

Technical University of Denmark



## Orientering om projekt: "StorageUtsira"

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## StorageUtsira

### Orientering om projekt: "StorageUtsira"

Møde om FENCO og CCS  
Energinet.dk , 4. marts 2009

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## Analysis of potentials and costs of storage of CO<sub>2</sub> in the Utsira aquifer in the North Sea

### Objectives

- Provide stakeholders with a detailed overview of the national and regional costs, benefits and bottlenecks of carbon capture and transporting and storing CO<sub>2</sub> into the Utsira formation.
- Developing a modelling tool within the framework of the continued model development on the basis of the Pan European NEEDSTIMES model and/or national MARKAL/TIMES models.

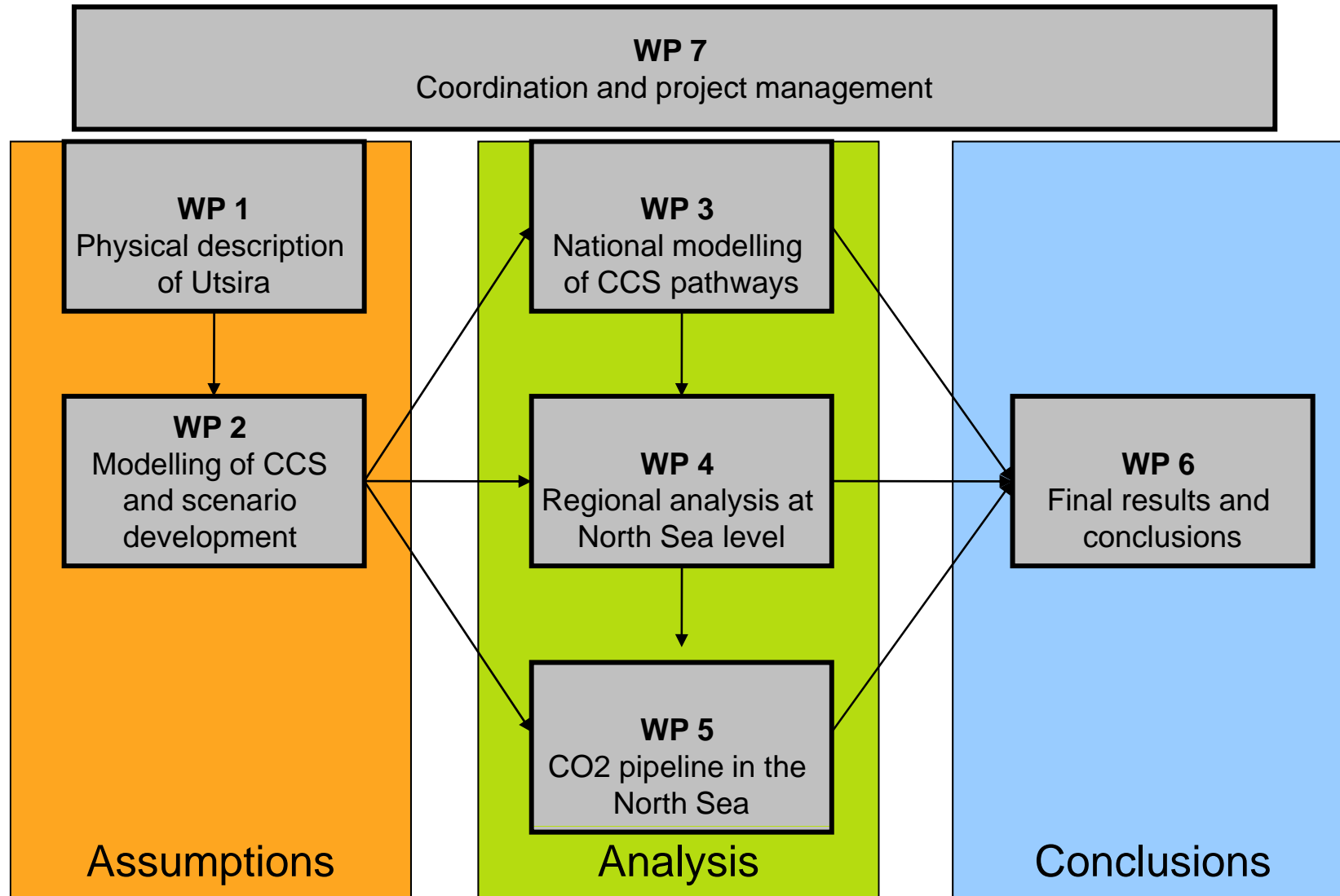
### Partners

- Insititute for Energy Technology (IFE)
- Universität Stuttgart, Institute of Energy Economics
- and the Rational Use of Energy (IER)
- Risø DTU
- Utrecht Universiteit
- King's College London

