

# The Basic Plan for Long-term Electricity Supply and Demand in Korea: A Comparison of the 7th and 8th Basic Plans

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## 1. Background

The stable supply of energy is very important in Korea owing to its high level of energy consumption and heavy reliance on imports for its energy use. As of 2017, Korea's final energy consumption per capita was 4.55 tons of oil equivalent (toe), 3.5 times the global average of 1.28 toe, with imported energy accounting for 94 percent of the primary energy supply.

However, the current government is pushing to shift its energy policy stance from supply-side expansion to demand management. The 8th Basic Plan for Electricity Supply and Demand announced in 2017 sets basic directions for energy policy, focusing on the environment and safety by reducing the use of nuclear power and coal.

The shift in the country's energy policy stance reflects the legal obligations of environmental protection and public safety, growth trends in the use of renewable energy and reduced use of nuclear energy and coal in developed countries and domestic conditions of stable electricity supply and demand. However there are many

concerns, including the possibility of unstable energy supply and demand, and the chance that a rapid transition of the energy scheme does not fully consider the environment and safety when renewable energy use is expanded.

With these concerns in mind, this report compares and analyzes the main content of the 8th Basic Plan — which reflects the current government's energy policy stance — with the previous 7th Basic Plan, discussing the major issues arising from the shift in policy stance.

## 2. Overview of Korea's Electricity Supply and Demand Plan

The electricity supply-demand plan basically aims to establish annual supply-related facilities and construction plans for a stable supply of energy according to future demand forecasts and provide information on electricity supply and demand projections. It also suggests long-term policy directions.

In Korea, electricity supply-demand plans began with the electric power development plans

(EPDP) of the 1960s, which eventually became the Long-term Electricity Supply and Demand Plans (LESDP) by the 1990s. These plans are now known as the Basic Plans for Long-term Electricity Supply and Demand (BPLESD).

The EPDP, which was linked to Korea’s 5-year economic development plans, focused on the construction of power plants and the expansion of Korea Electric Power Corporation (KEPCO)<sup>1</sup> facilities in order to stably supply the electricity necessary for economic growth. The LESDP, first promulgated in 1991, was a long-term plan that considered both the supply and demand of electricity, but heavily emphasized the expansion of KEPCO facilities, the preservation of the monopoly system and the protection of the public interest, and its top priority was stabilizing electricity supply and demand.

On the other hand, the BPLESD was specified as part of the Electricity Business Act at a time of restructuring in the electricity industry,

which began in the year 2000, and is characterized by its focus on a competitive system and profitability and the harmonization of stability and efficiency in supply and demand.

The BPLESD is a comprehensive power policy that includes basic directions for electricity supply and demand as well as long-term prospects, electric facilities planning and electricity demand management for a 15-year period in Article 25 of the Electricity Business Act and Article 15 of the Enforcement Decree. The plan is formulated every two years; its implementation and modification are subject to review by the Electricity Policy Review Board (EPRB).

BPLESD high-level plans include the Green Growth Master Plan and the Energy Master Plan. Related plans include the New Renewable Energy Base Plan and the Natural Gas Supply Plan.

Preparing the BPLESD comprises the following six steps: 1) forecasting mid- to long-term reference demand, 2) calculating target demand for

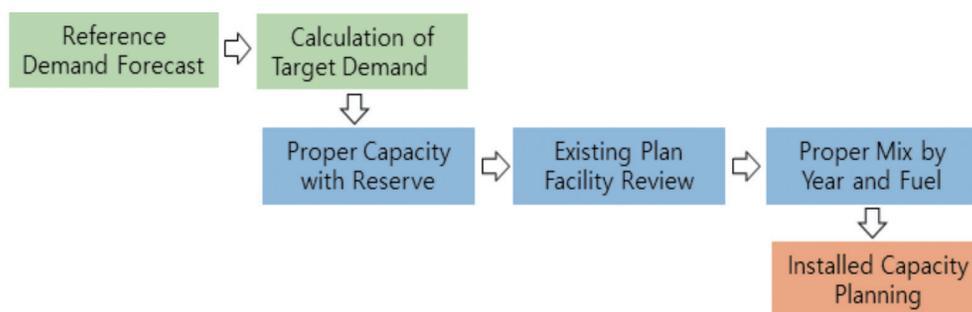
**Table 1. The Evolution of Electricity Supply Plans in Korea**

