"Current use of biomass for energy in Sweden and forecast for the coming years"

Gustav Melin, President
SVEBIO

Oslo 2009-09-23
## Allocation of commitment, EU

<table>
<thead>
<tr>
<th>Country</th>
<th>RES share in 2005</th>
<th>Flat rate increase of 5.5%</th>
<th>Additional effort based on GDP per capita</th>
<th>Figures adjusted by early starter bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE</td>
<td>2.2%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BG</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CZ</td>
<td>6.1%</td>
<td>5.5%</td>
<td>5.5%</td>
<td>-1.2%</td>
</tr>
<tr>
<td>DK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>5.8%</td>
<td></td>
<td>5.5%</td>
<td>7.5%</td>
</tr>
<tr>
<td>EE</td>
<td>18%</td>
<td>5.5%</td>
<td></td>
<td>-1.6%</td>
</tr>
<tr>
<td>IE</td>
<td>3.1%</td>
<td></td>
<td></td>
<td>-0.9%</td>
</tr>
<tr>
<td>EL</td>
<td>6.9%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ES</td>
<td>8.7%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FR</td>
<td>10.3%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT</td>
<td>5.2%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CY</td>
<td>2.9%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT</td>
<td>15%</td>
<td>5.5%</td>
<td></td>
<td>2.5%</td>
</tr>
<tr>
<td>LU</td>
<td>5.5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HU</td>
<td>4.3%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NL</td>
<td>2.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>23.3%</td>
<td>5.5%</td>
<td></td>
<td>5.2%</td>
</tr>
<tr>
<td>PL</td>
<td>7.2%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI</td>
<td>16%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SK</td>
<td>5.5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE</td>
<td>39.8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>1.3%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2020 RES TARGET AND EU
Swedish Bioenergy Association

• Mission:
  – To increase the use of bioenergy in an economically and environmentally optimal way.
Svebio prefer working with incentives

- PPP – Polluter Pays Principle
- General Incentives
  - Cost efficient
  - Competitive
  - Most profitable solutions are chosen
- Demonstration or introduction support.
Bioenergy used in Sweden 1970-2007 (TWh)

The bioenergy share of total energy use:

- 1970: 9%
- 1980: 11%
- 1990: 15%
- 2000: 20%
- 2004: 24%
- 2007: 28%
Bioenergy, Share of final energy use 2007

- Hydro power: 60.7 TWh (15.3%)
- Bioenergy: 113.4 TWh (28.6%)
- Heat pumps: 3.6 TWh (0.9%)
- Wind power: 1.3 TWh (0.3%)
- Oil: 123.8 TWh (31.3%)
- Coal: 23.2 TWh (5.9%)
- Fossil gas: 10.8 TWh (2.7%)
- Nuclear power: 59.5 TWh (15.0%)
Reduced emissions and increased GDP!
Decoupling 1990-2007

![Graph showing the decoupling of bioenergy, GDP growth, and climate gas emissions from 1990 to 2007. The graph illustrates that while emissions have decreased, GDP has increased.](www.svebio.se)
Share of bioenergy in energy sectors, percent in 2008

- Bio-fuels: 95 TWh, 4.9%
- Electricity: 145 TWh, 6.2%
- Heat: 175 TWh, 57.7%
Bioenergy use in 2007

- Industry: 54.5%
- District heating: 32.3%
- Housing/other: 13.8%
- Transport: 3.6%
- Electricity production: 9.2%
Waste and peat

• In 2008, there were 30 waste incineration plants in Sweden. They supply both heat and electricity in CHP plants. Approximately 48% of household waste is burned to an equivalent of approximately 10 TWh. Electricity production from waste incineration is equivalent to approximately 0.3% of the total production of electricity in Sweden (Swedish Waste Management).

• There are about 200 approved exploitation concessions for peat of which just over 100 are in production (red). Following a good harvest these can yield up to 4 TWh (Geological Survey of Sweden).
Trend for total standing volume since 1920, all land-use

1 Excl. high mountains, restricted military areas, urban land and water surfaces.

Millions cubic metre standing volume (stem volume over bark from stump to tip)
Source: National Board of Inventory

1 Excl. high mountains, restricted military areas, urban land and water surfaces.
Millions cubic metre standing volume (stem volume over bark from stump to tip)
Source: National Board of Inventory
How much is available after cutting down the trees?
Example CHP in Östersund
Energy in Östersund

ENERGY BALANCE DISTRICT HEATING
ÖSTERSUND

- OIL
- COAL
- Flue Gas
- Kondensor
- PEAT
- WOOD
- ELECTRICITY
- HEATPUMP
- WASTE HEAT
- Gas from refuse dump
- NOx
- Sulphur

