The 4th Basic Plan of Long-Term Electricity Supply and Demand
(2008 ~ 2022)

December 2008

Ministry of Knowledge Economy

Korea Power Exchange

This translation was prepared by KPX in December 2008. In the event of any discrepancies in interpretation, the Korean text shall prevail.

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1. Background and Objectives

A. Legal Background

□ The 4th Basic Plan of Long-term Electricity Supply and Demand (BPE) is prepared pursuant to Article 25 of the Electricity Business Act (EBA) and Article 15 of the Electricity Business Decree. The EBA requires the Ministry of Knowledge Economy (MKE) to prepare and announce the BPE on a biennial basis.

O The BPE stipulates electricity policy directions on supply and demand, long-term outlook, construction plans, DSM, etc.

B. Objectives

□ The plan shall provide the long-term electricity policy directions and information on electricity supply and demand such as the electricity facility plan to secure electricity supply.

O The government shall exert every effort to implement the BPE through various administrative formalities such as licensing the electricity business. Special measures shall also be taken when electricity shortages are expected.

□ Generation companies (GenCos) can apply for the approval of their generation business based on the BPE.

* Submission of construction intents → reflection in the BPE → Approval of the generation business and the construction plan.

* The power plants listed in the BPE are exempt from the 19 approvals required for the construction of power plants in pursuant to the Power Resources Development Law (Clause 3, Article 2 and Clause 1, Article 6).

* Power plants not listed in the BPE may be constructed by obtaining the approvals required by individual laws.

C. Procedure

☐ Six subcommittees consisting of experts from universities, research institutes, electricity companies, and other organizations shall submit study reports individually.

* 6 subcommittees: General Policy, Generating Capacity Expansion, Demand Forecast, Climate Change (newly established), Demand Side Management (DSM) and Transmission System Expansion.

☐ The BPE shall be made based on the construction intentions of GenCos and the demand forecast provided by Korea Power Exchange (KPX).

☐ The government shall collect and review ideas and opinions on every aspect from various economic organizations through a public hearing, and shall finalize the BPE by incorporating comments from the Electricity Policy Review Board on the plan.

☐ The government shall revise and/or supplement the BPE considering the changes in the letter of intent for construction submitted by GenCos and the changes of the electricity supply and demand situation.

Figure 1.1 Procedure for BPE Establishment

Establish directions for BPE	○ MKE
⇩	
Submit materials covering each field (with the letter of intent for construction by GenCos)	○ GenCos/KPX
⇩	
Review and prepare the working drafts	○ 6 subcommittees (General Policy, Generating Capacity Expansion, Demand Forecast, Climate Change, Demand Side Management and Transmission System Expansion)
⇩	
Collect opinions on the BPE (tentative plan)	○ Public hearing
⇩	
Examine the BPE (draft)	○ Electricity Policy Review Board
⇩	
Finalize and announce the BPE	○ MKE

2. Direction of the BPE

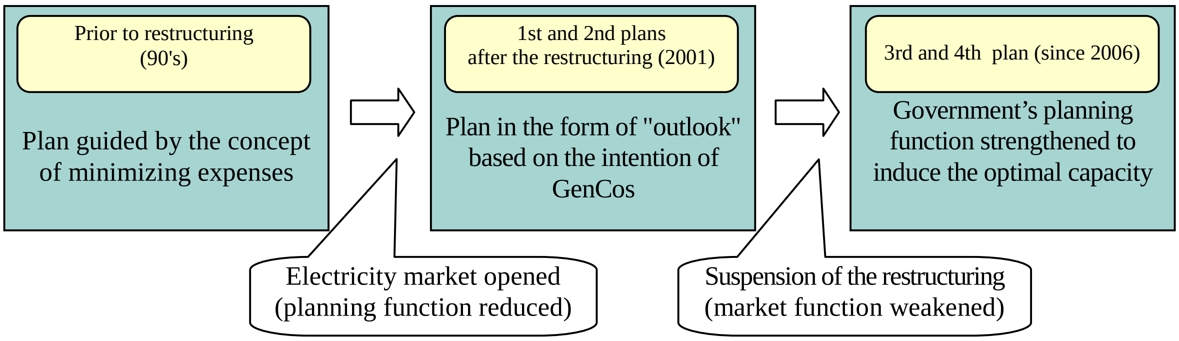
A. Planning Period: From 2008 to 2022

☐ The planning period has been set for 15 years, assuming the lead time and the actual construction time of coal and nuclear power plants which take approximately 8~10 years.

B. Strengthening the Planning Functions

☐ Taking into account the status of the current electricity market, i.e., guaranteeing the effective distribution of resources is difficult, and the "policy" function for the optimization of the capacity and generation mix has been strengthened since the 3rd BPE.

Figure 1.2 The Changes in Planning Characteristics



☐ The optimal generating capacity considering the minimization of social costs and desirable fuel mix is estimated and presented as the government plan, and the GenCos' construction intents are selectively reflected through their evaluation.

C. Improving Efficiency and Economic Feasibility

☐ Regional (Metropolitan, non-Metropolitan area, and Jeju Island) electricity supply and demand plan is established in order to address the imbalance between supply and demand in the Metropolitan area.

☐ Peak contribution of the generating facility on the power system shall be estimated in order to induce investment in load centers such as the metropolitan area.

* While the Metropolitan (Seoul and its vicinity) area accounts for 39% of the peak demand, it has only 22% of the generating capacity (as of 2007).

D. Composing the Generation Fuel Mix Considering Climate Change

□ CO_2 costs (KRW32,000/CO_2 ton*) are considered when analyzing the appropriate generation mix. The goal for CO_2 emission by generation resources is established (0.11kg-C/kWh as of 2022).

* Costs are calculated taking into consideration the overseas emission trading price and marginal CO_2 reduction costs.

□ Those renewable facilities which have submitted a letter of intent, or signed an RPA with the government, or obtained a license from the central/local self government, are preferentially reflected in the BPE.

* RPA: Renewable Portfolio Agreement

E. Minimizing Uncertainties of the Supply and Demand Outlook

□ Long-term fuel price, generation efficiency, and new technology outlook are derived by consulting with experts and is verified by subcommittees and reflected in the BPE.

□ The performance rate of plant construction takes into consideration the cancellation or delay of LNG CC, and renewable plant construction is estimated and reflected accordingly.

F. Strengthening the consistency with the National Energy Basic Plan and Subplan

□ The BPE is established taking into consideration demand side management and nuclear/renewable energy expansion plans in order to achieve the goal for CO_2 emission by generation resources.

□ The effect of demand side management by the Rational Energy Utilization Act such as the e-Stand-by power program and Minimum Energy Performance Standard is taken into consideration.

□ To strengthen the connection to the Gas Supply and Demand Plan, LNG generators are reflected after examining the possibility of interconnection to the gas pipe line network from KOGAS.

G. Strengthening Expertise and Transparency in the Process of Establishing Plans

□ Operation of the working subcommittee composed of experts in each field.

○ Meetings consisting of the 6 subcommittees: General Policy (18), Generating Capacity Expansion (19), Demand Forecast (14), Climate Change (16), Demand Side Management (13), Transmission System Expansion (16) (total of 96 persons).

□ To strengthen professionalism, working groups composed of experts in each field will be established to review the pending issues regarding the BPE.

3. Milestones

□ Basic directions for the 4th BPE were set and the working subcommittees were established. (March 2008~)

- ○ Characteristics of the BPE were defined in a direction wherein the government's political functions have been maintained, taking into consideration the current status of the electricity industry.
- ○ Composition of working subcommittees.
  - * Working subcommittee meetings were held: General Policy (twice), Generating Capacity (4 times), Demand Forecast (twice), Climate Change (3 times), Demand Side Management (4 times), Transmission System (3 times).
- ○ Composition of working group.
  - * Two areas related to Generating Capacity Subcommittee (nuclear, efficiency) and one area related to Climate Change Subcommittee (environment).

□ Surveys on 「Generating Capacity Expansion and Retirement Intention」 with GenCos were conducted. (March ~ April 2008)

□ Electricity demand forecast and demand side management plan were set considering the economic growth rate, changes in industrial structures, latest electricity demand, and other circumstantial changes. (April ~ September 2008)

□ A meeting regarding <the day difference between the plant construction and the grid construction after system Interconnection analysis of the construction intents submitted by GenCos> and <grid interconnection of LNG plants to the gas pipe> (July 2008)

□ Reference Generating Capacity plan was established based on the electricity demand, and GenCos' letters of intent for construction were assessed. (September ~ October 2008)

□ Mid- and long-term electricity supply and demand plan were set based on the generation capacity plan. (October 2008)

□ Consultation with the Presidential Commission on Sustainable Development. (November ~ December 2008)

□ Public hearing on the 4th BPE draft was held on December 5, 2008.

□ Electricity Policy Review Board was convened to discuss the 4th BPE draft. (December 18, 2008)

II. Long-term Electricity Demand Forecast

1. Recent Status of Electricity Demand
2. Target Demand Forecast
3. Reference Demand Forecast
4. Measures Related to Demand Side Management

1. Recent Status of Electricity Supply and Demand

A. Electricity Consumption

☐ Electricity consumption growth rate has gradually decreased.

* 11.6% in ’91~’95 → 8.0% in ’96~’00 → 6.8% in ’01~’04 → 5.7% in ’05~’07

Table 2.1 Annual average electricity demand increase

Year	’91~’95	’96~’00	’01~’04	’05~’07
Amount of annual average demand increase (GWh)	13,777	15,253	18,140	18,836
Rate of annual average demand increase (%)	11.6	8.0	6.8	5.7

☐ Electricity consumption for the 3 year period 2005~7 was higher than forecasted (the average forecast of former BPEs) by 3~5%.

○ It is caused by the increase of electricity demand due to the low cost of electricity compared to that of other energy types.

Table 2.2 Electricity consumption for the 3 year period 2005-7

Year	Forecast (GWh) (average for 1st ~ 3rd plan)	Actual (GWh)	Increase Rate (%)
2005	319,554	332,413	4.0
2006	338,025	348,719	3.2
2007	350,970	368,605	5.0

☐ The electricity consumption per capita (as of 2005) is higher than the average for OECD and BRICs (34 nations).

Table 2.3 Electricity consumption per capita

	Korea	USA	China	Japan	Germany	France	England	Norway
Electricity Consumption per Capita (2005, kWh/person)	8,064	14,448	1,914	8,628	7,522	9,176	6,651	29.894
Rank	14	5	33	11	17	9	21	1

* Based on OECD international statistics (as of 2007), consumption for self-generation facilities included

B. Peak Demand

☐ Increase rate of peak demand growth has gradually slowed from 9.5% in the ’90s to 5% since 2001.

- ○ Peak demand has increased by an annual average of 3,674MW for the 3 year period 2005~7, which is higher than an annual average of 2,457MW for the previous 10 years (’95 ～’04).
- ○ However, the rate of peak demand increase was only 0.8% (509MW) because of economic recession and power-saving programs.

Table 2.4 Peak demand by year (actual)

<table>
<tr><th>Year</th><th>1990</th><th>1995</th><th>2000</th><th>2001</th><th>2004</th><th>2005</th><th>2006</th><th>2007</th><th>2008</th></tr>
<tr><td>Actual (MW)</td><td>17,252</td><td>29,878</td><td>41,007</td><td>43,125</td><td>51,264</td><td>54,631</td><td>58,994</td><td>62,285</td><td>62,794</td></tr>
<tr><td rowspan="2">Rate of average increase (%)</td><td colspan="3">9.5(90’s : ’90 ～’99)</td><td colspan="6">5.5(since 2001 : ’01 ～’08)</td></tr>
<tr><td colspan="5"></td><td colspan="3">6.7(’05 ～’07)</td><td>0.8(’08)</td></tr>
<tr><td>Amount of average increase (MW)</td><td></td><td colspan="4">2,457(’95 ～’04)</td><td colspan="3">3,674(’05 ～’07)</td><td></td></tr>
</table>

☐ Recent peak demand increase is caused by the increased use of air-conditioning.

- ○ Abnormal high temperatures (continuous high temperatures and increased incidences of tropical nights) during the 3 year period 2005~7 have dramatically increased the demand for air-conditioning.

Table 2.5 Air-conditioning demand by year

Year	2003	2004	2005	2006	2007	2008
Days of high temperature	1	9	5	18	7	3
Days of tropical night	1	1	6	4	6	1
Air-conditioning demand (MW) (Increase rate, %)	9,003 (1.0)	10,250 (13.9)	11,560 (12.8)	12,911 (11.7)	14,313 (10.8)	13,144 (-8.2)

* Days of high temperature: number of days whose maximum temperature is above 30℃.

* Days of tropical night: number of days whose minimum temperature is above 25℃.

2. Target Demand Forecast

A. Key Assumptions

☐ “Target Demand” is reflected to achieve the goal for CO_2 emission by generation resources (47% compared to 2006) based on the National Energy Basic Plan (August 2008)

○ Measures such as the rationalization of the electric rate system and energy efficiency improvement are taken and pursued in order to achieve the target demand.

- Rationalization of the electric rate system: gradually switch over to the rate system by voltage based on supply cost and strengthen the elastic rate system of demand side management types such as customer preferential rate system and graded rate system by hour.

- Efficiency improvement of energy use: R&D for energy efficiency improvement, energy system innovation of industry and building, price moderation for high efficiency lighting apparatus, efficiency standardization for every machine.

B. Forecast Results

☐ Demand Forecast

○ Electricity demand is expected to increase by an annual average rate of 2.2% during the period 2007 ~ 2020.

Table 2.6 Demand Forecast (unit: GWh)

Year	2006 (Actual)	2020	2030	Rate of annual average increase (’07~’20,%)
Electricity Sales (GWh)	348,719	471,706	513,013	2.2

☐ Peak demand forecast

○ Peak demand is expected to increase by an annual average rate of 1.8% during the period 2007 ~ 2020.

Table 2.7 Peak Demand Forecast (unit: MW)

Year	2006(Actual)	2020	2030	Rate of annual average increase (’07~’20,%)
Electricity Sales (MW)	58,994	75,308	81,903	1.8

3. Reference Demand Forecast

(1) Assumptions for Demand Forecast

A. Key Assumptions

□ Economic Growth Forecast (data from the Korea Development Institute (KDI))

○ An annual average rate of 4.2% is forecasted for the period 2008 ~ 2022 (a 1.1% increase compared to 2022 on the 3rd BPE).

Table 2.8 Economic Growth Forecast (unit: trillion won)

Year	2008	2009	2010	2015	2020	2022
4th BPE	836	877	920	1,145	1,386	1,482
3rd BPE	829	867	906	1,121	1,371	-
Rate of increase	0.8	1.2	1.5	2.1	1.1	-

□ Industrial Structure Forecast (data from the Korea Institute for Industrial Economics and Technology (KIET))

○ Compared to the 3rd BPE, the ratio of manufacturing and service is expected to increase and decrease, respectively.

(Manufacturing is more power intensive than the service industry)

Table 2.9 Industrial Structure Forecast (unit: %)

Classification		2008	2010	2015	2022	’08~’22(%)
Agriculture and fisheries	4th (3rd)	3.0 (3.1)	2.7 (2.8)	2.2 (2.3)	1.7 (1.9)	1.6 -
Manufacturing	4th (3rd)	30.3 (29.2)	30.5 (29.4)	30.7 (28.9)	30.2 (28.3)	30.1 -
Service	4th (3rd)	66.4 (67.6)	66.6 (67.7)	66.9 (68.7)	68.0 (69.7)	68.2 -

□ Other assumptions include electricity rate outlooks, growth in the number of households, home appliance supply rate outlook, and value added outlook by sector.

B. Forecasting Methodologies

☐ Electricity demand forecast

○ Electricity demand (kWh) is forecasted based on 2 residential sectors, 3 commercial sectors, and 10 industrial sectors, taking into consideration economic growth, industrial structure, and trends in electricity demand in the future.

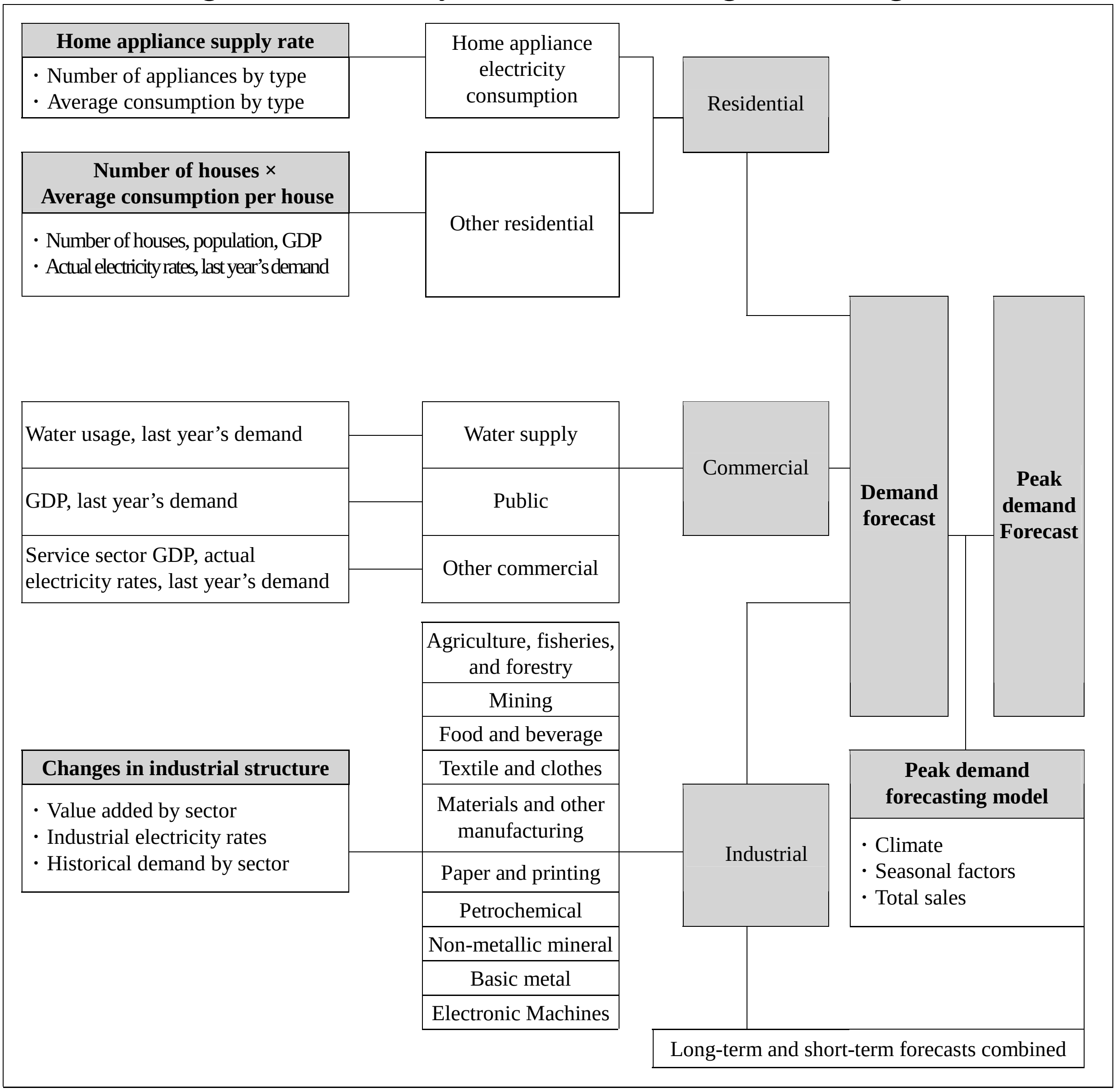
- The amount saved by demand side management is deducted from electricity demand forecasted.

