ENOS

Enabling Onshore Storage in Europe

Tallinn 2018

Baltic Carbon Forum – 4th BASRECCS

BASRECCS-ENOS knowledge sharing workshop

How to enable onshore CO_2 geological storage in the Baltic Sea Region

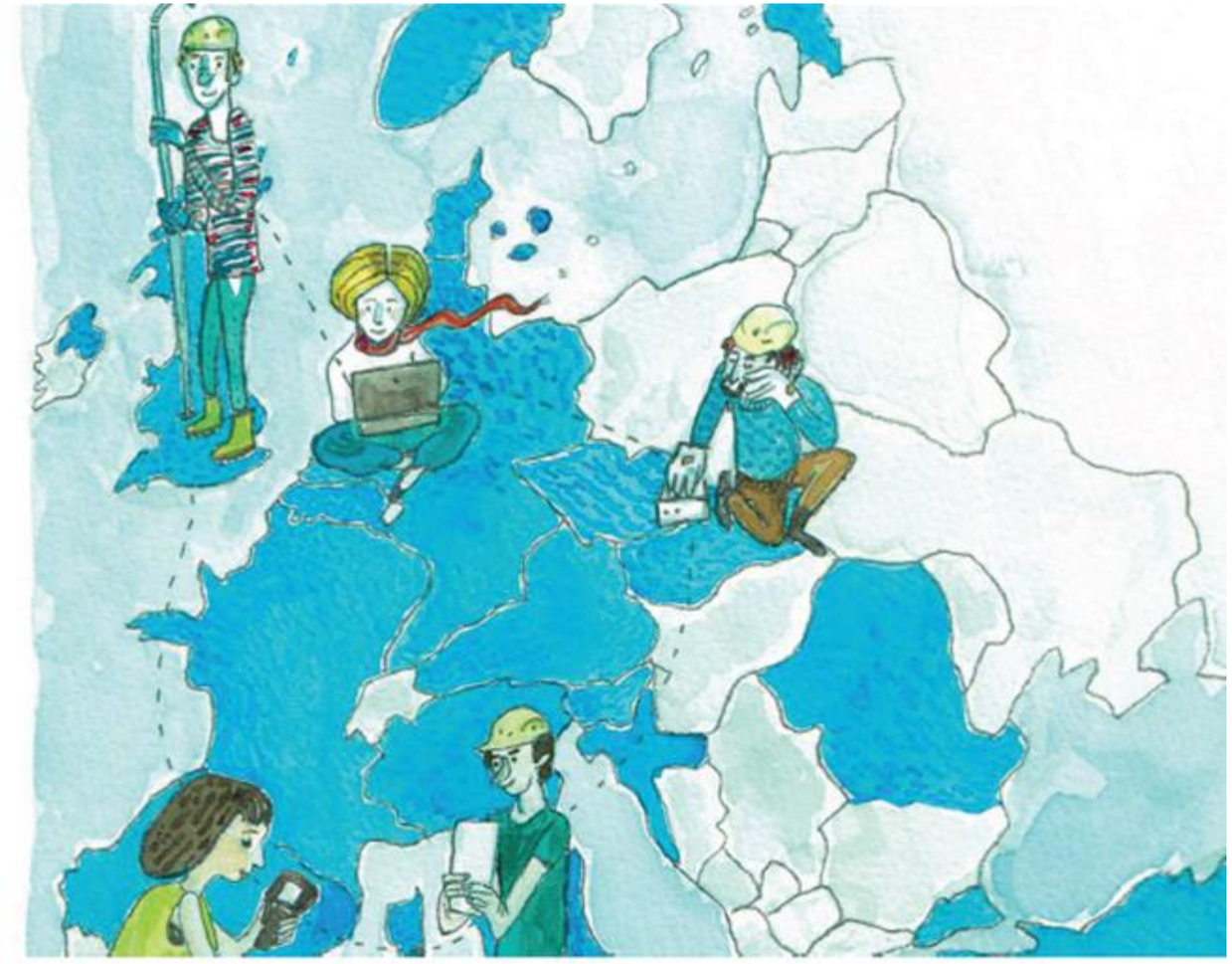
26.09.2018

ENOS

The Educational activities within the ENOS project. Spring schools, e-books, international master course on CO_2 geological storage and workshops with journalists and stakeholders

