



Visit from Danish delegation

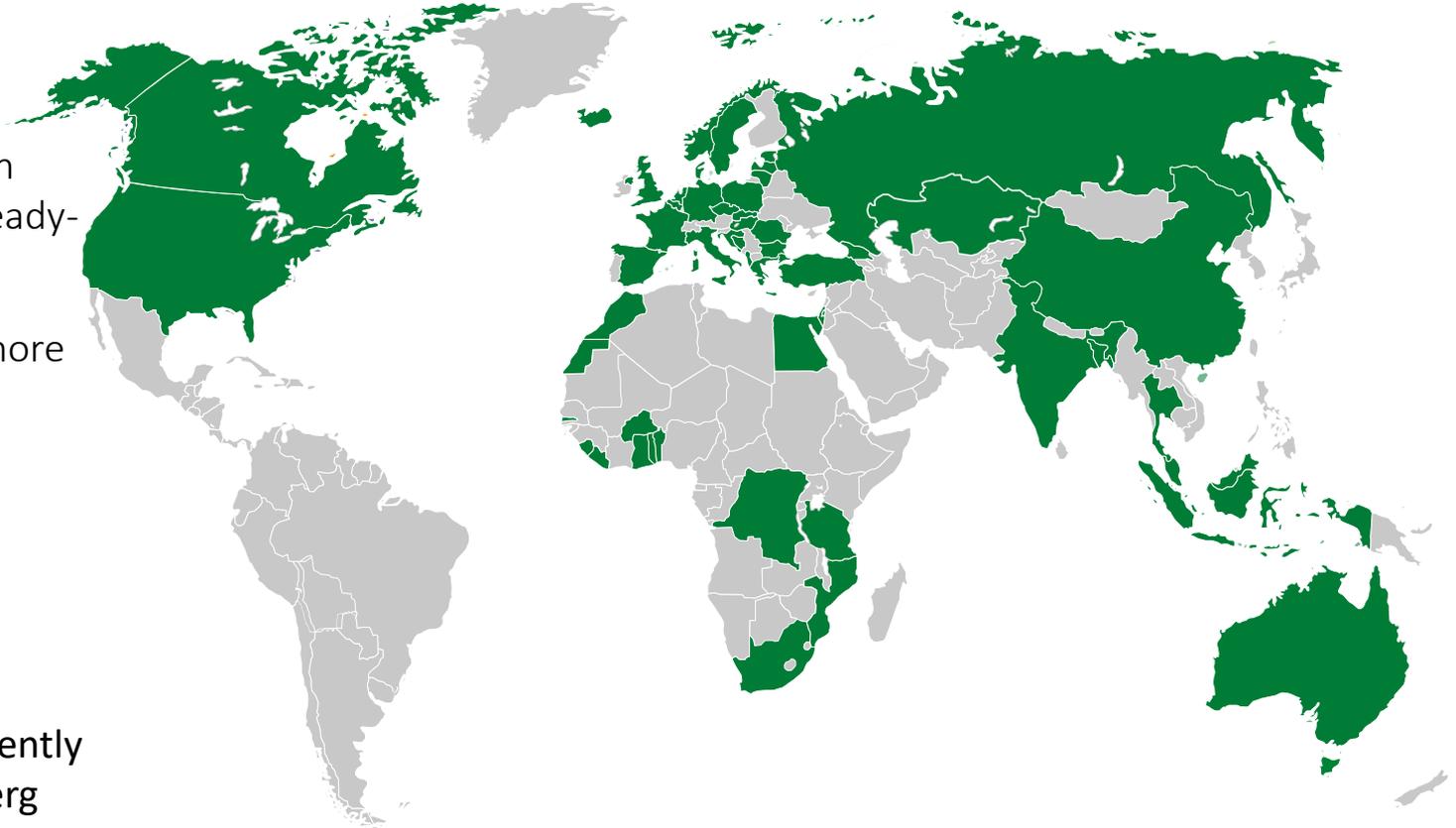
27 September 2022

Brevik CCS

Per Brevik, Public Affairs Brevik CCS

HM - one of the largest vertically integrated building materials producers in the world

- 53,000 employees
- Leading market positions in aggregates, cement, and ready-mixed concrete
- 3,000 production sites in more than 50 countries
- Cement capacity 184 mt (incl. joint ventures)
- Aggregates resources and reserves 19.2 bnt
- HeidelbergCement has recently changed name to Heidelberg Materials



