CO_2 negative carbon capture from waste in Oslo

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PURE ENERGY RECOVERY

- Green energy recovery of sorted rest waste
- Renewable heat and electricity from waste heat

We cut CO_2 emissions every day!

Proudly managing the leading professionals in WtE

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- Norway’s largest WtE-plant
- Capacity: 350 000 (405 000) t./year, 45 t./time
- Norwegian and international waste
- Direct incineration of special waste
- **El production**: 100 GWh (2016)
- **Heat production**: 800 GWh (2016)
- Large investments to increase prod. 2014-17’

Oslo’s cycle based waste system

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- Extencive source sorting (City of Oslo)
- Two optical sorting plants (CoO)
- One biogas plant (CoO)
- Two WtE plants (CoO /**KEA AS**)
- District heating system (Hafslund)

Hafslund and KEA AS are central actors in Oslo’s green shift

Fortum new owners of KEA and Hafslund Heat

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Oslo’s green goals

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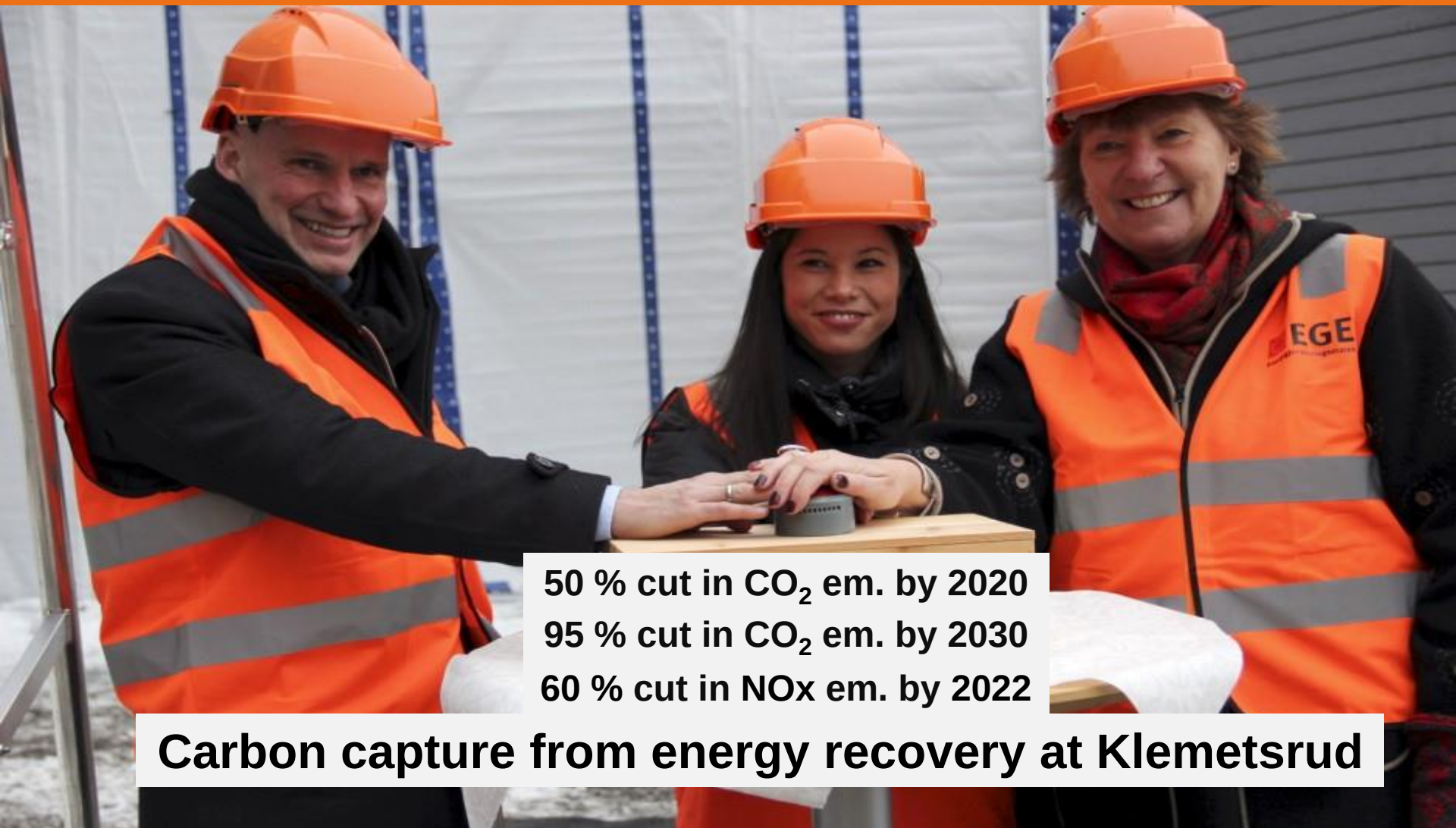

