Keeping the power on: our future energy technology mix: Biofuelwatch evidence to the DESNZ Select Committee.

Biofuelwatch provides information and undertakes advocacy and campaigning in relation to the climate, biodiversity, land and human rights and public health impacts of large-scale industrial bioenergy. We are a small team of staff and volunteers based in Europe (including UK) and the USA.

Our main input to this call for evidence therefore focuses on bioenergy use, however to eliminate reliance on bioenergy, which is what we advocate, our energy systems must be looked at as a whole, therefore we pass comment on other aspects.

General comments

The Government's prioritising of investment in wind infrastructure is welcomed. However its approach to flexibility of supply is extremely short sighted. Prioritising support for carbon capture and storage locks us into continued burning - whether that be of fossil fuels or biomass. There has been chronic underinvestment in the UK's electricity transmission system infrastructure and in forms of low carbon flexible capacity. This needs to be prioritised if we are to take advantage of the rapidly increasing amounts of clean, lower-cost electricity, which are currently being wasted.

While the government's prioritising of wind generation does show some long term planning, by issuing new oil and gas licences the government is showing a short sighted continued reliance on fossil fuels which as well as contributing to climate breakdown also takes away resources from renewable energy sources which are not finite as coal oil and gas are. The current support for biomass and BECCS is also short sighted. The supply models in the recently published biomass strategy show that by 2050 the UK may only have access to 62% of the biomass it needs, this is a big and risky gamble with the energy system and with achieving net zero.

Current technologies which could usefully be deployed at scale to deliver better energy security in the UK are proven technologies such as wind and solar. Demand reduction is also a key component of energy security: there needs to be proper funding and implementation of home insulation and heat pump installation schemes. There must be improved oversight to ensure that money allocated for these projects is channelled effectively, and that those installing the technology are properly trained and that the end product is of high quality with assurance standards for those receiving the installation in their homes.

The use of biomass for producing electricity should be abandoned. Far from being a climate solution, biomass burning releases huge amounts of carbon dioxide into the atmosphere and certainly the carbon payback period for woody biomass means it is counterproductive to addressing the climate crisis within relevant timeframes.

The quickest and most affordable way to get to net zero is to use proven technologies such as wind and solar which already exist and are ready to be further deployed and lead to immediate emissions reductions. Fossil fuels and biomass are carbon emitters and must be eliminated from the energy mix. Carbon capture does not lead to zero emissions.

Clearly with an energy mix dependent on wind, wave, hydro and solar power there will be regional variations and it is important that zero emission solutions are provided for homes and industries which are off grid.

Concerns regarding biomass burning for electricity generation

Burning millions of tonnes of imported wood to generate electricity is wasteful, inefficient, harms biodiversity and human health, and accelerates climate change. The signatories to the Leaders Declaration on Deforestation at COP26 committed to slow deforestation, recognising the negative impacts caused to nature, the climate, human health and society. Continued reliance on burning wood for electricity with a reliance on overseas imports is completely incompatible with this commitment.

The decades-long carbon payback period associated with using woody biomass as a fuel for power generation is incompatible with the need to reduce emissions before 2030 to safeguard 1.5 degrees of global warming. There is a growing scientific consensus[1] that the burning of woody biomass in power stations is not 'climate neutral'[2] when factors like soil carbon loss, foregone sequestration and tree regrowth performance are taken into account.

Biodiversity and community impacts of biomass production

Much of the wood pellet fuel imported to be burned in UK biomass powers stations comes from the logging of some of the world's most biodiverse forests in the Southern USA[3], Canada[4], Estonia[5] and Latvia[6] which are home to many rare and endangered species.

1Norton, M, Baldi, A, Buda, V, et al. Serious mismatches continue between science and policy in forest bioenergy. GCB Bioenergy. 2019; 11: 1256–1263.

