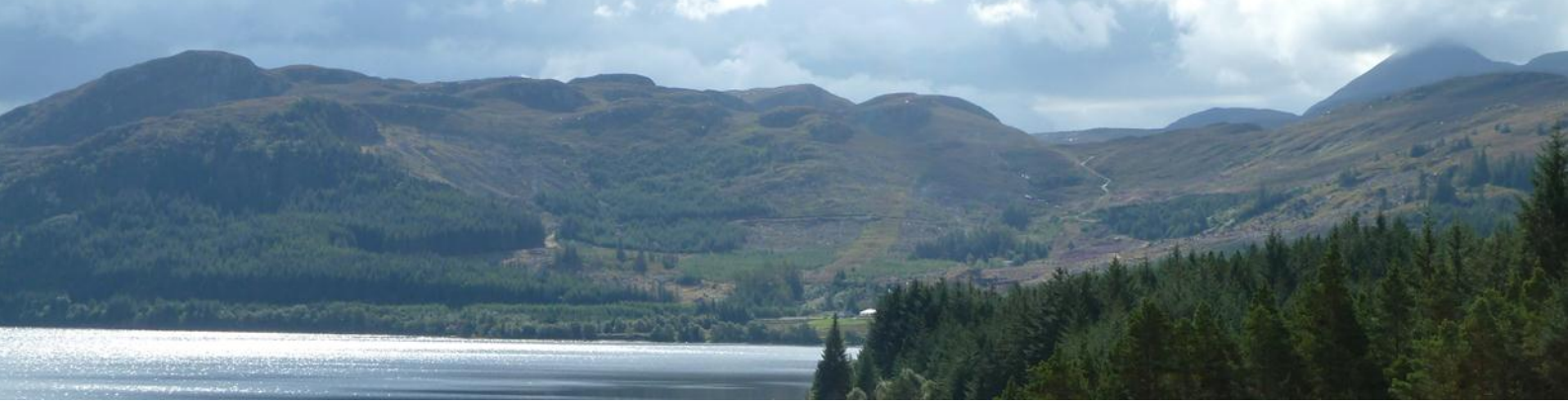


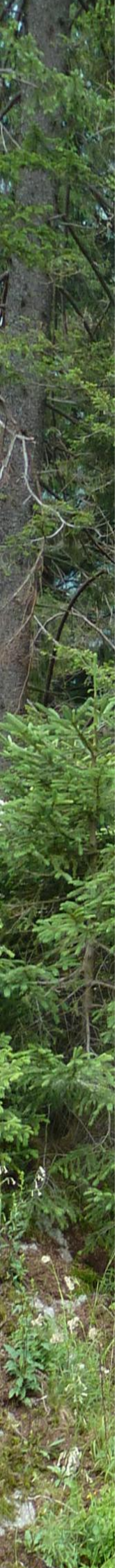
Institute for European Environmental Policy

# THE ROLE OF BIOENERGY IN EUROPE'S ENERGY FUTURE

## Based on the IEEP Report "The GHG Emissions Intensity of Bioenergy"

**October 2012**

**Produced for IEEP**
**By Nicholas Schoon**



**A non-technical summary of the main report's key messages**

Policy in the European Union and its member states is driving investment in bioenergy, which converts products made from wood and crops grown in forests and fields into useful heat and power. As a result, bioenergy is expanding rapidly across the bloc.

One of the main justifications for this promotion in policy and legislation, particularly the EU Renewables Energy Directive, is that bioenergy is a renewable, low carbon energy resource. Like wind and solar power, it cuts emissions of carbon dioxide and other climate-changing greenhouse gases (GHGs) by substituting for coal, oil and gas.

*Of the 16 million tonnes of wood pellets consumed globally in 2010, 13 Mt were burnt in Europe.*

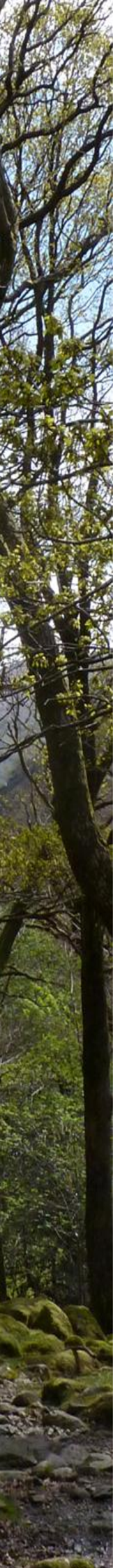
But there is no guarantee that this growing use of bioenergy in Europe will cut GHG emissions, either from the continent or the wider world. Indeed, some types of bioenergy are likely to increase these emissions during the time period that now appears to matter most for reducing the risks of destructive climate change – the next 40 years.