Poulsen N., Bigi S., Knopf, S., Martines R., Canteli, P. *et al.*

ENOS: The European scientific community working on CO_2 storage



The project is a initiative,

endorsed by

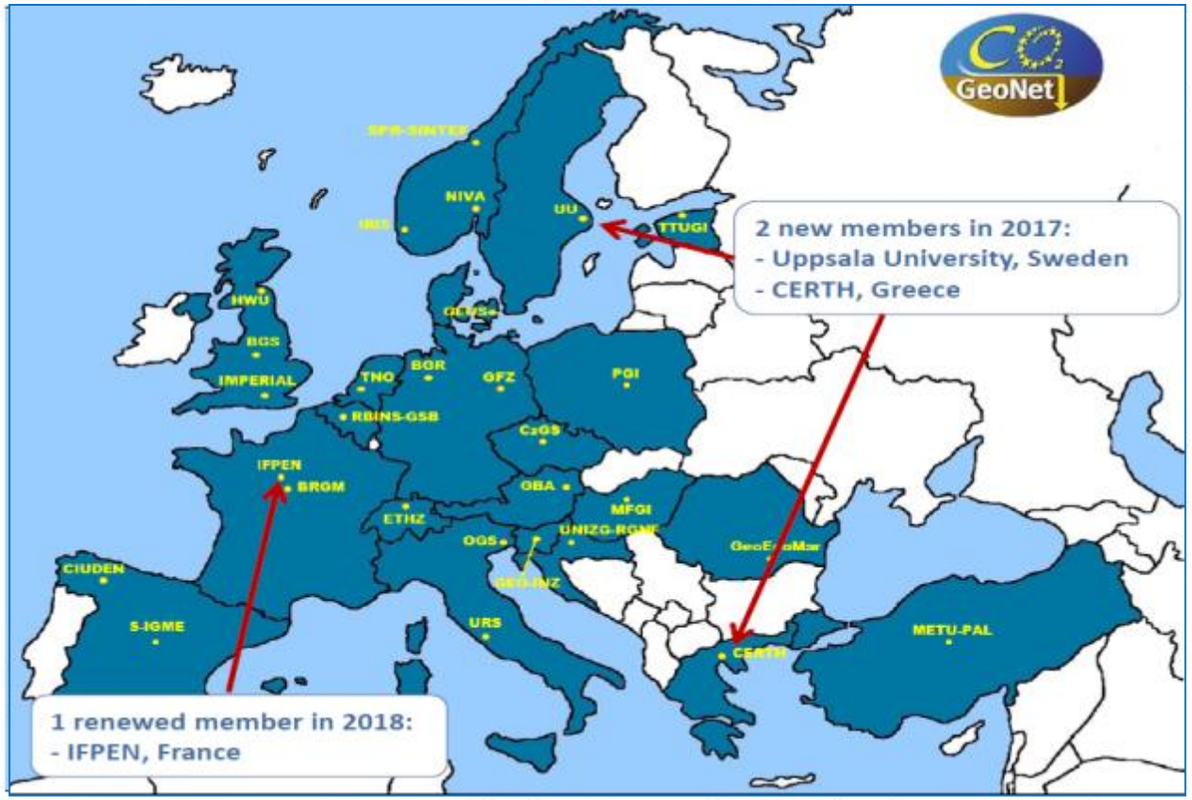
Visit our website:

www.enos-project.eu

Or contact us for information

enos@brgm.fr

CO_2GeoNet



CO_2GeoNet continues to expand both in terms of geographical coverage and expertise, benefitting Members and the scientific community where CCS is viewed as a key part of a low carbon future.

- ✓ Created as a EU **FP6 Network of Excellence** in 2004
- ✓ Became an **Association** under French law in 2008
- ✓ Founding Members: 13 research institutes over 7 countries
- ✓ Expansion thanks to CGS Europe FP7 project (2013-14)
- ✓ Now comprises 29 research institutes from 21 countries

ENOS
Enabling Onshore CO_2 Storage

ECO2BASE
Enhanced oil recovery with storage

Cooperation with international bodies:

ieaghg · carbon capture storage · GLOBAL CCS INSTITUTE · ISO International Organization for Standardization · United Nations Framework Convention on Climate Change · CTCN CLIMATE TECHNOLOGY CENTRE & NETWORK

ENOS: Develop CO_2 storage onshore in Europe

Develop and field tests key technologies adapted to onshore applications;

Integrate CO_2 geological storage into the socio-economical fabric by involving local population;

Create favourable environment for onshore storage across Europe by:

- support knowledge sharing to maximise the benefits of site demonstrations,
- integrate research results and creating best practices from real-life experiments,
- support preparation of new pilot projects and upscaling to demonstration,
- bring innovation to society through dialogue and communication,
- promote CCS through training and education.

