



KEEI

Korea Energy Demand Outlook



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Published by the Korea Energy Economics Institute (KEEI), Energy Demand Outlook takes a closer look at the global energy market and supply and demand trends in domestic energy and examines the outlook for short-term energy demand.

This report outlines the recent changes in the supply and demand of energy and provides important data and policy implications in an effort to contribute to the establishment and adjustment of a series of energy policies by the government.

This report is written by the Energy Demand and Supply Division of the Center for Energy Information and Statistics in cooperation with the Energy Statistics Research Division of KEEI and other related research divisions.

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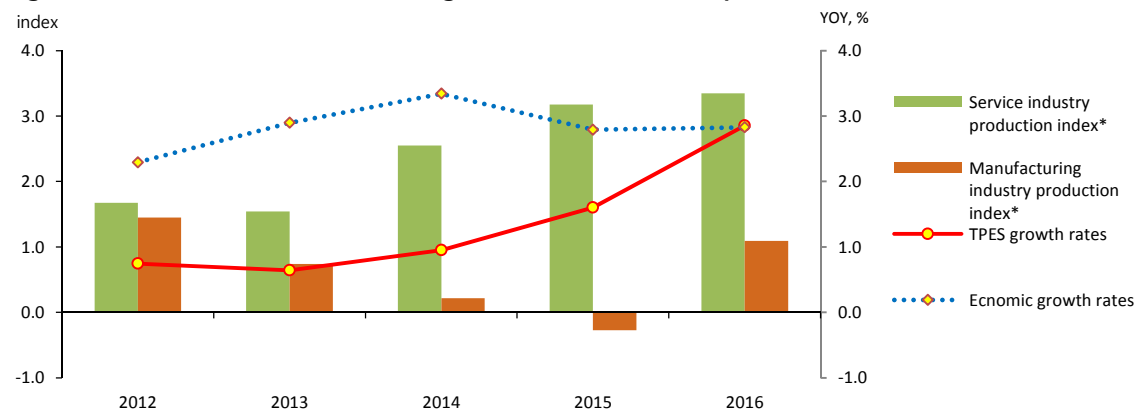
Summary

1. Energy Trends¹

□ **TPES is estimated to be 295.3Mtoe in 2016, recording a year-on-year increase of 2.7%.**

- The growth rate of TPES was over 2% for the first time in five years, despite disappointing performance in the manufacturing sector, due to record-breaking heatwave and the construction of new petrochemical facilities.
 - Lower energy prices and higher temperature drove up the energy demand in the transport and buildings sectors, and industrial energy consumption also increased by more than 1% affected due to expanded petrochemical facilities although the manufacturing industry was still struggling amid weak export demand.
- The gap between the growth rates of TPES and the economy was over 1%p for several years affected by extended recession of manufacturing business and comparably better performance of the service sector prior to a downturn in 2015. The gap, however, was narrowed down in 2016 due to temperature effect and expanded installed capacity.

Figure 1.1 Economic and TPES growth rates, Industrial production index (2012-2016)



* YOY(Index)

- TPES rose by 3.8% in 2016 from a year ago, excluding feedstock energy (non-energy oil, bituminous coal for steelmaking)

¹ The growth rates of TPES and TFC by energy source and sector were calculated in toe, and therefore, the figures could be different from the growth rates suggested in energy trend and outlook by source, as they are calculated in unique units of measurement.

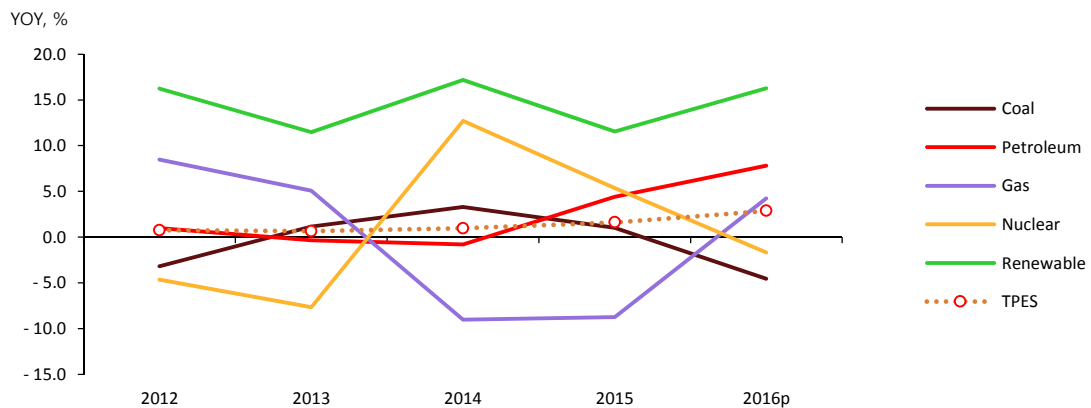
- The share of feedstock energy in TPES dropped by 0.7%p year-on-year to 27.5% as feedstock energy consumption maintained the prior-year level due to weak consumption of bituminous coal for steelmaking.

☐ **TPES rebounded along with rising petroleum and gas consumption despite decreased use of coal and nuclear energy.**

- The growth of petroleum consumption exceeded 7% for the first time since 1999(7.3%) because of the increased petroleum use for transport amid low oil prices, bigger paraxylene export volume to China following an accident in a Chinese paraxylene factory (2015.4) and a surge in naphtha and LPG consumption due to the expansion of mixed xylene and PHD facilities.
- Bituminous coal consumption declined despite a start-up of a new power plant due to lower maximum output of coal-fired power plants (2016.1) and increased preventive maintenance. Coking coal consumption for steelmaking plummeted as well, affected by the recession of iron & steel industry at home and abroad. Accordingly, coal consumption fell by more than 4%.
- Nuclear power generation rapidly increased by more than 6% until August because of the resumed operation of Hanbit unit 3 and Wolsong unit 1 (2015.6) ²along with the start-up of Shinwolsong unit 2(2015.7). Shinkori unit 3 also started operating from December. On an annual basis, however, nuclear generation declined by more than 1% as unit1-4 at Wolsong nuclear power plant were shut down for safety inspection after the outbreak of an earthquake in Gyeongju.
- Gas consumption rebounded by more than 4% after years of steep drop as unusually hot weather raised electricity demand and decreased nuclear generation was partially replaced by gas-fired power generation.
- As for the share of TPES by energy source in 2016, petroleum accounted for the largest share of 39.9% and was followed by coal (27.6%), gas (15.4%), nuclear (11.6%) and renewable energy (5.5%).

² Hanbit unit 3 resumed the operation in the mid-June 2015 after an inspection due to the accidental shutdown of the reactor in October 2014. Wolsong unit 1 also restarted at the end of June 2015 with a ten-year life extension (continued operation); it was previously shut down due to license expiration as of November 2012.

