Perspectives on Northeast Asian System Interconnection

S. Korea

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CONTENTS

- **Review of Korean Power Industry**
- **Views on Northeast Asian interconnection**
- **Suggestions**

Introduction

- **South Korea**
  - **Poor in natural resources : import 97% of primary energy**
  - **Mountainous country : 70% territory covered with mountains**
- **South Korean Power System**
  - **Isolated in 1945 from North Korean System**
  - **Limitations to expanding power system due to military and political tension between South and North Korea**
- **Difficulties and uncertainties**
  - **Restructuring power industry and so on**

Power Demand and Supply

5th long term planning of power supply by MOCIE

- **Power demand, supply and reserve**
  - **Increase rate of peak demand : 4.3%/year**
  - **Peak demand : 1.65 times during the next 15years**

[GW]

	'00	'05	'10	'15
Peak	40.9	51.7	60.7	67.5
Cap.	48.0	60.4	71.4	78.5
Res. (%)	7.1 (17.4)	8.7 (16.8)	10.7 (17.6)	11.0 (16.2)

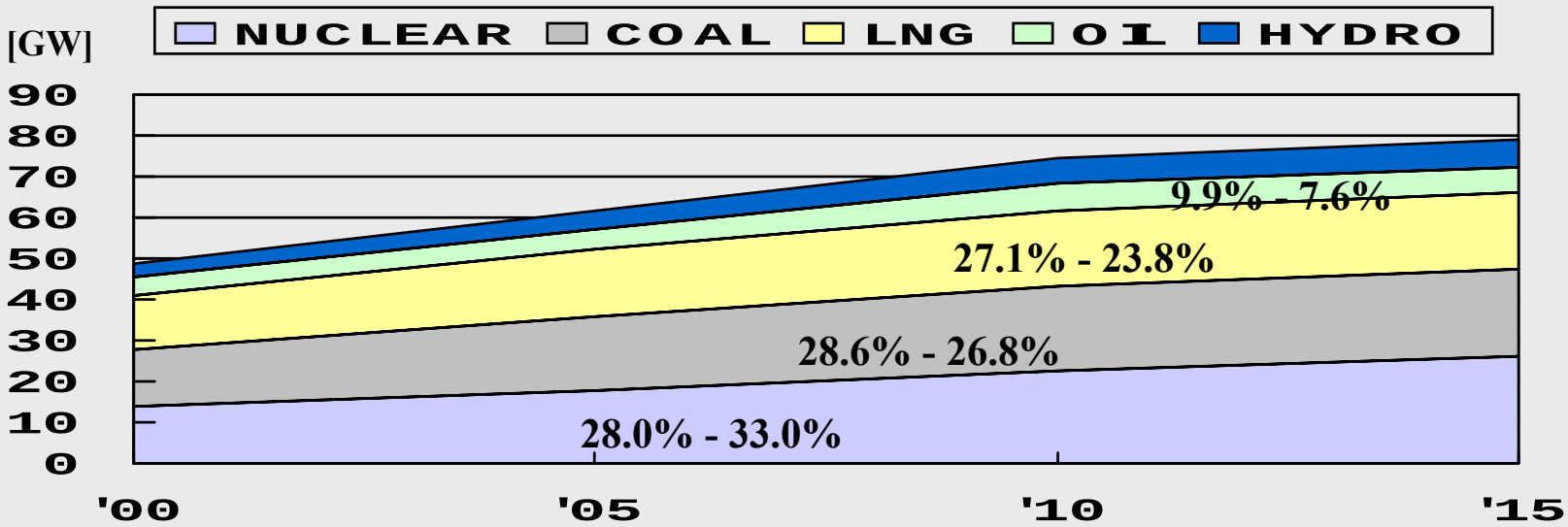
* 2015 DSM : 7.43[GW] (10%)

Generation Mix

5th long term planning of power supply by MOCIE

Generation Mix[GW]

- More dependent on nuclear
- Thermal more than 50%



Electrical Energy Consumption

5th long term planning of power supply by MOCIE

- **Annual consumption [kWh]**
  - **Annual increase rate : 4.1%**
  - **Much room for increase of consumption**

[kWh]

		'00	'05	'10	'15
Korea	Total [$*10^9$]	224.2	294.7	343.2	381.8
	Per person	4,740	6,000	6,780	7,390
Japan		6,273 [kWh/person] in 1997			
U.S.A		12,434 [kWh/person] in 1997			

