600
P-1/TR	2.2 – 200kVA	24,600	600
P-2/TM	200– kVA	23,800	WBP: K x 379, LWBP: 379
P-3/TR	–	–	635

where K : a factor to multiplied for peak hour use, takes a value between 1.4 and 2, determined by PLN.
P : a factor to multiplied, 1 for public facility, 1.17 for private facility
WBP : peak hour 18:00 ~ 22:00
LWBP : off peak hour, time zone outside WBP
Jam nyala : a value of monthly consumption kWh divided by contract power kVA

There are other categories and relevant tariffs not shown in Table 2.4-19, such as bulk contract, multipurpose contract, TRAKSI contract, etc.

TDL 2004 reveals its pricing policy that is to restraining consumption and redistributing income among members of society, by charging lower rates to small contract customers and higher rates to larger contract customers. A factor for peak hour is set at its maximum, 2, at the moment, in an attempt to divert the use of electricity to off peak hours.

There are some other contractual arrangements concerning the use and charges. Daya Max, or its advanced form, Daya Max Plus, is targeted for reducing power demand in peak hours, making agreement with particular customer to shift his use of electricity from peak to off peak hours, on the basis of past record of his electricity use, and charging him lower rate in return.

Daya Max Plus is an arrangement for category B2, I2, I3, I4 and P2 customers (relatively large commercial, industrial, government related customers), requiring a customer to reduce his use of electricity in peak hours by half, calculated on the basis of past record of use. For the power consumed outside peak hours as in the arrangement, the customer is charged at half the normal rate, while for the power consumed in peak hours despite the arrangement, the customer is charged twice as much the perk hour tariff, that is four times the off peak tariff.

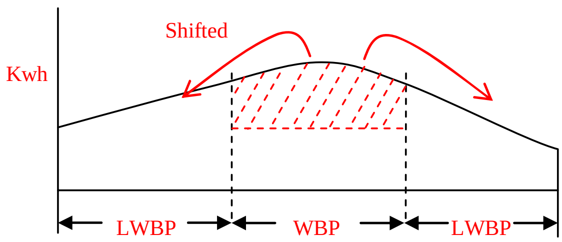


Fig. 2.4-27 Peak Demand Shift with Daya Max Plus

While electricity price system applicable at the moment is what set out in TDL 2004, various modifications have been implemented as shown above, particularly those with an intention to divert the demand in peak hours. Application of such arrangements is administered by regional business units of PLN.

Average unit prices by customer categories in 2006 are shown in the table below.

Table 2.4-20 Average Unit Prices by Customer Categories in 2006

(Rp./kWh)

	Residence	Industry	Commercial	Social	Government	Street Light	Overall
Unit price	571.12	624.23	764.25	585.30	755.53	644.87	628.14

Remark: unit price above includes connection fee. Source: PLN Statistiks 2006

PLN's reference electricity provision cost, called BPP (Baiya Pokok Penyediaan: cost of provision) is published by MEMR every year. For 2008 in Jamali Region, BPPs are as in the table below[4].

Table 2.4-21 PLN's Reference Electricity Cost (BPP) in Jamali Region

(Unit : Rp./kWh)

Sub-region	High V	Middle V	Low V
DKI Jakarta, Tangerang		850	1,005
West Jawa and Banten		853	1,024
Central Jawa and DI Yogyakarta	783	849	1,011
East Jawa		855	1,030
Bali		859	1,012

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The difference between the tariff and BPP is filled by government subsidy. Revenue and government subsidy of PLN for the latest six years are shown in the table below.

Table 2.4-22 PLN's Revenues

unit : million Rp.

	2001	2002	2003	2004	2005	2006	2007
Electricity sales	28,275,983	39,018,462	49,809,637	58,232,002	63,246,221	70,735,151	76,286,195
Connection fee	265,858	302,308	342,257	387,083	439,917	479,991	535,269
Other income	82,907	123,510	182,251	184,057	346,226	602,246	616,472
Subsidy		4,739,074	4,096,633	3,469,920	12,510,960	32,909,148	36,604,751

Source: PLN Statistiks 2006, Laporan Tahunan2007

Subsidy for 2008 is estimated at Rp. 62.5 trillion on the assumption that annual average crude oil price is $95 per barrel, and coal price Rp. 521 per kg. If the hike of fuel prices continued to the level of crude oil $ 120 per barrel and coal Rp. 800 per kg, the subsidy would reach Rp. 89.3 trillion (PLN "Operation Outlook 2008").

In order to ease an increasing burden of subsidy, new tariff arrangements to charge without-subsidy tariff to affluent customers is now under consideration. PLN has started, on the approval from the parliament[5], charging customer in the categories of residences (R), business (B), government (P) with the power from and above 6,600 VA at non-subsidised rate (Rp. 1,380/kWh) for their use of electricity above 80% of the category averages.. PLN intends to apply the same arrangement to residences with contracts above 2,200 VA, which is reportedly being discussed in the parliament but not confirmed by JICA team. However, as price increase of government determined consumer products is very much unpopular, it will be after the presidential election scheduled for 2009 that a TDL can be renewed to solve a problem of inflating subsidy to PLN.

(2) Fuel Prices

Recent fuel prices released by PLN for 2000 to 2006 are shown in Table 2.4-23. Fuel prices for geothermal power generation represent the steam cost paid to Pertamina.

[5] SIARAN PERS, 12/HUMAS DESDM/2008, DEPARTEMEN ENERGI DAN SUMBER DAYA MINERAL

Table 2.4-23 PLN Fuel Prices (Cost) from 2000 to 2006

Year	HSD	MFO	Coal	Natural Gas	Geothermal
	Rp/liter	Rp/liter	Rp/kg	Rp/MSC	Rp/kWh
2000	593.4	382.2	153.70	21787.67	221.56
2001	878.5	654.7	199.60	26073.78	296.54
2002	1406.8	1127.1	219.75	23496.92	310.36
2003	1740.9	1595.2	230.82	21550.40	316.28
2004	1829.1	1697.7	230.75	21258.05	297.39
2005	2819.2	2418.2	251.55	25323.76	461.70
2006	5629.2	3534.5	335.81	24185.59	505.40

Year	Ex. Rate	HSD	MFO	Coal	Natural Gas	Geothermal
		$/bbl	$/bbl	$/ton	$/MSC	$/kWh
2000	8,529 Rp/$	11.06	7.12	18.02	2.55	0.0260
2001	10,266 Rp/$	13.61	10.14	19.44	2.54	0.0289
2002	9,261 Rp/$	24.15	19.35	23.73	2.54	0.0335
2003	8,571 Rp/$	32.30	29.59	26.93	2.51	0.0369
2004	8,985 Rp/$	32.37	30.04	25.68	2.37	0.0331
2005	9,751 Rp/$	45.97	39.43	25.80	2.60	0.0473
2006	9,141 Rp/$	97.92	61.48	36.74	2.65	0.0553

Note: MSC means 1,000 Standard Cubic Feet Source: PLN Statistics 2006

Table 2.4-24 shows the price indexes in US$ to provide an idea on how high PLN's fuel cost has soared recently. As shown in the Table, prices of fuel oil, such as HSD and MFO, have risen about 9 times since 2000, while natural gas price remains at the same level of since 2000 due to the long-term (more than 10 years) fuel supply agreement. For future gas supply agreements, MEMR presumes 4.5 US$/MMBTU to 6.0 US$/MMBTU, or an average of 5.0 US$/MMBTU.

Table 2.4-24 Fuel Price Index (Year 2000 = 100)

Year	HSD	MFO	Coal	Natural Gas	Geothermal
2000	100	100	100	100	100
2001	123	142	108	100	111
2002	218	272	132	100	129
2003	292	416	149	98	142
2004	293	422	143	93	127
2005	416	554	143	102	182
2006	885	863	204	104	213

For fuel oil prices in 2008, Fig.2.4-28 shows the total spot price of FOB for crude oil from May 6, 2005 to April 4, 2008. After April 4, 2008, the spot price of crude oil recorded more than 120 US$ per barrel. Table 2.4-25 shows relationship between crude oil price of MOPS and HSD and MFO prices in Indonesia. For the period between March 31, 2008 to April 04, 2008, HSD price and MFO price in Indonesia were 40% higher and 15% lower than the crude oil price, respectively. If crude oil price of MOPS remains 120 US$ per barrel, HSD and MFO prices in Indonesia will be 168 US$/bbl and 102 US$/bbl, which are 15 times and 14 times more than those in 2000.

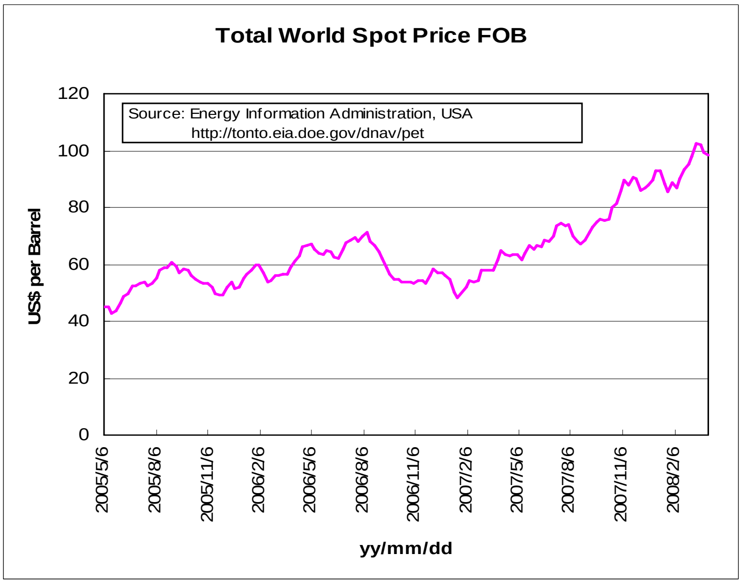


Fig.2.4-28 Crude Oil Total World Spot Price of FOB

Table 2.4-25 Relationship between Crude Oil Price and HSD/MOF Prices

MOPS (2008/03/31 ~ 2008/04/04)	$/barrel
High Speed Diesel Oil (0.05%)	132.02
Kerosene	128.36
Crude Oil	**104.30**

Note: HSD and Kerosene are FOB at Singapore
MOPS stands for Mean of Platts Singapore

PERTAMINA Price	$/barrel	Price Index (IP)
HSD	**145.93**	**1.40**
MFO	**89.14**	**0.85**
Crude Oil	**104.30**	**1.00**

Note : 1 barrel = 159 liter
Source://www.gu-goon.com/

New Fuel Prices for Industry in April 2008 released by PERTAMINA on March 31, 2008						
Fuel Type	Economical Selling Fuel Price - Non Tax (Base Price)					
	Region 1		Region 2		Region 3	
	Rp/KL	US$/KL	Rp/KL	US$/KL	Rp/KL	US$/KL
Gasoline	7080.13	768.17	7352.107	797.68	7508.057	814.60
Kerosene	8532.07	925.76	8718.104	945.94	8903.029	966.01
High Speed Diesel	8458.78	**917.77**	8819.464	956.91	9006.539	977.20
Marine Diesel Fuel	8284.08	898.88	8464.705	918.48	8644.250	937.97
Marine Fuel Oil	5166.53	**560.60**	5278.949	572.80	5390.924	584.95
Pertamina DEX	8757.37	950.14	-	-	-	-

Note : Fuel prices of PERTAMINA depend on MOPS. Source: www.pertamina.com/

3,400 MW Suralaya Coal-Fired Power Plant purchases fuel coal on CIF basis under conditions as shown in Table 2.4-26. The Jakarta Post dated August 12, 2008 reported that PT.Bukit Asam sold coal to the Tanjung Jati B power plant in Java at US$ 80 a ton, its record price for the domestic market.

Table 2.4-26 Coal Prices at PLTU Suralaya Coal-Fired Power Plant

Coal Type	Heat Content	Coal Price (1)	Coal Price (2)	Origin
Medium Rank Coal	5,100 kcal/kg	540,000 Rp/ton	58.7 US$/ton	Sumatra
Low Rank Coal	4,500 kcal/kg	420,000 Rp/ton	45.7 US$/ton	Kalimantan

Note: 1 US$ = 9,200 Rp. Caloric values are those as received. Source: Interview at PLTU Suralaya Thermal Plant on June 3, 2008

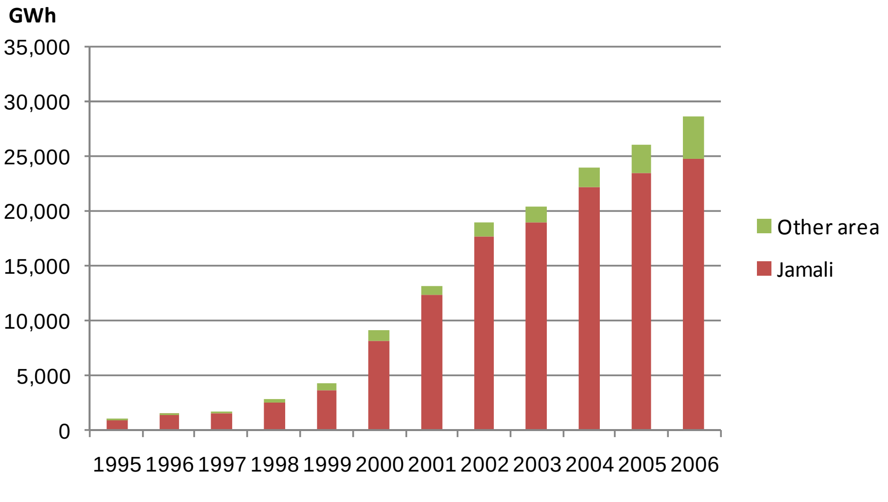
As for the current LNG price, no domestic market price is available, since all of LNG production is at present exported to countries, such as Japan, Korea and Taiwan. For reference, LNG FOB prices to Japan in 2008 are between 9 US$/MMBTU[6] to 12 US$/MMBTU, and their contracts include a clause to reflect escalations of the crude oil price.

2.4.8 IPP and Coal-Fired Power Plant Development in Fast Track Program

(1) IPP (Independent Power Producer)

In Jamali region, the need to expand power generation capacity is ever increasing to meet fast growing demand, and financial burden to sustain such expansion is and will be more demanding. PLN, as PKUK, being the sole power distributor in Jamali region, is mandated to provide electricity demanded by the region and it may fulfill this also by purchasing power generated by PIUKU, power producing licensees. There are several types of power producers, such as those selling surplus power from his own generation and power generation cooperatives, among which there are so called independent power producers who invest in power plants and operate them to sell power to PLN.

Purchasing power from IPP started as early as in 1994, when PLN made into power purchase agreements (PPA) with geothermal power plant Salak, coal fire power plant Paiton, combined cycle power plant Cikarang, etc. Since then, the power purchased by PLN has been growing rapidly, as shown in the figure below.



Source: Statistics PLN 2006

Fig. 2.4-29 Energy purchased by PLN

PLN makes power generation plan in RUPTL where some of generation is set to come from IPPs. According to RUPTL, PLN prepares for announcement of IPP project, call for candidates,

[6] Source: MIGAS, MEMR on June 5, 2008

selection, PPA, etc, while Minister of Energy and Mineral Resources grants license and approves power purchasing prices in PPA.

Selection of private entities for an IPP project is done in open bidding process in order to assure transparency and efficiency. As discussed in 2.1.2, there is an exception to rule, that is direct appointment, is applicable when open bidding is not realistic or efficient. Direct appointment is applicable when it is based on Ministerial Regulation No.44/2006 concerning promotion of primary energy diversification and shift to coal fire. This rule is effective when coal fire power plant project in Fast Track Program, to be discussed in next section, is implemented on IPP contract.

The process of IPP project for both open bidding and direct appointment methods are shown in flowcharts below.

Meanwhile for the selection of geothermal IPP, it is the central or a local government that is responsible for the management of geothermal as regional resource. The government in charge administers the IPP selection process, offering the site information and finally approving a license[7]. The government, central or local, carries out reconnaissance survey, and publishes the results. Concession to develop the site is put on an open tender, and the successful bidder is nominated as licensee of geothermal development (IUP). IUP would spend up to three years in prospecting[8], two years for feasibility study, and thirty years for exploitation of the resource. The mile stone can be extended, but if expired, the concession expires as well. PLN would list geothermal projects in RUPTL after the nomination of IUPs.

[7] UU Nomor 27, Tahun 2003 Tentang Panas Bumi
[8] Geothermal prospecting can also be carried out by the governments.

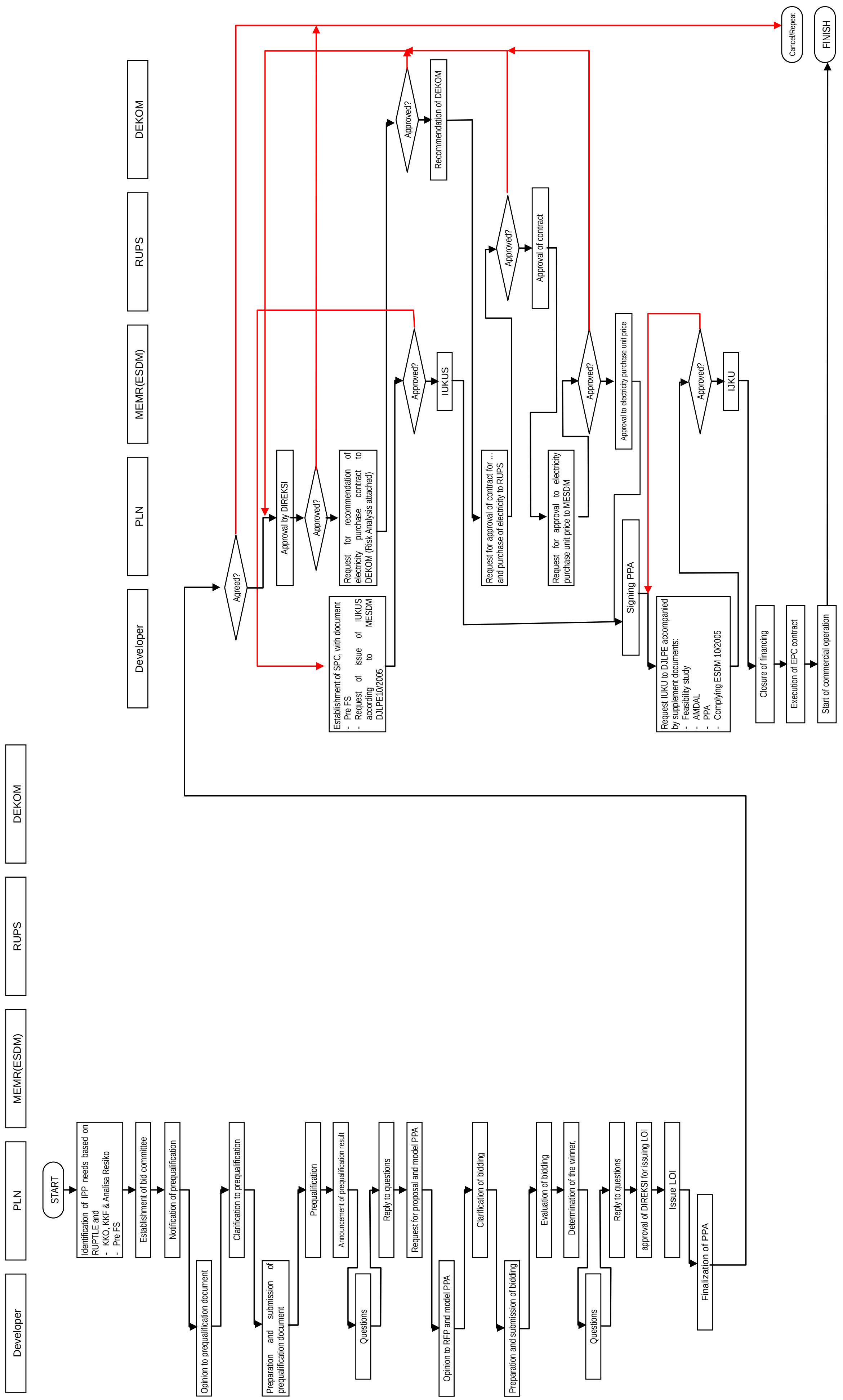


Fig. 2.4-30 Process of Open Bidding (General Auction) for IPP

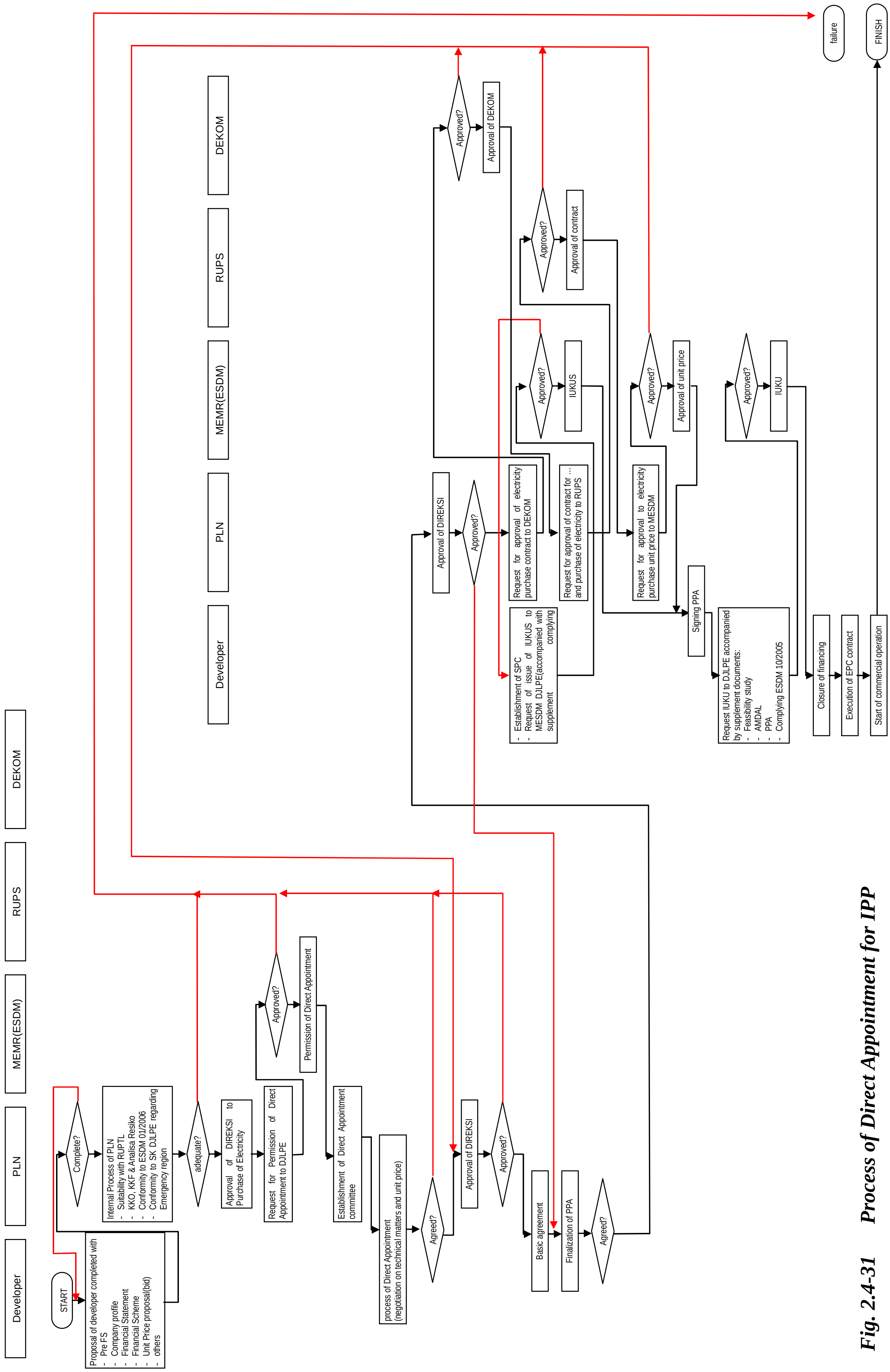


Fig. 2.4-31 Process of Direct Appointment for IPP

Unit price of power purchase stipulated in a power purchase agreement (PPA) is divided into four components as below.

