



B A S T O R – Baltic Sea Storage of CO₂

***CO₂ Capture and Storage – Response to Climate Change
Regional workshop for the Baltic Sea Region and C&E European Countries
13-14 April 2011, Vilnius, Lithuania***

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Presentation Outline

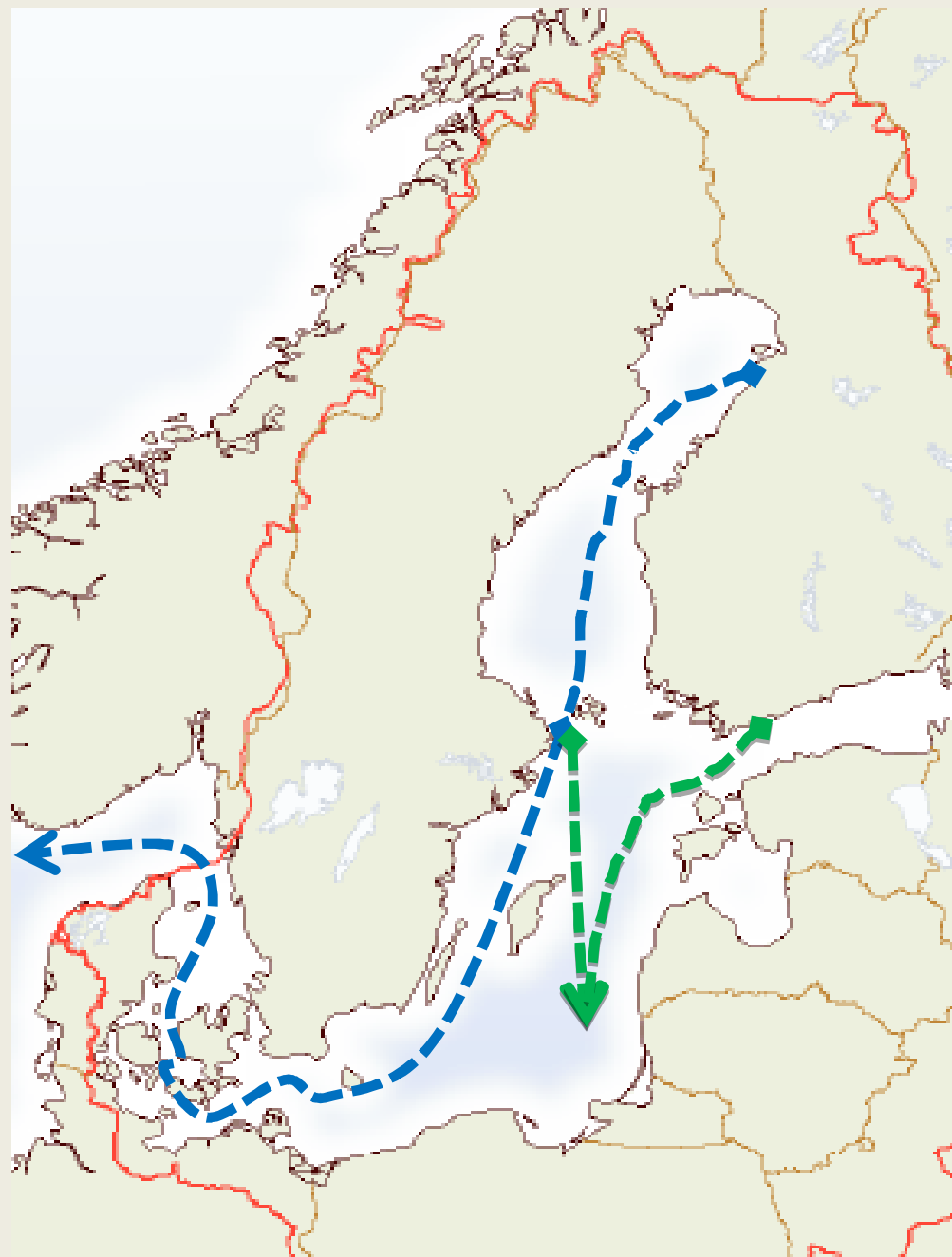
- Background
- Vision and rationale
- Regional and industrial interest
- Focus on geology
- Program design
- CCSP – New CCS program in Finland

Background

- Climate change is considered a threat to global welfare and a consequence of greenhouse gas emissions
- Carbon Capture and Storage (CCS) is by many seen as a bridge to a low-carbon society
- Technologies are being tested: Capture technologies are still too costly in energy consumption and secure sequestration is still to be proven
- CCS is questioned for risk of leakage with "Not-Under-My-Backyard" arguments" – community ownership is a condition for any CCS success