Deliverables

Internal deliverables
- Dissemination and exploitation plan
- Internal web site

Educational
- E-learning
- Spring schools
- Educational program
- Workshops

ENOS activities

Project reports
- Technical reports
- Technology demonstrations
- Tools

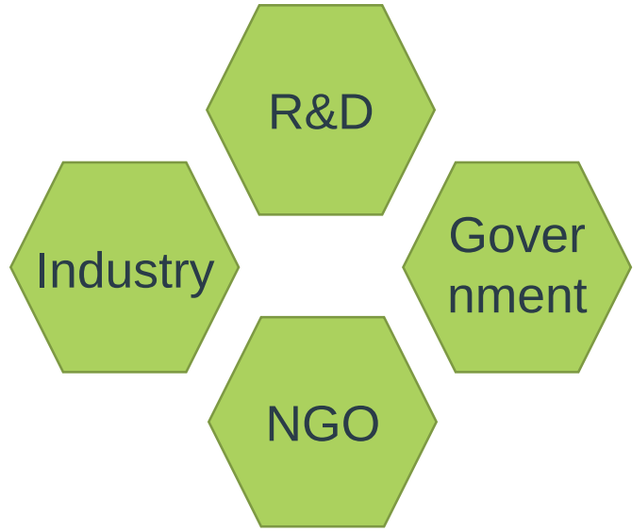
Dissemination
- Increasing technology uptake
- Scientific papers, conferences
- Patents

