



Steinsteypudagurinn 2020

Cement with reduced CO₂ footprint – Development activities

**Kjell Skjeggerud
HeidelbergCement Northern Europe**

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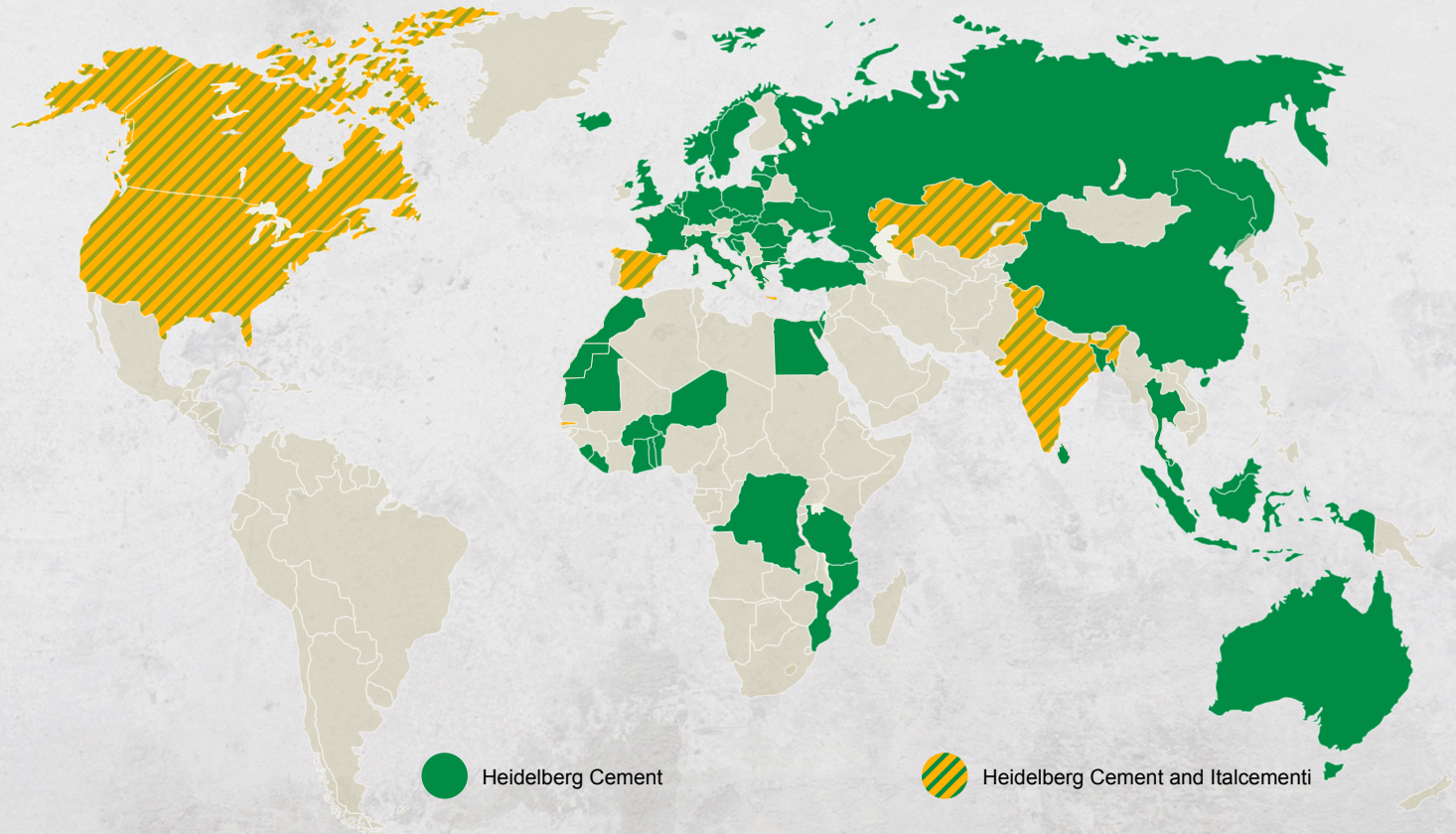
HEIDELBERGCEMENT GROUP
Worldwide

Market position:

01
Aggregates

02
Cement

03
Concrete



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Northern Europe (HCNE)

HCNE is a business area within HeidelbergCement, and consists of :

- Denmark
- Iceland
- Norway
- Sweden
- The Baltics

The HCNE-companies produce building materials including:

- Aggregates
- Cement
- Readymix concrete
- Prefab elements



Production and distribution

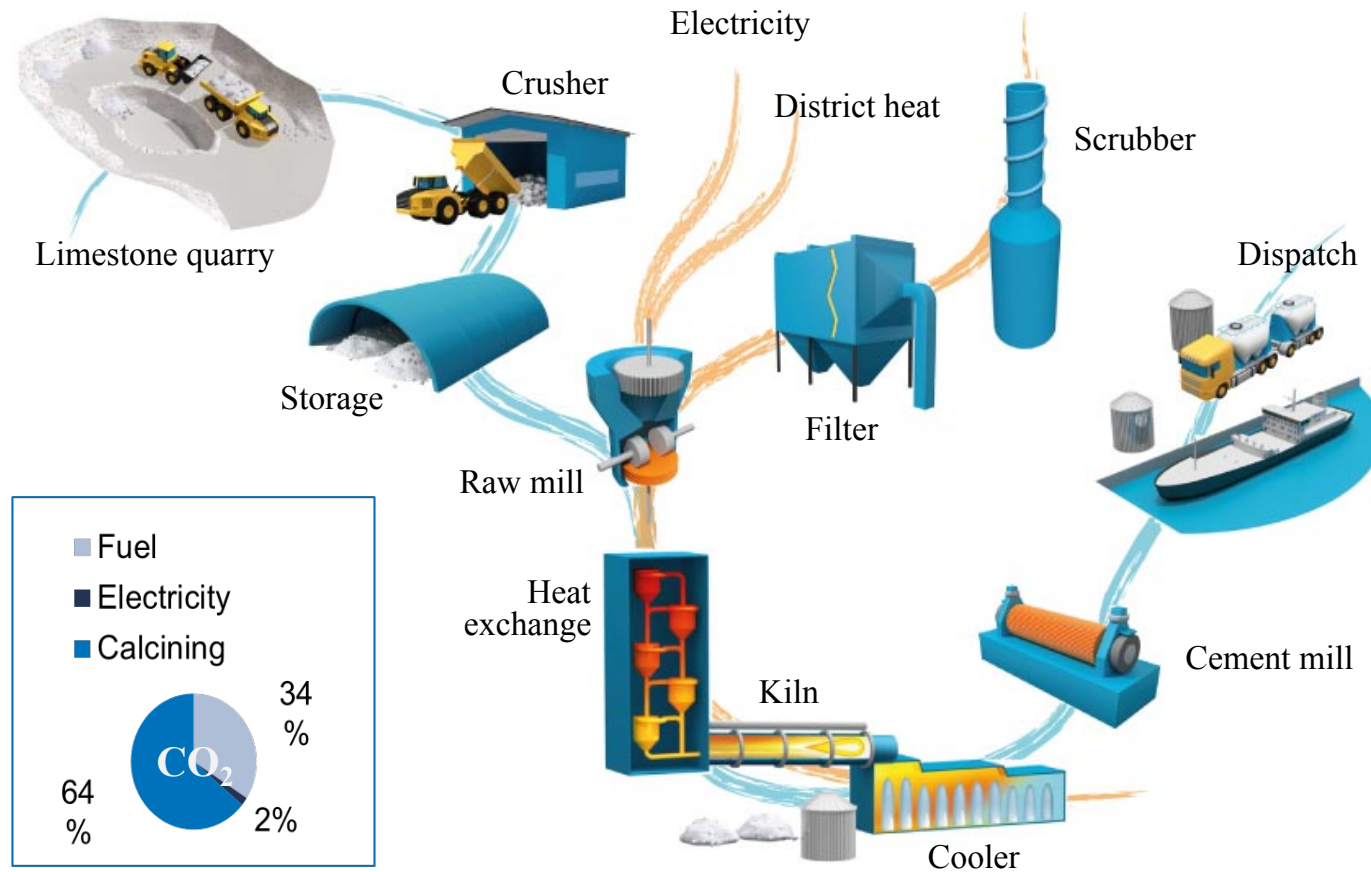
5
mill tonnes
Building materials by ship
along the coast



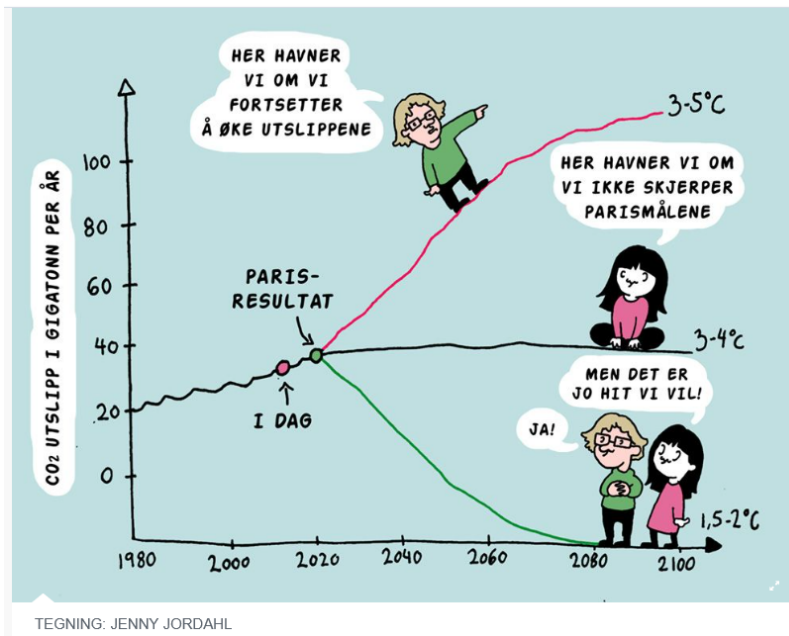
2
plants
Kjøpsvik in Nordland
Brevik in Telemark