Concrete is essential for building a sustainable society

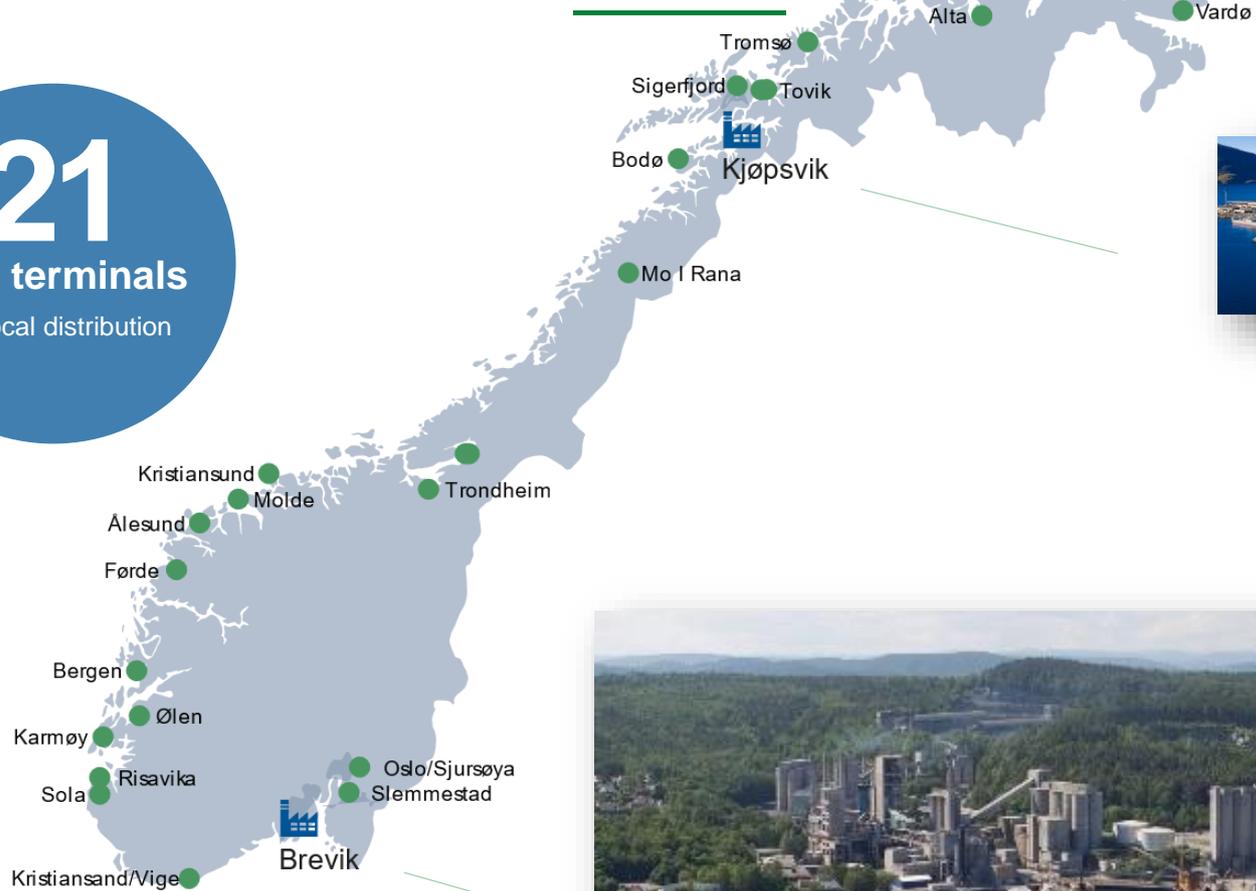


The main challenge for the concrete-industry is the production of cement

- ❑ 2 Gt CO₂ / year
- ❑ 6 – 8 % of the total CO₂-emissions

Norcem in brief...

