Characterisation of European CO_2 storage

January 2011 – December 2013

Overview

Role of CO_2 storage in securing CCS for Europe

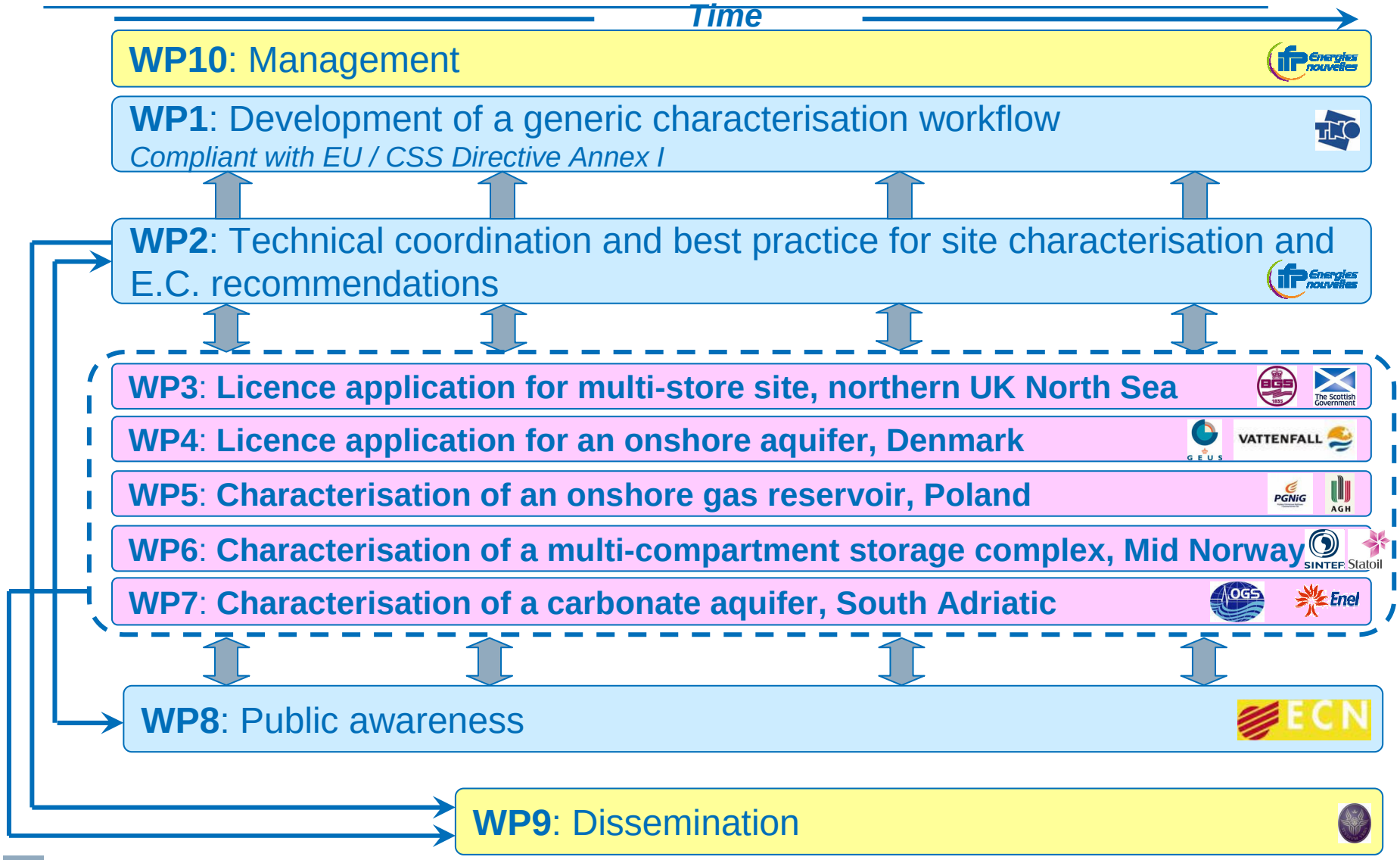
- **Reducing the uncertainties on storage capacities, especially for deep saline aquifers**
  - **Developing an efficient methodology using appropriate technologies and economic evaluations**
    - **allowing to better characterizing potential storage sites**
    - **reducing the risk, ensuring a safe and permanent storage**
    - **tested in various situations (onshore/offshore, SA/DOGF)**
    - **in relation with a sound regulation on CCS**
- **De-risking CO_2 storage**
- **Gaining public support**

The aim of *SiteChar*

Provide the key steps required to make on-time effective large-scale implementation of CO_2 storage in Europe:

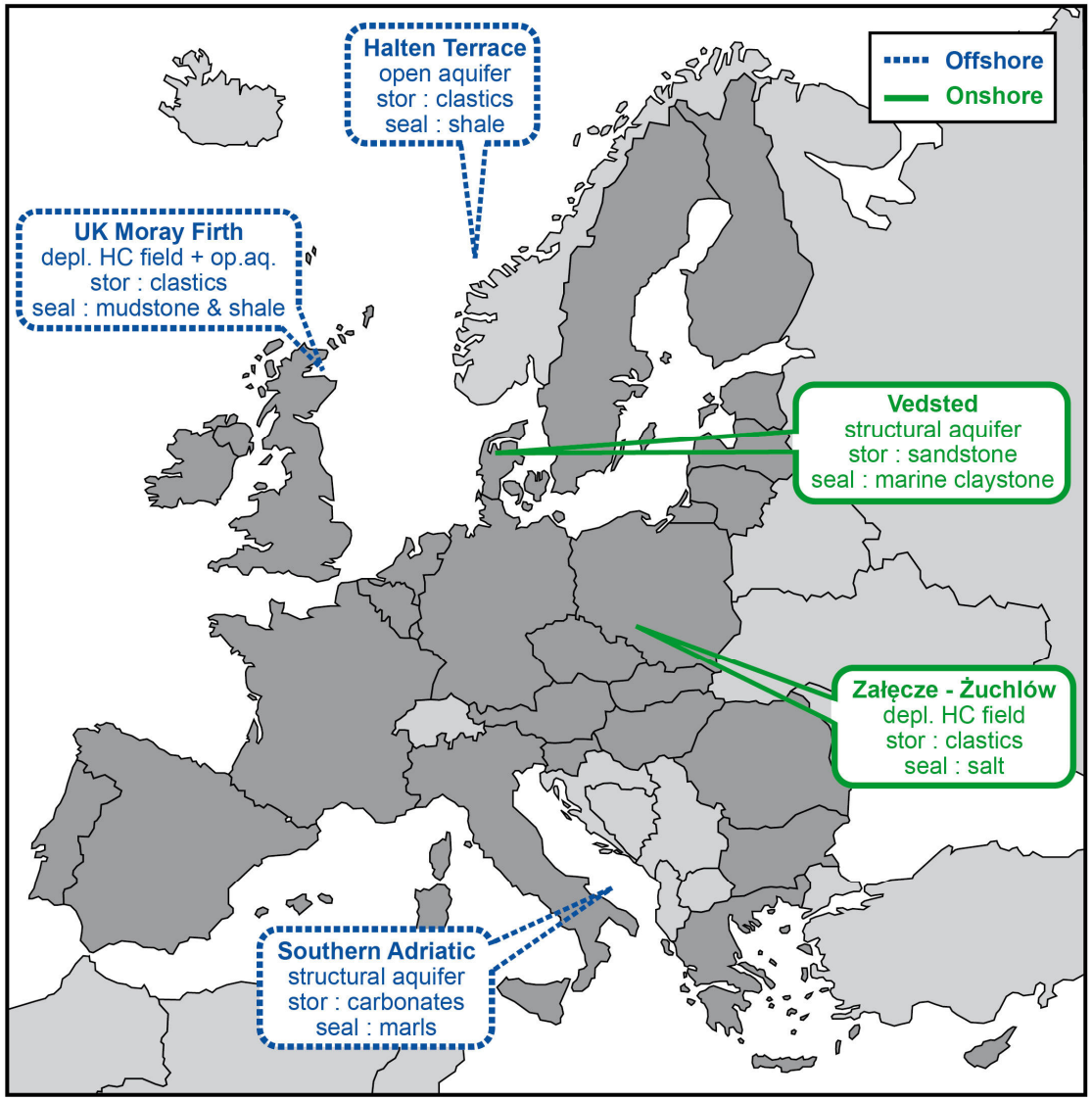
- ***Demonstrate the level of geological characterisation and the assessment of long-term storage complex behaviour in accordance with the regulatory requirements (EU Directive)***
- ***Develop a methodology for the preparation of exploration permit applications, accounting for all the technical and economic data, as well as the social dimension***
- ***Raise public awareness and enable informed opinion formation***

The *SiteChar* project



The *SiteChar* sites portfolio

- **Representative of sites where CCS is most likely to develop in the near term**
- **Allowing to test and improve the *SiteChar* methodology for site characterisation in different geological contexts**