Component A : for Capital Cost

Component B : for O & M fixed cost

Component C : for fuel cost

Component D : for O & M variable cost

The payment is done in US dollar, and the risk of currency exchange rate is allocated to PLN. There are some arrangements to ease the burden of liabilities of IPP, such as front-loaded pricing. Those IPPs developed so far are mostly base-load plants like geothermal and coal thermal, and there are rather high minimum plant capacity factors such as 80% assumed in PPA.

Table 2.4.-27 shows the PPA unit rates currently effective.

Table 2.4-27 Unit Prices of Power in PPA

Company	Power Plant	Fuel	Capacity (MW)	Component Unit Rate (sen US$/kWh)						Ex.R	Op
				A	B	C	D	E	TOTAL	(Rp)	year
PT. Paiton Energy Company	PLTU Paiton I	coal	2 × 615	3.5300	0.2936	0.9754	0.1310		4.9300	10,000	40
PT.Jawa Power	PLTU Paiton II	coal	2 × 610	3.2929	0.2848	1.0153	0.0869		4.6799	9,716	30
PT. Dayabumi Salak Pratama	PLTP Gunung Salak	geo	3 × 55						4.4500	8,500	30
Special Purpose Company	PLTU Tanjung Jati B	coal	2 × 660	3.4600	0.3000	1.0750	0.1000		4.9350		20
Amoseas Indonesia	PLTP Darajat	geo	1 × 50						4.2000	8,000	47
Himpurna Calipornia Energy	PLTP Dieng	geo	3 × 60						4.4500	8,500	30
Patuha Power Limited	PLTP Patuha	geo	3 × 60						4.4500	8,500	30
PT. Cikarang Listrindo	PLTGU Cikarang	gasCC	1 × 150	2.1296	0.3000	1.9404	0.1000		4.4700	9,000	20
PT. Pertamina (Persero)	PLTP Wayang Windu	Geo	1 × 110						4.4376	8,500	30
PT. Latoka Trimas Bina Energy	PLTP Kamojang	Geo	2 × 30						4.4250	8,500	30
Bali Energy Ltd.	PLTP Bedugul	Geo	1 × 10	70-71.25% of elec. tariff						8,900	30
PT. Sumber Segara Primadaya	PLTU Cilacap	Coal	2 × 300	3.0650	0.3120	1.0920	0.1010		4.5700	8,500	30
PT. Power Jawa Barat	PLTU Serang	Coal	1 × 450	3.4890	0.3000	1.1670	0.1000		5.0560	9,000	30
PT. Bosowa Energi	PLTU Jeneponto	Coal	2 × 100	2.7800	0.3000	1.5300	0.1000		4.7100	9,500	30
PT. Intidaya Prima Kencana	PLTGU Anyer	N Gas	1 × 380	2.0600	0.3000	2,08*	0.1000		4.5400	9,500	20

Source : MEMR

As mentioned before, cases of IPP are rapidly increased in 1990s. But PPAs of these earlier IPP became practically useless after Asian Financial Crisis in 1997. There had been continued efforts to renegotiate PPA and most of PPA were renewed and signed by 2003. Table 2.4-28 compares the PPA unit rates before and after the renegotiations.

Table 2.4-28 Unit Rates in PPA before/after Renegotiation

No.	Project and Company	Former Unit Price		Current Unit Price	
		Comp.	**UScent/kWh**	**Comp.**	**UScent/kWh**
			PPA:12/2/1994		
1.	PLTUPaitonI	A	5.8386	A	3.5300
	PT.PEC(PaitonEnergyCompany)	B	0.4350	B	0.2936
	1230MW(2x615MW)	C	1.7214	C	0.9754
	AF=85%	D	0.2850	D	0.1310
	Masakontrak40tahun	Total	8.2800	Total	4.9300
		Hargadasar1998		PersetujuanMenkoEkonomiNomor:	
		Tanpaspecialfacility,harga		S-23/M.EKON/09/2001,8Okt2001	
		levelized7,5senUSD/kWh		PersetujuanMESDMNomor:	
				1722/36/MEM.L/2002,21Mei2002	
			PPA:3/4/1995		
2.	PLTUPaitonII	A	4.3049	A	3.2900
	PT.JawaPower	B	0.4645	B	0.2800
	1220MW(2x610MW)	C	1.6304	C	1.0200
	AF=83%	D	0.1990	D	0.0900
	Masakontrak30tahun	Total	6.5988	Total	4.6800
		Hargadasar1999		PersetujuanMenkoEkonomiNomor:	
				S-62/M.EKON/03/2001,13Maret2002	
				PersetujuanMESDMNomor:	
				1709/36/MEM.L/2002,20Mei2002	
			AmandESC:16/11/1994		
3.	PLTPGunungSalak	StepI	8.4670	Listrik	4.4500
	PT.(DSPL)DayabumiSalakPratama.Ltd	StepII	4.9420	(4,5,6)	
	165MW(3x55MW)	Hargadasar1993		Uap	3.7240
	AF=85%			(1,2,3)	
	Masakontrak30tahun			PersetujuanMenkoEkonomiNomor:	
				S-76/M.EKON/04/2001,15Apr2002	
				PersetujuanMESDMNomor:	
				3128/36/MEM.L/2002,16September2002	
			PPA		
4.	PLTUTanjungJatiB		5.7300		2.26s.d3.0
	SpecialPurposeCompany(SPC)	Hargadasar1998		DalamProsesPersetujuanMenkoEkonomi	
	1320MW(2x660MW)				
	AF=80%				
	Masakontrak20tahun				
			ESC		
5.	PLTPDarajat		6.9500		4.2000
	AmoseasIndonesia	Hargadasar1995			(Uap=3.15)
	275MW(3x70+1x65MW)			PersetujuanMenkoEkonomiNomor:	
	Masakontrak30tahun			S-218A/M.EKUIN/08/2000,18Agts2000	
				PersetujuanMESDMNomor:	
				2232/20/MEM.S/2003,8Juli2003	
			PPA		
6.	PLTGUCikarang	A	2.9775	A	2.1296
	PT.CikarangListrindo	B	0.4300	B	0.3000
	150MW(1x150MW)	C	2.4000	C	1.9404
	Masakontrak20tahun	D	0.1900	D	0.1000
	Renegosiasi:	Total	5.9975	Total	4.4700
	AF=72%			PersetujuanMenkoEkonomiNomor:	
				S-338/M.EKON/12/2002,31Des2002	
				PersetujuanMESDMNomor:	
				726/36/MEM.L/2003,28Februari2003	

Source : MEMR

At the moment there are eight IPP power plants shown below in operation in Jamali region.

Table 2.4-29 IPP Power Plants in Operation in Jamali Region

No	Plant Name	MW	Company Name	COD
1	PLTP Salak 4,5 & 6	3 × 55	PT.Chevron Geothermal Indonesia	OCT1997
2	PLTP Darajat Unit 2, Unit 3	90 + 110	PT.Chevron Geothermal Indonesia	FEB 2000 Aug 2008
3	PLTU Paiton I	2 × 615	PT. Paiton Energy Company	JUL 2000
4	PLTU Paiton II	2 × 610	PT. Jawa Power	NOV2000
5	PLTGU Cikarang	150	PT. Cikarang Listrindo	DEC 1998
6	PLTP Dieng	1 × 60	PT. Geodipa Energi	SEP2000
7	PLTP Wayang Windu unit 1	1 × 110	Magma Nusantara, Ltd	JUN 2000
8	PLTU Cilacap	2 × 281	PT. Sumber Segara Primadaya	FEB 2007

Source : PLN

There are IPP power projects ongoing in the region as shown below.

Table 2.4-30 Ongoing IPP Power Projects in Jamali Region

No	Plant Name	MW	Company Name	COD
Under Construction				
1	PLTP Kamojang	1 × 60	PT. Pertamina (PERSERO) scrapped due to Minister of Forestry rejection	JAN 2008
2	PLTP Wayang Windu unit 2	1 × 110	PT. Magma Nusantara Limited	JAN 2009
3	PLTP Bedugul	3 × 55, 10	Bali Energi LTD	NA
Under Financing				
1	PLTP Dieng unit 2	1 × 60	PT. Geodipa Energi	2011
2	PLTP Patuha	3 × 60	PT. Geodipa Energi	NA
3	PLTP Cibuni	1 × 10	PT. Yala Tekno Geothermal	NA
4	PLTU Labuan	2 × 6	Kons. Cogindo Daya Bersama - Sutraco Dinamika Kencana	end 2009
5	PLTU Cirebon	1 × 660	Kons. Marubeni - Komipo - Tripatra - Samtan (PT Cirebon Electric Power)	Mar 2011
6	PLTU Paiton Ekspansi	1 ×800	PT Paiton Energy	2011

Source :BAPPENAS PKPS(Direktorat Pengembangan Kerjasama Pemerintah dan Swasta) rearranged by JICA team

There also are IPP projects currently under preparation in Jamali region shown in the table below.

Table 2.4-31 IPP Projects under Preparation in Jamali Region

Under bidding/contract negotiation				
1	PLTU Madura Kategori: Daerah Krisis	2 × 100	Pengembang: PT Madura Energy	Op.2011
2	PLTG Cikarang Kategori: Ekspansi	1 × 150	Pengembang: PT Cikarang Listrindo	Op.2010
3	PLTU Bali Kategori: Infra.Summit	2 × 100		PQ done temporarily postponed
4	PLTU Tj. Jati B Kategori: Ekspansi	2 × 660	Pengembang: PT Sumitomo Corp.	Nego. finished
5	PLTA Rajamandala Kategori: Energi Terbarukan	47	Pengembang: PT Indonesia Power dan Kansai Electric Power Co. Inc	Op.2010
6	PLTU Tj. Jati A Kategori: Ex. 27 IPP	2 × 660	Pengembang: PT TJ Power Company	Op.2015
Under evaluation/study				
1	PLTP Salak unit 7 & 8 Kategori: Ekspansi	2 × 65	PT.Chevron Geothermal Indonesia	-
2	PLTU Cilacap 3 & 4 (Ekspansi) Kategori: Ekspansi	1 × 600	Pengembang: PT Sumber Segara Primadaya	Proposal open Op.2011
3	PLTU Serang Kategori: Ex. 27 IPP	2 × 300	Pengembang: PT Power Jawa Barat	Op.2013
4	PLTU Jawa Tengah Kategori: Infra.Summit	2 × 600		Model PPP 2015
5	PLTU Anyer	1 × 330	PT Intidaya Primakencana & Lestari Listrik Pte Ltd.	Mid 2011

Source :BAPPENAS PKPS (Direktorat Pengembangan Kerjasama Pemerintah dan Swasta) rearranged by JICA team

Source : PLN

Fig. 2.4-32 Location of IPP Power Plant on Java Island

Source : PLN

Fig. 2.4-33 Location of IPP Power Plant on Bali Island

(2) Coal Fire Power Plant Development Projects (Fast Track Program)

In 2006, in order to relieve a shortage of electricity supply and excessive dependency on oil fuel altogether, a new program called Fast Track Program, or alternatively called Crash Program or 10,000 MW coal-fired power plant project, was announced. This program includes 35 coal fired power plant projects in the country.

Presidential Decree on PLN's tasks for Implementing Accelerated Program for Coal Fired Power Plants No.71/2006

To meet a rapidly increasing demand, and to expedite diversification of primary energy use, PLN was mandated to develop coal fired power plants to be made operational in 2009.

In its original scheme, ten plants in Jamali region (6,900 MW) and 30 in outside Jamali, with total capacity of 10,000 MW listed below, should be build by 2009.

There are institutional arrangements made for the program, that are;

- ♦ Selection of EPC contractor
  Article 2 (1) of the law: When PLN carries out a project with untied finance, EPC contractor selection should be done in open bidding
  Article 2 (1) of the law: When PLN carries out a project with tied finance, EPC contractor can be nominated in direct appointment.
- ♦ Environment
  Article 2 (1) of the law: To expedite the process of building a power plant, authorities and organizations relevant shall proceed and conclude all necessary authorizations for EIA (Environmental Impact Assessment: AMDAL) and land acquisition and compensation for the power plant and transmission line route in 120 days from the receipt of application.

Table 2.4-32 Original Projects included in Fast Track Program

In Jamali Region

No	Power Plant Location	No.of Unit	Capacity Class (MW)
1	PLTU 1 in Banten	1	600 – 700
2	PLTU 2 in Banten	2	300 – 400
3	PLTU 3 in Banten	3	300 – 400
4	PLTU 1 in West Java	3	300 – 400
5	PLTU 2 in West Java	3	300 – 400
6	PLTU 1 in Central Java	2	300 – 400
7	PLTU 2 in Central Java	1	600 – 700
8	PLTU 1 in East Java	2	300 – 400
9	PLTU 2 in East Java	1	600 – 700
10	PLTU 3 in East Java	2	300 – 400

Outside Jamali Region

No	Power Plant Location	No.of Unit	Capacity Class (MW)
1	PLTU in Nangroe Aceh Darussalam	2	100 – 150
2	PLTU 1 in North Sumatra	2	100 – 150
3	PLTU 2 in North Sumatra	2	100 – 150
4	PLTU in West Sumatra	2	100 – 150
5	PLTU 1 in Bangka Belitung	2	10
6	PLTU 2 in Bangka Belitung	2	10
7	PLTU 3 in Bangka Belitung	2	25
8	PLTU 4 in Bangka Belitung	2	15
9	PLTU 1 in Riau	2	7
10	PLTU 2 in Riau	2	5
11	PLTU in Riau Islands	2	7
12	PLTU in Lampung	2	100 – 150
13	PLTU 1 in West Kalimantan	2	25
14	PLTU 2 in West Kalimantan	2	50
15	PLTU in South Kalimantan	2	65
16	PLTU 1 in Central Kalimantan	2	65
17	PLTU 2 in Central Kalimantan	2	7
18	PLTU 1 in North Sulawesi	2	25
19	PLTU 2 in North Sulawesi	2	25
20	PLTU in Gorontalo	2	25
21	PLTU in South Sulawesi	2	50
22	PLTU in Southeast Sulawesi	2	10
23	PLTU 1 in West Nusa Tenggara	2	7
24	PLTU 2 in West Nusa Tenggara	2	25
25	PLTU 1 in East Nusa Tenggara	2	7
26	PLTU 2 in East Nusa Tenggara	2	15
27	PLTU in Maluku	2	7
28	PLTU in North Maluku	2	7
29	PLTU 1 in Papua	2	7
30	PLTU 2 in Papua	2	10

Also, another Presidential Decree set up a "Coordinating Team for Accelerated Development of Coal Fired Power Plants" to oversee the progress of the program.

Presidential Decree concerning "Coordinating Team for Accelerated Development of Coal Fired Power Plants", No.72/2006

a. Chairman: Coordinating Minister in charge of Economy

b. Members :
1. Minister of Finance
2. Minister of Energy and Mineral Resources
3. Minister of Interior in charge of State Enterprises
4. Minister of Interior in charge of National Development/Chairman of BAPPENAS

The Coordinating Team has following mandates:

a. To take necessary measures to resolve problems concerning financing, land acquisition, expropriation and compensation for transmission route, authorizations, taxation, EIA, etc., for PLN's coal fired power plant development to diversify primary energy use.

b. To take necessary measures to resolve problems concerning authorizations and administration for power purchasing from privately owned power plants.

c. To take necessary measures to secure coal supply for power plants to be developed.

d. To take necessary measures to coordinate scheduling for projects.

Besides, for those projects to be developed by IPP, unit rates for purchasing power are regulated by a ministerial regulation shown below.

Ministerial regulation concerning power purchasing for direct appointment in primary energy diversification program, No.44/2006

To expedite diversification of primary energy with coal, PLN is allowed to purchase electricity, through direct appointment, from PIUKU including cooperatives, public enterprises, private firms, citizen organizations, and others operating for public purposes. In such cases, unit prices for power purchase are regulated by this regulation as follows.

(1) For non mine-mouth power plants, levelized price of power purchase shall be written down in the contract following the rules shown below.

a. When the price is set in Rupiah, highest basic unit price is as follows.
1. For power plant with capacity up to 25MW, Rp.520/kWh
2. For power plant with capacity above 25MW up to 150MW, Rp.495/kWh
3. For power plant with capacity above 150MW, Rp.485/kWh

b. When the price is set in US$, highest basic unit price is as follows.
1. For power plant with capacity up to 25MW, 4.95 US¢/kWh
2. For power plant with capacity above 25MW up to 150MW, 4.75 US¢/kWh
3. For power plant with capacity above 150MW, 4.50 US¢/kWh

c. When unit price is set on the basis of PLN’s average selling price or TDL, highest basic unit price is as follows.
1. For power plant with capacity up to 25 MW, 70% of TDL
2. For power plant with capacity above 25 MW up to 150 MW, 65% of TDL
3. For power plant with capacity above 150 MW, 60% of TDL

d. Average selling price in item c above is published by PLN every three month.

e. Basic unit price in items a, b, c above is those at bus bar, and on the assumptions, coal price US$ 30 per tonne, exchange rate US$ 1 = Rp. 9,200.

Unit price for power purchase can be made adjustable for such indices as inflation, power plant capacity factor, coal price, with mutual agreement of two parties.

For those projects developed with EPC contract, 85% of initial cost of the project is prepared by EPC contractor, while the rest, 15%, has to be secured by PLN. In order to ease the PLN’s task of securing finance from private banks at better conditions, a government guarantee was decided to be given to PLN’s debts as an exception to government rules.

Presidential decree concerning a provision of government guarantee for coal fired power project acceleration program, No.86/2006.

Presidential decision No. 59, Year 1972 prohibits giving government guarantee to any foreign debts. This decree is an exception to this rule solely for the purpose of expediting development to foreign banks providing export credits. The guarantee reportedly helped PLN secure loan at lower interest rate.

2.4.9 Environmental and Social Considerations

(1) Framework of Environmental Legislation in Indonesia

1) Environmental Impact Assessment

Government Regulation No.27/1999 requires actions to implement EIA. In response to this regulation, procedures for EIA are provided in the Minister of Environment Decree No.8/2006, and projects to require EIA are designated in the Minister of Environment Decree No.11/2006. Allocations of authorities between the national and local EIA review committees are specified in the Minister of Environment Decree No.40/2000. Public involvements and information disclosures are still in accordance with the Head of BAPEDAL Order No.8/2000.

Table 2.4-33 below summarizes facilities subject to EIA in the electricity sector, under the Minister of Environment Decree No.11/2006, and authorities competent to their EIA.

