Sustainability of biomass for cofiring

Debo Adams

14th APGTF Workshop, London 12-13 March 2014

Types of biomass

1. Primary residues from agriculture and forestry – cereal straw, logging residues
2. Secondary and tertiary residues – food and forest industry byproducts and post-consumer waste
3. Plants produced for energy supply - energy crops, surplus forestry, new plants

Most biomass used in cofiring is from forestry

Biomass sustainability issues

1. Environmental – GHG emission saving, biodiversity, environmental quality
2. Social – food security, use of inappropriately gained land, employment
3. Economic – contribution to national economy, investment required

Focus on the greenhouse gas emission aspect of sustainability

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Biomass resource in the UK

- Woodfuel demand for electricity has increased since 2009, but demand for UK-sourced biomass is steady at about 1.5 modt. Increased demand met by imports, up from 0.7 modt in 2009/10 to 1.7 modt in 2011/12.
- UK wood use only expected to increase from 0.8 modt in 2012/13 to 1.0 modt in 2017/18.
- Expected use of UK-sourced total biomass is expected to be 2.5-3.5 modt by 2016/17
- Large scale biomass use forecast to be 5.9 modt in 2014, increasing to 11.8 modt by 2016/17.
- Future UK biomass availability depends on the ability to overcome market constraints and meet sustainability requirements.
- More imports forecast.

(DECC, using RO data of plants using solid biomass for electricity and CHP)

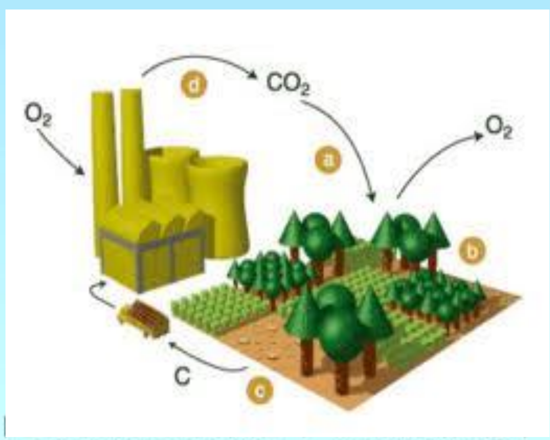
Carbon neutrality of biomass

ASSUMPTION: Biomass combustion is inherently ‘carbon neutral’ as it only releases carbon taken from the atmosphere during plant growth.

BUT: Land to produce plants for energy means that this land is not producing plants for other purposes, including carbon otherwise stored.

If bioenergy production replaces forests, reduces forest stocks or reduces forest growth, it can increase C in atmosphere.

GHG are emitted in the cultivation, processing and transport of biomass.



If bioenergy crops displace food crops, there are repercussions and may be emissions from land use change.

Life cycle assessment (LCA) of biomass

LCA includes all processes, it's cradle-to-grave

A reference system is needed for comparison and a functional unit

System boundary should include all processes

Allocation – important concept for bioenergy systems, as often multiple products. For example, manure from poultry farming is used to generate electricity

Bioenergy systems generally emit less GHG than fossil fuel ones

Factors included in life cycle analysis

GHG emissions

Energy balance

Choice of biomass feedstock

Land use change, direct and indirect

Non-CO_2 GHG emissions from soils

Soil organic carbon

Timing of emissions and removals

Choice of biomass feedstock

Industrial and domestic residues for bioenergy have the lowest GHG emissions.

Energy crops grown specifically for bioenergy have the highest emissions, due to the energy and material input.

Bioenergy systems based on in-field crop and forestry residues generally have intermediate emissions.

Most biomass for cofiring is from forestry origins.

Direct land use change (DLUC)

DLUC occurs when new agricultural land taken into production and feedstock for biomass purposes displaces a prior land use.

Depending on the earlier use of the land and the crop to be established, LUC can be a benefit or a disadvantage.

Indirect land use change (ILUC)

ILUC, or leakage, occurs when land currently used for feed or food crops is changed into bioenergy feedstock production and the demand for the previous land use (that is feed or food) remains. The displaced agricultural production will move to other places (for instance, expansion of agricultural land after deforestation).

Non-CO2 GHG emissions from soils

- Nitrous oxide from fertilisers, uncertainties magnified by GWP of 298 over 100 y.
- Methane
- Effects of agricultural residue removal
- Soil organic carbon - changes are hard to measure

Timing of GHG emissions and removals

LCA usually not concerned with the time at which the environmental impacts occur.

But bioenergy systems may cause short-term GHG emissions by combustion as compared to natural decay. This can affect short-term GHG targets, but over a long term perspective sustainable bioenergy causes less GHG emissions than comparable fossil energy systems.

