

## **Felled for Fuel?**

Why burning trees for electricity  
should not get UK government subsidies





## Summary

The UK is becoming increasingly dependent on imported wood pellets for power generation as a result of government policies intended to increase the use of renewable energy sources and reduce greenhouse gas emissions. Yet studies show that burning trees can result in higher greenhouse gas emissions than burning coal, exacerbating our impacts on climate change. The shift to wood is also being used to keep some of the UK's dirtiest coal-fired power stations in business, and to add to the problem, they are being fuelled by supplies of imported wood pellets, sourced from endangered natural forests (e.g. wetland forests) and unsustainably managed plantations, damaging biodiversity. There are also concerns that burning wood in power stations could increase air pollution, which has serious health impacts and should not be allowed.

While some forms of biomass can provide a sustainable source of low carbon energy for the UK, limits and tighter government policies are needed to ensure genuine carbon reductions without harmful impacts on the wider environment.

## What is bioenergy?

**Bioenergy** refers to all forms of heat and power from organic materials:

**Biomass** is solid fuel used to generate energy and heat and can include wood from forestry, woody energy crops as well as agricultural and forestry waste.

**Biogas** is produced by the breakdown of organic matter in the absence of oxygen, examples include landfill gas and gas made by bacteria from agricultural waste in anaerobic digesters.

**Biofuel** usually refers to a liquid fuel mostly made from agricultural crops used primarily in road transport.

This briefing focuses on the impacts of burning of woody biomass in power stations.

Drax power station in Selby, Yorkshire



## Background

The UK is generating an increasing amount of its electricity from burning wood, as a result of government policies to encourage the use of biomass for power generation. The Government sees biomass as a renewable source of energy that can be used to reduce reliance on fossil fuels such as coal, with the aim of cutting carbon emissions.

The UK Government is committed to increasing the UK's use of renewable energy supplies to 15% by 2020,<sup>1</sup> and biomass – which includes energy crops, wood, and organic waste – has been suggested as an affordable means of meeting the target. The government has estimated that bioenergy (including biofuels for transport) could provide up to two thirds of our renewable energy supplies.<sup>2</sup>

To encourage power generators to switch to biomass, the government is providing subsidies for burning biomass. As a result, some large-scale coal plants, including Drax in North Yorkshire, are switching to wood pellets instead of coal. A number of smaller dedicated biomass power plants have also been built, and more are planned. Because the UK has limited supplies of domestic biomass, these plants have to import biomass fuel from overseas, with increasing imports of wood pellets from the United States.

Other countries are also turning to biomass in an attempt to reduce carbon emissions, increasing international demand and driving the rapid development of an international market in wood pellets. But the lack of regulation means that neither the sustainability of the wood nor real benefits for the climate are guaranteed.

## Burning biomass in the UK

The UK Department for Energy and Climate Change (DECC) has estimated that the UK could generate 6GW of electricity from biomass by 2020, mainly by rapidly increasing the use of solid biomass.<sup>3</sup> Additionally there are plans to ramp up the use of biomass for heat.

The Government's Strategy for Bioenergy states that: "The pre-eminent concern of the UK Government in bioenergy policy is that bioenergy offers a genuine reduction in greenhouse gas emissions,

that this reduction is cost effective and that the biomass is produced sustainably".<sup>4</sup> It also recognises that "current sustainability standards applied to renewables incentives will need to be more stringent."