Table 2.4-33 Facilities Subject to EIA in Electricity Sector and Competent Authorities

<table>
<tr><th colspan="2">Facilities</th><th>Scale</th><th>Authorities Competent to EIA</th></tr>
<tr><td colspan="2">Construction and decommissioning of nuclear reactors</td><td>Any scale for commercial reactors</td><td>Ministry of Environment (MOE)</td></tr>
<tr><td rowspan="4">Non-nuclear power stations</td><td>Thermal</td><td>≥ 100MW</td><td>Province (MOE, if more than one province involved)</td></tr>
<tr><td>Geothermal</td><td>≥ 55MW</td><td>Province (MOE, if more than one province involved)</td></tr>
<tr><td>Hydroelectric</td><td>Dam height ≥ 15m
Reservoir ≥ 200ha
Capacity ≥ 50MW</td><td>Province (MOE, if more than one province involved)</td></tr>
<tr><td>Renewable</td><td>Capacity ≥ 10MW</td><td>Prefecture/city (province, if more than one prefecture/city involved. MOE, if more than one province involved)</td></tr>
<tr><td colspan="2">Transmission lines</td><td>> 150kV</td><td>Prefecture/city (province, if more than one prefecture/city involved. MOE, if more than one province involved)</td></tr>
</table>

Source: Decree of Environment Minister, Peraturan Menteri Negara Lingkungan Hidup Nomor 11 Tahun 2006

While the Ministry of Environment has issued general guidelines on EIA, each ministry has issued specific EIA guidelines for projects under its responsibility. As for those in the electricity sector, the Ministry of Energy and Mineral Resources has established specific guidelines to provide for contents of EIA separately for thermal power stations, hydroelectric power stations, diesel power stations, geothermal power stations and transmission lines as its Ministerial Decisions. Environmental Impact Assessment (AMDAL) has to be conducted and Environmental Impact Statement (ANDAL), Environmental Management Plan (RKL) and Environmental Monitoring Plan (RPL) have to be prepared for these facilities. For smaller facilities, simplified Environmental Management Policy (UKL) and Environmental Monitoring Policy (UPL) are required.

As shown in the table above, the Minister of Environment Decree No.11/2006 requires

EIA of nuclear power stations. The Ministry of Environment is planning to issue EIA guidelines for nuclear power stations within the next year. Safety standards for nuclear power stations are yet to be established, but they will be made in accordance with relevant international standards.

In Indonesia, the Environmental Management Agency (BAPEDAL), which had administered EIA, merged with the Ministry of Environment at the end of 2006, and the Ministry of Environment is now responsible for EIA. Within the Ministry of Environment, Asisten Deputi Urusan Perencanaan Lingkungan, or Assistant Deputy Director of Environmental Impact Assessment, is responsible for EIA.

In the Ministry of Energy and Mineral Resources, Sub-Directorate of Electricity Environmental Protection, Directorate of Electric Power Engineering & Environment, DGEEU is involved in EIA of the electricity sector. Under this Sub-Directorate, Section of Power Station Environmental Protection is in charge of EIA for power stations, and Section of Transmission Line Environmental Protection is responsible for EIA of transmission lines. The Ministry of Energy and Mineral Resources only submits opinions and recommendations to EIA for national projects in the electricity sector and for those with more than one province is involved. The Ministry will not conduct EIA by itself, and it will not manage EIA procedures.

2) Protected Areas

In Indonesia, the Ministry of Environment is not a competent authority for protected areas. The Directorate of Protected Areas, the Ministry of Forestry is responsible for designations and managements of protected areas.

Six types of protected area are designated under the Forestry Act (Law No.41/1999) as below. All of the protected areas in Java and Bali have been notified by official gazettes. No protected area has been established in Madura.

1) Cagar Alam, or Strict Nature Reserves, are very important for protection of ecosystems or conservation of rare species, and they require very strict managements.

2) Suaka Margasatwa, or Wildlife Sanctuaries, are important for protection of ecosystems or conservation of rare species, and they require strict managements.

3) Taman Nasional, or National Parks, are important for protection of ecosystems or conservation of rare species, but they are open to the public for their recreation.

4) Taman Wisata Alam, or Nature Recreation Parks, have rather limited importance for protection of ecosystems and conservation of rare species, and they are open to the public for their recreation.

5) Taman Buru, or Hunting Game Reserves, have limited importance for protection of

ecosystems and conservation of rare species, and hunting and capture of the designated animals, such as wild boars, deer and fish, are permitted.

6) Taman Hutan Raya, or Grand Forest Parks, require conservation of forests to protect catchment areas.

In these 6 types of protected areas, constructions of power stations and installations of transmission lines are not allowed in principle. Constructions of some geothermal power stations have been permitted exceptionally, but substantial amount of time would be required to obtain a construction permit. Time-consuming efforts would hardly guarantee permission of their constructions. Furthermore, there is no time limit for review of the application for a construction permit.

Table 2.4-34 lists the protected areas designated in Jamali as of December 2006, and their locations are shown in Figs. 2.4-34 (1/2) and 2.4-34 (2/2) (Source: CONSERVATION AREAS IN INDONESIA BY PROVINCE AS OF DECEMBER 2006 - Directorate General of Forest Protection and Nature Conservation, Ministry of Forestry of Republic Indonesia, the Indonesian Institute for sustainable environment management, Japan International Cooperation Agency). No additional national park has been designated in the area until May 16, 2008 since December 2006.

Table 2.4-34 Protected Areas in Jamali

No.*	Category	Protected Area	Area (ha)
DKI Jakarta			
1	Strict Nature Reserve	Pulau Bokor	18.00
2	Wildlife Sanctuary	Muara Angke	25.02
3	Wildlife Sanctuary	Pulau Rambut dan perairan sekitar	90.00
4	Nature Recreation Park	Angke Kapuk	99.82
5	National Park	Kepulauan Seribu (with marine area)	107,489.00
Banten Province			
1	Strict Nature Reserve	Rawa Danau	2,500.00
2	Strict Nature Reserve	Gunung Tukung Gede	1,700.00
3	Strict Nature Reserve	Pulau Dua	30.00
4	Nature Recreation Park	Pulau Sangiang	528.15
5	Nature Recreation Park	Pulau Sangiang (with marine area)	720.00
6	Nature Recreation Park	Carita	95.00
7	National Park	Ujung Kulon	120,551.00
8	National Park	Gunung Halimun Salak	51,981.25
West Java Province			
1	Strict Nature Reserve	Telaga Patengan	21.18
2	Strict Nature Reserve	Gunung Tilu	8,000.00
3	Strict Nature Reserve	Malabar	8.30
4	Strict Nature Reserve	Cigenteng Cipanyi I/II	10.00
5	Strict Nature Reserve	Junghunh	2.50
6	Strict Nature Reserve	Gunung Simpang	15,000.00
7	Strict Nature Reserve	Gunung Tangkuban Perahu	1,290.00
8	Strict Nature Reserve	Cadas Malang	21.00
9	Strict Nature Reserve	Bojonglarang Jayanti	750.00
10	Strict Nature Reserve	Takokak	50.00
11	Strict Nature Reserve	Sukawayana	30.50
12	Strict Nature Reserve	Cibanteng	447.00
13	Strict Nature Reserve	Tangkuban Prahu Pelabuhanratu	22.00
14	Strict Nature Reserve	Dungus Iwul	9.00

No.*	Category	Protected Area	Area (ha)
15	Strict Nature Reserve	Yaniapa	32.00
16	Strict Nature Reserve	Telaga Wama	368.25
17	Strict Nature Reserve	Arca Domas	2.00
18	Strict Nature Reserve	Gunung Burangrang	2,700.00
19	Wildlife Sanctuary	Cikepuh	8,127.50
20	Nature Recreation Park	Cimanggu	154.00
21	Nature Recreation Park	Telaga Patengan	65.00
22	Nature Recreation Park	Kawah Gunung Tangkuban Perahu	370.00
23	Nature Recreation Park	Jember	50.00
24	Nature Recreation Park	Sukawayana	16.00
25	Nature Recreation Park	Telega Wama	5.00
26	Nature Recreation Park	Gunung Pancar	447.50
27	Nature Recreation Park	Cibungur	51.00
28	Grand Forest Park	Pancoran Mas Depok	6.00
29	Grand Forest Park	Ir. H. Djuanda	590.00
30	Strict Nature Reserve	Talaga Bodas	261.15
31	Strict Nature Reserve	Leuweung Sancang	2,157.00
32	Strict Nature Reserve	Gunung Papandayan	6,807.00
33	Strict Nature Reserve	Kawah Kamojang	7,536.00
34	Strict Nature Reserve	Leuweung Sancang (with marine area)	1,150.00
35	Strict Nature Reserve	Gunung Jagat	126.60
36	Strict Nature Reserve	Nusa Gede Panjalu	16.00
37	Strict Nature Reserve	Pananjung Pangandaran	419.30
38	Strict Nature Reserve	Pananjung Pangandaran (with marine area)	470.00
39	Wildlife Sanctuary	Sindangkerta	90.00
40	Wildlife Sanctuary	Gunung Sawal	5,400.00
41	Nature Recreation Park	Talaga Bodas	23.53
42	Nature Recreation Park	Gunung Papandayan	225.00
43	Nature Recreation Park	Kawah Kamojang	481.00
44	Nature Recreation Park	Gunung Guntur	250.00
45	Nature Recreation Park	Gunung Tampomas	1,250.00
46	Nature Recreation Park	Pananjung Pangandaran	37.70
47	Nature Recreation Park	Linggarjati	11.51
48	Grand Forest Park	Gunung Palasari	35.81
49	Game Hunting Park	Masigit Kareumbi	12,420.70
50	National Park	Gunung Halimun Salak	61,375.75
51	National Park	Gunung Gede Pangrango	21,975.00
52	National Park	Gunung Ciremai	15,500.00
Central Java Province			
1	Strict Nature Reserve	Kecubung Ulolanang	69.70
2	Strict Nature Reserve	Peson Subah I	10.40
3	Strict Nature Reserve	Peson Subah II	10.00
4	Strict Nature Reserve	Curug Bengkawah	1.50
5	Strict Nature Reserve	Moga	3.50
6	Strict Nature Reserve	Bantarbolang	24.50
7	Strict Nature Reserve	Sub Vak 18C & 19B Jatinegara	6.60
8	Strict Nature Reserve	Vak 53 Comal	29.10
9	Strict Nature Reserve	Gebugan	1.80
10	Strict Nature Reserve	Sepakung	10.00
11	Strict Nature Reserve	Getas	1.00
12	Strict Nature Reserve	Pringombo I/II	58.00
13	Strict Nature Reserve	Telogo Dringo	26.10
14	Strict Nature Reserve	Telogo Ranjeng	48.50
15	Strict Nature Reserve	Pager Wunung Darupono	33.20
16	Strict Nature Reserve	Guci	2.00
17	Strict Nature Reserve	Karang Bolong	0.50
18	Strict Nature Reserve	Nusakambangan Timur	277.00
19	Strict Nature Reserve	Nusakambangan Barat	675.00
20	Strict Nature Reserve	Wijaya Kusuma	1.00
21	Strict Nature Reserve	Cabak I/II	30.00
22	Strict Nature Reserve	Bekutuk	25.40
23	Strict Nature Reserve	Gunung Celering	1,328.40

No.*	Category	Protected Area	Area (ha)
24	Strict Nature Reserve	Keling IA, B, C	6.80
25	Strict Nature Reserve	Keling I/II	61.00
26	Strict Nature Reserve	Kembang	1.80
27	Strict Nature Reserve	Gunung Butak	45.10
28	Strict Nature Reserve	Donoloyo	8.30
29	Strict Nature Reserve	Telogo Sumurup	20.10
30	Strict Nature Reserve	Pantodomas	7.10
31	Wildlife Sanctuary	Gunung Tunggangan	103.90
32	Nature Recreation Park	Gunung Selok	126.20
33	Nature Recreation Park	Tuk Songo Kopeng	6.50
34	Nature Recreation Park	Telogo Wamo/Telogo Pengilon	39.60
35	Nature Recreation Park	Sumber Semen	17.10
36	Nature Recreation Park	Grojogan Sewu	64.30
37	Grand Forest Park	Ngargoyoso	231.30
38	National Park	Kepulauan Karimun Jawa (marine only)	111,624.70
39	National Park	Gunung Merapi	4,567.93
40	National Park	Gunung Merbabu	5,725.00
DIY Yogyakarta			
1	Strict Nature Reserve	Teluk Baron	2.40
2	Wildlife Sanctuary	Paliyan	615.60
3	Grand Forest Park	Gunung Bunder	4,567.93
4	Strict Nature Reserve	Gunung Batu Gamping	1.05
5	Nature Recreation Park	Gunung Gamping	0.04
6	National Park	Gunung Merapi	1,842.07
East Java Province			
1	Strict Nature Reserve	Manggis Gadungan	12.00
2	Strict Nature Reserve	Besowo Gadungan	7.00
3	Strict Nature Reserve	Gunung Picis	27.90
4	Strict Nature Reserve	Gunung Sigogor	190.50
5	Strict Nature Reserve	Pulau Saobi	430.00
6	Strict Nature Reserve	Goa Nglirip	3.00
7	Strict Nature Reserve	Pulau Noko Nusa	725.00
8	Strict Nature Reserve	Pulau Bawean	725.00
9	Wildlife Sanctuary	Pulau Bawean	3,831.60
10	Strict Nature Reserve	Pancur Ijen I/II	3.95
11	Strict Nature Reserve	Sungai Kolbu Iyang Plateau	18.80
12	Strict Nature Reserve	Ceding	2.00
13	Strict Nature Reserve	Janggangan Ronggojampi I/II	7.51
14	Strict Nature Reserve	Pulau Sempu	877.00
15	Strict Nature Reserve	Curah Manis Sempolan (I-VIII)	16.80
16	Strict Nature Reserve	Pulau Nusa Barung	6,100.00
17	Strict Nature Reserve	Watangan Puger I-VI	2.00
18	Strict Nature Reserve	Gunung Abang	50.40
19	Wildlife Sanctuary	Dataran Tinggi Yang	14,177.00
20	Nature Recreation Park	Tretes	10.00
21	Nature Recreation Park	Gunung Baung	196.50
22	Grand Forest Park	Raden Suryo	27,868.30
23	Strict Nature Reserve	Kawah Ijen	2,468.00
24	Nature Recreation Park	Kawah Ijen	92.00
25	National Park	Alas Purwo	43,420.00
26	National Park	Meru Betiri	58,000.00
27	National Park	Baluran	25,000.00
28	National Park	Bromo Tengger Semeru	50,276.20
Bali Province			
1	Strict Nature Reserve	Batukau I/II/III	1,762.80
2	Nature Recreation Park	Danau Buyan-Danau Tamblingan	1,336.50
3	Nature Recreation Park	Panelokan	540.00
4	Nature Recreation Park	Sangeh	13.97
5	Grand Forest Park	Ngurah Rai	1,373.50
6	National Park	Bali Barat	19,002.89

* Numbers in Fig.2.4-34(1/2) and Fig 2.4-34(2/2)

Fig. 2.4-34 (1/2)　Protected Areas in Jamali (Overview)

Fig.2.4-34 (2/2)   Protected Areas in Java

3) Environmental Quality Standards and Emission/Effluent Standards

Article 14 of the Environment Act (Law No.23/1997) provides that “any activity shall not violate standards for environment”.

[Air Quality Standards]

Environmental standards for air quality are established for substances such as sulfur dioxides, carbon monoxide, nitrogen oxides, ozone, particulate matters, lead, hydrogen sulfide, ammonia, hydrocarbons, fluoride, and chloride, by Regulation (No.41/1999).

[Emission Standards]

Emission standards for stationary sources are established for 5 categories; coal-fired power stations, cement production, paper/pulp mills, iron mills, and other plants by the Decree of Environment Minister (No.13/1995).

[Water Quality Standards]

Environmental standards for surface water quality are established separately for 4 types of water uses. On the other hand, environmental standards for seawater quality are established by the Decree of Environment Minister (No.51/2004) amended by the Decree of Environment Minister (No.179/2004).

[Effluent Standards]

Effluent standards for discharges of wastewater from general industrial facilities are established by the Decree of Environment Minister (No.51/1995). Effluent standards for geothermal power stations are established separately by the Decree of Environment Minister (No.4/2007).

4) Management of Hazardous/Toxic Wastes

Management of hazardous/toxic wastes is required by the Decree of Environment Minister (No.18/1999) amended by the Decree of Environment Minister (No.85/1999). Hazardous/toxic wastes are regulated from their generation to final storage/disposal. Proponents must not dispose hazardous/toxic wastes to the environment without treatments.

(2) Potential Impacts of the Fast Track Program on Protected Areas and Endangered/ Precious/Rare Species

Environmental Impact Statements (EISs) of the seven power stations (Suralaya Baru Power Station, Paiton Baru Power Station, Rembang Power Station, Tanjung Jati Baru Power Station, Jatim Selatan Power Station, Labuhan Power Station and Jabar Selatan Power Station) were disclosed to the JICA Study Team, but there was no description in these EISs whether these power stations were located within any protected area. However, comparison of the location map of protected areas in Fig. 2.4-34 (2/2) with the locations of coal-fired power stations under the Fast Track Program shown in Fig.2.4-35 clearly indicates that eight power stations (Suralaya Baru Power Station, Paiton Baru Power Station, Jabar Utara Power Station = Jabar Indramayu Power Station, Rembang Power Station = Jateng Rembang Power Station, Tanjung Awar-Awar Power Station, Jatin Selatan Power Station = Jatim Pacitan Power Station, Tanjung Jati Baru Power Station = Jateng Cilacap Baru Power Station, and Labuhan Power Station) are not located within or in the vicinity of any protected area. As for the other two coal-fired power stations under the Program (Teluk Naga Power Station = Banten Lontar Power Station, and Jabar Selatan Power Station = Jabar Palabuhanratu Power Station), the Fast Track Program officers and environmental officer of PT Perusahaan Umum Listrik Negara (PLN) have confirmed that they are not located within or in the vicinity of any protected area. None of the 10 coal-fired power stations to be constructed under the Fast Track Program is located within or in the vicinity of any protected area.

For each power station, an indicative year to start its operation is shown. Source: P3B, October 2007

Fig.2.4-35 Locations of Coal-Fired Power Stations under the Fast Track Program

For all of the 10 power stations under the Fast Track Program, the Environmental Impact Statement (ANDAL) has been approved by BAPEDALDA of the relevant provincial government.

Environmental Impact Statements of the seven power stations (Suralaya Baru Power Station, Paiton Baru Power Station, Rembang Power Station, Tanjung Jati Baru Power Station, Jatin Selatan Power Station, Labuhan Power Station and Jabar Selatan Power Station) were disclosed to the JICA Study Team, but they only describe major species occurring at their construction sites, and there is no description to confirm that endangered/rare/precious species are not recognized at these sites or there occurs no protected species there. The Fast Track Program officers and environmental officer of PLN, however, have confirmed that surveys on local fauna and flora have been conducted for all of the Fast Track Program power stations but no occurrence of endangered/precious/rare species has been recognized in and around their proposed sites.

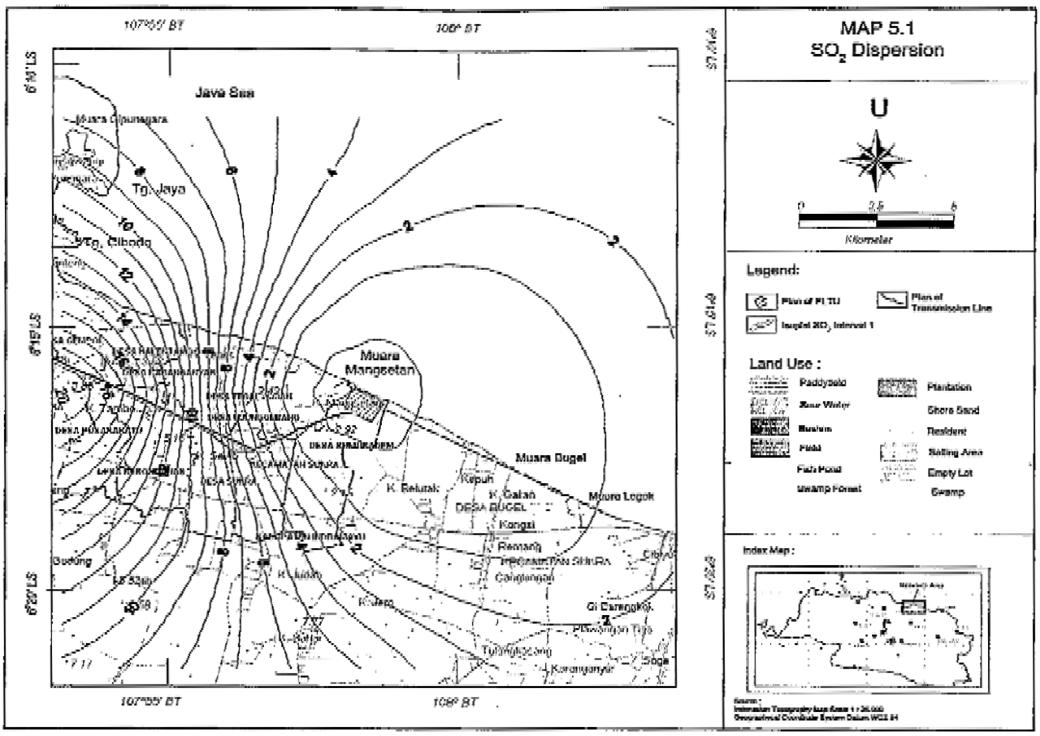
Under the Fast Track Program, 10 coal-fired power stations will be constructed. Among them, Suralaya Baru Power Station and Paiton Baru Power Station are actually extensions of the existing power stations, and the other 8 power stations (Teluk Naga Power Station = Banten Lontar Power Station, Jabar Utara Power Station = Jabar Indramayu Power Station, Rembang Power Station, Tanjung Awar-Awar Power Station, Jatin Selatan Power Station = Jatim Pacitan Power Station, Tanjung Jati Baru Power Station = Jateng Cilacap Baru Power Station, Jabar Selatan Power Station = Jabar Palabuhanratu Power Station, Labuhan Power Station) are new ones.