The North Sea Moray Firth site, UK

A multi-store site, comprising

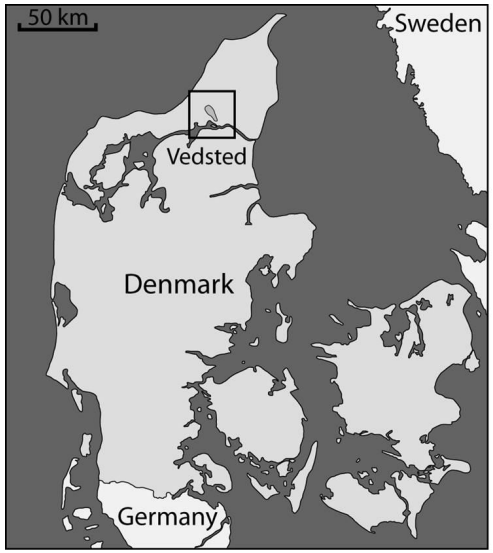
- **A hydrocarbon field: near-term storage capability**
- **The host saline aquifer sandstone: greater storage potential, later in the storage cycle**

Objective:

- **Characterize a multi-store site sufficient for submission of a 'dry-run' permit application to the Scottish Government**
  - ***All components of a permit application developed as far as possible***
- **Investigate the relationship between a producing hydrocarbon field and the host saline aquifer**

The Vedsted site, Denmark

An onshore saline aquifer processed by Vattenfall till late 2011 to be an industrial scale CCS demo project



Objective:

- **Perform a full-chain techno-economic assessment to reach readiness for storage permit as far as possible**
- **Investigate different ways to supplement sparse data**
- **Explore the impact on the surrounding region**
- **Design a monitoring program in order to assure the best risk management**

The Zalecze & Zuchlow site, Poland

An onshore gas reservoir,

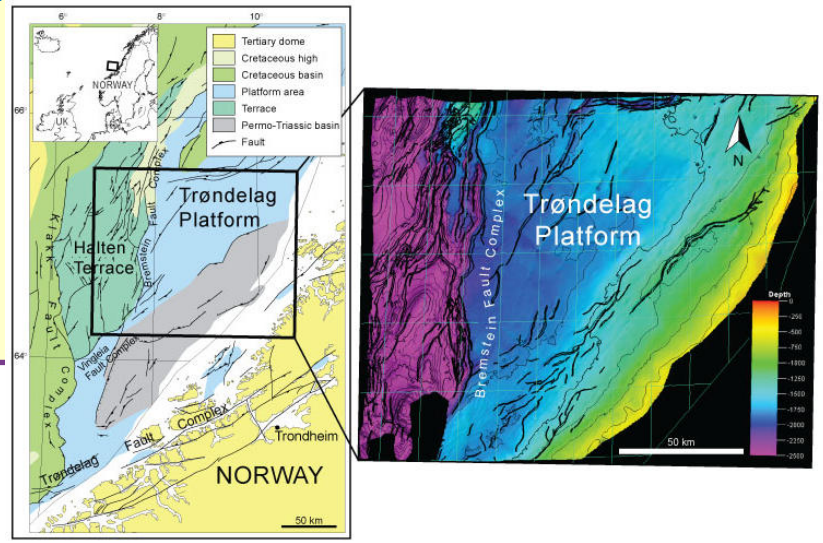
representative of a series of natural gas reservoirs in the Polish Lowland with CO_2 storage potential

Objective:

- **Undertake the whole workflow from the first stages through to the development of an injection strategy**
- **Investigate the behaviour of the reservoir rock and caprock during CO_2 injection**
  - **Integrate the results of laboratory experiments**
  - **Perform reactive flow simulations coupled with geomechanical simulations**

The Halten Terrace / Trøndelag site, Mid Norway

An offshore multi-compartment saline aquifer presenting possible storage sites in saline formations and dry structures



