Bioenergy for Europe
status, trends,
gaps and future actions

Seminar on New and Upcoming EU Policies for
Sustainable Energy and Climate Protection
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www.panda.org/powerswitch

Bio-energy use worldwide

• Global energy demand: ~420 EJ
• About 10-15% (or 45 ± 10 EJ) of this demand
  is covered by biomass resources:
  – Traditional biomass: ~29
  – Commercial non-modern: 9 ± 6 EJ
  – Commercial: ~7 EJ (16%)
  – Liquid biofuels ~0.5 EJ

BIO-POWERSWITCH! Study

Key findings:
• 15% of OECD power demand by 2020 (30% under PowerSwitch Scenario)
• Up to 1800 Mt of CO₂ emissions savings (between about 10% and 30% power sector CO₂ by 2020)
• At least 400,000 full time equivalent jobs
• About 2% of the total available land dedicated to biomass production

http://www.inforse.org/europe/seminar04nov9_10.htm
The role of biomass

- Biomass production in 2001: 56 Mtoe
- Additional estimated 79 Mtoe:
  + 34 Mtoe for power
  + 27 Mtoe for heating
  + 18 Mtoe for transport biofuels

<table>
<thead>
<tr>
<th>Energy production from biofuels (Mtoe)</th>
<th>2001</th>
<th>Additional contribution</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>13</td>
<td>34</td>
<td>47</td>
</tr>
<tr>
<td>Heat</td>
<td>42</td>
<td>27</td>
<td>69</td>
</tr>
<tr>
<td>Transport</td>
<td>1</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>56</td>
<td>79</td>
<td>135</td>
</tr>
</tbody>
</table>

Biomass availability

- Not an issue! EC 2004 study “Bioenergy role in the EU market”
- Overall biomass availability in the EU 25: 140-150 Mtoe
- New Member States have high potential for both electricity and heat generation
- Untapped large biopower potential in Poland, Hungary, Czech Republic, Slovakia, Baltic countries

Biopower

- 21% target will only be achieved if biomass contributes to 40% to it
- Biopower would need to grow by 18% per year over the next 8 years compared to the 7% average between 1997-2004
- An additional 32 Mtoe of biopower is need in the EU by 2010

How are we doing?

- The share of renewable energy was still only 6% in the year 2000
- The increase of bioenergy in the first 5 years from 1995 to 2001 was only 6 Mtoe equal to 7% of the proposed total increase in 15% years
- Production concentrated in 2 countries, Finland accounts for 30% and Sweden for 17%. Need for other countries to follow (Germany, Spain, France, Poland, Italy)

TRENDS

PowerSwitch! Scenario

Energy saving by up to 30%
Biomass and wind are key

http://www.inforse.org/europe/seminar04nov9_10.htm
Sweden: ~ 20% bio-energy in 2000

Power sector

Heating sector

GAPS

What is not working?

- **Demand side**
  - Great potential in heating sector but competition from large scale natural gas deployment (short-term solution)
  - Lack of mandated markets for RES heating

- **Supply side**
  - Carbon trading is not expected to benefit bioenergy
  - Need to meet increasing demand for woody biomass
  - Flow of solid and liquid biomass into EU
  - Lack of environmental certification

Energy crops

- A additional 27 Mtoe of woody energy crops is needed
- Short rotation forestry (SRF) is a good replacement of annual food crops: more efficient and environmental friendly
- Large scale development is needed to reduce costs (e.g. Swedish strategy estimates to cost reduced by 20-25% if area ~ 100,000 ha)
- Market intervention needed to make SRF (e.g. Coppice or Miscanthus) competitive
- Current area-payment of EUR 45/ha is expected to have marginal effect on biogas-power and bioethanol, let alone woody crops.

FUTURE ACTIONS

**EU level**
- Adopt renewable heat directive
- New area-based scheme for woody and grass energy crops needed (EUR 300/ha) within the CAP reform
- Prioritise bioenergy schemes with Structural Funds
- Link incentives to sustainability certification schemes

**National level**
- Adopt strategic national bioenergy plans and targets (heat and power)
- Implement realistic biopower and bioheat tariffs
- Focus R&D on syngas based fuels (to allow biofuels from woody crops)

http://www.inforse.org/europe/seminar04nov9_10.htm
Conclusions

• Bioenergy is key to meet renewables and climate goals
• Need to build political momentum for European biomass deployment strategy
• Strategic policy support has resulted in massive increase in some European countries
• CAP reform must prioritise perennial woody and grass crops
• Environmental certification is needed to guarantee sustainability

Potential for Biopower in OECD Countries by 2020

Assumption (conservative)

• Recovery of 25% of technically recoverable forestry and agricultural waste corresponding to 6 EJ of primary energy
• Conversion of 5% of crop, forest and wood land to energy plantations corresponding to 10 EJ of primary energy

Results

• 15% of the power demand - 30% under PowerSwitch Scenario
• No conflict between nature conservation and biomass production - about 2% of the total available land dedicated to biomass production
• Supply for at least 100,000,000 households - estimated additional capacity of 200 GW.