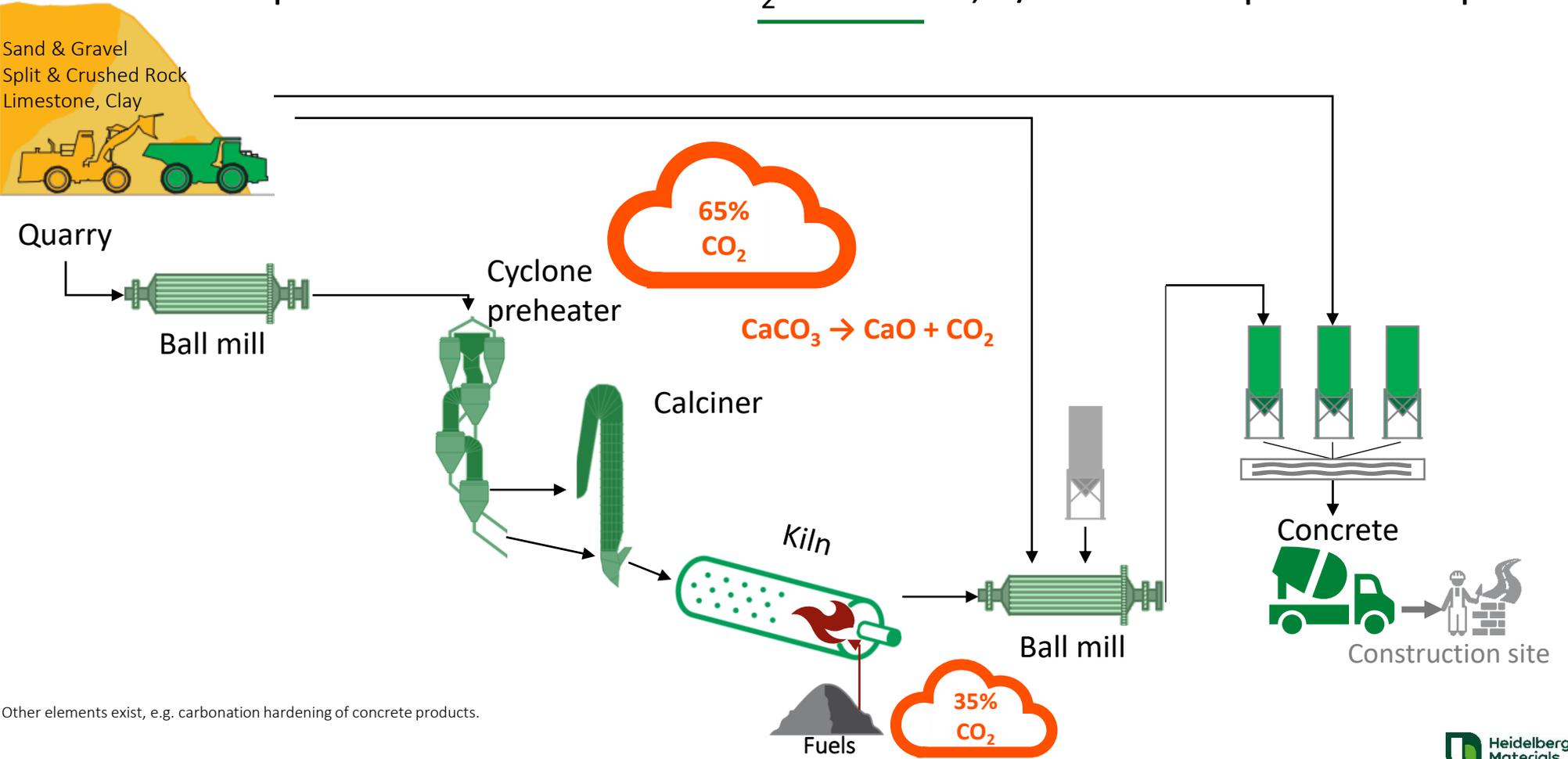
21
Silo terminals
For local distribution



2
plants
Kjøpsvik in Nordland
Brevik in Telemark



Cement represent 6 – 8% of total CO₂ emissions; 2/3 from the production process



Other elements exist, e.g. carbonation hardening of concrete products.

1) In addition: kiln efficiency, green hydrogen fuel, electrification of kilns.

