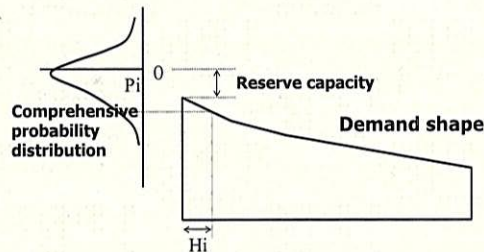


## Definition of System Reliability

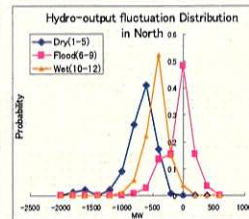
- Reliability; LOLE Loss of Load Expectation
- $LOLE = \sum (P_i \times H_i)$



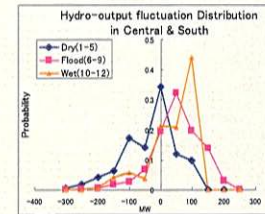
91

## Water Flow Fluctuation

- Difference between actual record and plan of Hydropower plant outputs at peak demand in 1996 - 2001



North system



South system

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## Proceeding Power Development Projects

- Total 430MW will be delayed by 2005
- The North system -300MW
- The Central & South system -130MW

Unit: MW

	2005		
	Plan	Actual	Diff.
North	500	200	-300
C&S	1140	1010	-130
Total	1640	1210	-430

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## Balance between Supply and Demand

- Balance in the North and C&S systems

	2003		2004		2005	
	North	C&S	North	C&S	North	C&S
Demand (MW)	3111	4165	3453	4759	3830	5398
Firm Capacity (MW)	3169	4933	3288	6321	3392	7341
Reserve Margin (MW)	58	768	-165	1562	-438	1943
Reserve Margin Rate (%)	1.9	18.4	-4.8	32.8	-11.4	36.0
LOLE (hour)	72	61	62	4	115	2

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## Issues of the revised 5<sup>th</sup> MP

- Limitation of 500kV interconnection capacity
- Delay of Power development project
- Water Flow Fluctuation
- Reconciling PDP with Energy resource development plan

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## Establishment of Scenarios

- Energy policy
- System reliability
- Demand fluctuation, fuel cost rising, International power exchange etc.

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### Establishment of Scenarios

- ❖ Setting up Assumptions & Conditions based on the Risks
  - ❑ Daily load Curve, Limitation of transmission
- ❖ System reliability analysis
  - ❑ Necessary Reserve margin
- ❖ Screening Analysis
  - ❑ Selection of Economical Arrangement

To establish Scenarios for Quantification of annual costs by "PDPAT II" & "Strategist" Simulation for divided systems

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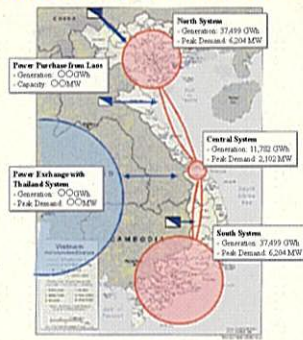
### Risks to consider for PDP

- ❖ Demand forecast scenarios (High, Base)
- ❖ Limitation of 500kV interconnection between North and South systems
- ❖ Feasibility of power import
- ❖ Power exchange with neighboring countries through interconnections
- ❖ Delay of power development projects
- ❖ Constraint and condition of BOT plant operation
- ❖ Fuel price hike
- ❖ Reconciling PDP with power resource development plan
- ❖ Changing a daily load curve
- ❖ Water flow fluctuation

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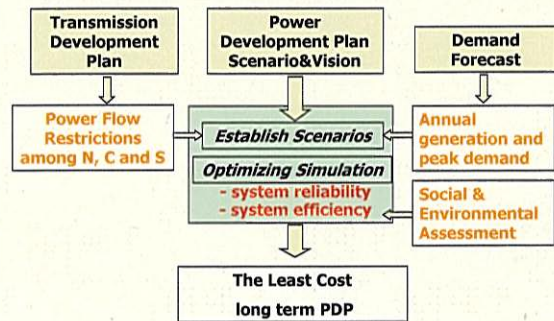
### Power system and Interconnection in Vietnam



