

*The Study on National Power Development Plan for the period of 2006-2015, perspective up to 2025 in Vietnam*

## Progress of JICA Study

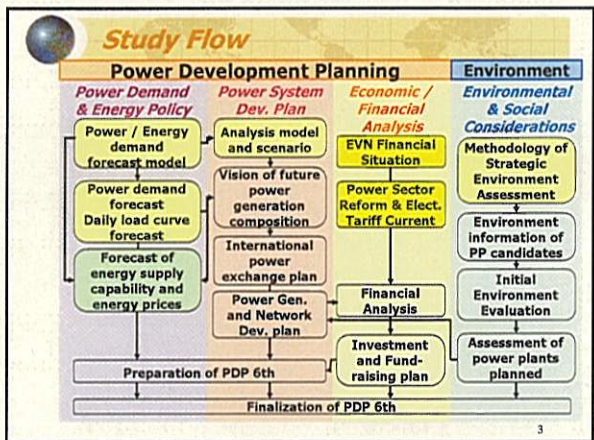
Jul. 2005

Japan International Cooperation Agency (JICA)

Tokyo Electric Power Co., Inc. (TEPCO)  
Tokyo Electric Power Service Co., Ltd. (TEPSCO)

## Scope of the Study

- (1) Review of implementation of 5th MP
- (2) Preparation of PDP 6th
  - a. Power demand forecast
  - b. Primary energy policy for PDP
  - c. Optimization of power generation development plan
  - d. Optimization of power network development plan
  - e. Financial and economic analysis
  - f. Environmental and social considerations
- (3) Finalization of PDP 6th
- (4) Capacity development



## Schedule

Assignment	2005					2006								
	5	6	7	8	9	10	11	12	1	2	3	4	5	
preparation in Japan														
1st study in VN														
2nd study in VN														
3rd study in VN														
4th study in VN														
5th study in VN														
1st study in Japan														
2nd study in Japan														
Power Demand and Primary Energy														
Power System Development Planning														
Economics and Finance														
Socio-environmental Consideration														
Work shop														
Report														

Legend: study in Vietnam (orange), study in Japan (blue)

## End of Session

Thank you for your attention!

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## Power Demand Forecasting

Jul. 2005

Japan International Cooperation Agency (JICA)

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## CONTENTS

1. Social economic plan
2. Power demand Forecast
3. Daily load curve forecast
4. Recommends

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## 1. Social economic plan

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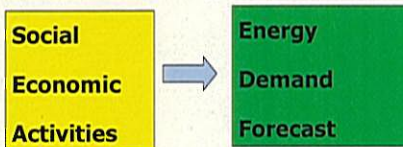


## 1. Social economic plan

### 1. Social economic plan

#### (1) Source of social economic outlook

- Energy demand and social economic activities have strongly relation each another.
- The indicators of social economic outlook are preconditions for energy demand forecasting



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## 1. Social economic plan

- **"ECONOMIC DEVELOPMENT FORECAST SERVING STUDY ON ENERGY DEVELOPMENT FOR THE PERIOD UP TO 2050" is already studied.**
- **The economic development outlook is used as the precondition**
- **The report is also referred by IE - EVN**

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## 1. Social economic plan

### (2) The Economic Development Scenarios

- The international environment is stable with economic globalization and liberalization.
- The investment flows (especially FDI) are more favorable.
- Technology progress will be continued but there is no big change.
- The energy price in the world is stable
- Vietnam restructuring will succeed.

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## 1. Social economic plan

- Industry development of export, labor-intensive sectors with high value are promoted.
- Tourism and commerce, finance are strongly and rapidly developed.
- The infrastructure facilities, basic industries will be developed.
- The transportation, telecommunication, water supply systems have been developed.
- The main industries (metal, chemical, machinery, IT etc.) have been developed.

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## 1. Social economic plan

### (3) The Economic Outlook by Scenario

Three kinds of scenarios are prepared. GDP growth rates are follow;

	2006-10	2011-20	2021-30
<b>1. High case</b>			
Accomplish all scenarios	8.5%	8.5%	8.0%
<b>2. Base case</b>			
Accomplish most of the scenario, but not all	7.5%	7.2%	7.0%
<b>3. Low case</b>			
Not realize the scenario	6.0%	7.0%	7.0%

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## 2. Power demand Forecast

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## 2. Power demand Forecast

### 2. Power Demand Forecast

#### (1) Concept of Forecast Model

- Power demand is forecasted by region (North, Central South)
- Energy prices are considered as important factors
- Power demand is forecasted in line with total energy demand
- Daily load curve and Peak demand are forecasted
- Supply and demand balance of primary energies are examined.