The government supports biomass use through the Renewables Obligation, which provides financial subsidies for burning wood. This subsidy is being replaced by a "contract for difference" scheme, which is scheduled to come into force in 2017. Because the UK has limited supplies of wood available for bioenergy, the government recognises that bioenergy use will depend on international supplies, particularly from North America.<sup>5</sup>

In 2012, bioenergy provided less than 3% of the UK's electricity,<sup>6</sup> primarily generated from land-fill gas. The government envisages that between 5 and 11% of total power generation could come from biomass by 2020,<sup>7</sup> with much of the increase coming from the use of wood in power stations, requiring the equivalent of 36 million tonnes of oven-dried (Modt) wood to be used as fuel.<sup>8</sup>

The biggest user of biomass for electricity is currently Drax Power in Selby, Yorkshire, previously the country's largest coal-fired power plant. Drax began co-firing biomass with coal in 2008,<sup>9</sup> and in 2012 announced plans to convert three of its six power units to biomass, with the aim of burning mainly biomass by 2016.<sup>10</sup> The first unit began running on biomass in April 2013.<sup>11</sup> Once the conversion is complete, Drax expects to burn up to 7 million oven dried tonnes of wood each year, making it the biggest biomass-burning power station in the world.<sup>12</sup>

In addition, Ironbridge in Shropshire converted from burning coal to burning wood pellets in 2013, but if it wants to run beyond the end of 2015, it will have to meet new plant standards under the Industrial Emissions Directive.<sup>13</sup> There is also an E.On biomass plant at Steven's Croft in Scotland. Plans to convert Eggborough power station in North Yorkshire to biomass from coal have received planning permission, but have not yet secured funding.<sup>14</sup> Lynemouth power station in Northumberland, owned by RWE, is one of three biomass projects approved so far under the new "contract for difference" scheme, which effectively provides guaranteed electricity prices.<sup>15</sup>



The focus of the Government's strategy is to use biomass to replace coal, but there are also plans for new dedicated biomass power stations, with some already in operation. There are smaller-scale wood-fired plants at Slough in Berkshire (20MW), Wilton in Teesside (30MW) and Port Talbot in Wales (14MW), and planning applications for a number of new plants including at Avonmouth near Bristol and at Blackburn Meadows near Sheffield.<sup>16</sup> A biomass plant with combined heat and power (CHP) has also been approved in Teesside under the government's contract for difference scheme.<sup>17</sup>

## The problems with biomass

### (i) Climate impacts

Although biomass is classed as a renewable energy supply, it is not carbon neutral. Burning wood, and other biomass, releases greenhouse gas emissions which contribute to climate change. One tonne of dry wood burnt in a power station emits 1.8 tonnes of CO<sub>2</sub> into the atmosphere.<sup>18</sup> The UK Government has said that biomass should contribute to a genuine reduction in greenhouse gas emissions,<sup>19</sup> but does not include the CO<sub>2</sub> released when the fuel is burnt in its overall calculations, incorrectly assuming that burning biomass is carbon-neutral.

In May 2014 60 eminent US Scientist wrote a letter to Secretary of State for Energy and Climate Change Edward Davey warning him that "Recent advances in science and accounting for pollution from different types of woody biomass have clarified that burning trees to produce electricity actually increases carbon emissions compared with fossil fuels for many

decades and contributes to other air pollution problems."<sup>20</sup>

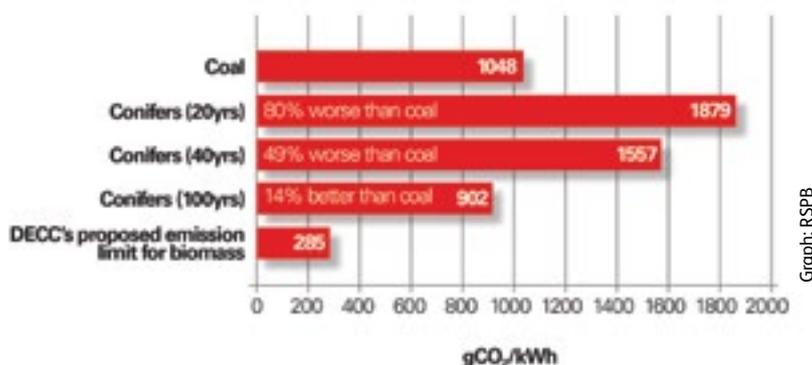
Making precise calculations about the carbon balance of bioenergy is complex. The amount of carbon in biomass depends on what it is, how old it is, the conditions it was grown under, and the way it is processed. The carbon released by burning the biomass creates a carbon debt, which is only repaid if the felled tree is replaced by a tree that is allowed to absorb an equivalent amount of carbon. Whether the debt is repaid therefore will depend on the lifecycle of what is replanted.

