HAUT CONSEIL
pour le CLIMAT

STATEMENT ON THE **STRATEGY FOR CARBON CAPTURE, USAGE AND STORAGE (CCUS)**

A REPORT OF THE
HIGH COUNCIL ON CLIMATE

NOVEMBER 2023

EXECUTIVE SUMMARY

Net zero emissions scenarios at the global (IPCC, IEA), European (EU) or national (SNBC, Ademe) level take into account the use of carbon capture and storage (CCS) technologies to reduce emissions from the energy and/or industrial sectors and/or to generate "negative emissions", in addition to strengthening natural sinks in order to offset residual emissions and achieve net zero emissions.

The CCS technological value chain covers CO_2 capture, transport and storage activities, and may also enable all or part of the captured CO_2 to be valorised ("Carbon capture, usage and storage", CCUS).

CCS technologies present varying degrees of maturity for each segment of their respective value chains, as well as specific constraints that condition their deployment and impose lead times for operational implementation. The CCS applied to hydrocarbon exploitation is historically mature through enhanced oil recovery (EOR) and natural gas processing. The most advanced segments, but still lacking technological and operational maturity, are those of CO_2 capture, transport (by pipeline, rail, truck or ship) and storage at onshore or offshore sites. In the most favourable technical configurations, total CCS costs, including transport and storage, are estimated at between €60/tCO_2 and €150/tCO_2.

The processes involved in CCS technologies are energy-intensive on the whole, and generate an "energy penalty" that needs to be assessed for the climate relevance and economic viability of the projects. Additional water resource requirements, of the order of 2 m^3 to 4 m^3 of water/tCO_2 captured, and chemical inputs for CO_2 capture also need to be taken into account.

On a global level, Europe and the United States are among the regions in which CCS is undergoing the most active commercial development. The number of CCS projects worldwide is growing, but there are currently only 37 operational installations, which is still modest in comparison with those within decarbonisation scenarios. CCS technologies applied to biomass ("Bioenergy with CCS", BECCS) or of direct capture of CO_2 from the atmosphere ("Direct Air CCS", DACCS) are at a less advanced stage of maturity or deployment. BECCS could be of interest in biomass energy recovery, as a complement to the reinforcement of natural carbon sinks, but the potential of this technology will be limited by the land available for biomass energy production without conflicts of use with food security, land use including carbon sinks, land rights and water resources. DACCS, on the other hand, is based solely on the economic value of negative emissions, given its current costs of around US$ 350 to US$ 550/tCO_2, and involves significant energy penalties.

In France, the use of CCS depends on the availability of storage volumes and sites, the real potential of which is difficult to quantify due to a lack of available data.

The lack of a rigorous regulatory framework means that there remains uncertainty regarding the carbon accounting of CCS, the responsibilities of the various stakeholders, and the investment strategies in these technologies.

Given these limiting factors in terms of economics, energy, technology, the environment, regulations and storage sites, the use of CCS should be reserved as a priority for applications aimed at reducing residual emissions that cannot be eliminated at source, as a complement to energy saving and efficiency measures.

A multi-criteria analysis by the HCC concludes that CCS is appropriate for decarbonising industry, particularly in the cement sector where decarbonisation solutions are limited. The use of CCS in other industrial sectors can be ruled out if there are decarbonised alternatives, such as in hydrogen production (by electrolysis using low-carbon electricity) and in the steel industry (by using decarbonised hydrogen and electrifying blast furnaces). The deployment of CCS in certain industries would also make it possible to develop CCS technology in France and the EU, in order to explore the possibility of other subsequent uses, in particular for BECCS if the conditions for deployment are met.

CO_2 recovery in the context of CCUS is currently marginal, and is driven more by considerations of diversifying the raw material supply chains of the industries concerned by these applications than by any climate imperative. The potential contribution of the CCUS to the climate objectives is limited and conditional on fossil intrants substitution, carbon looping, availability of biomass and energy and requires monitoring.

On the basis of these elements, the HCC concludes that CCS can be used as a lever in the projections of the French National Low-Carbon Strategy (SNBC) and in its operational implementation, to support emissions reductions in the industrial sector. Taking into account the time required to deploy these technologies, the potential targeted by the government's CCUS strategy of capturing 4 to 8 $MtCO_2$ per year by 2030 appears ambitious, given the projects already underway and the lack of maturity of the storage phases. The potential targeted by the government's strategy of capturing 15 to 20 $MtCO_2$ per year by 2050 is consistent with available knowledge. These projections need to be refined by further studies and deployment experiences to establish their operational limits. For the time being, the dependence of the SNBC scenarios on negative emissions from BECCS and DACCS must be limited to its minimum necessary contribution, while recognising the need for possible mobilisation of these CO_2 elimination technologies as a last resort solution for achieving net zero all-GHG in 2050.

RECOMMENDATIONS

1. Give priority to deep decarbonisation solutions, for which CCS should not be substituted, as well as the conservation and enhancement of carbon sinks in forests and soils.

2. Develop CCS in France as a lever for decarbonising concentrated industries that have no alternatives, anticipating in the National Low-Carbon Strategy (SNBC) a limited potential of around 2-4 $MtCO_2$ per year by 2030, and 15-20 $MtCO_2$ per year by 2050.

3. Prioritize R&D funding to remove uncertainties about geological storage capacity in France, technological potential, impact on water resources, biomass availability for BECCS, and power system sizing to take into account the CCS energy requirements.

4. Clarify the regulatory framework and liability regime for CCS projects, in particular by ratifying the amendment to the London Protocol, develop monitoring and reporting processes, and facilitate public debate.

HAUT CONSEIL
pour le CLIMAT

STATEMENT ON THE STRATEGY FOR CARBON CAPTURE, USAGE AND STORAGE (CCUS)

www.hautconseilclimat.fr
@hc_climat