Availability of sustainable biomass feedstocks for biofuels: update on key issues

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The context

“How much resources we have available today and how can we sustainably increase them?”

- What feedstock types?
- Where from (indigenous supply & trade)?
- What is the cost?
- How can we mobilise/efficiently collect existing, create new biomass?
- What are the sustainability impacts related to feedstock production?
- How can we reduce uncertainty and improve data collection/accuracy?
- How should research be shaped in the future?
Why is biomass production under such pressure?

In the past:
- Provide food
- Provide materials
- Enjoy nature

- Climate change
- Security of supply
- Demographic changes
- Consumers attitude

- 1 Ha

Source: BBC
European energy portfolio in 2005 (Mtoe)
Total primary energy consumption 1811 Mtoe

- Fossil energy sources 1692
- Other renewables 53
- Biomass 66

Renewables = hydro, wind, geothermal, solar, biomass, biodegradable waste
Wood biomass in 2004 was 61.2 Mtoe

Biomass scenario for 20% share in 2020 (Mtoe)
Maximum biomass contribution 230 Mtoe of which 20% imported

- Agricultural crops 132
- Other biomass 35
- Forest wood 63

Hilkka Summa: European Policies to Promote Energy Crops
EUBIONET, CEPI Event in Brussels 28.11.2007 (www.eubionet.net)
A range of potentials...

EEA, 2006

- 2010: 46.9
  - 2030: 142.3
- 2010: 42.4
  - 2030: 38.8

LOT5

- 2010: 54.15
  - 2020: 60
- 2010: 46.5
  - 2020: 51.35

IEE, 2006

- 2010: 40.9
  - 2020: 50
- 2010: 25.7
  - 2020: 26.7

And more recent studies: RENEW, 2007
REFUEL, 2008
etc.
European biomass feedstock matrix is diverse

Source: LOT5 Biomass role in EU
Biomass trade: pellets

Trading of pellets in Europe

Production in Europe
6.2 million tons, 60% in Baltic Sea Area
Most common agro-forestry crops for bioenergy & biofuels

**Annual species**
- Cereals (wheat, barley)
- Maize
- Sugarbeet
- Rapeseed
- Sunflower
- Sorghum (sweet & fibre)
- Kenaf
- Jerusalem artichoke

**Perennial species**
- Jatropha
- Miscanthus
- Switchgrass
- Giant reed
- Cardoon
- Poplar
- Willow
- Black Locust
Strengths & Weaknesses

**Annuals**
*(wheat, sorghum, kenaf, etc.)*
- Annual growing season
- Easy access to seed
- Easy introduction in crop rotation
- Existing farm machinery
- High environmental impact
  - Use of soil tillage
  - High use of agrochemicals
- Existing farm machinery
- High environmental impact
- Use of soil tillage
- High use of agrochemicals

**Perennials**
*(miscanthus, switchgrass, SRC, cardoon)*
- High annual productivity
- Longevity
- Seed propagation (cynara, switchgrass)
- Easy adaptation
- Reduced environmental impact
  - Less use of agrochemicals (herbicides)
  - Absence of soil tillage
  - Control of soil erosion
- Low yield in the establishment year(s)
- Propagation material (miscanthus, arundo)
- New farm machinery needed
- High ash content

**Source:** Prof. S. Cosentino, Biofuels Technology Platform
Underlying factors so far...

**Agriculture**
- **Size of agricultural area:** Member states like FR, DE, PL, BU, RO result in higher potentials both for field residues & land for energy crops.
- **Short-term yield improvements:** Potentials from eastern EU Member States (PL, HUN, BU, RO, etc.) are expected to rise up to four-fold (improved yields, management practices, etc.) BUT cost is also expected to rise (improved salaries, higher economic standards, land prices will increase).

**Forestry**
- Northern Member States have higher potentials and well developed forest industries due to landscape, climate & tradition.
- South Member states face increasing forest fires which along with less-developed infrastructure and low productivity restricts forest potential.

**Wastes**
- Untapped potential but a lot needs to be done for pre-conditioning and pre-sorting (e.g. fiber containing waste).