Climate actions in the cement industry



Alternative fuels

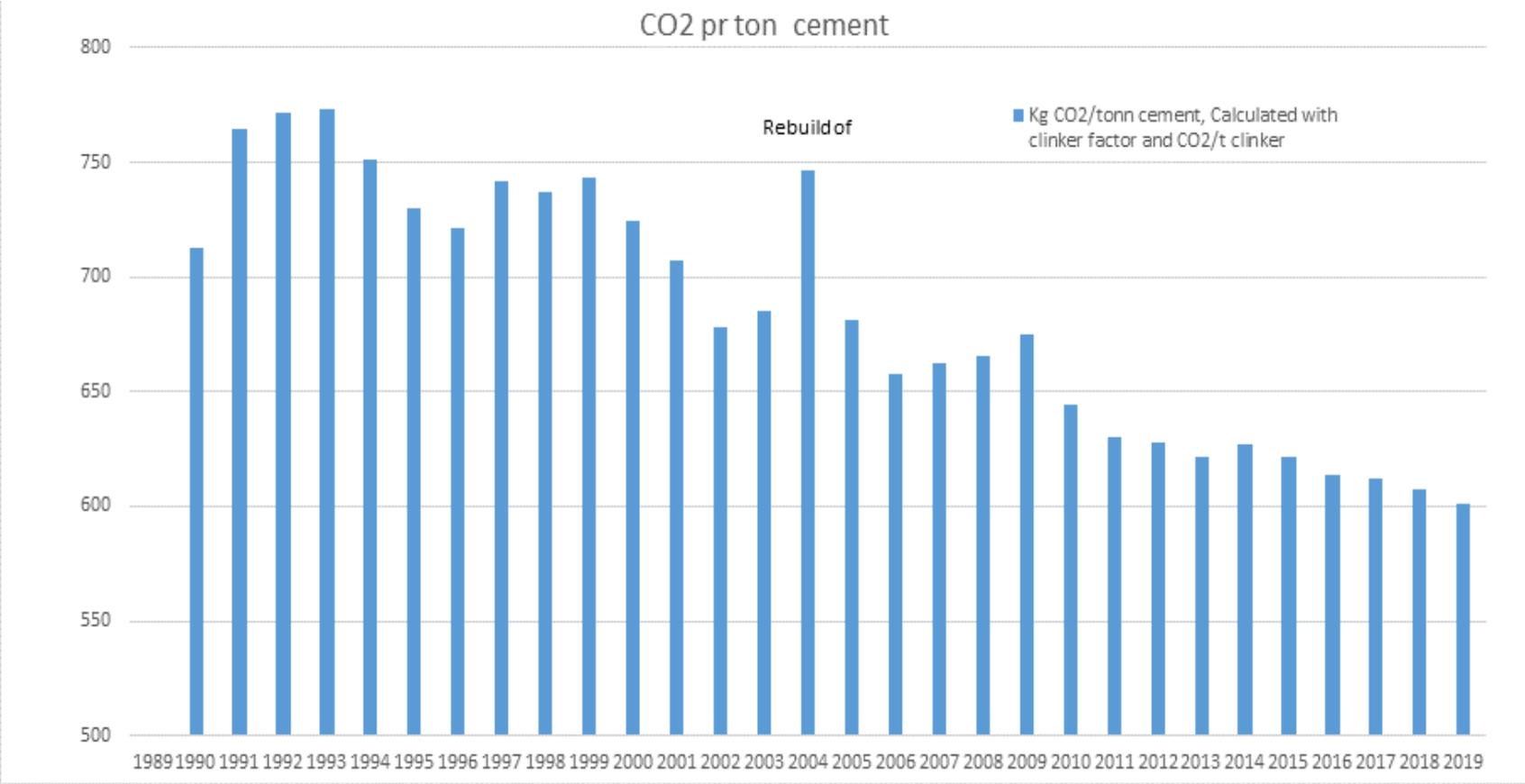


Alternative raw materials



Carbon capture

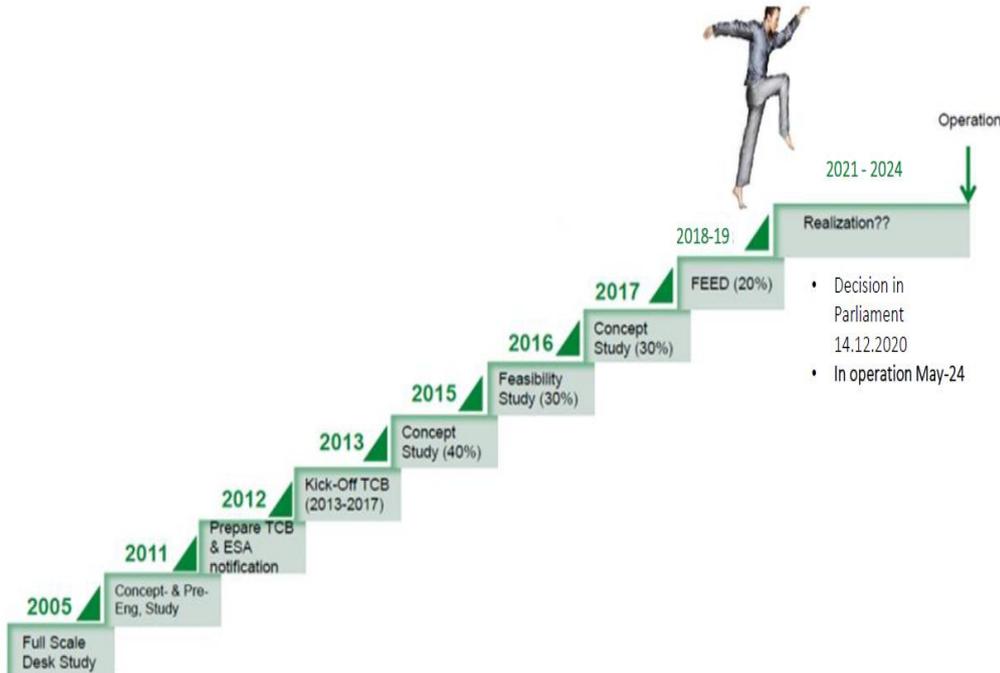
CO₂-reduction Brevik 1990 - 2020



22% reduction
totally of CO₂
from 1990 to
2020

11% reduction
still planned
towards 2030
(excl CCS).

CCS in Norcem



- First internal desk studies in co-operation with Regional Technical college. R&D-project.
- Received 2010 economic support (100 k€) from ECRA to develop an application for Gassnova funding
- The test-project 2013 – 17 key for developing carbon capture at Norcem Brevik. The project is still the basis for our work. First results presented at the CCS-seminar in Langesund in May 2015.
- From 2015 part of Norwegian Carbon capture Development project (Feasibility, Concept and FEED studies)
- Longship launched 21 September 2020

Testing four capture technologies in Brevik 2013 - 2017

Aker Solutions amine technology – TRL 9



Air Products/ NTNU membrane technology – TRL 5



RTI solid sorbent technology – TRL 4



Testing of four capture technologies on real flue gas Conclusions

1. Technologies are available
