

2. Power Source Development Scenarios

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Objectives

- To select scenarios of annual cost saving analysis for optimal peak supply development plans

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Presentation Outline

- Features of the revised 5th MP
- Scenarios
- Conditions & assumptions of scenarios
- Next step

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Features of the revised 5th MP

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Power System of Vietnam

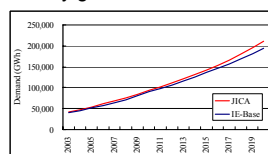
- Slender geography
- Historical changes in demand profile
- Seasonal fluctuation of supply capability
 - Especially hydropower out put
- International electricity exchanges

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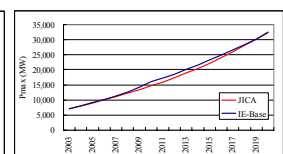
Demand trends

- GWh 9.8%/yr, MW 9.1%/yr

Yearly generation Base case



Peak demand Base case

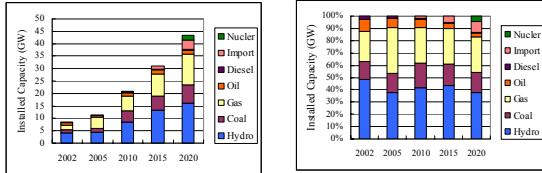


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Power Development Plan in 2020 (1)

- Capacity & Composition based on the 5th revised MP

Whole system



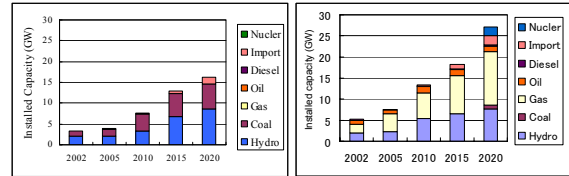
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Power Development Plan in 2020 (2)

- Capacity of divided systems

North

Central & South



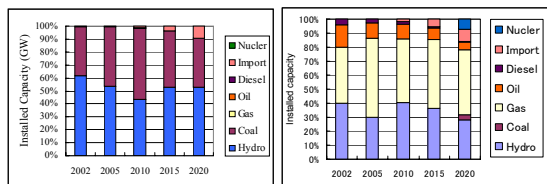
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Power Development Plan in 2020 (3)

- Composition of divided systems

North

Central & South



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Scenarios

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Scenarios

	PSPP	GT	CC
Target Year	2015, 2020	2015, 2020	2015, 2020
System	Whole, N C&S	Whole, C&S	Whole, C&S
Installed capacity	0 - 10%	0 - 10%	25% - Limit*
Capacity of domestic interconnection	1000 - 2200MW	1000 - 2200MW	1000 - 2200MW
Timing of Son La	2400 or 0	2400 or 0	2400 or 0
Demand conditions	Base, High, Load Profile	Base, High, Load Profile	Base, High, Load Profile
Power purchase from China, Laos, Cambodia	Laos, None, All	Laos, None, All	Laos, None, All
Rise in fuel prices	Base, ×2	Base, ×2	Base, ×2

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Results of Preliminary study

- Preliminary study identified four issues
 - Regional differences in electricity demand and power sources composition
 - Plans for international electricity exchange
 - Actual operations of hydropower plants
 - Differences between dry and rainy seasons
 - Comparison of costs among peaking supplies

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Impacts of development timing

- Arranging Power development to meet the system reliability criteria
 - Timing of development of PSPP
 - Timing of development of thermal power plants
 - Timing of extension of domestic transmission systems
 - Interconnection between Thailand and Vietnam

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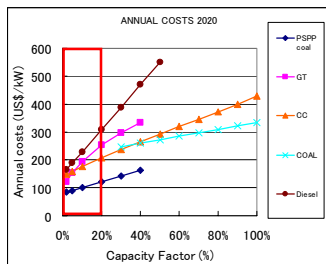
Considering risks

- Progress of Son La hydropower development
- Progress of power purchase from neighbor countries
- Change of demand characteristics
 - ◆ Peak shift, Load factor
- Rise in fuel prices

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Results of screening curve analysis

- PSPP, GT and CC in order have an economical advantage for peaking supplies



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Parameters of Scenarios (1)

- Selection of economical peaking supplies
 - To reflect the results of screening analysis
- Divided systems
- Capacity of domestic interconnection