(3) Potential Impacts of the Fast Track Program on Local Air Quality

The Fast Track Program officers and environmental officer of PLN have confirmed that potential impacts of emissions of air pollutants from the Fast Track Program coal-fired power station on local air quality have been predicted and evaluated for all of the 10 Fast Track Program coal-fired power stations as a part of their EIA, to assure that concentrations of pollutants in the ambient air around these power stations will not exceed relevant air quality standards even after these power stations come into operation.

Environmental Impact Statements for Jabar Utara Power Station (=Jabar Indramayu Power Station) and Jabar Palabuhanratu Power Station (= Jabar Selatan Power Station) were disclosed to the JICA Study Team by the Fast Track Program officers of PLN. In these EISs, baseline concentrations of air pollutants were measured in the field around the proposed power station sites. The maximum ground concentration was predicted for each pollutant from the proposed power stations by simulations on the basis of their stack heights, its concentration in the flue gas, emission rate of the flue gas, local meteorological data such as wind directions and velocities, and local topographical data. Its maximum ground concentration was then combined with its maximum baseline concentration to obtain its maximum likely concentration in the ambient air around these power stations after they come into operation. This maximum likely concentration after these power stations come into operation was finally evaluated against the relevant air quality standard to confirm that it would not exceed the applicable standard.

Simulations for diffusions of air pollutants from the power station are reproduced in Fig. 2.4-36 for Jabar Utara Power Station and in Fig. 2.4-37 for Jabar Palabuhanratu Power Station (Source: their EISs).



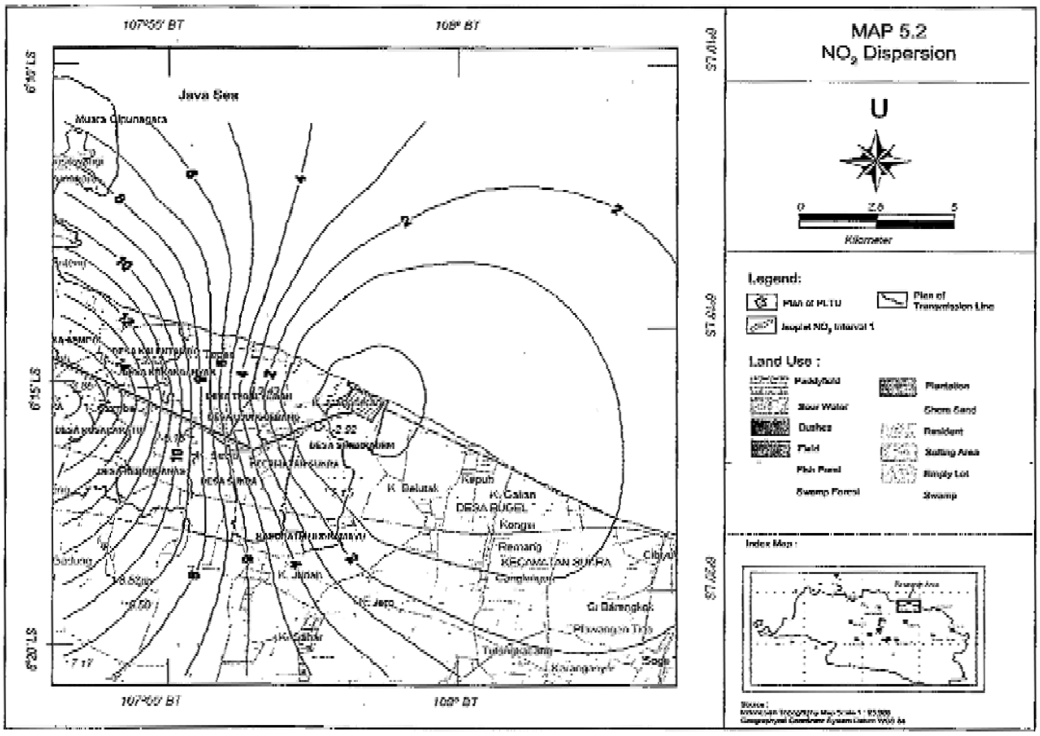
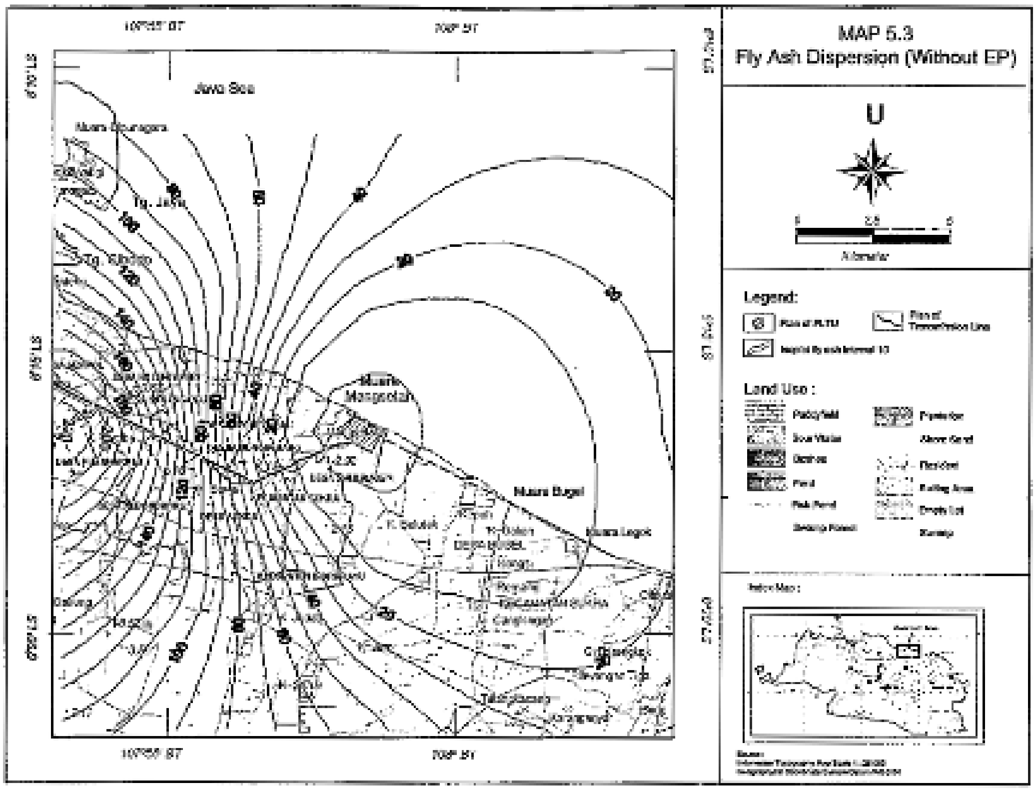


Fig. 2.4-36 (1/2) Simulations for Diffusions of Air Pollutants from Jabar Utara Power Station

(Up: SO_2, Down: NOx)



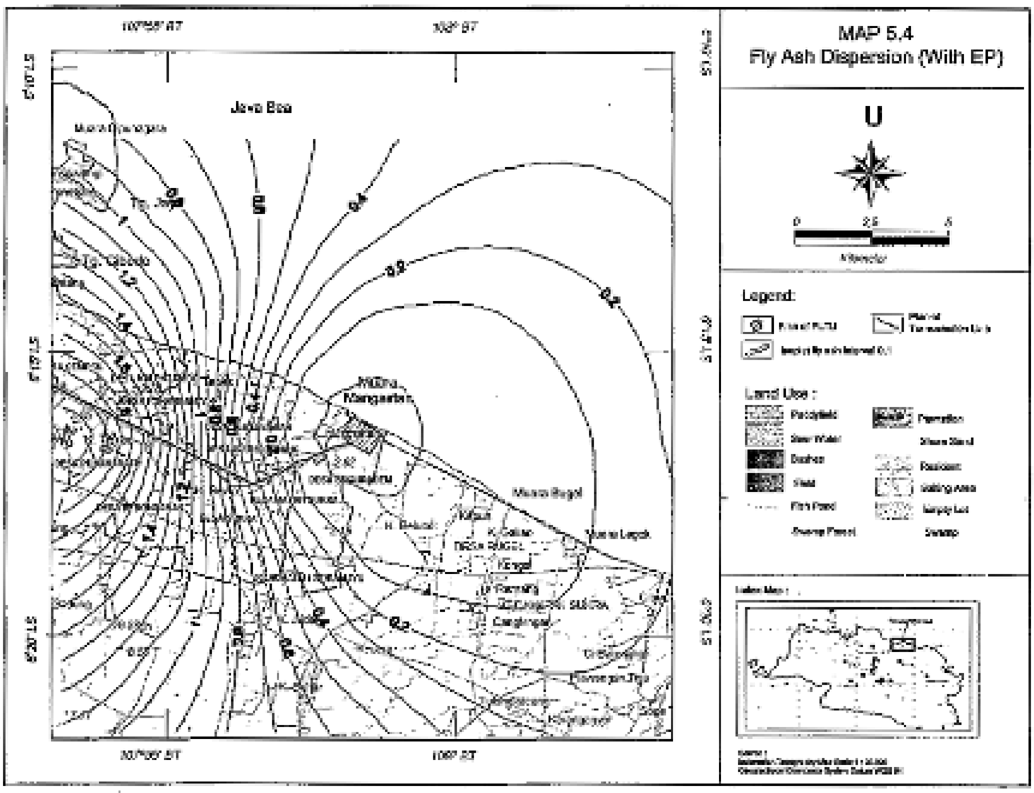


Fig. 2.4-36 (2/2) Simulations for Diffusions of Air Pollutants from Jabar Utara Power Station

(Suspended Particulate Matters; Up: without Electrostatic Precipitator (EP), Down: with EP)

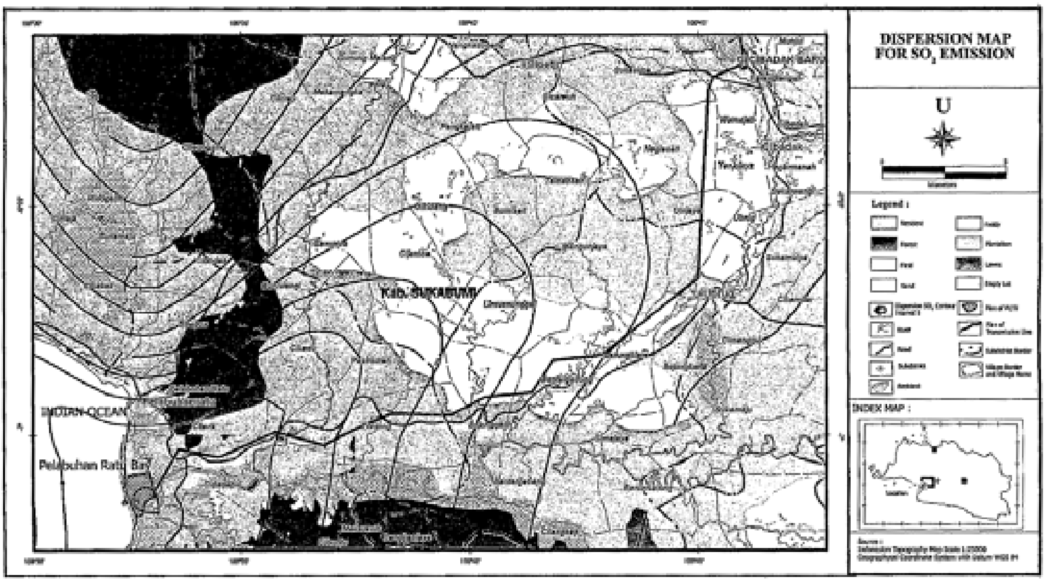


Figure 5.12 Dispersion Map for SO_2 Emission

Fig. 2.4-37 (1/3) Simulations for Diffusions of Air Pollutants from Jabar Palabuhanratu Power Station (SO_2)

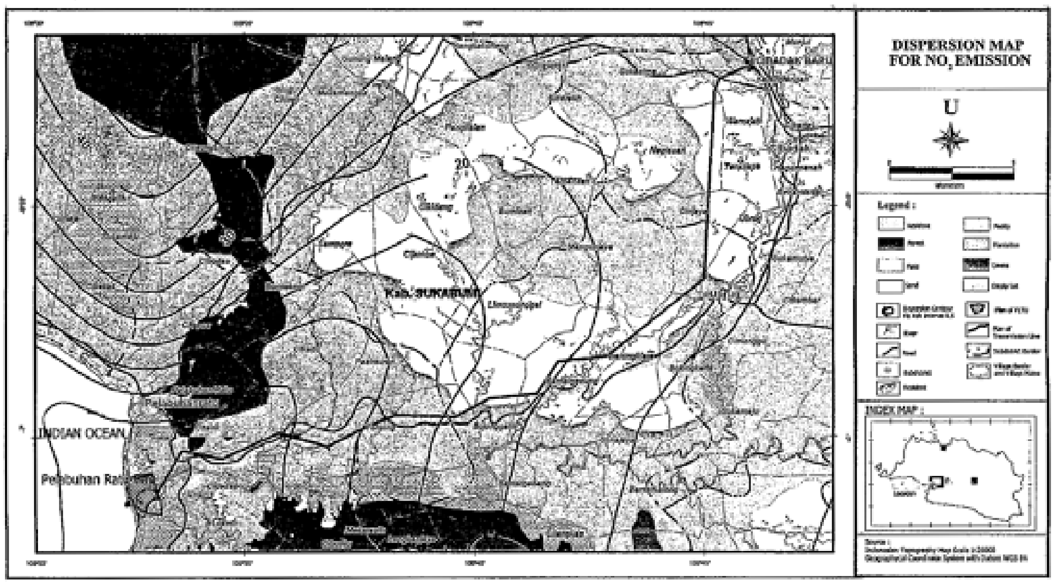


Figure 5.13 Dispersion Map for NO_2 Emission

Fig.2.4-37 (2/3) Simulations for Diffusions of Air Pollutants from Jabar Palabuhanratu Power Station (NOx)

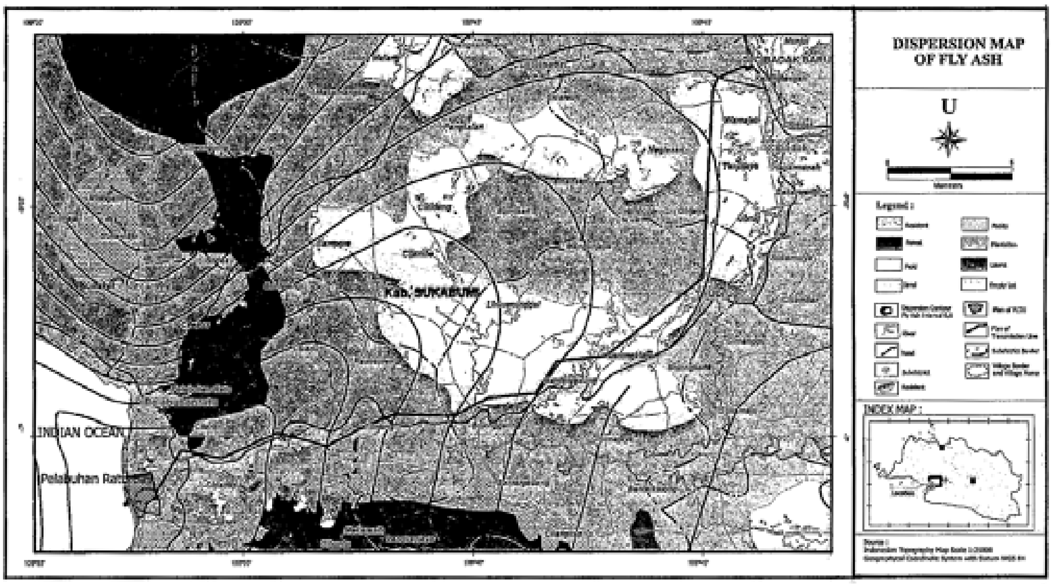


Figure 5.11 Dispersion Map for *Fly Ash* Emission

Fig.2.4-37 (3/3) Simulations for Diffusions of Air Pollutants from Jabar Palabuhanratu Power Station

(Suspended Particulate Matters)

Above prediction and evaluation methodology is a common practice and acceptable in principle. However, baseline concentrations of pollutants in the ambient air around the proposed power station site were measured spontaneously only once in October 2006 for Jabar Utara Power Station and also only once in September 2006 for Palabuhanratu Power Station. It is questionable whether the measured concentrations represent the local air quality around the proposed site. In Japan, air quality is continuously monitored for more than one year at and around the proposed power station site, to identify the data representing the worst air quality in the area, so that they can be used for conservative predictions of final air quality under impacts by operations of the proposed power station.

An officer in the Ministry of Energy and Mineral Resources responsible for EIA of power development projects and also the Fast Track Program officers and environmental officer in PLN have stated that it is a common practice in Indonesia to measure baseline concentrations of air pollutants only once in EIA prior to construction of the proposed power station. They have explained that there are only few large-scale emission sources such as industrial facilities in Indonesia, resulting in low concentrations of air pollutants in the ambient air with less fluctuation. They also have mentioned that there usually is less road traffic around the proposed power station site, leading to limited air pollution there. They have claimed that even single measurement can reasonably represent local air quality.

In Japan, it is a common practice to monitor concentrations of air pollutants for more than one year at and around the proposed power station site, to identify their ambient concentrations in the case of the worst air quality (without impacts by operations of the proposed power station), for conservative predictions of final air quality under impacts by its operations, so that it can be demonstrated that ambient concentrations of air pollutants will not exceed the relevant air quality standards even when their concentrations go up due to operations of the proposed power station at the time of the worst air quality. This would provide more reliable prediction and evaluation. However, monitoring and periodical reports to the competent authority, or the Ministry of Energy and Mineral Resources, of concentrations of air pollutants in emissions from power stations and also in the ambient air around them are conducted also in Indonesia. It would be detected if actual air quality after the proposed power station comes into operation differs significantly from what was predicted, and measures against it could be taken at that time as required.

(4) Legislation for Resettlement and Procedures to Obtain Consent from Local Residents

When involuntary resettlement is required to secure a land to construct some public facility, such as a power station and transmission line, consent from local residents shall be obtained in accordance with the Land Appropriation Law (Presidential Decree No.36/2005 amended by Presidential Decree No.65/2006) administered by the National Land Agency, and compensations shall be conducted under this Law. There is no regulation in Indonesia to require specific actions to obtain consent from those to be resettled.

According to the environmental officer of PLN, actual procedures to obtain consent from local residents to be resettled differ between regions, and they vary also depending on the number of households to be resettled. There is no standard procedure to follow. When only a few people need to be resettled, their consent will be sought through consultations by door-to-door visits or informal meetings. When many people need to be resettled, formal consultation meetings will be held to obtain their consent. A signature to the consent document may be sought from all of the households to be resettled, but if a head of the community to be resettled promises to obtain consent from all of its members, PLN may require only his consent.

In the case of loans by the World Bank and the Asian Development Bank, cost for resettlement and/or compensation can be covered by loans.

(5) How Major International Development Finance Organizations address to Resettlement

Construction of power stations and transmission lines in Jamali area would require loan from international development finance organizations. Each international development finance organization addresses differently to resettlement, so depending on whose loan to apply for, a proponent in Indonesia would bear different burden. Present guidelines of the World Bank, Asian Development Bank and Japan Bank for International Cooperation are summarized below for resettlement in Table 2.4-35.

Table 2.4-35 How Major International Development Finance Organizations Address to Resettlement

	World Bank	Asian Development Bank	Japan Bank for International Cooperation
Disclosure of Resettlement Action Plan (RAP)	Draft and Final RAPs Open to Public.	Draft and Final (and Revised) RAPs Open to Public.	No Specific Provision, but Not Open to Public in Practice.
Consultations on RAP	Consultations Required.	RAP must be Produced upon Consultations with PAPs.	No Specific Provision.
Compensation for Reacquisition	Compensation Required on the basis of Reacquisition Prices.	Compensation Required on the basis of Reacquisition Prices.	Compensation Required at least to Maintain Previous Living Standards, but No Provision on the Amount of Compensation.
Compensation before Resettlement	Compensation Required before Resettlement.	Compensation Required before Resettlement.	Compensation Required at “Appropriate Phase”.
Grievance Procedure	Grievance Procedure Required, if Appropriation of Land Involved.	Grievance Procedure Required, if Appropriation of Land Involved.	No Provision on Grievance Mechanism.
Loan for Resettlement*	Expenditure for Resettlement and Compensation can be Covered by Loan.	Expenditure for Resettlement and Compensation can be Covered by Loan.	Expenditure for Resettlement and Compensation can NOT be Covered by Loan.

* Information obtained from Japan Bank for International Cooperation.

Source: Recommendations by NGOs for revision of “Japan Bank for International Cooperation Guidelines to Confirm Environmental and Social Considerations” (November 26, 2007).