50 % cut in CO_2 em. by 2020

95 % cut in CO_2 em. by 2030

60 % cut in NOx em. by 2022

Carbon capture from energy recovery at Klemetsrud

- Waste; both a problem and a resource
- Huge health, climate and environmental challenge
- Almost 4 **bill**. tons of waste generated yearly
- Energy recovery best solution for sorted waste
- CCS from waste incineration; great global transfer value

Rest products after incineration

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Fly ash

Bottom ash

Flue gas

Landfill hazardous waste

Metal recovery + landfill

Climate emissions (CO_2)

Establishing carbon capture opens new possibilities for reducing emissions – gains both the climate and the local environment

Carbon capture at KEA

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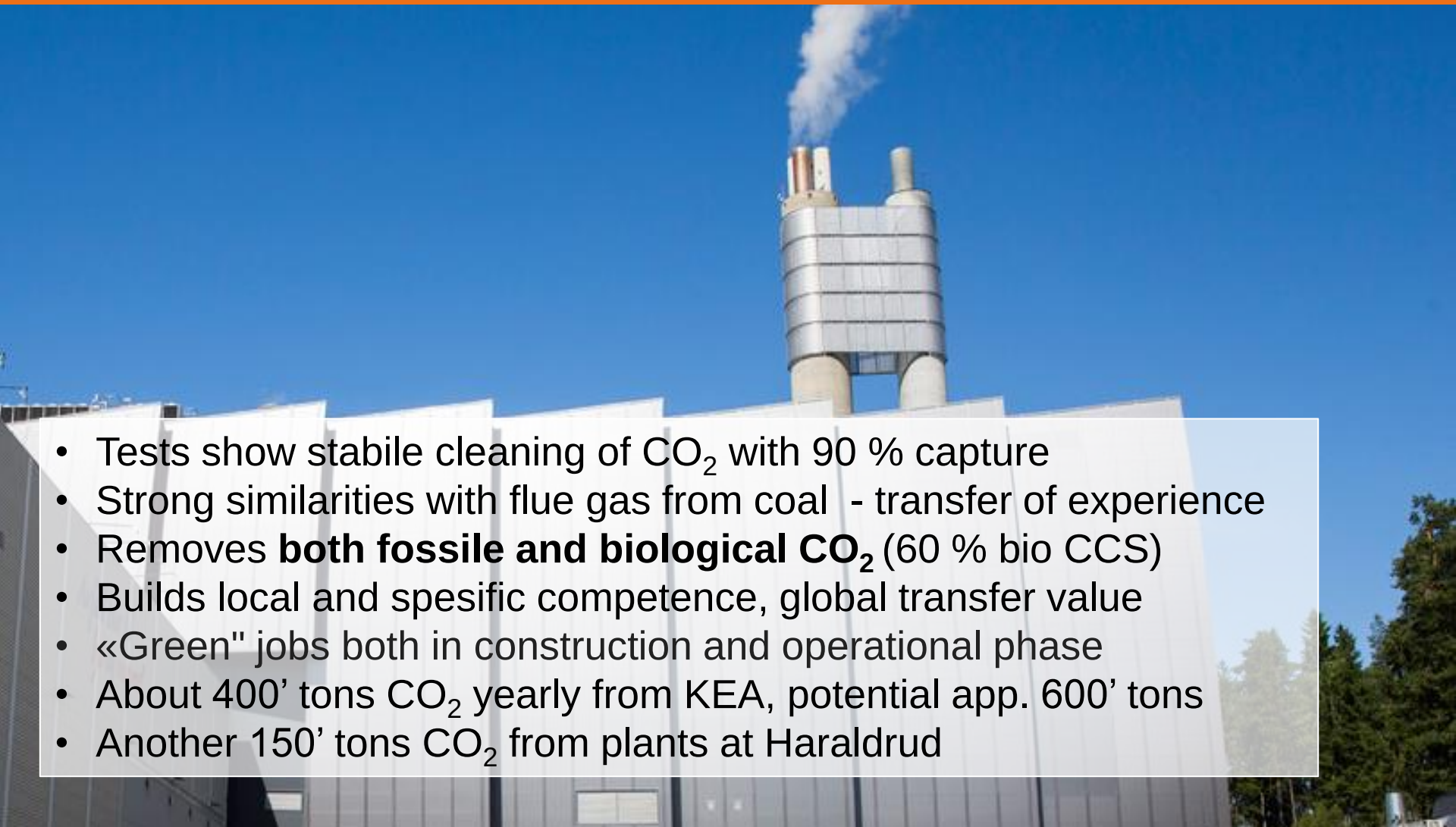

