



# An Introduction to Korean Electric Energy System

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## Presentation Topics

- I** Korean Energy Status
- II** The Outline of Korean Electricity Market
- III** The 4<sup>th</sup> Basic Plan of Long-term Electricity Supply & Demand
- IV** Issues : NRE, RPS, Wind Power, DR, Smart-Grid



## Location of Korea

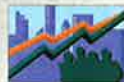
- Located in Northeast Asia : South and North 1,100km



## Energy Profile of Korea (2008)



- Total Energy Consumption : 238 Mil. TOE
- Growth Rate in Energy Consumption : 0.7%
- Oversea Energy Dependency : 96.4%
- Petroleum Consumption : 758 Mil. Bbl



Economic Growth  
 (5.1%)



Trade  
 (Rank 12)



Energy Consump.  
 (Rank 7)



Petroleum Consump  
 (Rank 5)

## The Keynote of Energy Policy History

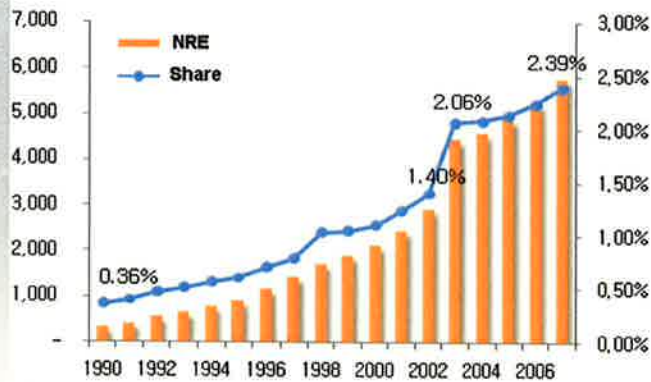


## Definition of NRE (Article II of NRE Act)

- ❖ The New & Renewable Energy is classified into the following two categories
- ❖ Renewable Energy :
  - Solar thermal, Photovoltaic, Biomass, Wind, Small - hydro power, Geothermal, Marine, Waste
- ❖ New Energy :
  - Fuel Cell, Hydrogen Energy, Integrated Gasification Combined Cycle (IGCC)

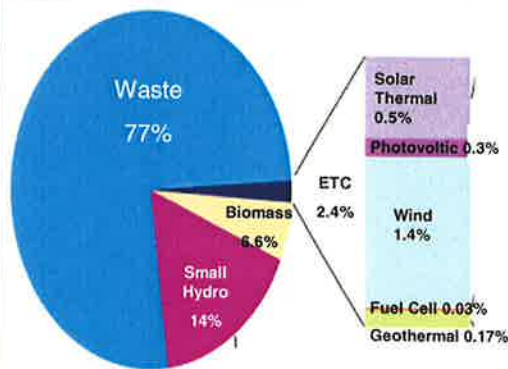
## Share of NRE in Total Energy

- ❖ Percentage of NRE in 2007 : 2.37%(5,764 thousand TOE)
- ❖ 18.2% increased during 1990~2007.
  - Average increase rate ( primary energy ) : 5.7%



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## Supply of NRE by Sources(2007)



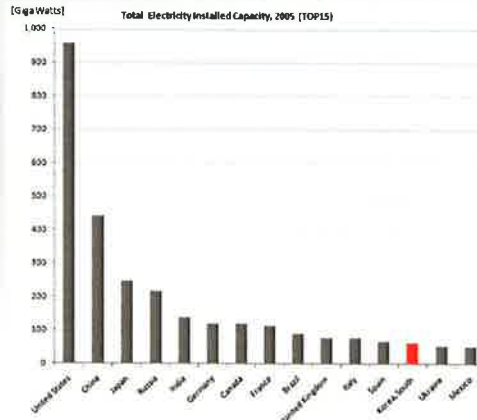
- ❖ Waste-to-energy accounted for 77 % of NRE
- ❖ While naturally available renewable energies accounted for merely 23%