Figure 1.2 TPES growth rates by energy source



□ **TFC recorded 226.6Mtoe in 2016, a year-on-year increase of 3.7%, with the transport and buildings sectors accounting for the largest part.**

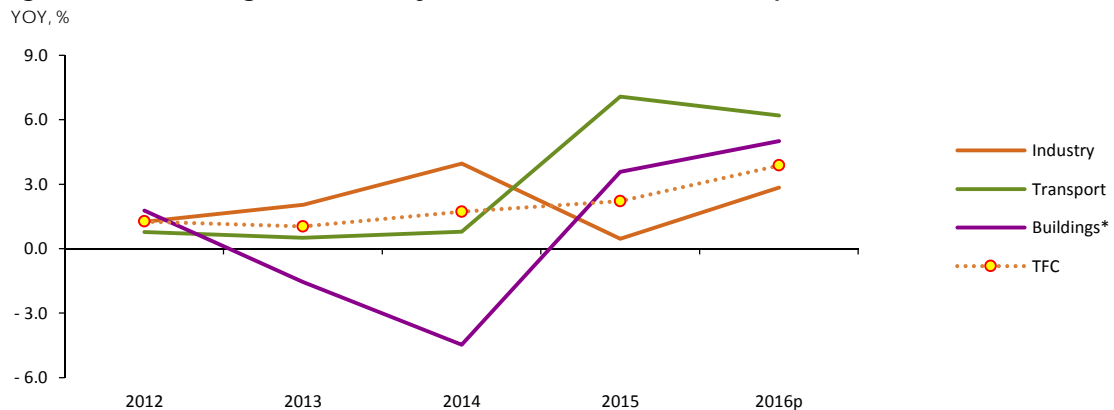
- Energy consumption in the industrial sector rose by 2.9% due to rapid consumption growth naphtha as raw material and LPG for industrial use although bituminous coal consumption decreased in the steelmaking sector.
 - Industrial LPG consumption made a sharp increase of over 70% as an effect of PHD facility expansion, leading the growth of industrial petroleum consumption.
 - Meanwhile, the use of energy as raw material stayed at the previous year's level despite over 4% rise in non-energy oil consumption, especially naphtha, because of a 9% decline in bituminous coal consumption for steelmaking due to weak demand in the domestic and global iron & steel industry.
- Energy consumption in the transport sector continued rapid growth (5.1%) as steep decline in global oil prices stretched through 2016.
 - In 2015, the transport sector consumed 7.1% more energy amid plummeting global oil prices (-47.5%). Meanwhile, the growth of energy use in the transport sector slowed down in 2016 compared to last year after the global oil prices started to increase moderately from the 2nd quarter, although the oil prices plunged on annual average (-18.8%).
 - The consumption of most petroleum products sharply increased except LPG ³ as a result of heavier traffic and increased air conditioning due to low oil prices and record-breaking summer heat, the introduction of new short-distance air routes mainly by low cost airlines and the base effect of Middle East Respiratory Syndrome (MERS) in 2015.

³ LPG consumption for transport maintained downward trend despite lower prices due to the falling number of LPG cars

Summary

- Energy consumption in the buildings sector rose by 5.0%-the fastest growth since 2005(6.6%)-mostly for heating and cooling due to lower energy prices, record heat wave and colder winter than last year.
 - City gas rates were lowered in January, March and May 2016 with the adoption of raw material cost pass-through system, and heat energy rates were also reduced reflecting the drop in the city gas rates. In addition, the progressive electricity rate system was relaxed during the summer and then reformed in December, alleviating consumers' burden on electricity bills.
 - Heating and cooling degree days increased by 56.9% and 4.5% respectively and energy rates declined in the buildings sector. Consequently, gas, electricity and heat energy consumption in buildings went up by 5.1%, 4.0% and 9.7% respectively on a year-on-year basis.
- The consumption of electricity, a type of final energy, was up almost 3% as electricity consumption increased rapidly in buildings due to higher cooling and heating loads even though the growth of industrial electricity consumption made weak recovery because of less power use in the primary metals industry and stagnant consumption growth in the fabricated metals industry.

Figure 1.3 TFC growth rates by end-use sectors (2012-2016p)



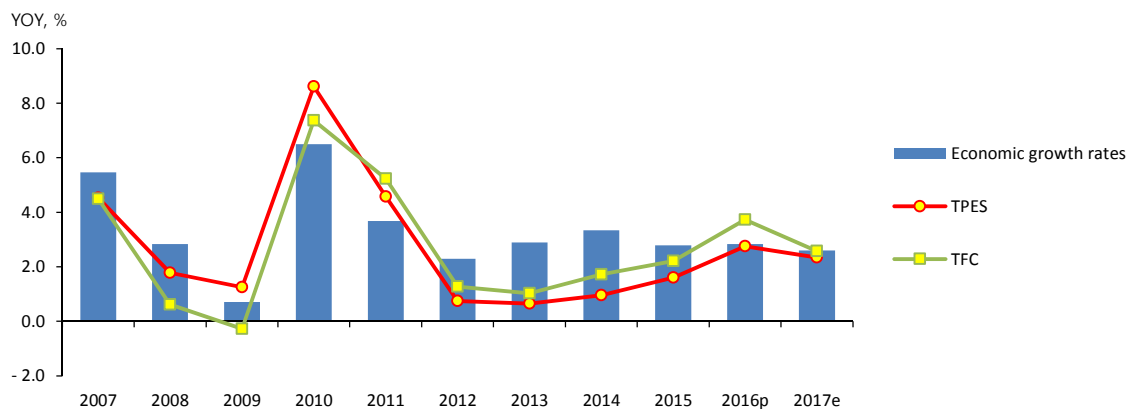
* The Buildings sector includes residential, commercial and other public buildings.

2. Energy Outlook

☐ Energy demand is predicted to rise at a similar level with GDP growth rate of 2.6% in 2017.

- Energy demand growth is to slow down compared to the previous year, due to oil price hikes and temperature moving back to seasonal average, however, the growth will be more modest compared to the period from 2012 to 2015 during which consumption remained low.
- TPED will mark 202.2Mtoe, up 2.3% year-on-year, driven by the increased demand for coal and petroleum along with newly introduced large-scale bituminous coal plants and additional petrochemical facilities.
- TFC is expected to recover and record 232.5Mtoe, up 2.6% year-on-year, thanks to the modest recovery of exports in the industrial sector and expansion of petrochemical facilities.

Figure 2.4 Economic growth and growth trend of TPED and TFC



☐ Energy efficiency is expected to show moderate improvement and energy consumption per capita will continue to rise.

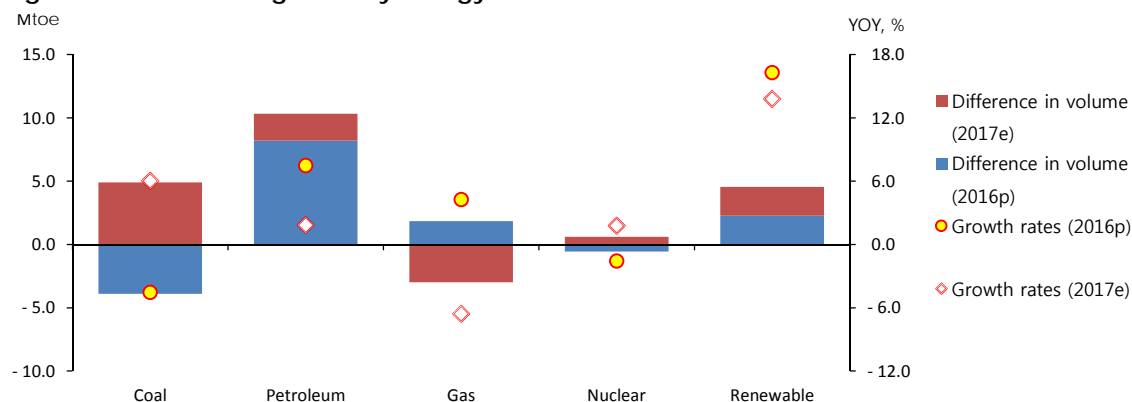
- Energy intensity (toe/KRW mil), an energy efficiency index, will improve slightly as the growth rate of TPED decreased (0.4%p) more dramatically than the economic growth rate (0.2%p) compared to the previous year.
- However, energy consumption per capita, despite its year-on-year decrease driven by declining TPED growth, is anticipated to go up by 1.9% to 5.9 toe.

