Sustainable Bioenergy and Environmental Aspects
An IEA Perspective

Paolo Frankl
Head, Renewable Energy Division
International Energy Agency

Sustainable bioenergy: sowing the seeds of sustainable development
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Topics

- Current Trends in Biomass for Energy
- The Role of Bioenergy in a Sustainable Energy Future
- IEA Roadmaps on Biofuels and Bioenergy
Bioenergy today provides around 10% of global primary energy supply

Most of it, however, is inefficient, traditional biomass
Recent Trends in Bioelectricity Production

- Growth particularly strong in Germany and China
- Bioenergy provides around 1.3% of electricity today
Recent Trends in Biofuels Production

- Production concentrated in Brazil, US and EU
- Biofuels provide around 2% of transport fuels (c. 3% of road transport fuels)
The IEA ETP 2010 Blue Map Scenario Towards a Low Carbon Future

- **Baseline Scenario** – business-as-usual; no adoption of new energy and climate policies
- **BLUE Map Scenario** - energy-related CO$_2$-emissions halved by 2050 through CO$_2$-price and strong support policies
  - Serves as basis for all IEA Technology Roadmaps
- Bioenergy contributes in all four end-use sectors
A wide range of technologies will be necessary to reduce energy-related CO$_2$ emissions substantially.
Biofuels Contribution to Emission Reductions in the Transport Sector

- **Efficiency improvements are the most important low-cost measure to reduce transport emissions.**
- **Biofuels can reduce global transport emissions by 2.1 Gt CO₂-eq. in 2050.**
- **To achieve these reductions, all biofuels must provide considerable life-cycle GHG emission reductions.**

Note: Modal shifts (not included) could contribute an additional 1.8 Gt CO₂-eq. of emission reductions.
Final Biomass Use by Sector in ETP 2010

- Biomass currently provides around 910 Mtoe (38 EJ) of final energy per year
  - 200 Mtoe (8.3 EJ)/yr of commercial heat and power and 53 Mtoe (2.2 EJ)/yr of liquid transport fuels
- Traditional biomass accounts for over 670 Mtoe (28 EJ)/yr
- In BLUE Map final biomass use increases to around 1850 Mtoe (78 EJ)/yr in 2050.
- This will require roughly 7000 Mt dry biomass
IEA Roadmaps - Bioenergy

- Roadmaps are intended to:
  - Highlight pathway(s) to reach large scale use of low-carbon technologies, consistent with *Energy Technology Perspectives 2010*
  - Focus on the key steps over the next 5-10 years, as well as long-term milestones, including:
    - Identify barriers and obstacles and how to overcome these
    - Identify key conversion pathways
    - Key RD&D gaps and how to fill them while ensuring sustainability
    - Identify market requirements and policy needs
    - Define international collaboration needs

- **Biofuels for Transport**
  - Published April 2011

- **Bioenergy for Heat and Power**
  - Work in progress
  - Published Spring 2012
A considerable potential of “low risk” biomass sources has been assessed.

145 EJ of sustainable biomass primary energy supply could come entirely from residues, wastes, and sustainably grown energy crops.
IEA Biofuel Roadmap: Vision

- Global biofuel supply grows from 2.5 EJ today to 32 EJ in 2050
- Biofuels share in total transport fuel increases from 2% today, to 27% in 2050
- Diesel/kerosene-type biofuels become particularly important to decarbonise heavy transport modes
- Biofuels could reduce global transport emissions by 2.1 Gt CO$_2$-eq. in 2050
- Large-scale deployment of advanced biofuels will be vital to meet the roadmap targets
Land Requirements

- Land required to produce biofuels increases from 30 Mha today to 100 Mha in 2050, in addition to 1 billion tons of residues.
- Sustainable land expansion will be challenging given increasing demand for food and biomaterial.
- Sound policies are needed to ensure sustainability and mitigate risk of indirect land-use change (ILUC).
- In the long-term, a sustainable land-use management for all agricultural and forestry land is needed.

Note: This is gross land demand, excluding land-use reduction potential of co-products.
Sustainability of Bioenergy – A focus on environmental aspects

- **Lifecycle-GHG** emission reductions, uncertain **ILUC**
- **Land-use competition** with other sectors (agriculture, forestry, nature conservation etc.)
- **Impact on biodiversity**
- **Water use** (in cultivation and processing) is becoming an increasingly important issue
  - UNEP and IEA Bioenergy have recently published a report on the issue
Most biofuels can reduce GHG-emissions compared to gasoline/diesel.

To achieve GHG reductions, biofuels must be produced in an efficient way.

However, uncertainty on the impact of land-use change on GHG balance remains.
Measures to reduce environmental impact of bioenergy production

Pressure on agricultural land can be limited and risk of ILUC can be mitigated through:

- Productivity improvements
- Efficient use of co-products (biorefinery concept)
- Use of residues and wastes as feedstock
- Biomass cascading
- Use of pasture/ unused land
- Land-use zoning and sustainable land-use management schemes
Importance of Sustainability Criteria

- Sound policies are needed to ensure biomass for energy is produced **sustainably**

- Adoption of internationally aligned sustainability certification for all bioenergy based on **internationally agreed sustainability criteria** such as those developed by GBEP

- Ultimately, **all agricultural and forestry products** should be certified