So argues a report from the London and Brussels-based Institute for European Environmental Policy (IEEP). It is based on a wide-ranging review of the rapidly growing literature on bioenergy's GHG emissions. This has highlighted intense debate and great uncertainty about claims of emissions reductions and carbon neutrality. Research for the report was funded by the European Climate Foundation

The report focuses on the growing use of bioenergy in heating and cooling buildings and generating electricity, rather than the production of liquid biofuels for use in transport. Transport biofuels, too, have been promoted heavily by the EU and member states. This policy has faced similar criticisms that claimed carbon savings compared to fossil fuel use are exaggerated or non-existent. But while biofuels policy is starting to change in response to the debate, the promotion of bioenergy continues unabated.

Like fossil fuels, bioenergy sources such as wood and crop residues produce carbon dioxide (CO2) when they are burnt to generate heat and power. Indeed, in any weight for weight comparison they actually produce more CO2 per tonne burnt.

The claim that they are carbon neutral, or nearly carbon neutral, is based on the notion that fresh timber or crops always grow subsequently to replace those used for bioenergy, thereby absorbing the same quantity of carbon dioxide that was released into the



atmosphere during combustion through photosynthesis. The assumption is that this regrowth and CO2 absorption would not have happened in the absence of bioenergy production.

But the report says that in many real world cases, both now and in the coming years, this claim will be questionable or false and amounts to a very large accounting error.

Part of the problem is the great variety of bioenergy resources – examples include trees felled in forests, wood from coppices, forest thinnings, specially grown annual energy crops, the residues left when crops are processed into foods and slurries and manures from farm animals which can be used to make methane gas.

Switching these resources, or the land they are grown on, from its existing use into bioenergy production will have very different impacts on overall GHG emissions depending on the type of resource and its location.

Some of them, such as anaerobic digestion of manure, can achieve deep carbon savings when they substitute for fossil fuels. Others, such as burning woodchip made from entire trees, are likely to increase overall emissions in the medium term.

If an area of forest is felled for bioenergy, all the carbon in the wood will be released as CO2 into the atmosphere in the next few months or years as it is burnt. But it will take several decades, or possibly centuries, before the regrowth of trees in that cleared area absorbs the equivalent quantity of CO2, thereby paying off the 'carbon debt.'

A great deal depends on how the forest is managed for bioenergy in the long term, compared to how it would have been managed in the absence of pro-bioenergy policies. If promotion of bioenergy causes a forest already managed at its optimum to be exploited more intensively, with the trees felled more frequently and the thinnings being burnt rather than left to rot, then the forest may absorb less carbon from year to year and also store less carbon in the long term.

A wind farm or a solar power plant can make a fairly simple and credible claim of carbon neutrality. Its construction may have caused some CO2 emissions, but once it starts operating it is substituting for fossil fuels using a guaranteed carbon-free energy source.

For a bioenergy heat or power plant, matters are far more complex. Its carbon impacts depend heavily on its fuel supply chains. It may use several different fuels, its supplies may change as the years pass and they may come from different parts of the globe. Each supply chain will have its own, different overall CO2 balance.

*Primary energy production from wood and wood waste grew by 38 per cent between 2003 and 2010*

Exploiting any one bioenergy resource is likely to cause a range of complex and far-flung changes which impact on the overall global balance between CO2 emissions and absorption by carbon sinks. Other non-bioenergy industries which used that resource may have to find new supplies, or even move. There is a wide range of industries and users which could find themselves competing for supplies with bioenergy generators – for example, fibreboard manufacture from sawmill residues.

As bioenergy expands there are likely to be changes in land use, near and far, direct and indirect. Land that is currently pasture or under arable crops may be switched to bioenergy crops. The way in which woods and forests are managed may change as well. In short, bioenergy's expansion in Europe is likely to have a range of "carbon leakage" effects within and beyond the continent.

The IEEP's report warns that as bioenergy rapidly scales up from today's fairly modest levels, with new, large plants requiring fuels supplies for decades, it becomes increasingly difficult to predict the impact on overall GHG emissions.

Life cycle analysis (LCA) of supply chains is the main tool used to estimate bioenergy's carbon savings and in principle is the right approach. However, the report says that in practice many of these analyses are based on unsatisfactory assumptions, creating a weak foundation for policy formation. In some cases bioenergy is presented, much too simplistically, as "carbon neutral".