Electricity Tariff

statistics of power industry in 2000 by MOCIE

- **Tariff of neighboring countries[•/kWh]**
  - **Nearly equal to Chinese and about 1/3 of Japanese**

A(agriculture), S(street lighting), C(commercial), R(residential), I(industry) : [•]

	Korea	*Russia*	*China*[*1]	*Japan*	*U.S.A*
Min	A 44.04			S 118.92	I 52.23
Max	C 102.45			R 253.31	S 126.80
Average	71.59	?	69.55	211.69	78.57
Exchange			1 RMB= 163.67	1 ¥= 11.2184	1 US$= 1145.4

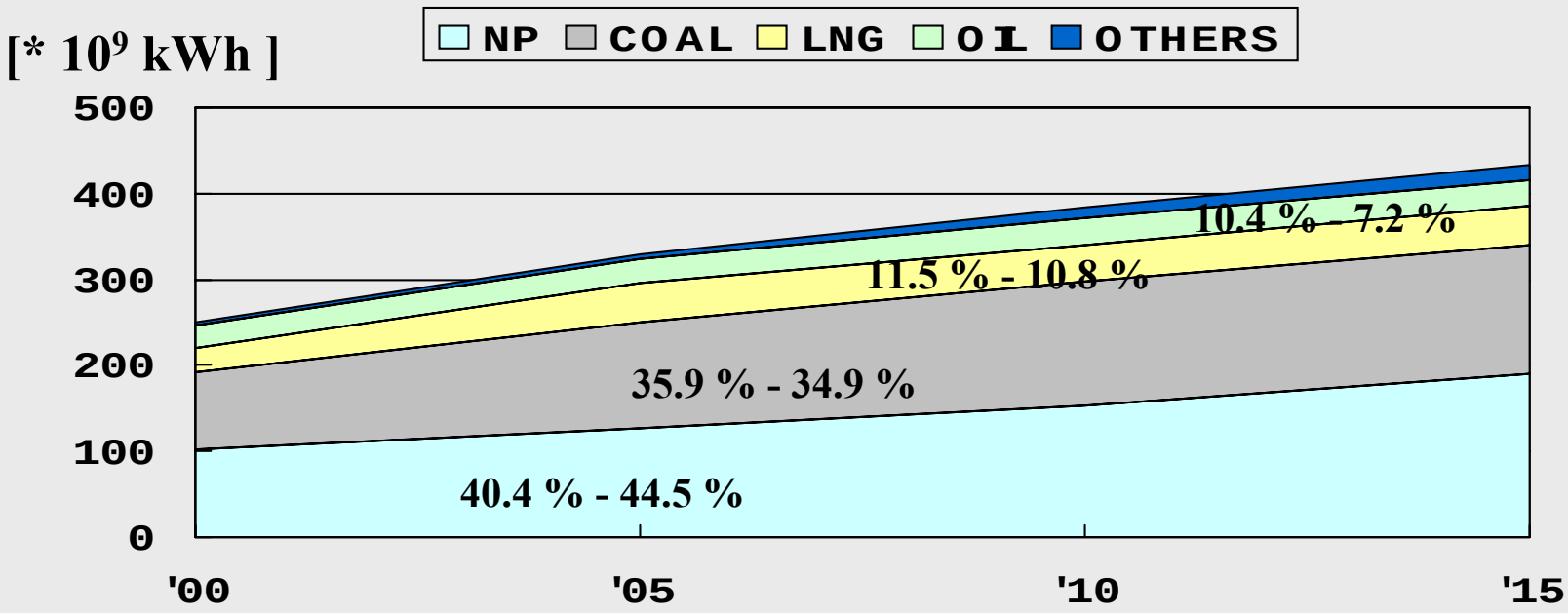
* 1 : Statistics of Chinese power industry, 1998

Production of Electricity

5th long term planning of power supply by MOCIE

Generation

- Increase the weight of N/P and slightly reduce the production of T/P



Electricity Fraction

Research report in 2001 by KEEI and statistics of power industry in 2000 by MOCIE

- **Primary energy for generation**
  - **Import 97.4% of primary energy**
  - **About 31% of total primary energy used for generation**
  - **Electricity fraction likely to reach 35% in 2015**