VISION AND RATIONALE

*CCS in the Baltic Sea region
is much about transport and
storage*



*Considerable transport penalty if
no suitable storage available in
the basin*

REGIONAL AND INDUSTRIAL INTEREST

Recent study of CO₂ emissions in the Nordic countries

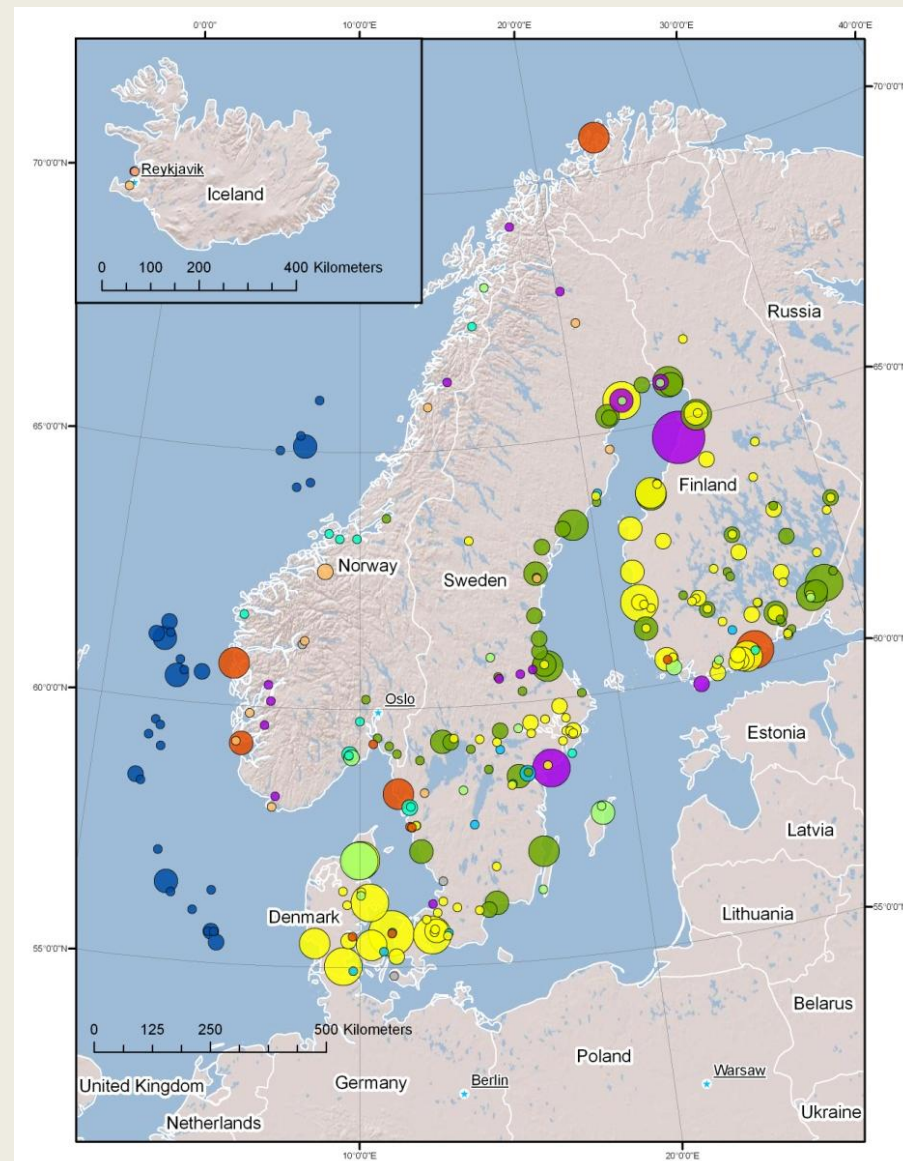
Data from 2007 for
Finland, Sweden and Denmark:

- 217 sources >100 Ktpa
- Fossil CO₂ 88 Mtpa
- Bio CO₂ 53 Mtpa
- Industrial > Power

Legend

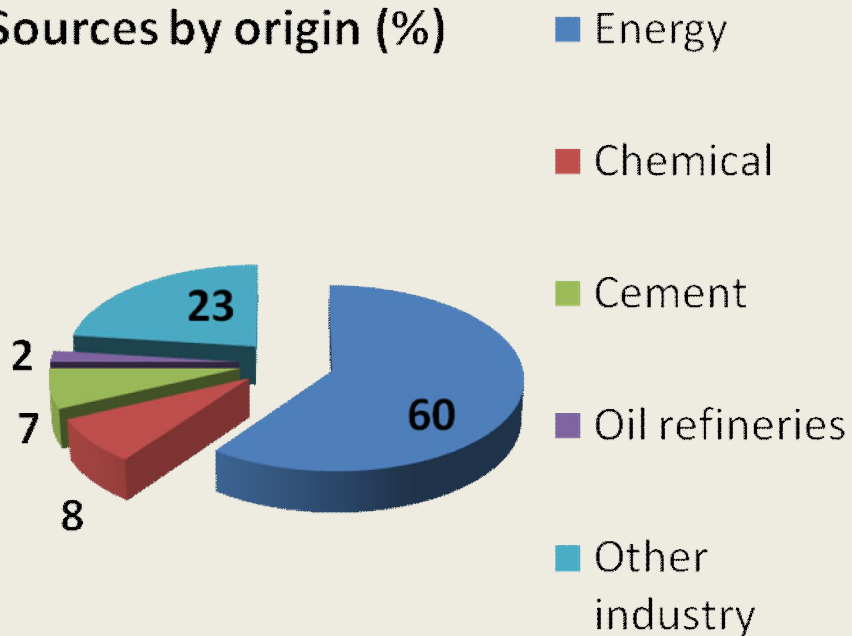
- Cement and lime production
- Iron and steel production
- Non-ferrous metal production
- Offshore oil and gas activities
- Oil and gas refineries
- Other
- Power and heat production
- Production of chemicals
- Pulp and paper production
- Waste treatment or incineration

