Finland

Energy efficiency report

Objectives:
- 35 TWh/year of energy savings by 2016
- 44 TWh/year of energy savings by 2020
- 11 TWh/year of energy savings in industry by 2020

<table>
<thead>
<tr>
<th>Overview</th>
<th>2010</th>
<th>2000-2010 (%/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary intensity (EU=100)¹</td>
<td>172</td>
<td>-0.7%</td>
</tr>
<tr>
<td>CO₂ intensity (EU=100)</td>
<td>138</td>
<td>0.0%</td>
</tr>
<tr>
<td>CO₂ emissions per capita (in tCO₂/cap)</td>
<td>11</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power generation</th>
<th>2010</th>
<th>2000-2010 (%/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency of thermal power plants (in %)</td>
<td>37</td>
<td>-1.0%</td>
</tr>
<tr>
<td>Rate of electricity T&amp;D losses (in %)</td>
<td>3</td>
<td>-0.2%</td>
</tr>
<tr>
<td>CO₂ emissions per kWh generated (in gCO₂/kWh)</td>
<td>226</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Industry</th>
<th>2010</th>
<th>2000-2010 (%/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy intensity (EU=100)</td>
<td>224</td>
<td>-3.2%</td>
</tr>
<tr>
<td>Share of industrial CHP in industrial consumption (in %)</td>
<td>26</td>
<td>0.3%</td>
</tr>
<tr>
<td>Unit consumption of steel (in toe/t)</td>
<td>0.30</td>
<td>-0.7%</td>
</tr>
</tbody>
</table>

++ Among best countries  + Better than the EU average  - Below the EU average  -- Among countries with the lowest performances

Latest update: March 2012

¹ The European Union, as the best performing region, is used as the benchmark.
1. Overview

1.1. Policies: 44 TWh of energy savings by 2020

In June 2011 Finland adopted its second National Energy Efficiency Action Plan (NEEAP), updating the first one (2007), which had set an energy savings target of 17.8 TWh (1.5 Mtoe) for the period between 2008 and 2016. The new NEEAP energy savings target is set at 24.7 TWh (2 Mtoe) by 2016, of which 58 percent should be achieved in buildings, 13 percent in transport, 11 percent in industry and 7 percent in agriculture. Including the efficiency measures not imposed by the European Directive on energy efficiency (ESD) in the industrial and energy sectors, energy savings should amount to 34.9 TWh (3 Mtoe) by 2016.

The second NEEAP also raises the energy savings target set in the Long-Term Climate and Energy Strategy (2009) from 37 TWh to nearly 44 TWh by 2020. Of these savings, 77 percent (about 34 TWh) should be achieved through measures related to the ESD and 10 TWh should come from efficiency measures in industry and the energy sector.

Energy audits for buildings and production processes were introduced in 1992, and between then and 2009 cost a total of 61 million euros (85 million US dollars), 27 million euros (38 million US dollars) of which were subsidized. An Energy Aid System (1997) grants subsidies for efficiency projects (up to 40 percent of the cost of energy audits).

1.2. Energy consumption trends: high consumption per capita compared with the EU average

Energy consumption in Finland is almost double the EU average, at 6.7 toe/cap in 2010. Total energy consumption increased regularly between 1990 and 2006 (+1.7 percent/year) but declined by 10 percent between 2007 and 2009. In 2010, energy consumption picked up again (+8 percent), although it remains below its 2007 level.

Figure 1: Energy consumption trends by sector

The contributions of industry and the power sector in the country's total energy consumption have been almost stable since 1990, at about 40 percent and 20 percent, respectively.

Oil covered 28 percent of Finland's energy needs in 2010, followed by biomass with 22 percent, coal with 17 percent and gas with 11 percent. Nuclear power accounts for 17 percent of primary consumption, while hydroelectricity and power imports represent 3 percent of primary consumption each.

Electricity consumption, which grew by 2.3 percent/year between 1990 and 2007, dropped by 3.9 percent in 2008 and by 6.4 percent in 2009. That fall was linked to the sharp decrease in industrial electricity consumption.
(-7.2 percent in 2008 and -16 percent in 2009). In 2010 electricity consumption grew by 7.6 percent, but it remains below its pre-crisis level.

Industry is the largest electricity consuming sector and currently accounts for 48 percent of electricity consumption (56 percent in 1990).

![Figure 2: Electricity consumption trends by sector](image)

Source: Enerdata

1.3. Energy efficiency trends: slight improvement in energy intensity

Energy intensity (primary energy consumption per unit of GDP) decreased slightly between 1990 and 2010 (-0.7 percent/year). This improvement was mainly linked to the 0.5 percent/year reduction in the energy intensity of the industrial sector, since the energy intensity of the power generation sector remained stable over the period.

