



# CO<sub>2</sub>GeoNet Position paper

*CO<sub>2</sub>GeoNet Association*  
*The European Network of Excellence*  
*on the Geological Storage of CO<sub>2</sub>*

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## Support for the draft H2020 Call on LC-SC3-NZE-6-2020: Building a “champion” CO<sub>2</sub> geological storage pilot project

The CO<sub>2</sub>GeoNet Association supports inclusion of a call supporting the development and operation of CO<sub>2</sub> geological storage pilot projects in the upcoming H2020 call. CO<sub>2</sub>GeoNet is the European Network of Excellence on geological storage of CO<sub>2</sub>, comprising 29 research institutes from 21 countries. CO<sub>2</sub>GeoNet Members have internationally recognised expertise in CO<sub>2</sub> storage.

**Why:** Europe needs new CO<sub>2</sub> storage pilot(s) that support deployment of Carbon dioxide Capture Utilisation and Storage (CCUS). Across the globe, the first generation of CCUS demonstration projects have highlighted the need for the next generation of pilot and demonstration projects to act as seed points for large-scale implementation, to refine relevant technologies and to engender engagement with the wider stakeholder community.

**Who will benefit?** The task of the next generation ‘champion’ CO<sub>2</sub> storage pilot project(s) would be to benefit the wider stakeholder community by engaging more fully with and including the perspective of project developers, researchers, policy makers, public administration bodies, members of the public, financiers, CO<sub>2</sub> emitters and lobbying groups.

**What a CO<sub>2</sub> storage pilot can offer:** There is no substitute for practical experience; moving from laboratory to pilot to demonstration scale provides huge learnings at each stage<sup>1</sup>. Each pilot project offers unique opportunities for learning through real life experience and sharing of lessons learned to improve the business case for CCUS, to inform the global conversation on reducing emissions through CCUS and to support world-leading research and innovation.

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<sup>1</sup> For the purposes of this paper; testbeds are described as having 1 – 10s of tonnes of CO<sub>2</sub> injected over project lifetime, pilot projects 1 – 100 thousand tonnes (kt) injected over project lifetime, demonstration projects 100+ kt CO<sub>2</sub> injected per year and industrial scale projects 1+ million tonnes CO<sub>2</sub> stored per year

The key aims of storage pilot(s) will be to respond to needs highlighted by the wider stakeholder community *inter alia*:

- a) CO<sub>2</sub> storage pilot projects improve the business case for full scale CCUS by:
  - i. demonstrating and developing national political and regulatory support via enabling policies and mechanisms
  - ii. acting as a stepping stone by proving the technology in new regions/geological settings, thereby de-risking specific storage zones
  - iii. meeting the needs of project operators by advancing low cost and effective tools and techniques relevant to CO<sub>2</sub> storage and other emission reduction technologies such as fuel switching and electrification
  - iv. exploring the potential benefits of synergies with other climate technologies such as renewables
  - v. promoting new business activities and local employment
- b) CO<sub>2</sub> storage pilot projects move the conversation on CO<sub>2</sub> storage forward by:
  - i. building trust in the wider stakeholder community, including the general public, as focal points for engagement
  - ii. developing relationships with local communities and the general public
  - iii. building confidence in CO<sub>2</sub> storage within the wider stakeholder community, including investors and insurers, by expanding the portfolio of CCUS projects at scale
  - iv. demonstrating how innovative monitoring solutions can satisfy social and legal requirements
  - v. supporting talent development through training and capacity building
- c) CO<sub>2</sub> storage pilot projects offer powerful research and innovation platforms:
  - i. advancing innovative research through real-life experience and practical learning
  - ii. building (inter)national partnerships between industrials and researchers
  - iii. examining specific research questions to refine understanding and thereby improve efficiency of storage

### **Improving the business case for CO<sub>2</sub> storage**

Geological CO<sub>2</sub> storage cannot be tackled with a ‘one size fits all’ approach. Large-scale pilot projects de-risk regions for full-scale implementation of CCUS by showing, in a very practical way, that storage works in that particular geological environment. Large-scale pilot projects provide real data for future project operators to refine operational procedures, to calibrate modelling techniques and to reduce uncertainty, thereby also making CCUS more attractive to investors.

