2018-IP13: BECCS is like Marmite – you either love it or hate it!

We have seen the projections from the IEA in their below 2°C modelling scenario in WEO 2017 that indicate we need negative emission technologies, of which BECCS is the leading contender technology[1]. The Shell Sky Scenario also requires BECCS to get us to below 2°C [2]. We understand that BECCS has issues, namely: land use completion with food production, water conflicts with food production and the need for sustainable biomass production amongst others, but there a few alternatives. Geoengineering is not considered viable; air capture is only at the pilot scale and considered to be very expensive compared to other CCS options. BECCS has been demonstrated at the 1Mt/year scale in the USA and there are several other bioethanol plants in the USA capturing CO_2 that is sold for CO_2-EOR. The fact these projects are using waste biomass is seen as advantageous rather than using purpose grown biomass.

A new research paper in Nature Climate Change proposes, "**Alternative pathways to the 1.5°C target reduce the need for negative emission technologies"** see:
https://www.nature.com/articles/s41558-018-0119-8

The research presented in the paper provides an alternative route to achieving 1.5°C than, let's say, the more traditional modelling routes used by the IEA and Shell. One of the reasons the researchers suggest that IAM's come out favouring BECCS is because they are considered to be "cost-optimal", which means they prioritise low-cost solutions. The researchers also suggest that most IAM's don't aggressively target non-CO_2 GHG emission reductions.

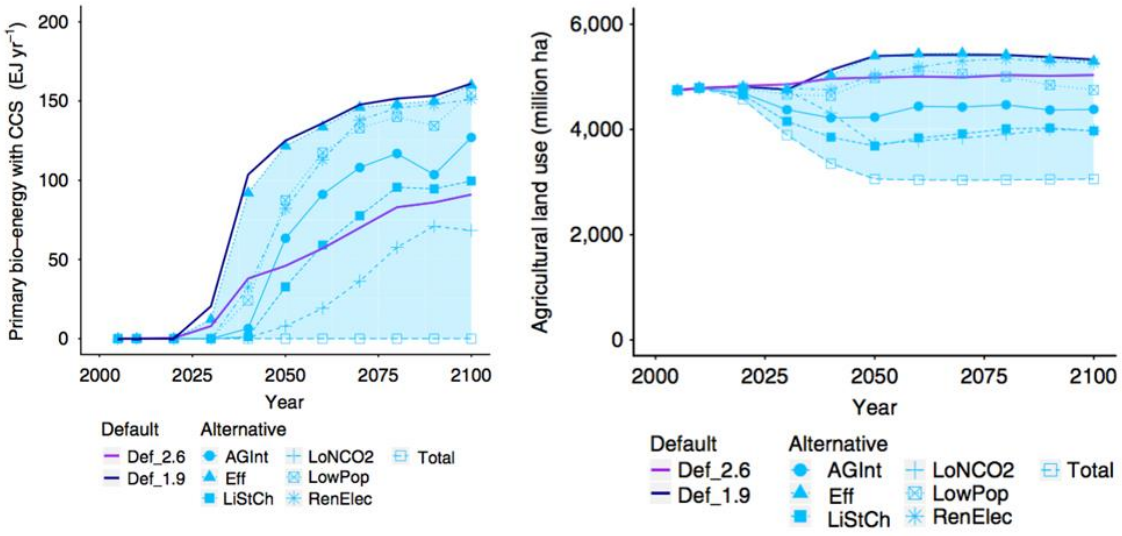
The alternative scenarios to meet the 1.5°C goal they propose that reduce reliance on BECCS are:

- **Renewable electrification:** All energy end-use sectors are rapidly electrified, including heat. The technical constraints to integrating variable renewables on the grid are overcome. Some fossil-fuelled power stations retire early and, by 2030, all new cars are electric.
- **High efficiency:** The best available technologies are quickly adopted for all energy and material uses, including cement and steel. From 2025 onwards, only highly efficient new cars and aeroplanes are sold and only the most efficient home appliances allowed.
- **Low non-CO_2**: Non-CO_2 greenhouse gases are reduced using the best-available technologies and further technological progress. For example, by 2050, fugitive emissions of methane are cut by 100% in the oil-and-gas sector and by 90% for coal mining. Methane emissions from livestock are cut significantly and, by 2050, 80% of meat and eggs are replaced by cultured protein, including lab-grown meat.
- **Agricultural intensification:** Optimistic assumptions for crop yield improvements are combined with 80% worldwide adoption of the most efficient livestock systems, including improved feed digestibility and "genetic improvements".
- **Population:** Improved access to education accelerates the trend towards reduced fertility, so that global population rises from 7 billion people today to 8.4 billion in 2050, before falling to 6.9 billion in 2100. This is broadly in line with the UN's lowest scenario for population, whereas the high end of UN projections reaches 13.2 billion people in 2100.

[1] https://www.iea.org/weo2017/
[2] http://www.ieaghg.org/docs/General_Docs/Information_Papers/2018/2018-IP12_Shells_Vision_of_a_Zero_Emission_World.pdf

- **Lifestyle change:** The majority of the world population adopts sustainable lifestyles, including, by 2050, 100% adoption of healthy diets with lower levels of meat consumption. There is less private car use and more walking or cycling, while air travel is reduced.

Each of the mitigation alternatives cuts emissions, with the electrification and efficiency scenarios mostly affecting CO_2 and the others having a greater impact on other greenhouse gases. This, in turn, cuts the need for BECCS (chart, below left) and for agricultural land (below right).



Left: Primary energy from BECCS (exajoules) and Right: Agricultural land use (millions of hectares) in a 2°C scenario and a range of alternative 1.5°C scenarios. Source: Van Vuuren et al (2018)

Combining all of the mitigation options together ("Total"), the researchers suggest, effectively eliminates the need for BECCS to stay within a 1.5°C limit. This frees up significant areas of agricultural land in the model, some of which is reforested, resulting in "natural" CO_2 removal.

Comments

Before we are critical, it is interesting to consider that there are alternative options to the CCUS/BECCS routes to going below 2°C from the likes of IEA and Shell that we are more familiar with. I guess the question that we must ask of this academic exercise is, are the scenarios they offer any more or less plausible than those from what we could call the more conventional modelling groups.

Of the options they propose, increased renewable electricity production is not unrealistic if energy storage technology is developed quickly and at low costs. We see in the Shell Sky Scenario that coal generation reduces significantly as well so there are parallel trains of thought here. The same is true for electric cars. However, electric cars don't address the emissions from automotive transport vehicles, shipping and aviation. Going all out on energy efficiency is something the IEA is keen on, but we note their comments in the Energy Efficiency Report of 2017 that we need a big global push on policies that promote energy efficiency[3]. Groups like IPICEA, OGCI, World Bank and others are pushing the application of best practise in the oil and gas sector the reduce non-CO_2 GHG emissions, if we cut coal use emissions from mining should decrease.

[3] http://www.ieaghg.org/docs/General_Docs/Information_Papers/2018/2018-IP09_2017_Energy_Efficiency_at_a_Cross_Roads.pdf

There are some options that might not be as palatable to the public as a whole; for example, will genetic modification of livestock be acceptable? There has been resistance to genetically modified corn etc. Will the population accept the transition to “laboratory manufactured” protein? Can education bring about the population reduction they propose in their model? If so, great! Concerning lifestyle changes – going vegan, for example, a recent study suggested that this change only cut GHG emissions by half what was expected. Also, there is a trend to veganism in developed countries but in developing countries meat consumption is rising. We have also seen the increasing trend in increased social mobility, car ownership especially in developing countries - so are we about to abandon the car for a bike?

The big question is: can the greater good to save the plant prevail? The researchers who wrote the paper seem to think so and it is a good thought piece. Does it provide all the answers? It does not, and it may raise more questions about the global ability to follow this route than a more conventional one. We should not easily dismiss new ideas or old ones, like BECCS, out of hand as they all have a place. The key point is that if we are going to meet the Paris Goal, we are going to have to do something much more radical to reduce global GHG emissions than we are now and the sooner we start the better.

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