Source: VTT Research Notes 2556, Sept 2010



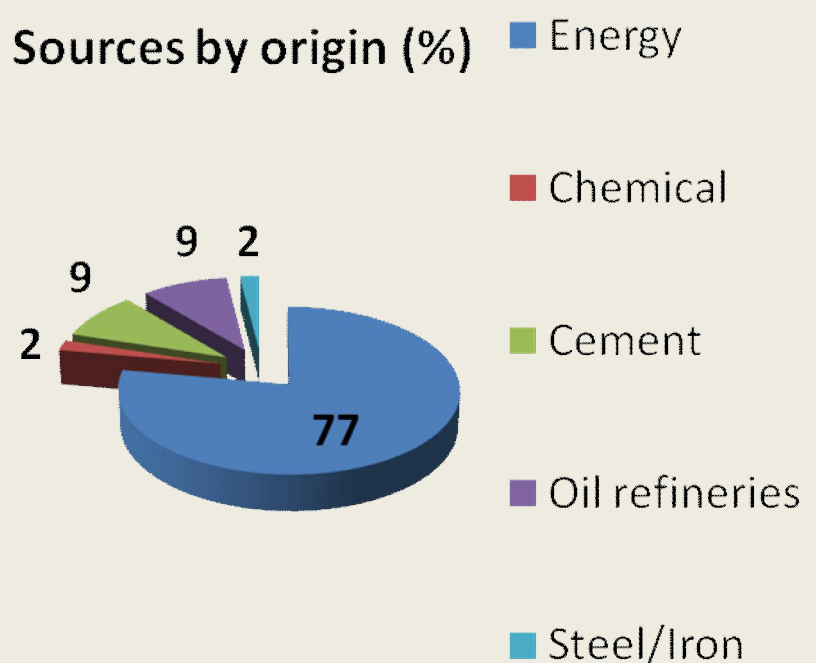
Considerable emissions in Poland and the three Baltic States

Poland
Sources by origin (%)



Total CO₂ 230 m t p a

Baltic states
Sources by origin (%)



Total CO₂ 19 m t p a

source: Jacek Skiba, Central Mining Institute,
Katowice, Geneva, 18/11/2008, Adam Wojcicki, PBG (Castor WP1)

source: A Shogenova et al, EAGE 69th Conference
& Exhibition-London, UK, 11-14 June 2007

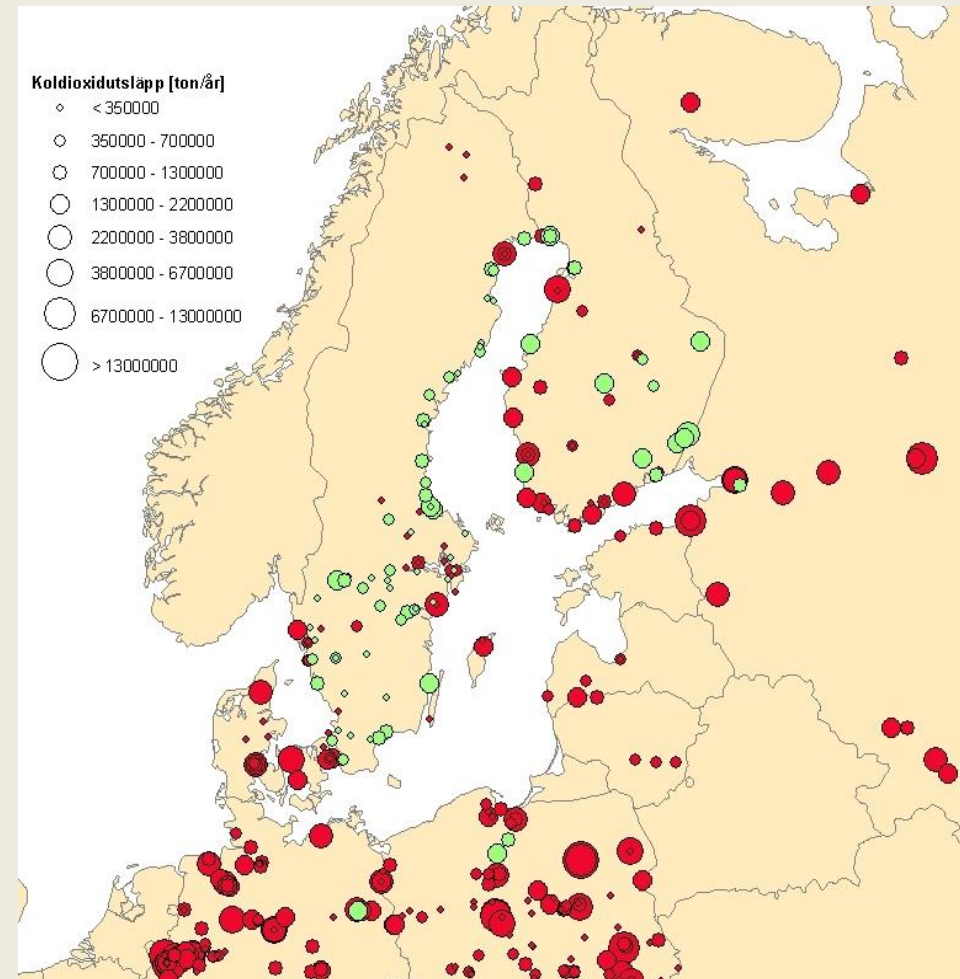
No doubt, regional emissions are large enough to bother....