☐ Peak demand forecast

○ Peak demand (kW) is forecasted taking into consideration seasonal, climate and electricity elasticity factors on sales.

- The constraint amount by demand side management is deducted from peak demand forecasted.

Figure 2.1 Electricity Demand Forecasting Methodologies



(2) Electricity Demand Forecast

C. National Electricity Demand

□ Electricity demand

○ An average growth rate of 2.1% per annum is expected from 2008 to 2022 (389,745GWh in 2008 → 500,092GWh in 2022).

- Increase rate by contract classification: 2.4% for residential, 3.2% for commercial and 1.2% for industrial.

Table 2.10 Electricity demand by contract classification (unit: GWh)

Classification	2008	2010	2015	2022	’08~’22(%)
Residential	73,472	80,891	90,225	99,281	2.4
Commercial	119,422	130,897	155,234	179,335	3.2
Industrial	196,851	213,232	227,507	221,476	1.2
Total	389,745	425,020	472,966	500,092	2.1

* The amount of electricity demand is the amount after DSM.

□ Peak demand

○ An annual average growth rate of 1.9% is expected during the period 2009~2022 (2009: 67,226MW → 2022: 81,805MW).

- Peak demand is expected to reach 81,805MW in 2022 by saving 12,2% (11,321MW) of peak demand before DSM.

Table 2.11 Peak demand Forecast (unit: MW)

Classification	2009	2010	2015	2022	’09~’22(%)
Before DSM	67,881	70,827	82,554	93,126	2.9
Amount of DSM	655	1,372	5,340	11,321	-
After DSM	67,226	69,455	77,214	81,805	1.9

* The amount of DSM is based on the annual demand side management targets (aggregate total) versus the 2008 plan.

D. Electricity Demand by Region

☐ Metropolitan area

○ Electricity demand is expected to increase by an annual average rate of 2.4% during the period 2008~2022.

- 2008: 148,172GWh → 2022: 201,204GWh

○ Peak demand is expected to increase by an annual average rate of 2.2% during the period 2008~2022.

- 2008: 25,543MW → 2022: 33,497MW

Table 2.12 Electricity demand in metropolitan area

Classification	2008	2010	2015	2022	’08~’22(%)
Electricity sales (GWh)	148,172	162,766	188,214	201,204	2.4
Peak demand (MW)	25,543 (actual)	27,545	31,162	33,497	2.2

☐ Jeju Island

○ Electricity demand is expected to increase by an annual average rate of 1.9% during the period 2008~2022.

- 2008: 3,201GWh → 2022: 4,021GWh

○ Peak demand is expected to increase by an annual average rate of 3.3% during the period 2008~2022.

- 2008: 553MW → 2022: 897MW

Table 2.13 Electricity demand in Jeju

Classification	2008	2010	2015	2020	’08~’22(%)
Electricity sales (GWh)	3,201	3,493	3,954	4,021	1.9
Peak demand (MW)	553 (actual)	631	754	897	3.3

* Peak demand is an asynchronous peak demand.

4. Measures Related to Long-term DSM

A. Direction

□ Considering the current domestic and foreign status, DSM shall be maintained and new policies shall be developed.

□ DSM policy based on “the Rational Energy Utilization Act” is taken into consideration as well as DSM based on the Electricity Industry Support Fund.

B. Summary

□ Making the most use of DSM resources taking into consideration the status of supply and demand.

- Strengthen the management of the load that has the highest effect on peak reduction versus investment in order to secure a stable supply and demand since the installed reserve rate is expected to be about 10% in the short-term (’08 ~’12).
- In the long run, the reserve rate is expected to be exceeded by more than 15%, and DSM shall focus on the efficiency improvement program and actively respond to the Climate Change Agreement.

□ Improving DSM results by promoting effective DSM projects.

- Reviewing the separation of the supervising institution from the evaluating institution in order to improve the specialization of DSM projects.
- The Evaluation System shall be improved in order to demonstrate DSM performance.
- Promote the accuracy of DSM by excluding the target amount of direct load reduction.
- Reflect the target amount of DSM project based on market (regular fund bidding system) and expand it continuously.

□ Reflect energy saving amount by promoting efficiency improvement projects such as high efficiency apparatus.

- The target amount of the Minimum Energy Performance Standard and the e-Standby power program based on the 4^{th} Rational Energy Utilization Act are taken into consideration.
- R&D investment shall be expanded in the DSM area and, in the long-term, EERS projects shall be promoted.

* EERS: Energy Efficiency Resource Standard

C. DSM Target

□ The DSM target shall be set to increase in the short-term and decrease a little after the mid-term.

□ Taking into consideration the Rational Energy Utilization Act, efficiency improvement projects shall be set to increase drastically after the mid-term.

○ Peak reduction amount (net incremental amount): 3rd (11,615MW) → 4th (11,321MW)

○ Energy saving amount (net incremental amount): 3rd (not considered) → 4th (62,762GWh)

* The share of efficiency improvement (based on the incremental peak reduction amount): 20.8% ('08) → 52.7% ('22)

Table 2.14 Peak Demand Saving Targets

(unit: MW, GWh, 1000ton)

Classification		2008 (actual)	2009	2013	2018	2022
Peak Reduction	Load control	(4,654)	5,077	6,660	7,855	8,129
	Efficiency improvement	(1,222)	1,454	2,908	5,922	9,068
	Total	(5,876)	6,531 **(655)**	9,568 **(3,692)**	13,777 **(7,901)**	17,197 **(11,321)**
Energy Saving	Efficiency improvement	1,001	2,557	14,183	38,196	62,762

* Efficiency improvement: electricity use saving effect by the DSM project based on the Electricity Industry Support Fund and The Rational Energy Utilization Act.
* Peak reduction amount: based on accumulated amount by program, figures in parenthesis denote the accumulated net increment compared to 2008.
* Energy saving amount: based on the accumulated net increment compared to 2008 of high efficient apparatus supply and the Rational Energy Utilization Act.

D. Investment in DSM

□ The total investment in DSM from 2008 to 2022 will amount to KRW 2809.4 billion.

Table 2.15 Estimated Investments in DSM

(unit: 100 million)

Classification		2009	2013	2018	2020	2022	Total
4th BPE	Load control	913	1,088	1,047	992	939	15,149
	Efficiency improvement	465	743	1,073	1,203	1,274	12,945
	Total	**1,378**	**1,831**	**2,120**	**2,195**	**2,213**	**28,094**

* Only subsidies are calculated based on the current constant unit price (excluding the Rational Energy Utilization Act).

III. Generating Capacity Plan and Electricity Supply and Demand Outlook

1. Basic Direction
2. Surveys on Gencos' Intents for Construction
3. Criteria for Evaluating the Intents for Construction
4. Results of the Generating Capacity Plan

1. Basic Direction and Planning Principle

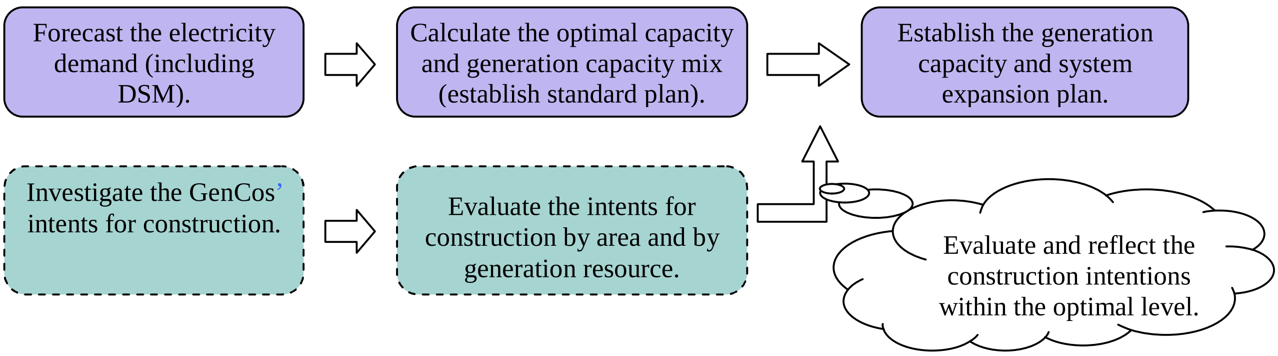
A. Basic Direction

○ Draw the optimal generating capacity and fuel mix with the least social costs based on the demand forecast through a computer model.

- According to the calculated necessary generation capacity, the GenCos' intents for construction are evaluated considering the generation capacity required by region and generation resource; the results are reflected selectively.

  * All construction intents to distributed generation systems (renewables and Regional Cogeneration System (RCS)) are reflected without evaluation and take into consideration the promotion policy.

Figure 3.1 Conceptual Drawing of the Method of Establishing the Capacity Plan



B. Reference generating capacity planning principle

○ Optimal solutions (appropriate level of facilities and generation fuel mix) shall be derived through a computer model based on supply reliability, environmental impact (CO_2 emissions), and economic value according to the forecasted electricity demand.

○ Application standard for prerequisite input

- Regional (metropolitan, non-metropolitan, Jeju Island) supply reliability criteria: LOLP* 0.5days/years

- CO2 emission limits: 0.11 kg-C/kWh; CO2 emission costs reflected: KRW32,000/ CO_2 ton

  * LOLP (Loss of Load Probability): The probabilistic electricity supply reliability index when the electricity supply does not satisfy demand, taking into consideration the number of days of a generator's failure/repair

C. Results of the Planning Principle

☐ Reference generating capacity and composition ratio based on target demand

Table 3.1 Reference generating capacity for target demand

Classification	New Capacity Added by Generation Resources (MW)			Total (MW)	Remarks
	Nuclear	Coal	LNG		
Nationwide	8,400 (6 units)	2,000 (2 units)	-	10,400	

* Reference generating capacity plan based on target demand is only established nationwide.

Table 3.2 Generating capacities composition ratio (based on 2022)

Nuclear	Coal	LNG	Petroleum	Others
34% level	27% level	23% level	4% level	12% level

* Coal: anthracite + bituminous. Others: hydro + pumped storage + renewables/RCS.

☐ Reference generating capacity and composition ratio based on BAU demand

Table 3.3 Reference generating capacity for BAU demand

Classification	New Capacity Added by Generation Resources (MW)			Total (MW)	Remarks
	Nuclear	Coal	LNG		
Metropolitan areas	-	1,600 (2 units)	1,000 (2 units)	2,600	
Non-metropolitan areas	8,400 (6 units)	3,000 (3 unit)	-	11,400	
Total (new project added)	8,400 (6 units)	4,600 (5 units)	1,000 (2 units)	14,000	

* Jeju Island shall be analyzed separately.

Table 3.4 Generating capacities composition ratio (based on 2022)

Nuclear	Coal	LNG	Petroleum	Others
33% Level	29% level	23% level	4% level	11% level

2. Surveys on Gencos' Intents for Construction

A. Survey Outline

☐ Purpose: The goal of the survey is to reflect the Gencos' intents to participate in the market.

☐ Period: 10 March 2008 ~ 18 April 2008 (40 days).

☐ Objects: Capacity plans under construction, new construction and power plant retirement plans.

B. Overall data on Power Plant Construction Intents

☐ Construction intents covering a total of 66,136MW were submitted during the period 2008~2022.

- ○ Under construction (including renewables and RCS): 28,196MW
- ○ New Intentions: 37,940MW
  - 5 major GenCos prefer bituminous coal and LNG combined plants, with private GenCos preferring LNG combined.

Table 3.5 Construction intents by company

(unit: MW)

<table>
<tr><th>Classification</th><th>KHNP</th><th>5 Major GenCos</th><th>Private* GenCos</th><th>Others (Renewables, RCS, Islands)</th><th>Total</th></tr>
<tr><td>Under construction (permits ~ commencement of work)</td><td>6,860</td><td>6,660</td><td>3,300</td><td rowspan="2">11,376</td><td rowspan="2">66,136</td></tr>
<tr><td>Under planning</td><td>9,900</td><td>18,740</td><td>9,300</td></tr>
<tr><td>Total</td><td>16,760</td><td>25,400</td><td>12,600</td><td>11,376</td><td>66,136</td></tr>
</table>

* Private: POSCO Construction, Daelim, SK Construction, POSCO Power, GS Power, GS EPS, Meiya, DOP Service, Hyundai Green Power.

Table 3.6 Generation capacity intents by fuel type

(unit: MW, units)

Classification	Nuclear	Coal	LNG	Petroleum	Renewables	Pumped storage/ RCS	Total
Capacity (no. of units)	16,700 (13)	15,220 (18)	21,780 (34)	237 (5)	6,456	5,743 (49)	66,136 (119)
Percentage	25.3%	23.0%	32.9%	0.4%	9.7%	8.7%	100%

* 1.Pumped storage capacities (total of 800MW), RCS capacities (total of 4,943MW).
  2. Renewable energy power plants are excluded in unit count.

C. Overall data on Power Plant Retirement Intents

☐ GenCos plan to retire 3,886MW (22 units) from 2008 to 2022.

○ 2 coal-fired units (Boryeong #1,2), 4 oil-fueled units (Pyeongtaek #3,4, JejuGT #1,2) are excluded from the retirement plan compared to the 3rd BPE.

Table 3.7 Generation Capacity Retirement Intents

(unit: MW, units)

Classification	Nuclear	Bituminous Coal	Anthracite Coal	LNG	Petroleum	Hydro	Total
'08-'22	-	-	525 (3)	1,538 (6)	1,823 (13)	-	3,886 (22)

* Plants on islands are excluded from unit count.

D. Summary

☐ GenCos have submitted their intents to construct a total of 66,136MW during the period 2008~2022.

Table 3.8 Submitted GenCos' Intents for Construction by Year

Year	Peak Demand (MW)	Generating Capacity (MW)			Installed Reserve Margin (%)
		Retirement	Expansion	Generating Capacity	
2008.3		Existing capacity 68,806			
2008	62,794	3	1,507	70,310	12.0
2009	67,226	338	4,183	74,158	10.3
2010	69,455	333	3,121	76,946	10.8
2011	71,324	455	4,806	81,297	14.0
2012	72,958	432	6,677	87,541	20.0
2013	74,564	625	3,490	90,406	21.2
2014	75,942	1,000	7,639	97,044	27.8
2015	77,214	-	5,662	102,706	30.0
2016	78,398	-	9,557	112,263	43.2
2017	79,442	-	7,354	119,617	50.6
2018	80,174	-	3,523	123,140	53.6
2019	80,789	-	1,400	124,540	54.2
2020	81,151	-	4,315	128,855	58.8
2021	81,502	700	1,400	129,555	59.0
2022	81,805	-	1,500	131,055	60.2
Total		3,886	66,136		

* 1. Generating capacity: based on summer capacity (July).

2. Renewable and RCS do not consider the uncertainties of contribution to peak and construction performance.

3. Criteria for Evaluating the Intents for Construction

☐ The GenCos' intents for construction are evaluated to establish a generation capacity plan at an optimal capacity shown in the "Reference generating expansion plan," and the results are reflected selectively.

○ However, that all intents for the construction of renewables and RCS are reflected in consideration of promotion policy for the distributed generation systems.

☐ Basic evaluation directions

○ Social costs including generation costs and transmission costs are evaluated in relation to the construction of facilities.

○ Construction workability, timely retirement of aged plants, and cases of delay in planning are evaluated; extra points are granted to private utilities to promote the participation of private enterprises.

Table 3.9 Criteria for Evaluating the Intents for Construction

Classification	Evaluation Index	Details	Evaluation Standard	Weighted Value		Appraiser: Index value	Appraiser: Decision
Metric index	Transmission costs	Grid connection costs (KRW)	Total costs	8		System Subcommittee	General Subcommittee
		System reinforcement costs (KRW)					
	Generation costs	Power plant facilities (KRW)				Generation Subcommittee	
		Operation costs (KRW)					
Non-metric index	Public Acceptance	Desire to induce	Whether inducement is desired by the local area	20	2	Generation Subcommittee	
	Project progress	Obtain sites for power plants	Degree of acquisition	10			
		Acquire grid connecting facilities	Degree of acquisition	5		System Subcommittee	
		Degree of prior preparation	Construction feasibility survey service	5		Generation Subcommittee	
			Level of environmental impact assessment	5			
	Policy effectiveness	High-cost aged facilities to be retired	Replace construction project in the same site	20			
		Project delays to be suppressed	Extent of project delays	20			
		Promote participation by private enterprises	Private projects	15			

* 1. Plants required to be evaluated

- Plants with C1 grade among the plants that had submitted intents for construction.

