Potential and Perspectives for Sustainable Second-Generation Biofuels

Anselm Eisentraut

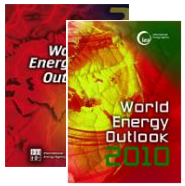
Renewable Energy Division

Biolyfe Workshop

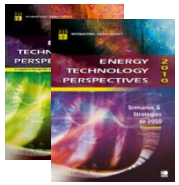
07.06.2011, Berlin

IEA analysis on transport and liquid fuels

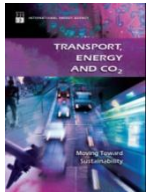
Relevant publications



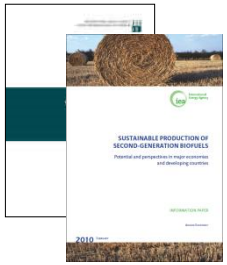
- **World Energy Outlook 2010 (WEO)**
  Horizon 2035, all energy sources
  Scenarios depicting different developments on the basis of policy actions
  Special focus on renewable energy, incl. a chapter on biofuels



- **Energy Technology Perspectives 2010 (ETP)**
  Horizon 2050, all energy sources
  Scenarios that pay particular attention to the role of technology, especially on the demand side



- **Transport, energy and CO_2 (Transport book)**
  Moving towards sustainability
  Horizon 2050, all energy sources
  Builds and expands the work done on ETP



- **From 1st- to 2nd-Generation Biofuel Technologies** (2009)
  Current state of the art of 2nd-generation biofuel industry
- **Sustainable Production of Second-Generation Biofuels (2010)**
  Potential for biofuels form agricultural and forestry residues
  Focus on emerging and developing countries
  Both publications available at ***www.iea.org***

- **IEA Technology Roadmap – Biofuels for Transport**
  Launched 20 April 2011, Washington
  Focus on global biofuel deployment to 2050
  www.iea.org/roadmaps

Definition: 1st- and 2nd-generation biofuels

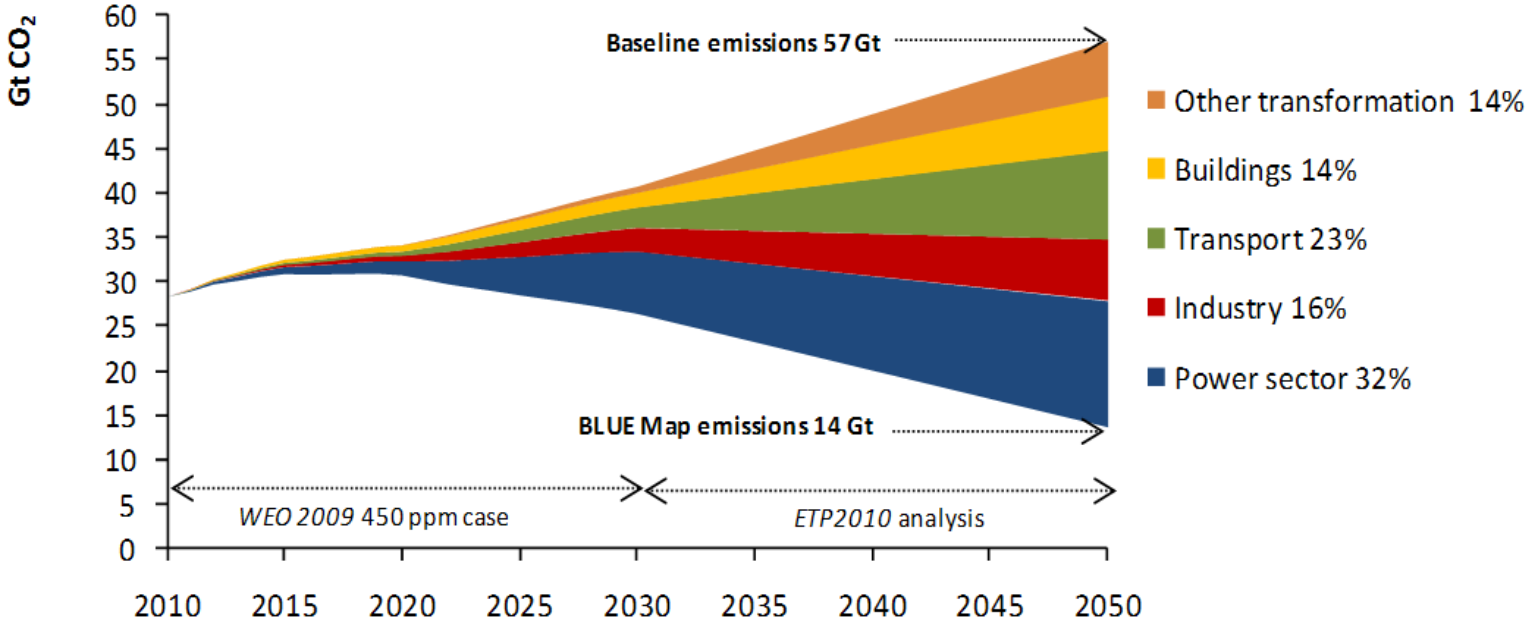
Conventional Biofuels (1st-generation)

