

# Trees for Burning

## The biomass controversy

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## Summary

- Burning trees typically creates more carbon dioxide per megawatt-hour of energy than burning fossil fuels.
- Burning imported wood chips to generate electricity is officially 'zero carbon' because the smokestack emissions are credited to the country where the trees are felled.
- The woody biomass industry is heavily subsidised in the UK and its energy is relatively expensive.
- Further subsidies are dependent on the industry adopting carbon capture technology which will add further costs and which the Department for Energy Security & Net Zero says is 'unproven at scale'.
- Current carbon accounting practices create perverse incentives without which it is unlikely that woody biomass would be part of the UK's energy mix.

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## Introduction

Since 2005, several British power plants have been converted from coal to biomass as part of the transition to a low-carbon electricity grid. The biggest biomass generator, Drax, imported 8.2 million tonnes of wood pellets in 2022, of which 4.9 million tonnes were imported from the USA, and two million tonnes from Canada (Drax 2023: 41).

Aided by government subsidies, the introduction of wood to coal-fired power stations initially took the form of co-firing small proportions of biomass with coal. This had negligible carbon benefits but added little to the cost of coal-fired electricity. Since then, the move from co-firing to standalone biomass generation has increased costs, whereas some other renewables, such as onshore wind and solar, have enjoyed falling capital costs, which have allowed them to bid for Contracts for Difference (CfD)<sup>1</sup> below the level that biomass could likely afford if it were bidding. Since burning imported wood chips for electricity often creates more carbon dioxide than burning fossil fuels, further subsidies for this industry are controversial.

## Environmental arguments

Trees are a renewable resource, and burning them is a sustainable way of producing energy insofar as the forests can regrow. However, burning trees can create more carbon dioxide per megawatt-hour (MWh) of energy than fossil fuels, including coal. Wood and coal emit similar amounts of carbon dioxide relative to their energy content, but when the full chain is considered from fuel production to electricity generation, wood-fired generation is usually responsible for more carbon dioxide per unit of electricity (DECC 2014; Sterman et al. 2018). Drax's power plant is by far the biggest emitter of carbon dioxide in the UK energy sector, producing 13.3 megatons in 2020 (BEIS 2023: 54).

International carbon accounting frameworks allow emissions from burnt wood to be included in the carbon budget of the country in which the trees are grown rather than the country in which the wood is burnt. Smokestack emissions from UK biomass power plants are therefore not counted as UK emissions. Although perfectly legal and in line with rules laid out by the Intergovernmental Panel on Climate Change designed to prevent double-counting, critics have described this as an 'accounting trick'.<sup>2</sup> While it helps the UK reduce its official emissions, it does not reduce global emissions, and, in practice, the UK is creating more greenhouse gases to produce electricity than it says it is.

Proponents of biomass argue that US forests have been net carbon sinks for at least 75 years and that this would be true even if all the harvested material were used for energy, let alone when only thinnings,<sup>3</sup> sawmill waste and low-grade material were burnt. They argue that waste wood will

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<sup>1</sup> The CfD sets a fixed price for electricity. If the wholesale price falls below the strike price, the generator is paid the difference. If it goes above the strike price, the generator pays the government the surplus.

<sup>2</sup> Clark, R. 'This polluting green sham has been mocking taxpayers for years - but Drax depriving taxpayers of £639 million last year by gaming the subsidy system takes the biscuit', *Daily Mail*, 3 August 2023 (<https://www.dailymail.co.uk/debate/article-12367009/ROSS-CLARK-polluting-green-sham-mocking-taxpayers-years-Drax-depriving-taxpayers-639-million-year-gaming-subsidy-takes-biscuit.html>); Lawson, D. 'Time's up for Drax's tree-burning racket', *Sunday Times*, 4 June 2023 (<https://www.thetimes.co.uk/article/times-up-for-draxs-tree-burning-racket-drw2gd23x>).

<sup>3</sup> Trees cut down to allow other trees to grow.

naturally produce greenhouse gas emissions through decay or forest fires as part of the carbon cycle, and so it might as well be burnt for electricity.

Critics argue firstly that waste wood does not have to decay or be burnt, but rather can be used to make other products (e.g. pulp, fence posts) and secondly that, depending on the type of tree, the 'carbon debt payback period' (the time it takes new trees to absorb the carbon emitted by the trees that have been burnt) is between 44 and 104 years (Sterman et al. 2018) and could be even longer (Holtmark 2010; Sterman et al. 2022). Even if replanting trees absorbed all the carbon dioxide created by felling, processing, shipping and burning the old trees, this time lag would make woody biomass unsuitable for the UK government's target of reaching Net Zero by 2050. They further argue that to prevent climate change, forests should not be merely carbon neutral but should be large net absorbers of carbon dioxide and that burning trees undermines this function.