[10^6 TOE]

	'99	'05	'10	'15
TOTAL "T"	181.3	235.7	275.0	307.1
Generation "E"	56.2	78.6	92.9	100.5
T/E * 100 [%]	31.0	33.3	33.8	? 32.7

*** Except for non-utility generation in common use(10%)**

Air Pollution

5th long term planning of power supply by MOCIE

- **Statistics of air pollution in '99 : regarding CO_2**
  - **About 22.6% emitted by generation**
  - **Estimated price : about 600 million $US based on $25/ton**
- **Kyoto Protocol : to reduce 20 ~ 40% of the total emission expected in 2010 or 2020**

	SOx [k-ton]	*NOx [k-ton]*	*Dust [k-ton]*	*CO_2 [k-ton]*
Total "T"	1,320	1,230	430	103,820
KEPCO "E"	217	153	11	23,460
*E/T * 100[%]*	16.5	12.5	2.6	22.6

*** CO_2 [kg-C/kWh] : 0.1185 in 2000 and 0.1145 in 2010**

Development of Generating Plants

5th long term planning of power supply by MOCIE

- **Construct 106 units by 2015**
  - **67 units by 2010**
  - **43 units under construction**
- **Need to site 24 units**
  - **9 sites for 18 units decided and 2 more sites needed**
- **Difficulty in siting, now**
  - **Become more and more difficult in the future**
  - **Need more construction cost**

Reinforcement of Network

5th long term planning of power supply by MOCIE

- **Transmission lines**
  - **Construct about 10,000[C-km] T/L during the next 15 years including 1,335[C-km] of 765[kV] T/L**
  - **Totally 35,165[C-km] T/L in 2015**
- **Substations**
  - **Construct about 200 substations during the next 15years including six 765[kV] substations**
  - **Totally 756 substations in 2015**