Best-practice documents

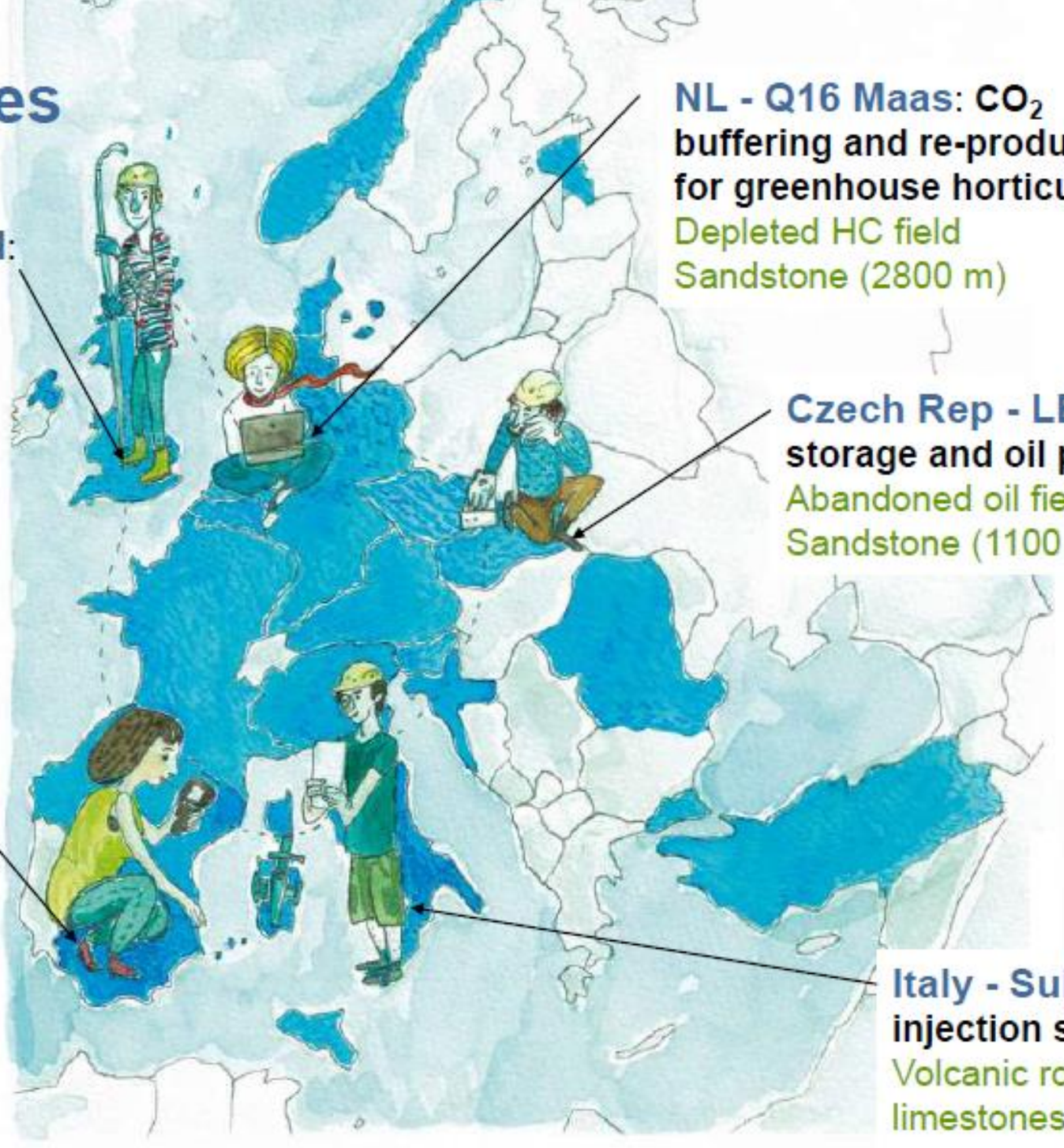
Address particular audience

Short summary of key findings

Key element in exploitation of ENOS results



ENOS test sites



UK - GeoEnergy Test Bed:
injection site in a shallow aquifer overlain by caprock
Sandstone (250 m)

NL - Q16 Maas: **CO_2 buffering and re-production for greenhouse horticulture**
Depleted HC field
Sandstone (2800 m)

Czech Rep - LBR-1: **CO_2 storage and oil production**
Abandoned oil field
Sandstone (1100 m)

Spain - Hontomin:
CO_2 injection pilot
Deep saline aquifer
Carbonates (1500 m)

Italy - Sulcis Fault Lab:
injection site through a fault
Volcanic rocks, clays and limestones (250 m)

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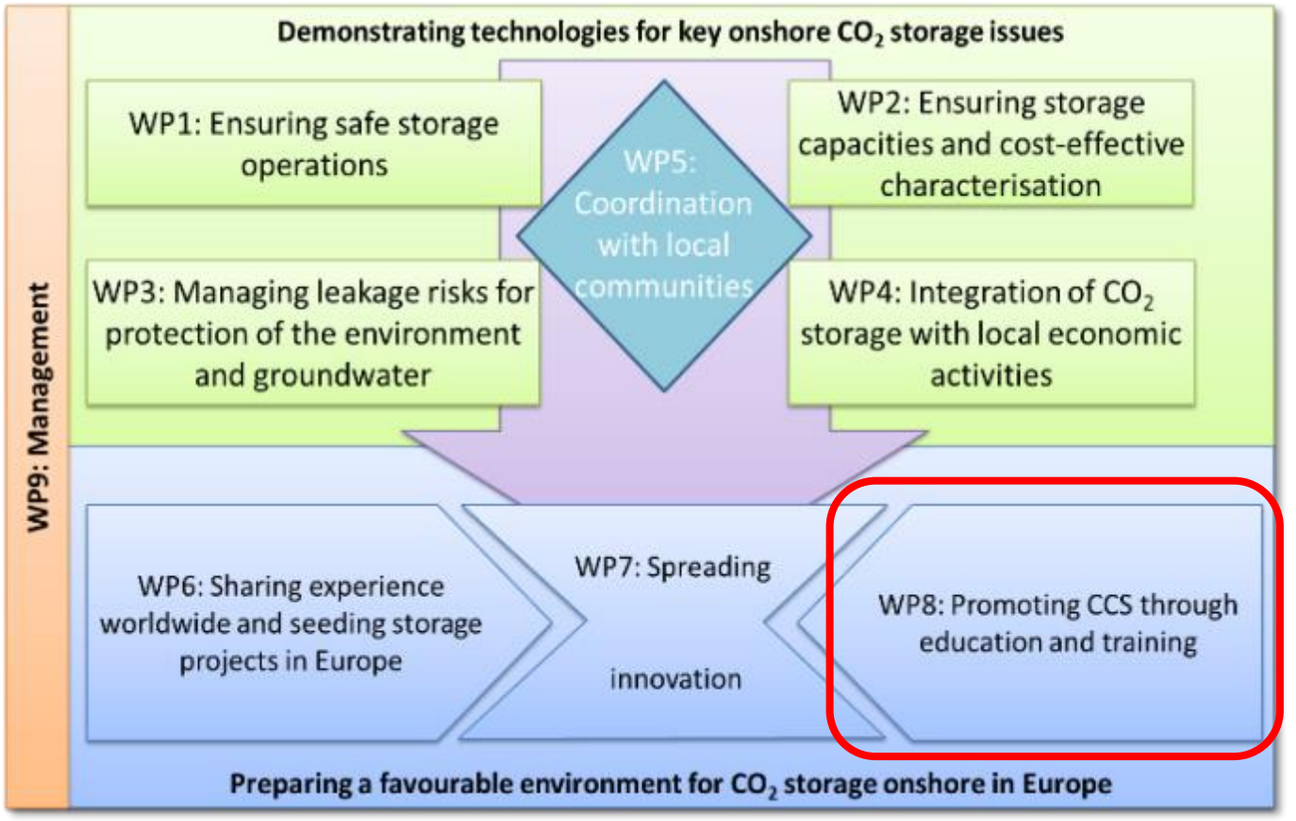
Enabling Onshore CO_2 Storage

