An illustration on a teal background showing a globe with industrial buildings and smokestacks. A person is pulling a rope attached to a thought bubble containing 'CO2'. Another person is running towards a large 'CO2' molecule being captured from a smokestack.

BIR's Carbon Capture Project and  
how Waste-to-Energy can  
Contribute to Negative Emissions.

ATLE PEDERSEN, PLANT MANAGER, BIR







**BIR is one of the largest waste treatment companies in Norway. BIR treats municipal waste for the 361 407 inhabitants in the area. BIR also treats commercial waste.**

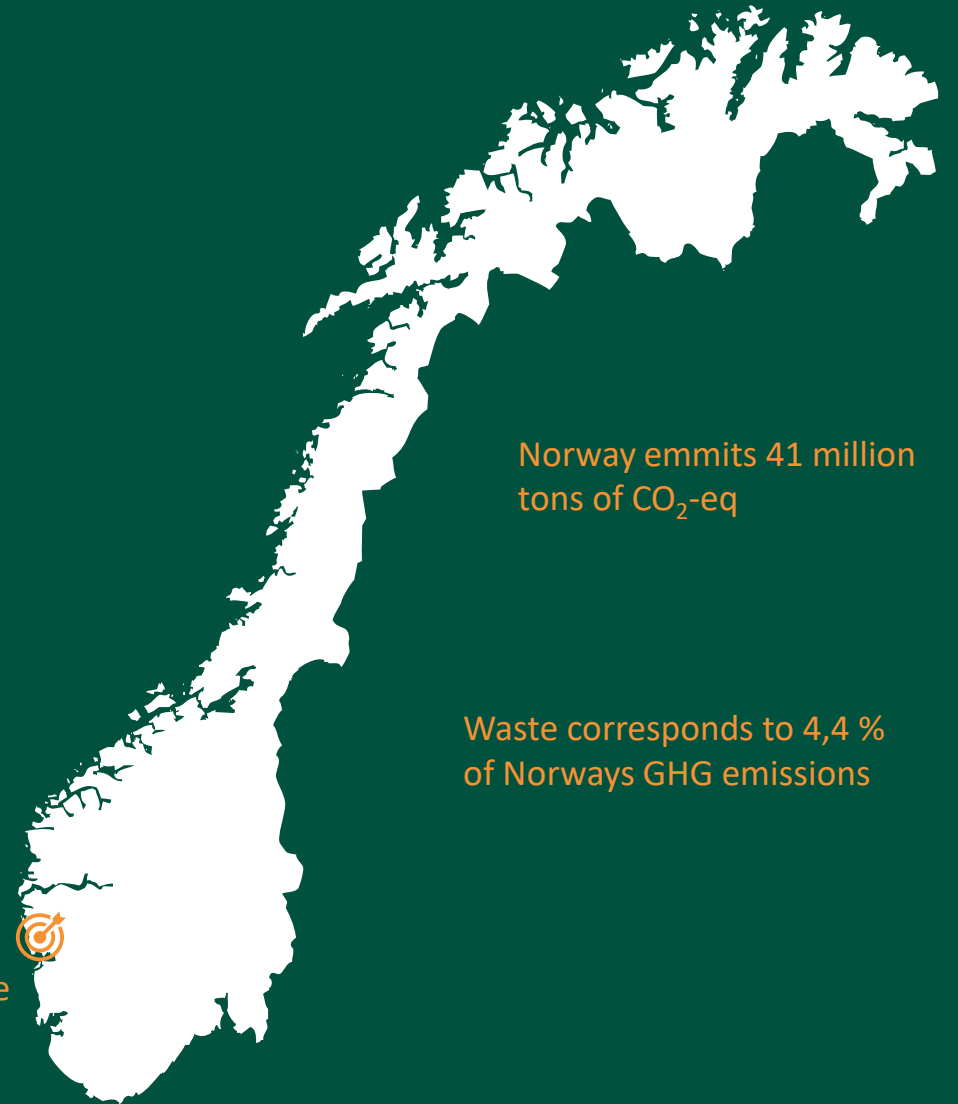
**BIR's Waste-to-Energy plant is one of the largest in Norway.**



# We all Produce Recidual Waste, and CO<sub>2</sub>-emissions are a Global Problem

- BIR is responsible for the waste treatment
- The WtE plant in Rådalen is the largest single point of CO<sub>2</sub> emissions in Bergen
- A full carbon capture will reduce the GHG emissions by 240 000 ton
  - Corresponds to the emissions from all private cars in Bergen

