SEVENTH FRAMEWORK PROGRAMME

Characterisation of European CO_2 storage

The *SiteChar* project

- **EU 7th Framework Integrated Project**

  Topic ENERGY.2010.5.2.1: CCS - storage site characterisation

  Grant agreement no: 256705

- **Coordinator: IFPEN** - *florence.delprat-jannaud@ifpen.fr*
- **Timing: 1st January 2011 – 31st December 2013**
- **Budget 5.07 MEuros**
- **Collaborative project funded by**
  - **The European Union,**
  - **Industry: *ENEL, PGNiG, STATOIL, Vattenfall***
  - **The *Scottish Government***
  - **External partners: *Veolia Environnement, Gassnova***

Outline

- **The consortium**
- **The main objectives of the project**
- **The sites portfolio**
- **The structure of the project**
- **The research in the different WorkPackages**

The *SiteChar* consortium

Research Institutes and Academics

IFP Energies nouvelles — France

GFZ Helmholtz-Zentrum Potsdam — Germany

BGS 1835 — United Kingdom

Sapienza Università di Roma — Italy

AGH — Poland

Imperial College London — United Kingdom

TNO — The Netherlands

SINTEF — Norway

OGS — Italy

GEUS — Denmark

ECN — The Netherlands

UfU Unabhängiges Institut für Umweltfragen — Germany

Industrial partners

Statoil — Norway

PGNiG — Poland

VATTENFALL — Sweden

Enel — Italy

A public institution

The Scottish Government — United Kingdom

External partners

VEOLIA ENVIRONNEMENT — France

GASSNOVA — Norway

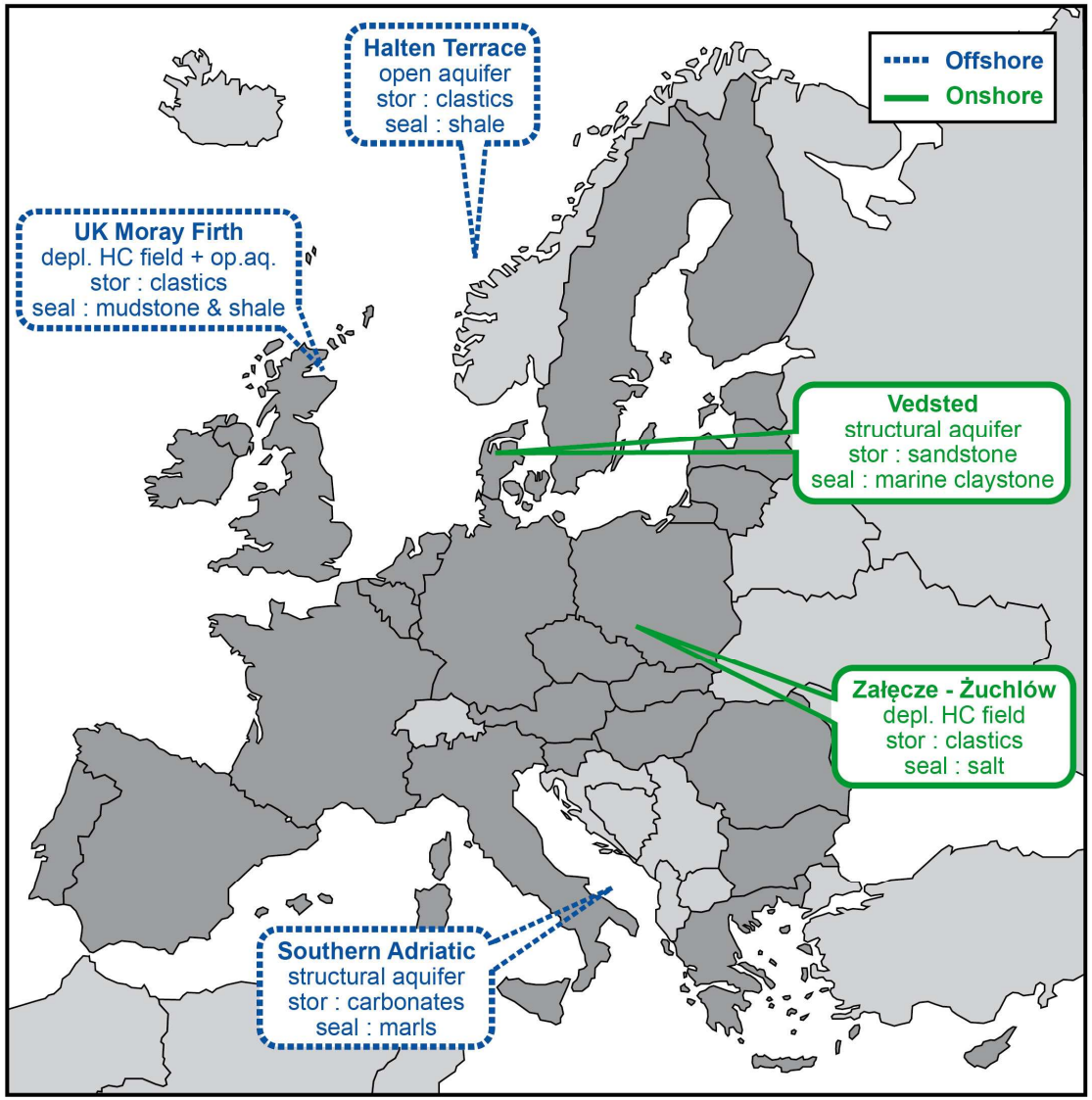
The aim of *SiteChar*

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

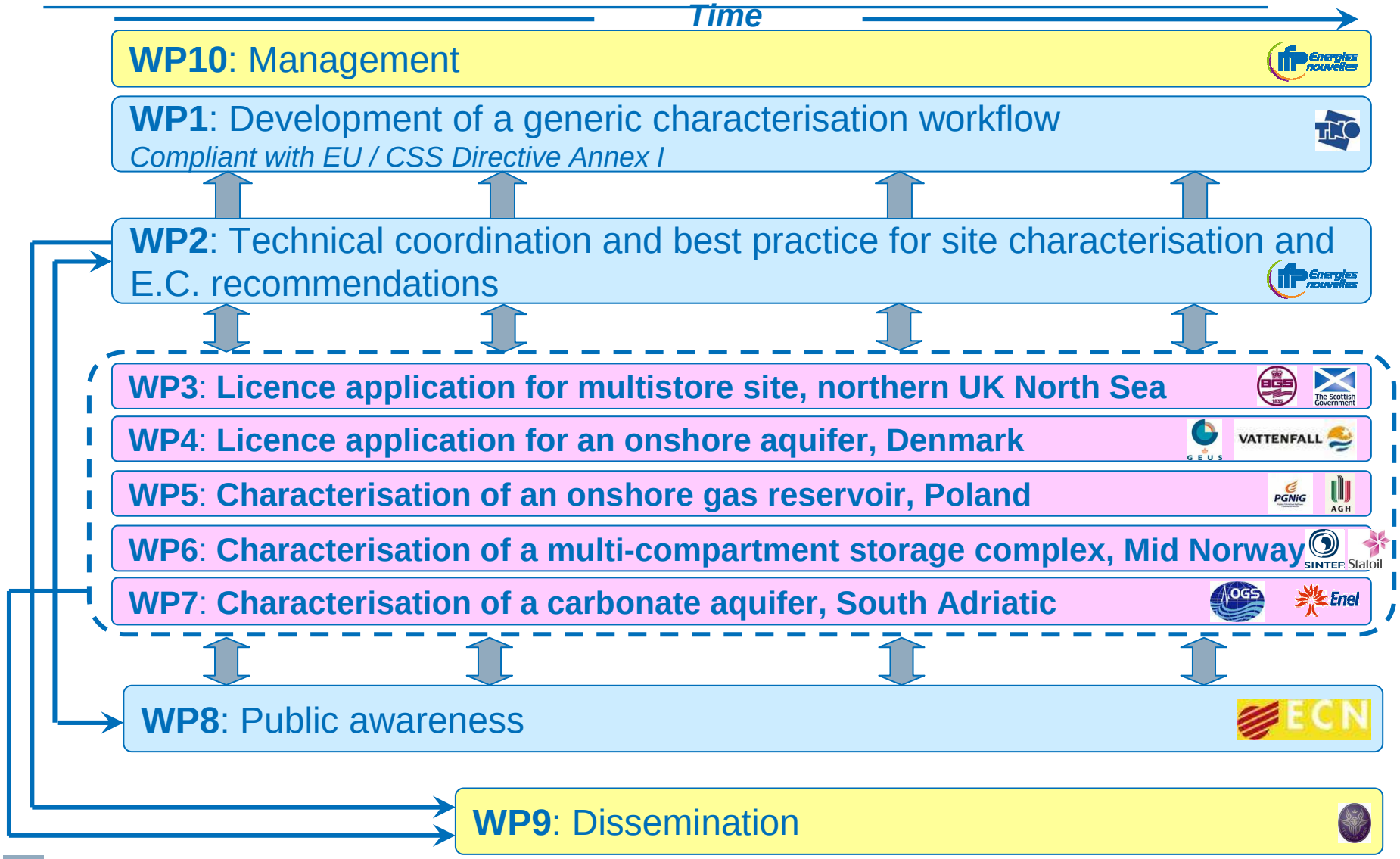
- ***Demonstrate the level of geological characterisation and the assessment of long-term storage complex behaviour in accordance with the regulatory requirements (EU Directive)***
- ***Develop a methodology for the preparation of exploration permit applications, accounting for all the technical and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