Pilot projects build relationships between storage project operators and national policy makers/regulators/supervisors, supporting collaborative actions that will move CCUS forward, including development and testing of enabling regulatory frameworks and incentives. In addition, pilot projects can build confidence that the national policy framework will continue to enable CO<sub>2</sub> storage, providing project operators with regulatory certainty such that they can make decisions about investments in CCUS projects.

Pilot projects are a stage-gate in increasing the Technology Readiness Level (TRL) of monitoring solutions, answering the needs of commercial project operators for effective, low cost monitoring technologies that allow them to show that the storage site is meeting regulatory requirements. Many of these monitoring and site management technologies are transferable to other low emission technologies, e.g. technologies used at CO<sub>2</sub> storage sites can also be used to monitor storage sites for hydrogen and natural gas used to reduce emissions through fuel switching.

### **Moving the conversation forward on CO<sub>2</sub> storage; engagement to build wider trust and confidence**

One of the key barriers to advancing CCUS is engaging and establishing dialogue with the wider stakeholder community including policy makers, public administrators, the public, financiers, CO<sub>2</sub> emitters and lobbying groups. A pilot project where interested stakeholders work together to build and manage a storage site that satisfies their requirements would be a new model for cooperation around CO<sub>2</sub> storage sites.

Engagement outside the scientific community needs to focus on values including what CCUS can offer and what it costs. Demonstrating the safety and effectiveness of the storage process is key to successfully engaging the public. Pilot and demonstration sites play a key role in this conversation as they show what CCUS looks like in practice. Showing examples of where CO<sub>2</sub> storage is already working provides reassurance that this is a developed and safe technology. Pilot projects tend to be onshore and therefore offer more opportunities for public engagement than offshore demonstrations. Innovative monitoring solutions that satisfy the needs of the public (particularly the local community) as well as the needs of storage operators and regulators can be developed at pilot sites.

For widespread implementation of CCUS, significant investment in the next generation of scientists and engineers is needed. Pilot projects offer ideal platforms for training and capacity building through learning by doing. Pilot projects act as hubs for talent development at all career stages.

### **Advancing international research**

The H2020 INFRADEV-3 ECCSEL project Research Strategy Roadmap and the key messages from the 2017 ENOS<sup>2</sup> Open Workshop on research priorities and future pilots<sup>3</sup> illustrate the need for a wide variety of pilot projects and set out the key research questions to be addressed by future pilot projects. The outcomes of the recent ENOS exercise to assess potential opportunities for new pilot projects in Europe highlight that there are project developers ready to act given effective support<sup>4</sup>.

There is potential to build on the ENOS storage pilot project international twinning programme that has enabled bilateral partnerships between pilot projects from four countries and more pilot projects could enrich the existing European CCS Demonstration Project Network<sup>5</sup> and thus strengthen Europe's technology position.

Pilot projects expand existing and engender new partnerships including those between industrials, SMEs and research stakeholders, thereby enabling innovation. Pilot projects and testbeds act as hubs for collaboration as exemplified by real projects across the world (e.g. ENOS project at Hontomin Technology Development Platform in Spain, FP6 CO<sub>2</sub>SINK project at Ketzin in Germany, the FP7 MUSTANG/TRUST project at Heletz in Israel). These projects all illustrate the value and appetite for collaboration at practical field sites, learning by doing and sharing knowledge. Pilot projects build

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<sup>2</sup> <http://www.enos-project.eu/>

<sup>3</sup> <http://conference2017.co2geonet.com/>

<sup>4</sup> Short summary of outcomes at <http://conference2018.co2geonet.com/media/28829/2-pearce.pdf>

<sup>5</sup> <https://ccsnetwork.eu/>

long-lasting international partnerships that drive science forward. Sharing knowledge will advance the state of the art of CCUS research.

Pilot projects and testbeds can answer specific research topics highlighted by storage project operators, including those that cannot be tested at demonstration projects due to reasons of cost, operational constraints or conflicting project goals (e.g. quantifying leakage risks through faults/boreholes or testing reservoir remediation technologies). Pilot projects enable testing of novel (including low TRL) monitoring technologies, emerging synergies (e.g. CO<sub>2</sub> storage and geothermal and storing excess energy generated from renewables as synthetic hydrocarbons) and utilisation options (e.g. enhanced oil recovery optimised for CO<sub>2</sub> storage) eventually leading to commercial deployment.

