Future climate and energy policy - a Strategy for long-term EU greenhouse gas emissions reductions

Supporting paper from the Zero Emissions Technology and Innovation Platform (ZEP)

The European Zero Emission Technology and Innovation Platform (ZEP) welcomes the opportunity to input into the Commission's proposal for a Strategy for long-term EU greenhouse gas emissions reductions.

ZEP is a European Technology and Innovation Platform (ETIP) under the Commission's Strategic Energy technologies Plan (SET-Plan), and acts as the EU's technical adviser on the deployment of Carbon Capture and Storage (CCS).

1. CCS is a multi-sector and multi-pathway climate solution

1.1. Carbon Capture and Storage (CCS) is not a sector-specific technology, but provides a decarbonisation solution for multiple sectors to support a number of routes to a low-carbon or net-zero carbon Europe in 2050. By removing CO_2 emissions from sites of production, CCS enables production of electricity, hydrogen and industrial products (steel, cement, plastic, etc.) without the carbon footprint. Furthermore, technologies to remove CO_2 from the atmosphere are dependent on the availability of CCS (i.e. Direct Air Capture and Bioenergy with CCS). These technologies are likely to be needed to achieve a balance of emissions and sinks in 2050 or in the second half of the century in line with the Paris Agreement.

1.2 Whether a high-electrification pathway or a more mixed portfolio of low-carbon technologies is used to meet 2050 targets, CCS has an essential enabling role. The high volumes of new electricity demand required by a high-electrification pathway will require dispatchable and flexible power to complement high levels of renewable energy in the power system, which can be provided by CCS. In a more mixed pathway involving other low-carbon energy vectors, CCS can enable the production of large volumes of low-carbon hydrogen for use across transport, heat and industry. In all scenarios, CCS remains the only way of permanently removing process emissions from heavy industry.

1.3 Norway has been permanently storing CO_2 offshore in designated geological storage in the North Sea for over 20 years. There are 21 CCS projects operating or under construction globally today. The main barrier to implementation of CCS in Europe is therefore not technical in nature, but the result of no business model for CCS existing in the EU.

1.4 If CCS is to contribute to 2050 climate targets this issue needs to be urgently overcome. Large-scale deployment of CCS should be a priority focus for the long-term strategy as the EU begins to look at the solutions needed for deep emissions reduction across the economy.

2. CCS is essential to meeting 2050 targets in a way that is cost effective, and supports a just transition to a low-carbon economy

2.1. CCS is the only solution for industrial process emissions at existing sites in Europe. If the EU is to achieve deep emissions reductions while at the same time retaining valuable industries such as steel, cement and chemicals within the EU, it is essential that CCS is available to these industries. In Germany alone, over 50 million tonnes of residual process CO2 emissions would remain unabated without CCUS, risking about 3.5 million steel-related jobs alone, and several hundred thousand more in the chemicals and cement sectors[1].

2.2 Furthermore, social fairness entails taking a cost-effective route to decarbonisation, given that much of the associated cost will ultimately be paid by consumers or taxpayers. It is estimated that a portfolio of solutions which includes CCS, biomethane and hydrogen as part of a balanced energy mix, delivers a saving of over €1,150bn compared to a pathway without CCS[2]. This compares to €1,000bn modelled in ZEP's 5th Market Economics report.

Recommendation: Macroeconomic modelling should be undertaken at both an EU and national level to understand the impact of different pathways on jobs and growth, with value of solutions being presented alongside cost.

Further reading:
ZEP, Role of CCS in a Below 2 Degrees Scenario
http://www.zeroemissionsplatform.eu/news/news/1689-launch-of-zep-report-qrole-of-ccus-in-a-below-2-degrees-scenarioq.html
ZEP, Market Economics 5th report http://www.zeroemissionsplatform.eu/library/publication/271-me5.html

3. CCS can provide choice and flexibility in the energy sector

3.1. The energy mix of EU Member States varies radically. A variety of solutions will be needed to support the transition to a low-carbon economy; however some have considerably larger potential for emissions reduction than others. CCS can provide high volumes of both flexible low-carbon electricity and low-carbon hydrogen, which can each be used as solutions in the power, heat, transport and industrial sectors.