The *SiteChar* 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 *SiteChar* project

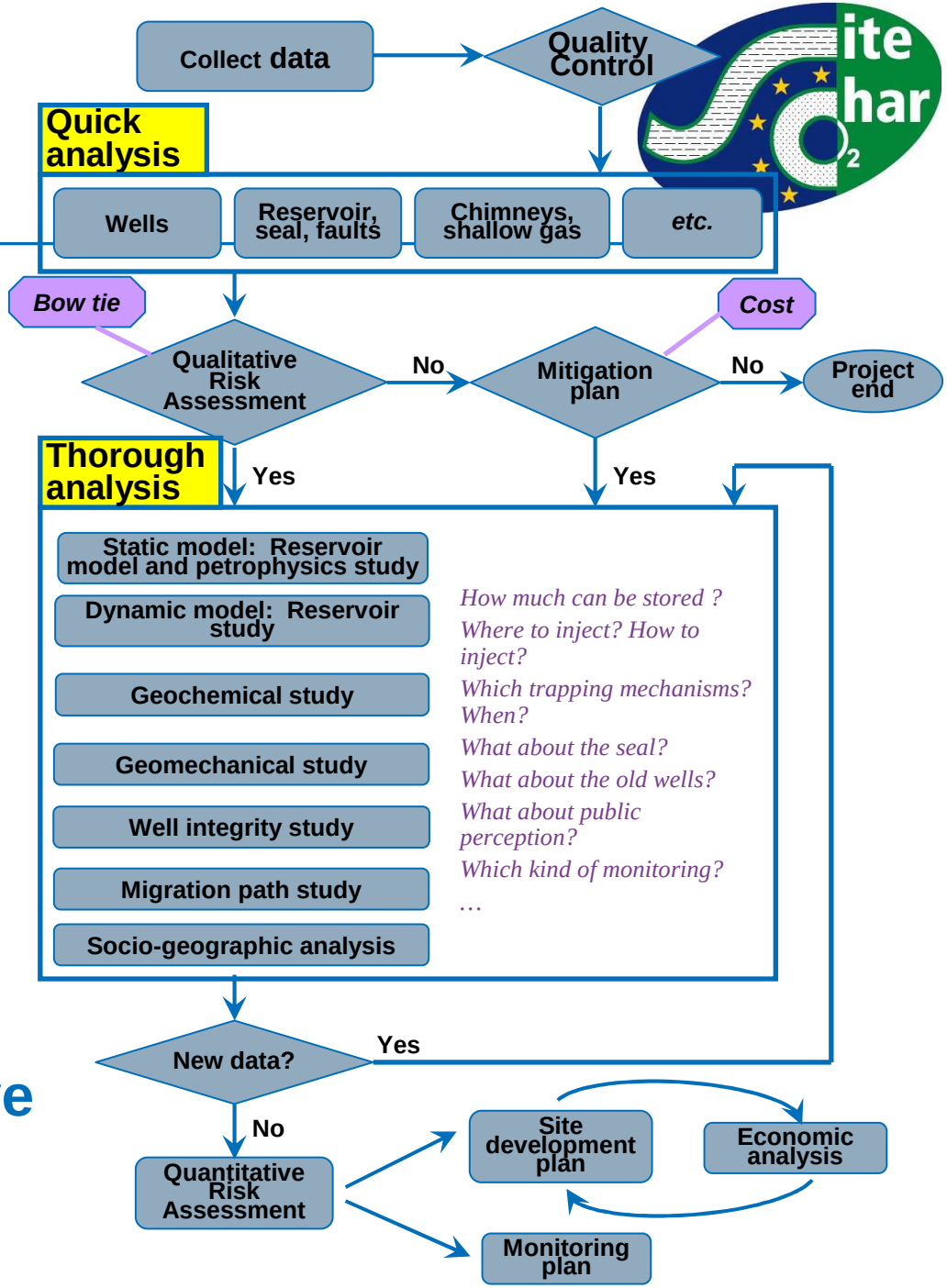


WP1 - Development of a generic workflow

A methodology for site characterization

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

➢ So as to guide the implementation of the EC CO_2 Storage Directive and OSPAR regulation in Member States