4. Results of the Generating Capacity Plan

A. Criteria for Establishing the Capacity Plan

☐ Derive required capacities (Reference + Supplementary) for target and BAU demand

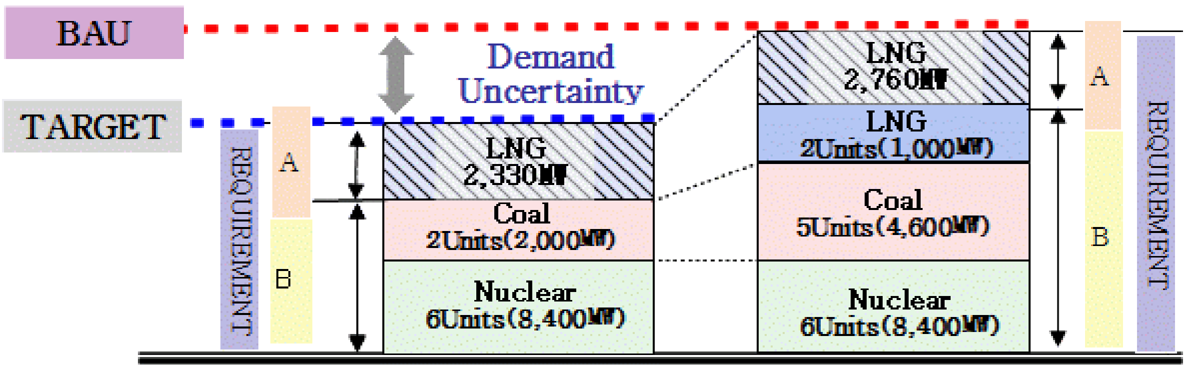
- ㅇ Appropriate capacities are calculated based on cost minimization approach subject to the LOLP target.
- ㅇ The BPE reflects the performance rate of generators considering cancellation or delay of LNG CC and renewable plant construction.

☐ Required capacity by fuel induced by target demand is reflected as decided capacity.

* LNG generators reflect the reference capacities based on BAU demand.

- ㅇ The gap between the capacity based on target demand and the capacity based on BAU demand is reflected as capacity to meet uncertainty.

* Capacities for uncertainty will be reviewed for permission to do business and adjustment of completion period of construction considering the status of electricity demand and supply.



* 1. BAU : Business as usual
2. A : Supplementary capacities ▨, B : Reference capacities
3. 6 units, not 5, of coal plants are reflectd because coal plant projects are done by 2 units for efficiency.

B. Generating Capacities Expansion

☐ Amount of added generating capacity (2008 ~ 2022)

- ㅇ Out of the capacity (total of 66,136MW) indicated in the intents for construction submitted by GenCos, only 47,686MW are finally reflected to the generation capacity plan.

Table 3.10 Generating Capacity additions by fuels

(unit: MW, number of units)

Classification		Nuclear	Coal	LNG	Oil	Renewables	Pumped storage/ RCS	Total
3rd BPE	'06-'20	9,600(8)	9,980(15)	11,239(19)	258(3)	2,265	4,384(18)	37,726(63)
4th BPE	'08-'20	15,200(12)	9,480(12)	10,730(17)	77(1)	6,456	5,743(49)	47,686(91)

* Renewable and small island facilities are excluded from the number of units.

☐ Generator retirement (2008~2022): total of 3,886MW (22 units).

C. Grade Classification and Projects to be reflected

Table 3.11 Grade Classification and Projects to be reflected

Grade		Nuclear	Coal	Gas Combined	Others	Total Capacity (MW)	Remarks
A, B Grade		Singori #1 ('10.12) 1000 #2 ('11.12) 1000 Sinwolseong#1 ('12.03) 1000 #2 ('13.01) 1000 Singori #3 ('13.09) 1400 #4 ('14.09) 1400	Boryeong #7 ('08.06) 500 #8 ('08.12) 500 Hadong #7 ('08.12) 500 #8 ('09.06) 500 Youngheung #3 ('08.06) 870 #4 ('08.12) 870	Incheon#2 ('09.06) 508.9 Gunsan#1 ('10.05) 718 Youngwol('10.11) 853 POSCO#5('10.12) 500 POSCO#6('11.06) 500 Godeok('11.06) 800 Songdo#1,2('11.10,12.02) 1000 Bugok#3('11.12) 500	Jeju Int. combustion #2 ('09.06) 40 Yecheon pump #1('11.09) 400 Yecheon pump #2('11.12) 400 Renewables 6,456.33 RCS 4942.66 Small Islands 36.75	Retirement -3,886.39	**Reflected**
		6,800	3,740	5,379.9	12,275.74	28,195.64 (24,309.25)	
C1 Grade	Metropolitan areas		**Youngheung #5 ('14.06) 870** **#6 ('14.12) 870**	**Incheon #3 ('12.12) 700** **Seoul #1,2 ('12.06, 12) 1000** **Bucheon #2('12.07) 550** **Yangju #1 ('11.12) 700**		**3,990**	**Reflected**
				Pocheon #1 ('13.07) 750 **Ansan #1 ('14.03) 750**		**1,500**	**Capacity for uncertainty**
			Youngheung #7 ('17.09) 870 #8 ('18.03) 870	Pocheon #2,3 ('13.12,'16.12) 1500 Ansan #2 ('14.03) 750 Munsan ('15.01) 750 Incheon#4 ('15.12) 700 POSCO #7,8 (' 15.12,'16.03) 1200 Songdo #3,4 ('17.01) 1000 #5,6 ('20.01) 1000			
	Non-metropolitan areas	**Sinuljin #1 ('15.12) 1400** **#2 ('16.12) 1400** **Singori #5 ('18.12) 1400** **#6 ('19.12) 1400** **Sinuljin #3 ('20.06) 1400** **#4 ('20.06) 1400**				**8,400**	**Reflected**
			Dangjin #9 ('14.12) 1000 **#10 ('15.12) 1000** **Samcheok #1,2 ('15.12) 2000**	**Andong ('11.12) 900** **Sinulsan('13.12) 700**		**5,600**	**Capacity for uncertainty**
			Sinboryeong #1 ('16.04)1000 #2 ('16.12)1000 Taean #9 ('17.01) 1000 #10 ('17.11)1000	Gunsan#2 ('14.02) 700 Bugok #4 ('14.12) 500 Yulchon #2 ('15.01) 550 Yeongnam ('15.07) 1000 Gunjang #1,2 ('17.05, 11) 1400			
	Jeju Island						**Reflected**
		Jeju Int. combustion #3 ('15.12) 40 Jeju Int. combustion #4('16.06) 40 NamJeju Int. combustion #5 ('17.12) 40 NamJeju Int. combustion #6 ('18.03) 40 HVDC #3 ('18.06) 200					
C2 Grade		New Nuclear #1 ('22.06) 1500					
		1,500					
Total reflected	(C1)	8,400	5,740	5,350	-	19,490	
	Total	15,200	9,480	10,729.9	12,275.74	47,685.64 (43,799.25)	

* Figures in parenthesis denote those when the retired capacity is included.

* Since the site for the New nuclear #1 has not been designated yet, the New nuclear #1 (1,400MW, 2022) project was excluded from the evaluation.

IV. Renewable · RCS Capacity Plan

1. Renewable Facilities Expansion Plan

2. RCS Facilities Expansion Plan

1. Renewable Facilities Expansion Plan

A. Basic Direction and Planning Principle

□ Basic Direction

- ○ All intents for the construction of renewables are reflected to the BPE without an evaluation process.
  - Facilities under construction, facilities that submitted intents for construction, facilities that obtained licenses to do business, and facilities that signed an RPA agreement with the government are included.

  * RPA: Renewable Portfolio Agreement
- ○ In case RPS systems are definitely settled, it will be planned to reflect this situation in the 5^{th} BPE.

  * RPS: Renewable Portfolio Standard

□ Criteria for Planning Principle

- ○ Performance rate of solar and wind power facilities shall be reflected.
  - The 4th BPE is established reflecting the performance rate of solar and wind power because of the low performance rate of the capacity on submitted intents.
- ○ Pre-review for large renewable unit interconnection.
  - Renewables over 20MW are pre-reviewed for interconnection, and reflected to the BPE if interconnection is possible at the completion of construction.
  - If interconnection is not possible, the time of completion will be adjusted after consulting with KEPCO and GENCOs.
- ○ Peak contribution rate of renewable shall be reflected.
  - As renewables such as solar and wind power depend on natural energy during peak times, peak contribution rate of renewable is reflected when calculating reserve capacity.

B. Results of Renewable Facilities Expansion Plan

☐ Status and outlook for renewable facilities expansion

○ Status of renewable facilities

- Current Status of renewable facilities as of December 2007: total of 1,943MW.
- Hydro generating capacity is 1,592MW (81.9%), comprising the biggest share among renewables.

Table 4.1 Status of renewable facilities

(unit: MW)

Classification	Hydro		Wind	Solar	Biomass	Waste	By-product Gas	Fuel Cell	Total
	Hydro	Pumped storage							
As of December 31 2007	1,521.6	70.5	191.9	37.8	82.4	8.0	30.3	0.3	1,942.8
	78.3%	3.6%	9.9%	1.9%	4.2%	0.4%	1.6%	0.02%	100%

○ Outlook for renewable facilities expansion

- Total of 6,456MW new renewable facilities are expected to be constructed during the period 2008 ~ 2022, and ocean energy (tide energy) facilities are expected to amount to 3,081MW (48%), accounting for the highest share among them.

Table 4.2 Outlook for renewable facilities expansion (2008 ~ 2022)

(unit: MW)

Classification	Hydro	Wind	Ocean Energy	Solar	Biomass	Waste	By-product Gas	Fuel Cell	IGCC /CCT	Total
Under Construction	16.1	108.7	254.0	121.6	0.7	40.3		26.5		567.9
submitted intents for construction	66.0	237.6	2,826.0	19.4		3.0	900.0	9.6	600.0	4,661.6
RPA agreement	5.4	111.0	1.0	16.9				1.0		135.3
Licensed to do business	0.1	225.5		849.8	3.2	6.8		6.0		1,091.4
Total	87.6	682.8	3,081.0	1,007.7	3.9	50.1	900.0	43.1	600.0	6,456.2

* Renewable facilities under construction include facilities completed January ~ June 2008.

C. Investment Cost by Generation Resource

□ Total investment cost of renewable facilities is expected to reach approximately 14 trillion won during the period 2008~2022.

ㅇ It has been increased by 3.1 times compared to the 3rd BPE.

* Construction unit cost in the 4th BPE is applied to calculate the investment cost outlook in the 3rd BPE.

Table 4.3 Investment Cost by Generation Resources

(unit: 100 million won)

Classification	3rd BPE	4th BPE				
		~2007	2008~2010	2011~2015	2016~2020	Total
Hydro	2,235	66.6	1,088.9	1,035.6	0	2,191
Wind	10,671	11.5	10,078.5	714.0	0	10,804
Ocean	17,322	2,235.4	2,818.5	40,606.7	8,565.4	54,226
Solar	4,770	3,313.3	39,007.4	1,189.3	150	43,660
Biomass	932	4.0	52.0	4.3	9.7	70
Waste	-		418.7	484.3		903
By-product Gas	5,760		9,607.0	3,353.0		12,960
Fuel Cell	23	8.4	2,439.6	1,474.0		3,922
IGCC	-		162.0	9,078.0		9,240
CCT	4,800		27.2	4,772.8		4,800
Total	**46,513**	**5,639.2**	**65,699.8**	**62,712**	**8,725.1**	**142,776**

* 1. Construction unit cost for solar, wind, small hydro, biomass, ocean and fuel cell confers to the data used for estimating the FIT (Feed in Tariff) fund.

2. Construction unit cost for By-product gas and IGCC/CCT confers the data submitted by GENCOs.

3. Investment cost outlook is the figure considered the performance rate of construction.

□ 5.4 trillion won (38%) of total investment cost is expected to invest in ocean energy, 4.4 trillion won (31%) in solar, 4.5 trillion won in the rest of the renewables.

2. RCS Facilities Expansion Plan

☐ Status of RCS facilities (as of December 2007)
- ○ District heating: 11 companies in 26 areas
- ○ Industrial complex: 19 companies in 20 areas

Table 4.4 Status of RCS facilities

Classifications	Number of companies	Number of sites	Amount of supply	
			Heat(Gcal/h)	Electricity(MW)
District heating	11	26	12,728	2,631
Industrial complex	19	20	9,196	1,949
Total	30	46	21,924	4,580

☐ RCS facilities expansion outlook (2008 ~ 2022)
- ○ Total of 4,943MW new RCS facilities are expected to be constructed during the period 2008 ~ 2022.
  - It has been increased by 2.5 times compared to the 3rd BPE (1,975MW) and the number of companies has increased by more than 3 times.

Table 4.5 RCS facilities expansion outlook

Classifications	General	CES	Total
Number of companies	17	29	46
Capacity (MW)	3,128.6	1,814.0	4,942.6

☐ RCS facilities investment cost outlook (2008 ~ 2022)
- ○ Total investment cost of RCS facilities during the period 2008 ~ 2022 is expected to reach approximately 8 trillion won.

Table 4.6 RCS facilities investment cost outlook

Classifications	Capacity (MW)	Investment Cost (billion won)
3rd BPE	1,974.8	3,075
4th BPE	4,942.6	7,697

* 1. The data submitted by RCS companies is applied to estimate the investment cost.
2. Construction unit cost in the 4th BPE is applied to calculate the investment cost outlook in the 3rd BPE.

V. Outlook for Electricity Balance and Generation Capacity Mix

1. Key Assumptions

2. Electricity Supply and Demand Outlook

3. Generating Capacity Mix Outlook by Fuel Type

4. Generation Outlook by Fuel Type

5. Investment Cost Outlook

1. Key Assumptions

☐ Electricity demand: the saving amount by DSM is deducted from BAU demand by region

☐ Capacity by region basis

- ㅇ Nationwide basis: all the generating capacity except self generation facilities
- ㅇ Metropolitan area: all the generating capacity except self generation facilities in Seoul and Gyeong-gi area plus transmission credit
- ㅇ Jeju Island: all the generating capacity except self generation facilities in Jeju Island plus transmission credit

☐ Reserve Margin / Generation Capacity Mix Outlook by year

- ㅇ Reserve Margin Outlook: Facilities completed by June of that year are included
- ㅇ Fuel Mix Outlook: Facilities completed by December of that year are included

☐ Supply uncertainties of the generating facilities are considered

- ㅇ Supplementary facilities considering cancellation or delay of LNG are excluded when calculating installed reserve margin.
- ㅇ Effective capacity considering peak contribution rate is used for distributed generation system (renewable and RCS)

Table 5.1 Peak Contribution Rate for Distributed Generation System

Classification	Renewable							RCS	
	Hydro	Small Hydro	Wind	Ocean	Solar	Biomass/ Waste/ By-product Gas	Fuel Cell/ IGCC	Central	Non central
Peak Contribution Rate	100	62.2	21.9	30.0	42.8	40.9	100	60	30

* The performance rate is additionally considered for Wind and Solar facilities which obtained license to do business. (Wind: 79.0%, Solar: 39.8%)

2. Electricity Supply and Demand Outlook

☐ Nitionwide basis

- Since the installed reserve margin is expected to be 6~10% until 2011, active measures should be taken to respond effectively in terms of short-term supply and demand.
- The reserve margin is expected to remain at 12~24% after 2012, thereby enabling the effective stabilization of supply and demand.

Table 5.2 Electricity Supply and Demand Outlook by Year

Year	Peak Demand (MW)	Total Capacity (MW)		Installed Reserve Margin (%)
		Summer	Year-end	
2007 (actual)	62,285	65,874 (66,778)	67,246	5.8 (7.2)
2008 (actual)	62,794	69,207 (68,519)	71,364	10.2 (9.1)
2009	67,226	72,118	72,543	7.3
2010	69,455	73,552	76,136	5.9
2011	71,324	77,209	80,015	8.3
2012	72,958	81,500	82,482	11.7
2013	74,564	83,439	85,530	11.9
2014	75,942	85,400	88,848	12.5
2015	77,214	88,848	93,568	15.1
2016	78,398	93,812	95,250	19.7
2017	79,442	95,682	95,682	20.4
2018	80,174	95,682	97,082	19.3
2019	80,789	97,082	98,791	20.2
2020	81,151	100,191	100,191	23.5
2021	81,502	100,891	100,891	23.8
2022	81,805	100,891	100,891	23.3

* Figures in parenthesis are based on the actual availability and operating reserve.

☐ Metropolitan area

Table 5.3 Electricity Supply and Demand Outlook in Metropolitan Area

Year	Peak Demand (MW)	Generating Capacity (MW)		Transmission Credit (MW)	Total Capacity (MW)		Installed Reserve Margin (%)
		Summer	Year-end		Summer	Year-end	
2007	24,327	14,429	14,765	13,100	27,529	27,865	13.2
2008	25,543	15,638	16,516	13,100	28,738	29,616	12.5
2009	26,581	16,711	17,007	13,400	30,111	30,407	13.3
2010	27,545	17,014	17,556	13,400	30,414	30,956	10.4
2011	28,396	18,955	19,243	14,530	33,485	33,773	17.9
2012	29,152	19,743	19,445	15,030	34,773	35,725	19.3
2013	29,843	20,695	21,051	15,050	35,745	36,101	19.8
2014	30,528	21,921	21,943	15,250	37,171	38,063	21.8
2015	31,162	22,813	22,813	15,420	38,233	38,233	22.7
2016	31,707	23,057	23,057	16,590	39,647	39,647	25.0
2017	32,206	23,489	23,489	16,870	40,359	40,359	25.3
2018	32,523	23,489	23,489	16,870	40,359	40,359	24.1
2019	32,808	23,489	23,489	16,970	40,459	40,459	23.3
2020	33,076	23,489	23,489	16,970	40,459	40,459	22.3
2021	33,306	22,789	22,789	16,730	39,519	39,519	18.7
2022	33,497	22,789	22,789	16,910	39,699	39,699	18.5

☐ Jeju Island

Table 5.4 Electricity Supply and Demand Outlook in Jeju

Year	Peak Demand (10,000 ㎾)	Generating Capacity (MW)		Transmission Credit (10,000 ㎾)	Total Capacity (MW)		Installed Reserve Margin (%)
		Summer	Year-end		Summer	Year-end	
2007	552	644	648	150	794	798	43.9
2008	553	648	661	150	798	811	44.3
2009	604	698	707	150	848	857	40.3
2010	631	707	714	150	857	864	35.9
2011	656	659	659	150	809	1,059	23.3
2012	682	628	628	400	1,028	1,028	50.8
2013	706	628	628	400	1,028	1,028	45.6
2014	731	628	628	400	1,028	1,028	40.7
2015	754	628	628	400	1,028	1,028	36.4
2016	776	628	628	400	1,028	1,028	32.5
2017	799	628	628	400	1,028	1,028	28.7
2018	821	628	628	400	1,028	1,028	25.2
2019	843	628	628	400	1,028	1,028	22.0
2020	861	628	628	400	1,028	1,028	19.4
2021	880	628	628	400	1,028	1,028	16.8
2022	897	628	628	400	1,028	1,028	14.6

* Completion time of HVDC#2 (200MW x 2pole): 6 months delay from June of 2011 → December of 2011 because of civil appeals.

