Biomass in the future energy system – a global overview

Dr. Heinz Kopetz
World Bioenergy Association
WBA workshop, Belo Horizonte
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World Bioenergy Association (WBA) – the global voice of bioenergy

Together with our members

• we work for an increased use of biomass in the global energy system in the markets for heat, electricity and biofuels
• We follow the principles of sustainable, efficient and economic biomass development
• We influence and inform the public opinion in favor of sustainable biomass solutions worldwide and in particular countries
• We cooperate with global institutions, UNFCCC, IEA, IRENA and others, towards the target 100% Renewable
WBA: How we work?

- **Office** in Stockholm, Sweden
- **Our board**: 22 members from 5 continents (Africa 4, Americas 6, Asia 6, Australia 1, Europe 5)
- **Our members**: companies, associations, individuals from all over the world
- **Main activities**: fact sheets, projects, position papers, press releases, presentations in conferences and workshops, supporting biomass trade with the platform: bioenergy connect (BC)
ANDRITZ
The Official supporter of World Bioenergy Association
2000 – 2010: a period of dynamic growth of bioenergy worldwide; a few examples:
The global pellets production

- 2000: about 2Mt
- 2005: 4Mt
- 2010: 15Mt (more than 5 fold increase!)

Main producers at present: Europe, North America
Main markets: 1 residential heat,
               2 power production,
               3 manufacturing industry

Dynamic development goes on:
New producer regions: South America, Australia, new consumer regions: some Asian countries, new technologies like torrefaction
Global Biofuel production
2000: 18 bn l, 2005 35 bn l, 2010 106 bn l
2000-2010: 20% annual growth; next decade slower growth

Ethanol; 2/3 corn based, 1/3 sugar based!
Biodiesel 50% rape oil.
2000-2010: Impressive regional developments

- **China**: Electricity
  - In 2000 biomass for power insignificant, now roughly 5000MW installed capacity in biomass power plants
- **Germany**: Biogas
  - Biogas from below 1 TWh in 2000 to more than 16 TWh electricity in 2010
- **Sweden**: 1990-2010, biomass replaced fossil fuels in district heating!
- **Europe Union**: Biomass to energy from 60 Mtoe to 105 Mtoe (2000 to 2009) – fastest growing renewable energy source!
Total primary energy supply

Brazil

* Excluding electricity trade.
During the previous 30 years, biomass has taken over as fuel in Swedish district heating. The fossil fuels dominated in the 1980’s, but today bioenergy (wood fuels, peat and waste) accounts for 75 percent of the used fuels. Note: The development in the last two years is primarily a result of unusually cold winters. This is especially the case for 2010.

Source: Swedish Energy Agency and Statistic Sweden.
Bioenergy success 2000 – 2010: also technological breakthroughs

• Small scale heat: emission reduction more than 90%, improvement of combustion efficiency from 50 to 90%

Figure 1: Efficiency and CO emissions of small-scale wood boilers

This figure shows how small scale wood boilers efficiency have been increased and CO emissions decreased the last 30 years of technological improvements.

Source: [13]
What next?

Bioenergy and the challenge of climate change!
Why a climate compatible energy system?
Climate change: two cornerstones

1 Global warming: not more than 2 degree!

to avoid feedback mechanisms, to avoid the breakdown of ecosystems!

2 Not more than 750 billion tons (Gt) CO2 emissions between 2010 and 2050!

At present we are moving to 2000Gt emissions between 2010 and 2050 and a warming of 6° C!
Why a climate compatible energy system?

- 2012 World Bank Report: Turn down the heat. Why a 4°C Warmer World must be avoided?

- Heat waves, fires, intensive rainfalls followed by huge inundations, loss of ice: glaciers, Greenland, the Antarctic, oceans, sea level rise, coastal inundation and loss of mega cities, increased tropical cyclone intensity, droughts, food crises, acidification of the ocean – breakdown of maritime ecosystems, in parts of the world adaption no longer possible, dislocation is forced!

- To avoid this disaster: agreement among 200 nations (Kopenhagen Cancun, Doha) no more than 2°C temperature rise!
World Bank report: „The world would be so dramatically different from today‘s world that it is hard to describe accurately!“
WBA and REN Alliance: the 100% RESproject

The purpose:
publication of a concept for a energy system in line with the 2°C target.
This WBA-RENAlliance paper should be finished in July 2013. The title:
„the fast track towards 100% renewables:

2010: 14%

2035: 50%

future (2050): 100%

Distribution among international organisations like IEA, IRENA, UN Climate conference in Warzaw.
In compliance with the 2° target, 2035: 50% renewables.