LCA struggles to cope with the complexity of bioenergy's impacts on emissions, particularly in light of the many different sectors, energy applications and land management choices involved as well as impacts across national borders. One of several problems lies in the continuing debate about how to account for carbon savings in one nation which are likely to lead to increases in emissions in another. Agreement on a single, all-embracing methodology for LCAs and on carbon accounting for bioenergy will not be easy or come quickly.

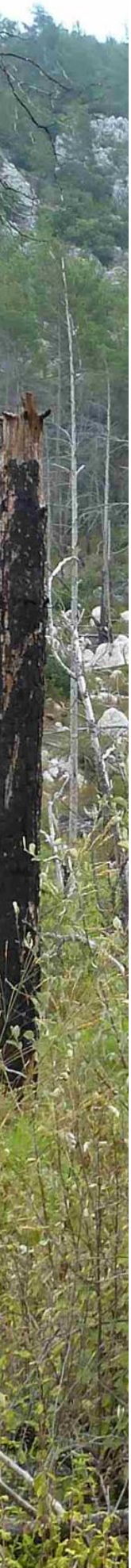
The IEEP report singles out 'counterfactuals' as a further key concern inherent to LCA. Any credible assessment of the impacts on GHG emissions of today's pro-bioenergy policies and legislation depends on a credible, widely accepted assessment of what would have happened in the absence of those policies, now and in the future.

This need for a realistic counterfactual applies not just to supply chains and land use, but also to scenarios for future fossil fuel use.

Bioenergy's emissions cutting potential is shown in the best light when it is posited as a substitute for coal, the most carbon-intensive fossil fuel. Assessments have often been made on this basis. But when used for power generation, its GHG emissions per unit of generation should arguably be compared to the average emissions from grid supplies, which are much lower than those for coal. These grid average emissions are gradually being reduced as other renewable energy and lower carbon power plants expand.

The report sets out a number of urgently required ways of making the evidence base for bioenergy policies more robust, and of starting to make these EU and member state policies more climate safe and climate friendly.

- Better, more sophisticated life cycle analysis is needed to estimate the overall emissions impacts of different bioenergy supply chains. This will have to be done in stages, with interim improvements being superseded as models and data improve.
- In particular, the way in which plans for forests to be exploited for bioenergy are handled by life cycle analysis urgently needs improving.
- Policies based on misleading LCAs need to be revisited and revised.
- Research is needed to develop more robust, integrated assessments of the carbon leakage consequences of increasing bioenergy use in Europe. This needs to take account of the nature, origin and use of bioenergy imports, the impacts on land use and on other industries relying on resources which could be switched to bioenergy.



- There is a need for agreement on an acceptable time period for repaying the carbon debt created when existing forests start to be exploited for bioenergy. The report argues that when the EU is aiming to reduce the bloc's GHG emissions by 80% by 2050, it is difficult to justify policies in which the extra emissions caused by burning forest products are not compensated for by regrowth until several decades or even centuries have passed.

- Researchers and policy makers need to focus on integrating bioenergy policies with other pro-sustainability policies on land use and resource efficiency, particularly for bioresources including various wood and waste derived products. The report suggests that a resource such as timber should have a cascade of uses, being used first for construction and only being burnt at the end of its life. Substituting wood for steel in the construction industry achieves much greater GHG reductions, weight for weight, than substituting wood for fossil fuels as an energy resource. Biowastes such as manure should be first in line for bioenergy use.

- The EU needs a more sophisticated framework covering bioenergy's role in its energy and climate policies which takes far better account of the large differences in GHG emissions associated with different supply chains. This improved framework should incorporate reasoned judgements about the relative merits of different bioenergy resources, in terms of their likely impacts on GHG emissions. The EU also needs to improve its monitoring of the bloc's changing bioenergy useage and its feedstock supply patterns.

*Globally, use of wood for energy is predicted to more than double over the next 20 years*

The report argues that taking these steps would allow policy on bioenergy to be aligned with the EU's climate ambitions in a way in which it is not now.

EU policy makers do not know nearly enough about what contemporary pro-bioenergy policies mean for current and future GHG emissions. Nor do they have any policies in place to ensure expanding bioenergy use actually succeeds in cutting these emissions in the next few decades, when Europe is committed to major reductions.

*The full report, including an executive summary, can be found here: http://www.ieep.eu/publications/2012/10/does-bioenergy-have-a-role-in-reducing-europe-s-ghg-emissions*