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## 2. Power demand Forecast

- For building the model, **econometric method** is applied
- The model can be classified to two sub-models, "Power Demand Forecasting Model" and "Daily Load Curve Forecasting Model"

### Power Demand

1. Macro Economy
2. Power Demand
3. Energy demand
4. Regional PD

### Daily Load Curve

1. Daily load curve
2. Peak demand
3. Load Factor
4. Power Demand

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## 2. Power demand Forecast

### (2) Main output

- Power demand forecast
  - by economic scenario (High, Base, Low)
  - by region (North, Central, South).
  - by sector (Agriculture, Industry, Transport,,,,)
- Energy demand forecast
- Daily load curve
- Load factor and Peak demand

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## 2. Power demand Forecast

### (3) Power demand Forecasting Model

#### 1. Macro economic Forecast

- (1) Social economic indices
  - Employees
  - Population
  - GDE
  - Prices & foreign exchange
- (2) Production activities
  - GDP by sector
  - Labor productivity
- (3) Energy prices
  - Crude oil price
  - Electricity tariffs
  - Fuel prices

#### 2. Power demand Forecast

- (1) Energy demand by sector
  - Agriculture
  - Manufacturing
  - Trade & Commercial
  - Transport & Communication
  - Residential
- (2) Power demand by sector
- (3) Own use & T/D loss
- (4) Power generation
- (5) Energy consumption for power

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## 2. Power demand Forecast

### 3. Regional power demand

(1) North  
GDP  
Power demand

(2) Central  
GDP  
Power demand

(3) South  
GDP  
Power demand

### 4. Oil Refinery

(1) Oil Productions  
RF-LPG  
Gasoline  
Jet fuel  
Kerosene  
Diesel  
Fuel oil  
Naphtha  
etc.

(2) Production from NGL

(3) Production total

(4) Hydro cracking

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## 2. Power demand Forecast

### (4) Model image in EXCEL

Sheets	CONTENTS
Power	Calculate the capacities of Power generators
Data	Input area for actual data
Model	Describe the model structure
Simulation	Forecast results from SimpleE
Growth	Calculate the growth rate and Elasticity
Summary	Summary for Energy & Power demand forecast
Ex/Import	Export & Import Petroleum Products

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## 2. Power demand Forecast

### (5) The preconditions of the forecast

<Exchange rate >

Cases	Unit	2005	2010	2015	2020	2025
All Cases	VND/\$	16,077	17,621	19,313	21,168	21,168

<Population growth rate >

Cases	Unit	05/00	10/05	15/10	20/15	25/20
All Cases	%	1.4	1.1	1.1	1.1	0.8

<Crude oil price (WTI) >

Case	Unit	2004	2005	2006	2007	2025
High Case	bbl/\$	40	45	40	35	35

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## 2. Power demand Forecast

<GDP growth rate >

Cases	Unit	05/00	10/05	15/10	20/15	25/20
High	%	7.4	8.5	8.5	8.5	8.0
Base	%	7.4	7.5	7.2	7.0	7.0
Low	%	7.4	6.0	7.0	7.0	7.0

< Power ratio >

Case	Unit	2005	2010	2015	2020	2025
Agriculture	%	11	13	13	13	13
Industry	%	15	20	25	30	30
Transport	%	0.6	1.0	1.3	1.7	2.0
Commercial	%	13	20	27	34	40
Residential	%	11	16	21	25	30

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## 2. Power demand Forecast

<Power ratio (13% in 2025) of Agriculture >

Agriculture %

$ER = \text{Power} / (\text{Power} + \text{fossil energy}) * 100$

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## 2. Power demand Forecast

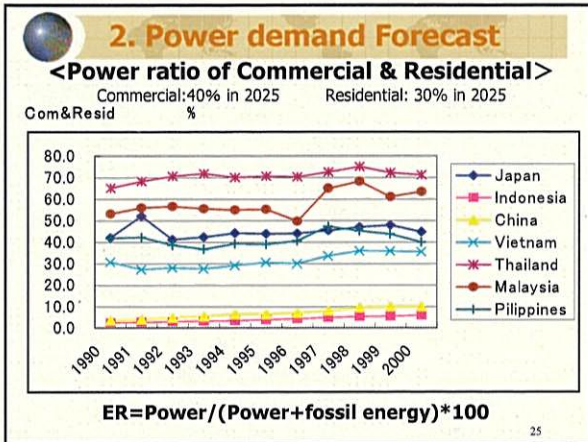
<Power ratio (30% in 2025) of Industry >

