

Potential, challenges and risks of CCS and CCU for Energy Intensive Industries

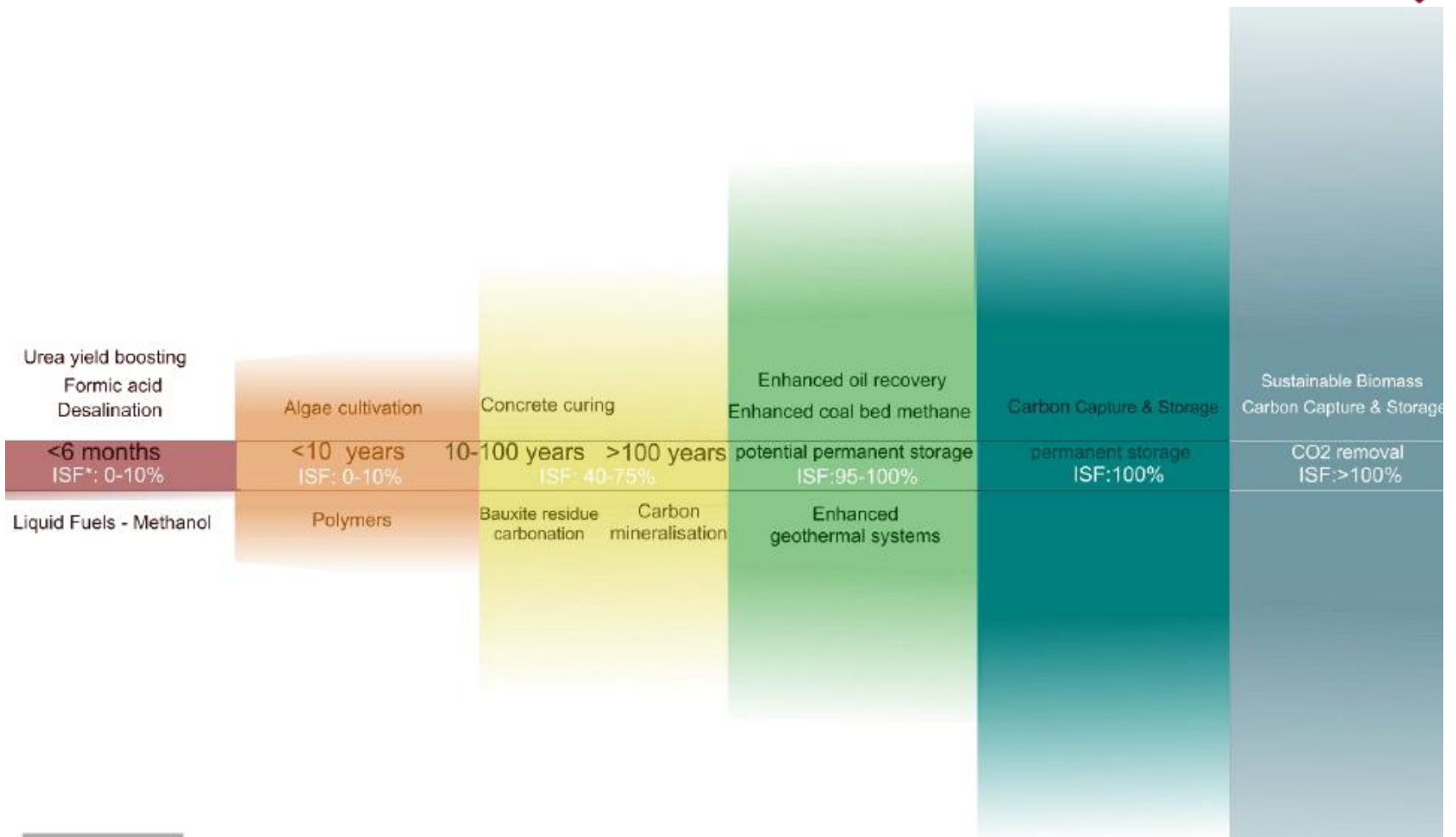
Introduction- Classifying CCU and CCS



- CCU is a term applied to a wide range of processes and products, which vary in their climate benefit
- Introduces concept of “sink factors”:
- Recommends classification of CCU based on permanence of carbon abatement.