- Tests show stabile cleaning of CO_2 with 90 % capture
- Strong similarities with flue gas from coal - transfer of experience
- Removes **both fossile and biological CO_2** (60 % bio CCS)
- Builds local and spesific competence, global transfer value
- «Green" jobs both in construction and operational phase
- About 400’ tons CO_2 yearly from KEA, potential app. 600’ tons
- Another 150’ tons CO_2 from plants at Haraldrud

Great transfer value

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- Large global waste market
- WtE plants extensive sources of emissions
- 450 plants in Europe, app. 700 in the world
- 82/120 mill t. **incinerated yearly** in EU/world
- 98 mill. tons **landfilled yearly** in EU
- Heavily regulated waste business

Challenges

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- Business modell negociations
- Expensive ‘’first of a kind’’ plant
- Transportation to port
- Immature market for CO_2
- Developing a chain of value – start-up challenges to be expected!
- Not In My Back Yard

Reduced climate emissions through the value chain

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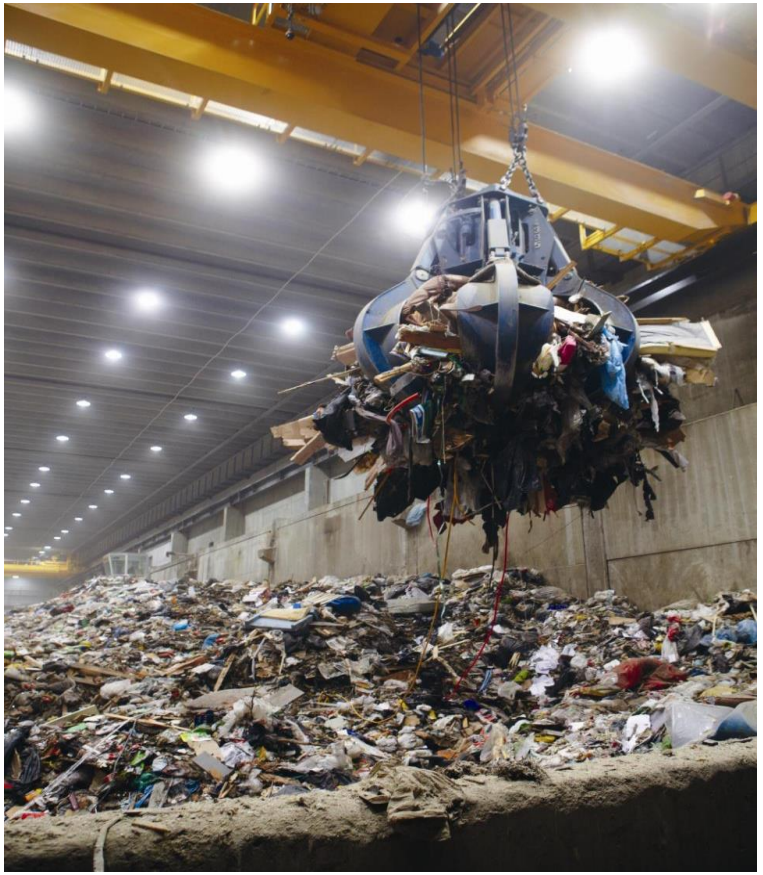
1. Reduced landfilling of waste prevents methane emissions
2. Recycled waste saves CO_2 by replacing fossil raw materials
3. Sorted rest waste replaces fossile heat sources
4. CO_2 post combustion can be captured
5. Carbon critera in tenders will move carbon upwards in the waste pyramid
6. Bio CCS