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Parameters of Scenarios (2)

- Timing of development of Son La hydropower
- Demand conditions
 - Historical changes in demand profile
- Power purchase from neighbor countries
- Rise in fuel prices

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Scenarios

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Conditions & assumptions of scenarios

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Conditions

- Target year: 2015, 2020
- Power system structure:
 - a single system, divided systems
- Power demand: revised 5th Master Plan (Base Case)
- Development plan: ditto
- Output of conventional hydropower:
 - 50% out put for GWh, 90% out put for MW
- Peak duration time of PSPP: 7 hours

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Conditions for divided systems

- Divided systems
 - Planned power plants in C system mainly supply S system
- Divided 2 systems: N and C&S



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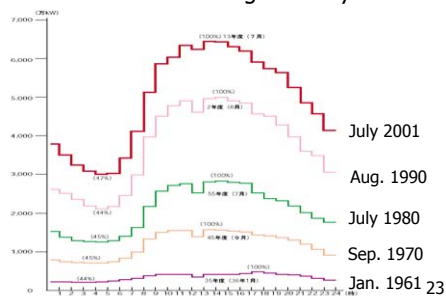
Power Demand Forecast used for the Study Base case

		Whole	North	C&S
Energy demand (GWh)	2020	201,367	72,557	127,590
Peak demand (MW)	2020	32,606	12,074	22,337
Load factor	2020	70.5%	68.6%	65.2%

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Historical change of other countries

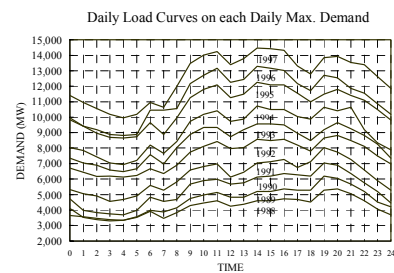
- A peak time is shifted from night to daytime
- Japan TEPCO



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Historical change of other countries

- Thailand

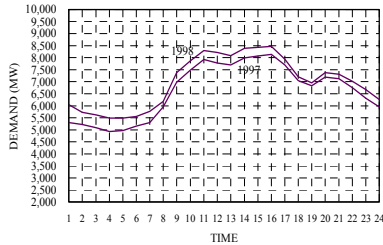


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Historical change of other countries

Malaysia

Daily Load Curves on each Daily Max. Demand



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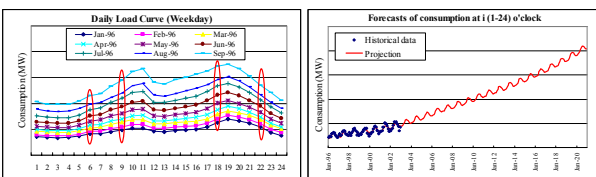
Regression analysis

- To provide demand data for optimization analysis, historical hourly demand data are categorized into the following 3 types.
 - Peak Day: average of the maximum 3 days in each month
 - Weekday: average of weekdays except the maximum 3 days and holidays
 - Holiday: average of Sunday and holidays in each month

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Regression analysis for hourly demand

Hourly demand forecast



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Regression formula

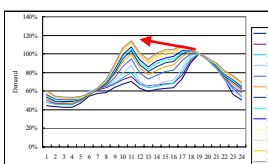
- 1 hr(MW) = $A_1X_1 + B_1X_2 + \dots + P_1X_{16} + C_1$
 - 2 hr(MW) = $A_2X_1 + B_2X_2 + \dots + P_2X_{16} + C_2$
 - ...
 - 24hr(MW) = $A_{24}X_1 + B_{24}X_2 + \dots + P_{24}X_{16} + C_{24}$
- X_1, X_2, \dots, X_{16} ; Explanatory Variable (Population, GDP, Temperature, Humidity, Population of electrification)
 - A_i, B_i, \dots, P_i ; Regression Coefficient

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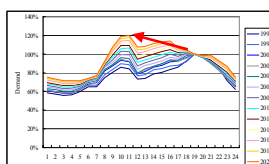
Assumptions of Peak Shift

Peak is going to shift night to daytime

The north region (normalized: 7pm=100)



The south region (normalized: 7pm=100)



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Conditions & Assumptions for output of hydropower

