Nordic Energy Research

CCS in the Nordic countries

Svend Søyland,
Senior Adviser, Nordic Energy Research (NER)
svend.soyland@nordicenergy.org

NER Goals

1. Build research cooperation and competencies within the development of sustainable energy solutions.
2. Provide research-based analytical support to energy technology decision- making.
3. Enhance the knowledge base for increased competitiveness of the Nordic energy system and disseminate Nordic sustainable energy solutions.

NEF guiding principles

1. Nordic added value

2. System perspective

3. Politically relevant research results

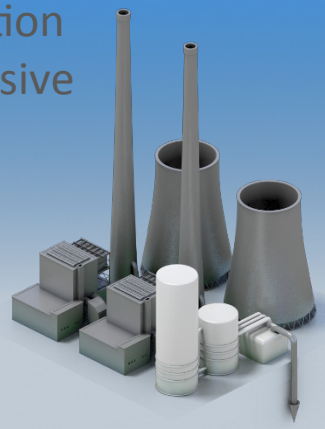
Focus areas

1. Infrastructure enabling system solutions

3. Energy efficiency improvements in demand sectors

2. Transportation fuels and sustainable biomass

4. Decarbonisation of energy-intensive industries



According to IPCC, WB and IEA: CCS and Carbon-negative options is essential!

norden
Nordic Energy Research

CCUS in a Nordic Context

- Experience in storage (Sleipner)
- Two projects “NordicCCS” and “Negative $C0_2$”
- Top-level research and pilots

Relevant sectors:

- Oil and Gas
- Power sector (coal and gas)
- Industrial CCS (steel, cement, fertilisers)

Co-firing biomass -the potential for going carbonnegative!

norden
Nordic Energy Research

Technology Centre Mongstad

Some Nordic CCS pilots

- Sleipner CO_2 storage
- Test Center Mongstad
- Brevik Cement
- Chalmers and SINTEF labs
- Negative CO_2 - new NER flagship programme

NORDICCS – a NER Sustainable Energy Systems - 2050 project

Main objective: boost the deployment of carbon capture and storage

1. Provide Nordic industry-driven leadership within CCS innovation and realization
2. Demonstrate how CCS can contribute to the Nordic portfolio of climate change mitigation options.
3. Enable the Nordic countries to join forces to become pioneers in large-scale implementation of CCS.
4. Multi-contextual focus to utilize Nordic differences for broad stakeholder and global relevance.
5. Strengthen the competitive power of the region by combining complementary capacities of the Nordic countries.

Completed in November 2015.

More information here: : http://www.sintef.no/projectweb/nordiccs/

NER Flagship: Negative CO_2 Closed-loop Bio-CCS

Nordic Energy Research

Goal:

- Enable CO_2 capture and negative CO_2 emissions with the lowest possible cost and energy penalty.
- Produce power and steam for industrial and other applications.
- Utilizes Nordic expertise and competence in fluidized bed technology.
- Sustainable use of available biomass: waste and wood

Partners:

SWEDEN

- Chalmers University of Technology (Chalmers)
  Sibelco Nordic AB (Sibelco)