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### Study Flow on PDP



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**End of Session**

**Thank you for your attention!**

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



## Power Network Development

Jul. 2005

Japan International Cooperation Agency (JICA)

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

### Transition of total circuit length of transmission lines

(Unit: km)

year	1990	1995	1999	2003
500 kV	-	1,487	1,532	1,530
220 kV	1,359	2,272	3,257	4,649
66 kV	4,265	6,059	7,493	8,965
110 kV				(only 110 kV)

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### Needs of studies

#### on countermeasures against excess fault current

- ❖ Over 40 kA around Thu Duc, Phu Lam and Tanh Dinh in 220 kV and 110 kV systems
- ❖ Countermeasures
  - ❑ Installation of the circuit breakers with larger capacity
  - ❑ Splitting buses

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### 500 kV 1st Transmission Lines

Interval	Distance	No.	Conductor	Commission year
Hoa Binh – Ha Tinh	341 km	1	ACSR 330 mm *4	1994
Ha Tinh -Da Nang	390 km	1	ACSR 330 mm *4	1994
Da Nang – Plei Ku	259 km	1	ACSR 330 mm *4	1994
Pleiku - Phu Lam	496 km	1	ACSR 330 mm *4	1994
<b>Total</b>	<b>1,486 km</b>	-	<b>ACSR 330 mm *4</b>	
Yaly - Plei Ku	20.2 km	2	ACSR 330 mm *4	1999

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### Revised plans

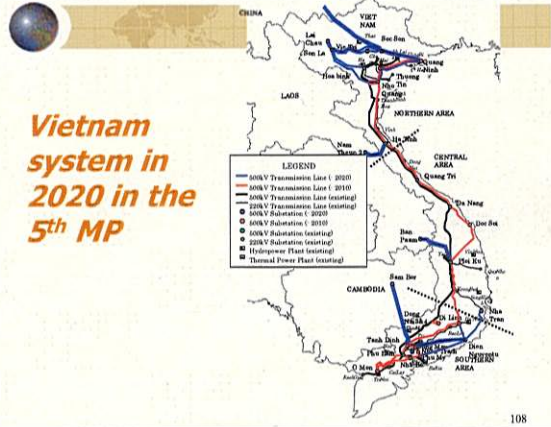
- ❖ The plan of adding a route of the 500 kV transmission lines and doubling circuits was made in the 5th MP.
- ❖ The plan was reviewed through the revised 5<sup>th</sup> MP in march 2003 in order to put up with the increase in power demand and enhancing system efficiency.

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### Power network construction

Works	No. of line x km	Revised 5 <sup>th</sup> MP	Present actual situation as of 2005
Plei Ku-Phu Lam (2nd line)	1 x 547	2003	Completed
Phu My – Nha Be	2 x 49	2003	Completed
Nha Be – Phu Lam	1 x 16	2003	Completed
Nha Be-O Mon	1 x 180	2005	Cai Lay-O Mon Sep 2005 2009 Designed for 500 kV now under operation of 220 kV
Plei Ku-Doc Soi-Da Nang	1 x 300	2004	Completed
Da Nang-Ha Tinh	1 x 390	2005	Completed
Ha Tinh-Tuong Tin	1 x 335	2005-2006	Not yet
Branch to Nho Quang 500 kV station	2 x 30	2005	2005

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**The planned power flows of north to south 500 kV transmission lines in 5th MP**

Year	2010	2020
Wet season	From north to south 800 MW - 1,000 MW	From north to south 800 - 1,100MW
Dry season	From south to north 200MW - 500 MW	From north to south 500 - 800MW

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**DC transmission line in 5th MP**

- ❖ DC transmission lines not suitable.
  - ❑ Requiring t-branch offs on the way of transmission lines and high cost.
- ❖ DC transmission lines could be for interregional connection to neighboring countries.

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**Voltage maintenance**

- ❖ The 5th MP pointed out the needs of the studies of the voltage maintenance.
- ❖ There are few var-compensators in the bulk power transmission system except for;
  - ❑ A 200 MVAR capacitor of Phu Lam.
  - ❑ A synchronous var-compensator with 48 MVAR in Uong Bi.