WP1 - Development of a generic characterisation workflow

- **EU Storage Directive…**
  - **Requires many aspects to be considered**
  - **Does not prescribe the level of detail**
  - **Does not prescribe the method**

- **SiteChar workflow…**
  - **Shows how elements of characterisation study contribute to EU SD list of aspects**
  - **Shows the links between elements of characterisation study**
  - **Emphasises the need for cooperation between areas of expertise (experts) in characterisation study**

WP2 - Technical coordination, best practice for site characterisation and EC recommend.

Objectives

- **Ensure integration and synchronisation of the site-specific research**
- **Act as the independent regulator for licence applications and economic assessments**
- **Draw out the learnings of the project**

WP2 - Technical coordination, best practice for site characterisation and EC recommend.

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**

WP2 - Technical coordination, best practice for site characterisation and EC recommend.

Regulatory Steering & Licensing

- **Provide guidance on regulatory requirements to (and in consultation with) all site-specific WPs**
- **Two sites developing and submitting dry-run licence applications:**
  - **WP3: Moray Firth (UK North Sea) – interim and final**
  - **WP4: Vedsted (onshore Denmark) – interim and final**
- **Evaluation of these dry-run licence applications by an Advisory Panel, comprising**
  - **The *SiteChar* Regulatory Advisory Board**
  - **UK CCS Regulatory Contact Group**
- **Constructive and iterative evaluation, through close dialogue to maximise the 'learning'**

WP2 - Technical coordination, best practice for site characterisation and EC recommend.

The SiteChar Advisory Board

- **Advise on the approach for regulatory steering and licensing so as to ensure the consistency with the regulatory requirements**
- **Provide guidance on the content and scope of draft and final dry-run licence applications**
- **Critically review reports on the results of the dry-run licence development and review process**

Australia	Geoscience Australia	*Greg Leamon*
	RET	*Steve Tantala*
Germany	BGR	*Franz May*
UK	BP	*Stephen Cawley*
The Netherlands	Shell	*Owain Tucker*
Spain	CIUDEN	*Fernando Recreo Jimenez*

WP2 - Technical coordination, best practice for site characterisation and EC recommend.

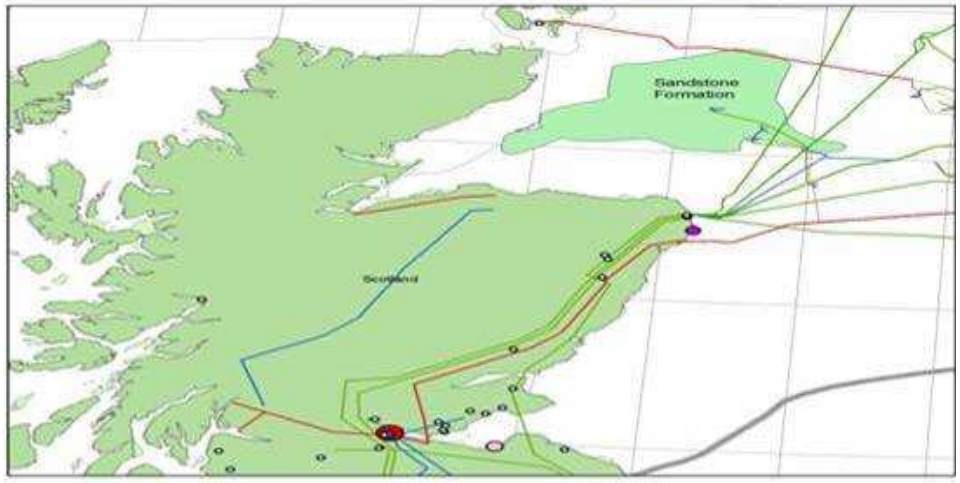
Recommendations for the E.C., Member State regulators and industry

- **Provide**
  - **Technical recommendations for storage site characterisation**
  - **Best practice guidance for storage licensing from the perspective of both applicant and regulator**
- **Identify and address**
  - **Issues met on specific elements of the workflow that could limit or compromise CO_2 storage deployment**

WP3 - Licence application for a multistore site, northern UK North Sea

The North Sea Moray Firth site

- **A multistore site, combining an hydrocarbon field together with associated saline aquifer**