☐ Coal and nuclear energy use will make a turnaround while the demand growth of petroleum and gas are predicted to slow down and tumble, respectively.

- In 2017, petroleum demand growth is set to record about 2.0%, showing a significant downward movement year-on-year, as increasing oil prices offset the growth stimulated by expanded petrochemical facilities.
 - Naphtha demand is growing more rapidly than the previous year due to additional installation of mixed-xylene (1Mton as of December 2016) and naphtha cracker (0.599Mton in H2 2017) plants and expansion of para-xylene production (0.2Mton in 2017), and will drive up the petroleum demand for industrial uses.
 - However, taking into account that global oil prices are expected to jump by 32.3% year-on-year in 2017, petroleum demand in the transport sector will be strongly down and that for buildings and power generation uses will start to decline.
- Coal demand, despite the sluggish demand in the industrial sector, is expected to rise around 6% due to the surging demand for power generation along with the expansion of bituminous coal-fired power plants.
 - Demand for coking coal, which takes up the largest share of the industrial demand, is expected to mark positive growth from a sharp decline (-9.0%) in the previous year while it will still remain stagnant due to slow recovery of exports dragged by global trade protectionism and sluggish demand from the domestic steel industry including shipbuilding, construction and automobile sectors.
 - The total capacity of bituminous coal power plants, with 5.4GW of new installations including Bukpyeong Units 1 & 2, Shin Boryeong Units 1 & 2, Samcheok Green Unit 2 and Taean Unit 10, will increase to 36.3GW at the end of 2017, up about 17% year-on-year.
 - Coal demand for power generation will not increase in proportion to new facilities built taking into account a possibility of constrained transmission due to delayed construction of transmission lines, the diminishing effect of lowered maximum output of coal plants (January 2016)⁴ and newly introduced power plants that have improved the overall efficiency of coal-fired power generation.

⁴ The maximum generating capacity of coal-fired power plants was changed from maximum continuous rating to nominal rating as a prevention measure to thermal power plant failure.

Figure 2.2 Demand growth by energy source in TPED



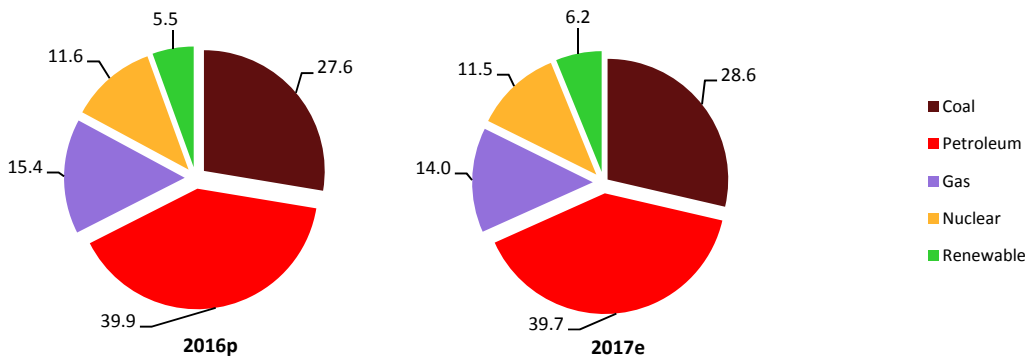
- Nuclear power generation is anticipated to make a turnaround from negative to positive growth but the growth will remain modest at the 1%-range due to restart of several nuclear power plants, the diminishing effect of newly introduced power plants and decreased capacity of nuclear power generation.
 - Nuclear power generation growth will be limited in the first half of 2017 taking into account the resumption of Hanbit Unit 3 and Wolsong Unit 1 operations (June 2015)⁵ which led a dramatic increase in power generation, and the diminishing effect of newly introduced Shinwolsong Unit 2 (July 2015).
 - Meanwhile, the introduction of Shinkori Unit 4 (1,400MW) which was originally planned in 2017 has been postponed to the second half of 2018 and Kori Unit 1 (587MW) was shut down permanently (June 2017), which may lead to a decrease in nuclear power generation capacity.
- Despite increasing city gas demand, gas demand is expected to decline by 6% or more as gas use for power generation plunged again.
 - Gas demand for power generation will reverse from positive growth in 2016 to dramatic negative growth in 2017, due to the sluggish growth of electricity demand and considerable expansion of base load power plants (coal and nuclear power generation) which is mainly driven by bituminous coal-fired power generation.

⁵ Hanbit Reactor Unit 3, after the maintenance period since the unplanned nuclear reactor outage in October 2014, resumed production in mid-June 2015. Wolsong Reactor Unit 1 which was suspended due to the expiration of its operating license in November 2012 was granted a 10-year extension and restarted at the end of June 2015.

Summary

- Decreasing gas power generation will further raise the share of new high-efficiency gas power plants in gas power generation and thus, the overall gas demand for power generation will decline more dramatically compared to power generation.
 - Renewable power generation is predicted to maintain the rapid growth thanks to the government's renewable energy expansion policy and transition of Youngdong Units 1 and 2 to biomass which was implemented as part of the government's countermeasure against fine dust.
- ☐ **The share of coal and renewable energy are expected to increase while that of other energy sources will be down in 2017.**
- The share of coal in the total primary energy demand had steadily decreased until 2014 then it rose for two consecutive years from 2015 to 2016 thanks to decreased oil prices. However, rising oil prices are expected to reverse the trend again in 2017.

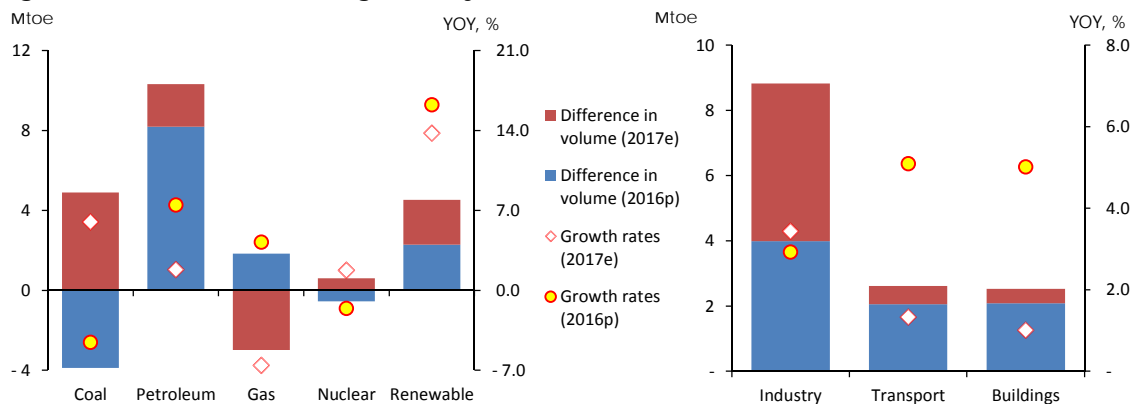
Figure 2.3 Composition of energy sources in TPED



- ☐ **Energy demand in the industrial sector is projected to further increase whereas the demand growth in the transport sector and buildings are expected to show a dramatic decrease in 2017.**
- Energy demand in the industrial sector is forecasted to improve from the previous year's 2% to the 3%-range, driven by a modest recovery in exports and expansion of petrochemical facilities.
 - Feedstock energy is expected to show a strong rebound from the previous year taking into account that naphtha demand, with its expanded facilities, has maintained the steady growth since 2016, and coal demand for iron-making which plummeted in 2016 remains unchanged due to the base effect.
 - However, due to increasing oil prices and LPG demand which soared in 2016 decreasing owing to the diminishing effect of propylene facilities, fuel energy demand in the industrial sector is predicted to grow at a slower pace compared the previous year.