“A risk is that the reuse of captured industrial fossil C or CO₂ could contribute to a lock-in of carbon-intensity in sectors where other options exist or are being developed.”

Introduction- Classifying CCU and CCS



Role of electrification in decarbonising Energy Intensive Industries



- Assessment of the electrical energy requirements and CO₂ abatement potential of major industrial electrification routes has shown that relying on electrification alone is not an achievable decarbonisation pathway for European industrial production.
- Electrifying European chemical process would require 140% of total current electricity generation in Europe.
- Converting CO₂ to fuels requires very large electricity inputs. Power to fuels is electricity intensive, requiring many multiples the electricity input compared with direct electrification of industrial process.
- CO₂ capture, transport and storage places comparatively small additional demands on low carbon electricity. Low carbon electricity is required for CO₂ compression for transport and storage.

Role of electrification in decarbonising Energy Intensive Industries

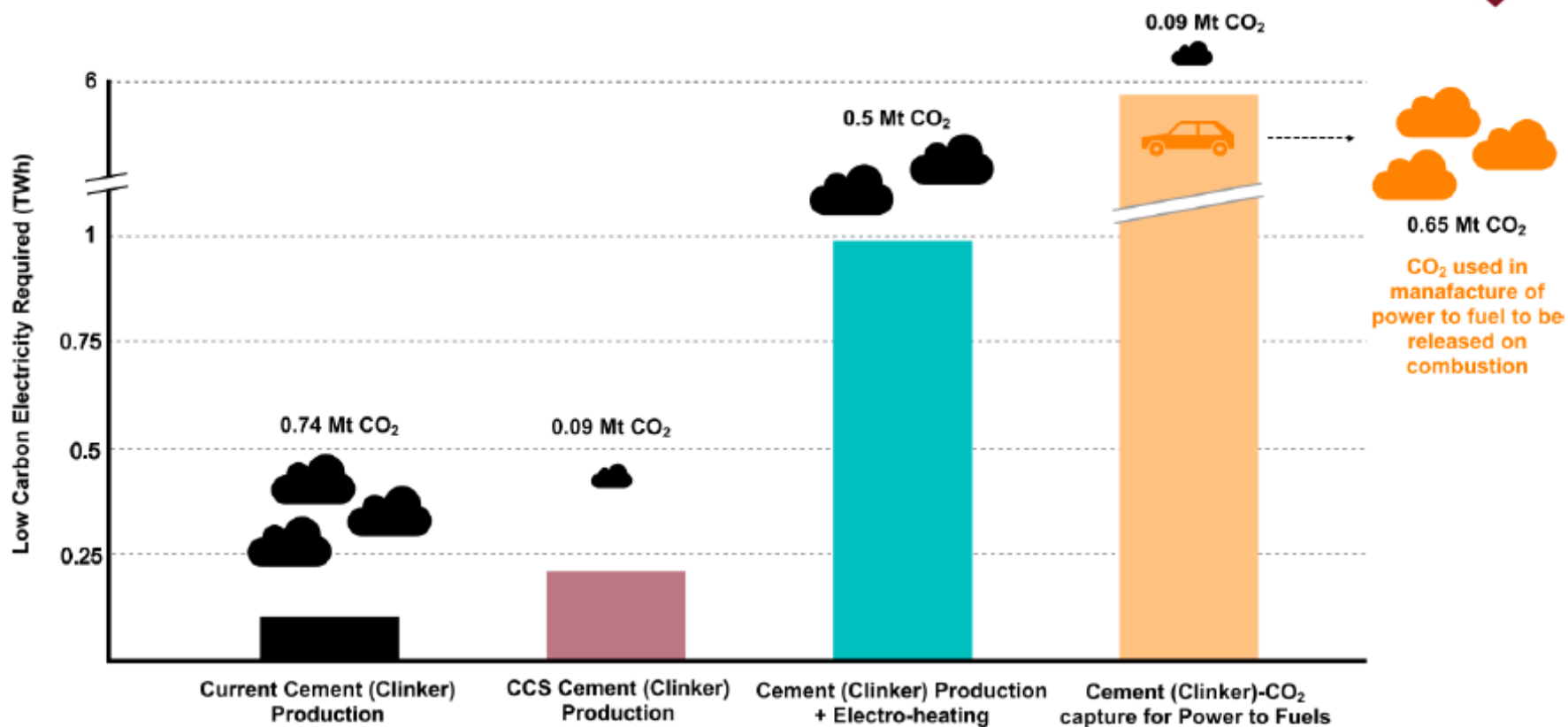


Figure 1 Reference cement production facility of 1 million tonnes per annum. Comparing the electricity requirements and CO₂ reduction of carbon capture and storage, electric heating, CO₂ conversion via power to fuels.⁸

Decarbonisation roadmaps for European EIs

- Analyses 2050 decarbonisation roadmaps produced by steel, cement, chemicals and pulp and paper sector
- Between 9-20% of carbon that needs to be abated will be used for CCU

“Given the high levels of carbon sequestration needed to achieve significant levels of decarbonisation within Energy Intensive Industries, provision of both infrastructure and market structures to enable deployment of CCS within these industries is crucial.”

“Focusing on CCS as the dominant route to enable the levels of sequestration required does not exclude emitters from choosing to sell CO₂ for use where there are opportunities to do so. However, any application for CCU must have a high sink factor to be comparable to the carbon abatement potential of CCS and as such, eligible for climate mitigation funding.”