- **Develop a credible scenario of CO_2 storage injection history over a 25 - 50 years term, compatible with likely current and future industrial sources**
- **Perform a full-chain techno-economic assessment to reach readiness for storage licence application**

WP3 - Licence application for a multistore site, northern UK North Sea

Objectives

- **Perform a full-chain techno-economic assessment to reach readiness for storage licence application**
  - **All components of a licence application developed as far as possible by a research project (including detailed assessment of containment risks)**
- **Dry-run licence application**
  - **Assessed by external regulatory authorities**
  - **Consideration of public awareness**

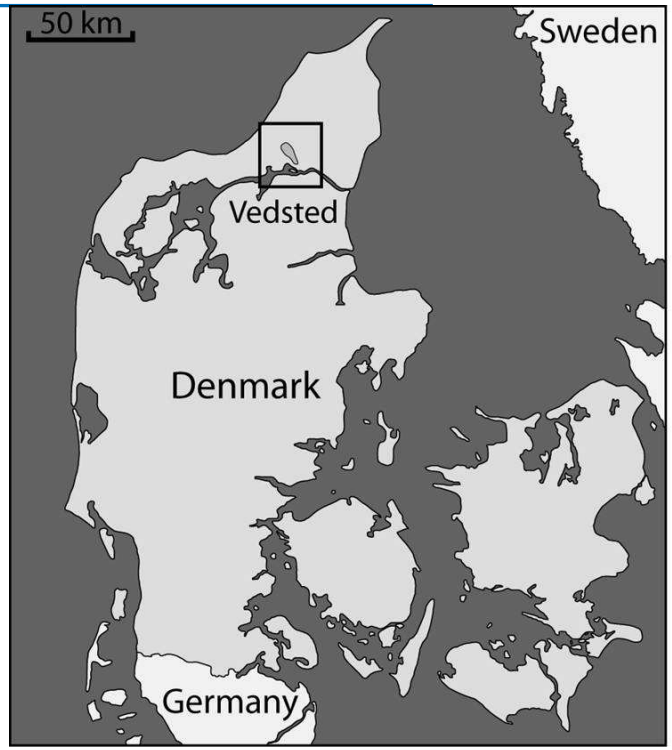
Research

- **Investigate the relationship between a hydrocarbon field and associated saline aquifer store**
  - **Two scenarios for simulated injection of CO_2:**
    - **Into the HC field and 'spilling over' into the aquifer**
    - **Into the aquifer and then migrating up into the field**

WP4 - Licence application for an onshore aquifer, Denmark

The Vedsted site

- **An onshore Upper Triassic-Lower Jurassic aquifer at 1800-1900 m depth, situated in the northern part of Denmark close to the Nordjylland Power Station**



- ➢ **Perform a full-chain characterisation of the site to reach readiness for storage licence application**

WP4 - Licence application for an onshore aquifer, Denmark

Objectives

- **Perform a full-chain characterisation of the site to reach readiness for storage licence application**

Research

- **Investigate different ways to supplement the sparse data usually available from saline aquifers**
- **Explore the impact on the surrounding region, especially pressure development in the saline aquifer and any possible effects in the overlying layers in this onshore single site**
- **Design a monitoring program in order to assure the best risk management**

WP5 - Characterisation of an onshore gas reservoir, Poland

The Zalecze & Zuchlow site

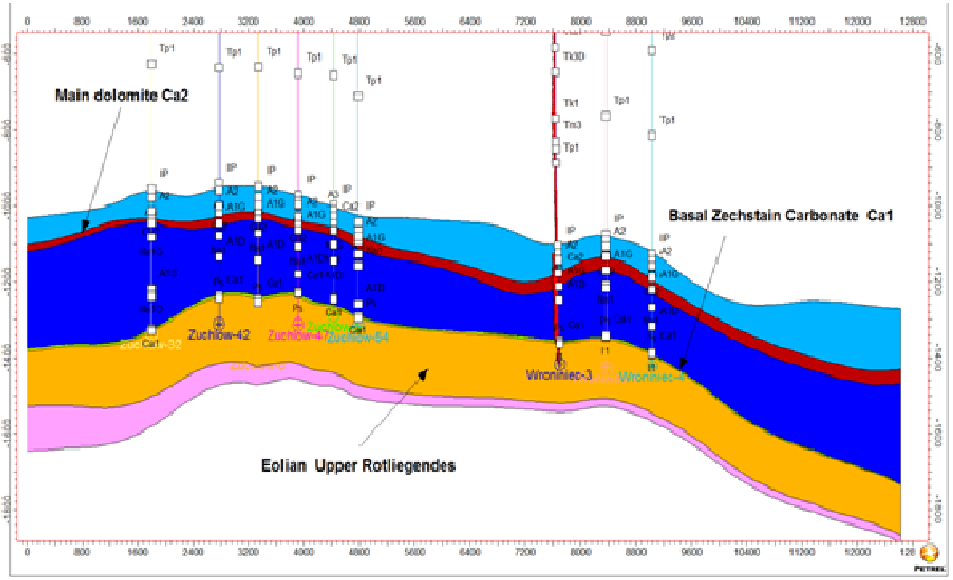
- **An onshore Permian gas reservoir located in western Poland at 1300m depth**
- **Representative of sites in the Polish Lowland, which offer a series of natural gas reservoirs with CO_2 storage potential**