Prognos

GWh, ton


Rev.1e /GE
Electricity from District Heating
2004 to 2015

Electricity from CHP plants 2004-2015

- Oil
- Gas
- Biomass
- Coal
- Waste

TWh

Use of forest bioenergy,
(Forestry Research Institute of Sweden)

- **Current use:**
  - Industrial by-products 95 TWh
  - Forest residue 11 TWh
  - Fuelwood, cleaning, thinning 1 TWh
Potential use of forest bioenergy,
(the Forestry Research Institute of Sweden)

Mid-term range

The industry can be made more effective in order to increase volume.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Potential (TWh/year)</th>
<th>Available (TWh/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest residue</td>
<td>20-25</td>
<td>40</td>
</tr>
<tr>
<td>Stubs</td>
<td>10-12</td>
<td>40</td>
</tr>
<tr>
<td>Fuelwood</td>
<td>10-15</td>
<td>40</td>
</tr>
<tr>
<td>Increased felling</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

Long-term range

<table>
<thead>
<tr>
<th>Activity</th>
<th>Potential (TWh/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A smaller portion of acreage is fertilized</td>
<td>30</td>
</tr>
</tbody>
</table>
Multifuel pulverised fuel burner, TPS

An industrial burner for boiler retrofit, co-firing and process applications.
Burner sizes 5 – 50 MWth

 Suppliers are:
TPS
Petrokraft
WTS World Thermal Systems AB
Fors paper mill retrofit with Multifuel burner

Two original oil burners exchanged to Multifuel pulverised wood burners

The Champion hammer mill
Generated Electricity from Biomass in Forest Industry

Increase in electricity production

- Generated electricity, GWh
Biostor, Storuman

- Production: 105,000 tonnes of pellets per year
- Electricity: 8 MW, Production 48 GWh/year, 6000 h
- District heating: 40 GWh/year
- Production: 22 ton/h Wood powder
- Investment: 39 MEUR.
Pellet production in Sweden

- Total
- < 25 kW
- 25 kW - 2 MW
Pellet burner sales in Sweden < 25 kW

Source: SBBA, 2007
Pellet trade

![Pellet trade graph](graph.png)
Cultivating, harvesting and chipping of Salix

• Salix is harvested approximately every four years. The root system allows repeated harvests over many years. According to statistics from the Swedish Board of Agriculture, in 2006, Salix was farmed on approximately 14 000 hectares.
Agricultural and food industry by-products

- **Agricultural by-products**
  - Cereal residue
  - Straw
  - Manure for decomposition

- **Food industry by-products**
  - Slaughter waste
  - Waste from retail foods trade
  - Waste from large-scale kitchens, etc.
Share of renewable transport fuels in Sweden 2008, based on energy content

- Gasoline: 51.1%
- Diesel: 43.7%
- Ethanol in E85: 1.4%
- Biofuels: 4.9%
- Biogas: 0.4%
- Ethanol low-blend: 1.8%
- Biodiesel (RME): 1.3%
Share of renewable transport fuels in Sweden 2008, based on energy content
FIGURE 24
Potential for cropland expansion

<table>
<thead>
<tr>
<th>Region</th>
<th>Million ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latin America and the Caribbean</td>
<td>1,200</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>1,000</td>
</tr>
<tr>
<td>Industrial countries</td>
<td>800</td>
</tr>
<tr>
<td>Transition countries</td>
<td>400</td>
</tr>
<tr>
<td>East Asia</td>
<td>200</td>
</tr>
<tr>
<td>South Asia</td>
<td>100</td>
</tr>
<tr>
<td>Near East and North Africa</td>
<td>50</td>
</tr>
</tbody>
</table>

Arable land in use, 1997–99
Additional land with potential for rainfed crop production

- actual used biofuels until 2008
- current trend
- government goal
- Svebio forecast (incl. electricity for transport)
Energy Combine – a way forward

Agroetanol, Norrköping is located beside a Combined Heat and Power plant using biomass, able to produce biogas from by-products.
Clean Vehicles

• 38 % Clean Vehicles sold in Sweden autumn 2008, the major part FFV-hybrids.
• Ethanol-petrol hybrids and petrol-electric hybrid technologies widely accepted on the market, biogas increasing.
• E85 today available from 1 300 of all filling stations throughout the country (35%)
• Ethanol hybrids fuelled with E85
  – 85% sustainable ethanol from Brazilian sugar cane
  – 15% 95 octane petrol
Thank you for your attention!

Gustav Melin

gustav.melin@svebio.se
+46 8 4417081, +46 705 244400
www.svebio.se