TECHNOLOGY AND POTENTIAL OF BIOCCS IN PULP AND PAPER INDUSTRY

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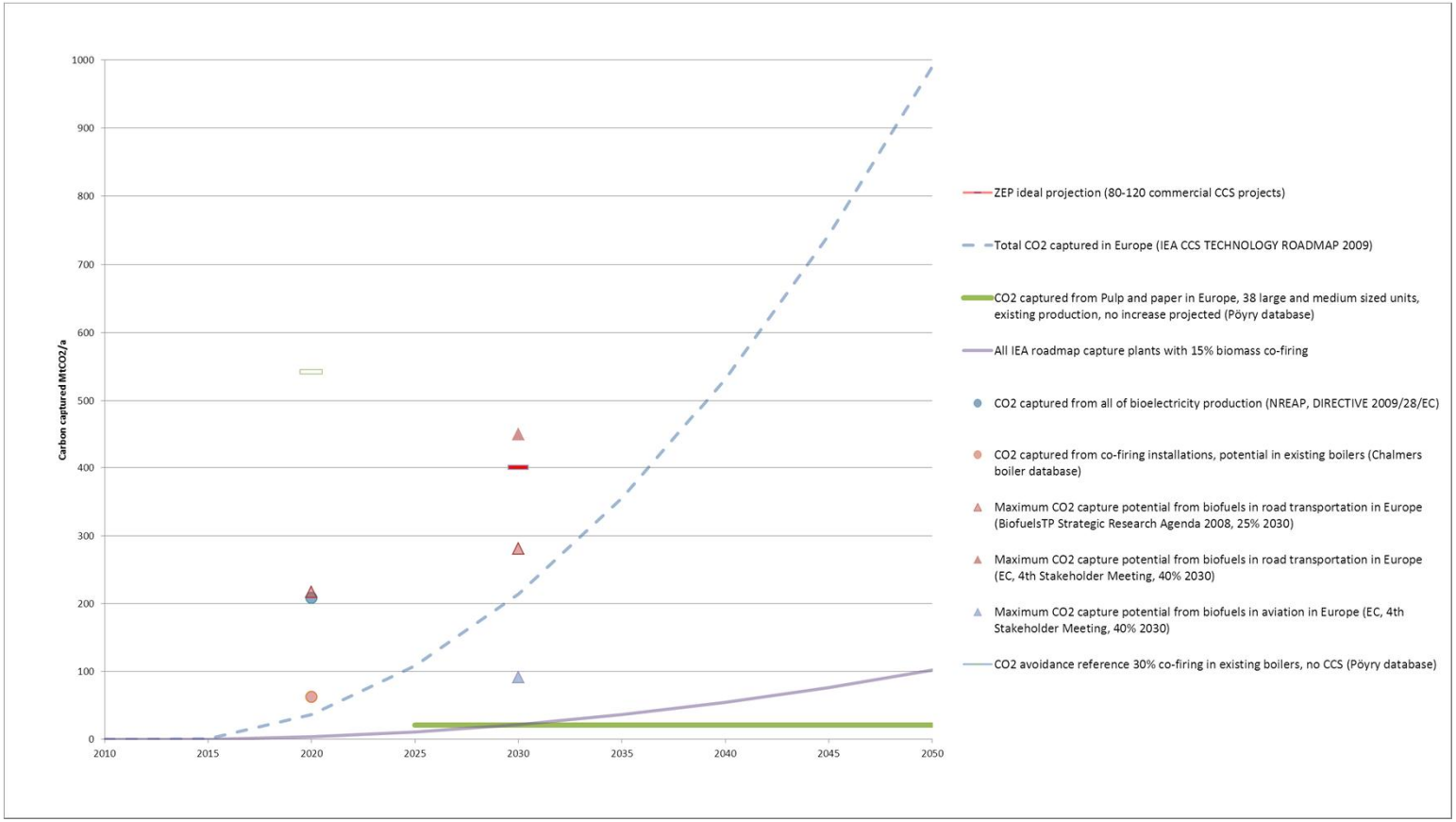
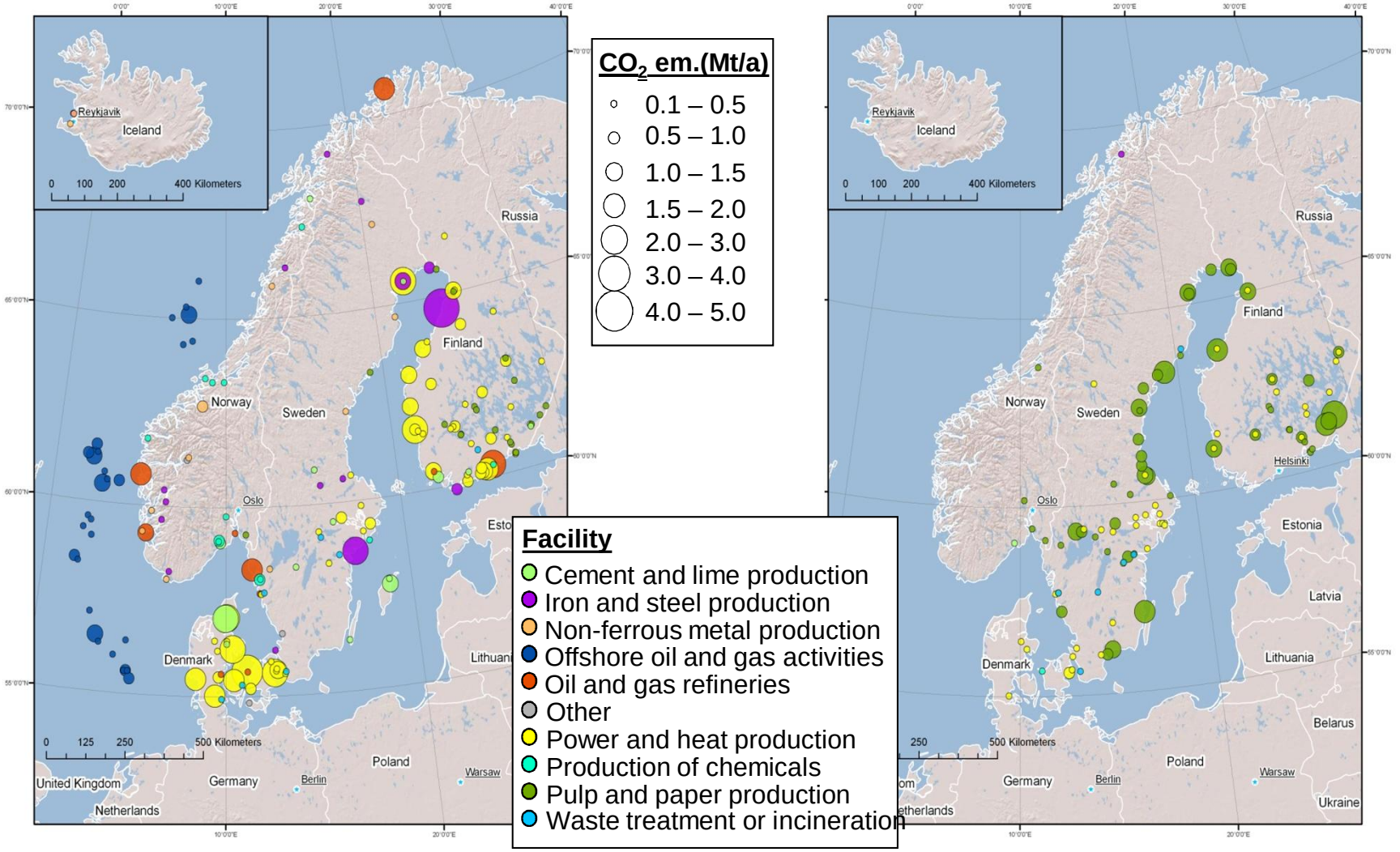
CO2 capture roadmap and BioCCS potentials in Europe