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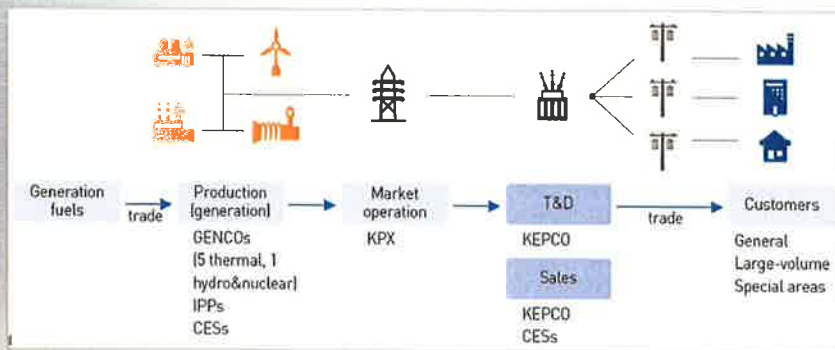


## Characteristics of Korean Power System

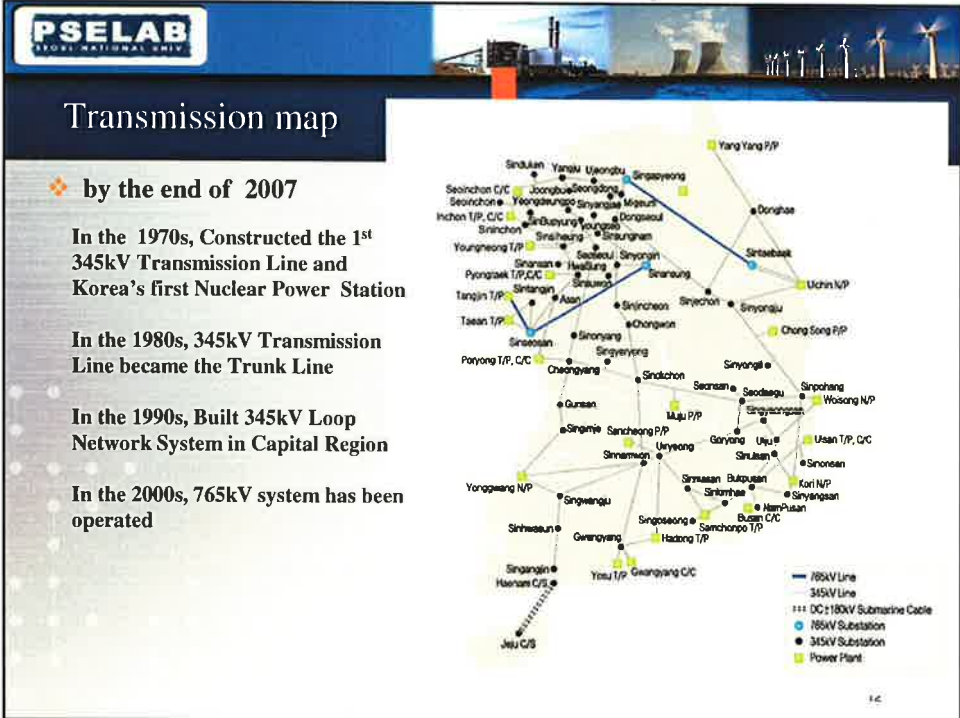
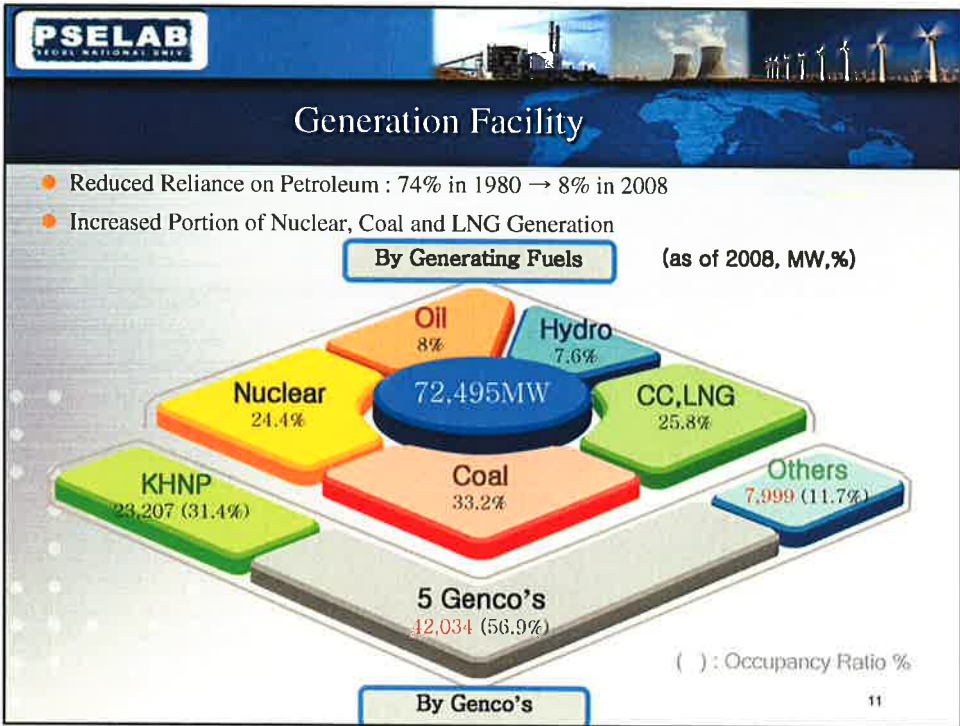
- One of the largest power systems in the world – 13<sup>th</sup>
  - Peak power demand : 62.79 GW (15<sup>th</sup> July 2008)
  - Installed Generation Capacity : 70.35 GW (2008)