(point sources > 100 kt p a)

- Emissions within reasonable distance to the Baltic Sea basin >100 Mtpa
- If only 50 % catchable, still >50 Mtpa
- 25 years capture requires storage capacity >1 250 Mt
- Incentives for bio-CCS could give significant economy of scale in infrastructure development

The availability of suitable storage will impact the competitiveness of the region's carbon intensive industry

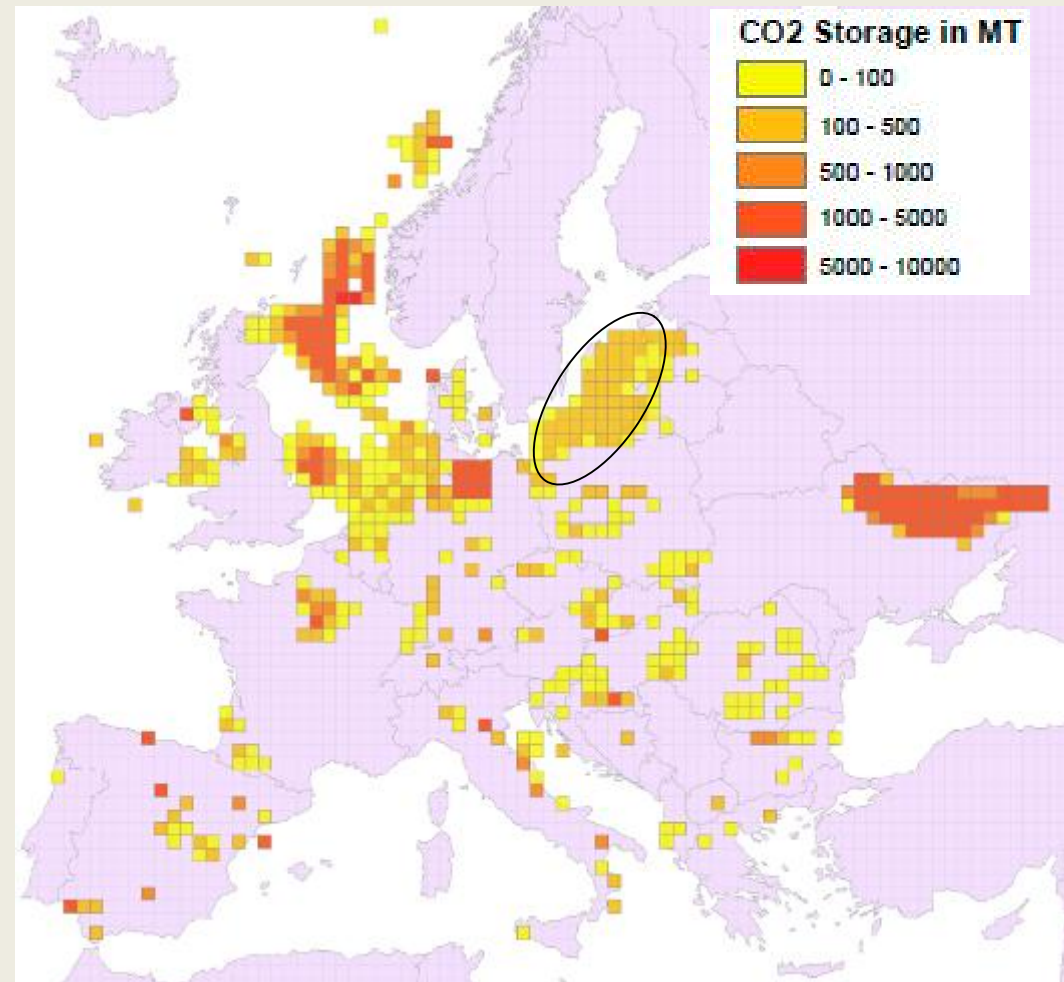
Baltic Sea countries, CO₂ sources
(red fossil, green biogenic)