- **One of the strategic locations for the upcoming CO_2 injection program at the national level in Poland**

WP5 - Characterisation of an onshore gas reservoir, Poland

Objectives

- **Undertake the whole workflow from the first stages through to the development of an injection strategy**



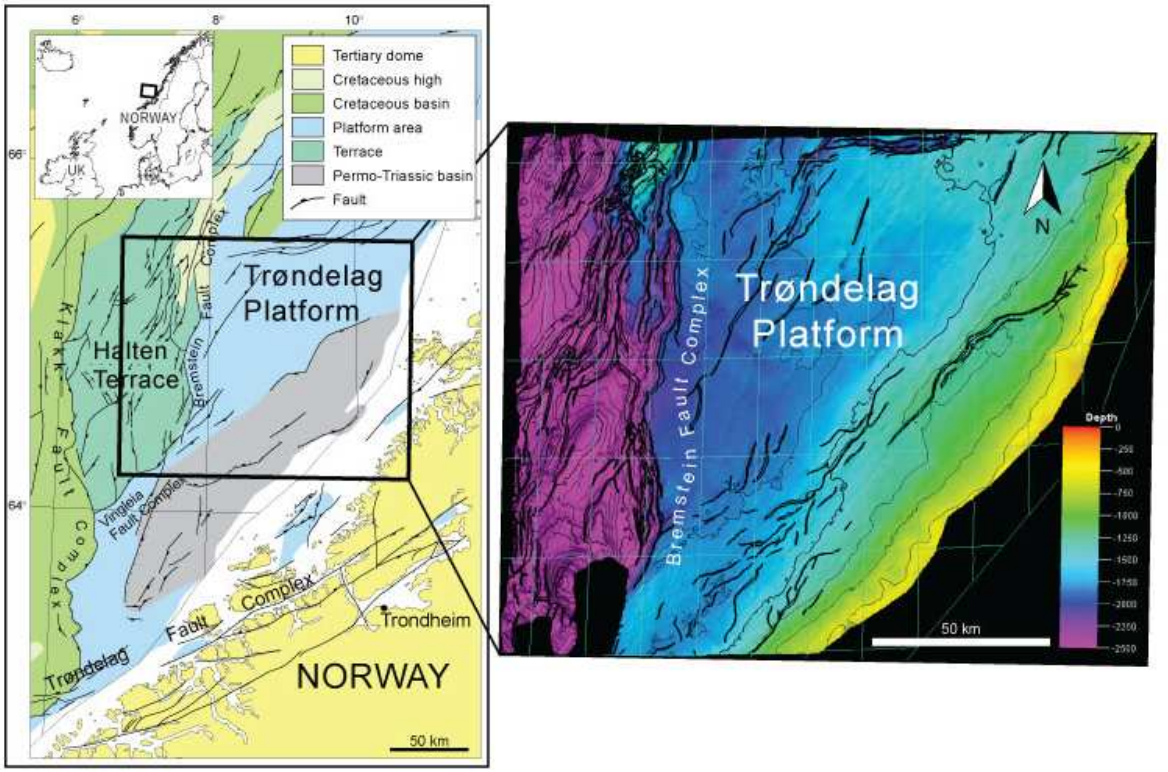
Research

- **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**

WP6 - Characterisation of a multi-compartment storage complex, Mid Norway

The Halten Terrace site

- **An offshore area of 150x50 km that contains gas with natural high CO_2 content that can be extracted and stored**