According to the information source affiliated with PLN, Resettlement Action Plans are produced only to apply for loan from the World Bank or Asian Development Bank, and they are not required under Indonesian legislation. The World Bank and Asian Development Bank make it mandatory for PLN to provide new lands for PAPs to resettle. PLN can provide new lands for PAPs from its own property, but if PAPs need to move to other lands, PLN has to purchase these lands for PAPs. On the other hand, requirements under Indonesian legislation are not so demanding, and PLN only needs to pay compensation to PAPs so that they can maintain their life. Although PLN will provide guidance on how to spend compensation money, this is up to PAPs, and they are not required to spend it only for purchases of new lands.

Under loan from the World Bank or Asian Development Bank, PLN is responsible all the way for the life of PAPs until PLN confirms by itself that their previous living standards are maintained. On the other hand, under Indonesian legislation, PLN will implement Resettlement Action Plan under leadership of relevant ministries, such as the Ministry of Social Welfare, the Ministry of Education, the Ministry of Forestry and the Ministry of Agriculture. While the World Bank and Asian Development Bank require the advance payment of compensation prior to resettlement, Indonesian legislation does not have a specific provision on when compensation shall be paid.

The World Bank and Asian Development Bank address significantly differently from Indonesian legislation to the people living illegally in a PLN’s property. While the World Bank and Asian Development Bank require PLN to implement “full compensation” also to these illegal residents, PLN needs to pay only certain amount of money to them under Indonesian legislation.

3. POWER DEMAND FORECAST

3.1. Review of Existing Demand Forecast

3.1.1 Demand Forecast by MEMR

MEMR forecasts power demand for next 20 years by each sector, which is composed of Residential, Commercial, Industrial and Public, using software named "Simple-E". In Simple-E, which is Excel based software, regression formula derived with explanatory variables can be set. In MEMR, energy sales by each sector are calculated through regression analysis with explanatory variables such as GDP per capita. Peak load is then calculated considering own use, transmission/distribution loss and load factor.

Fig.3.1-1 shows forecast of energy sales and peak load in RUKN 2006-2026.

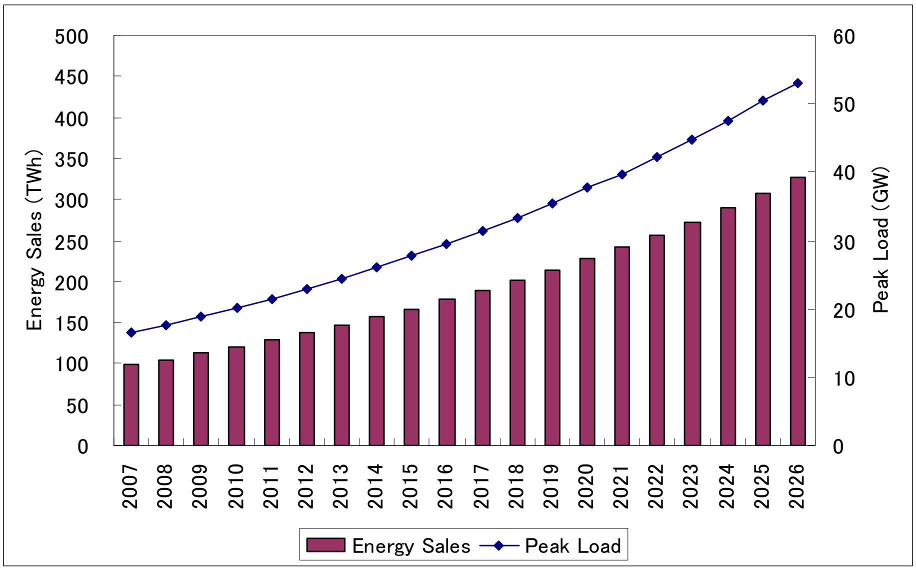


Fig.3.1-1 Demand Forecast in RUKN 2006-2026

According to RUKN 2006-2026, the annual energy growth rate in Jamali is expected to be around 6-7%. Consequently, the peak demand will be 27,846 MW in 2015 and 52,900 MW in 2026 respectively.

3.1.2 Demand Forecast by PLN

In PLN, power demand is forecasted using software "DKL" for the next ten years by each sector (Residential, Commercial, Industrial and Public). The forecast is conducted for each region (Jakarta, West Java, Central Java, East Java and Bali) as well as whole Jamali. DKL is Excel based software developed by PLN, and enables forecast using demand elasticity which indicates the ratio of demand growth to GDP growth. Then, peak load is calculated from energy sales considering own use, transmission/distribution loss and load factor.

Forecast of energy sales and peak load in RUPTL 2007-2016 are shown in Fig.3.1-2.

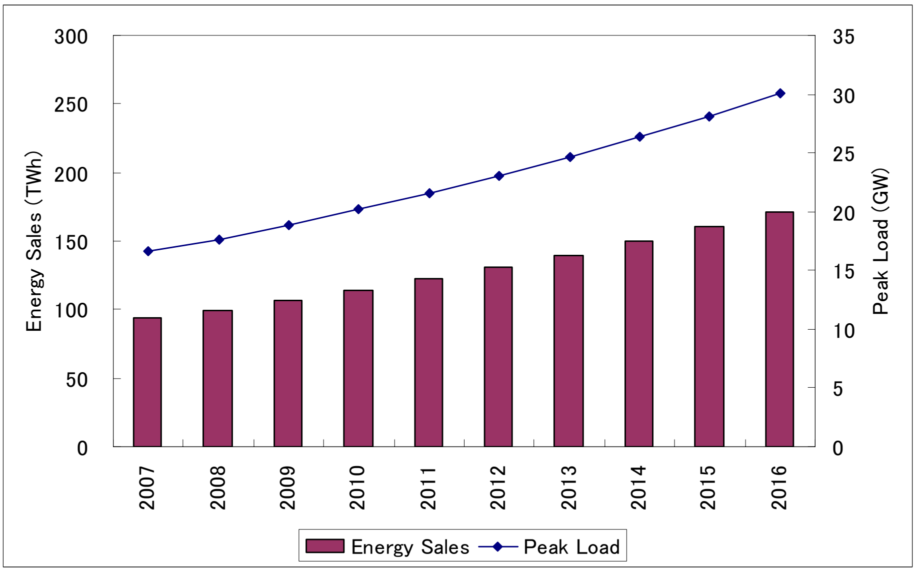


Fig.3.1-2 Demand Forecast in RUPTL 2007-2016

According to RUPTL 2007-2016, annual growth rate of power demand in Jamali will be around 6-7 % until 2016. As a result, the peak demand will be 30,072 MW in 2016.

3.1.3 Demand Forecast in Previous JICA Study

In the previous JICA study "Study on the Optimum Electric Power Development in Java-Bali", power demand was forecasted using a model in which explanatory variables such as economic condition (RGDP) were used. Energy sales were calculated using a model with explanatory variables including RGDP by sector. Peak demand was calculated based on the forecasted energy sales and the other factors including own use, transmission/distribution loss and load factor. In another JICA study "Study on the Optimal Electric Power Development in Sumatra", the same methodology was applied to demand forecast.

Fig.3.1-3 shows forecasted energy sales and peak load in JICA study "Study on the Optimum Electric Power Development in Java-Bali".

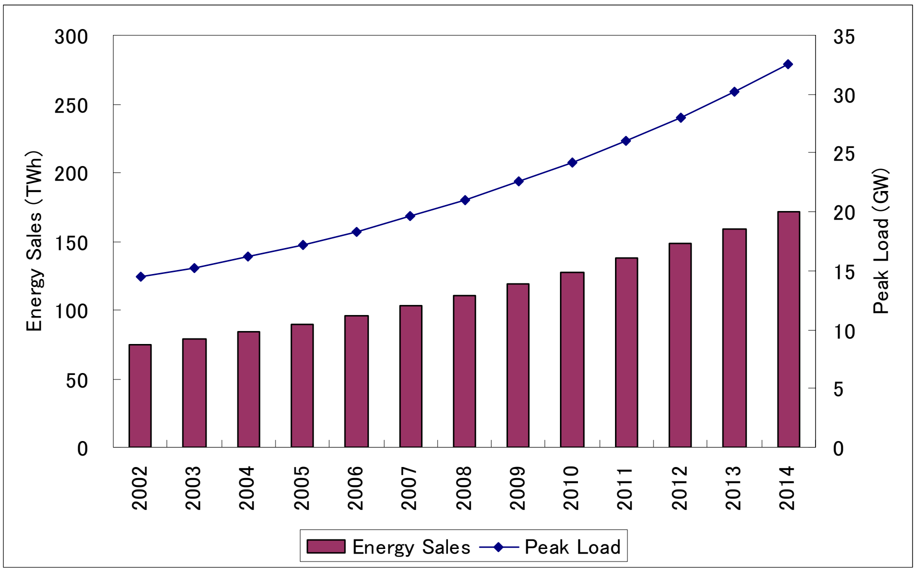


Fig.3.1-3 Demand Forecast by JICA in 2002

According to the study, power demand in Jamali is forecasted to grow by around 7% annually.

3.2. Review of Economic Policy, Growth, and Regional Development

3.2.1 Economic Development and Growth of Jamali Region

Economic development plan currently effective, National Medium Term Development Plan (Presidential Decree No.7/2005), envisages that the country's economy should grow at 6 to 7% per annum in order to lower the present over 10% unemployment to 5% level, with the growth of labour market taken into consideration. Actual growth rate of the economy for the last few years almost reaches this level.

As discussed in Section 2.3.2, national policy of regional development opts for regional and special diversification of economic activities across the nation, moving its focuses from Jamali region where industrial activities have been centered to the level of over-congestion and various negative consequences have emerged, to the outside Jamali regions where developments are lagging behind. In Jamali region, the focus of development efforts seem to have shifted from increasing industrial output to enhancing efficiency by means of improvement of transport infrastructures, etc.

Meanwhile, on the demand side, the level of capital formation has not recovered to that of 1990s. Inadequate investment in oil, coal and gas production in particular has been attributable to the slump of output of the important industry. Capital investment has shown a slight recovery in and around 2004, and can be expected to be improved more. The outcome of such investment, however, may take long time to materialize, and if it does, it will be in the regions outside Jamali where natural resources endowments are located such as Sumatra and Kalimantan, and would not directly push up economic output of industries in Jamali region. Moreover, the economy has been steadily expanding for the last few years may well be negatively affected by recent oil price increase. Electricity tariff will surely be revised upward in or after 2009.

Jamali region has been the core of economic development of the country, and leading the country with higher-than-average growth rate. This position will not change for sure. But the factors that lead to economic development are now located outside Jamali region. That the outside regions will expand and contribute to the national development in terms of foreign exchange earnings and primary energy provision on the basis of rich natural resource endowment, while Jamali region will improve its efficiency and move to the next stage of development, seems to be a plausible and desirable grand picture of development of the country for the coming decades.

A fundamental understanding of economic conditions of Jamali region for the purpose of electricity demand forecast is summarized as follows.

- Economy of Jamali region has been growing at 5.5 to 6.5% with some regional variations for the last 5 - 6 years. There seem to be few internal factors that upturn this trend.

- It should be noted that there are some external factors present at the moment that may affect and disturb so-far stable development of the economy, such as energy price increase and resulting inflations.

3.3. Review of DSM and Possibility of Energy Conservation

Regarding the energy conservation, "The Study on Energy Conservation and Efficiency Improvement in the Republic of Indonesia" is being separately conducted by JICA. The detailed outcome of the study should be left to the final report of the study due early next year, and only preliminary results reported so far is reflected in this master plan.

3.3.1 DSM and Government Policy and Activity on Energy Conservation

The Government of the Republic of Indonesian has made the following efforts to improve the country's EE&C (Energy Efficiency & Conservation) since the early 1980s:

- Enacting "National Policy Aiming at EE&C" whereby to promote EE&C enlightenment in the early 1980s.
- Setting up a state-owned institution, KONEBA with assistance from the World Bank in 1987, for the purpose of promoting EE&C through various activities such as database and human resources development, public information and energy auditing for industrial establishments.
- Issuing the Presidential Decree regarding EE&C, requiring energy consumers to improve energy efficiency in 1991; enacting an guideline for EE&C, "National EE&C Basic Plan: RIKEN" in 1995 (by MEMR).
- Enacting the "Demand Side Management (DSM) Action Program" with the help of USAID in 1992, based on which the State-own Power Generation Corporation (PLN) continued its efforts in the field of EE&C including the pilot project of Compact Fluorescent Lamp (CFL) introduction.

Reduction in consumption of natural resources including oil has been an issue for long time in Indonesia although the actions for energy conservation efforts were temporarily suspended by an Asian monetary crisis in 1997. "Energy conservation guideline" that followed "Presidential Instructions on Energy Efficiency" was announced officially in July, 2005, and the needs for conservation of energy have been mounting.

Thus, energy conservation and its implementations including DSM have been studied with relevant policies of Presidential Instruction and the government ordinance, etc. in the background. Large scale distribution of CFL and the introduction of highly effective road lighting have been examined in Indonesia. "The study on Energy Conservation and Efficiency Improvement in the Republic of Indonesia" started in September, 2007 with the objectives of researching the environment that surrounds the energy conservation and examining the system concerning promotion of energy conservation and the capacity building of organizations/individuals in Indonesia.

Table 3.3-1 Existing Registrations and Regulations

Name of regulation	Contents
Ministerial Electricity Saving Blueprint (2008.1)	Roadmap & action plan on electricity saving
Government law No.30/2007	Basic policy on Energy Saving - Government, region government, business operators and nation people has responsibility on Energy Saving - "National Energy Council" shall be established - Practical regulations shall be prepared with in 1 year after. - The government or local government shall provide incentive and disincentive
Presidential Regulation No.5/2006	Energy elasticity < 1 by 2025, Optimization on the share of primary energy mix; 1. Oil becoming less than 20% (twenty percent); 2. Natural gas becoming more than 30% (thirty percent); 3. Coal becoming more than 33% (thirty-three percent); 4. Bio-fuel becoming more than 5% (five percent); 5. Geothermal becoming more than 5% (five percent); 6. Other new energy and renewable energy in particular biomass, nuclear, water, solar and wind becoming more than 5% (five percent);
Ministerial Regulation No.100.K/48/M.PE/1995 (RIKEN1995, 2005)	Obligation for energy users that consume energy > 12,000 TOE per year or demands electricity > 6,000 kVA - Appointment of energy manager - Planning and implementation of energy conservation program - Conduct of periodical energy audits - Periodical report on implementation of energy conservation activities
Presidential Instruction No.10/2005	Instruction on central and regional governments: - To implement the energy efficiency measures in the institutes - To Enlighten the people about EE&C - To monitor and report to the President
Ministerial Regulation No.0031/2005	Procedure of EE&C in government offices, commercial buildings, industry, transportation, household and others was regulated
Government regulation No.2/1993	Establishment of KONEBA
MEMR Decision No.30.K/48/MPE/1993	Operational guidance for implementation, such as energy manager, energy conservation program, energy audit
DGEEU Decision No.15-12/48/600.1/1994	Technical guidance for energy auditing, implementation of energy management and conservation technique
Presidential Instruction No.15-12/48/600.1/1994	Instruction on energy conservation in governments organization
Presidential Decree No.43/1991	Showing the governmental policy on Energy Saving, such as dissemination, campaign, education, training, exhibition, pilot project, research & development, energy audit system and standardization of energy efficiency

3.3.2 Current State of Energy Conservation Approach

In Indonesia, the energy prices are suppressed to lower-than-market price level historically and institutionally, as primary energy such as oil, natural gas, and coal, etc. are produced in home country. Therefore, people's consciousness for energy conservation is still low. Meanwhile, reduction of consumption of oil resource became a pressing issue because of a sharp decrease of oil circulation in domestic market observed in recent years in a short term. "Energy conservation guideline" that followed "Presidential instructions on Energy Efficiency" was announced officially in July, 2005. As a result, needs for the reduction of energy consumption, especially oil consumption has become much stronger.

Energy conservation measures in Indonesian are being implemental following "Procedure of Energy Efficiency Implementation" Regulation No.0031/2005 that MEMR issued in 2005. The programs to e executed by PLN are included in this regulation, and the distribution of CFL and the Energy Diagnostics are included. Mid-term/long-term target and short-term actions that the government and PLN arranged are as follows.

Table 3.3-2 PLN's DSM Target and Actions

Categories	Contents	Expected EC Effects	Remarks and Comments by PLN
Long-term Target	Energy intensity reduction by 1% yearly		Not total amount target but intensity, taking into account of economic growth
Medium-term Target	Electricity Conservation for 2005 – 2010	Cumulated 14.3 TWh	Corresponding to yearly 2.9% of Total demand (14.3 ÷ 98.31 × 100 ÷ 5)
Short-term Actions	Power Reduction as peak load measures	600-900 MW	Corresponding to 3.6 – 5.4 % of Peak Load (600 ÷ 166,002 × 100) Reduction by the replacement to CFL at most 200 MW in Java

As a specific approach for the energy conservation accomplishment, followings are executed with JICA support.

- Consolidation of legal system
- Energy efficiency labeling
- Enhancement of test equipment
- Manufacturer support

PLN focuses on the following as the strategic approach to DSM.

- Primary/Secondary industry: Introduction of Energy Conservation Technology and Management
- Household and Commercial: Introduction of Energy Conservation Facilities
- Power generation: Introduction of Energy Conservation Technology and Management
- Electricity Tariff Adjustment Strategy (TDL; TARIF DASAR LISTRIK)

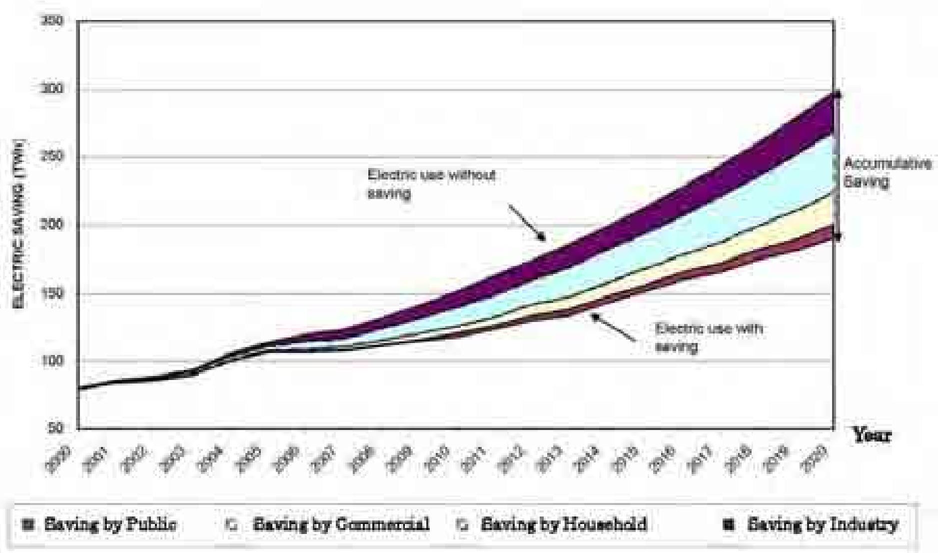
3.3.3 DSM and Energy Conservation Action

The following are energy conservation actions with higher possibility of realization in Indonesian.

- Distribution of CFL
- Distribution of highly effective fluorescent lamp stabilizer
- Expanding the use of highly effective street light
- Efficiency improvement of refrigerator
- Efficiency improvement of air conditioner (household/institutional use)
- Efficiency improvement of electric motor
- Efficiency improvement of television

PLN will distribute 51 million of CFLs free of charge to its customers in 2008. Effectiveness of this campaign, particularly on the peak load of electricity demand, is expected to be proven. The application of each energy conservation technique will be launched one by one from the one with more effectiveness and completed by 2025 as shown in Fig.3.3-1.

Approximately 30% reduction of electricity demand is expected in Indonesia as a whole, if successfully introduced. As the possibility of introductions of these measures is affected largely by institutional and society environment, the effect of DSM and energy conservation measures is considered the low case of electricity demand forecast in this master plan.



Source ; Electricity Saving Blueprint 2008

Fig.3.3-1 Electric Power Saving Roadmap

3.3.4 EE&C in Power Generation

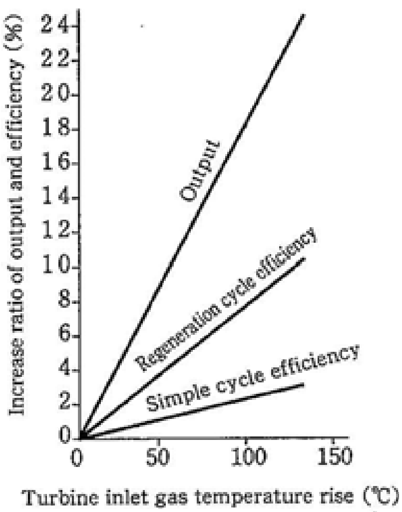
EE&C (Energy Efficiency and Conservation) on the power generation side is also important as well as the approach in power consumption. There are two types of EE&C in power station in terms of electricity generation and electricity consumption.

1) Effectively converting primary energy into electric energy by adopting high efficiency system/equipments.
2) Reducing power consumption of auxiliary equipment in power generation.

