MKE Notice #2013-63
(February 25, 2013)

The 6th Basic Plan for Long-term Electricity Supply and Demand (2013~2027)

February 2013

지식경제부
Ministry of Knowledge Economy

Contents

Ⅰ. Introduction

□ Legal Background

○ The Basic Plan for Long-term Electricity Supply and Demand (BPE) is prepared and announced biennially by the Minister of Knowledge Economy pursuant to Article 25 of the Electricity Business Act (EBA)

○ BPE is reviewed and released by Electricity Policy Review Board pursuant to Article 15 of the Electricity Business Decree

□ Characteristics

○ Policy directions outlining demand outlook, DR goals, adequate reserve, fuel type ratio, construction plans, and etc. ⇒ Objectives

○ GenCos pursue construction projects based on the outlook and capacity plans in BPE ⇒ Action Plans

□ Procedures

Electricity Supply-Demand Committee Meeting (May 25, 2012)	• Discuss directions of the plan • Consists of two subcommittees (Demand Planning / Capacity Planning)
⇩	
Receive Intents for Construction (May 31 to Oct. 25, 2012)	• From 29 GenCos, 77,405MW total (July 25) • Receive docs for evaluation (Oct. 25)
⇩	
Disclosure of Evaluation Criteria (Aug. 24, 2012)	• Finalize EC (Aug. 10), Hearings (Aug. 13 – 21), Disclose EC (Aug. 24)
⇩	
Prepare Demand Outlook & Capacity Plan (Sep.-Dec. 2012)	• Forecast mid- & long-term demand • Set fuel type ratio for gen. capacity
⇩	
Evaluate Construction Intents (Jan. 15-25, 2013)	• Verify required docs for evaluation (Jan. 16-17), re-evaluate objections raised (Jan. 25)
⇩	
Electricity Policy Review Board Review (Feb. 22, 2013), Announcement	• Electricity S-D Committee Meeting(Jan. 30) → Public Hearing (Feb. 7) → EPRB Review (Feb. 22) → Announcement

Ⅱ. Status of Electricity Supply and Demand

1 Electricity Demand

A. Consumption

□ **(Total)** Nationwide consumption was 455,070GWh for 2011

○ 63%(176,619GWh) increase compared to 2002 (278,451GWh)

○ 8th largest in the world in 2011 after Germany & Canada

【 Electricity Consumption World Rankings (Unit : TWh) **】**

Rank	Country	Consumption	Rank	Country	Consumption
1	P.R. China	4,693.0	6	Germany	509.5
2	United States	3,889.0	7	Canada	504.8
3	Japan	859.7	8	**S. Korea**	**455.1**
4	Russia	808.0	9	France	451.4
5	India	637.6	10	Brazil	438.3

Source: US CIA the World Factbook 2012

□ **(By Sector)** Industry took more than half, while commercial and residential grabbed about 30% and 20% respectively

○ Main industries such as machines & electronics had grown big* in the past decade, causing industrial demand to rise

* Increase in output of the main industries outpaced economic growth

【 Electricity Sales Breakdown By Sector (Unit : %) **】**

Class	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Residential	19.5	19.5	19.6	19.5	19.4	18.9	18.7	18.5	17.8	16.9
Commercial	28.6	29.3	29.7	30.4	30.6	30.5	30.8	31.3	30.8	29.9
Mach./Elec.	13.6	14.1	15.0	15.9	16.5	17.1	17.5	17.2	18.3	19.1
Industrial	51.9	51.2	50.7	50.2	50.1	50.5	50.5	50.1	51.4	53.2
Total	100	100	100	100	100	100	100	100	100	100

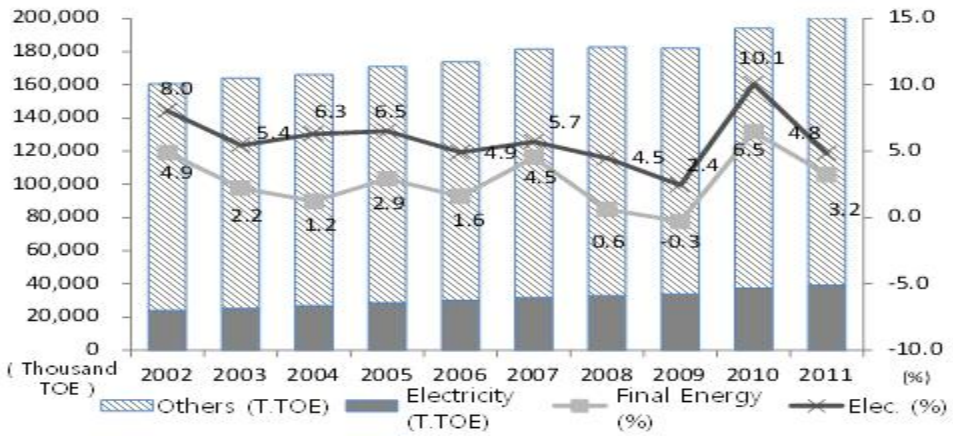
* Mach./Elec. : Machineries, metal assembly, electronics, semiconductors, displays, automobiles, shipbuilding, trains, aeronautics, etc.

□ **(Average Yearly Growth)** About 5.6% between 2002 and 2011

○ Exceeds final energy growth of 2.7%(2.1% excl. electricity)

- Even when global recession in 2009 caused final energy consumption drop(-0.3%), electricity consumption rose(2.4%)

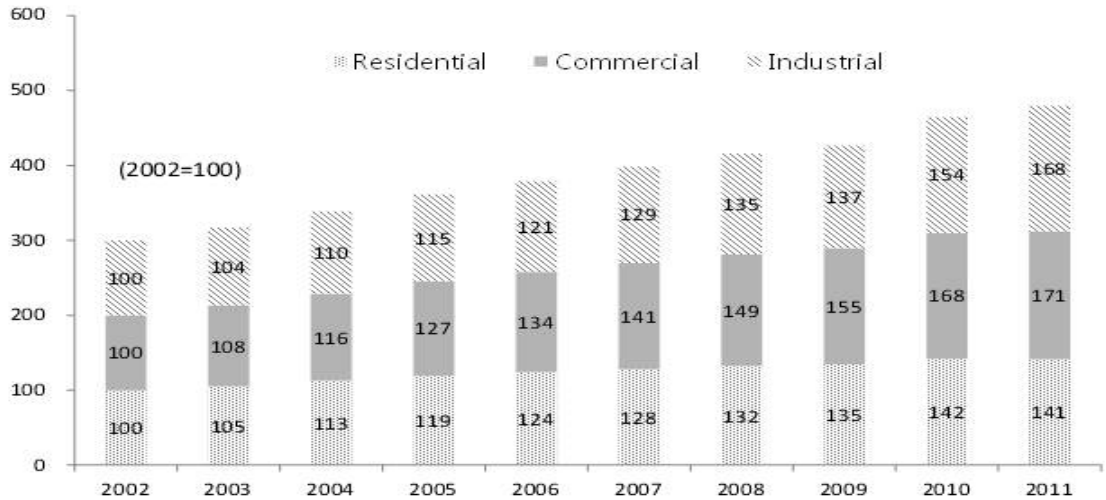
【 Final Energy and Electricity Consumption 】



□ **(Growth by Sector)** Growth rates for the past decade are 6.4% for commercial, followed by 6.0% for industrial & 4.6% for residential

○ Consumption increased 1.4 times for residential (54,291GWh→76,727GWh) and 1.7 times for commercial (79,707GWh→136,139 GWh) and industrial (144,454GWh→242,204GWh) during 2002-2011

【 Changes in Consumption by Sector (Year 2002 = 100) **】**



B. Peak Demand

□ **(Total)** Peak demand was 74,291MW in the summer of '12

○ 72%(31,166MW) increase from 43,125MW in 2002

□ **(By Sector)** Compared to base load(April, October), industrial share falls, while regular share rises sharply at peak demand

○ Compared to base load, regular sector's cooling/heating demand rises significantly and cause increase of peak

【 Peak Demand and Base Load by Sectors (Unit: MW) **】**

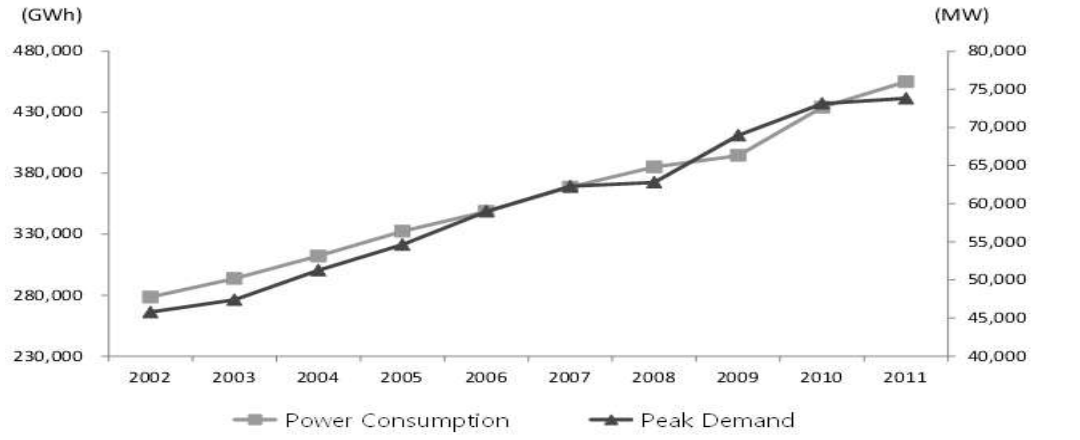
	Industrial	Regular	Edu.	Resid.	Agric.	St. Light	Overnight	Others	Total
April 2011	31,697	12,924	1,360	5,662	1,208	424	836	2,541	56,652
Share(%)	56.0	22.8	2.4	10.0	2.1	0.7	1.5	4.5	100
Sum.Peak (Aug. 2011)	35,728	19,920	2,427	7,911	1,616	375	839	3,378	72,194
Share(%)	49.5	**27.6**	3.4	10.9	2.2	0.5	1.2	4.7	100
Oct. 2011	34,222	12,553	1,094	5,890	1,102	416	450	2,920	58,647
Share(%)	58.4	21.4	1.9	10.0	1.9	0.7	0.8	5.0	100
Win.Peak (Feb. 2012)	35,207	21,018	2,254	8,580	1,857	485	1,036	3,396	73,833
Share(%)	47.7	**28.5**	3.0	11.6	2.5	0.7	1.4	4.6	100

* Others : Temporary, Auxiliary Power

□ **(Average Yearly Growth)** About 5.3% between 2002 and 2011

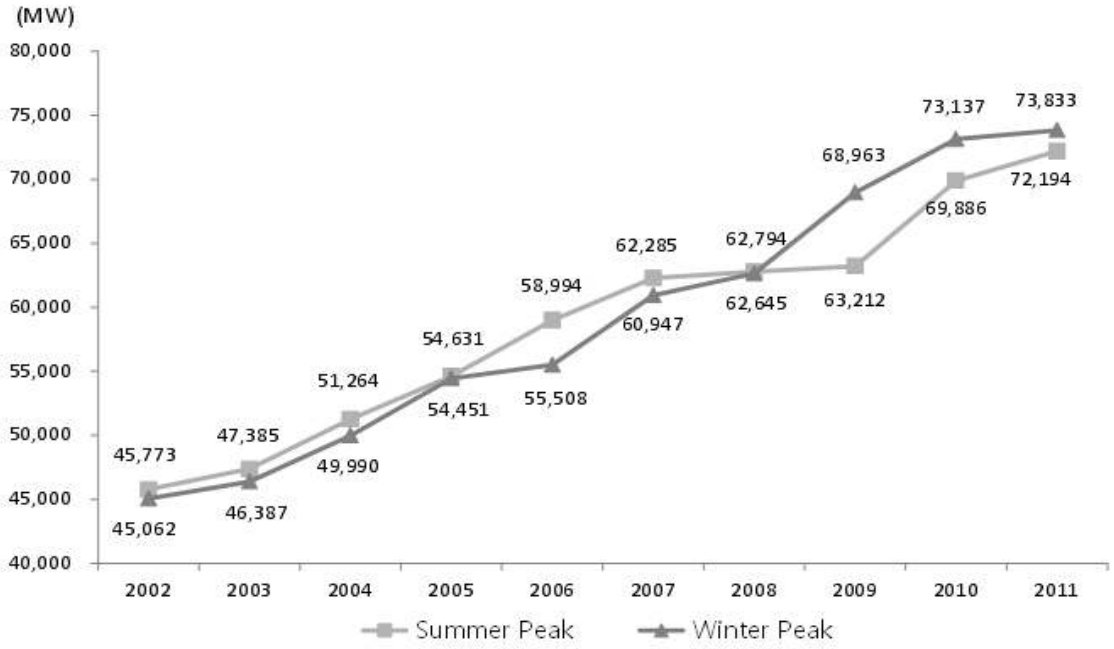
○ Average yearly growth of the peak demand has strong correlation with that of the total consumption (5.6%)

【 Comparison Between Consumption and Peak Demand Trends 】



□ **(Occurring Season)** Peak demand used to occur in summer, but since 2009 it is occurring in winter

【 Yearly Summer/Winter Peak Demand 】



□ **(Load Factor)** Due to the large share of the demand being industrial, which is relatively consistent throughout the year, load factor (average demand divided by peak demand) is notably higher than that of other countries

* Higher load factor results in more efficient use of the capacity

【 Load Factor by Country (Unit : %) **】**

Year	South Korea	Japan	USA	Canada	P. R. China	France	Germany	UK	Italy
2002	76.4	58.5	59.8	65.9	...	67.2	72.5	64.8	56.5
2005	76.2	62.4	58.7	69.2	84.7	64.1	77.0	66.3	58.4
2010	74.1	...	59.7	64.4	...	60.6	71.6	64.7	58.8

* Source : JEPIC (Japan Electric Power Information Center)

2 Electricity Supply

□ **(Total)** Total installed capacity is 81,806MW as of end of 2012

○ 52%(28,005MW) increase compared to 2002 (53,801MW)

○ 13th largest in the world in 2010, which is smaller than the total size of the electricity demand (8th largest)

* Countries with 8 to 12th largest capacities have less demand than S. Korea

Installed Capacity World Rank (Unit : GW, 2010, Inc. Self Generation) 】

Rank	Country	Capacity	Rank	Country	Capacity
1	USA	1,025.0	8	France	119.1
2	P. R. China	877.7	9	Brazil	106.2
3	Japan	284.5	10	Italy	101.2
4	Russia	225.3	11	Spain	96.28
5	India	189.3	12	UK	88.02
6	Germany	146.9	**13**	**S. Korea**	**80.59**
7	Canada	131.5	14	Mexico	59.33

* Source : US CIA the World Factbook 2012

* Key OECD countries with high demand (e.g. USA, Japan, Germany, France, Italy, and Spain) have 25% or higher reserve (S. Korea has less than 10%)

□ **(By Type)** In capacity, Nuclear, Coal and LNG have the largest shares, though LNG's share of generation has been rising due to tight supply/demand balance

【 Size and Share of Installed Capacity by Type (Year-End) (Unit : MW) 】

Year	Nuclear	Coal	LNG	Oil	Pumped	Renew.	Total
2002	15,716	15,931	13,618	4,660	2,300	1,576	53,801
	29.2	29.6	25.3	8.7	4.3	2.9	100
2012	20,716	25,128	21,885	5,293	4,700	4,084	81,806
	25.3	30.7	26.8	6.5	5.7	5.0	100

【 Amount and Share of Generation by Type (Year-End) (Unit : GWh) 】

Year	Nuclear	Coal	LNG	Oil	Pumped	Renew.	Total
2002	119,103	118,022	38,943	25,095	2,078	3,233	306,474
	38.9	38.5	12.7	8.2	0.7	1.1	100
2012	150,623	200,482	126,358	15,610	3,675	11,632	508,380
	29.6	39.4	24.9	3.1	0.7	2.3	100

* Source (for 2012) : Generation Management System's Tentative Values

* Share for RCS(Regional Cogeneration System) was divided and integrated into the data by type

□ **(Private)** IPP's share rose from 6.0% in 2002 to 12.2% in 2012

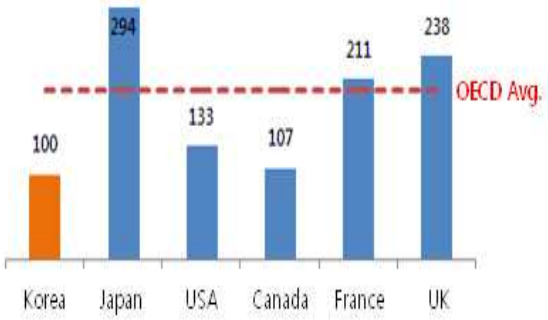
【 Public and IPPs Capacity (unit : MW, %) **】**

Year	Total		Public		IPP (Private)	
	Capacity	Share	Capacity	Share	Capacity	Share
2002	53,801	100	50,571	94.0	3,230	6.0
2012	81,806	100	71,825	87.8	9,981	12.2

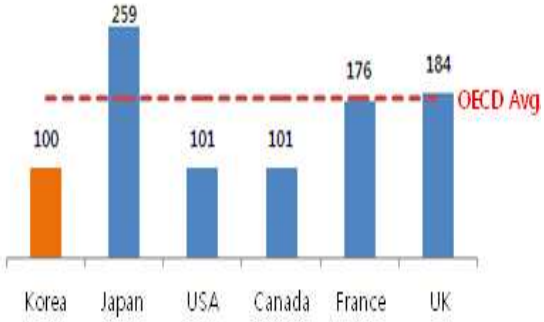
* IPP breakdown by type : 2002 LNG 99%, Renewable 1%
2012 LNG 72%, Coal(RCS) 6%, Oil(RCS) 3%, Renew. 19%

□ **(Price Level)** Lower than raw cost - cheapest among OECD countries for residential and industrial uses

【 Electricity Price Comparison (S. Korea=100, as of 2011) **】**



【Residential】



【Industrial】

□ **(Quality Level)** Among the world's best in various metrics

【 Electricity Quality Comparison 】

Metric	Korea	Japan	Taiwan	France	UK	USA	Rank
SAIDI (Min./Customer)	**12.4 (2011)**	10.0 (2008)	18.2 (2011)	73 (2011)	68 (2011)	120 (2009)	2
Voltage Holding Ratio (%)	**99.93 (2012)**	99.9 (1993)	96.6 (1996)	94.5 (1996)	-	-	1
Freq. Holding Ratio (%)	**99.97 (2011)**	99.99 (1994)	93.4 (1999)	99.9 (1997)	-	-	2
Transmission Loss (%)	**3.69 (2011)**	4.8 (2011)	4.7 (2011)	6.9 (2011)	7.8 (2011)	5.8 (2011)	1

* Source : KPMG Electric Energy Evaluation (2012)
* SAIDI = System Average Interruption Duration Index

3 Analysis of Recent Supply-Demand Imbalance

A. Recent Issues

□ **(Surge in Demand)** Since 2010, actual demand was more than 5,000MW higher compared to 3rd BPE (2006 to 2020)

○ 3rd BPE predicted 67,120MW of demand for 2012, but in reality it was 74,291MW, an error of 7,171MW

【 Electricity Demand - Prediction and Result (Unit : MW) **】**

Year	Prediction			Result
	3rd BPE	4th BPE	5th BPE	
2006	58,994			58,994
2007	59,678			62,285
2008	61,382	62,794		62,794
2009	62,987	67,226		63,212
2010	64,605	69,455	69,886	69,886
2011	65,944	71,324	72,620	72,194
2012	67,120	72,958	74,414	74,291

* Values are for summer peaks

□ **(Reserve)** Reserve rate fell due to unexpected rise in demand

【 Reserve Power and Margin by Year 】

	Type	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12
Installed Capacity	Reserve (MW)	6,507	7,026	8,696	7,865	7,106	5,784	4,911	7,559	10,160	**4,521**	**7,052**	**7,261**
	Reserve Margin(%)	15.1	15.3	18.4	15.3	13.0	9.8	7.9	12.0	16.1	**6.5**	**9.8**	**9.8**
Supply Capability	Reserve (MW)	5,574	6,340	8,103	6,264	6,187	6,189	4,493	5,725	9,420	**4,458**	**5,442**	**2,791**
	Reserve Margin(%)	12.9	13.9	17.1	12.2	11.3	10.5	7.2	9.1	14.9	**6.4**	**7.5**	**3.8**

* Bold values reflect application of short-term Demand Side Management (DSM)

□ **(DSM)** Due to deteriorating balance since 2010, short-term demand curtailment has been carried out (3,666MW in 2012)

○ 75 warnings were issued in 2012 and spent 386 billion KRW in DSM

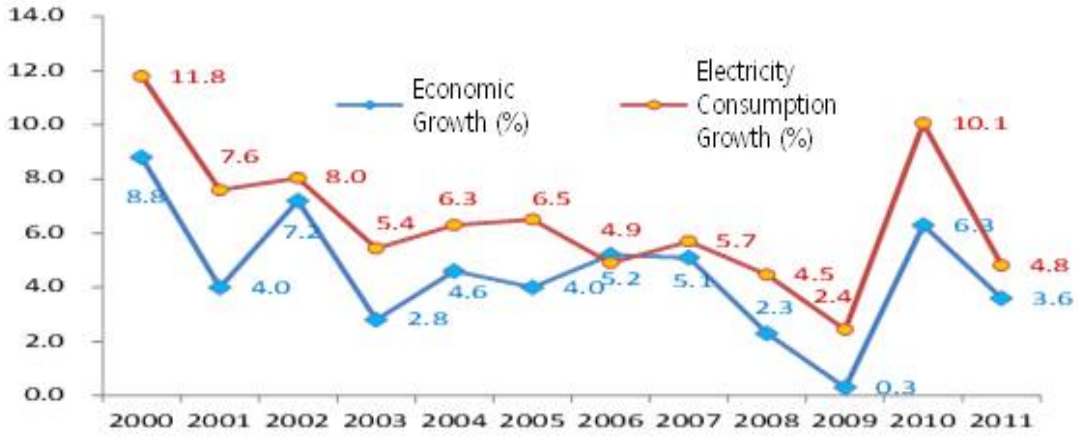
* Warnings issued : Prepared 63 times, Guarded 10 times, Elevated 2 times

B. Cause of Rising Demand

□ **(Economic Growth)** Steady economic growth throughout the past decade resulted in similar rise of electricity demand

* GDP and electricity consumption have strong correlation

【 Comparison of Economic Growth and Electricity Consumption Trend 】



□ **(Industry Structure)** Rise of the share of electricity-heavy industries in the GDP caused electricity demand to increase

○ Manufacturing's share rose from 22.7%(2002) to 28.8%(2011)

* Manufacturing's need for electricity to increase a unit of GDP is three times that of agriculture/fishery or service sectors

* Electricity Consumption Per Unit of GDP (kWh/KRW1,000) - Agric./Fish.: 0.278, Mining : 0.694, Mfg. : 0.751, Service : 0.211 ※ Estimated average for the past decade in terms of KRW

□ **(Living Standard)** Increase of nuclear families and housing, and popularity of electronics caused more use of electricity

○ Between 2000 and 2010, four-member households dropped, while single-member households rose by 86.2%

* Per capita electricity consumption for a single-member household is about 1.5 times that of a four-member household

【 Comparison of Households, Members, and Housing 】

Year	Households (thousands)	Number of Members (thousands)				Average Members	Housing (thousands)
		1	2 to 3	4 to 6	7+		
2000	14,312	2,224	5,718	6,235	134	3.1	11,472
2010	17,339	4,142	7,901	5,218	79	2.7	14,677
Change	21.2%	86.2%	38.2%	△16.3%	△41.3%	△0.4	27.9%

* Source : 『2000, 2010 Census』 (Statistics Korea)

【 Comparison of Per Capita Electricity Consumption by Household Size 】

# of Members	1	2	3	4	5+
Total Consumption	163	271	325	412	434
Per Capita Cons.	166	135	108	103	87

* Source : Consumption Sampling (KEPCO, Aug. 2012, 2,176 Households)

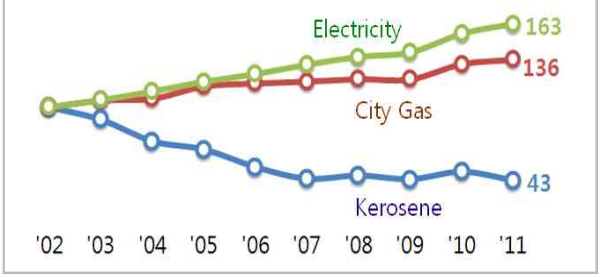
○ Rise of income, improved ease-of-use of electric devices drove adoption of devices old & new(humidifiers, cellphones, etc.)