## Structure of the electric power business



CES : Community Energy Suppliers





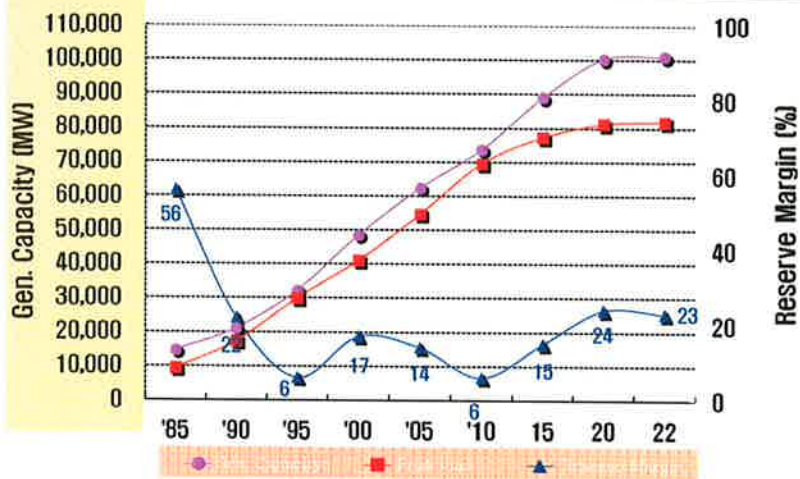
## Power demand & supply prospects

- Over the last 30 years, electricity demand has grown very rapidly in line with the country's remarkable economic growth
- Demand growth rate in the 1990's recorded an average increase of 9%
- Power demand is expected to increase 30% by 2022 compared to 2008
- Generation capacity is expected to increase 46% by 2022 compared to 2008

Year	2008	2009	2011	2013	2015	2022
Peak Load (MW)	62,794	67,226	71,324	74,564	77,214	81,805
Generation Capacity (MW) (Hydroelectric included)	69,207	72,118	77,209	83,439	88,848	100,891
Reserve Margin (%)	10.2	7.3	8.3	11.9	15.1	23.3



## Graph of Power demand & supply



## Renewable Facilities Expansion Plan

[unit : MW]

