Climate Neutrality: What is next for Carbon Capture in Europe?

By Lee Beck

"Carbon capture, utilization, and storage is a building block for a climate-neutral Europe. We need to move along quickly," Frans Timmermans, Executive President for the European Green Deal, recently stated in response to a presentation of carbon capture projects in planning.

Indeed, Europe is redefining the role of carbon capture in its climate ambition; the technology is included as one of the seven strategic building blocks of the European Commission's Vision for an EU 2050 Long-term Strategy. At least 11 member states have cited it in their national energy and climate plans. The UK Committee on Climate Change, which advises the UK government on climate policy, reaffirmed carbon capture's role as a "necessity, not an option". Even in Germany, where the technology had once been considered off the table, Chancellor Angela Merkel told the media in May 2019: "Now it is back."

Indeed, thanks to its climate-forward approach to innovation, Europe is poised to become a global leader in carbon capture. A replenished number of projects in planning also signals renewed private sector interest. However, carbon capture-specific policy mechanisms that send clear market signals are needed for a sustained scale-up aligned with climate ambition.

Carbon capture reduces CO_2 emissions from energy-intensive industries or captures them directly from the air and stores them underground. It is not only widely regarded as highly valuable asset in the quest to manage climate change, but its importance also increases with climate ambition. That is due to its applications in hard-to-abate sectors such as cement and steel production, where we have few to no alternatives to eliminate emissions. Research also shows that the deployment of carbon capture reduces the overall cost of decarbonization, making it crucial for a least cost energy transition. In the European Commission's scenarios, up to 600 million tons of CO_2 are captured and stored in 2050. For comparison, the 21 facilities currently in operation globally capture some 40 million tons per year (mtpa), so we have a long way to go in just a few decades.

The Current Status of Carbon Capture in Europe

Alas, Europe has been slow in developing actual carbon capture projects. There are now just two operational facilities, and both are in Norway, Europe's carbon capture frontrunner. To align Europe's practice with its ambition, its revamped approach to carbon capture focuses on building infrastructure hubs. These hubs would couple multiple industrial and power facilities that are physically close to each other and equip them to capture their CO_2 emissions allowing the facilities to share CO_2 transport and storage infrastructure. This model promises to achieve economies of scale, allocate risk more efficiently, and can be expanded to involve direct air capture.

There are now about a dozen carbon capture facilities in the planning stages in Europe with a combined capture capacity of 30 mtpa of CO_2. All of them are or are related to hubs. The planned projects involve capturing emissions from natural gas power plants, low-carbon hydrogen and cement plants, as well as waste-to energy facilities.

Recent announcements include:

- Equinor's aim to develop an at-scale gas-to-hydrogen carbon capture facility as part of the Zero Carbon Humber Cluster in the UK.
- The Italian energy company Eni publicized intentions to build a CO_2 storage hub off the coast of Ravenna.
- Project Athos at the Port of Amsterdam is evaluating the offshore storage of CO_2 in the North Sea.

Northern Lights is the most advanced European carbon capture project currently in planning. The Norwegian project seeks to build transport and offshore storage infrastructure. It is initially expected to receive CO_2 from a cement and a waste-to-energy plant in Norway. It could then ramp up to become a European open access CO_2 storage hub, sequestering CO_2 from various industrial facilities all over Europe.

In just a year, Northern Lights has made impressive progress; the project partners signed Memoranda of Understanding with companies all over Europe; it was included in the EU's fourth list of Projects of Common Interest; a regulatory barrier to cross-border CO_2 transport in the London Protocol was lifted; and a successful test well was drilled. The project received a green light from project partners Equinor, Shell, and Total in the spring of 2020. Most recently, EFTA's Surveillance Authority, which monitors that governments outside the EU and part of the bloc's single market stick to its rules, approved up to €2.1B in state aid. Now, Northern Lights is awaiting a final investment decision from the Norwegian Government this fall and could be operational by 2024.

The Port of Rotterdam project – Porthos – aims to collect about 2.5 mtpa of CO_2 and store it 12 miles off the coast of the Netherlands in the North Sea. The Drax power plant in the UK is adding capture equipment to its biomass-fueled power stations. These projects may be able to achieve negative emissions if supplied with waste biomass that would have otherwise been burned or rapidly decomposed. Negative emissions will be critical to reduce the stock of CO_2 already in the air. Currently, the EU is evaluating how to approach negative emissions also known as carbon removal from a policy perspective.