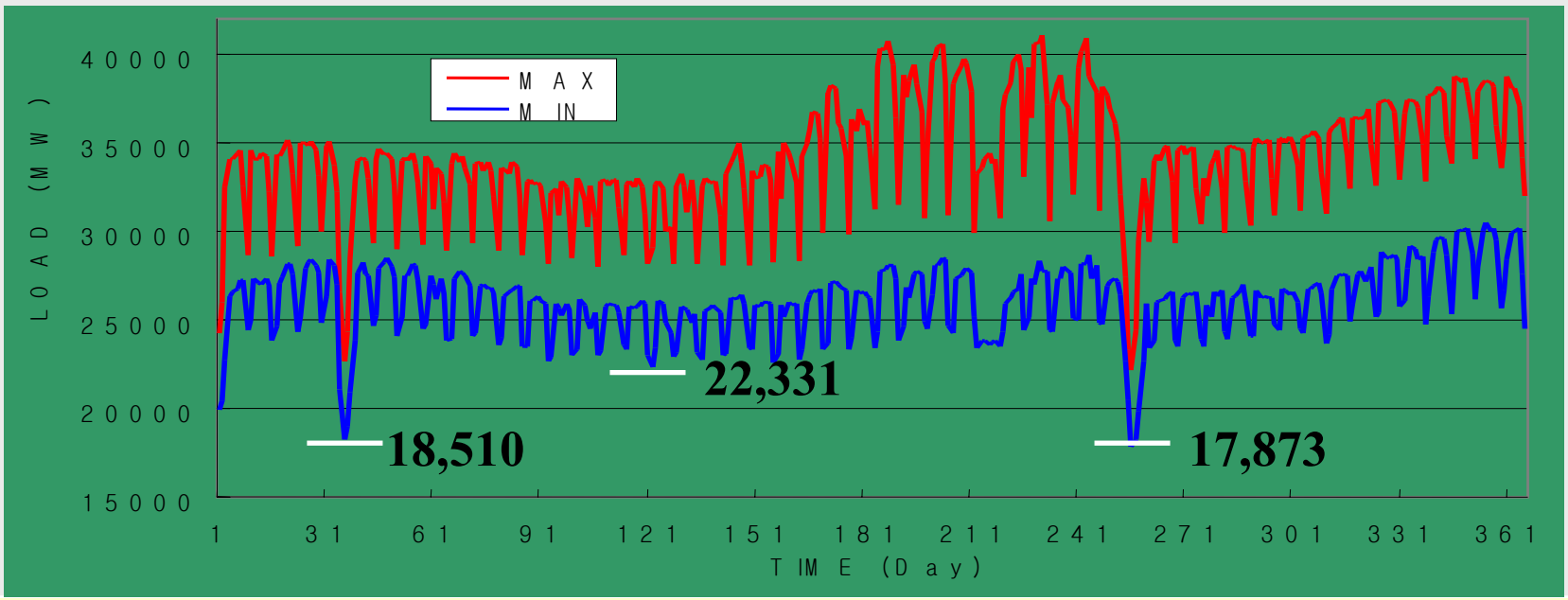
Financial Costs

5th long term planning of power supply by MOCIE

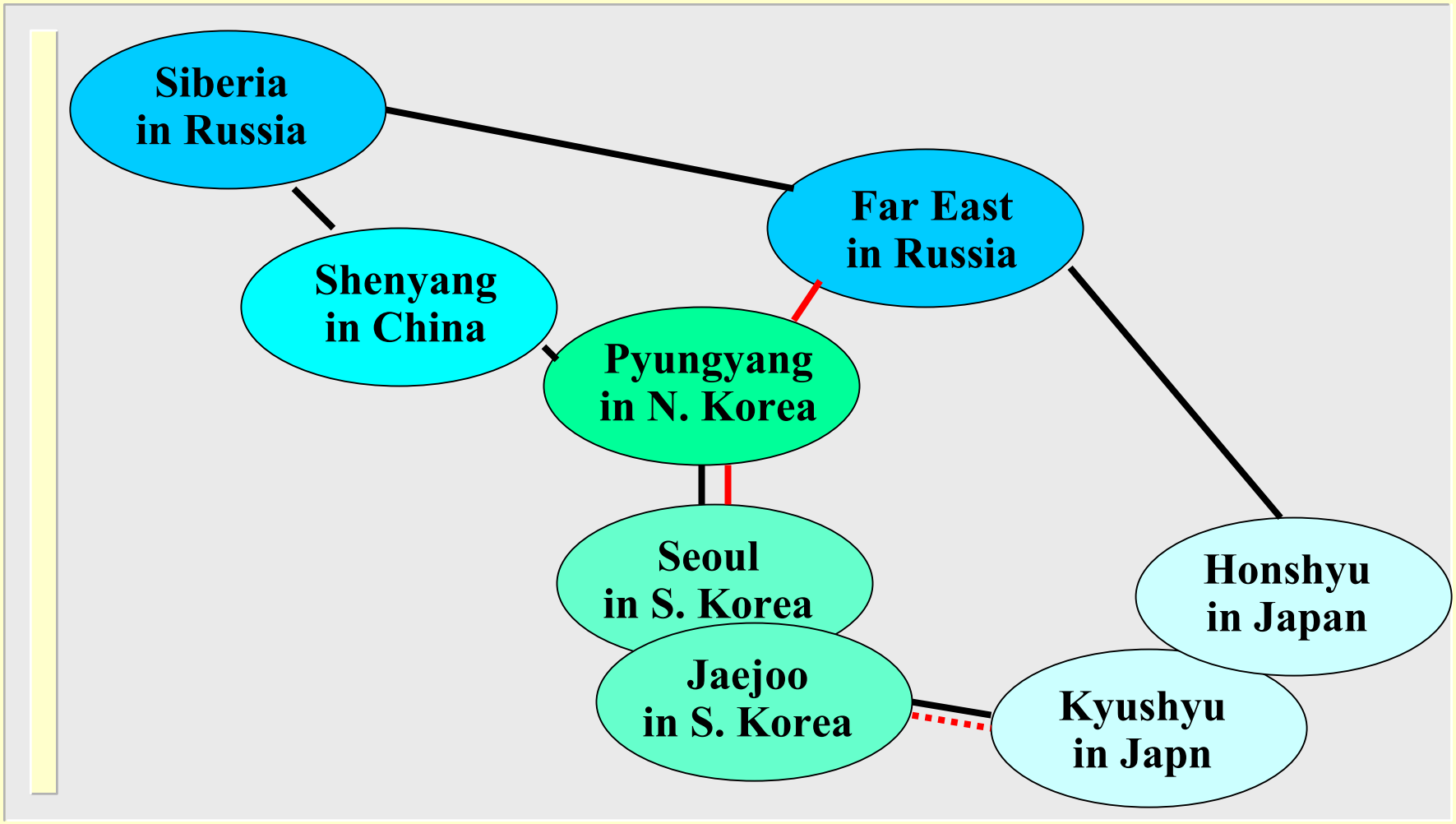
- **Costs for the next 15years**
  - **Based on fixed price at 1999**
  - **Generation : 32.6 billion $ US**
  - **Transmission and substation : 14.1 billion $ US**
  - **Total : 46.7 billion $ US**

