

ENabling Onshore CO₂ Storage in Europe

Reporting

Project Information

ENOS

Grant agreement ID: 653718

[Project website](#) 

Status

Closed project

Start date

1 September 2016

End date

31 August 2020

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H2020-EU.3.3.2.3.

Overall budget

€ 12 485 258,75

EU contribution

€ 12 485 258,75

Coordinated by

BUREAU DE RECHERCHES
GEOLOGIQUES ET MINIERES

 France

Periodic Reporting for period 2 - ENOS (ENabling Onshore CO₂ Storage in Europe)

Reporting period: 2018-03-01 to 2019-04-30

Summary of the context and overall objectives of the project

To meet the ambitious EC target of an 80% reduction in greenhouse gas emissions by 2050, CO₂ Capture and Storage (CCS) needs to move rapidly towards full-scale implementation with geological storage solutions both on and offshore. Onshore storage offers increased flexibility and reduced infrastructure and monitoring costs. Onshore storage can support the management of decarbonisation strategies at territory level while enhancing security of energy supply and local economic activities, and securing jobs across Europe. However, successful onshore storage also requires overcoming some unique technical and societal challenges.

ENOS will provide crucial advances to help foster onshore CO₂ storage across Europe through:

- i) Developing, testing and demonstrating key technologies in onshore contexts, including consideration of their social aspects. R&D at pilot sites and experiments under industrial scale conditions will allow demonstration of technologies for safe and environmentally sound storage.
- ii) Contributing to the creation of a favourable environment for onshore storage across Europe, by:
 - a. supporting knowledge sharing to maximise the benefits of demonstration from each site,
 - b. integrating research results and setting out best practices on key topics based on the findings from real-life experiments,
 - c. supporting the preparation of new pilot projects and upscaling from pilot to demonstration,
 - d. bringing innovation to society through dialogue and communication,
 - e. promoting CCS through training and education.

The main objective to enable onshore CCS is to strengthen the confidence of the public, operators, emitters, investors, policy-makers, and regulators. This incorporates:

- Demonstrating through practical experience that injection operations can be run safely and efficiently onshore, providing grounds for a well-developed regulatory environment;
- Ensuring that estimated storage capacities are reliable and affordable, to enable investments;
- Demonstrating our capacity to understand, detect and manage potential leakage risks, which is key for regulatory issues and to demonstrate CO₂ storage is environmentally sound and safe;
- Integrating CO₂ storage into the local economic activities for creating a financial incentive and local benefit, thereby supporting initial storage projects;
- Engaging the local population, without which project development is impossible.

Guidance document will be developed using experience gained from the field experiments with the participation of local stakeholders and the lay public. ENOS will produce improved integrated research outcomes and increase stakeholder understanding and confidence in CO₂ storage. ENOS will catalyse new onshore pilot and demonstration projects in new locations and geological settings across Europe, taking into account the site-specific and local socio-economic context. By developing technologies from TRL4/5 to TRL6 across the storage lifecycle, feeding the resultant knowledge and experience into training and education, cooperating at the pan-European and global level, ENOS will have a decisive impact on innovation and build the confidence needed for enabling onshore CO₂ storage in Europe.

Work performed from the beginning of the project to the end of the period covered by the report and main results achieved so far ^

Main achievements of ENOS so far are given below

Safe and efficient management of injection operations:

- First injection strategy test data collected in Hontomin
- Baseline for reservoir and soil gas monitoring acquired
- Test of iDAS-VSP

Ensuring storage capacities and cost-effective site characterization:

- FEED study on low cost drilling rig
- First version of smart characterisation tool

Assessment of reliability of storage capacity assessment

- Assessment of reliability or storage capacity assessment

Understand, detect and manage potential leakage risks:

- Setting up of the two experimental sites, in Italy and the UK, to simulate leakage
- Start of acquisition of baseline data
- Developments and improvements of portfolio of monitoring tools

Integration of CO₂ storage into the local economic activities

- Technical design for seasonal CO₂ buffering, along with cost and production simulation
- Definition and simulation of novel concepts for EOR, demonstrating the possibility for carbon neutrality
- Development of socio-economic models for both cases

Development of storage projects with the local population

- Illustrated materials presenting the project technical content in lay terms
- Development of a coordinated approach for engaging the public in four different countries, first results from the citizen groups
- Exploration of cooperation pathways for citizen groups, policy makers and industrial operator in the Netherlands

Knowledge and experience sharing within the European and international CCS community:

- Continued exchanged between twinned sites
- Experience sharing webinars with recordings available online
- Launch of the Shallow Migration Network to link all the sites injecting CO₂ in shallow environments
- Identification of new pilot opportunities in Europe
- Preparation of upscaling study for buffer storage and EOR CCS in large basin, contact with stakeholders

Spreading innovation to end-users:

- monitoring of all results and publications by the editor committee
- Consultation of end-user committee
- Preliminary work on guidance documents

Education and training:

- Launch of an international master course in academic year 2019-2020
- Annual spring schools
- E-lectures available to all

Progress beyond the state of the art and expected potential impact (including the socio-economic impact and the wider societal implications of the project so far) ^

The expected results of the ENOS project will target technological challenges as well as encompassing the social and economic implications of CO₂ geological storage.