Conclusion

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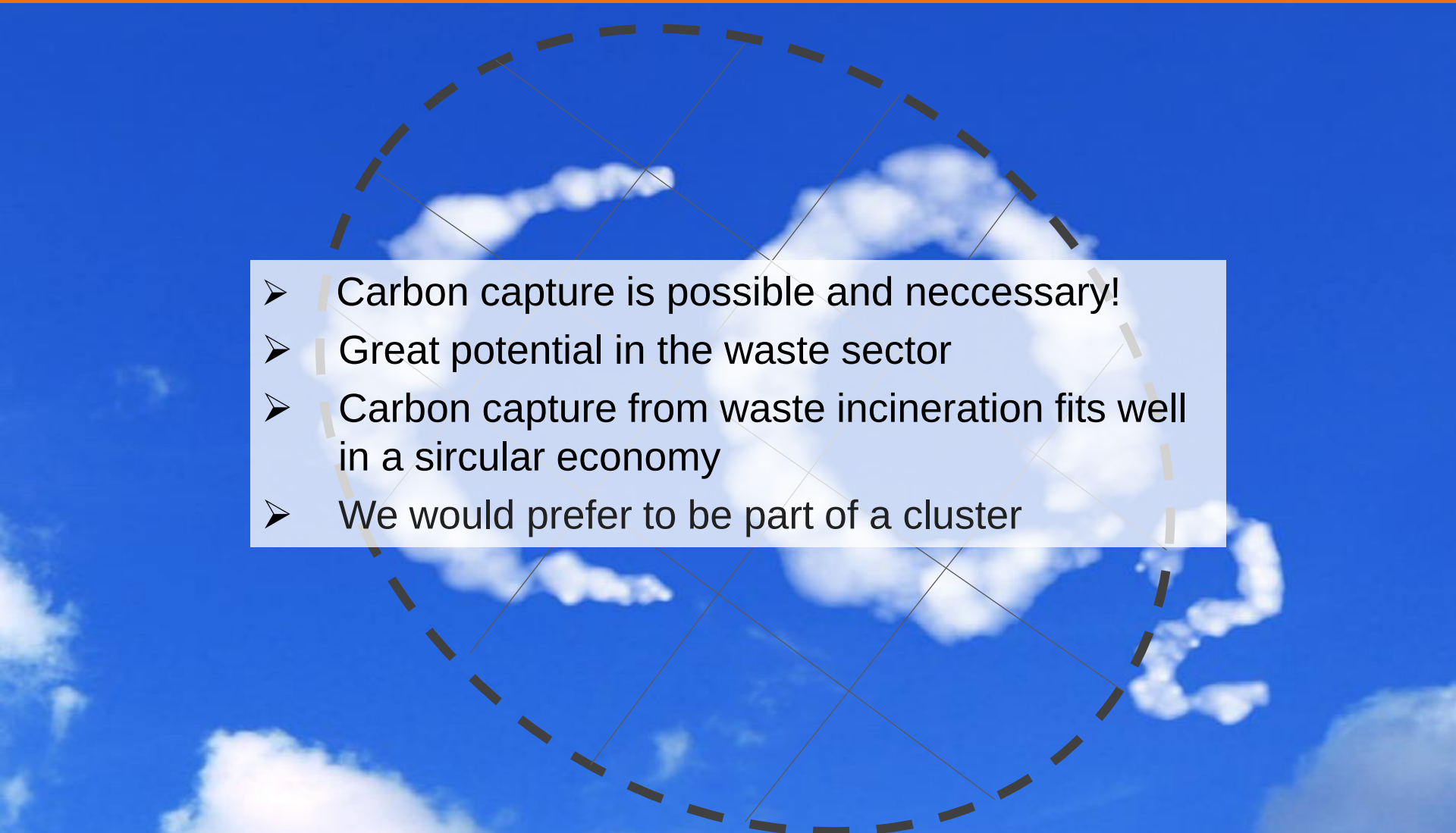

- Carbon capture is possible and neccessary!
- Great potential in the waste sector
- Carbon capture from waste incineration fits well in a sircular economy
- We would prefer to be part of a cluster

Thank you!

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The future is
PURE ENERGY RECOVERY

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Is profit possible?

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Phase 1

- Carbon capture plant must receive a price **per ton captured CO_2**

Long term:

- Can give a competitive edge if low carbon footprint is emphasized sufficiently in tender processes
- Public tenders will be a key in the beginning
- Increases the value of waste incineration -> stronger incentives for waste sorting
- CO_2 as a commodity in a market

Overall plan

PROSJEKT CCS
KARBON-FANGST OSLO

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