WORKSHOP FOR EIBI TEAM

Longer term R&D needs and priorities on Bioenergy

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R&D needs and priorities for Bio-CCS

What is Bio-CCS?

Carbon capture and storage is one of the major technologies for reducing carbon dioxide emissions to the level needed to stabilize global temperature rise to 2 °C and low carbon road map by 2050. As the 2 °C target is slowly getting more and more challenging, there is an urgent need for near term solutions that can make a significant contribution to the restriction of atmospheric CO_2 concentrations. Bio-CCS combines sustainable biomass conversion with CO_2 Capture and Storage (CCS) – e.g. in biofuels and bioenergy production in the first phase of deployment followed by large scale deployment in utility co-firing plants in the second phase. By combining CCS with conversion of sustainable biomass, CO_2 can be removed from the atmosphere over time. Because growing biomass binds carbon dioxide in photosynthesis, carbon capture from biomass firing power plants and industrial processes utilising biomass as raw material would lead to negative emissions on a life cycle basis, which means removing CO_2 from the atmosphere e.g. creating a carbon sink.

European Biofuels Technology platform and Zero Emission Platform Joint task Force on Bio and CCS produced a background report on Bio-CCS deployment [http://www.biofuelstp.eu/downloads/bioccsjtf/EBTP-ZEP-Report-Bio-CCS-The-Way-Forward.pdf].
In the Nordic Energy Technology perspectives IEA states the following about Bio-CCS potentials in the Nordic countries alone: "*This additional reduction in the CNBS is due to an increased use of bioenergy with CCS (BECCS) in the power sector, which results in negative net CO2 emissions. In the CNBS, 7 Mt of CO2 are captured at BECCS plants in the power sector compared with 3 Mt in the CNS*." [http://www.iea.org/media/etp/nordic/NETP.pdf].
In addition to this VTT has evaluated more in detail what the implications of realising Bio-CCS could be. As a result, the role of Bio-CCS will be emphasised along the road towards competitive low carbon economy in 2050. [http://www.vtt.fi/inf/pdf/visions/2012/V2.pdf].

Bio-CCS can be more economically feasible in comparison to fossil CCS depending on the availability and price of the biomass raw material. In order to meet the profound Energy Roadmap 2050 targets, significant parts of the RTD funding should be allocated to Bio-CCS.

Bio-CCS deployment status

The technical implementation of Bio-CCS to different industrial sectors goes hand in hand with the development of "conventional" CCS technology deployment. In general, same technologies are suitable for capturing CO_2 from biomass applications as for fossil fuels, and Bio-CCS deployment is seen to be tangled with deployment of CCS in general. Thermochemical biomass conversion processes, such as biodiesel production based on gasification Fischer–Tropsch synthesis or second generation ethanol production are considered the first phase targets for applying capture of CO_2 as by-products, both from logistics and cost point of view. The potential for Bio-CCS in co-firing applications is European is considered to be large whereas combined heat and power production enables superior overall efficiencies also in connection to CCS. Non-traditional biomass processes, such as algae and artificial photosynthesis can open up new opportunities for capturing and storing of biogenic CO_2. The question underlying is the most efficient utilisation of biomass; overall efficiency in the sustainable biomass value chains.

Bottlenecks for implementation

Large scale deployment of Bio-CCS takes place after 2030 when “conventional” CCS is being deployed; large scale deployment and existence of CCS infrastructure, legislation and acceptance of technology are considered as prerequisites of Bio-CCS as the primary motivation for Bio-CCS cannot be CCS but combining biomass utilising processes to existing infrastructure. There is no direct incentive for owner of carbon neutral biomass conversion process to invest in CCS technology development and thus increase risk exposing to carbon markets. However Bio-CCS can be economically attractive if fiscal incentives are in place. Major barriers for commercialisation of Bio-CCS are:

1. Regulation level bottlenecks; Currently, the policies aiming for climate change mitigation do not consider biogenic CO_2 emissions comparable to fossil CO_2 emissions and the current EU-ETS does not recognize negative emissions. Therefore no fiscal incentive for capturing biogenic CO_2 exists yet.

2. The long term safety and technical feasibility of generic CO_2 storage needs to be proven and publically accepted

3. Capture: capture technologies need to be demonstrated in commercial scale, starting from low hanging fruits such as by-product CO_2 in liquid biofuels production

R&D needs

The profound Energy Roadmap 2050 emission reduction targets for greenhouse gases cannot be met without deployment of CCS and reasoned Bio-CCS. Because Bio-CCS binds CO2 from the atmosphere the net CO2 reduction impact per unit energy produced can be multifold in comparison to fossil CCS or 2nd generation biofuels alone. Because of the constrained availability of sustainable biomass the most rational biomass utilisation concepts should be prioritized. The emphasis should be put in the identification and demonstration of these concepts e.g. on European level.

1. System approach to outline the realistic role for Bio-CCS emission reduction efforts in the EU and beyond in the short/medium/long term (2020/2030/2050) and its implications for EU industries, energy systems and the broader economy under consideration of socio-economic and institutional constraints including available sustainable biomass resources as well as competition in global bio-economy with aspects also on non-traditional biomass sources, such as algae and solar based hydrocarbon transportation fuels. The credibility and the relevance should be assured by the technology platform driven execution with the priorities defined by the realizers of the SET Plan and European technology platforms. The objective of this system approach is the alignment of technological priorities in steps two and three.

2. Development of technologies applicable to different biomass processing industries: power and CHP production; liquid biofuels and other energy bioenergy carrier production; others non-traditional bio based processes such as algae etc.

3. Demonstration of capture technology by 2020 for CCU-Carbon Capture and Utilization in order to enable rapid deployment when CCS infrastructure and services will be commercialised. This means 2-5 large scale demonstrations of Bio-CCS capture plants based the realisation of short term market potential with CCU.