□ **(Switching)** Due to relatively lower price, electricity absorbed significant demand from other energy sources

【 Price & Usage Comparison of Electricity and Other Energy Sources 】

【Price Trend (2002=100)】

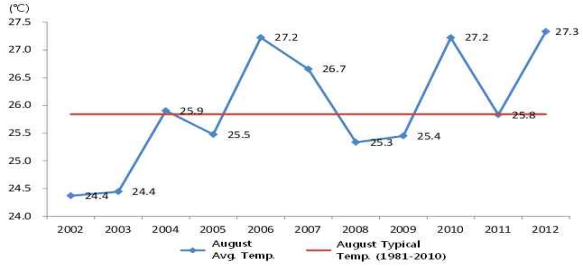
【Usage Trend (2002=100)】

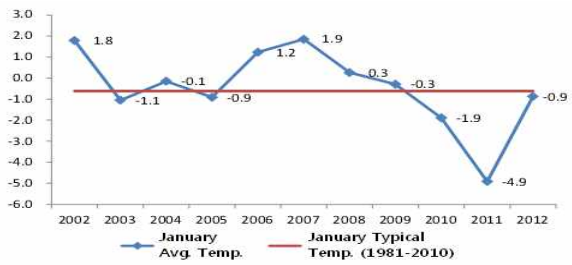


□ **(Surge in Heating, Cooling)** Temperature spikes(heat & cold waves) led to prevalence of heating & cooling apparatuses

○ Rise of income, adoption of intuitive electric heating & cooling caused more electricity use at same temperature

【 Summer (Aug.) & Winter (Jan.) Average Temperature Trend 】



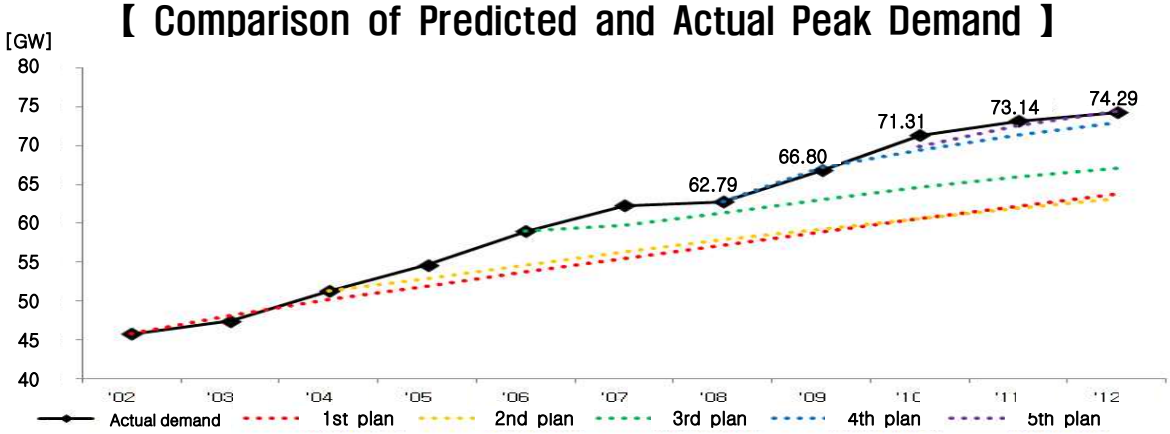


C. Cause of Supply Shortage

□ **(Error in Demand Prediction)** Calculation of needed generation facilities had a problem because of the low prediction for the power demand

○ Actual demand exceeded the predicted demand, and about 10% prediction error happened especially in medium-and long-term

【 Comparison of Predicted and Actual Peak Demand 】



【 Error Rate in Demand Prediction by Plans 】

Plan	1st BPE ('02～'15)		2nd BPE ('04～'17)		3rd BPE ('06～'20)		4th BPE ('08～'22)		5th BPE ('10～'24)	
Target Demand by Term	Short	1.2%	Short	6.7%	Short	4.0%	Short	1.9%	Short	0.4%
	Medium	8.5%	Medium	12.4%	Medium	9.6%	Medium	1.8%	Medium	-
	Long	14.0%	Long	15.0%	Long	-	Long	-	Long	-

* Error rates in demand prediction by plan and term
(Short term : 1～3 years, Medium term : 4～7 years, Long term : more than 7 years)

□ **(Insufficient Demand Side Management)** Active demand side management goal was made as a part of the low power consumption policy, but the schemes to make it happen was insufficient

○ There's a big dependency on the emergency resources such as weekly notice system and specified period system to deal with recent supply-demand uncertainty

○ The efforts to actualize the price of electricity, which is a major means of demand side management, and to reform the pricing system are relatively lacking

□ **(Delay or Cancellation of Power Plant Projects)** Many power plants in the original BPE faced delays or cancellation

○ 4,150MW worth of power plants due for operation in 2013 according to the 3rd BPE have been delayed or cancelled

【 Delay or Cancellation of Power Plant Projects】

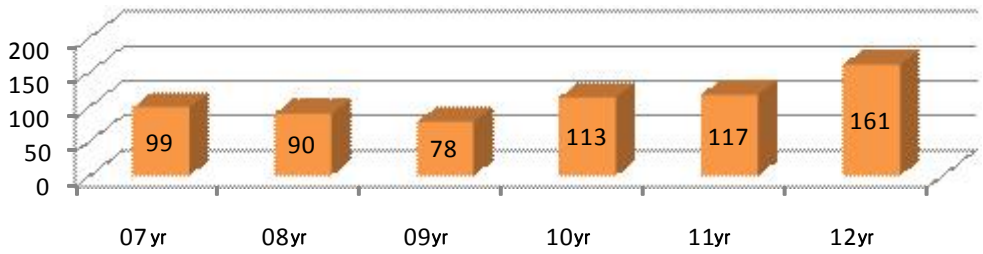
Year	Capacity	Name (Numbers in ( ) are capacity in MW, **Bold means cancelled plants**)
'12	4,983MW	Bugok CC #3,4(1000), Seoul CC #1,2(1000), **Songdo CC #1,2(900), Yangju CC #1(700), Yulchon CC #2(550)**, Oseong CC(833)
'13	4,150MW	Bugok CC #3,4(1000), Seoul CC #1,2(1000), **Songdo CC #1,2(900), Yangju CC #1(700), Yulchon CC #2(550)**

□ **(Rapid Decrease of Supply Capacity)** Since 2010, supply reserve has fallen due to the reinforcement of nuclear plant safety standard and rise of generator trip (supply reserve in summer 2012: 3.8%)

○ Some nuclear plants suspended operation due to the reinforced safety standard

○ Generator trips rose from 113 cases in 2010 to 161 cases in 2012

【 Number of Generator Trips 】



D. Response Efforts and Its Limits

□ **(Response Efforts)** After the 3rd BPE, efforts to minimize supply problem such as adding uncertainty mitigation facilities, postponing abolition, and dispatching emergency facility have been ongoing

○ **(Uncertainty Mitigation Capacity)** Since the 3rd BPE, they have been added in the plan to mitigate delay or cancellation of projects

* 3rd BPE(3,250MW): Bugok CC #3~4, Songdo CC #1~2, Yangju CC #2
* 4th BPE(4,100MW): Andong CC, Seoul CC #1~2, Pocheon CC #1, Sinulsan CC, Ansan CC
* 5th BPE(7,300MW): Pocheon CC #2, Chuncheon CC, Seoul CC #1~2, Donducheon CC #1~2, POSCO CC #7~8, Yeosu #1, Taean #9~10

○ **(Delay of Abolition)** Abolitions worth 2,510MW in the 4th BPE and 2,568MW in the 5th BPE (1,143MW in 2012) have been delayed

* 4th BPE(2,510MW): Boryeong #1~2, Pyeongtaek #1~4, Jeju GT #1~2
* 5th BPE(2,568MW): Yeongdong #1, Seocheon #1~2, Seoul #4~5, Incheon #1~2, Pyeongtaek #1~2, Yeongnam #1~2, Jeju GT #3

○ **(Emergency Capacity)** 6,064MW of capacity from emergency facilities (reflected in the 5th BPE), RCS, and renewable energy are to be secured

* RCS and renewable energy facilities worth 3,360MW such as Gunjang Cogeneration Plant, Paju Cogeneration Plant, Songdo Cogeneration Plant, and etc.
* Emergency facilities worth 2,704MW to be constructed in 2013 and 2014 (Sinulsan CC, Sinpyeongtaek 2nd Phase, Yulchon CC #2)

○ **(Securing Private Supply Capacity)** Additional generation capacity is secured from private power plants such as industry, community energy system, and renewable energy - these operate at maximum capacity during peak hours (Jan. 2012~)

* Summer(850MW) : Community Energy System (12 units, 450MW), Self-Operating Generators (400MW)
* Winter(650MW) : Community Energy System (12 units, 250MW), Self-Operating Generators (400MW)

○ **(Reinforcing Peak Management)** Demand side management measures, e.g. dispersion of industry vacation and weekly notice system are reinforced

* Contracts made with 2,300 businesses to disperse vacation, reducing more than 2,500MW during the peak hours
* Expansion of weekly notice system (3,130MW and 4,375 businesses in 2011, → 5,150MW and 5,760 businesses in 2013)

□ **(Limitations)** Mitigation of exploding demands is limited despite these countermeasures due to long construction times for power plants

< Implications >

◈ High power demand is due to the power-overspending industry structure and relatively cheap price of electricity

○ Power consumption increased constantly with the economic growth, as major industries that spend lots of electricity lead the economy

○ Commercial and residental power demand like cooling and heating has increased due to improved income and convenience of devices

○ Electrification is accelerated due to the relatively cheap electricity price

⇒ **Due to the domestic industry structure, it is difficult to lower power demand in a short time, but we need to keep up our efforts to reduce demand by actualizing price and reforming pricing system**

◈ Power supply-demand instability is due to the fact that the installed capacity is insufficient to meet the domestic power consumption

⇒ **There needs to be sufficient reserve facilities matching the national economy scale based on the rational demand prediction**

Ⅲ. Basic Directions of the 6th BPE

1 Domestic & Foreign Changes in the Environment

A. Increasing Supply-Demand Uncertainty

□ **(Demand)** Temperature anomaly, uncertainty of electricity price hike (policy variable) and rise of economic volatility make forecast difficult

* On the 6th power plan report by American Northwest Environment Committee, maximum error of 30 to 40% occurs due to the uncertainty of demand prediction

□ **(Supply)** In 2012, the number of trips has increased as 27.1% of all generators are more than 20 years old. Supply uncertainty has also risen as regional civil complaints about power plants and transmission-distribution facilities construction are increasing

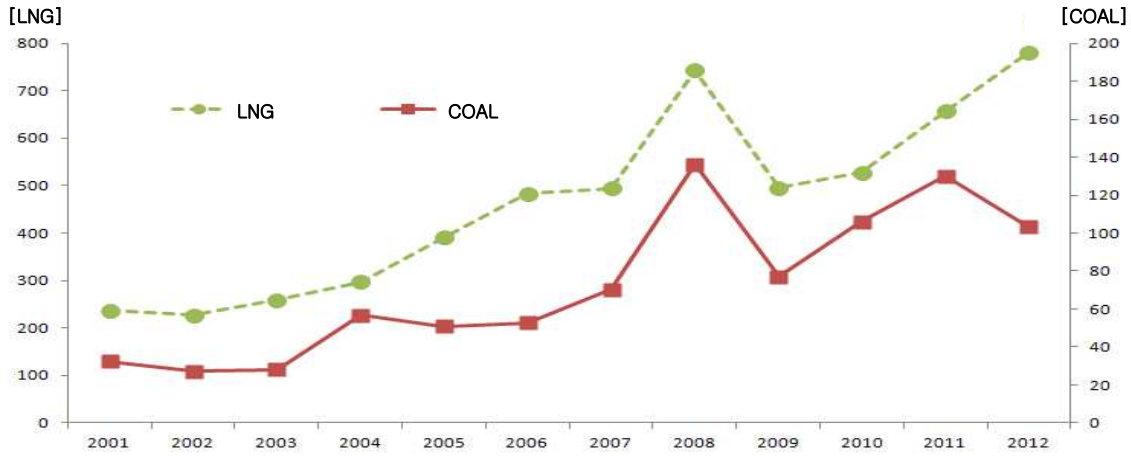
【 Trend of Power Plants Aging (unit : number, %) **】**

Age	Standard Year				
	2012	2015	2020	2025	2030
More than 20 years (Ratio)	93(27.1)	110(31.1)	146(38.9)	174(50.3)	201(60.1)
More than 30 years (Ratio)	49(9.3)	68(14.5)	75(15.7)	110(24.3)	146(38.1)

* Excludes RCS & renewable energy plants; ratios are based on capacity

□ **(Supply-Demand of Fuel)** Since 97% of generator fuel depends on import, the uncertainty of international energy market is directly connected to instability of domestic power supply

【 Trend of Coal and LNG Price Change (Unit : $/Ton) **】**



* Coal : For Australian thermal coal (source : IMF Primary Commodity Prices)
* LNG : LNG import price (source : Korea Energy Statistics Integration System (KESIS))

B. Increase of Social Need for Power Supply-Demand Stability

□ **(Isolated System)** Korean system is an island type, so it is different from the European system*, which have interconnected power, and it is essential to secure stable reserve

* France, Germany, Czech Republic, Austria, Denmark, Netherlands, Switzerland, etc. (North Europe)

□ **(Power Supply-Demand Crisis After Sept.15 Blackout)** Social sympathy for the need of stable supply-demand management and sufficient reserve have been spreading out

* Estimation of domestic outage cost (GDP/power sales, thousand Won/MWh)
  : 1,981(in 1990) → 3,274(in 2020)
  (Source : Study on Reestablishment of Supply Reliability Standard, KPX, 2009)

□ **(Need for Effective Supply-Demand Plan)** The demand for securing supply-demand plan effectiveness by minimizing demand prediction error and reinforcement of plants completion in proper time has increased due to the instability of power supply-demand conditions

C. Limitation Factors by Power Supply Types

□ **(Nuclear)** Public acceptance for nuclear plants expansion has declined due to the Fukushima nuclear plant accident and the debacle on using non-verified components

□ **(Coal)** Negative recognition for the coal power generation remains unchanged even though pollutant reduction technology is developing

* Efficiency improvement of coal generation environment facility (2000→2010)
  : Desulfurization facility 91%→99%, denitrification facility 72%→98%
* Carbon Capture & Storage(CCS) skill is now being developed

□ **(LNG)** Lower gas generation costs is expected due to the introduction of shale gas, but there is a limit to replacing coal based on price outlook

* Price outlook with shale gas (in 2025) : nuclear $3.5/MMBtu, coal $6/MMBtu, gas $13/MMBtu (production 4 + liquefaction 3 + transportation 3 + supply 3)

□ **(Renewable Energy)** Actual limits such as environmental conditions and generation costs exist even though efforts are made to expand distribution

* Renewable energy is strictly dependent on the national land scale and the environmental conditions (hydropower-water resource, solar energy-gross area, wind power-wind condition and gross area, bio energy-forest and grain resource, etc.)

2 Basic Directions of the BPE

Basic Directions

① Minimize new power plants requirement with active demand side management
② Secure stable reserve suitable for economy scale
③ Expand power plants with regional acceptance and transmission system condition in consideration

Core Tasks

Demand Forecast	1 Minimize demand prediction error
Demand Side Management	1 Reinforce existing demand side management measures 2 Improve power rate system and expand smart grid ⇒ 12% reduction of peak demand, and 15% reduction of power consumption
Power Supply Plan	1 Secure stable reserve facilities ⇒ 22% Reserve margin in 2027 2 Power supply mix that considers limitation factors by power supply types 3 Power plants completion in proper time and secure system stability ⇒ Reinforce assessment of regional acceptance and transmission system condition

Ⅳ. Reference Demand Outlook

1 Model and Major Premise

□ **(Prediction Model)** Forecast power has been improved by the introduction macro model in addition to the existing micro model

Demand Prediction Models

◇ **(Micro Model)** Classify power consumption into 3 big, 15 small sectors (2 residential uses, 3 commercial uses, 10 industrial uses) and predict, reflecting economic growth, population, industry change (existing model)

* Deduce peak power by using past load pattern

◇ **(Macro Model)** Predict power consumption reflecting future economic growth outlook, power consumption trend, and power demand growth pattern of major developed countries (new model)

* Deduce peak power by using temperature response level (additional cooling and heating load according to the temperature)

□ **(Major Premise)** Economic growth, industry structure, population increase rate, weather forecast, etc. are reflected

○ **(Economic Growth Outlook)** Economic growth rate to decrease in the short term and increase in the long term, reflecting economic growth rate outlook (Dec. 2012) of KDI

- Annual average growth rate has slightly decreased in comparison with the 5th BPE

【 GDP Growth Rate Outlook (KDI) (Unit : %) **】**

Plan	2012	2013	2015	2020	2024	2027	Annual Average ('12～'27)
5th BPE	**4.3**	**4.2**	4.1	3.8	2.9	-	**3.6**
6th BPE	**2.2**	**3.0**	4.5	3.5	3.1	2.7	**3.5**

○ **(Industry Structure)** Manufacturing business portion will decrease and service industry portion will increase

- Increase in manufacturing business portion and decrease in service industry portion is expected in comparison to the 5th BPE

【 Industry Structure Outlook (KIET) (Unit : added value portion %) **】**

Division		Agriculture & Fishing	Mining	Manufacturing	Service	Tax
2011	5th (Plan)	2.8	0.2	**25.9**	61.1	10.0
	6th (Result)	2.6	0.2	**28.8**	58.8	10.0
2024	5th	1.9	0.1	**25.4**	63.0	10.0
	6th	1.7	0.1	**27.8**	60.0	10.0
2027	5th	1.8	0.1	**24.9**	63.8	10.0
	6th	1.5	0.1	**27.6**	60.3	10.0

○ **(Population Growth)** Population will increase until 2030 according to future population estimate (Dec.'11) of National Statistical Office (NSO)

- 5.5 % population increase in 2024 in comparison to the 5th BPE

  * Population decrease was expected on 2018 in the 5th BPE, reflecting the NSO data of 2005, but now the starting point of decrease was pushed to 2030 according to the NSO data of 2010

【 Population Outlook (National Statistical Office) (Unit : thousand, %) **】**

Plan	2011	2015	2020	2024	2027
5th BPE	48,989	49,277	49,326	49,168 **(100.0)**	-
6th BPE	49,779	50,617	51,435	51,888 **(105.5)**	52,094

○ **(Electricity Price)** Electricity price shall be actualized to the cost level by 2014, and the normalized rate* of price increase for the past 15 years will be applied thereafter

* Periods of regional financial crises and recent period of rapid increase in fuel cost shall be excluded

○ **(Temperature)** Temperature outlook up to 2027 is reflected (data from Korea Meteorological Administration)

* Change of peak demand reflects future climate change, reflecting the case of global warming progress applied to the trend of the Korea's climate change scenarios of KMA

2 Result of Prediction (Using Macro Model)

□ **(Power Consumption)** 771,007GWh in 2027 with 3.4% annual average increase for the next 15 years (2013 to 2027) are expected

* 5th BPE : 3.1% increase in annual average for 15 years between 2010 and 2024

□ **(Peak Demand)** 126,740MW in 2027 with 3.5% annual average increase for the next 15 years (2013 to 2027) are expected

* 5th BPE : 3.1% increase in annual average for 15 years between 2010 and 2024

○ Peak demand is expected to go beyond 80,000MW in winter 2013, 90,000MW in summer 2017, and 100,000MW in summer 2020

○ Peak demand will increase by 3.4% in summer and 3.0% in winter during the duration of the plan

【 Power Consumption and Peak Demand Prediction Results 】

Year	Power Consumption (GWh)		Peak Demand (MW)		
	5th BPE	6th BPE	5th BPE	6th BPE	
			Summer	Summer	Winter
2013	482,400	485,428	79,784	78,998	80,374
2014	502,613	505,315	83,360	81,657	82,309
2015	520,842	526,356	86,754	83,532	84,658
2016	536,092	547,794	89,629	86,919	86,499
2017	550,527	569,141	92,281	91,031	89,694
2018	567,175	590,257	95,075	94,694	92,699
2019	582,461	610,823	97,405	98,621	96,243
2020	598,221	630,964	99,653	102,205	100,809
2021	612,289	651,845	101,640	105,852	104,714
2022	626,427	672,544	103,644	109,476	108,528
2023	640,297	693,056	105,614	113,065	111,913
2024	**653,541 (100.0)**	**713,310 (109.2)**	**107,437 (100.0)**	**116,602 (108.5)**	**114,442 (106.5)**
2025		733,060		120,078	116,982
2026		752,364		123,450	119,345
2027		771,007		126,740	121,684
'13～'27*		3.4	-	3.4	3.0

