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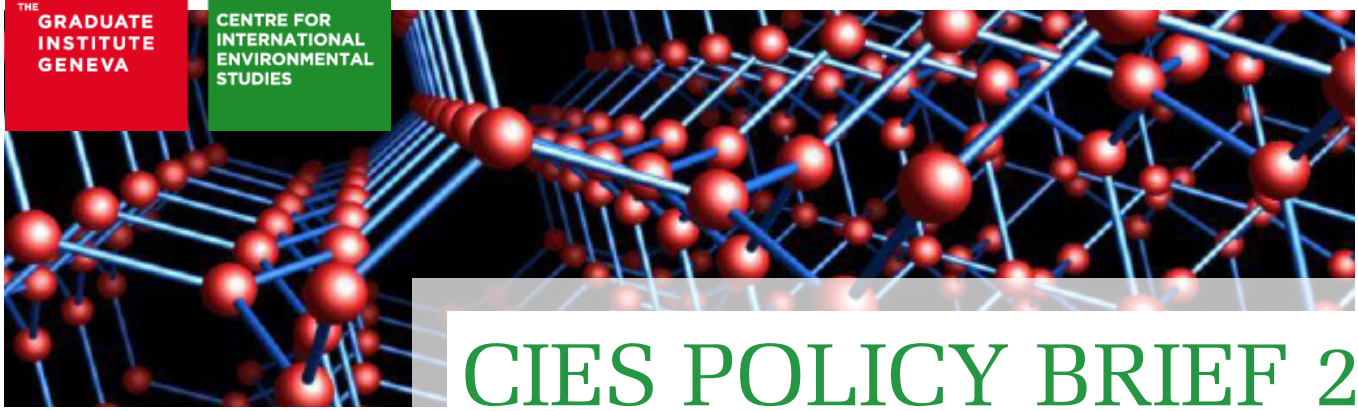

CIES POLICY BRIEF 2

THE NEW US TAX CREDITS AND CARBON NEGATIVE TECHNOLOGIES

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It is no longer possible to achieve the goals of the Paris Climate Agreement – of keeping average global temperatures to 'well below 2C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5C[1] - without removing large volumes of CO2 from the atmosphere.[2] This will involve the development and deployment of carbon negative technologies at the gigatonne scale. Because developmental pathways for such technologies are likely to be decades-long, it is necessary that large-scale investment begin now, if we hope to have mature technologies operating at the appropriate scale by 2050.

As integrated into IPCC projections, carbon negative technologies have been parsed as Bio-Energy with Carbon Capture and Storage (BECCS). The process involves the burning of biomass, followed by the capture and geological storage of the CO2 generated by combustion. In fact a far wider array of possibilities exist for capturing and sequestering CO2, including the deployment of carbon negative building materials, decomposition of silicate rocks, seaweed farming, and direct air capture of CO2 to manufacture plastics and carbon fibre, to name just a few.[3]

Interest in carbon neutral[4] and carbon negative technologies is likely to grow as a result of the first Trump Budget, passed in February 2018. Under Division B of the US Bipartisan Budget Act of 2018, the US government established tax credits for the storage or productive use of 'carbon oxide' (CO2). The initiative received bipartisan support, being sponsored by Senators Heidi Heitkamp and Sheldon Whitehouse (Democrat) and Shelley Moore Capito and John Barroso (Republican). In effect, as noted by Senator Whitehouse, by putting a dollar value on reducing carbon pollution, the US Federal government has placed a shadow price on carbon.

Section 41119 (45Q) of the Act outlines the conditions under which the tax credits are available. They are payable per metric tonne of CO2 used or sequestered by US taxpayers within the US and its territories (including territorial waters), for a 12-year period commencing in 2017. Construction of the carbon capture and sequestration or utilisation facilities must commence prior to 2024. The credits for sequestration are set at 'between $22.66 and $50 for each calendar year during the period'; and for productive use, between $12.83 and $35 with the highest amount applying after 2025 (productive use) or 2026 (sequestration).[5] To qualify for the credit, a minimum of 100,000 metric tonnes of CO2 must be captured annually.

The tax credit appears to have been framed with conventional geological CO2 sequestration in mind. Such sequestration has a long history in the oil and gas sector, with the captured CO2 being used to increase yields by injecting CO2 into oil and gas-yielding geological strata, to increase head pressure in wells. It has also been applied to coal-fired power

Image: Professor Tim Flannery (source: clarepress.com)

plants, though there it has proved uneconomic.[6] The bill has, however, been framed in a way that potentially permits a broad array of carbon neutral and carbon negative technologies to benefit. For example, for the purposes of both sequestration and productive use, it permits 'direct air capture' of CO2, though it forbids capture by photosynthesis for the purposes of sequestration. For the purposes of 'productive use' (which merits a $35 tax credit), however, the bill allows fixation via natural photosynthesis, for production of materials 'for which a market exists'.