CO2 Emisions in Nordic countries

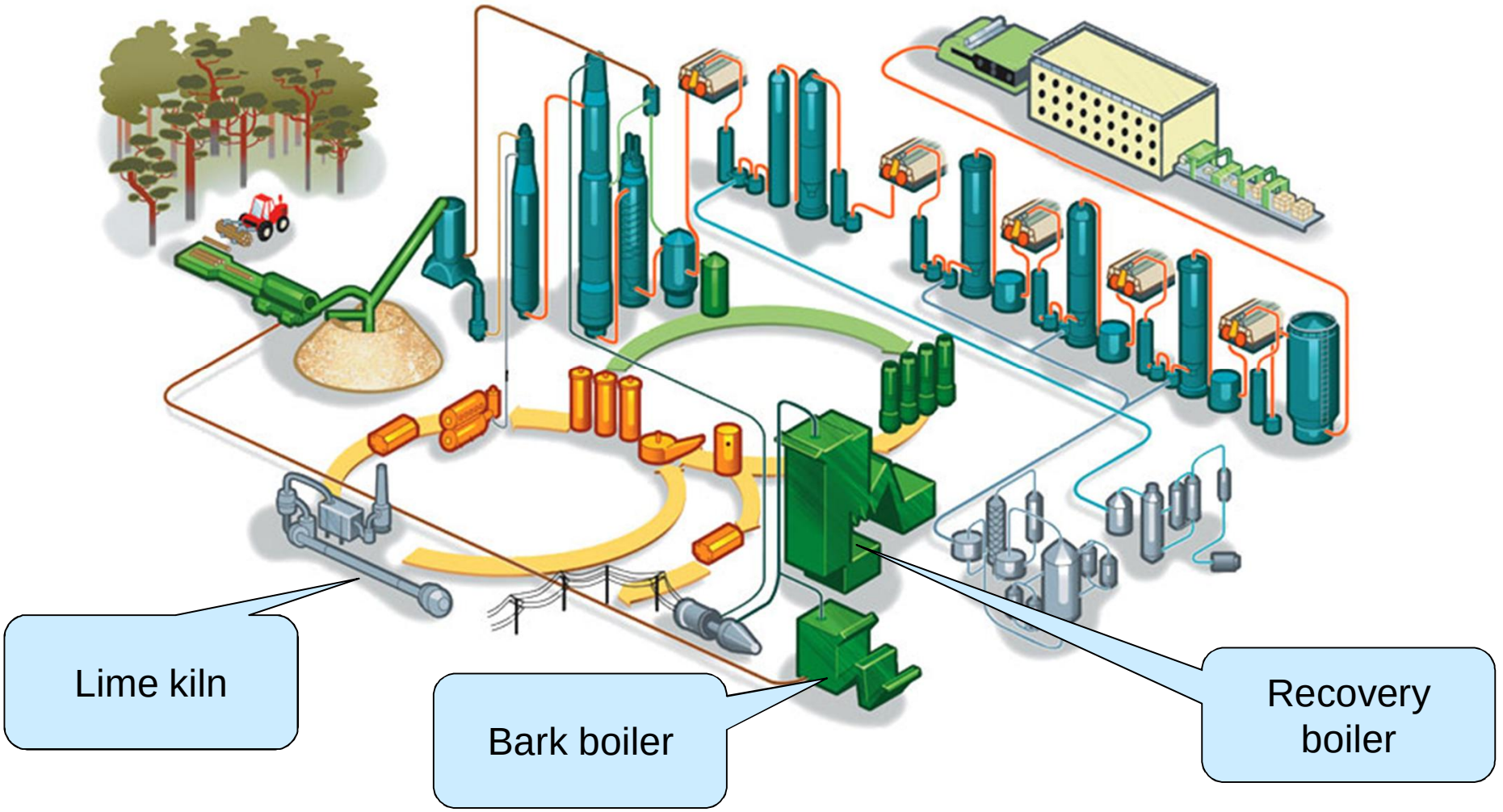
Fossil and inorganic CO_2 emissons



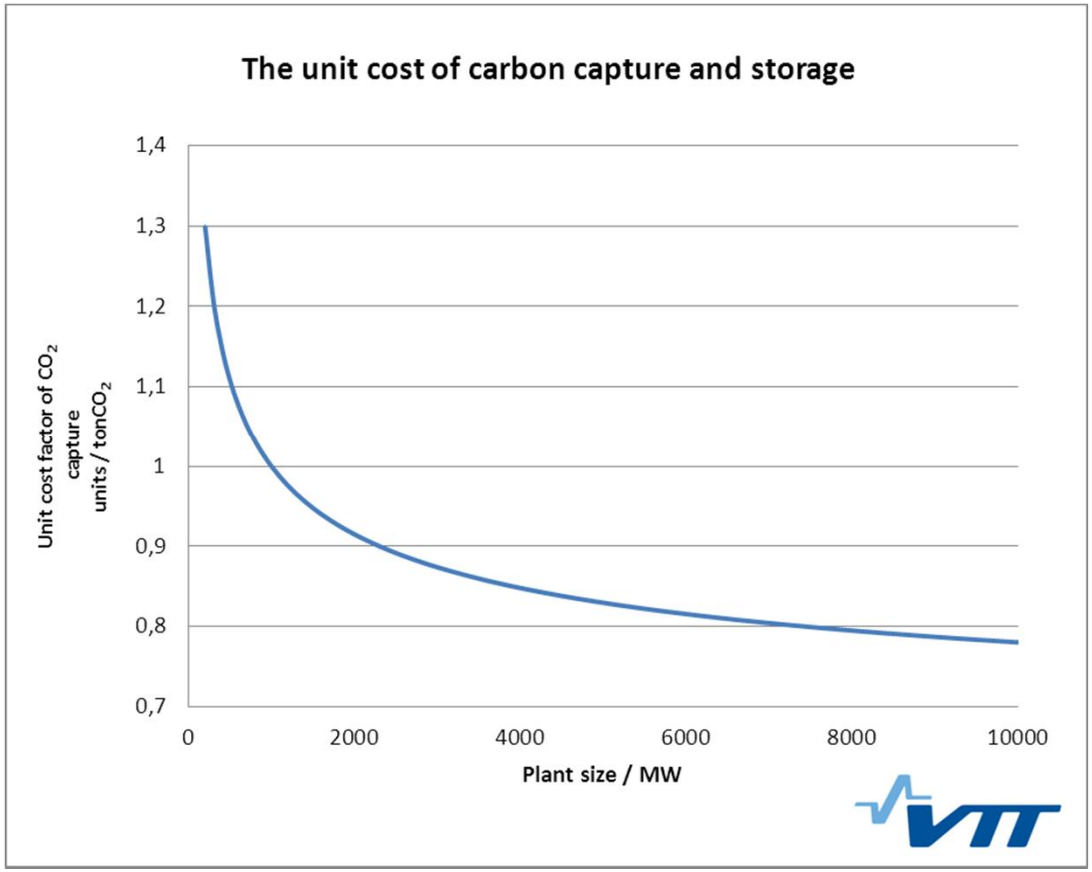
Biogenic CO_2 emissons

Kraft process for wood chemical pulping

50% yield from wood



Economics of scale – The unit cost of carbon capture and storage



Flue gas and process properties

- Recovery boiler
  - Essential part of Kraft pulping process
  - Recovery of coocing chemicals
  - Recovery of energy
  - Producing power and heat
- Lime kiln
  - Also part of chemical cycle
  - CaCO3 - > CaO
  - Rotating kiln
  - High temperatures ~1100C
  - Generally not Biogenic