* Annual average growth rate

Ⅴ. DSM and Target Demand Outlook

1 Demand Side Management Plan
(Peak Demand 12%↓, Power Consumption 15%↓)

□ **(Efficiency Improvement)** Keep existing business of distributing high efficiency devices on track, but gradually turn to distributing device & control/management package, and greatly improve power consumption efficiency of electric & electronic products

○ Maintain existing business of distributing high efficiency devices

- By 2020, 60% of total illumination and 100% of public institution illumination are to be converted to LED
- Incentives (subsidy, tax break, etc.) for the use of high efficiency devices such as inverters and premium electric motors will be greatly expanded

○ Build systematic management structure of power efficiency

- Certification standards for BEMS (Building Energy Management System) and data center network device will be made, and they will be merged to the efficiency management policy (by amending energy use rationalization act and its subordinates)
- Introduce new rules to install and support BEMS, power control system, and high efficiency devices as single packages

○ Innovative improvement of power consumption efficiency of electric and electronic products

- Power consumption efficiency standard for cooling and heating devices, home appliances, electric motor, etc. will be constantly reinforced
- Standby power standard for electronic product will be gradually reinforced, and 24-hour networking products such as set-top box, IPTV, etc. will be intensively managed
- Power efficiency management system for the built-in appliances and networking products will be newly introduced (amendment of energy use rationalization act may be considered)

□ **(Load Management)** Effectiveness of load management devices distribution business shall be ensured by assessing the devices' performance of peak demand decrease

○ Performance assessment of the load management devices for distribution, such as cold storage facility, gas cooling, air conditioner remote control, peak power control device, etc. shall be reinforced

○ Based on the performance assessment, the products that have good effects for peak demand decrease shall be supplied intensively, and supported targets shall be expanded

□ **(Electricity Pricing System Improvement)** Distortion of substituted spending among energy sources shall be prevented by the cost-based pricing system, and price function shall drive rational consumption

○ Price level will be actualized to the cost level, and fuel expenses link system that reflects international fuel price change just-in-time will be conducted

○ Customers eligible for seasonal and hourly differential pricing that reflect different power supply cost due to the power supply-demand condition will be expanded

- Development and application of variable selective pricing that considers the characteristics of the consumers and the need of power supply-demand stability will be expanded

○ Existing pricing system that differentiate by use types will be simplified to that which differentiate by voltage types based on the cost, so that it can prevent power over-use by specific use

- The price differences by the use types will be gradually relaxed, so that it can ensure fairness among the different consumers types and correct cross-subsidy distortion

□ **(Early Expanding of Smart Grid)** Smart meters shall be distributed early, while ESS and smart demand management shall be expanded

○ Plans to switch to smart meters in accordance to the Smart Grid Act will be laid out by first half of 2013, with the aim of 100% distribution by 2020

- For the low voltage users (20 million customers), distribution for general use and industrial use will be completed by 2015, and residential use, by 2020 (completed for high voltage users(170,000 customers))

- Smart meter system in group buildings (apartment, commercial building, etc.) will be reorganized together

  * Smart meter will be mandatory for new buildings, and existing buildings will aim to have replacement by 2020

○ Distribution of electricity storage system will be expanded to 500MW by 2015 and 2,000MW by 2020 (equal to two nuclear plants)

  * Pilot distribution of the system worth 11MW will be put in place of shopping districts & buildings as part of the 2013 smart grid distribution business

  - In the long term, these facilities will be distributed to interconnect renewable energy system and tune system frequency

○ Plans to foster smart demand management business will be drawn out (2013) to expand smart demand management and invigorate demand side management market

  - We will foster the increase of load aggregators that professionally manage the whole cycle* of smart demand management, and set up the system to plan and assess the process

    * Find demand resources → Check energy use pattern → Install devices → Participate in demand response program → Spread profit

  - In the long term, a system that competes with the generation sector in the power market (economic demand response) will be introduced

    * Smart DR will be compensated from the power fund, and economic DR will be settled by the power market

【 Peak Power Demand Management Target [Unit : MW] **】**

Year	Summer				Winter			
	Load Manage Device	Efficiency Improvement	Smart Grid & Electricity Pricing Sys.	Total	Load Manage Device	Efficiency Improvement	Smart Grid & Electricity Pricing Sys.	Total
2013	90	371	190	**651**	92	413	157	**662**
2016	187	1,072	1,084	**2,343 (1,692)**	207	1,080	1,045	**2,332 (1,669)**
2020	957	2,240	3,692	**6,889 (6,238)**	991	2,232	3,572	**6,795 (6,132)**
2023	2,094	3,901	6,263	**12,258 (11,607)**	1,867	4,105	6,158	**12,130 (11,467)**
2027	2,484	5,722	7,648	**15,854 (15,203)**	2,223	5,373	7,624	**15,220 (14,557)**

* Peak control amount (sum of net increase) : 5th BPE (12,399MW) → 6th BPE (15,854MW)
* Peak control amount : Sum of each program types, ( ) means sum of net increase compared to 2013

2 Target Demand Outlook

□ **(Power Consumption)** 655,305GWh in 2027 with 2.2% annual growth rate for 15 years (2013 to 2027) expected (annual growth rate of 1.9% for 2010-2024 in the 5th BPE)

○ In 2024, power consumption is expected to be 611,734GWh, which is a 10.9% increase compared to the 5th BPE (551,606GWh)

□ **(Peak Demand)** 110,886MW for 2027 with 2.4% annual growth rate for 15 years (2013 to 2027) expected (annual growth rate of 2.2% for 2010-2024 in the 5th BPE)

○ It is expected to go beyond 80,000MW in 2014, 90,000 MW in 2018, and 100,000MW in 2023

○ In 2024, peak demand is expected to be 102,839MW, which is a 8.2% increase compared to the 5th BPE (95,038MW)

【 Peak Demand Forecast Results in Targeted Demand 】

Year	5th BPE			6th BPE		
	Demand Side Management (MW)	Peak Demand (MW)	Power Consumption (GWh)	Demand Side Management (MW)	Peak Demand (MW)	Power Consumption (GWh)
'13	3,577	76,207	471,996	662	79,712	482,527
'14	5,343	78,017	485,051	1,340	80,969	499,116
'15	6,745	80,009	496,590	1,981	82,677	516,156
'16	7,641	81,988	506,482	2,343	84,576	532,694
'17	8,368	83,913	515,591	2,813	88,218	548,241
'18	9,265	85,810	523,867	3,185	91,509	564,256
'19	9,798	87,607	531,261	4,938	93,683	578,623
'20	10,428	89,225	535,779	6,889	95,316	590,565
'21	10,927	90,713	540,078	8,342	97,510	597,064
'22	11,533	92,111	544,153	10,113	99,363	602,049
'23	12,016	93,598	547,997	12,258	100,807	605,724
'24	12,399	**95,038 (100.0)**	**551,606 (100.0)**	13,763	**102,839 (108.2)**	**611,734 (110.9)**
'25				15,022	105,056	624,950
'26				15,413	108,037	640,133
'27				15,854	110,886	655,305
13-24*		2.0	1.4		2.3	2.2
13-27*					2.4	2.2

* Average annual growth rate

Ⅵ. Installed Capacity Planning

Basic Directions and Goals

Basic Directions

- Secure stable reserve suitable for economy scale
- Make power supply mix that minimizes economic and social costs considering local and overseas socio-political environment
- Expand power plants with regional acceptance and system condition in consideration

Goals

- Keep reserve rate over 22%, and put additional capacity to mitigate construction uncertainty
- Make renewable generation take over 12% of generation and 20% of installed capacity

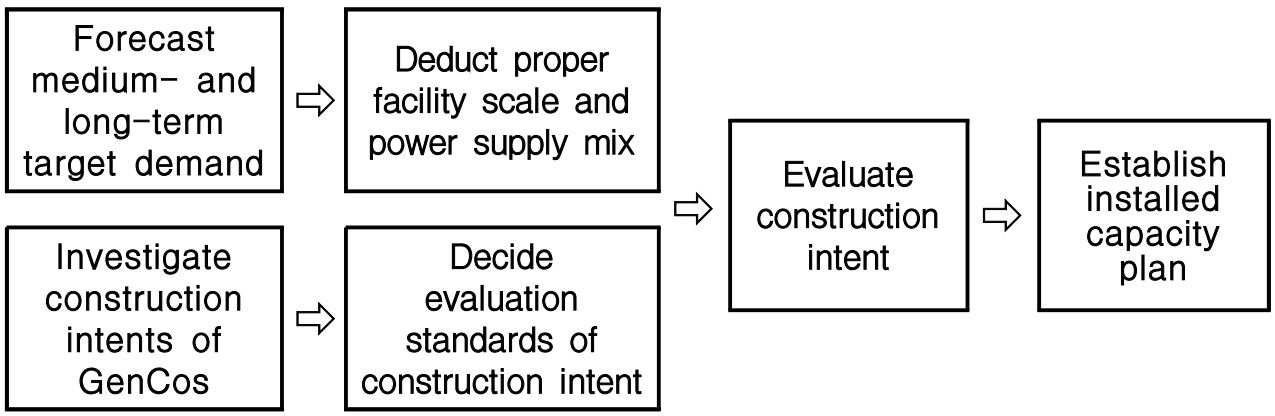
1 Establishment Procedures

□ **(Power Supply Mix)** Proper scale of facilities is deducted from the target demand; supply mix is determined for the new power plants requirement

□ **(Construction Intent Reflection)** GenCos' intents for construction are investigated and selectively reflected after evaluation

○ Target amounts of nuclear plants, renewable energy, and RCS, which are determined by policy, will be fully reflected without extra evaluation

【 Establishment Procedure of Installed Capacity Plan 】



2 Proper Generation Capacity Scale

□ **(Reserve Rate : 22%)** Reserve rate goal for 2027 is 22%, considering demand uncertainty and minimum reserve rate to prepare for generator trips, etc.

○ We maintain 15% minimum reserve rate level, taking overhaul period extension and generator trips due to aging into account

* Standard of supply reliability : LOLE(Loss of Load Expectation) 0.3 day/year

- Particularly, to enforce stability of nuclear plants, additional reserve power is secured by decreasing use rate of nuclear plants through extension of overhaul period, etc.

* Decrease in use rate of Npps by enforcing stability : 80~85% (Capacity Factor)

○ Additional 7% reserve rate is considered on the basis of the uncertainty of demand forecast

□ **(Construction Uncertainty Mitigation Capacity)** Extra 3,900MW margin is reflected to mitigate plant construction delays due to civil complaints

【 Basis of Proper Capacity Reserve Rate in the 6th BPE 】

Division		Consideration Factors	Reserve Rate	Decision Basis
Target Reserve Rate	Minimum Reserve Rate	Trip, overhaul, increased nuclear plants safety measure	15%	LOLE 0.3 day/year (WASP simulation)
	Demand Uncertainty	Prediction error and demand side management uncertainty	7%	Average of annual target demand error rates in the 1st~4th BPE
	Subtotal		22%	
Supply Uncertainty		Delay or cancellation of construction	3,900MW	The rate of delay or cancellation of generation plants construction in the 1st~4th BPE

* WASP : Plan-setting digital model that deduces proper facility scale and power supply mix

□ **(Generation Capacity Scale)** Gross generation capacity needed in 2027 is 139,815MW considering 110,886MW target demand, 22% reserve rate, and construction uncertainty

○ Newly needed generation capacity is 29,570MW when excluding 110,245MW of finalized capacity reflected in the 5th BPE

3 Generation Mix

A. Policy-Driven Generation

□ **Nuclear Power Plants : Reflection of new supplies is postponed until the 2nd Master Plan for National Energy (MPNE) is finalized**

○ **(Postponing of New Reflections)** Judgment is postponed for new reflection amount for 2025 to 2027 considering public acceptance level after the Fukushima nuclear plant accident

* 11 nuclear plants of KHNP in the 5th BPE that are planned to be built by 2024 are reflected in certainty
* More review is needed for permitting nuclear plants construction for IPPs, but in the case of this plan, they were excluded due to site adequacy issues
* 6th BPE will be supplemented through the 6th revised plan, if the direction for additional nuclear plants construction is decided in the 2nd MPNE in 2013 → Second tier base capacities like Coal Power plants determined from the 2013 evaluation of construction intents will be reflected if more thermal power generation is needed

○ **(Extension of Approved Duration)** This will be decided later with overall assessment of economic factors and public acceptance, assuming strict safety check has been passed

□ **Renewable Energy : More than 12% of generation and 20% of installed capacity by 2027**

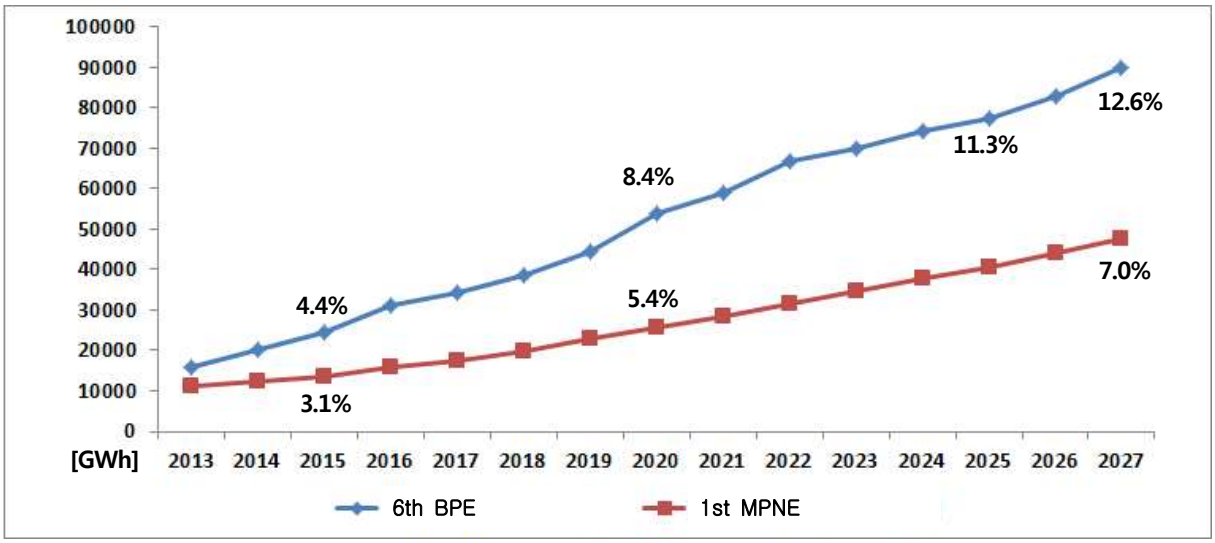
○ **(By Generation)** The ratio of renewable energy generation is projected to increase to 12% by 2027, which is higher than the 7% figure projected in the 1st MPNE (2008)

- Private investment of renewable energy will be invigorated by developing technology to lower the generation cost and relaxing land regulation to promote private investment

※ The 4th Master Plan for Renewable Energy will be set this year

【 Ratio of Renewable Energy Generation (Unit : GWh, %) **】**

Year	2015		2020		2025		2027	
6th BPE	24,664	(4.4%)	54,139	(8.4%)	77,364	(11.3%)	90,134	(12.6%)
1st MPNE	13,716	(3.1%)	25,562	(5.4%)	40,569	-	47,433	(7.0%)



○ **(By Installed Capacity)** Renewable generation capacity will be expanded to about 20% (20.2%, 32,014MW) by 2027

【 Ratio of Renewable Energy Capacity (Nominal) (Unit : MW, %) **】**

Year	2015	2020	2025	2027
6th BPE	9,277 (8.6)	20,066 (13.9)	29,178 (18.7)	32,014 (20.2)
1st MPNE	9,053 -	16,775 -	25,091 -	28,863

○ **(Effective Capacity)** 4,560MW of effective capacity, based on the peak contribution, will be reflected in the installed capacity plan due to the inability for these generation capacities to control load

【 Effective Capacity of the Renewable Energy (Unit : MW) **】**

Division	Hydro	Solar	Wind	Off-shore	Bio/ Waste	Fuel Cell	Byproduct Gas	IGCC	Total
Nominal Capacity	119	4,724	16,679	1,190	1,726	1,693	300	1,500	27,929
Peak Contribution (%)	23.6	13.0	1.5	2.1	8.7	100	100	100	-
Effective Capacity	28	615	249	25	150	1,693	300	1,500	4,560

□ RCS

○ RCS will be reflected with priority because these facilities are made to provide heat and produce electricity as a byproduct

* RCS construction plans that obtained business permission will be surveyed and reflected
(27 businesses worth 4,665MW are scheduled to be built by 2019, and effective capacity based on the peak contribution will be reflected)

B. Thermal Power Generation

□ **(Capacity Scale)** Out of 29,570MW new plants in 2027, thermal power plants take up 15,300MW

○ Following amounts from the total new plants are excluded
; suspended four nuclear power plants (6,000MW), renewable energy (4,560MW), and RCS (3,710MW)

○ The amount reflects additional capacity of 3,900MW that mitigate uncertainty due to construction delay or cancellation

□ **(Premise for Generation Mix)** Generation mix is decided by using WASP, a plan-setting digital model, to reflect economic and social costs by generation type on the 22% reserve rate and capacity that mitigate uncertainty, and by applying standard construction time

○ **(Fuel Cost)** Average cost for 2011 is applied to coal plants and existing LNG plants

- In the case of new LNG plants, we suppose that there will be a 25% price decrease due to the introduction of shale gas

○ **(Environmental Cost)** Environmental cost of pollutants (SOx, NOx, PM) and emissions cost for reducing greenhouse gas are reflected

* (Environmental Cost of Pollutants) Emission records of SOx, NOx, PM by generation types and external costs of each pollutant types as calculated by executive committee of EU (standardized to a generator in a city with 100 thousand people)

* (Emission Cost of Greenhouse Gas) 21,000 Won/tCO_2e (average of EU-ETS trading price in 2010)

○ **(Transmission Cost)** Unit price set in Transmission & Distribution Facilities Utilization Regulation and other rules are applied

* Connection Cost : Average connection cost of newly intended generators in the 6th BPE is uniformly applied according to the generation types

* Use Cost : Average of the local unit price in the transmission tariff table is applied with the regional capacity and generation type in consideration

○ **(Construction Time)** Standard construction time of 7 years for coal and 5 years for combined cycle is applied

【 Standard Construction Time by Generator Types 】

Type		Preparation		Implementation	Total
		Assessment of Environmental Influence	Permisssion After Submitting Action Plan	Construction Start to Completion	
Coal	1,000MW	24 months	6 months	56 months	86 months
Combined Cycle	500MW and Higher	20 months	6 months	28 months	54 months

□ **(Generation Mix Result)** 10,500MW of coal, 4,800MW of LNG by 2027

【 New Capacity Demand by the Final Year (2027) (Unit : MW) **】**

Coal	LNG	Renewable	RCS	Total
10,500	4,800	4,560	3,710	23,570

* Coal and LNG demands include capacity mitigating uncertainty (Coal 1,500MW, LNG 2,400MW)
* Judgment for the four nuclear generators (6,000MW) is postponed and aren't replaced with thermal power plants
* In the cases of renewable energy and RCS, the figures are based on the peak contribution

【 Proper Capacity Scale and Generation Mix Scheme [Unit : MW, %] **】**

Year	Peak Demand	Existing + Fixed + Renew. + RCS	Proper Capacity Scale					Construction Uncertainty Mitigation	
			Nuclear	Coal	LNG	Cumulative Capacity	Capacity Reserve Rate	Coal	LNG
2013	79,712	85,605		4		85,605	7.4		
2014	80,969	94,192				94,192	16.3		
2015	82,677	99,227				99,227	20.0		
2016	84,576	105,415				105,415	24.6		
2017	88,218	110,179				110,179	24.9		
2018	91,509	110,957			2,400	113,357	23.9		2,400
2019	93,683	111,011				113,411	21.1	500	
2020	95,316	113,453				115,853	21.5	1,000	
2021	97,510	116,295		1,000		119,695	22.8		
2022	99,363	116,587		2,000		121,987	22.8		
2023	100,807	116,622		2,000		124,022	23.0		
2024	102,839	116,659		2,000		126,059	22.6		
2025	105,056	117,097	(1,500)	1,000		127,497 (128,997)	21.4 (22.8)		
2026	108,037	117,739	(1,500)	1,000		129,139 (132,139)	19.5 (22.3)		
2027	110,886	118,515	(3,000)			129,915 (135,915)	17.2 (22.6)		
New Need			(6,000)	9,000	2,400			1,500	2,400

New facilities : Proper scale 19,670MW (coal 9,000, LNG 2,400, renewable energy 4,560, RCS 3,710), uncertainty mitigation facilities 3,900MW (coal 1,500, LNG 2,400)

* 1. Fixed capacities are retired plants and planned plants that already have started their construction or have its main facility contracts / building contracts signed
  2. Annual fixed capacities don't reflect withdrawal of abolition intents or adjustment of construction time after intent evaluation
  3. ( ) : In the case where the four postponed nuclear generators (6,000MW) are included
  4. Peak demand, installed capacity and capacity reserve rate figures are for the year-end period up to 2015 and the summer period from 2016

4 GenCos' Intents for Construction

□ **(Survey Outline)** Survey on intents for construction and retirement was conducted from May 31 to July 25, 2012

* After conducting the survey, a public hearing was held on Sep. 19 in order to allow some necessary adjustments to GenCos' intents, e.g. withdrawal of their plans or any other projects' changes, and then a final survey was conducted on Sep. 24

□ **(Survey Result)** Intents for construction worth 116,348MW were surveyed (excluding renewable, RCS, and island area generators)

○ Under construction or in planning for the 5th BPE : 38,943MW (43 units)

○ Intents for new construction submitted for the 6th BPE : 77,405MW (84 units)

- In total, 29 companies, which includes 6 major public GenCos (21 units, 20,140MW) and 23 private GenCos (63 units, 57,265MW), have provided their intents for 84 units (77,405MW)

【 Aggregate of New Construction Intents (Unit : Company, Unit, MW) **】**

Classification	Nuclear			Coal			LNG C.C.			Total		
	Company	Unit	Capacity	Company	Unit	Capacity	Company	Unit	Capacity	Company	Unit	Capacity
Public	1	6	9,000	4	9	7,740	4	6	3,400	**6**	**21**	**20,140**
Private	1	2	2,800	15	40	37,100	11	21	17,365	**23**	**63**	**57,265**
Total	2	8	11,800	19	49	44,840	15	27	20,765	**29**	**84**	**77,405**

- From the beginning year of the planning, most intents for coal are focused within 6 to 7 years, while LNG are within 4 to 5 years