Year	Hydro		Wind Power	Ocean Energy	Solar	Biomass	wastes	By-product gas	Fuel Cell	IGCC/CCT	Total
	normal	small									
2007.12 (actual)	1,521.6	70.5	191.9		37.8	82.4	8.0	30.3	0.3		1,942.8
2008.06		8.6	2.2		121.6	0.7			0.3		133.4
2008.12	2.3	3.1	201.3	1.0	683.3	1.4			2.2		894.8
2009.06		0.1	10.7		102.3	1.0	5.7		4.8		124.6
2009.12		12.3	316.6	254.0	41.5		13.2		4.8		642.0
2010.06		1.0			11.7		1.2	200.0	4.8		218.7
2010.12			110.0		24.4			350.0	10.0		494.4
2011.06	60.0				4.0		10.0	150.0			224.0
2011.12					1.2		20.0		16.2		37.4
2012.06			42.0		1.6						43.6
2012.12					6.03						6.03
2013.06					2.3			200.0			202.3
2013.12									300.0		300.0
2014.06											
2014.12					520.0						520.0
2015.06											
2015.12					53.0	10.0				300.0	363.0
2016.06					813.0		0.8				813.8
2016.12						1.0					1.0
2017.06					1,440.0						1,440.0
2017.12						2.7					2.7
2018.06						0.6					0.6
2018.12											
2019-2022											
New	62.3	25.3	682.8	3.081	1,007.8	3.9	50.1	900.0	43.1	600.0	6,456.3
Total	1,583.9	95.8	874.7	3.081	1,045.6	86.3	58.1	930.3	43.4	600.0	8,399.1

➔ Incheon IGCC 300  
➔ Taean CCT 300

※ 1. Renewable expansion plan above does not consider the performance rate of construction.  
 2. In case the 3rd renewable basic plan and RPS system are definitely settled, it will be planned to be

## New & Renewable Energy Generation Capacity Trends

- Total Generation Capacity of New & Reliable Generation Facility : 1942.8 MW
- Hydro power capacity is 80% of New & Reliable generation capacity.

Year (Generation capacity (MW))	Hydro Power		Wind Power	Solar	Biomass	Waste	LFG	Fuel Cell	Total
	Hydro	Small Hydro							
2007.12.31	1,521.6	70.5	191.9	37.8	82.4	8.0	30.3	0.3	1,942.8
	78.3%	3.6%	9.9%	1.9%	4.2%	0.4%	1.6%	0.02%	100%





## New & Renewable Energy Generation Capacity prospects

- **Total Generation Capacity of New & Reliable Generation Faculty is expected to increase 432% by 2018 compared to 2007**
- **Wind Power, Ocean, Solar, IGCC, LFG generation capacity is growing very rapidly.**

NRE Generation capacity (MW)	Hydro Power		Wind Power	Ocean	Solar	Biomass	Waste	LFG	Fuel Cell	JRCO	Total
	Hydro	Small Hydro									
2007	1,521.6	70.5	191.9	0	37.8	82.4	8.0	30.3	0.3	0	1,942.8
2009	1523.9	82.2	395.4	1	842.9	84.5	8.0	30.3	2.6	0	2971
2013	1583.9	95.8	874.7	255	1031.3	85.5	58.1	730.3	172.8	300	5187.4
2018	1583.9	95.8	874.7	3081	1045.6	86.3	58.1	930.3	43.4	600	8399.1

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## Demand Side Management Trends

Demand Side Management(DSM)

- 1974 : Progressive Tariff Program
- 1977 : Time Of Use(TOU) rate Program
- Dissemination of efficiency equipment, Introducing DSM

Year	1993	1995	1997	2000	2002	2007
Peak Load before DSM (MW)	22,640	31,085	38,057	43,866	49,233	62,285
Effect of DSM (MW)	528	1,207	2,206	2,900	3,460	5,460
Peak Load After DSM(MW)	22,112	29,878	35,851	41,007	45,773	62,285
Percent (%)	2.3	3.9	5.8	6.5	7.0	8.7

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## Demand Side Management Prospects

- Load control is expected to increase 174% by 2022 compared to 2008
- Efficiency improvement is expected to increase 743% by 2022 compared to 2008

Year		2008 (actual)	2009	2013	2018	2022
<i>Peak Reduction [Mw]</i>	<i>Load Control</i>	(4,654)	5,077	6,660	7,855	8,129
	<i>Efficiency improvement</i>	(1,222)	1,454	2,908	5,922	9,068
	<i>Total</i>	(5,876)	6,531 (655)	9,568 (3,692)	13,777 (7,901)	17,197 (11,321)
<i>Energy saving [Gwh]</i>	<i>Efficiency Improvement</i>	1,001	2,557	14,183	38,196	62,762

