MOTIE Notice #2015-403
(July 24, 2015)

The 7th Basic Plan for Long-term Electricity Supply and Demand

(2015 – 2029)

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Contents

Ⅰ. Introduction

□ Legal Background

○ The Basic Plan for Long-term Electricity Supply and Demand (BPE) is prepared by the Ministry of Trade, Industry and Energy pursuant to Article 25 of the Electricity Business Act (EBA) for a stable supply and demand of electricity

○ BPE is announced biennially and it is reviewed and released by the Electricity Policy Review Board pursuant to Article 15 of the Electricity Business Decree after the consultation among the Ministries, the report to the National Assembly Standing Committee, and the public hearing.

□ Period

○ 2015 - 2029 (a 15-year long-term plan)

□ Characteristics

○ Basic directions for electricity supply and demand; long-term outlook for electricity supply and demand, plans for generation facilities, transmission facilities, and transformation facilities; electricity demand management; and the evaluation on the previous BPE

☐ Procedures

Electricity Policy Review Board Meeting (April 2014)	• Directions for the 7th BPE • Discussion of major changes in the 7th compared with the 6th BPE
⇩	
Electricity Supply-Demand Committee Meeting & Subcommittee Meeting (April 2014 - May 2015)	• Two subcommittees for demand planning & capacity planning • Mid-to-long-term demand forecast, DSM targets, generation mix premises
⇩	
BPE Preparation (June 2015)	• Estimation of facilities needed by year and by fuel type • Reflection of policy-based fuel types (nuclear & renewable)
⇩	
Public Hearing & Report to the Standing Committee (June - July 2015)	• Public hearings • Consultation with and report to the National Assembly Standing Committee
⇩	
Electricity Policy Review Board Review (July 2015), Announcement	• EPRB Review

Ⅱ. Status of Electricity Supply and Demand

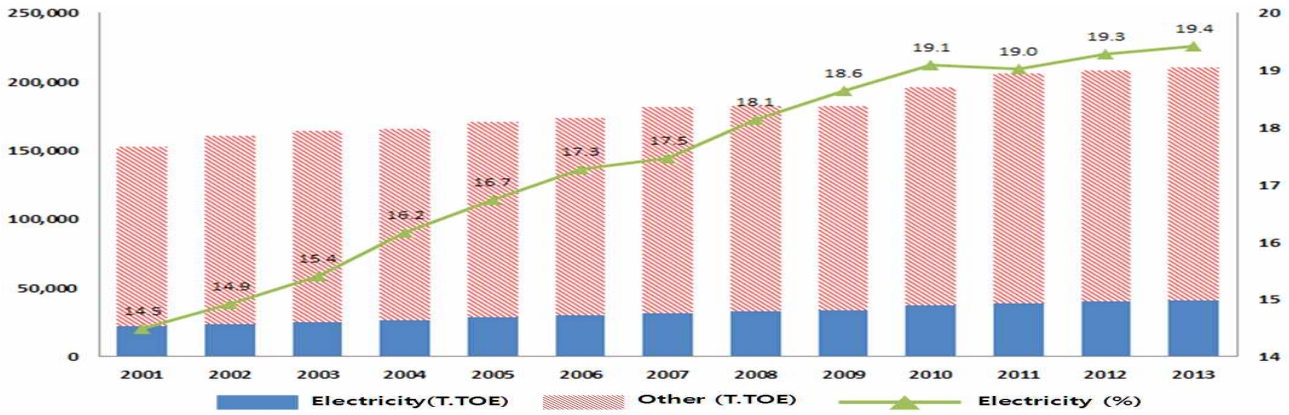
1 Electricity Demand

A. Consumption and Peak Demand

□ **(Total)** The nationwide consumption was 477,592 GWh as of the end of 2014, which is a 4.1% yearly increase on average of the past 10 years (2005 - 2014)

○ The growth rate of electricity consumption hovered around the growth rate of the final energy consumption. The share of electricity consumption out of the final energy consumption was 19.4% and it has been on the increase

【 Final Energy and Electricity Consumption 】



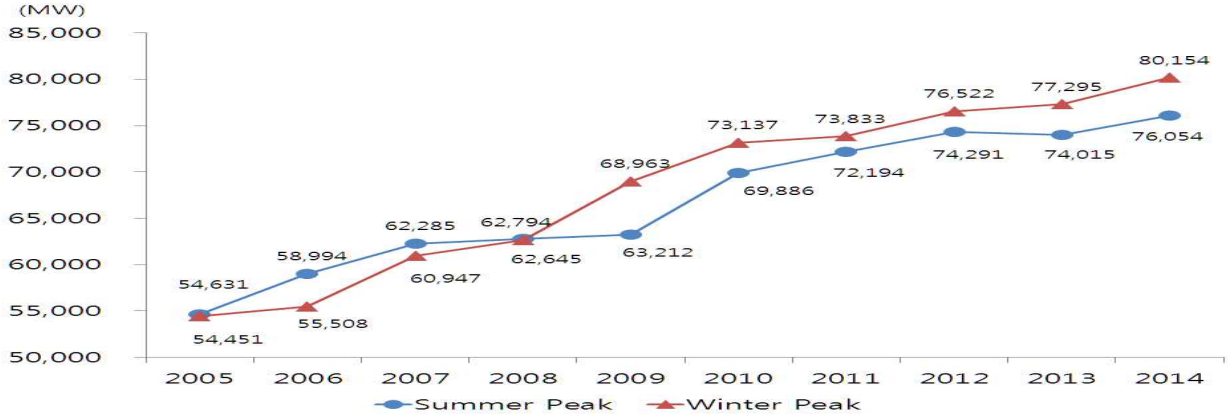
□ **(Peak Demand)** The peak demand in 2014 was 80,154 MW (recorded at 11:00 on December 17 in the year), which increased 4.4% annually on average in the past 10 years

○ Peak demand used to occur in summer afternoon, but since 2009 it has been occurring in winter morning

○ Even in winter since then, the peak demand has been in each different month every year due to higher-than-expected temperatures and the fluctuation in temperatures

* Months in peak demand in winter: (2010) January → (2011) February → (2012) January → (2013) February → (2014) December

【 Peak Demand Trends by Season and Year 】

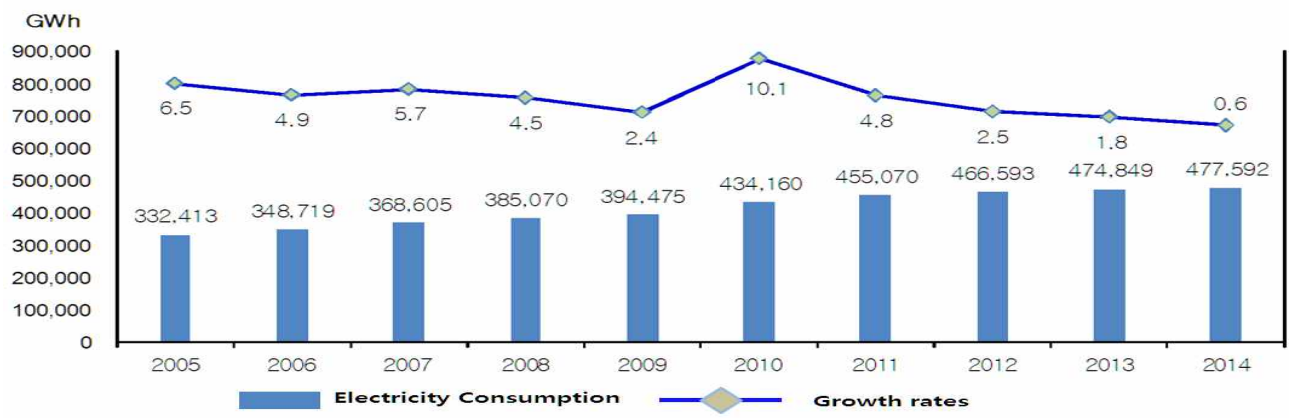


B. Trends in Recent Electricity Demand

□ The growth rates of electricity consumption have been on the decrease since the rolling blackout in September 2011, which is mainly due to intensive demand side management (DSM), rates management, and temperatures

* Electricity consumption growth: (2011) 4.8% → (2012) 2.5% → (2013) 1.8% → (2014) 0.6%

【 Trend of Electricity Consumption by Year 】



○ The electricity demand decreased in 2012 and 2013 due to the strong drive in DSM and the nation-wide proactive energy saving campaign

* The peak consumption in summer 2013 decreased by 6,070 MW mainly due to the enforced energy saving policy
* The Korean government budgeted 386.9 billion won in 2012 and 120.3 billion won in 2013 for DSM

○ The electricity consumption was also reduced by the rates management in 2012 and 2013

* Utility rates growth: (2012) 10.9% → (2013) 7.3% → (2014) 4.7%
(Inflation rates during the years: (2012) 2.2% → (2013) 1.3% → (2014) 1.3%)

○ In 2014, the decrease in demand for heating and cooling loads was remarkably low due to the mild weather conditions

* Average temperatures in 2013: (Winter) -2.9℃ (Summer) 26.6℃ → Average temperatures in 2014: (Winter) 0.3℃ (Summer) 25.7℃ (the cold wave and heat wave lasted only 3 to 5 days in 2014)
* The commercial electricity consumption decreased 2.5% and the household electricity consumption decreased 2.4% from the previous year in 2014

□ The peak demand in 2014, however, rose up significantly because of the fluctuation in temperatures

* The electricity demand increased 0.6% year on year to 477,592 GWh from 474,848 GWh while the peak demand increased 3.7% to 80,154 MW from 77,295 MW during the same period

2 Electricity Supply

□ **(Total)** The total installed capacity was 93,216 MW as of the end of 2014, a 50% increase from 62,258 MW in 2005

* The total installed capacity is the world's 13th largest, which is smaller than the total size of the electricity demand (the world's 9th largest)

□ **(By Type)** LNG, coal and nuclear have the largest shares in the total installed capacity while coal, nuclear and LNG do in the generation output

【 Size and Share of Installed Capacity (Unit: MW) **】**

Year	Nuclear	Coal	LNG	Oil	Other	Total
2005	17,716	17,965	16,447	4,710	5,420	62,258
	28.5	28.9	26.4	7.6	8.7	100
2014	20,716	26,274	26,742	3,850	15,634	93,216
	22.2	28.2	28.7	4.1	16.8	100

【 Amount and Share of Generation by Type (Unit: GWh) **】**

Year	Nuclear	Coal	LNG	Oil	Other	Total
2005	146,779	134,892	57,962	16,385	8,352	364,370
	40.3	37.0	15.9	4.5	2.3	100.0
2014	156,407	203,765	111,705	7,759	41,773	521,409
	30.0	39.1	21.4	1.5	8.0	100.0

* Source: KEPCO Statistics 2015
* Other: Renewable Energy, pumped-storage, and RCS (Regional Cogeneration System)

□ **(Private)** The share of IPPs rose from 8.2% in 2005 to 19.2% in 2014

【 Capacity by Public Sector and IPPs (Unit: MW, %) **】**

Year	Total		Public		Private (IPPs)	
	Capacity	Share	Capacity	Share	Capacity	Share
2005	62,258	100	57,178	91.8	5,080	8.2
2014	93,216	100	75,282	80.8	17,934	19.2

* IPP breakdown by type:
2005 LNG 75%, Coal (RCS) 4%, Oil (RCS) 17%, Renewable 4%
2014 LNG 70%, Coal (RCS) 4%, Oil (RCS) 4%, Renewable 22%

Ⅲ. Evaluation of the 6th BPE

◈ One of the key considerations in the 6th BPE in February 2013 was to increase and expand the generation facilities amid the growing need for power supply-demand stability since the Sept. 15 rolling blackout in 2011

○ There has been another room for improvement, however, in terms of timely completion of the scheduled plant construction, accuracy in demand forecasts, and response to climate change

A. Expansion of Power Plants

□ The plan for increasing the number of power plants was laid out for the power supply-demand stability. However, the actual construction may be put off because of environmental regulations and complaints from the public about transmission lines.

○ The 6th BPE laid out a plan of the installed capacity amounting to 15,940 MW including the generation by coal (10,740 MW) and LNG CC (5,200 MW)

○ There have been delays in the construction of power plants because of the slow agreement regarding environmental regulations and the problems in supplying transmission lines

< Delays by Issue Type >

Issue Type	Compliance to Environmental Regulations	Problems in Supplying Transmission Lines
Example	Youngheung #7,8	Dongbu Haslla #1,2

○ There has been no penalty about such delays of the intended

construction so far, so some criticize that the BPE is less effective than expected

B. Demand Forecast

□ The forecast in the 6th BPE almost matched the actual peak demand while the forecast of electricity consumption was higher compared to the actual

○ The peak demand forecast in the 6th BPE was 80,969 MW, which was similar to the actual peak demand of 80,154 MW in winter 2014

○ The 6th BPE forecast the growth rates of electricity consumption to be 2.9% in 2013 and 3.4% in 2014. The growth rates, however, turned out to have decreased to 1.8% in 2013 and 0.6% in 2014 because of the rise in utility rates, high temperatures, and the declining economic growth rates

* GDP growth: (2013) forecast 3.0% → actual 2.8%,
(2014) forecast 4.3% → actual 3.1%

C. Reserve Rate Imbalances by Year

□ With the reserve rate targeted to be 22% for the final year 2027 under the plan, there are large differences by year in terms of capacity reserve as the intents of construction by operators have been reflected

○ The reserve rate is expected to be over 30% by 2020 while the final reserve rate by 2027 is expected to remain at 17.7% due to the four nuclear power plants not reflected

○ There is also a controversy over whether the capacity of 3,900 MW is proper in addition to the reserve rate at 22% in response

to uncertainty of supply

D. Response to Greenhouse Gas Emissions

□ The 6th BPE focused on increasing the number of LNG and coal-fired power plants that require a relatively short period of construction, resulting in not that impressive reduction in greenhouse gas emissions

○ It is imperative to secure low-carbon energy resources to reduce greenhouse gas emissions as part of the post-2020 effort

E. Institutional Approach in Selecting Operators

□ The BPEs used to select operators directly and it mitigated the policy perspective of the plan and caused an escalating controversy during the selection process

○ Some have said that the selection of operators leads to operating license issues mingled with M&A and thus it is necessary to review the qualification of large stakeholders

Ⅳ. Basic Directions of the 7th BPE

A. Power Supply Stability on Top Priority

□ The Sept. 15 rolling blackout in 2011 and the ongoing severe electric supply crisis since then have been casting light on the importance of power supply stability under the plan

* Some experts said that the cycle of power supply underestimation, slow increase in the construction of power plants, increase in power consumption and the resulting crisis in supply repeated, and the Sept. 15 blackout in 2011 might have been caused by the underestimation about demand in the 3rd BPE

□ The top-notch focus in the expansion of generation facilities was power supply stability in response to a possible instability of power supply caused by any drastic changes in temperatures and delays in construction of facilities

○ Extreme weather conditions such as cold wave and heat wave are particularly one of the key considerations because the peak demand is determined by the highest and lowest temperatures, not average temperatures

⇨ The additional facilities were expected to secure the reserve rate at 22%[1)]

B. Accurate and Objective Demand Forecast

□ Recently economic growth rates and utility rates are one of the factors considered in demand forecast

* Annual average of GDP growth during the BPE period: (6th) 3.48% → (7th)

1) See page 26 on how to calculate the proper reserve rate

3.06%

* The recent changes in cost were fully considered in forecasting utility rates

□ Forecast has been based on a scientific modeling and the fact-based decision by the subcommittee consisting of experts in power demand, away from personal judgment

○ There has been remarkable improvement in modeling the demand forecast by considering the power demand trend of 14 developed countries and the changes in temperatures

* By contrast, the 6th BPE followed Japan's past demand pattern only

C. New Energy Industry-led DSM

□ Market-led demand side management will be bolstered by the new demand response market (also known as negawatt market)

* The demand resources are planned to account for over 3% out of the total electric power demand by 2029

□ The ICT-based new energy industry such as ESS and EMS will lie at the heart of DSM and thus the support for a new business model for the industry will be promoted

D. Low-carbon Energy Mix for Post-2020 Greenhouse Gas Reduction

□ **(Less Share of Coal-fired Power)** The construction of four coal-fired power plants was canceled because they had failed to receive permits because of fuel and transmission facility issues[2)]

* Exceptions are Youngheung #7,8 (1,740 MW) and Dongbu Haslla #1,2 (2,000 MW)

2) See page 27 on the cancelation of the construction of four coal-fired power plants

□ **(Replacement of Aged Facilities with Environmentally-friendly Facilities)** Greenhouse gas emissions are now under control by allowing the aged coal-fired power plants to be replaced within the capacity only when they were upgraded for the environment. The aged power plants here mean the power plants that have been operating over 40 years since construction.