	EPDP	ESDP	BPESD
period	1962–1990	1991–2000	2001–present
cycle	5 years	2 years	2 years
characteristic	<ul style="list-style-type: none"> <li>· linking the 5-year economic development plan</li> <li>· the construction of power plants and the expansion of KEPCO facilities</li> </ul>	<ul style="list-style-type: none"> <li>· expansion of KEPCO facilities, monopoly system and public interest</li> <li>· prioritized stabilizing electricity supply and demand</li> </ul>	<ul style="list-style-type: none"> <li>· focusing competition system and profitability</li> <li>· emphasizing the harmonization of stability and efficiency in supply and demand</li> </ul>

Note: EPDP=Electric Power Development Plan; ESDP=Long-term Electricity supply and demand Plan; BPESD=Basic Plan for Long-term Electricity supply and demand.

1 Korea Electric Power Corporation (KEPCO) was founded under the Korea Electric Power Corporation Act to facilitate the development of electric power sources, satisfy the nation’s demand for electric power demand and contribute to the development of national economy. The Act on the Management of Public Institutions classifies KEPCO as a market-oriented public corporation.

**Figure 1. Formulating BPLEDS**



demand side management, 3) calculating proper capacity reflecting the target reserve rate, 4) reviewing existing facility plans, 5) deciding on a proper power supply mix by year and fuel and 6) conducting installed capacity planning.

### 3. Features of the 8th Basic Plan: Comparison with the 7th Basic Plan

#### (1) Basic Directions

The basic directions of the 8th plan can be summarized into the following five main points: 1) proper capacity margin setting for a stable electricity supply, 2) more viable demand-side management related to the Fourth Industrial

Revolution (4IR), 3) an economical, safe, and clean energy mix, 4) building a system infrastructure that supports an environmentally friendly energy mix and 5) transparent information disclosure and public hearings.

As shown in Table 2, the basic directions of the 8th plan constitute a significant enhancement of environmental and safety perspectives compared to the 7th plan. The basic directions of the 7th plan are primarily concerned with the stability and economic feasibility of electricity demand and supply, but the most notable feature of the 8th plan is its promotion of stable electricity supply and demand as well as environmental improvement by optimizing economic and environmental dispatch.

**Table 2. Basic Directions in 7th and 8th Plans**

7th Plan	8th Plan
<ul style="list-style-type: none"> <li>· Power supply stability top priority</li> <li>· new energy industry-led demand side management</li> <li>· ICT-based new energy industries, such as ESS and EMS</li> <li>· low-carbon energy mix for post-2020 greenhouse gas reduction</li> <li>· basis for more distributed energy resources</li> <li>· more viable power generation projects</li> </ul>	<ul style="list-style-type: none"> <li>· proper capacity margin setting for stable electricity supply</li> <li>· more viable demand-side management in 4IR</li> <li>· economical, safe and clean energy mix</li> <li>· system infrastructure construction that supports an environmentally friendly energy mix</li> <li>· transparent information disclosure and public hearings</li> </ul>

Note: ESS=energy storage system, EMS=energy management system.