- Although the increased number of vehicles and higher demand for travel and cargo transport will boost energy demand in the transport sector, the energy demand will grow much slower than last year and remain at the 1%-range due to rising oil prices.
 - With oil prices plunged by 18.8% year-on-year, energy demand in the transport sector surged by more than 5% in 2016, however, oil prices are forecasted to increase at an annual rate of 30% or more in 2017, decreasing the growth of energy demand significantly.
- The growth rate of energy demand in buildings, with the temperature returning to usual levels, is forecasted to slow down considerably to about 1.0%.
 - Assuming that the mean temperature for the last 10 years is applied, the growth rate of electricity, which makes up the majority of energy consumption, will slow down along with a sharp decrease in CDD (-50.3%).
 - City gas demand in buildings will increase thanks to a rise in HDD (1.9%) and its improved price competitiveness against petroleum.

Figure 2.4 TFC volume and growth by source and sector



- Despite a modest recovery in the industrial sector, a significant decrease in energy demand for buildings will drive down the electricity demand growth (TFC) to the 1%-range.
 - Electricity demand for industrial uses, thanks to an increase in exports along with global economic recovery, expansion of petrochemical facilities and the base effect of the primary metal industry, is expected to go up by around 2% year-on-year, maintaining its modest recovery pace.
 - Although the residential progressive electricity rates were lowered, decreasing energy demand for air-conditioning due to the temperature recovering back to seasonal average is expected to bring down the growth of electricity demand in buildings to early- or mid-1% range.

3. Key Features and Implication

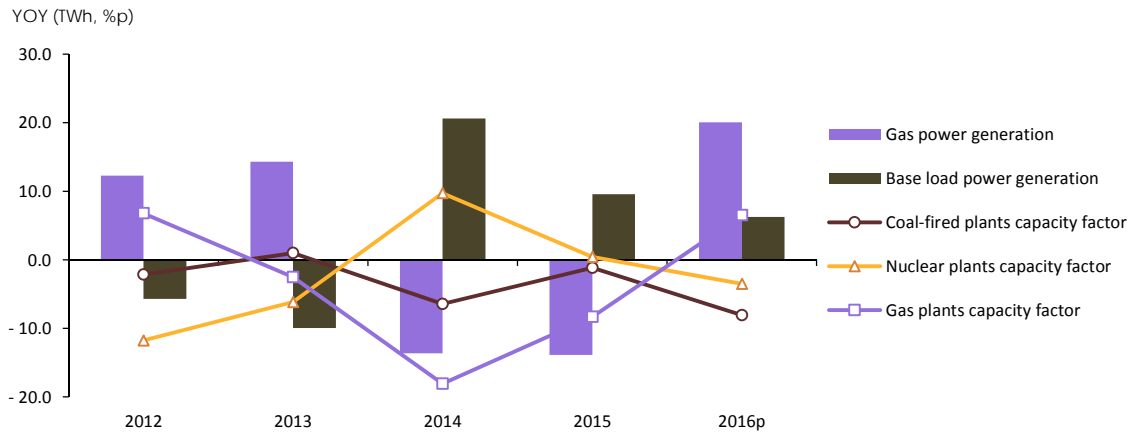
- **Gas power generation and gas input for power generation made a turnaround from the recent rapid decline due to the reduction of nuclear power generation in 2016.**
 - In 2016, the growth of base load (coal and nuclear energy) generation, despite the introduction of new generation facilities, decreased from the previous year due to the lowered maximum output of coal-fired power plants, earthquake effects, etc. As a result, the capacity factor of nuclear plants dropped dramatically.
 - The capacity of base load generation facilities increased to 53.5GW⁶ as of the end of 2016, up by 9.3% year-on-year, driven by newly introduced coal-fired power plants including Dangjin Unit 9 (Jul. 2016), Yeosu Coal-fired Unit 1 (Aug. 2016), Dangjin Unit 10 (Sep. 2016), Taean Unit 9 (Oct. 2016), Samcheok Green Unit 1 (Dec. 2016) and nuclear power plant Shinkori Unit 3 (Dec. 2016).
 - However, the growth of coal-fired power generation was limited due to downward revision to the maximum output of coal-fired plants (Jan. 2016) and more preventive maintenance on a daily average basis (12.3%), and nuclear power generation plunged by an annual rate of 1.7% since September 2016, led by increased preventive maintenance (16.9%) and safety inspections of four power plants (Wolsong Units 1 to 4) following the earthquake in Gyeongju.
 - As a result, the capacity factor of coal-fired and nuclear power plants went down by 8%p and more than 3%p year-on-year, to 78% and 83%⁷, respectively.
 - On the other hand, with gas taking a bigger role in power generation along with extreme heat wave and the reduced effect of plunging oil prices, gas power generation and gas input for power generation rebounded from the steep downward trend that continued from 2014 to 2015.
 - The growth of electricity consumption increased to 2.8% in 2016, up 1.5%p year-on-year. In particular, the peak load, which is handled by gas and oil-fired power generation, soared due to the scorching heat wave during the summer, and the plunge of oil-fired power generation drove gas power generation to take a bigger role.

⁶ The share of base load generation facilities in the total capacity of power generation facilities (104GW) increased to 51.4% in 2016, up by 1.2%p year-on-year.

⁷ For annual capacity factor calculation, power generation facilities as of the end of year are used, thus, the actual capacity factor may be different.

- Due to plummeting oil prices, oil-fired power generation skyrocketed by 58.4% and 27.2% in 2014 and 2015, respectively. Although the annual average oil price declined in 2016, the oil prices modestly rebounded from the first quarter, driving down oil-fired power generation by more than 55%.
- Against this backdrop, gas power generation and gas input for power generation recovered from the sharp downward trend at an average rate of the 11% and 9% range in 2014 and 2015, to 19.9% and 5.3% in 2016, respectively. Moreover, the capacity factor of gas power plants rebounded from the three consecutive years of decrease to 42% up 6%p year-on-year.

Figure 3.1 Power generation and capacity factor by major energy source (2012-2016)



* Capacity factor is the ratio of actual energy produced to the amount of energy produced from continuous operation at full-rated power (as of the end of quarter).

□ The abrupt drop of gas power generation was mitigated considerably due to a significant decrease in nuclear generation outlook compared to the forecast made in the previous issue.

- Due to changes in generation capacity assumptions, the forecast for the nuclear power generation growth decreased by 5.6%p in 2017 compared to the forecast in the previous issue, whereas gas demand for power generation declined by the mid-10% range, indicating that the sharp decline forecasted in the previous issue was mitigated considerably.
 - The growth of nuclear power generation in 2017 was revised down to less than 2% taking into account that the introduction of Shinkori Unit 4 (1,400MW), which was supposed to be commissioned in 2017, is postponed to the second half of 2018 and the capacity of nuclear power plants for preventive maintenance in the first quarter soared (182.5%).
 - In this regard, the plunge in gas demand for power generation was revised to be mitigated considerably compared to the previous forecast, but the gas demand will continue to drop at a fast pace due to increasing coal-fired power generation.