(unit: MW, GWh, 1000ton)

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## ❖ Issues

- Back Ground
- NRE Promotion
- RPS
- Wind Power
- DR/DSM
- Smart-Grid

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## Low Carbon Green Growth

- ❖ New Energy Vision “Low Carbon Green Growth” (’08.8)
  - Basic National Energy Plan(’08~’30)

Establishment of Presidential Committee on Green Growth (2009.2)

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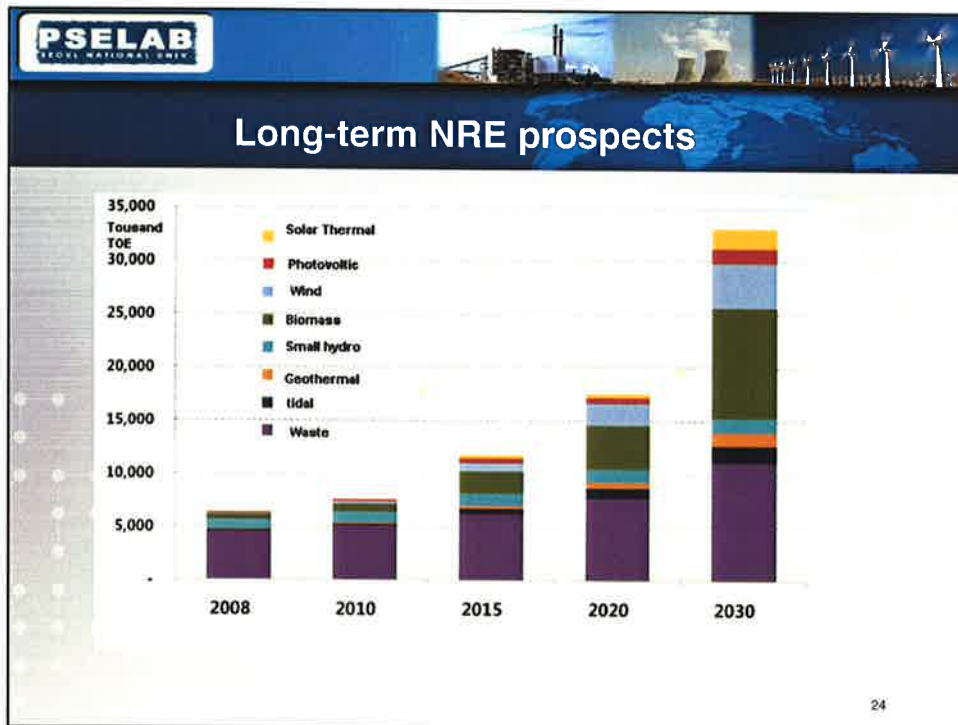
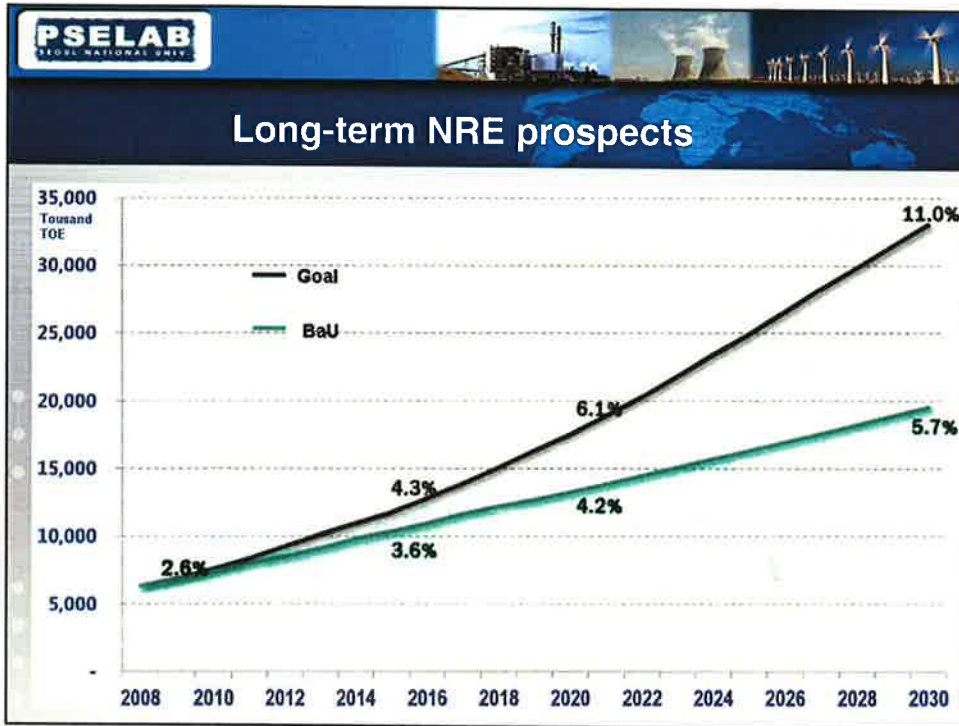
## Concept of Green Power