**Table 3. Reference Demand Forecasts**

	7th Plan		8th Plan	
	Electricity Consumption (Twh)	Peak Demand (GW)	Electricity Consumption (Twh)	Peak Demand (GW)
2015	498.0	83.3	na	na
2016	520.9	86.0	na	na
2017	546.8	90.2	509.0	86.5
2018	573.2	94.6	523.5	88.9
2019	597.0	98.4	538.0	91.3
2020	617.8	101.9	552.3	93.6
2021	637.0	105.5	566.7	96.0
2022	655.0	108.6	579.6	98.1
2023	671.9	111.7	592.1	100.3
2024	688.4	114.4	604.1	102.3
2025	704.9	117.1	615.8	104.4
2026	720.6	119.7	627.1	106.3
2027	736.0	122.3	637.9	108.2
2028	751.1	124.8	647.9	110.0
<b>2029</b>	<b>766.1</b>	<b>127.2</b>	<b>657.7</b>	<b>111.8</b>
2030	na	na	667.0	113.4
2031	na	na	675.4	114.9
average annual growth rate	2.9%	2.9%	2.1%	2.1%

Source: Ministry of Trade, Industry and Energy (2015), The 7th Basic Plan for Long-term Electricity Supply and Demand (2015–2029); Ministry of Trade, Industry and Energy (2017), The 7th Basic Plan for Long-term Electricity Supply and Demand (2017–2031).

## (2) Electricity Demand Forecast

Econometric models have been developed and used to enhance the accuracy of demand forecasts. Micro models were used until the 5th plan, but the 6th plan adopted macro models. Mid- to long-term forecasts of economic growth rates, electricity prices, population and temperatures were incorporated as important input variables in these models.

The reason why the demand forecast of the 8th plan is lower than that of the 7th plan is mainly due to lower prospects for economic growth. For the 7th plan, the economic growth rate was assumed to average 3.38 percent annually in the planning period, while the 8th plan assumes 2.43 percent annual growth. In addition, the recent slowdown in the growth of

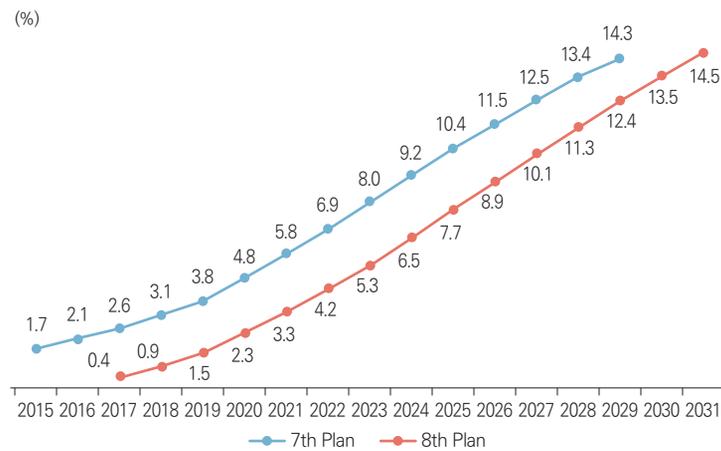
electricity demand was one of the reasons for the lower demand forecast.

## (3) Target for Demand Side Management

Reduction targets in the 8th plan were hiked from the 7th plan in terms of both electricity consumption and peak demand. In the 7th plan, the targets for the final year 2029 were to reduce peak demand by 12 percent of reference peak demand and electricity consumption by 14.3 percent of reference consumption. In the 8th plan, the reduction targets of peak demand and electricity consumption were increased to 12.3 percent and 14.5 percent, respectively, compared with reference demand in the final year.

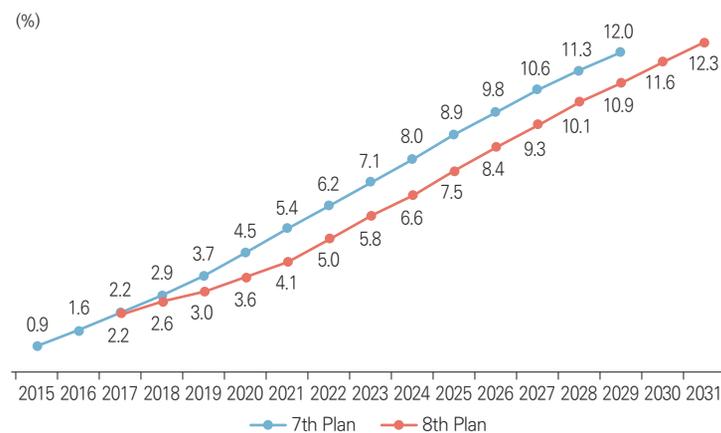
Regarding target management, the 8th plan is characterized by the introduction of a new plan

**Figure 2. Electricity Consumption Reduction Targets**



Source: Ministry of Trade, Industry and Energy.