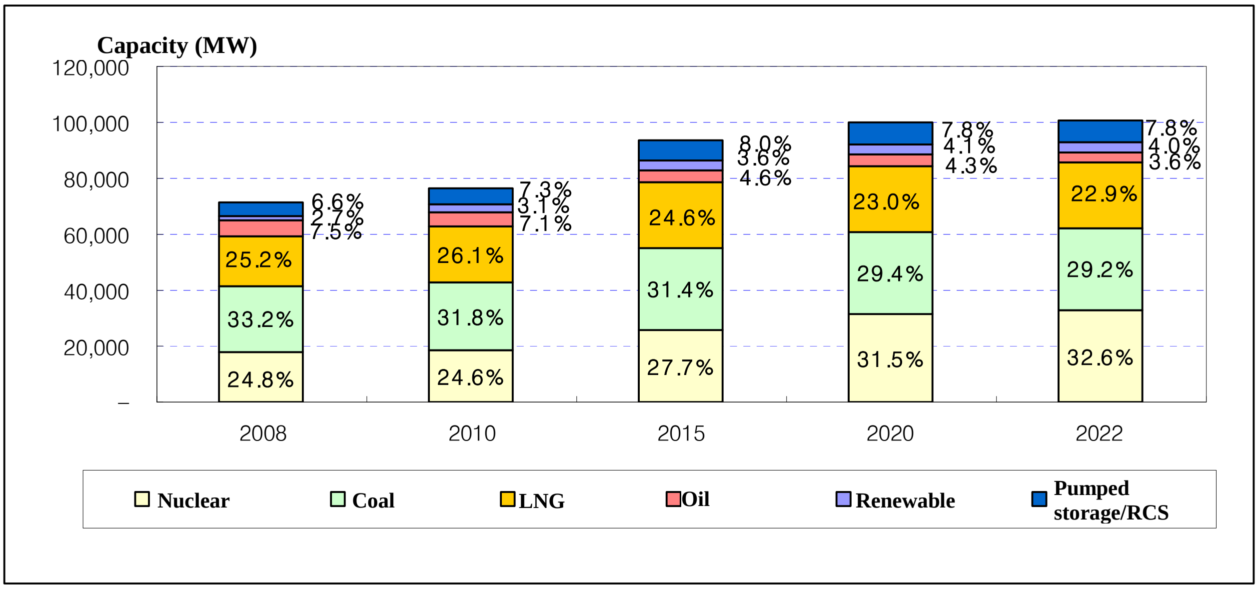
3. Generating Capacity Mix Outlook by Fuel Type

☐ The percentage of nuclear capacity is expected to increase by 7.8%, whereas that of Coal and LNG are expected to decrease.

Table 5.5 Generating Capacity Mix Outlook

(unit: MW, %)

Classification		Nuclear	Coal	LNG	Oil	Renewable	Pumped /RCS	Total
2008	4th	17,716	23,705	17,969	5,340	1,900	4,734	71,364
		24.8	33.2	25.2	7.5	2.7	6.6	100.0
2010	3rd	18,716	24,205	20,386	4,820	1,766	6,102	75,995
		24.6	31.9	26.8	6.3	2.4	8.0	100.1
	4th	18,716	24,205	19,899	5,383	2,365	5,568	76,136
		24.6	31.8	26.1	7.1	3.1	7.3	100.0
2015	3rd	25,916	26,420	22,898	2,365	2,198	6,991	86,788
		29.9	30.4	26.4	2.7	2.5	8.1	100.0
	4th	25,916	29,420	23,062	4,291	3,384	7,495	93,568
		27.7	31.4	24.6	4.6	3.6	8.0	100.0
2020	3rd	27,316	26,420	22,898	2,325	2,198	6,991	88,148
		31.0	30.0	26.0	2.6	2.5	7.9	100.0
	4th	31,516	29,420	23,062	4,291	4,060	7,842	100,191
		31.5	29.4	23.0	4.3	4.1	7.8	100.0
2022	4th	32,916	29,420	23,062	3,591	4,060	7,842	100,891
		32.6	29.2	22.9	3.6	4.0	7.8	100.0



* Coal: Anthracite + Bituminous

4. Generating Capacity Mix Outlook by Fuel Type

☐ As the percentage of nuclear capacity increases, the percentage of nuclear generation is expected to increase by more than 12%.

Table 5.6 Generation outlook

(unit: GWh, %)

Year	Nuclear	Coal	LNG	Oil	Renewable	Pumped storage /RCS	Total
2007 (actual)	142,937	154,674	78,427	18,228	4,313	4,546	403,125
	(35.5)	(38.4)	(19.5)	(4.5)	(1.1)	(1.1)	(100.0)
2010	145,070	190,089	91,192	10,465	11,943	15,132	463,891
	(31.3)	(41.0)	(19.7)	(2.3)	(2.6)	(3.3)	(100.0)
2015	199,726	206,482	66,577	934	20,942	23,206	517,867
	(38.6)	(39.9)	(12.9)	(0.2)	(4.0)	(4.5)	(100.0)
2020	249,848	206,837	34,592	914	25,844	27,859	545,894
	(45.8)	(37.9)	(6.3)	(0.2)	(4.7)	(5.1)	(100.0)
2022	265,180	198,822	34,132	887	25,844	28,432	553,297
	(47.9)	(35.9)	(6.2)	(0.2)	(4.7)	(5.1)	(100.0)

* Coal: Anthracite + Bituminous

5. Investment Cost Outlook

☐ Total of 37 trillion won is expected to be invested in generation facilities during the period 2009 ~ 2022.

Table 5.7 Investment Cost Outlook

(unit: 100 million)

Year	2009~2012	2013~2017	2018~2022	Total
Nuclear	112,149	103,278	46,728	262,155
Coal	15,650	41,437	-	57,087
Oil	-	-	-	-
LNG	43,801	-	-	43,801
Pumped Storage	5,290	-	-	5,290
Total	176,890	144,715	46,728	368,333

* Basis of price: Fixed price as of January 2008, excluding investment in renewables/RCS

VI. Transmission Expansion Plan

1. Long-term Transmission System Expansion Policy
2. Direction and Planning of the Implementation of Transmission Expansion

1. Long-term Transmission System Expansion Policy

A. Direction

□ Role of network systems classified by voltage level

- 765kV: delivers electricity from the large scale generation complex to load congested areas
- 345kV: builds inter-regional network or a bulk power source in city areas
- 154kV: builds the intercity network within the 345kV-supplied areas or works as the supply source of electricity distribution
- 66kV: construction of any new line shall be minimized with flexibility

□ Security of adequate network reliability

- Prepare for the locating of transmission lines and substations in advance and expand the transmission facilities at a suitable time
- Strengthen the linkage between the generating facilities construction plans and transmission facilities construction plans as well as the stability of power systems in the metropolitan areas and Jeju Island

□ Harmony of supply reliability and economical efficiency

- Minimize the Transmission and Distribution (T&D) loss and congestion costs to promote the efficiency of investment in transmission facilities
- Minimize power supply interruption in case of failure of the transmission system
- Improve the techniques for examining the economic value of the transmission system and introduce supply reliability evaluation techniques

□ Improving the stability of the transmission system

- Enhance the stability of a large scale transmission system
  : Introduce new technologies such as the flexible AC transmission system (FACTS)
- Minimize fault current
  : upgrade rated short circuit breaking circuit, installation of serial reactors, bus split, and transmission lines off
- Balance the reactive power supply and demand
  : Install power condensers, shunt reactors and static var compensators, deploy distributed generations, and the transmission lines can be switched off under light load conditions load, etc

B. Criteria for Transmission System Expansion

☐ Reliability Limit in Contingencies

Table 6.1 Reliability Limit in Contingencies

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

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

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

□ Power plant interconnection to the power system

○ Interruption principle: based on 『Provision for transmission facilities use 』

○ Criteria for power plant interconnection to the power system

- 500MW ~ 1,000MW: 345kV or 154kV
- over 1,000MW: over 345kV

□ Criteria for the construction of a new transmission system

○ Standard for reinforcing 765kV transmission

- 765kV shall be installed in case the transmission efficiency is more than that of 345kV.
- 765kV shall be expanded to maintain its capability considering only n-1 contingency.

○ Standard for reinforcing 345kV transmission

- 345kV shall be installed if a large increase in demand is expected due to the construction of a large-scale industrial complex or new city, and generation restriction or transmission congestion occur.
- In principle, construction of new overhead lines is 2 lines (1 route).
- Subtransmission system considers route failure, while single system and underground system consider n-1 contingency.

○ Standard for reinforcing 154kV transmission

- 154kV shall be installed if an over-load occurs at existing substations and demand increases due to the development of an industrial complex or new city.
- The regional network supplied by a 345kV substation is configured by a 154kV self-loop system.
- 154kV shall form a multi-system (about 800MW load supply) itself for a 345kV unit.
- Main lines such as the regional network supplied by a 345 kV substation will take into account route failures, while the other lines and underground lines are expanded taking into consideration the n-1 contingency.

□ Criteria for expanding substation

○ Extra high voltage substations

- In principle, the final size of extra high voltage transformers is 4 Bank and the number of initial Bank is decided considering load supply and economic value.

- 765kV substation shall be installed in case the transmission requirement is more than 345kV.

- 345kV substation shall be installed in case there is a region which is required to install additionally to the existing substation with 3 Banks, there is a need to improve power system efficiency such as transient stability, and there is more advantage to construct 345kV substation than 154kV in some areas such as a large-scale industrial complex and a new city development project.

- Transformers shall be extended in case 1 bank fails and the other bank exceeds the supply capacity.

○ 154kV substations

- In principle, the size of 154kV transformers is 4 Bank and the number of initial Bank is 2 Bank or 3 Bank at most. (Transformer #4 is installed for future uncertainties such as sudden load increase or the construction delay of a new substation)

- 154kV substations shall be installed in case an over-load occurs at existing substations and demand increases due to the development of an industrial complex or a new city.

- 154kV transformers shall be extended in case 1 Bank fails and the other bank exceeds the supply capacity. (Demand disconnection amount is considered in the area that is easy to switch the load from one distribution line to the other.)

2. Transmission Expansion Plan and direction

A. Transmission System Expansion

☐ Transmission

- Total length of transmission lines: 1.34 times longer in 2022 compared to 2007
- Share of underground line: 8.6% (2007) → 12.3% (2022)

Table 6.2 Transmission Expansion Outlook

(unit: C-km)

Voltage		2007 (actual)		2012		2017		2022	
765kV	Overhead	755	755 (3%)	1,004	1,004 (3%)	1,004	1,004 (3%)	1,004	1,004 (3%)
345kV	Overhead	8,063	8,284 (28%)	9,289	9,585 (27%)	9,556	9,988 (27%)	9,566	9,998 (26%)
	Underground	221		296		432		432	
154kV	Overhead	17,656	19,917 (69%)	20,989	24,401 (70%)	22,399	26,336 (70%)	23,391	27,715 (71%)
	Underground	2,261		3,412		3,937		4,324	
Total	Overhead	26,474	28,956	31,282	34,990	32,959	37,328	33,961	38,717
	Underground	2,482		3,708		4,369		4,756	

☐ Number of substations

- Total number of substations: 1.37 times more in 2022 compared to 2007 (from 677 to 926 substations)

Table 6.3 Substation Expansion Outlook

(unit: stations)

Voltage	2007(actual)	2012	2017	2022
765kV	5	7	8	8
345kV	81	98	107	107
154kV	591	699	768	811
Total	677	804	883	926

☐ Capacity of substations

- Capacity of substation: 1.4 times larger in 2022 compared to 2007
- Share of extra high voltage substation in 2022: 52.4%

Table 6.4 Substation Capacity Outlook

(unit: MVA)

Classification		2005 (actual)	2010	2015	2020
Capacity (MVA)	765kV	23,114	29,114	31,114	31,114
	345kV	95,278	116,784	132,287	135,788
	154kV	109,268	133,968	145,808	151,668
	Total	227,660	279,866	309,209	318,570

B. Direction and Planning of the Implementation of Transmission Expansion

☐ Flexible implementation of the Plan

- ○ The BPE specifies only the primary criteria in the transmission and substation expansion plan. Therefore, KEPCO establishes a detailed long-term transmission and substation expansion plan based on the BPE and obtains approval from the government as a transmission operator. KEPCO is set to implement the confirmed plan in 3 months.

- ○ The confirmed transmission and substation plan can be modified or added to by the transmission operator only under the following situations:

  - In case of changes in power plant construction plans or in demand

  - In case of unavoidable circumstances such as control of the fault current or system voltage level, etc.

  - In case inevitable modification is required for the ongoing project

- ○ KEPCO is entitled to invoke a special law called Power Resources Development Law after establishing a self review committee to acquire land for transmission facilities unless KEPCO and the land owner enter into an agreement for the land.

- ○ KEPCO promotes the details of the plan according to Power Resources Development Law procedures in consideration of the cost required, so that KEPCO can acquire the right of existing land for transmission lines.

☐ Improvement of service reliability for large customers and load concentrated areas.

- ○ Expansion of the service limit for bilateral customers (154kV)

  - The service limit for bilateral contract customers (154kV) has been raised from 300MW to 500MW (Electricity Supply Agreement amended on August 1, 2007).
  - Contribution to national economy and improvement of customer satisfaction by relieving customer burden.

- ○ Construction of 154kV hub substation

  - 154kV hub substations shall be constructed in order to promote service reliability in large industrial complexes, new cities, and other load concentrated areas.
  - Supply capacity shall be increased. (Final size of transformers: 4Bank → 8Bank)

□ Efficient promotion of transmission access and reinforcement work.

○ Formulate effective system connection measures for Renewable Expansion Plans.

○ To secure electricity supply in Community Energy System (CES) areas, select suppliers in newly developed areas at the early stages to prevent double investment in electricity supply facilities.

- Although an increase in Community Energy System suppliers and Regional Cogeneration System (RCS) suppliers entering the market is expected, it is not compulsory for them to carry out the construction plan. Therefore, there is a need to manage small-scale supply resources through government policy.

VII. Direction of Future Policy

1. Preparation for future energy environment change

□ Forecast and analysis of Future energy uncertainty

○ Research the electricity supply and demand policies of other countries and investigate their implication for Korean electricity policy.

○ Study Energy System Models such as MARKAL and TIMES for energy plan optimization and pursue related training.

○ Create a scenario for electricity supply and demand by analyzing future energy uncertainties such as fuel balance, price and environmental regulations.

□ Create security measures for short and mid-term electricity supply and demand

○ Create measures for stable electricity balance corresponding to short- and mid-term (2009 ~ 2011) supply shortages.

- Check for the performance rate and construction milestones of short and mid-term facilities.

- Take measures to secure electricity supply, such as reducing the construction period and delaying the retirement of construction facilities during the same period.

- Strengthen the DSM in summer, such as direct load reduction for emergencies and expansion of direct load control amount.

○ Reforecast GDP and electricity demand taking into account the recent economic slump.

□ Improvement of the principle and process of the BPE.

○ Review the methodology and principle of the BPE.

- Re-establish LOLP (supply reliability criteria) taking into consideration the changes to the power system.

- Verify the problems with existing regional planning and review their adequacy.

○ Introduce the concept of risk management of the BPE.

- Analyze the reasons for uncertainty, such as demand forecast and construction delay, and establish a probability index for it.

○ Address construction uncertainties and encourage the timely construction of high efficiency facilities.

- Improve the evaluation standard of Genco’s intents for construction to minimize supply uncertainties.

- Strengthen the support of business related to national R&D projects in order to improve the competitiveness of the electricity industry, such as localization of the facilities.

○ Establish the foundation of integrated evaluation for generation and transmission facilities, such as the development of a computation model for the minimization of total investment cost.

2. Developing Countermeasures against Low Carbon Green Growth

□ Establish adequate generation mix against environmental change

○ Expand non-fossil generation in order to reduce greenhouse gas emissions in the power sector.

- CO2 emission cost is reflected to reduce CO2 emissions in the power sector during economic analysis for each generation source.

○ Actively reflect new technology generation resources such as CCT and ocean energy which are proven by forecasting and promoting future environmental technology.

* CCT: Clean Coal Technology

○ Contribute to the expansion of renewable energy by reflecting the related facilities in the BPE in order to respond to the enforcement of the RPS system.

□ Strengthen the DSM policy to reduce electricity demand.

○ Promote the optimization of utilization for DSM resources taking into consideration the status of the electricity balance.

- Strengthening the DSM has a big effect on peak reduction compared to investment cost in order to correspond to the supply shortage in the mid-term.

- Actively respond to the Climatic Change Agreement by expanding high efficiency resources after the mid-term.

○ Promote business efficiency by improving the DSM evaluation system and providing proof of the performance.

○ Expand DSM based on market function.

- Expand the demand resource market which has been carried out by way of showing an example in 2008.

· Expand related infrastructure such as the project budget (Electric Power Industry Basis Fund) supplement for demand resource market expansion.

- Promote EERS projects in the mid- and long-term period.

○ Develop new programs to improve efficient energy use and expand R&D investment.

□ Study reasonable improvement of the electricity rate system

○ Gradually review the reorganization of the tariff system so that electricity demand side management can be realized through the rate system.

○ To rationalize demand for electricity supplied midnight at a below cost rate, gradually implementing the actualization of charges covering the industrial light load rate.

□ Strengthen DSM through an efficiency improvement system of energy use such as the Minimum Energy Performance Standard and the e-Standby program.