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**Series capacitors**

- ❖ Planned in some 500 kV transmission system realizing stable power transmission
- ❖ Requirements of the study on generator-shaft distortional oscillation by series capacitors

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**Power stability checking**

- ❖ System stability seemed to be checked in the 5th MP through the 1LG-O-C
- ❖ Severer and more general assumed faults such as 3LG-O (not re-closed) have to be applied for checking system stability

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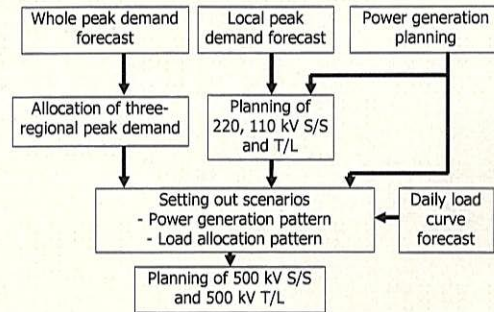
**The 6th MP Power Network**

## Method of Study of System Reliability

- ❖ System reliability and economic efficiency
  - ❑ Stabilization of whole transmission system spread over Vietnam
  - ❑ Power trades flow from the neighboring countries
  - ❑ Existence of large power trade brought by the various types of power sources

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## Planning procedure



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## Tools

- ❖ PSS/E
  - ❑ Generally used for this study
- ❖ IMPACT (developed by TEPCO)
  - ❑ Used for data arrangement
  - ❑ Special analysis

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## Analysis data phase for the 6<sup>th</sup> MP

- ❖ Year 2015 and 2020.
- ❖ Seasonal and hourly load variations.
- ❖ Generation operation patterns.
- ❖ N-1 criteria that means the power supply would be possible with remaining system even in case of a lack of unit of facilities of the system.

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## Stability analysis

- ❖ 220 kV and 110 kV systems
  - ❑ 3LGO (opening circuit breakers after 80 ms of three phases fault occurrence)
- ❖ 500 kV systems
  - ❑ 1LG-O-C-1LG-3O or 3LG-O

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## Maximum permissible fault currents and fault clearing times

Voltage level	Maximum fault current	Maximum fault clearing time
500 kV	40 kA	80 ms
220 kV	40 kA	100 ms
500 kV	31.5 kA	150 ms

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## Interregional transmission lines connected to foreign countries

- Only power sources transmission lines taken into account

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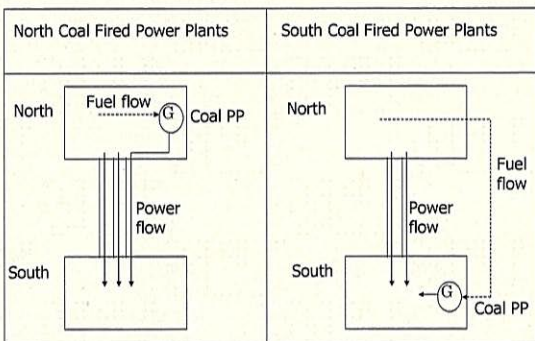
## Optimization Study

- How about reinforcement of 500 kV from north to south?