Within 2030 Bergen aims to be a «low emission city»





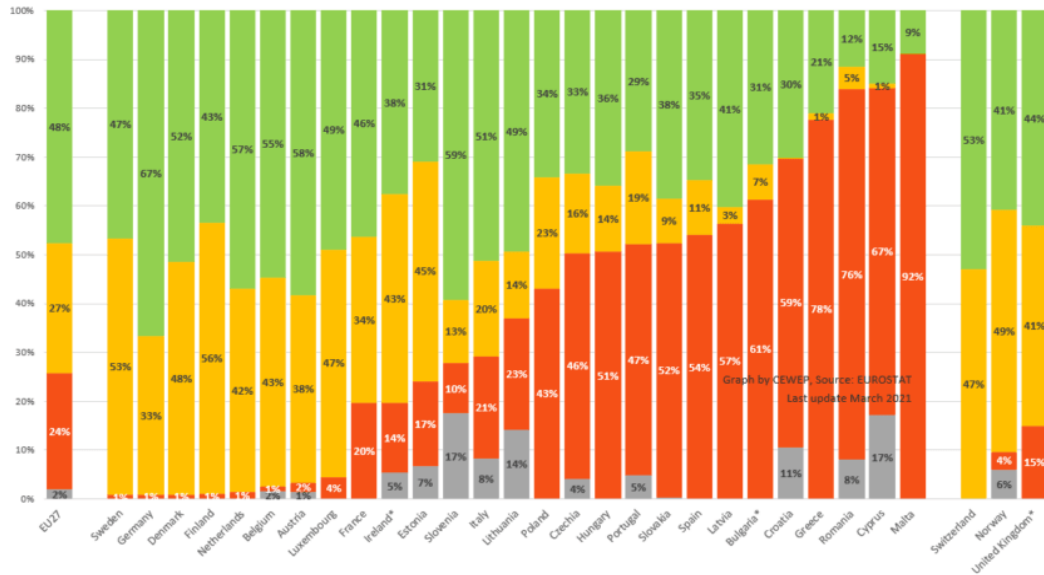
# A Global View on Waste Treatment.

Source: World Bank Group.  
"What a waste 2.0"



# Waste Treatment in Europe

**Municipal waste treatment in 2019**  
EU 27 + Switzerland, Norway and the UK



Percentages are calculated based on the municipal waste reported as generated in the country

\*: 2018 data (last available)