The green credentials of woody biomass are clearly stronger if wood chips are made from the by-products of commercial forestry rather than from whole trees, but while Drax claims to only burn 'sawmill residues' and 'waste material collected from the forests which would otherwise be burned',<sup>4</sup> this has been contested. An investigation by *BBC Panorama* found persuasive evidence of primary forest being cut down to make wood pellets in Canada, and the Southern Environmental Law Centre (2022) has found evidence indicating that not all the trees felled to produce wood pellets in the USA are being replanted. It is not always clear where the biomass has come from. A report from the European Commission's Joint Research Centre found that the amount of biomass used in the EU (while Britain was still a member) exceeded the amount reported to have been produced by more than 20 per cent (Giuntoli et al. 2021: 7). Of the woody biomass reported to have been used for energy, 14 per cent was 'uncategorised', but was 'more likely made up of primary than secondary wood' (ibid.: 57).

## Economic Arguments

In principle, the market should decide how commodities are used and how electricity is generated. If sawmill residue, or even whole trees, can fetch the highest price by being turned into wood chips, that is how they should be used, and the cheapest form of electricity should be chosen over more expensive alternatives. The energy market is, however, more complicated because consumers can rarely choose how their energy is generated, and the negative externalities of carbon emissions require an institutional framework to determine their value. Reliance on the cheapest forms of electricity (wind and solar) would lead to frequent blackouts because they are intermittent. We cannot compare the cost of wind, solar and biomass directly because the first two are intermittent while the third is dispatchable. Instead, we need to discover the optimum combination of different technologies at each moment. If they do not receive disproportionate subsidy, our electricity markets are designed to do that.

To date, the biomass energy industry has only been viable thanks to government subsidies. In 2022, Drax received £617 million in subsidies and posted pre-tax profits of £146 million (Drax 2023: 192). Its net debt was £1.2 billion (ibid.: 21). The subsidies paid under the Contracts for Difference and the Renewables Obligation<sup>5</sup> are due to expire in March 2027, by which time Drax will have received an estimated £11 billion from the taxpayer (BEIS 2023: 55). Moreover, being

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<sup>4</sup> [https://www.drax.com/press\\_release/drax-response-to-bbc-panorama-programme-on-canadian-forestry/](https://www.drax.com/press_release/drax-response-to-bbc-panorama-programme-on-canadian-forestry/)

<sup>5</sup> The Renewables Obligation Scheme, which closed to new applications in 2017, requires electricity suppliers to buy a certain percentage of their energy from renewable sources.

exempt from the emissions trading schemes<sup>6</sup> because the emissions are technically outsourced, the industry gets an effective tax break that the energy think tank Ember estimates was worth £258 million in 2020 (MacDonald 2021).

Although it is not unusual for the government to subsidise renewable energy in its infancy, the price of wind and solar energy has fallen sharply in the last decade, while biomass is relatively expensive and will become pricier still if it starts using carbon capture and storage (see below). The strike price<sup>7</sup> for biomass varies by plant but ranges between £100 and £125 per MWh, while the strike price for new offshore wind rose to £73 per MWh in November 2023 after the government failed to attract any bids in the last CfD Allocation Round, and the strike price for solar rose to £61 per MWh hour (DECC 2023a: 5). Electricity from biomass remains significantly more expensive than electricity from wind, solar and gas. It is also more expensive than nuclear power (Hinkley Point C's CfD strike price is £92.50 per MWh). With rising global demand for wood pellets, the price of biomass energy is unlikely to fall. The strike price for biomass in the next CfD Allocation Round is £179 per MWh (ibid.)

Power generated by burning woody biomass has the virtue of being dispatchable<sup>8</sup> but so does power generated by burning gas. It has the virtue of being renewable, but it not only creates greenhouse gas emissions and pollutants such as sulphur dioxide; it is also expensive. In 2023, a report from the Business, Energy and Industrial Strategy Committee concluded that 'We do not believe that the historic allocation of subsidies to large-scale biomass, such as Drax, has represented either value for money or the best use of public funds' (BEIS 2023: 59).

## BECCS

With growing political opposition to unabated wood-burning, the woody biomass industry insists that bioenergy with carbon capture and storage (BECCS) will become integral to its operations within a few years, thereby providing energy that theoretically delivers negative emissions. The Climate Change Committee and the BEIS Committee have both said that the burning of wood pellets for energy production should only continue if BECCS captures and permanently stores the carbon produced under the North Sea.

However, as the government's Biomass Strategy admits, 'BECCS is, as yet, unproven at scale' (DECC 2023b: 123), and the BEIS Committee has said that it is 'uncertain' whether BECCS could decarbonise bioenergy sustainably (BEIS 2023: 28). Advocates of carbon capture and storage (CCS) have often made big promises that do not deliver. A review of 263 CCS projects between 1995 and 2018 found that 78 per cent had been cancelled or put on hold (Wang et al. 2021).