- Hydropower supply capacities
 - Firm capacity(MW): 90% probability Out put
 - Minimum capacity(MW):
 - Dry season(Jan. – May, Dec.): 25% of firm capacity
 - Rainy season(Jun – Nov.): 45% of firm capacity
 - Annual and Monthly generation(GWh): 50% probability generation

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Assumptions for power development plan

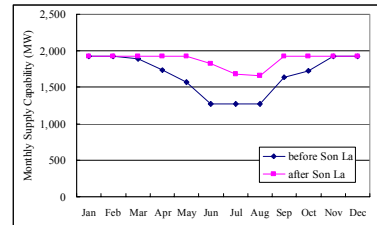
- To arrange Power development plan
 - PDP arranged to satisfy LOLE 24hr
 - Incorporated power purchase from Laos
 - Base case not included PSPP, GT

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Effects from Son La hydropower

- To change operations of Da river system

Hoa Binh 90% out put w and w/o Son La



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Assumptions for domestic interconnections

- Capacity of interconnection between N and C&S systems
 - > None
 - > Saturated capacity on effects of reliability improvement
 - > Planned capacity in MP: 2200MW

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Effects from interconnections

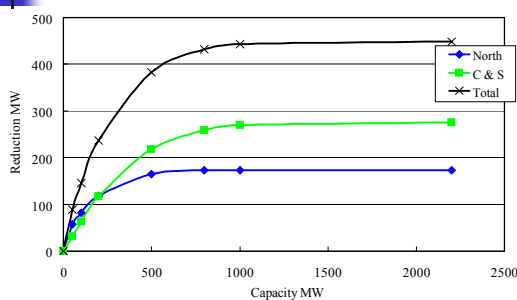
- Utilization of peak supplies among interconnected systems



- Reduction in total reserve capacities

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Saturated capacity on effects of reliability improvement

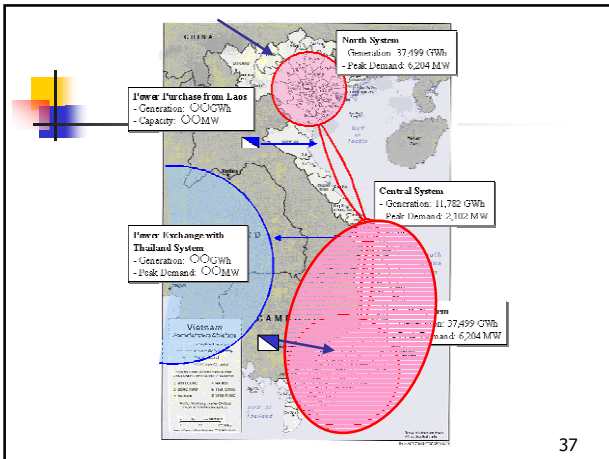


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Interconnection between Vietnam and Scenarios

- Timing and capacity of interconnection between Thailand and Vietnam are important

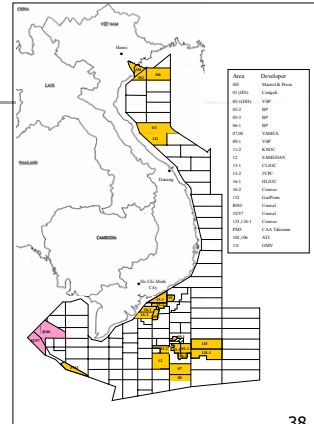
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Gas reserves

- A lot of gas reservoirs in South
- Limitation of potential
- 12.6GW, 77TWh (cf=70%) in 2020



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Next step

- What do we need to do in the next stage?



- Selected scenarios will be examined
- ◆ Quantification of annual costs saving
 - Demand-and-supply simulation
- ◆ Power system analysis
 - Stability
 - Power supply reliability

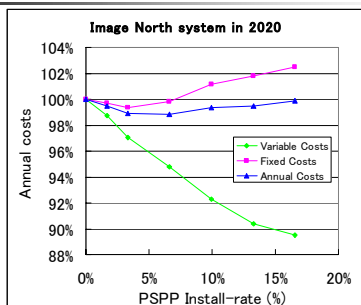
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Annual cost saving analysis(1)

- System operations are simulated by replacing thermal power plants with PSPP.
- Changes in operations and annual costs are identified.

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Annual cost saving analysis(2)



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The End

Thank you for your attention.

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