**Figure 3. Peak Electricity Demand Reduction Targets**



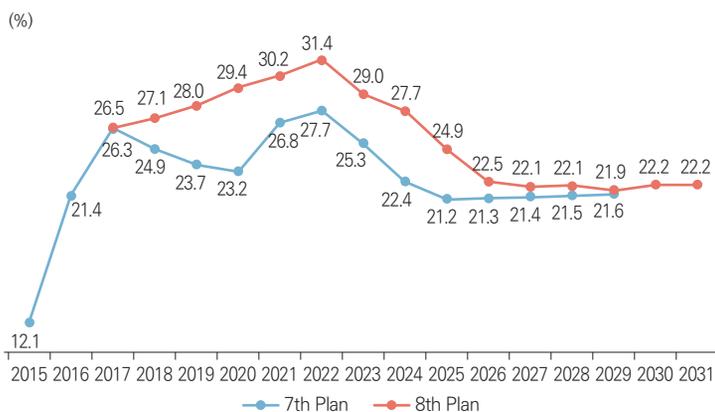
Source: Ministry of Trade, Industry and Energy.

to expand solar photovoltaics (PV) power generation through projects for renewable energy subsidies, solar PV rental businesses and the introduction of a distributed energy resource market under the revised Electricity Business Act. It is expected to reduce consumption by 0.32 gigawatts (GW) by disseminating self-generation for solar PV to about one in 15 households by 2030.

#### (4) Proper Rate of Capacity Reserve

The proper rate of capacity reserve refers to the share of backup facilities for future peak demand in a certain period of time, which consists of the minimum reserve rate and the reserve rate for uncertainty. In both the 7th and 8th plans, the proper rates of capacity reserve for the final year were set at 22 percent, but

**Figure 4. Target Reserve Rates in 7th and 8th Plans**



Source: Ministry of Trade, Industry and Energy.

there are many differences in the annual trend and the composition of the minimum reserve and uncertainty reserve rates.

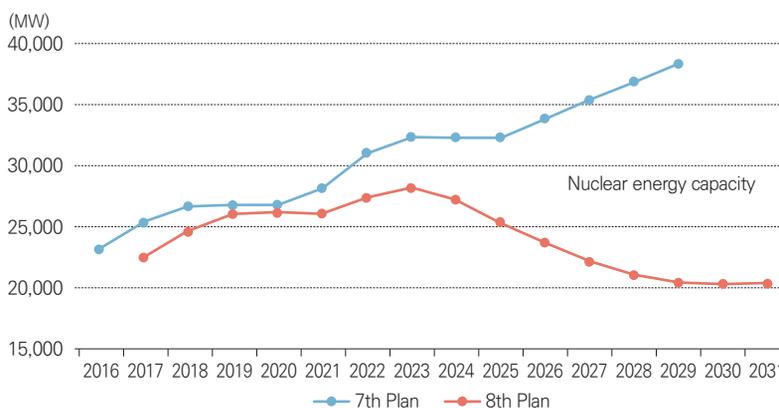
In the 7th plan, the reserve rate goal for the final year of 2029 was set at 22 percent, considering demand uncertainty of seven percent and a minimum reserve rate above 15 percent to respond to possible generator trips. The 8th plan projected that capacity reserve would be above 22 percent and the electricity supply would be stable through 2026. The capacity reserve is

expected to hit a record high of 31.4 percent by 2022. The capacity reserve of 22.1 percent will be met in 2027 through the installation of new facilities.