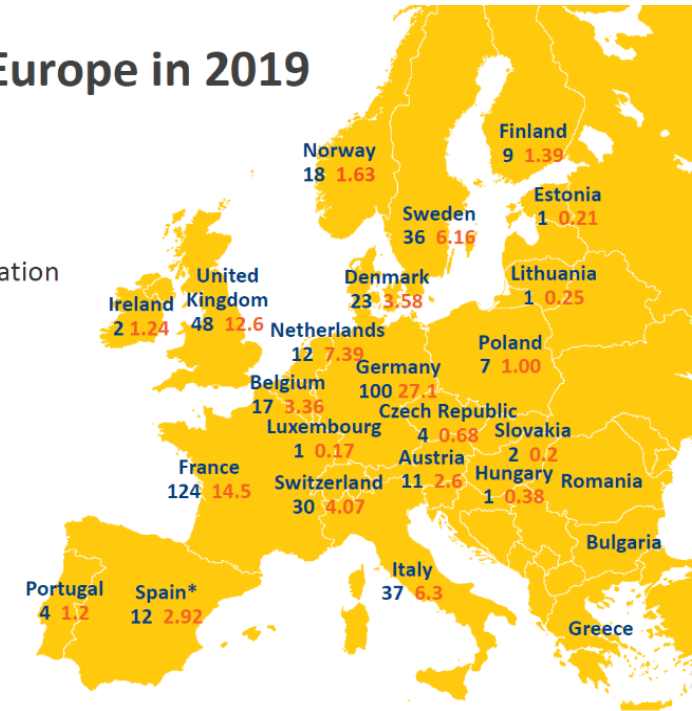


## Waste-to-Energy in Europe in 2019

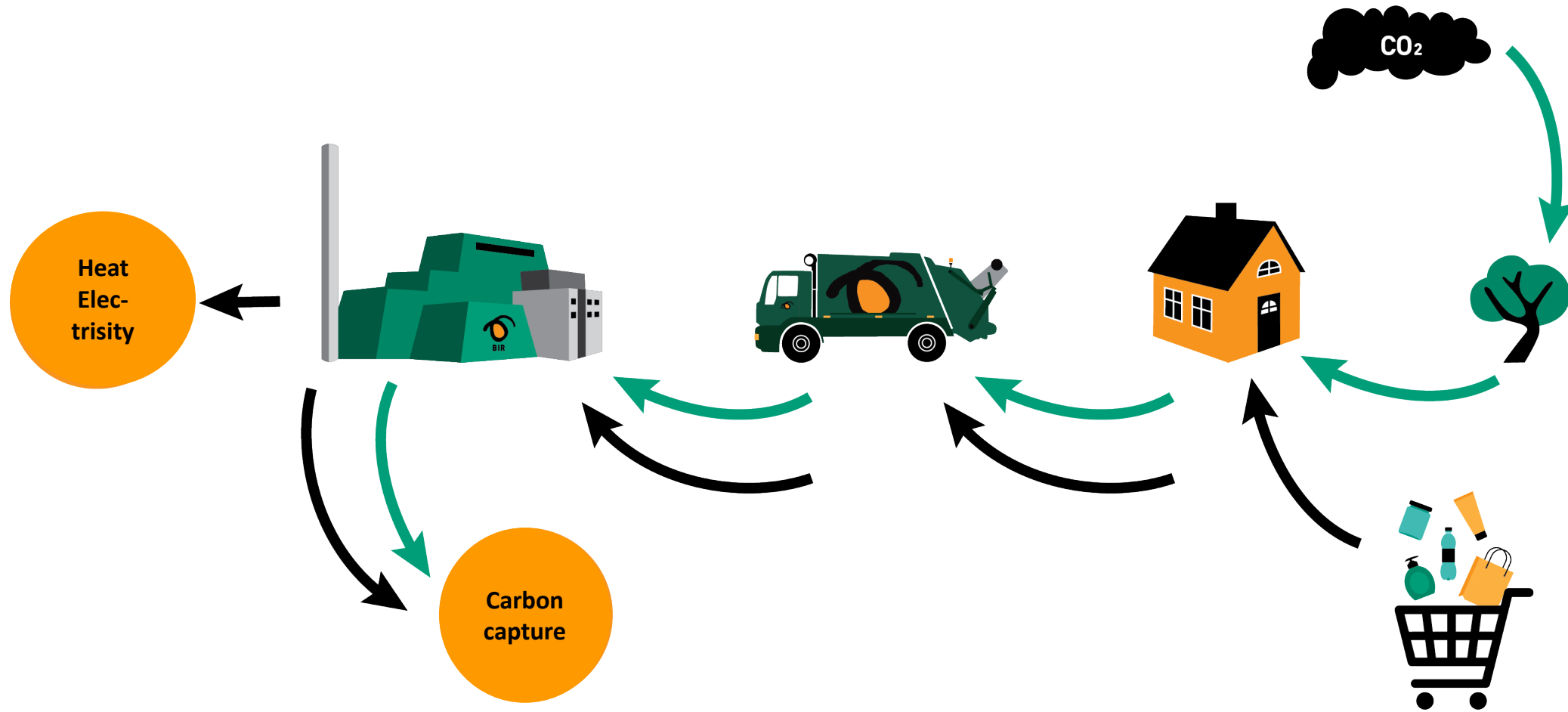
- WtE Plants operating in Europe (not including hazardous waste incineration plants) : 499
- Waste thermally treated in WtE plants (in million tonnes): 99