Summary

- In particular, the preventive maintenance period for nuclear power plants was extended due to safety inspection requirements strengthened in the first quarter of 2017, and the capacity factor of nuclear power plants which plummeted in the wake of the earthquake in Gyeongju has maintained the 70%-range since the last quarter of 2016.
- Following the earthquake in Gyeongju in September 2016, a total of 10 nuclear power plants were suspended simultaneously in October 2016, resulting in the capacity factor of the quarter down to 70.6%.
- The capacity factor of the first quarter of 2017 was 77.4%, showing a dramatic year-on-year decrease (15.8%p), as a number of nuclear power plants extended the preventive maintenance period from the original plan.
- Hanbit Units 1 and 2 and Hanul Unit 1 were shut down in the first quarter of 2017 as the maintenance period of the plants were extended due to replacement of containment liner plates in the reactor containment buildings. Furthermore, the preventive maintenance period of Kori Unit 3 and Shinkori Unit 1 which were due in the first quarter have also been extended for additional 80 and 65 days, respectively.
- The capacity factor of nuclear power plants is expected to remain low at around 83% for two consecutive years taking into account its dramatic downward movement in the first quarter of 2017.

Table 3.1 Nuclear power plants shutdown records

	2016												2017					2016												2017			
	4	5	6	7	8	9	10	11	12	1	2	3	4	4	5	6		7	8	9	10	11	12	1	2	3	4						
Kori1														Hanul1																			
Kori2														Hanul2																			
Kori3														Hanul3																			
Kori4														Hanul4																			
Shinkori1														Hanul5																			
Shinkori2														Hanul6																			
Shinkori3														Wolsong1																			
Hanbit1														Wolsong2																			
Hanbit2														Wolsong3																			
Hanbit3														Wolsong4																			
Hanbit4														Shinwolsong1																			
Hanbit5														Shinwolsong2																			
Hanbit6																																	

Notes: ■ normal operation, ■ prevented maintenance, ■ unscheduled shutdown

□ **While coal demand will rapidly rise and energy use in buildings is expected to decrease, uncertainty is likely to expand.**

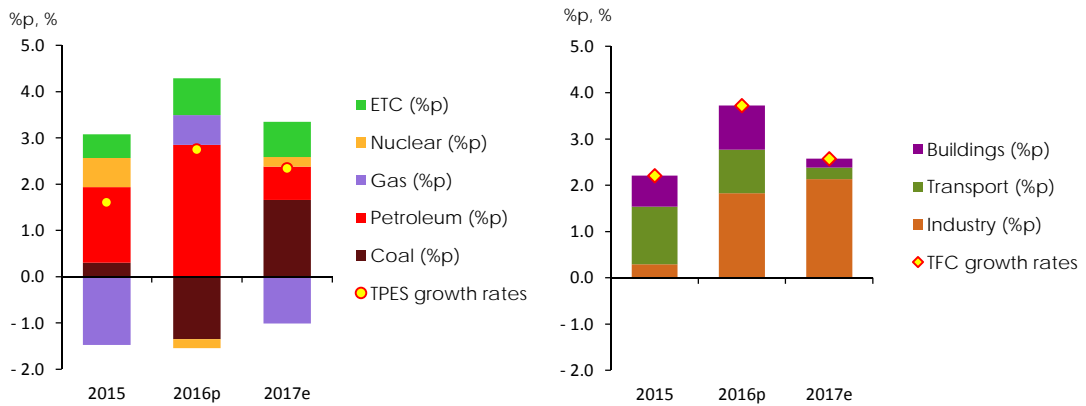
- In terms of energy source, coal is predicted to drive energy demand and among different sectors, energy demand for buildings will go down dramatically in 2017.
 - Coal demand, mainly led by newly introduced large-scale bituminous coal-fired power plants, will drive TPED in 2017, whereas gas demand is forecasted to reverse from the previous year and show a downward movement.
 - Meanwhile, energy demand in buildings, which surged due to extreme heat wave in 2016, will drop sharply as the temperature returns to usual levels.
- However, taking into account that this forecast is made in the beginning of May 2017⁸, uncertainty regarding the energy demand outlook has increased due to a possibility of revision of energy policy and recurrence of heat wave.
 - As one of emergency response measures to fight fine dust, on 15 May 2017, President Moon ordered a temporary shutdown of old coal-fired power plants which had run for 30 years or longer. Thus, a total of 8 aged coal power plants amounting to 2,845MW, including Yongdong Units 1 and 2, Boryeong Units 1 and 2, Seochon Units 1 and 2 and Samcheonpo Units 1 and 2, will be down for a month since June 2017.
 - Furthermore, given that the new government pledged to shut down Wolsong Unit 1⁹ and increase the operating rate of gas power generation facilities from 40% to 60%¹⁰, gas and nuclear energy demand outlook may change dramatically once details on energy policy are determined.
 - The extreme heat wave has been witnessed as early as in May since 2014 and if the sweltering heat prevails in 2017, energy demand in buildings is likely to continue its dramatic upward trend as in the previous year.

⁸ The forecast preparation started at the end of April 2017 and details were finalized at the beginning of May 2017.

⁹ After the Nuclear Safety and Security Commission (NSSC) granted the continued operation of Wolsong Unit 1 (Feb. 2015), the Seoul Administrative Court canceled the permit (Feb. 2017) and NSSC lodged an appeal to extend the reactor's lifespan.

¹⁰ In this report, the gas plants capacity factor will decrease from 42.3% in 2016 to the early 30%-range in 2017.

Figure 3.2 TPED and TFC growth and contribution by energy source and sector



Note: TPED growth (%) = Total contribution by energy source (%p); TFC growth (%)=Total contribution by sector (%p)

4. The Main Indicator and Energy Outlook Result

Main Economic and Energy Indicators

	2013	2014	2015			2016			2017		
			1H	2H		1H	2H		1H	2H	
Economy and Population											
GDP (2010 trillion won)	1 380.8	1 427.0	711.7	755.1	1 466.8	734.1	774.1	1 508.3	753.2	794.3	1 547.5
Industrial Production(2010=100)	108.2	108.4	107.4	108.8	108.1	107.7	110.7	109.2	108.2	111.4	109.8
Crude Oil Price (Dubai, USD/bbl)	105.3	96.7	56.3	45.2	50.8	36.8	45.7	41.2	53.6	55.6	54.6
Working Days	274.5	271.5	135.5	138.5	274.0	133.5	139.5	273.0	136.0	136.5	272.5
Population (million)	50.4	50.7	51.0	51.0	51.0	51.2	51.2	51.2	51.4	51.4	51.4
Average Temperature (°C)	12.5	13.4	10.4	16.8	13.6	10.2	16.9	13.6	9.8	16.0	12.9
Cooling Degree days	194.8	125.4	13.5	138.3	151.8	10.2	227.9	238.1	1.7	116.8	118.5
Heating Degree days	2 911.2	2 519.6	1 611.0	866.1	2 477.1	1 654.1	935.6	2 589.7	1 670.0	970.1	2 640.1
Energy Indicators											
Total Primary Energy Demand (Mtoe)	280.2	282.9	143.1	144.3	287.4	146.7	148.6	295.3	149.7	152.4	302.2
Energy Intensity (toe/million won)	0.203	0.199	0.202	0.191	0.196	0.200	0.192	0.196	0.199	0.192	0.196
TPED/capita (toe/capita)	5.556	5.574	2.805	2.829	5.633	2.863	2.899	5.762	2.911	2.963	5.874
Electricity Generation (TWh)	517.7	522.0	260.6	267.5	528.1	266.1	274.4	540.4	269.2	278.4	547.6
Electricity Generation/capita (MWh/capita)	10.3	10.3	5.1	5.2	10.4	5.2	5.4	10.5	5.2	5.4	10.6
Electricity Demand/capita (MWh/capita)	9.4	9.4	4.8	4.7	9.5	4.8	4.9	9.7	4.9	4.9	9.8