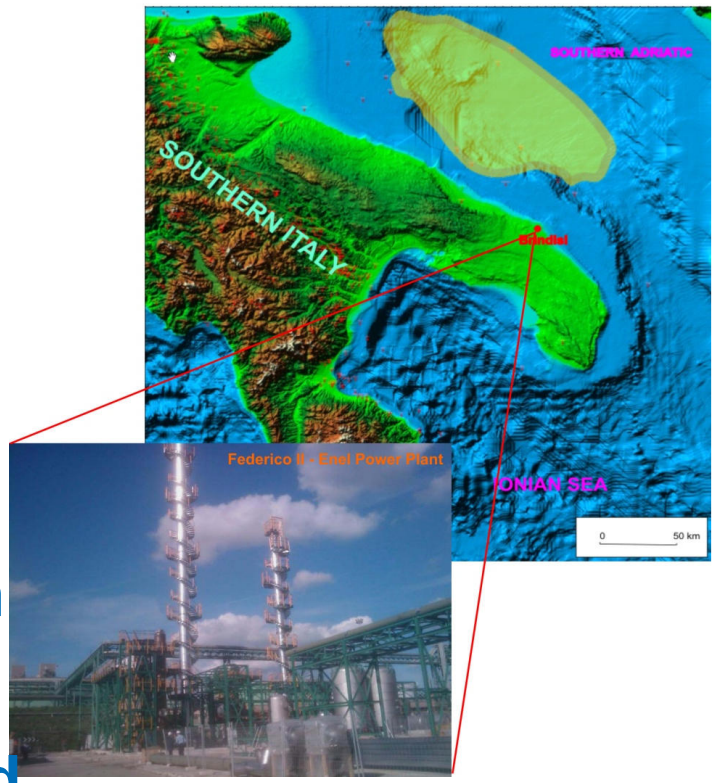
Objective:

- **Establish a robust approach for basin to individual CO_2 storage compartment scale evaluation of performance**
- **Quantify the possibility of leakage**
- **Determine effective injection, monitoring and remediation strategies with emphasis on storage capacity optimisation**

The South Adriatic site, Italy

A structural trap in a offshore carbonate saline aquifer, located in a relatively stable area

Site location



Objective:

- **Develop a robust methodology for storage site characterisation in carbonate formations**
- **Simulate the geomechanical and dynamic behaviour of the storage complex due to the CO_2 injection**

The *SiteChar* public engagement activities

- **Social site characterization and advancing public awareness:**
  - **Raising public awareness and enabling informed opinion formation**
  - **Making available and comprehensive to lay people site-specific information**

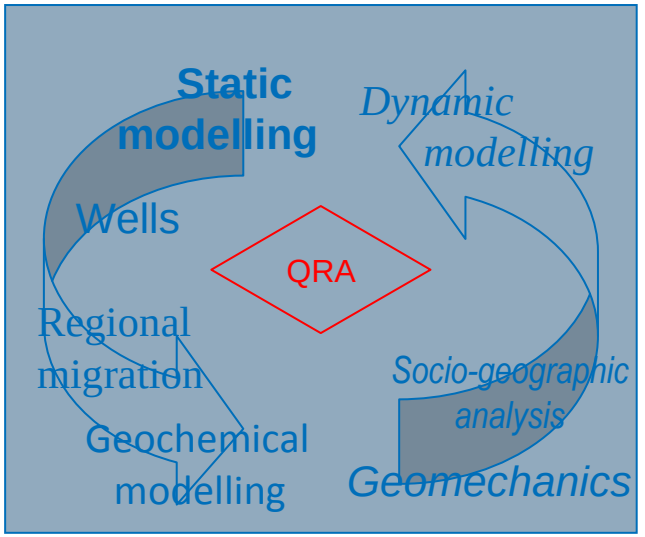
- **On two sites:**
  - **The Scottish site**
  - **The Polish site**

→ *www.sitechar-co2.eu* or *www.sitechar.eu*

The *SiteChar* workflow

Consolidation of a site characterization workflow

- in line with EC storage directive 2009/31/EC
- validated from insight from research on the *SiteChar* sites portfolio



➢ **So as to support**

- an uniform characterization of a storage complex
- an assessment of the security of the storage

pursuant to the EC CO_2 Storage Directive

The *SiteChar* techno-*economic analysis*

- **Conduct a comparable evaluation approach at four sites (*e.g.*, same hypothesis & same methodology)**
  - **The UK site / The Danish site / The Norwegian site / The Italian site**
- **Address mainly the storage part on the full-life time of the storage site:**
  - **Account for all CAPEX and OPEX to be mobilized over the life of the project**
  - **Provide not only values but also related assumptions**
  - **Five stages to be considered:**
    - **Exploration / Development / Injection & production / Monitoring / Abandonment**

The *SiteChar* exemplar permit applications

- **Development of internal dry-run permit applications**
- **Evaluation by a group of independent geological experts and regulators**

➔ **A pragmatic and efficient approach to**

- **Promote a more realistic licence application process**
- **Ensure that key lessons on best practices can be fully applied**

The *SiteChar* benefits

Technical recommendations for storage site characterisation and best practice guidance for storage licensing from the perspective of both applicant and regulator

For further use by storage site operators and regulatory bodies

www.sitechar-co2.eu

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