COMMODITIES | OCTOBER 2023

BIOMASS – CARBON CAPTURE AND BECCS

This is the second of our articles on biomass, which form part of our bioenergy series. Our first article, available here, covered an introduction to biomass and considerations around deforestation and sustainability. This article offers an introduction to the use of biomass as energy in combination with carbon capture and storage, known as BECCS, and considerations affecting the development of BECCS projects.

What is BECCS?

When biomass is used for energy generation, it is sometimes paired with carbon capture and storage ("CCS"). Commonly known together as BECCS, the combination of bioenergy and carbon capture and storage is considered by some to be the only carbon dioxide removal technique that can also provide energy.

BECCS relies on the ability to bury the CO_2 emissions created during the process of burning biomass to create fuel. The theory is that certain biomass (namely trees and crops) absorb CO_2 whilst they are growing, removing it from the atmosphere. If the CO_2 that is created when those products are burned to create fuel can be captured and stored, the whole process will have: (a) removed CO_2 from the atmosphere through the growth phase; and (b), not released any further CO_2 when the biomass is incinerated through the energy generation phase. This process would go beyond carbon neutral, and may in fact be 'carbon negative', since it would result in a net removal of CO_2 from the atmosphere.

Why is this important?

This matters because, even if the generation of all greenhouse gas ("GHG") emissions ceased today, those emissions already in the world's atmosphere would continue to increase global temperatures for another decade.[1] The Intergovernmental Panel on Climate Change has concluded that CO_2 removal from the atmosphere will be necessary to meet the Paris Agreement goal of limiting the temperature increase to 1.5°C above pre-industrial levels.[2] According to the International Energy Agency ("IEA"), only around 2Mt of CO_2 is currently captured each year. This falls far short of the annual 190 Mt of CO_2 removal envisioned by the IEA in its Net Zero by 2050 scenario.[3]

Development of BECCS plants globally could contribute significantly to CO_2 removal, but progress has been slow and the technologies required have not yet been tested at commercial scale. There are a number of BECCS projects in varying stages of deployment, including plans for, "*two new carbon capture usage and storage clusters*", in the North East of Scotland and the Humber, announced by the UK Government earlier this year.[4] The IEA estimates that the projects currently anticipated could result in just under 50Mt of CO_2 removal per year by 2030 - still well short of its Net Zero by 2050 scenario.

Why is the development of BECCS projects slow?

As BECCS projects are still a relatively new concept, there remain number of important considerations to address, especially for those projects with additional elements such as carbon transportation or cross-border elements.

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[1] Geoengineering: What is BECCS? | Earth.Org

[2] IPCC_AR6_WGII_FullReport.pdf

[3] Bioenergy with Carbon Capture and Storage - Energy System - IEA

[4] Hundreds of new North Sea oil and gas licences to boost British energy independence and grow the economy - GOV.UK (www.gov.uk)

Consideration 1: Technology and Cost

- Technological barriers remain an impediment. Most critical BECCS technologies are still at the demonstration or pilot stage and are still undergoing further development.[5]
- Cost is also a major issue. A BECCS project developer has estimated the cost of BECCS (including the cost of power generation) at GBP 150 per tonne of CO_2 equivalent.[6] The cost of the CO_2 capture component itself has been estimated at between USD 56 and 64 per tonne of CO_2 equivalent.[7]
- The cost barrier means that financing through voluntary carbon markets is required to make BECCS projects commercially viable, even where government subsidies are available. This gives rise to a number of further considerations.

Consideration 2: Financing Through Carbon Markets: Lack of Established Methodologies

- The general principle of capturing and storing GHG for long periods of time is not a new one in the voluntary carbon markets. However, voluntary standards and methodologies have historically focused on forestry and land use solutions for removing GHG from the atmosphere. Standards and methodologies for BECCS and CCS more generally are still being developed and would be expected to undergo further refinement over time.
- The Verified Carbon Standard (administered by Verra) and Gold Standard (the two most commonly used standards in the voluntary carbon markets) have each approved a handful of methodologies for carbon capture, utilization and storage ("**CCUS**") projects using specific technologies, such as the capture of GHG for storage in recycled plastics or concrete.[8] None of these methodologies relate specifically to BECCS projects (though see the last bulleted point below).
- A further standard, Puro.earth, has published a methodology for carbon capture and storage in geological formations that includes BECCS.[9]
- The CCS+ Initiative released its first batch of CCS methodologies for public consultation in June 2023 and is in the process of seeking approval from Verra for use under the Verified Carbon Standard. The Methodology Framework for Carbon Capture and Storage (CN0129) (which includes a methodology for carbon capture and storage and is intended to cover BECCS) is under assessment by a verification/validation body.[10]
- For completeness, we note that other standards are in the process of revising their carbon capture and storage methodologies. In the case of the American Carbon Registry program, it has proposed including BECCS as an eligible CCS project component but without considering the "potential negative carbon accounting" associated with such activity.[11]

