Smoke and Mirrors: Bioenergy with Carbon Capture and Storage (BECCS)

For a fully referenced version, and for a new comprehensive report on BECCS in December see www.biofuelwatch.net

According to the 2014 report by the International Panel on Climate Change (IPCC), the great majority of climate models rely both on rapid emissions reduction and on 'negative emissions', i.e. removing CO_2 from the atmosphere, in order to keep global temperature rise within 2°C. BECCS was the main 'negative emissions' technology considered for removing CO2 from the atmosphere, although the IPCC report cautioned: "*The availability and scale of these and other Carbon Dioxide Removal (CDR) technologies and methods are uncertain and CDR technologies and methods are, to varying degrees, associated with challenges and risks*"[i].

Since then, BECCS has been discussed increasingly as a potential 'climate change mitigation' technology – although investment in BECCS technologies remains virtually non-existent.

The draft CBD report on geoengineering[ii] highlights concerns about the potential biodiversity impacts of large-scale BECCS.

However, while BECCS might pose a major threat to biodiversity in theory, there is virtually no possibility of large-scale BECCS application because the technologies are technically and economically unviable. The real threats posed by promotion of BECCS are ongoing distraction from the urgent necessity of a rapid phase out of fossil fuel burning and ecosystem and biodiversity destruction, and the distraction of attention away from genuine and credible ways of sequestering carbon: agroecology and ecosystem regeneration.

Large-scale BECCS: A dystopian vision for biodiversity

According to a peer-reviewed study[iii] a BECCS programme designed to sequester 1 billion tonnes of carbon through BECCS using switchgrass would result in:

- Conversion of 218-990 million hectares of land [around 7-33 times more than the land used for biofuel production worldwide at present];
- Increasing current annual global nitrogen fertiliser use by up to 75%;
- Use of an additional 1.6-7.4 trillion m^3 of freshwater per year;
- Additional nitrous oxide emissions which would have a warming impact up to 3.1 times greater than the 'avoided global warming impact' from sequestering 1 billion tonnes of carbon.

Some models included in IPCC analyses would require up to 2.7 times that scale of BECCS and thus of land, water and fertilizer use. According to the draft CBD update report on climate-related geoengineering considered at the SBSTTA: "*to obtain the land area needed for upper estimates of bioenergy development, there is risk of near-total loss of primary, unmanaged forest and ~90% loss of unmanaged pasture by 2100 unless appropriate environmental safeguards are in place*".

BECCS remains a science-fiction fantasy:

Several governments and corporations – especially Shell[iv] - have endorsed BECCS as a climate change mitigation strategy. However, this has not translated into investment in BECCS technologies.

Since 2011, there has been only one project worldwide which many class as BECCS: CO_2 from ethanol fermentation is being captured from an ADM corn ethanol refinery in order to test the storage potential of a sandstone formation in Indiana. Capturing CO_2 from ethanol fermentation is far cheaper and simpler than capturing it from power plants.

However, ADM themselves have only claimed that CO_2 capture reduces the plants carbon emissions[v], not that it results in 'negative emissions'. This is because the life-cycle fossil fuel emissions associated with corn ethanol production exceed the CO_2 emitted during fermentation[vi].

The technologies proposed for BECCS, for example by the International Energy Agency (IEA)[vii] are far more complex and untested:

For biofuels, they involve capturing CO_2 either from cellulosic ethanol fermentation or from Fischer-Tropsch synthesis of biodiesel, although the IEA points out that the amount of CO_2 that could be sequestered from any form of ethanol fermentation is very small. ***Cellulosic ethanol fermentation and Fischer-Tropsch synthesis of biodiesel*** so far have not proven commercially viable. Not one single commercial Fischer-Tropsch biofuel plant exists. As of May 2015, four cellulosic ethanol plants had been opened (and not yet closed down) in the US with a combined capacity of 60 million gallons per year, supported by over $750 million in public grants and loan guarantees. Altogether these four refineries were operating at a mere 3% of their capacity[viii]. There is no evidence that cellulosic ethanol production is possible with any net energy gain. BECCS from biofuels is thus not a realistic option with current technology.