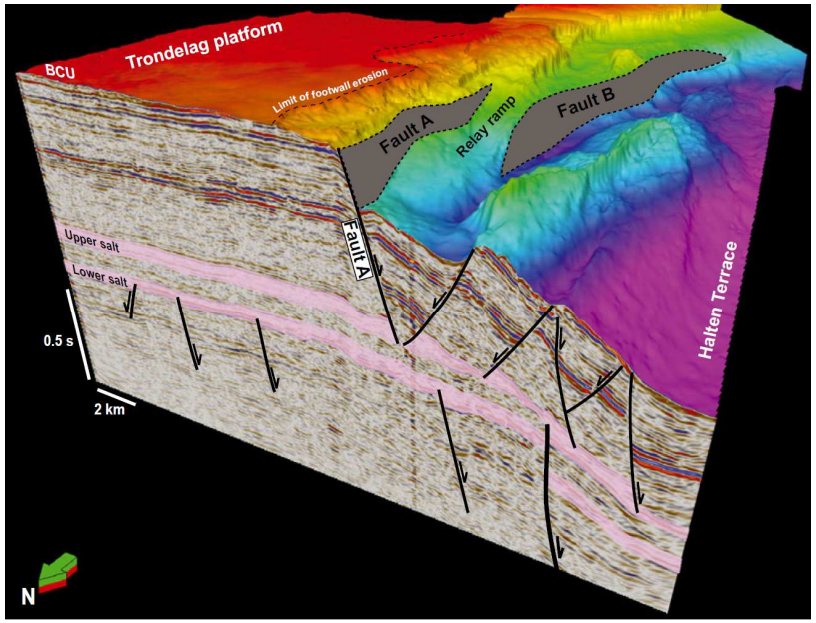


- **Reservoir boundaries defined by fault compartments that will influence possible migration of the planned stored CO_2 and possible fluid flow**

WP6 - Characterisation of a multi-compartment storage complex, Mid Norway

Objectives

- **Develop site characterisation procedure for a multi-storage complex with structural traps and open saline aquifers**