2. Dependent on economic support
3. In the 2020 perspective, Aker Solutions' amine technology was the only one ready for a full-scale realization

Alstom Power Calcium Looping – TRL 3



«Langskip» - the biggest climate project in Norwegian industry

«Langskip» launched 21 Sept. 2020

- Full-scale capture at Norcem Brevik
- Conditional support to FOV
- Northern Lights responsible for:
 - Transport
 - Intermediate storage at Øygarden outside Bergen

➔ Total cost 2,5 B€ incl 10 year of operation

- Government's part: 1,7 B€

➔ Approval in Parliament 14 Dec. 2020

➔ Started 4 January 2021



Longship today

Equinor, Total and Shell ("Northern Lights")
Responsible for CO₂ transport and storage



Onshore terminal in
Øygarden, Hordaland

- Onshore terminal with buffer storage, pump and heater
- 110 km pipeline, 12 inches
- One injection well



Hafslund Oslo Celsio AS
Waste-to-energy plant



Norcem AS, Brevik
Cement plant



- Transport by 1 or 2 ships
- 700 km distance
- Liquefied state (15 barg, -26°C)

- Capture of 400 kt/y at Norcem and Hafslund Oslo Celsio each
- Amine technology incl. CO₂ cleaning, liquefaction and buffer storage (4 days)