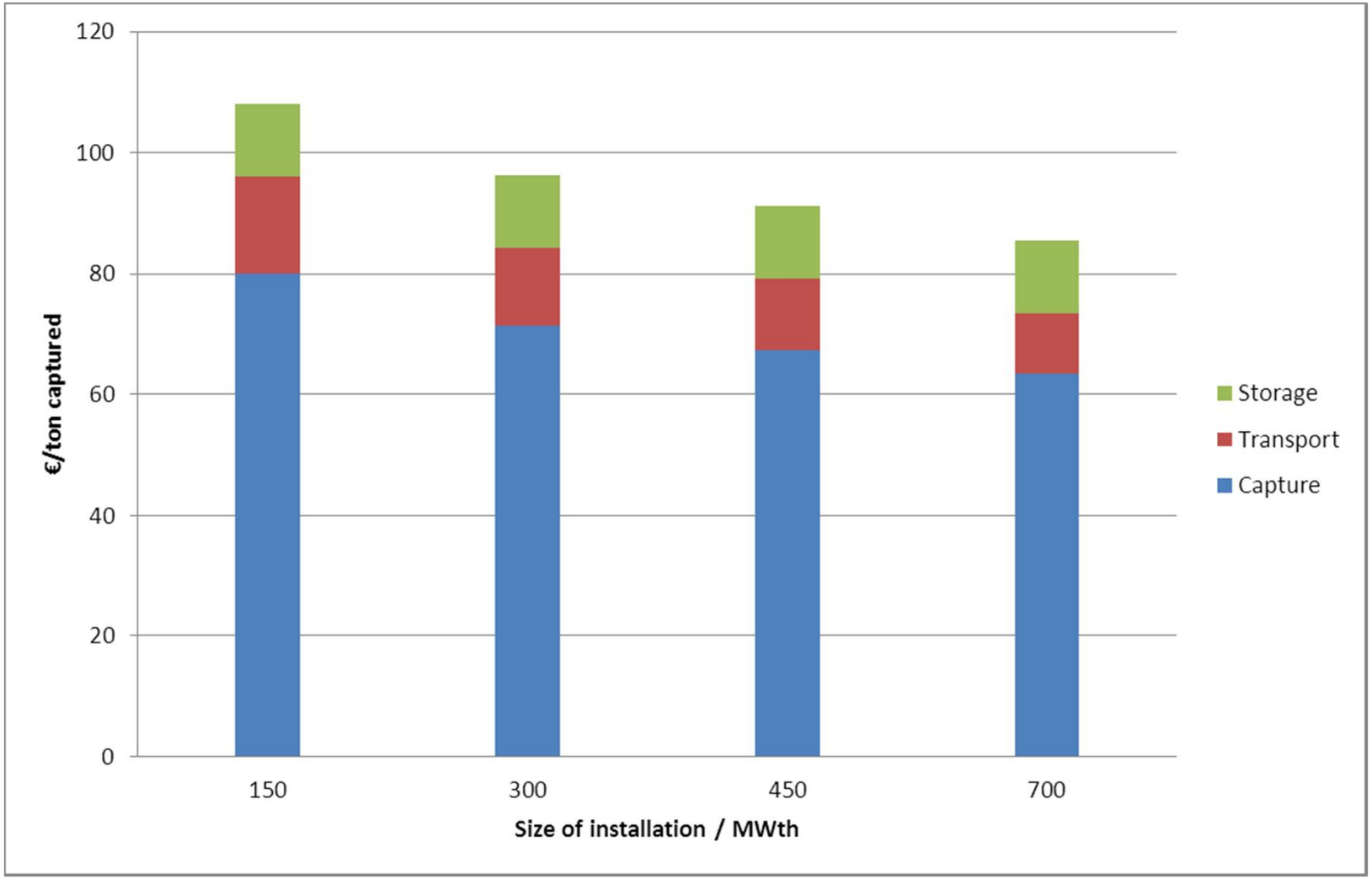
	Recovery boiler	**Lime Kiln**
CO_2, vol-%	15 – 25	10 – 20
NO_x, mg/Nm^3	150 – 200	150 – 200
SO_x, mg/Nm^3	varied	5 – 20

Pulp mill flue gas properties

Technologies for carbon capture in pulp and paper industry – technological restrictions

- Pre-combustion capture
  - Only applicable to black liquor gasification (not commercial yet)
- Oxyfuel combustion
  - operational conditions, availability requirements, temperature profiles and impurity levels not in favour
- Post-combustion carbon capture
  - SOx, NOx, dust, lay-out restrictions

Cost of post combustion carbon capture in pulp and paper industry



Conclusions

- In 2030 BioCCS can account for a larger share of carbon mitigation than in the projected CCS deployment scenarios
  - In the longer term, beyond 2050 the role of fossil CCS is dominating
- Potential small in Europe ~20Mt/a
  - Finland and Sweden majority
- Costs higher in comparison to other CCS and BioCCS technologies
  - Mainly due to small scale and challenging operation conditions

Thank you for your attention

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