FOCUS ON GEOLOGY

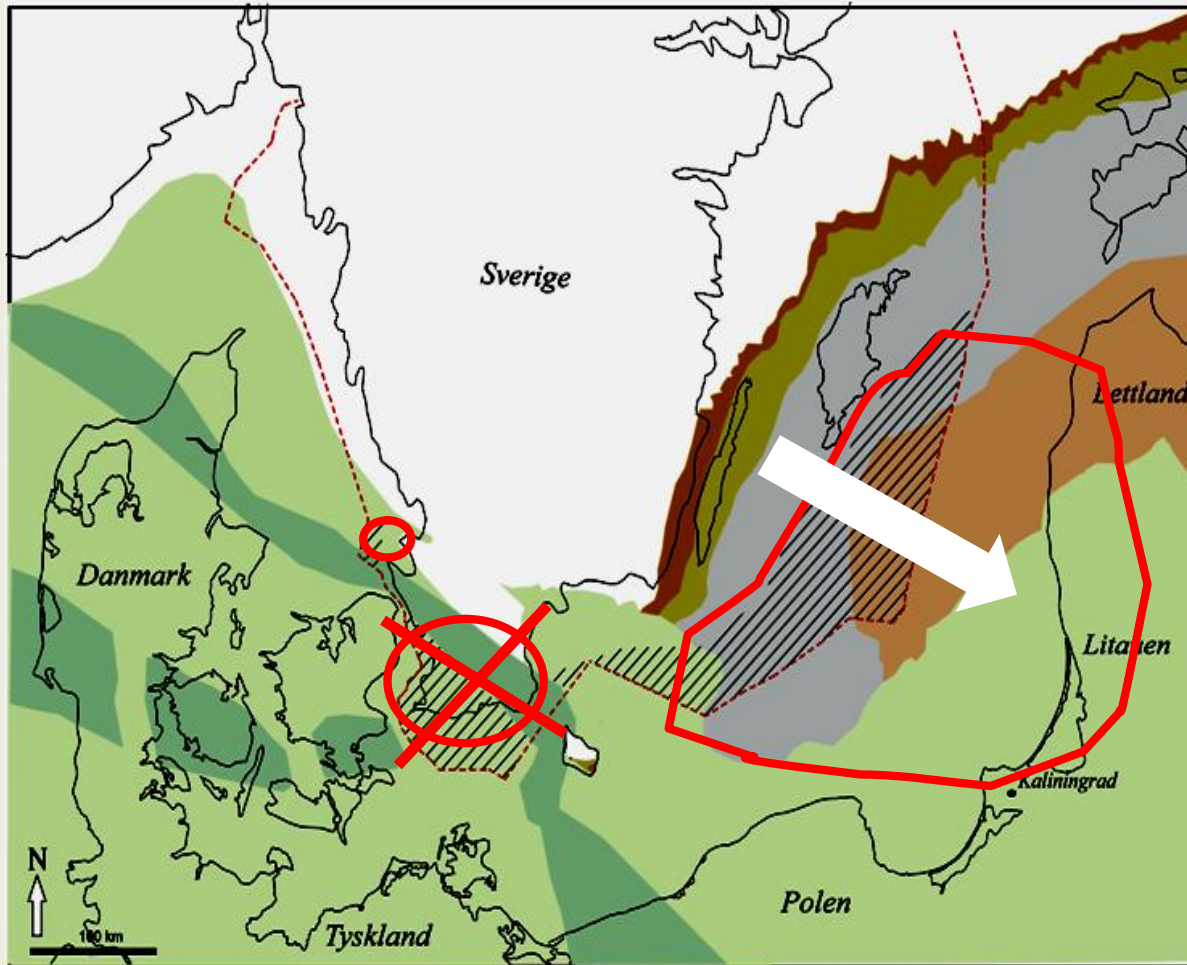
Nordic geology less favourable than the Baltics'

“North Sea much more advanced than Baltic, and likely to develop first.”



Source: Arup SCCS study 2010, Forum on Sustainable Fossil Fuels Berlin 18-19 October 2010