Project structure

Marie Gastine, BRGM
Project coordinator

Lionel Loubeau, CIUDEN
WP1 leader

Ceri Vincent, BGS
WP3 leader



Pascal Audigane, BRGM
WP2 leader

Samuela Vercelli, UniRoma1
WP5 leader

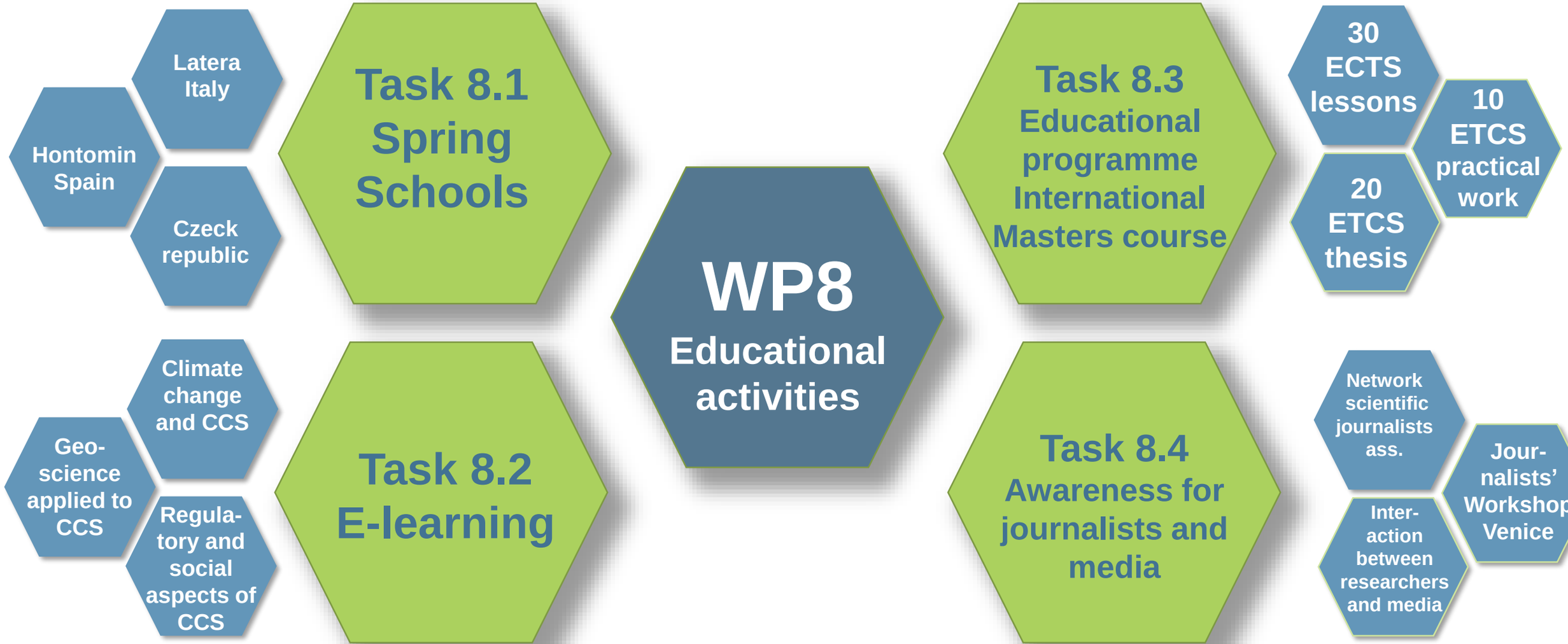
Ton Wildenborg, TNO
WP4 leader

Vit Hladik, CGS
WP6 leader

Roman Berenblyum, IRIS
WP7 leader

Niels Poulsen, GEUS
WP8 leader

WP8 Promoting CCS through education and training



WP8.1 Three spring schools

Task

Develop intensive training weeks, for young scientists, dedicated to onshore CO_2 geological storage and the implementation of the EU- Directive and will be based on latest research results and real-life experience.

