Role of Carbon Capture and Storage (CCS) or Use (CCU) on Climate Mitigation

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Abstract ArcelorMittal, world leader in steel production, is working together with industrial partners from the cement and chemical industries, other energy intensive sectors, for potential synergies between the respective manufacturing processes and how these could contribute to the reduction of overall CO₂ emissions. Based on this project, the session aimed at demonstrating the place of LCM methods and tools in support of regional and/or local policy frameworks. Industrial representatives and policy makers involved in the panel presented and discussed the technical and political challenges faced when developing and implementing disruptive technologies and associated business models.

1 Synthesis of Presentations and Discussions

Eric De Conick (ArcelorMittal) presented the reuse of various process gases as feedstock for producing low carbon fuels and chemical feedstocks are under development or study at ArcelorMittal. The latter will allow producing plastics which can be ground at the end of life, and be re-injected as a C-agent in the blast furnace. That way a circular economy will emerge from the re-use of the second-hand carbon in industrial gasses. Even if, in a first stage of this development, the gasses would be converted in fuels for transport, and the carbon would be burnt and emitted in the atmosphere, a significant reduction of GHG emissions worldwide will be realized by the replacement of fossil oil and gas fuels. The replacement of the electricity, currently produced from these process gasses, should be done with renewable electricity. Minerals or steel slags can be further carbonated
and converted into building materials with surplus CO$_2$. A third of overall steel production related CO$_2$ emissions of today could potentially be diverted for reuse. For the remaining CO$_2$ volumes, underground permanent storage becomes an option once such infrastructure is being built.

Scale up of carbon reuse projects without a specific regulatory frame work is unlikely as the cost of products from carbon reuse will be higher than for the fossil equivalent.

**Manuela Ojan** (HeidelbergCement) introduced an installation that HeidelbergCement is piloting in Moroccan cement plant that produces micro algae for fish feed. This application allows this stand-alone plant to capture 10% of its total CO$_2$ emissions.

**Tom Bradley** (Narec Distributed Energy—UK) presented the InteSusAl project in Portugal, which is producing algae for conversion into fuel. To enable comparisons of different process set-ups, the LCA methodology for assessing the various algae technologies were harmonized.

**Colin Hills** (UK Centre for Environment Research and Innovation) explained that technologies are being implemented in 2 UK plants (5 by 2021) to mineralize CO$_2$ with reactive waste (APCr). However, other wastes (e.g. red mud, …) can also be processed into aggregates for construction. From mapping EU available wastes, a conservative potential of 6 Mt carbon abatement exists while producing 122 Mt of aggregate, covering 6% of EU consumption.

Finally, **Anders Hammer Stromman** (Norwegian University of Science and Technology) stated that methodologies assessing the abatement potential of CCU technologies should consider their beneficial effect on anthropogenic perturbation of global carbon cycle. Attention should be given to whether these are in the domains of either the slow else the fast carbon cycle.

Some conclusions were drawn from discussion between panel and audience after the Q&A session:

- Without a price on carbon, these new technologies cannot economically compete with their fossil-based alternatives.
- A regulatory support is required to enable them a market.
- To maximize their impact on carbon abatement, the technologies will require renewable energy as input for operation.
- Assessment methodologies shall reflect an evolution to more renewable energy to enable the initial viability of the new CCU technologies.
- Regulation framework has to reward synergies created by combined production systems rather stimulate the market based on benchmarking of the individual products as the latter will raise allocation issues.
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