In 2012 Timothy Searchinger, a researcher at Princeton University who specialises in bioenergy, used DECC data to calculate that over a 20-year period, emissions from power generation using wood from conifer plantations would be 1879 g/kWh. That is 80% more than the level of emissions from burning coal.<sup>21</sup>

"Producing energy from biomass is meant to reduce GHG emissions. But burning biomass increases the amount of carbon in the air if harvesting the biomass decreases the amount of carbon stored in plants and soils, or reduces ongoing carbon sequestration [...] legislation that encourages substitution of fossil fuels by bioenergy, irrespective of the biomass source, may even result in increased carbon emissions" *(European Environment Agency, Opinion of the EEA Scientific Committee On Greenhouse Gas Accounting in Relation to Bioenergy, 2011)*



The implications of carbon debt – lifecycle greenhouse gas emissions per kWh of electricity



The UK government recognises that the best way to use trees as biomass is to only use the bark and branches for burning. It says that small roundwood (from tree trunks) and sawlogs should be reserved for other uses, such as furniture, retaining the carbon locked in the wood. But, the reality is that growing demand for biomass is driving the clear-cutting of many forests for biomass, with whole trees being converted to pellets.<sup>22</sup>

“The use of the entire tree for bioenergy is undesirable as it is generally associated with sub-optimal carbon scenarios and can result in increased greenhouse gas emissions;”  
**(UK Government Bioenergy Strategy, 2012, p30)**

Because biomass power stations create constant demand, woods that are being harvested for fuel tend to be cut more intensely, and more frequently, than plantations that are being managed for timber. This reduces the net amount of carbon stored.

While burning trees clearly exacerbates greenhouse gas emissions, flaws in the international carbon accounting systems mean that these emissions are not necessarily counted. Under the rules agreed under the Kyoto Protocol, emissions from deforestation are counted under land-use change, not as a fuel (to avoid double-accounting). But countries have considerable flexibility in how they report on land-use change emissions – meaning they may not be reported; and deforestation in countries which have not ratified the Kyoto Protocol, such as the USA, are effectively left off the balance sheet.<sup>23</sup>

This means that wood burnt for electricity in the UK is counted as carbon neutral. This assumes that the carbon debt for each tree burnt is repaid immediately. Given that some of the trees being used come from old growth forests, this is highly speculative, and even if correct, means that the carbon debt is repaid over the lifespan of a tree – so it may only become carbon neutral within 90 or 100 years (the carbon payback period). Given the urgent need to stabilise carbon emissions, this is not soon enough.

What is more, the partial use of biomass allows

power stations to carry on burning coal. Drax has to meet new emissions controls by the end of 2015 as it moves from compliance with the Large Combustion Plant Directive to the requirements of the new Industrial Emissions Directive. Partially converting to burning biomass is helping it to meet these new requirements, which, when met, will allow it to carry on burning dirty coal in half its units. Drax Power burnt 8.5 million tonnes of coal in 2013.<sup>24</sup>

#### **(ii) Impacts on forests**

Logging forests can have a damaging impact on wildlife, especially if logging practices are not sustainably managed. Where old-growth and semi-natural forests are cleared, vital wildlife habitat can be destroyed. Even if clear-cutting is not used, over extraction of dead wood can affect the biodiversity, as it provides habitat for birds, insects and fungi, and rots to provide valuable micronutrients for the soil.