Energy Demand

	2013	2014	2015			2016p			2017e		
			1H	2H		1H	2H		1H	2H	
Total Primary Energy Supply											
Coal (Mton)	129.6	133.3	66.7	68.1	134.8	61.9	67.1	129.0	66.3	70.5	136.9
Oil (Mbbbl)	825.2	821.5	417.5	438.7	856.2	451.8	469.7	921.5	459.7	480.6	940.3
Gas (Bm ³)	40.3	36.6	18.2	15.2	33.4	17.9	17.0	34.9	17.5	15.0	32.6
Hydro (TWh)	8.4	7.8	2.8	3.0	5.8	3.0	3.6	6.6	3.3	3.9	7.2
Nuclear (TWh)	138.8	156.4	78.5	86.3	164.8	86.5	75.7	162.2	80.8	84.2	165.0
Other Renewables (Mtoe)	9.0	11.0	6.4	6.4	12.8	7.5	7.5	15.0	8.5	8.5	17.1
Total (Mtoe)	280.2	282.9	143.1	144.3	287.4	146.7	148.6	295.3	149.7	152.4	302.2
Coal	81.9	84.6	42.3	43.2	85.5	39.2	42.4	81.6	42.0	44.5	86.5
Oil	105.8	104.9	53.5	56.1	109.6	57.9	59.9	117.8	58.7	61.2	119.9
Gas	52.4	47.7	23.7	19.8	43.5	23.2	22.1	45.4	22.8	19.6	42.4
Nuclear	1.8	1.6	0.6	0.6	1.2	0.6	0.8	1.4	0.7	0.8	1.5
Hydro	29.3	33.0	16.6	18.2	34.8	18.3	16.0	34.2	17.0	17.8	34.8
Other Renewables	9.0	11.0	6.4	6.4	12.8	7.5	7.5	15.0	8.5	8.5	17.1
Total Final Consumption											
Coal (Mton)	49.5	53.1	25.5	26.8	52.4	23.2	25.7	49.0	23.3	25.9	49.2
Oil (Mbbbl)	799.1	808.5	410.2	431.3	841.6	439.2	460.7	899.8	449.7	473.3	923.0
Gas (Bm ³)	23.9	22.1	12.2	8.6	20.8	12.3	9.0	21.3	12.5	9.0	21.5
Electricity (TWh)	474.8	477.6	244.5	239.2	483.7	248.5	248.5	497.0	253.2	252.2	505.3
Heat (Mtoe)	1.7	1.6	1.0	0.6	1.6	1.0	0.7	1.7	1.1	0.7	1.8
Other Renewables (Mtoe)	7.9	9.5	5.6	5.5	11.1	6.4	6.3	12.7	7.2	7.2	14.4
Total (Mtoe)	210.2	213.8	109.8	108.7	218.5	113.2	113.4	226.6	116.0	116.5	232.5
Coal	32.7	35.4	17.1	17.8	34.9	15.5	17.1	32.6	15.6	17.2	32.8
Oil	101.8	103.0	52.4	55.0	107.3	55.9	58.5	114.4	57.1	60.1	117.2
Gas	25.3	23.3	12.9	9.2	22.0	13.0	9.5	22.5	13.2	9.6	22.8
Electricity	40.8	41.1	21.0	20.6	41.6	21.4	21.4	42.7	21.8	21.7	43.5
Heat	1.7	1.6	1.0	0.6	1.6	1.0	0.7	1.7	1.1	0.7	1.8
Other Renewables	7.9	9.5	5.6	5.5	11.1	6.4	6.3	12.7	7.2	7.2	14.4
Industry	130.8	136.0	67.4	69.2	136.6	68.9	71.8	140.6	71.2	74.2	145.5
Transport	37.3	37.6	19.6	20.7	40.3	20.6	21.8	42.3	20.7	22.2	42.9
Buildings	42.0	40.1	22.8	18.8	41.6	23.8	19.9	43.7	24.1	20.1	44.1

Energy Demand

(yoy, %)

	2013	2014	2015			2016p			2017e		
			1H	2H		1H	2H		1H	2H	
Total Primary Energy Supply											
Coal (Mton)	1.1	2.9	2.7	-0.4	1.1	-7.3	-1.5	-4.4	7.2	5.1	6.1
Oil (Mbbbl)	-0.3	-0.5	3.2	5.2	4.2	8.2	7.1	7.6	1.8	2.3	2.0
Gas (Bm ³)	4.8	-9.2	-5.8	-11.9	-8.7	-2.0	11.7	4.2	-1.9	-11.5	-6.6
Hydro (TWh)	9.7	-6.8	-22.3	-29.0	-25.9	7.4	20.9	14.3	8.7	8.2	8.4
Nuclear (TWh)	-7.7	12.7	0.7	9.9	5.3	10.2	-12.3	-1.6	-6.6	11.3	1.8
Other Renewables (Mtoe)	11.8	21.9	17.6	16.8	17.2	17.1	15.8	16.4	14.1	14.4	14.3
Total (Mtoe)	0.6	1.0	1.5	1.7	1.6	2.5	3.0	2.7	2.1	2.6	2.3
Coal	1.2	3.3	2.4	-0.3	1.0	-7.4	-1.8	-4.5	7.0	5.0	6.0
Oil	-0.3	-0.8	3.3	5.4	4.4	8.2	6.8	7.5	1.4	2.2	1.8
Gas	5.1	-9.0	-5.9	-12.0	-8.8	-2.0	11.7	4.2	-1.9	-11.5	-6.6
Nuclear	9.7	-6.8	-22.3	-29.0	-25.9	7.4	20.9	14.3	8.7	8.2	8.4
Hydro	-7.7	12.7	0.7	9.9	5.3	10.2	-12.3	-1.6	-6.6	11.3	1.8
Other Renewables	11.8	21.9	17.6	16.8	17.2	17.1	15.8	16.4	14.1	14.4	14.3
Total Final Consumption											
Coal (Mton)	2.3	7.1	-2.7	0.1	-1.3	-9.0	-4.0	-6.4	0.5	0.6	0.5
Oil (Mbbbl)	0.3	1.2	3.6	4.6	4.1	7.1	6.8	6.9	2.4	2.7	2.6
Gas (Bm ³)	0.5	-7.5	-2.7	-10.1	-5.9	1.1	3.8	2.3	1.5	1.0	1.3
Electricity (TWh)	1.8	0.6	1.8	0.7	1.3	1.7	3.9	2.8	1.9	1.5	1.7
Heat (Mtoe)	-3.2	-7.6	6.1	-9.7	-0.5	8.1	12.3	9.7	3.8	2.8	3.4
Other Renewables (Mtoe)	10.7	20.1	17.7	16.7	17.2	14.6	13.7	14.2	13.5	14.3	13.9
Total (Mtoe)	1.0	1.7	2.2	2.2	2.2	3.1	4.4	3.7	2.5	2.7	2.6
Coal	2.2	8.4	-2.9	0.1	-1.4	-9.1	-4.3	-6.7	0.5	0.7	0.6
Oil	0.1	1.1	3.8	4.6	4.2	6.8	6.4	6.6	2.2	2.7	2.5
Gas	-0.3	-7.8	-2.3	-9.8	-5.6	1.1	3.7	2.2	1.5	1.0	1.3
Electricity	1.8	0.6	1.8	0.7	1.3	1.7	3.9	2.8	1.9	1.5	1.7
Heat	-3.2	-7.6	6.1	-9.7	-0.5	8.1	12.3	9.7	3.8	2.8	3.4
Other Renewables	10.7	20.1	17.7	16.7	17.2	14.6	13.7	14.2	13.5	14.3	13.9
Industry	2.0	4.0	-0.4	1.3	0.5	2.1	3.7	2.9	3.4	3.4	3.4
Transport	0.5	0.8	6.9	7.2	7.1	5.1	5.1	5.1	0.8	1.8	1.3
Buildings	-1.6	-4.5	6.6	0.2	3.6	4.3	5.9	5.0	1.1	1.0	1.0

