



## ZEP, IMPACTS9 and EERA Response – Past, present and future of the Horizon R&I programmes 2014-2027

The Zero Emissions Platform (ZEP), the CCUS SET Plan IMPACTS9, and the European Energy Research Alliance (EERA) welcome the opportunity to provide input to the European Commission's consultation on the 'Past, present and future of the EU's Horizon research and innovation programmes 2014-2027'.

### Background

The at-scale deployment of Carbon Capture and Storage (CCS), Carbon Capture and Utilisation (CCU) and low-carbon hydrogen, along with the supporting transport and storage infrastructure, is essential for the decarbonisation of the European Union (EU) industrial and power sectors and to deliver negative emissions. The accelerated deployment of these solutions will thus support the achievement of the EU net-zero and net-negative ambitions, as outlined in the European Green Deal and the European Climate Law.

A favourable investment framework is necessary to support these technologies along the innovation cycle – from R&I to commercialisation. The Horizon programme and the Innovation Fund have been instrumental in driving the development of these technologies. We also welcome the new Horizon Europe Work programme for 2023-2024 which includes calls for R&I activities on CCS and CCU, including carbon removals and transport and storage demonstration projects.

Below we highlight priority areas for CCUS Research and Innovation (R&I) activities. Collaboration, knowledge sharing and coordinated calls at the regional, national and EU levels should be fostered to fully explore the potential of EU funding programmes. In addition, synergies with other EU programmes (e.g., Innovation Fund, Connecting Europe Facility, Important Projects of Common European Interest, Projects of Common/Mutual Interest) should be explored so that priority areas for R&I can be better tailored to commercial applications.

### Key R&I solutions to support CCS/CCU deployment and scale up

CCS and CCU applications, as well as CO<sub>2</sub> infrastructure, are deployable today and already operational in Europe, although not at scale. Some challenges remain, where further R&I is needed. Recommended focus areas for the CCS/CCU value chain are:

#### *CO<sub>2</sub> Capture:*

- Developing flexibility in capture systems
- Integrated capture systems for industry clusters, exploring multi-user capabilities
- Cost-effective small-scale or highly flexible capture systems

#### *CO<sub>2</sub> Transport:*

- Building, operating and managing complex transport networks
- Developing standards / guidelines for CO<sub>2</sub> quality
- Developing the knowledge basis on the impact of CO<sub>2</sub> composition and impurities – to support emitters and the development of sufficiently flexible quality specifications for CO<sub>2</sub> transport and storage projects. This can also inform the development of Europe-wide CO<sub>2</sub> specifications, with the view of supporting a cross-border, interoperable transport network.

#### *CO<sub>2</sub> Storage:*

- CCS solutions for remote emitters (e.g., combine CO<sub>2</sub> storage and geothermal systems)
- Effective and efficient monitoring strategies
- Develop solutions for long-term risks (e.g., EU or national trust funds)
- Develop methods for site conformance monitoring and assessment
- Develop performance standards for storage projects, supporting storage development and avoiding creating unnecessary barriers
- Explore solutions for legacy wells, namely their cost-effective reparation, and techniques for their examinations and characterisation
- Speed up CO<sub>2</sub> storage development and decreasing the time it takes for a storage site to get to permitting stage (e.g., funding to explore potential storage sites)
- Map storage capacity in Europe – a Europe-wide storage atlas will support strategic planning. It is recommended to leverage on the experience of Member States that have developed national storage maps. The use of big data and artificial intelligence applications can also be explored for this purpose. The functionalities and benefits of the Atlas is further explored in the IWG9 report '[Recommendations on the Steps to establish a R&I Activity 4 European Storage Atlas](#)'.
- Support to pre-commercial CO<sub>2</sub> geological storage appraisal activities, to speed up storage site (commercial) development, to support planning of CO<sub>2</sub> capture projects (and related source to store linkages), and help closing the storage capacity gap. This is further explored in the IWG9 report '[Unlocking European CO<sub>2</sub> Storage Capacity](#)'.

#### *Cross-cutting:*

- Capacity building of competent authorities / regulators
- Map supply chains of CCS and CCU applications, identifying the sourcing of key materials and forecasting demand
- Metering, supporting the identification of biogenic and fossil CO<sub>2</sub> streams
- Social acceptance of CCS and CCU solutions
- Harmonisation of life cycle assessment (LCA) and sustainability assessment for the use of biomass (e.g., in Bioenergy with CCS applications)

Are there European scientific areas of strengths or weaknesses which should be prioritised in Horizon Europe to keep Europe at the forefront of international scientific competition?

The transition to net-zero and, subsequently, net-negative will require a portfolio of technologies, including CCS and CCU. Below are recommended areas in the CCS/CCU space:

- CCS for industry: adaption of current capture methods to new areas, development and deployment of higher TRL capture, and cost reduction
- CCS for flexible power generation
- The role/scale of different CCU applications
- Low-carbon hydrogen: the role of CCS-enabled low-carbon hydrogen in meeting early demand and scaling up the hydrogen market
- The role/scale of engineered carbon removal solutions (i.e., Bioenergy with CCS and Direct Air Capture), e.g., definition/volumes of residual emissions
- The required CO<sub>2</sub> transport and storage infrastructure to link source to store, including the development of a Europe-wide storage market to broaden the choice of storage sites
- Collaboration initiatives, such as the SET Plan Implementation working groups, which bring together key actors – from industry, R&I, governments, and the European Commission. Such collaboration initiatives achieve high impact, speed up innovation cycles, and strengthen the coupling of national, regional and supra-national approaches.

Messages for the future of the programme on funding priorities and on procedures

The industrial scale CCS and CCU projects is expected to generate new knowledge and to encounter areas where further research is needed. For this reason, synergies between EU-supported projects at different stages of the innovation cycle should be explored. By establishing feedback loops and effective communication channels, R&I projects will be able to better address industrial challenges of high-TRL projects and benefit from the knowledge created at an industrial scale.

In addition, the Horizon Europe model and process can hinder its attractiveness among CCS project developers – notably, the evaluation process takes long and has an uncertain result which creates unnecessary delays for R&I projects. In this context, it is important to explore options to increase chances of application success by setting up clear requirements and to expedite evaluation process.