Conventional biofuels are on the market in considerable amounts today. Typical conventional biofuels are **sugarcane ethanol**, **starch-based ethanol**, **biodiesel** and biogas from anaerobic digestion.

Advanced biofuels (2nd-generation / 3rd generation)

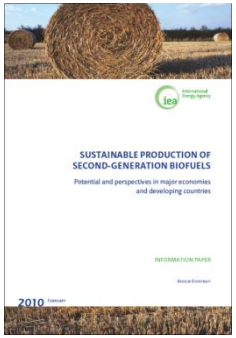
Advanced biofuels are currently in R&D, pilot or demonstration stage. This category includes **hydrotreated vegetable oil**, as well as biofuels produced from lignocellulosic biomass, such as **cellulosic-ethanol, biomass-to-liquids diesel (BtL-diesel)**, and **bio-synthetic gas (bio-SNG)**. It also comprises novel conversion technologies such as **algae-based biofuels** and **conversion of sugars into diesel/ kerosene-type** biofuels.

The IEA BLUE Map Scenario



- 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
  - **23% of global emission savings occur in the transport sector**
  - Serves as basis for all IEA Technology Roadmaps

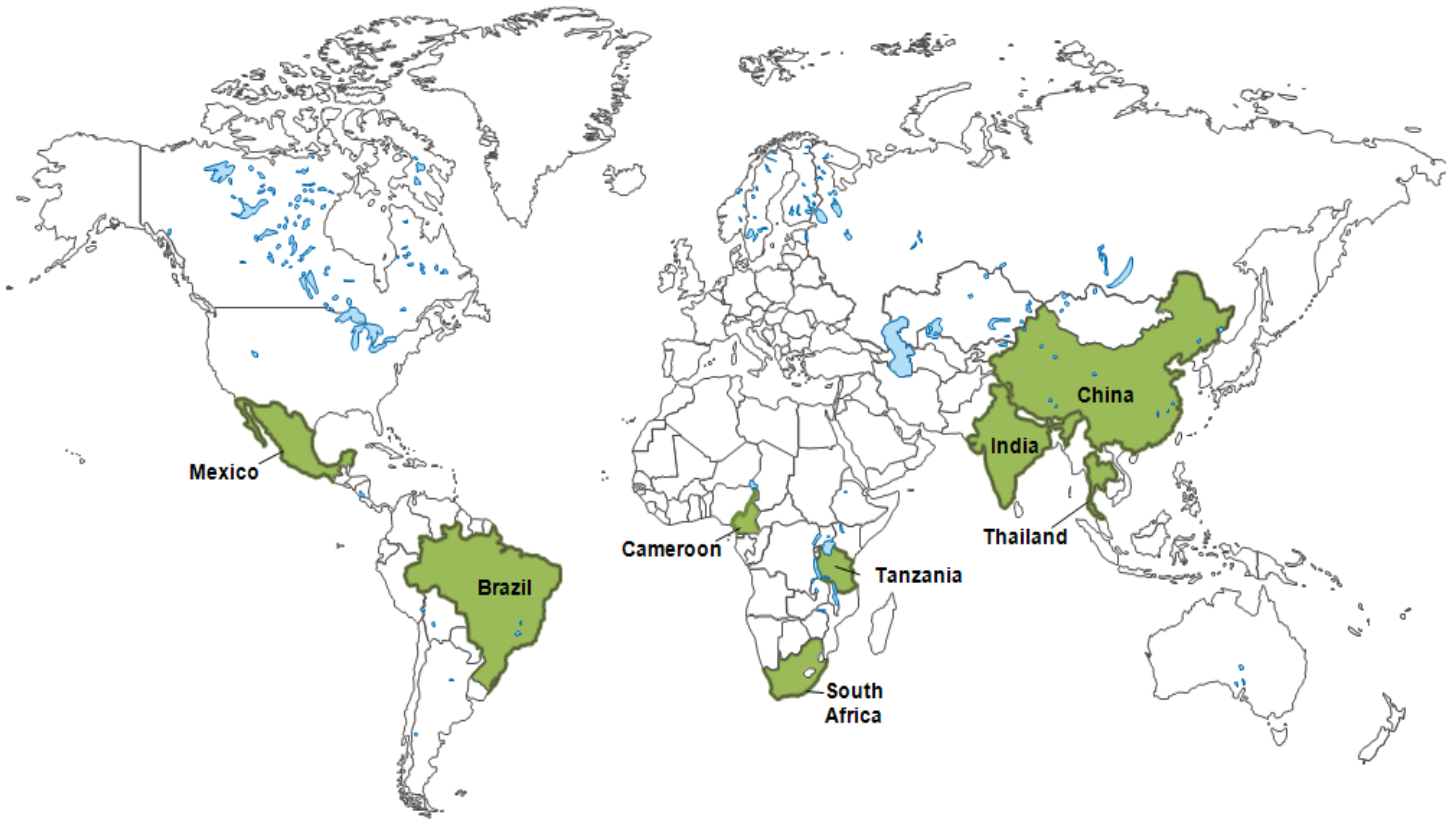
Sustainable Production of Second-Generation Biofuels



