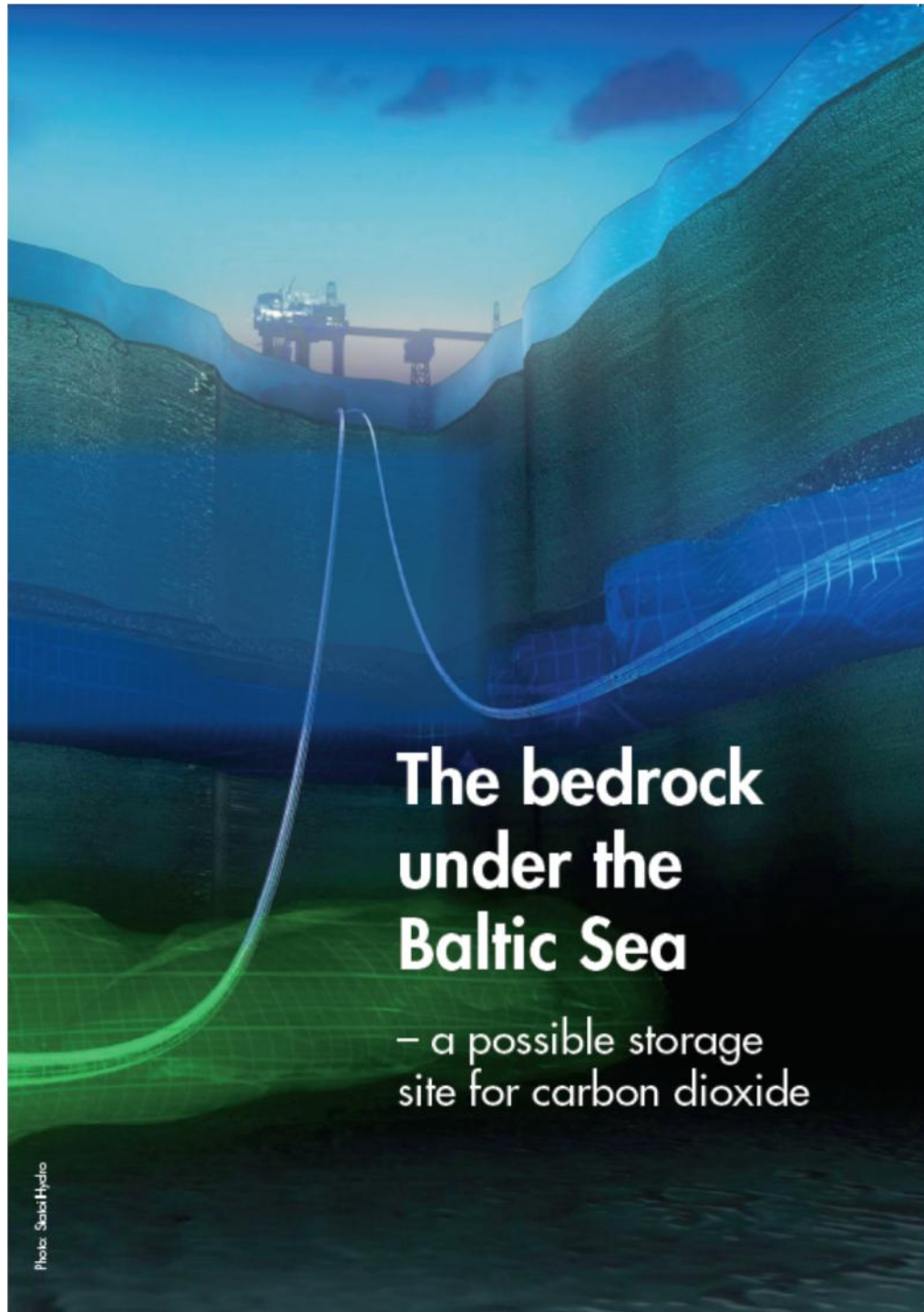


Sweden –
Strategic Research & Innovation Agenda

Process Industry and the Zero Emission Vision

Per Arne Nilsson
Baltic Carbon Forum
Tallinn, Estonia
22-23rd April 2015



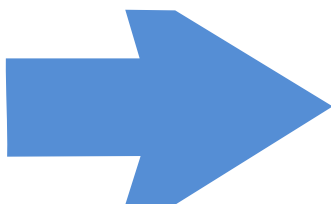
BASTOR – Baltic Storage of CO₂

- Geology
- Environmental Impact
- Communication and Acceptance
- International Law
- Infrastructure for Transport