Switching from coal to biomass will mean that the UK will be dependent on large quantities of imported wood from forests overseas to generate electricity. The UK government expects that 99% of the biomass for large-scale electricity generation will come from imported biomass, and estimates that large-scale generators will need 11.8 Modt of biomass by 2016/17, double the amount predicted for 2014/15.<sup>25</sup> Currently, the UK burns just 3 Modt of biomass for electricity, including some imports.<sup>26</sup> Most of the new imports are expected to come from the United States, with almost half of international forest resources found in the US.<sup>27</sup> Most of these are privately owned and logging activities are virtually un-regulated.

One of the companies supplying wood to the UK market is the US company, Enviva, one of the biggest manufacturers of wood pellets in the United States.<sup>28</sup> Enviva supplies wood pellets to Drax and to E.On. The company claims to use timber residues at its manufacturing facilities in the Southern US, but US NGOs, the Dogwood Alliance and the Natural Resources Defense Council (NRDC), says Enviva is sourcing timber from whole trees from hardwood wetland forests. Enviva has chain of custody certification from the Sustainable Forestry Initiative (SFI) and the Programme for the Endorsement of Forest Certification (PEFC) but neither of these standards actually prevent large-scale clear-cutting in endangered forests.<sup>29</sup>

Enviva's pellet mill in Ahoskie, North Carolina, is also reported to be using logs from wetland forests, with some trees that are more than 100 years old being turned into pellets.<sup>30</sup> These swamp forests have been described as "some of the most biologically important habitats in North America"<sup>31</sup> and play a vital role in the local ecosystem, providing habitat for black bears, waterfowl and reptiles, as well as providing flood protection for nearby communities and maintaining water quality.<sup>32</sup> Less than one per cent of the forests surrounding the Ahoskie pellet mill are protected from logging activities.<sup>33</sup>

Green Circle is another US-based pellet supplier, with contracts to supply Drax in the UK.<sup>34</sup> Green Circle claims to source wood from sustainable plantation style forests in the south-eastern US, burning bark to produce the pellets.<sup>35</sup> According to the Dogwood Alliance, photographic evidence suggests that Green Circle is using whole trees at its facilities.<sup>36</sup>

As well as sourcing pellets from Enviva and Green Circle, Drax Power is building its own pellet mills in Mississippi and Louisiana. These will have the capacity to provide 900,000 tons of wood pellets a year. Drax Biomass has signed a deal with the US-based Plum Creek Timber Company to supply wood fibre to the mills.<sup>37</sup> The timber supplied will have SFI certification, but this does not guarantee that whole

trees will not be used, or that natural forests will not be converted to plantations.

### (iii) Air quality

As well as releasing greenhouse gas emissions, burning wood produces other pollutants, including particulates, nitrogen oxides, and polycyclic aromatic hydrocarbons (PAHs)<sup>38</sup>, which pose a threat to human health and ecosystems. Official estimates suggest particulates kill 29,000 people prematurely in the UK each year<sup>39</sup>, Nitrogen Dioxide or NO<sub>2</sub> is increasingly understood to have independent health effects<sup>40</sup> and also contributes to the formation of ground-level ozone<sup>41</sup>, a potent greenhouse gas which restricts the ability of plants to fix carbon, and can lead to smog and episodes of bad air pollution. The UK is facing legal action from the EU<sup>42</sup> over its failure to tackle Nitrogen Dioxide concentrations, mainly as a result of traffic pollution and other sources of combustion. In some parts of the UK, levels of PAHs already exceed safety limits.<sup>43</sup>

Energy plants over 20 MW are subject to pollution controls, using filters to limit emissions and local authorities are required to monitor air quality.<sup>44</sup> Burning wood is likely to exacerbate the problems for people with asthma and breathing difficulties – as well as increasing the risks of heart disease and stroke. Communities living near wood-processing plants have raised concerns about the health impacts of wood dust from waste wood chipping facilities.<sup>45</sup>

