Background to ILUC and other mechanisms influencing use of bioenergy to replace fossil energy

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Overview

- **ILUC**: concept, data on ILUC-related GHG emissions of biofuels; considerations for future iLUC policies
- “C debt” for bioenergy from forests; risk matrix approach
- **Bioeconomy** with broader system boundaries to avoid “cherry picking” and burden shifting; sustainability requirements for all biomass
- Potential longer-term (2050) view, role of **BECCS**
- SDGs and acceptable “**bioenergy corridor**” until 2030
Indirect LUC

• ILUC occurs outside system boundaries - for all incremental use

• iLUC of bioenergy = direct LUC of agriculture

• non-local character (modeling instead of monitoring); **real** world: only **direct** LUC

• **Views:** analytical (science) vs. regulatory (policy)

• iLUC factor = proxy for regulation
Selected Results on ILUC (1)

GHG emissions only from ILUC [g CO₂-eq/MJ]

- = 50% GHG reduction

Comparative to E1OH - with high risks

ca. 320
Selected Results on ILUC (2)

Dynamic View on ILUC

• Future iLUC can become low
  – Dampening ILUC through REDD (if adequately financed)
  – Intensifying agricultural land use (baseline, tradeoffs!)
  – Better governing LUC in key countries (AR, BR, ID...)

• Prioritizing low-iLUC feedstocks
  – residues & wastes (2\textsuperscript{nd} generation)
  – unused + degraded land (+ biodiversity/social safeguards)

• iLUC is no “fate”
C Balance of Forest Bioenergy

- Models give 10-20 years of payback time for forest residues = nearly carbon neutral
- Forest baseline (what happens if no bioenergy?) and fossil reference: influence of counterfactual
- Differentiation:
  - Type of forest biome (boreal, temperate, (sub)tropic)
  - Type of forest product (residues, thinnings, low- or high quality stemwood)
## “C Debt“ from Forest Bioenergy?

<table>
<thead>
<tr>
<th>Woody biomass source for energy use</th>
<th>Time horizon for CO₂ emission reduction</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>short (10 years)</td>
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<tr>
<td></td>
<td>Coal</td>
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<tr>
<td>Boreal forest, stems final harvest</td>
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<tr>
<td>Temperate forest, stems final harvest</td>
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<tr>
<td>Harvest residues, thinnings, landscape care &amp; salvage wood*</td>
<td>+/-</td>
</tr>
<tr>
<td>SRC on marginal agricultural land</td>
<td>+++</td>
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<tr>
<td>SRC replacing forest</td>
<td>-</td>
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<tr>
<td>Industrial residues, wastes</td>
<td>+++</td>
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</tbody>
</table>

-; --; ---: **bioenergy system emits more** CO₂eq than reference fossil system **in given time frame**

+/-: GHG emissions of bioenergy and fossil are comparable **in given time frame**

+; ++; +++: **bioenergy system emits less** CO₂eq than reference fossil system **in given time frame**

* For harvest/thinning residues & salvage wood, balance depends on alternative use (burning) and decay rates

Source: own compilation based on JRC (2013)
Biomass: Cascading!?

Biomass crops

1st priority: food & (high-value) materials

Residues/wastes

End of cascade: energy use

Consistent with EU circular economy concept – but not as a criterion for certification, see IEA Bio (2016) Cascading of woody biomass: definitions, policies and effects on international trade.

A Matter of Scale: Biomass and Energy

Source: IINAS calculation for 2010 based on data from IEA and nova
Long-term Perspective

IEA Roadmap: Delivering Sustainable Bioenergy

- More climate change mitigation ($2 \rightarrow 1.5 \, ^\circ\text{C}$), more bioenergy (esp. BECCS)
- More activities to ensure sustainability of the bioeconomy, incl. food and materials
- Governance of a sustainable bioeconomy: SDGs
SDGs: The normative framework

from: https://sustainabledevelopment.un.org/sdgs
Medium-term Bioenergy Corridor?

**IEA Roadmap:** Delivering **Sustainable** Bioenergy

- Sustainable global bioenergy potential enough for IEA scenarios, but **role of BECCS remains disputed**
- To reduce risk of negative tradeoffs between SDGs, consider an “agreeable corridor“ of sustainable global bioenergy use until **2030**, e.g. 70 – 90 EJ (excluding BECCS)
Sustainable Bioeconomy: a Vision

Key role for biorefineries across sectors

- Sustainable food systems (protein, fibers etc. for food & feed; organic farming, agroforestry, aquaculture, balanced diets, reduced losses)
- Sustainable supply of bio-materials based on feedstocks from forestry, marginal/degraded land, re-use of biogenic residues/wastes
- Sustainable supply of bioenergy (agroforestry, intercropping, marginal/degraded land, biogenic residues and wastes)

- Global food security, secure land tenure
- Regional/local employment and value added (rural development)
- Sustainable production in agriculture, fishery and forestry
- Reduction of food losses, recycling of wastes (circularity)
- Conservation of ecosystem services (biodiversity, C sequestration, recreation, soil fertility, water...)
More Information

**IEA Bioenergy** Inter-task project “Measuring, governing and gaining support for sustainable bioenergy supply chains” [http://itp-sustainable.ieabioenergy.com](http://itp-sustainable.ieabioenergy.com)

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