- ❖ Electric Power that minimizes environmental pollution by using energy more efficiently

**Eco Value > Market Value**

Power Generation	Transmission	Distribution	Business
<ol style="list-style-type: none"> <li>1. Increasing Nuclear &amp; NRE units</li> <li>2. Development of IGCC &amp; CCS</li> <li>3. Improvement of Generator Efficiency</li> </ol>	<ol style="list-style-type: none"> <li>1. IT based substation</li> <li>2. Development of Eco-high efficiency material</li> <li>3. Efficient Management of Facilities Construction and Operation</li> </ol>	<ol style="list-style-type: none"> <li>1. Smart-distribution system</li> <li>2. Demand management</li> <li>3. Constructing Electric Car Infrastructure</li> </ol>	<ol style="list-style-type: none"> <li>1. Eco-products; Green PC, Hybrid Car</li> <li>2. Smart-building</li> <li>3. Dissemination of LED</li> </ol>

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## Generation Support Policy

- ❖ **Mandatory Purchasing System**
  - Electricity act, 2001
  
- ❖ **Prime rate purchasing electricity from NRE resources**
  - Earmarked higher than wholesale price (market price)
  - Applied to Solar PV, Wind, Small hydro, LFG, Tidal, and Waste
  
- ❖ **Purchasing period guaranteed**
  - 5 to 15 years

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## RPS in Korea

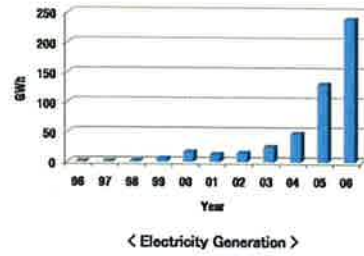
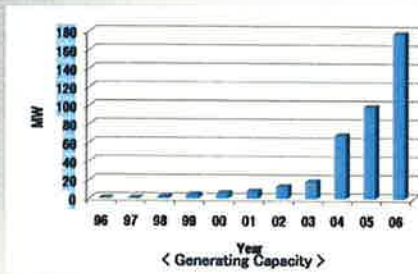
- ❖ RPS is expected as the policy mechanism which is providing the greatest potential for future growth of NRE capacity
  
- ❖ **Phase I : RPA (Renewable Portfolio Agreement)**
  - GENCO in KEPCO make agreement to produce NRE electricity
  - Voluntary system
  
- ❖ **Phase II : RPS (Renewable Portfolio Standard)**
  - NRE electricity production quarter distributed to GENCOs
  - Penalty imposed upon contravention
  
- ❖ **In Phase I**
  - 9 companies including 7 gencos are expected to increase NRE generation 5,884GWh until 2008

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## Wind Power in Korea

- Wind Power (2008)
  - Generation Capacity : 191.9 MW
  - Electricity Generation : 758 GWh



## Wind Power in Korea



< Teagi Mountain Wind Farm >



< Hankyeong Wind Farm >



## Too many construction of Wind Power Plants in Jeju

- Off-peak in jeju area will be about 300MW in 2009
- But capacity of wind power plants will exceed 270MW
- Wind power is likely to fluctuate unpredictably