Consideration 3: Financing Through Carbon Markets: Additionality

- Additionality is a key requirement in the voluntary carbon markets. It generally means demonstrating that the project would not have occurred without the carbon finance. There are various facets to additionality, including financial considerations and regulatory considerations. For instance, where the action is mandated by regulations, it would have happened even without carbon finance, and therefore would not be additional.
- In the context of BECCS, there may be concerns about the additionality of issuing carbon credits to finance such projects. This is because, depending on the jurisdiction in which the power plants are located, they may be covered by a carbon tax or emissions trading scheme, which provides other financial incentives to reduce

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[5] [5] Bioenergy with Carbon Capture and Storage - Energy System - IEA

[6] UK's Drax puts a cost on Beccs | Argus Media

[7] Current cost of CO2 capture for carbon removal technologies by sector – Charts – Data & Statistics - IEA

[8] See e.g. VM0043 Methodology for CO2 Utilization in Concrete Production, v1.0 - Verra

[9] https://7518557.fs1.hubspotusercontent-na1.net/hubfs/7518557/Supplier%20Documents/Puro.earth%20Geologically%20Stored%20Carbon%20Methodology.pdf

[10] https://verra.org/methodologies/methodology-for-carbon-capture-and-storage/

[11] https://americancarbonregistry.org/carbon-accounting/standards-methodologies/carbon-capture-and-storage-projects/acr-ccs-v2-0-public-comment-draft.pdf

CO_2 emissions. In addition, government incentives for the production and use of biomass may also cause concerns regarding additionality.

Consideration 4: Financing Through Carbon Markets: Paris Agreement

- Under the Paris Agreement, all participating countries must commit to reduce their GHG emissions as part of their nationally determined contributions ("**NDCs**"). Article 6 of the Paris Agreement also provides two market mechanisms, namely the Article 6.2 cooperative approaches for the trading of internationally-transferred mitigation outcomes ("**ITMOs**"), and the Article 6.4 mechanism for the trading of Article 6.4 emission reductions ("**A6.4ERs**") which can be used, amongst others, by countries towards the fulfilment of their NDCs.
- It is not clear whether BECCS-related activity will be considered an eligible activity for the generation of A6.4ERs under the Article 6.4 mechanism.[12] This may mean that BECCS-related activity may only be viable under the Article 6.2 cooperative approaches and for the generation of ITMOs.
- Where the production of biomass, its combustion, and storage of the resulting GHG occur in different countries, there is a question as to how the GHG removal is to be apportioned between the NDCs of the countries involved, whether the countries (or any authorised private sector participants) will seek to trade ITMOs or A6.4ERs and how any corresponding adjustments will be applied by these countries, to prevent double counting.

Consideration 5: Sustainability

- As discussed in our earlier article, although biomass is commonly called a renewable energy source, this does not necessarily mean that it is a sustainable energy source. Sustainability related considerations include:
  - The ability of BECCS effectively to produce net removals of GHG from the atmosphere depends on the carbon footprint of the biomass used. Carbon footprint depends heavily on how biomass is produced, transported and used. For example, if forests and peatlands are cleared to grow plants used to make biomass, the biomass produced may have a high carbon footprint due to the release of CO_2 from the cleared forests and peatlands.
  - As will be apparent from the above example, accurate measurement of carbon footprint is also problematic.
  - Where the production of biomass is competing with agriculture and local communities for land and water resources, such competition may have adverse effects at local level and may be unsustainable.[13]
- Renewable energy standards such as the EU's Renewable Energy Directive have introduced criteria to assess the sustainability of biomass used as fuels.[14] Voluntary carbon standards appear to be building upon such criteria.

Consideration 6: Site and Operator Certification

- Done properly, CCS can provide a high degree of permanence, storing CO2 for potentially hundreds or thousands of years.[15]
- However, site selection and the use of proper injection techniques for pumping CO_2 into geological reservoirs are critical to ensuring that the injected gases do not leak out or cause other adverse environmental impacts at the injection site. It is for this reason that jurisdictions such as the EU and the US have enacted laws which establish requirements and a licensing regime for the operation of geological CCS sites in their respective jurisdictions.[16]

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[12] There are ongoing discussions on the types of removal activity being accepted under the Article 6.4 Mechanism: see e.g., the information note: https://unfccc.int/sites/default/files/resource/a64-sb005-aa-a09.pdf

[13] a64-sb002-aa-a06.pdf (unfccc.int)

[14] Renewable Energy – Recast to 2030 (RED II) (europa.eu)

[15] a64-sb002-aa-a06.pdf (unfccc.int)

[16] A legal framework for the safe geological storage of carbon dioxide (europa.eu); Class VI - Wells used for Geologic Sequestration of Carbon Dioxide | US EPA

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