Landscape perspective

It's important to consider the implications from a landscape perspective, not from a stand perspective.

If a stand is clear-felled and takes 100 y to regrow then over a short timescale it is not carbon neutral.

But at the landscape level, if one parcel is harvested each year on an 80 y rotation, the carbon implications are completely different.

Efficient land use

Bioenergy versus C sequestration

Should a piece of land be used to grow energy crops for bioenergy generation or be used to store atmospheric CO2 in biomass carbon pools (such as forest)?

Bioenergy production should be preferred if biomass from high-yielding plantations is produced and converted efficiently, displaces GHG-intensive and low-efficiency fossil energy, and if a long term view is taken.

Challenges

The determination of environmental performance is complex, and different combinations of feedstocks, conversion routes, fuels, end-use applications and methodological assumptions may lead to a wide range of results.

Standardisation in GHG balance accounting (the carbon footprint) of products is perceived as urgent by policy makers, and so standards are being developed to try to address this need.

Certification of bioenergy standards

Concept of certification:

To verify sustainable production through a third party audit.

The process of certifying the bioenergy supply chain encourages the sustainability of biomass production for energy and the bioenergy trade.

Certification organisations

Global Bioenergy Partnership (GBEP from the G8+5)

OECD Roundtable on Sustainable Development

UN-Energy

International Bioenergy Platform, IBEP

FAO Forestry Department

IEA Bioenergy Task 31 and Task 40

International Organisation for Standardisation (ISO)

European Committee for Standardisation (CEN)

Technical committee (CEN TC 383) on ‘sustainably produced biomass for energy applications’

Biomass standards - forestry

There is a proliferation of standards

Forest Stewardship Council (FSC)

Since 1994, 150 million hectares (mha) in more than 80 countries have been certified

Programme for the Endorsement of Forest Certification Schemes (PEFC)

245 mha are managed in compliance

Fuel supply standards

CEN/TS 15234 - Solid biofuels, fuel quality assurance

Green electricity labels including Milieukeur, ok-power and Green Power, some of which include a definition for biomass

Electrabel – certification procedure

Green Gold Label – Essent

Laborelec – sustainability criteria

Difficulties of a harmonised scheme

Wide variety of biomass

Different feedstocks present different challenges

Also: The sustainability risks relating to domestic biomass production originating from wastes and agricultural and forestry residues, where no land use change occurs, are currently low.

So: The Commission does not at this stage propose binding biomass sustainability criteria at EU level, but the issue is being considered and a report is expected in 2014.

EU sustainability policy

EU: About 5% of final energy consumption is from bioenergy. The Renewable Energy Road Map of January 2007 suggested that the use of biomass could be expected to double, to contribute around half of the total effort for reaching the 20% renewable energy target in 2020.

Renewable Energy Directive (Directive 2009/28/EC) June 2009 contained sustainability criteria for the use of biofuels for transport and bioliquids for heat and electricity generation and cooling, but did not address the use of solid and gaseous biomass sources together (biomass).

UK sustainability criteria

From April 2015 biomass industry must show fuel is sustainable or lose financial support under the Renewables Obligation. Biomass electricity must produce over 70% greenhouse gas savings compared to fossil fuel alternatives.

New criteria for sustainable forest management are based on issues such as:

- sustainable harvesting rates,
- biodiversity protection and
- land use rights for indigenous populations.

UK sustainability criteria 2

By 2020 biomass generators of 1MW+ will have to meet a 200 kgCO2eq/MWh annual target (72% saving compared to the EU fossil fuel electricity average). From 2025 this reduces further to a 180 kgCO2eq/MWh (75% saving compared to the EU fossil fuel electricity average).

Biomass is expected to make a significant contribution to delivering the UK's 2020 renewable energy target. Around 38% of UK renewable electricity comes from bioenergy.

Summary

Carbon neutrality – misapplication of guidance from UNFCCC, maintained by Kyoto Protocol.

EU ETS ignores CO2 emissions from biomass combustion

EU RED implicitly sets CO2 emissions from biomass combustion to zero.

There is a lack of agreed standards and criteria.

But...

If harvested forests regrow, and those supplying biomass, generally do, then C parity is reached at some point.

Forest management for biomass can promote C uptake.

Biomass energy systems are often connected to existing forestry industry.

EU relies on imports largely from North American pulp-grade plantation roundwood.

Biomass as a renewable energy source is not intermittent.

It benefits from the existing infrastructure for coal-fired power plants.

In cofiring it reduces emissions of SOx and NOx.

Thank you for your attention!

Debo.Adams@iea-coal.org

www.iea-coal.org

State Park, PA, USA

http://cofiring4.coalconferences.org