The potential for geological storage



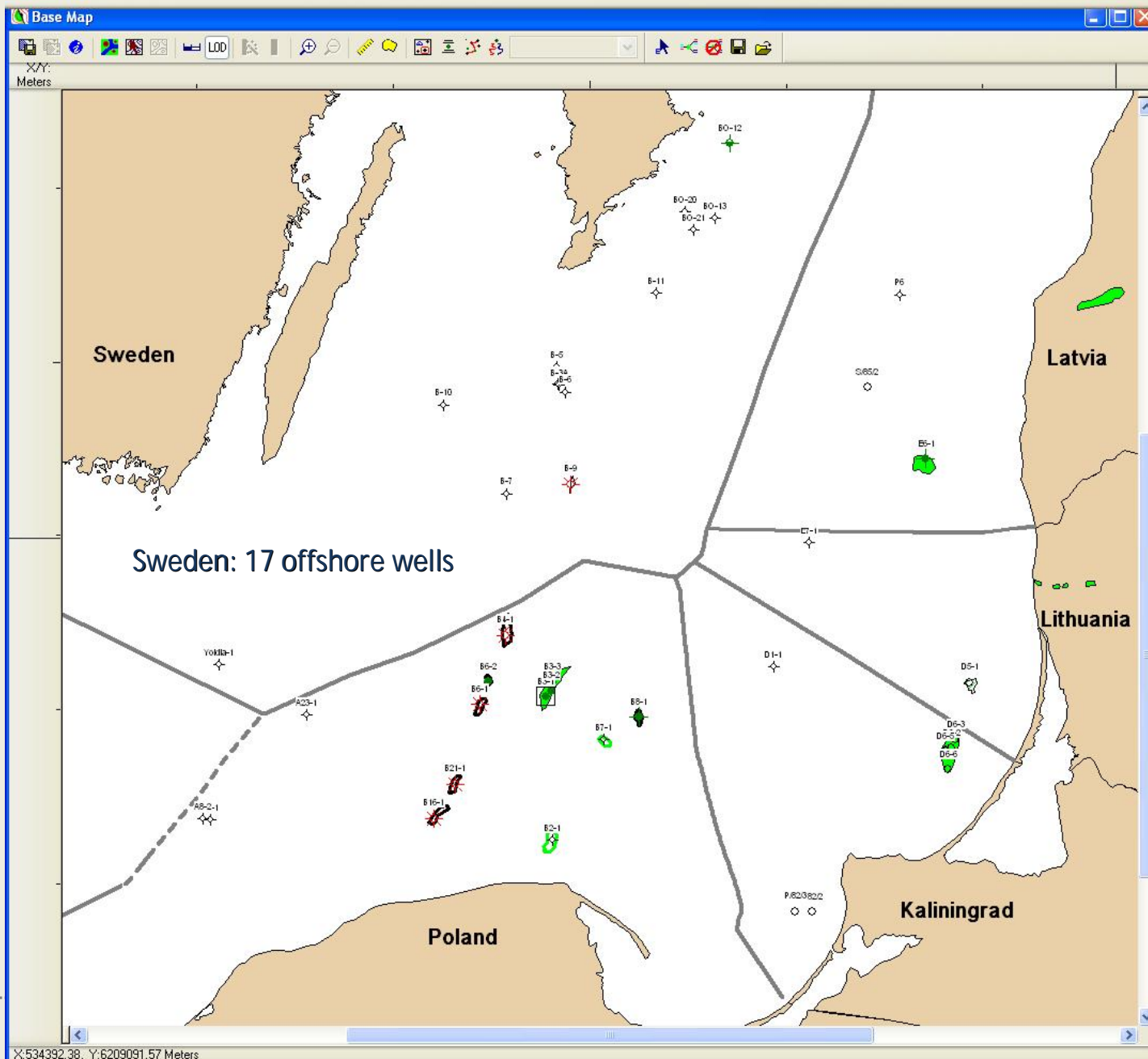
Areas with deep aquifers of Cambrian sandstone in the Swedish zone and further south east

Porosity, volume potential and containment (sealing) require significant exploration efforts

Swedish Government excludes Scania (SW) from CO₂ storage when implementing CCS Directive

Source: Erlström, SGU, (OPAB)

Drilled wells in the Baltic Sea



In total approx. 965 wells have been drilled in the Baltic Region

OPAB - seismic surveys 1969-07

(32 000 km seismic lines)