□ **(New Nuclear Power Plants)** The BPE needs to reflect both the pending construction of four nuclear power plants (6,000 MW) under the 6th BPE and the target of nuclear power plant share (29%) by 2035 under the 2nd Master Plan for National Energy (MPNE).

* According to the Wien Automatic System Planning Package (WASP) model, it is expected to take two nuclear power plants to meet the capacity of new facilities (3,456 MW) (one unit for 2028 and the other unit for 2029[3])

□ **(Renewable Energy)** Generation mix is to be determined by abiding by the targets for the installed capacity and generation output of renewable energy described in the 2nd MPNE and the 4th BPE

⇨ Compared with the 6th BPE, the shares of nuclear and LNG slightly increased while the share of coal decreased in the 7th BPE[4])

Classification	Nuclear	Coal	LNG	Renewable	RCS	Oil,pumped
6th (2027)	27.4%	34.7%	24.3%	4.5%	4.6%	4.5%
7th (2029)	28.2%	32.3%	24.8%	4.6%	5.8%	4.3%

3) See pages 32 - 33 on the new energy mix according to WASP, an electric planning model for optimal facility size and the energy mix

4) See pages 39 - 41 on the final energy mix forecast and the examples of major countries

E. Basis for More DR Resources

※ Generation facilities for renewable energy, RCS, and self-generation (less than 40 MW) or generation facilities near the site of demand

□ Renewable energy supply will be boosted by utilizing the new energy business model through technology development, deregulation, and rentals

* This effort will include the support in system interconnection for small-scale renewable energy providers

⇨ **The target share of renewable energy by 2029 is 11.7% out of the total generation output[5)]**

□ Market incentives will be put in place to promote the use of demand response resources, and the installation of new transmission lines and the construction of large power generation complex will be minimized by expanding the self-generation facilities in the Seoul metropolitan area

⇨ **The target share of demand response resources by 2029 is 12.5% out of the total generation output[6)]**

F. More Viable Power Generation Projects

□ A clause of canceling the permit for power generation projects that fail to meet the deadline defined in the BPE was added to the act

* Valid from the Electricity Business Act revised in January 2015
* Earlier, the act allowed only the cancelation of power generation projects that failed to install the electrical facilities or get started by the deadline designated by the Minister of the Trade, Industry & Energy (missing the requirements for launching construction)

5) See pages 31 and 44 - 45 on how to increase the generation output, the share of renewable energy and to lay out its expansion plan
6) See page 45 - 48 on how to promote the use of demand response resources

□ A new institutional framework was put in place by changing large stakeholders in electric businesses reviewed and permitted by the government

* Earlier, there was no way of reevaluating the changed operator's ability in technology and finances for supervision and management

□ Operators are to be selected in the licensing process in line with the new installation size by year and fuel type instead of the previous system that evaluated their intent for construction[7)]

○ There was some improvement in the supply-demand imbalance issues (reserve margin errors) by year. The issues were mainly due to the scheduling that reflected the intent of construction by the operators without any coordination.

* The capacity reserve by year in the 7th BPE (2015 - 2029) is expected to remain below 30%

7) See page 24 - 25 on the procedure of establishing the plan and page 41 on the reserve rate by year

Ⅴ. Target Demand and DSM Outlook

1 Model and Major Premise

□ **(Prediction Model)** Forecast power has been improved to enhance accuracy and integrity in addition to the existing macro model (panel)*

* 6th BPE: Gap and catch-up model → 7th BPE: Power demand growth pattern of major developed countries

* The peak power forecast model is divided into forecast for summer and forecast for winter

□ **(Major Premise)** Economic growth, utility rates, population growth rate, weather forecast, etc. are reflected

○ **(Economic Growth Outlook)** Reflects economic growth rate outlook by KDI (March 2015)

- Annual average growth rate has decreased by 0.42%p in comparison with the 6th BPE

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

Plan	2014	2015	2020	2027	2029	Annual Average
6th BPE	4.3	4.5	3.5	2.7	2.4	3.48
7th BPE	3.1	3.5	3.3	2.5	2.3	3.06

○ **(Utility Rates)** Reflects the recent ground rule of rationalizing utility rates and the factors that affect the changes in costs*

* The rates include the considerations of the fuel cost outlook released by international organizations and they are also based on the simulations on generation mix

○ **(Population Growth)** The Korean population is predicted to

continue to increase by 2030 according to the population outlook by National Statistical Office (NSO) in December 2011

* The population outlook by NSO is on a five-year basis and thus the premise is the same with that of the 6th BPE

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

Plan	2011	2015	2020	2027	2029
7th BPE	49,779	50,617	51,435	52,094	52,154

○ **(Temperature)** Long-term temperature outlook on the Korean peninsula is reflected (released by Korea Meteorological Administration)

- A scenario under a valid policy for reducing greenhouse gas emissions has been applied

* The 6th BPE reflected climate change to come, taking into account the case of global warming process applied to the trend of the Korea's climate change scenarios released by KMA

2 Target Demand Outlook

□ **(Power Consumption)** 656,883 GWh by 2029 with 2.1% annual average increase for 15 years (2015 - 2029) are expected (6th BPE: 2.2% increase in annual average)

* The estimate for 2029 of the 2nd Master Plan for National Energy (MPNE) is 656,770 GWh, which is similar to that of the 7th BPE

□ **(Peak Demand)** 111,929 MW by 2029 with 2.2% annual average increase for 15 years (2015 - 2029) is expected (6th BPE: 2.4% increase in annual average)

* Under the plan, the power consumption and the peak demand are expected to go down by 14.3% and 12% respectively by 2029 through load management along with the new energy industry including the demand response resources market as well as improved energy efficiency

* The target peak demand by 2027 under the 7th BPE is expected to decrease 1.4% from 110,896 MW under the 6th BPE

【 Power Consumption and Peak Demand Prediction Results 】

Year	6th BPE		7th BPE	
	Power Consumption (GWh)	Peak Demand (MW)	Power Consumption (GWh)	Peak Demand (MW)
2015	516,156	82,677	489,595	82,478
2016	532,694	84,576	509,754	84,612
2017	548,241	88,218	532,622	88,206
2018	564,256	91,509	555,280	91,795
2019	578,623	93,683	574,506	94,840
2020	590,565	95,316	588,352	97,261
2021	597,064	97,510	600,063	99,792
2022	602,049	99,363	609,822	101,849
2023	605,724	100,807	617,956	103,694
2024	611,734	102,839	625,095	105,200
2025	624,950	105,056	631,653	106,644
2026	640,133	108,037	637,953	107,974
2027	655,305 (100)	110,886 (100)	644,021 (98.3)	109,284 (98.6)
2028			650,159	110,605
2029			656,883	111,929
BPE Period Average*	2.2	2.4	2.1	2.2

* Annual average growth rate

3 Demand Side Management Plan
(Peak Demand 12%↓, Power Consumption 14.3%↓)

A. Basic Directions

□ Transform the finance-focused demand side management (DSM) to a market-friendly one led by the ICT-based new energy industry by promoting the industry

○ The 2nd MPNE in January 2014 already shifted the focus of the energy policy from supply to DSM

○ The ICT-based new energy businesses such as energy storage system (ESS), energy management system (EMS), and negawatt market have been emerging since 2013 and they now play an active role and are related to setting the DSM target

B. DSM with ICT and New Energy Industry

□ **(Load Management)** The load management system should be overhauled from a system in response to crises of electric power supply to a standing DSM and performance assessment of load management devices should be reinforced

○ Market-led load management is in place by utilizing the "demand response market (negawatt market)"*

* The demand response market refers to a market where DSM providers make profits through demand curtailment instead of power generation when the demand curtailment cost is lower than the generation cost

- The general social cost for generation, transmission and distribution of electricity can be reduced by curbing the

demand all the time not only in contingencies in short of capacity reserve

* The target of the demand response resources is 3% of the total electricity demand by 2029

○ Based on the performance assessment, the load management devices for distribution should be supplied intensively and the support for them needs to be bolstered accordingly

- Non-electronic cold storage facilities for gas cooling and district cooling should be installed more and the support for air conditioner remote control should be bolstered

□ **(Expanding of Smart Grid)** The electricity market should be further promoted as a platform of new energy industry through development of new energy technology in synergy with ICT and support for its commercialization

* Major models in the brand-new industry: Energy storage system (ESS) service, energy self-sufficient island projects, electronic vehicles, use of hot wastewater from thermal power plants, solar PV rental service, zero-energy buildings, eco-friendly towns, etc.

○ Incentives for introduction of energy efficiency management system should be provided to public buildings and factories at certain size, including BEMS and FEMS, and the introduction needs to become mandatory

○ The energy storage system (ESS) needs to be spread more widely by discounting charging fees and laying out a clause for the use of emergency power resources in the technical standard for electrical facilities

□ **(Electricity Pricing System Improvement)** The improved utility

pricing system should provide rational price signals to consumers to support a new energy market

○ Manage the pricing system properly in consideration of socal costs that come with the generation, transportation and distribution of electricity and fluctuations of the international fuel prices

* Take into account decommissioning costs for nuclear power plants, compensation costs for residents living near transmission facilities, and costs for reducing greenhouse gas emissions

○ Considering the wider use of smart meters, the current pricing system should apply the pricing differentiated by hour to all use types (including agricultural use) and all voltage types (including low voltage type)

* Note that application of this new system to household bills is under review to make it optional

○ A variety of selective pricing systems should be put in place depending on consumer patterns to generate a new energy industry and boost the market

- The selective pricing is expected to lead to more investments in DSM including self-generators and energy storage devices

- In the mid-to-long term, other alternatives may be introduced and the examples include individual pricing between consumers and service providers, and the differentiated pricing based on the quality of electricity (e.g., pricing in line with Advanced Metering Infrastructure)

- Incentive-based or selective pricing systems should be promoted further to boost the new industry sectors such as

V2G, energy storage devices and micro grids

□ **(Efficiency Improvement)** To support finding out new high-efficiency devices and always put them under management to distribute energy-saving products with high energy efficiency more widely

○ Promote the distribution of high-efficient energy-saving products and continue to explore new devices of that kind

- Incentives for the use of LED lighting products and high-efficiency devices such as inverters, motors, and heat pump boiler systems are expected to increase
  * Current incentives: Inverters 15%, LED 11%, Motors 14%, Refrigerators 20%
- Another devices with high potential of energy saving will be explored and disseminated further considering the pace of technology development and the demand from the market

○ Reinforce energy efficiency management for electric/electronic products and new buildings

- Maintain the percentage of energy efficiency level 1 products at 20% and continue to level up the efficiency standard to drive the low-efficiency products out of the market
- The standards for design and certification of new buildings are to be strengthened including the standard for insulation, higher energy performance and more installations of energy-saving facilities

□ **(Promoting Awareness on Energy-saving)** Promote public awareness on energy saving based on open communication and consensus with the Koreans

○ Energy-saving campaign related to daily life can promote public

awareness on energy saving of their own*

* Examples include smart meters, In Home Display (IHD), Internet mobile services, etc.

○ ICT-based DSM can enrich the life quality of people by lifting inefficient regulations such as elevator operation control and cooling and heating loads control

【 Peak Power Demand Management Target (Unit: MW) **】**

Year	Efficiency Improvement	Smart Grid & Pricing System	Load Management/ Policies	Total
2015	271	298	203	**772**
2020	1,901	979	1,722	**4,602**
2025	3,761	2,761	3,949	**10,471**
2029	5,257	4,144	5,899	**15,300**

※ The 8th BPE is expected to set a goal of more rational demand side management through a thorough review on the DSM performances to come

Pre-DSM Demand Outlook

☐ **(Power Consumption)** 766,109 GWh as of 2029

☐ **(Peak Demand)** 127,229 MW as of 2029

【 Forecasts of Power Consumption and Peak Demand 】

Year	Power Consumption (GWh)	Peak Demand (MW)	
		Summer	Winter
2015	498,000	80,671	83,250
2016	520,900	84,985	85,959
2017	546,810	89,352	90,214
2018	573,240	93,764	94,554
2019	596,950	97,731	98,446
2020	617,769	101,223	101,863
2021	637,040	104,865	105,452
2022	654,998	108,073	108,633
2023	671,936	111,108	111,658
2024	688,429	113,837	114,386
2025	704,934	116,547	117,115
2026	720,633	119,114	119,711
2027	735,990	121,605	122,250
2028	751,135	124,017	124,754
2029	766,109	126,338	127,229

Ⅵ. Installed Capacity Planning

Basic Directions

- ◈ **Maintain the reserve rate at above 22% by increasing the number of power plants**
- ◈ **Make a low-carbon power supply mix to meet the goal of greenhouse gas emissions**
- ◈ **Consider economic feasibility, environmental aspects and public acceptance in the power supply mix**
- ◈ **Make the distributed energy resources take over 12.5% by 2029**

1 Establishment Procedures

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

* The target amounts of renewable energy and RCS by policy will be reflected without additional evaluation and those of nuclear power plants and coal power plants will follow the optimal mix by WASP modeling.

□ **(Construction Intent Reflection)** For new energy supply by fuel, the intent for construction by GenCos will be surveyed and reflected

* From the 7th BPE, all of the candidates with construction intent are up for final selection in the permit process in line with the new generation capacity by year and by fuel, instead of abolishing the construction intent evaluation system at the phase of planning

* This change aims to solve imbalances between supply and demand by year that came with the previous system of simply reflecting the construction intent by operators

【 Establishment Procedure of Installed Capacity Plan 】

2 Proper Generation Capacity Scale

□ The reserve rate goal for 2029 is 22%, considering demand uncertainty (7%) and minimum reserve rate (above 15%) to respond to possible generator trips

○ **(Minimum Reserve Rate)** We maintain at least 15% of minimum reserve rate, taking into account generator trips and the overhaul period according to the standard of supply reliability*

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

* Outage period

· Nuclear power plants (1,500 MW) 64 days, coal (1,000 MW) 31 days, and LNG C/C (900 MW) 27 days

○ **(Uncertainty Factors)** Extra 7% of the reserve rate is reflected according to uncertainty in supply

- Unlike the previous plan,* uncertainty factors in supply were all considered and the reserve rate is set to around 7%

* The 6th BPE reflected the additional amount caused by uncertainty in supply as well as the reserve rate

* In an effort to minimize uncertainty in supply, the Electricity Business Act has stated since January 2015 that construction permits may be canceled when the plant construction is delayed

【 Basis of Proper Capacity Reserve Rate in the 7th BPE 】

Classification		Considerations	Reserve Rate	Decision Basis
Target Reserve Rate	Minimum Reserve Rate	Generator trips, overhaul period, stronger nuclear safety measures, etc.	15%	LOLE 0.3 day/year (WASP simulation)
	Demand Uncertainty	Forecast errors, DSM, uncertainty in time of supply	7%	Average of annual target demand error rates in the past BPEs
	Subtotal		22%	

* WASP: A plan-setting digital model that draws proper facility scale and power supply mix

3 Proper Generation Capacity Scale and Additional Generation

A. Proper Generation Capacity Scale

□ The gross generation capacity needed in 2029 is 136,553 MW considering the target demand of 111,929 MW and the proper reserve rate of 22%

* Proper generation capacity scale = target demand × (1 + proper reserve rate)

□ Newly needed generation capacity is calculated by excluding the existing installed capacity and the finalized capacity from the proper generation capacity

* The installed capacity as of December 2014 was 88,155 MW

【 Standard for Classifying Finalized Capacity 】

Type	Standard
Finalized Capacity	○ Generation capacity with operating permits ○ Capacity subject to decommissioning ○ Power supply sources driven by the government policy goals

B. Considerations in Calculating Finalized Capacity

□ Generation capacity with operating permits: **28,287 MW**

○ The generators with operating permits were reflected including the generators under construction or under the plan for construction

○ Note that four coal-fired power plants (a total of 3,740 MW) reflected in the 6th BPE were excluded because they failed to get the permits issued because of the transmission line and fuel issues

- Dongbu Haslla #1,2 (2,000 MW): Approval pending for the plan on the interconnection facility and system reinforcements by the Electricity Regulatory Commission

- Youngheung #7,8 (1,740 MW): Discussion pending on the use of solid fuel regarding the Clean Air Conservation Act

* Dongbu Haslla #1,2, Youngheung #8 were conditionally reflected in the 6th BPE

□ Capacity subject to decommissioning: △6,760 MW

○ **(Capacity Applied for Decommissioning)** A total of 6,760 MW was excluded including the capacity of 6,173 MW applied for decommissioning in the 6th BPE and Kori #1 subject to plant shutdown

【 Plant Decommissioning Scale in the BPE [Unit: MW, units] **】**

Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Hydro	Total
587 (1 unit)	-	400 (2 units)	3,118 (12 units)	2,655 (8 units)	-	**6,760 (23 units)**

Summary of Kori #1 Shutdown Decision

□ Background

○ The KHNP had to decide if it would apply for the continued operation of Kori #1 by June 18, 2015, two years before the expiration of its operating permit, to the Nuclear Safety and Security Commission under the Nuclear Safety Act

○ There had been pros and cons of the continued operation at Kori #1. Nuclear energy experts were in favor of the continued operation for safety and economic aspects; on the other hand, the National Assembly, local governments, civic groups, and local residents insisted that the plant shut down permanently.