21
Silo terminals
For local distribution

Produksjons prosessen for sement



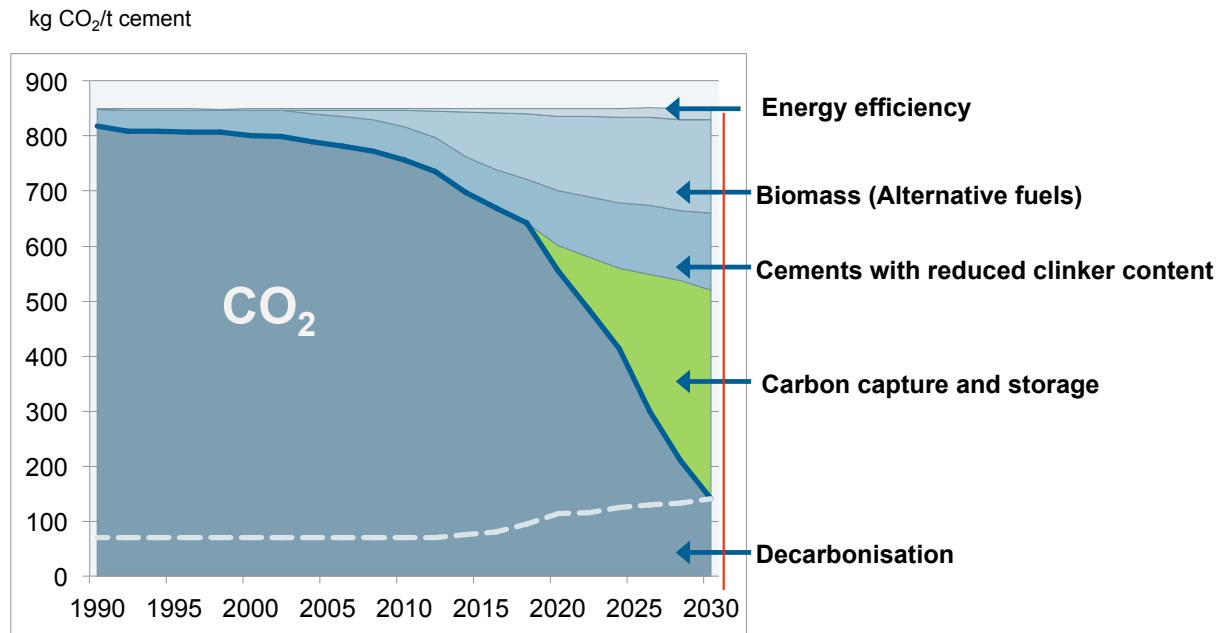
CO2 emissions from Cement and Concrete amounts to 5-8% of world emissions We need to reduce our emissions.



Ifølge FN var det ti mega-byer, med mer enn ti millioner innbyggere, i 1990. I dag er det 35 mega-byer, og tallet over mennesker som søker seg mot byer vil bare øke i årene som kommer. São Paulo, med over 21 millioner innbyggere, er en av verdens største byer. Mange bor i byens slumområder, som her i «the milli». Området ligger mellom en jernbanelinje og en motorvei, og ble kjent fordi mange lik ble dumpet i området, og fordi det har vært stor narkotrafikk. Foto: Carlos Cazalis / Reuters / NTB Scanpix

■ HeidelbergCement Northern Europe have developed our Zero - vision

- No emissions from our products over the lifetime of a concrete structure



Alternative fuels - an important part of our development activities

- Waste materials used as energy recourse in clinker production
- Reduced amount of fossil fuels
- Reduced emissions of CO₂
- **Examples:**
 - Biomass like animal meal and wood chips
 - Refuse derived fuels from households an industry like paper, plastics, wood and textiles
 - Waste oil
 - Hazardous waste like paints and solvents («hot-mix»)
 - Sludge from fish farms
- Status today: > 70% alt. fuels
- target 2025: > 90% alt. fuels

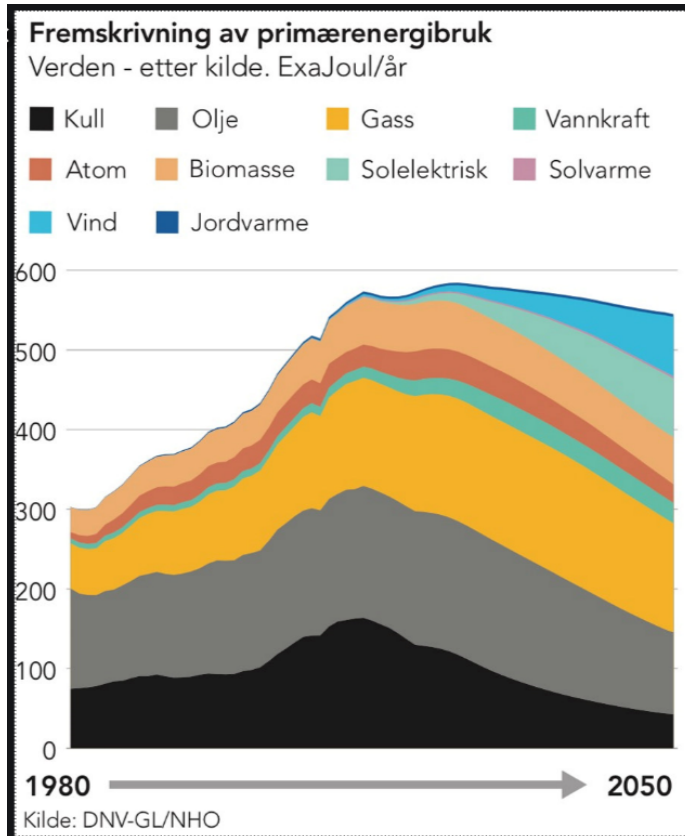


New cements with lower clinker content – by use of SCMs



- **HeidelbergCement Northern Europe have used Fly Ash from coal fired power plants since early 1980s.**
- **Fly Ash and Granulated Blast furnace Slag are well established as SCM in the European cement and concrete market**
- **How does the future look like ?**

Coal as the primary source of energy for power production are about to change



- Renewable energy resources like wind and solar increase
- Europe is not going to be the last part of this development
- Availability of Fly Ash will be reduced

How will the steel industry in Europe look like in 2040?