【 Submitted GenCos' Intents for Construction by Year (Unit : MW) **】**

Year	Nuclear	Coal	LNG C.C.	Total
2013				
2014				
2015			2,425 (3 units)	2,425 (3 units)
2016			2,355 (4 units)	2,355 (4 units)
2017		500 (1 unit)	12,215 (15 units)	12,715 (16 units)
2018		6,840 (9 units)	3,770 (5 units)	10,610 (14 units)
2019		14,000 (15 units)		14,000 (15 units)
2020		10,500 (11 units)		10,500 (11 units)
2021		3,000 (3 units)		3,000 (3 units)
2022	2,900 (2 units)	5,000 (5 units)		7,900 (7 units)
2023	2,900 (2 units)	5,000 (5 units)		7,900 (7 units)
2024				
2025	1,500 (1 unit)			1,500 (1 unit)
2026	1,500 (1 unit)			1,500 (1 unit)
2027	3,000 (2 units)			3,000 (2 units)
Total	**11,800 (8 units)**	**44,840 (49 units)**	**20,765 (27 units)**	**77,405 (84 units)**

* 1. Excludes renewable, RCS, and island area generators
2. Based on initial intents (Schedules adjusted : Dangjin CC #5, Yeongheung #7, 8, Tongyangpower #2, Sinwolseong #2, Singori #3)

○ GenCos plan to retire 8,123MW (30 units) from 2013 to 2027

【 GenCos' Intents for Retirement (Unit : MW) **】**

Years	Nuclear	Coal	Bituminous Coal	LNG	Oil	Hydro	Total
'08～'22	-	-	400 (2 units)	4,068 (15 units)	3,655 (13 units)	-	**8,123 (30 units)**

* Excludes island area generators

□ **(Evaluation Targets)** After classifying intents for construction into "Fixed" and "Evaluated", the latter projects are evaluated

【 Criteria in Classifying Intents for Construction 】

Classification	Criteria
Projects to be fixed	○ Capacity included in the 5th BPE - Capacity under construction (in progress) - Capacity readying construction with main facility or construction contract signed ○ Policy-driven capacity derived from proper facility scale - Nuclear, renewable, RCS ○ Retired capacity
Projects to be evaluated	○ Capacity included in the 5th BPE that are readying construction, but do not satisfy the criteria for **projects to be fixed** even though its intent for construction has been submitted ○ Capacity from the new construction intent submissions that do not fall into the policy-driven fuel type

□ **(Evaluation Criteria)** By assigning 25 points each to Public Acceptance and Grid Connecting Condition, construction delay or cancellation is minimized and on-time completion is encouraged

【 Criteria in Evaluating Intents for Construction 】

Evaluation Index			Points
Cost Index	Facility Cost	Grid Connection + Transmission	15
		Construction + Fuel	
Workability Index	Public Acceptance	Local Government's Desire	10
		Local Residents' Acceptance	15
	Project Condition	Securing of Sites	10
		Securing of Fuel and Water	5
	Grid Connecting Condition	Adequacy of Site	15
		Ease of Construction	10
	Environmental Condition	Environmental Impact Assessment	8
		Greenhouse Gas Reduction Efforts	6
	Extent of Project Delay		Demerit
	Promoting of Private Investment		6
	Unexpected Things to Consider in Evaluating Intents for Construction		Committee Decision

5 Results of Reflecting Intents for Construction

□ Fixed Projects

○ Nuclear and thermal power plants in the 5th BPE but under construction worth 38,943MW (43 units) are reflected

* One unit (Chuncheon CC, 500MW) in the 5th BPE has been cancelled, and there is no facility classified as the projects that need evaluation

* All renewable and RCS are reflected

□ New Projects

○ **(Reserve Rate 22%)** Total of 11,980MW (14 units)

* Coal 8,740MW (10 units) and LNG 3,240MW (4 units)

○ **(Uncertainty Mitigation)** Total of 3,820MW (4 units)

* Coal 2,000MW (2 units) and LNG 1,820MW (2 units)

【 List Reflecting New Intents for Construction (Unit : MW) **】**

Classification	Coal			LNG			Total
	Company	Unit	Capacity	Company	Unit	Capacity	
Proper Scale	KOSEP	Yeongheung #7 #8	870 870	GS EPS	Dangjin CC #5	950	
	KOMIPO	Sinseocheon #1 #2	500 500	KOSPO	Yeongnam CC	400	
	SK E&C	NSP IPP #1 #2	1000 1000	DAEWOO E&C	Daewoopocheon #1	940	
	SAMSUNG C&T	G-Project #1 #2	1000 1000				
	TONGYANG POWER	Tongyangpower #1 #2	1000 1000	SK E&S	Yeoju CC	950	
	8,740 (10 units)			3,240 (4 units)			11,980 (14 units)
Uncertainty Mitigation	DONGBU HASLLA	Dongbuhaslla #1 #2	1000 1000	KOWEPO HDC	Sinpyeongtaek CC 3rd Phase Tongyeong CC #1	900 920	
	2,000 (2 units)			1,820 (2 units)			3,820 (4 units)
Total	10,740 (6 companies, 12 units)			5,060 (6 companies, 6 units)			15,800 (12 companies, 18 units)

* New thermal power plants required : 15,300MW (proper scale 11,400MW, uncertainty mitigation 3,900MW)

* Yeongheung #8 and Dongbuhaslla #1, 2 are to be considered for permission of construction after Electricity Regulatory Commission approves plans for connecting facilities and system reinforcements, considering system constraints

【 Annual Comparison between Required Capacity and the Results of Reflecting Intents for Construction (Units : MW, %) 】

Year	Required Thermal Power Plants			Intents for Construction (Thermal)			Total
	LNG (800)	Coal (1000)	Sub Total	LNG	Coal	Sub Total	
2013							85,605
2014							94,192
2015							100,177
2016				Dangjin CC#5(950,'15.12) Yeongnam CC(400,'16.6)		1,350	106,765
2017				Daewoopocheon#1(940,'16.10) Yeoju CC (950, '17. 6)		1,890	113,419
2018	3 units		2,400				114,197
2019					NSP IPP#1 (1000, '18.10) Yeongheung#7 (870, '18.12) Yeongheung#8 (870, '19.6) Sinseocheon#1 (500, '18.12) Sinseocheon#2 (500, '19. 6) NSP IPP#2 (1000, '19. 4) G-Project#1 (1000, '19. 4)	5,740	119,991
2020					G-Project#2 (1000, '19.10) Tongyangpower#1(1000, '19.12)	2,000	124,433
2021		1 unit	1,000				127,275
2022		2 units	2,000		Tongyangpower#2(1000, '21. 7)	1,000	128,567
2023		2 units	2,000				128,602
2024		2 units	2,000				128,639
2025		1 unit	1,000				129,077 (130,577)
2026		1 unit	1,000				129,719 (132,719)
2027							130,495 (136,495)
Total	3 units	9 units	11,400	3,240	8,740	11,980	

* 1. The figures of ( ) in the total columns include the new nuclear power plants (4 units)
2. The figures of ( ) in the intents columns show capacity and the time of completion ('YY.MM)

<Ref#1> Overall Intended and Planned Capacity

[Unit : MW]

Classification			Nuclear	Coal	LNG	Renew, RCS	Total
Projects to be fixed	Included as Finalized		Singori#3 ('13.12) 1400 #4 ('14. 9) 1400 #5 ('19.12) 1400 #6 ('20.12) 1400 #7 ('23.12) 1500 #8 ('24.12) 1500 Sinuljin#1 ('17. 4) 1400 #2 ('18. 4) 1400 #3 ('21. 6) 1400 #4 ('22. 6) 1400 Sinwolseong#2 ('13.10)1000	Yeongheung#5('14.6) 870 #6('14.12) 870 Dangjin #9 ('15.12) 1020 #10 ('16.6) 1020 Samcheok#1('15.12)1000 #2('16.6) 1000 Bukpyeong#1('16.2) 595 #2('16.6) 595 Taean #9 ('16. 6) 1050 #10('16.12) 1050 Yeosu #1 ('16. 2) 350 Dongbugreen#1('16.6)550 #2('16.12)550 Sinboryeong#1('16.6)1000 #2('17.6)1000	Dangjin CC#3('13.8) 373 Yulchon#2 GT('13.7) 590 ST('14.7) 295 Sinulsan GT('13.7) 581 ST('14.7) 291 Sinpyeongtaek GT('13.7) 631 ST('14.11)316 Andong CC ('14. 3) 400 Ansan CC ('14.10) 834 Pocheon CC#1('14.5) 725 #2('14.11) 725 POSCO CC#7('14. 7) 382 #8('14.12) 382 #9('15.3) 382 Dongducheon CC#1('14.12) 858 #2('14.12) 858 Jangmun CC#1('15.3) 900 #2('15.6) 900 Seoul CC#1 ('16. 9) 400 #2 ('16. 9) 400	Renewable 27,929 RCS 4,665 Island 26	Retirement -8,123 Retirement in Islands -12
			15,200 (11 units)	12,520 (15 units)	11,223 (17 units)	32,620	71,563 (63,428)
Projects to be evaluated	Included after Evaluation	Proper Scale		Yeongheung#7('18.12)870 #8('19.6) 870 Sinseocheon#1('18.12)500 #2('19.6)500 NSP IPP#1('18.10) 1000 #2('19. 4) 1000 G-project#1('19. 4) 1000 #2('19.10) 1000 Tongyangpower #1 ('19.12) 1000 #2 ('21. 7) 1000	Dangjin CC #5('15.12) 950 Yeongnam CC('16.6) 400 Daewoopocheon#1('16.10)940 Yeoju CC('17. 6) 950		
		Uncertainty Mitigation		Dongbuhaslla#1('19.12)1000 #2('20.6)1000	Sinpyeongtaek3('17.11)900 Tongyeong CC#1('17.12)920		
				10,740 (12 units)	5,060 (6 units)		15,800
	Not Included After Evaluation		Cheonji#1 ('23.12) 1500 #2 ('24.12) 1500 #3 ('27. 6) 1500 Daejin #1 ('25.12) 1500 #2 ('26.12) 1500 #3 ('27. 6) 1500 POSCO NPP #1('22.6) 1400 #2('23.6) 1400	Gunjang#1 ('17.12) 500 Gimje #1 ('18. 6) 300 #2 ('18.12) 300 Hanyanggreen#1('18.10)1000 Sinhonam#1('18.11) 1000 Namhaegreen#1('18.12)1000 #2('19. 6)1000 STXsamcheok#1('19.3)1000 #2('19.9)1000 Samcheokeco#1('19.8)1000 #2('20.2)1000 #3('21.8)1000 #4('22.2)1000 Samcheok#3('19.12)1000 #4('19.12)1000 Dongbusamcheok#1('19.12)1000 #2('20.6)1000 Daewoogreen#1('19.12)500 #2('20. 6)500 Donghaepower#1('19.12) 1000 #2 ('20.6) 1000 POSCOsamcheok#1('20. 6)1000 #2 ('20.12)1000 #3 ('23. 6)1000 #4 ('23.12)1000 Daelimgosung#1('20.6)1000 #2('20.12) 1000 #3('22. 6) 1000 #4('22.12) 1000 POSCOgoheung#1('20.10)1000 #2 ('21. 7) 1000 #3 ('22. 7) 1000 #4 ('23. 4) 1000 Trubengosung#1('21.4)1000 #2('22.4)1000 #3('23.4)1000 #4('24.4)1000	Dangjin CC #6 ('15.12) 950 Bucheon CHP#2('15.12) 525 Bundang CC#3('16. 9) 600 Boeun CC #1 ('16.12) 415 #2 ('17.12) 415 Daewoopocheon#2('17.4) 940 Siheung CC('17. 6) 500 Yangju CC#1 ('17. 6) 950 #2 ('17. 9) 950 Daesong CC#1('17. 6) 850 #2('18. 6) 850 YeongheungdoCC#1('17.6) 920 #2('17.12) 920 Pocheon CC#3('17. 6) 850 Yongin CC('17. 8) 850 Gunjang CC#1 ('17.11) 900 #2 ('18.6) 900 Yeongwol CC#2('17.12) 400 Gunsan CC#2 ('18. 6) 900 Tongyeong CC#2('18.6) 920 Jeju CC ('18.12) 200		
			11,800 (8 units)	34,100 (37 units)	15,705 (21 units)		61,605
Total			15,200 (11 units)	23,260 (27 units)	16,283 (23 units)	32,620	87,363 (79,228)

* 1. The figures of ( ) in the total column includes retired capacity

2. Cheonji Nuclear #1, 2 intends to supplant Singori #7, 8

3. Schedules adjusted : DangjinCC #5 ('15.6→'15.12), Yeongheung #7 ('18.6→'18.12), Yeongheung #8 ('18.12→'19.6), Tongyangpower #2 ('20.6→'21.7), Sinwolseong #2 ('13.1→'13.10), Singori #3 ('13.9→'13.12)

<Ref#2> Intended and Planned Capacity by Year

[Unit : MW]

Year	Projects to be fixed	Projects to be evaluated		Retired Capacity	Renew. & RCS
	Included		Not Included	Included	
2013	Sinwolseong#2 (Oct., 1000) Singori#3 (Dec., 1400) Yulchon#2 GT (Jul., 590) Sinulsan GT (Jul., 581) Sinpyeongtaek2 GT (Jul., 631) Dangjin CC#3 (Aug., 373)				
2014	Singori#4 (Sep., 1400) Yeongheung#5 (Jun., 870) Yeongheung#6 (Dec., 870) Andong CC (Mar., 400) Pocheon CC#1 (May, 725) Pocheon CC#2 (Nov., 725) POSCO CC#7 (Jul., 382) POSCO CC#8 (Dec., 382) Yulchon#2 ST (Jul., 295) Sinwoolsan ST (Jul., 291) Sinpyeongtaek2 ST (Nov., 316) Ansan CC (Oct., 834) Dongducheon CC#1 (Dec., 858) Dongducheon CC#2 (Dec., 858)			Yeongnam#1～2 (Jan., -400) Ulsan#1～3 (Jan., -600) Incheon#1～2 (Mar., -500) POSCO CC#1 (Aug., -450)	Renewable 27,929 RCS 4,665 Islands 26 Retirement in Islands -12
2015	Dangjin#9 (Dec., 1020) Samcheok#1 (Dec., 1000) POSCO CC#9 (Mar., 382) Jangmun CC#1 (Mar., 900) Jangmun CC#2 (Jun., 900)	Dangjin CC#5 (Dec., 950)	Bucheon CHP#2 (Dec., 525) Dangjin CC#6 (Dec., 950)	POSCO CC#2 (Jan., -450)	
2016	Yeosu#1 (Feb., 350) Bukpyeong#1 (Feb., 595) Bukpyeong#2 (Jun., 595) Taean#9 (Jun., 1050) Taean#10 (Dec., 1050) Dongbugreen#1 (Jun., 550) Dongbugreen#2 (Dec., 550) Dangjin#10 (Jun., 1020) Samcheok#2 (Jun., 1000) Sinboryeong#1 (Jun., 1000) Seoul CC#1 (Sep., 400) Seoul CC#2 (Sep., 400)	Yeongnam CC (Jun., 400) Daewoopocheon#1 (Oct., 940)	Boeun CC#1 (Dec., 415) Bundang CC#3 (Sep., 600)	Seoul#4～5 (Sep., -388)	
2017	Sinuljin#1 (Apr.,1400) Sinboryeong#2 (Jun.,1000)	Yeoju CC(Jun., 950) <Uncertainty Mitigation> Sinpyeongtaek3 CC (Nov., 900) Tongyeong CC#1 (Dec., 920)	Gunjang (Dec., 500) Daewoopocheon#2 (Apr., 940) Yangju CC#1 (Jun., 950) Yangju CC#2 (Sep., 950) YeongheungdoCC#1 (Jun., 920) YeongheungdoCC#2 (Dec., 920) Siheung CC (Jun., 500) Pocheon CC#3 (Jun., 850) Daesong CC#1 (Jun., 850) Yongin CC (Aug., 850) Gunjang CC#1 (Nov., 900) Boeun CC#2 (Dec., 415) Yeongwol CC#2 (Dec., 400)	Seocheon#1,2 (Sep., -400)	

* Schedules adjusted : Dangjin CC #5 ('15.6→'15.12), Yeongheung #7 ('18.6→'18.12), Yeongheung #8 ('18.12→'19.6), Tongyangpower #2 ('20.6→'21.7), Sinwolswong #2 ('13.1→'13.10), Singori #3 ('13.9→'13.12)

Year	Projects to be fixed	Projects to be evaluated		Retired Capacity	Renew. & RCS
	Included		Not Included	Included	
2018	Sinuljin#2 (Apr., 1400)	Yeongheung#7 (Dec., 870) Sinseocheon#1 (Dec., 500) NSP IPP#1 (Oct., 1000)	Gimje#1 (Jun., 300) Gimje#2 (Dec., 300) Hanyanggreen (Oct., 1000) Sinhonam (Nov., 1000) Namhaegreen#1 (Dec., 1000) Gunsan CC#2 (Jun., 900) Gunjang CC#2 (Jun., 900) Daesong CC#2 (Jun., 850) Tongyeong CC#2 (Jun., 920) Jeju CC (Dec., 200)	Jeju GT#3 (Jan., -55) Pyeongtaek CC (Jan., -480)	
2019	Singori#5 (Dec., 1400)	NSP IPP#2 (Apr., 1000) G-project#1 (Apr., 1000) G-project#2 (Oct., 1000) Yeongheung#8 (Jun., 870) Sinseocheon#2 (Jun., 500) Tongyangpower#1(Dec., 1000) <Uncertainty Mitigation> Dongbuhaslla#1 (Dec., 1000)	STXsamcheok#1(Mar., 1000) STXsamcheok#2 (Sep., 1000) Namhaegreen#2 (Jun., 1000) Samcheokeco#1 (Aug., 1000) Donghaepower#1 (Dec., 500) Dongbusamcheok#1 (Dec., 1000) Samcheok#3 (Dec., 1000) Samcheok#4 (Dec., 1000) Donghaepower#1 (Dec., 1000)		
2020	Singori#6 (Dec., 1400)	<Uncertainty Mitigation> Dongbuhaslla#2 (Jun., 1000)	Samcheokeco#2 (Feb., 1000) Daelimgosung#1 (Jun., 1000) Daelimgosung#2 (Dec., 1000) POSCOsamcheok#1 (Jun., 1000) POSCOsamcheok#2 (Dec., 1000) Donghaepower#2 (Jun., 500) Dongbusamcheok#2 (Jun., 1000) Donghaepower#2 (Jun., 1000) Goheung#1 (Oct., 1000)		
2021	Sinuljin#3 (Jun., 1400)	Tongyangpower#2 (Jul., 1000)	Trubengosung#1 (Apr., 1000) Goheung#2 (Jul., 1000) Samcheokeco#3 (Aug., 1000)		
2022	Sinuljin#4 (Jun., 1400)		POSCO NPP#1 (Jun., 1400) Samcheokeco#4 (Feb., 1000) Trubengosung#2 (Apr., 1000) Daelimgosung#3 (Jun., 1000) Daelimgosung#4 (Dec., 1000) Goheung#3 (Jul., 1000)	Ulsan#4～6 (Jan., -1200)	
2023	**Singori#7(Dec., 1500)**		Cheonji#1 (Dec., 1500) POSCO NPP#2 (Jun., 1400) Goheung#4 (Apr., 1000) Trubengosung#3 (Apr., 1000) Trubengosung#4 (Apr., 1000) POSCOsamcheok#3 (Jun., 1000) POSCOsamcheok#4 (Dec., 1000)	Seoincheon CC #1～8 (Dec., -1800)	
2024	**Singori#8(Dec., 1500)**		Cheonji#2 (Dec., 1500)	Pyeongtaek #1～4 (Dec., -1400)	
2025			Daejin#1 (Dec., 1500)		
2026			Daejin#2 (Dec., 1500)		
2027			Cheonji#3 (Jun., 1500) Daejin#3 (Jun., 1500)		
Total	38,943 (43 units)	15,800 (18 units)	61,605 (66 units)	- 8,123 (30 units)	32,608

* 1. Schedules adjusted : DangjinCC #5 ('15.6→'15.12), Yeongheung #7 ('18.6→'18.12), Yeongheung #8 ('18.12→'19.6), Tongyangpower #2 ('20.6→'21.7), Sinwolswong #2 ('13.1→'13.10), Singori #3 ('13.9→'13.12)

2. Cheonji Nuclear #1, 2 intends to supplant Singori #7, 8

6 Investment Cost Outlook

□ **(New Capacity)** A total of 16 trillion Won is expected to be invested in generation capacity expansion of 11,980MW (14 units : coal 10 units, LNG 4 units)

【 Investment Cost Outlook for New Generation Capacity 】

(Unit : Billion KRW)

Classification	2013~2017	2018~2022	Total
Nuclear	0	0	0
Coal	8,232.1	4,234.5	12,466.6
LNG	3,171.5	0	3,171.5
Total	11,403.6	4,234.5	15,638.1

* 1. Constant price as of the beginning of 2012, excludes investment in renewable/RCS
2. Excludes uncertainty mitigation capacity

□ **(Including Fixed Projects)** A total of 70 trillion Won is expected to be invested in generation capacity expansion of 50,923MW (57 units : nuclear 11 units, coal 25 units, LNG 21 units) if new projects and fixed capacity under construction are added

【 Overall Investment Cost Outlook 】

(Unit : Billion KRW)

Classification	2013~2017	2018~2022	2023~2027	Total
Nuclear	11,073.6	15,271.5	1,596.5	27,941.6
Coal	24,190.7	4,234.5	-	28,425.2
LNG	13,524.7	-	-	13,524.7
Total	48,789.0	19,506.0	1,596.5	69,891.5

* 1. Constant price as of the beginning of 2012, excludes investment in renewable/RCS
2. Excludes uncertainty mitigation capacity

7 Supply and Demand & Generation Mix Outlook

A. Key Assumptions

□ Electricity Supply and Demand & Generation Capacity

○ Only the domestic demand and capacity are included, while self-generating plants and CES are excluded

□ Reserve Rate & Generation Mix Outlook

○ **(Reserve Rate)** Based on the capacity as of June in case of having the summer peak demand, or the capacity as of December in case of having the winter peak demand

【 Criteria on Deciding Reserve Rate 】

Classification	Criteria
Summer Peak Demand	Capacity at the end of June Peak demand from July to Aug.
Winter Peak Demand	Capacity at the year end Peak demand from Dec. to Feb. of next year

○ **(Generation Mix)** Based on the capacity at the year-end

○ **(Capacity)** In principle, the nominal capacity is applied, but their contribution to the peak demand is considered for renewable and RCS

B. Electricity Supply and Demand Outlook

□ **(Electricity Supply and Demand Outlook)** Supply constraint is expected to be alleviated after 2014

○ Some active short-term measures, including reinforcement of demand side management, are needed until summer of 2013, because expanding more capacity at that time is impossible due to the time it takes for construction

