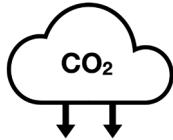




CCUS Aalborg Infrastructure requirements and system integration




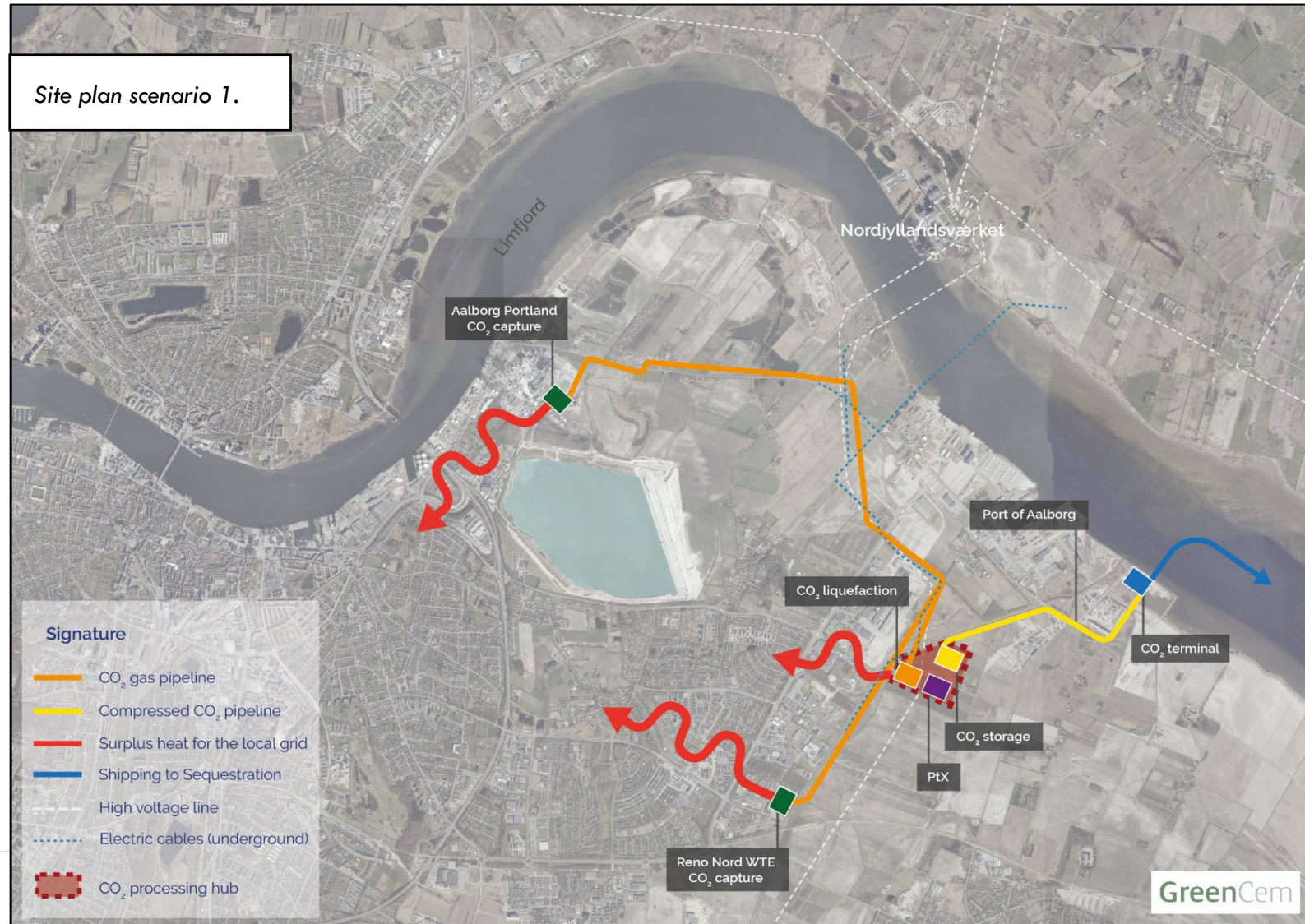
GreenCem site planning at a glance

 = 1.3 MtCO₂/y from two sites

 = 9,3 km of CO₂ pipelines

 = 25 ha CO₂ processing hub

 = 2.450 GWh / year surplus heat



Pipeline infrastructure



- Pipeline network comprising:
 - 7,2 km of gas pipe from CC sites to processing hub.
 - 2,1 km of liquid pipe from hub to CO₂ terminal.
- Gaseous transport attractive — from an economic and HSE perspective — for smaller CO₂ flow rates, over shorter distances in simple networks.
 - Design to account for installation in populated areas.
- Estimated LCC of ~ €6–€9M.