1) Efficiency Improvement in Power Generation

a) High Efficiency Gas Turbine

- Improvement of gas turbine inlet gas temperature
  As shown in Fig.3.3-2, the improvement of the gas turbine inlet gas temperature greatly contributes to the efficiency. The gas turbine inlet gas temperature of existing gas turbines in Indonesia is designed around 1,150 to 1,200°C by gas firing, but in many cases gas turbines are actually firing HSD (High Speed Diesel Oil) due



Source ; T/N Power Engineering Society

Fig.3.3-2 Gas Temp. vs Eff. and Output

to the delay of gas supply. In HSD firing, GT inlet gas temperature should be lowered in the actual operating condition to prevent high temperature corrosion of gas turbine component, and power output is constrained in comparison with gas firing case. As the ability of a gas turbine cannot be exploited in both efficiency and output when firing HSD, the earliest supply of natural gas is desirable.

For new power plants to be developed where LNG will be supplied in future, newer types of gas turbines with higher efficiency and larger capacity (F type or G type) will be adopted, and the inlet gas temperature will be set at 1,350 to 1,450°C.

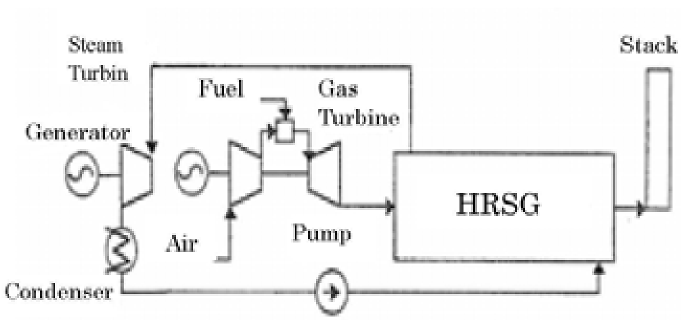
- Repowering (PLTG to PLTGU)

  For open-cycle gas turbine (PLTG) discharges exhaust gas of 500 to 600°C to the atmosphere without utilizing the energy contained in the gas. A gas turbine combined cycle (PLTGU) with which this energy is recorded by the HRSG (Heat Recovery Steam Generator) and the electricity is generated by the steam-turbine generator can produce additional 50% of energy without increasing the fuel consumption. Fig.3.3.-3 is the example of the repowering (from PLTG to PLTGU).

Unit	Available Capacity
GT-1	134 MW
Efficiency	27 %

By installing the steam cycle, 67 MW additional Power, 50% of efficiency (relative base) can be achieved.

Unit	Available Capacity
GT-1	134 MW
ST-1	66 MW
SUM	200 MW
Efficiency	41%



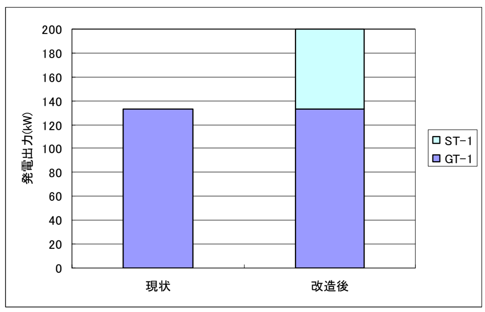


Fig.3.3-3 Effect of Re-powering (Efficiency and Power Generation)

b) Efficiency Improvement of Steam Turbine

Application of high efficient LP turbine blades, such as 3 dimensional blades, or rotor seal that minimizes a leakage around turbine rotor shroud, is effective in the improvement of steam turbine efficiency.

iii) Improvement of Steam Condition of Conventional Thermal Plant

In a large scale power generating unit, steam with higher temperature, 560 to 600°C, and higher pressure (supercritical or ultra- supercritical pressure), is used so as to realize most effective energy conversion.

Fig.3.3-4 is an example of calculation result for the relationship between steam condition and net heat rate. The higher steam condition raises the efficiency of the cycle, and the fuel consumption can be reduced. Thus improvement in efficiency by applying Super-critical pressure instead of Sub-critical pressure influences the design and operation of the plant as shown in Table 3.3-3.

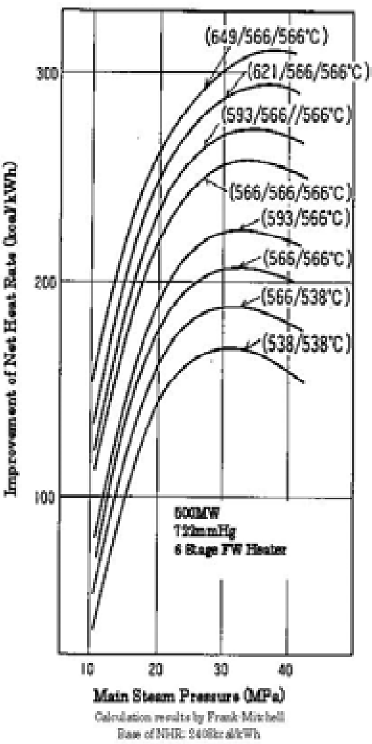


Fig.3.3-4 Effect of Steam Condition

Table 3.3-3 Improvement by Applying Super-critical Pressure

Item	Influence
Plant Efficiency	Approx. 2% increase
Material	Grade up in high temperature zone is required
Starting Time	Shorter start up time due to no heavy component such as drum
Load Swing	Can follow the rapid load swing
Effect of high pressure	Thicker materials are required for pressure parts
Water & Steam quality	Strict management is required
Difference in Technology	Only the number of extraction is different and there is no big difference in technologies.

2) Electricity Conservation in Power Station

In a power generating unit, 5 to 6% of the generated electric power is consumed in the operation of auxiliary equipment in power generation, and the rate varies with generation type PLTU, PLTGU and PLTG. A PLTU firing low grade fuels consumes more energy in proportion to produced energy, because a lot of auxiliaries such as cooling water pumps, feed water pumps, fans, coal handling equipments, flue gas treatment systems, etc. are installed in the unit.

As described bellow, 10 to 30% reduction of electricity consumption in power station is attainable by introducing improvement measures described below.

a) Variable Speed Control of Plant Auxiliaries

The pump/fan connected directly to the motor are rotated at a constant speed, and flow rate of water/air is adjusted by squeezing the valve/damper. The loss of energy incurred in this manner can be reduced by changing the rotation speed (motor speed control by an inverter or rotation speed control with hydraulic coupling).

Moreover, when the unit is operated at partial load, it is also beneficial to decrease the number of the operating auxiliaries.

b) Adoption of High Efficiency Auxiliaries

Replacing existing equipment with highly effective equipment such as axial flow fan, highly efficiency motor, energy conservation type lighting, LED indicator, etc. is effective. Online supervising of performance deterioration by diagnosis device enables better management of equipment, and is also effective for the conservation and the reliable operation of the plant.

3.4. Update of Power Demand Forecast

3.4.1 Method for Demand Forecast

(1) Model for Demand Forecast

In order to select optimum method for demand forecast, the methods used by MEMR, PLN and previous JICA study should be considered. As mentioned above, every organization forecasts energy sales using economic indices such as GDP, and then calculates peak demand considering own use, transmission/distribution loss and load factor. Therefore, in this study, energy sales are forecasted through regression analysis with GDP by sector, and peak load are calculated considering own use, transmission/distribution loss and load factor.

Power demand is forecasted in the following procedure, as illustrated in Fig.3.4-1;

i) Extract variables and parameters which affect demand forecast
ii) Build a demand forecast model and assume a transition of variables and parameters
iii) Calculate energy consumption by sector and total energy consumption
iv) Calculate entire generated energy considering own use and loss
v) Calculate entire peak demand considering load factor

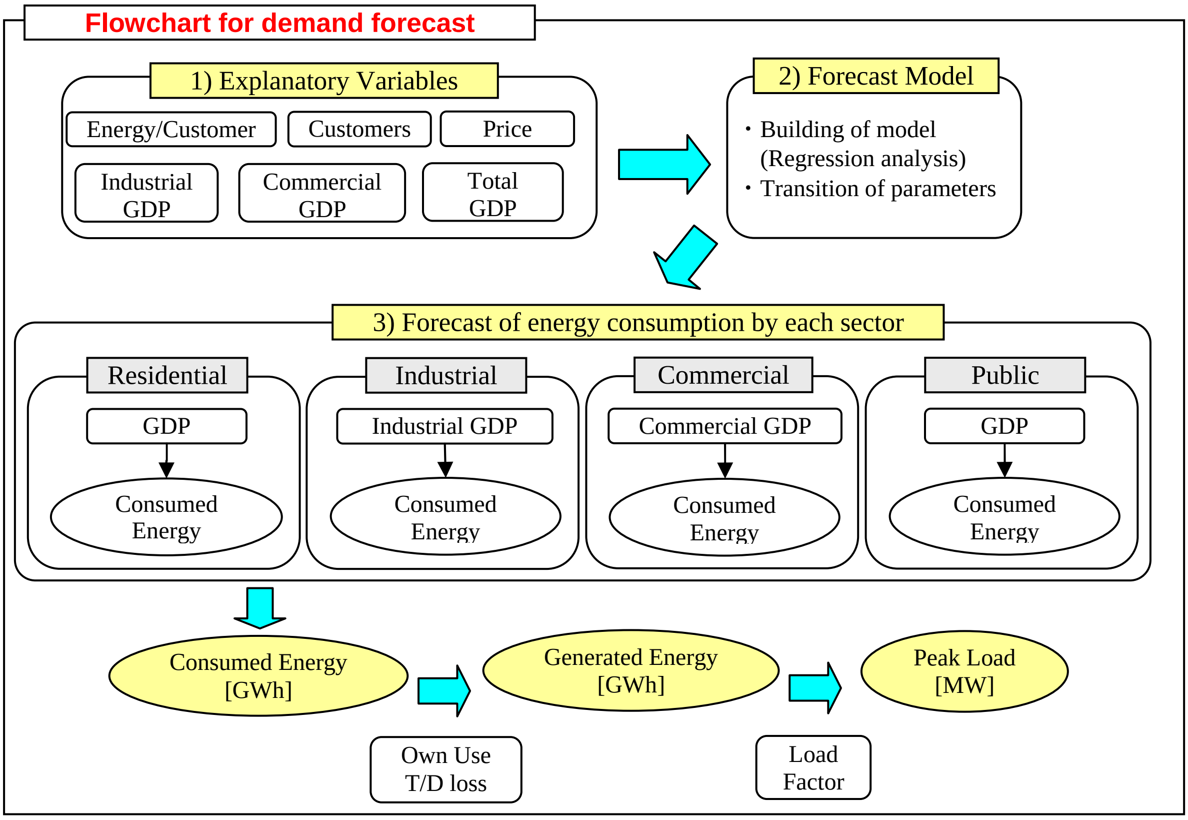


Fig.3.4-1 Flowchart of Demand Forecast

In general, various indices such as GDP by sector, population, the number of households, electrification ratio and electricity price, are considered to be applicable as explanatory variables. In this study, several models are tested through regression analysis, and appropriate variables are selected. In Jamali, above mentioned explanatory variables are correlative each other, and multicollinearity would be a problem if those variables are used simultaneously. Considering such problem, explanatory variables are selected for each sector as shown in Table 3.4-1. In the table, Industrial GDP and Commercial GDP mean the sum of subdivided GDP by sector which has close relationship to Industrial sector and Commercial sector respectively.

Table 3.4-1 Explanatory Variables by Sector

Sector	Explanatory Variable
Residential	GDP
Industrial	Industrial GDP
Commercial	Commercial GDP
Public	GDP

(2) Scenarios for Study

After the building of power demand forecast models as mentioned above, assumption of the transition of parameters, namely future scenarios, is studied. GDP, which is an explanatory variable, and parameters including load factor are forecasted in consideration with past records and assumptions made by other related parties including PLN. Not only base case scenario, high case scenario in which potential demand is counted, and low case scenario in which energy saving is counted, are studied. Concepts in each scenario are described below.

[Base Case]

Base case is the most probable and reliable scenario, and is used for generation planning and system planning. GDP growth rate is assumed to be 6.0% considering past records and assumptions by PLN. Own use is supposed to be constant due to its characteristics, and transmission/distribution loss ratio is assumed to decline slightly judging from the record in recent years. Load factor will change based on the transition of the daily load curve including peak shift from night to daytime, which is forecasted in this study.

[High Case]

There is a view that demand in recent years has been constrained compared to its potential because of the shortage of supply. In Indonesia, power demand grew more than 10% annually before the economic crisis, and such high growth might emerge again in the future.

Therefore, historical data before the economic crisis are included in regression, and higher GDP growth rate than base case, 6.5%, is assumed in the high case. Moreover, waiting customers in “Waiting List” would raise power demand suddenly if enough supply is secured and those customers are allowed to connect in the future. This potential demand is calculated considering capacity of waiting customers in Waiting List in Fig.2.4-10 and demand factor in Jamali system which is around 50%. Own use, transmission/distribution loss and load factor is assumed to be same as in the base case.

[Low Case]

In low case, GDP growth is assumed to be 6.0% as in the base case. In addition, the effect of energy savings including DSM, which would expand in the future, is considered. The effect of energy saving is assumed based on the result of the study in "Energy Saving Blueprint" by MEMR and in "The Study on Energy Conservation and Efficiency Improvement" by JICA. Own use, transmission/distribution loss and load factor is assumed to be same as in the base case.

In terms of the assumption of load factor, transition of daily load curve was analyzed and the peak shift from night to daytime was reflected. According to experience in neighboring countries of Indonesia, there seems to be some relationship between peak time of power demand and economic condition in each area. Fig.3.4-2 shows relationship between GDP per capita and peak time in Indonesia and neighboring countries. It can be said that peak time shifts from night to daytime in line with economic growth in each area.

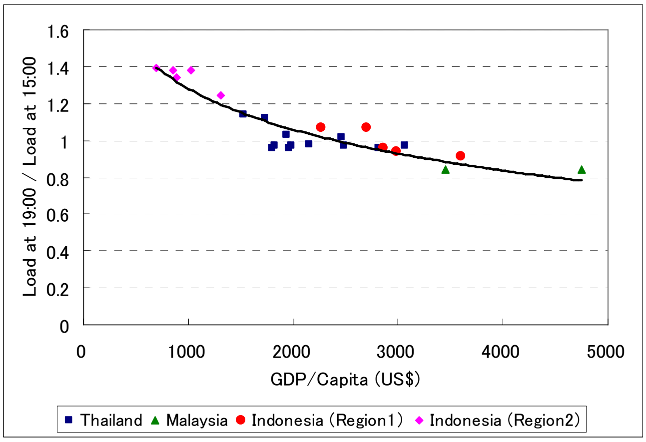


Fig.3.4-2 GDP per Capita and Peak Time

In Indonesia, peak demand appears already in daytime at around two o'clock in Region 1 including Jakarta. The peak shift from night to daytime will also occur according to economic growth in whole Jamali. This can be predicted by the following procedure;

1) Based on the current value of GDP/capita and expected growth in Jamali, the future year when the GDP/capita in Jamali becomes same level as that of current Region 1 will be assumed.

2) In that year, the shape of daily load curve of Jamali becomes the same as that of present Jakarta.

3) Based on daily load curve in the assumed year, daily load curve in the middle years and future years are assumed.

Fig.3.4-3 shows transition of daily load curve for Jamali assumed through above procedure. GDP/capita in Jamali is expected to be the same as that in present Jakarta in around year 2020, and load curve will change accordingly. The load in night and daytime will be the same in 2015 due to demand growth in daytime, and the peak time will be in daytime thereafter.

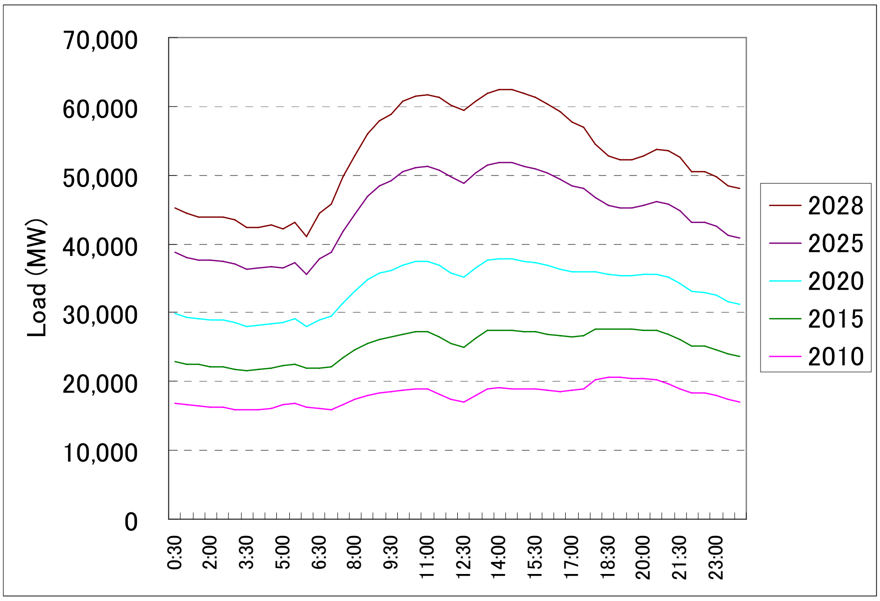


Fig.3.4-3 Daily Load Curve in Jamali

3.4.2 Results of Demand Forecast

(1) Demand Forecast in Jamali

The result of power demand forecast from 2009 to 2028 is listed in Table 3.4-2. Energy sales and peak load in the base case scenario are shown in Fig.3.4-4.

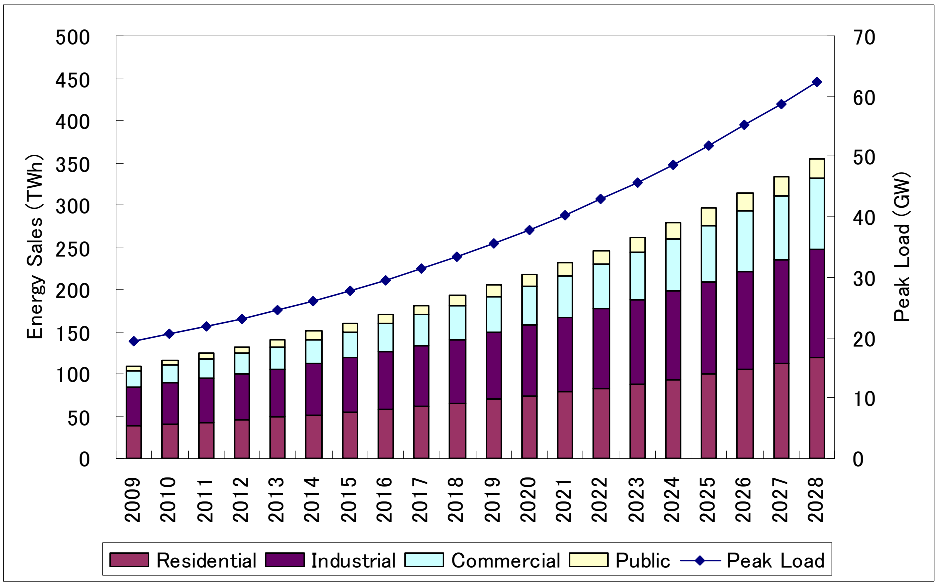


Fig.3.4-4 Energy Sales and Peak Load (Base Case)

In the base case, energy sales is expected to grow at around 6.5% annually, and reaches 159,838 GWh in 2015 and 354,835 GWh in 2028, respectively. The peak load will be 27,657 MW in 2015 and 62,474 MW in 2028, respectively.

In the high case, energy sale is assumed to grow at around 9% annually for the next ten years. It will reach 487,725 GWh in 2015 and 487,725 GWh in 2028, respectively. The peak load will be no less than 34,491 MW in 2015 and 85,871 MW in 2028, respectively.

In the low case, reduction of energy consumption is assumed to be around 30% finally due to energy saving including DSM. Annual demand growth will be around 4.5%, and energy sales will reach 141,214 GWh in 2015 and 230,643 GWh in 2028, respectively. The peak load will be 23,508 MW in 2015 and 40,608 MW in 2028, respectively.