□ Considerations

○ **(Safety Assessment by KHNP)** All the requirements of the 158 items in the 24 disciplines were met, including reactor's pressurizer described in the Nuclear Safety Act, in June 2015

○ **(Economic Feasibility)** The Korea Energy Economics Institute estimated a profit of 179.2 - 268.8 billion won. By contrast, some people said that the economic benefit was hard to see considering uncertainty caused by local subsidies and shortened operational period following the delayed licensing.

○ **(Power Supply and Demand)** The permanent shutdown is not expected to significantly affect the power supply over the long term considering the power supply forecast by 2035 and the reserve rates to come in the 2nd MPNE

* The generation capacity of Kori #1 (about 590,000 kW) is expected to account for around 0.5% out of the estimated total power demand by 2035 (about 148 million kW)

○ **(Nuclear Decommissioning Industry)** Decommissioning typically takes more than 15 years. Considering this, it was the right time to determine when to decommission in preparation for the intensive period of decommissioning beyond the year 2030

□ **Process**

○ **(Hearing)** The Ministry of Trade, Industry and Energy held public hearings in a series to collect opinions about Kori #1's future: with Busan district representatives (June 9, 2015), with the Busan Mayor (June 9, 2015), with civic groups (June 2, 2015), and with the Busan municipal assembly (April 28, 2015)

○ **(Expert Discussion)** After two rounds of discussion with the Special Committee on Nuclear Safety (June 10 and June 12) and the National Energy Committee (June 12) on the considerations above, they decided to recommend the permanent shutdown of Kori #1

○ **(Decision by KHNP)** KHNP executives agreed to shut down Kori #1 permanently on June 16, 2015

□ **Plan**

○ Measures to promote the nuclear decommissioning industry will be put in place. To this end, close cooperation with the Ministries concerned will follow in an effort to develop decommissioning technology, streamline the related institutions, and promote the industry.

○ **(Long-operating Thermal Power Plants)** Some construction requirements will be relaxed to a degree to support the construction of plants replacing the long-operating thermal power plants aged over 40 years after construction for the sake of installed capacity and environmental aspects

* New plants need to improve environmentally with the equivalent generation capacity (including changes within 10%)

* The permit for the change is based on the Electricity Business Act without reflecting the change in the BPE

□ Generation capacity by policy: **23,415 MW**

○ **(Renewable Energy)** 11.7% of generation output and 20.1% of installed capacity by 2029

【 Generation Output and installed Capacity Share (Unit: GWh, MW, %) **】**

Classification	2015	2020	2025	2029
Generation	23,857 (4.5%)	50,655 (7.9%)	66,622 (9.7%)	83,090 (11.7%)
Installed Capacity	7,335 (7.5)	17,273 (12.9)	26,098 (17.3)	32,890 (20.1)

- An additional effective capacity of 4,477 MW will be reflected in the installed capacity plan based on the peak contribution as the generation capacity by renewable energy is not able to control load

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

Type	Hydro	Solar	Wind	Off-shore	Bio	Waste	Fuel Cell	Byproduct Gas	IGCC	Total
Nominal Capacity	57	14,774	7,460	770	56	16	1,190	1,427	900	26,649
Peak Contribution	28.0	13.0	2.2	1.1	23.3	10.2	70.1	68.6	60.0	-
Effective Capacity	16	1,921	164	8	13	2	834	979	540	4,477

○ **(RCS)** RCS will be reflected on the basis of the installed

capacity with operating licenses

- An additional effective capacity of 3,739 MW because these facilities are installed to supply heat and generate electricity as a byproduct

  * RCS projects are under way in 16 areas including Osan and Hwaseong (Dongtan)

○ **(Nuclear Power Plants)** The policy goal of 29% for nuclear power plant share by 2035 will be reflected under the 2nd MPNE

  * The scale of new nuclear power plants is to be determined within the scope of proper power supply mix in consideration of the reserve rate, economic feasibility, environmental aspects and accident risk cost

C. New Capacity Scale

□ The new capacity needed is 3,456 MW minus the finalized capacity of 133,097 MW out of the proper capacity of 136,553 MW

D. Generation Mix for New Capacity

◈ Generation mix is determined by using WASP, a plan-setting digital model, to reflect economic and social costs by generation type in line with the international standard

□ Premise for Generation Mix

○ **(Fuel Cost)** The actual fuel prices reflecting the recent trend applied

* (Nuclear and coal) Average of recent 14 months, (LNG) Price as of May 2015

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

* (Environmental Cost of Pollutants) Emission records of SOx, NOx, PM by generation types, and external costs by pollutant type calculated by the EU executive commission were reflected
* (Cost for Reducing Greenhouse Gas Emissions) 25,000 won / tCO2e according to IEA forecast

○ **(Transmission Cost)** The unit price set in the Regulation on Transmission & Distribution Facilities Utilization and other rules are applied

* Connection cost: The construction cost and the operating cost are applied by generation types based on the selected standard connection facility
* Use cost: The average of the local unit price in the transmission tariff table is applied along with the consideration of the regional capacity and generation type

○ **(Policy Cost)** Estimates of subsidies for areas near transmission lines and plants, post-accident cost, and accident risk cost of nuclear power plants are reflected

* Subsidies for areas near transmission lines and plants: calculated by the applicable act and the record of recent three years
* Post-accident cost of nuclear power plants: reflected in the operating cost
* Accident risk cost of nuclear power plants: calculated by the data including the precedent in Japan released by the verification committee

○ **(Construction Period)** The standard construction period is applied; 10 years for nuclear power plants, 7 - 8 years for coal-fired power plants and 6 years for combined cycle power plants

【 Standard Construction Period by Generator Type 】

Type		Permission after Submitting Action plan	Construction start to completion	Total
Nuclear	1,000 MW+	4 years	6 years	10 years
Coal	500 MW	3 years	4 years	7 years
	1,000 MW		5 years	8 years
Combined Cycle	500 MW+	3 years	3 years	6 years

□ Generation Mix Result

○ A total of 3,000 MW of nuclear power in 2028 and 2029 (1,500 MW respectively, 2 units)

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

Year	Peak Demand	Fixed	Proper Capacity Scale				
			Nuclear	Coal	LNG	Cumulative Capacity	Capacity Reserve Rate
2015	82,478	92,438				92,438	12.1%
2016	84,612	102,722				102,722	21.4%
2017	88,206	111,367				111,367	26.3%
2018	91,795	114,624				114,624	24.9%
2019	94,840	117,283				117,283	23.7%
2020	97,261	119,809				119,809	23.2%
2021	99,792	126,502				126,502	26.8%
2022	101,849	130,092				130,092	27.7%
2023	103,694	129,890				129,890	25.3%
2024	105,200	128,719				128,719	22.4%
2025	106,644	129,292				129,292	21.2%
2026	107,974	131,001				131,001	21.3%
2027	109,284	132,702				132,702	21.4%
2028	110,605	132,894	1,500			134,394	21.5%
2029	111,929	133,097	1,500			136,097	21.6%
New			3,000				
* New facilities: Proper capacity scale 3,000 MW (2 nuclear generators) * Renewable 4,477 MW, RCS 3,739 MW							

* 1. Peak demand, installed capacity and capacity reserve rate figures are for the year-end winter period
2. Renewable energy and RCS figures are based on peak contribution
3. The fixed capacities by year reflect the adjustments in the capacity and the period of construction to completion
4. The fixed capacity does not include the capacity of Kori #1 subject to permanent shutdown

4 New Intents for Construction by BPE

□ **(Facilities Surveyed)** Nuclear power generators, renewable energy generators, etc.

○ Intents for construction of thermal power plants were not surveyed because there was no need for new installations

* Before conducting the survey, a public hearing was held to allow some adjustments to GenCos' intents such as withdrawal of their plans or any other schedule changes in the ongoing projects

□ **(Survey Outline)** A public hearing was held to survey the intents for construction of the capacity by generator type and year defined in the 7th BPE (2015 - 2029)

□ **(Survey Result)** Intents for construction were surveyed for the planned generators and new generation capacity

○ Facilities under construction or in planning as per the 6th BPE: 43,487 MW (45 units)

- KHNP submitted its intent for construction of Cheonji (Youngdeok) #1,2 (2026 - 2027) in consideration of Shin Kori #7,8 that is already under construction

○ New intents for construction the 7th BPE: 3,000 MW (2 units)

* KHNP only submitted an intent for construction (3,000 MW, 2 units)

- For two new nuclear generators, KHNP submitted its intents for construction for Daejin (Samcheok) #1,2 or Cheonji (Youngdeok) #3,4

* The location of the nuclear power plants is going to be determined in the licensing phase of the construction project

【 Preparation Period by Generator Type 】

Classification	Nuclear & Hydro	Coal		Natural Gas	Renewable & Other
		Less than 500MW	More than 500MW		
Period	10 years	7 years	8 years	6 years	TBD (up to 10 years)

[Table 1] Aggregate of Planned & New Construction Intents

[Unit: MW]

Classification		Nuclear	Coal	LNG	Renewable &RCS	Total
Planned	Included	Shin Kori #3 ('16. 4) 1400 #4 ('17. 2) 1400 #5 ('21. 3) 1400 #6 ('22. 3) 1400 Cheonji' #1 ('26.12) 1500 #2 ('27.12) 1500 Shin Hanwool #1 ('17. 4) 1400 #2 ('18. 4) 1400 #3 ('22.12) 1400 #4 ('23.12) 1400 Shin Wolsong #2 ('15. 7) 1000	Dangjin #9 ('15.12) 1020 #10('16. 6) 1020 Samcheok Green #1 ('16. 6) 1022 #2 ('16.10) 1022 Bukpyeong #1 ('16. 2) 595 #2 ('16. 6) 595 Taean #9 ('16. 6) 1050 #10('16.12) 1050 Shin Boryeong #1 ('16. 6) 1000 #2 ('17. 6) 1000 Yeosu #1 ('16. 8) 350 Dangjin Echo #1 ('21.11) 580 #2 ('22.. 3) 580 Shin Seocheon #1 (19. 9) 1000 Goseong Hai #1 ('20.10) 1040 #2 ('21. 4) 1040 Gangneung Anin #1 ('19.12) 1040 #2 ('20. 6) 1040 Samcheok Thermal #1 ('21. 6) 1050 #2 ('21.12) 1050	POSCO C.C #9' ('15. 1) 376 Dongducheon C.C #1 ('15. 3) 858 #2 ('15. 1) 858 Seoul C.C #1 ('17.12) 400 #2 ('17.12) 400 Jangwoon C.C #1 ('17. 3) 900 #2 ('17. 7) 900 GS Dangjin C.C. #4 ('17. 7) 950 Youngnam C.C #1 ('17.10) 470 Daewoo Pocheon #1 ('17. 2) 960 Yeoju C.C #1 ('20. 6) 1000 Shin Pyeongtaek C.C #1 ('19.11) 951 Tongyoung C.C #1 ('18.12) 920 Jeju (new) #1 ('18. 6) 200	Renewable 26,649 RCS 4,276	Withdrawal -6,760
		15,200 (11 units)	**18,144 (20 units)**	**10,143 (14 units)**	**30,925**	**74,412 (67,652)**
	Not Included		Youngheung #7 ('23. 1) 870 #8 ('23. 6) 870 Dongbu Haslla #1 ('21. 6) 1000 #2 ('21.12) 1000			
			3,740 (4 units)			**3,740**
New		New nuclear power plant #1 ('28.12) 1500 #2 ('29.12) 1500				
		3,000 (2 units)				**3,000**
Total		**18,200 (13 units)**	**18,144 (20 units)**	**10,143 (14 units)**	**30,925**	**77,412 (70.652)**

* The figures in ( ) mean the capacity for withdrawal
* The intent for construction of Shin Kori #7,8, a fixed capacity, was submitted as one for Cheonji #1,2 by the GenCo
* The intent for construction of new nuclear power plant was submitted as one for Daejin #1,2 or Cheonji #3,4 by the GenCo (site conditions are to be determined at the licensing phase of the construction project)
* Gangneung Anin #1,2 and Samcheok Thermal #1 are expected to reflect in the December 2021 plan for calculating the reserve rate considering the time of construction of transmission lines

(Table 2) Submitted GenCos' Intents for Planned/New Construction by Year

[Unit: MW]

Year	Planned		New	Withdrawal	Renewable & RCS
	Included	Not Included		Included	
2015	Shin Wolsong #2 (July, 1000) Dangjin #9 (December, 1020) POSCO C.C #9 (January, 376) Dongducheon C.C #1 (March, 858) #2 (March, 858)			POSCO C.C #2 (January, -450) Seoul #4 (December,-138)	
2016	Shin Kori #3 (April, 1400) Dangjin #10 (June, 1020) Samcheok Green #1 (June, 1022) #2 (October, 1022) Bukpyeong #1 (February, 595) #2 (June, 595) Taean #9 (June, 1050) #10 (December, 1050) Shin Boryeong #1 (June, 1000) Yeosu #1 (August, 350)			Seoul #5 (December,-250)	
2017	Shin Kori #4 (February, 1400) Shin Hanwool #1 (April, 1400) Shin Boryeong #2 (June, 1000) Daewoo Pocheon #1 (February, 960) Jangmun C.C #1 (March, 900) #2 (July, 900) GS Dangjin C.C #4 (July, 950) Youngnam C.C #1 (October, 470) Seoul C.C #1 (December, 400) #2 (December, 400)			Kori #1 (June, -587) Pyeongtaek C.C (December,-480)	Renewable 26,649 RCS 4,276
2018	Shin Hanwool #2 (April, 1400) Tongyoung #1 (December, 920) Jeju (new) #1(June, 200)			Seocheon #1-#2 (September,-400) Jeju GT#3 (January,-55)	
2019	Shin Seocheon #1 (September, 1000) Gangneung Anin #1* (December, 1040) Shin Pyeongtaek #1 (November, 951)				
2020	Gangneung Anin #2* (June, 1040)				

	Goseong Hai #1 (October, 1040) Yeoju CC #1 (June, 1000)				
2021	Shin Kori #5 (March, 1400) Goseong Hai #2 (April, 1040) Samcheok Thermal #1 (June, 1050) #2 (December, 1050) Dangjin Echo #1 (November, 580)	Dongbu Haslla #1 (June, 1000) #2 (December, 1000)		Ulsan #4 - #6 (December,-1200)	
2022	Shin Kori #6 (March, 1400) Shin Hanwool #3 (December, 1400) Dangjin Echo #2 (March, 580)				
2023	Shin Hanwool #4 (December, 1400)	Youngheung #7 (January, 870) #8 (June, 870)		Seo-Incheon C.C #1~8 (December,-1800)	
2024				Pyeongtaek #1-#4 (December,-1400)	
2025					
2026	Cheonji #1 (December, 1500)				
2027	Cheonji #2 (December, 1500)				
2028			New nuclear power plant #1 (December, 1500)		
2029			New nuclear power plant #2 (December, 1500)		
Total	43,487 (45 units)	3,740 (4 units)	3,000 (2 units)	- 6,760 (23 units)	30,925