Data supplied by CEWEP members and national sources

\*: Includes plant in Andorra and SAICA plant



# CARBON CAPTURE, FOSSIL AND BIOGENIC CO<sub>2</sub>



# Waste to Energy Climate Roadmap – CEWEP

Confederation of European Waste-to-Energy Plants

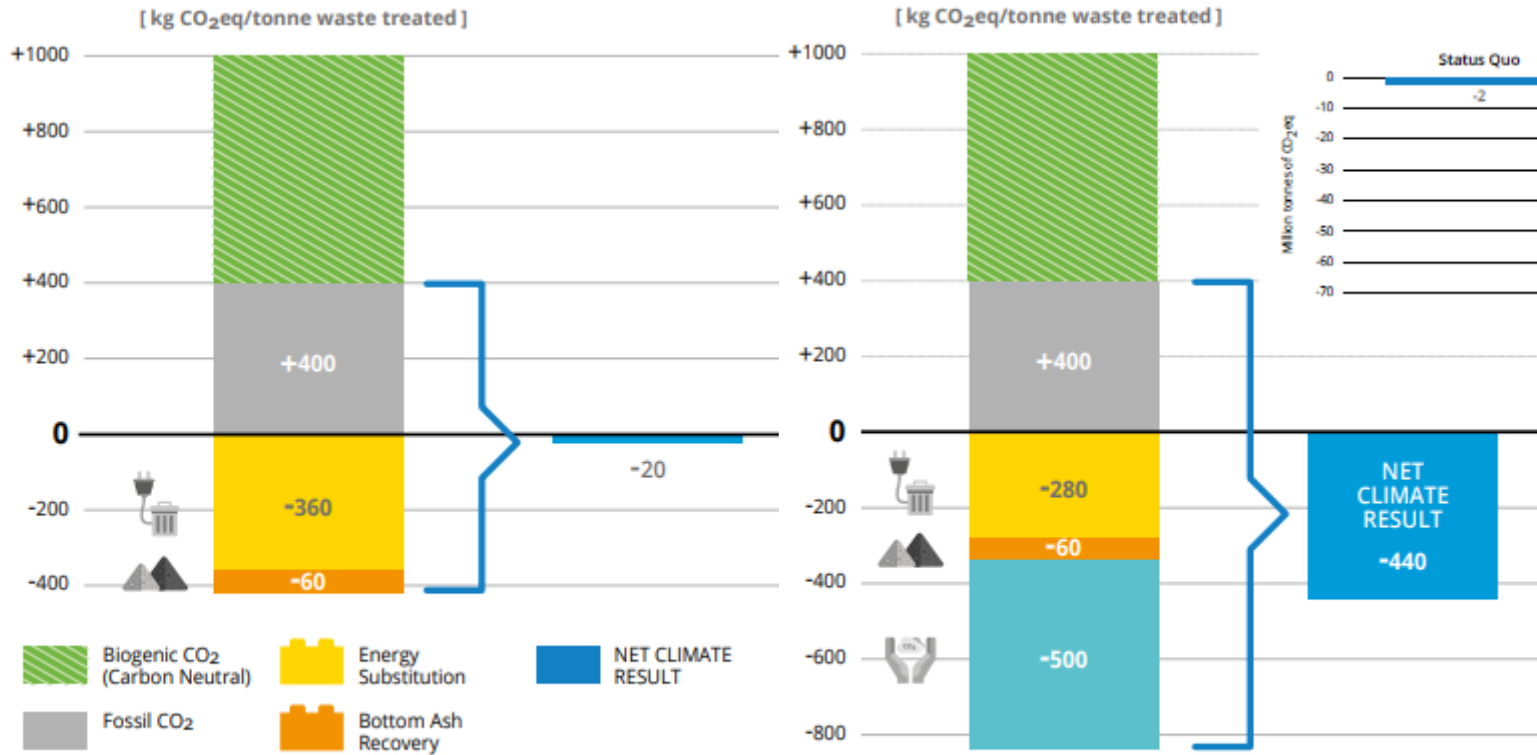


Figure 3: Current net carbon balance of the European WtE Sector, excluding landfill diversion.