NORWAY

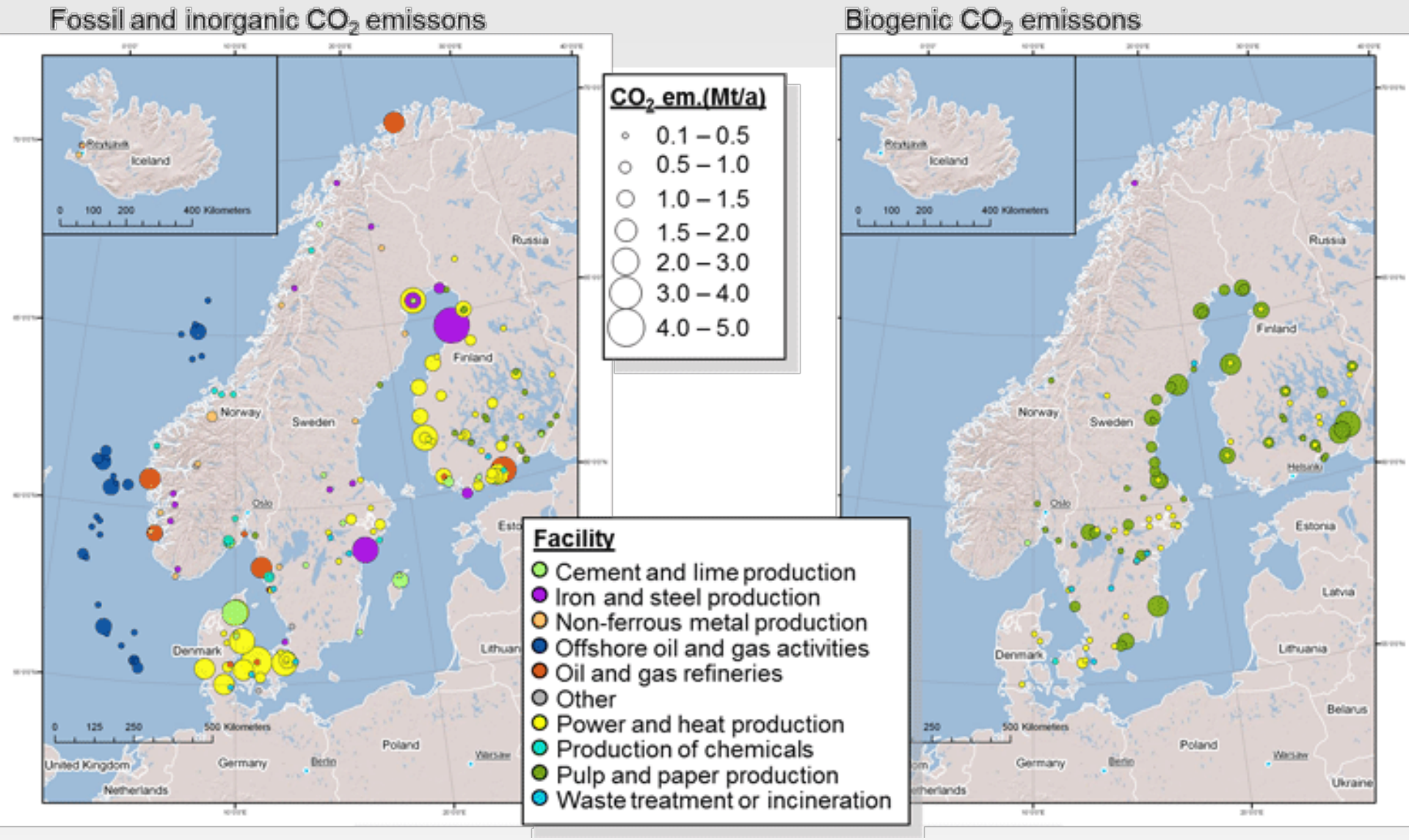
- The Bellona Foundation (Bellona)
  SINTEF Energy Research (SINTEF ER)
  SINTEF Materials and Chemistry (SINTEF MC)

FINLAND

- VTT Technical Research Centre of Finland Ltd (VTT) Åbo Akademi University (Åbo Akademi)