* The intent for construction of Shin Kori #7,8, a fixed capacity, was submitted as one for Cheonji #1,2 by the GenCo
* The intent for construction of new nuclear power plant was submitted as one for Daejin #1,2 or Cheonji #3,4 by the GenCo (site conditions are to be determined at the licensing phase of the construction project)
* Gangneung Anin #1,2 and Samcheok Thermal #1 are expected to reflect in the December 2021 plan for calculating the reserve rate considering the time of construction of transmission lines

5 Outlook of Investment in Generation Facilities

□ **(New Installations)** It is estimated to take a total of 7 trillion won constructing 2 units of nuclear power plants (3,000 MW) in this round of BPE

【 New Investment Outlook (Unit: hundred million won) **】**

Type	2015 - 2019	2020 - 2024	2025 - 2029	Total
Nuclear	-	2,633	68,377	71,010

* Fixed cost and the amounts of investment in renewable and RCS as of early 2014 excluded

□ **(Fixed Facilities Included)** It is estimated to take a total of 60 trillion won constructing the 47 new or fixed facilities (under construction) (nuclear: 13 units, coal: 20 units, and LNG: 14 units) totaling 46,487 MW

【 Aggregate Investment Outlook (Unit: hundred million won) **】**

Type	2015 - 2019	2020 - 2024	2025 - 2029	Total
Nuclear	122,871	112,867	107,617	343,354
Coal	146,976	33,478	0	180,453
LNG	74,817	1,292	0	76,109
Total	344,663	147,636	107,617	599,916

* Fixed cost and the amounts of investment in renewable and RCS as of early 2014 excluded

6 Final Generation Mix Outlook

A. Premises

□ Power Demand and Generation Capacity

○ Domestic demand and facilities excluding the self-generators and the CES demand & facilities

□ Outlook of Reserve Rates and Generation Mix

○ **(Reserve Rate)** The reference rate for peak demand in summer is the installed capacity for June and that of winter is the installed capacity for December

【 Calculation Standard 】

Classification	Standard
Summer Peak Demonstration	Installed capacity as of the end of June and peak demand as of summer (July - August)
Winter Peak Demonstration	Installed capacity as of the year end and peak demand as of winter (December - February)

○ **(Generation Mix)** The reference period is the installed capacity as of the year end (December)

○ **(Installed Capacity)** Nominal capacity serves as the reference in principle, but peak contribution is reflected for renewable energy and RCS

B. Supply Outlook

□ A stable power supply and demand is expected with the growing supply within the planned period

○ The capacity reserve rates by year are expected to remain at a proper level, but measures for checkup and response are to be

taken for possible changes of supply and demand conditions. To this end, the effects of power supply and demand should be assessed and follow-up measures for generation facilities need to be taken.

【 Power Supply Outlook by Year 】

(Unit: MW, %)

Year	Peak Demand (MW) Winter	Installed Capacity (MW)	Capacity Reserve (%)
2015	82,478	92,438	12.1%
2016	84,612	102,722	21.4%
2017	88,206	111,367	26.3%
2018	91,795	114,624	24.9%
2019	94,840	117,283	23.7%
2020	97,261	119,809	23.2%
2021	99,792	126,502	26.8%
2022	101,849	130,092	27.7%
2023	103,694	129,890	25.3%
2024	105,200	128,719	22.4%
2025	106,644	129,292	21.2%
2026	107,974	131,001	21.3%
2027	109,284	132,702	21.4%
2028	110,605	134,394	21.5%
2029	111,929	136,097	21.6%

* 1. Operation at Kori #1 is scheduled to stop from the year 2017
  2. Peak contribution is reflected for renewable energy and RCS

C. Generation Mix Outlook

□ **(By Nominal Capacity)** Bituminous coal (26.4%) followed by nuclear (23.4%), LNG (20.6%), and renewable (20.1%) by nominal capacity as of the final year 2029

□ **(By Peak Contribution)** Bituminous coal (31.8%) followed by nuclear (28.2%) and LNG (24.8%) by peak contribution as of the final year 2029

○ The shares of base load fuels such as nuclear and bituminous coal and distributed energy resources such as renewable energy are on the steady increase while the share of peak load fuels such as LNG have been on slight decrease

○ The generation facilities based on anthracite coal and oil are expected to be retired gradually

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

Type		Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped	Renewable	RCS	Total
2014 (Installed)	Nominal Capacity	20,716	25,149	1,125	26,742	3,850	4,700	6,241	4,693	93,216
		22.2	27.0	1.2	28.7	4.1	5.0	6.7	5.0	100
	Peak Contribution	20,716	25,149	1,125	26,742	3,740	4,700	1,846	4,137	88,155
		23.5	28.5	1.3	30.3	4.2	5.3	2.1	4.7	100
2018	Nominal Capacity	26,729	34,873	725	33,616	3,795	4,700	13,416	7,684	125,538
		21.3	27.8	0.6	26.8	3.0	3.7	10.7	6.1	100
	Peak Contribution	26,729	34,873	725	33,616	3,685	4,700	3,706	6,590	114,624
		23.3	30.4	0.6	29.3	3.2	4.1	3.2	5.7	100
2020	Nominal Capacity	26,729	36,913	725	35,567	3,795	4,700	17,273	8,479	134,181
		19.9	27.5	0.5	26.5	2.8	3.5	12.9	6.3	100
	Peak Contribution	26,729	36,913	725	35,567	3,685	4,700	4,105	7,385	119,809
		22.3	30.8	0.6	29.7	3.1	3.9	3.4	6.2	100
2025	Nominal Capacity	32,329	43,293	725	33,767	1,195	4,700	26,098	8,969	151,076
		21.4	28.7	0.5	22.4	0.8	3.1	17.3	5.9	100
	Peak Contribution	32,329	43,293	725	33,767	1,085	4,700	5,518	7,875	129,292
		25.0	33.5	0.6	26.1	0.8	3.6	4.3	6.1	100
2029	Nominal Capacity	38,329	43,293	725	33,767	1,195	4,700	32,890	8,969	163,868
		23.4	26.4	0.4	20.6	0.7	2.9	20.1	5.5	100
	Peak Contribution	38,329	43,293	725	33,767	1,085	4,700	6,323	7,875	136,097
		28.2	31.8	0.5	24.8	0.8	3.5	4.6	5.8	100
	6th (2027)	**27.4**	**34.1**	**0.6**	**24.3**	**0.9**	**3.6**	**4.5**	**4.6**	**100**

* 1. Based on the installed capacity as of the year end
2. For more details about this generation mix outlook, see "Generation Mix Outlook" in the Appendix

Ⅶ. DER Expansion Plan

1 Standard and Scope

□ Basic Directions

○ Lay out the applicable standard for distributed energy resources (DER) with details in order to clearly show the direction of minimizing the construction of large-size transmission lines on policy described in the 2nd Master Plan for National Energy (MPNE)

○ Build consistency between this DER expansion plan and other energy policies and find out policies needed to achieve the goal of the generation output by DER, which is 15% by 2035, under the MPNE

□ Standard for DER

○ **(Definition)** DER is defined as a) small-scale generation facilities, and b) proper generation facilities near the demand site to minimize the construction of transmission lines

* Internationally, IEA and CIGRE define DER similarly to this BPE: BPE is defined by a) location of generators, b) generator scale, c) type of connecting grid, and d) probability for the dispatch

○ **(Detailed Standards)** The limit for DER scale has been referenced from the Standard for the Plant Grid Connection under the Provision for Transmission Facilities Use

【 Detailed Standards for DER 】

Type	DER Standard			Reason for Standard Establishment	Transmission Lines
	Voltage	Lines	Marginal Capacity		
Small -scale	22.9 kV (distribution)	2	Less than 40 MW	Maximum applied within the connectable capacity with no construction of transmission lines	N/A
Near Demand Site	154 kV (transmission)	2	Less than 500 MW	Capacity limit set to 154 kV to minimize the construction of transmission lines	Minimized

* The demand site here means a) industrial complex, b) downtown available for heat energy supply, and c) other area available for self-generation

2 Goal and Outlook of Distribution of DER

◈ Goal of generation output by DER: **12.5% out of the total by 2029**

* The number is equivalent to 12.4%, the value for 2029 converted from the goal of 15% by 2029 under the 2nd MPNE

□ **(Renewable)** The 4th renewable energy penetration plan is reflected in terms of the target

⇨ The share of DER out of the total renewable energy facilities by 2029 will account for about 70%

□ **(RCS)** The 4th RCS energy plan is reflected in terms of the operating license status

⇨ The share of DER out of the total RCS energy facilities by 2029 will account for about 69%

【 Outlook of Mid-to-long-term DER Supply (generation output, GWh) 】

Type		2013 (done)	2015	2020	2025	2029
DER Output (GWh)	Renewable	4,428	14,820	24,423	33,296	39,748 (5.3%)
	RCS	16,871	19,816	29,325	29,426	29,426 (4.0%)
	Self-generation	20,021	21,732	22,792	23,431	23,941 (3.2%)
	Total	41,320	56,368	76,540	86,153	93,115
Share of DER		7.6%	10.1%	11.4%	12.0%	12.5%

* The numbers in the parenthesis mean the shares of each fuel type out of the total generation output
* Only the permitted projects in RCS are reflected, affecting the modest changes of output beyond 2021. The next BPE, however, is expected to add more projects.

3 DER Expansion Plan

□ **(More Market Incentives for Demand Sites)** Reflect the market price differences among the areas to encourage more sites for DER to be selected

○ Strictly apply the Transmission Loss Factor (TLF) so that higher market settlement can be paid for energy sources generated near demand sites*

* TLF is a number multiplied by a premise's metered energy to account for electricity losses between the generator and the nearest connected

transmission control point. The nearer the generator is, the TLF increases with lower loss.

○ Review ways to merit capacity payments (CP) for the DER generated in the near connected points including downtowns and industrial complexes

* Improve RCF for the payment of CP and find out ways to make use of transmission fees

□ **(Dissemination of DER by Fuel Type)** Support a wider use of renewable energy, more installations of self-generators and more competitiveness in Community Energy Service (CES) projects

○ Boost the dissemination of renewable energy through proactive private investment as well as government-led support and leading public-funded investment

- Explore new business models such as the solar PV rental projects. In the projects, private-sector providers are responsible for installing the facilities without any subsidies and post-purchase services while the consumers pay their rental fees.

- Renewable energy needs to be spread to areas in high demand and with possible positive effects such as remote areas without grid connection and agricultural or environmental infrastructure

* Build energy independence of remote areas that are dependent on diesel generators in low fuel efficiency

○ Review ways to increase the number of self-generators in the Seoul metropolitan area to boost their supply

* Public acceptance is one of the considerations in taking this approach

○ Power generation technology should be developed using super critical CO2 in far-sighted ways in order to support small-scale generation facilities and enhance efficiency

□ **(Greater Support for Small-scale Renewable Energy Providers)** Diversify supports for the renewable energy industry in laying its groundwork and relieving the burden of small-scale providers

○ Continue to increase the shares selected by the small-scale providers with less momentum for sale for their support

* Selection of the solar energy providers: This selection allows the generators and suppliers to make 12-year contracts with the fixed amounts in selling REC (Renewable Energy Certificate) to help small-scale solar energy providers secure economy in their investments

○ Review ways for more system interconnections by small-scale providers such as reducing system interconnection costs, leveling up the grid connection capacity at substations, and strengthening the facility reinforcements to help small-scale renewable energy providers relieve their burden

* Focus on low-voltage connections with relatively low interconnection cost (current less than 100 kW → less than 500 kW)

□ **(Mid-to-long Term Competitiveness of Renewable Energy Industry)** Secure competitiveness independently through brisk

R&D support and more global market activities

○ Lead practical, short-term R&D and develop convergence-based, future-oriented technology over the long term with focus on commercialization such as lower generation cost, more project initiatives, more demonstrations

○ It is not easy to obtain competitiveness only in the small Korean market. Brisk advancement into the global market will build a synergistic, virtuous cycle with the distribution in the Korean market.

* Customized approaches were taken for prospective countries. In 2015, a 10-billion won project was launched to fund the overseas projects.

Ⅷ. Transmission System Plan

◈ The facilities under the 6th long-term power grid master planning for transmission systems (August 2013) were reflected as fixed facilities and some modifications have been made in the circumstances

○ Major plans for 345kV or above transmission systems are reflected in this plan and the detailed plans for less than 154kV facilities shall be prepared by the providers for the review by the Electricity Regulatory Commission

* New generation facilities under this plan shall be reflected in the master planning for transmission systems at the time of getting the operating license issued for the finalized site

1 Directions and Challenges

1 Support a stable electric power supply by increasing the construction of transmission facilities

○ Lay out an optimal plan for installing the facilities needed for a stable supply of electric power

○ Improve the availability of the older facilities by application of new technology including the Flexible AC Transmission System (FACTS) and increase of line capacity to minimize the demand for new construction

2 Improve power system reliability

○ Enhance the system reliability by upgrading the performance and characteristics of transmission facilities including the improvement of system voltage level

○ Establish facilities available for a stable operation of electric power system based on the strengthened reliability standards (December 2012)

* 765kV two line failure-contingencies and the application of the expansion standards

3 Promote public acceptance of transmission lines

○ Promote public acceptance by implementing the reasonable compensation and support for the areas adjacent to transmission lines

* Implementation of property compensation, housing purchase, projects for areas near transmission lines (for about 500,000 households) in accordance with the Act on support and compensation for areas near transmission lines

○ Increase transparency in selecting sites by establishing site selection committees involving residents

* The test-run project of "third-party-led site selection committee" has been ongoing since October 2014 for the 154kV transmission line in Namcheongwon

○ Review increasing the supply of high-voltage direct current (HVDC) systems for the bulk, long-distance transmission and in favor of public acceptance

* Develop technology for commercialization of the voltage-source HVDC systems

○ Look for ways to promote public acceptance through undergrounding (installing underground lines) in the highly populated areas

○ Review ways for proactive management of transmission line construction issues prone to conflicts by forming a conflict resolution committee made up of experts

4 Take into account system constraints in the construction of power plants

○ Review the construction plan and the transmission plan comprehensively at the phase of project permit and then finalize the plant construction plan

* GenCo's intent for construction has not been valid since the 7th BPE. Project owners are now selected at the phase of project permit.

○ Recommend power plants to be built in the areas where construction of transmission lines can be reduced to a minimum by providing the data on transmission lines before calculating new installation of thermal power plants

2 Criteria for Transmission Expansion Planning

A. Reliability Limit in Contingencies

☐ Acceptable Fault Range

Voltage	Fault	Issues		Interconn-ection System	Load Supply Systems	Main Systems
154kV	Single	Extent of Failure	· Overload · Load drop · Generator drop out	Allowed Not allowed Not allowed	Allowed Not allowed Not allowed	Allowed Not allowed Not allowed
		Actions	· Adjustment of generation power · Load shifting	Allowed N/A	Allowed Allowed	Allowed Allowed
	Double	Scope	· Overload · Load drop · Generator drop out	Allowed Not allowed Allowed	Allowed Allowed* Allowed	Allowed Allowed* Not allowed
		Actions	· Adjustment of generation power · Load shifting	Allowed N/A	N/A Allowed	Allowed Allowed
345kV	Single	Scope	· Overload · Load drop · Generator drop out	Not allowed Not allowed Not allowed	Allowed Not allowed Not allowed	Allowed Not allowed Not allowed
		Actions	· Adjustment of generation power · Load shifting	Not allowed N/A	Allowed Allowed	Allowed Allowed
	Double	Scope	· Overload · Load drop · Generator drop out	Allowed Not allowed Allowed	Allowed Allowed* Allowed	Allowed Not allowed Not allowed
		Actions	· Adjustment of generation power · Load shifting	Allowed N/A	N/A Allowed	Allowed N/A
765kV	Single	Scope	· Overload · Load drop · Generator drop out	Not allowed Not allowed Not allowed	N/A	Allowed Not allowed Not allowed
		Actions	· Adjustment of generation power · Load shifting	Not allowed N/A	N/A	Allowed N/A
	Double	Scope	· Overload · Load drop · Generator drop out	Allowed Not allowed** Allowed	N/A	Allowed Not allowed** Allowed
		Actions	· Adjustment of generation power · Load shifting	Allowed N/A	N/A	Allowed N/A

□ Transformer Bank Fault Range

Type	154kV	345kV	765kV
· Overload · Load drop · Generator drop out	Not allowed*** Allowed* N/A	Not allowed Not allowed Not allowed	Not allowed Not allowed Not allowed
· Adjustment of generation power · Load shifting	N/A Allowed	Not allowed N/A	Not allowed N/A

※ Allowed overload in transmission lines is defined as a condition wherein the power supply can be restored in a short period at the nominal capacity of 120% or below

* Conditions 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

** Conditions wherein load drop is unavoidable to avoid any large-scale interruptions in supply affected by failures

*** Overload is allowed in the scope where load shifting is available in distribution lines

B. Criteria for the Power Plant Interconnection

□ Interconnection Principles

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

○ Small-scale renewable energy sources require a reasonable interconnection plan with the minimum total project costs. Lines for public use may have to be reinforced.