CO₂ capture Brevik

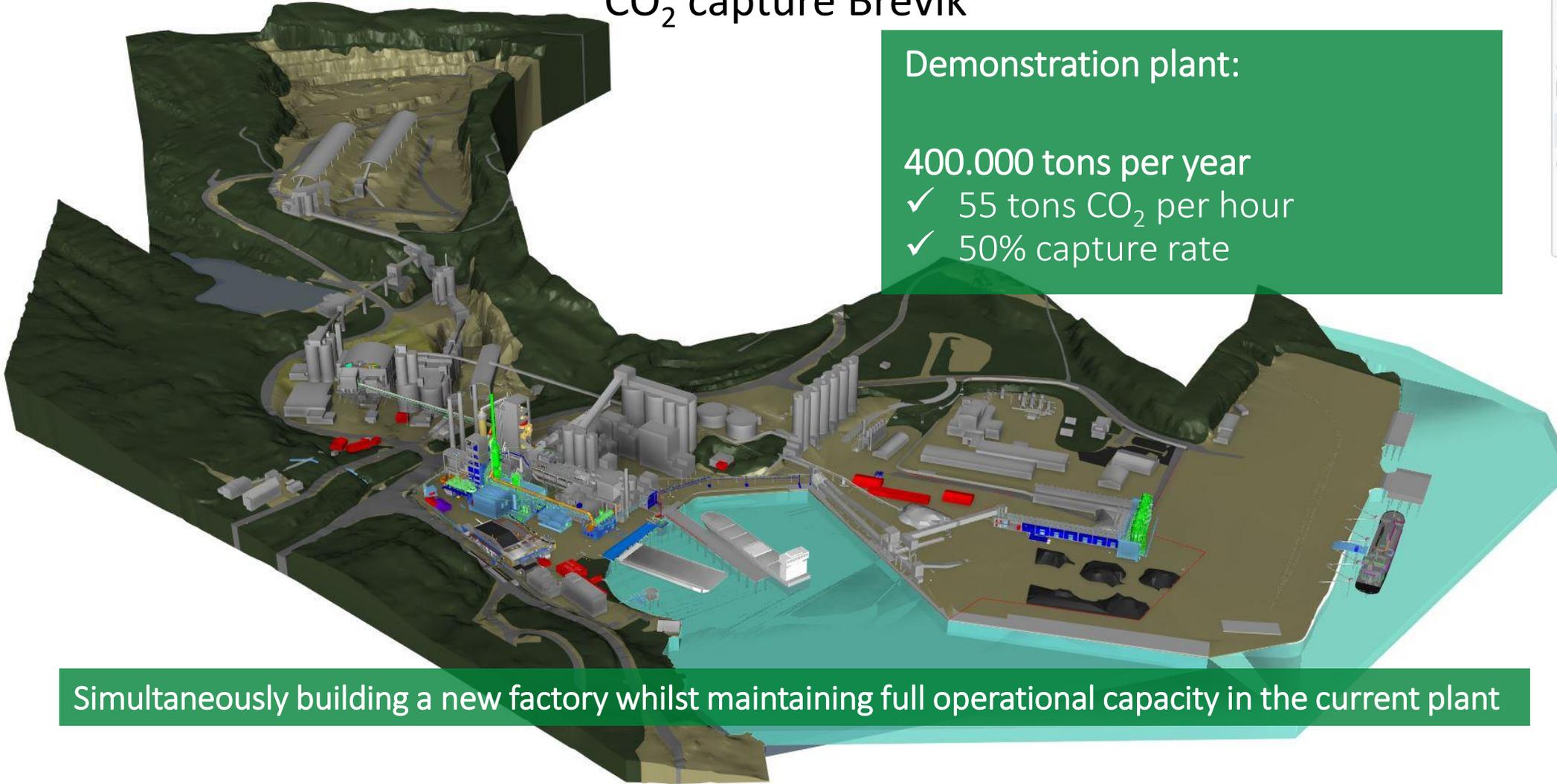
Demonstration plant:

400.000 tons per year

✓ 55 tons CO₂ per hour

✓ 50% capture rate

Simultaneously building a new factory whilst maintaining full operational capacity in the current plant



A 3D architectural rendering of a large industrial facility, likely a carbon capture plant, situated in a valley. The scene is dominated by a complex network of pipes and structures. A prominent feature is a tall, slender green chimney stack. Other structures are colored in shades of orange, yellow, and red. A long, thick orange pipe runs horizontally across the middle of the site. In the foreground, there are several large, modern buildings with blue and white facades. To the right, a blue dam or barrier is visible. The background shows rugged, greyish-brown hills under a clear sky. A green laser line is visible in the upper left, extending from a structure towards the center.

Installation of WHRU's started
in May 2022.

The remaining of the CCS plant
(all the **green**) will be installed
in 2023.

Contractual Mechanical
Completion 15th of Feb 2024

First ship load
1st of July 2024

Acceptance test
31st of August 2024

We have started the journey towards 2024

Started
2021

Current status

2024



Estimated view July 2024



Demolition phase

Building phase

Testing phase





An aerial night photograph showing a large industrial facility, identified as Heidelberg Cement, situated on a hillside. The plant features several tall, cylindrical silos and complex piping structures, some of which are illuminated from within. In the foreground, a residential neighborhood is visible, with several houses and a road. A large white truck, likely a Waste Heat Recovery Unit (WHRU), is driving on the road, followed by several smaller vehicles. The scene is set against a dark, overcast sky, with the lights from the plant and houses providing the primary illumination.