【 Electricity Supply and Demand Outlook by Year 】

Year	Peak Demand (MW)		Capacity (MW)		Capacity Reserve Rate	
	Summer	Winter	Summer	Winter	%	Peak Season
2012	74,291	76,522	76,286	78,483 (80,713)	2.6 (5.5)	Winter
2013	78,347	79,712	81,717	85,605	7.4	
2014	80,328	80,969	86,998	94,192	16.3	
2015	81,577	82,677	96,357	100,177	21.2	
2016	84,576	84,167	106,765	110,067	26.2	Summer
2017	88,218	86,922	113,419	113,332	28.6	
2018	91,509	89,581	114,197	116,621	24.8	
2019	93,683	91,424	119,991	124,404	28.1	
2020	95,316	94,014	124,433	125,875	30.5	
2021	97,510	96,462	127,275	128,339	30.5	
2022	99,363	98,503	128,567	128,602	29.4	
2023	100,807	99,781	128,602	128,639	27.6	
2024	102,839	100,934	128,639	129,077	25.1	
2025	105,056	102,348	129,077	129,719	22.9	
2026	108,037	104,444	129,719	130,495	20.1	
2027	110,886	106,463	130,495	130,853	17.7	

* 1. The figures of ( ) for 2012 are the supply capacity and the result of supply reserve rate during the winter peak demand (Jan. 13, 2013)
2. For renewable and RCS, their peak contribution are applied
3. Uncertainty mitigation capacity (Sinpyeongtaek CC 3rd Phase, Tongyeong CC #1, Dongbuhassla #1, 2) is excluded when calculating the capacity reserve rate
4. For capacity in detail, refer to the 'Generation Capacity Expansion Plan' in the appendix

C. Generation Mix Outlook

□ **(Based on Nominal Capacity)** Coal (28.2%), nuclear (22.7%), and renewable (20.2%) in 2027 ; installed capacity

□ **(Based on Peak Contribution)** Coal (34.1%), nuclear (27.4%), and LNG (24.3%) in 2027 ; effective capacity

○ The base-load generation (nuclear & coal) portion will grow from 56.2% to 61.5% by 2027 (5.3%p↑) and LNG generation portion will decline a little bit (1.3%p↓)

○ Anthracite coal and oil generation plants will be phased out

【 Generation Mix Outlook [Unit : ㎿, %] **】**

Classification		Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pump. Hydro	Renewable	RCS	Total
2012 (Existing)	Installed Capacity	20,716	23,409	1,125	20,116	4,888	4,700	4,084	2,768	81,806
		25.3	28.6	1.4	24.6	6.0	5.7	5.0	3.4	100
	Effective Capacity	20,716	23,409	1,125	20,116	4,778	4,700	1,277	2,362	78,483
		26.4	29.8	1.4	25.6	6.1	6.0	1.6	3.0	100
2015	Installed Capacity	24,516	27,169	1,125	31,372	3,901	4,700	9,277	6,373	108,433
		22.6	25.1	1.0	28.9	3.6	4.3	8.6	5.9	100
	Effective Capacity	24,516	27,169	1,125	31,372	3,791	4,700	2,317	5,186	100,177
		24.5	27.1	1.1	31.3	3.8	4.7	2.3	5.2	100
2020	Installed Capacity	30,116	43,669	725	33,594	3,849	4,700	20,066	7,434	144,154
		20.9	30.3	0.5	23.3	2.7	3.3	13.9	5.2	100
	Effective Capacity	30,116	43,669	725	33,594	3,739	4,700	3,262	6,071	125,875
		23.9	34.7	0.6	26.7	3.0	3.7	2.6	4.8	100
2025	Installed Capacity	35,916	44,669	725	31,794	1,249	4,700	29,178	7,434	155,666
		23.1	28.7	0.5	20.4	0.8	3.0	18.7	4.8	100
	Effective Capacity	35,916	44,669	725	31,794	1,139	4,700	4,703	6,071	129,719
		27.7	34.4	0.6	24.5	0.9	3.6	3.6	4.7	100
2027	Installed Capacity	35,916	44,669	725	31,794	1,249	4,700	32,014	7,434	158,502
		22.7	28.2	0.5	20.1	0.8	3.0	20.2	4.7	100
	Effective Capacity	35,916	44,669	725	31,794	1,139	4,700	5,837	6,071	130,853
		27.4	34.1	0.6	24.3	0.9	3.6	4.5	4.6	100

* 1. The generation mix are based on the capacity at the year end
2. For generation mix outlook in detail, refer to the 'Generation Mix Outlook' in the appendix

Ⅶ. Transmission System Plan Directions

◇ A long-term transmission system plan is established based on the expansion criteria set in this plan; this is then finalized and announced after being deliberated by the Electricity Regulatory Commission

1 Basic Directions

1 Power System Reliability Enhancement

- ○ Minimize the power supply problems by expanding the transmission system facilities on time
- ○ Secure the performance nature of transmission system such as voltage stability enhancement
- ○ Establish the transmission system plan that balances the reliability and economic feasibility

2 Reliability Reinforcement of Generation Interconnected Area

- ○ Select the optimal interconnection point by considering the power system marginal transfer capabilities
- ○ Establish the generation interconnection plan by considering the interconnection line construction condition
- ○ Newly constructed generation areas are given priority consideration of having the interconnection line construction on time
  * Network construction plan for major large-scale power generation sources make use of the advice of the external consulting group

※ Reference : Roles of Network Systems by the Voltage Level

- ○ (765㎸) delivers electricity from large-scale generation complexes to congested load centers
- ○ (345㎸) builds an inter-regional network or a bulk power source in city areas
- ○ (154㎸) builds the intercity network within the 345kV-supplied areas or works as the supply source for electricity distribution

2 Criteria for Transmission System Expansion

A. Reliability Limit in Contingencies

Contingency Conditions	Overload Factor	Extent of Failure	Available Steps After a Fault
· One line of the 345kV system connected to the power plant · 1 Bank of the 345㎸ main transformer	Prohibit overload	· Prohibit load drop · Prohibit generator drop out	· Prohibit adjustment of generation power
· One line of the 154kV system connected to the power plant	Allow temporary overload	· Prohibit load drop · Prohibit generator drop out	· Allow adjustment of generation power
· One line of the main system below 345kV · One line of the load supply system below 345kV	Allow temporary overload	· Prohibit load drop · Prohibit generator drop out	· Allow adjustment of generation power. · Allow load cutoff
· 1 Bank of 154kV main transformer	Allow temporary overload	· Allow temporary load drop (note 1) · Prohibit permanent load drop (note 2)	· Allow load cutoff
· Two lines of the load supply system below 345kV · Two lines of the 154kV main system	Allow temporary overload	· Allow temporary load drop (note 1) · Prohibit permanent load drop (note 2) · Allow generator drop out	· Allow load cutoff
· Two lines of the 345kV main system · One line of the 765kV main system (note 3)	Allow temporary overload	· Prohibit load drop. · Prohibit generator drop out.	· Allow adjustment of generation power
· One line of the 765kV system connected to the power plant (note 3) · Two lines of the system connected to power plants below 345kV	Allow temporary overload	· Prohibit load drop. · Allow generator drop out	· Allow adjustment of generation power

※ 1. A temporary load drop is defined as a condition wherein the power supply can be restored in a short period following an interruption using means such as a load reallocation to other substations without repairing the facilities that failed

※ 2. A permanent load drop is defined as a condition wherein power supply cannot be restored following an interruption using means such as load reallocation to other substations without repairing the facilities that failed

※ 3. Overload and affected ranges for two line failures of the 765kV system will be reflected later following the revision of the 『Maintenance Criteria for Power System Reliability and Quality』 notice (December 2012)

B. Criteria for the Power Plant Interconnection

□ Interconnection Principles

○ Decided by the contract between the generation company and the transmission company as per 『Provision for Transmission Facilities Use』

□ Criteria for Power Plant Interconnection Configuration

○ (Below 1,000MW) 345kV or 154kV

○ (Over 1,000MW) over 345kV

○ (Generation Company) Interconnected with more than two lines in principle

* One line interconnection is available only when the system is not greatly influenced and the generation company wants it

○ (Interconnection Lines) More than four lines in case the system could not satisfy the power system planning criteria, such as the transient stability problem which occurs with system failure

C. Criteria for the Construction & Expansion of a Transmission System

□ Criteria for the Construction of a Transmission System

○ **(Reinforcing 765kV Transmission)** 765kV shall be installed in case it is more advantageous than 345kV and a large-scale interchange of electricity is in demand

- System shall be reinforced to prevent a large-scale power supply problem or an extended failure spread due to a two-line failure

○ **(Reinforcing 345kV Transmission)** 345kV shall be installed when it is more appropriate than 154kV, such as when a large increase in demand is expected or the interchange and supply of electricity is not enough with new 154kV lines

- In principle, two lines forming one route shall be constructed for new overhead lines, and the supporting structure shall be selected in consideration of the long-term change of the power system

- Main transmission systems consider two-line failure, while singular systems and underground systems consider one-line failure

○ **(Reinforcing 154kV Transmission)** 154kV shall be installed if the existing interconnection cannot be maintained adequately due to the increase in generation capacity and power demand

- It shall form a multi-system (about 800MW load supply) by itself for each 345kV unit
- In principle, four-line branch off is considered for the existing lines, and two-line branch off is considered only if there are no problems in load characteristics, short circuit currents, overloads, or system maintenance
- If possible, 345kV substation network should be configured with the line size of 410mm^{2}x2B (over 2000mm^2 for underground), considering the power flow
- Underground lines should be configured to the largest scale, taking the increasing load demand into account, and regional networks close to a city areas should be configured by installing power tunnels depending upon the power system expansion
- Main lines such as regional networks supplied by a 345 kV substation take two-line failures into account, while underground and other lines are expanded while taking one-line failure into account

□ Criteria for Constructing & Expanding a Substation

○ **(Extra High Voltage Substations)** In principle, the final size of extra high voltage transformers is four banks, while the number of initial banks is decided by considering load supply and economic efficiency

- 765kV substations shall be installed where the transmission requirement is more than 345kV or a large-scale interchange of electricity is in demand
- 345kV substations shall be installed in regions requiring additional installation to the existing substation with three banks, or in cases where performance improvement such as transient instability solutions is needed or future load increase makes it more reasonable than a 154kV facility
- Transformers shall be added in case one bank fails and the other bank exceeds the normal supply capacity

○ **(154kV Substations)** In principle, the size is four banks, while the number of initial banks is two or three, with consideration for future expansion

* The #4 transformer is installed in consideration of the future uncertainty of the load increase and the delay of new substation construction

- 154kV substations shall be installed in case where a large-scale load source is expected, or a distribution system constraint is expected such as low voltages or an overload of 22.9kV distribution lines
- 154kV transformers shall be added in case one bank fails and the other bank exceeds the supply capacity

* Decision takes into consideration the conditions of the switch of the load from one distribution line to the other where the load switching is easily available

3 Transmission System Plan Actions

□ The future long-term transmission expansion plan is established based on the transmission expansion plan criteria defined in this plan

- ○ The future long-term transmission expansion plan is a part of this plan, and the transmission owner should expand the transmission system defined by this plan
- ○ The long-term transmission expansion plan should follow this base plan criteria, and then finalized by the deliberation of the Electricity Regulatory Commission

□ The finalized transmission system plan can be modified or added to by the transmission owner only under the following situations

- ○ In case of changes in power plant construction plans or in demand
- ○ In case of unavoidable circumstances such as control of the fault current or system voltage level, etc
- ○ In case inevitable modification is required for the ongoing project

□ Constant effort to improve the power system stability characteristics

* (Securing the large-scale power system stability) Seek the introduction of new technologies such as HVDC, FACTS, etc.
* (Limiting the short circuit currents) Fortifying circuit breaker standard (63kA, 6,300A installation, etc.), installing series reactor & BTB, applying high impedance (Step-up) Tr., operate bus and transmission line separately, etc.
* (Balancing the reactive power supply) Installing power condenser, shunt reactor, and STATCOM, developing distributed power supply, opening transmission line partially in low power demand, etc.
* (Developing for large scale) Large scale transmission and transformation equipment development for the expected generation and power system scale increase

□ An agreement is required with the land owners in case of the relocation of existing transmission lines by public services

- ○ The transmission owner is entitled to invoke the Power Resources Development Act after establishing an internal review committee to acquire land for transmission facilities unless the transmission operator and the land owner enter into an agreement for the land

□ The transmission owner follows the details of the plan according to the Power Resources Development Act procedures in consideration of the cost required, so that the transmission owner can acquire the right of existing land for transmission lines

Ⅷ. Follow-up Plan Directions

A. Reliability and Facility Management Plan

□ **(Reliability Enhancement to the Level of Advanced Countries)** Establish a reliability management agency, train manpower in power system operations and induce technology enhancement

○ **(Establish a Management Agency)** Establish a 「Power System and Facility Reliability Agency」 to implement a management system for the power system reliability on the level of advanced countries
- Perform monitoring, investigation, and evaluation of power system and facility reliability
  * Foreign examples : NERC (U.S.), National Grid (U.K.), Power System Council (Japan)
- Reliable operations of power system after 2013 by establishing a reliability criteria on the level of advanced countries

○ **(Train Manpower, Induce Technology Enhancement)** Induce technology enhancement, etc. by creating a 'Certificate of Technical Qualification' for power system operators

□ **(Reliability Reinforcement of Generation Facilities)** Restore public trust for the reliability of generation facilities by reinforcing the management of electric facilities

○ **(Reinforcement of Electric Facility Management)** Electric facility investigation and failure diagnosis, reinforced criteria for the extension of permission period, and extensive reinforcement of inspection and maintenance for the deteriorated facilities

○ **(Form Usage Standard for Low Grade Coal)** Operation of generation above rated output and forming of usage standard for low grade coal in order to curb low grade coal overuse

B. Transmission System Plan and Policy Reform

□ **(Establish Detailed Transmission System Plan)** Establish and enforce separate transmission system plan and after this plan is finalized

○ Include reliability enhancement plan for the Seoul (capital) and western region which have the power generation concentrated, preventive measures for large-scale power supply problems and wide area outages caused by power system instability, reinforcement plan for the interconnection facilities and power system in the eastern coast for the new large-scale power generation sources

□ **(Transmission System Neighboring Area Compensation Reinforcement)** Improve the construction condition of transmission system by creating standards for supporting the transmission system's neighboring area

○ Enlargement of compensation range of the Electricity Business Act and legislate the supporting of the transmission system's neighboring area

C. Demand Side Management Reinforcement

□ **(Establish Comprehensive Demand Side Management Measures)** Implement a system of demand side management based on market and policy by normalizing energy market functions and enlarging the support for increasing efficiency

○ Form an innovative expansion plan of demand side management for energy and reflect into the energy use rationalization general plan, and consider securing finances for the demand side management such as the use of Electric Power Industry Basis Fund

D. Greenhouse Gas Emissions Reduction Plan Follow-up

□ **(Fulfillment Status Check)** Regular fulfillment status check of greenhouse gas emissions reduction plan submitted with the intents for construction

* Greenhouse gas emissions reduction plan is reviewed separately in evaluating the intents for construction (6 points)

○ Fulfillment status of greenhouse gas emissions reduction plan are reflected in the future processes such as the approval of implementation plan

E. Facility Construction Management Reinforcement

□ **(Systematic Management of Construction Processes)** Regular construction status check and implementation of a digital system for electric facility construction status management

○ Inducement of on-time construction completion by checking the processes of construction reflected on the plan for generation and transmission facilities half-yearly

○ Implementation of a digital system for construction status management

Appendix

1 Details of Establishing BPE

□ Set basic directions and working subcommittees (May 25, 2012)

* (5th BPE) Demand Forecast+DSM, Generation Plan+Transmission Plan
  → (6th BPE) Demand Planning, Capacity Planning

○ Operate two subcommittees (May 2012 to Jan. 2013)

* Meetings held : Demand Planning (4 times), Capacity Planning (5 times)

□ Survey GenCos' 「Intents for Construction」 (May 31 to Oct. 25)

○ Receive initial intents : 30 GenCos, 89,775MW (May 31 to Jul. 25)

○ Survey final changes : 29 GenCos, 77,405MW (Sep. 24, 2012)

○ Receive documents for evaluation (Oct. 25, 2012)

□ Finalize and disclose 「Evaluation Criteria for Intents」 (Aug. 24)

○ Finalize criteria (Aug. 10) and open hearings (Aug. 13 to 21)

○ Disclose criteria (Aug. 24)

□ Prepare demand outlook and capacity plan (Sep. to Dec. 2012)

○ Forecast reference demand, set DSM plans & target demand

○ Set proper capacity scale and generation mix

□ Evaluate intents, decide finalized capacity (Nov. 2012 to Jan. 2013)

○ Verify required docs & consult experts on each criteria

○ Evaluate, receive objections, re-evaluate (Jan. 16 to 25, 2013)

□ Hold Electricity Supply-Demand Committee meeting on 「6th BPE (Draft)」 (Jan. 30, 2013)

□ Hold public hearing on 「6th BPE (Draft)」 (Feb. 7, 2013)

□ Hold Electricity Policy Review Board meeting to finalize 「6th BPE (Draft)」 (Feb. 22, 2013)

□ Announce 「6th BPE」 to the public (Feb. 25, 2013)

2 Electricity Demand Outlook

A. Reference Demand

□ Nationwide

Year	Consumption		Peak Demand				Load Factor (%)
	GWh	Increase (%)	Summer (MW)	Increase (%)	Winter (MW)	Increase (%)	
2012 (Actual)	469,049		74,291		76,522		73.6
2013	485,428	3.5	78,998	6.3	**80,374**	5.0	74.7
2014	505,315	4.1	81,657	3.4	**82,309**	2.4	76.0
2015	526,356	4.2	83,532	2.3	**84,658**	2.9	77.0
2016	547,794	4.1	**86,919**	4.1	86,499	2.2	78.2
2017	569,141	3.9	**91,031**	4.7	89,694	3.7	77.6
2018	590,257	3.7	**94,694**	4.0	92,699	3.3	77.3
2019	610,823	3.5	**98,621**	4.2	96,243	3.8	76.8
2020	630,964	3.3	**102,205**	3.6	100,809	4.7	76.6
2021	651,845	3.3	**105,852**	3.6	104,714	3.9	76.4
2022	672,544	3.2	**109,476**	3.4	108,528	3.6	76.2
2023	693,056	3.1	**113,065**	3.3	111,913	3.1	76.0
2024	713,310	2.9	**116,602**	3.1	114,442	2.3	75.9
2025	733,060	2.8	**120,078**	3.0	116,982	2.2	75.7
2026	752,364	2.6	**123,450**	2.8	119,345	2.0	75.6
2027	771,007	2.5	**126,740**	2.7	121,684	2.0	75.5
'13～'27		3.4		3.4		3.0	

* Peak demand basis : (Summer) July to Aug., (Winter) Dec. to Feb. of next year

□ Maximum & Minimum Expectation of Peak Demand

Year	Maximum				Minimum			
	Summer (MW)	Increase (%)	Winter (MW)	Increase (%)	Summer (MW)	Increase (%)	Winter (MW)	Increase (%)
2012 (Actual)	74,291		76,522		74,291		76,522	
2013	81,910	10.3	83,337	8.9	77,219	3.9	78,564	2.7
2014	84,109	2.7	84,781	1.7	79,432	2.9	80,066	1.9
2015	86,054	2.3	87,214	2.9	81,236	2.3	82,331	2.8
2016	89,534	4.0	89,101	2.2	84,421	3.9	84,013	2.0
2017	93,764	4.7	92,387	3.7	88,584	4.9	87,283	3.9
2018	97,594	4.1	95,538	3.4	92,199	4.1	90,257	3.4
2019	101,530	4.0	99,081	3.7	96,013	4.1	93,697	3.8
2020	105,302	3.7	103,864	4.8	99,353	3.5	97,996	4.6
2021	108,989	3.5	107,817	3.8	103,012	3.7	101,904	4.0
2022	112,769	3.5	111,792	3.7	106,551	3.4	105,628	3.7
2023	116,553	3.4	115,366	3.2	110,159	3.4	109,037	3.2
2024	120,135	3.1	117,910	2.2	113,352	2.9	111,252	2.0
2025	123,716	3.0	120,526	2.2	116,849	3.1	113,836	2.3
2026	127,158	2.8	122,930	2.0	120,091	2.8	116,097	2.0
2027	130,562	2.7	125,354	2.0	123,213	2.6	118,298	1.9
'13～'27		3.4		3.0		3.4		3.0

□ Seoul Metropolitan Area

Year	Consumption		Peak Demand			
	GWh	Increase (%)	Summer (MW)	Increase (%)	Winter (MW)	Increase (%)
2012 (Actual)	170,171		29,482		31,137	
2013	173,025	1.7	30,377	3.0	31,808	2.2
2014	177,559	2.6	31,104	2.4	32,582	2.4
2015	182,415	2.7	31,880	2.5	33,392	2.5
2016	187,460	2.8	32,685	2.5	34,213	2.5
2017	192,545	2.7	33,494	2.5	35,041	2.4
2018	197,686	2.7	34,311	2.4	35,874	2.4
2019	202,876	2.6	35,134	2.4	36,708	2.3
2020	208,070	2.6	35,955	2.3	37,545	2.3
2021	213,316	2.5	36,783	2.3	38,386	2.2
2022	218,586	2.5	37,612	2.3	39,230	2.2
2023	223,889	2.4	38,445	2.2	40,076	2.2
2024	229,213	2.4	39,278	2.2	40,916	2.1
2025	234,495	2.3	40,103	2.1	41,751	2.0
2026	239,767	2.2	40,924	2.0	42,577	2.0
2027	244,984	2.2	41,736	2.0	43,396	1.9
'13～'27		2.5		2.3		2.2

□ Jeju Island Area

Year	Consumption		Peak Demand			
	GWh	Increase (%)	Summer (MW)	Increase (%)	Winter (MW)	Increase (%)
2012 (Actual)	3,865		669		621	
2013	3,937	1.8	707	5.7	640	3.1
2014	4,058	3.0	730	3.3	660	3.1
2015	4,183	3.0	753	3.2	680	3.0
2016	4,312	3.1	776	3.1	700	2.9
2017	4,443	3.0	799	3.0	720	2.9
2018	4,574	2.9	823	3.0	740	2.8
2019	4,707	3.1	846	2.8	760	2.7
2020	4,839	2.8	869	2.7	780	2.6
2021	4,972	2.7	892	2.6	799	2.4
2022	5,104	2.6	914	2.5	819	2.5
2023	5,234	2.5	936	2.4	837	2.2
2024	5,363	2.5	957	2.2	855	2.2
2025	5,486	2.4	978	2.2	873	2.1
2026	5,606	2.2	997	1.9	889	1.8
2027	5,720	2.0	1,016	1.9	904	1.7
‘13～‘27		2.7		2.6		2.5