2Helmut Haberl, Detlef Sprinz, Marc Bonazountas, Pierluigi Cocco, Yves Desaubies, Mogens Henze, Ole Hertel, Richard K. Johnson, Ulrike Kastrup, Pierre Laconte, Eckart Lange, Peter Novak, Jouni Paavola, Anette Reenberg, Sybille van den Hove, Theo Vermeire, Peter Wadhams, Timothy Searchinger, Correcting a fundamental error in greenhouse gas accounting related to bioenergy, Energy Policy, Volume 45, 2012, Pages 18-23, ISSN 0301-4215

3https://edition.cnn.com/interactive/2021/07/us/american-south-biomass-energy-invs/
4https://www.bbc.co.uk/news/science-environment-63089348
5https://www.channel4.com/news/fears-biomass-green-revolution-could-be-fuelling-habitat-loss
6https://elfond.ee/biomassreport

Production of woodfuel in the USA for the Drax power station - the largest biomass plant in the UK and the country's biggest user of wood pellets as fuel - adversely affects people there with noise and air pollution. Drax has been accused of driving 'environmental racism' in the Southern USA, after paying $3.2 million to settle air pollution violation claims against its wood pellet mills in Louisiana[7]. The company has violated air pollution rules in the state yet again subsequently demonstrating its utter disregard for the regulations and the impacts on local people.[8]
The biodiversity and community impacts of biomass sourcing have been widely documented elsewhere.

Concerns around reliance on Bioenergy with Carbon Capture and Storage

Carbon Capture at Boundary Dam and Shute Creek

There are current proposals for the development of carbon capture facilities at Drax power station, the UK's largest biomass power station. This is novel and significantly larger than any existing operational carbon capture facility worldwide. Most carbon capture projects on thermal power stations have failed, either through technical difficulties or because of cost overruns or regulatory uncertainty. The 'White Rose' development initiated by Drax in 2012 was abandoned in 2015[9]

In the light of repeated failures by the CCS industry over the past decade, and the consequent lack of operational experience, Biofuelwatch considers Drax's projections of performance expected to result from retrofitting PCC to biomass units at Drax to be highly optimistic. The following paragraphs show how the only operational large-scale carbon capture facility on a thermal power station worldwide has failed to come close to its original performance targets.

The world's only operating commercial carbon capture facility at a coal-fired power plant, is Boundary Dam, in Canada. The carbon capture rate in 2021 was less than 37% of the official target of 90% [10]. The carbon capture rate at the plant deteriorated in 2021 by 43 percent compared to the previous year according to data from Sask Power, the Canadian utility company operating the project[11]. The plant's performance is so far short of its original target, the company has now revised its carbon capture target to just 65%[12].

7https://unearthed.greenpeace.org/2022/09/26/drax-accused-environmental-racism-further-pollution-claims-against-wood-pellet-mills-us/
8https://www.theguardian.com/business/2023/may/29/drax-owned-wood-pellet-plant-in-us-broke-air-pollution-rules-amite-bioenergy-mississippi-emissions-limits
9Drax Press Release: "Drax announces plan to end further investment in White Rose Carbon Capture & Storage project" downloaded from Drax's website on 22 February 2023
10Karin Rives, Only still-operating carbon capture project battled technical issues in 2021, published 6 Jan 2022, S&P Global Market Intelligence, available on S&P Global Market Intelligence's website and downloaded 22 February 2023
11Carlos Anchondo, CCS 'red flag?' World's sole coal project hits snag, 10 January 2022, E&E News, downloaded from E&E news' website on 22 February 2023
12Press Release and David Schlissel, IEEFA: Carbon capture goals miss the mark at Boundary Dam 3 coal plant, 20 April 2021, Institute for Energy Economics & Financial Analysis. Downloaded from IEEFA website 22 February 2023