3. Expanding Infrastructure and Securing Transparency

□ Strengthen the competency of the BPE

○ Strengthen the competency of the general support institution (KPX) by acquiring and developing various analysis techniques and by fostering specialists.

○ Formulate systematic support measures such as supporting the fund for political study and human resource fostering business.

□ Secure the transparency and compatibility of the BPE

○ Promote the participation of experts from various fields in the working subcommittees (6 sectors) for the establishment of a BPE.

○ Ensure consistency in the other energy plans by establishing a BPE which takes into account the long-term supply and demand conditions of resources including gas and renewable energy.

○ Change the characteristics of plans flexibly and according to market conditions, as well as increasing the stabilized supply and expand the information provision functions by harmonizing market functions with planning functions.

4. Future Policy Studies

□ Study the improvement of the method for establishing the BPE

○ Study the adequate supply reliability criteria taking into consideration the VOLL of the generating system.

○ Study the adequate supply reliability criteria for establishing optimal transmission system expansion plans.

- It is required to re-establish the system connection requirement and reliability criteria taking into consideration system condition changes such as the large scalization of generating stations and operational uncertainty.

○ Introduce the advanced electricity system analysis model and formulate its method of application.

○ Develop a method to secure stable electricity demand and supply in metropolitan areas.

- It is required to derive the method to secure stable and economical electricity demand and supply in metropolitan areas taking into account the direction of the national energy policy such as the National Energy Basic Plan.

□ Study ways of improving the accuracy of demand forecast

○ Study the factors affecting the long-term electricity demand forecast

- Analyze the effect of the relative price by fuel on electricity demand and the ripple effect on electricity demand through a survey of electricity consumption behavior by industry.

○ Study ways of narrowing the demand forecast gap through the evaluation of DSM peak reduction

○ Corresponding to the recent uncertain demand forecast environment, such as oil prices and economic fluctuation, continuously improve the long-term demand forecast model and foster specialties.

□ Study ways of improving system technology and investment efficiency

○ Study ways of improving the method to calculate transmission tariff

- Calculate a reasonable rate by improving the method of tracing power flow used to calculate a transmission tariff and review the measures used to differentiate the transmission tariff by region.

○ Development of technology localizing direct flow connection facilities

- Study ways in which to divide the national power system in order to prevent against the consequences of failure in one area and pursue the localization of BTB (Back To Back) direct flow interconnection technology.

○ Improvement of the DB management system for the electricity facility plan

- Effective management of raw data for power system plans and analysis and the introduction of advanced systems for improving accuracy.

○ Introduction of an advanced computation model for system planning

- Introduce an advanced computation model required for the numerical evaluation of supply security and the economic optimality evaluation of facilities expansion plan.

[Appendix]

1. Electricity Demand Outlook
2. Demand Side Management
3. Generating Capacity Expansion and Retirement
4. Renewable Facilities Expansion Plan
5. RCS Facilities Expansion Plan
6. Electricity Supply and Demand in the Island Areas
7. Major Transmission Facilities Expansion Plan

1. Electricity Demand Outlook

A. Reference Demand

☐ national forecasts

Year	Electricity Sales		Peak Load					
			Before DSM		DSM Effect (MW)	After DSM		
	GWh	Increase Rate (%)	MW	Load Factor (%)		MW	Increase Rate (%)	Load Factor (%)
2007 (actual)	368,605	5.7	62,285		(5,460)	62,285	5.6	73.9
2008	389,745	5.7	62,794	77.4	(5,876)	62,794	0.8	77.2
2009	409,029	4.9	67,881	75.5	655(6,531)	67,226	7.1	75.7
2010	425,020	3.9	70,827	75.5	1,372(7,248)	69,455	3.3	76.1
2011	438,762	3.2	73,442	75.6	2,118(7,994)	71,324	2.7	76.5
2012	449,798	2.5	75,873	75.5	2,915(8,791)	72,958	2.3	76.7
2013	458,982	2.0	78,256	75.2	3,692(9,568)	74,564	2.2	76.6
2014	466,856	1.7	80,448	75.0	4,506(10,382)	75,942	1.8	76.4
2015	472,966	1.3	82,554	74.7	5,340(11,216)	77,214	1.7	76.2
2016	478,337	1.1	84,566	74.4	6,168(12,044)	78,398	1.5	75.9
2017	483,034	1.0	86,449	74.2	7,007(12,883)	79,442	1.3	75.6
2018	487,219	0.9	88,075	74.3	7,901(13,777)	80,174	0.9	75.7
2019	491,214	0.8	89,495	74.4	8,706(14,582)	80,789	0.8	75.7
2020	494,527	0.7	90,719	74.8	9,568(15,444)	81,151	0.4	75.9
2021	497,559	0.6	91,937	75.0	10,435(16,311)	81,502	0.4	76.0
2022	500,092	0.5	93,126	75.3	11,321(17,197)	81,805	0.4	76.1
‘08︶’22	-	2.1	2.7	-	-	-	1.8	-

※ 1. DSM effect refers to the net incremental value compared to the year 2008. The values in parenthesis refer to the cumulative total amounts.

2. Electricity Sales reflect the reduction by DSM, Peak Load for 2008 is an actual value.

☐ forecasts by area

[Metropolitan Area]

Year	Electricity Sales		Peak Load				
			Before DSM	DSM Effect (MW)	After DSM	
	GWh	Increase Rate (%)	MW		MW	Increase Rate (%)
2007 (actual)	140,516	5.0	24,327	(1,266)	24,327	2.3
2008	148,172	5.4	25,543	(1,376)	25,543	5.0
2009	155,556	5.0	26,760	179(1,555)	26,581	4.1
2010	162,766	4.6	27,923	378(1,753)	27,545	3.6
2011	169,841	4.3	28,987	591(1,967)	28,396	3.1
2012	175,982	3.6	29,981	829(2,205)	29,152	2.7
2013	181,137	2.9	30,969	1,125(2,501)	29,843	2.4
2014	185,282	2.3	31,921	1,393(2,768)	30,528	2.3
2015	188,214	1.6	32,833	1,670(3,046)	31,162	2.1
2016	190,924	1.4	33,660	1,953(3,328)	31,707	1.7
2017	193,523	1.4	34,447	2,241(3,616)	32,206	1.6
2018	195,671	1.1	35,147	2,623(3,999)	32,523	1.0
2019	197,233	0.8	35,728	2,920(4,296)	32,808	0.9
2020	198,696	0.7	36,309	3,234(4,609)	33,076	0.8
2021	199,979	0.6	36,855	3,550(4,925)	33,306	0.7
2022	201,204	0.6	37,371	3,874(5,250)	33,497	0.6
‘08-’22 (%)		2.4	2.9			2.2

[Jeju Island]

Year	Electricity Sales		Peak Load				
			Before DSM	DSM Effect (MW)	After DSM	
	GWh	Increase Rate (%)	MW		MW	Increase Rate (%)
2007 (actual)	3,038	5.7	552	(13)	552	5.6
2008	3,201	5.4	553	(15)	553	0.2
2009	3,352	4.7	607	3(18)	604	9.2
2010	3,493	4.2	637	5(21)	631	4.5
2011	3,617	3.5	665	9(24)	656	4.0
2012	3,728	3.1	694	12(27)	682	4.0
2013	3,825	2.6	722	16(31)	706	3.5
2014	3,899	1.9	751	20(35)	731	3.5
2015	3,954	1.4	778	24(39)	754	3.1
2016	3,998	1.1	805	29(44)	776	2.9
2017	4,027	0.7	833	33(48)	799	3.0
2018	4,048	0.5	859	38(53)	821	2.8
2019	4,048	0.0	885	43(58)	843	2.7
2020	4,038	-0.2	909	48(63)	861	2.1
2021	4,033	-0.1	932	53(68)	880	2.2
2022	4,021	-0.3	955	58(73)	897	1.9
‘08︶’22 (%)		1.9	3.7			3.3

B. Electricity Sales by Use

Year	Residential		Commercial		Industrial	
	(GWh)	Increase Rate (%)	(GWh)	Increase Rate (%)	(GWh)	Increase Rate (%)
2007 (actual)	69,751		112,603		186,252	
2008	73,472	5.3	119,422	6.1	196,851	5.7
2009	77,593	5.6	125,194	4.8	206,242	4.8
2010	80,891	4.3	130,897	4.6	213,232	3.4
2011	83,439	3.2	136,416	4.2	218,907	2.7
2012	85,314	2.2	141,630	3.8	222,854	1.8
2013	87,001	2.0	146,566	3.5	225,415	1.1
2014	88,640	1.9	151,054	3.1	227,162	0.8
2015	90,225	1.8	155,234	2.8	227,507	0.2
2016	91,717	1.7	159,335	2.6	227,285	-0.1
2017	93,171	1.6	163,141	2.4	226,721	-0.2
2018	94,530	1.5	166,714	2.2	225,975	-0.3
2019	95,822	1.4	170,242	2.1	225,149	-0.4
2020	97,051	1.3	173,394	1.9	224,081	-0.5
2021	98,170	1.2	176,469	1.8	222,920	-0.5
2022	99,281	1.1	179,335	1.6	221,476	-0.6
'08～'22	2.4		3.2		1.2	

2. Demand Side Management

A. Demand Side Management Targets by Year(cumulative total)

[unit : MW]

Year	Load Control								Efficiency Improvement							Total
	Summer Vacation	Voluntary Conserva-tion	Demand Response	Accumu-lated Air Conditi-oning	Gas Air Conditiio ning	Remote Air Conditio-ner	Peak Load Control	**Sub total**	Lighting	Inverter	Motor	Trans-former Pump	New	Minimum Energy Performance Standard /Standby Power	**Sub total**	
2007 (actual)	1,656	771	-	461	1,414	78	22	4,402	813	225	19	1	-	-	1,058	5,460
2008	1,461	887	137	521	1,485	104	59	4,654	863	298	28	4	29	3	1,222	5,876
2009	1,510	928	246	591	1,559	136	107	5,077	927	373	44	10	84	16	1,454	6,531 (655)
2010	1,536	1,059	287	666	1,637	170	158	5,513	1,005	450	64	19	156	41	1,735	7,248 (1,372)
2011	1,555	1,160	325	746	1,721	206	213	5,926	1,095	529	89	31	246	78	2,068	7,994 (2,118)
2012	1,561	1,264	358	830	1,808	244	270	6,335	1,200	609	119	46	349	133	2,456	8,791 (2,915)
2013	1,566	1,297	399	908	1,890	283	317	6,660	1,320	687	154	64	478	205	2,908	9,568 (3,692)
2014	1,569	1,360	417	980	1,959	323	365	6,973	1,454	763	196	88	618	290	3,409	10,382 (4,506)
2015	1,572	1,404	435	1,042	2,016	364	414	7,247	1,604	837	251	121	770	386	3,969	11,216 (5,340)
2016	1,575	1,417	431	1,105	2,075	406	464	7,473	1,769	909	313	163	925	492	4,571	12,044 (6,168)
2017	1,514	1,442	448	1,160	2,126	449	515	7,654	1,949	979	383	213	1,096	609	5,229	12,883 (7,007)
2018	1,454	1,452	508	1,212	2,169	492	568	7,855	2,144	1,047	461	275	1,270	725	5,922	13,777 (7,901)
2019	1,365	1,463	484	1,256	2,205	536	620	7,929	2,354	1,113	547	350	1,446	843	6,653	14,582 (8,706)
2020	1,203	1,508	500	1,301	2,240	581	674	8,007	2,589	1,178	642	442	1,625	961	7,437	15,444 (9,568)
2021	1,134	1,513	456	1,346	2,276	626	728	8,079	2,829	1,236	742	540	1,806	1,079	8,232	16,311 (10,435)
2022	1,042	1,549	378	1,392	2,313	672	783	8,129	3,089	1,291	852	648	1,990	1,198	9,068	17,197 (11,321)

※ 1. The values for 2007 are actual values; ditto for the values for the summer vacation and voluntary conservation. The values for other programs are based on the total amount of supply.

2. Figures in parenthesis denote the net increments compared to 2007.

3. Annual targets after 2008

◦ Summer Vacation, Voluntary Conservation, Demand Response : Targets for the year

◦ Other programs : 2007 Actual + Net increment total for the year

B. Electricity Sales Reduction by Year

[unit : GWh]

Year	Electricity Sales Reduction													
	Lighting		Inverter		Motor		Transformer /Pump		New		Minimum Energy Performance Standard /Standby Power		**Total**	
	annual	cumulative total	annual	cumulative total	Annual	cumulative total	annual	cumulative total	annual	cumulative total	annual	cumulative total	annual	cumulative total
2007 (actual)	256	1,613	461	1,555	36	135	3	5	-	-	-	-	**756**	**3,308**
2008	253	253	441	441	54	54	29	29	147	147	77	77	**1,001**	**1,001**
2009	324	578	453	893	97	151	58	87	279	426	345	422	**1,555**	**2,557**
2010	395	973	465	1,358	121	272	87	175	365	790	802	1,224	**2,235**	**4,791**
2011	456	1,429	477	1,834	151	422	117	291	456	1,246	935	2,159	**2,591**	**7,383**
2012	532	1,961	483	2,317	181	603	146	437	522	1,768	1,304	3,463	**3,167**	**10,550**
2013	608	2,569	471	2,788	211	815	175	612	654	2,422	1,515	4,978	**3,633**	**14,183**
2014	679	3,248	459	3,247	253	1,068	233	845	709	3,131	1,683	6,660	**4,016**	**18,199**
2015	760	4,008	447	3,693	332	1,400	321	1,166	770	3,901	1,829	8,489	**4,458**	**22,657**
2016	836	4,844	434	4,128	374	1,774	408	1,574	785	4,687	1,976	10,465	**4,814**	**27,471**
2017	912	5,756	422	4,550	422	2,197	486	2,059	866	5,553	2,125	12,590	**5,234**	**32,705**
2018	988	6,744	410	4,960	471	2,667	602	2,662	882	6,435	2,138	14,728	**5,491**	**38,196**
2019	1,064	7,808	398	5,359	519	3,186	729	3,390	892	7,326	2,150	16,878	**5,752**	**43,947**
2020	1,191	8,998	392	5,751	573	3,759	894	4,284	907	8,233	2,163	19,040	**6,119**	**50,067**
2021	1,216	10,214	350	6,101	603	4,363	952	5,236	917	9,150	2,175	21,216	**6,214**	**56,280**
2022	1,317	11,532	332	6,433	664	5,027	1,049	6,285	932	10,083	2,188	23,403	**6,482**	**62,762**

C. Investment Cost of DSM

[unit : KRW 100 million]

Year	Load Control							Efficiency Improvement						Total
	Summer Vacation	Voluntary Conserva-tion	Demand Response	Accumulated Air Conditioning	Remote Air Conditio-ner	Peak Load Control	**Sub total**	Lighting	Inverter	Motor	Transfor-mer Pump	New	**Sub total**	
2008	273	157	75	227	70	17	819	95	210	20	8	58	391	1,210
2009	269	162	96	259	106	21	913	128	150	57	20	110	465	1,378
2010	273	185	109	278	112	22	979	146	144	67	31	144	532	1,511
2011	277	203	121	296	119	24	1,040	164	144	79	41	180	608	1,648
2012	278	221	131	311	125	25	1,091	186	140	88	51	206	671	1,762
2013	279	227	144	289	129	20	1,088	204	127	96	58	258	743	1,831
2014	279	238	149	266	132	21	1,085	218	120	111	75	280	804	1,889
2015	280	246	155	229	135	21	1,066	233	113	141	100	304	891	1,957
2016	280	248	154	233	139	22	1,076	248	106	154	122	310	940	2,016
2017	269	252	159	204	142	22	1,048	270	100	168	141	342	1,021	2,069
2018	259	254	177	192	142	23	1,047	283	94	180	168	348	1,073	2,120
2019	243	256	170	163	145	22	999	294	89	195	196	352	1,126	2,125
2020	214	264	175	167	149	23	992	317	86	211	231	358	1,203	2,195
2021	202	265	161	167	149	23	967	312	75	218	236	362	1,203	2,170
2022	185	271	137	170	152	24	939	338	72	240	256	368	1,274	2,213
Total	3,860	3,449	2,113	3,451	1,946	330	15,149	3,436	1,770	2,025	1,734	3,980	12,945	28,094

※ Investment costs denote the subsidies for the year by program.