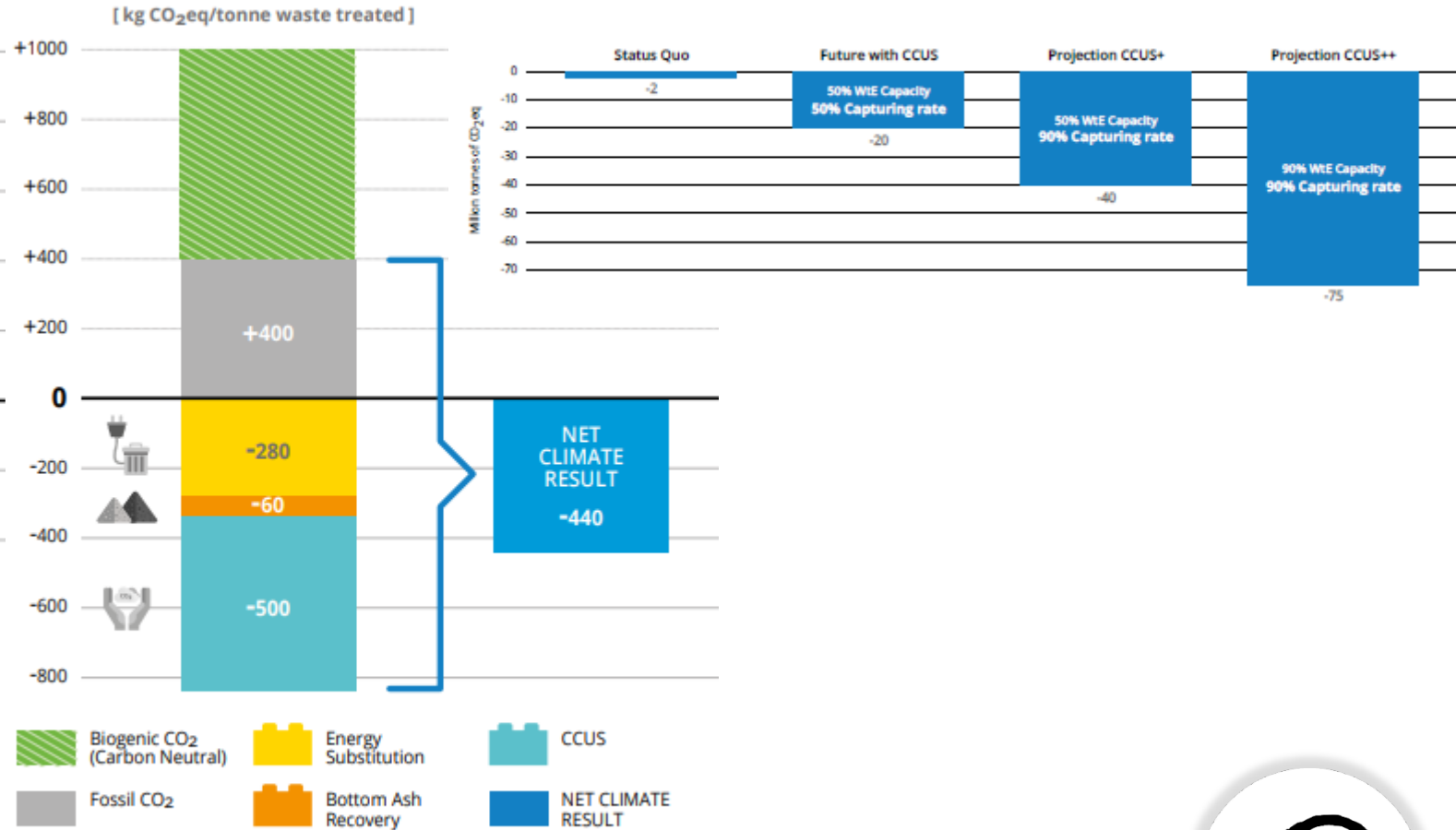


Figure 5: Future net carbon balance of the European WtE Sector with CCUS, excluding landfill diversion

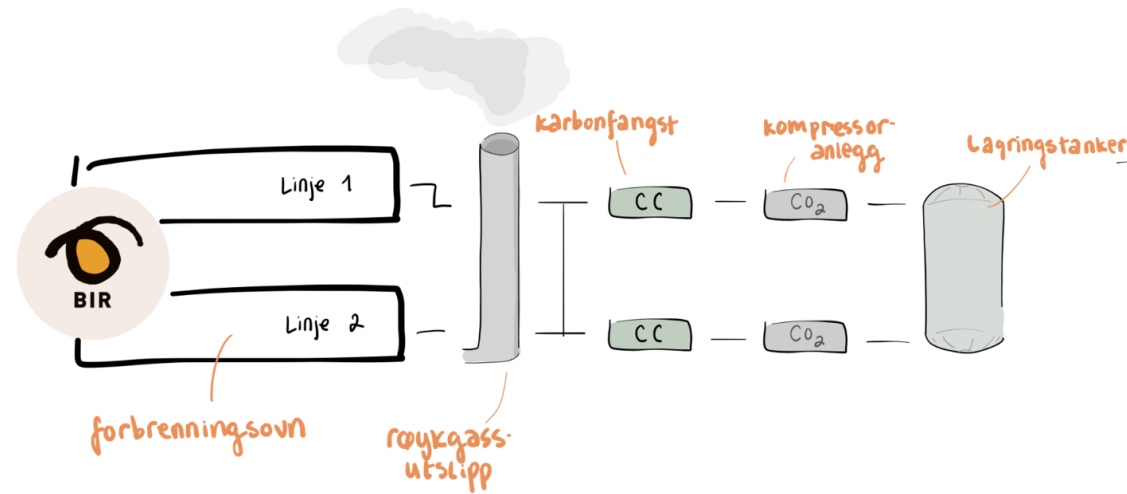


# FEASIBILITY STUDY Q4-21/Q1-22

(AKER CARBON CAPTURE & NORSK ENERGI)