B. Target Demand

□ Nationwide

Year	Consumption		Peak Demand				Load Factor (%)
	GWh	Increase (%)	Summer (MW)	Increase (%)	Winter (MW)	Increase (%)	
2012 (Actual)	469,049		74,291		76,522		74.7
2013	482,527	2.9	78,347	5.5	79,712	4.2	74.9
2014	499,116	3.4	80,328	2.5	80,969	1.6	76.3
2015	516,156	3.4	81,577	1.6	82,677	2.1	77.3
2016	532,694	3.2	84,576	3.7	84,167	1.8	78.1
2017	548,241	2.9	88,218	4.3	86,922	3.3	77.1
2018	564,256	2.9	91,509	3.7	89,581	3.1	76.5
2019	578,623	2.5	93,683	2.4	91,424	2.1	76.6
2020	590,565	2.1	95,316	1.8	94,014	2.8	76.8
2021	597,064	1.1	97,510	2.3	96,462	2.6	75.9
2022	602,049	0.8	99,363	1.9	98,503	2.1	75.1
2023	605,724	0.6	100,807	1.5	99,781	1.3	74.5
2024	611,734	1.0	102,839	2.0	100,934	1.2	73.8
2025	624,950	2.2	105,056	2.2	102,348	1.4	73.8
2026	640,133	2.4	108,037	2.8	104,444	2.0	73.5
2027	655,305	2.4	110,886	2.6	106,463	1.9	73.3
'13～'27		2.2		2.5		2.1	

* Peak demand basis : (Summer) July to Aug., (Winter) Dec. to Feb. of next year

□ Seoul Metropolitan Area

Year	Consumption		Peak Demand			
	GWh	Increase (%)	Summer (MW)	Increase (%)	Winter (MW)	Increase (%)
2012 (Actual)	170,171		29,482		31,137	
2013	171,952	1.0	30,123	2.2	31,551	1.3
2014	175,265	1.9	30,586	1.5	32,062	1.6
2015	178,641	1.9	31,119	1.7	32,625	1.8
2016	181,873	1.8	31,777	2.1	33,307	2.1
2017	184,812	1.6	32,398	2.0	33,954	1.9
2018	188,066	1.8	33,074	2.1	34,650	2.0
2019	190,962	1.5	33,212	0.4	34,809	0.5
2020	193,122	1.1	33,252	0.1	34,859	0.1
2021	193,047	-0.0	33,487	0.7	35,106	0.7
2022	192,503	-0.3	33,582	0.3	35,216	0.3
2023	191,576	-0.5	33,550	-0.1	35,205	-0.0
2024	191,630	0.0	33,797	0.7	35,480	0.8
2025	194,494	1.5	34,113	0.9	35,826	1.0
2026	198,242	1.9	34,772	1.9	36,515	1.9
2027	202,174	2.0	35,400	1.8	37,186	1.8
'13～'27		1.2		1.2		1.2

□ Jeju Island Area

Year	Consumption		Peak Demand			
	GWh	Increase (%)	Summer (MW)	Increase (%)	Winter (MW)	Increase (%)
2012 (Actual)	3,865		669		621	
2013	3,908	1.1	702	4.9	634	2.1
2014	3,996	2.3	720	2.6	648	2.2
2015	4,081	2.1	738	2.5	663	2.3
2016	4,161	2.0	758	2.7	680	2.6
2017	4,234	1.8	777	2.5	697	2.5
2018	4,314	1.9	798	2.7	714	2.4
2019	4,385	1.6	808	1.3	720	0.8
2020	4,435	1.1	815	0.9	724	0.6
2021	4,424	-0.2	827	1.5	731	1.0
2022	4,399	-0.6	835	1.0	737	0.8
2023	4,361	-0.9	841	0.7	738	0.1
2024	4,347	-0.3	850	1.1	744	0.8
2025	4,405	1.3	861	1.3	752	1.1
2026	4,484	1.8	877	1.9	766	1.9
2027	4,563	1.8	893	1.8	778	1.6
'13～'27		1.1		1.7		1.5

3 Demand Side Management Targets

A. Peak Demand Reduction Plan

(Unit : MW)

Year	Summer				Winter			
	Load Manage-ment Facility	Efficiency Enhance-ment	Smart Grid & DSM Pricing	Total	Load Manage-ment Facility	Efficiency Enhance-ment	Smart Grid & DSM Pricing	Total
2013	90	371	190	**651**	92	413	157	**662**
2014	142	681	506	**1,329**	145	750	445	**1,340**
2015	164	933	857	**1,954**	181	935	865	**1,981**
2016	187	1,072	1,084	**2,343**	207	1,080	1,045	**2,332**
2017	242	1,234	1,337	**2,813**	277	1,228	1,267	**2,772**
2018	391	1,410	1,384	**3,185**	372	1,350	1,396	**3,118**
2019	614	1,702	2,622	**4,938**	630	1,763	2,426	**4,819**
2020	957	2,240	3,692	**6,889**	991	2,232	3,572	**6,795**
2021	1,355	2,797	4,190	**8,342**	1,322	2,691	4,239	**8,252**
2022	1,746	3,349	5,018	**10,113**	1,617	3,324	5,085	**10,026**
2023	2,094	3,901	6,263	**12,258**	1,867	4,105	6,158	**12,130**
2024	2,274	4,443	7,046	**13,763**	2,056	4,670	6,782	**13,508**
2025	2,422	4,979	7,621	**15,022**	2,195	5,131	7,309	**14,635**
2026	2,457	5,391	7,565	**15,413**	2,207	5,235	7,459	**14,901**
2027	2,484	5,722	7,648	**15,854**	2,223	5,373	7,624	**15,220**

* 2013 values are net increase from 2012; values thereafter are cumulative of net increase
* Others include ESS (Energy Storage System), smart appliance, etc.

B. Electricity Consumption Reduction Plan

(Unit : GWh)

Year	Efficiency Enhancement		Pricing & Smart Grid	Total
	Appliance Adoption	Regulation		
2012				
2013	551	1,030	1,320	2,901
2014	1,149	1,883	3,167	6,199
2015	1,853	2,808	5,539	10,200
2016	2,653	3,765	8,682	15,100
2017	3,939	4,763	12,198	20,900
2018	4,355	5,321	16,325	26,001
2019	5,395	5,872	20,933	32,200
2020	7,654	6,442	26,303	40,399
2021	11,571	7,692	35,518	54,781
2022	16,834	8,716	44,945	70,495
2023	19,861	10,058	57,413	87,332
2024	20,294	11,258	70,024	101,576
2025	20,947	13,478	73,685	108,110
2026	21,727	14,231	76,273	112,231
2027	22,023	15,131	78,548	115,702

4 Renewable Capacity Plan

☐ Overall Renewable Capacity Expansion Plan (2013 to 2027)

[Unit : MW]

Year	Hydro	Wind	Offshore	Solar	Biomass	Waste	Byproduct Gas	Fuel Cell	IGCC	Total
Existing on 2012. 12	1,746 (412)	477 (7)	255 (5)	690 (90)	93 (8)	74 (6)	692 (692)	56 (56)	0 (0)	4,084 (1,277)
2013. 06	1,746 (412)	505 (8)	255 (5)	911 (118)	94 (8)	99 (9)	692 (692)	65 (65)	0 (0)	4,367 (1,317)
2013. 12	1,746 (412)	725 (11)	255 (5)	1,157 (150)	164 (14)	102 (9)	842 (842)	151 (151)	0 (0)	5,142 (1,595)
2014. 06	1,749 (413)	893 (13)	255 (5)	1,209 (157)	379 (33)	112 (10)	992 (992)	181 (181)	0 (0)	5,770 (1,804)
2014. 12	1,749 (413)	1,837 (28)	255 (5)	1,487 (193)	399 (35)	112 (10)	992 (992)	197 (197)	0 (0)	7,028 (1,872)
2015. 06	1,759 (415)	2,267 (34)	255 (5)	1,592 (207)	420 (37)	112 (10)	992 (992)	227 (227)	0 (0)	7,624 (1,927)
2015. 12	1,759 (415)	3,286 (49)	260 (5)	1,807 (235)	460 (40)	144 (13)	992 (992)	268 (268)	300 (300)	9,277 (2,317)
2016. 06	1,759 (415)	3,286 (49)	260 (5)	1,807 (235)	460 (40)	144 (13)	992 (992)	296 (296)	300 (300)	9,305 (2,345)
2016. 12	1,764 (416)	4,471 (67)	260 (5)	1,808 (235)	500 (44)	144 (13)	992 (992)	332 (332)	300 (300)	10,572 (2,404)
2017. 06	1,764 (416)	4,511 (68)	260 (5)	1,809 (235)	520 (45)	144 (13)	992 (992)	332 (332)	300 (300)	10,632 (2,406)
2017. 12	1,764 (416)	5,205 (78)	275 (6)	1,812 (236)	520 (45)	144 (13)	992 (992)	332 (332)	600 (600)	11,644 (2,717)
2018. 06	1,764 (416)	5,205 (78)	275 (6)	1,812 (236)	520 (45)	144 (13)	992 (992)	332 (332)	600 (600)	11,644 (2,717)
2018. 12	1,764 (416)	7,635 (115)	275 (6)	1,812 (236)	620 (54)	244 (21)	992 (992)	332 (332)	600 (600)	14,274 (2,771)
2019. 06	1,764 (416)	7,635 (115)	275 (6)	1,812 (236)	620 (54)	244 (21)	992 (992)	332 (332)	600 (600)	14,274 (2,771)
2019. 12	1,780 (420)	9,881 (148)	315 (7)	1,844 (240)	860 (75)	344 (30)	992 (992)	379 (379)	900 (900)	17,295 (3,190)
2020. 06	1,790 (422)	9,887 (148)	1,255 (26)	1,853 (241)	860 (75)	344 (30)	992 (992)	385 (385)	900 (900)	18,266 (3,220)
2020. 12	1,790 (422)	11,387 (171)	1,355 (28)	1,853 (241)	960 (84)	444 (39)	992 (992)	385 (385)	900 (900)	20,066 (3,262)
2021. 06	1,790 (422)	11,387 (171)	1,355 (28)	1,853 (241)	960 (84)	444 (39)	992 (992)	385 (385)	900 (900)	20,066 (3,262)
2021. 12	1,790 (422)	14,087 (211)	1,355 (28)	1,853 (241)	1,060 (92)	544 (47)	992 (992)	390 (390)	900 (900)	22,972 (3,325)
2022. 06	1,790 (422)	15,337 (230)	1,355 (28)	1,923 (250)	1,060 (92)	544 (47)	992 (992)	390 (390)	900 (900)	24,292 (3,352)
2022. 12	1,790 (422)	15,967 (240)	1,355 (28)	1,923 (250)	1,205 (105)	688 (60)	992 (992)	390 (390)	900 (900)	25,211 (3,387)
2023. 12	1,805 (426)	16,417 (246)	1,355 (28)	2,718 (353)	1,205 (105)	688 (60)	992 (992)	613 (613)	900 (900)	26,694 (3,724)
2024. 12	1,820 (430)	16,417 (246)	1,355 (28)	3,558 (463)	1,205 (105)	688 (60)	992 (992)	838 (838)	900 (900)	27,774 (4,061)
2025. 12	1,835 (433)	16,417 (246)	1,355 (28)	4,421 (575)	1,205 (105)	688 (60)	992 (992)	1,064 (1,064)	1,200 (1,200)	29,178 (4,703)
2026. 12	1,850 (437)	16,417 (246)	1,445 (30)	4,421 (575)	1,205 (105)	688 (60)	992 (992)	1,535 (1,535)	1,500 (1,500)	30,054 (5,479)
2027. 12	1,865 (440)	17,155 (257)	1,445 (30)	5,414 (704)	1,205 (105)	688 (60)	992 (992)	1,749 (1,749)	1,500 (1,500)	32,014 (5,837)

* Values in ( ) show effective capacity

□ Renewable Generation Outlook by Year (2013 to 2027)

[Unit : GWh]

Year	Hydro	Wind	Off-shore	Solar	Bio-mass	Waste	By-product Gas	Fuel Cell	IGCC	Total
2013	5,934	1,101	467	1,205	211	224	6,065	565		15,771 (3.0%)
2014	5,940	1,765	467	1,564	610	241	8,036	1,457		20,080 (3.7%)
2015	5,962	4,477	467	2,036	922	252	8,693	1,856		24,664 (4.4%)
2016	5,979	7,168	476	2,390	1,036	324	8,693	2,471	2,628	31,165 (5.4%)
2017	5,996	9,797	476	2,392	1,149	324	8,693	2,906	2,628	34,360 (5.7%)
2018	5,996	11,354	503	2,397	1,171	324	8,693	2,906	5,256	38,599 (6.3%)
2019	5,996	16,655	503	2,397	1,396	549	8,693	2,906	5,256	44,350 (7.0%)
2020	6,066	21,560	1,436	2,446	1,937	774	8,693	3,344	7,884	54,139 (8.4%)
2021	6,083	24,838	2,480	2,452	2,162	1,000	8,693	3,370	7,884	58,961 (9.0%)
2022	6,083	32,091	2,480	2,498	2,387	1,225	8,693	3,419	7,884	66,759 (10.1%)
2023	6,083	34,828	2,480	2,544	2,713	1,549	8,693	3,419	7,884	70,193 (10.5%)
2024	6,134	35,810	2,480	3,596	2,713	1,549	8,693	5,373	7,884	74,231 (11.0%)
2025	6,185	35,810	2,480	4,707	2,713	1,549	8,693	7,344	7,884	77,364 (11.3%)
2026	6,236	35,810	2,480	5,848	2,713	1,549	8,693	9,323	10,512	83,164 (11.8%)
2027	6,287	35,810	2,645	5,848	2,713	1,549	8,693	13,449	13,140	90,134 (12.6%)

* 1. Usage rate for each fuel type is derived from 2009 - 2011 results
  2. Usage rate for offshore energy is based on the data from the RPS research project (KERI, 2010)

□ Renewable Capacity Expansion by Year

[Unit : MW]

Year	Hydro	Wind	Off-shore	Solar	Biomass	Waste	Byproduct Gas	Fuel cell	IGCC	By Policy	Total (Cumul.)
2012	1,746.0	476.7	255.0	690.3	93.4	74.3	692.3	56.1			4,084.1
2013		Hwasun 20 Small scale 8		KnH 10 Busan 10.8 JN#1 10 Changwon 3 Jungpyeong 1 Cheongju 2 NBP#1 18.4 SeoulI 10 Sinan power 5 Yeongwol 40 Small scale 110.8	Small scale 0.2	Busan RDF 25		Oseong 2.8 Ilsan 2.8 Ulsan 2.8			282.6 (4,366.7)
		Yeongheung 2 complex 22 Jeongam 40 Pyeongchang 30 TaebaekII 22 Gyeongju 2 steps 20 Daegiri 24 Sangmyeong 21 Cheongsa 15 Tamna marine 12 Busan 10 Small scale 4.7		JN#2 17 Pyeongtaek 0.27 West Incheon 0.4 Yeongyang F1 6 Sejong city II 25 Small scale 74.3	Donghae biomass 30 Bio Heavy oil mixed 40	Small scale 2.7	Pohang transient #1 150	Samcheok 28 Gyeonggi green 58.8		Solar 122.33	775.5 (5,142.2)
2014	Dangin II 3	Wondong 20 Eco island 2 AninI 40 Danyang 30 Yeongyang 46 Gasiri 30		Eco island 3 NBP#2 10.4 SeoulII 10 Sinan power #3 5 Small scale 23.8	Bio mixed 115 Bio 100	Wonju green 10	Pohang transient #2 150	SeoulI 30			628.2 (5,770.4)
		Miryang 36 Muju 30 Bonghwa 60 DaejeongI ocean 84 Gimcheon Baramjae 20 New Wolsung 40 Andong Hwanghaksan 20 Yeongdeok Satgatbong 20 Yeongdeok Hwacheon-ri 20 Samcheok Ukebaeksan 40 Geoje 40 Ulsan Dongdaesan 40 Yangsan 1 step 20 Yangsan 2 steps 30 yeongcheon Bohyeonsan 34 Pohang Seongbeop ridge 40 Pohang Janggigoat 20 Daeseongsan 34 Imgye 50 Jeongseon 20 Jeju 20 Pohang Daebo-myeon 40 Jangheung 20 Yeodong 20 Yanggu 20 Bigeumdo 15 Tamna marineII 18 Cheongsong 90 Small scale 3		JN#3 10 Metropolitan Landfill 10 Cheongu integration filtration plant 2.26 Hannam 18 MPC 0.22 Small scale 86.9	Nonsan 20 Small scale 0.1			West new 10 MPC I 5.6		Solar 150.42	1,257.5 (7,027.9)

* “By Policy” facilities exist to fulfill RPS obligation (GenCos not yet chosen)

** “Small” are small-scale GenCos permitted by the local government

Year	Hydro	Wind	Off-shore	Solar	Biomass	Waste	Byproduct Gas	Fuel cell	IGCC	By Policy	Total (Cumul.)
2015	Seoul 10	Boseong 20 Hwasun 20 West Namhae demonstration 100 Jinan Jangsu 30 Jeonnam 5GW I 200 Hyunjongsan 60		NBP#3 15.1 Kwangyang port 37 SeoulIII 10 Small 42.8	Gyeonggi South 20 Small 1.5			SeoulII 30			596.4 (7,624.3)
		Yemi 40 Jeju east 105 Hanlim ocean 150 Goheung 40 Pyeongchang II 14 Yeongyang Podosan 20 Gimhae 20 Ulsan gohunsan 20 Gunwi 40 Gyeongju III 20 Gimcheon 30 Bonghwa I 40 Bonghwa II 20 Busan 20 Samcheok 40 Yangyang 20 Yeonggwang 40 Yeongyang I 40 Yeongyang II 40 Yeongyang III 40 Ulsan 30 Jangseong 40 Taebaek 40 Hadong 30 Hwacheon 40 Bukmyen 40	Eco island tide 5	Small 9.8	West bio 40	Pohang RDF 12 Wonju 20		SeoulIII 30 MPC II 5.6 MPC III 5.6	Taean 300	Solar 205.3	1,652.3 (9,276.6)
2016				Small 0.8				Andong 28			28.8 (9,305.4)
	Taean #2 5	Soksa 40 Nambyung 40 Gnduk 40 Dunnae 40 Hancheon 40 West Nanhae demonstration 400 Daehwa 90 Daejeong II 115 Samcheok Yonghwa-ri 20 Samcheok Nogok-ri 20 Cheorwon 40 Jeonnam 5GW Ocean 300		Small 1	Gyeong-gi 20 Jeonju 20			SeoulIV 30 MPC IV 5.6			1,266.6 (10,572.0)
2017		Hyunnam 40		Small 0.2	Pyeongtaek 20						60.2 (10,632.2)
		Anin II 90 Odu 90 Samgyo 60 Daejo 20 Mokdo ocean 35 Woljeong ocean 99 DaehwaII 50 Hado ocean 150 South coast ocean 100	Uldolm-ok 14.5	Small 3.1					Yeongnam 300		1,011.6 (11,643.8)
2018				Small 0.5							0.5 (11,644.3)
		Cheonbong 90 Gyeongju Gampo 40								WInd power 2300 Bio 100 Waste 100	2,630 (14,274.3)

Year	Hydro	Wind	Off-shore	Solar	Biomass	Waste	Byproduct Gas	Fuel cell	IGCC	By Policy	Total (Cumul.)
											(14,274.3)
2019	STX 10.8 Gangne-ung 5	West Namhae Spread 2000 Gangneung 6	Jangjuk Sudo Tide 40	STX 4.8 Gangneung 13	STX 100 West 40			Gangneu-ng 7 West 40	Gunja-ng 300	Wind 240 Solar 14 Bio 100 Waste 100	3,020.6 (17,294.9)
2020	Samche-ok 10	Samcheok 6	Gnagh-wa 420 Garolim 520	Samcheok 9				Samcheok 6			971.0 (18,265.9)
		West 100	Incheon tide 100							Wind 1400 Bio 100 Waste 100	1,800.0 (20,065.9)
											(20,065.9)
2021								MPC V 5.6		Wind 2700 Bio 100 Waste 100	2,905.6 (22,971.5)
2022										Wind 1250 Solar 70	1,320.0 (24,291.5)
										Wind 630 Bio 145 Waste 144	919 (25,210.5)
2023										Water 15 Wind 450 Solar 795 Cell 223	1,483.0 (26,693.5)
2024										Water 15 Solar 840 Cell 225	1,080.0 (27,773.5)
2025										Water 15 Solar 863 Cell 226 IGCC 300	1,404.0 (29,177.5)
2026										Water 15 Tide 795 Cell 223 IGCC 300	876.0 (30,053.5)
2027										Water 15 Wind 738 Solar 993 Cell 214	1,960.0 (32,013.5)
New	43.8	6,970.7	1,099.5	670.7	566.8	69.7	300	334.2	900	16,974	27,929.4
Total	1,789.8	7,447.4	1,354.5	1,361.0	660.2	144.0	992.3	390.3	900	16,974	32,013.5

* Incheon Bay Tidal (1,320MW) and Asan Bay Tidal (254MW) have been suspended from this plan and will be reevaluated after business conditions mature

□ Comparison of Renewable Capacity Plans

[Unit : MW]

Classification	5th BPE				6th BPE			
1. Period	2010～2024 (15 years)				2013～2027 (15 years)			
2. Size by Type	'10～'12	'13～'15	'16～'20	'21～'24	'13～'15	'16～'20	'21～'24	'25～'27
○ Hydro	121.7	17.3	51.9	41.5	13.0	30.8	45.0	30.0
○ Wind	1,550.6	664.0	2,629.4	3,784.0	2,809.7	8,101.0	5,030.0	738.0
○ Offshore	254.0	570.5	2,213.0	0	5.0	1,094.5	0	90.0
○ Solar	681.6	1,001.7	1,199.7	930.1	1,116.3	46.4	2,568.0	993.0
○ Biomass	22.1	248.0	38.8	40.0	366.8	500.0	245.0	0
○ Waste	18.8	74.5	145.1	133.2	69.7	300.0	244.0	0
○ Byproduct Gas	634.0	500.0	0	0	300.0	0	0	0
○ Fuel Cell	80.0	130.5	250.0	200.0	212.0	116.6	679.6	685.0
○ IGCC/CCT	0	300.0	600.0	0	300.0	600.0	300.0	300.0
○ Geothermal	0.2	0	7	24	0	0	0	0
○ **Total**	**19,157.4**				**27,929.4**			
3. Peak Contribution								
○ Small Hydro	45.0%				23.6%			
○ Wind	24.6%				1.5%			
○ Solar	18.0%				13.0%			
○ Biomass / Waste	39.7%				8.7%			
○ Offshore	29.5%				2.1%			
○ Byproduct Gas	39.7%				100%			
○ Fuel Cell	-				100%			
○ IGCC	-				100%			