3. Generating Capacity Expansion and Retirement

A. Generating Capacity Expansion by year

☐ Nationwide

Year	Month	Plant Name(company)	Utility					Remarks
			Capacity (MW)	Total Capacity(MW)		Peak Load (MW)	Installed Reserve Margin (%)	
				Summer	Winter			
2007		Existing Capacity		65,874	67,246	62,285	5.8	
2008				69,207	71,364	62,794	10.2	
	3	Bugok C/C#2(GSEPS)	533					
	6	Boryeong thermal#7(KOMIPO)	500					
	6	Yeongheung thermal#3(KOSEP)	870					
	6	Wind Power	0.5					
	6	Solar Power	52					
	6	Other Renewables	5.9					
	11	Yeocheon CHP add (Gumho petrochemical)	79.2					
	11	Daegu RCS(KDHC)	27.9					
	3	Yeongheung thermal#4(KOSEP)	870					
	12	Boryeong thermal#8(KOMIPO)	500					
	12	Hadong thermal#7(KOSPO)	500					
	12	Yangju Goeup CHP(Daelim)	6.3					
	12	Island Area Int.(KEPCO) (Heuksando, Jodo etc)	8.6					
	12	Ret-Island Area Int.(KEPCO)	-2.7					
	12	Hydro Power	2.3					
	12	Wind Power	39.9					
	12	Tidal Power(Uldokmok)	0.3					
	12	Solar Power	120.8					
	12	Other Renewables	4.7					
2009				72,118	72,543	67,226	7.3	
	1	Tangjeong-2 industrial estate CHP (Samsung Everland)	2.2					
	1	Ret-Jeju thermal#1(KOMIPO)	-10					
	4	Seoul southeast distribution center CHP(KDHC)	9.6					
	6	Incheon C/C#2(KOMIPO)	508.9					
	6	Jeju int.#2(KOMIPO)	40					
	6	Hadong therma#8(KOSPO)	500					
	6	Ret-Incheon thermal#4(KOMIPO)	-325					

Year	Month	Plant Name(company)	Utility					Remarks
			Capacity (MW)	Total Capacity(MW)		Peak Load (MW)	Installed Reserve Margin (%)	
				Summer	Winter			
	6	Wind Power	1.9					
	6	Solar Power	18.7					
	6	Other Renewables	7.6					
	9	Ret-Incheon thermal#3(KOMIPO)	-325					
	10	GwangjuSuwanHanam2section(Gyeongnam)	32.7					
	10	Cheonan Chungsu CHP(JB City Gas)	7.6					
	10	Gwangmyeong Station CHP (Samchully)	13.8					
	10	Woomyun2 CHP(YuseongTNS)	2.4					
	11	Songdo CHP(Incheon Total Energy)	123					
	11	Paju CHP(KDHC)	309					
	11	Pangyo CHP(KDHC)	87.7					
	12	Iksan industrial estate 2 CHP (Sanggong Energy)	0.9					
	12	Sinjeong 3 section(SH)	1.8					
	12	Island Area Int.(KEPCO) (Jangjado, Jawoldo)	8.6					
	12	Ret-Island Area Int.(KEPCO)	-2.8					
	12	Wind Power	63.6					
	12	Tidal Power(Lake Sihwa)	76.2					
	12	Solar Power	7.1					
	12	Other Renewables	18					
2010				73,552	76,136	69,455	5.9	
	2	Yeosu industrial estate CHP (Yeosu CHP Genco)	75					
	3	Sangam 2 section CHP(KDHC)	1.8					
	4	Kunjang National industrial estate (Hanhwa construction complany)	72					
	4	Kunsan industrial estate(Kunjang Energy)	52					
	5	Kunsan C/C#1(WP)	718					
	6	Solar Power	2.9					
	6	Other Renewables	87.7					
	11	Yeongwol C/C(KOSPO)	853					
	12	Posco#5(Posco Power)	500					
	12	Singori#1(KHNP)	1,000					
	12	Seoul Kangil CES(Daehan city gas)	10					
	12	Namyangju Byeollae CHP (Kyungnam company)	32.1					
	12	Island Area Int.(KEPCO) (Ulneungdo, Chujado)	16.2					
	12	Ret-Island Area Int.(KEPCO)	-8.5					
	12	Wind Power	24.1					

Year	Month	Plant Name(company)	Utility					Remarks
			Capacity (MW)	Total Capacity(MW)		Peak Load (MW)	Installed Reserve Margin (%)	
				Summer	Winter			
	12	Solar Power	4.2					
	12	Other Renewables	153.2					
2011				77,209	80,015	71,324	8.3	
	1	Ret-Yeongnam thermal#1,2(KOSPO)	-400					
	1	Seoul Gajaeul CHP(KDHC)	2.7					
	1	Asan Baebang CHP(KNHC)	35					
	1	Ret-Jeju thermal GT#3(KOMIPO)	-55					
	3	Lake Suwon Maesil sectioin CHP(Samchully)	21					
	6	Posco#6(Posco Power)	500					
	6	Solar Power	0.7					
	6	Other Renewables	65.4					
	6	Goyang Culture Complex CHP(Seoul city gas)	14.9					
	6	Cheongpyeong Hydro add.(KHNP)	60					
	6	Godeok C/C(DOP service)	800					
	6	Daejeon Seo Nambu CHP(Jugong)	28.4					
	9	Yecheon PS#1(KOSEP)	400					
	9	Pyeongtaek Sosabul section CHP(Dusan construction)	13.6					
	10	Songdo C/C#1(Songdo Power)	500					
	10	Yangsan Sasong section CHP(Kyungnam Energy)	29.4					
	10	Goyang Samsong Section CHP(KDHC)	30					
	10	Suwon Gwanggyo CHP(KDHC)	84.6					
	11	Daegu Innovation City CHP (Daegu City Gas)	136.2					
	11	Jeonggwan CHP(Jeonggwan Energy)	30.1					
	12	Bugok C/C#3(GSEPS)	500					
	12	Andong C/C(KOSPO)	(900)					
	12	Uijeongbu Millak 2 Section CHP(Hanjin SC)	13.4					
	12	Gwangju Jeonnam Innovation City CHP(KDHC)	12					
	12	Hwasung Hyangnam 2 Section CHP(Samchully)	18.2					
	12	Ret-Seoul thermal#4,5(KOMIPO)	-387.5					
	12	Singori#2(KHNP)	1,000					
	12	Yecheon PS#2(KOSEP)	400					
	12	Island Area Int.(Jodo, KEPCO)	1					
	12	Solar Power	0.2					
	12	Other Renewables	24.4					
2012				81,500	82,482	72,958	11.7	
	1	Ret-Nam Jeju Int.#1-4(KOSPO)	-40					
	2	Songdo C/C#2(Songdo Power)	500					

Year	Month	Plant Name(company)	Utility					Remarks
			Capacity (MW)	Total Capacity(MW)		Peak Load (MW)	Installed Reserve Margin(%)	
				Summer	Winter			
	3	Sinwolseong#1(KHNP)	1,000					
	6	Seoul C/C#1(KOMIPO)	(500)					
	6	Ulsan Ujeong Section CHP (Samsung Everland)	15.8					
	6	Wind Power	9.2					
	6	Solar Power	0.2					
	7	Bucheon C/C#2(GS Power)	550					
	8	Incheon Unbok Leisure Complex CHP (Sambu)	23.1					
	9	Daejeon Hakha Section CHP (Chungnam City Gas)	8.9					
	10	Gangwon Wonju Innovation City CHP (KOMIPO)	18.9					
	12	Seoul C/C#2(KOMIPO)	(500)					
	12	Songpa Geoyeo Section CHP (SKE&S)	136.8					
	12	Ret-Incheon thermal#1,2(KOMIPO)	-500					
	12	Island Area Int.(KEPCO) (baengnyeongdo etc)	7					
	12	Ret-Island Area Int.(KEPCO)	-5					
	12	Solar Power	0.001					
	12	Incheon C/C#3(KOMIPO)	700					
	12	Yangju Okjung Section(Hanjin SC)	41.9					
2013				83,439	85,530	74,564	11.9	
	1	Ret-Yeongdong#1(KOSEP)	-125					
	1	Sinwolseong#2(KHNP)	1,000					
	6	Other Renewables	81.8					
	6	Solar Power	0.9					
	7	Pocheon C/C#1(Daelim)	(750)					
	9	Singori#3(KHNP)	1,400					
	10	Sihwa CHP(KG Energy)	10.5					
	11	Happiness CItty CHP (KDHC, KOMIPO, KOSPO)	309					
	12	Sin Ulsan C/C(KEWESPO)	(700)					
	12	Other Renewables (IncheonIGCC)	300					
	12	Gyeongnam Jinju Innovation Section CHP (Moorim Powertech)	25.6					
	12	Osan Segyo 2 Section CHP(Daesung Ind)	45.6					
2014				85,400	88,848	75,942	12.5	
	1	Ret-Unsan thermal#1 ~ 3(KEWESPO)	-600					
	1	Ret-Seocheon thermal#1,2(KOMIPO)	-400					
	3	Ansan C/C#1(Posco E&C)	(750)					
	6	Yeongheung thermal#5(KOSEP)	870					
	9	Singori#4(KHNP)	1,400					

Year	Month	Plant Name(company)	Utility					Remarks
			Capacity (㎿)	Total Capacity(㎿)		Peak Load (㎿)	Installed Reserve Margin	
				Summer	Winter			
	10	Siheung Jangmyeon Mokgam Section CHP(GS Holdings)	21.6					
	12	Dangjin thermal#9(KEWESPO)	1,000					
	12	Yeongheung thermal#6(KOSEP)	870					
	12	Tidal Power(Garolim)	156					
2015				88,848	93,568	77,214	15.1	
	12	Samcheok thermal#1(KOSPO)	1,000					
	12	Samcheok thermal#2(KOSPO)	1,000					
	12	Dangjin thermal#10(KEWESPO)	1,000					
	12	Sinuljin#1(KHNP)	1,400					
	12	Solar Power	4					
	12	Tidal Power(Wando)	15.9					
	12	Other Renewables (Taean IGCC)	300					
2016				93,812	95,250	78,398	19.7	
	6	Other Renewables	0.3					
	6	Tidal Power(Ganghwa)	243.9					
	12	Sinuljin#2(KHNP)	1,400					
	12	Solar Power	0.2					
	12	Gunjang Industrial estate CHP (JB City Gas)	37.5					
2017				95,682	95,682	79,442	20.4	
	6	Tidal Power(Incheon Bay)	432					
	12	Solar Power	0.5					
2018				95,682	97,082	80,174	19.3	
	6	Solar Power	0.1					
	12	Singori#5(KHNP)	1,400					
2019				97,082	98,791	80,789	20.2	
	11	Happiness City CHP (KDHC,KOMIPO,KOSPO)	309					
	12	Singori#6(KHNP)	1,400					
2020				100,191	100,191	81,151	23.5	
	6	Sinuljin#3(KHNP)	1,400					
2021				100,891	100,891	81,502	23.8	
	1	Ret-Pyeongtaek thermal#1,2(WP)	-700					
	6	Sinuljin#4(KHNP)	1,400					
2022				100,891	100,891	81,805	23.3	

※ 1. Installed Reserve Margin is based on summer(July)

2. The Distributed Generation(Renewables/RCS) capacity is derived by excluding the capacity with uncertain level of contribution to the peak time. In addition, the capacity for Wind PP and Solar PP licensed by central government/local government is derived by excluding the capacity with uncertain level of contribution to the completion time.
(Wind Power : 79.0%, Solar Power : 39.8%)

☐ Metropolitan Area

Year	Month	Plant Name(company)	Utility					Remarks
			Capacity (MW)	Total Capacity(MW)		Peak Load (MW)	Installed Reserve Margin(%)	
				Summer	Winter			
2007		Existing Capacity		27,529	27,865	24,327	13.2	
2008				28,738	29,616	25,543	12.5	
	1	ATC increments	-					
	6	Other Renewables	2.2					
	6	Solar Power	0.2					
	6	Yeongheung thermal#3(KOSEP)	870					
	12	Yeongheung thermal#4(KOSEP)	870					
	12	Other Renewables	2.1					
	12	Solar Power	1.5					
	12	Wind Power	0.7					
	12	Yangju Goeup CHP(Daelim)	6.3					
2009				30,111	30,407	26,581	13.3	
	1	ATC increments	300					
	4	Seoul southeast distribution center CHP(KDHC)	9.6					
	6	Incheon C/C#2(KOMIPO)	508.9					
	6	Ret-Incheon thermal#4(KOMIPO)	-325					
	6	Solar Power	0.6					
	6	Other Renewables	0.4					
	9	Ret-Incheon thermal#3(KOMIPO)	-325					
	10	Gwangmyeong Station CHP (Samchully)	13.8					
	10	Woomyun2 CHP(YuseongTNS)	2.4					
	11	Songdo CHP(Incheon Total Energy)	123					
	11	Paju CHP(KDHC)	309					
	11	Pangyo CHP(KDHC)	87.7					
	12	Sinjeong 3 section(SH)	1.8					
	12	Tidal Power(Lake Sihwa)	76.2					
	12	Solar Power	0.5					
	12	Other Renewables	7					
2010				30,414	30,956	27,545	10.4	
	1	ATC increments	-					
	3	Sangam 2 section CHP(KDHC)	1.8					
	6	Other Renewables	4.8					
	6	Solar Power	0.2					
	12	Posco #5(Posco Power)	500					

Year	Month	Plant Name(company)	Utility					Remarks
			Capacity (MW)	Total Capacity(MW)		Peak Load (MW)	Installed Reserve Margin (%)	
				Summer	Winter			
	12	Namyangju Byeollae CHP	32.1					
	12	Seoul Kangil CES(Daehan city gas)	10					
2011				33,485	33,773	28,396	17.9	
	1	ATC increments	1,130					
	1	Seoul Gajaeul CHP(KDHC)	2.7					
	3	Lake Suwon Maesil sectioin CHP(Samchully)	21					
	6	Goyang Culture Complex CHP (Seoul City Gas)	14.9					
	6	Godeok C/C(DOP service)	800					
	6	Posco#6(Posco Power)	500					
	6	Cheongpyeong Hydro add.(KHNP)	60					
	9	Pyeongtaek Sosabul section CHP(Dusan construction company)	13.6					
	10	Songdo C/C#1(Songdo Power)	500					
	10	Goyang Samsong Section CHP(KDHC)	30					
	10	Suwon Gwanggyo CHP(KDHC)	84.6					
	11	Uijeongbu Millak 2 Section CHP(Hanjin SC)	13.4					
	12	Hwasung Hyangnam 2 Section CHP(Samchully)	18.2					
	12	Ret-Seoul thermal#4,5(KOMIPO)	-387.5					
	12	Other Renewables	16.2					
2012				34,773	35,725	29,152	19.3	
	1	ATC increments	500					
	2	Songdo C/C#2(Songdo Power)	500					
	6	Seoul C/C#1(KOMIPO)	(500)					
	7	Bucheon C/C#2(GS Power)	550					
	8	Incheon Unbok Leisure Complex CHP(Sambu)	23.1					
	12	Seoul C/C#2(KOMIPO)	(500)					
	12	Incheon C/C#3(KOMIPO)	700					
	12	Ret-Incheon thermal#1,2(KOMIPO)	-500					
	12	Yangju Okjung Section(Hanjin) SC)	41.9					
	12	Songpa Geoyeo Section CHP (SKE&S)	136.8					
2013				35,745	36,101	29,843	19.8	
	1	ATC increments	20					
	7	Pocheon C/C#1(Daelim)	(750)					
	10	Sihwa CHP(KG Energy)	10.5					
	12	Other Renewables (IncheonIGCC)	300					
	12	Osan Segyo 2 Section CHP (Daesung Ind)	45.6					

Year	Month	Plant Name(company)	Utility					Remarks
			Capacity (MW)	Total Capacity(MW)		Peak Load (MW)	Installed Reserve Margin	
				Summer	Winter			
2014				37,171	38,063	30,528	21.8	
	1	ATC increments	200					
	3	Ansan C/C#1(Posco E&C)	(750)					
	6	Yeongheung thermal#5(KOSEP)	870					
	10	Siheung Jangmyeon Mokgam	21.6					
	12	Yeongheung thermal#6(KOSEP)	870					
2015				38,233	38,233	31,162	22.7	
	1	ATC increments	170					
2016				39,647	39,647	31,707	25	
	1	ATC increments	1,170					
	6	Tidal Power(Ganghwa)	243.9					
2017				40,359	40,359	32,206	25.3	
	1	ATC increments	280					
	6	Tidal Power(Incheon Bay)	432					
2018				40,359	40,359	32,523	24.1	
	1	ATC increments	-					
2019				40,459	40,459	32,808	23.3	
	1	ATC increments	100					
2020				40,459	40,459	33,076	22.3	
	1	ATC increments	-					
2021				39,519	39,519	33,306	18.7	
	1	Ret-Pyeongtaek thermal#1,2(WP)	-700					
	1	ATC increments	-240					
2022				39,699	39,699	33,497	18.5	
	1	ATC increments	180					

※ 1. Installed Reserve Margin is based on summer(July)

2. The Distributed Generation(Renewables/RCS) capacity is derived by excluding the capacity with uncertain level of contribution to the peak time. In addition, the capacity for Wind PP and Solar PP licensed by central government/local government is derived by excluding the capacity with uncertain level of contribution to the completion time.
(Wind Power : 79.0%, Solar Power : 39.8%)

□ Jeju Island

Year	Month	Plant Name(company)	Utility					Remarks
			Capacity (MW)	Total Capacity(MW)		Peak Load (MW)	Installed Reserve Margin(%)	
				Summer	Winter			
2007		Existing Capacity		794	798	552	43.9	
2008				798	811	553	44.3	
	6	Solar Power	0.2					
	6	Wind Power	0.3					
	12	Solar Power	3.1					
	12	Wind Power	10.1					
2009				848	857	604	40.3	
	1	Ret-Jeju thermal#1(KOMIPO)	-10					
	6	Solar Power	4.5					
	6	Wind Power	1.8					
	6	Jeju int. #2(KOMIPO)	40					
	12	Wind Power	9.9					
2010				857	864	631	35.9	
	12	Wind Power	6.6					
2011				809	1,059	656	23.3	
	1	Ret-Jeju thermal GT #3 (KOMIPO)	-55					
	12	HVDC #2(KEPCO)	250					
2012				1,028	1,028	682	50.8	
	1	Ret-Nam Jeju int. #1-4(KOSPO)	-40					
	6	Wind Power	9.2					
2013				1,028	1,028	706	45.6	
2014				1,028	1,028	731	40.7	
2015				1,028	1,028	754	36.4	
2016				1,028	1,028	776	32.5	
2017				1,028	1,028	799	28.7	
2018				1,028	1,028	821	25.2	
2019				1,028	1,028	843	22.0	
2020				1,028	1,028	861	19.4	
2021				1,028	1,028	880	16.8	
2022				1,028	1,028	897	14.6	

※ 1. Installed Reserve Margin is based on summer(July)

2. The Distributed Generation(Renewables/RCS) capacity is derived by excluding the capacity with uncertain level of contribution to the peak time. In addition, the capacity for Wind PP and Solar PP licensed by central government/local government is derived by excluding the capacity with uncertain level of contribution to the completion time.
(Wind Power : 79.0%, Solar Power : 39.8%)

3. The capacity of Jeju GT#1,2(Installed Capacity 110 MW) operaing as a synchronous phase modifier is adjusted to 40 MW.

B. Generating Capacity Retirement Plan

[unit : MW]