[2012 – 2014]

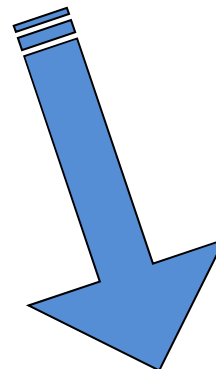
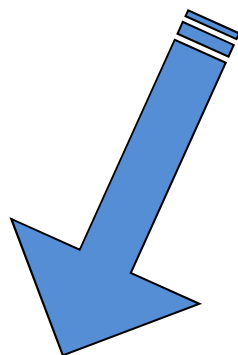
So, overall, what did we learn?

- There are opportunities for CO₂ storage
 - At industrial scale from the Swedish sector of the Baltic Sea
 - At (larger) regional scale, potentially further East
 - Expanded regional collaboration is a prerequisite
- Transboundary transport and storage necessary but international law is not (yet) coming in support
- Transport is (inter-) national infrastructure, prompting government initiative
- Building public support relates to the perception of climate threats and to how environment impact can be kept in check



For industry, 2050 is only one or two investment cycles away, so early action is of essence!

Post BASTOR – the immediate legacy:

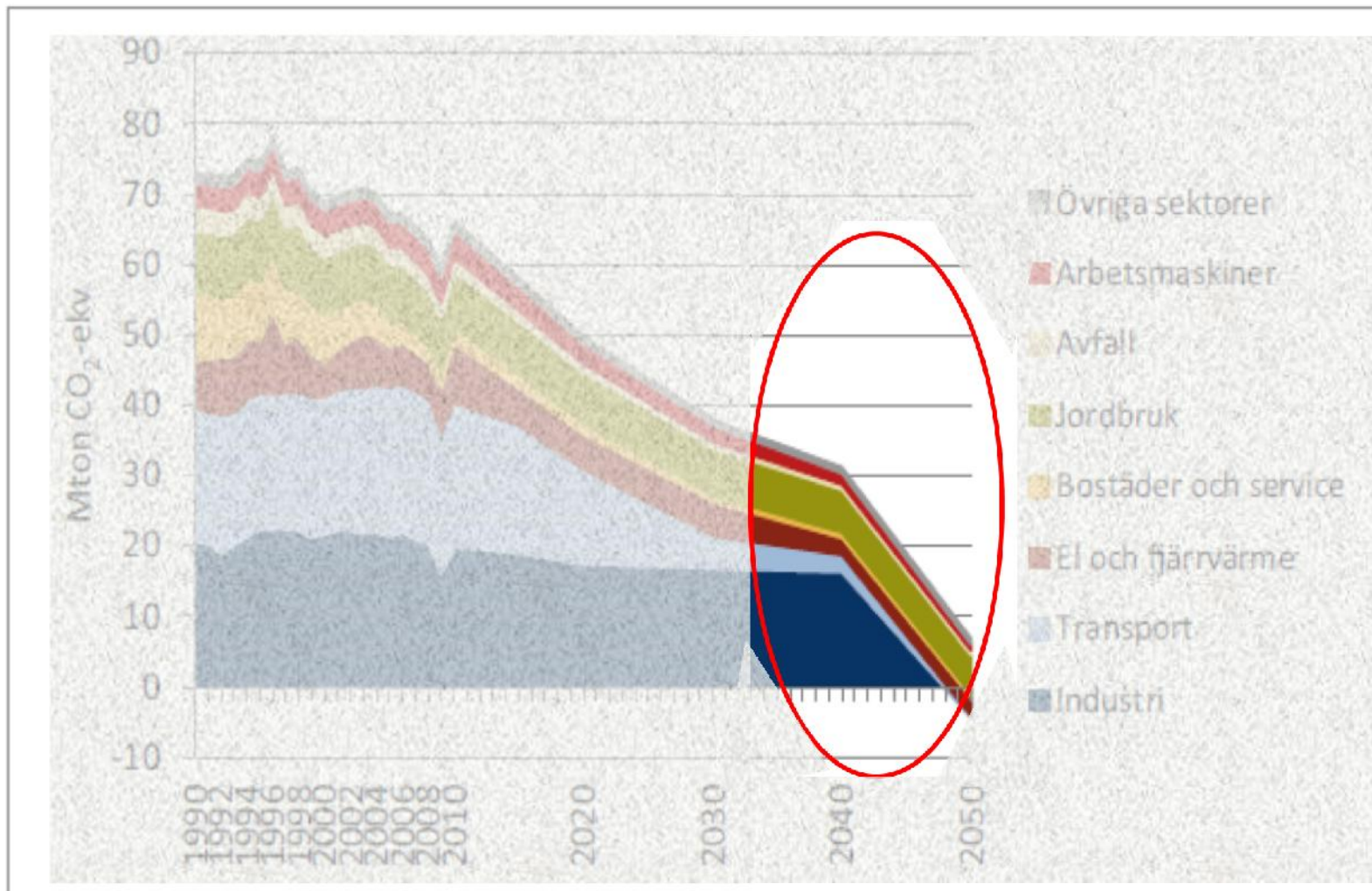


- **Strategic Research and Innovation Agenda**
 - Some 20+ partners, from industry, academy and agencies
 - Proposed way forward to be presented summer 2015

- **CCS Expertise Network**
 - Initiated by the Baltic Sea States through the Baltic Sea Region Energy Cooperation (BASREC)
 - In support of long term development towards regional CCS deployment

Why does Sweden need a Strategic Innovation Agenda for the Process Industry?