Difficult to operate stable power system



- Have proper controlling powers as an example of HVDC
- Restrict wind power plant construction by regulations

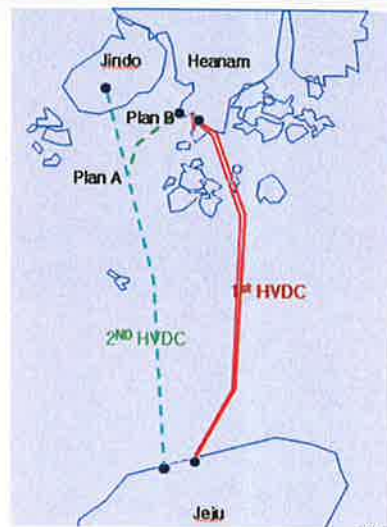


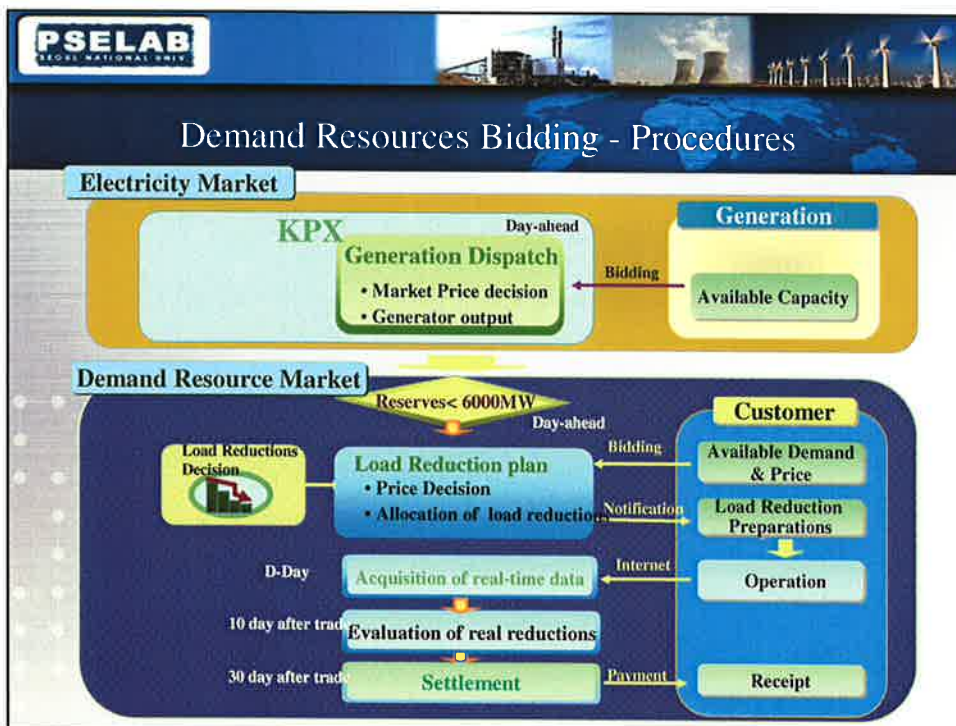
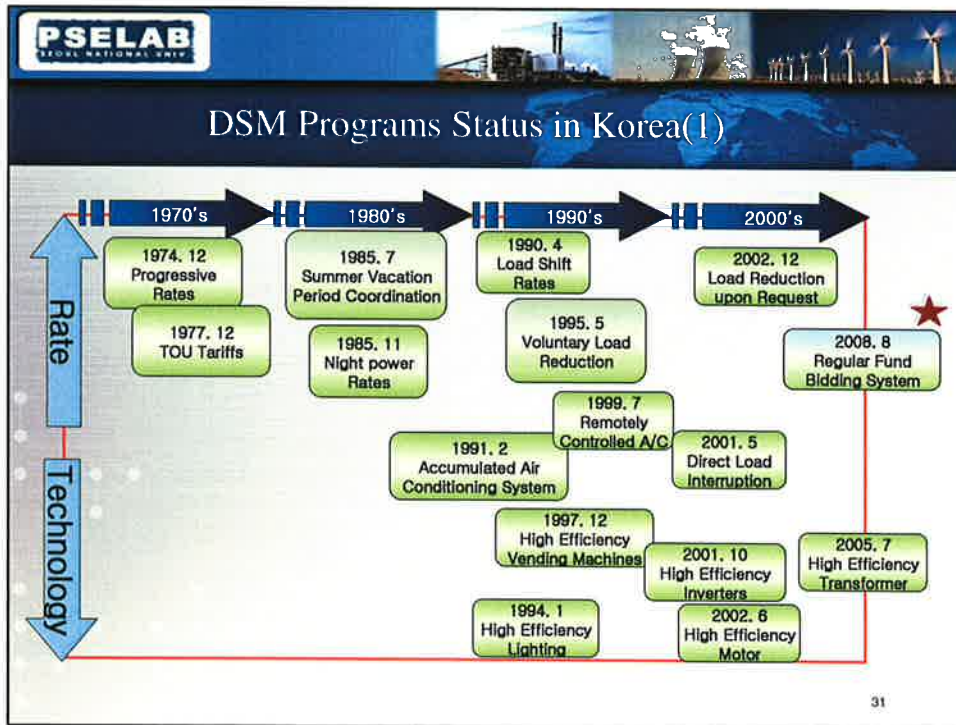
## The 2<sup>ND</sup> HVDC Construction Map