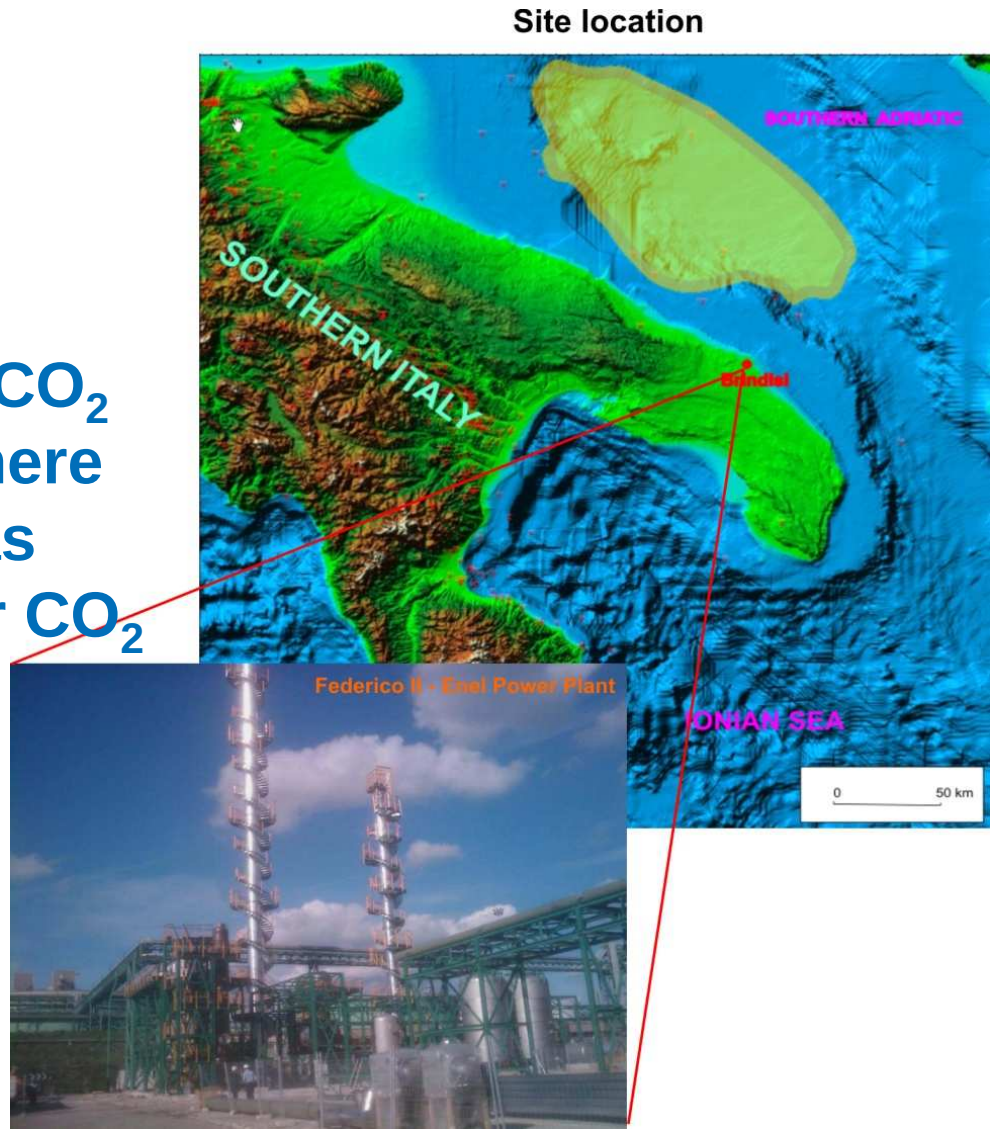
Research

- **Use several simulation tools and softwares to evaluate optimal (*e.g.* efficient and safe) reservoirs to store CO_2**
  - **Simulate possible migration of the planned stored CO_2 and possible fluid flow along faults**
  - **Quantify CO_2 saturation and possible flow and leakage**

WP7 - Characterisation of a carbonate aquifer, South Adriatic

The South Adriatic site

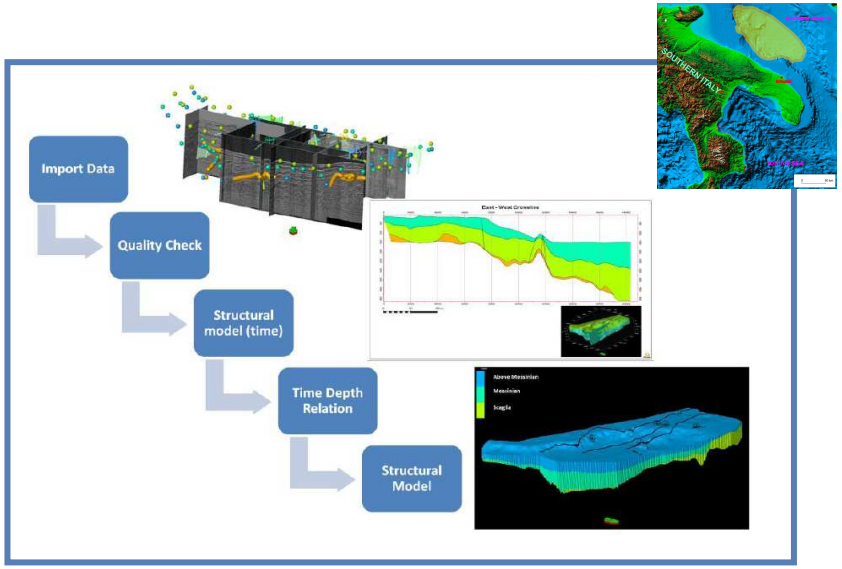
- **A structural trap in a carbonate saline aquifer, close to the main Italian CO_2 emission power plant where energy company Enel has launched a pilot plant for CO_2 capture in March 2011**



WP7 - Characterisation of a carbonate aquifer, South Adriatic

Objectives

- **Develop a robust methodology for storage site characterisation in carbonate formations**



Research

- **Simulate the geomechanical and dynamic behaviour of the storage complex due to the CO_2 injection in the specific reservoir, consisting of fractured carbonate formations**
  - **The storage complex will be characterized at reservoir level thanks to the seismic and well log information available in the area**

WP8 - Public Awareness

Objectives

- **Unobtrusively measure relevant characteristics of the local population**
- **Increase public confidence in decision-making on the operation**
- **Make available trustworthy generic and site-specific information on CCS**

➢ ***On two sites:*** **the offshore UK North Sea site & the onshore Polish site**

WP8 - Public Awareness

Research

Parallel to technical site characterisation, advance public awareness and enable informed opinion formation on CCS

- **Social site characterisation**
  - **Unobtrusively measure relevant characteristics of the local population, describe local history, and describe other relevant local factors for each of the selected candidate storage locations**
- **Trust building and raising public awareness**
  - **“Focus conferences”**
- **Repeat measurements**
  - **Measure the effect of the availability of generic or site-specific information and/or the effect of local focus conferences**

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

Acknowledgments

Many thanks to

the European Union, Industry (ENEL, PGNiG, STATOIL, Vattenfall, Veolia Environnement, Gassnova) and the Scottish Government

for participating and funding the project

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