1st school

The first spring school was in May 2018 in ECCSEL NatLab (onshore natural field laboratory of Latera (OGS)) north of Rome.

It was a week of lectures and exercises, targeting 15 young researchers (mainly PhD students and Post Docs on CO_2 geological storage

Following schools

Second will be in May 2019 in Hontomin, Spain

Third in Czech Republic, spring 2020

ECCSEL NatLab (onshore natural field laboratory of Latera (OGS)) north of Rome

Local engagement, mixture of lectures and exercises, field learning, poster presentation

Spring school set up

Topics

- **CCS in general and geological site characterisation**
- **Dynamic modelling**
- **Risks and monitoring**
- **Non-technical aspects: legal framework and requirements, economics and policy**
- **Excursion, visiting Latera caldera to explore natural CO_2 leakage**
- **Poster presentation**

Days programme

- **9.00 start of day**
- **Summarising the previous day.**
- **Lectures, 3 – 4 hours**
- **Exercise related to the topic of the day,** rest of day
- **13.00 Lunch**
- **19.30 Dinner**

WP8.2 E-learning, 10 e-books

www.enos-project.eu/

Task 8.2 E-learning

The task has developed an e-learning course on various aspects of CCS, containing generic knowledge (aimed at the general public), as well as specific technical knowledge on CO_2 storage, based on state-of-the-art understanding of comprehensive ongoing R&D efforts (aimed at students or stakeholders).

Performed activities during the period:

The first two e-books containing nine of ten e-lectures are published and available on the ENOS website.

The first e-book "Climate change and importance of CCS technology for decarbonisation of energy and industry" consists of two e-lectures:

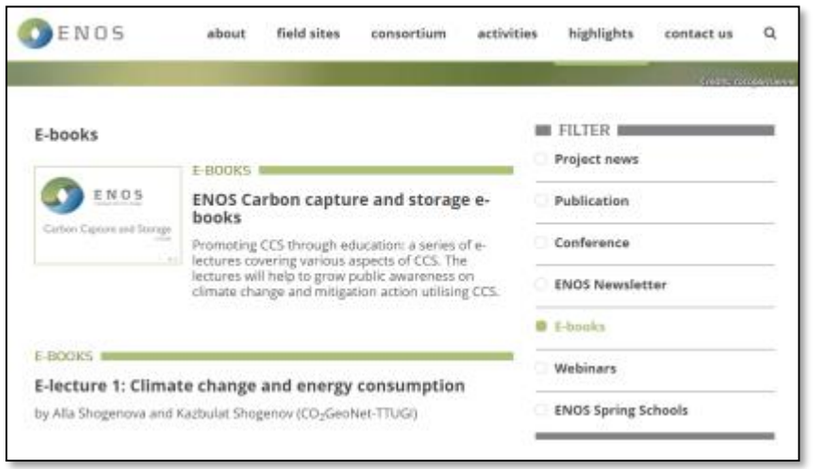
e-lectures 1 & 2.

The second e-book "Geoscience applied to geological storage of CO_2" consists of seven e-lectures:

e-lectures 3 to 9

The third e-book Regulatory and social aspects of CCS technology consists of one e-lectures:

e-lecture 10 (by end October)



EXAMPLE

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Carbon Capture and Storage

e-book

26.09.2018

e-book overview

1. Climate change and energy consumption
2. CCS as an option for CO_2 emission reduction
3. Geologic storage and trapping mechanisms
4. Storage potentials and capacity estimates
5. Site selection + characterisation
6. CO_2-EOR
7. Storage risks
8. Monitoring
9. Numerical modeling of CO_2 storage
10. Regulatory and social aspects of CCS technology

EXAMPLE

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Enabling Onshore CO_2 Storage

lecture 4

storage potential and capacity estimate

by Niels E. Poulsen
Geological Survey
of Denmark and Greenland

lecture overview

- introduction
- distribution of CO_2 storage potential
- deterministic methodology
- capacity estimations for saline aquifers
- capacity estimations for depleted hydrocarbon fields
- probalistic methodology
- summary
- test
- glossary
- references

WP8.3 to build and activate a post-graduate course on CCS

Task 8.3 Educational programme

Initiate a university cooperation on CO_2 storage education

Coordinated Master and post-graduate Master programmes through the development of a network of institutions and laboratories, and the development of educational modules.