Importantly, geological storage is not defined in the bill, but is left to the relevant US regulatory agencies (the EPA, Secretary of Energy, and Secretary of the Interior) to determine. This opens the possibility of decomposition of silicate rocks, and even the manufacture of appropriately disposed bioplastics may qualify as geological storage.

Among the carbon neutral technologies that could benefit from the tax credit is the production of liquid fuels from atmospheric CO2.

The Canadian-based firm Carbon Engineering has recently announced that it has broken through the $100 per barrel price point.[7] A $35 tax credit could significantly improve its competitive position. The construction industry could benefit from both the sequestration and productive tax credits. Carbon neutral concretes are only marginally more expensive than conventional, high emitting products, and building blocks exist that are carbon negative at the rate of 14kg per tonne.[8]

Silicate rocks offer one of the most promising avenues for the large-scale capture of CO2, with some researchers estimating that by 2100 they could be used to reduce CO2 concentrations in the atmosphere by 30 to 300ppm.[9] Application of silicate rocks to absorb CO2 is hindered by the fact that, given current technologies, fossil fuels must be burned to quarry and crush the rock, so taking full advantage of this opportunity must await the development of clean energy and transport.

An early start on using silicate rocks, however, exists in the form of rock-flour (ground up rock). Large volumes of rock flour exist at the snouts of retreating glaciers, especially in Greenland. The average carbon absorbing potential of crustal rocks is -125kg of CO2 per tonne, and it seems likely that the carbon absorbing potential of Greenland rock-flour is around this value. If the rock-flour can be shipped at scale to locations, such as shallow waters or agricultural lands, where decomposition is accelerated, large-scale absorption of CO2 will occur.[10]

An opportunity for large scale productive use exists in seaweed farming. Seaweed grows rapidly (up to 30 times the rate of trees), and sequesters large volumes of CO2. Seaweed culture is well advanced, the crop yielding human food, animal feed, and more specialised products. Increasingly the industry is moving to an 'ocean permaculture' model, in which high quality protein, in the form of fish and shellfish, is grown in the highly buffered seawater that exists around seaweed farms.

The 100,000 metric tonne per annum minimum threshold established in the bill is a significant barrier to those seeking to take advantage of the tax credits through the use of carbon negative technologies, especially in light of the 12-year window of credit availability. Hopefully the existence of the credits will at least lead to some economic modelling to establish where the least-cost and most scalable pathways lie. In the longer term, the most significant aspect of the tax credits offered in the first Trump budget may be their potential as a template by other tax jurisdictions wishing to incentivise the development of carbon neutral and carbon negative technologies.

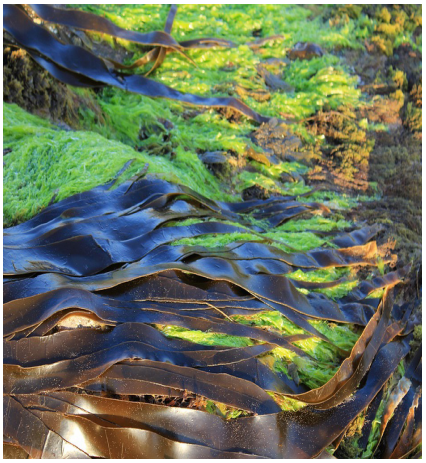

Image: Seaweed kelp farming (source: Pixabay)

References

1 The Paris Agreement. https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

2 Theme issue 'The Paris Agreement: understanding the physical and social challenges for a warming world of 1.5°C above pre-industrial levels' compiled and edited by Dann Mitchell, Myles R Allen, Jim W Hall, Benito Mueller, Lavanya Rajamani and Corinne Le Quéré. 13 May 2018; volume 376, issue 2119. http://rsta.royalsocietypublishing.org/content/376/2119

3 Flannery, T.F, (2015). *Atmosphere of Hope*. Text Publishing. Melbourne, Aust.

4 Carbon neutral technologies, which include the synthesis of liquid fuels from biomass or CO2, are generally at a more advanced state than carbon negative technologies.

5 P 246. US Bipartisan Budget Act of 2018,

6 Geuss, M. (2018). Budget Deal has tax credit for extensions for nuclear, fuel cells, carbon capture. Arstechnica. Feb. 10 2018. https://arstechnica.com/tech-policy/2018/02/budget-deal-has-tax-credit-extensions-for-nuclear-fuel-cells-carbon-capture/

7Patel, T. (2018). Making fuels with carbon dioxide pulled from air could be affordable. IEEE SPECTRUM. https://spectrum.ieee.org/energywise/energy/environment/capturing-carbon-dioxide-from-air-could-be-done-for-100-a-ton

8 https://materia.nl/material/carbon-buster/

9 Layla et al (2016). Enhanced Weathering strategies for stabilising climate and averting ocean acidification. *Nature Climate Change* volume 6: 402–406

10 Rosing, M.T. et al (2018). Reactivity of glacially derived particles in west Greenland coastal environments. Abstract. Where the poles Come Together. Open Science Conference 19-23 June 2018. Davos, Switzerland. ISBN 978-0-948277-54-2

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