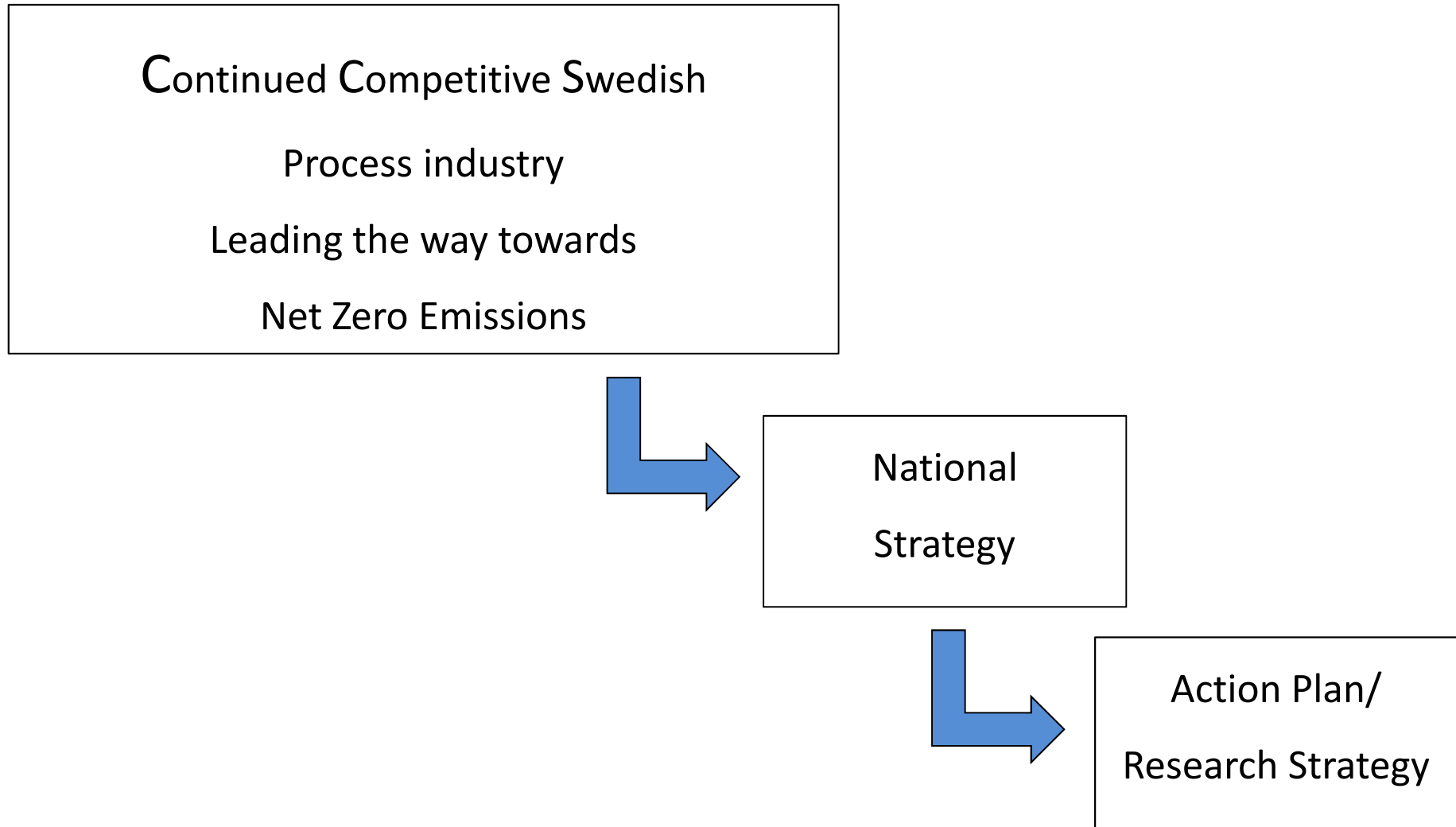
- 20% of the Swedish GHG come from base industry exposed to global competition
- How could we best utilize our strategic assets and reach for the vision?
Forests, iron ore, lime?
- Point source emissions in Sweden, eligible for CCS:
Process industry, rather than energy!
- CCS is large scale and could be perceived as intimidating – How do we reach (enough) acceptance?