■ Sustainable cement production in the future

■ Cement consumption in Europe 220 Mill t / y



■ Availability of GBFS in Europe 30 Mill t / y



■ Availability of Fly Ash in Europa 25 Mill t / y



■ We will have to look for alternatives in the future

Limestone

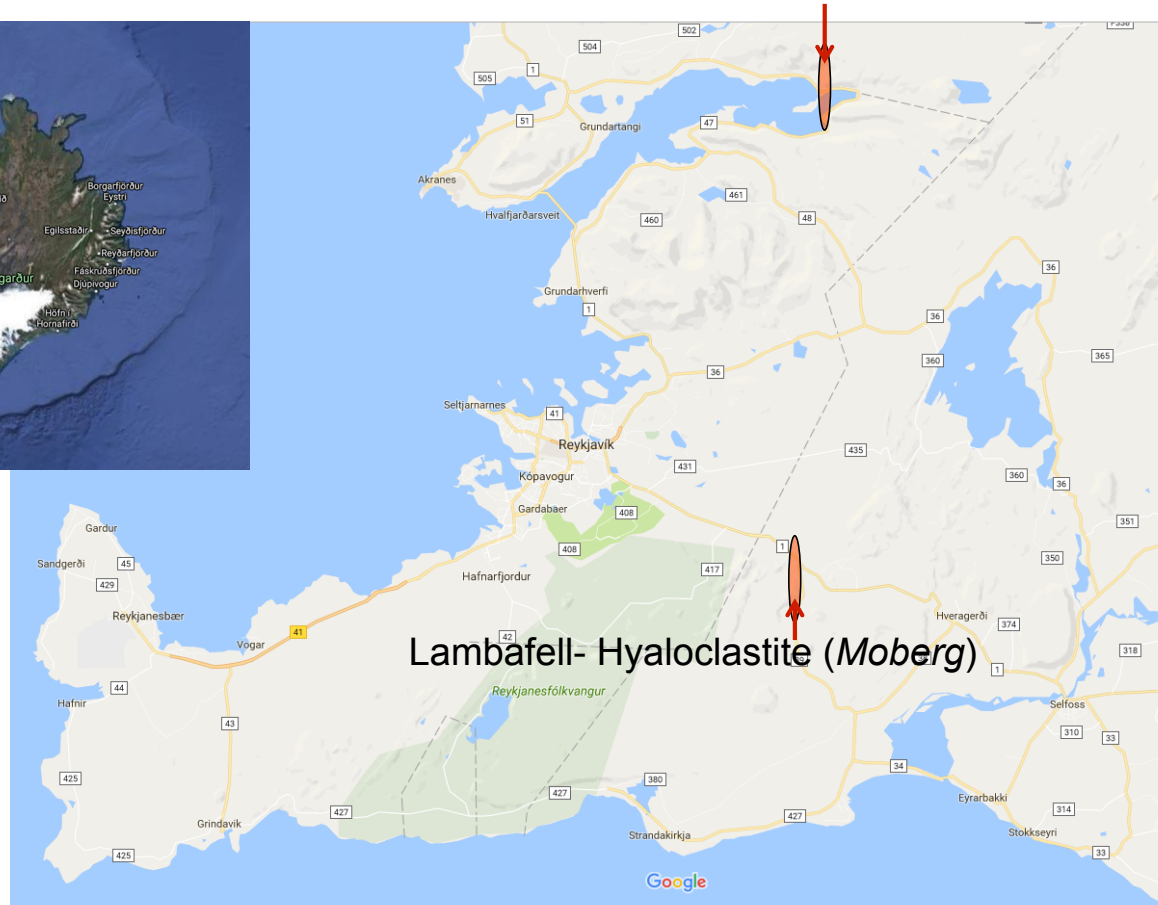


Slide 13 -
Steinsteyrudagurinn 2020

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Natural pozzolans - Volcanic ashes Potential resources

Hvalfjörður - Rhyolite (*Líparít*)



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Rhyolite (*Líparít*) quarry in Iceland



Raw-material for Icelandic cement (1958 – 2012)



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■ Sample sent to SINTEF, Norway - 2018

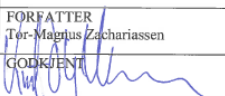


Børge Johs. Wigum

Kristján Sæmundsson

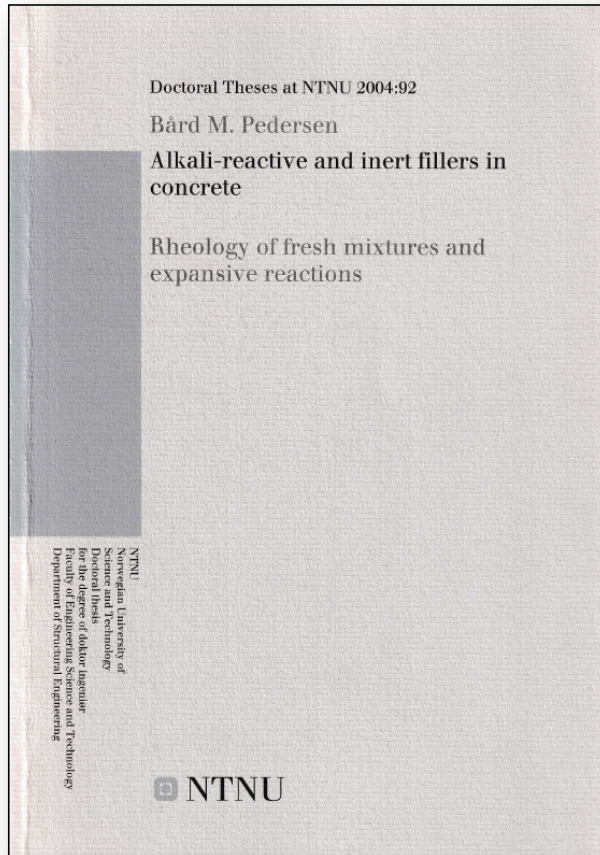
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Rhyolite (*Líparít*) – As pozzolanic material