- Reduction of fossil fuels
- Increase of solar, wind, bioenergy
- Other renewable energy sources (RES)
- Biomass
- Nuclear
- Hydro
Biomass - a pillar in the future system, EJ
(two fold increase of hydro, three fold of biomass, 20 fold of other renew.!)
50% RES in 2035: transformation of the electricity sector – draft figures

<table>
<thead>
<tr>
<th>energy sources</th>
<th>2010 TWh</th>
<th>2035 TWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>fossil sources</td>
<td>14 447</td>
<td>3 200</td>
</tr>
<tr>
<td>hydro</td>
<td>3 431</td>
<td>7 000</td>
</tr>
<tr>
<td>bioenergy</td>
<td>331</td>
<td>1 200</td>
</tr>
<tr>
<td>wind</td>
<td>342</td>
<td>10 100</td>
</tr>
<tr>
<td>solar PV</td>
<td>32</td>
<td>8 400</td>
</tr>
<tr>
<td>CSP</td>
<td>2</td>
<td>700</td>
</tr>
<tr>
<td>total</td>
<td>21 408</td>
<td>33 800</td>
</tr>
<tr>
<td>hereof renewable</td>
<td>4 207</td>
<td>27 900 (83%)</td>
</tr>
</tbody>
</table>

Table 2 IEA 450ppm scenario in comparison to the RENA concept electricity in 2035
Mobilization of biomass: from 54 to 153 EJ

1 residues and byproducts and waste,
2 better forest management,
3 new forests
4 additional land for energy crops,
5 higher productivity in agriculture,
100 EJ additional biomass until 2035:
60 EJ from Waste, 25 from forests, 15 from energy crops
100 EJ more biomass in detail:

- 1 EJ = 140 million m³ wood = 278TWh = 24 Mtoe = 56 million t dry matter = 4 million ha short rot. Forest (14 t dry matter/ha)
- 1 EJ = 58 million tonnes pellets

25 EJ from forests: 10EJ from SRF requires 40 million ha

- 15 EJ (additional 1.4bn m³ wood from existing forests – there are 4bn ha forests, that means from 1/3 of the forests one additional m³!

15 EJ from agric.crops means about 100 million ha land

60 EJ from waste such as straw, bagasse, (1EJ ca 60 million t straw = 20 million ha) wood residues, waste for biogas, etc.
The biomass potential of residues: almost 100 EJ

914 million tonnes residues will be available and can replace half of the gasoline needs in the above regions

Source: Bloomberg New Energy Finance, 'Moving Towards a Next-Generation Ethanol Economy', 12/01/2012
China: decentralized straw storage for power production
The contribution of 100,000m³ wood to the final energy demand depending on the chosen conversion technology:
Sustainability, carbon neutrality, biodiversity

These concerns have to be taken seriously.

- WBA position: we cannot use more biomass than we produce on a permanent basis, we have to take care of the biodiversity.

Sustainable biomass is carbon neutral. The carbon stems from the atmosphere and is given back to the atmosphere. Sustainability means, among else production of biomass is bigger or equal than the use.
The use of biomass in 2010, EJ

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>To conversion</th>
<th>Direct use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid biomass</td>
<td>51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st gen fuels</td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>biogas</td>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>54</strong></td>
<td><strong>6.5</strong></td>
<td><strong>46.5</strong></td>
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</table>
## The use of biomass in 2035, EJ

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<th>To conversion</th>
<th>Direct use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solid biomass</strong></td>
<td>134</td>
<td>44</td>
<td>90</td>
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<tr>
<td>Hereof electr. distr. Heat 2nd gen fuels syngas</td>
<td>9.0 10.0 20.0 5.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1st gen fuels</strong></td>
<td>6</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td><strong>biogas</strong></td>
<td>13</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>Hereof electr./heat upgraded</td>
<td>6.0 7.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>153</td>
<td>57</td>
<td>96</td>
</tr>
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**2° target and CO2 emissions**

Transformation of the energy system: The longer we wait, the faster we have to move and reduce the emissions to comply with the 2° target!

Average 19Gt/year
Future of RES – mitigation of climate change

Table: share of primary energy (%)

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<thead>
<tr>
<th></th>
<th>2010</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Biomass</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>Other RES</td>
<td>4</td>
<td>24</td>
</tr>
<tr>
<td>Fossil and nuclear</td>
<td>86</td>
<td>47</td>
</tr>
</tbody>
</table>
Building of a new energy system – the challenge of the next decades

• Awareness
• Responsibility
• Shift of paradigm – not bau (business as usual)

Starting now:

• Investment in energy = investment in renewable energy (production – logistics – conversion – creation of markets)
• Brazil should play a key role in this transformation!
The role of WBA

• WBA will play its role in this transformation:
• We need the support also from members from Brazil!

We invite you: join WBA!
for more: www.worlebioenergy.org
Thank you for your attention!

Join the INTERNATIONAL VOICE OF BIOENERGY!
www.worldbioenergy.org