Energy Demand by Sector

(Mtoe)

	2013	2014	2015			2016e			2017e		
			1H	2H		1H	2H		1H	2H	
Industry	130.8	136.0	67.4	69.2	136.6	68.9	71.8	140.6	71.2	74.2	145.5
Coal	31.8	34.7	16.8	17.4	34.2	15.3	16.7	32.0	15.4	16.9	32.3
Oil	60.1	61.2	30.3	31.9	62.2	32.7	34.3	67.0	33.8	35.7	69.5
Gas	10.3	9.3	4.2	3.8	8.0	4.1	3.8	7.8	4.2	3.8	7.9
Electricity	22.1	22.8	11.5	11.4	22.8	11.5	11.7	23.2	11.8	11.9	23.7
Heat	-	-	-	-	-	-	-	-	-	-	-
Other Renewables	6.5	8.1	4.7	4.7	9.4	5.3	5.3	10.6	6.0	6.0	12.1
Transport	37.3	37.6	19.6	20.7	40.3	20.6	21.8	42.3	20.7	22.2	42.9
Coal	-	-	-	-	-	-	-	-	-	-	-
Oil	35.5	35.8	18.6	19.7	38.4	19.6	20.8	40.3	19.7	21.1	40.8
Gas	1.3	1.3	0.6	0.7	1.3	0.6	0.6	1.3	0.6	0.6	1.3
Electricity	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.2
Heat	-	-	-	-	-	-	-	-	-	-	-
Other Renewables	0.4	0.4	0.2	0.2	0.4	0.3	0.3	0.5	0.3	0.3	0.5
Buildings*	42.0	40.1	22.8	18.8	41.6	23.8	19.9	43.7	24.1	20.1	44.1
Coal	0.9	0.7	0.2	0.4	0.7	0.2	0.4	0.6	0.2	0.3	0.5
Oil	6.2	6.0	3.4	3.3	6.8	3.7	3.4	7.1	3.6	3.3	6.9
Gas	13.7	12.7	8.1	4.7	12.7	8.3	5.1	13.4	8.4	5.2	13.6
Electricity	18.6	18.1	9.5	9.1	18.6	9.7	9.6	19.3	9.9	9.7	19.5
Heat	1.7	1.6	1.0	0.6	1.6	1.0	0.7	1.7	1.1	0.7	1.8
Other Renewables	1.0	1.0	0.7	0.6	1.3	0.8	0.8	1.6	0.9	0.9	1.8
Transform	137.8	135.1	68.1	65.9	134.0	68.9	66.7	135.5	69.7	67.9	137.6
Coal	49.2	49.2	25.2	25.3	50.6	23.7	25.3	49.0	26.4	27.3	53.7
Oil	4.0	2.0	1.1	1.1	2.2	1.9	1.4	3.3	1.5	1.1	2.6
Gas	52.4	47.7	23.7	19.8	43.5	23.2	22.1	45.3	22.8	19.5	42.3
Nuclear	29.3	33.0	16.6	18.2	34.8	18.3	16.0	34.2	17.0	17.8	34.8
Hydro	1.8	1.6	0.6	0.6	1.2	0.6	0.8	1.4	0.7	0.8	1.5
Renewables	1.1	1.5	0.8	0.9	1.7	1.1	1.2	2.3	1.3	1.3	2.7

* include residential, commercial, public-etc usage

Coal

(Mton)

	2013	2014	2015			2016e			2017e		
			1H	2H		1H	2H		1H	2H	
Total Coal Demand	129.6	133.3	66.7	68.1	134.8	61.9	67.1	129.0	66.3	70.5	136.9
Transform	80.0	80.3	41.2	41.3	82.5	38.6	41.3	80.0	43.0	44.6	87.6
Power Generation	80.0	80.3	41.2	41.3	82.5	38.6	41.3	80.0	43.0	44.6	87.6
Heat	-	-	-	-	-	-	-	-	-	-	-
Gas Manufacture	-	-	-	-	-	-	-	-	-	-	-
Total Final Consumption	49.5	53.1	25.5	26.8	52.4	23.2	25.7	49.0	23.3	25.9	49.2
Industry	47.6	51.4	25.0	25.9	50.9	22.8	25.0	47.7	22.9	25.2	48.1
Transport	-	-	-	-	-	-	-	-	-	-	-
Buildings	1.9	1.6	0.6	0.9	1.5	0.5	0.8	1.3	0.4	0.7	1.1
Consumption by products											
Anthracite	10.7	10.2	5.1	5.6	10.7	4.7	6.2	10.9	4.5	5.8	10.3
Bituminous	118.8	123.1	61.7	62.5	124.2	57.2	60.9	118.0	61.9	64.7	126.6
Iron making	32.1	37.6	18.0	18.7	36.8	16.2	17.3	33.5	16.3	17.4	33.7
Cement	4.6	4.9	2.3	2.3	4.7	2.1	2.5	4.6	2.1	2.5	4.6
Power Generation	79.7	78.2	40.1	40.3	80.4	37.6	40.1	77.7	42.2	43.7	85.9

Oil

(Mbbbl)

	2013	2014	2015p			2016e			2017e		
			1H	2H		1H	2H		1H	2H	
Total Oil Demand	825.2	821.5	417.5	438.7	856.2	451.8	469.7	921.5	459.7	480.6	940.3
Transform	26.1	13.0	7.3	7.3	14.6	12.6	9.0	21.6	10.0	7.3	17.3
Power Generation	23.0	11.0	6.3	6.6	12.8	11.6	8.2	19.8	9.0	6.5	15.5
Heat	1.3	1.0	0.6	0.2	0.8	0.4	0.2	0.6	0.4	0.2	0.6
Gas Manufacture	1.9	0.9	0.5	0.6	1.0	0.6	0.6	1.2	0.7	0.6	1.2
Total Final Consumption	799.1	808.5	410.2	431.3	841.6	439.2	460.7	899.8	449.7	473.3	923.0
Industry	482.0	491.8	243.8	257.2	501.0	264.3	279.1	543.4	274.7	289.9	564.6
Transport	267.4	268.8	139.4	147.6	287.1	145.7	154.7	300.4	146.5	157.2	303.8
Buildings	49.7	47.9	27.0	26.5	53.5	29.1	26.9	56.0	28.5	26.1	54.6
Consumption by products											
Gasoline	73.4	73.5	37.1	39.5	76.6	38.2	40.8	78.9	38.0	41.4	79.3
Diesel (including Transformation)	143.0	144.8	76.0	80.4	156.4	81.3	85.2	166.6	81.1	86.3	167.3
Kerosene (including Transformation)	18.8	15.4	8.2	8.0	16.2	10.0	9.0	19.1	9.1	8.5	17.6
B-C (including Transformation)	46.4	33.3	19.3	19.0	38.3	25.4	22.1	47.4	23.7	20.7	44.3
Jet Oil	30.3	32.0	17.1	17.3	34.4	18.2	18.8	37.0	18.4	19.3	37.7
LPG (including Transformation)	93.1	89.6	41.5	48.4	89.9	50.4	59.2	109.6	54.4	59.6	114.0
Naphtha	384.2	396.3	203.1	207.7	410.8	210.7	216.2	426.8	218.7	226.6	445.3
Other Non-Energy	36.0	36.6	15.4	18.3	33.7	17.6	18.5	36.1	16.4	18.2	34.6