NORCEM HEIDELBERGCEMENT Group		NORCEM A.S FoU – Avd.		Postboks 38 3991 BREVIK Norge Tel.: +47 35 57 20 00 E-Mail: tor.magnus.zachariassen@norcem.no Org.nr.: NO 954 969 165 MVA		
RAPPORT NR.	9D4/R13012	PROSJEKT NR:	S3.2	GRADERING	Fortrolig	
RAPPORTTITTEL	Undersøkelse av pozzolanisk effekt i Líparit. Ved bruk av metode for aktivitetsindeks av flygeaske iht NS-EN 450-1	DATO :	02.01.2014	OPPDR.NR	LAB:	
		SIDEANT./VEDL.	7 / 3		43/13	
		FORFATTER	Tor-Magnus Zachariassen			
		GODKJENT				
OPPDRAGSGIVER	Knut O Kjellsen/Gunnar Sigurdsson, Sementverksmidjan.	STIKKORID	Líparit, Aktivitetsindeks, Sementverksmidjan.			
SAMMENDRAG						
<p>Norcem FOU har fått tilsendt en prøve av líparit fra Sementverksmidjan på Island, med spørsmål om líparit kan egne seg som klinkersubstitutt for Norcem.</p> <p>Det er gjort forsøk med bruk av Líparit som substitutt i sement for å se om líparit kan ha en pozzolanisk effekt. Det er brukt er samme metode som blir brukt for testing av pozzolanisk effekten i flyveaske iht NS-EN 450-1. Under testing ble det benyttet Norcem Standardsement.</p> <p>Tester viser at líparit har meget gode pozzolanisk egenskaper.</p> <p>Målinger viser at Líparit i stor grad øker vannbehovet til sementen.</p> <p>I tillegg har lípariten et høyt alkalie innhold og høyt glødetap.</p>						

- Very good pozzolanic properties
- High water-demand
- High alkali-content & high loss of ignition

Rhyolite (*Líparít*) – As pozzolanic material



Rhyolite filler:

- The pozzolanic reactivity was distinct.
- Significantly reduced the ASR-expansion compared to reference concrete.
- Significant increase in compressive strength.

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■ Lambafell- Hyaloclastite (*Moberg*)

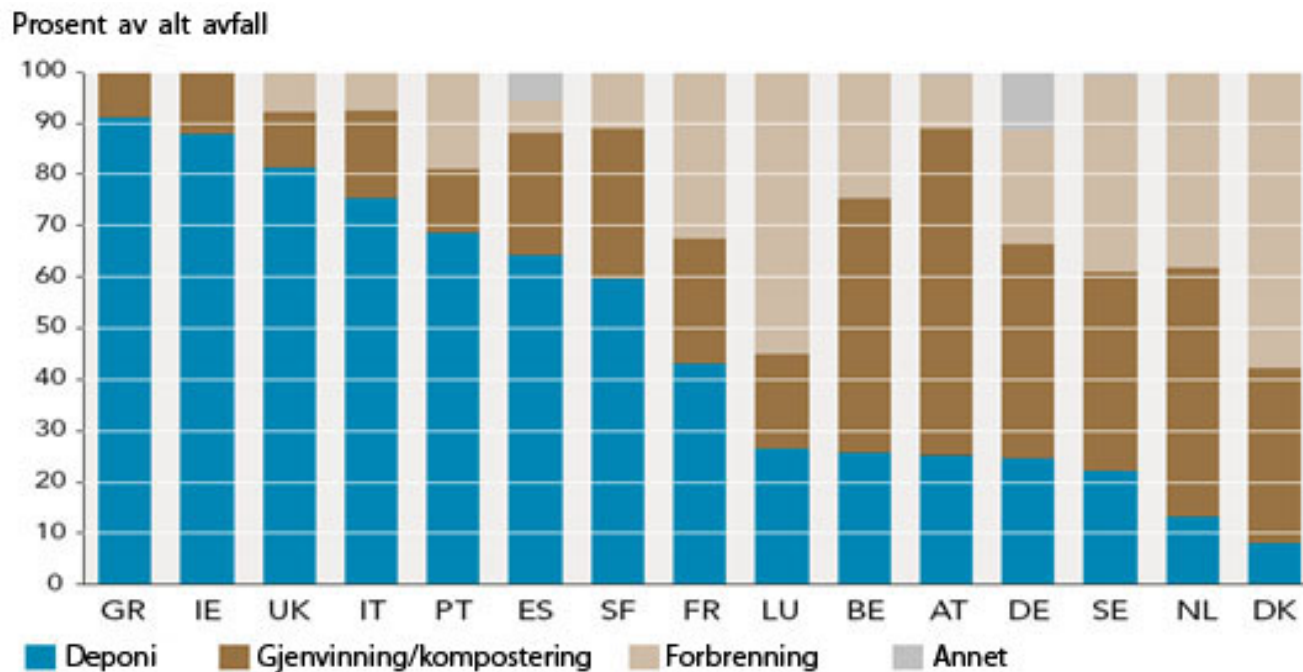


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■ Sample sent to SINTEF, Norway - 2019

