Bioenergy for Sustainable Development

Thematic Meeting on Bioenergy at IRENA Eighth Assembly
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IRENA
Major Modern Biomass Needs in 2050

REmap 2050
235 EJ

- Solar PV: 11%
- Wind: 15%
- Power: 40%
- Heat and other direct uses: 44%
- Hydropower: 7%
- Transport: 16%
- Geothermal: 2%
- Biomass power: 3%
- CSP: 3%
- Solar thermal: 15%
- Geothermal heat: 4%
- Renewable district heat: 3%
- Biofuel industry: 13%
- Biofuel buildings: 10%
- Hydrogen for transport: 3%
- Liquid biofuels: 11%
Meeting the Challenge Sustainably

• Social Challenge: Food vs Fuel
  - Sustainable intensification: higher yields
  - Allows to produce more food AND fuel.

• Environmental Challenge: Land Use Change
  - Sustainable intensification: energy crops
  - Avoid forest loss, encourage forest expansion
  - Convert degraded land to productive use

• Economic Challenge: Low Price of Oil
  - Efficient use of biomass for cooking, heat, power
  - Competition not mainly with oil in these sectors
  - Count value of reducing atmospheric pollutants
Bioenergy for Sustainable Development

IRENA – International Renewable Energy Agency
http://www.irena.org/

IEA Bioenergy – International Energy Agency Technology Collaboration Programme on Bioenergy
http://www.ieabioenergy.com/

FAO – Food and Agriculture Organization of the UN
http://www.fao.org/
Yield Gap: Illustrated by Maize

Ratio of Actual to Potential Yield for Maize (Year 2000)

Source: Global Agro-Ecological Zones
Yield Gap: Illustrated by Wetland Rice

Ratio of Actual to Potential Yield for Rice (Year 2000)

Source: Global Agro-Ecological Zones
Pastureland Available Globally for Biofuel Crops

- Pastureland (3.4 billion ha)
- Cropland (1.5 billion ha)

- 1.5 billion ha marginal & very
  Could possibly grow some energy crops adapted to saline or desert conditions

- 1.4 billion ha prime & good
  Could be more suitable for energy crops than food crops

- 70 million ha more for food by 2050 (FAO)

% Dietary protein

% Harvested Crops

Agricultural Land (Billion Hectares)
Expansion Measures: Higher Yields

Several measures can help boost yields... Agricultural extension services can promote adoption of modern farming techniques and development of good management practices at a local level, including agroforestry strategies for growing a mix of high-yielding food and fuel crops in different soils and climates. Secure land tenure can give farmers financial incentives to manage their land for high yields while sustaining soil productivity.
## Best Practice Losses by Food Chain Stage

<table>
<thead>
<tr>
<th>Food Type</th>
<th>Agricultural Production</th>
<th>Postharvest Handling &amp; Storage</th>
<th>Processing and Packaging</th>
<th>Distribution: Supermarket Retail</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>2%</td>
<td>2%</td>
<td>3.5%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>Roots &amp; Tubers</td>
<td>6%</td>
<td>7%</td>
<td>10%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Oilseeds &amp; Pulses</td>
<td>6%</td>
<td>0%</td>
<td>5%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Fruits &amp; Vegetables</td>
<td>10%</td>
<td>4%</td>
<td>2%</td>
<td>8%</td>
<td>5%</td>
</tr>
<tr>
<td>Meat</td>
<td>2.9%</td>
<td>0.2%</td>
<td>5%</td>
<td>4%</td>
<td>2%</td>
</tr>
<tr>
<td>Milk</td>
<td>3.5%</td>
<td>0.5%</td>
<td>0.1%</td>
<td>0.5%</td>
<td>0.1%</td>
</tr>
</tbody>
</table>
Reduced Food Chain Waste and Losses

Food chain losses could be reduced by promoting good harvesting techniques, investing in storage and refrigeration facilities, developing transportation infrastructure to safely deliver food to markets, discounting imperfect food items to encourage their sale, modifying labels so food is not discarded prematurely, and educating consumers to better match food purchases to their needs.
Use of degraded or marginal land is an option for biomass production that helps restore soil productivity and avoids or mitigates competition for higher quality land. Economic incentives to promote such land uses should be combined with dissemination of information on suitable production systems and experience from previous initiatives, while protecting vulnerable communities.
Potential Land for Solid Biomass

- Closing the Yield Gap: 550 M ha
- Better Use of Pasture Land: 950 M ha
- Reduced Food Chain Losses: 270 M ha
- Landscape Restoration: 350 M ha
- TOTAL: OVER 2 BILLION HECTARES, 300 EJ
Farm and Forest Residues

- **Farm Residues** (46-95 EJ of bioenergy)
- **Forest Management** (27 EJ of bioenergy)
- **Forest Residues and Waste** (15-30 EJ of bioenergy)
- **Modern Cookstoves** (8-17 EJ of bioenergy conserved)
Farm and Forest Residues

Other steps can support **better use of residues and waste from agriculture and forestry value chains**. Examples include incentives for sustainable use of residues, supported by **guidelines to ensure appropriate residue extraction rates** in different conditions. **Soft loans for machinery** can further support the ramping up of bioenergy systems that use residues and waste as feedstock... **Logistical approaches** for cost-effective harvesting and transport of ... residues can be disseminated.
IRENA Bioenergy Work – 3 Pillars

• Sustainable resources
• Technology pathways
• Scale-up tools and strategies
Sustainable Resource Pillar

- SR-1 Sustainability Outreach to Build Support
- SR-2 Logistics of Collecting Sustainable Feedstocks
- SR-3 Scaling Up Sustainable Sugarcane
- SR-4 Mass Balances: Sustainable Use of Forest Wood
- SR-5 Mass Balances: Sustainable Use of Farm Residues
- SR-x ADDITIONAL IDEAS from IRENA Members
Technology Pathways Pillar

- TP-1 Biorefineries w/ High Value Chemicals, Materials
- TP-2 Baseload Power from Biogas with Wind & Solar
- TP-3 Bioenergy Costs – Energy Cane vs Sugarcane
- TP-4 Case Studies: Advanced Liquid Biofuel Plants
- TP-5 Case Studies: Bioenergy for Agroprocessing
- TP-x ADDITIONAL IDEAS from IRENA Members
Scaleup Tools & Strategies Pillar

- ST-1 Improved Bioenergy Simulator for a Mix of Food and Fuel Crops
- ST-2 Strategies to Reduce Food Chain Waste & Losses
- ST-3 REstore – Developing Wood on Degraded Land
- ST-4 Municipal Waste and Methane to Markets
- ST-5 Effective Bioenergy Promotion Policies
- ST-6 Bioenergy Scale-up Strategies for Russia
- ST-7 Bioenergy Scale-up Strategies for Southeast Asia
- ST-x ADDITIONAL IDEAS from IRENA Members
Thanks for listening!