Gas

	2013	2014	2015			2016e			2017e		
			1H	2H		1H	2H		1H	2H	
Total Gas Demand (Mton)	40.3	36.6	18.2	15.2	33.4	17.9	17.0	34.9	17.5	15.0	32.6
Transform	40.0	36.4	18.1	15.0	33.1	17.7	16.8	34.5	17.3	14.9	32.2
Power Generation	17.6	15.9	7.6	7.0	14.6	6.9	8.4	15.3	6.4	6.4	12.8
Heat	2.6	2.2	0.9	0.7	1.5	0.9	0.8	1.7	1.0	0.8	1.8
Gas Manufacture	19.8	18.3	9.7	7.3	17.0	9.8	7.7	17.5	9.9	7.7	17.7
Industry	0.4	0.3	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.2	0.3
City Gas (Bm³)	23.9	22.1	12.2	8.6	20.8	12.3	9.0	21.3	12.5	9.0	21.5
Industry*	9.5	8.7	3.8	3.5	7.3	3.7	3.5	7.2	3.8	3.5	7.3
Transport	1.2	1.3	0.6	0.6	1.2	0.6	0.6	1.2	0.6	0.6	1.2
Buildings	13.1	12.2	7.7	4.5	12.2	8.0	4.9	12.8	8.1	5.0	13.0

* exclude industrial LNG usage

Electricity

(TWh)

	2013	2014	2015			2016e			2017e		
			1H	2H		1H	2H		1H	2H	
Net Electricity Demand	517.7	522.0	260.6	267.5	528.1	266.1	274.4	540.4	269.2	278.4	547.6
Own use and Losses	42.9	44.4	16.2	28.3	44.4	17.6	25.8	43.4	16.1	26.2	42.3
Total Final Consumption	474.8	477.6	244.5	239.2	483.7	248.5	248.5	497.0	253.2	252.2	505.3
Industry	256.8	264.6	133.3	132.4	265.6	134.1	135.8	270.0	137.2	138.0	275.2
Transport	2.2	2.0	1.1	1.2	2.2	1.3	1.4	2.7	1.4	1.5	2.8
Buildings	215.8	211.0	110.1	105.7	215.8	113.1	111.3	224.4	114.6	112.7	227.3
Installed Electrical Capacity (GW)*	327.2	357.5	190.1	194.4	384.5	197.5	205.2	402.7	218.6	230.7	449.3
Coal	98.1	103.6	54.1	54.3	108.4	54.9	60.5	115.4	65.7	73.0	138.7
Oil	19.5	18.5	8.5	8.5	17.0	8.4	8.3	16.6	8.3	8.3	16.6
Gas	89.1	110.6	63.1	64.1	127.2	65.0	65.2	130.3	69.6	73.5	143.1
Nuclear	82.9	82.9	41.4	43.4	84.9	43.4	43.9	87.3	46.0	45.1	91.1
Hydro	25.8	25.8	12.9	12.9	25.9	13.0	13.0	25.9	13.0	13.0	25.9
Other Renewables	11.8	16.1	10.0	11.1	21.2	12.8	14.3	27.1	16.0	17.9	33.9
Electricity Generation of Power Plants*	517.7	522.0	260.6	267.5	528.1	266.1	274.4	540.4	269.2	278.4	547.6
Coal	200.4	203.4	102.6	102.1	204.7	101.6	112.1	213.7	114.2	122.5	236.7
Oil	15.8	25.0	15.7	16.0	31.7	8.4	5.8	14.3	6.5	4.6	11.1
Gas	128.3	114.7	51.7	49.1	100.8	55.4	65.5	120.8	51.4	49.7	101.1
Nuclear	138.8	156.4	78.5	86.3	164.8	86.5	75.5	162.0	80.8	84.0	164.8
Hydro	8.5	7.8	2.8	3.0	5.8	3.0	3.6	6.6	3.3	3.9	7.2
Other Renewables	11.3	14.7	9.4	10.9	20.3	11.1	11.9	23.0	13.1	13.6	26.7
Fuel Consumption of Power Plants (Mtoe)*	108.3	108.1	54.2	55.4	109.6	54.7	55.6	110.3	55.4	56.7	112.1
Coal	49.2	49.2	25.2	25.3	50.6	23.7	25.3	49.0	26.4	27.3	53.7
Oil	3.6	1.7	1.0	1.0	2.0	1.8	1.3	3.1	1.4	1.0	2.4
Gas	23.3	21.0	10.0	9.3	19.3	9.2	11.1	20.3	8.5	8.4	17.0
Nuclear	29.3	33.0	16.6	18.2	34.8	18.3	16.0	34.2	17.0	17.8	34.8
Hydro	1.8	1.6	0.6	0.6	1.2	0.6	0.8	1.4	0.7	0.8	1.5
Other Renewables	1.1	1.5	0.8	0.9	1.7	1.1	1.2	2.3	1.3	1.3	2.7

* District Heat is classified by fuel type since 2014

Heat and Other Renewables

(Mtoe)

	2013	2014	2015			2016e			2017e		
			1H	2H		1H	2H		1H	2H	
Net Heat Demand	1.8	1.6	1.0	0.6	1.6	0.9	0.6	1.6	1.0	0.6	1.6
Own use and Losses	0.1	-0.0	-0.0	0.0	0.0	-0.1	-0.0	-0.2	-0.1	-0.0	-0.2
Total Final Consumption	1.7	1.6	1.0	0.6	1.6	1.0	0.7	1.7	1.1	0.7	1.8
Industry	-	-	-	-	-	-	-	-	-	-	-
Transport	-	-	-	-	-	-	-	-	-	-	-
Buildings	1.7	1.6	1.0	0.6	1.6	1.0	0.7	1.7	1.1	0.7	1.8
Heat Production by fuel											
Coal	-	-	-	-	-	-	-	-	-	-	-
Oil	1.2	1.0	0.6	0.4	1.0	0.7	0.4	1.1	0.7	0.4	1.2
Gas	0.6	0.5	0.3	0.2	0.5	0.2	0.2	0.4	0.2	0.2	0.4
Nuclear	-	-	-	-	-	-	-	-	-	-	-
Hydro	-	-	-	-	-	-	-	-	-	-	-
Other Renewables	-	-	-	-	-	-	-	-	-	-	-
Fuel Consumption of District Heat											
Coal	-	-	-	-	-	-	-	-	-	-	-
Oil	0.2	0.2	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.1
Gas	3.3	2.8	1.1	0.9	2.0	1.2	1.0	2.2	1.3	1.0	2.3
Nuclear	-	-	-	-	-	-	-	-	-	-	-
Hydro	-	-	-	-	-	-	-	-	-	-	-
Other Renewables	-	-	-	-	-	-	-	-	-	-	-
Other Renewables	10.8	12.6	7.0	7.1	14.1	8.1	8.2	16.3	9.2	9.4	18.6
Hydro	1.8	1.6	0.6	0.6	1.2	0.6	0.8	1.4	0.7	0.8	1.5
Transform	1.1	1.5	0.8	0.9	1.7	1.1	1.2	2.3	1.3	1.3	2.7
Total Final Consumption	7.9	9.5	5.6	5.5	11.1	6.4	6.3	12.7	7.2	7.2	14.4
Industry	6.5	8.1	4.7	4.7	9.4	5.3	5.3	10.6	6.0	6.0	12.1
Transport	0.4	0.4	0.2	0.2	0.4	0.3	0.3	0.5	0.3	0.3	0.5
Buildings	1.0	1.0	0.7	0.6	1.3	0.8	0.8	1.6	0.9	0.9	1.8

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