□ Criteria for Power Plant Interconnection Configuration

○ (Below 1,000 ㎿) 345㎸ or 154㎸ AC

○ (Over 1,000 ㎿) Over 345㎸ AC or the equivalent capacity of HVDC

○ (Power Plant) 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 requests

○ (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 and Expansion of a Transmission System

□ Criteria for the Construction of a Transmission System

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

- System shall be reinforced to prevent any large-scale power supply problem or extended failure spread due to a two-line failure at the same time

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

- Construction conditions and public acceptance shall be considered for the construction of overhead lines or underground lines, and the supporting structure shall be selected in consideration of the long-term change of the power system

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

○ **(Reinforcing 154 kV Transmission)** 154 kV 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 800 MW load supply) by itself for each 345 kV unit and consider the construction of overhead lines and underground lines at the same time
- 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, 345 kV substation network should be configured with the line size of 410 ㎟ × 2B (over 2000 ㎟ for underground), considering the power flow and the increasing load in the substation
- Underground lines should be configured to the largest scale, taking the increasing load demand into account, and regional networks close to downtown areas should be configured by installing power tunnels depending on 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

○ **(Reinforcing HVDC Transmission)** HVDC shall be installed when direct current transmission is appropriate because of technical problems in alternating current transmission

- In principle, HVDC transmission line shall accommodate bipole installations. If needed, it can be monopole or 2 bipole.

□ Criteria for Constructing and Expanding a Substation

○ **(765kV Substations)** In principle, the final size of extra high voltage transformers is five banks, while the number of initial banks is decided by considering load supply and economic efficiency

- 765 kV substations shall be installed in cases where the transmission requirement more than 345 kV or a large-scale interchange of electricity is in demand

- 765 kV substations shall be installed in cases where performance improvement such as transient instability solution is needed

- Transformers shall be added in case one bank fails and the other bank exceeds the normal supply capacity (100%)

○ **(345kV Substations)** In principle, the final size of 345 kV transformers is four banks, while the number of initial banks is decided by considering load supply and economic efficiency

- 345 kV substations shall be installed in the areas where more 3-bank substations need to be installed

  * For areas in slow demand over the long term, the 345 kV substations shall be installed if there are overloads in the remaining transformers in case of contingency in the final size

- 345 kV substations shall be installed when a large increase in demand is expected, but the expansion of existing substations is not expected to accommodate it

- 345 kV substations shall be installed when needed to reduce the generation cost of the 154 kV grid generators

- 345 kV substations shall be installed in cases where performance improvement such as transient instability solution is needed

- 345 kV shall be installed in case it is more advantageous than 154 kV

- Transformers shall be added in case one bank fails and the other bank exceeds the normal supply capacity (100%)

○ **(154kV Substations)** In principle, the size is four banks, while the number of initial banks is two, in consideration of future expansion and no more installations exceeding final size

- 154 kV substations shall be installed in consideration of the possibility of the large-scale load increase

- 154 kV substations shall be installed in case where a 22.9 kV distribution system deterioration is expected

- Substations shall be installed in cases where there is an overload in the transformer in case of contingency in the existing substation (one bank fewer than the final size) in consideration of the future uncertainty and load conditions

  * Note that decisions shall be made in consideration of load shifting conditions from one distribution line to the other where load shifting is available

- 154 kV transformers shall be added in case one bank fails and the other bank exceeds the normal supply capacity (100%)

  * Decisions shall be made in consideration of the capacity of load shifting from one distribution line to the other where load shifting is available

3 Transmission System Plan Actions

A. Power System Interconnection

Plant (Operator)	Installed Capacity (MW)	Location	Completion Year	System Interconnection
Shin Wolsong #2 (KHNP)	1,000	Gyeongbuk Gyeongju	2015	Installed line
Shin Kori #3 - #6 (KHNP)	1,400 × 4	Ulsan	2016, 2017 2021, 2022	Installed line
Taean IGCC (KOWEPO)	380	Chungnam Taean	2015	Installed line
Dangjin #9, 10 (EWP)	1,020 × 2	Chungnam Dangjin	2015, 2016	Installed line & Dangjin T/P - Bukdangjin
Samcheok Green Power #1, #2 (KOSPO)	1,022 × 2	Gangwon Samcheok	2016	Uljin N/P - Donghae 154kV Uljin - Taebaek
Bukpyeong Thermal #1, 2 (GS Donghae Electric Power, Co, Ltd.)	595 × 2	Gangwon Donghae	2016	Bukpyeong T/P - Donghae
Yeosu Thermal #1 (KOEN)	350	Jeonnam Yeosu	2016	Installed line
Seoul CC #1, 2 (KOMIPO)	400 × 2	Seoul	2017	Installed line
Taean #9, 10 (KOWEPO)	1,050 × 2	Chungnam Taean	2016	Installed line
Shin Boryeong #1, 2 (KOMIPO)	1,000 × 2	Chungnam Boryeong	2016, 2017	Installed line
GS Dangjin CC #4 (GS EPS)	950	Chungnam Dangjin	2017	Installed line
Jangmun CC #1, 2 (PMP)	900 × 2	Gyeonggi Paju	2017	Jangmun C/C - Shindeokeun
Daewoo Pocheon #1 (Daewoo E&C)	960	Gyronggi Pocheon	2017	Shingapyeong - Shinpocheon

Plant (Operator)	Installed Capacity (MW)	Location	Completion Year	System Interconnection
Youngnam CC (KOSPO)	470	Ulsan	2017	Installed line
Shin Hanwool #1 - #4 (KHNP)	1,400 × 4	Gyeongbuk Uljin	2017, 2018 2022, 2023	Installed line & 765kV Shin Hanwool - Shingyeonggi
Tongyoung CC #1 (Tongyoung Eco Power)	920	Gyeongnam Tongyoung	2018	154kV switching station & three lines
Jeju CC (KOMIPO)	200	Jeju Samyang	2018	Installed line
Shin Pyeongtaek CC #1 (신평택발전)	951	Gyeonggi Pyeongtaek	2019	Pyeongtaek T/P - Hwaseong
Yeoju CC #1 (SK E&S)	1,000	Gyeonggi Yeoju	2020	Yeoju C/C - Gonjiam
Shin Seocheon Thermal (KOMIPO)	1,000	Chungnam Seocheon	2019	Installed line
Goseong Hai Thermal #1, 2 (Goseong Green Power)	1,040 × 2	Gyeongnam Goseong	2020, 2021	Goseong Hai T/P - Euiryeong Goseong Hi T/P - Samcheonpo T/P
Gangneung Anin Thermal #1, 2 (Gangneung Eco Power)	1,040 × 2	Gangwon Gangneung	2019, 2020	Gangneung Anin T/P - Gangwon Donghae - Yangyang pumped-storage (Shinyangyang)
Samcheok Thermal #1, 2 (POSPower Co., Ltd.)	1,050 × 2	Gangwon Samcheok	2021	Samcheok T/P - Shintaebaek
Dangjin Eco Power #1, 2 (Dangjin Eco Power)	580 × 2	Chungnam Dangjin	2021, 2022	Installed line Dangjin T/P - Bukdangjin

* The plan on how to interconnect transmission lines of new facilities will be laid out at the phase of project permit

B. Transmission System Plan

Type	Voltage (kV)	Transmission System Plan	Project Year
Distri-bution	765	Shin Hanwool - Gangwon	December 2021
	765	Gangwon - Shingyeonggi	December 2021
	500	Bukdangjin - Godeok C/S (phases 1, 2)	June 2018, June 2021
	500	Saemangeum offshore wind farm HVDC	December 2023
	345	Sejong	April 2016
	345	Shinbupyeong 2 - Youngseo	April 2016
	345	Saemangeum - Gunsan	October 2016
	345	Yeoju C/C - Gonjiam	March 2017
	345	Bukdangjin - Shintangjeong	June 2017
	345	Gangneung T/P7 - Gangneung T/P3	October 2017
	345	Danghae - Shinyangyang	October 2017
	345	Pyeongtaek T/P - Hwaseong	November 2017
	345	Dongducheon C/C - Yangju	April 2019
	345	Samcheok Thermal T/P - Shintaebaek	August 2019
	345	Gwangyang C/C - Shinyeosu	October 2020
	345	Seogwangju	April 2021
	345	Dangjin T/P - Bukdangjin	June 2021
	345	Godeok - Seoanseong	June 2021
	345	Shingyeonggi - Gyeonggi	December 2021
	345	Shingyeonggi - Gonjiam	December 2021
	345	Goseong T/P - Euiryeong	April 2022
Transf-ormat-ion (switch-ing)	765	Shinjungbu	June 2017
	765	Gangneung T/P7	October 2017
	765	Shingyeonggi	December 2021
	500	Godeok	June 2018
	345	Sejong	April 2016
	345	Changwon	November 2016
	345	Shinsihwa	April 2020
	345	Seogwangju	April 2021

※ Construction projects of transmission lines (above 345 kV, longer than 10 km) and new substations

4 Details of Establishing BPE

□ The long-term transmission expansion plan should follow this base plan criteria, and then finalized by the deliberation of the Electricity Regulatory Commission

○ The future long-term transmission expansion plan is a part of this plan, and the transmission owners shall expand their transmission system as directed in this plan

□ The finalized transmission system plan can be modified or added to by transmission owners only in 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

IX. Follow-up Plan Directions

A. Action Management Plan

□ **(Reinforce Licensing Procedure)** Reinforce the licensing requir ements in the detailed standard (public announcement) for generation projects and level up the actions for generation projects

○ **(Relate the BPEs to Operating Licenses)** Issue licenses to GenCos who submitted their intent for construction in establishing the BPE

* Even GenCos who did not submit their intent for construction may exceptionally apply for facilities on some special purposes such as emergencies, renewable energy, replacement for aging, and demonstration

- Note that IGCC and fuel cell facilities over 40 MW that exceed the targets of this plan may move forward after this BPE is finalized including the evaluation compared with coal and LNG CC

○ **(Establish Licensing Standard)** Establish project licensing standard, detailed criteria and grading standard to level up the actions for generation projects

* Without GenCos' intent for construction, GenCos are selected at the phase of project permit

B. Facility Construction Management Reinforcement

□ **(Systematic Management of Construction Process)** Conduct construction status check regularly and implement a digital system for management of electric facility construction status

○ Induce on-time construction completion by checking the processes of construction every quarter and minimize risks by canceling delayed construction projects

【 Project Preparation Period by Fuel Type & Detailed Permit Standard (Announcement) 】

Classification	Nuclear Hydro	Coal		Natural Gas	Renewable & Other
		Below 500,000 kW	Over 500,000 kW		
Permit - Approval for Plan (Launch of Construction)	4 yrs	3 yrs	3 yrs	3 yrs	TBD up to 10 yrs
Preparation Period	10 yrs	7 yrs	8 yrs	6 yrs	

C. Transmission System Plan and Policy Reform

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

□ **(Strengthen Compensation and Support for Areas near Transmission Facilities)** Conduct a project for reasonable compensation of property and housing purchase as well as support for the areas adjacent to transmission lines in accordance with the applicable act*

* 「Act on support and compensation for areas near transmission lines」

D. Demand Side Management Reinforcement

□ **(Establish Comprehensive DSM Measures)** Establish and implement demand side management measures to meet the DSM targets

○ Carry out energy use rationalization, develop technology for a

variety of demand response resources such as BEMS, FEMS and ESS, and promote the use of LED and other devices with high energy efficiency

○ Revitalize DSM by incorporating the earlier demand side management systems such as weekly heads-up and designated period system into the demand response market (negawatt market)

○ Secure finances for DSM such as the Electric Power Industry Basis Fund and step up the checkup of annual performances

E. Greenhouse Gas Emissions Reduction Plan Follow-up

□ **(Reduce Greenhouse Gas Emissions)** This plan will help reduce greenhouse gas emissions as much as possible by promoting the use of low-carbon fuel types such as renewable energy and nuclear power and replacing the aged, long-operating facilities with environmentally-friendly facilities

□ **(Fulfill Status Check)** In the licensing process for plant construction, the plan for reducing greenhouse gas emissions is evaluated and check up the implementation of the plan regularly

Appendix

1 Details of Establishing BPE

□ Working subcommittees were formed under the basic directions of BPE (April 1, 2014)

* The Electricity Policy Review Board meeting was held with the agenda of the 7th BPE directions, procedure, and major revisions

○ The Electricity Supply-Demand Committee and two working subcommittees were operated (April 2014 - May 2015)

* Meetings held: Electricity Supply-Demand Committee (2 times), Demand planning (6 times), Capacity planning (5 times)

□ Demand outlook and capacity plan were prepared (June 2014 - May 2015)

○ Reference demand forecast, DSM plans and target demand were reviewed

○ Proper capacity scale and generation mix were laid out

□ Electricity Supply-Demand Committee meeting was held to finalize the 7th BPE (draft) (May 2015)

○ The 7th BPE draft was reported to the Committee regarding power demand and the facility plan

□ A seminar was held for GenCos (June 2015)

○ Improvements in the BPE and new installations in demand were on the agenda

○ Ways for preliminary survey and public hearing were

announced in the seminar

□ Consultation among the Ministries and report to the National Assembly Standing Committee were carried out regarding the BPE (May - July 2015)

□ Public hearing was held on the 7th BPE (draft) (June 2015)

□ Electricity Policy Review Board meeting was held to finalize the 7th BPE (draft) (July 2015)

□ The 7th BPE was announced to the public and notified to the Ministries concerned (July 2015)

2 Electricity Demand Outlook

A. Reference Demand

□ Nationwide

Year	Consumption		Peak Demand			
	GWh	Increase (%)	Summer (MW)	Increase (%)	Winter (MW)	Increase (%)
2014 (Actual)	477,592	0.6	76,054	2.8	80,613	**4.3**
2015	498,000	4.3	80,671	6.1	83,250	3.3
2016	520,900	4.6	84,985	5.3	85,959	3.3
2017	546,810	5.0	89,352	5.1	90,214	5.0
2018	573,240	4.8	93,764	4.9	94,554	4.8
2019	596,950	4.1	97,731	4.2	98,446	4.1
2020	617,769	3.5	101,223	3.6	101,863	3.5
2021	637,040	3.1	104,865	3.6	105,452	3.5
2022	654,998	2.8	108,073	3.1	108,633	3.0
2023	671,936	2.6	111,108	2.8	111,658	2.8
2024	688,429	2.5	113,837	2.5	114,386	2.4
2025	704,934	2.4	116,547	2.4	117,115	2.4
2026	720,633	2.2	119,114	2.2	119,711	2.2
2027	735,990	2.1	121,605	2.1	122,250	2.1
2028	751,135	2.1	124,017	2.0	124,754	2.0
2029	766,109	2.0	126,338	1.9	127,229	2.0
'15 - '29		3.1		3.3		3.1

* Peak demand basis: (Summer) July - August, (Winter) December - February of the next year