Industry %

$ER = \text{Power} / (\text{Power} + \text{fossil energy}) * 100$

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### 2. Power demand Forecast

(6) The results of the forecast < High case >  
 • Power Demand forecast by JICA team

GWh

	1995	2000	2005	2010	2015	2020	2025
(1)Agriculture	241	428	777	870	925	977	1,003
(2)Manufacturing	4,619	9,088	19,345	39,406	66,934	111,127	161,287
(3)Transportation	105	244	337	1,540	2,989	4,810	6,727
(4)Commercial	548	1,084	2,143	5,670	10,916	19,639	31,024
(5)Residential	5,369	10,986	21,629	35,501	55,288	84,769	127,919
(6)Others	316	567	1,451	2,460	3,520	5,006	6,975
<b>Total</b>	<b>11,198</b>	<b>22,398</b>	<b>45,682</b>	<b>85,447</b>	<b>140,572</b>	<b>226,329</b>	<b>334,933</b>
Growth rate		19.3%	15.3%	13.3%	10.5%	10.0%	8.2%

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### 2. Power demand Forecast

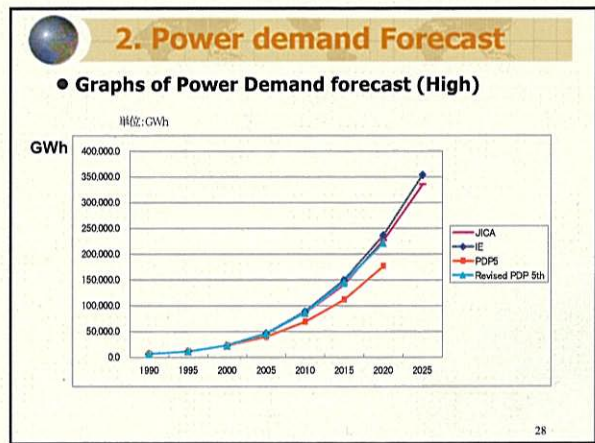
• Comparison of Power Demand forecast (High)

GWh

	1995	2000	2005	2010	2015	2020	2025
JICA	11,198	22,398	45,682	85,447	140,572	226,329	334,933
IE	11,198	22,398	45,682	87,909	148,938	235,890	353,456
PDP5	11,198	22,398	39,066	68,538	111,066	176,696	
Revised PDP5th	11,198	22,398	44,944	85,678	144,057	221,723	

IE's is greater than JICA's with 5.5% in 2025.

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### 2. Power demand Forecast

< Base case >  
 • Power Demand forecast by JICA team

GWh

	1995	2000	2005	2010	2015	2020	2025
(1)Agriculture	241	428	777	849	890	926	933
(2)Manufacturing	4,619	9,088	19,345	37,726	61,288	97,118	136,426
(3)Transportation	105	244	337	1,448	2,532	3,741	4,952
(4)Commercial	548	1,084	2,143	5,381	9,515	15,820	23,444
(5)Residential	5,369	10,986	21,629	34,577	51,639	75,238	108,386
(6)Others	316	567	1,451	2,342	3,158	4,236	5,644
<b>Total</b>	<b>11,198</b>	<b>22,398</b>	<b>45,682</b>	<b>82,324</b>	<b>129,022</b>	<b>197,079</b>	<b>279,784</b>
Growth rate		19.3%	15.3%	12.5%	9.4%	8.8%	7.3%

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### 2. Power demand Forecast

• Comparison of Power Demand forecast(Base)

GWh

	1995	2000	2005	2010	2015	2020	2025
JICA	11,198	22,398	45,682	82,324	129,022	197,079	279,784
IE	11,198	22,398	45,682	84,611	137,577	204,972	291,130
PDP5	11,198	22,398	37,116	61,572	95,747	146,555	
Revised PDP5th	11,198	22,398	44,944	80,486	124,203	178,568	

IE's is greater than JICA's with 6.0% in 2025.