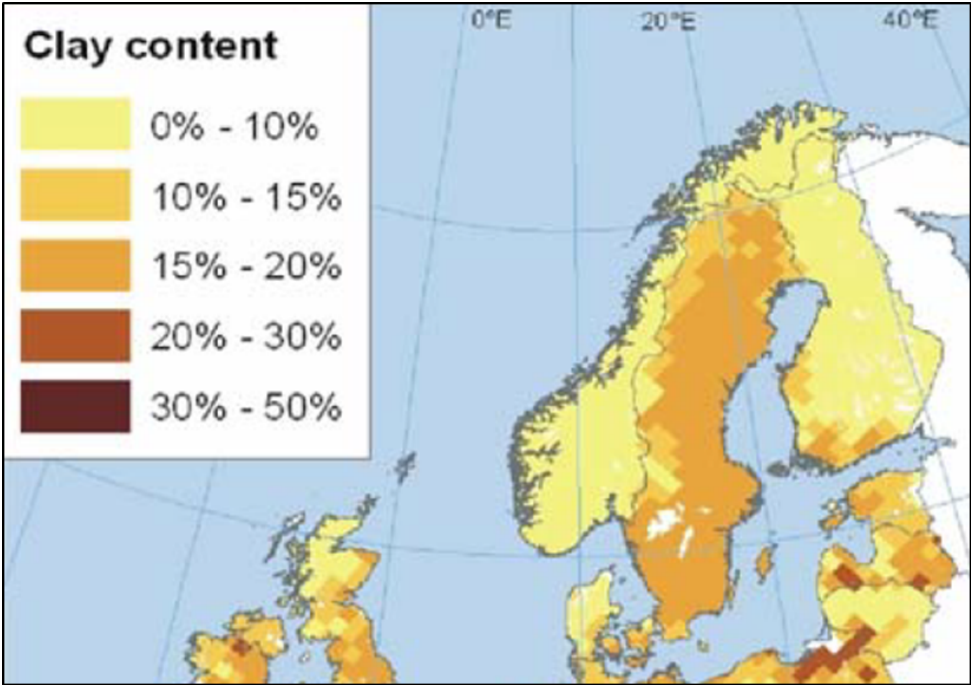


Ashes from waste incineration



Av Cskotland - cskotland, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=5725440>

■ Calcined Clay



HeidelbergCement Northern Europe works actively on Calcined Clay Kunda Calcined Clay

Calcination experiments of Kunda clay at the “semi” full-scale rotary kiln at IBUtec, Weimar, Germany