CO2 processing hub – 1.3 Mt CO₂/y

Liquefaction

- Energy requirement estimated at ~ 180 GWh / year

Synthesis of methanol from CO₂ and H₂ (PtX)

- 300 MW facility ≈ 220.000 t/methanol/y

Intermediate CO2 storage

- Carbon steel with operating conditions of 15–18 bar and -21–27°C
- Significant cost component

Methanol tanks

- New build vs. retro-fitting
- Challenges relating to the corrosivity of methanol



CO2 processing hub – realizing economies of scale

Liquefaction

- Alternate scenario with separate liquefaction plants also considered.

Cost

- €12–€15 M for demo-scale unit
- Economics of individual vs. shared

Economies of scale

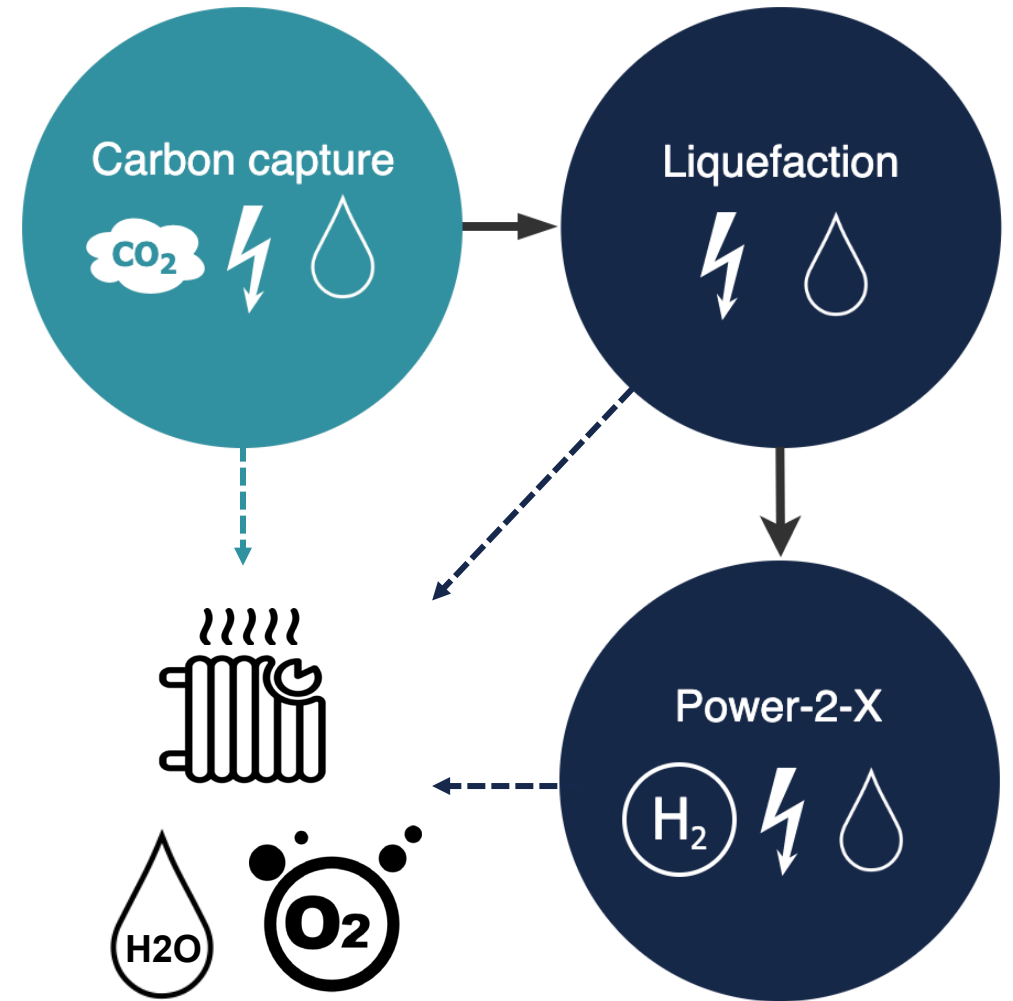
- Similar analyses show that scaled liquefaction facilities can reduce full-chain cost by <10%.