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First WHRU arriving
during night ...





The project will emerge the next year

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Mostly according to plan ...

Schedule

- On track to load the first CCS ship summer 2024
- Mechanical complete Feb.-24
- Commissioning will be tight and challenging

Challenges/Risks

- Ground works more challenging than assumed
- Price development for the fabrication contract
- Covid-19
- War in Ukraine

Cost control

- We announced an overrun in Oct-21 (Baseline 01). Second baseline showed reduced costs and lower risks.
- Ongoing process with Ministry regarding funding of the overrun



Public interest is high / Many prominent guests

Stakeholders

- Government / Ministry / Politicians
- EU / EEA
- Norcem/HeidelbergCement
- Academia – R&D
- Neighbours/Community

Huge responsibility

- «Norwegian tax payers' money»
- “Open door”-policy
- Public procurement

Benefits realization

- Responsibility as a big emitter
- Control regarding progress and costs
- «Lessons learnt» - sharing experiences for contribute to further CCS deployment



Prime minister Erna Solberg. With two fellow cabinet members visiting Norcem in Oct. 2020

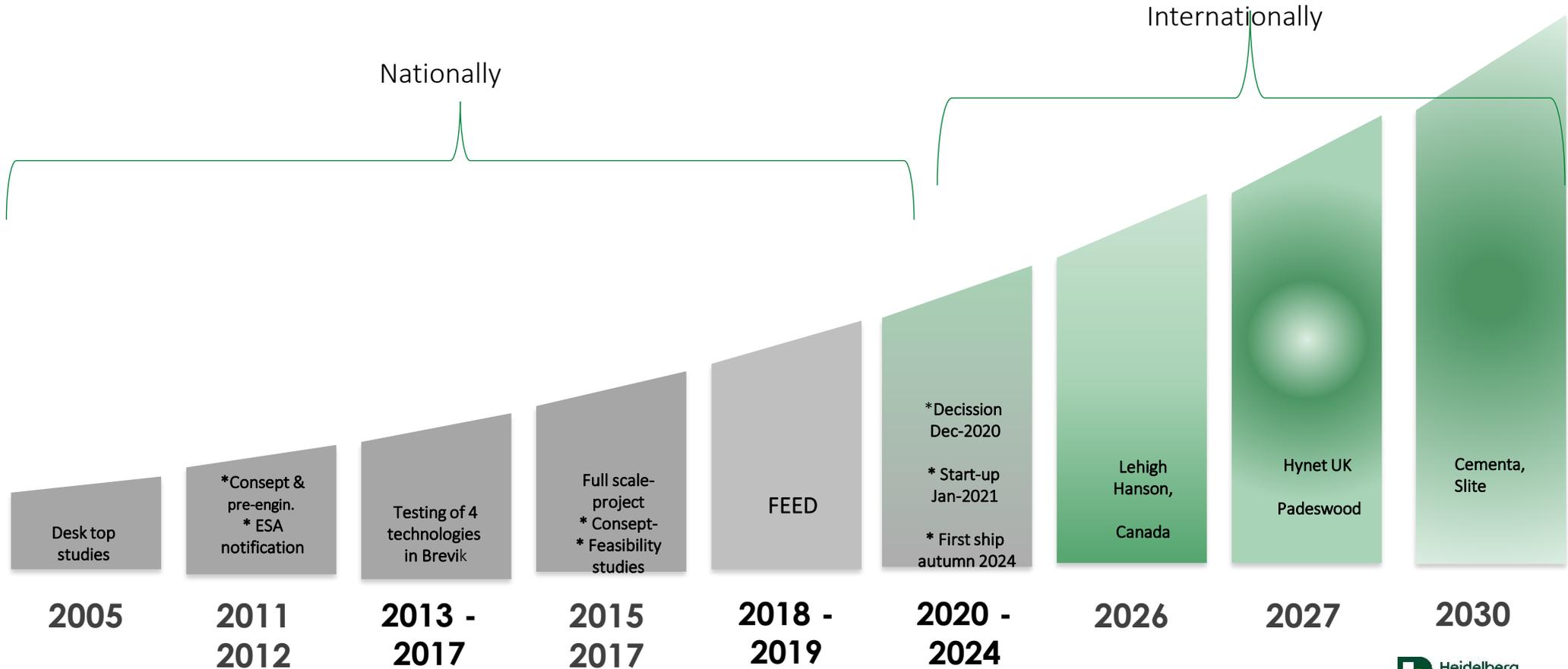


Former Prime Minister Jens Stoltenberg, now NATO Secretary General



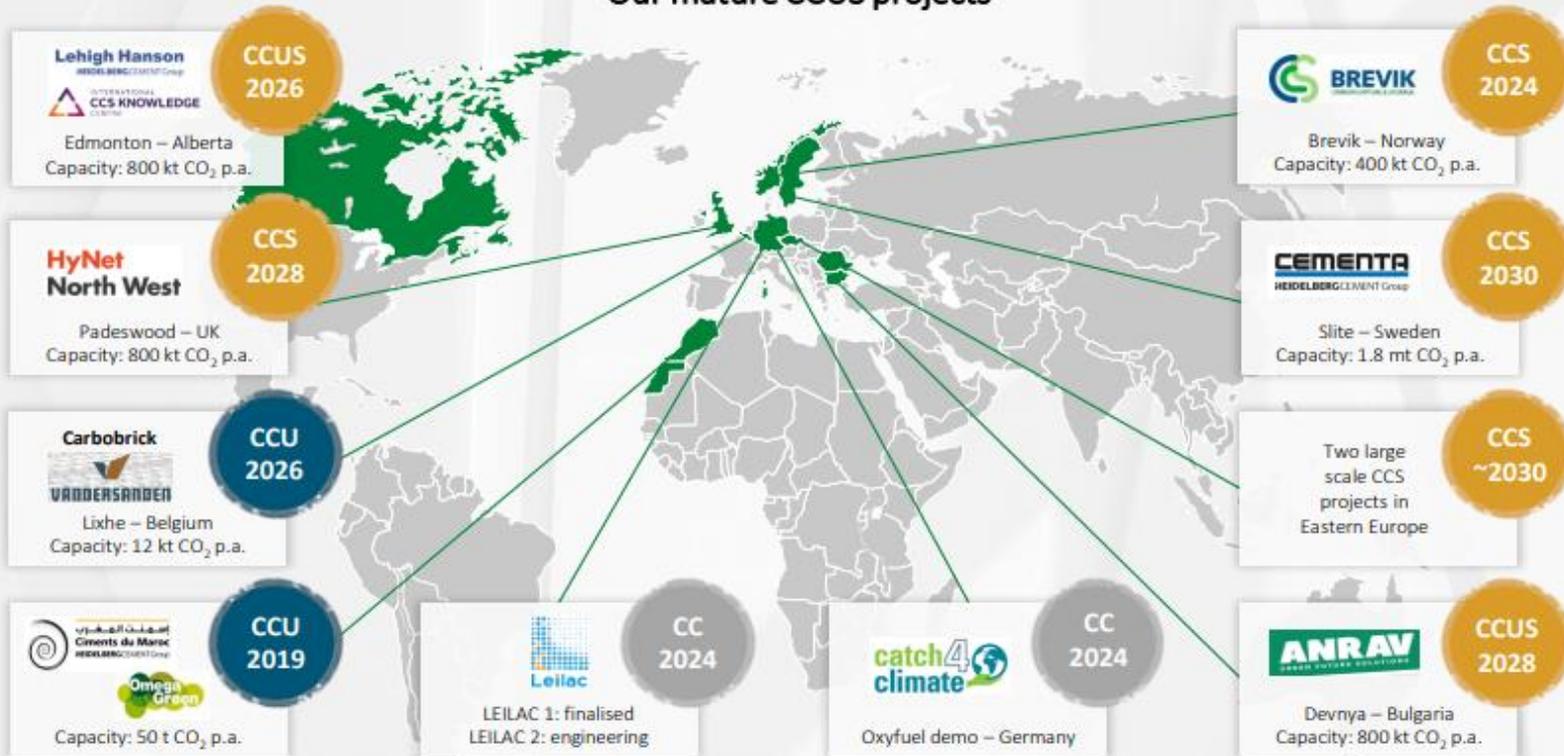
Crown Prince Haakon visiting Norcem 2020.

Brevik taking the lead; now “the ball is rolling”...



Driving CCUS with extensive and most advanced project portfolio in the sector

Our mature CCUS projects



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Changing the future starts today!