Capturing CO2 from biomass power stations has never been attempted. A BECCS power station would be even more prohibitively expensive than a coal CCS power station, because of additional technical requirements and because biomass is much less energy dense than fossil fuels, which means much more has to be purchased and burned. Coal CCS power plants are already so costly and difficult to operate that only one commercial-scale plant has been commissioned. That plant, in Saskatchewan, is projected to operate at a net financial loss over its projected lifespan[ix]. It would not have been built without financial gain from Enhanced Oil Recovery (EOR), i.e. without the CO_2 being used to exploit oil that would not otherwise be recoverable. Once emissions from burning this additional oil are taken into account, CCS with EOR may well result in a net increase of CO2 emissions[x].

According to the IEA, the greatest BECCS potential lies with Biomass Integrated Combined Cycle Gasification (IGCC) plants. Yet no such plant has ever been built beyond a very small pilot scale. IGCC technology is highly complex, expensive and failure-prone. For example, one coal IGCC plant in Spain (operated without carbon capture) has required over 6,000 significant modifications due to technical problems[xi]. A single IGCC coal power station with carbon capture is under construction – at Kemper County, Mississippi – and its costs have already spiralled from $1.6 to $6 billion, with long delays[xii]. Both the use of biomass and the use of carbon capture increase costs and technical failure risks significantly.

Finally, the long-term safety of CO2 storage is increasingly in doubt.

<u>Why BECCS needs to be denounced:</u>

Hype about BECCS is dangerous for three reasons:

- Claims that BECCS can sequester significant amounts of CO_2 legitimise ongoing fossil fuel burning because they make policymakers believe that today's emission can be scrubbed out of the air in future;
- Claims that BECCS could be 'sustainable' greenwash the very real and highly destructive impacts of large-scale industrial bioenergy;
- The focus on sci-fi technologies like BECCS distracts attention from proven available ways of sequestering carbon – agroecology and ecosystem regeneration. There is no way to reverse the impacts of burning billions of tonnes of fossil fuels – but there are ways of reversing some carbon loss from soils and ecosystem destruction that are available and would have many other benefits.

[i] http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_summary-for-policymakers.pdf

[ii] https://www.cbd.int/doc/meetings/sbstta/sbstta-19/information/sbstta-19-inf-02-en.pdf

[iii] Ecological limits to terrestrial biological carbon dioxide removal, Lydia J. Smith and Margaret S. Torn, Climatic Change, May 2013, http://link.springer.com/article/10.1007/s10584-012-0682-3#/page-1

[iv] E.g. http://blogs.shell.com/climatechange/2015/06/fourdemands/

[v] http://www.adm.com/en-US/responsibility/2011CR/Pages/carbon_sequestration.aspx

[vi] http://www.extension.umn.edu/agriculture/business/renewable-energy-bio-fuel/docs/umn-ext-reducing-life-cycle-greenhouse-gas-emissions-of-corn-ethanol.pdf

[vii] Potential for Biomass and Carbon Dioxide Capture and Storage, Report 2011/06, July 2011, www.ieaghg.org/docs/General_Docs/Reports/2011-06.pdf

[viii] www.energytrendsinsider.com/2015/06/22/cellulosic-ethanol-is-going-backwards/

[ix] http://static1.squarespace.com/static/5394a3cbe4b032d797fe179c/t/55142e0ee4b06a02803077d1/1427385870286/150326-BoundaryCCS-Report.pdf

[x] 'Carbon Capture Scam (CCS): How a False Climate Solution Bolsters Big Oil', Greenpeace, April 2015, www.greenpeace.org/usa/wp-content/uploads/legacy/Global/usa/planet3/PDFs/Carbon-Capture-Scam.pdf

[xi] www.usea.org/sites/default/files/082013_Recent%20operating%20experience%20and%20improvement%20of%20commercial%20IGCC_ccc222.pdf

[xii] http://exp.grist.org/clean-coal