Just Catch™ facility



**The study concluded that it is technically possible to establish a CO<sub>2</sub> capture facility at the Waste-to-Energy plant.**

- 1 or 2 modular plants (captures 100 000-200 000 tons CO<sub>2</sub> per year)
- Compression and liquefaction of CO<sub>2</sub>
- Tank facility for temporary storage
- Filling station for loading on trucks

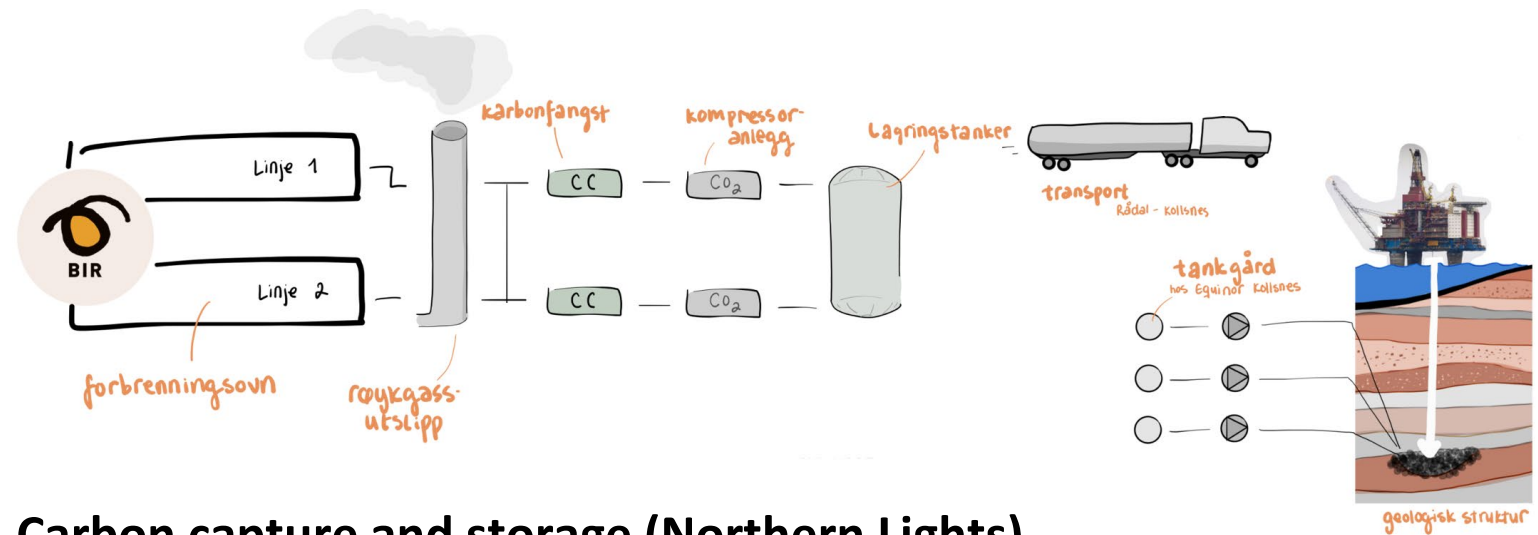






# PRE-STUDY PROJECT (Q2/Q3-22)

COWI & CITEC



## Carbon capture and storage (Northern Lights)

- One modular plant (100 000 tons CO<sub>2</sub> per year)
- Plant location including compression and liquefaction of CO<sub>2</sub>
- Heat integration into the district heating network
- Tank facility for temporary storage and truck filling station
- Transportation to Northern Lights terminal in Øygarden



