South Korea
Energy efficiency report

Objectives:
- 38 Mtoe of end-user energy savings by 2030, including 17 Mtoe in industry

<table>
<thead>
<tr>
<th>Overview</th>
<th>2011</th>
<th>2000-2011 (%/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary intensity (EU=100)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>162</td>
<td>--</td>
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<tr>
<td>CO₂ intensity (EU=100)</td>
<td>173</td>
<td>--</td>
</tr>
<tr>
<td>CO₂ emissions per capita (in tCO₂/cap)</td>
<td>12.0</td>
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</table>

**Power generation**

<table>
<thead>
<tr>
<th>2011</th>
<th>2000-2011 (%/year)</th>
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<tbody>
<tr>
<td>Efficiency of thermal power plants (in %)</td>
<td>39</td>
</tr>
<tr>
<td>Rate of electricity T&amp;D losses (in %)</td>
<td>3.8</td>
</tr>
<tr>
<td>CO₂ emissions per kWh generated (in gCO₂/kWh)</td>
<td>507</td>
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</tbody>
</table>

**Industry**

<table>
<thead>
<tr>
<th>2011</th>
<th>2000-2011 (%/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy intensity (EU=100)</td>
<td>145</td>
</tr>
<tr>
<td>Share of industrial CHP in industrial consumption (in %)</td>
<td>11</td>
</tr>
<tr>
<td>Unit consumption of steel (in toe/t)</td>
<td>0.317</td>
</tr>
</tbody>
</table>

++ Among the best performing countries  + Above the EU average<sup>1</sup>  - Below the EU average<sup>1</sup>  --Among the worst performing countries

Latest update: March 2013

<sup>1</sup> The European Union, as the best performing region, is used as the benchmark.
1. Overview

1.1. Policies: 38 Mtoe of energy savings by 2030

South Korea's energy efficiency objective, which was established in its Basic National Energy Plan 2008-2030, is to reduce energy intensity by 46 percent between 2007 and 2030. The overall energy savings goal for 2030 is nearly 38 Mtoe, 44 percent of which should be achieved in industry (17 Mtoe), 32 percent in the residential and commercial sector (12 Mtoe), 19 percent in the transport sector (7 Mtoe), and 5 percent in the public sector (1.9 Mtoe).

The Korean Energy Management Corporation (KEMCO), created in 1980 through the Rational Energy Utilization Act, implements the energy efficiency programs. The Rational Energy Utilization Act (1979) was amended in 2002, 2003 and 2008 to introduce new energy-saving measures. Three labeling programs have been launched to promote high-efficiency appliances: the Energy Efficiency Standards and Labeling Program (1992), the High-efficiency Appliances Certification Program (1996) and the E-Standby Program (1999).

South Korea's energy efficiency strategy includes building codes for new buildings over a certain size and a certification system; businesses with buildings that consume more than 2 ktoe/year can participate in Energy Saving Partnerships or enter into voluntary agreements. Businesses and individuals who invest in energy-saving facilities are entitled to tax reductions (up to 20 percent of investment costs for a year) or low-interest loans. Energy service companies (ESCOs) have been operating since 1992.

1.2. Energy consumption trends: buoyant energy consumption

South Korea's energy consumption per capita is nearly three times as high as the world average (around 5.3 toe/cap in 2011) and has been higher than the OECD average since 2007 (+25 percent in 2011). The strong growth in total energy consumption (5 percent/year between 1990 and 2011) was only interrupted briefly by the Asian crisis in 1998.

Industry (including non-energy uses) is the largest consuming sector in South Korea and its share in total consumption has remained relatively stable over time (around 37 percent). The power sector saw its share increase from 13 percent in 1990 to 30 percent in 2011, making it the country's second largest consuming sector.

Figure 1: Energy consumption trends by sector

![Energy consumption trends by sector](image-url)
At around 9,800 kWh/cap in 2011, electricity consumption per capita is more than three times as high as the world average and almost 30 percent higher than the OECD average. Total electricity consumption is growing very rapidly, increasing by an average of around 8 percent/year between 1990 and 2011.

The growth in industrial electricity consumption was rapid (+7.3 percent/year). However, this sector’s share in electricity consumption fell from 61 percent in 1990 to 51 percent in 2011 as a result of an even stronger growth in the demand from the residential and service sector (+9.1 percent/year).