Decarbonisation roadmaps for European EIs

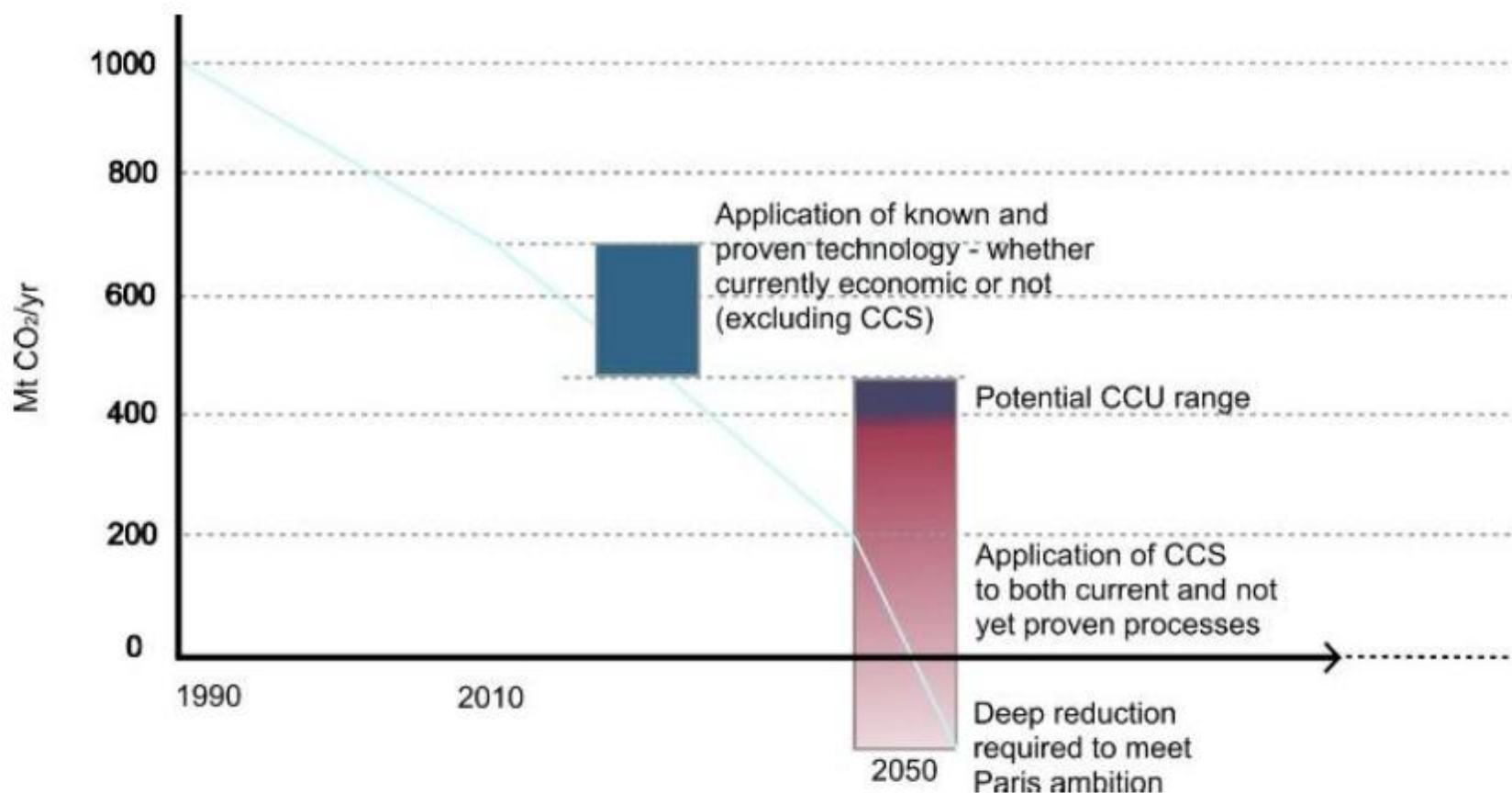


Figure 6 Potential in the Energy Intensive Industries within the Paris agreement target setting indicates that more emissions reductions are needed by CCS/CCU than before. Includes EU Steel, Cement, Chemicals and Pulp & Paper Industrial emissions

Economics of CCU and CCS



- ETS currently provides an insufficient price signal to deeply cut CO₂ emission from energy intensive industries, and will not drive development of CO₂ transport and storage infrastructure
- Commercial uses for CO₂ could incentivise investment in CO₂ capture at industrial sites, but will not direct resources to the timely development of shared CO₂ storage.
- Short term focus on CCU must not delay development of CO₂ storage capacity. CCU and CCS must be developed in parallel
- By providing revenues independent of the EUA price, CCU can enable investment in the capture of small CO₂ volumes and de-risk the integration of capture with industrial process, with a view to then scale-up the capture operations as CO₂ storage becomes available.