The area of C/S was decided in summer 2007

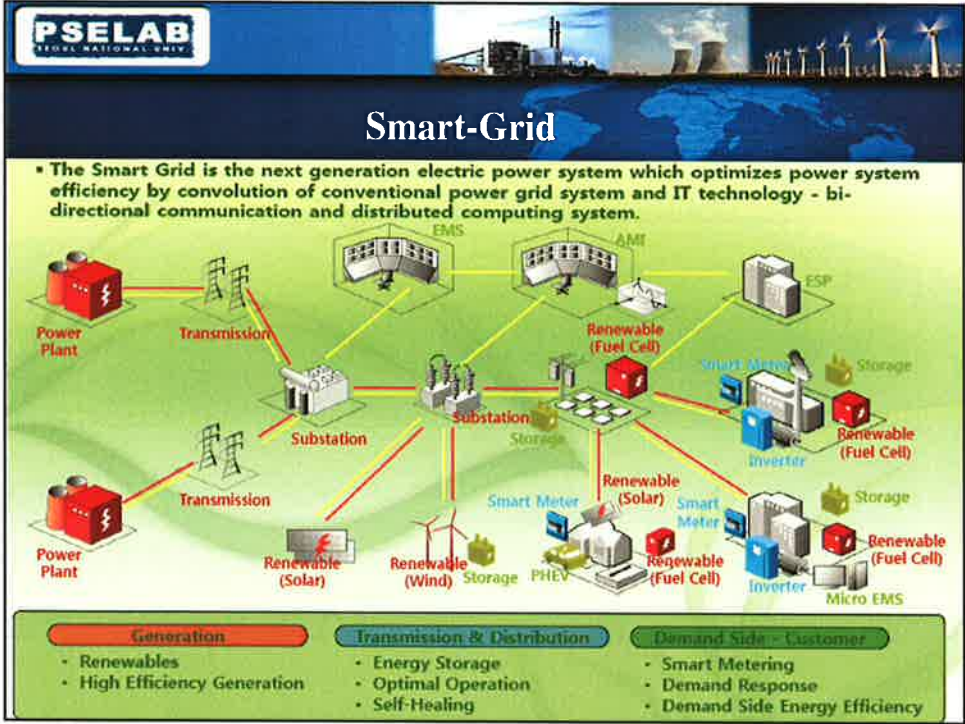
- Plan A : From Jindo to Jeju
- Plan B : From Heanam to Jeju

Plan A is more reasonable than Plan B in consideration of public hatred, construction circumstance.









**See You at ICEE 2010**  
**Paradise Hotel, Busan, Korea**  
**July 11~14, 2010**

*IEEJ, CSEE, HKIE, KIEE*

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