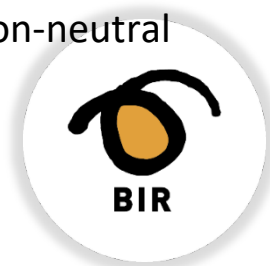




# INVESTMENT AND OPERATING COST



- Estimates are uncertain due to significant factors like shifting prices, maturity of technology, lack of experiences with a CC-facility.....
- CAPEX (100 000 tons) estimated to MNOK 1 000
- Operation
  - Costs of operation and maintenance, capture, liquefaction, storage and transportation
  - Reduced profit from electricity production
  - Increased profit by handling waste from the business sector in a carbon-neutral way (not priced)
  - Reduced carbon tax





# PLACEMENT OF CAPTURE FACILITY



- Regulatory process for a carbon capture in Rådalen has started
- Pre-study shows recommended location
- Requires the acquisition of land close to BIR's property





# Industrial Network



- Partners: BIR, Hafslund Oslo Celsio, Lyse(Forus), Returkraft, Statkraft and Borg CO2
- Share information
  - Technology, heat integration
  - Logistics
  - Business models
- A united, stronger communication
  - Greater political impact and influence



# BIR AND CARBON CAPTURE PROJECTS



### BIR - Bergen Carbon Solutions prosjektet

Carbon Nanofibers

**2020**  
We successfully tested our patented technology at the BIR Waste to Heat plant in Bergen, Norway

**2021**  
We collaborate with several large industrial companies worldwide, further upscaling our technology

**2022**  
Our full-scale CCUS modules will be ready for pre-order, suitable for retrofitting to any existing fossil burning industrial plant, including power plant, cement plants, etc.

Contact us

### Verification and demonstration of an advanced adsorption reactor for cost effective CO<sub>2</sub> capture (CSAR)

- A Climit Demo funded project
- Partners: SINTEF (leader), Captico2 (TD&C), BIR WTE plant (Demo site)
- Budget: 12 MNOK (**6.2 MNOK contribution from Climit Demo**)
- Key deliverable: construction and demonstration of CSAR pilot as a cost-effective technology
- Project Manager: Abdel Zaabout

CCUS timeline



• Startup feasibility study (Norsk Energi)

• Feasibility study CO<sub>2</sub>-capture (Norsk Energi)  
• Project Bergen Carbon Solution

• Pilot CAPTICO2 (CO<sub>2</sub> converted to calcium carbonate)  
• NEWEST – CCUS (Advisory board)

• Industrial network (KAN)  
• Feasibility study ACC and Norsk Energi

• Pilot Bergen Carbon Solution  
• CSAR (SINTEF og CAPTICO2)  
• Pre-study with COWI and CITEC

NEWEST-CCUS

About the Project Facts About Waste Partners News & Events Contact

Negative Emissions in the Waste-to-Energy Sector: Technologies for Carbon Capture, Utilisation & Storage

