Advanced Biofuels Playing a Key Role in Finland’s Energy and Climate Policy

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Finland in brief: the coldest country in Europe

Area
Situated in northern Europe with an area of 338,432 km² of which 72% forest, 10% water, 8% cultivated land.

Population
5.5 million, with average density of 18 persons per square kilometre. More than two-thirds of the population reside in the southern third of the country.

Average temperatures in 2016

<table>
<thead>
<tr>
<th>Town</th>
<th>Latitude</th>
<th>January</th>
<th>July</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helsinki</td>
<td>60°</td>
<td>–8.8°C</td>
<td>17.8°C</td>
</tr>
<tr>
<td>Sodankylä</td>
<td>67°</td>
<td>–18.1°C</td>
<td>16.8°C</td>
</tr>
</tbody>
</table>

Economy
In 2016* GDP totalled € 214.1 bil., i.e. € 38,959/capita. In 2014* services were 70.7%, secondary production 26.5% and primary production 2.8% of the GDP.

Structure of industry, Value added gross in production in 2015

<table>
<thead>
<tr>
<th>Industry</th>
<th>Bill. €</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total industry</td>
<td>37.2</td>
<td>100</td>
</tr>
<tr>
<td>Mining and quarrying</td>
<td>0.6</td>
<td>1</td>
</tr>
<tr>
<td>Forest industry</td>
<td>4.3</td>
<td>12</td>
</tr>
<tr>
<td>Chemical industry</td>
<td>4.9</td>
<td>13</td>
</tr>
<tr>
<td>Metal industry</td>
<td>16.5</td>
<td>44</td>
</tr>
<tr>
<td>Basic metals and metal prod.</td>
<td>3.8</td>
<td>10</td>
</tr>
<tr>
<td>Electrical and electronics ind.</td>
<td>5.8</td>
<td>16</td>
</tr>
<tr>
<td>Other metal industry</td>
<td>6.9</td>
<td>18</td>
</tr>
<tr>
<td>Other manufacturing ind.</td>
<td>5.0</td>
<td>13</td>
</tr>
<tr>
<td>Energy supply</td>
<td>4.2</td>
<td>11</td>
</tr>
<tr>
<td>Water supply and waste management</td>
<td>1.7</td>
<td>5</td>
</tr>
</tbody>
</table>

Municipalities with high electricity consumption 2015

Total energy consumption in 2016*
1,348 PJ (32.2 Mtoe)
245.0 GJ/capita (5.9 toe/capita)

Electricity consumption in 2016*
85.1 TWh
15,479 kWh/capita
High energy consumption due to climate, long distances and energy-intensive industry

Total energy consumption 1975–2016
- Wide energy mix - fossil fuels losing ground
- Renewables and nuclear growing; wood-based fuels the most important energy source!

Final energy consumption by sector 2016
- High seasonality in heating & lighting

<table>
<thead>
<tr>
<th>Sector</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>45%</td>
</tr>
<tr>
<td>Transport</td>
<td>17%</td>
</tr>
<tr>
<td>Others</td>
<td>12%</td>
</tr>
<tr>
<td>Space heating</td>
<td>26%</td>
</tr>
<tr>
<td>Others</td>
<td>12%</td>
</tr>
</tbody>
</table>
Renewable energy in Finland 1970 – 2016

Source: Statistics Finland
Coordination of Energy and Climate Policy

- Ministry of Economic Affairs and Employment in charge

Political coordination and decision making
Final approval of the National Energy and Climate Strategy by the Government

Coordination for the Ministerial WG

Preparation of Energy and Climate Strategies (incl. Scenarios):
Each sectoral ministry is responsible for the preparation with regards to its respective remit

Sectoral studies and modelling
Impact assessments
Funded by sectoral ministries and VN TEAS (joint analysis, assessment and research activities, coordinated by the Government)

Ministerial WG on Bioeconomy and Clean Solutions
(Chair Minister Kimmo Tiilikainen)

Network of Senior Officials
(Chair MEAE/Energy DG Riku Huttunen)

Sectoral ministries
(Expert level coordination MEAE/Energy/Energy Markets)

Government research institutions, Universities and consultants

Minister for Housing, Energy and the Environment, Co-Chair
Minister of Agriculture and Forestry Co-Chair
Minister of Social Affairs and Health
Minister of Employment
Minister of the Interior
Minister for Foreign Trade and Development

Sectoral ministries
PM's Office, Ministry of Foreign Affairs and Ministry of Education and Culture

Ministry of Economic Affairs and Employment
Ministry of Environment
Ministry of Agriculture and Forestry
Ministry of Transport and Communications
Ministry of Finance
Energy and climate targets (1/3)