5 RCS Capacity Plan

□ RCS Capacity Expansion Outlook by Year (2013 to 2027)

Completion	Power Plant Name	Capacity (MW)	Company	Location	Reference
13.01	Yeosu Group Energy	48.4	Hyundai Energy	Jeonnam Yeosu	
13.01	Wonju Cogeneration	63.0	Chambit Wonju City Gas Industry	Gangwon Wonju	
13.01	Pyeongtaek Sosabeol District	16.0	Pyeongtaek Clean Energy	Gyeonggi Pyeongtaek	
13.05	Daegu Technopolis	127.1	STX Energy	Kyungbuk Daegu	
13.06	Kimcheon Industry Complex	59.0	kolon, SKE&S	Kyungbuk Kimcheon	
13.07	Gunjang Energy Cogeneration	56.4	Gunjang Cogeneration Power Generation	Jeonbuk Gunsan	New
13.09	Namyangju Byeollae	194.1	Byeollae Energy	Gyeonggi Namyang	
13.11	Sejong Cogeneration(1step)	515.0	Korea District Heating Coporation, KOMIPO	Chungnam Yeongi	
13.12	Yangju Cogeneration	559.0	Daeryun Power Generation	Gyeonggi Yangju	
14.06	Gangdong Cogeneration	288.0	Daehan City Gas	Seoul Gangdong	
14.06	Daegu Innovation City	400.0	Daegu City Gas, KOSPO	Daegu Dong-gu	
14.10	Wirye New City	228.0	SKE&S, Korea District Heating Coporation	Seoul Songpa	
14.11	Siheung Cogeneration	38.0	GS Power	Gyeonggi Siheung	
14.12	Kyungnam, Jinju Innovation	12.0	Murim PowerTec	Kyungnam Jinju	
14.12	Asan National Industrial Complex Poseung District	75.0	Yuho Industry Development	Gyeonggi Pyeongtaek	New
14.12	Magok City Development District	49.2	SH Public Coporation	Seoul Gangseo	New
15.01	Hwaseong Dongtan (2) District	325.0	KDHC	Gyeonggi Hwaseong	New
15.05	Anseong New Town	45.8	Pyeongtaek Clean Energy	Gyeonggi Anseong	
15.08	Osan Cogeneration	408.4	Daeseong Industry	Gyeonggi Osan	
15.12	Youngjong EP Power Plant	22.1	Youngjong EP	Incheon Jung-gu	
15.12	Daesan Cogeneration	50.7	Daesan Cogeneration Power Generation	Chungnam Seosan	New
15.12	Daejeon Cogeneration Extension	25.0	Daejeon Cogeneration	Daejeon Daedeok	New
16.12	Sokmun Industry Cpmplex	39.0	SKE&S, EWP, Sohae City Gas	Chungnam Dangjin	
16.12	Chungnam Provincial Government Relocation New City	75.5	Lotte Construction	Chungnam Yesan	New
16.12	Chuncheon Group Energy	202.0	POSCO Power	Gangwon Chuncheon	New
19.10	Hwaseong Hyangnam Cogeneration (2 district)	228.6	Samchully(Huses)	Gyeonggi Hwaseong	
19.11	Sejong Cogeneration(2steps)	515.0	KDHC, KOMIPO, KOSPO	Chungnam Yeongi	
	Total	4,665.3			

6 Island Area Supply-Demand Plan & Outlook

□ Duration of the Plan : 2013 to 2017 (5 years)

○ Sought as a mid-term plan due to short construction time of the internal combustion(IC) generators(about 1 year) and demand forecast uncertainty

□ Targeted Islands : 25 in total

○ Chosen from 63 KEPCO-operated areas with 200 or more households

○ Targets will be gradually expanded in the future (including local government operated areas, and interconnection may be considered)

□ Basis for Peak Demand Forecast

Applied Basis	Remarks
(Trend Analysis+Structural Analysis) / 2 + Newly Accepted Projects (50% of Total)	Avg. Yearly Growth : -2.7% ~ 15.0% (Nagwoldo) (Yeonpyeongdo)

※ 1. Trend : Analysis of the trend for the peak demand results (2001 to 2012)
2. Structural : Recursive analysis based on consumption, load factor, & customer count

□ Basis for Proper Capacity Reserve Rate

○ Proper capacity reserve can be exceeded in order to curb additional projects in five years (considering site, investment conditions)

○ Unit capacity takes number of generators and capacity in each island into account

○ Applied Reserve Rate : 25%(Ulleungdo) ~ 55%(Janggodo)

【 Basis for Proper Capacity Reserve Rate 】

<table>
<tr><th rowspan="2">Total Generators</th><th rowspan="2">Base Capacity Reserve Rate</th><th colspan="3">Added Based on Capacity Configuration</th></tr>
<tr><th>1 (2x)</th><th>2 (2x)</th><th>Other Multiplier</th></tr>
<tr><td>3</td><td>55 %~</td><td>30 %p (*1)</td><td>15 %p (*2)</td><td rowspan="2">Applied Proportionately</td></tr>
<tr><td>4</td><td>38 %~</td><td>15 %p</td><td>10 %p</td></tr>
<tr><td>5</td><td>30 % (*3)</td><td colspan="3" rowspan="3">(Max Capacity / Installed Capacity) +5% and base rate on the left column are compared; Larger one is chosen as the base reserve rate</td></tr>
<tr><td>6 to 8</td><td>25 %</td></tr>
<tr><td>9 +</td><td>20 %</td></tr>
</table>

※ Based on research on optimal demand forecast for isolated islands (2008)
※ (*1) Configuration (3 units, 150kW,150kW,300kW,) : 55%(Base)+30% added
(*2) Configuration (3 units, 150kW,300kW,300kW) : 55%(Base)+15% added
(*3) Configuration (6 units, 150kW×3, 500kW×3) : (500/1950)%+5%=31%

□ Basis for Capacity Retirement

○ Reflects the generators' design life cycle based on revolutions

○ Final determination of retirement takes life cycle diagnosis based on actual operated hours into account

Classification	Low-Speed	Mid-Speed	High-Speed
Design Life(Year)	25	20	15
Revolutions(rpm)	300 or lower	300 to 1,000	1,000 or higher

※ Based on "Research on Optimal Demand Forecast for Isolated Islands" (KERI, May 2008)

□ Capacity Plans for Island Areas

○ New Projects : 23 units, 27,850kW

○ Retirement : 24 units, 11,890kW

[Unit : kW]

Island	2012 (Actual)	2013	2014	2015	2016	2017	Remarks
Baengnyeongdo	6,000		2,000*	9,000 (4,500)			3,000×3 (1,500×3)
Daecheongdo		750*		2,600 (950)			1,300×2 (450, 500)
Yeonpyeongdo						3,800 (2,000)	1,900×2 (1,000×2)
Jawoldo					1,000 (150)		1,000×1 (150×1)
Seungbongdo		500*		1,000 (300)			1,000×1 (150×2)
Janggodo			750 (240)				250×3 (80×3)
Sapsido			1,000 (300)				500×2 (150×2)
Eocheongdo	500 (150)				500 (150)		500×1 (150×1)
Hongdo			750*	2,000 (750)			1,000×2 (250, 500)
Gageodo						1,000 (550)	500×2 (250, 300)
Jodo			2,600 (1,000)				1,300×2 (500×2)
Geomundo		2,000* 2,600 (1,000)					1,300×2 (500×2)
Chujado	2,000 (900)						
Total	**8,500 (1,050)**	**2,600 (1,000)**	**4,350 (1,540)**	**14,600 (6,500)**	**1,500 (300)**	**4,800 (2,550)**	

※ 1. Value in ( ) are retired capacity

2. Value with * are mobile generators (temporary; excluded from total)

3. Mobile generators in areas expecting low (<5%) reserve rate before expansion : Baeknyeongdo(5.22%), Daecheongdo(▽7.85%), Seungbongdo(3.35%), Hongdo(▽1.71%)

□ Supply-Demand Outlook by Islands

[Units : kW, %]

Classification		2012	2013	2014	2015	2016	2017	Remarks (Base Capacity Reserve Rate)
Baengnyeongdo	Installed(kW)	15,000	15,000	17,000	19,500	19,500	19,500	25%
	Peak(kW)	8,321	10,635	11,405	12,195	13,007	13,846	
	Reserve(%)	82.2	41.0	49.1	59.9	49.9	40.8	
Daecheongdo	Installed(kW)	3,550	4,300	4,300	5,200	5,200	5,200	48%
	Peak(kW)	2,187	2,442	2,688	2,964	3,271	3,612	
	Reserve(%)	62.3	76.1	60.0	75.4	59.0	44.0	
Socheongdo	Installed(kW)	2,650	2,650	2,650	2,650	2,650	2,650	43%
	Peak(kW)	596	669	740	808	876	942	
	Reserve(%)	344.6	296.1	258.3	227.8	202.6	181.3	
Yeonpyeongdo	Installed(kW)	7,700	7,700	7,700	7,700	7,700	9,500	30%
	Peak(kW)	3,193	4,124	4,620	5,163	5,760	6,416	
	Reserve(%)	141.2	86.7	66.7	49.1	33.7	48.1	
Deokjeokdo	Installed(kW)	2,900	2,900	2,900	2,900	2,900	2,900	25%
	Peak(kW)	1,773	1,834	1,900	1,970	2,044	2,122	
	Reserve(%)	63.6	58.1	52.6	47.2	41.9	36.7	
Jawoldo	Installed(kW)	1,650	1,650	1,650	1,650	2,500	2,500	43%
	Peak(kW)	918	994	1,064	1,140	1,223	1,312	
	Reserve(%)	79.7	66.0	55.0	44.7	104.4	90.5	
Seungbongdo	Installed(kW)	1,950	2,450	2,450	2,650	2,650	2,650	31%
	Peak(kW)	1,328	1,403	1,471	1,535	1,596	1,657	
	Reserve(%)	46.8	74.6	66.6	72.7	66.0	59.9	
Janggodo	Installed(kW)	440	440	750	750	750	750	55%
	Peak(kW)	243	282	303	325	350	376	
	Reserve(%)	81.1	56.0	147.6	130.5	114.5	99.4	
Sapsido	Installed(kW)	1,200	1,200	1,600	1,600	1,600	1,600	48%
	Peak(kW)	69.7	765	845	918	997	1,081	
	Reserve(%)	72.2	56.9	89.3	74.2	60.5	48.0	
Oiyeondo	Installed(kW)	750	750	750	750	750	750	53%
	Peak(kW)	311	333	352	371	391	410	
	Reserve(%)	141.2	125.5	112.9	101.9	91.9	82.9	
Eocheongdo	Installed(kW)	1,250	1,250	1,250	1,250	1,600	1,600	53%
	Peak(kW)	595	659	726	797	874	957	
	Reserve(%)	110.3	89.8	72.3	56.8	83.0	67.2	
Gaeyado	Installed(kW)	1,500	1,500	1,500	1,500	1,500	1,500	48%
	Peak(kW)	626	682	711	731	746	758	
	Reserve(%)	139.6	120.1	110.9	105.1	101.0	97.9	
Wido	Installed(kW)	2,850	2,850	2,850	2,850	2,850	2,850	53%
	Peak(kW)	1,241	1,254	1,262	1,265	1,264	1,259	
	Reserve(%)	131.3	127.2	125.8	125.3	125.5	126.4	

Classification		2012	2013	2014	2015	2016	2017	Remarks (Base Capacity Reserve Rate)
Nagwoldo	Installed(kW)	750	750	750	750	750	750	55%
	Peak(kW)	155	152	148	145	140	136	
	Reserve(%)	383.9	394.7	405.9	418.9	434.2	452.5	
Hongdo	Installed(kW)	2,350	2,350	3,100	3,600	3,600	3,600	43%
	Peak(kW)	1,161	1,469	1,577	1,687	1,799	1,914	
	Reserve(%)	102.4	60.0	96.6	113.4	100.1	88.1	
Heuksando	Installed(kW)	4,000	4,000	4,000	4,000	4,000	4,000	30%
	Peak(kW)	2,382	2,449	2,480	2,510	2,540	2,569	
	Reserve(%)	67.9	63.3	61.3	59.3	57.5	55.7	
Gageodo	Installed(kW)	1,050	1,050	1,050	1,050	1,050	1,500	38%
	Peak(kW)	584	621	660	700	740	782	
	Reserve(%)	80.0	69.0	59.1	50.1	41.8	91.8	
Jodo	Installed(kW)	2,600	2,600	3,600	3,600	3,600	3,600	38%
	Peak(kW)	1,629	1,729	1,792	1,858	1,927	2,000	
	Reserve(%)	72.0	50.4	100.9	93.8	86.8	80.0	
Sisando	Installed(kW)	750	750	750	750	750	750	55%
	Peak(kW)	164	165	165	165	164	163	
	Reserve(%)	357.3	355.0	354.1	354.7	356.6	360.1	
Yeojado	Installed(kW)	450	450	450	450	450	450	55%
	Peak(kW)	135	137	139	141	143	145	
	Reserve(%)	233.3	227.8	222.9	218.4	214.4	210.3	
Chodo	Installed(kW)	750	750	750	750	750	750	55%
	Peak(kW)	234	234	234	233	231	229	
	Reserve(%)	220.5	220.1	220.6	222.2	224.6	227.5	
Geomundo	Installed(kW)	3,500	7,850	5,100	5,100	5,100	5,100	34%
	Peak(kW)	2,235	2,649	2,748	2,849	2,952	3,057	
	Reserve(%)	56.6	196.3	85.6	79.0	72.8	66.8	
Ulleungdo	Installed(kW)	19,200	19,200	19,200	19,200	19,200	19,200	25%
	Peak(kW)	9,804	11,152	11,685	12,539	13,115	13,713	
	Reserve(%)	95.8	72.2	64.3	53.1	46.4	40.0	
Chujado	Installed(kW)	5,500	5,500	5,500	5,500	5,500	5,500	23%
	Peak(kW)	3,210	3,495	3,518	3,522	3,506	3,467	
	Reserve(%)	71.3	57.4	56.3	56.2	56.9	58.6	
Gapado	Installed(kW)	450	450	450	450	450	450	55%
	Peak(kW)	243	254	266	278	290	303	
	Reserve(%)	85.2	77.1	69.3	62.0	55.0	48.5	

7 Generation Capacity Expansion Plan

☐ Nationwide

Year	M	Generation Facility	Capacity (MW)	Total Cap. (MW)		Peak (MW)		Reserve Rate (%)
				Summer	Year-End	Summer	Winter	
2012	12	Existing Facilities			78,483 (80,713)		76,522	2.6 (5.5)
2013				81,717	85,605	78,347	79,712	7.4
	1	Incheon CC#3	450					
	3	Oseong CC	833					
	6	Renewable Energy	40					
	6	RCS	109					
	7	Yulchon#2 GT	590					
	7	Sinulsan GT	581					
	7	Sinpyeongtaek2 GT	631					
	8	Dangjin CC#3	373					
	10	Sinwolseong#2	1,000					
	12	Singori#3	1,400					
	12	Renewable Energy	278					
	12	RCS	835					
	12	Island Area IC	3					
	12	Retired - Island Area IC	-1					
2014				86,998	94,192	80,328	80,969	16.3
	1	Retired - Ulsan#1~3	-600					
	1	Retired - Yeongnam#1,2	-400					
	3	Andong CC	400					
	3	Retired - Incheon#1,2	-500					
	5	Pocheon CC#1	725					
	6	Yeongheung#5	870					
	6	Renewable Energy	210					
	6	RCS	688					
	7	Yulchon#2 ST	295					

* 1. For renewable and RCS, their peak contribution are applied
2. Jeju GT#1,2(110MW) are used as sync. compensators - excluded (can't contribute to peak)
3. Namjeju IC#1~4(40MW) were originally to retire on Mar. 2012 but kept for now for short-term supply stability
4. Uncertainty mitigation capacity (Sinpyeongtaek CC 3rd Phase, Tongyeong CC #1, Dongbuhassla #1, 2) is excluded when calculating the capacity reserve rate
5. ( ) are total capacity and reserve on the peak of the 2012 winter season (Jan. 3, 2013)
6. Emergency facilities (Yulchon CC#2 GT, Sinulsan CC GT, Sinpyeongtaek CC GT 2nd Phase) are included for summer contribution (announced as 5th BPE amendment)

Year	M	Generation Facility	Capacity (MW)	Total Cap. (MW)		Peak (MW)		Reserve Rate (%)
				Summer	Year-End	Summer	Winter	
	7	Sinwoolsan ST	291					
	7	POSCO CC#7	382					
	8	Retired - POSCO CC#1	-450					
	9	Singori#4	1,400					
	10	Ansan CC	834					
	11	Sinpyeongtaek2 ST	316					
	11	Pocheon CC#2	725					
	12	POSCO CC#8	382					
	12	Dongducheon CC#1	858					
	12	Dongducheon CC#2	858					
	12	Yeongheung#6	870					
	12	Renewable Energy	68					
	12	RCS	362					
	12	Island Area IC	4					
	12	Retired - Island Area IC	-1					
2015				96,357	100,177	81,577	82,677	21.2
	1	Retired - POSCO CC#2	-450					
	3	POSCO CC#9	382					
	3	Jangmun CC#1	900					
	6	Jangmun CC#2	900					
	6	Renewable Energy	54					
	6	RCS	379					
	12	Dangjin CC#5	950					
	12	Dangjin#9	1,020					
	12	Samcheok#1	1,000					
	12	Renewable Energy	391					
	12	RCS	451					
	12	Island Area IC	15					
	12	Retired - Island Area IC	-7					

Year	M	Generation Facility	Capacity (MW)	Total Cap. (MW)		Peak (MW)		Reserve Rate (%)
				Summer	Year-End	Summer	Winter	
2016				106,765	110,067	84,576	84,167	26.2
	2	Yeosu#1	350					
	2	Bukpyeong#1	595					
	6	Bukpyeong#2	595					
	6	Samcheok#2	1,000					
	6	Dangjin#10	1,020					
	6	Dongbugreen#1	550					
	6	Sinboryeong#1	1,000					
	6	Taean#9	1,050					
	6	Yeongnam CC	400					
	6	Renewable Energy	28					
	9	Retired - Seoul#4,5	-388					
	9	Seoul CC#1	400					
	9	Seoul CC#2	400					
	10	Daewoopocheon CC#1	940					
	12	Dongbugreen#2	550					
	12	Taean#10	1,050					
	12	Renewable Energy	58					
	12	RCS	291					
	12	Island Area IC	2					
	12	Retired - Island Area IC	-1					
2017				113,419	113,332	88,218	86,922	28.6
	4	Sinuljin#1	1,400					
	6	Sinboryeong#2	1,000					
	6	Yeoju CC	950					
	6	Renewable Energy	2					
	9	Retired - Seocheon#1,2	-400					
	11	Sinpyeongtaek3 CC	(900)					

Year	M	Generation Facility	Capacity (MW)	Total Cap. (MW)		Peak (MW)		Reserve Rate (%)
				Summer	Year-End	Summer	Winter	
	12	Tongyeong CC#1	(920)					
	12	Renewable Energy	311					
	12	Retired - Island Area IC	5					
	12	Island Area IC	-3					
2018				114,197	116,621	91,509	89,581	24.8
	1	Retired - Jeju GT#3	-55					
	1	Retired - Pyeongtaek CC	-480					
	4	Sinuljin#2	1,400					
	6	Renewable Energy	0.					
	10	NSP#1	1,000					
	12	Yeongheung#7	870					
	12	Sinseocheon#1	500					
	12	Renewable Energy	54					
2019				119,991	124,404	93,683	91,424	28.1
	4	NSP#2	1,000					
	4	G-project#1	1,000					
	6	Sinseocheon#2	500					
	6	Yeongheung#8	870					
	10	G-project#2	1,000					
	12	Singori#5	1,400					
	12	Tongyangpower#1	1,000					
	12	Dongbuhaslla#1	(1,000)					
	12	Renewable Energy	419					
	12	RCS	594					
2020				124,433	125,875	95,316	94,014	30.5
	6	Dongbuhaslla#2	(1,000)					
	6	Renewable Energy	29					

Year	M	Generation Facility	Capacity (MW)	Total Cap. (MW)		Peak (MW)		Reserve Rate (%)
				Summer	Year-End	Summer	Winter	
	12	Singori#6	1,400					
	12	Renewable Energy	42					
2021				127,275	128,339	97,510	96,462	30.5
	6	Sinuljin#3	1,400					
	7	Tongyangpower#2	1,000					
	12	Renewable Energy	64					
2022				128,567	128,602	99,363	98,503	29.4
	1	Retired - Ulsan#4～6	-1,200					
	6	Sinuljin#4	1,400					
	6	Renewable Energy	28					
	12	Renewable Energy	35					
2023				128,602	128,639	100,807	99,781	27.6
	12	Retired - Seoincheon #1～8	-1,800					
	12	Singori#7	1,500					
	12	Renewable Energy	337					
2024				128,639	129,077	102,839	100,934	25.1
	12	Retired - Pyeongtaek#1～4	-1,400					
	12	Singori#8	1,500					
	12	Renewable Energy	338					
2025				129,077	129,719	105,056	102,348	22.9
	12	Renewable Energy	642					
2026				129,719	130,495	108,037	104,444	20.1
	12	Renewable Energy	776					
2027				130,495	130,853	110,886	106,463	17.7
	12	Renewable Energy	358					

□ Seoul Metropolitan Area

Year	M	Generation Facility	Inst. Cap. (MW)	Flow Cap. (MW)	Total Cap. (MW)		Peak (MW)		Reserve Rate (%)
					Summer	Year-End	Summer	Winter	
2012	12	Existing Facilities	18,784	14,696		33,480		31,137	7.5
2013				14,919	35,022	35,976	30,123	31,551	14.0
	1	Incheon CC#3	450						
	3	Oseong CC	833						
	6	Renewable Energy	30						
	6	RCS	6						
	7	Sinpyeongtaek2 GT	631						
	12	Renewable Energy	63						
	12	RCS	260						
2014				14,827	37,269	42,404	30,586	32,062	32.3
	3	Retired - Incheon#1,2	-500						
	5	Pocheon CC#1	725						
	6	Yeongheung#5	870						
	6	Renewable Energy	2						
	6	RCS	288						
	7	POSCO CC#7	382						
	8	Retired - POSCO CC#1	-450						
	10	Ansan CC	834						
	11	Sinpyeongtaek2 ST	316						
	11	Pocheon CC#2	725						
	12	Dongducheon CC#1	858						
	12	Dongducheon CC#2	858						
	12	POSCO CC#8	382						
	12	Yeongheung#6	870						
	12	Renewable Energy	1						
	12	RCS	358						
2015				15,612	45,335	45,777	31,119	32,625	40.3
	1	Retired - POSCO CC#2	-450						
	3	Jangmun CC#1	900						
	3	POSCO CC#9	382						