- Published February 2010
- Conducted in collaboration with Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)
- Objectives of this study were to:
  - Analyse the potential for advanced biofuel production from agricultural and forestry residues
  - Identify required framework conditions and key barriers for the new technology, in particular in developing countries
  - Provide detailed information to policy maker and other stakeholder to ensure a sustainable development of the new industry

Scope of the study

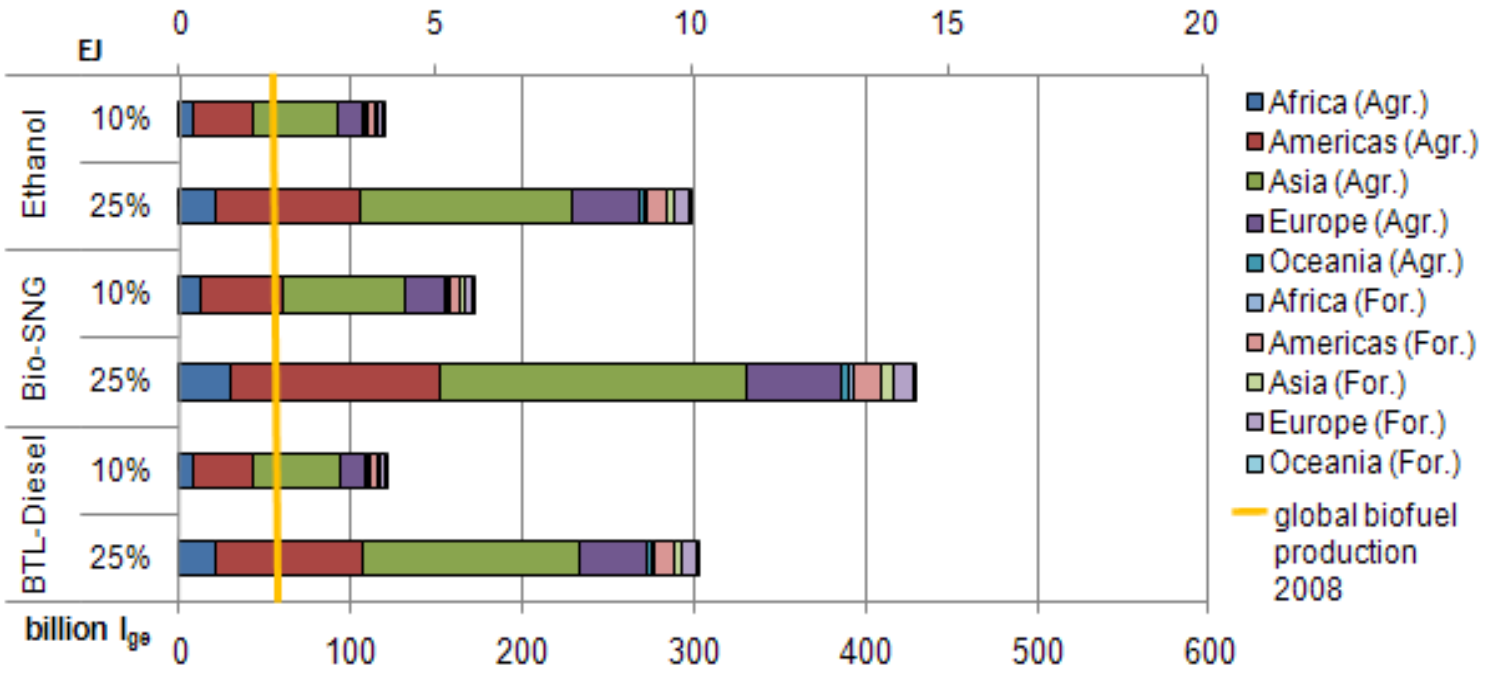
- **Based on a global assessment and specific findings from eight country profiles**
  - Brazil, Cameroon, China, India, Mexico, South Africa, Tanzania, Thailand



