Mind the CCS Gap

Carbon capture storage technology risks captivating business as usual – who will bear the cost of uncaptured carbon?

Executive Summary

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Carbon Capture and Storage (CCS) offers a technology solution for high carbon emitting assets and practices to remain an integral part of energy and industrial systems for coming decades. Climate models targeting goals set out by the Paris Agreement to achieve 2 degrees or beyond 2 degree targets rely on CCS as one of the technologies required to achieve these goals. The current development of CCS considerably lags these expectations, with significant implications for key industries such as utilities, steel, cement and chemicals which rely on CCS to achieve their decarbonization goals. We evaluate the impact of excluding CCS from the IEA scenarios and identify which sectors are more exposed to the risk/opportunities arising.

Carbon capture and storage (CCS) is a set of technologies capable of delivering significant carbon emission reductions from the use of fossil fuels in power generation and in multiple industrial applications. CCS is often presented as one of the key technologies in tackling climate change, to the point where in the majority of climate models, CCS is critical to meeting decarbonization goals set by the Paris Agreement to limit global warming to well below 2 degrees by 2100. In this report, we evaluate the status of CCS technologies, their role in decarbonization pathways and the risk and opportunities they present. We also show a simple sensitivity of what would need to happen in the power and industry sectors to meet decarbonization goals should CCS not be developed or not deployed as foreseen by the International Energy Agency (IEA) climate scenarios.

In the beyond-2-degree-scenario (B2DS) of the IEA (Energy Technology Perspective 2017), the deployment of CCS covers around 20% of the cumulative carbon abatement to 2060 compared to a reference scenario (RTS) where temperature rises by 6 degrees. This equates to a total of 227 Gt captured over the period. CCS deployment is expected to grow across all high emitting sectors in a B2DS. The technology plays a particularly vital role in sectors where Scope 1 emissions are a core part of the production process (e.g. cement, chemicals, steel), and where substitution is constrained because of the economics and scale of alternative technologies. Cumulatively, CCS is responsible for 37% of the emissions abatement in the industrial sectors and 14% in the power sector.

The appeal of CCS technologies is multi-faceted. Firstly, it allows fossil fuel and high emitting production practices to remain an integral part of the energy and industrial systems for years to come. In combination with bioenergy it is among the few existing methods to generate negative emissions – currently still largely a theoretical principle, but potentially a necessary feature in case of meaningful overshoots in decarbonization pathways. And in theory it can be applied at scale, given vast availability of storage, existing capture technologies, and available knowledge of infrastructure requirements.

Despite the intuitive potential of CCS, implementation has been slow at best, with limited investment and perhaps more worryingly, a widening gap between its presence in scenario analysis and absence from policy frameworks. Today, there are 17 operating plants which capture around 30Mt of carbon per annum and a pipeline of projects in development with a capacity of ~40Mt potentially coming on-line by the mid-2020s. This compares to a projected capture rate of 900Mt in the B2DS in 2025 (IEA, 2017).

One key reason for the slow development has been that in most cases, CCS is not commercial under the current carbon pricing backdrop and requires either stronger carbon pricing signals or for governments to fill the funding gap. Studies estimate carbon prices between €60 and €215 would be required to make the technology economic. However, the expectation is that these levels of carbon pricing are not likely to materialize in the near future, potentially opening a dangerous gap in terms of R&D spending, capital allocation decisions, piloting, and regulation development. Carbon capture and utilization (CCU) has potential to grow and is relatively established within the oil & gas sector with

Enhanced Oil Recovery (EOR), and in certain chemical processes. These however represent only a small fraction of the role CCS is expected to play across sectors in the future.

Policy uncertainty is the other main hurdle to development, on areas ranging from responsibility for long-term storage liability, projects spanning international boundaries and the flexibility of the contractual terms of grants. A clear policy framework which incentivizes corporates to early action coupled with government financing are therefore crucial to bridge the period-gap to commerciality, although often budgetary constraints and political motives create serious barriers to long-term planning.

The analysis we performed in our sector reports such as utilities shows that a number of companies will break their carbon budgets in years to come based on existing fossil fuel assets. Technologies like CCS might help to correct or even reverse the lock-in of emissions helping avoid capital being misallocated and stranded assets, but the continued delay in action increases the probability of these risks materializing. While there is no first mover advantage for any single company given the scale of investment required, collaborative cross-sectoral action can be taken to push forward policy makers at the highest level, a strategy that has worked with offshore wind. This matters particularly for some industrial sectors, where the alternative to early abatement strategies and CCS means a radical departure from current business models, with a substantial redefinition of core production processes and a complete overhaul of feedstocks.

Different sectors have so far taken different stances toward CCS and other abatement strategies, with some early-movers and others late in acting. The chemical sector stood out in our analysis as better placed and comparatively more proactive in the CCS value chain, where it plays a key role in developing and using CCS technologies, supplying them to other sectors, while being simultaneously an end user of CO_2. The fact that 6 out of the 17 currently operating plants are chemical plants, and the BASF collaboration with Air Liquide at the NCCC coal-fired power station in Alabama are just examples of this. At the other end of the spectrum lies in our view the cement industry, despite being one of the main users of CCS in most climate models. Currently none of the 37 operating or in development plants are cement ones, and there are only few pilots running globally. The sector’s fragmented and localized nature, largely skewed to non-OECD countries, together with the low margins and low R&D intensity of its activities, explain its reluctance to engage in development of abatement strategies, and are likely to make this sector a relative laggard in any decarbonization pathway.

A simplified sensitivity analysis based on the IEA B2DS highlights significant challenges for a world without CCS. The power sector would require significant displacement from other low carbon technologies such as nuclear and renewables, with gas replacing coal in scenario analysis. Given the limitations posed by nuclear power and the large existing asset base in coal fired power generation, scope for maneuver is limited. Within industry the challenges are even greater, with CCS accounting for 37% of emissions abatement in the B2DS. Substitute technology options are even more limited with a number of substitute technologies in turn relying on CCS. Our sensitivity analysis on the cement sector for example, shows that if CCS needs to be replaced, material efficiency measured by the clinker ratio would need to improve by around 30% relative to a 10% improvement required in the IEA B2DS.

CCS carries with it numerous and far-reaching implications with the current risk/reward unbalanced, in terms of the benefits of success vs cost of failure, timing and who bears the cost of delayed deployment. This trade-off requires careful handling and active decision making amongst key actors such as corporates and policy makers which is largely absent. CCS development should be encouraged and forcefully pursued and should remain a technology option of decarbonization pathways given its abatement potential. At the same time however, the risk of failure should be hedged more credibly.

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