Current Status and Future Prospects of World’s Renewable Energy

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What are Renewable Energies (RE)

- **Traditional RE**: today 18% of global energy supply
  - Large hydro: 6% of global supply
  - Fuel wood and other biomass in poor households (12%)

- **New RE**: today a few % in Germany, USA, China...
  - Wind power
  - Solar photovoltaics (pv power)
  - Solar heat
  - Small hydro power
  - Bio-energy (power, fuels, and heat)
  - Geothermal power and heat
Why we need RE Now!

- Most conventional energies will by and large have been exhausted by 2050: markets become progressively tight, prices tend to go up - RE are plentiful and inexhaustible
- The import dependence on conventional fuels is increasing in most countries - RE are available everywhere, energy autonomy is a possible outlook
- Environment and climate problems of conventional energies are high on political agenda (World Summits, IPCC) - RE are clean and neutral for GHG emissions
- RE stimulate the global economy by technological innovation, new opportunities in industry (SMEs!) and finance, new jobs, rural development
- A new hope for the 2,000 million ‘energy poor’ - RE are decentralised, easy to implement
**Is the RE Option realistic?**

- RE getting cheaper and increasingly competitive through growing mass production, assisted by R&D
- All RE have already conquered important niche markets where they compete successfully
- Being decentralised and partly intermittent, RE imply a new energy supply and demand system, different from the conventional ones - challenges ahead are gigantic: entrenched conservative assets, attitudes and bureaucracies lay on the way
Global Aspects

• RE are, except geothermal energy, derived from the SUN, our all ‘world heritage’: Fossil energies are also derived from the SUN, but they are owned by a few only.

• Energy autonomy through RE is a realistic option for all: communities, regions, nations. But as conditions of use are not the same everywhere, trade is important: example, international trade of pv modules exceeds this year 15 billion USD.

» Trade in RE stimulates PEACE while the fight for access to the fossil resources tempts to military intervention.
RE today: Power Markets (1)

- **Wind power**: globally installed end 2008: 120 GW; +/- 25 GW new in 08 (40 x more than new atomic capacity since 05)
  - Market leader in 08: USA with +/-10 GW newly installed
  - For total capacity USA pass Germany in 08, both exceeding over 22 GW each

- **Photovoltaics**: world capacity end 2008: 15 GW; +/-5 GW new in 08
  - Market leader in 2008: Spain with +/-1.3 GW newly installed followed by Germany with 1.1 GW, USA, Italy, and Japan with +/- 250 GW each
  - For total capacity Germany is global leader with +/- 5GW inst.
RE today: Power Markets (2)

- **Bio power**: +/- 50 GW totally installed (increasing trend for small co-generation units (in the EU 2/3 of total), electricity from biogas (from landfill or agricultural biomass)
  - Germany had in 2007 for first time more electricity from bio-energy than from hydro
- **Small hydro**: +/- 100 GW (20 GW new in 2007)
  - 12 GW in EU
- **Geothermal power**: 10 GW
**RE Heat**

- **Buildings** represent in many countries 50% of total energy demand. Trend towards ‘Passive Solar Buildings’ (3 litres of heating oil per m² and year), ‘Zero-energy houses’, ‘Energy-producing houses’, all relying on solar, and/or bio-energy, and/or geothermal up-graded with electric heat pumps.

- **Solar heat collectors**: over 200 million m² globally
  - 300 million people dispose today of solar heated water (SWH)
  - China has more than half of global capacity installed

- **Biomass**: in the EU, 10% of the 65 mtoe/y of total solid biomass goes into commercial heat (toe: tonnes of oil equivalent)
  - **Wood pellets** globally 14 mt/y; Germany 2 mt/y in 2008 (5 x consumption in 2005)
RE Bio-fuels

- **Bio-alcohols**: in 2008 global production volume +/- 54 mt (million tonnes per year), production costs 30 cent - 60 cent per litre
  - Market leader USA: +/-27 mt/y from corn; 3% of gasoline consumption
  - Brazil: +/-20 mt/y from sugar; 40% gasoline consumption
- **Vegetable oils and bio-diesel**: 10 mt/y, production costs 19 cents - 88 cents per litre
  - Market leader Germany (EU): 3.4 (5.4) mt/y from rapeseed
  - Malaysia: 1 mt/y palm oil for export
- **Bio-gas**: over 13 mtoe/y for local consumption or, upgraded, for natural gas networks
  - 6 mtoe/y in EU
Cumulative World RE Business in 2008

In billion USD

<table>
<thead>
<tr>
<th>Resource</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Wind power</td>
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<tr>
<td>Solar pv</td>
<td>35</td>
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<td>Solar water heater</td>
<td>10</td>
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<tr>
<td>Small hydro</td>
<td>30</td>
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<td>Geothermal</td>
<td>3</td>
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<tr>
<td>Bio-energy</td>
<td>91</td>
</tr>
</tbody>
</table>

Bio-energy
- Bio-electricity       35
- Heat                  10
- Bio-gas               6
- Bio-liquids for transport 40
  - Alcohols             34
  - Oils/Diesels        6

Total 214
China’s Leadership in RE

• China has the world’s biggest solar pv industry
• China has the world’s largest park of installed Solar Water Heaters
• The growth rate of wind power installation is globally the highest
• China leads the world in the small hydro market
Global RE Technology Outlook
Short-term by 2010

- **Wind power**: cumulative 200 GW (40 GW/y)
- **Solar pv**: production capacity 20 GW; market volume only 1/2 or 1/3 of industry capacity? World investments will reach level of electronic chip manufacturing industry by 2010
- **Geothermal power**: 13.5 GW
Global RE Political Outlook
Short-term by 2010

- EU Directive: 21% electricity share from RE sources
- EU Directive: 5.75% bio-fuels (alcohols and biodiesel/vegetable oils) in all transport fuels
- California law: 20% electricity share from RE sources
- USA: applications for +/- 70 GW solar plants on a million km2 in the South-West are on the table
- China: over 10 GW wind, 10% RE electricity target
- Spain: over 3 GW solar pv, 30% RE electricity goal
Global RE Outlook
Medium-term 2017-2020

• Shell Study: 31% RE supply to energy consumption globally by 2020
• EU Draft Directive: 20% RE as part of over-all EU consumption by 2020
• Total world’s wind capacity by 2017: 700 GW
• USA:
  – AL Gore demand: all US electricity from RE within 10 years
  – US law: 5 x the current volume of bio-fuels for transport (36 billion gallons by 2020)
  – RE investment tax bill extended October 2008 could trigger 440,000 new jobs and 230 billion USD investments by 2016
Global RE Outlook
Long-term 2050

- World Energy Council’s policy scenario sees doubling of global energy supply need. Share of electricity could increase threefold.
- Shell scenario finds 65% RE contribution to consumption by 2060.
- Politicians and RE experts in Europe, including the World Council for RE, see realistic option of 100% RE supply in a commercial energy market free of any subsidy by 2050.
Renewable Energies:

Join the March into the Solar Age, for a better World

Welcome