Residues as biofuel feedstock

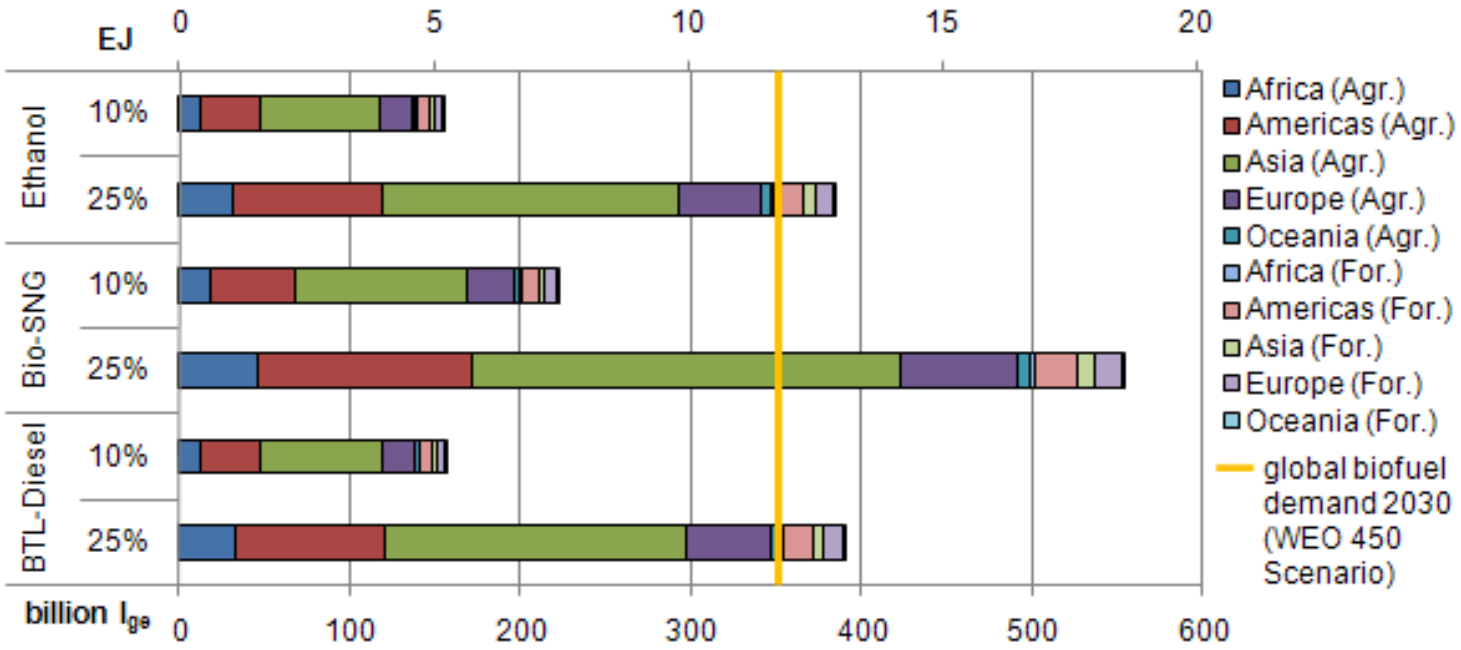
- Already produced in both forestry and agricultural sector
- Potentially low opportunity costs
- Little constraints regarding sustainability
  - No additional land needed for cultivation
- In developing countries residues are often already used (animal fodder, fuel for heating and cooking)
  - Other studies suggest between 25-50% of residues could be used
  - Some country studies showed that sometimes even less is available
- Two scenarios:
  - 25% of residues assumed available
  - 10% of residues assumed available