Year	Steam Power			Internal Combustion		Capacity Retirement
	Bituminous Coal	Heavy Oil	LNG	Heavy Oil	Light Oil	
2008					Island(2.7) Jodo, Heuksando	2.7 (2stations)
2009		Jeju Thermal #1(10)	Incheon #3,4(650)		Island(2.75) Jangjado, Jawoldo	662.75 (5stations)
2010					Island(8.48) Ulneungdo, chujado Geomundo, Deokjukdo Daecheongdo,Yeonpyeongdo seungbongdo,Gaeyado	8.48 (8stations)
2011		Yeongnam #1,2(400)	Seoul #4,5(387.5)		JejuG/T #3(55)	842.5 (5stations)
2012			Incheon #1,2(500)	South Jeju #1 ~ 4(40)	Island(4.96) Baekryeongdo,Sapsido	544.96 (8stations)
Subtotal (‘08︺’12)		410 (3stations)	1,537.5 (6stations)	40 (4stations)	73.89 (15stations)	2061.39 (28stations)
2013	Yeongdong #1(125)					125 (1stations)
2014	Seocheon #1,2(400)	Ulsan #1 ~ 3(600)				1,000 (5stations)
Subtotal (‘13︺’17)	525 (3stations)	600 (3stations)				1,125 (6stations)
2021		Pyeongtaek #1,2(700)				700 (2stations)
Total (‘08︺’22)	525 (3stations)	1,710 (8stations)	1,537.5 (6stations)	40 (4stations)	73.89 (15stations)	3,886.39 (36stations)

C. Generating Capacity Outlook by Fuel Type

☐ Nationwide

[unit : MW, %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped storage	Renewables	RCS	Total
2007	17,716	19,340	1,125	17,436	5,334	3,900	1,673	721	67,246
	26.3%	28.8%	1.7%	25.9%	7.9%	5.8%	2.5%	1.1%	100.00%
2008	17,716	22,580	1,125	17,969	5,340	3,900	1,900	835	71,364
	24.8%	31.6%	1.6%	25.2%	7.5%	5.5%	2.7%	1.2%	100.00%
2009	17,716	23,080	1,125	17,828	5,376	3,900	2,093	1,425	72,543
	24.4%	31.8%	1.6%	24.6%	7.4%	5.4%	2.9%	2.0%	100.00%
2010	18,716	23,080	1,125	19,899	5,383	3,900	2,365	1,668	76,136
	24.6%	30.3%	1.5%	26.1%	7.1%	5.1%	3.1%	2.2%	100.00%
2011	19,716	23,080	1,125	21,812	4,929	4,700	2,515	2,138	80,015
	24.6%	28.8%	1.4%	27.3%	6.2%	5.9%	3.1%	2.7%	100.00%
2012	20,716	23,080	1,125	23,062	4,891	4,700	2,525	2,383	82,482
	25.1%	28.0%	1.4%	28.0%	5.9%	5.7%	3.1%	2.9%	100.00%
2013	23,116	23,080	1,000	23,062	4,891	4,700	2,907	2,774	85,530
	27.0%	27.0%	1.2%	27.0%	5.7%	5.5%	3.4%	3.2%	100.00%
2014	24,516	25,820	600	23,062	4,291	4,700	3,063	2,795	88,848
	27.6%	29.1%	0.7%	26.0%	4.8%	5.3%	3.4%	3.1%	100.00%
2015	25,916	28,820	600	23,062	4,291	4,700	3,383	2,795	93,568
	27.7%	30.8%	0.6%	24.6%	4.6%	5.0%	3.6%	3.0%	100.00%
2016	27,316	28,820	600	23,062	4,291	4,700	3,628	2,833	95,250
	28.7%	30.3%	0.6%	24.2%	4.5%	4.9%	3.8%	3.0%	100.00%
2017	27,316	28,820	600	23,062	4,291	4,700	4,060	2,833	95,682
	28.5%	30.1%	0.6%	24.1%	4.5%	4.9%	4.2%	3.0%	100.00%
2018	28,716	28,820	600	23,062	4,291	4,700	4,060	2,833	97,082
	29.6%	29.7%	0.6%	23.8%	4.4%	4.8%	4.2%	2.9%	100.00%
2019	30,116	28,820	600	23,062	4,291	4,700	4,060	3,142	98,791
	30.5%	29.2%	0.6%	23.3%	4.3%	4.8%	4.1%	3.2%	100.00%
2020	31,516	28,820	600	23,062	4,291	4,700	4,060	3,142	100,191
	31.5%	28.8%	0.6%	23.0%	4.3%	4.7%	4.1%	3.1%	100.00%
2021	32,916	28,820	600	23,062	3,591	4,700	4,060	3,142	100,891
	32.6%	28.6%	0.6%	22.9%	3.6%	4.7%	4.0%	3.1%	100.00%
2022	32,916	28,820	600	23,062	3,591	4,700	4,060	3,142	100,891
	32.6%	28.6%	0.6%	22.9%	3.6%	4.7%	4.0%	3.1%	100.00%

※ The capacities outlook is based on year-end

□ Metropolitan Area

[unit : MW, %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped storage	Renewables	RCS	Interchange	Total
2007	0	1,600	0	10,621	1,400	400	227	517	13,100	27,865
	0.0%	5.7%	0.0%	38.1%	5.0%	1.4%	0.8%	1.9%	47.0%	100.0%
2008	0	3,340	0	10,621	1,400	400	232	523	13,100	29,616
	0.0%	11.3%	0.0%	35.9%	4.7%	1.4%	0.8%	1.8%	44.2%	100.0%
2009	0	3,340	0	10,480	1,400	400	317	1,071	13,400	30,407
	0.0%	11.0%	0.0%	34.5%	4.6%	1.3%	1.0%	3.5%	44.1%	100.0%
2010	0	3,340	0	10,980	1,400	400	322	1,115	13,400	30,956
	0.0%	10.8%	0.0%	35.5%	4.5%	1.3%	1.0%	3.6%	43.3%	100.0%
2011	0	3,340	0	12,392	1,400	400	398	1,313	14,530	33,773
	0.0%	9.9%	0.0%	36.7%	4.1%	1.2%	1.2%	3.9%	43.0%	100.0%
2012	0	3,340	0	13,642	1,400	400	398	1,515	15,030	35,725
	0.0%	9.3%	0.0%	38.2%	3.9%	1.1%	1.1%	4.2%	42.1%	100.0%
2013	0	3,340	0	13,642	1,400	400	698	1,571	15,050	36,101
	0.0%	9.3%	0.0%	37.8%	3.9%	1.1%	1.9%	4.4%	41.7%	100.0%
2014	0	5,080	0	13,642	1,400	400	698	1,593	15,250	38,063
	0.0%	13.3%	0.0%	35.8%	3.7%	1.1%	1.8%	4.2%	40.1%	100.0%
2015	0	5,080	0	13,642	1,400	400	698	1,593	15,420	38,233
	0.0%	13.3%	0.0%	35.7%	3.7%	1.0%	1.8%	4.2%	40.3%	100.0%
2016	0	5,080	0	13,642	1,400	400	942	1,593	16,590	39,647
	0.0%	12.8%	0.0%	34.4%	3.5%	1.0%	2.4%	4.0%	41.8%	100.0%
2017	0	5,080	0	13,642	1,400	400	1,374	1,593	16,870	40,359
	0.0%	12.6%	0.0%	33.8%	3.5%	1.0%	3.4%	3.9%	41.8%	100.0%
2018	0	5,080	0	13,642	1,400	400	1,374	1,593	16,870	40,359
	0.0%	12.6%	0.0%	33.8%	3.5%	1.0%	3.4%	3.9%	41.8%	100.0%
2019	0	5,080	0	13,642	1,400	400	1,374	1,593	16,970	40,459
	0.0%	12.6%	0.0%	33.7%	3.5%	1.0%	3.4%	3.9%	41.9%	100.0%
2020	0	5,080	0	13,642	1,400	400	1,374	1,593	16,970	40,459
	0.0%	12.6%	0.0%	33.7%	3.5%	1.0%	3.4%	3.9%	41.9%	100.0%
2021	0	5,080	0	13,642	700	400	1,374	1,593	16,730	39,519
	0.0%	12.9%	0.0%	34.5%	1.8%	1.0%	3.5%	4.0%	42.3%	100.0%
2022	0	5,080	0	13,642	700	400	1,374	1,593	16,910	39,699
	0.0%	12.8%	0.0%	34.4%	1.8%	1.0%	3.5%	4.0%	42.6%	100.0%

※ The capacities outlook is based on year-end

☐ Jeju Island

[unit : MW, %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped storage	Renewables	RCS	HVDC	Total
2007	0	0	0	0	640	0	8	0	150	798
	0.0%	0.0%	0.0%	0.0%	80.2%	0.0%	0.9%	0.0%	18.8%	100.0%
2008	0	0	0	0	640	0	21	0	150	811
	0.0%	0.0%	0.0%	0.0%	78.9%	0.0%	2.6%	0.0%	18.5%	100.0%
2009	0	0	0	0	670	0	37	0	150	857
	0.0%	0.0%	0.0%	0.0%	78.1%	0.0%	4.4%	0.0%	17.5%	100.0%
2010	0	0	0	0	670	0	44	0	150	864
	0.0%	0.0%	0.0%	0.0%	77.5%	0.0%	5.1%	0.0%	17.4%	100.0%
2011	0	0	0	0	615	0	44	0	400	1,059
	0.0%	0.0%	0.0%	0.0%	58.1%	0.0%	4.2%	0.0%	37.8%	100.0%
2012	0	0	0	0	575	0	53	0	400	1,028
	0.0%	0.0%	0.0%	0.0%	55.9%	0.0%	5.2%	0.0%	38.9%	100.0%
2013	0	0	0	0	575	0	53	0	400	1,028
	0.0%	0.0%	0.0%	0.0%	55.9%	0.0%	5.2%	0.0%	38.9%	100.0%
2014	0	0	0	0	575	0	53	0	400	1,028
	0.0%	0.0%	0.0%	0.0%	55.9%	0.0%	5.2%	0.0%	38.9%	100.0%
2015	0	0	0	0	575	0	53	0	400	1,028
	0.0%	0.0%	0.0%	0.0%	55.9%	0.0%	5.2%	0.0%	38.9%	100.0%
2016	0	0	0	0	575	0	53	0	400	1,028
	0.0%	0.0%	0.0%	0.0%	55.9%	0.0%	5.2%	0.0%	38.9%	100.0%
2017	0	0	0	0	575	0	53	0	400	1,028
	0.0%	0.0%	0.0%	0.0%	55.9%	0.0%	5.2%	0.0%	38.9%	100.0%
2018	0	0	0	0	575	0	53	0	400	1,028
	0.0%	0.0%	0.0%	0.0%	55.9%	0.0%	5.2%	0.0%	38.9%	100.0%
2019	0	0	0	0	575	0	53	0	400	1,028
	0.0%	0.0%	0.0%	0.0%	55.9%	0.0%	5.2%	0.0%	38.9%	100.0%
2020	0	0	0	0	575	0	53	0	400	1,028
	0.0%	0.0%	0.0%	0.0%	55.9%	0.0%	5.2%	0.0%	38.9%	100.0%
2021	0	0	0	0	575	0	53	0	400	1,028
	0.0%	0.0%	0.0%	0.0%	55.9%	0.0%	5.2%	0.0%	38.9%	100.0%
2022	0	0	0	0	575	0	53	0	400	1,028
	0.0%	0.0%	0.0%	0.0%	55.9%	0.0%	5.2%	0.0%	38.9%	100.0%

※ The capacities outlook is based on year-end

D. Electricity Generation Outlook by Fuel

[unit : GWh, %]

Year	Nuclear	Bituminous Coal	Anthracite	LNG	Oil	Pumped storage	Renewables	RCS	Total
2008	144,756	161,984	5,589	92,316	8,110	1,710	6,016	5,303	425,783
	34.0%	38.0%	1.3%	21.7%	1.9%	0.4%	1.4%	1.2%	100.0%
2009	144,324	181,692	5,574	87,661	11,223	1,801	7,506	7,326	447,107
	32.3%	40.6%	1.2%	19.6%	2.5%	0.4%	1.7%	1.6%	100.0%
2010	145,070	184,478	5,610	91,192	10,465	1,685	11,943	13,448	463,891
	31.3%	39.8%	1.2%	19.7%	2.3%	0.4%	2.6%	2.9%	100.0%
2011	153,053	184,601	5,600	98,579	6,799	1,712	13,465	14,777	478,587
	32.0%	38.6%	1.2%	20.6%	1.4%	0.4%	2.8%	3.1%	100.0%
2012	167,344	184,642	5,650	99,773	863	1,528	13,577	16,815	490,192
	34.1%	37.7%	1.2%	20.4%	0.2%	0.3%	2.8%	3.4%	100.0%
2013	179,043	184,198	5,013	93,854	848	1,410	17,320	18,279	499,965
	35.8%	36.8%	1.0%	18.8%	0.2%	0.3%	3.5%	3.7%	100.0%
2014	190,263	188,207	3,156	86,393	903	1,971	18,450	19,920	509,263
	37.4%	37.0%	0.6%	17.0%	0.2%	0.4%	3.6%	3.9%	100.0%
2015	199,726	203,317	3,165	66,577	934	3,167	20,942	20,039	517,867
	38.6%	39.3%	0.6%	12.9%	0.2%	0.6%	4.0%	3.9%	100.0%
2016	211,448	218,582	3,117	45,026	935	5,466	22,766	19,814	527,154
	40.1%	41.5%	0.6%	8.5%	0.2%	1.0%	4.3%	3.8%	100.0%
2017	220,879	213,805	3,146	42,241	942	5,856	25,844	20,024	532,737
	41.5%	40.1%	0.6%	7.9%	0.2%	1.1%	4.9%	3.8%	100.0%
2018	222,015	215,845	3,124	43,417	935	5,961	25,844	20,219	537,360
	41.3%	40.2%	0.6%	8.1%	0.2%	1.1%	4.8%	3.8%	100.0%
2019	233,148	212,406	3,162	39,830	931	6,014	25,844	20,516	541,851
	43.0%	39.2%	0.6%	7.4%	0.2%	1.1%	4.8%	3.8%	100.0%
2020	249,848	203,661	3,176	34,592	914	6,265	25,844	21,594	545,894
	45.8%	37.3%	0.6%	6.3%	0.2%	1.1%	4.7%	4.0%	100.0%
2021	260,028	197,382	3,161	34,439	870	6,600	25,844	21,531	549,855
	47.3%	35.9%	0.6%	6.3%	0.2%	1.2%	4.7%	3.9%	100.0%
2022	265,180	195,646	3,176	34,132	887	7,112	25,844	21,320	553,297
	47.9%	35.4%	0.6%	6.2%	0.2%	1.3%	4.7%	3.9%	100.0%

4. Renewable Facilities Expansion Plan

☐ Renewable facilities expansion plan (2008 ~ 2022)

◯The share of renewable facilities is increased from 2.7% in 2007 to 4.0% in 2022.

[unit : MW]

Year	Hydro		Wind Power	Ocean Energy	Solar	Biomass	wastes	By-product gas	Fuel Cell	IGCC/CCT	Total
	normal	small									
2007. 12 (actual)	1,521.6	70.5	191.9		37.8	82.4	8.0	30.3	0.3		1,942.8
2008. 06		8.6	2.2		121.6	0.7			0.3		133.4
2008. 12	2.3	3.1	201.3	1.0	683.5	1.4			2.2		894.8
2009. 06		0.1	10.7		102.3	1.0	5.7		4.8		124.6
2009. 12		12.5	316.6	254.0	41.5		13.2		4.8		642.6
2010. 06		1.0			11.7		1.2	200.0	4.8		218.7
2010. 12			110.0		24.4			350.0	10.0		494.4
2011. 06	60.0				4.0		10.0	150.0			224.0
2011. 12					1.2		20.0		16.2		37.4
2012. 06			42.0		1.0						43.0
2012. 12					0.03						0.03
2013. 06					2.3			200.0			202.3
2013. 12										300.0	300.0
2014. 06											
2014. 12				520.0							520
2015. 06											
2015. 12				53.0	10.0					300.0	363
2016. 06				813.0		0.8					813.8
2016. 12					1.0						1.0
2017. 06				1,440.0							1,440.0
2017. 12					2.7						2.7
2018. 06					0.6						0.6
2018. 12											
2019~2022											
New	62.3	25.3	682.8	3,081	1,007.8	3.9	50.1	900.0	43.1	600.0	6,456.3
Total	1,583.9	95.8	874.7	3,081	1,045.6	86.3	58.1	930.3	43.4	600.0	8,399.1

※ 1. Renewable expansion plan above does not consider the performance rate of construction.

2. In case the 3rd renewable basic plan and RPS system are definitely settled, it will be planned to be reflected in the 5th BPE.