Öland

Gotland

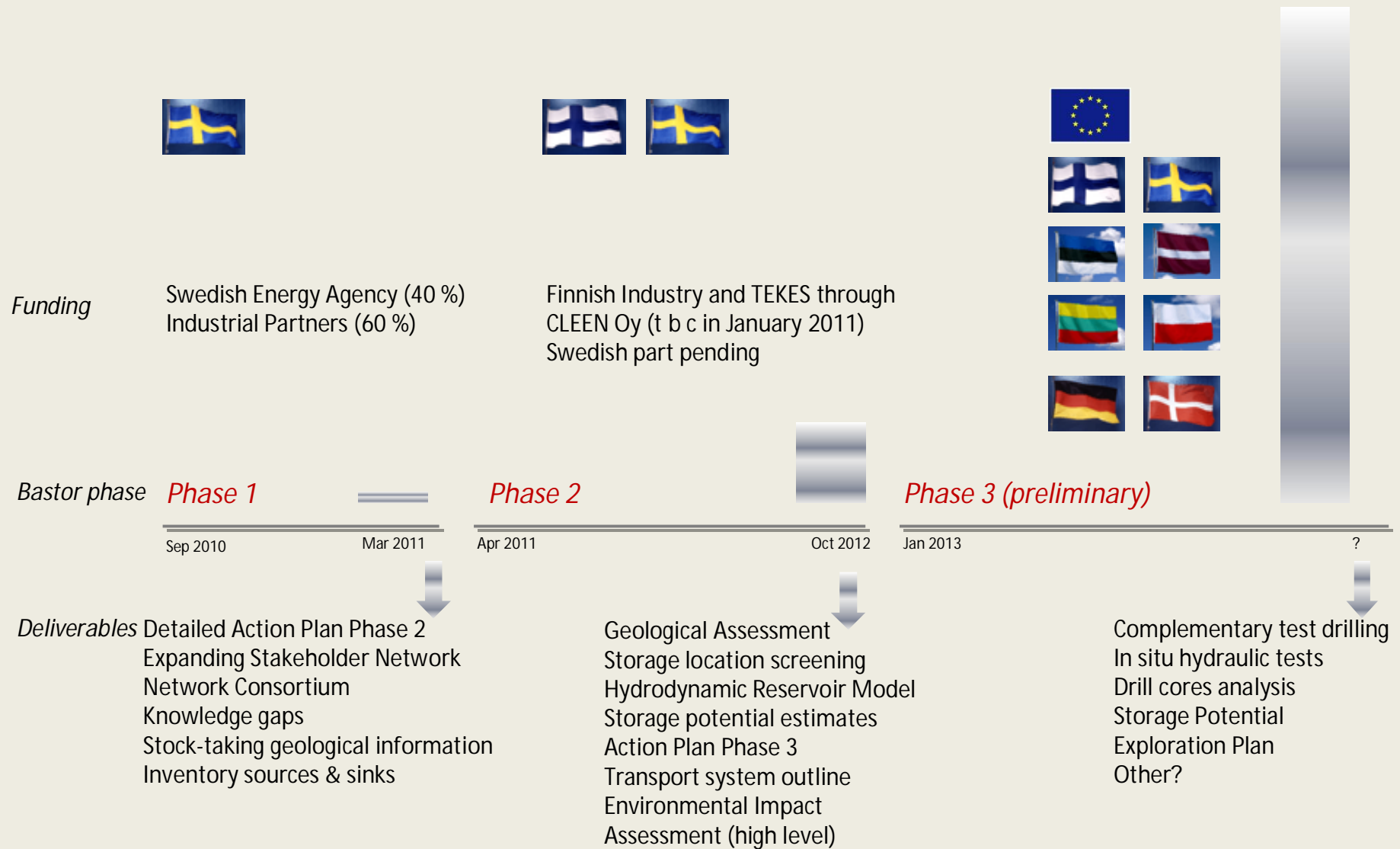


PROGRAM DESIGN

The Bastor Initiative – Summary

- Vision: Common, regional infrastructure for transport and sequestration of carbon dioxide in the Baltic Sea Region
- Descriptive: "Concrete steps towards clarifying the potential for geological storage of CO₂ and providing a platform for common transport solutions in the Baltic Sea Region"
- Public engagement: Drive open dialogue, accept public challenge and seek sustainable solutions

Bastor - Long term program with three discrete phases



The Bastor Initiative

Objectives for *Phase 1 (completed)*:

- Screening study to develop a detailed action plan for geological assessment and identify sources of funding for following project phases
 - Establish a platform for an active CCS network with stakeholders from all states in the Baltic Sea Region
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Phase 2 – Pre-feasibility level

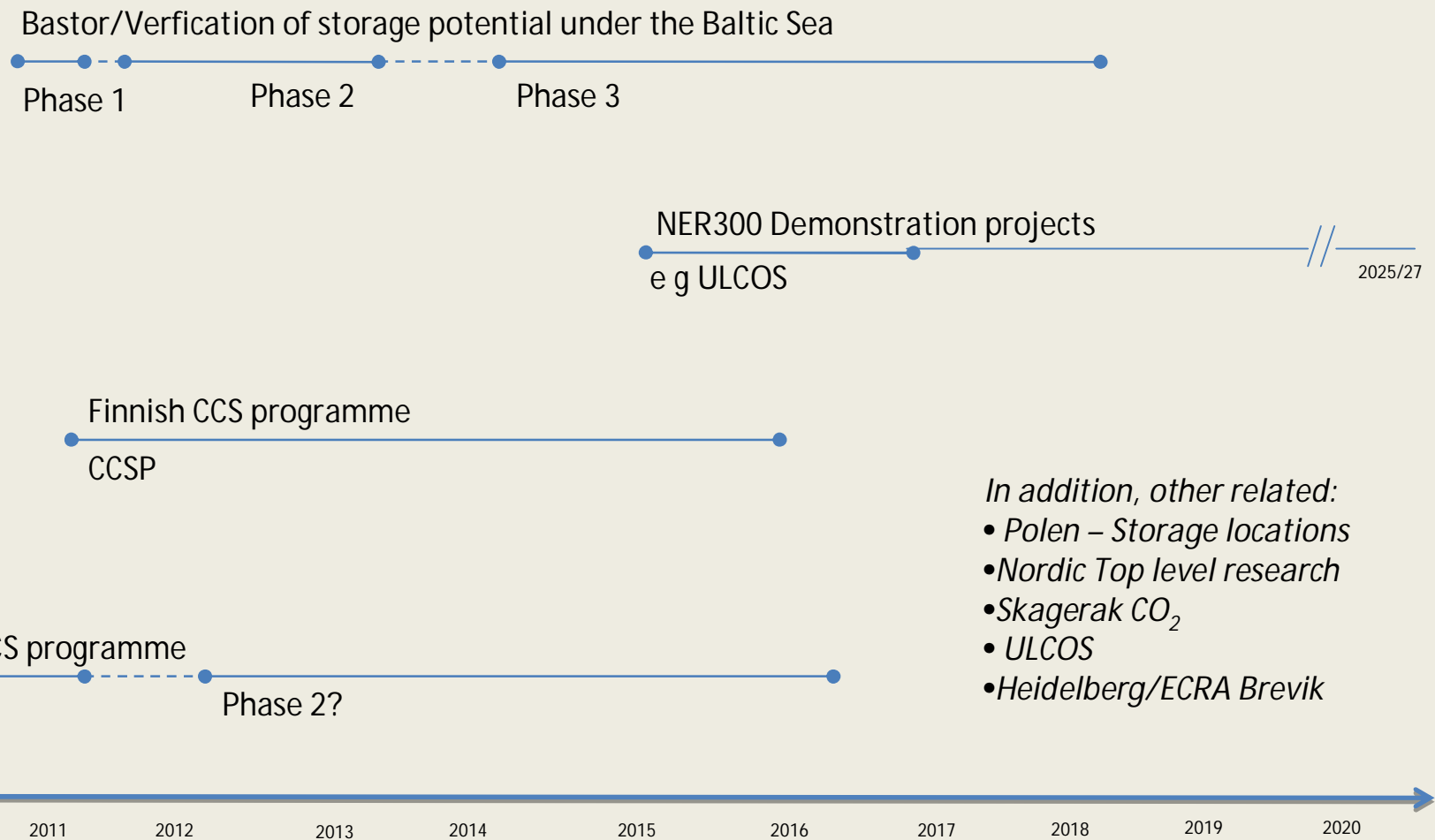
- Geological assessment of available information from Baltic Sea countries
- Identification of storage locations in the Baltic Sea
- Storage potential calculations
- Containment risk analysis
- Expand the Baltic Sea CCS network and increase public outreach
- Transport system integration