![Figure 3: Energy intensity trends](image)

Source: Enerdata
2. Power generation

2.1. Policies: voluntary agreements and promotion of CHP

Finland’s main measures for the power sector are energy efficiency agreements, including subsidized annual energy audits (2008): the Energy Production operational program for power generation companies; and the Energy Services operational program for district heating companies and power transmission and distribution companies.

The Energy Production operational program grouped together 33 businesses with about 200 premises in June 2011, covering 93 percent of Finland’s electricity production and 76 percent of its heating production. These companies are committed to a primary energy savings target of 1 TWh and 1 TWh of increased energy efficiency in electricity production by 2016.

The Energy Services operational program is directed at district heating and electricity distribution companies, and sets an energy savings target of at least 5 percent on their own energy use by 2016. This measure is expected to save about 300 GWh by 2016 (320 GWh by 2020). The voluntary agreements also include energy savings for final consumers (energy savings target of 9 percent of their energy use over the period 2008-2016).

Finland has introduced incentives to promote CHP: new market-based feed-in tariffs for small-scale CHP partially entered into force on 1 January 2011.

2.2. Efficiency of the power sector: low rate of T&D losses and CO\textsubscript{2} emissions

The average efficiency of power generation decreased slowly between 1990 and 2010, from 42 percent to 40 percent, in line with the efficiency of thermal generation (from 40 percent in 1990 to 37 percent in 2010). The share of high-efficiency combined cycle power plants rose to 14 percent in 2010 (9 percent in 1990).

The efficiency of the power sector continues to be influenced by the generation mix: about 30 percent of the electricity production comes from low-efficiency nuclear power plants and 38 percent from steam thermal power plants, with hydropower (highly efficient) accounting for just 16 percent.

Figure 4: Efficiency of power generation and thermal power plants

![Figure 4: Efficiency of power generation and thermal power plants](image)

Source: Enerdata

Figure 5: Thermal electricity capacity, by technology

![Figure 5: Thermal electricity capacity, by technology](image)
The rate of T&D losses is very low (3.4 percent) and has followed a decreasing trend since 1990.

3. Industry

3.1. Policies: nearly 11 TWh of energy savings by 2016

Finland’s second National Energy Efficiency Action Plan (2011) sets an energy savings target of 2.6 TWh by 2016; including measures beyond the scope of the European Directive on energy efficiency (ESD), totaling 8.2 TWh, energy savings could reach nearly 11 TWh by 2016. The previous targets and measures adopted in 2010 for industry were also expected to lead to savings of up to 8 TWh (688 ktoe) by 2020.

These savings should be achieved through energy audits in industry (1.9 TWh/year by 2020) and through voluntary agreements with energy-intensive industries and SMEs (8.2 TWh/year and 0.5 TWh/year, respectively, by 2020).

Finland introduced subsidized energy audits for industry (up to 40 percent of audit costs) in 1992 and energy efficiency agreements in 1997. Energy audits must lead to energy efficiency measures and are followed by update meetings. Voluntary agreements cover about 85 percent of industrial energy consumption; subsidies can be granted for energy conservation investments (up to 20 percent for conventional technologies and up to 35 percent for new technologies). Energy efficiency measures also target electricity savings, including the improvement of the efficiency of compressed air technology.

3.2. Energy consumption trends: overall increase in industrial energy consumption

Industrial energy consumption grew by 1.6 percent/year, on average, between 1990 and 2007. The trend then reversed and industrial energy consumption declined by 4 percent in 2008 and 17 percent in 2009, due to the economic downturn. In 2010, industrial energy consumption picked up again (+5.3 percent), although it remains below its 2000 level.
Electricity accounts for 32 percent of industrial energy consumption and biomass for 29 percent (33 percent in 2000); the large share of biomass is explained by the size of the paper industry in Finland. Heat accounts for 16 percent (6 percent in 2000), followed by oil (12 percent), gas (6 percent) and coal (5 percent).

The share of energy-intensive branches in industrial energy consumption is very high in Finland, at 76 percent in 2009. The paper industry accounts for 54 percent of industrial energy consumption, followed by the chemical and steel branches (10 percent each compared with 12 percent and 5 percent, respectively, in 2000) and by the non-metallic minerals (mainly cement) industries (at 3 percent).
3.3. Energy intensity trends: efficiency gains in the paper branch

Between 2000 and 2009 industrial energy intensity decreased by 3.4 percent/year. Efficiency gains were mainly reported in the paper industry (2.3 percent/year decrease in the unit consumption, i.e., the energy consumption per ton of paper produced), and to a lesser extent in the cement and steel branches (-0.7 percent/year decrease). However, the energy intensity of the chemical industry rose slightly (+1.2 percent/year).

**Figure 10: Trends in the energy intensity of industrial branches**

The share of industrial CHP in industrial electricity consumption is high, at 26 percent in 2010, compared with the EU average of 19 percent.

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