Infrastructure, Technology

A Round-up of Carbon Capture Projects Around The World

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Work Area: Carbon Capture


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2021 will be a year of climate commitments. On the fifth anniversary of the Paris Agreement, the pressure is mounting for nations to raise their ambitions and set firm commitments to reach net-zero by 2050. The nature of those commitments will dictate investment for years to come, which is why the

global climate community must incorporate carbon capture storage, removal and storage projects into its roadmap.

Preventing the worst effects of climate change will require us to reduce emissions as soon as possible. That means embracing all clean energy technologies, including carbon capture, removal, and storage – they will be an essential part of a diverse portfolio of options required to reduce net-zero emissions by mid-century. Research from the Intergovernmental Panel on Climate Change (IPCC) has shown that carbon capture, removal, and storage will be crucial in reducing emissions from industrial sectors while also drawing down CO2 that has already been released into the atmosphere.

Carbon capture technologies have not yet been implemented at scale, but the number of projects under development globally has been growing significantly. This is thanks to both increased ambition from the private sector and increasingly supportive policy. However, we still require substantially more investments and policy support to effectively decarbonize by deploying carbon capture, removal, and storage at the scale required. Without deploying carbon capture technologies, industries will emit some 600 GT tonnes of carbon dioxide over the next 50 years into the atmosphere, according to the International Energy Agency (IEA). The energy transition is also likely to be more expensive without carbon capture, removal, and storage – if, indeed, it is achievable at all.

> By 2030, we need to be well underway with mitigating current emissions *and* have adapted the existing systems for a net-zero future.

That means the commitments and plans made today need to be effective in the short, medium, and long term. The IEA estimates that 75% of the emissions reductions necessary to meet net-zero emissions are dependent on technologies that have not yet reached commercial maturity. Thus we urgently need to focus our efforts on carbon capture, removal, and storage today.

Despite some encouraging signs for global climate mitigation, the world's largest emitters of CO2 still lack credible decarbonization pathways. Industry emits approximately one fifth of global CO2, and a substantial fraction of those emissions will be quite costly or impossible to eliminate with electrification. High temperature process heating in the petrochemicals sectors, for example, may be especially difficult to convert to electricity. In addition, the fundamental chemistry of some production processes, such as those used in cement and ironmaking, can result in large CO2 emissions irrespective of the energy source used. Carbon capture, removal, and storage is critical for those industries both to capture the inherent CO2 emissions, to capture CO2 emissions from fuel use (where that approach makes the most sense) and to allow for on-site production of carbon free hydrogen as both fuel and feedstock.

Moreover, the world is expected to overshoot its climate goals, requiring negative emissions. Simultaneously, some sectors like aviation might require synthetic hydrocarbon fuels for quite some time, both critical reasons we need to commercialize carbon removal technologies in the near-term.

Fortunately, there has been increasing carbon capture, removal, and storage activity in three regions poised to lead commercialization.

Roundup of Global Carbon Capture Projects

Europe

Example of a European carbon capture project in Copenhagen. Click through to read more.

Europe has seen a reinvigoration of support for carbon capture, removal, and storage over the past two years as part of the ambitious European Green Deal agenda. There are more than a dozen projects in planning – a result of multiple factors, including the prospect of EU Innovation Funding, direct government investment as in the case of the Northern Lights Projects, and national decarbonization policy schemes such as the SDE++.

More than one-fifth of all applications to the first round of the EU Innovation Fund are for carbon capture, removal, and storage projects. The analysis also shows a proliferation of technology across Europe. At the same time, new actors are entering the space through joining existing projects or building out expertise. For example, Microsoft joining the Northern Lights Project signaled significant momentum for the industry. Most of the planned projects aim to capture CO2 from multiple industrial sources, to aggregate the CO2 in shared transport and storage infrastructure, achieving economies of scale. Moreover, the political economy of carbon removal has been evolving at rapid speed, with new industry

coalitions being formed and policymakers and NGOs alike diving into policy options, accounting, and governance frameworks.

Whilst Europe is leading on this net-zero momentum and has set some solid foundations, both the EU and individual European countries will need to design more ambitious technology deployment-specific policy approaches in order to scale carbon capture and storage.

US

Map of current carbon capture projects in the US – click through to explore it.

The US remains a global leader with 13 carbon capture facilities and some 30 underway in a variety of industries, thanks to deployment-oriented policies such as the 45Q tax credit. Most of the projects in development are planning to store their CO2 through saline geologic storage, signaling a shift toward the commercialization of such storage facilities. While the US government has done more than any other government in the world to commercialize carbon capture, removal, and storage technologies, the policy landscape is further evolving; the mammoth Omnibus bill that was passed in Congress at the end of 2020 included some $6 Billion in authorizations for carbon capture, removal, and storage over the next five years. This included demonstration funding to propel technologies beyond just first-of-a-kind, paving the way to bridge the gap between one-off demonstration projects and large-scale deployment.

The introduction of the SCALE Act and a bill containing updated provisions for 45Q signal that policymakers are already thinking about medium-term policy needs, including infusion of federal capital into the build-out of CO2 transport and storage infrastructure, a priority on the road to net-zero, as a recent Princeton study suggests.

Middle East

This region is making strides with regard to innovation. We have seen an acceleration of carbon capture commitments across the Middle East, which already has three facilities in operation.

For example, there have been some exciting moves in the UAE that are pursuing carbon capture, low-carbon steel, and blue hydrogen for export. Abu Dhabi National Oil Company (ADNOC) has a carbon capture facility in Al Reyadah, and has announced a target to scale this up to capture 5 million tons of CO2 per year by 2030 from its gas plants. More recently, a partnership between ANDOC and Eni for carbon capture to lower CO2 emissions is encouraging, particularly against Eni's storage resources' backdrop in Italy. Also of note is Abu Dhabi's Hydrogen Alliance between ADNOC, Mubadala and ADQ, which will develop low-carbon green and blue hydrogen production for power and industrial activities. Saudi Arabia has also acknowledged the important role of carbon capture and storage, recently agreeing plans with South Korea to ship carbon dioxide emitted in its the hydrogen-making process back to the kingdom. Meanwhile, Qatar Petroleum plans to build carbon capture facilities for capturing more than 7mn t/yr of CO2 per year from its operations by 2030.

The way forward

These initial steps are encouraging to demonstrate that the industry is starting to move in the right direction. Given carbon capture, removal and storage's long-term importance for the decarbonization of energy-intensive industries and reduction of historical emissions, the challenge lies in making them commercially viable as soon as possible.

This will involve new policies and business models that recognize the role of carbon capture so that it can reach the scale required to have significant climate

impact. A deeper understanding of the issues surrounding carbon capture is needed to get there, especially amongst policymakers. In particular, getting policy frameworks right *and* continuously updating them will be important for at-scale deployment.

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Clean Air Task Force's (CATF) Europe Carbon Capture Project and Activity Map shows more than 40 carbon capture projects have been announced across 13 different European countries. These announcements signal unprecedented industry interest in developing and deploying carbon capture and storage facilities for a climate-neutral Europe. This should be a...

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Two Carbon Capture Projects: A Deeper Look

Two carbon capture projects made headlines in 2017. The Petra Nova project at NRG's Texas Parish coal-fired power plant began capturing CO2 in January. Petra Nova was built on time and on budget, and is on is on track to capture 1.6 million tons of CO2 each year. More recently, Southern Company announced that the Kemper plant in Mississippi would no longer burn coal, and would cease capturing the coal plant's CO2 emissions. Now Kemper will burn natural gas without CO2 controls.

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