Carbon Capture and Storage (CCS) can contribute to meeting Paris Agreement GHG emission ambition.

- The Paris Agreement and the IPCC (Intergovernmental Panel on Climate Change) 1.5°C report a very ambitious global trajectories that can only be achieved **with a combination of a wide range of technologies** and new business models. Possible technology pathways have been investigated for the EU chemical industry[1] and for EU's energy-intensive industries[2,3]
- Different options and technologies are needed to address climate change. Besides avoiding emissions in the most effective ways, remaining emissions need to be reused/recycled (CCU), stored (CCS or deposition of carbon in solid forms) or compensated to reach carbon neutrality.
- Carbon Capture Storage (CCS) involves the capture, transport and permanent storage of CO2.
- CCS has a role to play in meeting the EU's climate commitment and is recognized by the IPCC, IEA and in SET plans. According to the IEA (2017), CCS will need to provide 14% of all global cumulative CO2 reductions by 2060 to meet the IEA's '2ºC' (2DS) scenario and will provide one third of the incremental CO2 reductions in the IEA's 'Below 2ºC' (B2DS) scenario. Moreover, the IPCC (2014) reported that 2ºC scenarios, which use alternatives to CCS, would on average cost more than twice as much (a 138% increase).
- CCS is also a multi-pathway and cross-sector climate solution for ensuring deep emissions reduction in power, decarbonization of natural gas to hydrogen, in industrial processes, and for bioenergy (bio CCS to enable negative emissions). These solutions enable low carbon heat, low carbon transport and low carbon industries.

Carbon Capture and Storage (CCS) is being deployed

- There are currently 43 commercial large-scale CCS facilities around the world of which 18 in operation, 5 in construction and 20 in various stages of development. In Europe, there are currently two operating projects (both in Norway), and several CCS projects that are in early or advanced development (Netherlands 'PORTHOS' project; Norway 'Northern Lights' project; UK 'H21' project; Netherlands 'H2M' (Hydrogen 2 Magnum) project)[4].

[1] DECHEMA (2017): Low carbon energy and feedstock for the European chemical industry

[2] VUB report (2018): "Industrial Value Chain: A Bridge towards a Carbon Neutral Europe"

[3] EU Commission (2018): "A clean Planet for All"

[4] Global CCS Institute report, 2019

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Carbon Capture and Storage (CCS) can work for large and smaller CO2 sources, but CO2 source concentration levels are key

- CCS could be an option for decarbonising large point sources of CO2 as well as for more diffuse smaller emitting sites via CO2 transportation infrastructures. To address diffused CO2 emissions from smaller industrials sites, the development of and proximity to larger scale capture and logistic infrastructures will thus reduce CCS costs per tonne of CO2.
- Atmospheric carbon dioxide is abundant but as such is currently not an attractive carbon source due to high capture technology costs as it is very diluted with only some 0.04% CO2 by volume in air. However, the use of CCS with renewable biomass (BECCS – Biomass Energy with Carbon Capture and Storage) is one of the few carbon abatement technologies that provides an opportunity to create permanent negative carbon emissions, i.e. the removal of CO2 from the atmosphere.
- Among Chemical manufacturing activities, CCS should primarily benefit **large emission activities** (e.g. Steam Crackers, Ammonia, Hydrogen, Soda ash, Polymers,…) and therefore maintain value chains, save jobs and create new employment.

Carbon Capture and Storage (CCS) still has some economic limitations and barriers to be addressed

- Capturing and compressing CO2 will increase the energy needs of an operation. There is thus a need for better consistency when proposing political targets on energy efficiency and GHG reductions, regarding industrial policies and long-term ambitions.
- CO2 capture costs are a significant component of the CCS value chain. Capture costs can be over €100 per tonne of CO2, but it can also be as low as €20 per tonne for applications where CO2 removal is part of the production process e.g. in ethanol production. In general, the cost of capture depends on the purity and concentration of the CO2 stream of the respective facility and is lower for those plants that emit higher concentrated streams of CO2. The total cost of CCS also depends on the infrastructure available and cost of capital and labour in the location where the plant is being constructed (Global CCS Institute, 2019)
- CCS is a proven technology, is regulated in the EU (EU CCS Directive 2014), and benefits economically via transferred CO2 reducing regulated installation emissions under EU ETS.
- Underground CCS storage is still faced with societal concerns. Public awareness of the technology and value of CCS in delivering the goals of the Paris Agreement is generally low. Increased engagement will be necessary to secure public support for individual carbon storage projects.
- The higher EU ETS carbon prices could stimulate investment in CCS projects. Even though some existing CCS pilots and infrastructures have been enabled with the help of public funding[5], continued transitional incentives and targeted policy for demonstration and initial scale up will be crucial to unlock the full potential of CCS in Europe.

[5] However, public support for CCS accounts for some 3% of that for renewable energies (F. Birol, IEA, 2018)

Carbon Capture needs coherent regulation: transport

- The current CCS legislation only recognises CO2 that is transported by pipeline[6]. When CO2 is transferred by barge (in liquid phase) from the source to the next storage location (for later injection in the depleted gas field), it is regarded as an emission.
- Solution: Not only transport by pipeline but also other transport modalities (e.g. by barge) also across borders should be acknowledged. Therefore, legislation needs to be modified to include other transport modalities.

CCS projects need demonstration at scale to reduce technology costs via 'learning by doing'. Public support will help.

In view of globally asymmetric climate policies and the significant investment costs, a harmonized EU policy approach7 towards enabling a broader underground CCS implementation (e.g. by providing infrastructure to connect sources and sinks) need to be considered.

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About Cefic
Cefic, the European Chemical Industry Council, founded in 1972, is the voice of large, medium and small chemical companies across Europe, which provide 1.2 million jobs and account for 15% of world chemicals production.

[6] CCS Directive, 2009