Commercial bioenergy production worldwide

<table>
<thead>
<tr>
<th>Technology</th>
<th>Increase in energy production 1997-2001 (PJ/year)</th>
<th>Operating capacity, end 2001 (TWh)</th>
<th>Capacity factor (%)</th>
<th>Energy production, 2001 (TWh)</th>
<th>Investment costs (USD/kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>−2.5</td>
<td>−210 GWh</td>
<td>25 − 80</td>
<td>170 TWh (a)</td>
<td>500 − 6,000</td>
</tr>
<tr>
<td>Heat</td>
<td>−2</td>
<td>19 bln litres</td>
<td>−450 PJ</td>
<td>730 TWh (b)</td>
<td>170 − 1,000</td>
</tr>
<tr>
<td>Ethanol</td>
<td>−1</td>
<td>−1.2 bln litres</td>
<td>−45 PJ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bio-diesel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a: Heat embodied in steam (or hot water in district heating), often produced by combined heat and power systems using forest residues, black liquor, or bagasse. Source: WEA 2001

Changing technology choices

• Heat production (domestic, industrial, via CHP)
• Combustion: CHP, Co-combustion, BFB/CFB concepts; continuous increasing capacities (largest so far: 500 MWh), limited waste incineration.
• Digestion; successfull, but limited contribution.
• Classic biofuels (RME, starch/sugar EtOH)
• RD&D: wide portfolio and considerable expenditures:
  − Strong R&D effort gasification; so far limited market deployment.
  − new concepts; hydrolysis and syngas based fuels (FT, MeOH, DME, H2)?

Future world’s energy supply… (combined with 80% reduction of GHG-emissions)

http://www.inforse.org/europe/seminar04nov9_10.htm
Breakdown of biomass increase

- Residues from agriculture/forestry: 30 Mtoe
- Energy crops for heat/power: 22 Mtoe
- Energy crops for liquid biofuels: 18 Mtoe
- Biogas: 15 Mtoe

Source: EC White Paper 1997 - energy crops: 10 million hectares

Renewable energy (EU 15)

- Contribution of Renewables to Inland Consumption in the EU-15

How are we doing?

- **Heat**: In 1990 the production of heat from biomass 1500 PJ to over 1800 PJ in 1999 (2% per year).
- **Electricity**: 54 PJ in 1990 to 166 PJ in 1999 (9% per year).
- **Biofuels**: Currently 25 PJ; 80 ktonne in 1993 to 216 ktonnes in the same period (Germany and France)

Biopower markets (EU 15)

<table>
<thead>
<tr>
<th>Country</th>
<th>Without large hydro (TWh)</th>
<th>Without large hydro (2010) (TWh)</th>
<th>Increase to 2010 (TWh)</th>
<th>Increase to 2010 (TWh)</th>
<th>Biopower demand (TWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>11.8</td>
<td>12.7</td>
<td>0.9</td>
<td>0.9</td>
<td>28</td>
</tr>
<tr>
<td>Denmark</td>
<td>8.7</td>
<td>9.0</td>
<td>0.3</td>
<td>0.3</td>
<td>28</td>
</tr>
<tr>
<td>Germany</td>
<td>2.4</td>
<td>10.3</td>
<td>8</td>
<td>8</td>
<td>170</td>
</tr>
<tr>
<td>Holland</td>
<td>5.5</td>
<td>12.0</td>
<td>6.5</td>
<td>6.5</td>
<td>28</td>
</tr>
<tr>
<td>England</td>
<td>0.9</td>
<td>4.2</td>
<td>3.3</td>
<td>3.3</td>
<td>100</td>
</tr>
<tr>
<td>France</td>
<td>2.2</td>
<td>8.9</td>
<td>6.7</td>
<td>6.7</td>
<td>86</td>
</tr>
<tr>
<td>Sweden</td>
<td>5.1</td>
<td>15.7</td>
<td>10.6</td>
<td>10.6</td>
<td>49</td>
</tr>
<tr>
<td>EU-15</td>
<td>3.2</td>
<td>11.5</td>
<td>8.3</td>
<td>8.3</td>
<td>86</td>
</tr>
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Source: AEBIOM 2004

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