## Storage Utsira – Sub goals

- Improved knowledge on uncertainties and limitations to use the Utsira Formation as a CO<sub>2</sub> reservoir (capacity, user conflicts, leakage problems etc).
- Improved knowledge on transportation alternatives and barriers (both technical and political/economical) including possible synergies and conflicts for constructing an international CO<sub>2</sub> pipeline network.
- Coordinate analysis of CCS for the countries around the North Sea (Norway, Denmark, Germany, the Netherland and the United Kingdom) for the time period 2015-2050.
- Analysis of techno-economic parameters of future carbon capture technologies and their impact on CCS market penetration, considering alternative carbon reduction measures.
- Develop experience using the TIMES model for infrastructure development leading to an identification of a set of possible stepwise developments.

# Storage Utsira – Project structure



## WP 3. National modelling of CCS Pathways

- The development of CCS pathways in the North Sea region is the results of combining information on CO<sub>2</sub> reduction targets, mitigation technologies, costs, CO<sub>2</sub> capture potentials and the capacity and availability of geological reservoirs in each of the countries as well as the storage capacity of the Utsira Formation and the development of the infrastructure for CO<sub>2</sub> transport.
- Standardised data for modelling of the CCS pathways for each of the countries will be developed with WP2. This WP3 aims to implement these standardized data and parameter into a harmonised model based on the modelling tools developed within the IEA Implementation Agreement ETSAP.

### Tasks

- 3.1. Running existing model:
- 3.2. Test of integer features.
- 3.3. User interface for data input and reporting of national models.
- 3.4. National reporting

## Task 3.1 Running existing model

- The starting point of our analysis is the national MARKAL and TIMES models for the five countries developed by each of the partners involved. T
- These models will be used with harmonised modelling assumptions and scenarios to analyse pathways for CCS for all five countries.

### Existing models

- UK – *MARKAL family*
- The Netherlands – *simplified national CCS model*
- Germany – *selected sectors from Pan European Model*
- Denmark – *selected sectors from Pan European Model*
- Norway – *MARKAL family*

### Reference from application:

- Ref 3. Fidje, A., Energy Scenarios for the Nordic Region Towards 2035, IFE report no IFE/KR/E-2008/001, Kjeller, Norway (Available online from: [www.ife.no](http://www.ife.no) :publications)
- Ref 14. Grohnheit, P.E., Denmark: Using the IEA ETSAP modelling tools for Denmark. Risø-R-1656, Risø National Laboratory for Sustainable Energy, Technical University of Denmark, Risø-R-1656, 2008.