☐ Outlook on Renewable Facilities Construction

[unit : MW]

Year	Hydro	Wind	Ocean Energy	Solar	Biomass	Wastes	By-product gas	Fuel Cell	IGCC /CCT	Total
2007	1,592.1	191.9	0	37.8	82.4	8.0	30.3	0.3	0	1,942.8
2008	Chuncheon#2 add#2.3 Tae'an 2.2 Yeoungheung 3 Daechung 0.8 seoungnam Ⅱ 0.36 Hwabuk 1.9 Boryung Ⅱ 2.5 Hongik 0.85	Maebong 3 Yanggu 20 Gyegye rab. 0.75 Hwoengseong 40 Chungoksan 1.5 Banaamuri 3 Seongsan 20 Korea wind 1 Wind city 14 Wind com. 4 Wind gen. 9 Jungseoun 20 DongHae 20 Yangsan 12 Samdal 33 Woljeoung 1.5 Gori 0.75	Yuldolmok tide 1	805.2	Siemens 0.82 Changnyung 0.541 Baeksuk 0.7			Boryung 0.5 Boryung 0.5 Gunho 1.2 Poscon 0.3		1,028.2
2009	DongHwa 0.09 Boryung#1,2 7.5 Dangjin 5	Nansan 10.5 Hanjin 0.2 Milyang 50.6 Jeju 45 Taebaek 20 Gimcheon 97.5 Maebongdongseong 3 Daegiri 24 YeongYang 76.5	SiHwaho Tide 254	143.8	Dongdaemungu 1	Daegu woodchip 3 Chungju wastes 2.7 Masan wastes 2.9 Goyang 5.3 Iksan 5		Meiya yulchon 4.8 Bundang 4.8		767.2
2010	Cungju 1	Pyungchang 20 Milyang2 60 Sammoo 30		36.1		Georim 1.2	still gen. #1,2 200 still gen. #3,4 200 Gwangyang BFG1 150	ilsan 4.8 Ulsan 10		713.1
2011	Cheongpyung add 60			5.2		Wonju 10 Jeonnam 20	Gwangyang BFG22 150	Songpa Geoyeo 9 Yangju Okjung 7.2		261.4
2012		Isidol 42		1.0						43.0
2013				2.3			still gen. #5,6 200		Incheoun IGCC 300	502.3
2014			Garorim Tide 520	0						520.0
2015			Wando Tide 53	10.0					Taean CCT 300	363.0
2016			GangHwa Tide 813	1.0	FDI G&G 0.82					814.8
2017			Incheoun man Tide 1440	2.7						1,442.7
2018				0.6						0.6
New	27.6	682.8	3,081.0	1,007.8	3.9	50.1	900.0	43.1	600.0	6,456.3
Total	**1,619.7**	**874.7**	**3,081.0**	**1,045.6**	**86.3**	**58.1**	**930.3**	**43.4**	**600.0**	**8,399.1**

☐ Review Renewables Facilities(3rd BPE vs. 4th BPE)

[unit : MW]

Classification	The 3rd BPE	The 4th BPE
1. Planning Period	’06 ~’20 (15years)	’08 ~ ’22 (15years)
2. Env. Reference · Carbon Emission Cost · Carbon Emissions	13,000Won/CO_2Ton 0.11 kg-C/kWh	32,000Won/CO_2Ton 0.11 kg-C/kWh
3. Facilities Plan · Hydro · Wind · Tide · Solar · Biomass · Wastes · By-product gas · Fuel Cell · IGCC/CCT · **Total**	'06 ~ '10 '11 ~ '15 29.4 60 627.7 0 254 480 54.1 0.1 51.8 0 8 0 400 0 0.3 0 0 300 **2,265.4**	'08 ~ '10 '11 ~ '15 '16 ~'20 27.6 60 0 640.8 42 0 255 573 2,253 985 18.5 4.3 3.1 0 0.8 20.1 30 0 550 350 0 26.9 16.2 0 0 600 0 **6,456.3**
4. Peak Contribution · Small Hydro · Wind · Solar · Biomass	 60% 10% 30% 50%	 62.2% 21.9% 42.8% 40.9%
5. Construction performance · Wind · Solar	N/A	79.0% 39.8%

※ The rate of performance is not considered in the scale of construction by fuel

5. RCS Facility Outlook

☐ RCS Outlook by year (2008 ~ 2022)

Classifi-cation	Completion	Plant Name	Capacity (MW)	Company	Location	Remarks
general	08.11	Daegu RCS	46.5	kdhc	Daegu	
	08.11	Yeocheoun	132	kumho	Yeosu	
	09.11	Songdo cogen	205	Incheoun total	Yeonsu	Intents
	09.11	Paju cogen	515	kdhc	Paju	
	09.11	Pankyo cogen	146.1	kdhc	Seoungnam	
	09.12	Iksan 2 section	3	sanggong	Iksan	
	10.04	Gunjang section	120	hanhwa	Gunsan	
	10.04	Gunsan section	86.6	gunjangenergy	Gunsan	
	11.06	Daejun cogen	47.345	jugong	yusung	
	11.10	Suwon gwangkyo	141	kdhc	Suwon	Intents
	11.10	Daegu	227	Daegu citygas	Daegu	
	11.12	Kwangju	20	kdhc	Naju	Intents
	12.10	Songpa geoyeo	228	SKE&S	Songpa	
	13.12	Osan seokyo 2section	76	Daesung	Osan	
	13.12	Kyungnam,Jinju	42.6	Murim power	Jinju	
	16.12	Gunjang section	62.5	Jungbu citygas	Seocheoun	
	13.11/19.11	Hangbok city	515×2	kdhc,nambu,jungbu	Yeoungi	Intents
	Total		**3,128.6**			
CES	08.12	Yangju cogen	21	Daerim	Yangju	
	09.01	Tangjung 2section	7.3	Samsung everland	Asan	
	09.04	Seoul Dongnam	32	kdhc	Songpa	Intents
	09.10	Woomyen	8	Yusung T&S	Seocho	
	09.10	Cheounan cogen	25.3	Jungbo citygas	Cheounan	
	09.10	Kwangju hanam	109	Kyungnam	Kwangsan	
	09.10	Kwangmyung	46.0	samchully	Kwangmyung	Intents
	09.12	Sinjung	6	SH	Yangcheoun	
	10.02	Yeosu	250	yeosu cogen	yeosu	
	10.03	sangam 2section	6	kdhc	Mapo	Intents
	10.12	Gangil CES	33.4	Daehan citygas	Gangdong	Intents
	10.12	Namyangju	107.1	Kyungnam	Namyangju	
	11.01	Seoul gajeul	9	kdhc	SeoDaemun	Intents
	11.01	Asan cogen	116.6	Jugong	Asan	
	11.03	Suwon maesil	70.1	samchully	Kweunsun	Intents
	11.06	Goyang cogen	49.6	Seoul citygas	Goyang	Intents
	11.09	Sosabeoul	45.26	Doosan	PyungTak	Intents
	11.10	Goyang samsong	100	kdhc	Goyang	Intents
	11.10	Yangsan sasong	98	Kyungnam	Yangsan	
	11.11	Jung kwan	100.3	Jungkwan	Yangsan	
	11.12	Minrack 2section	44.7	Hanjin	Uijungbu	Intents
	11.12	Hwasung 2section	60.55	samchully	Hwasung	Intents
	12.06	Ulsan woojung	52.5	Samsung everland	Ulsan junggu	
	12.08	Incheoun unbuk	77	Samboo	Incheoun	Intents
	12.09	Daejun Hakha	29.5	Choongnam	Daejun	
	12.10	Gangwon,wonju	63	iwest	Wonju	Intents
	12.12	Yangju okjung	139.7	Hanjin	Yangju	Intents
	13.10	Sihwa cogen	35	KGenergy	Siheong	Intents
	14.10	Siheong Mokgam	72.1	GSholdings	Siheong	
	Total		**1,814.01**			

6. Electricity Supply and Demand in the Island Areas

A. Planning Criteria

☐ Scope

○ Establishing the generating capacity plan for 15 islands with more than 300 households.

○ Islands covered by the plan shall be expanded gradually to islands with 50 or more households (62 islands)

☐ Load forecast

○ Period : Year 2008 ~ 2012 (5 years)

○ Demand forecast :

- Induce peak demand for scenario 1 based on trend analysis program.
- Induce peak demand for scenario 2 based on structural analysis program. (based on Electricity sales, load rate, number of households etc.)
- Forecast peak demand by averaging scenario 1 and scenario 2 and reflect 50% of the capacity to the peak load.

☐ Standard for the adequate reserve margin

○ According to facility organization such as total number of plants and capacity, adequate installed reserve rate will be applied differently.

- Decide the expansion scale based on the demand forecast for 5 years forward.

<table>
<tr><th rowspan="2">Total plant number</th><th rowspan="2">Reference reserve margin</th><th colspan="3">Additional application</th></tr>
<tr><th>1unit(2times)</th><th>2units(2times)</th><th>etc.</th></tr>
<tr><td>3 units</td><td>55 % ~</td><td>30%p (ref1)</td><td>15%p (ref2)</td><td rowspan="2">Applied in proportion</td></tr>
<tr><td>4 units</td><td>38 % ~</td><td>15%p</td><td>10%p</td></tr>
<tr><td>5 units</td><td>30 %</td><td colspan="2" rowspan="3">-</td><td rowspan="3"></td></tr>
<tr><td>6 -8 units</td><td>25 %</td></tr>
<tr><td>More than 9 units</td><td>20 %</td></tr>
</table>

※ ref1) Facilities (3units, 150, 150, **300** MW) : 55%(BAU)+**30%** (additional)

ref2) Facilities (3units, 150, **300, 300** MW) : 55%(BAU)+**15%** (additional)

※ Based on the research results of optimal demand forecast about islands not connected to the system in 2008.

○ Standard for generation facilities retirement

- Facilities life shall be assumed to be 15 ~ 25 years depending on the engine rpm.

Classification	Slow-speed engine	Medium-speed engine	High-speed engine
Design life(years)	25	20	15
rpm	300 or less	300 ~ 1000	1000 or more

B. Generation Facilities Plan

□ Peak demand outlook by year

○ The average increase rate for 5 years is expected to be 9.7%

[unit : kWh]

Island	Peak Demand					Average Increase Rate (%)
	2008	2009	2010	2011	2012	
Ulneungdo	7,761	8,252	8,766	9,133	9,471	5.1
Paikryungdo	4,934	5,679	6,465	6,857	7,151	9.8
Jodo	1,214	1,324	1,366	1,596	1,634	7.9
Huksando	2,266	2,317	2,356	2,390	2,419	1.7
Chujado	2,801	3,295	3,496	3,708	3,931	8.9
Geomundo	2,115	2,491	2,604	2,719	2,844	7.8
Duckjukdo	1,269	1,331	1,393	1,456	1,521	4.6
Wido	1,341	1,409	1,461	1,524	1,570	4.0
Daecheongdo	899	1,285	1,374	1,510	1,677	17.6
Yeonpyeongdo	1,971	2,324	2,796	3,397	4,206	20.9
Jangjado	1,177	1,369	1,566	1,791	2,049	14.9
Jawoldo	585	736	789	851	921	12.3
Seungbongdo	1,010	1,089	1,429	1,522	1,603	12.7
Sapsido	444	482	519	563	612	8.3
Gaeyado	830	933	1,048	1,179	1,333	12.6
Total	**12,695**	**15,216**	**16,605**	**17,500**	**18,299**	**9.7**

□ Generator construction and retirement

○ New construction(Total of 35 units 30,150kW)

- Int. combustion plant construction : 29,850kW(200 ~ 2,500kW, 14 islands)
- Solar power plant construction : 300KW(100kW, 3 islands)

○ Existing facilities retirement(total of 37units 16,550kW)

○ New generator construction cost : 92.1billion

[unit : kW]

Island	2008	2009	2010	2011	2012	Total	Remarks
Ulneungdo			2,500			2,500	2,500×1
Paikryungdo					6,000	6,000	2,000×3
Jodo	1,000			1,000	100	2,100	500×2, 1000 100
Huksando	2,000					2,000	1,000×2
Chujado			2,400			2,400	1.200×2
Geomundo			1,500			1,500	750×2
Duckjukdo			500			500	500×1
Wido					100	100	100
Daecheongdo			1,600			1,600	800×2
Yeonpyeongdo			4,500			4,500	1,500×3
Jangjado		2,400				2,400	800×3
Jawoldo		1,000				1,000	500×2
Seungbongdo	1,000		800			1,800	500×2,300,500
Sapsido					400	400	200×2
Gaeyado			1,250		100	1,350	750, 500, 100
Total	4,000	3,400	15,050	1,000	6,700	30,150	

※ 1. Values in parenthesis denote the retirement capacity.

2. Select areas where isolation rate is relatively high or islands which has small capacity for solar plant construction.(Jodo, Wido, Gaeyado)

□ Electricity Supply and Demand Outlook

○ The Installed reserve margin for 2008 ~ 2012 is maintained to be 6 ~ 132%

○ Hybrid type(solar) generation is tested in islands where is int. combustion oriented.

[Unit : kW, %]

Classification		2008	2009	2010	2011	2012
Ulneungdo	Capacity	13,200	13,200	13,700	13,700	13,700
	Capacity reserve margin	70.08	59.96	56.28	50.34	44.65
Paikryungdo	Capacity	9,000	9,000	9,000	9,000	10,500
	Capacity reserve margin	82.40	58.48	39.22	31.26	45.81
Jodo	Capacity	2,000	2,000	2,000	3,000	3,100
	Capacity reserve margin	64.72	51.02	46.37	87.95	84.21
Huksando	Capacity	4,000	4,000	4,000	4,000	4,000
	Capacity reserve margin	76.55	72.61	69.77	67.36	65.33
Chujado	Capacity	4,400	4,400	5,900	5,900	5,900
	Capacity reserve margin	57.06	33.55	68.75	59.09	50.09
Geomundo	Capacity	3,500	3,500	4,000	4,000	4,000
	Capacity reserve margin	65.52	40.51	53.63	47.11	40.63
Duckjukdo	Capacity	2,900	2,900	2,500	2,500	2,500
	Capacity reserve margin	128.53	117.96	79.47	71.66	64.39
Wido	Capacity	2,850	2,850	2,850	2,850	2,950
	Capacity reserve margin	112.50	102.22	95.05	86.95	82.17
Daecheongdo	Capacity	1,850	1,850	2,550	2,550	2,550
	Capacity reserve margin	105.85	46.30	85.53	68.87	52.10
Yeonpyeongdo	Capacity	3,350	3,350	6,500	6,500	6,500
	Capacity reserve margin	70.01	44.18	132.45	91.33	54.55
Jangjado	Capacity	1,250	2,900	2,900	2,900	2,900
	Capacity reserve margin	6.20	111.85	85.22	61.93	41.56
Jawoldo	Capacity	950	1,650	1,650	1,650	1,650
	Capacity reserve margin	62.39	124.33	109.11	93.93	79.13
Seungbongdo	Capacity	1,950	1,950	2,300	2,300	2,300
	Capacity reserve margin	92.98	79.13	60.95	51.16	43.47
Sapsido	Capacity	900	900	900	900	600
	Capacity reserve margin	102.53	86.61	73.35	59.81	63.50
Gaeyado	Capacity	1,500	1,500	2,250	2,250	2,350
	Capacity reserve margin	80.64	60.74	114.79	90.89	69.54

※ For the construction of new power plants, KEPCO as the actual operator of the facilities may change the scheduled completion time considering the characteristics of the islands after checking the progress of work related to the application for the construction of new facilities.

7. Major Transmission Facilities Expansion Plan

A. Transformation Facilities

Classification	Substation Name	Region	Year of Completion	Necessity
765kV	Bukgyeongnam	Gyeongnam Changnyeong	2010	○ Transmission of power from future Kori nuclear units
	Sinuljin	Gyeongbuk Uljin	2013	○ Transmission of power from future Uljin units
345 kV	Sinyangyang	Gangwon Injae	2009	○ Power supply to the northern Youngdong area
	Sinpaju	Kyonggi Paju	2009	○ Power supply to the northern Kyonggi area
	Sintangjeong	Chungnam Asan	2009	○ Power supply to the Chungnam Tangjeong industrial complexes
	Sinpochun	Kyonggi Dongduchun	2010	○ Power supply to the northern part of the capital area
	Seoansseong	Kyonggi Anseong	2010	○ Power supply to the Anseong, Songtan areas
	Sinchungju	Chungbuk Chungju	2010	○ Power supply to the Eumseong, Jeungpyeong, and Pongdong areas
	Sinnoksan	Busan Gangseogu	2011	○ Power supply to the southern part of Busan City
	Saemangeum	Junbuk Gunsan	2010	○ Power supply to the Junbuk Gunsan area.
	Singimpo	Kyonggi Gimpo	2011	○ Power supply to the Gimpo area
	Pangyo	Kyonggi Seongnam	2012	○ Power supply to the Seongnam,Yongin areas
	Changwon	Gyeongnam Changwon	2012	○ Power supply to the Masan, Changwon areas
	Dongbusan	Busan Namgu	2013	○ Power supply to the eastern part of Busan City
	Sinonsu	Seoul Gurogu	2013	○ Power supply to the Gangseo, Guro areas
	Dongulsan	Ulsan Bukgu	2013	○ Power supply to the Ulsan area
	Sinnamwon	Junbuk Namwon	2014	○ Power supply to the eastern part of the Junbuk area
	Seopyeongtaek	Kyonggi Pyeongtaek	2015	○ Power supply to the Kyonggi southern industrial complex area
	Seoseoul#2	Kyonggi Gunpo	2015	○ Power supply to the southwestern part of the Kyonggi area
	Dongseoul#2	Kyonggi Hanam	2015	○ Power supply to the southeastern part of the Seoul area
	Sincheongwon	Chungbuk Cheongwon	2015	○ power Supply to the Administration centered complex city
	Sinsihwa	Gyeonggi Siheung	2016	○ power supply to the Gyeonggi Sihwa industrial complex

B. Transmission Facilities

Classification	Section	Length (c-km)	Year of Completion	Necessity
765 kV	Sinansung - Singapyeong	75	2008	○ Interconnection between the capital area and rear network (southern area - eastern area)
	Singori - Bukgeungnam	200	2009	○ Future Kori units (the 2nd site) interconnection
345 kV	Gwangyang - Singangjin	212	2009	○ Reinforce the Junnam Province network.
	Sinsuwon-Sinyongin	22	2009	○ Reinforce the Suwon area network.
	Sinonyang-Sintangjung	20	2009	○ Power supply to the Asan Tangjung Industrial Complex
	Sinpochun-Singapyeong	128	2010	○ Reinforce the northeastern capital area network.
	Sindukeun-Sinpochun	90	2010	○ Reinforce the northwestern capital area network.
	Bukkyeongnam 1st branch	60	2010	○ Singori # 1, 2 nuclear plant interconnection
	Sinkimhae-Sinnoksan	40	2011	○ Reinforce the Busan Noksan Industrial Complex area network.
	Yeochun P/P- Sinyeongju	40	2010	○ Yeochun PS plant interconnection
	Sinchungju branch	104	2010	○ Reinforce the Chungbuk Province network.
	Posco-Seoincheon, Incheon-thermal	10	2010	○ Posco P/P interconnection
	Sinwolseong branch	40	2010	○ Sinwolseong #1,2 nuclear plant interconnection
	Bugok P/P-Sindangjin	60	2011	○ Bugok P/P interconnection
	Seonsan branch	100	2011	○ Reinforce the Gumi area network.
	Sindangjin-Sinonyang	92	2012	○ Reinforce the midwestern Chungnam area network.
	Yulchon P/P branch	4	2012	○ Yulchon P/P plant interconnection
	Bukkyeongnam 2nd branch	120	2012	○ Singori # 3, 4 nuclear plant interconnection
	Sinulsan-Sinonsan	16	2013	○ Reinforce the Ulsan area network.
	Posco-Sindeokeun	96	2015	○ Reinforce the southern metropolitan area network
	Gajung-Sinonsu	54	2015	○ Reinforce the Westsouthern Seoul area network

※ The construction plan may be changed based on the results of KEPCO's system assessment (as of October 2008).