The problems are even worse when waste wood is used as it may contain chemicals including dioxins, arsenic, lead and mercury.<sup>46</sup> Burning waste wood also diverts it from recycling by the wood panel industry.<sup>47</sup>

### (iv) Sustainability standards

Domestic supplies of wood are required to comply with the UK Forestry Standard, which while including some loopholes, imposes some sustainability requirements on the way in which wood is harvested in the UK. Imported biomass however does not have to meet these standards, with the government establishing separate sustainability criteria for biomass burned in power stations in 2014.<sup>48</sup>

While the power industry claims that these standards ensure that the wood being burnt is sustainable, in reality the standards recognise a

Tree trunks being delivered to Drax's supplier ENVIVA for pellet production



range of timber certification schemes, including the American Sustainable Forestry Initiative (SFI), which considers clear-cutting as sustainable and does not adequately protect forests with high biodiversity. Clear-cut logging is allowed on SFI-certified lands in sizes that can reach 120 acres – the size of 90 football fields. Clear-cuts of this size destroy habitat for wildlife that depend upon mature and semi-mature forest. The cumulative damage from these mammoth clear-cuts on watersheds, water quality and soil productivity is often permanent. Furthermore, SFI provides virtually no protection against the destruction of old-growth forests, or other forests in which ecological values are especially rich (e.g., wetland forests).<sup>49</sup>

As a result wood being burned in UK power stations which has come from clear cut sensitive wetland forest habitats<sup>50</sup> – some of America's most endangered ecosystems that provide critical habitat for imperiled species – is considered to be sustainable.

The standards also include a carbon reduction requirement to produce 70% greenhouse gas savings compared to fossil fuel alternatives by 2020,<sup>51</sup> but this does not include the carbon released from burning the wood. This calculation ignores the carbon debt created by burning biomass. As a result, power stations can claim to meet the criteria when in reality the net effect on the climate may be worse than when burning fossil fuels.

While generators are required to report the amount of renewable electricity generated and the source of the biomass to the Office of the Gas and Electricity Markets (Ofgem), there is no enforcement procedure currently in place, so generators continue to benefit from renewable energy subsidies, whether or not their supplies are sustainable.

## What we need

Friends of the Earth is calling for the government's ambitions for bioenergy to be scaled down and capped at a level that ensures supplies can be sourced sustainably and domestically.

The Government must also review the way in which it assesses the carbon impacts of burning wood. Clear-cutting old-growth forest to burn in UK power stations is likely to generate more carbon

emissions than burning coal. The Department for Energy and Climate Change (DECC) needs to implement a comprehensive accounting system in its sustainability criteria for biomass that includes carbon debt and indirect emissions from product substitution.

Public subsidies such as through the Renewables Obligation and the incoming "Contracts for Difference" (CFDs) must be subject to strengthened and mandatory sustainability criteria and must exclude power plants that rely on imported biomass from whole trees, such as Drax.

Weak and controversial voluntary standards like the US Sustainable Forest Initiative (SFI) must be excluded as proof of sustainability.

There is also an urgent need for the government to assess and if necessary exclude biomass projects which are shown to have indirect effects on habitat loss, deforestation and biodiversity. Bioenergy operates in a global market for agricultural and forest products. Increasing demand for products, even ones judged 'sustainable' is likely to increase overall pressure on supplies and encourage overexploitation elsewhere.

The government needs to refocus support for bioenergy on the use of feedstocks such as agricultural and forestry wastes and biogas from sewage, food waste and other organic wastes where indirect substitution emissions can be shown to be minimal.

Planning consent for new biomass power stations and conversions must not be given where this would result in a worsening of air quality

The use of the available sustainable biomass must be limited to modern combined heat and power (CHP) plants which would ensure the most efficient use of these limited feedstocks, making use of the energy for heat as well as generating electricity. CHP plants can achieve efficiencies of 65 – 75% compared to 20-25% for biomass-only electricity.



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## Endnotes

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