FIND OUT MORE

**KAN**  
Klimakur for avfallsbrenning i Norge

Industrisamarbeid for CO<sub>2</sub>-håndtering i avfallsbransjen

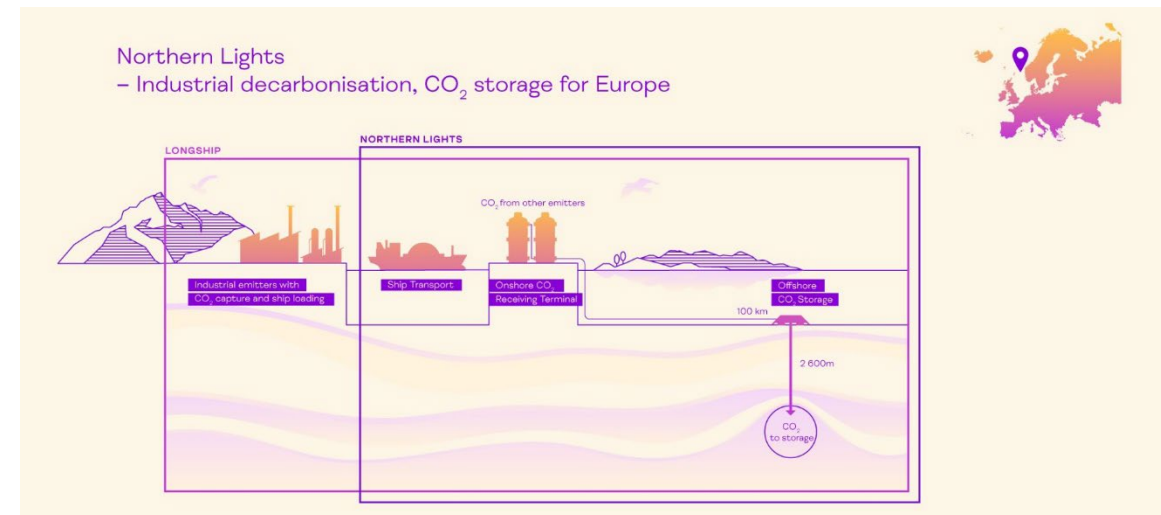
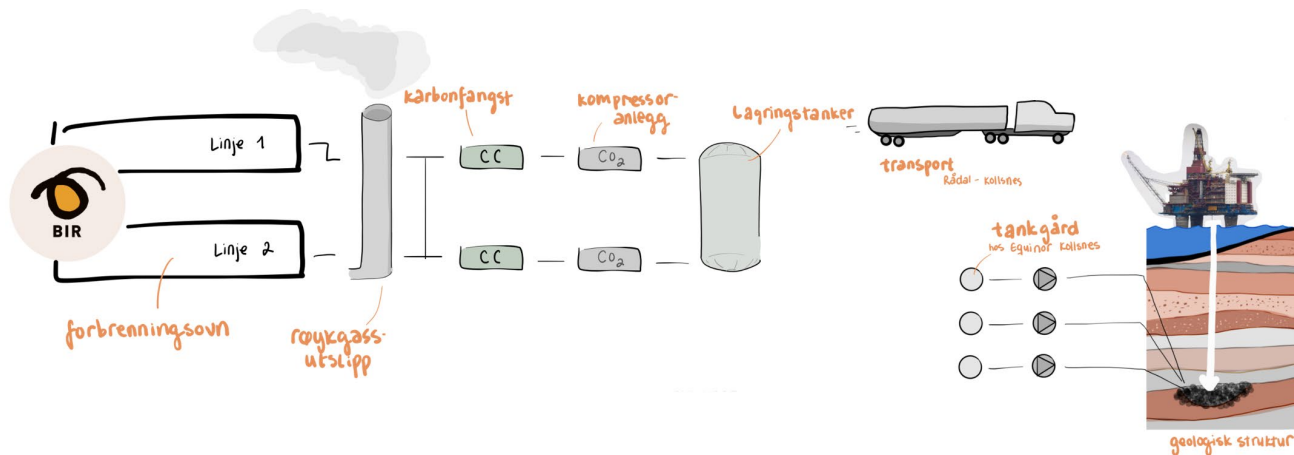
- Lyse Energigjenvinning, BIR, Returkraft, Fortum Oslo Varme, Borg CO<sub>2</sub> og Statkraft Varme etablerer industrisamarbeidet KAN
- Aktørene har alle aktiviteter knyttet til fangst, lagring og/eller utnyttelse av CO<sub>2</sub>, med flere av de samme utfordringene
- KAN skal bidra til økt informasjonsdeling og bedre løsninger rundt fangst, lagring og utnyttelse av CO<sub>2</sub> i avfallsbransjen, via økt samarbeid om felles utfordringer

### Aker Carbon Capture

- Design of a CO<sub>2</sub> capture and liquefaction facility of 12.5 t/h (~100 000 t/a)
- Assess integration options between CO<sub>2</sub> capture plant and the Rådalen WTE facility
- Evaluate layout solutions of a CO<sub>2</sub> capture process at the Rådalen site
- Determine CO<sub>2</sub> conditioning requirement for transport to storage
- Capital expenses

# Status: BIR's CO<sub>2</sub>-Capture

- BIR and our owners are very focused on carbon capture at the waste to energy plant
  - BIR-Rådalen is the largest single source of CO<sub>2</sub> in Bergen
  - A potential to reduce the CO<sub>2</sub>-emissions in the municipalities with more than 20 %
  - Close to the storage site – Northern Lights
- Continued pilots for testing CCUS-technology
- Continued studies to detail technology and costs





# THE WAY FORWARD



- Secure support for the project to establish CC-plant
  - Dialogue with relevant authorities about different financing and operating concepts
  - Continue discussions with Northern Light
  - Media attention
- Acquisition of land for the CC-plant
- Choose the best CC-technology for BIR and Bergen
- (and participate in projects with local start-ups and University)



# Close Collaborations with Norwegian and Nordic Incineration Plants Through Industrial Networks



Plant visit at the Technology Centre Mongstad (TCM) CO<sub>2</sub> technology centre, Equinor