Table 3.4-2 Result of Demand Forecast in Jamali

(1) Base Case

	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Energy Sales																					
- Residential	GWh	37,960	40,348	42,879	45,563	48,407	51,422	54,618	58,006	61,597	65,403	69,438	73,715	78,248	83,054	88,148	93,547	99,271	105,338	111,768	118,585
- Public	GWh	6,209	6,739	7,301	7,897	8,529	9,199	9,909	10,661	11,459	12,304	13,201	14,151	15,158	16,225	17,357	18,556	19,827	21,175	22,603	24,117
- Commercial	GWh	18,701	20,421	22,259	24,226	26,329	28,579	30,984	33,557	36,309	39,252	42,399	45,765	49,365	53,216	57,334	61,738	66,448	71,485	76,872	82,634
- Industrial	GWh	46,357	48,972	51,729	54,634	57,697	60,924	64,326	67,912	71,692	75,676	79,875	84,302	88,967	93,884	99,067	104,530	110,289	116,358	122,755	129,498
Total Energy Sales	**GWh**	**109,227**	**116,480**	**124,169**	**132,320**	**140,962**	**150,124**	**159,838**	**170,137**	**181,057**	**192,636**	**204,913**	**217,933**	**231,738**	**246,379**	**261,905**	**278,371**	**295,834**	**314,355**	**333,999**	**354,835**
(Growth)	%		6.64%	6.60%	6.56%	6.53%	6.50%	6.47%	6.44%	6.42%	6.40%	6.37%	6.35%	6.33%	6.32%	6.30%	6.29%	6.27%	6.26%	6.25%	6.24%
- Station Use	%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
- T&D Loss	%	11.00%	10.90%	10.80%	10.70%	10.60%	10.50%	10.40%	10.30%	10.20%	10.10%	10.00%	9.90%	9.80%	9.70%	9.60%	9.50%	9.40%	9.30%	9.20%	9.10%
Generated Energy	**GWh**	**127,841**	**136,177**	**145,003**	**154,349**	**164,246**	**174,725**	**185,823**	**197,576**	**210,023**	**223,206**	**237,168**	**251,957**	**267,621**	**284,213**	**301,790**	**320,409**	**340,133**	**361,029**	**383,167**	**406,622**
Load Factor	%	75.5%	75.7%	75.9%	76.1%	76.3%	76.5%	76.7%	76.7%	76.5%	76.3%	76.1%	75.9%	75.7%	75.5%	75.3%	75.1%	74.9%	74.7%	74.5%	74.3%
Peak Load	**MW**	**19,329**	**20,535**	**21,809**	**23,153**	**24,573**	**26,073**	**27,657**	**29,406**	**31,340**	**33,395**	**35,577**	**37,895**	**40,357**	**42,973**	**45,751**	**48,703**	**51,840**	**55,172**	**58,712**	**62,474**
(Growth)	%		6.24%	6.20%	6.17%	6.13%	6.10%	6.07%	6.32%	6.58%	6.56%	6.53%	6.52%	6.50%	6.48%	6.47%	6.45%	6.44%	6.43%	6.42%	6.41%

(2) High Case

	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Energy Sales																					
- Residential	GWh	42,262	46,051	50,087	54,386	58,964	63,839	69,031	74,561	80,450	86,722	93,402	100,515	108,092	116,160	124,753	133,905	143,652	154,032	165,086	176,860
- Public	GWh	6,268	6,859	7,488	8,158	8,872	9,632	10,442	11,304	12,222	13,200	14,242	15,351	16,533	17,791	19,131	20,558	22,078	23,696	25,420	27,256
- Commercial	GWh	20,178	22,487	24,970	27,641	30,512	33,599	36,919	40,489	44,327	48,455	52,893	57,666	62,797	68,315	74,249	80,629	87,489	94,866	102,798	111,328
- Industrial	GWh	47,365	50,488	53,794	57,294	60,999	64,921	69,072	73,466	78,117	83,041	88,253	93,770	99,609	105,791	112,335	119,261	126,593	134,354	142,570	151,266
- Potential	GWh	0	2,269	4,555	6,858	9,178	11,516	13,870	14,464	15,021	15,575	16,127	16,678	17,227	17,773	18,318	18,862	19,403	19,942	20,480	21,015
Total Energy Sales	**GWh**	**116,071**	**128,154**	**140,895**	**154,337**	**168,525**	**183,507**	**199,334**	**214,284**	**230,138**	**246,993**	**264,917**	**283,980**	**304,258**	**325,831**	**348,786**	**373,215**	**399,214**	**426,890**	**456,354**	**487,725**
(Growth)	%		10.41%	9.94%	9.54%	9.19%	8.89%	8.63%	7.50%	7.40%	7.32%	7.26%	7.20%	7.14%	7.09%	7.05%	7.00%	6.97%	6.93%	6.90%	6.87%
- Station Use	%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
- T&D Loss	%	11.00%	10.90%	10.80%	10.70%	10.60%	10.50%	10.40%	10.30%	10.20%	10.10%	10.00%	9.90%	9.80%	9.70%	9.60%	9.50%	9.40%	9.30%	9.20%	9.10%
Generated Energy	**GWh**	**135,851**	**149,825**	**164,535**	**180,031**	**196,361**	**213,579**	**231,741**	**248,844**	**266,957**	**286,190**	**306,617**	**328,316**	**351,369**	**375,866**	**401,901**	**429,575**	**458,994**	**490,273**	**523,534**	**558,907**
Load Factor	%	75.5%	75.7%	75.9%	76.1%	76.3%	76.5%	76.7%	76.7%	76.5%	76.3%	76.1%	75.9%	75.7%	75.5%	75.3%	75.1%	74.9%	74.7%	74.5%	74.3%
Peak Load	**MW**	**20,541**	**22,593**	**24,746**	**27,006**	**29,378**	**31,871**	**34,491**	**37,036**	**39,836**	**42,818**	**45,995**	**49,379**	**52,986**	**56,831**	**60,928**	**65,297**	**69,955**	**74,923**	**80,220**	**85,871**
(Growth)	%		9.99%	9.53%	9.13%	8.78%	8.48%	8.22%	7.38%	7.56%	7.49%	7.42%	7.36%	7.30%	7.26%	7.21%	7.17%	7.13%	7.10%	7.07%	7.04%

(3) Low Case

	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Energy Sales																					
- Residential	GWh	37,960	40,348	42,879	45,563	48,407	51,422	54,618	58,006	61,597	65,403	69,438	73,715	78,248	83,054	88,148	93,547	99,271	105,338	111,768	118,585
- Public	GWh	6,209	6,739	7,301	7,897	8,529	9,199	9,909	10,661	11,459	12,304	13,201	14,151	15,158	16,225	17,357	18,556	19,827	21,175	22,603	24,117
- Commercial	GWh	18,701	20,421	22,259	24,226	26,329	28,579	30,984	33,557	36,309	39,252	42,399	45,765	49,365	53,216	57,334	61,738	66,448	71,485	76,872	82,634
- Industrial	GWh	46,357	48,972	51,729	54,634	57,697	60,924	64,326	67,912	71,692	75,676	79,875	84,302	88,967	93,884	99,067	104,530	110,289	116,358	122,755	129,498
- Energy Saving	GWh	(3,277)	(5,824)	(8,692)	(11,909)	(15,506)	(19,516)	(23,976)	(28,923)	(34,401)	(40,453)	(47,130)	(54,483)	(62,569)	(71,450)	(78,572)	(86,295)	(94,667)	(103,737)	(113,560)	(124,192)
Total Energy Sales	**GWh**	**105,950**	**110,656**	**115,477**	**120,412**	**125,456**	**130,608**	**135,862**	**141,214**	**146,656**	**152,182**	**157,783**	**163,449**	**169,169**	**174,929**	**183,334**	**192,076**	**201,167**	**210,618**	**220,440**	**230,643**
(Growth)	%		4.44%	4.36%	4.27%	4.19%	4.11%	4.02%	3.94%	3.85%	3.77%	3.68%	3.59%	3.50%	3.40%	4.80%	4.77%	4.73%	4.70%	4.66%	4.63%
- Station Use	%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
- T&D Loss	%	11.00%	10.90%	10.80%	10.70%	10.60%	10.50%	10.40%	10.30%	10.20%	10.10%	10.00%	9.90%	9.80%	9.70%	9.60%	9.50%	9.40%	9.30%	9.20%	9.10%
Generated Energy	**GWh**	**124,005**	**129,368**	**134,853**	**140,458**	**146,179**	**152,011**	**157,950**	**163,988**	**170,119**	**176,333**	**182,620**	**188,968**	**195,363**	**201,792**	**211,253**	**221,082**	**231,290**	**241,889**	**252,890**	**264,305**
Load Factor	%	75.5%	75.7%	75.9%	76.1%	76.3%	76.5%	76.7%	76.7%	76.5%	76.3%	76.1%	75.9%	75.7%	75.5%	75.3%	75.1%	74.9%	74.7%	74.5%	74.3%
Peak Load	**MW**	**18,749**	**19,509**	**20,282**	**21,070**	**21,870**	**22,683**	**23,508**	**24,407**	**25,386**	**26,382**	**27,394**	**28,421**	**29,461**	**30,511**	**32,026**	**33,605**	**35,251**	**36,965**	**38,750**	**40,608**
(Growth)	%		4.05%	3.97%	3.88%	3.80%	3.72%	3.64%	3.82%	4.01%	3.92%	3.84%	3.75%	3.66%	3.56%	4.97%	4.93%	4.90%	4.86%	4.83%	4.79%

(2) Regional Demand Forecast

Regional power demand is forecasted in the same way as the whole Jamali region, using regional GDP by sector. Jamali region is separated into Jakarta, West Java, Central Java, East Java and Bali. Table 3.4-3 shows the result of regional demand forecast by each region. Characteristics of forecasted demand in each region are mentioned below.

1) Jakarta

Fig.3.4-5 shows energy sales and peak load by sector in Jakarta region. In Jakarta which is the political and economic center of Indonesia, residential demand based on millions of people and commercial demand based on commercial activities lead the regional demand.

Transition of daily load curve in Region 1 which includes Jakarta is shown in Fig.3.4-6. In Region 1, peak time has already moved to daytime, and steady growth of the load is expected in future.

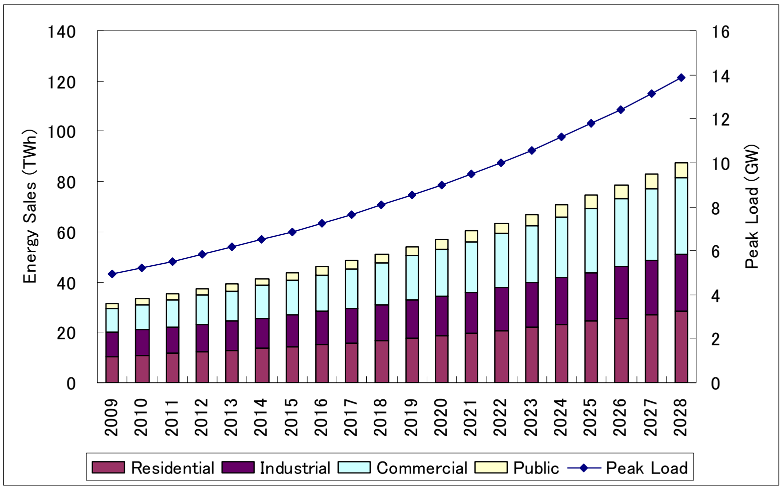


Fig.3.4-5 Energy Sales and Peak Load in Jakarta

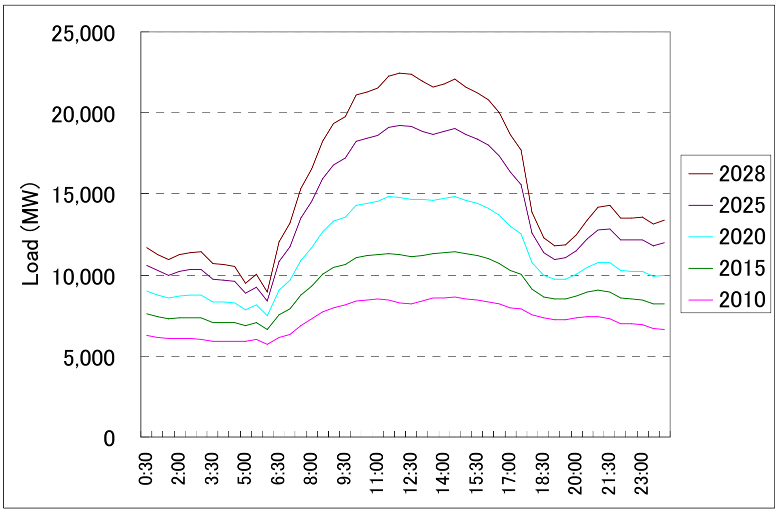


Fig.3.4-6 Daily Load Curve in Region 1

2) West Java

Energy sales and peak load by sector in West Java region are shown in Fig.3.4-7. In West Java, which is geographically located near Jakarta, industrial demand including factories has led demand. This tend is likely to continue, and industrial demand is expected to account for large portion of the demand.

Fig.3.4-8 shows transition of daily load curve in Region 2 which is included in West Java region. In Region 2, load in daytime and night will be at the same level in 2021 reflecting the growth of load in daytime, and peak time will be daytime thereafter.

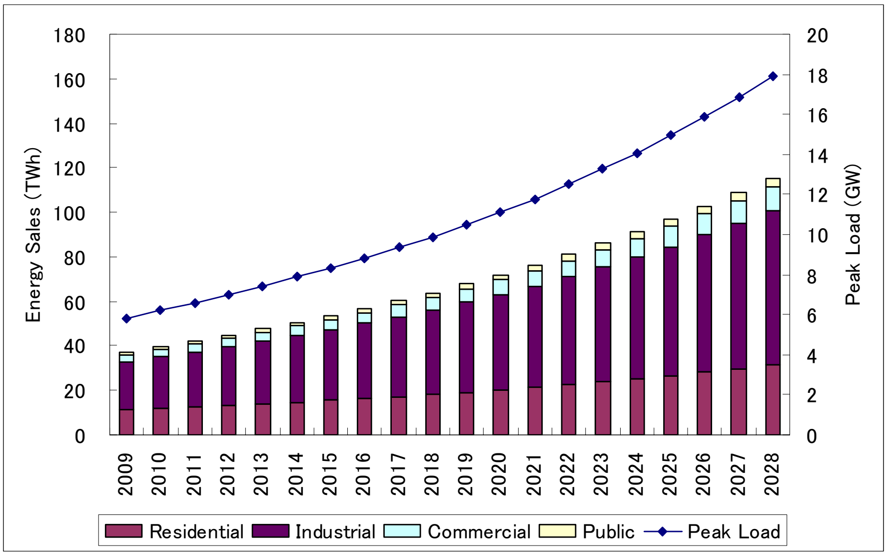


Fig.3.4-7 Energy Sales and Peak Load in West Java

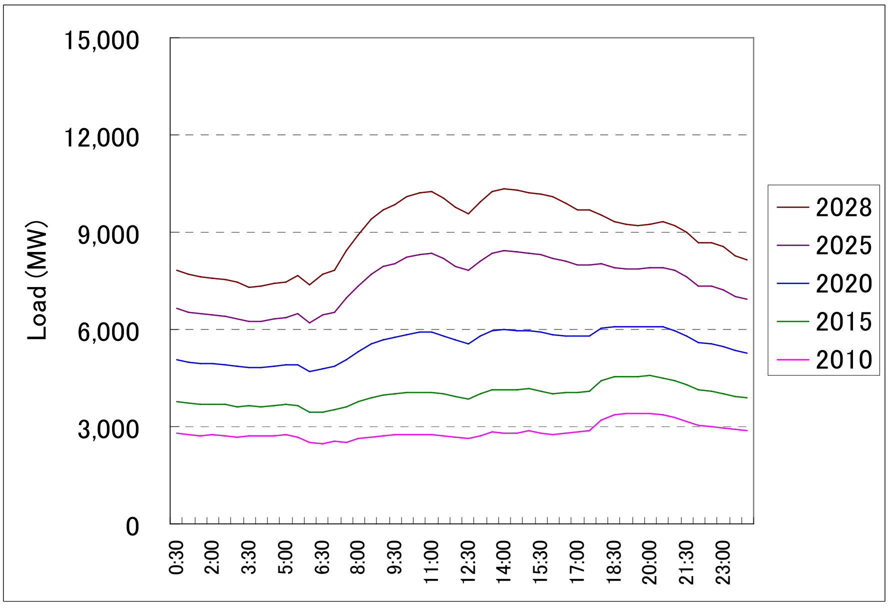


Fig 3.4-8 Daily Load Curve in Region 2

3) Central Java

Fig.3.4-9 shows energy sales and peak load by sector in Central Java region. Central Java does not have metropolis and is not developed much compared to the other regions. Therefore, residential demand takes large part of power demand, and the characteristics will continue.

Fig.3.4-10 shows transition of daily load curve in Region 3. In Region 3, it is considered that load at night continue to be the major load, and peak shift will occur gently.

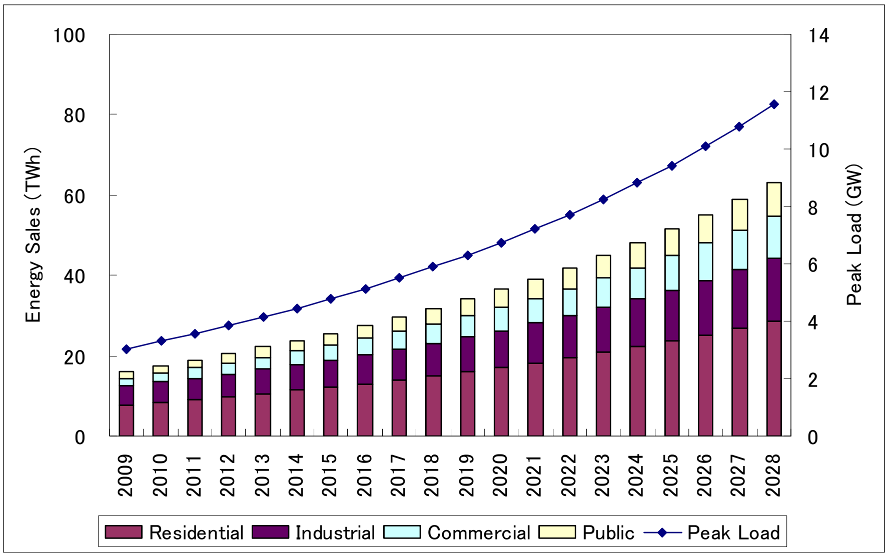


Fig.3.4-9 Energy Sales and Peak Load in Central Java

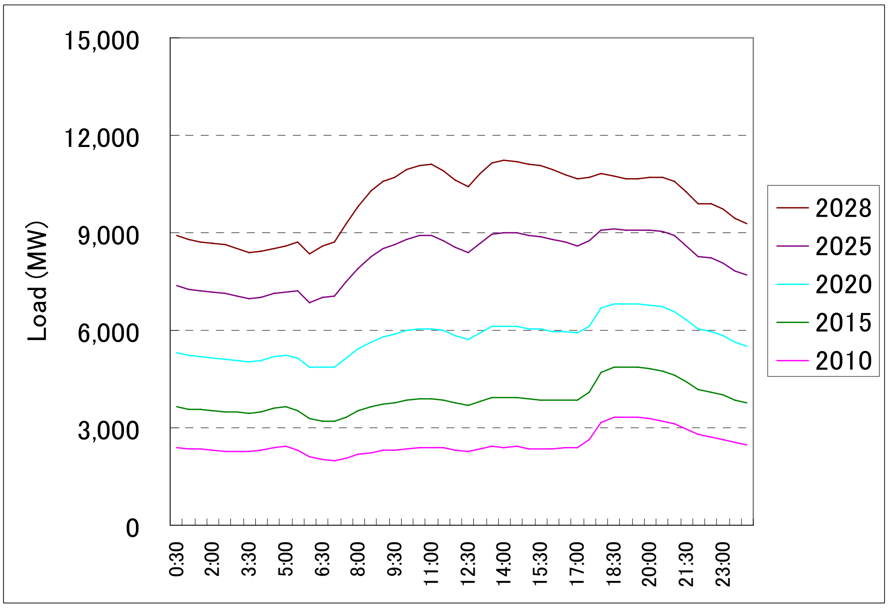


Fig.3.4-10 Daily Load Curve in Central Java

4) East Java

Energy sales and peak load by sector in West Java region are shown in Fig.3.4-11. East Java, which has the second largest city in Java Island, is relatively urbanized and industrialized. Therefore, steady growth is expected in all sectors.

Fig.3.4-12 shows transition of daily load curve in East Java. In East Java, peak shift will occur relatively early in around 2018, reflecting the development of urban areas and industries.

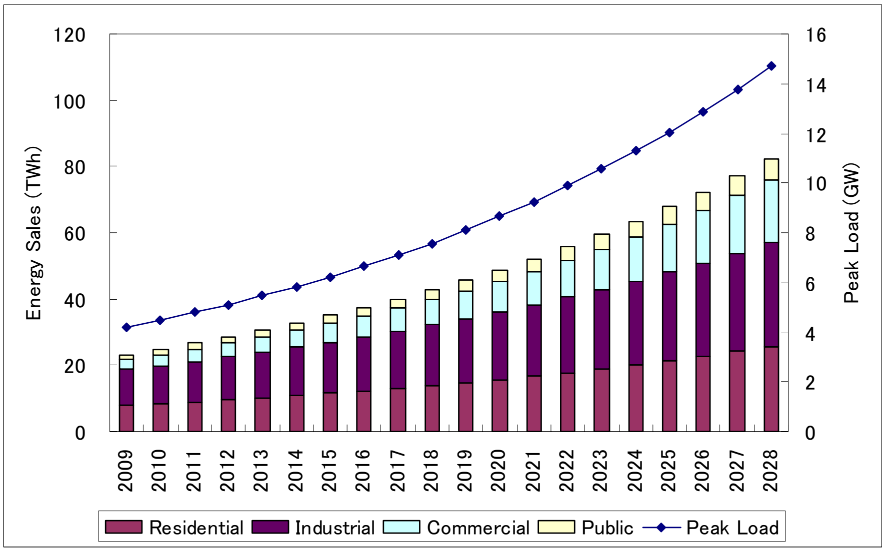


Fig.3.4-11 Energy Sales and Peak Load in East Java

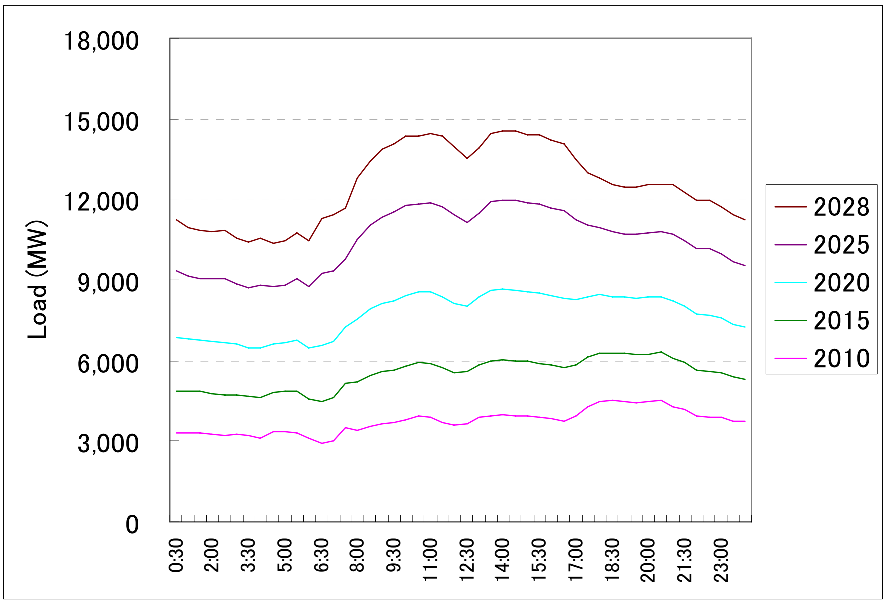


Fig.3.4-12 Daily Load Curve in East Java

5) Bali

Fig.3.4-13 shows energy sales and peak load by sector in Bali region. In Bali, tourism is the major industry and it is reflected in demand growth. Compared to the other regions, the proportion of commercial demand is large and it will continue to grow in the future.