□ Maximum & Minimum Expectation of Peak Demand

Year	Maximum				Minimum			
	Summer (MW)	Increase (%)	Winter (MW)	Increase (%)	Summer (MW)	Increase (%)	Winter (MW)	Increase (%)
2014 (Actual)	76,054	2.8	80,613	4.3	76,054	2.8	80,613	4.3
2015	80,721	6.1	83,321	3.4	80,622	6.0	83,179	3.2
2016	85,082	5.4	86,063	3.3	84,889	5.3	85,854	3.2
2017	89,557	5.3	90,435	5.1	89,185	5.1	90,035	4.9
2018	94,077	5.0	94,892	4.9	93,508	4.8	94,277	4.7
2019	98,117	4.3	98,863	4.2	97,352	4.1	98,039	4.0
2020	101,733	3.7	102,410	3.6	100,779	3.5	101,385	3.4
2021	105,469	3.7	106,100	3.6	104,275	3.5	104,818	3.4
2022	108,819	3.2	109,435	3.1	107,416	3.0	107,929	3.0
2023	111,996	2.9	112,612	2.9	110,339	2.7	110,833	2.7
2024	114,867	2.6	115,491	2.6	112,953	2.4	113,437	2.3
2025	117,721	2.5	118,375	2.5	115,549	2.3	116,045	2.3
2026	120,394	2.3	121,085	2.3	118,005	2.1	118,522	2.1
2027	123,067	2.2	123,821	2.3	120,367	2.0	120,922	2.0
2028	125,678	2.1	126,538	2.2	122,644	1.9	123,278	1.9
2029	128,167	2.0	129,197	2.1	124,812	1.8	125,589	1.9
‘15 – ‘29		3.4		3.2		3.2		3.0

□ Seoul Metropolitan Area

Year	Consumption		Peak Demand	
	GWh	Increase (%)	MW	Increase (%)
2014 (Actual)	169,776	-1.0	29,843	0.2
2015	175,948	3.6	31,898	6.9
2016	182,899	4.0	32,937	3.3
2017	190,793	4.3	34,096	3.5
2018	198,759	4.2	35,262	3.4
2019	205,696	3.5	36,295	2.9
2020	211,565	2.9	37,192	2.5
2021	216,835	2.5	38,015	2.2
2022	221,594	2.2	38,776	2.0
2023	225,950	2.0	39,487	1.8
2024	230,098	1.8	40,175	1.7
2025	234,190	1.8	40,859	1.7
2026	237,962	1.6	41,505	1.6
2027	241,569	1.5	42,134	1.5
2028	245,054	1.4	42,750	1.5
2029	248,434	1.4	43,355	1.4
‘15 - ‘29		2.5		2.2

□ Jeju Island Area

Year	Consumption		Peak Demand	
	GWh	Increase (%)	MW	Increase (%)
2014 (Actual)	4,220	3.0	762	6.6
2015	4,485	6.3	766	0.5
2016	4,596	2.5	790	3.1
2017	4,786	4.1	814	3.0
2018	5,029	5.1	838	2.9
2019	5,262	4.6	865	3.2
2020	5,477	4.1	893	3.2
2021	5,682	3.7	919	2.9
2022	5,883	3.5	947	3.0
2023	6,078	3.3	974	2.9
2024	6,271	3.2	1,000	2.7
2025	6,467	3.1	1,027	2.7
2026	6,659	3.0	1,054	2.6
2027	6,850	2.9	1,080	2.5
2028	7,042	2.8	1,106	2.4
2029	7,234	2.7	1,132	2.4
‘15 - ‘29		3.5		2.8

B. Target Demand

□ Nationwide

Year	Consumption		Peak Demand			
	GWh	Increase (%)	Summer (MW)	Increase (%)	Winter (MW)	Increase (%)
2014 (Actual)	477,592	0.6	76,054	2.8	80,154	3.7
2015	489,595	2.5	79,923	5.1	82,478	2.9
2016	509,754	4.1	83,653	4.7	84,612	2.6
2017	532,622	4.5	87,363	4.4	88,206	4.2
2018	555,280	4.3	91,028	4.2	91,795	4.1
2019	574,506	3.5	94,151	3.4	94,840	3.3
2020	588,352	2.4	96,650	2.7	97,261	2.6
2021	600,063	2.0	99,237	2.7	99,792	2.6
2022	609,822	1.6	101,324	2.1	101,849	2.1
2023	617,956	1.3	103,183	1.8	103,694	1.8
2024	625,095	1.2	104,695	1.5	105,200	1.5
2025	631,653	1.0	106,127	1.4	106,644	1.4
2026	637,953	1.0	107,436	1.2	107,974	1.2
2027	644,021	1.0	108,707	1.2	109,284	1.2
2028	650,159	1.0	109,952	1.1	110,605	1.2
2029	656,883	1.0	111,145	1.1	111,929	1.2
'15 - '29		2.1		2.4		2.2

* Peak demand basis: (Summer) July - August (Winter) December - February of the next year

□ Seoul Metropolitan Area

Year	Consumption		Peak Demand	
	GWh	Increase (%)	MW	Increase (%)
2014 (Actual)	169,776	-1.0	29,843	0.2
2015	172,978	1.9	31,602	5.9
2016	178,985	3.5	32,421	2.6
2017	185,843	3.8	33,337	2.8
2018	192,532	3.6	34,233	2.7
2019	197,962	2.8	34,966	2.1
2020	201,491	1.8	35,512	1.6
2021	204,249	1.4	35,975	1.3
2022	206,310	1.0	36,354	1.1
2023	207,798	0.7	36,671	0.9
2024	208,929	0.5	36,949	0.8
2025	209,845	0.4	37,206	0.7
2026	210,660	0.4	37,436	0.6
2027	211,383	0.3	37,665	0.6
2028	212,111	0.3	37,902	0.6
2029	213,014	0.4	38,141	0.6
‘15 - ‘29		1.5		1.4

□ Jeju Island Area

Year	Consumption		Peak Demand	
	GWh	Increase (%)	MW	Increase (%)
2014 (Actual)	4,220	3.0	762	6.6
2015	4,409	4.5	759	-0.4
2016	4,498	2.0	778	2.5
2017	4,662	3.6	796	2.3
2018	4,871	4.5	814	2.2
2019	5,064	4.0	833	2.4
2020	5,216	3.0	853	2.3
2021	5,352	2.6	870	2.0
2022	5,477	2.3	888	2.1
2023	5,590	2.1	905	1.9
2024	5,694	1.9	920	1.7
2025	5,795	1.8	935	1.7
2026	5,895	1.7	951	1.7
2027	5,994	1.7	965	1.6
2028	6,095	1.7	981	1.6
2029	6,203	1.8	996	1.6
‘15 - ‘29		2.5		2.0

3 Demand Side Management Targets

A. Peak Demand Reduction Plan

(Unit: MW)

Year	Efficiency Enhancement		Smart Grid & DSM Pricing	Load Management & Policy Will	Total
	Appliance Adoption	Efficiency Management			
2015	249	22	298	203	**772**
2016	504	69	336	438	**1,347**
2017	764	122	450	672	**2,008**
2018	1,028	178	590	963	**2,759**
2019	1,289	239	765	1,313	**3,606**
2020	1,599	302	979	1,722	**4,602**
2021	1,906	368	1,243	2,143	**5,660**
2022	2,207	437	1,560	2,580	**6,784**
2023	2,500	508	1,926	3,030	**7,964**
2024	2,783	581	2,334	3,488	**9,186**
2025	3,103	658	2,761	3,949	**10,471**
2026	3,412	737	3,170	4,418	**11,737**
2027	3,706	811	3,548	4,901	**12,966**
2028	3,984	891	3,880	5,394	**14,149**
2029	4,246	1,011	4,144	5,899	**15,300**

B. Electricity Consumption Reduction Plan

(Unit: GWh)

Year	Efficiency Enhancement		Smart Grid & DSM Pricing	Policy Will	Total
	Appliance Adoption	Efficiency Management			
2015	1,012	498	6,397	498	**8,405**
2016	2,012	1,250	6,842	1,042	**11,146**
2017	3,101	2,023	7,424	1,640	**14,188**
2018	4,288	2,923	8,169	2,580	**17,960**
2019	5,575	3,880	9,109	3,880	**22,444**
2020	7,159	4,819	11,880	5,559	**29,417**
2021	8,801	5,797	15,053	7,326	**36,977**
2022	10,478	6,812	18,716	9,170	**45,176**
2023	12,135	7,862	22,896	11,087	**53,980**
2024	13,724	8,950	27,580	13,080	**63,334**
2025	15,405	10,080	32,711	15,085	**73,281**
2026	16,955	11,242	37,332	17,151	**82,680**
2027	18,390	12,438	41,858	19,283	**91,969**
2028	19,709	13,671	46,114	21,482	**100,976**
2029	20,925	14,939	49,613	23,749	**109,226**

4 Renewable Capacity Plan

□ Overall Renewable Capacity Expansion Plan (2015 - 2029)

(Unit: MW)

Year	Hydro	Wind	Off-shore	Solar	Bio	Waste	Byproduct Gas	Fuel Cell	IGCC	Total
Dec 2014 Existing	1,767 (495)	604 (13)	255 (3)	1,791 (233)	137 (32)	152 (16)	1,373 (942)	161 (113)	0 (0)	6,241 (1,846)
Dec 2015	1,767 (495)	732 (16)	260 (3)	2,354 (306)	173 (40)	155 (16)	1,373 (942)	241 (169)	300 (180)	7,335 (2,167)
Dec 2016	1,767 (495)	1,204 (26)	260 (3)	3,403 (442)	177 (41)	155 (16)	1,373 (942)	321 (225)	300 (180)	8,960 (2,371)
Dec 2017	1,767 (495)	1,785 (39)	275 (3)	4,218 (548)	179 (42)	155 (16)	1,373 (942)	410 (287)	300 (180)	10,462 (2,552)
Dec 2018	1,767 (495)	2,375 (52)	275 (3)	5,084 (661)	179 (42)	155 (16)	2,800 (1,921)	481 (337)	300 (180)	13,416 (3,706)
Dec 2019	1,769 (495)	2,955 (65)	315 (3)	6,004 (781)	193 (45)	155 (16)	2,800 (1,921)	561 (393)	300 (180)	15,052 (3,899)
Dec 2020	1,779 (498)	3,588 (79)	835 (9)	6,982 (908)	193 (45)	155 (16)	2,800 (1,921)	641 (449)	300 (180)	17,273 (4,105)
Dec 2021	1,784 (500)	4,114 (91)	835 (9)	8,018 (1,042)	193 (45)	155 (16)	2,800 (1,921)	721 (505)	300 (180)	18,920 (4,309)
Dec 2022	1,789 (501)	4,534 (100)	835 (9)	9,103 (1,183)	193 (45)	168 (17)	2,800 (1,921)	801 (562)	300 (180)	20,523 (4,518)
Dec 2023	1,794 (502)	4,967 (109)	835 (9)	10,223 (1,329)	193 (45)	168 (17)	2,800 (1,921)	861 (618)	300 (180)	22,141 (4,716)
Dec 2024	1,799 (504)	5,414 (119)	835 (9)	11,355 (1,476)	193 (45)	168 (17)	2,800 (1,921)	961 (674)	300 (180)	23,825 (4,945)
Dec 2025	1,804 (505)	5,884 (129)	835 (9)	12,473 (1,621)	193 (45)	168 (17)	2,800 (1,921)	1,041 (730)	900 (540)	26,098 (5,518)
Dec 2026	1,809 (507)	6,380 (140)	925 (10)	13,549 (1,761)	193 (45)	168 (17)	2,800 (1,921)	1,121 (786)	900 (540)	27,845 (5,727)
Dec 2027	1,814 (508)	6,905 (152)	925 (10)	14,563 (1,893)	193 (45)	168 (17)	2,800 (1,921)	1,201 (842)	900 (540)	29,469 (5,928)
Dec 2028	1,819 (509)	7,464 (164)	925 (10)	15,505 (2,016)	193 (45)	168 (17)	2,800 (1,921)	1,281 (898)	900 (540)	31,055 (6,120)
Dec 2029	1,824 (511)	8,064 (177)	1,025 (11)	16,565 (2,153)	193 (45)	168 (17)	2,800 (1,921)	1,351 (946)	900 (540)	32,890 (6,323)

* The values in ( ) indicate effective capacity

□ Renewable Generation Outlook (2015 - 2029)

(Unit: GWh)

Year	Hydro	Wind	Off-shore	Solar	Bio	Waste	Byproduct Gas	Fuel Cell	IGCC	Total
2015	6,749	1,434	480	2,741	680	303	10,235	1,234	0	23,857 (4.5%)
2016	6,749	2,078	485	3,808	768	306	10,235	1,726	2,102	28,256 (5.1%)
2017	6,749	3,207	499	5,040	781	306	10,235	2,244	2,102	31,164 (5.4%)
2018	6,749	4,464	513	6,152	786	306	15,554	2,736	2,102	39,361 (6.6%)
2019	6,753	5,097	550	7,333	816	306	20,873	3,199	2,102	47,030 (7.6%)
2020	6,776	6,399	1,073	8,589	847	306	20,873	3,691	2,102	50,655 (7.9%)
2021	6,804	8,265	1,558	9,921	847	306	20,873	4,182	2,102	54,858 (8.5%)
2022	6,823	9,280	1,558	11,323	847	318	20,873	4,673	2,102	57,799 (8.8%)
2023	6,842	10,196	1,558	12,782	847	331	20,873	5,103	2,102	60,634 (9.1%)
2024	6,861	11,140	1,558	14,271	847	331	20,873	5,594	2,102	63,579 (9.4%)
2025	6,881	12,124	1,558	15,759	847	331	20,873	6,147	2,102	66,622 (9.7%)
2026	6,900	13,160	1,642	17,210	847	331	20,873	6,638	6,307	73,909 (10.7%)
2027	6,919	14,256	1,726	18,593	847	331	20,873	7,129	6,307	76,982 (11.0%)
2028	6,938	15,419	1,726	19,886	847	331	20,873	7,621	6,307	79,949 (11.3%)
2029	6,957	16,663	1,819	21,210	847	331	20,873	8,081	6,307	83,090 (11.7%)

5 RCS Capacity Plan

☐ RCS Capacity Expansion Outlook by Year (2015 - 2029)

Power Plant Name	7th BPE		Company	Location
	Completion	Capacity		
Hanam Cogeneration	Oct 2015	398.9	Hanam Energy Service	Seoul Gangdong
Youngjong EP Power Plant	Dec 2015	22.1	Youngjong EP	Incheon Joonggu
Daesan Cogeneration	Dec 2015	50.7	Daesan Cogeneration	Chungnam Seosan
Osan Cogeneration	Mar 2016	408.0	DS Power	Gyeonggi Osan
Gunjang Energy (block 2)	Mar 2016	250.0	Gunjang Energy	Jeonbuk Gunsan
Pyeongtaek Poseung Renewable energy plant	Jul 2016	75.0	Yooho Development & Construction, KOWEPO	Gyeonggi Pyeongtaek
Wirye CHP	Oct 2016	460.0	Wirye Energy Service	Seoul Songpa
Naepo CHP	Dec 2016	76.0	Naepo Green Energy	Chungnam Yesan
Chuncheon CHP	Dec 2016	422.4	Chuncheon Energy	Gangwon Chuncheon
Sokmun CHP	Dec 2016	38.9	Seokmun Energy	Chungnam Dangjin
Hwaseong-Dongtan 2 CHP	May 2017	751.0	KDHC	Gyeonggi Hwaseong
Siheung Cogeneration	Jul 2018	38.0	GS Power	Gyeonggi Siheung
Sejong Cogeneration (block 2)	Nov 2019	515.0	KDHC, KOMIPO, KOSPO	Chungnam Yeonggi
Magok CHP	Dec 2020	280.0	SH Corporation of the Seoul Metropolitan	Seoul Gangseo
Daejeon Cogeneration (Expansion)	Dec 2021	25.0	Daejeon Cogeneration	Daejeon Daedeok
Anyang CC (Expansion)	Dec 2021	465.0	GS Power	Gyeonggi Anyang
Total		4,276		

6 Generation Capacity Retirement Plan

[Unit: MW]

Year	Nuclear	Anthracite	LNG	Oil	Total
2015			POSCO CC #2 (450) (January) Seoul Thermal #4 (138) (December)		588 (2 units)
2016			Seoul Thermal #5 (250) (December)		250 (1 unit)
2017	Kori #1 (587) (June)		Pyeongtaek CC (480) (December)		1,067 (2 units)
2018		Seocheon #1,2 (400) (September)		Jeju GT#3 (55) (January)	455 (3 units)
2021				Ulsan #4 - 6 (1,200) (December)	1,200 (3 units)
2023			Seincheon CC #1 - 8 (1,800) (December)		1,800 (8 units)
2024				Pyeongtaek #1 - 4 (1,400) (December)	1,400 (4 units)
Total ('15 - '29)	587 (1 unit)	400 (2 units)	3,118 (12 units)	2,655 (8 units)	6,760 (23 units)