WP manager: Dr. Rolands Cepuritis



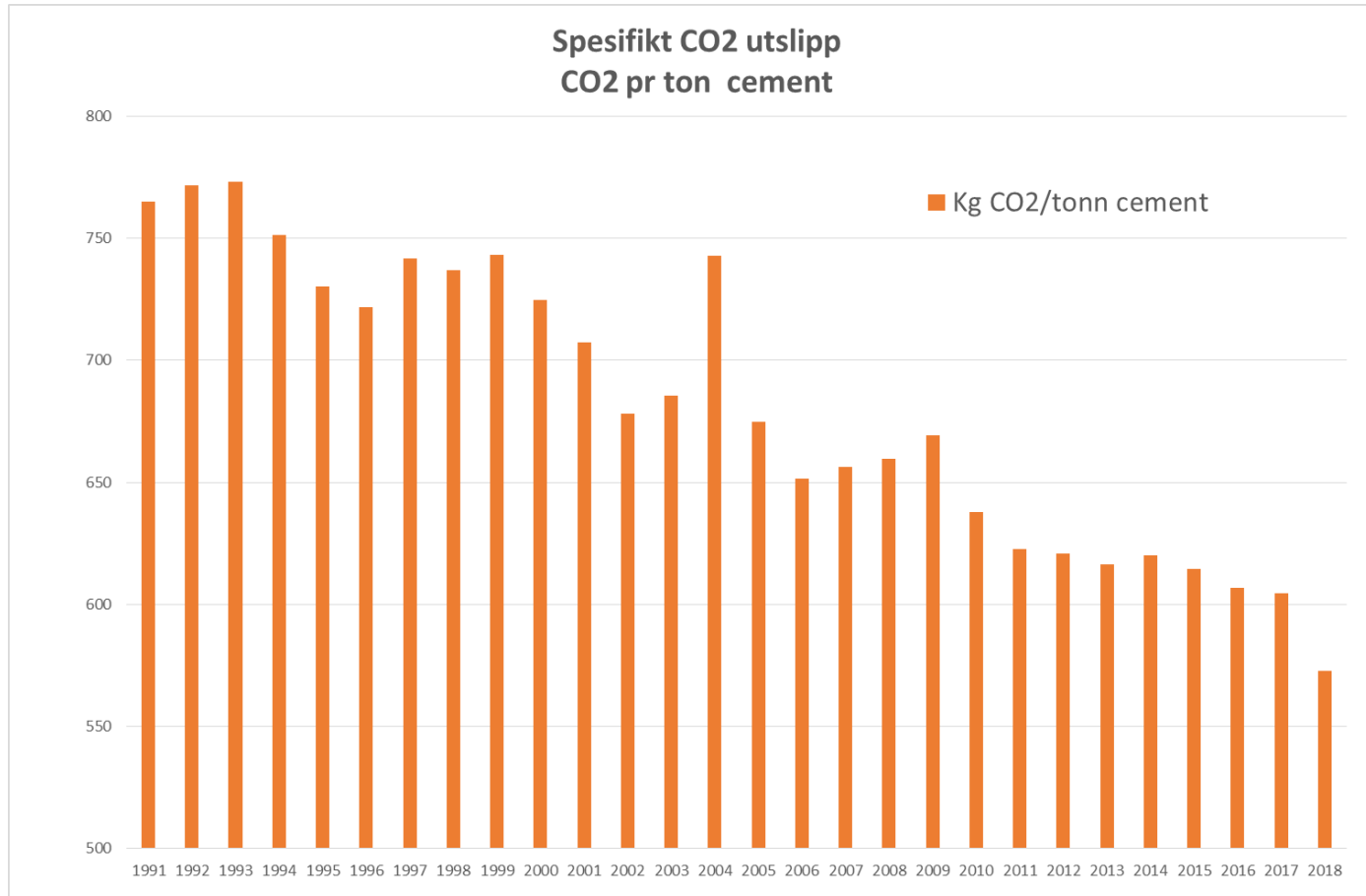
Final calcined product



Slide 10 - 21.03.2019
Rolands Cepuritis



CO₂-reduction for Norcem cement products 1990 - 2019



➤ Total **26%** reduction of CO₂ from 1990 till 2019

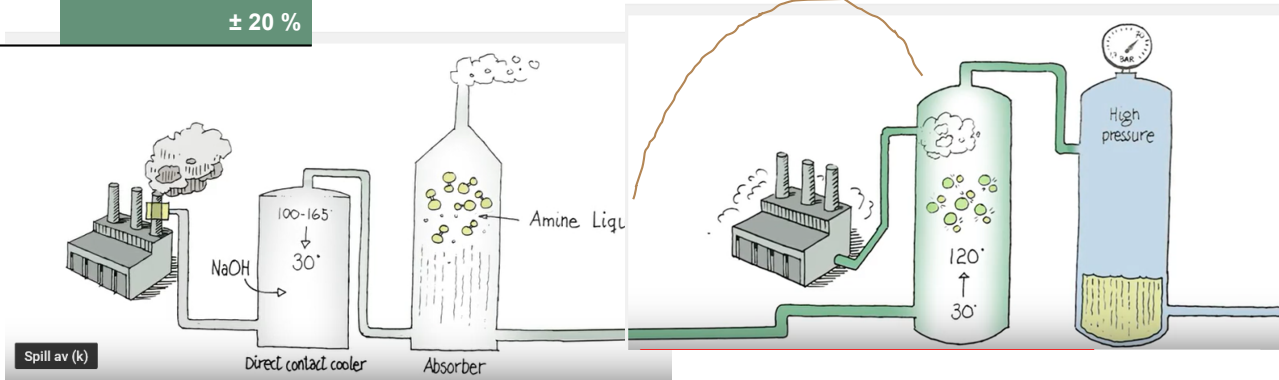
To achieve the targets of the Paris agreement we need Carbon Capture and Storage



HeidelbergCement Northern Europe work actively on CCS Brevik full scale Carbon Capture and Storage project

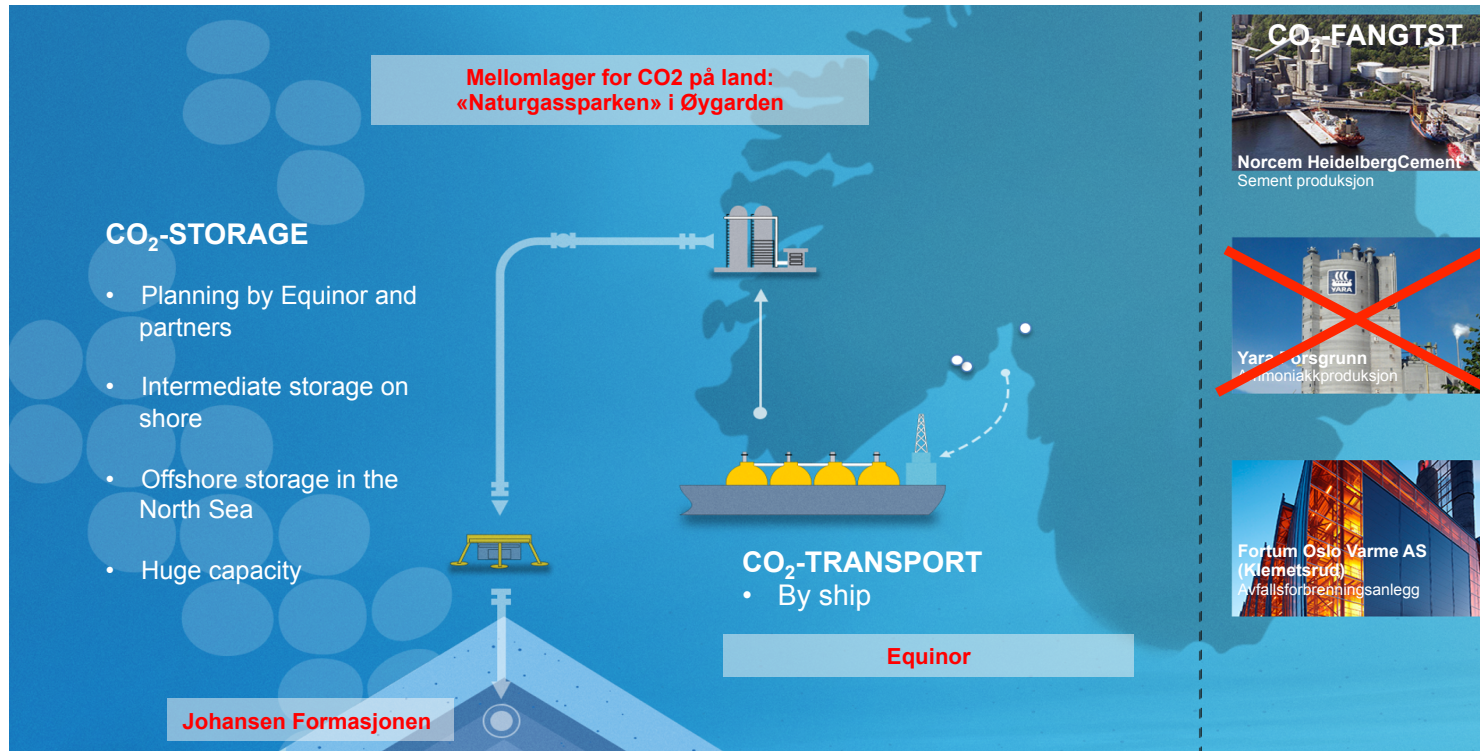
Norcem FEED Study

Technology	Amine
Technology Vendor	Aker Solutions
Capture Capacity	400 000 t/ y
Waste Heat recovery	46 MW
Transitory Storage	5000 t
Cost Estimation	± 20 %