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## Optimization Study



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## End of Session

*Thank you for your attention!*

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



## Economic/Financial Analysis

Jul. 2005

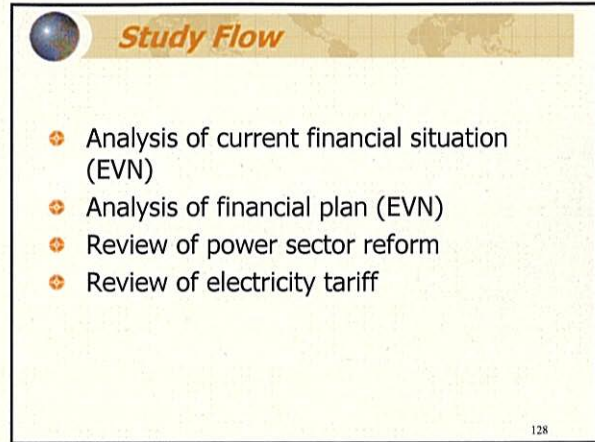
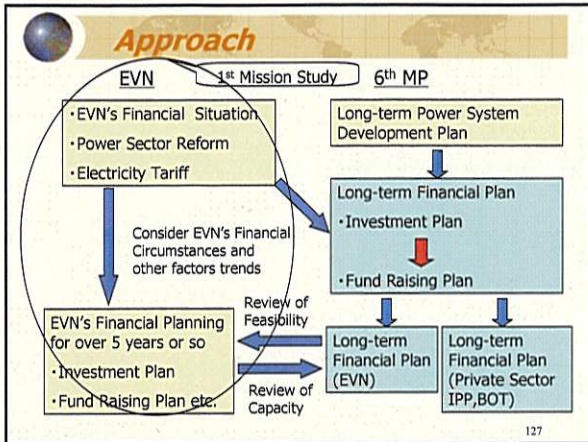
Japan International Cooperation Agency (JICA)

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

## CONTENTS



1. Approach
2. Study Flow
3. Analysis of current financial situation
4. Analysis of financial plan
5. Review of power sector reform
6. Review of electricity tariff



### Analysis of current financial situation (EVN)

- Balance Sheet Items (EVN)

Unit: Billion VND

	1999	2000	2001	2002	2003
<b>Total Assets</b>	51,539	60,035	63,924	76,174	87,716
<b>Non-current assets</b>	36,676	48,844	51,204	58,545	65,735
<b>Current assets</b>	14,863	11,191	12,720	17,629	21,981
<b>Equity</b>	27,090	27,897	28,747	34,154	36,749
<b>Long-term borrowings</b>	19,064	25,565	26,601	32,640	39,349
<b>Current Liabilities</b>	5,385	6,572	8,576	9,380	11,595

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### Analysis of current financial situation (EVN)

- Income Statement Items (EVN)

Unit: Billion VND

	1999	2000	2001	2002	2003
<b>Net sales</b>	14,121	16,510	19,209	23,565	30,245
<b>Cost of sales</b>	(10,929)	(13,574)	(15,958)	(19,087)	(21,886)
<b>Gross profit</b>	3,191	2,936	3,250	4,477	8,538
<b>Profit from operations</b>	2,086	1,947	2,127	3,110	2,880
<b>Net profit before tax</b>	1,733	1,397	1,540	2,328	1,848
<b>Profit after tax</b>	1,088	882	999	1,650	1,828

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### Analysis of current financial situation (EVN)

- Cash Flow Statement Items (EVN)

Unit: Billion VND

	1999	2000	2001	2002	2003
<b>Net cash flows from operating activities</b>	5,882	7,311	6,739	8,412	10,903
<b>Net cash flows from investing activities</b>	(11,666)	(13,696)	(9,206)	(9,913)	(13,522)
<b>Net cash flows from financing activities</b>	7,004	7,772	3,426	4,640	4,680
<b>Net increase in cash</b>	1,221	1,387	959	3,139	2,064
<b>Bank balance and cash at beginning of the year</b>	4,085	5,306	6,693	7,653	10,792
<b>Bank balance and cash at end of the year</b>	5,306	6,693	7,653	10,792	12,855

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### Analysis of current financial situation (EVN)

- Profitability (Over view)
  - Net sales have doubled in the last five years.
  - The indices show the stable profitability.

↓

Current situation: Soundness

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### Analysis of current financial situation (EVN)

- Profitability  
(Point 1: Increase of Net Sales)

	1999	2000	2001	2002	2003
Sales of Electricity (Billion VND)	14,124	15,135	17,540	21,474	27,480
Power Sales (Million kWh)	19,531	22,398	25,843	30,257	34,885
Electricity Rate (VND/kWh)	723	676	678	710	788

The Sales of Electricity increase is primarily attributable to the Power Sales increase.