Current potential for second-generation biofuels from residues



- Advanced biofuel from 10% of residues could potentially meet two to three times the current biofuel supply
- However, technologies not yet available on a commercial-scale

Potential for second-generation biofuels from residues in 2030



- Biofuels are projected to provide 9% of total transport fuel in 2030
- Advanced biofuels from 10% of global residues could meet 45-60% of projected biofuel demand in 2030
- Two-third of the residue potential located in developing countries

- **Share of different types of residues**
- **…**

Sustainability of advanced biofuel production from residues

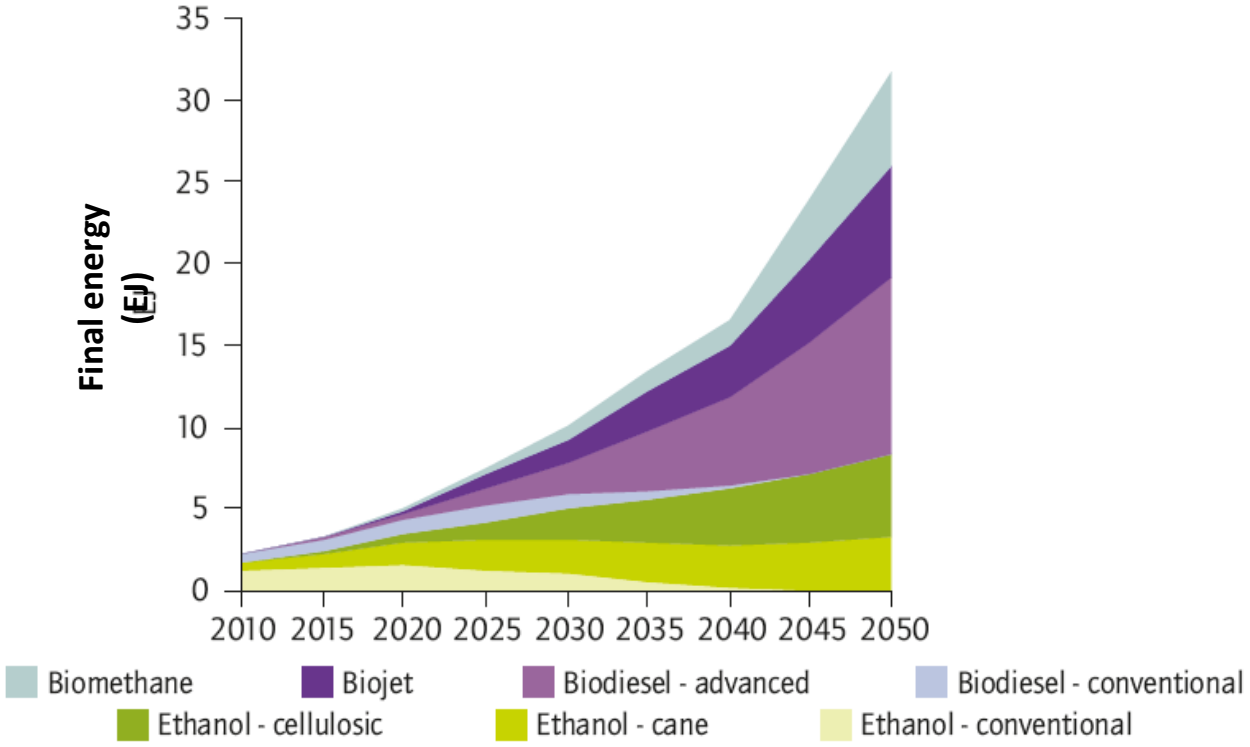
- **General benefits:**
  - Selling residues can create a win-win situation for farmer
  - Potential for job creation through transport of residues and biofuel production
  - No additional land required
    - → Virtually no competition with food production
    - → low risk of (indirect) landuse change – related only to possible over-exploitation of residues
- **Country-specific analysis and management required:**
  - Assessment of specific biomass supply and conversion costs
  - Evaluation of impacts of residue utilisation on local agricultural markets
    → Including trade-offs through increasing demand for residues
  - Monitoring of nutrient-cycles and impact on soil productivity
  - Viable small-holder concepts, *e.g.* co-operatives