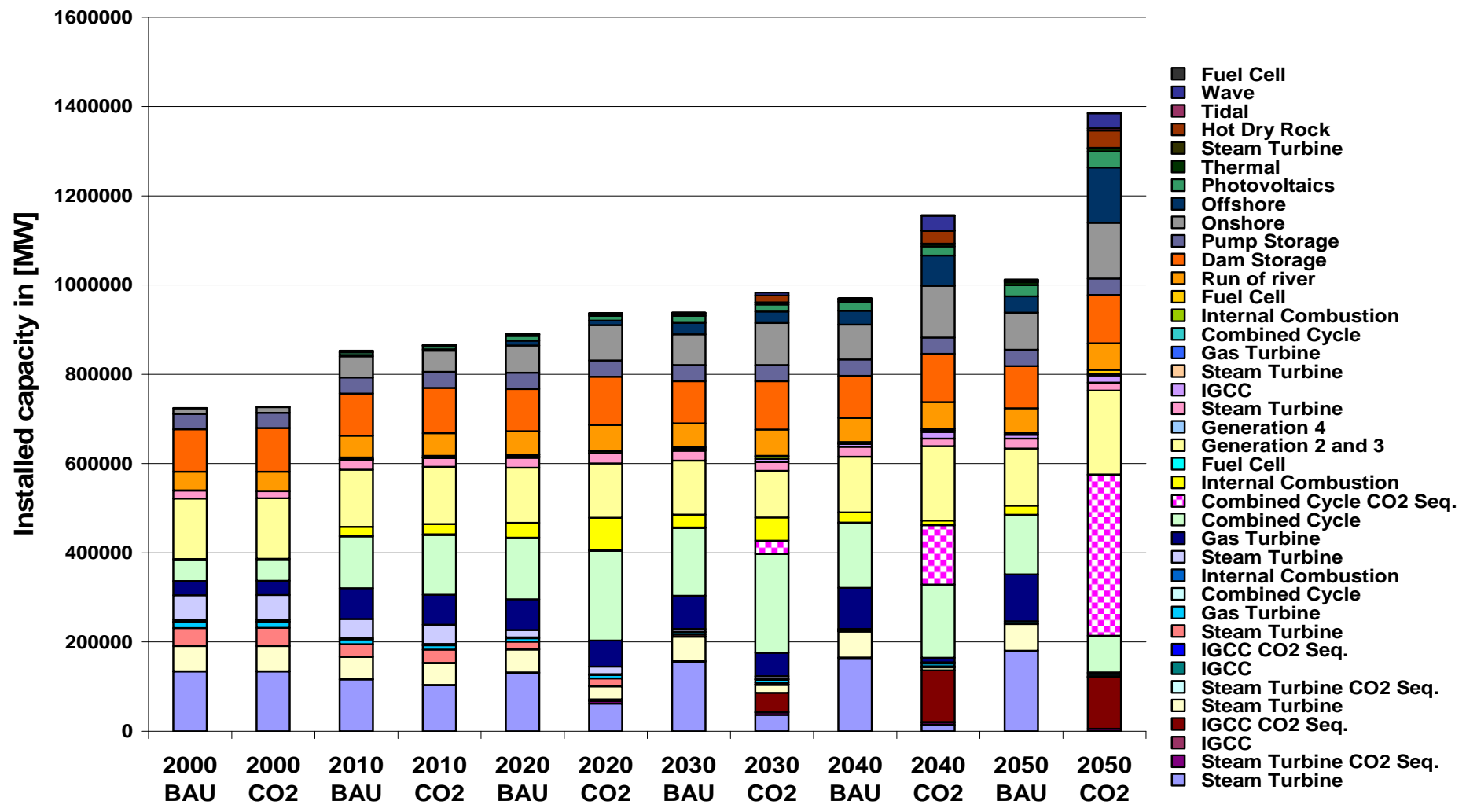
## Risø projekter vedr. TIMES

- NEEDS  
New Energy Externalities Developments for Sustainability, Research Stream 2a:  
“Energy systems modelling and internalisation strategies, including scenarios building”.  
*EU 6th Framework Programme, 2004-08.*
- ETSAP  
Danish participation in IEA-ETSAP, Annex X, 2005-07/Annex XI, 2008-10  
*EFP 2005. Energi og Samfund/ EUDP 2008*
- RES 2020  
Monitoring and Evaluation of the RES directives: implementation in EU27 and  
policy recommendations for 2020,  
*Intelligent Energy – Europe (IEE), 2006-09.*
- EFDA  
EFDA-TIMES Model.  
*European Fusion Development Agreement (EFDA), 2006-08, 2009.*

Risø-R-1656 “Using the IEA ETSAP modelling tools for Denmark”,  
[http://www.risoe.dtu.dk/Knowledge\\_base/publications/Reports/ris-r-1656.aspx](http://www.risoe.dtu.dk/Knowledge_base/publications/Reports/ris-r-1656.aspx).