### (5) Capacity Mix

The capacity mix is based on planning for the proper installed capacity, which takes into account the lifespan of existing generators and obsolescence plans for older generators. In

**Figure 5. Energy Transition Road-map in the 7th and 8th Plans**



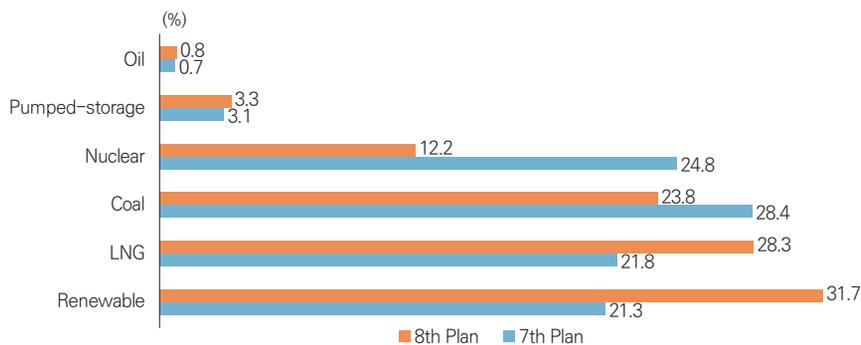
**Table 4. Capacity Mix Outlook in 8th Plan**

	Renewable	LNG	Coal	Nuclear	Others
2017	9.7	31.9	31.6	19.3	7.5
2025	23.1	29.5	26.5	16.9	4.4
2031	33.6	27.2	22.9	11.7	4.6

Unit: %

Source: Ministry of Trade, Industry and Energy.

**Figure 6. Capacity Mix in 7th and 8th Plans (2029)**



the 8th plan, the capacity mix was estimated through a comprehensive review of government policies including the energy transition road-map and anti-fine dust measures, renewable energy promotion goals and a review of the status of power generation facilities.

As shown in Table 5, while the share of renewable energy increases from 9.7 percent to 33.6 percent, the share of LNG decreases from 31.9 percent to 27.2 percent, coal from 31.6 percent to 22.9 percent and nuclear energy from 19.3 percent to 11.7 percent in the planned period (2017–2031).

On the other hand, when comparing the capacity mix of the 7th and 8th plans for the year 2029, as shown in Table 6, the shares of renewable energy and LNG are greater in the 8th plan,

and the shares of the remaining energy sources are greater in the 7th plan. In particular, the share of nuclear energy was forecast to be 12.2 percent in the 8th plan, only half the 28.4 percent figure listed in the 7th plan.

#### 4. Major Issues in the 8th Plan

The 8th plan is part of an energy transition policy in that it represents a shift away from nuclear energy to renewable energy, unlike the previous basic plans. The policy places a priority on strengthening demand management and focuses on steady increases in the use of various energy resources. While the policy of moving from nuclear and coal to renewable and natural gas is widely supported with its eco-friendly and

safety nature, there are also many challenges to solve in realizing the policy goals.

One of the principal challenges of the 8th plan is that the expansion of renewable energy increases the instability of the power supply. Since nuclear energy is more stable than renewable energy as a source of electricity, the supply and demand plan in which renewable energy replaces nuclear energy is destabilizing. Therefore, we argue that supplementary measures are needed to minimize this uncertainty.

Another concern centers on a rise in electricity prices due to the reduction of nuclear and coal power generation. Nuclear power and coal power generation are both cost-effective and stable, and if reduced will inevitably lead to higher power prices due to higher power generation costs. In the plan, tax adjustments following the replacement of power generation fuels and the utilization of greenhouse gas emission

trading costs were considered, but questions have been raised about their effectiveness.

It is also urgent to reform the energy system considering the environment and safety. While reducing greenhouse gases and fine dust is emphasized in the basic directions, specific measures for reducing coal power generation are insufficient. In particular, we argue that proper regulations should be stipulated and announced.

Finally, the plan does not sufficiently reflect 4IR electricity demand. The impact was generally reviewed, but only a handful of factors, such as an increasing use of electric vehicles, were reflected because of forecast uncertainties. Therefore, it is necessary to closely monitor the progress of core 4IR technologies including artificial intelligence, the Internet of Things, big data and robots and analyze their impact on electricity demand in depth.

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