Making Bioenergy Sustainable

Gernot Klepper
Kiel Institute for the World Economy

3. November 2020
Trade-Offs in the use of Biomass

Commercial use of biomass serves many needs
... and it supports global ecosystem functions

Bioenergy is embedded in a global system of natural resource use
Global biomass potentials and Net Primary Production (NPP)

Global yearly biomass flows around 2000 in EJ/year

- Aboveground current NPP
- Unharvested residues, Fires
- Harvested primary crops
- Harvested crop residues
- Biomass grazed
- Wood removals (FAO)
- Plant-based food
- Feed (grazing, residues)
- Wood
- Other uses
- Food for humans
- Timber and paper
- Bioenergy (IEA)
- Other uses

Source: IEA, 2012
Which ecosystems are used for bioenergy?

A large part of current bioenergy use is traditional bioenergy (mostly wood burning) and rather inefficient. Modern bioenergy (e.g. biofuels) is still negligible, but may create conflicts in the future.

Quellen: Erb et al., 2007; Schneider et al., 2009; FAO, 2010; Wirsenius, 2003; Sims et al., 2006; Krausmann et al., 2008; FAOSTAT, 2012; Kummu et al., 2012
Bioenergy in the context of sustainability requires consideration of complex feedback effects

- Direct Trade-offs
  - Food
  - Ecosystem functions
  - Fibre uses
  - Alternative sources (waste/residues)

- Indirect Knock-on effects
  - Rural development
  - Overall land use
  - Distributional effects

- Welfare aspects
  - Income generation
  - Poverty reduction

- Ecologic sustainability
  - Biodiversity
  - Carbon sinks (forests, peat)
SDGs set the framework for sustainable economic activities
SDGs may be in conflict to each other:
Need for societal decisions about such trade-offs!
ISCC as an example for a practical introduction of sustainability certification of global supply chains:

**ISCC principles** – a balanced set of ecological and social criteria

**Principle 1:** Protection of Biodiverse and Carbon Rich Areas

**Principle 2:** Good Agricultural Practice

**Principle 3:** Safe Working Conditions

**Principle 4:** Compliance with Human, Labour and Land Rights

**Principle 5:** Compliance with Laws and International Treaties

**Principle 6:** Good Management Practices and Continuous Improvement
Reconciling SDGs and the Paris Agreement with practical approaches to sustainable supply chains for Bioenergy

GOVERNMENTS AGREED:

- A long-term goal of keeping the increase in global average temperature to well below 2°C above pre-industrial levels
- To aim to limit the increase to 1.5°C, since this would significantly reduce risks and the impacts of climate change
- On the need for global emissions to peak as soon as possible, recognising that this will take longer for developing countries
- To undertake rapid reductions thereafter in accordance with the best available science
- GHG requirements are already implemented in ISCC. Detailed methodology for international supply chains in place

ISCC PRINCIPLE 1 & 2: Protection of land with high biodiversity value or high carbon stock. Production in an environmentally responsible way including the protection of soil, water and air:

- SDG7 Affordable and clean energy
- SDG13 Climate Action
- SDG14 Life below water
- SDG15 Life on land

ISCC PRINCIPLE 3: Safe working conditions:

- SDG3 Good health and well-being
- SDG6 Clean water and sanitation

ISCC PRINCIPLE 4: Human rights, labour rights and land rights:

- SDG1 No poverty
- SDG2 Zero hunger
- SDG4 Quality Education
- SDG5 Gender equality
Traceability as a crucial element of global supply chains
Potential agricultural and forestry feedstocks for bioenergy

Examples

- Soy
- Rapeseed/Canola
- Palm
- Sunflower
- Cereals
- Corn
- Sugarcane
- Sugarbeet
- Wood
- Cotton
- Shea Nuts
- Camelina
Waste and residue-based supply chains can avoid land use conflicts, but also feedstocks of non-biological origin.

### Waste and processing residues
- End-of-life tires
- Municipal solid waste / mixed plastic waste
- Crude glycerine
- CO2

### Renewable non-bio feedstocks
- Power-to-Gas
- Power-to-Liquid

### Forestry / agricultural crop residues
- UCO
- Landfill gas
- Tall oil
- Forestry residue
- Husks
- Straw
Support, encouragement, and regulation are crucial elements for farmers and companies to ask for sustainability certification.