Economics of CCU and CCS

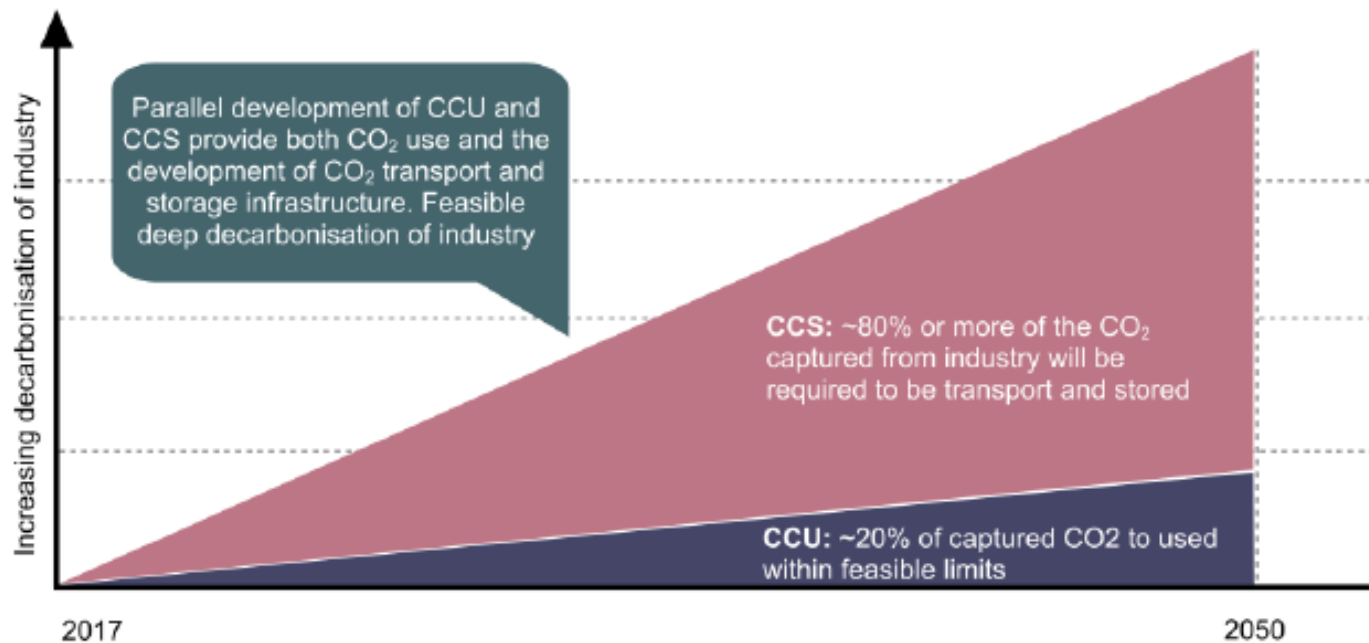


Figure 8 Co-development pathway of CCU and CCS provides a long-term pathway to deep emissions cuts in energy intensive industries

Conditions for success for CCU and CCS

- CCU can help to mitigate a small proportion of emissions from sectors that have uses for CO₂ *that result in real world full life cycle CO₂ emissions reductions.*
- One key barrier for implementation of CCS (and many CCU) projects is that they will not result in economically feasible business cases in the current framework.
- The second key barrier is that technologies are often not available at scale, or will benefit from cost reductions only with wider deployment and learning.
- Imports from non- or less-carbon constrained exporters should be subject to appropriate constraints to ensure a level playing field
- Without prospects for access to storage, industry is unlikely to risk large investment in capture technology at scale, which given CCU market limitations would become stranded assets in the absence of transport and storage infrastructure.

Conclusions and recommendations



- EU & Member States' climate policy must be linked to European climate change commitments. As public funds for the purpose will always be limited, it is crucial that those funds are spent in a way that can enable the achievement of long-term targets.
- Climate solutions must be merited not only on their impact in one specific sector, but on the pressure they place on resource use that could be more efficiently spent in other sectors. For example, the production of hydrogen through renewable energy for fuels has limited climate impact (due to the eventual emission of the CO₂ from a vehicle), and the vast electricity required to produce the hydrogen means that the electricity could be used more effectively in the sector in question, in this case for electromobility.
- There is not a 100 % accurate answer to exactly how much CO₂ needs to be captured, utilised and stored from EU energy-intensive industries. However we know substantial amounts of storage will be required, therefore providing EU industry with shared infrastructure networks for CO₂ transport with access to large-scale storage should be seen as a no-regrets option.
- 5. As long as Europe fails to put in place such enabling infrastructure as a public good, industry will inevitably be looking for short-term, commercial opportunities to mitigate some of its CO₂ liabilities – not mainly from a climate perspective, but for the purpose of retaining economic activity and jobs.