**Energy crops**
- Member states with large agricultural area (FR, DE, PL, BU, RO) result in higher potentials for land to use energy crops.
- Scenarios estimate potentials based on land suitability & concern for conflicts with food & feed place further restrictions.
Biomass availability: a ‘constraint’ reality

Potentials

- ≤100 - ≥400EJ/y
- Agriculture, forestry, energy crops

Costs

- Current: 3-5 £/GJ
- Future: 2-4 £/GJ
- Reductions expected from yield increases, increased conversion efficiencies

GHG balances

- Wide range - careful with underlying assumptions
- Research focuses on comparison with ‘displaced ecosystems’
Agriculture currently uses 70% of the world’s fresh water, and climate change impacts will create further pressure in areas that are suffering from droughts (UNDP).
Sustainability criteria (EU)

- A sufficiently positive greenhouse gas balance.
- No competition with foodstuff or other local uses such as medicines or building materials.
- No adverse effects to the vulnerable biodiversity.
- No adverse effects to the environment.
- Contribution to local prosperity.
- Contribution to the welfare of the employees and the local population.

In addition:

- Start monitoring of indirect land use macro-effects and
- Develop steering mechanisms to combat such undesirable indirect effects.
Ongoing initiatives for biofuels

- Roundtable on Sustainable Palm Oil (RSPO)
- Roundtable on Sustainable Soy (RTRS)-Basel Criteria for responsible Soy
- Better Sugarcane Initiative (BSI)-principles and standards for ‘better sugarcane’
- Cramer certification scheme including GHG balance and sustainability indicators (NL & DE)
- Roundtable on Sustainable Biofuels (RSB). EPFL, Switzerland
- UK RTFO-linking RTFO certificates with GHG savings


- Biofuels must comply with a minimum reduction percentage of 35% of emissions of greenhouse gases (calculated across the whole production chain).
- Areas with high biodiversity or with high carbon content are named that may not be used for cultivating crops (certain types of forest, wet peat bogs and grasslands with high biodiversity, for example).
Supply Roadmap

**Short Term**
- Oilseeds
- Grains
- Residues
- Co-products
- Wastes
- Crop yield
- Breeding
- Management practices

**Medium Term**
- Tailored crops (incl. SRC, perennial grasses, etc.)
- Systems
- Double cropping
- Multi-function crop systems
- Co-products

**Long Term**
- Ligno-cellulosic, Wastes, Algae
  (out of the food chain..)
- Crop ideotypes
- Genetics (e.g. cell walls)
- Bio-wastes (collection, pre-treatment, etc.)
Biomass in ‘sustainable’ futures

WORLD POPULATION GROWTH

1050: 2.5bn
1075: 4.1bn
2000: 6.1bn
2025: 8.0bn
2050: 9.2bn

SOURCE: UN

Biomass potentials
Spatial distribution Costs

Technical potentials per region
Impacts, side effects Trade offs

Sustainable biomass potentials
Bioenergy carriers Biomaterials

Region: displaced ecosystems

Time: mobilise existing create new streams

Brussels, 22nd January 2009
2nd Stakeholder Plenary Meeting
www.biofuelstp.eu
The way forward

Action steps
- Selecting production regions
- Crop/ raw material choice
- Management practices
- Harvesting/ logistics
- End use markets
- Local community involvement

Tools
- Policies, frameworks & regulations
- Intnl. standards/ certifications
- Harmonised methodologies (potentials, GHG balances)
- Ecosystem service values
- Cost benefit
- Knowledge transfer
Critical parameters & gaps

Availability factors
- Intensive vs. extensive crop management
- Weather, water, soil, biodiversity, species change
- Water availability & distribution
- Degraded lands (with lower yields but still in the range of current biofuel-crop streams)
- Global interdependencies

Data/ information gaps
- Differences in statistics & terminology (e.g. agricultural land, fallow land, etc.)
- Harmonise databases
- Credibility and compatibility of land cover maps
- Different drivers (in EU, US, Africa, Asia, Latin America) for future development of bioenergy/ biofuels need to be taken into account
Key issues for assessing the sustainable biomass

- **Terminology & Definitions** need to be harmonised and carefully set in order to apply to a range of feedstocks, markets & applications.

- **Value of co-products**: attention should be paid to the co-products and their value in respective market sectors.

- Any methodology for the calculation of the greenhouse gases **should take into account the potential CO₂ savings from optimising the cropping system** e.g. crop rotation. This will allow a successful comparison of traditional annual crops (i.e. rapeseed, sunflower, etc.) with perennial ones.

- **Dialogue** with the involved ‘feedstock producers’.
• Public acceptance of bioenergy/ biofuels depends largely on sustainability

• Sustainability criteria should be as consistent as possible between different biomass applications, unless there are good reasons for differentiation

• Constraint factors vary at different regional & temporal scales

• Historic crop yield increases: can they continue & will they be sustainable?

• How to optimise supply chains and manage complex interactions (e.g. volume, moisture, etc.)

• Involve relevant stakeholders & build on the experience gained from previous ‘standard- setting’ (soy, palm, wood) and national biofuels activities (DE, NL, UK).
Thank you for your attention!

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