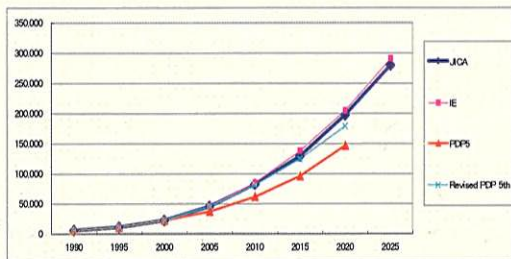
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## 2. Power demand Forecast

- Graphs of Power Demand forecast (Base)

GWh



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## 2. Power demand Forecast

- (7) Evaluation of the results

- Energy & Power demand per capita

High case		2005	2010	2015	2020	2025
Energy demand per capita	KOE /person	442	605	763	949	1,182
Power demand per capita	KWh /person	550	975	1,520	2,318	3,304
Base Case		2005	2010	2015	2020	2025
Energy demand per capita	KOE /person	442	580	687	805	963
Power demand per capita	KWh /person	550	940	1,395	2,018	2,760

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## 2. Power demand Forecast

- Energy demand per capita of other countries

(KOE/cap.)

Country	2001	2010	2015	2020	2025
Vietnam (High)	115	417	588	787	1,036
Thailand	374				
Malaysia	720				
Indonesia	443				
Philippines	112				

Exclude Renewable energies

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## 2. Power demand Forecast

- Power demand per capita of other countries

(kWh/cap.)

Country	2001	2010	2015	2020	2025
Vietnam (High)	316	975	1,520	2,318	3,304
Thailand	1,460				
Malaysia	2,706				
Indonesia	384				
Philippines	490				
Japan	6,800				

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## 2. Power demand Forecast

- Power demand per GDP of other countries

(kWh / \$)

Country	2001	2010	2015	2020	2025
Vietnam (High)	0.81	0.94	0.84	0.74	0.56
Thailand	0.79				
Malaysia	0.74				
Indonesia	0.60				
Philippines	0.53				

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## 3. Daily load curve forecast

### 3. Daily load curve forecast

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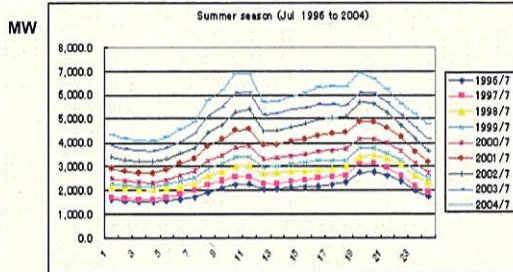




### 3. Daily load curve forecast

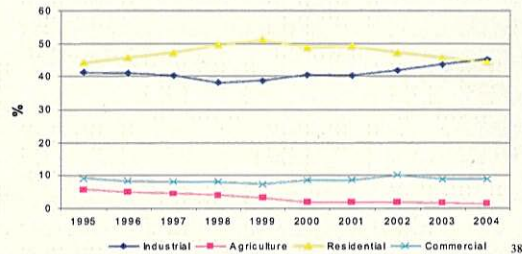
#### (1) Present situation

- The daily load curve in Vietnam shows peak demand at 11 am and at 7 pm.



### 3. Daily load curve forecast

- Recently, the growth rate of power demand in day time prefers to ones of power demand in night time in proportion with increasing power demand in industry and commercial sectors.



### 3. Daily load curve forecast

- The differences between day time power demand and night time power demand becomes narrow year by year, and peak demand rapidly increases.

	1998	1999	2000	2001	2002	2003	2004
Peak Demand (kW)	3,875	4,328	4,893	5,655	6,552	7,408	8,283
Growth Rate (%)	7.8	11.7	13.1	15.6	13.9	13.1	11.8
Load Factor	0.64	0.62	0.63	0.62	0.63	0.64	0.64

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### 3. Daily load curve forecast

#### (2) Concept of the forecasting

- The daily load curve forecast is carried out under the preconditions of several economic and nature preconditions and using **regression analysis**.
- The daily load curve is forecasted with classification of North, Center and South due to different preconditions in each region.