1.3. Energy efficiency trends: significant improvement in the 2000s

Total energy intensity (total energy consumption per unit of GDP, measured at purchasing power parity) is much higher than the EU average (by around 60 percent) and is still at the same level as in 1990, despite a significant decrease since 2000 (-1.1 percent/year). Since 2000 industry has contributed to around 30 percent of that decrease, whereas the power sector has the opposite effect.
2. Power generation: rising share of combined cycle power plants

The average efficiency of power generation increased slightly between 1990 and 2000, and then remained stable at around 38 percent (2011). The improvement until 2000 was mainly linked to the growth in the efficiency rate of thermal power plants (from 32 percent in 1990 to around 40 percent since 2000, in line with the OECD average), which was achieved through a switch to natural gas in the generation mix and through a growing share of combined cycle power plants in the thermal capacity. Combined cycle power plants now account for nearly 40 percent of the thermal capacity.

South Korea’s rate of transmission and distribution losses is among the lowest in the world (3.8 percent in 2011).
3. Industry

3.1. Policies: 17 Mtoe of energy savings by 2030

The Basic National Energy Plan 2008-2030 sets an energy use reduction target of nearly 17 Mtoe in industry by 2030 (a 13 percent reduction, approximately, from a BAU scenario).

KEMCO promotes five-year voluntary agreements with industrial groups; businesses that enter into voluntary agreements or invest in energy-saving technologies are entitled to financial and technical support and tax credits covering up to 20 percent of the investment cost. Since 2007 large energy consumers (over 2 ktoe/year) have to carry out mandatory energy audits every 5 years; in the case of small and medium sized enterprises (under 5 ktoe/year) up to 90 percent of the audit costs can be subsidized. Under the Integrated Energy Supply Act (1999), industries that invest in CHP plants for their own supply of heat are entitled to tax reductions.

The Energy Saving Partnership Program (ESP) aims to share new energy saving technologies within the industrial branches; factories consuming more than 20 ktoe can participate in the ESP (over 10 ktoe in the automobile, food, electrical and electronics industries). A total of 195 companies are involved in this program, which made it possible to save 285 ktoe of fuel and 393 GWh of electricity between 2000 and 2007.

3.2. Energy consumption trends: soaring industrial energy demand

South Korea’s industrial energy consumption doubled between 1990 and 2000, despite the 1998 drop caused by the Asian crisis. Since then, growth has slowed down (2.2 percent/year between 2000 and 2011). The global economic downturn, which led to a 5.6 percent decrease in energy consumption in 2009, did not affect this overall trend.

![Figure 7: Trends in industrial energy consumption](image)

The energy mix in industrial consumption changed dramatically between 1990 and 2010. The share of oil, which accounted for 48 percent of energy consumption, fell significantly and now accounts for less than 10 percent. The market shares of electricity and gas increased substantially: from 22 percent to 36 percent of industrial consumption for electricity, and from 1 percent in 1993 to 13 percent in 2011 for gas. Coal consumption remained stable at around 30 percent, while biomass accounts for nearly 10 percent of industrial consumption.

The share of the energy-intensive sectors in industrial energy consumption is high (61 percent in 2010) and has been rather stable over time. The steel industry is the main consuming sector, accounting for 34 percent of consumption in 2010 (26 percent in 1990), followed by the chemical industry (14 percent) and the non-metallic mineral branch (10 percent in 2010, down from 15 percent in 1990). The paper and pulp industry accounts for just 4 percent of industrial consumption.
3.3. Energy intensity trends: large efficiency gains since 2000

Between 2000 and 2010, industrial energy intensity decreased at the significant pace of 3 percent/year. Large efficiency gains were achieved in the chemical industry (-1.5 percent/year), the cement sector (-2.3 percent) and the paper branch (-2.5 percent/year). Over the same period, the energy consumption per ton of steel produced grew by 0.6 percent/year.
The share of industrial CHP in electricity consumption is relatively low in South Korea. Since 2006, CHP has covered about 11 percent of industrial electricity consumption.

**Figure 11: Share of industrial CHP in industrial consumption**

![Graph showing the share of industrial CHP in industrial consumption from 1990 to 2011.](image)

Source: Enerdata

The manufacturing industry (i.e., excluding construction) posted higher energy intensity decreases than industry as a whole, with a 4.2 percent/year reduction over the period 2000-2008. However, that reduction is mainly the result of changes in the structure of industrial value added. Indeed, when calculated at constant structure to remove the effect of those structural changes, the decrease is 1.5 percent/year. The difference reflects an increase in the share of machinery and transport equipment, i.e., the branch with the lowest energy intensity, in the industrial value added. That structural effect explains about 60 percent of the total variation.

**Figure 12: Trends in the energy intensity of manufacturing and structural effect**

![Bar chart showing the trends in energy intensity of manufacturing and structural effect from 1991-2008 and 2000-2008.](image)

Source: Enerdata