* 1. Excludes POSCO CC #2 retired in January 2015
* 2. The assumption in this table is that facilities are retired on the last date of every month

7 Generation Mix Outlook

A. By Nominal Capacity

□ Nationwide

[Unit: MW, %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped storage	Renewable	RCS	Total
2014	20,716	25,149	1,125	26,742	3,850	4,700	6,241	4,693	93,216
	22.2	27.0	1.2	28.7	4.1	5.0	6.7	5.0	100
2015	21,716	26,169	1,125	28,246	3,850	4,700	7,355	5,165	98,326
	22.1	26.6	1.1	28.7	3.9	4.8	7.5	5.3	100
2016	23,116	33,873	1,125	27,996	3,850	4,700	8,960	6,895	110,515
	20.9	30.6	1.0	25.3	3.5	4.3	8.1	6.2	100
2017	25,329	34,873	1125	32,496	3,850	4,700	10,462	7,646	120,481
	21.0	28.9	0.9	27.0	3.2	3.9	8.7	6.3	100
2018	26,729	34,873	725	33,616	3,795	4,700	13,416	7,684	125,538
	21.3	27.8	0.6	26.8	3.0	3.7	10.7	6.1	100
2019	26,729	35,873	725	34,567	3,795	4,700	15,052	8,199	129,640
	20.6	27.7	0.6	26.7	2.9	3.6	11.6	6.3	100
2020	26,729	36,913	725	35,567	3,795	4,700	17,273	8,479	134,181
	19.9	27.5	0.5	26.5	2.8	3.5	12.9	6.3	100
2021	28,129	42,713	725	35,567	2,595	4,700	18,920	8,969	142,318
	19.8	30.0	0.5	25.0	1.8	3.3	13.3	6.3	100
2022	30,929	43,293	725	35,567	2,595	4,700	20,523	8,969	147,301
	21.0	29.4	0.5	24.1	1.8	3.2	13.9	6.1	100
2023	32,329	43,293	725	33,767	2,595	4,700	22,141	8,969	148,519
	21.8	29.1	0.5	22.7	1.7	3.2	14.9	6.0	100
2024	32,329	43,293	725	33,767	1,195	4,700	23,825	8,969	148,803
	21.7	29.1	0.5	22.7	0.8	3.2	16.0	6.0	100
2025	32,329	43,293	725	33,767	1,195	4,700	26,098	8,969	151,076
	21.4	28.7	0.5	22.4	0.8	3.1	17.3	5.9	100
2026	33,829	43,293	725	33,767	1,195	4,700	27,845	8,969	154,323
	21.9	28.1	0.5	21.9	0.8	3.0	18.0	5.8	100
2027	35,329	43,293	725	33,767	1,195	4,700	29,469	8,969	157,447
	22.4	27.5	0.5	21.4	0.8	3.0	18.7	5.7	100
2028	36,829	43,293	725	33,767	1,195	4,700	31,055	8,969	160,533
	22.9	27.0	0.5	21.0	0.7	2.9	19.3	5.6	100
2029	38,329	43,293	725	33,767	1,195	4,700	32,890	8,969	163,868
	23.4	26.4	0.4	20.6	0.7	2.9	20.1	5.5	100

* 1. Based on year-end installed capacity; renewable & RCS as per nominal capacity
2. Jeju GT #1,2 (110 MW) are used as sync. compensators but are included in nominal capacity

□ Seoul Metropolitan Area

[Unit: ㎿, %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped storage	Renewable	RCS	Flow Capacity	Total
2014	-	5,080	-	15,742	1,431	400	967	2,585	12,900	39,105
	-	13.0	-	40.3	3.7	1.0	2.5	6.6	33.0	100
2015	-	5,080	-	17,246	1,431	400	1,140	3,006	14,642	42,945
	-	11.8	-	40.2	3.3	0.9	2.7	7.0	34.1	100
2016	-	5,080	-	16,996	1,431	400	1,288	3,875	15,254	44,324
	-	11.5	-	38.3	3.2	0.9	2.9	8.7	34.4	100
2017	-	5,080	-	20,076	1,431	400	1,484	4,626	16,834	49,931
	-	10.2	-	40.2	2.9	0.8	3.0	9.3	33.7	100
2018	-	5,080	-	20,076	1,431	400	1,656	4,664	17,107	50,414
	-	10.1	-	39.8	2.8	0.8	3.3	9.3	33.9	100
2019	-	5,080	-	21,027	1,431	400	1,885	4,664	17,815	52,302
	-	9.7	-	40.2	2.7	0.8	3.6	8.9	34.1	100
2020	-	5,080	-	22,027	1,431	400	2,596	4,944	20,187	56,665
	-	9.0	-	38.9	2.5	0.7	4.6	8.7	35.6	100
2021	-	5,080	-	22,027	1,431	400	2,782	5,409	20,734	57,863
	-	8.8	-	38.1	2.5	0.7	4.8	9.3	35.8	100
2022	-	5,080	-	22,027	1,431	400	2,967	5,409	20,693	58,007
	-	8.8	-	38.0	2.5	0.7	5.1	9.3	35.7	100
2023	-	5,080	-	20,227	1,431	400	3,137	5,409	20,728	56,412
	-	9.0	-	35.9	2.5	0.7	5.6	9.6	36.7	100
2024	-	5,080	-	20,227	31	400	3,338	5,409	20,763	55,248
	-	9.2	-	36.6	0.1	0.7	6.0	9.8	37.6	100
2025	-	5,080	-	20,227	31	400	3,526	5,409	20,797	55,470
	-	9.2	-	36.5	0.1	0.7	6.4	9.8	37.5	100
2026	-	5,080	-	20,227	31	400	3,803	5,409	20,832	55,782
	-	9.1	-	36.3	0.1	0.7	6.8	9.7	37.3	100
2027	-	5,080	-	20,227	31	400	3,987	5,409	20,867	56,001
	-	9.1	-	36.1	0.1	0.7	7.1	9.7	37.3	100
2028	-	5,080	-	20,227	31	400	4,170	5,409	20,021	55,338
	-	9.2	-	36.6	0.1	0.7	7.5	9.8	36.2	100
2029	-	5,080	-	20,227	31	400	4,457	5,409	19,669	55,273
	-	9.2	-	36.6	0.1	0.7	8.1	9.8	35.6	100

* Based on year-end installed capacity; renewable & RCS as per nominal capacity

☐ Jeju Island Area

[Unit: ㎿, %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped storage	Renewable	RCS	HVDC	Total
2014	–	–	–	–	700	–	187	–	300	1,187
	–	–	–	–	59.0	–	15.8	–	25.3	100
2015	–	–	–	–	700	–	232	–	400	1,332
	–	–	–	–	52.6	–	17.4	–	30.0	100
2016	–	–	–	–	700	–	364	–	400	1,464
	–	–	–	–	47.8	–	24.9	–	27.3	100
2017	–	–	–	–	700	–	511	–	400	1,611
	–	–	–	–	43.5	–	31.7	–	24.8	100
2018	–	–	–	200	645	–	662	–	400	1,907
	–	–	–	10.5	33.8	–	34.7	–	21.0	100
2019	–	–	–	200	645	–	813	–	400	2,058
	–	–	–	9.7	31.3	–	39.5	–	19.4	100
2020	–	–	–	200	645	–	977	–	400	2,222
	–	–	–	9.0	29.0	–	44.0	–	18.0	100
2021	–	–	–	200	645	–	1,120	–	400	2,365
	–	–	–	8.5	27.3	–	47.3	–	16.9	100
2022	–	–	–	200	645	–	1,242	–	400	2,487
	–	–	–	8.0	25.9	–	50.0	–	16.1	100
2023	–	–	–	200	645	–	1,369	–	400	2,614
	–	–	–	7.7	24.7	–	52.3	–	15.3	100
2024	–	–	–	200	645	–	1,498	–	400	2,743
	–	–	–	7.3	23.5	–	54.6	–	14.6	100
2025	–	–	–	200	645	–	1,632	–	600	3,077
	–	–	–	6.5	21.0	–	53.0	–	19.5	100
2026	–	–	–	200	645	–	1,770	–	600	3,215
	–	–	–	6.2	20.1	–	55.1	–	18.7	100
2027	–	–	–	200	645	–	1,912	–	600	3,357
	–	–	–	6.0	19.2	–	57.0	–	17.9	100
2028	–	–	–	200	645	–	2,059	–	600	3,504
	–	–	–	5.7	18.4	–	58.8	–	17.1	100
2029	–	–	–	200	645	–	2,219	–	600	3,664
	–	–	–	5.5	17.6	–	60.6	–	16.4	100

* 1. Based on year-end installed capacity; renewable & RCS as per nominal capacity

2. Jeju GT #1,2 (110 MW) are used as sync. compensators but are included in nominal capacity

B. By Peak Contribution

□ Nationwide

[Unit: MW, %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped storage	Renewable	RCS	Total
2014	20,716	25,149	1,125	26,742	3,740	4,700	1,846	4,137	88,155
	23.5	28.5	1.3	30.3	4.2	5.3	2.1	4.7	100
2015	21,716	26,169	1,125	28,246	3,740	4,700	2,167	4,575	92,438
	23.5	28.3	1.2	30.6	4.0	5.1	2.3	4.9	100
2016	23,116	33,873	1,125	27,996	3,740	4,700	2,371	5,801	102,722
	22.5	33.0	1.1	27.3	3.6	4.6	2.3	5.6	100
2017	25,329	34,873	1125	32,496	3,740	4,700	2,552	6,552	111,367
	22.7	31.3	1.0	29.2	3.4	4.2	2.3	5.9	100
2018	26,729	34,873	725	33,616	3,685	4,700	3,706	6,590	114,624
	23.3	30.4	0.6	29.3	3.2	4.1	3.2	5.7	100
2019	26,729	35,873	725	34,567	3,685	4,700	3,899	7,105	117,283
	22.8	30.6	0.6	29.5	3.1	4.0	3.3	6.1	100
2020	26,729	36,913	725	35,567	3,685	4,700	4,105	7,385	119,809
	22.3	30.8	0.6	29.7	3.1	3.9	3.4	6.2	100
2021	28,129	42,713	725	35,567	2,485	4,700	4,309	7,875	126,502
	22.2	33.8	0.6	28.1	2.0	3.7	3.4	6.2	100
2022	30,929	43,293	725	35,567	2,485	4,700	4,518	7,875	130,092
	23.8	33.3	0.6	27.3	1.9	3.6	3.5	6.1	100
2023	32,329	43,293	725	33,767	2,485	4,700	4,716	7,875	129,890
	24.9	33.3	0.6	26.0	1.9	3.6	3.6	6.1	100
2024	32,329	43,293	725	33,767	1,085	4,700	4,945	7,875	128,719
	25.1	33.6	0.6	26.2	0.8	3.7	3.8	6.1	100
2025	32,329	43,293	725	33,767	1,085	4,700	5,518	7,875	129,292
	25.0	33.5	0.6	26.1	0.8	3.6	4.3	6.1	100
2026	33,829	43,293	725	33,767	1,085	4,700	5,727	7,875	131,001
	25.8	33.0	0.6	25.8	0.8	3.6	4.4	6.0	100
2027	35,329	43,293	725	33,767	1,085	4,700	5,928	7,875	132,702
	26.6	32.6	0.5	25.4	0.8	3.5	4.5	5.9	100
2028	36,829	43,293	725	33,767	1,085	4,700	6,120	7,875	134,394
	27.4	32.2	0.5	25.1	0.8	3.5	4.6	5.9	100
2029	38,329	43,293	725	33,767	1,085	4,700	6,323	7,875	136,097
	28.2	31.8	0.5	24.8	0.8	3.5	4.6	5.8	100

* 1. Based on year-end installed capacity; renewable & RCS as per peak contribution

2. Jeju GT #1,2 (110 MW) are used as sync. compensators; excluded in installed capacity (no peak contribution available)

□ Seoul Metropolitan Area

[Unit: ㎿, %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped storage	Renewable	RCS	Flow Capacity	Total
2014	-	5,080	-	15,742	1,431	400	207	2,518	12,900	38,278
	-	13.3	-	41.1	3.7	1.0	0.5	6.6	33.7	100
2015	-	5,080	-	17,246	1,431	400	258	2,939	14,642	41,996
	-	12.1	-	41.1	3.4	1.0	0.6	7.0	34.9	100
2016	-	5,080	-	16,996	1,431	400	312	3,540	15,254	43,013
	-	11.8	-	39.5	3.3	0.9	0.7	8.2	35.5	100
2017	-	5,080	-	20,076	1,431	400	367	4,291	16,834	48,479
	-	10.5	-	41.4	3.0	0.8	0.8	8.9	34.7	100
2018	-	5,080	-	20,076	1,431	400	414	4,329	17,107	48,837
	-	10.4	-	41.1	2.9	0.8	0.8	8.9	35.0	100
2019	-	5,080	-	21,027	1,431	400	467	4,329	17,815	50,549
	-	10.0	-	41.6	2.8	0.8	0.9	8.6	35.2	100
2020	-	5,080	-	22,027	1,431	400	526	4,609	20,187	54,260
	-	9.4	-	40.6	2.6	0.7	1.0	8.5	37.2	100
2021	-	5,080	-	22,027	1,431	400	579	5,074	20,734	55,325
	-	9.2	-	39.8	2.6	0.7	1.0	9.2	37.5	100
2022	-	5,080	-	22,027	1,431	400	633	5,074	20,693	55,338
	-	9.2	-	39.8	2.6	0.7	1.1	9.2	37.4	100
2023	-	5,080	-	20,227	1,431	400	686	5,074	20,728	53,626
	-	9.5	-	37.7	2.7	0.7	1.3	9.5	38.7	100
2024	-	5,080	-	20,227	31	400	740	5,074	20,763	52,315
	-	9.7	-	38.7	0.1	0.8	1.4	9.7	39.7	100
2025	-	5,080	-	20,227	31	400	793	5,074	20,797	52,402
	-	9.7	-	38.6	0.1	0.8	1.5	9.7	39.7	100
2026	-	5,080	-	20,227	31	400	848	5,074	20,832	52,492
	-	9.7	-	38.5	0.1	0.8	1.6	9.7	39.7	100
2027	-	5,080	-	20,227	31	400	900	5,074	20,867	52,579
	-	9.7	-	38.5	0.1	0.8	1.7	9.7	39.7	100
2028	-	5,080	-	20,227	31	400	952	5,074	20,021	51,785
	-	9.8	-	39.1	0.1	0.8	1.8	9.8	38.7	100
2029	-	5,080	-	20,227	31	400	1,001	5,074	19,669	51,482
	-	9.9	-	39.3	0.1	0.8	1.9	9.9	38.2	100

* Based on year-end installed capacity; renewable & RCS as per peak contribution

□ Jeju Island Area

[Unit: MW, %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped storage	Renewable	RCS	HVDC	Total
2014	–	–	–	–	590	–	11	–	300	901
	–	–	–	–	65.5	–	1.2	–	33.3	100
2015	–	–	–	–	590	–	14	–	400	1,004
	–	–	–	–	58.8	–	1.4	–	39.8	100
2016	–	–	–	–	590	–	21	–	400	1,011
	–	–	–	–	58.4	–	2.1	–	39.6	100
2017	–	–	–	–	590	–	27	–	400	1,017
	–	–	–	–	58.0	–	2.7	–	39.3	100
2018	–	–	–	200	535	–	33	–	400	1,168
	–	–	–	17.1	45.8	–	2.8	–	34.2	100
2019	–	–	–	200	535	–	40	–	400	1,175
	–	–	–	17.0	45.5	–	3.4	–	34.0	100
2020	–	–	–	200	535	–	47	–	400	1,182
	–	–	–	16.9	45.3	–	4.0	–	33.8	100
2021	–	–	–	200	535	–	53	–	400	1,188
	–	–	–	16.8	45.0	–	4.5	–	33.7	100
2022	–	–	–	200	535	–	60	–	400	1,195
	–	–	–	16.7	44.8	–	5.0	–	33.5	100
2023	–	–	–	200	535	–	66	–	400	1,201
	–	–	–	16.7	44.5	–	5.5	–	33.3	100
2024	–	–	–	200	535	–	73	–	400	1,208
	–	–	–	16.6	44.3	–	6.0	–	33.1	100
2025	–	–	–	200	535	–	80	–	600	1,415
	–	–	–	14.1	37.8	–	5.7	–	42.4	100
2026	–	–	–	200	535	–	87	–	600	1,422
	–	–	–	14.1	37.6	–	6.1	–	42.2	100
2027	–	–	–	200	535	–	94	–	600	1,429
	–	–	–	14.0	37.4	–	6.6	–	42.0	100
2028	–	–	–	200	535	–	100	–	600	1,435
	–	–	–	13.9	37.3	–	7.0	–	41.8	100
2029	–	–	–	200	535	–	107	–	600	1,442
	–	–	–	13.9	37.1	–	7.4	–	41.6	100