# NEEDS-TIMES – Results of Pan European Model (October 2007)



Source: Markus Blesl, IER Stuttgart. CEEH Workshop Roskilde, 6 February 2008

## UK: Carbon capture & storage (CCS)

Technical storage potential and relevant costs from

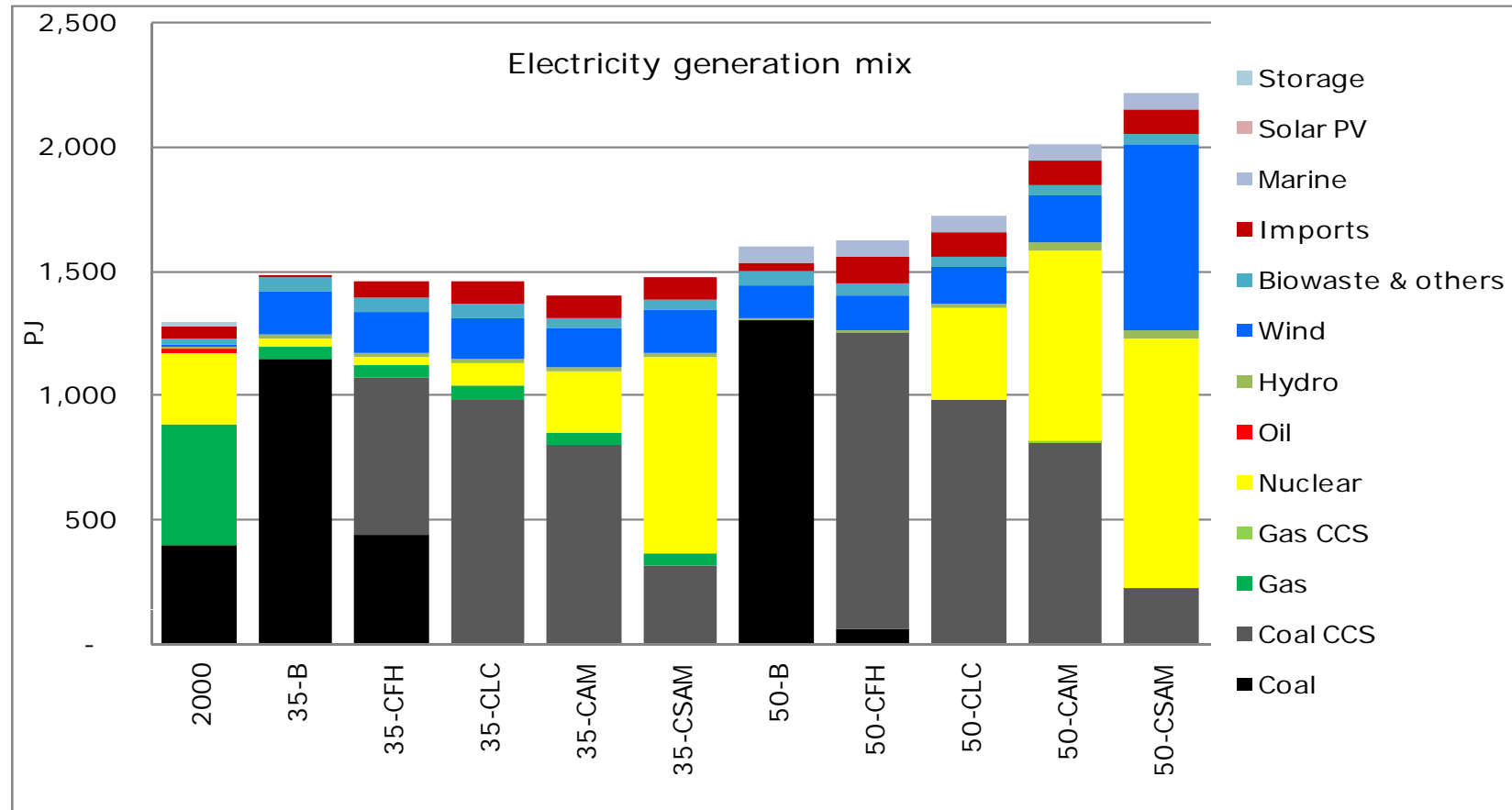
*DTI (2005) The role of fossil fuel carbon abatement Technologies (CATs) in a low carbon economy (Authors: Marsh G, Pye S and Taylor P)*

Constraints are imposed to limit captured-carbon from power and other sectors using annual and cumulative storage bounds

Storage sources	Annual Capacity	Capital cost	O&M cost	
			Fixed	Variable
	<i>MtC/year</i>	<i>£M/MtCO<sub>2</sub></i>	<i>£M/MtCO<sub>2</sub>/year</i>	
Near shore gas	5.46 (2010 - 2050)	26	0.6	0.22
Offshore oil and gas	5.45 (2010) 10.91 (2020 - 2050)]	34	0.6	0.22
Offshore aquifer	5.45 (2010) 10.91 (2020 - 2050)]	44	1.1	0.22

Source: Dr. Neil Strachan, King's College London, Kick-Off meeting 10-02-09

# UK: Decarbonisation of Power Sector (CO2 reduction 40-90 %)



- Power sector is decarbonised by three technologies/resources
  - Small cost differential between Coal-CCS, Nuclear and Wind
  - Rising electricity production - linkages to buildings and transport sectors

## GeoCapacity

- Assessing European capacity for geological storage of carbon dioxide – the EU GeoCapacity project
- Exchange of data with GEUS - Geological Survey of Denmark and Greenland is required in the contract with the Danish research programme for financing this project

### GeoCapacity

- EU 6th Framework Programme
- Co-ordinated by GEUS - Geological Survey of Denmark and Greenland
- 25 partners
- Database on CO<sub>2</sub> storage sites
- Assessment of CO<sub>2</sub> storage capacity in most European countries

## Samarbejde med GEUS / GeoCapacity

Kotrakt med ForskEL:

- ”Projektet er godkendt under forudsætning af, at GEUS - De Nationale Geologiske Undersøgelser for Danmark og Grønland inddrages i projektet med henblik på dataudveksling.”

Vigtigste emner for samarbejdet

- Harmoniserede beregninger med GeoCapacity Decision Support System (DSS) – Neele et al., GHGT-9, November 2008.
- Storskala CO<sub>2</sub> lagring i Vedsted-strukturen i Vendsyssel – Frykman et al. GHGT-9, November 2008.

*Næste projektmøde 16. marts 2009 – Skype konference.*