



Business from technology


Conditions for CCS in Northern Baltic Sea countries

Risk assessment and management of strategic energy technologies- ENERO 3rd scientific workshop

Matti Nieminen
VTT Technical Research Centre of Finland

VTT TECHNICAL RESEARCH CENTRE OF FINLAND

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Background/Starting point

- CCS as a whole chain is a new chain of processes and operations
- Most of the components are known from other fields of technology
- The most challenging technological question: storage of CO₂
- Significant reduction of the power production efficiency

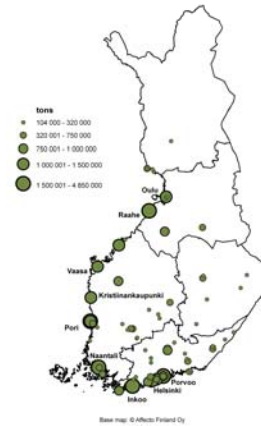
- The overall environmental impact of CCS: reduction of emissions
..... but more fuels needed to produce power as much as without CCS
- In some cases, risk of solvent emissions

- Specific conditions in Baltic Sea area: no identified geological storage sites available in near neighbourhood

The largest CO₂ emission sources (energy and industry)

- Largest single sources
 - Steel mills
 - Oil refineries
 - Condensing power plants

- CHP plants
- Pulp and paper mills



VTT project: Application of CCS in Finnish conditions

- Only few condensing power plants in Finland
- Most of the power plants are Combined Heat and Power (CHP) plants

- Significant share of biomass

- The most potential CCS applications:
 - Steel mills
 - Condensing power plants
 - Oil refineries

The most potential technologies in Finland

- Oxyfuel (oxygen blown fluidised bed combustion)
- Post combustion

- In connection to NGCC: precombustion

- IGCC not yet considered as mature technology => less potential in near future
 - In longer term significant potential (high efficiency)

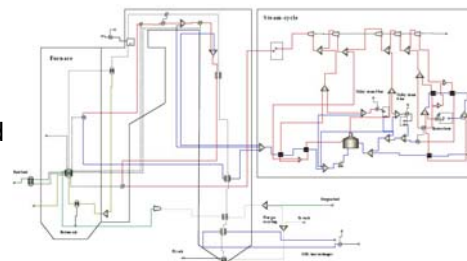
- In long term: Chemical looping combustion and other looping processes

Oxyfuel (fluidised bed)

- Large scale air separation unit(s) needed
 - Specific safety regulations related to large volumes of oxygen

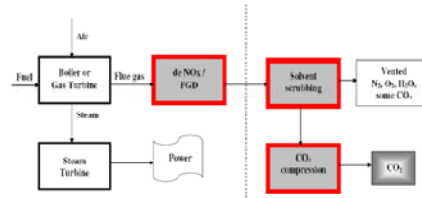
- Very low overall emissions
- No risks of solvent emissions etc.

- In Finland: very strong expertise and knowhow related to fluidised bed combustion technologies (R&D and industrial)



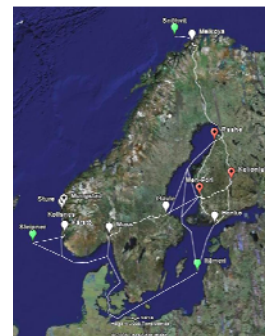
Post combustion

- CO₂ capturing by solvent enables risks of solvent emissions
 - Solvents primarily non-toxic
 - Effects of long term exposure?
- Relatively easy to apply as a retrofit installation
- Intensive development of new solvents
 - Lower energy consumption in stripping phase
 - Decreased need for make-up (lower emissions)
 - ⇔ Better economy and lower environmental impacts



Transportation

- Potential storage sites located outside Baltic Sea Region
- Transportation alternatives:
 - Ship transportation
 - More feasible when transportation volumes are reasonable (not very large) and long transportation distance
 - Intermediate storages required
 - CO₂ pipeline
 - More feasible when volumes of CO₂ very large
- Risks related to CO₂ leakages (environmental & health)



Summary

- CCS is still in R&D and early demonstration phase
 - The overall impacts not yet identified in industrial scale
- CCS will achieve significant role within next few decades
- The least known part of CCS is long term storage of CO₂
- A specific attention has to be focused on large volumes of oxygen (oxyfuel), possible emissions of solvents (post combustion) and CO₂ leakages during overall process chain (environmental and health)
- From economic point of view the challenge is high energy consumption of CCS



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