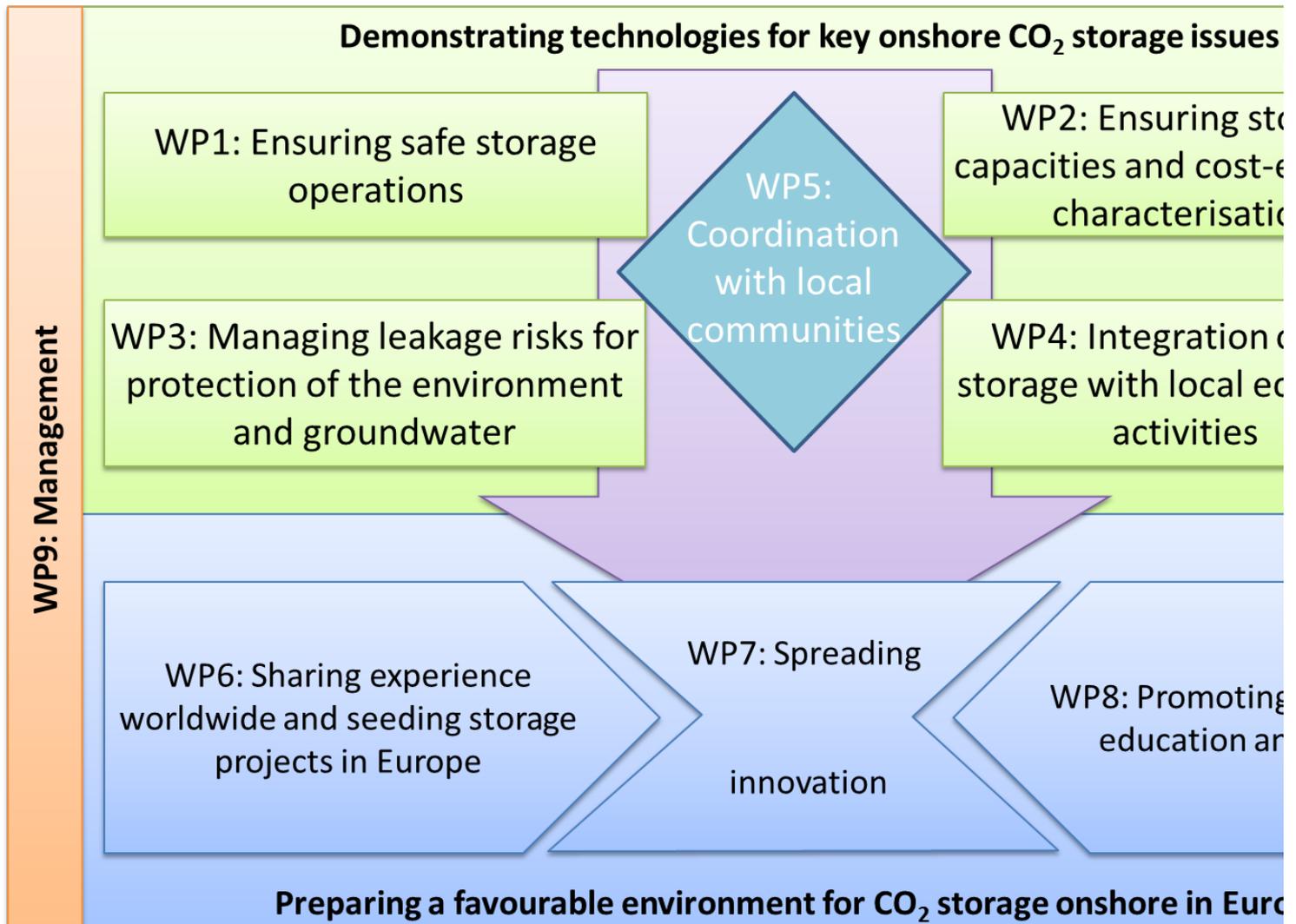
Demonstration of safe and environmentally sound storage - ENOS will participate in CO₂ injection activities at Heterosid and develop modelling and monitoring techniques that will further demonstrate

activities at Hontomin and deploy modelling and monitoring techniques that will further demonstrate the concept of environmentally sound storage. Fieldwork at leakage simulation sites will prove our ability to understand leakage risks and thereby to mitigate them. In particular, improved understanding of leakage through faults will shed light on one of the last major unknowns for the safety of storage. Early leakage detection will permit rapid response, thereby limiting the amount and impact of any leakage.

Optimising safe operations - Integrated workflows validated in ENOS with a clear link to Risk Management will allow regulators to have a better overview of site behaviour, thus offering a collaborative link between site operators and regulatory authorities. The development of a protocol for daily management of injection and an alert system will allow integration of monitoring data and thereby optimisation of injection and storage while ensuring safety.

Increased confidence - The coordination of storage projects with the local communities is key to building confidence in the population. This includes the integration of local needs into storage implementation procedures. ENOS will produce new understanding on how the requirements of the local stakeholders and population can be taken into account in CO₂ storage development, for instance for the management and mitigation of leakage risks or to ensure the protection of groundwater resources. An on-line communication tool, providing information on site operations will be created, based on the needs expressed by the local community.

Public awareness - ENOS will publish documents that are complementary to existing materials, for civil society and industry, to explain CO₂ storage technology. Online dissemination materials will be openly accessible.



ENOS Work Package structure

Country	Site	Type of storage	Depth	Reservoir	Phase
Spain	Hontomin	Deep saline aquifer	1500 m	carbonate	injection
UK	GeoEnergy Test bed (GTB)	Injection site into shallow aquifer with caprock	250 m	sandstone	characterisation and injection
Italy	Salcis Fault Lab	Injection tests through faults	250 m	fault through volcanic rock, clays, limestones	characterisation and injection
Czech Rep.	LBr-1	Depleted oil field	1100 m	sandstone	characterisation
Netherlands	Q16-Mass	Buffer storage in depleted O&G fields	2000 m	sandstone	characterisation

Summary of the ENOS sites

 **29** Partners
 **17** Countries involved
 **5** Field sites

GeoEnergy TestBed 





Map of ENOS sites and participating countries

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