* 1. Based on year-end installed capacity; renewable as per peak contribution
2. Jeju GT #1,2 (110 MW) are used as sync. compensators; excluded in installed capacity (no peak contribution available)

8 Generation Capacity Expansion Plan

☐ Nationwide

Year	M	Generation Facility	CAP. (MW)	Total CAP. (MW)		Peak (MW)		Reserve Rate (%)
				Summer	Year-end	Summer	Winter	
2014	12	Existing Facilities			88,155 (89,357)		80,154	10.0 (11.5)
2015				89,866	92,438	79,923	82,478	12.1
	1	Retired - POSCO CC #2 (POSCO Energy)	-450					
	1	Dongducheon CC #2 (Dongducheon Dream Power)	858					
	1	POSCO CC #9 (POSCO Energy)	376					
	3	Dongducheon CC #1 (Dongducheon Dream Power)	858					
	6	Renewable Energy	70					
	7	Shin Wolseong #2 (KHNP)	1,000					
	12	Dangjin #9 (EWP)	1,020					
	12	Retired - Seoul Thermal #4 (KOMIPO)	-138					
	12	Renewable Energy	250					
	12	RCS	439					
2016				99,450	102,722	83,653	84,612	21.4
	2	Bukpyeong #1 (GS Donghae Electric Power, Co., Ltd.)	595					
	4	Shin Kori #3 (KHNP)	1,400					
	6	Samcheok Green #1(KOSPO)	1,022					
	6	Dangjin #10 (EWP)	1,020					
	6	Bukpyeong #2 (GS Donghae Electric Power, Co., Ltd.)	595					
	6	Shinboryeong #1 (KOMIPO)	1,000					
	6	Taean #9 (KOWEPO)	1,050					
	6	Renewable Energy	102					
	6	RCS	228					
	8	Yeosu #1 (KOSEP)	350					
	10	Samcheok Green #2 (KOSPO)	1,022					
	12	Taean #10 (KOWEPO)	1,050					
	12	Retired - Seoul Thermal #5 (KOMIPO)	-250					
	12	Renewable Energy	102					
	12	RCS	997					

* CAP Standards for Capacity.

Year	M	Generation Facility	CAP. (MW)	Total CAP. (MW)		Peak (MW)		Reserve Rate (%)
				Summer	Year-end	Summer	Winter	
2017				108,636	111,367	87,363	88,206	26.3
	2	Shin Kori #4 (KHNP)	1,400					
	2	Daewoo Pocheon CC #1 (Daewoo E&C)	960					
	3	Jangmun CC #1(PMP)	900					
	4	Shin Hanwool #1 (KHNP)	1,400					
	6	Shinboryeong #2 (KOMIPO)	1,000					
	6	Retired - Kori #1	-587					
	6	Renewable Energy	91					
	6	RCS	751					
	7	GS Dangjin CC #4 (GS EPS)	950					
	7	Jangmun CC #2 (PMP)	900					
	10	Youngnam CC (KOSPO)	470					
	12	Seoul CC #1(KOMIPO)	400					
	12	Seoul CC #2 (KOMIPO)	400					
	12	Retired - Pyeongtaek CC (KOWEPO)	-480					
	12	Renewable Energy	91					
2018				113,000	114,624	91,028	91,795	24.9
	1	Retired - Jeju GT#3 (KOMIPO)	-55					
	4	Shin Hanwool #2 (KHNP)	1,400					
	6	Jeju CC (KOMIPO)	200					
	6	Renewable Energy	88					
	9	Retired - Seocheon #1,2 (KOMIPO)	-400					
	12	Tongyoung CC #1 (HDC)	920					
	12	Renewable Energy	1,066					
	12	RCS	38					
2019				114,720	117,283	94,151	94,840	23.7
	6	Renewable Energy	96					
	9	Shinseocheon #1 (KOMIPO)	1,000					
	11	Shinpyeongtaek CC #1 (SPPC)	951					
	12	Renewable Energy	97					
	12	RCS	515					

Year	M	Generation Facility	CAP. (MW)	Total CAP. (MW)		Peak (MW)		Reserve Rate (%)
				Summer	Year-end	Summer	Winter	
2020				118,382	119,809	96,650	97,261	23.2
	6	Yeoju CC #1 (SK E&S)	1,000					
	6	Renewable Energy	99					
	10	Goseong Hai Thermal #1 (Goseong Green Power)	1,040					
	12	Renewable Energy	107					
	12	RCS	280					
2021				122,350	126,502	99,237	99,792	26.8
	3	Shin Kori #5 (KHNP)	1,400					
	4	Goseong Hai Thermal #2 (Goseong Green Power)	1,040					
	6	Renewable Energy	101					
	11	Dangjin Eco Power #1 (Dangjin Eco Power)	580					
	12	Gangneung Anin #1 (Gangneung Eco Power)	1,040					
	12	Gangneung Anin #2 (Gangneung Eco Power)	1,040					
	12	Samcheok Thermal #1 (POS Power, Co., Ltd.)	1,050					
	12	Samcheok Thermal #2 (POS Power, Co., Ltd.)	1,050					
	12	Retired - Ulsan #4 - 6 (EWP)	-1,200					
	12	Renewable Energy	103					
	12	RCS	490					
2022				128,586	130,092	101,324	101,849	27.7
	3	Shin Kori #6 (KHNP)	1,400					
	3	Dangjin Eco Power #2 (Dangjin Eco Power)	580					
	6	Renewable Energy	104					
	12	Shin Hanwool #3 (KHNP)	1,400					
	12	Renewable Energy	105					
2023				130,190	129,890	103,183	103,694	25.3
	6	Renewable Energy	99					
	12	Shin Hanwool #4 (KHNP)	1,400					
	12	Retired - Seoincheon CC #1 - 8 (KOWEPO)	-1,800					
	12	Renewable Energy	100					

Year	M	Generation Facility	CAP. (MW)	Total CAP. (MW)		Peak (MW)		Reserve Rate (%)
				Summer	Year-end	Summer	Winter	
2024				130,004	128,719	104,695	105,200	22.4
	6	Renewable Energy	114					
	12	Retired - Pyeongtaek #1 - 4 (KOWEPO)	-1,400					
	12	Renewable Energy	115					
2025				128,825	129,292	106,127	106,644	21.2
	6	Renewable Energy	106					
	12	Renewable Energy	467					
2026				129,395	131,001	107,436	107,974	21.3
	6	Renewable Energy	103					
	12	Cheonji #1 (KHNP)	1,500					
	12	Renewable Energy	106					
2027				131,101	132,702	108,707	109,284	21.4
	6	Renewable Energy	100					
	12	Cheonji #2 (KHNP)	1,500					
	12	Renewable Energy	101					
2028				132,797	134,394	109,952	110,605	21.5
	6	Renewable Energy	95					
	12	New nuclear power plant #1	1,500					
	12	Renewable Energy	97					
2029				134,494	136,097	111,145	111,929	21.6
	6	Renewable Energy	100					
	12	New nuclear power plant #2	1,500					
	12	Renewable Energy	103					

* 1. For renewable and RCS, their peak contributions are applied
2. Jeju GT #1,2 (110 MW) are used as sync. compensators; excluded in installed capacity (no peak contribution available)
3. The values in ( ) for 2014 indicate the supply capacity and reserve rate as of the winter peak day on December 17, 2014
4. The operator submitted its intent for construction of Shin Kori #7, 8, fixed facilities, as Cheonji #1, 2
5. The operator submitted its intent for construction of new nuclear power plant as Daejin #1,2 or Cheonji #3,4 (to be reflected at the phase of operating permit)
6. The reserve rates of Gangneung Anin Thermal #1, 2 and Samcheok Thermal #1are to be considered as of December 2021 because of the time for construction of transmission lines
   - GenCos' intents for construction: Gangneung Anin Thermal #1 (December 2019), Gangneung Anin Thermal #2 (June 2020), and Samcheok Thermal #1 (June 2021)

□ Seoul Metropolitan Area

Year	M	Generation Facility	CAP. (MW)	Flow Capacity (MW)	Total Cap. (MW)		Peak (MW)	Reserve Rate (%)
					Summer	Year-End		
2014	12	Existing Facilities	25,378	12,900		38,278	29,843	28.3
2015				14,642	41,688	41,996	31,602	32.9
	1	Retired - POSCO CC #2 (POSCO Energy)	-450					
	1	Dongducheon CC #2 (Dongducheon Dream Power)	858					
	1	POSCO CC #9 (POSCO Energy)	376					
	3	Dongducheon CC #1 (Dongducheon Dream Power)	858					
	6	Renewable Energy	26					
	12	Retired - Seoul Thermal #4 (KOMIPO)	-138					
	12	Renewable Energy	26					
	12	RCS	421					
2016				15,254	42,777	43,013	32,421	32.7
	6	Renewable Energy	27					
	6	RCS	142					
	12	Retired - Seoul Thermal #5 (KOMIPO)	-250					
	12	Renewable Energy	27					
	12	RCS	460					
2017				16,834	47,232	48,479	33,337	45.4
	2	Daewoo Pocheon CC #1 (Daewoo E&C)	960					
	3	Jangmun CC #1 (PMP)	900					
	6	Renewable Energy	28					
	6	RCS	751					
	7	Jangmun CC #2 (PMP)	900					
	12	Seoul CC #1(KOMIPO)	400					
	12	Seoul CC #2 (KOMIIPO)	400					
	12	Retired - Pyeongtaek CC (KOWEPO)	-480					
	12	Renewable Energy	28					
2018				17,107	48,775	48,837	34,233	42.7
	6	Renewable Energy	23					
	12	Renewable Energy	23					
	12	RCS	38					

Year	M	Generation Facility	CAP. (MW)	Flow Capacity (MW)	Total Cap. (MW)		Peak (MW)	Reserve Rate (%)
					Summer	Year-End		
2019				17,815	49,572	50,549	34,966	44.6
	6	Renewable Energy	27					
	11	Shinpyeongtaek CC #1 (SPPC)	951					
	12	Renewable Energy	27					
2020				20,187	53,947	54,260	35,512	52.8
	6	Yeoju CC #1(SK E&S)	1,000					
	6	Renewable Energy	26					
	12	Renewable Energy	33					
	12	RCS	280					
2021				20,734	54,833	55,325	35,975	53.8
	6	Renewable Energy	26					
	12	Renewable Energy	27					
	12	RCS	465					
2022				20,693	55,311	55,338	36,354	52.2
	6	Renewable Energy	27					
	12	Renewable Energy	27					
2023				20,728	55,400	53,626	36,671	46.2
	6	Renewable Energy	27					
	12	Retired - Seoincheon CC #1 - 8 (KOWEPO)	-1,800					
	12	Renewable Energy	27					
2024				20,763	53,688	52,315	36,949	41.6
	6	Renewable Energy	27					
	12	Retired - Pyeongtaek #1 - 4 (KOWEPO)	-1,400					
	12	Renewable Energy	27					
2025				20,797	52,376	52,402	37,206	40.8
	6	Renewable Energy	27					
	12	Renewable Energy	27					

Year	M	Generation Facility	CAP. (MW)	Flow Capacity (MW)	Total Cap. (MW)		Peak (MW)	Reserve Rate (%)
					Summer	Year-End		
2026				20,832	52,464	52,492	37,436	40.2
	6	Renewable Energy	27					
	12	Renewable Energy	28					
2027				20,867	52,553	52,579	37,665	39.6
	6	Renewable Energy	26					
	12	Renewable Energy	26					
2028				20,021	51,759	51,785	37,902	36.6
	6	Renewable Energy	26					
	12	Renewable Energy	26					
2029				19,669	51,457	51,482	38,141	35.0
	6	Renewable Energy	24					
	12	Renewable Energy	25					

□ Jeju Island Area

Year	M	Generation Facility	CAP. (MW)	HVDC Flow (MW)	Total Cap. (MW)		Peak (MW)	Reserve Rate (%)
					Summer	Year-End		
2014	12	Existing Facilities	601	300		901	762	18.2
2015				400	1,003	1,004	759	32.3
	6	Renewable Energy	2					
	12	Renewable Energy	2					
2016				400	1,007	1,011	778	29.4
	6	Renewable Energy	3					
	12	Renewable Energy	3					
2017				400	1,014	1,017	796	27.4
	6	Renewable Energy	3					
	12	Renewable Energy	3					
2018				400	1,165	1,168	814	43.1
	1	Retired - Jeju GT#3	-55					
	6	Jeju CC	200					
	6	Renewable Energy	3					
	12	Renewable Energy	3					
2019				400	1,171	1,175	833	40.6
	6	Renewable Energy	3					
	12	Renewable Energy	3					
2020				400	1,179	1,182	853	38.2
	6	Renewable Energy	4					
	12	Renewable Energy	4					
2021				400	1,185	1,188	870	36.2
	6	Renewable Energy	3					
	12	Renewable Energy	3					

* 1. For renewable, its peak contribution is applied
2. Jeju GT #1,2 (110 MW) are used as sync. compensators; excluded in installed capacity (no peak contribution available)
3. The winter peak for 2014 and 2015 and the summer peak beyond 2016 were applied in calculating the reserve rates

Year	M	Generation Facility	CAP. (MW)	HVDC Flow (MW)	Total Cap. (MW)		Peak (MW)	Reserve Rate (%)
					Summer	Year-End		
2022				400	1,191	1,195	888	34.1
	6	Renewable Energy	3					
	12	Renewable Energy	3					
2023				400	1,198	1,201	905	32.4
	6	Renewable Energy	3					
	12	Renewable Energy	3					
2024				400	1,204	1,208	920	30.9
	6	Renewable Energy	3					
	12	Renewable Energy	3					
2025				600*	1,411	1,415	935	50.9
	6	Renewable Energy	3					
	12	Renewable Energy	3					
2026				600	1,418	1,422	951	49.1
	6	Renewable Energy	3					
	12	Renewable Energy	3					
2027				600	1,425	1,429	965	47.7
	6	Renewable Energy	3					
	12	Renewable Energy	3					
2028				600	1,432	1,435	981	46.0
	6	Renewable Energy	3					
	12	Renewable Energy	3					
2029				600	1,439	1,442	996	44.5
	6	Renewable Energy	4					
	12	Renewable Energy	4					

* By 2025, #3 HVDC interconnection line is expected to be built

9 Opinions from Public Hearing and the Trade, Industry and Energy Committee

1. Public Hearing Opinions

① Intend to construct new power plants to boost local economy (Paju LNG, Yeosu Thermal)
② Request canceling the plan to withdraw the construction plan of Youngheung Thermal in consideration of the willingness of the residents
③ Nuclear power and renewable energy need to gain public acceptance and take into account environmental protection
④ A thorough review is required to obtain a proper level of power demand forecast and reserve rates

2. Opinions from the Trade, Industry and Energy Committee

① The members raised opinions about the reserve rate (22%). Some said the review about it was needed. Some said a stable power supply and its characteristics of isolated island grid should be taken into account. Some also said that reserve facilities would be required for uncertainty.
② Some members were in favor of LNG generation citing the reduction of greenhouse gas emissions while some were against it because of its high generation cost.
③ The members shared in common that new thermal power plant facilities in Youngheung, Galsaman and Samcheok where the residents are highly in favor of the construction would need to be reflected in the BPE to come.
④ They also said that the Korean government should continue to make its effort in communicating with the public to promote public acceptance about nuclear power plants.

This English version was prepared by KPX in March 2016.
In the event of any discrepancies in interpretation,
the Korean version shall prevail.