3.2. Hydrogen production through Steam Methane Reforming (SMR) or Autothermal Reforming (ATR) of natural gas with CCS (also referred to as "blue" hydrogen) is the cheapest form of low-carbon hydrogen production today; it can also provide large volumes of low-carbon hydrogen in the timeframe to 2050. Hydrogen production through electrolysis of water using renewable energy is an R&I objective under Horizon Europe; however the large volumes of cheap renewable electricity needed to make this a solution at scale means that commercialisation of "blue" hydrogen is a more feasible solution in the timeframe to 2050.

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[1] https://bdi.eu/publikation/news/klimapfade-fuer-deutschland/
[2] http://www.poyry.com/sites/default/files/media/related_material/poyrypointofview_fullydecarbonisingeuropesenergysystemby2050.pdf.

3.3. Often energy systems modelling assumes that carbon capture technologies have a maximum CO_2 capture rate of 90%. A recent study by DG ENER used this assumption to conclude that Direct Air Capture (DAC) would be needed to mitigate the final 10% of emissions, making this an expensive option[3]. However, commercially available CCS technologies can already achieve a capture rate of between 85% -95%; next-generation technologies at lower TRLs such as Chemical Looping Combustion can enable 100% capture rates[4]. If early-stage technologies such as DAC are represented in energy system models, then less mature, but proven, capture technologies with >95% capture rates should also be included.

Recommendation: Prioritise development of low-carbon hydrogen from CCS alongside production from electrolysis under Horizon 2020, to ensure low-carbon hydrogen is available at scale within the timeframe to 2050.

Recommendation: Ensure energy systems modelling does not assume 90% CO_2 capture rate as "maximum" capability for CCS without qualification.

Further reading:
ZEP Commercial scale feasibility of clean hydrogen
http://www.zeroemissionsplatform.eu/news/news/1669-launch-of-zep-report-commercial-scale-%20feasibility-of-clean-hydrogen.html

4. CCS remains the only solution for industrial emissions in Europe

4.1. Industrial CCS is included within the "energy" cluster of the Horizon Europe proposal; however many industry CO_2 emissions are emissions from energy use. The hardest-to abate emissions are process emissions, such as the CO_2 produced by the calcination process in cement production. Capture is the only solution for such emissions at existing plant.

4. 2. New technologies are in early stages of development which in future will remove process emissions in some sectors, such as a hydrogen reduction furnace for steel. These solutions would require huge amounts of renewable electricity were the demand for hydrogen to be met through electrolysis. A ZEP report in 2017 demonstrated that to decarbonise all new EU steel production in Europe would require 50% of the total offshore wind capacity of the North Sea.

4.3. Carbon Capture and Utilisation (CCU) can provide an important value stream for CO2 and therefore incentivise industry to develop CO2 capture. However, the global existing market for CO2 today is about 80Mt; even with the development of new products, the potential of CCU to contribute to emissions reduction is small. Furthermore, the CO2 in products will eventually be released back to atmosphere, either relatively quickly as in the case of fuels, or over a longer term in case of building products.

4.4. ZEP's position is that any CCU activity funded through climate mechanisms should be able to demonstrate a significant CO2 saving over the lifecycle of the product.

[3] https://ec.europa.eu/energy/sites/ener/files/documents/final_draft_asset_study_12.05.pdf
[4] https://ieaghg.org/exco_docs/2017-TR3.pdf

Recommendation: CCS needs to be available to industry in order to deeply decarbonise the European economy. CCU should be developed alongside CCS where it can add economic value; but should not be viewed as an alternative to CCS for industry.

Further reading:
ZEP, Climate solutions for EU Industry http://www.zeroemissionsplatform.eu/library/publication/276-climate-solutions-for-eu-industry.html

5. Research and Innovation

Horizon Europe

5.1. Initiatives in industrial hubs such as Rotterdam in the Netherlands and Teesside in the UK seek to combine CO2 capture with both permanent storage (CCS) and utilisation (CCU). Under the proposals for Horizon Europe, industrial CCS is included in the "climate, energy and mobility" cluster whereas CCU is included in "Digital and industry". This could be a barrier to effective R&D to accelerate deployment of CCUS in industrial clusters.

5.2. Additionally, R&D funding for low carbon hydrogen production is currently restricted to electrolysis. Reforming of natural gas with CCS should also be eligible given that this will be able to provide the volumes of low carbon hydrogen needed for use in industry or decarbonising heat networks in the coming decades. This would bring Horizon Europe in line with other international innovation programmes such as Mission Innovation, which lists hydrogen production using CCS as a Priority Research Direction for CCUS.

