BIOENERGY WITH CARBON CAPTURE AND STORAGE (BECCS): NEW PANACEA OR A *REALLY* BAD IDEA?

Briefing prepared by Biofuelwatch

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BECCS, or biomass with CCS, has recently gained attention in national as well as international high level discussions on climate, as a supposedly viable means to reduce atmospheric carbon dioxide levels. For example, the IPCC's recent Special Report on Renewable Energy Sources and Climate Change Mitigation[1] claims "*Bioenergy technologies coupled with CCS...could substantially increase the role of biomass-based GHG mitigation if the geological technologies of CCS can be developed, demonstrated and verified to maintain the stored CO2 over time.*"

But the underlying premises for these claims are unfounded and dangerous.

Capturing carbon and pumping it underground itself requires considerable energy consuming from 10-40% of the power generated at the power station where it is applied, and hence increasing energy demand and cost of construction and operation.[2] For Bioenergy with CCS, this means burning more biomass for less energy. Most biomass combustion facilities already operate at best at about 30% efficiency. Adding CCS will make them even more inefficient, and result in even more deforestation, land use change and air pollution.

The faulty carbon-accounting behind BECCS

Proponents of burning biomass for energy claim it is largely "carbon neutral", since following harvest, regrowth of trees or plants will reabsorb an amount of carbon equivalent to that released during combustion. If carbon released from burning biomass in power stations was captured and pumped into geological reservoirs then the whole process is claimed to become 'carbon negative' because re-growing crops and trees would sequester additional carbon and thus help reduce the overall amount of CO2 in the atmosphere.

BUT: The "carbon neutral" claim has been soundly refuted by the scientific community.

- When ***forests are logged*** for bioenergy, massive quantities of carbon are emitted, including from equipment, transportation of bulky materials and soil disturbance (which causes oxidation of soil organic material). There is no guarantee that new forest will grow back. And even if they were to grow back and re-absorb all the carbon released from burning previous trees, it will take decades or even centuries. This s referred to as a "carbon debt". According to a study by scientists from the Joanneum Research Institute, the carbon debt from burning trees logged from 'well-managed European forests' can be 200 years[3]. Burning biomass will result in more carbon emissions even than fossil fuels, at least for the "short term" (decades or centuries) whereas climate scientists are warning that greenhouse gas emissions must be reduced immediately.
- ***Industrial tree plantations*** are not forests but rather are "green deserts" that store far less carbon than forests or other natural ecosystems, require synthetic fertilizers and other agro-chemicals, and they deplete freshwater and soils. Bioenergy is fast becoming a major driver for the expansion of industrial tree plantations, at the expense of forests, grasslands and people's farmlands and livelihoods. Destroying ecosystems for plantations, whether directly or indirectly (by displacing other activities into forests) also incurs a carbon debt of

decades or centuries. A growing large number of scientists and scientific institutes have warned that ignoring the direct and particularly the indirect impacts of land-conversion for bioenergy, policies are being implemented which run a high risk of further accelerating climate change. As European Environment Agency's Scientific Committee recently stated: "*It is widely assumed that biomass combustion would be inherently 'carbon neutral' because it only releases carbon taken from the atmosphere during plant growth. However, this assumption is not correct and results in a form of double-counting, as it ignores the fact that using land to produce plants for energy typically means that this land is not producing plants for other purposes, including carbon otherwise sequestered. If bioenergy production replaces forests, reduces forest stocks or reduces forest growth, which would otherwise sequester more carbon, it can increase the atmospheric carbon concentration*." 4 This statement was followed by a letter from nearly 200 scientists warning about the role of indirect land use change[5].

- Many in the industry claim they will only use "***wastes and residues***" from forest harvests that "would happen anyway". But this is a myth. Using branches, twigs and "non merchantable" timber, or even stumps, means removing too much – it results in exposed and depleted soils, and failure of regeneration. In any case, there is nowhere near enough "waste and residue" to meet the demand. Consider for example that a facility burning wood chips for electricity requires around 13,000 dry tons of wood per megawatt per year – that is 650,000 tons per year for a medium-size 50 MW facility, year after year. Supplying that quantity of wood from nearby forests (to avoid long distance transportation) is not possible from wastes and residues alone. Forests are already being cut specifically to supply biomass.