Load Curve

- **Daily load variation in 2000 : max and min**
  - **Annually minimum load : about 18[GW] on New Year's Day and Thanks Given Day**
  - **Minimum load on average : about 25[GW]**



System Interconnection



National Energy Security

- Nearly not source but load
- Max continuous power inflow
  - 2 ~ 3[GW] in 2000 and 3 ~ 4 in 2015
  - Considering min load on average, capacity of nuclear power plants, stability and reliability
- Little impact on energy security until 2015
  - Not so much difficulty in developing additional power plants
  - Power inflow is about 10% of additional generating capacity

Economic Impacts

statistics of power industry by MOCIE

- **New projects**
  - **Expected to cost 6 or more billion $ US**
- **Effects of the tariff : in the case of 1% increase**
  - **Price**
    - **Consumer's price : 0.0142% increase**
    - **Producer's price : 0.0259% increase**
  - **Production costs**
    - **Steel companies : 3.6% increase**
    - **Manufacturing industry : 1.7% increase**

Economic Impacts - cont'

- **Difficulty in estimating its effects on the tariff**
  - **Due to being at the beginning stage of deregulation**
  - **Expected to reduce the tariff : 1% or more(?)**
    - **import of electricity : 2 [GW] * 8760[hr] = 17,520[GWh]**
    - **expected margins : 10 [•/kWh] * 17,520 * 10^6[kWh] = 175.2 billion[•]**
    - **total sales of electricity in 2000 : 17,220 billion[•]**
    - **reduction of operation cost in UCPTE : 3%**
- **Reduction of environmental costs**
  - **Reduction of CO_2 emission : 85 billion[•]**
    - **23,460[k-ton] * 17,520/144,990[GWh] * 25,000[$/k-ton]**
  - **Development of renewable energy in neighboring countries**

Environmental Impacts

- To reduce air pollution
- To protect the coast and countryside being destroyed by siting new plants
- To increase opportunity to develop renewable energy
- Too dependent on each other country : increase of pollutant inflow from neighboring country

Barriers

- **Political**
  - **Extremely sensitive to the political relationship, between North and South Korea, of great uncertainty**
  - **Weak trust in each other's country resulting in considerable concern for national energy security**
- **Institutional, or other barriers**
  - **Lack of ….. ?**

Impacts of Deregulation

- **Negative impacts**
  - **Many companies pursuing for their own interests**
  - **Many different views difficult to reach an agreement**
- **Positive views**
  - **GENCO's : opportunity to develop generating resources in the neighboring countries**
  - **TRANCO : opportunity to enlarge the business**
  - **Consumers : possibility to lower the tariff**

Countermeasures

- **Periodical meeting of the government officials**
  - **Reinforce the role or function of APEC**
- **Start a feasibility study sponsored by**
  - **International organization such as ADB and WB**
  - **Neighboring countries**

Mechanism for Financing

- **Funded by an international consortium**
  - **Include ABRD, WB..**
  - **Require the investment of the member countries**
- **Multilateral guarantee agreement or guarantee of international organization**
  - **in order to hedge against risk**

Decision Making Body

- **State Council**
  - **Likely to be decided politically due to its extreme sensitivity to political situation in the Korean peninsula**
- **Ministry of Commerce, Industry and Energy**
  - **Decide long term plan for power supply**
  - **Biggest stockholder of network company[TRANCO]**
  - **Director general of energy policy officer**
- **Electricity Council and TRANCO**

Suggestions

- **Start a feasibility study**
  - **Carried out by international consortium**
  - **Funded by every member country or international organization such ABRD, WB..**
  - **Managed by international steering committee**
- **Join pre-feasibility study**
  - **Each member organization should fund**
  - **KERI in Korea is likely to get sponsorship from the government**