The Carbon Capture Policy Environment

Typically, new technologies are demonstrated, and then brought to market via commercial deployment. First-mover deployment of innovative technologies like carbon capture lowers cost and risk, enhances learning-by-doing, and shortens project deployment timelines. Commercializing a suite of climate technologies enables option creation, reducing the risk of relying on any single decarbonization strategy. Catalyzing technology diffusion around the globe has benefits at home and abroad, similar to what Germany has done for solar, or Denmark for offshore wind energy.

As the policy visions and instruments to achieve net-zero emissions by mid-century have taken shape, so have mechanisms for which carbon capture projects are eligible. As carbon capture has not been widely deployed, it is considered a risky investment, much as wind and solar were in their earlier days. Grants for facilities, infrastructure, and CO_2 storage development can motivate industry to build demonstration facilities. Policy mechanisms that provide per-ton incentives for CO_2 storage, such as the US 45Q tax credit, are important to create a business case for investment and accelerate commercial deployment at the scale necessary for net-zero decarbonization.

In the EU, the EU Green Deal defines the bloc's roadmap towards climate neutrality, calling for industry "climate and resource frontrunners" to develop commercial carbon capture demonstration facilities. Accordingly, carbon capture projects are eligible for funding through a variety of instruments such as Connecting Europe Facility and Horizon Europe. The €10B Innovation Fund was launched in 2019 and seeks to bolster advanced clean energy technologies more broadly. Financed through the auction of European Emissions Trading System (ETS) certificates, the Fund issued its first call for proposals in July. In a historic deal, EU leaders also agreed to a scheme boosting Europe's recovery. The plan includes funding for the InvestEU instrument, whose funds can be used for carbon capture deployment.

The ETS itself, currently trading around €25, is an important signal for carbon capture deployment, which will be strengthened as the scheme is being overhauled, and if the EU moves ahead with a carbon border tax adjustment. Moreover, carbon capture projects are eligible for European Investment Bank (EIB) funds as outlined in its revised energy lending policy. They are also regarded as a sustainable activity in the bloc's Sustainable Finance Taxonomy, which governs whether economic activities are defined as sustainable.

As a further example of a financing driver, the UK government announced a £800M carbon capture infrastructure fund earlier this year, topped by a recent £139M commitment to carbon capture as part of a green recovery, and is currently reviewing responses to a business model consultation. And in the Netherlands, carbon capture facilities are eligible for subsidies under the SDE++ scheme aimed at reducing emissions, and born out of SDE+, the Dutch subsidy for renewable energy.

Finally, the European Commission recently presented its Hydrogen Strategy which, in addition to calling for hydrogen production from renewables, suggests the near-term retrofitting of half of the existing natural gas-based hydrogen production plants with carbon capture costing some €11 Billion. However, the strategy lacks any description of how this would be facilitated. This points out the broader problem around the lack of dedicated carbon capture-specific policy mechanisms on the EU-level and in countries beyond the UK and the Netherlands that can sustain a broader scale-up of the technologies.

The Way Forward

Despite momentum and a solid foundation, both the EU and individual European countries will need to design more ambitious carbon capture deployment-specific policy approaches. How can carbon capture deployment be achieved at scale in the near-term? Which policy mechanisms can reduce cost, incentivize standardization, and streamline project development times moving from demonstration to commercial deployment?

Both the EU, its member countries, and neighbors have chosen the right track by teaming up with companies to develop and pursue dedicated carbon capture and carbon removal infrastructure hubs. But a dozen projects currently in the works are well short of the hundreds that may be needed in Europe, let alone the thousands needed globally, by mid-century. At current prices, the ETS will not drive this development on its own, either. Instead, complementary, bold deployment strategies via carbon capture-specific policy support, similar to the policy frameworks that have slashed the cost of and delivered an impressive built-out of renewables, are needed. This could include deployment subsidy incentives rewarding per ton of CO_2 reductions and eliminating barriers to investment in the technology while further funding geologic storage and CO_2 transport infrastructure development.

Europe's unparalleled climate ambition and track record of success on clean energy innovation sets it up for successfully commercializing carbon capture facilities. Recent successes and a flourishing project list have created positive momentum. But further European advancement will depend on establishing dedicated policy mechanisms. Clean Air Task Force and our European carbon capture partners are currently developing strategies to put those policy mechanisms in place and scale them up to address the enormous challenge of meeting our mid-century global decarbonization targets.