The plant's problems are explained in more detail by David Schlissel (Director of Resource Planning Analysis) and Dennis Wamsted (Associate Editor) in "Holy Grail of Carbon Capture Continues to Elude Coal Industry" published in 2018. The article says: 'SaskPower, the state-owned utility in Saskatchewan, has spent C$1.5 billion to retrofit Unit 3 at its Boundary Dam generation station with CCS technology. Of that total, 50%, or roughly C$750 million, went to CO2 capture equipment and C$440 million was spent to upgrade and modernise the ageing plant so that it would be able to run long enough to recover the carbon capture investments. SaskPower spent an additional C$293 million on related emission controls and efficiency improvements. 'In its 2014 annual report, the company touted the project as "the first commercial-scale post-combustion project of its kind at a coal-fired power station" and one that would be able to capture 1 million metric tons of CO2 annually—roughly 90% of the plant's CO2 output. Much of the captured CO2 was to be used in enhanced oil recovery efforts (EOR) at an oil field in southern Saskatchewan. The rest was to be stored underground. 'Given its first-of-a-kind status, it is no surprise that little has gone well. The project was over budget and behind schedule when it began operating in October 2014. Its overall CO2 capture rate during its first year of operation hovered at about 40%, a dismal performance, as David Jobe, SaskPower's director of carbon capture and chemical services, acknowledged in an interview with The Chemical Engineer in May of this year. '"Let's just say that out of the box, the plant didn't work as designed," Jobe said. 'Nor is the plant working now as promised. Boundary Dam has never hit its CO2 sequestration goal of 1 million metric tons a year, having captured a total of only 2.2 million metric tons in the four years since its carbon capture system came online. 'Meanwhile, the utility has had to pay millions of dollars for temporary units that boost the capacity of the system's thermal reclaimer, the unit that purifies the amine solution used to strip CO2 and sulphur dioxide from the plant's flue gases. The amine solution has been degrading faster than anticipated, overwhelming the plant's installed reclaimer and forcing the utility to bring in mobile units. The fix has worked, but according to a report prepared for SaskPower, it is "not economically sustainable." 'The amount of CO2 captured at Boundary Dam is not likely to increase anytime soon either, as the entire plant has been online only approximately 50% of the time from August 2015 to August 2018.' Capturing the CO2 from Boundary Dam Unit 3 also is very expensive, averaging about C$60 per metric ton (US$42 per short ton), doubling the overall cost of producing power at the Plant. SaskPower said this summer that its costly experience with Unit 3 prompted it to decide against retrofitting two other units at Boundary Dam with carbon capture technology. Instead, the two 1970s-era units will be shuttered, perhaps as early as next year.'

The world's longest running and largest CCS project involves carbon capture from a natural gas processing plant at Shute Creek in Wyoming, USA. The plant processes gas with a particularly high CO2 content of 65%, making it easier and cheaper to capture. In contrast, the flue gases emitted by biomass combustion are more complex and hard to treat. Regarding the performance of carbon capture at Shute Creek, the Institute for Energy Analysis and Financial Analysis (IEEFA) said: "despite its improved performance over recent years, the plant has reached its capturing capacity target (about 75% of total CO2 emissions) in only a few of those

years. At all other times, the plant has fallen short, mostly by a wide margin"[13]

Other large-scale CCS projects globally have failed to meet projected sequestration targets. Australian government data shows the Gorgon CCS project (capturing CO2 from extraction of reservoir gas) in Australia emitted over 7.7 million tons of CO2 in 2016-17. The project was initially planned to capture and inject underground up to 4 million tonnes (MT) of reservoir CO2 each year but actually sequestered on average less than 1MT per year. Quest, a blue Hydrogen Shell project in Canada, captured 48% of emitted GHG, well below their projected 90%. A Global Witness study found that over a 5 year period, overall project emissions (7.7 MT) significantly exceeded CO2 captured (4.8MT).

From these examples it is clear that historically carbon capture has performed very poorly against the intended objectives. Rates of carbon capture have fallen far short of expectations. This is of broad concern when considering how to meet our climate goals. More specifically, from our focus on bioenergy, the implications for the development of BECCS at Drax and elsewhere are addressed in the following section.

Lack of Evidence to Support CO2 Removal Performance using BECCS

While there have been decades of research and development into carbon capture from coal power stations, with however very little operational experience, BECCS has never been demonstrated to work at scale at all. Drax which in the UK is spearheading the push for BECCS, has previously admitted in written correspondence with Biofuelwatch that its assumptions about BECCS performance are not based on real-world trials[14]. There are currently no examples of large-scale BECCS working at scale, suggesting this technology is far from ready for implementation.

The poor performance of the world's only operating commercial carbon capture facility, Boundary Dam coal-fired power plant, is a strong indication that Drax's expectation of a 95% carbon capture rate from BECCS is highly implausible.