System integration +

- The CCUS value-chain is resource intensive.
- This requires the integrated planning of resource flows.
- ..but also presents unique opportunities to rethink resource streams, building on Aalborg's reputation in industrial symbiosis

CCUS resource chain

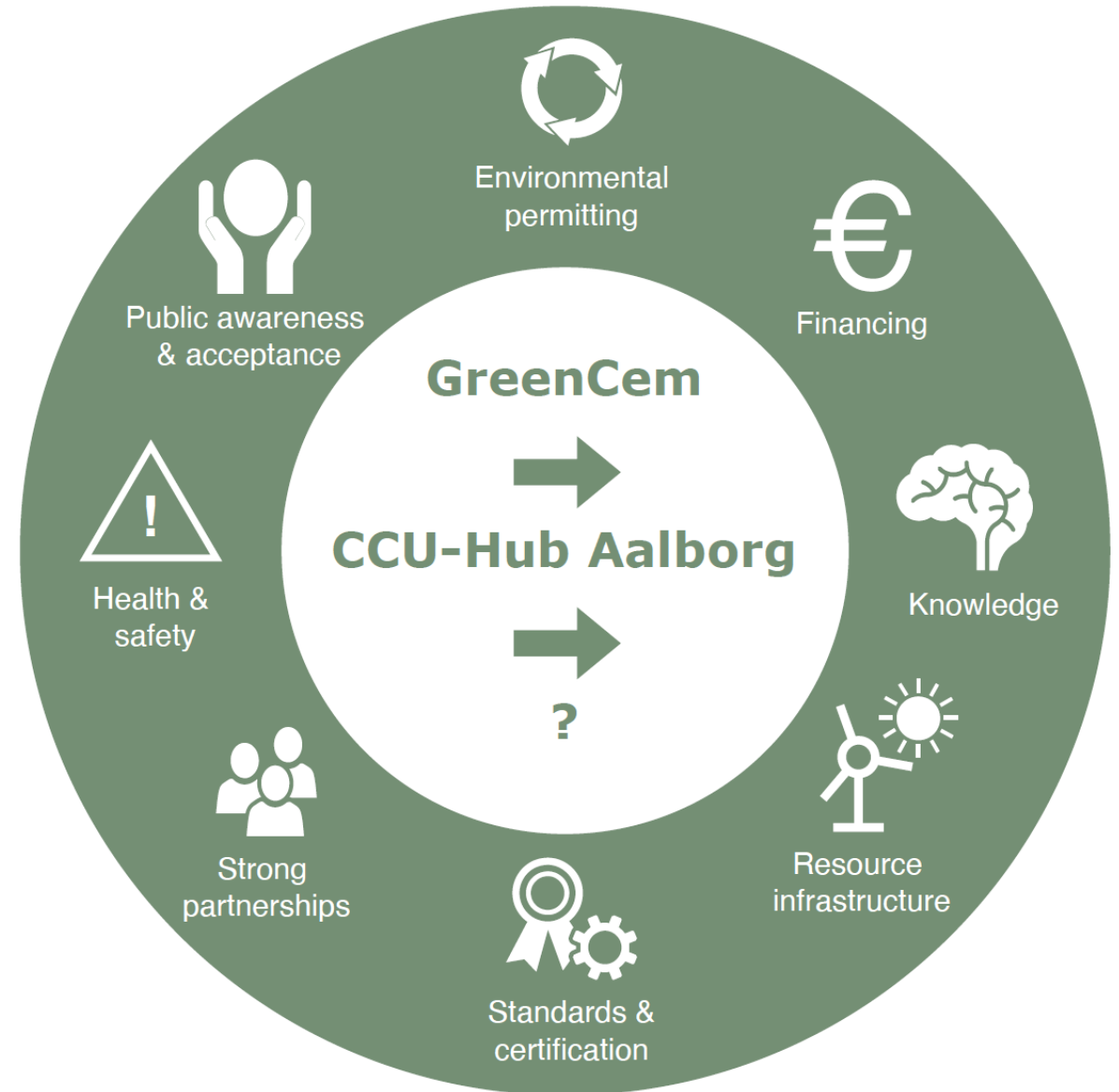


What's next?

- Holistic planning
- System scale-up and sector coupling.
- Unknowns?



Strong partnerships can help us reach our target





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