Nordic stationary CO_2 sources

norden
Nordic Energy Research



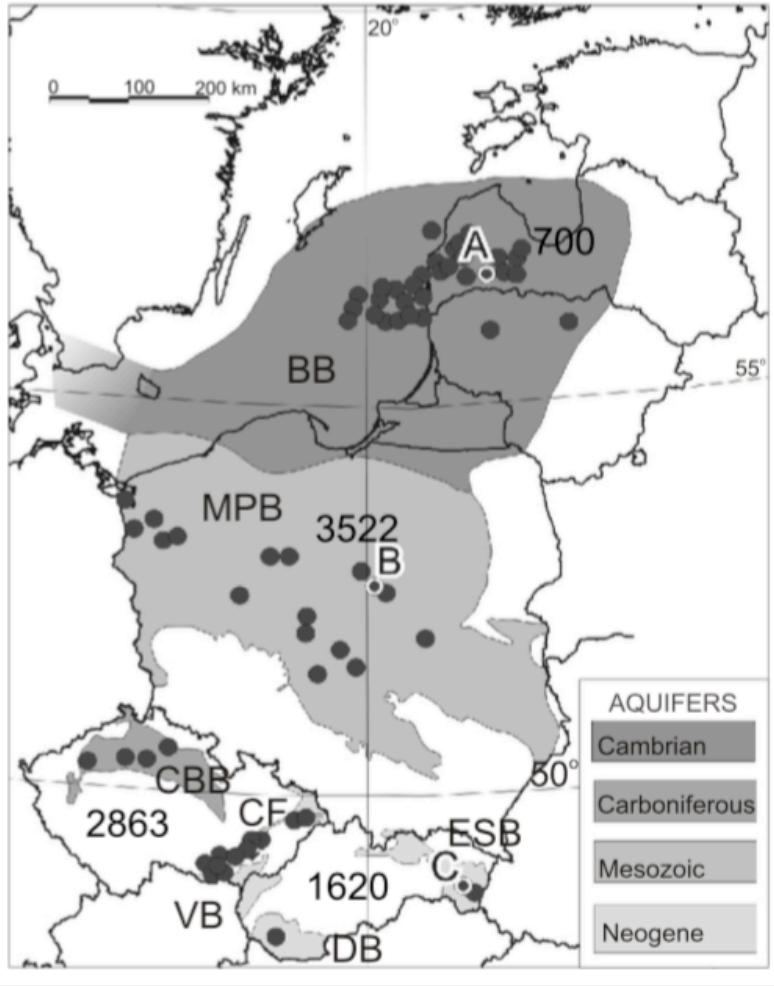
Baltic-Nordic Collaboration

- Security of supply
- BASREC
- Interconnectors
- Carbon Capture and Storage

Fossil energy in the Baltics

CO_2 sources in the Baltic States

CO_2 storage potential

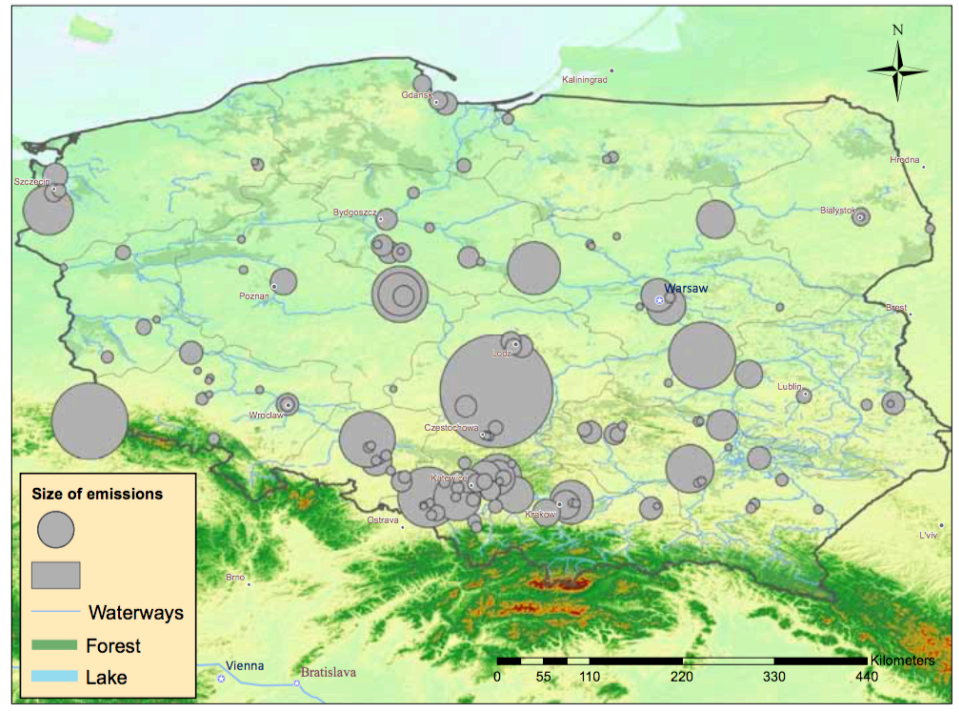


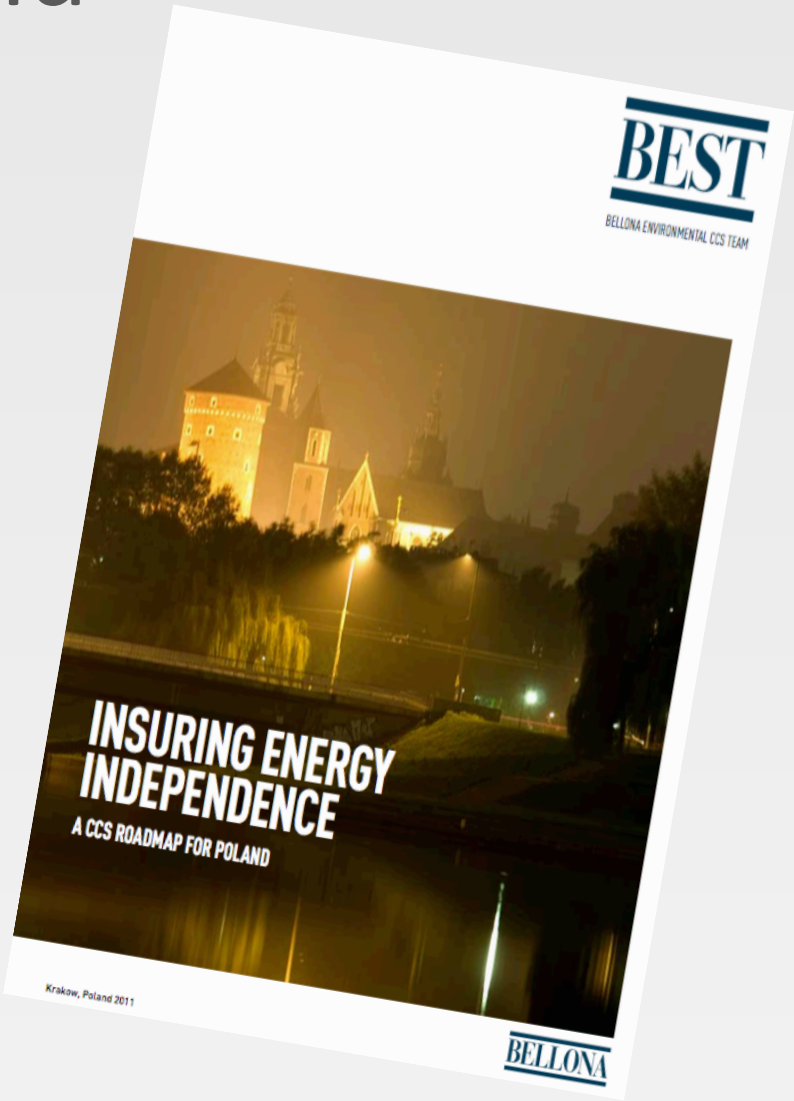
Source: Sliaupa et. Al. 2013

Biomass CHP in the Baltics and Finland - an opportunity for carbonnegative?

- Połaniec Power Station, 205MW Woodchips
- Alholmens Kraft, 265 MW forest residue and peat
- Wisapower 150 MW, “Black Licquer”
- Fortum Klaipeda, Lithuania 20MW + 50MW)
- Šiauliai Power Plant, 1MW + 27MW)
- Fortum, Jegava Latvia (23MW + 45 MW)
- 4Energia Ciecere, Latvia (3,98 MW +15,9) MW (2016)
- Liepaja
- Danpower Baltics, Kaunas Lithuania (2016)

CO_2 Sources in Poland





Concluding remarks

FIRST: CCS is technically feasible!

Opportunity:

- Baltic/Nordic cooperation
- Carbon pricing/ price on externalities
- Industrial processes
- Use of plentiful biomass
- Improved air quality (SO_X/NO_X)
- BioCCS - Net reduction
- Energy Security

Challenges:

- Costly
- Carbon Lock-in
- Energy Penalty
- Public support

Wildcard:

New renewables becoming cost-competitive