To provide sufficient certainty of the potential for geological CO₂ storage to make informed decision about a possible next phase

Parallel activity – Connection to Clean Oy CCS Program (CCSP)
Baltic Sea CCS Networking

- Create a Baltic Sea CCS network
- Focus on CCS and especially on safe geological storage
- Seeking synergies in transport
- Taking stock of current knowledge
- Develop private-public partnership

External project dependencies



CCS Programme (CCSP) in Finland

5 years/20 M€, 25 partners (16 industrial and 9 R&D)

Work Packages and Task List

Work Package 1: CCS related regulation, legislation and EHSS questions

Updating and forecasting of the legislative frame work of CCS, definition of CO₂ emissions in connection to CCS and monitoring, Environment Health Safety & Sustainability questions, International networking

Work Package 2: CCS concept studies

Power Plants, oil refining, steel industry, other industrial solutions

Work package 3: Capture of CO₂ including advanced technologies

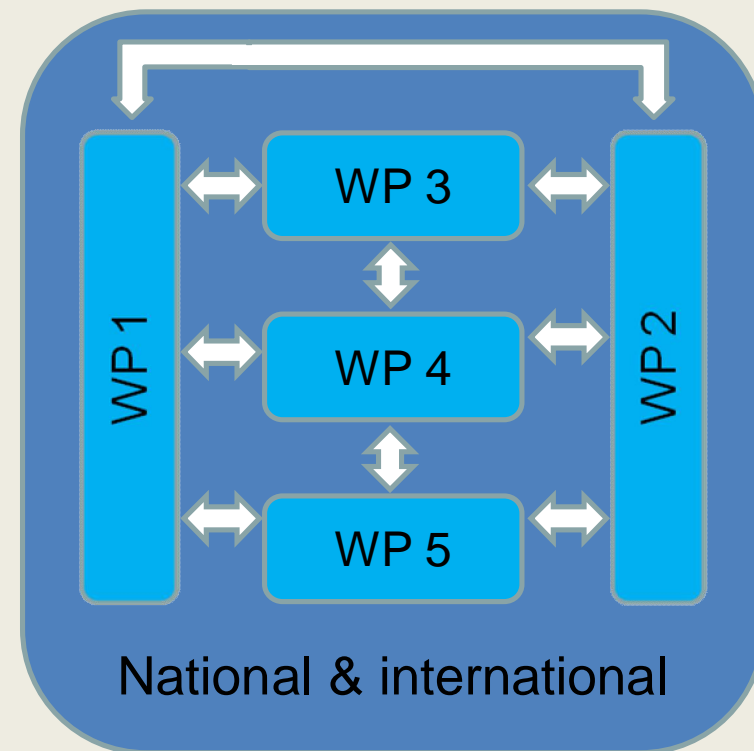
Oxyfuel solutions, post combustion capture, biomass related solutions, advanced solutions

Work Package 4: Processing and logistics of captured CO₂

Processing, logistics

Work Package 5: Storage of CO₂

Geological storage, CO₂ fixation by mineral matter



Task 5.1 Geological storage

Subtask 5.1.1 Status and analysis of global situation (Task leader GTK)

Objective: To provide updated and relevant information on status and capacities of geological storages.

Subtask 5.1.2 Baltic Sea region based opportunities (Task leader Fortum Oyj)

Objective: To establish an international Baltic Sea CCS network and to estimate the actual geological storage potential in Baltic Sea based on previously determined seismic data.

Subtask 5.1.3 Seismic Characterisation and monitoring (Task leader GTK)

Objective: To provide a thorough understanding of the structural geometry and flow pathways of the reservoir as required by the development of a CO₂ geological storage facility

Task 5.2 CO₂ fixation by mineral matter (Task leader Aalto/ENE)

Objective: Readiness for industrial scale demonstration of carbonation technology

Invitation

- We invite all relevant parties/shareholders in the Baltic Sea region to join the Baltic Sea CCS network in order to establish a common platform to promote CCS in the Baltic Sea region
 - Industry having significant CO₂ emissions
 - Geological surveys
 - Authorities
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Thank you for your attention!

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