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### Analysis of current financial situation (EVN)

- Profitability  
(Point 2: Foreign Exchange Losses)

Unit: Billion VND

	1999	2000	2001	2002	2003
Foreign exchange losses	520	153	245	313	4,157

The foreign exchange risk became obvious in the EVN financial status in 2003.

The foreign exchange fluctuation must be carefully noted.

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### Analysis of current financial situation (EVN)

- Solvency

	1999	2000	2001	2002	2003
1) Current Ratio (%)	276	170	148	187	189
2) Stockholders' Equity Ratio (%)	53	46	42	45	42
3) Cash Flow (Billion VND)	5,306	6,693	7,653	10,792	12,855

※1 Current Ratio = Current Assets / Current Liabilities

※2 Stockholders' Ratio = Equity / Total Assets

- Current Ratio (Short-term solvency) → Soundness
- Stockholders' Equity Ratio (Long-term solvency) → Still Good (but it tend to fall because of the increase of borrowings)

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### Analysis of financial plan (EVN)

- Forecasted Income statements (EVN)

Unit: Million US\$

	2004	2005	2006	2007	2008	2009	2010
Net sales	1,971	2,230	2,512	2,826	3,171	3,553	3,975
Cost of sales	1,806	2,073	2,452	2,703	3,131	3,469	3,944
Electricity purchase	320	536	727	981	1,262	1,545	1,694
Depreciation	524	546	609	591	732	818	967
Interest cost	82	93	107	135	177	216	270
Profit before tax	77	135	60	123	40	84	31
Net profit (after tax)	18	57	1	45	29	16	22

- Net sales increase thanks to the growing demand.
- The net profit remains unchanged because of the increase of the cost of sales, such as electricity purchase.

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### Analysis of financial plan (EVN)

- Forecasted Cash Flow (EVN)

Unit: Million US\$

	2004	2005	2006	2007	2008	2009	2010
Fund raising	1,508	1,833	2,385	2,776	2,847	2,917	2,843
• Internal fund	699	877	937	1,086	1,016	1,135	1,324
• Government subsidy	23	32	34	27	0	0	0
• Borrowings	786	924	1,414	1,663	1,831	1,782	1,518
Fund operation	1,508	1,833	2,385	2,776	2,847	2,917	2,843
• Power plant	547	891	1,319	1,645	1,644	1,595	1,278
• Transmission and distribution equipment	628	590	592	526	480	463	470
• Other	109	0	0	0	0	0	0
• JV	9	51	64	83	71	39	33
• Repayment	214	300	410	522	652	819	1,061

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### Review of Power sector Reform

- Concept of the Power Sector Reform

The purpose of the Power sector reform

- to introduce the principle of competition in the sector
- to establish the complete competition market

The power sector reform indispensably needs the organizational separation of EVN.

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### Review of Power sector Reform

#### Organization Separation of EVN

The regulatory body will study the future EVN organizational structure. Currently, it is planned as below;

- Generation sector
  - > Some of plant remain dependent accounting entities
  - > Some of plant will shift to independent accounting entities
  - > Some of plant will shift to equities company
  - > Some of plant will shift to Ltd. company

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### Review of Power sector Reform

#### Organization Separation of EVN

- Transmission sector
  - > The transmission sector will be regrouped into one NLDC and one transmission company.
  - > The transmission company will be a state own company like a EVN.
- Distribution sector
  - > Eight power companies will separate from EVN to be equities companies in the end.

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### Review of Power sector Reform

#### Conclusion

- > For the time being, EVN will own the majority of power generation, transmission and distribution companies' stocks.
- > All of them are expected to remain in the EVN group .

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### Review of Electricity Tariff

#### Fluctuation of the electricity tariff level

- > The tariff was revised four times since 1997 to increase but at a limited level.
  - > The package rate at a weighted average level increased from 5.2 ¢ to 5.6 ¢ (including VAT) in Sep., 2002 .
- After that, the tariff level has not been raised until now.

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### Review of Electricity Tariff

#### Future electricity tariff level

- > The increase of the electricity tariff in future expected to be difficult because of the current Vietnamese situation.



- > Continuous upward rigidity of electricity tariff in future may render ENV short of fund.

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