<table>
<thead>
<tr>
<th>Energy</th>
<th>Industrial Applications</th>
<th>Food</th>
<th>Feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable Energy Directive (RED) and Fuel Quality Directive (FQD) of the European Union</td>
<td>Der Blaue Engel</td>
<td>Sustainable Agriculture Initiative (SAI) Platform</td>
<td>ISCC in line with FEFAC Soy Sourcing Guidelines</td>
</tr>
<tr>
<td>Japanese Government</td>
<td>Textile Exchange’s “2025 Sustainable Cotton Challenge”</td>
<td>Coca Cola’s Sustainable Agriculture Guiding Principles</td>
<td>Soy Network Switzerland</td>
</tr>
<tr>
<td>Liquid Fuel Supply Regulation of Queensland</td>
<td>Sustainable supply of raw materials for the industrial use of biomass (INRO)</td>
<td>Retailers’ Soy Group (RSG) requirements for responsible soy of the Consumer Goods Forum</td>
<td>Soy sourcing supply chains of Mars petcare</td>
</tr>
<tr>
<td>Participation in CORSIA for sustainable alternative jet fuels</td>
<td>Green Deal, sustainability criteria for biobased polymer products</td>
<td>Unilever Sustainable Agricultural code</td>
<td>Soy sourcing supply chains of ADM</td>
</tr>
<tr>
<td>AIREG – Aviation for renewable energy in Germany</td>
<td></td>
<td>Diageo’s Sustainable Agricultural Sourcing Requirements</td>
<td>Others</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Responsible sourcing practices in areas that are exposed to high risk of deforestation</td>
<td></td>
</tr>
</tbody>
</table>
Future role of bioenergy for net-zero and net-negative GHG emissions

BECCS: Bioenergy and Carbon Capture and Storage
Ethanol plants with CC already in operation and storage technology ready with running demonstration projects
Can replace inefficient traditional bioenergy use!
Summary

Lessons for Sustainable Bioenergy

- Bioenergy will play an increasingly important role in future energy markets and in GHG-reduction (e.g. Sustainable Aviation Fuels (SAF), BECCS)
- But it needs to meet sustainability requirements in order to become effective in meeting societal goals
- Bioenergy along the entire supply chain is relevant for sustainability
- Latin America has large land resources and a climatic conditions for above average GHG-savings (e.g. ethanol, palmdiesel, etc.)
- Trade-offs between different sustainability objectives (ecologic, social, economic) need to be considered carefully
- Certification of the bioenergy supply chains is a transparent and cost effective way to establish a sustainable bioenergy sector
- Governments play a crucial role in making certification effective and wide-spread
Many thanks for your attention!
Backup
ISCC is a well established and credible certification standard

<table>
<thead>
<tr>
<th>System users in 100+ countries</th>
<th>26,000+ certificates</th>
<th>32 certification bodies 500+ ISCC trained auditors</th>
<th>Training Programme (93 Trainings so far for audits and system users)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovative tools and procedures to facilitate audits</td>
<td>5,000+ system users</td>
<td>Use remote sensing to verify land use change</td>
<td></td>
</tr>
<tr>
<td>6 Voluntary add-ons to address specific customer requirements</td>
<td>Stakeholder dialogue: 153 ISCC Association members</td>
<td>Discussion platform with 4 Regional and 3 Technical Committees</td>
<td>Integrity Programme 3 auditors</td>
</tr>
</tbody>
</table>
Over 4,000 ISCC certificates in more than 100 countries are currently valid.
Regular impact assessment conducted by ISCC

- Critical review of what has been achieved, and what is the impact on the ground
- Definition of the ISCC Theory of Change
- Gathering of data about impact is challenging
- Assessment includes sample data taken from audit reports and a survey with certification bodies
- Improvements in the ISCC system will provide more digitally accessible data about impact
- Continuous improvement process with involvement of stakeholders
- ISCC will report about impact on a regular basis in the future