The International Masters course on Geological Storage of CO_2 will include

- 30 credits (about 300 hours) of lessons,
- 10 credits (about 100 hours) of practical work and
- 20 credits for the final thesis (about two months of work).

The master course plan will be followed by a proposal for a PhD programme.

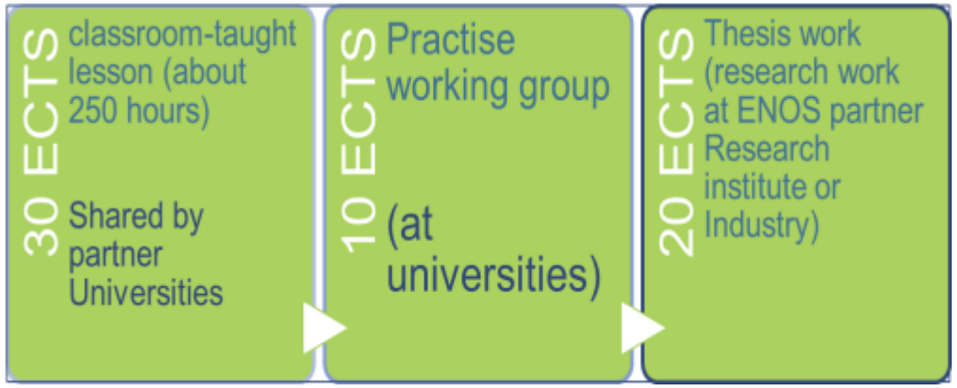
- Prepare a new generation of young people who want to work on these topics
- The Master course is aimed at solid professionalism in the field of geological storage of CO_2 interdisciplinary scientific and technical challenges
- Technical and scientific considerations for CO_2 injection and safety monitoring
- Critical processes in laboratory studies, and numerical modelling

Build and activate a post-graduate course on CCS

- In the first period, the University Partner discussed the possibilities to activate an international joint programme post graduate course.
- Joint Master Course of two years would require an unacceptable level of complexity in terms of permits and internal organization
- The second level professional master of one year will be the first one entirely dedicated to Geological storage of CO_2.

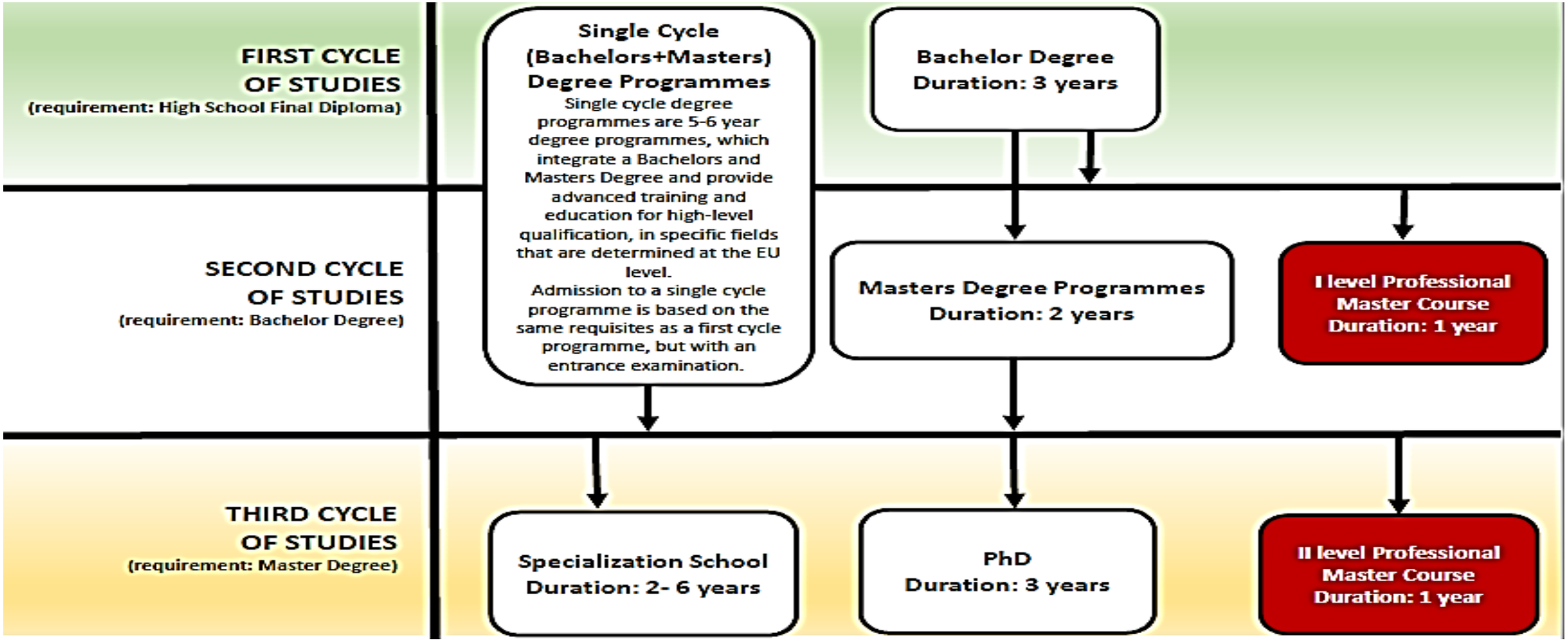
The Master course comprises 1500 hours (60 credits x 25 hours), of which:

  - 300 hours are reserved for classroom-taught lessons distributed among universities;
  - 150 hours of working group
  - 500 hours for the thesis work.
- ENOS partners to host students for the thesis work.
- Lessons structure organized in modules of 25 hours



- The mobility of the student has been defined, so that they will move between two universities, which also host teachers from the other institutions.
- At the present time, the teachers and the topic of the lessons are being defined and the procedure for gaining the approval of Universities' governance is under preparation.

Italian high educational system



A more simple structure: the Professional Master Course on Onshore Carbon Storage

It imply

- an agreement among the involved Universities
- the approval only from the University Governance
- it allows to shape courses as required

Student motivation

- more exercise and practical research activities
- the involvement of external partners (in our case the research institutes and industries

Next steps

- Invitation and selection of students 2018
- Start 2019
- The master course plan will be followed by a proposal for a PhD programme.

WP8.4 Workshops and short courses for journalists and media

Provide short workshops for journalists and media to raise awareness on CCS and enhance communication between scientists and journalists.

- Identification of groups of interests and other stakeholders
- Creating a network for information about scientific communication
  - Contact with national and international scientific journalists associations: the European Union of Scientific Journalists´ Associations (EUSJA) and the two Spanish Asociación Española de Comunicadores Científicos (AECC) and Asociación Catalana de Comunicadores Científicos (ACCC)

CO_2GeoNet Venice Open Forum

- Collecting ideas that can help for better interaction between researchers and media.
- The ENOS project continues the action started in 2010 by the FP7 project, CGS Europe, the "Pan-European coordination action on CO_2 Geological Storage" focused on the organization of opportunities for direct interaction between researches and journalists.
- Learnings and conclusions available on the CGS Europe project web page (www.CGS Europe.net).
- Interaction with ENOS WP5, Coordination with local communities

ENOS Journalists' Workshop, in Venice on 23th April 2018

35 journalists and scientific communicators from Belgium, Czech Republic, Denmark, France, Germany, Italy, The Netherlands, Spain, Estonia and UK in the network

7 were able to attend to the workshop.

ENOS Journalists' Workshop, in Venice on 23th April 2018

The Journalists' View

- Interaction between scientific and journalists
  - Scientists need journalists for dissemination
  - Journalists need scientists as source of information
  - This relation will be profitable if we accept the objectives of the other part
  - Journalists are looking for a story to tell
  - Common mistake of thinking that they are the translators of scientists.
- Journalists want to tell a story and need to understand the whole picture.
  - In general, they check several trustworthy sources
  - Different point of view
  - Avoid too detailed information and, usually, required in a very short time.

ENOS Workshops and short courses for journalists and media

Next steps

- To strengthen the international journalists network and adding new journalists
- Providing ENOS last results and dissemination materials.
- Local workshops in the area of the pilots
  - ensure more direct communication with local journalists and media
  - support the pilots' presence in the area.
- Interaction with WP5 (coordination with local population),
  - communication activities towards the public
  - exchange of information between CO_2 capture and storage scientists and science communicators

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