From the research perspective, storage pilot projects can be located on- or offshore, in principle. Practically, an onshore location seems to be more attractive because of its accessibility and reduced costs.

### **Alignment with Member State strategies and research programmes**

‘At least 3 new CO<sub>2</sub> storage pilots in preparation or operating in different settings’ is Target 7 of the SET-Plan Action 9 Renewing efforts to demonstrate carbon capture and storage (CCS) in the EU and developing sustainable solutions for carbon capture and use (CCU), as agreed by the European Commission, SET-Plan countries, and industry<sup>6</sup>. Storage pilots are ideal in combining the objectives of the SET Plan Action 9 at high TRLs with the objectives in Mission Innovation at low TRL. Storage pilots can serve as a test facility to advance new, low TRL technologies that are used to detect, measure and quantify the processes associated with CO<sub>2</sub> injection and storage.

CO<sub>2</sub> storage pilot projects will offer a significant contribution to the research, demonstration, innovation and market-uptake actions of the H2020 programme in the area of enabling near-zero CO<sub>2</sub> emissions from industries producing CO<sub>2</sub> including energy intensive industries and power plants.

Alignment of funding will ensure efficient use of resources. CO<sub>2</sub> storage pilot projects will align with European and Member State funding programmes, including INTERREG and European Regional Development Fund.

CCUS is specifically included in short- to medium-term clean growth strategies and/or regulations for France<sup>7</sup>, the Netherlands<sup>8</sup>, Norway<sup>9,10</sup> and the UK<sup>11</sup>.

### **Conclusions**

There is strong support for large-scale pilot projects in the European scientific community that will support the growing interest in CCUS from other key stakeholders including industry, policy makers, financiers, regulators and the public. Implementation of new large-scale pilot projects with a collaborative, inclusive approach will support these developing stakeholder relationships. CO<sub>2</sub> storage pilot projects improve the business case for full scale CCUS by tackling key technology and cost issues and help provide reassurance to the public that CCUS is a proven technology that can make real headway towards emission targets. Pilot projects thereby tackle the last remaining barriers to large-scale implementation of this important mitigation technology.

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<sup>6</sup>[https://setis.ec.europa.eu/system/files/set\\_plan\\_ccus\\_implementation\\_plan.pdf](https://setis.ec.europa.eu/system/files/set_plan_ccus_implementation_plan.pdf)

<sup>7</sup> <https://www.ecologique-solidaire.gouv.fr/strategie-nationale-bas-carbone-snbc>

<sup>8</sup> <https://www.kabinetformatie2017.nl/binaries/kabinetformatie/documenten/publicaties/2017/10/10/regeerakkoord-vertouwen-in-de-toekomst/Regeerakkoord+2017-2021.pdf>

<sup>9</sup> <https://www.regjeringen.no/no/dokumenter/meld.-st.-41-20162017/id2557401/>

<sup>10</sup> <https://www.regjeringen.no/en/aktuelt/norways-low-emissions-strategy/id2607245/>

<sup>11</sup> <https://www.gov.uk/government/publications/clean-growth-strategy>

**The following CO<sub>2</sub>GeoNet Member institutes have expressed their support for this paper:**

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**About CO<sub>2</sub>GeoNet**

CO<sub>2</sub>GeoNet is the European scientific body on CO<sub>2</sub> geological storage. The Association currently comprises 29 research institutes from 21 European countries, and brings together over 300 researchers with the multidisciplinary expertise needed to address all aspects of CO<sub>2</sub> storage. With activities encompassing joint research, training, scientific advice, information and communication, CO<sub>2</sub>GeoNet has a valuable and independent role to play in enabling the efficient and safe geological storage of CO<sub>2</sub>. CO<sub>2</sub>GeoNet was created in 2004 as a Network of Excellence supported by the EC FP6 programme for 5 years. In 2008, CO<sub>2</sub>GeoNet became a non-profit association under French law, active within both the EU and global scene. From 2013, the membership of CO<sub>2</sub>GeoNet expanded thanks to the support of the now completed FP7 CGS Europe project. New Members continue to join CO<sub>2</sub>GeoNet to further enhance the pan-European coverage and expertise of the Association.

More about CO<sub>2</sub>GeoNet at [www.co2geonet.com](http://www.co2geonet.com)