In principle, BECCS could be made to work, but it would be very expensive. Capturing and storing carbon is an energy-intensive process that would use a significant proportion of the energy generated from burning biomass. Dr Daniel Quiggin of Chatham House estimates that BECCS would reduce Drax's power efficiency from 36 per cent to 21 per cent (BEIS 2022: 16). This

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<sup>6</sup> The UK Emissions Trading Scheme, like the EU Emissions Trading Scheme the UK was part of before Brexit, places a cap on the greenhouse gases that can be emitted in the economy. Businesses can trade allowances with each other ('cap and trade').

<sup>7</sup> A set price for electricity. If the wholesale price of electricity falls below the strike price, the generator is paid the difference. If it goes above the strike price, the generator pays the government the surplus. Strike prices are typically expressed in 2012 prices and are updated each year.

<sup>8</sup> i.e. it can be turned off and on quickly to meet demand.

'energy penalty' means that more biomass would have to be burnt to generate the same amount of electricity, and the additional cost would be passed onto the public through higher prices and/or larger subsidies. Ember has estimated that Drax's proposed BECCS plant would cost £31.7 billion in public subsidies over 25 years, more than the total budget for the Hinkley Point C nuclear power station (MacDonald and Harrison 2021).

## Alternatives

The British government has set a target of achieving 'Net Zero' by 2050 and intends to decarbonise the electricity grid by 2035. The Labour Party has pledged to achieve the latter by 2030. These are all huge challenges, especially since electricity demand will increase as more people use electric vehicles and heat pumps. Ideally, all electricity would come from sources that are both renewable and carbon neutral, but that will not happen overnight. Gas, biomass and coal currently produce more than 40 per cent of the UK's electricity and will not be easy to replace. Given the need for dispatchable electricity, it is easy to see the appeal of woody biomass, especially since it is portrayed as being carbon neutral.

However, woody biomass is expensive relative to wind, solar, gas and nuclear and will become even more expensive with BECCS. Moreover, its green credentials are highly questionable. In October 2021, Drax was removed from the S&P Global Clean Energy Index because its 'carbon-to-revenue footprint' is too large. According to the European Academies' Sciences Advisory Council (2021), using wood pellets to generate electricity 'is not effective in mitigating climate change and may even increase the risk of dangerous climate change.' In the UK, the Climate Change Committee says that 'sustained use of large-scale biomass generation is not compatible with the path to Net Zero' (Climate Change Committee 2023: 36).

In the medium term, the UK will continue to emit greenhouse gases as it transitions to a low-carbon economy. The question in the short term is whether it makes sense to heavily subsidise the burning of imported wood pellets beyond 2027. The UK has alternatives to biomass generation, such as gas-fired generation, which are cheaper and produce far less carbon dioxide. Gas plants can be built relatively quickly, they produce dispatchable energy, and the UK has sufficient reserves of natural gas to fuel them for the foreseeable future. Nuclear energy is reliable, low-carbon and generally cheaper than biomass. Nuclear power plants take a long time to build in Britain (13-17 years), partly due to unnecessary bureaucracy, but although nuclear can modulate its output, it is best suited to running baseload. In the long term, if gas is phased out, the UK will likely require a significant increase in both non-polluting renewables and nuclear power to meet rising demand for electricity.

If CCS is to be part of the solution, it may make more sense to retrofit plants that burn natural gas rather than plants that burn wood (Babaee and Loughlin 2017). It is technically feasible, albeit expensive, in either case, but gas is cheaper and produces much less carbon dioxide from the outset. There is no reason why the fortunes of CCS should be tied to woody biomass (or to any other technology). Carbon capture and storage is an expensive business that trees do naturally – unless they are burnt.

## Conclusion

The negative externalities of greenhouse gas emissions leave more scope for political decisions and scientific judgements<sup>9</sup> in the energy market than in many other markets, but this does not mean that governments should 'pick winners', nor does it mean that market forces are redundant.

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<sup>9</sup> For example, valuing the social cost of carbon.

On the contrary, governments should set what Milton Friedman called ‘the rules of the game’ and allow the best solutions to prevail through ‘open and free competition without deception or fraud’.<sup>10</sup> We need an institutional framework that is technology-neutral and open to all, leaving it to innovators to produce environmentally sound energy at the lowest cost.

Current carbon accounting practices create perverse incentives and allow governments to boast about reductions in carbon dioxide emissions that only exist on paper. It is difficult to imagine the British government permitting, let alone subsidising, the incineration of imported wood chips to generate electricity if the emissions were counted on its own balance sheet. Far from internalising the externalities, the current system allows governments to completely ignore the externalities of this form of electricity generation, thereby blunting the price mechanism and distorting the market. Without this distortion, it is unlikely that woody biomass would be part of the UK’s energy mix at all.

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<sup>10</sup> Friedman, M. ‘A Friedman doctrine - The Social Responsibility of Business Is to Increase Its Profits’, *New York Times*, 13 September 1970 (<https://www.nytimes.com/1970/09/13/archives/a-friedman-doctrine-the-social-responsibility-of-business-is-to.html>).

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