SET-Plan Implementation Plan

5.3 The Strategic Energy Technologies Plan is a key research component of the Energy Union. The SET-Plan Implementation Plan for CCS and CCU was approved by the Commission in September 2017. The Implementation plan sets out eight R&I activities for completion by 2020 in order to meet SET-Plan targets. These include development of commercial and pilot-scale CCS and CCU projects. Achieving these R&I activities would greatly accelerate deployment of CCUS at scale in Europe within the timeframe needed to meet 2050 climate targets.

Recommendation: Revise the proposal for Horizon Europe to ensure industry can effectively access funding for developing CCU and CCS, by including industrial CCS in the "digital and industry" cluster.

Recommendation: Give low-carbon hydrogen production by SMR/ATR with CCS equal treatment to hydrogen produced through electrolysis under Horizon Europe.

Further reading:
SET-Plan Implementation plan for CCS and CCU
https://setis.ec.europa.eu/system/files/set_plan_ccus_implementation_plan.pdf

Commercial innovation

5.4 As well as bringing innovative technologies to market, innovation in business models and institutions is also needed to drive deployment of CCS. As explored elsewhere in this response, the development of a "Market Maker" entity to coordinate development of infrastructure will be key.

6. Financing

6.0 Successful funding of European CCS projects will require coordination of Member State, European and private sources of finance. For the pre-construction phase of a CCS project grant funding is necessary; funding mechanisms to enable capital and operational costs to be recovered, and appropriate risk allocation across the CCS chain, are also essential.

6.1 ZEP's position is that financing for the first CCUS projects in Europe can be achieved using existing funding mechanisms, provided they are implemented in a way that these projects are eligible. CCS and CCU projects can both be supported under the ETS Innovation Fund, the design of which will be decided by a Delegated Act. The previous NER 300 programme was highly restrictive in its definition of eligible technologies and requirements for delivery of full-chain CCS projects. Of the twenty renewable energy projects and one CCS project awarded funding through NER 300 only six renewable energy projects are operating today.

6.2 ZEP has produced detailed recommendations for the design of the Innovation Fund, to ensure CCS projects can be delivered. In particular:

- ZEP recommends that "Market Maker" projects which develop CO2 transport and storage for industrial use separate to the development of capture projects be supported under the fund.

- Funding should be targeted at projects or technologies that have the largest impact on reducing GHG emissions and on reducing technology costs over time. Minimum capacity/scale requirements should be applied to funding to focus support on the most impactful projects.

- It is important that EU funding sources can be linked to enable progression of projects to a commercial scale

6.3 Four projects for cross-border CO2 transport are currently listed as Projects of Common Interest under the TEN-E regulation and are therefore eligible for funding under the Connecting Europe Facility. Cross- border transport of CO2 to suitable storage sites can provide a solution for countries without access to their own offshore CO2 storage capability. In order for this to happen, a strategic approach to CO2 transport infrastructure is needed across Europe. Alongside a CO2 storage atlas (Activity 4 of the SET-Plan Implementation Plan for CCUS) a strategic plan for CO2 transport should be progressed.

6.4 Finally, the European Climate Foundation's Industrial Innovation for Competitiveness (I24C) platform commissioned a report in 2017 that looked at potential sources of funding for industrial CCS clusters in Europe, including public and private funding ant an EU and member state level. The report concluded that there is a gap in funding until the early 2030s which could be addressed by enabling access to the European Structural Funds (in particular the Regional Development Fund) for CCS projects, which are currently excluded. This could be justified by the ability of CCS to enable a socially fair transition in less developed regions with risk of significant job losses due to carbon leakage in the absence of a decarbonisation solution[5].

Recommendation: Ensure the Innovation Fund Delegated Act allows for part-chain CCS projects, including "Market Maker" projects.

Recommendation: Create a strategic plan for CO2 infrastructure development in Europe as part of the EU's long-term climate strategy

Recommendation: Allow CO2 infrastructure projects to access Regional Development Funds to enable a just transition in areas with high industrial emissions

Further reading:
ZEP position paper on funding a Market Maker through the ETS Innovation Fund
http://www.zeroemissionsplatform.eu/library/publication/279-market-makers.html
ZEP Executable Plan for CCS in Europe
http://www.zeroemissionsplatform.eu/news/news/1650-zep-executable-plan-for-ccs-in-europe.html

[5] http://i2-4c.eu/wp-content/uploads/2017/10/Deployment-of-an-industrial-CCS-cluster-in-Europe_v2.2_final_web.pdf