* 1. For renewable and RCS, their peak contribution are applied
2. Uncertainty mitigation capacity (Sinpyeongtaek CC 3rd Phase) is excluded when calculating the capacity reserve rate

Year	M	Generation Facility	Inst. Cap. (MW)	Flow Cap. (MW)	Total Cap. (MW)		Peak (MW)		Reserve Rate (%)
					Summer	Year-End	Summer	Winter	
	6	Jangmun CC#2	900						
	6	Renewable Energy	35						
	6	RCS	379						
	12	Renewable Energy	34						
	12	RCS	408						
2016				16,637	46,802	48,186	31,777	33,307	44.7
	9	Retired - Seoul#4,5	-388						
	9	Seoul CC#1	400						
	9	Seoul CC#2	400						
	10	Daewoopocheon CC#1	940						
	12	Renewable Energy	32						
2017				17,652	50,153	50,153	32,398	33,954	47.7
	6	Yeoju CC	950						
	6	Renewable Energy	2						
	11	Sinpyeongtaek3 CC	(900)						
2018				17,858	49,879	50,749	33,074	34,650	46.5
	1	Retired - Pyeongtaek CC	-480						
	12	Yeongheung#7	870						
2019				19,034	52,795	52,874	33,212	34,809	51.9
	6	Yeongheung#8	870						
	12	RCS	79						
2020				19,528	53,379	53,379	33,252	34,859	53.1
	6	Renewable Energy	9						
	6	RCS	2						
2021				20,021	53,872	53,872	33,487	35,106	53.5
2022				20,515	54,394	54,394	33,582	35,216	54.5
	6	Renewable Energy	28						
2023				21,008	54,887	53,087	33,550	35,205	50.8
	12	Retired - Seoincheon #1～8	-1,800						
2024				21,502	53,581	52,181	33,797	35,480	47.1
	12	Retired - Pyeongtaek#1～4	-1,400						
2025				21,245	51,924	51,924	34,113	35,826	44.9
2026				21,309	51,988	51,988	34,772	36,515	42.4
2027				20,948	51,627	51,627	35,400	37,186	38.8

□ Jeju Island Area

Year	M	Generation Facility	Inst. Cap. (MW)	HVDC Flow (MW)	Total Cap. (MW)		Peak (MW)		Reserve Rate (%)
					Summer	Year-End	Summer	Winter	
2012	12	Existing Facilities	633	150		783		621	50.2
2013				400	1,033	1,034	702	634	47.2
	12	Renewable Energy	1						
2014				400	1,035	1,039	720	648	43.8
	6	Renewable Energy	1						
	12	Renewable Energy	4						
2015				400	1,039	1,043	738	663	40.8
	12	Renewable Energy	4						
2016				400	1,043	1,045	758	680	37.6
	12	Renewable Energy	2						
2017				600	1,245	1,249	777	697	60.2
	12	Renewable Energy	4						
2018				600	1,194	1,194	798	714	49.6
	1	Retired - Jeju GT#3	-55						
2019				600	1,194	1,194	808	720	47.8
2020				600	1,194	1,194	815	724	46.5
2021				600	1,194	1,194	827	731	44.4
2022				600	1,194	1,194	835	737	43.0
2023				600	1,194	1,194	841	738	42.0
2024				600	1,194	1,194	850	744	40.5
2025				600	1,194	1,194	861	752	38.7
2026				600	1,194	1,194	877	766	36.1
2027				600	1,194	1,194	893	778	33.7

* 1. For renewable and RCS, their peak contribution are applied
2. Jeju GT#1,2(110MW) are used as sync. compensators - excluded (can't contribute to peak)
3. Namjeju IC#1~4(40MW) were originally to retire on Mar. 2012 but kept for now for short-term supply stability

8 Generation Capacity Retirement Plan

[Unit : MW]

Year	Anthracite	Bituminous Coal	LNG	Oil	Total
2014			POSCO CC#1 (450) 인천#1,2 (500)	Yeongnam #1,2 (400) Ulsan #1~3 (600)	1,950 (8 units)
2015			POSCO CC#2 (450)		450 (1 unit)
2016			Seoul Thermal #4,5 (388)		388 (2 units)
2017		Seocheon #1,2 (400)			400 (2 units)
2018			Pyeongtaek CC (480)	Jeju GT#3 (55)	535 (2 units)
2022				Ulsan #4~6 (1,200)	1,200 (3 units)
2023			Seoincheon CC#1~8 (1,800)		1,800 (8 units)
2024				Pyeongtaek #1~4 (1,400)	1,400 (4 units)
Total ('13~'27)		**400 (2 units)**	**4,068 (15 units)**	**3,655 (13 units)**	**8,123 (30 units)**

* 1. Excludes retiring island area IC units

2. Namjeju IC#1~4(40MW) were originally to retire on Mar. 2012 but kept for now for short-term supply stability and are excluded from this table

9 Generation Mix Outlook

A. By Nominal Capacity

□ Nationwide

[Unit : MW, %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped	Renew.	RCS	Total
2012	20,716	23,409	1,125	20,116	4,888	4,700	4,084	2,768	81,806
	25.3	28.6	1.4	24.6	6.0	5.7	5.0	3.4	100
2013	23,116	23,409	1,125	23,574	4,890	4,700	5,142	4,406	90,362
	25.6	25.9	1.2	26.1	5.4	5.2	5.7	4.9	100
2014	24,516	25,149	1,125	28,690	3,893	4,700	7,028	5,496	100,597
	24.4	25.0	1.1	28.5	3.9	4.7	7.0	5.5	100
2015	24,516	27,169	1,125	31,372	3,901	4,700	9,277	6,373	108,433
	22.6	25.1	1.0	28.9	3.6	4.3	8.6	5.9	100
2016	24,516	34,929	1,125	33,124	3,902	4,700	10,572	6,690	119,558
	20.5	29.2	0.9	27.7	3.3	3.9	8.8	5.6	100
2017	25,916	35,929	725	34,074	3,904	4,700	11,644	6,690	123,582
	21.0	29.1	0.6	27.6	3.2	3.8	9.4	5.4	100
2018	27,316	38,299	725	33,594	3,849	4,700	14,274	6,690	129,448
	21.1	29.6	0.6	26.0	3.0	3.6	11.0	5.2	100
2019	28,716	43,669	725	33,594	3,849	4,700	17,295	7,434	139,983
	20.5	31.2	0.5	24.0	2.7	3.4	12.4	5.3	100
2020	30,116	43,669	725	33,594	3,849	4,700	20,066	7,434	144,154
	20.9	30.3	0.5	23.3	2.7	3.3	13.9	5.2	100
2021	31,516	44,669	725	33,594	3,849	4,700	22,972	7,434	149,460
	21.1	29.9	0.5	22.5	2.6	3.1	15.4	5.0	100
2022	32,916	44,669	725	33,594	2,649	4,700	25,211	7,434	151,899
	21.7	29.4	0.5	22.1	1.7	3.1	16.6	4.9	100
2023	34,416	44,669	725	31,794	2,649	4,700	26,694	7,434	153,082
	22.5	29.2	0.5	20.8	1.7	3.1	17.4	4.9	100
2024	35,916	44,669	725	31,794	1,249	4,700	27,774	7,434	154,262
	23.3	29.0	0.5	20.6	0.8	3.0	18.0	4.8	100
2025	35,916	44,669	725	31,794	1,249	4,700	29,178	7,434	155,666
	23.1	28.7	0.5	20.4	0.8	3.0	18.7	4.8	100
2026	35,916	44,669	725	31,794	1,249	4,700	30,054	7,434	156,542
	22.9	28.5	0.5	20.3	0.8	3.0	19.2	4.7	100
2027	35,916	44,669	725	31,794	1,249	4,700	32,014	7,434	158,502
	22.7	28.2	0.5	20.1	0.8	3.0	20.2	4.7	100

* 1. Based on year-end installed capacity; Renewable & RCS show nominal capacity
2. Jeju GT#1,2(110MW) are used as sync. compensators but are included
3. Namjeju IC#1~4(40MW) were to retire on Mar. 2012 but kept for now for short-term supply stability
4. Uncertainty mitigation capacity (Sinpyeongtaek CC 3rd Phase, Tongyeong CC #1, Dongbuhassla #1, 2) is excluded when calculating generation mix

□ Seoul Metropolitan Area

[Unit : MW %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped Hydro	Renewable	RCS	Flow Capacity	Total
2012	-	3,340	-	11,651	1,400	400	705	1,946	14,696	34,138
	-	9.8	-	34.1	4.1	1.2	2.1	5.7	43.0	100
2013	-	3,340	-	13,565	1,400	400	857	2,711	14,919	37,192
	-	9.0	-	36.5	3.8	1.1	2.3	7.3	40.1	100
2014	-	5,080	-	17,695	1,400	400	882	3,389	14,827	43,673
	-	11.6	-	40.5	3.2	0.9	2.0	7.8	34.0	100
2015	-	5,080	-	19,427	1,400	400	1,027	4,190	15,612	47,136
	-	10.8	-	41.2	3.0	0.8	2.2	8.9	33.1	100
2016	-	5,080	-	20,779	1,400	400	1,077	4,190	16,637	49,563
	-	10.2	-	41.9	2.8	0.8	2.2	8.5	33.6	100
2017	-	5,080	-	21,729	1,400	400	1,097	4,190	17,652	51,548
	-	9.9	-	42.2	2.7	0.8	2.1	8.1	34.2	100
2018	-	5,950	-	21,249	1,400	400	1,097	4,190	17,858	52,144
	-	11.4	-	40.8	2.7	0.8	2.1	8.0	34.2	100
2019	-	6,820	-	21,249	1,400	400	1,097	4,419	19,034	54,419
	-	12.5	-	39.0	2.6	0.7	2.0	8.1	35.0	100
2020	-	6,820	-	21,249	1,400	400	1,517	4,519	19,528	55,433
	-	12.3	-	38.3	2.5	0.7	2.7	8.2	35.2	100
2021	-	6,820	-	21,249	1,400	400	1,517	4,519	20,021	55,926
	-	12.2	-	38.0	2.5	0.7	2.7	8.1	35.8	100
2022	-	6,820	-	21,249	1,400	400	2,837	4,519	20,515	57,740
	-	11.8	-	36.8	2.4	0.7	4.9	7.8	35.5	100
2023	-	6,820	-	19,449	1,400	400	2,837	4,519	21,008	56,433
	-	12.1	-	34.5	2.5	0.7	5.0	8.0	37.2	100
2024	-	6,820	-	19,449	-	400	2,837	4,519	21,502	55,527
	-	12.3	-	35.0	-	0.7	5.1	8.1	38.7	100
2025	-	6,820	-	19,449	-	400	2,837	4,519	21,245	55,270
	-	12.3	-	35.2	-	0.7	5.1	8.2	38.4	100
2026	-	6,820	-	19,449	-	400	2,837	4,519	21,309	55,334
	-	12.3	-	35.1	-	0.7	5.1	8.2	38.5	100
2027	-	6,820	-	19,449	-	400	2,837	4,519	20,948	54,973
	-	12.4	-	35.4	-	0.7	5.2	8.2	38.1	100

* 1. Based on year-end installed capacity; Renewable & RCS show nominal capacity
2. Uncertainty mitigation capacity (Sinpyeongtaek CC 3rd Phase) is excluded when calculating generation mix

☐ Jeju Island Area

[Unit : MW, %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped Hydro	Renewable	RCS	HVDC	Total
2012	-	-	-	-	740	-	116	-	150	1,006
	-	-	-	-	73.6	-	11.5	-	14.9	100
2013	-	-	-	-	740	-	149	-	400	1,289
	-	-	-	-	57.4	-	11.6	-	31.0	100
2014	-	-	-	-	740	-	319	-	400	1,459
	-	-	-	-	50.7	-	21.9	-	27.4	100
2015	-	-	-	-	740	-	574	-	400	1,714
	-	-	-	-	43.2	-	33.5	-	23.3	100
2016	-	-	-	-	740	-	689	-	400	1,829
	-	-	-	-	40.5	-	37.7	-	21.9	100
2017	-	-	-	-	740	-	938	-	600	2,278
	-	-	-	-	32.5	-	41.2	-	26.3	100
2018	-	-	-	-	685	-	938	-	600	2,223
	-	-	-	-	30.8	-	42.2	-	27.0	100
2019	-	-	-	-	685	-	938	-	600	2,223
	-	-	-	-	30.8	-	42.2	-	27.0	100
2020	-	-	-	-	685	-	938	-	600	2,223
	-	-	-	-	30.8	-	42.2	-	27.0	100
2021	-	-	-	-	685	-	938	-	600	2,223
	-	-	-	-	30.8	-	42.2	-	27.0	100
2022	-	-	-	-	685	-	938	-	600	2,223
	-	-	-	-	30.8	-	42.2	-	27.0	100
2023	-	-	-	-	685	-	938	-	600	2,223
	-	-	-	-	30.8	-	42.2	-	27.0	100
2024	-	-	-	-	685	-	938	-	600	2,223
	-	-	-	-	30.8	-	42.2	-	27.0	100
2025	-	-	-	-	685	-	938	-	600	2,223
	-	-	-	-	30.8	-	42.2	-	27.0	100
2026	-	-	-	-	685	-	938	-	600	2,223
	-	-	-	-	30.8	-	42.2	-	27.0	100
2027	-	-	-	-	685	-	938	-	600	2,223
	-	-	-	-	30.8	-	42.2	-	27.0	100

* 1. Based on year-end installed capacity; Renewable & RCS show nominal capacity
2. Jeju GT#1,2(110MW) are used as sync. compensators but are included
3. Namjeju IC#1~4(40MW) were to retire on Mar. 2012 but kept for now for short-term supply stability

B. By Peak Contribution

□ Nationwide

[Unit : MW, %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped	Renew.	RCS	Total
2012	20,716	23,409	1,125	20,116	4,778	4,700	1,277	2,362	78,483
	26.4	29.8	1.4	25.6	6.1	6.0	1.6	3.0	100
2013	23,116	23,409	1,125	23,574	4,780	4,700	1,595	3,306	85,605
	27.0	27.3	1.3	27.5	5.6	5.5	1.9	3.9	100
2014	24,516	25,149	1,125	28,690	3,783	4,700	1,872	4,356	94,192
	26.0	26.7	1.2	30.5	4.0	5.0	2.0	4.6	100
2015	24,516	27,169	1,125	31,372	3,791	4,700	2,317	5,186	100,177
	24.5	27.1	1.1	31.3	3.8	4.7	2.3	5.2	100
2016	24,516	34,929	1,125	33,124	3,792	4,700	2,404	5,477	110,067
	22.3	31.7	1.0	30.1	3.4	4.3	2.2	5.0	100
2017	25,916	35,929	725	34,074	3,794	4,700	2,717	5,477	113,332
	22.9	31.7	0.6	30.1	3.3	4.1	2.4	4.8	100
2018	27,316	38,299	725	33,594	3,739	4,700	2,771	5,477	116,621
	23.4	32.8	0.6	28.8	3.2	4.0	2.4	4.7	100
2019	28,716	43,669	725	33,594	3,739	4,700	3,190	6,071	124,404
	23.1	35.1	0.6	27.0	3.0	3.8	2.6	4.9	100
2020	30,116	43,669	725	33,594	3,739	4,700	3,262	6,071	125,875
	23.9	34.7	0.6	26.7	3.0	3.7	2.6	4.8	100
2021	31,516	44,669	725	33,594	3,739	4,700	3,325	6,071	128,339
	24.6	34.8	0.6	26.2	2.9	3.7	2.6	4.7	100
2022	32,916	44,669	725	33,594	2,539	4,700	3,387	6,071	128,602
	25.6	34.7	0.6	26.1	2.0	3.7	2.6	4.7	100
2023	34,416	44,669	725	31,794	2,539	4,700	3,724	6,071	128,639
	26.8	34.7	0.6	24.7	2.0	3.7	2.9	4.7	100
2024	35,916	44,669	725	31,794	1,139	4,700	4,061	6,071	129,077
	27.8	34.6	0.6	24.6	0.9	3.6	3.1	4.7	100
2025	35,916	44,669	725	31,794	1,139	4,700	4,703	6,071	129,719
	27.7	34.4	0.6	24.5	0.9	3.6	3.6	4.7	100
2026	35,916	44,669	725	31,794	1,139	4,700	5,479	6,071	130,495
	27.5	34.2	0.6	24.4	0.9	3.6	4.2	4.7	100
2027	35,916	44,669	725	31,794	1,139	4,700	5,837	6,071	130,853
	27.4	34.1	0.6	24.3	0.9	3.6	4.5	4.6	100

* 1. Based on year-end installed capacity; Renewable & RCS show peak contribution
2. Jeju GT#1,2(110MW) are used as sync. compensators - excluded (can't contribute to peak)
3. Namjeju IC#1~4(40MW) were to retire on Mar. 2012 but kept for now for short-term supply stability
4. Uncertainty mitigation capacity (Sinpyeongtaek CC 3rd Phase, Tongyeong CC #1, Dongbuhassla #1, 2) is excluded when calculating generation mix

□ Seoul Metropolitan Area

[Unit : ㎿, %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped Hydro	Renewable	RCS	Flow Capacity	Total
2012	-	3,340	-	11,651	1,400	400	102	1,891	14,696	33,480
	-	10.0	-	34.8	4.2	1.2	0.3	5.6	43.9	100
2013	-	3,340	-	13,565	1,400	400	195	2,157	14,919	35,976
	-	9.3	-	37.7	3.9	1.1	0.5	6.0	41.5	100
2014	-	5,080	-	17,695	1,400	400	198	2,803	14,827	42,403
	-	12.0	-	41.7	3.3	0.9	0.5	6.6	35.0	100
2015	-	5,080	-	19,427	1,400	400	267	3,590	15,612	45,776
	-	11.1	-	42.4	3.1	0.9	0.6	7.8	34.1	100
2016	-	5,080	-	20,779	1,400	400	299	3,590	16,637	48,185
	-	10.5	-	43.1	2.9	0.8	0.6	7.5	34.5	100
2017	-	5,080	-	21,729	1,400	400	301	3,590	17,652	50,152
	-	10.1	-	43.3	2.8	0.8	0.6	7.2	35.2	100
2018	-	5,950	-	21,249	1,400	400	301	3,590	17,858	50,748
	-	11.7	-	41.9	2.8	0.8	0.6	7.1	35.2	100
2019	-	6,820	-	21,249	1,400	400	301	3,669	19,034	52,873
	-	12.9	-	40.2	2.6	0.8	0.6	6.9	36.0	100
2020	-	6,820	-	21,249	1,400	400	310	3,671	19,528	53,378
	-	12.8	-	39.8	2.6	0.7	0.6	6.9	36.6	100
2021	-	6,820	-	21,249	1,400	400	310	3,671	20,021	53,871
	-	12.7	-	39.4	2.6	0.7	0.6	6.8	37.2	100
2022	-	6,820	-	21,249	1,400	400	338	3,671	20,515	54,393
	-	12.5	-	39.1	2.6	0.7	0.6	6.7	37.7	100
2023	-	6,820	-	19,449	1,400	400	338	3,671	21,008	53,086
	-	12.8	-	36.6	2.6	0.8	0.6	6.9	39.6	100
2024	-	6,820	-	19,449	-	400	338	3,671	21,502	52,180
	-	13.1	-	37.3	-	0.8	0.6	7.0	41.2	100
2025	-	6,820	-	19,449	-	400	338	3,671	21,245	51,923
	-	13.1	-	37.5	-	0.8	0.7	7.1	40.9	100
2026	-	6,820	-	19,449	-	400	338	3,671	21,309	51,987
	-	13.1	-	37.4	-	0.8	0.7	7.1	41.0	100
2027	-	6,820	-	19,449	-	400	338	3,671	20,948	51,626
	-	13.2	-	37.7	-	0.8	0.7	7.1	40.6	100

* 1. Based on year-end installed capacity; Renewable & RCS show peak contribution
2. Uncertainty mitigation capacity (Sinpyeongtaek CC 3rd Phase) is excluded when calculating generation mix

□ Jeju Island Area

[Unit : MW, %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped Hydro	Renewable	RCS	HVDC	Total
2012	-	-	-	-	630	-	3	-	150	783
	-	-	-	-	80.5	-	0.4	-	19.2	100
2013	-	-	-	-	630	-	4	-	400	1,034
	-	-	-	-	60.9	-	0.4	-	38.7	100
2014	-	-	-	-	630	-	9	-	400	1,039
	-	-	-	-	60.6	-	0.9	-	38.5	100
2015	-	-	-	-	630	-	13	-	400	1,043
	-	-	-	-	60.4	-	1.2	-	38.4	100
2016	-	-	-	-	630	-	15	-	400	1,045
	-	-	-	-	60.3	-	1.4	-	38.3	100
2017	-	-	-	-	630	-	19	-	600	1,249
	-	-	-	-	50.4	-	1.5	-	48.0	100
2018	-	-	-	-	575	-	19	-	600	1,194
	-	-	-	-	48.2	-	1.6	-	50.3	100
2019	-	-	-	-	575	-	19	-	600	1,194
	-	-	-	-	48.2	-	1.6	-	50.3	100
2020	-	-	-	-	575	-	19	-	600	1,194
	-	-	-	-	48.2	-	1.6	-	50.3	100
2021	-	-	-	-	575	-	19	-	600	1,194
	-	-	-	-	48.2	-	1.6	-	50.3	100
2022	-	-	-	-	575	-	19	-	600	1,194
	-	-	-	-	48.2	-	1.6	-	50.3	100
2023	-	-	-	-	575	-	19	-	600	1,194
	-	-	-	-	48.2	-	1.6	-	50.3	100
2024	-	-	-	-	575	-	19	-	600	1,194
	-	-	-	-	48.2	-	1.6	-	50.3	100
2025	-	-	-	-	575	-	19	-	600	1,194
	-	-	-	-	48.2	-	1.6	-	50.3	100
2026	-	-	-	-	575	-	19	-	600	1,194
	-	-	-	-	48.2	-	1.6	-	50.3	100
2027	-	-	-	-	575	-	19	-	600	1,194
	-	-	-	-	48.2	-	1.6	-	50.3	100

* 1. Based on year-end installed capacity; Renewable & RCS show peak contribution
2. Jeju GT#1,2(110MW) are used as sync. compensators - excluded (can't contribute to peak)
3. Namjeju IC#1~4(40MW) were to retire on Mar. 2012 but kept for now for short-term supply stability