Fig.3.4-14 shows a transition of daily load curve in Bali. In Bali, peak shift is expected to occur in around 2022.

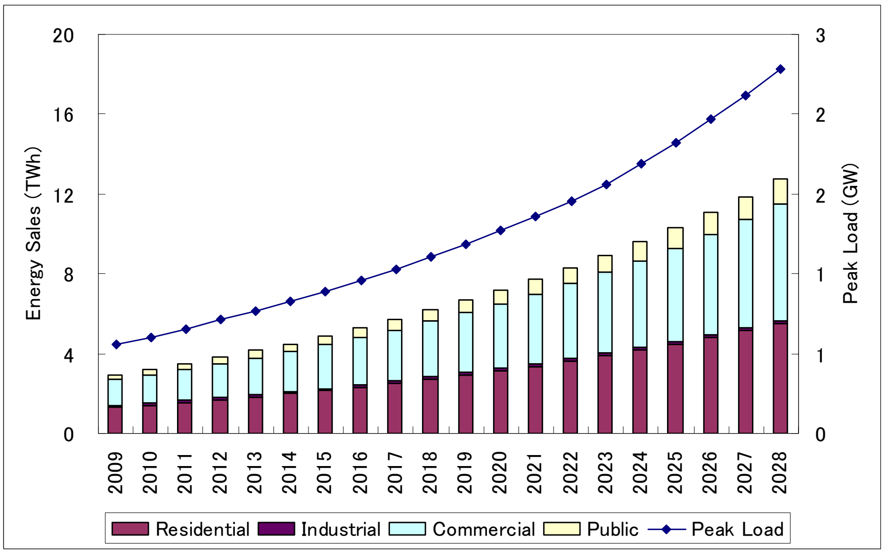


Fig.3.4-13 Energy Sales and Peak Load in Bali

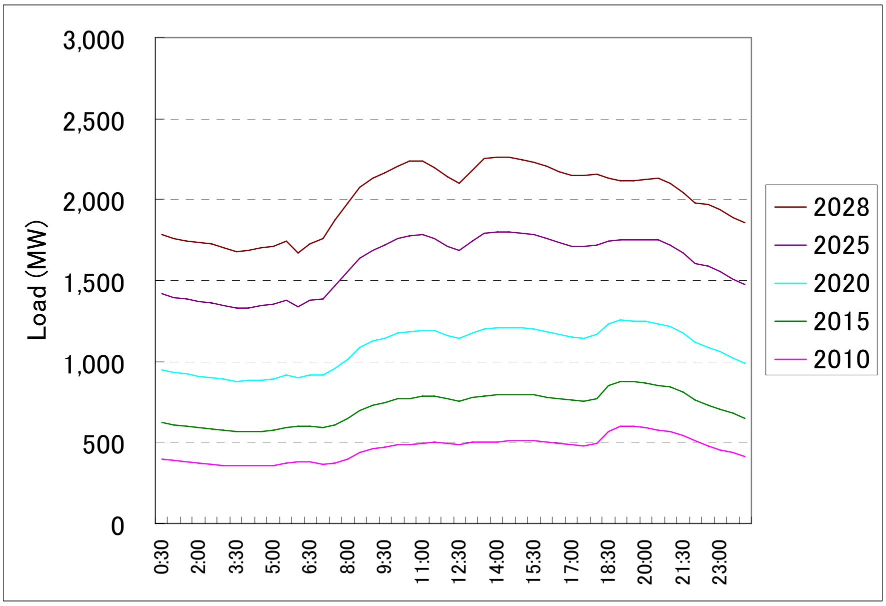


Fig.3.4-14 Daily Load Curve in Bali

Regional demand forecast should be consistent with a system wide demand forecast. Fig.3.4-15 shows the resultant peak demand of whole Jamali system whose calculations are explained in the previous section and the total peak demand which is calculated by adding daily load curves of these regions. The former indicates the peak demand at generating end including transmission/distribution losses and own use, while the latter indicates the peak demand at regional level without own use and losses in higher voltage system. Therefore, there are a few percent differences between them, but it can be judged that they are mutually consistent.

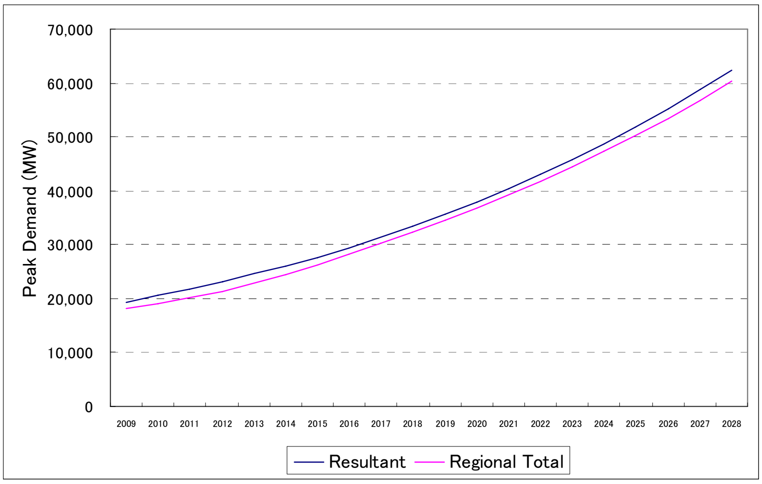


Fig.3.4-15 Resultant Peak Demand and Regional Total Demand

Table 3.4-3 (1/2) Result of Regional Demand Forecast

(1) Jakarta

	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Energy Sales																					
- Residential	GWh	10,311	10,886	11,493	12,133	12,808	13,521	14,273	15,066	15,902	16,785	17,716	18,699	19,735	20,829	21,982	23,199	24,483	25,838	27,267	28,775
- Public	GWh	2,107	2,228	2,355	2,490	2,632	2,782	2,940	3,106	3,282	3,468	3,663	3,870	4,088	4,317	4,560	4,816	5,086	5,370	5,671	5,988
- Commercial	GWh	9,261	9,902	10,581	11,301	12,064	12,873	13,731	14,639	15,602	16,623	17,705	18,852	20,067	21,356	22,721	24,168	25,702	27,328	29,051	30,877
- Industrial	GWh	9,575	10,012	10,470	10,948	11,449	11,973	12,522	13,095	13,695	14,323	14,980	15,667	16,386	17,138	17,925	18,748	19,609	20,510	21,452	22,438
Total Energy Sales	**GWh**	**31,253**	**33,027**	**34,899**	**36,872**	**38,954**	**41,149**	**43,464**	**45,906**	**48,482**	**51,199**	**54,065**	**57,087**	**60,276**	**63,639**	**67,188**	**70,931**	**74,880**	**79,046**	**83,441**	**88,078**
(Growth)	%		5.68%	5.67%	5.66%	5.64%	5.64%	5.63%	5.62%	5.61%	5.60%	5.60%	5.59%	5.59%	5.58%	5.58%	5.57%	5.57%	5.56%	5.56%	5.56%
- Station Use	%	0.34%	0.34%	0.34%	0.34%	0.34%	0.34%	0.34%	0.34%	0.34%	0.34%	0.34%	0.34%	0.34%	0.34%	0.34%	0.34%	0.34%	0.34%	0.34%	0.34%
- T&D Loss	%	11.80%	11.60%	11.40%	11.20%	10.90%	10.60%	10.30%	10.00%	9.70%	9.40%	9.10%	8.80%	8.50%	8.20%	7.90%	7.60%	7.30%	7.00%	6.70%	6.40%
Generated Energy	**GWh**	**35,571**	**37,506**	**39,541**	**41,683**	**43,887**	**46,204**	**48,640**	**51,201**	**53,893**	**56,724**	**59,700**	**62,830**	**66,121**	**69,582**	**73,221**	**77,048**	**81,074**	**85,307**	**89,760**	**94,443**
Load Factor	%	77.0%	76.5%	76.0%	75.5%	75.1%	74.8%	74.6%	74.5%	74.5%	74.4%	74.4%	74.3%	74.3%	74.2%	74.2%	74.1%	74.1%	74.0%	74.0%	73.9%
Peak Load	**MW**	**5,274**	**5,597**	**5,939**	**6,302**	**6,671**	**7,051**	**7,443**	**7,845**	**8,263**	**8,703**	**9,166**	**9,653**	**10,166**	**10,705**	**11,273**	**11,870**	**12,498**	**13,160**	**13,856**	**14,589**
(Growth)	%		6.13%	6.12%	6.11%	5.85%	5.70%	5.55%	5.41%	5.33%	5.32%	5.32%	5.31%	5.31%	5.30%	5.30%	5.30%	5.30%	5.29%	5.29%	5.29%

(2) West Java

	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Energy Sales																					
- Residential	GWh	10,965	11,580	12,230	12,915	13,639	14,404	15,212	16,064	16,965	17,916	18,920	19,980	21,100	22,283	23,531	24,850	26,242	27,713	29,266	30,906
- Public	GWh	1,066	1,152	1,243	1,340	1,442	1,549	1,663	1,784	1,911	2,046	2,188	2,338	2,497	2,665	2,843	3,030	3,229	3,438	3,660	3,894
- Commercial	GWh	2,890	3,127	3,378	3,641	3,920	4,214	4,524	4,851	5,196	5,559	5,943	6,348	6,776	7,226	7,702	8,204	8,733	9,291	9,880	10,502
- Industrial	GWh	21,817	23,170	24,607	26,135	27,758	29,482	31,314	33,261	35,329	37,526	39,861	42,342	44,978	47,779	50,754	53,916	57,275	60,844	64,637	68,666
Total Energy Sales	**GWh**	**36,738**	**39,029**	**41,458**	**44,031**	**46,759**	**49,649**	**52,713**	**55,960**	**59,400**	**63,047**	**66,913**	**71,009**	**75,351**	**79,953**	**84,830**	**90,000**	**95,479**	**101,287**	**107,443**	**113,967**
(Growth)	%		6.24%	6.22%	6.21%	6.19%	6.18%	6.17%	6.16%	6.15%	6.14%	6.13%	6.12%	6.11%	6.11%	6.10%	6.09%	6.09%	6.08%	6.08%	6.07%
- Station Use	%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
- T&D Loss	%	8.16%	8.12%	8.08%	8.04%	8.00%	7.96%	7.92%	7.87%	7.82%	7.77%	7.72%	7.67%	7.62%	7.57%	7.52%	7.47%	7.42%	7.37%	7.32%	7.27%
Generated Energy	**GWh**	**40,002**	**42,479**	**45,102**	**47,881**	**50,825**	**53,943**	**57,247**	**60,740**	**64,440**	**68,359**	**72,510**	**76,908**	**81,566**	**86,501**	**91,728**	**97,266**	**103,132**	**109,346**	**115,929**	**122,902**
Load Factor	%	75.2%	75.3%	75.4%	75.5%	75.6%	75.7%	76.0%	76.3%	76.6%	76.9%	77.2%	77.7%	78.1%	78.0%	77.9%	77.8%	77.6%	77.4%	77.2%	77.0%
Peak Load	**MW**	**6,072**	**6,440**	**6,828**	**7,240**	**7,674**	**8,135**	**8,599**	**9,087**	**9,603**	**10,148**	**10,722**	**11,306**	**11,922**	**12,660**	**13,442**	**14,272**	**15,171**	**16,127**	**17,142**	**18,221**
(Growth)	%		6.05%	6.03%	6.02%	6.01%	6.00%	5.71%	5.68%	5.68%	5.67%	5.66%	5.45%	5.45%	6.19%	6.18%	6.17%	6.30%	6.30%	6.30%	6.29%

(3) Cental Java

	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Energy Sales																					
- Residential	GWh	7,782	8,389	9,036	9,723	10,455	11,233	12,062	12,943	13,880	14,878	15,940	17,069	18,271	19,550	20,910	22,358	23,898	25,537	27,280	29,136
- Public	GWh	1,553	1,743	1,946	2,163	2,392	2,637	2,897	3,174	3,469	3,783	4,116	4,471	4,849	5,250	5,678	6,133	6,617	7,132	7,680	8,263
- Commercial	GWh	1,960	2,196	2,449	2,720	3,010	3,321	3,654	4,011	4,393	4,803	5,242	5,712	6,216	6,756	7,334	7,954	8,617	9,329	10,091	10,907
- Industrial	GWh	4,647	4,931	5,236	5,564	5,916	6,294	6,700	7,137	7,605	8,109	8,650	9,231	9,855	10,525	11,246	12,019	12,850	13,743	14,702	15,732
Total Energy Sales	**GWh**	**15,942**	**17,260**	**18,667**	**20,169**	**21,773**	**23,485**	**25,313**	**27,265**	**29,348**	**31,572**	**33,947**	**36,483**	**39,190**	**42,081**	**45,168**	**48,463**	**51,983**	**55,740**	**59,753**	**64,038**
(Growth)	%		8.27%	8.15%	8.05%	7.95%	7.86%	7.78%	7.71%	7.64%	7.58%	7.52%	7.47%	7.42%	7.38%	7.33%	7.30%	7.26%	7.23%	7.20%	7.17%
- Station Use	%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
- T&D Loss	%	7.95%	7.90%	7.85%	7.80%	7.75%	7.70%	7.65%	7.55%	7.45%	7.35%	7.25%	7.15%	7.05%	6.95%	6.85%	6.75%	6.65%	6.55%	6.45%	6.35%
Generated Energy	**GWh**	**17,319**	**18,740**	**20,257**	**21,876**	**23,602**	**25,444**	**27,410**	**29,491**	**31,710**	**34,077**	**36,601**	**39,292**	**42,163**	**45,224**	**48,489**	**51,971**	**55,686**	**59,647**	**63,873**	**68,380**
Load Factor	%	64.1%	64.2%	64.2%	64.3%	64.3%	64.4%	64.4%	64.5%	64.7%	65.0%	65.4%	65.9%	66.5%	67.2%	68.0%	68.9%	69.8%	69.8%	69.7%	69.6%
Peak Load	**MW**	**3,084**	**3,335**	**3,602**	**3,887**	**4,190**	**4,514**	**4,859**	**5,219**	**5,595**	**5,985**	**6,389**	**6,806**	**7,238**	**7,682**	**8,140**	**8,611**	**9,107**	**9,755**	**10,461**	**11,215**
(Growth)	%		8.13%	8.01%	7.90%	7.81%	7.72%	7.64%	7.43%	7.19%	6.97%	6.75%	6.54%	6.34%	6.14%	5.96%	5.78%	5.77%	7.11%	7.24%	7.21%

Table 3.4-3 (2/2) Result of Regional Demand Forecast

(4) East Java

	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Energy Sales																					
- Residential	GWh	7,923	8,423	8,955	9,521	10,123	10,764	11,446	12,171	12,943	13,765	14,638	15,568	16,557	17,610	18,730	19,921	21,189	22,538	23,973	25,501
- Public	GWh	1,401	1,538	1,683	1,837	2,001	2,175	2,361	2,559	2,769	2,993	3,231	3,484	3,753	4,040	4,345	4,670	5,015	5,382	5,773	6,189
- Commercial	GWh	3,015	3,361	3,739	4,151	4,599	5,088	5,622	6,203	6,836	7,526	8,279	9,099	9,993	10,967	12,029	13,186	14,448	15,823	17,321	18,955
- Industrial	GWh	10,720	11,400	12,112	12,859	13,640	14,460	15,318	16,217	17,160	18,147	19,181	20,265	21,401	22,591	23,837	25,143	26,512	27,946	29,448	31,022
Total Energy Sales	**GWh**	**23,060**	**24,722**	**26,489**	**28,367**	**30,364**	**32,488**	**34,747**	**37,150**	**39,708**	**42,430**	**45,329**	**48,416**	**51,704**	**55,207**	**58,941**	**62,920**	**67,163**	**71,689**	**76,516**	**81,667**
(Growth)	%		7.21%	7.15%	7.09%	7.04%	6.99%	6.95%	6.92%	6.88%	6.86%	6.83%	6.81%	6.79%	6.78%	6.76%	6.75%	6.74%	6.74%	6.73%	6.73%
- Station Use	%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
- T&D Loss	%	8.27%	8.22%	8.17%	8.12%	8.07%	8.02%	7.97%	7.92%	7.82%	7.72%	7.62%	7.52%	7.42%	7.32%	7.22%	7.12%	7.02%	6.92%	6.82%	6.72%
Generated Energy	**GWh**	**25,141**	**26,939**	**28,849**	**30,877**	**33,033**	**35,324**	**37,760**	**40,350**	**43,081**	**45,985**	**49,073**	**52,358**	**55,854**	**59,574**	**63,534**	**67,751**	**72,242**	**77,027**	**82,125**	**87,559**
Load Factor	%	68.2%	68.2%	68.2%	68.3%	68.3%	68.3%	68.4%	68.6%	68.8%	69.2%	69.1%	69.1%	69.0%	69.0%	68.9%	68.9%	68.8%	68.8%	68.7%	68.7%
Peak Load	**MW**	**4,211**	**4,510**	**4,827**	**5,165**	**5,523**	**5,903**	**6,301**	**6,718**	**7,147**	**7,590**	**8,106**	**8,655**	**9,239**	**9,862**	**10,525**	**11,232**	**11,985**	**12,788**	**13,644**	**14,558**
(Growth)	%		7.10%	7.04%	6.99%	6.93%	6.89%	6.74%	6.63%	6.38%	6.20%	6.79%	6.77%	6.75%	6.74%	6.72%	6.71%	6.71%	6.70%	6.70%	6.69%

(5) Bali

	Unit	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Energy Sales																					
- Residential	GWh	1,287	1,402	1,523	1,653	1,790	1,937	2,093	2,258	2,435	2,623	2,822	3,035	3,261	3,501	3,757	4,030	4,320	4,628	4,956	5,305
- Public	GWh	217	245	274	306	340	375	414	454	497	543	592	644	699	758	821	888	959	1,034	1,114	1,200
- Commercial	GWh	1,293	1,408	1,531	1,663	1,804	1,955	2,116	2,289	2,475	2,673	2,886	3,114	3,357	3,619	3,898	4,198	4,518	4,862	5,230	5,623
- Industrial	GWh	90	92	94	97	100	103	106	109	113	116	120	124	129	133	138	143	149	154	160	167
Total Energy Sales	**GWh**	**2,887**	**3,146**	**3,423**	**3,718**	**4,033**	**4,370**	**4,728**	**5,111**	**5,520**	**5,955**	**6,420**	**6,917**	**7,446**	**8,011**	**8,615**	**9,258**	**9,945**	**10,678**	**11,460**	**12,295**
(Growth)	%		8.98%	8.80%	8.63%	8.47%	8.33%	8.21%	8.10%	7.99%	7.90%	7.81%	7.73%	7.66%	7.59%	7.53%	7.47%	7.42%	7.37%	7.33%	7.28%
- Station Use	%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
- T&D Loss	%	7.75%	7.70%	7.65%	7.60%	7.55%	7.50%	7.45%	7.40%	7.35%	7.30%	7.25%	7.20%	7.15%	7.10%	7.05%	7.00%	6.95%	6.90%	6.85%	6.80%
Generated Energy	**GWh**	**3,130**	**3,409**	**3,707**	**4,024**	**4,363**	**4,724**	**5,109**	**5,520**	**5,957**	**6,424**	**6,922**	**7,453**	**8,020**	**8,624**	**9,268**	**9,955**	**10,688**	**11,469**	**12,303**	**13,192**
Load Factor	%	64.6%	64.9%	65.2%	65.5%	65.8%	66.1%	66.4%	66.7%	67.0%	67.3%	67.6%	67.9%	68.2%	68.5%	68.5%	68.1%	67.7%	67.3%	66.9%	66.5%
Peak Load	**MW**	**553**	**600**	**649**	**701**	**757**	**816**	**878**	**945**	**1,015**	**1,090**	**1,169**	**1,253**	**1,342**	**1,437**	**1,545**	**1,669**	**1,802**	**1,945**	**2,099**	**2,265**
(Growth)	%		8.42%	8.24%	8.07%	7.92%	7.78%	7.66%	7.55%	7.45%	7.36%	7.27%	7.20%	7.13%	7.06%	7.47%	8.04%	7.99%	7.95%	7.91%	7.87%