Next Generation Carbon Capture

PEP Report 180F

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Abstract

Net-zero emissions targets and decarbonization ambitions are driving demand for carbon sequestration solutions. Currently, countries that are responsible for 67% of the global greenhouse gas (GHG) emissions have set net-zero targets. Among these countries, the top-six emitters (50% emissions) have proposed carbon sequestration solutions to meet their net-zero targets. The IEA Sustainable Development Scenario also stresses the role of carbon capture, utilization, and storage (CCUS). Although in the short run, the carbon captured is expected to be from power-generating plants using coal as fuel; the applications will swiftly move on to natural gas combined cycle plants, hard-to-abate sectors like cement, iron and steel, and then to direct air capture. Blue hydrogen, which plays a critical bridge in the energy transition scenario, is also dependent on CCUS.

This report covers:

- Postcombustion carbon capture using a novel-activated-hindered amine (AMP/Piperazine blend) solvent
- Direct air capture using chemicals
- Postcombustion intensified carbon capture using an adsorbent (metal organic framework)

Apart from the technical and economic analysis, we also include in this report a material balance table, a sized equipment list, and a process flow diagram for each technology. An Excel®-based tool, iPEP Navigator® is provided for an easy economic analysis in different regions of the world.

The technological and economic assessment of the process is the Process Economics Program's (PEP) independent interpretation of a potential commercial process, which is based on information presented in open literature, such as patents or technical articles, and it may not reflect in whole or in part the actual plant configuration. We do believe that these sources are sufficient to represent the process and process economics within the range of accuracy necessary for economic evaluations of conceptual process designs.

It needs to be recognized that the novel technologies and solutions currently available in the market are not commercially verified at scale. The performance advertised by the technology provider needs substantiation by commercial deployment. Despite such hurdles, the urgency to seek more desirable solutions is driving technology improvements, some of which are marginal and some which claim to be revolutionary. Against this background, this report attempts to clear the air on technical and economic analysis of new technologies, while pointing out their potential risks and advantages.

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