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### 3. Daily load curve forecast

#### (3) Experiences of the peak demand changes

- As some Asian countries have experiences that the daily peak demand shifted from night time to day time, the regression analysis contains the DLC data of the other countries.
- The referred countries are selected under ① countries are located near Vietnam, ② countries have the same weather as Vietnam, ③ countries have the experience of DLC shifting
- As the results, Thailand, Malaysia, Philippines, Indonesia and Japan are selected.

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### 3. Daily load curve forecast

#### (4) Daily Load Curve Forecasting Model

##### 1. Daily Load Curve

Hourly demand in Months Classified

by region (North, Center, South)

by type (Peakday, Weekday, Holiday)

##### 2. Peak demand & Load Factor by region

(1) Monthly Consumption (MWh)

(2) Peak Load (MW)

(3) Monthly Load Factor

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### 3. Daily load curve forecast

< Daily Load Curve Forecasting Model in EXCEL >

Sheets	CONTENTS
Data	Input area for actual hourly load data
Model	Describe the model structure of future hourly load
Simulation	Forecast results from SimpleE
Data analysis	Calculate DLC & LF of Monthly and yearly
Whole	Graphs for DLC of whole country
North	Graphs for DLC of North country
Central	Graphs for DLC of Central country
South	Graphs for DLC of South country
Load factor	Comparison of LF

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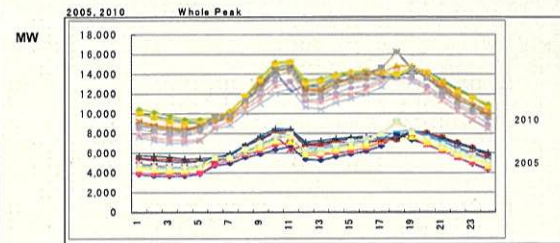


### 3. Daily load curve forecast

(5) The Results of Load Curve Forecast

• Night time to Day time

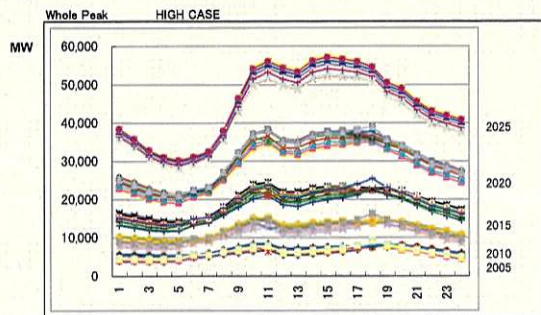
The peak demand in the day time becomes higher than peak demand in the night time year by year.



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### 3. Daily load curve forecast



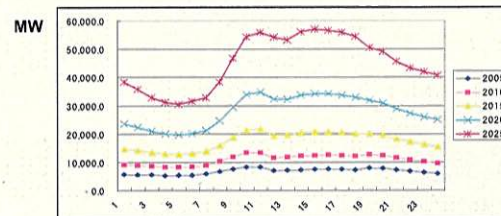
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### 3. Daily load curve forecast

• P-max at 11 o'clock in summer season

A day time peak and a night time peak appear in 2005. In 2010, a daytime peak increases higher than night time peak, especially summer season.



Peak demand in summer (High Case)

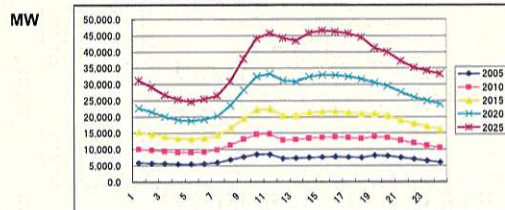
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### 3. Daily load curve forecast

The p-max at around 11 o'clock

July Peak demand (Base case)



Peak demand in summer (Base Case)

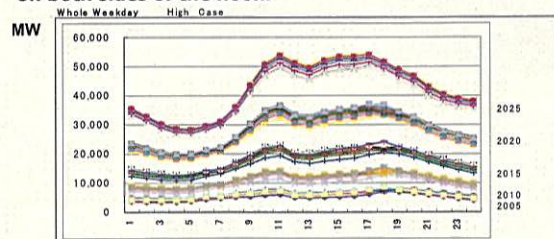
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### 3. Daily load curve forecast

• 14:00 – 16:00 increase

After 2010, the daytime power demand between 14:00–16:00 will increase, and Vietnam may approach a developed country type, which indicates two peaks on both sides of the noon.



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