Finland’s long-term objective is to be a carbon-neutral society

- 80-95% reduction of greenhouse gas emissions from 1990 level by 2050
- Wide Finnish forests are a big carbon sink: carbon emissions and sinks planned to be equal by 2045

European Union 2020 targets for Finland

- Renewable energy at least 38% of final consumption
  - Biofuels distribution obligation set at national level in Finland: By 2020 the share of biofuels will steadily increase to 20 per cent (physical share about 13,5%) of the total energy content of transport fuels supplied by the distributors.
- Greenhouse gas emissions in the EU non-Emissions Trading Scheme (transport, agriculture, heating, waste management, F-gases etc.) to be reduced by 16% from 2005 level
- Indicative energy efficiency target: final consumption not more than 310 TWh
Energy and climate targets (2/3)

European Union common targets for 2030

• EU Clean Energy Package (under negotiation)
  • Renewable energy target: 27% (or higher) on final energy consumption
    • Renewable energy in transport
    • European target: at least 14%?
    • Sustainability criteria for biofuels
    • Feedstock lists
  • Energy efficiency: 30% increase (2007 => 2030) in comparison to Business-as-usual scenario
  • New electricity market design (based on Energy only –markets)
  • Energy Union governance for coordinated European policies which lead to common targets

European Union obligation for Finland

• Greenhouse gas emissions in the non-Emissions Trading Scheme to be reduced by 39% from 2005 level
Energy and climate targets (3/3)
Finnish National Strategy for 2030

• Approved by the Government in November 2016
• The aim is to reach both Government and EU 2030 targets
• Emphasis on reducing CO2 emissions and promoting renewables:
  • 50% of final energy consumption to be covered by renewables in 2030
  • Transport fuels: at least 30% renewables by 2030 (especially by biofuel blending obligations)
  • Phasing out the use of coal in energy production by 2030 (with some conditions regarding security of supply etc.)
  • Halving the use of imported oil for energy
• Development of competitive power and gas markets is promoted
Renewable energy, share of final consumption in Finland
Non-ETS* greenhouse gas emissions: more than 50% of the reductions to come from the transport sector

Mt CO2 ekv

2005 2010 2015 2020 2025 2030

- 16 %
- 37 %
- 39 %

* emission trading scheme scope of 2013
Measures in the transport sector according to the national energy and climate strategy

• Improved **energy efficiency** of the transport system
  • Developing new transport services, influencing modes of travel and transport, utilising intelligent transport methods; Mobility-as-a-Service

• **Vehicle stock renewal** will be accelerated considerably

• A minimum of 250,000 **electric vehicles** and 50,000 **gas fuelled** vehicles in 2030

• The share of **biofuels** of all fuels sold to road transport to be increased to **30 per cent (physical share) by 2030** (quota obligation)
How the increased demand for road transport biofuels will be covered?

• Starting point is that additional biofuel supply will be based on advanced biofuels produced domestically
  • The required total amount of biofuels would be around 1.1 Mtoe/a (12.8 TWh/a) in 2030. This would mean 0.6 Mtoe/a (7 TWh/a) additional new capacity.

• Investments for the additional capacity are estimated to be about 1.5 billion €. Due to the technological risks involved, the investment aid would be about 40-50 M€/a in the next few years.

• Finnish companies with new, advanced biofuels technologies: Neste Oil, UPM, Fortum etc.

• There are many options for production technologies and feedstocks (domestic/imported):
  • HVO (Hydrotreated vegetable oil) plants
  • Co-processing of biofeedstocks in existing oil refineries
  • BTL (Biomass to Liquids) plants using gasification -> FT (Fischer-Tropsch) diesel
  • Bioethanol from wood and straw
  • Biogas production for transport is promoted and estimated to increase

• Typically drop-in fuels
Biofuel & biorefining projects

Biorefining initiatives in Finland

**Pulp production related**
- Kemijärvi
- Kuopio Finn pulp
- Äänekoski bio product mill

**Biofuels production**
- Kaidi Finland
- Kajaani Sti Cellunolix
- ST1 Etanolix
- Greenfuel Nordic
- Fortum Joensuu
- UPM Tall oil Lappeenranta
- Suomen Bioetanol Oy
- Biogas plants
- Stora Enso Lignin
- Neste Oil NexBTL
- Naantali taloil feed
- Bioruukki BTL 2030
Summary

By 2030, Finland aims at
• Increasing the share of renewables to 50%
• Increasing the share of biofuels in transport to 30%

In Finland, biofuels are the most cost-effective way to reduce CO2 emissions outside the Emissions Trading Scheme, due to
• Domestic production (replacing crude oil imports)
• Raw materials (e.g. wastes and residues from the forest industries)
• High knowledge and very advanced production technologies
Thank you