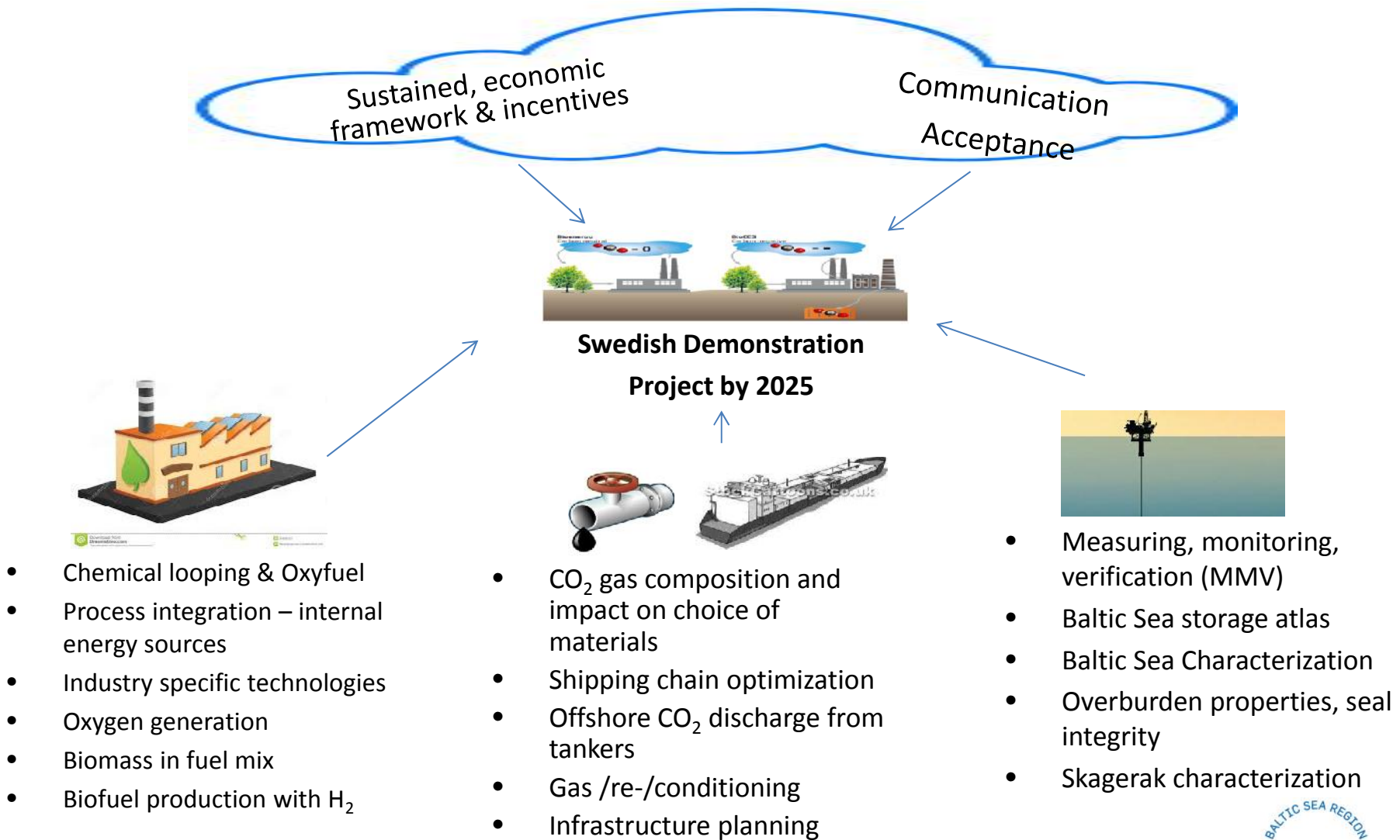
Strategic Research and Innovation Agenda – The Framework

- A program under the Swedish Energy Agency and VINNOVA, Sweden's Innovation Agency
- Research Agenda to be presented summer 2015
- No research
- Objective is to focus research towards industrialization
- Open for international cooperation

The progress plan



Proposed research (selection)

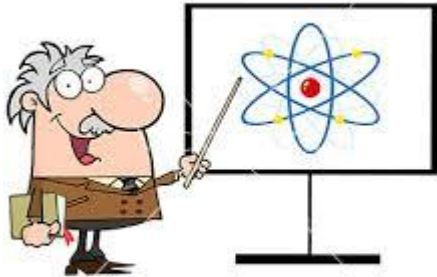


- Chemical looping & Oxyfuel
- Process integration – internal energy sources
- Industry specific technologies
- Oxygen generation
- Biomass in fuel mix
- Biofuel production with H₂

- CO₂ gas composition and impact on choice of materials
- Shipping chain optimization
- Offshore CO₂ discharge from tankers
- Gas /re-/conditioning
- Infrastructure planning

- Measuring, monitoring, verification (MMV)
- Baltic Sea storage atlas
- Baltic Sea Characterization
- Overburden properties, seal integrity
- Skagerak characterization

Partners behind the Agenda



Partner

Uppsala University

Lund University

Chalmers Technical University

Linköping University

IVL – Swedish Environmental Research Institute

Swerea MEFOS

Innventia

Swedish Mineral Processing Research Association

Swedish Geological Survey

SSAB

Cementa

Nordkalk

SMA Mineral

OPAB

Fortum

Confederation of Swedish Enterprise

Swedish Forest Industries Federation

The Swedish Steel Producers' Association

Energiforsk



"We produce approximately three-thousand cubic yards of satis at this factory each week."



Back casting – gives an idea of the urgency