In its written correspondence with Biofuelwatch[15], Drax said: "The plant will be designed to capture up to 95% of the CO2 in the flue gas". Designed to capture up to 95% of carbon dioxide does not guarantee that the design will capture 95% of carbon dioxide. Drax has confirmed that during startup and shutdown operations, Carbon Dioxide will be routinely released into the atmosphere - "vented" - rather than captured for transmission via the proposed pipeline to offshore storage.

Concerns regarding the viability of underground storage

A report has been published by the Institute for Energy Economics and Financial Analysis, June

13ieefa.org/resources/carbon-capture-crux-lessons-learned
14https://www.biofuelwatch.org.uk/2021/drax-beccs-response-december21/
15https://www.biofuelwatch.org.uk/2021/drax-beccs-response-december21/

2023 “Norway’s Sleipner and Snøhvit CCS: Industry models or cautionary tales? Unexpected subsurface geology developments in the two projects call into question the world’s offshore CO2 storage ambitions. Grant Hauber, Energy Finance Analyst. June 2023 Sleipner and Snøhvit CCS are offshore fields used for CCS storage which are widely cited as proof of the technology’s viability. However the paper reports on leaking carbon dioxide in these underground geological storage sites with the following key findings: Sleipner and Snøhvit demonstrate carbon capture and storage is not without material ongoing risks that may ultimately negate some or all the benefits it seeks to create. Every project site has unique geology, so field operators must expect the unexpected, make detailed plans, update the plans and prepare for contingencies. Ensuring storage is securely maintained implies a high level of proactive regulatory oversight, activities for which governments may not be adequately equipped. Sleipner and Snøhvit cast doubt on whether the world has the technical prowess, strength of regulatory oversight, and unwavering multi-decade commitment of capital and resources needed to keep carbon dioxide sequestered below the sea – as the Earth needs – permanently. In an article published in the Guardian “Carbon Capture and Storage is ‘no free lunch’ warns Climate Chief” on 6th June 2023, IPPC chair Hoesung Lee says over-reliance on the technology could mean the world misses 1.5C target and that “I have noticed that, in the past, various people cite the IPCC in a way that suits their needs, for unknown purposes.”

Energy Security

Energy Efficiency: Applying carbon capture technology to electricity generation results in a reduction in energy efficiency. Due to the energy penalty, installing carbon capture and storage will significantly reduce electricity output. In the case of Drax, based on the company’s own figures, this would remove 369 MW net electrical capacity from the National Grid.

Conclusion

We submit that BECCS is a dangerous distraction from genuine climate solutions. It is extremely costly requiring ongoing subsidies unlike other forms of generation which after initial investment pay for themselves. The development of electricity generation involving burning fuel whether fossil fuel or biomass, is itself a very inefficient process, applying carbon capture to these processes makes it even more so. Forward looking solutions for meeting both our energy security needs and our climate objectives must move beyond burning to genuinely low carbon forms of electricity generation such as wind and solar. Carbon capture processes will never lead to the capture rates required to keep carbon emissions within planetary limits if this technology forms a central plank of electricity production.

Instead - together with investment in demand reduction initiatives such as home insulation and heat pump installation - investments should be made into ensuring we are able take advantage of the increasing amount of genuinely low carbon energy being supplied to the grid, so that electricity needs are supplied and met effectively and efficiently, rather than investing further resources to keep old, outdated technologies going.

As stated earlier the biomass strategy show that by 2050 the UK may only have access to 62% of the biomass it needs - therefore this energy source does not help with energy security in the long term.

Finally, burning trees on an industrial scale will never be a climate solution. We already have working carbon capture technology: photosynthesis. Leaving trees in the ground where they can sequester carbon, where the soil can sequester carbon, makes significantly more sense than chopping them down, shipping them across the planet, and then burning them in a power station where if we're lucky, a proportion of the carbon released can be captured at great economic cost. It's easy to be blinded by statistics, science, figures and jargon but the reality is simple - to have any hope of avoiding climate catastrophe we really need to leave trees in the ground and forests standing.

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