Technology Roadmap

Biofuels for Transport

International Energy Agency

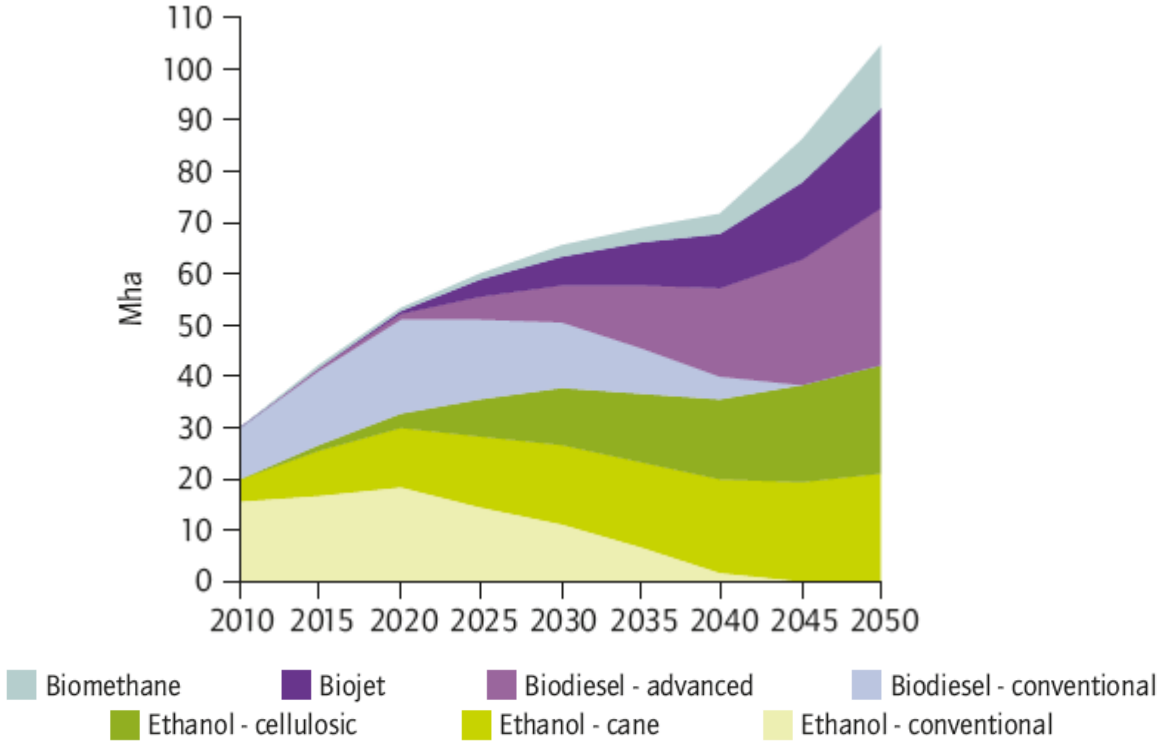
IEA Biofuel Roadmap: Vision



- 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

- **Large-scale deployment of advanced biofuels will be vital to meet the roadmap targets**

Land Requirements



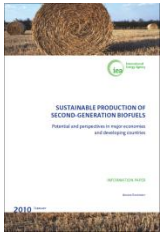
- Residues are feedstock of choice in terms of sustainability

  → Roadmap assumes use of 1 billion tons in 2050
- Nonetheless, sustainably grown energy crops will be needed to supply commercial biofuel plants and meet growing biofuel demand
- **Large-scale sustainable land expansion will be challenging and requires concerted action by all stakeholders!**

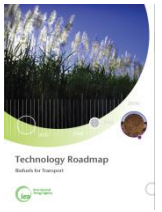
Key policy actions

- **Stability:**
  - Create a long-term policy framework for biofuels.
- **Innovation and RD&D**
  - Provide sustained funding, in particular for advanced biofuels RD&D.
  - Support research efforts on land availability mapping and biomass potential analysis.
- **Sustainability:**
  - Adopt sound, internationally aligned sustainability certification for biofuels.
  - Link economic incentives to sustainability performance of biofuels.
  - Incentivise use of wastes and residues.
- **International Collaboration:**
  - Engage in international collaboration on capacity building and technology transfer.
  - Promote the alignment of biofuel and other related policies (agriculture, forestry, rural development).

- **Sustainable Production of Second-Generation Biofuels**
  Available: *www.iea.org*



- **IEA Technology Roadmap - Biofuels for Transport**
  Available: ***www.iea.org/roadmaps***



- **Forthcoming:**
  IEA Technology Roadmap – *Bioenergy for Heat and Power*
  Available early 2012

- **Contact:**
  anselm.eisentraut@iea.org