The consequences of ignoring the full climate impacts of bioenergy are expected to be severe. According to a peer-reviewed study published in Science[6], putting a price on fossil fuel carbon emissions while ignoring those from land-use change due to bioenergy will result in wholesale destruction of virtually all remaining natural forests, grasslands and most other ecosystems by 2065, resulting in massive carbon emissions as well as much of the planet's biodiversity being wiped out.

If the claim that bioenergy is largely 'carbon negative is invalid, then bioenergy with CCS cannot possibly be 'carbon negative'.

BECCS would accelerate land-grabbing

Nobody openly advocates the destruction of natural forests for BECCS, but there are no credible ways of preventing it from happening, as experience with biofuels has shown. According to a report by the International Lands Coalition, 44% of all land deals in 2009 were for biofuels[7]. Claims that large-scale bioenergy production, including for BECCS, is possible without destroying natural ecosystems rely on the belief that hundreds of millions of hectares of 'marginal' or 'abandoned' lands are 'available', mostly in the global South, a claim which entirely ignores the livelihoods of hundreds of millions of people who live on those lands and depend on them for their livelihoods, whether they rely on farming or pastoralism or other activities.

CCS itself is riddled with problems and concerns

- CCS itself requires energy, overall **increasing energy demand** by 10-40%.
- CCS is **expensive**, estimated to increase the cost of energy production from 21-91% (IPCC). Large amounts of investment have nonetheless been directed to research and development of CCS. In the U.S., Department of Energy investment in the "FutureGen project was withdrawn after cost overruns for the 275 MW coal with CCS facility escalated to over $2 billion.
- CCS is **risky and unproven**. Capture, transport and storage components all carry risks and serious concerns about liability remain. The long term reliability of underground

storage cannot be guaranteed. Both slow, long term leakage, including from pipelines and any sudden large release could be dangerous. Exposure to high concentrations of CO2 is lethal. So far, there is little basis for confidence: the first commercial scale test of CCS, in Weyburn, Saskatchewan, is known to be leaking, first noted by a farmer who heard occasional booming noises and discovered numerous dead small animals nearby a pond where water become fizzy, discolored and algae filled. Testing confirmed very high CO2 concentrations.[8]

Monitoring of the BP and Statoil collaboration Sleipner CCS project off Norway revealed a large discrepancy between the amount of CO2 injected and what was subsequently detected in seismic surveys. Researchers concluded that the discrepancy was inexplicable, possibly due to miscalculations in their modeling, or, potentially, leakage.[9]

A recent study by researchers at Duke University revealed that leakage of CO2 from storage formations into overlying freshwater aquifers can occur and in some circumstances results in up to tenfold increase in dangerous contaminants (arsenic, uranium, barium and other).[10]

- Thus far, carbon captured from CCS projects has primarily been used for "Enhanced Oil Recovery (EOR), facilitating further exploitation of fossil reserves and associated emissions. Some current CCS projects involve capturing C from coal, natural gas, ethanol and fertilizer facilities, and pulp mills.[11]

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1 http://srren.ipcc-wg3.de/ Chapter 2

2 *IPCC special report on Carbon Dioxide Capture and Storage*. Prepared by working group III of the Intergovernmental Panel on Climate Change. Metz, B., O.Davidson, H. C. de Coninck, M. Loos, and L.A. Meyer (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 442 pp.

3 The upfront carbon debt of bioenergy, Joanneum Research, May 2010 www.birdlife.org/eu/pdfs/Bioenergy_Joanneum_Research.pdfThis study looks at the greenhouse gas balance of bioenergy from wood sourced from "sustainably managed" European Forests.

4 http://www.eea.europa.eu/about-us/governance/scientific-committee/sc-opinions/opinions-on-scientific-issues/sc-opinion-on-greenhouse-gas

5 www.ucsusa.org/global_warming/solutions/forest_solutions/EU-ILUC-Letter.html

6 Marshall Wise et al, Implications of Limiting CO2 Concentrations for Land Use and Energy. *Science* 324, 1183, May 2009

7 www.future-agricultures.org/index.php?option=com_docman&task=doc_download&gid=1427&Itemid=510

8 http://www.ecojustice.ca/media-centre/media-release-files/kerr-site-history/at_download/file

9 Looking for CO2 Buried at Sleipner: http://www.precaution.org/lib/looking_for_sleipner_co2.100727.pdf

10 Little, M. G. and Jackson, R. B. Potential Impacts of Leakage from Deep CO2 Geosequestration on Overlying Freshwater Aquifers. Environmental Science and Technology 2010

11 See list of projects: http://www.globalccsinstitute.com/projects/map?page=8