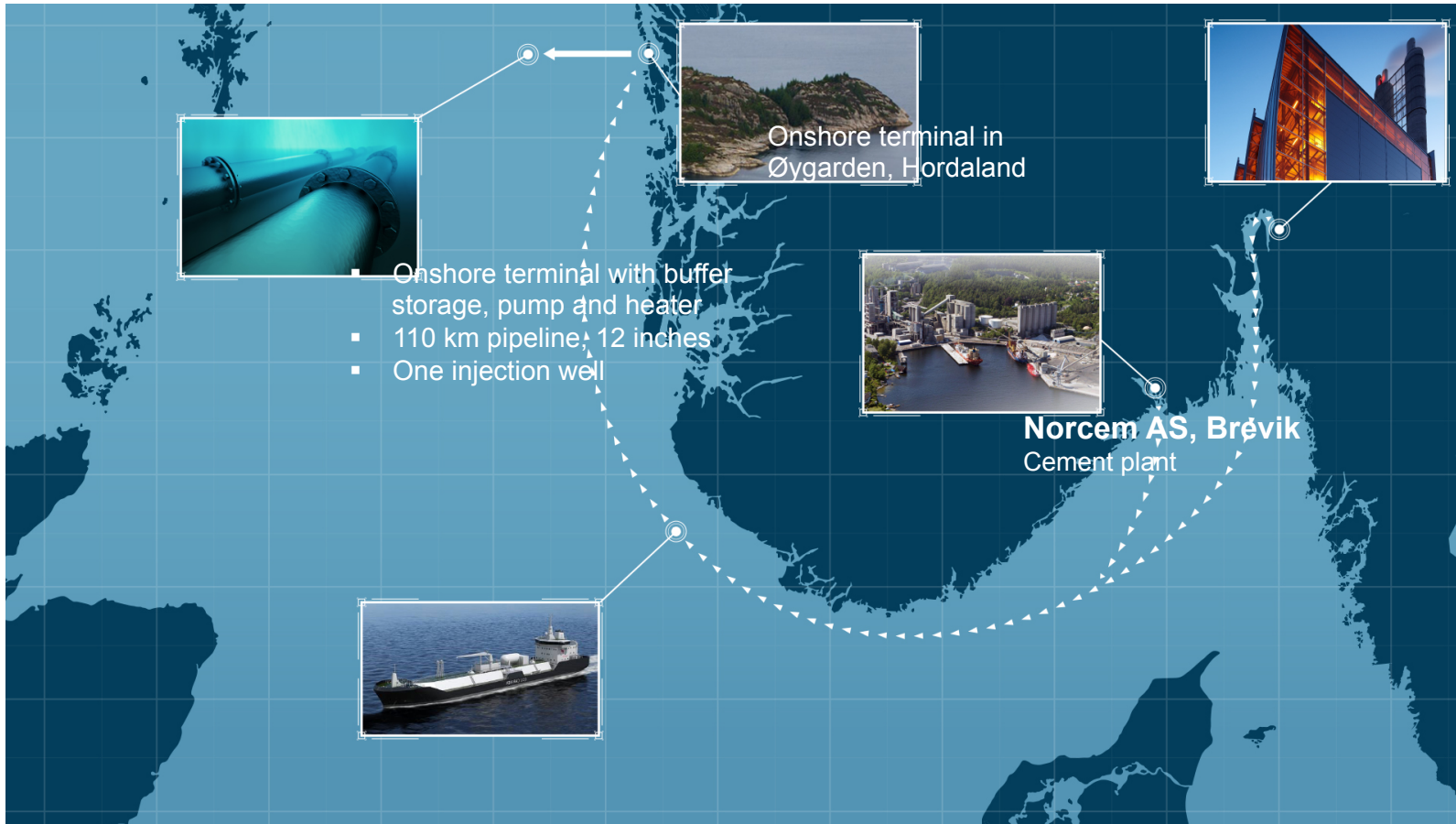


Demonstrasjon av verdikjeden er det viktigste

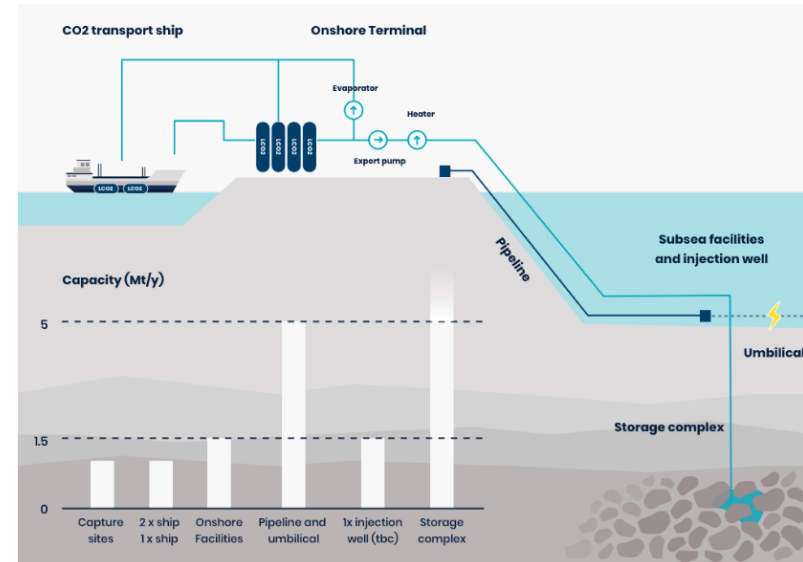
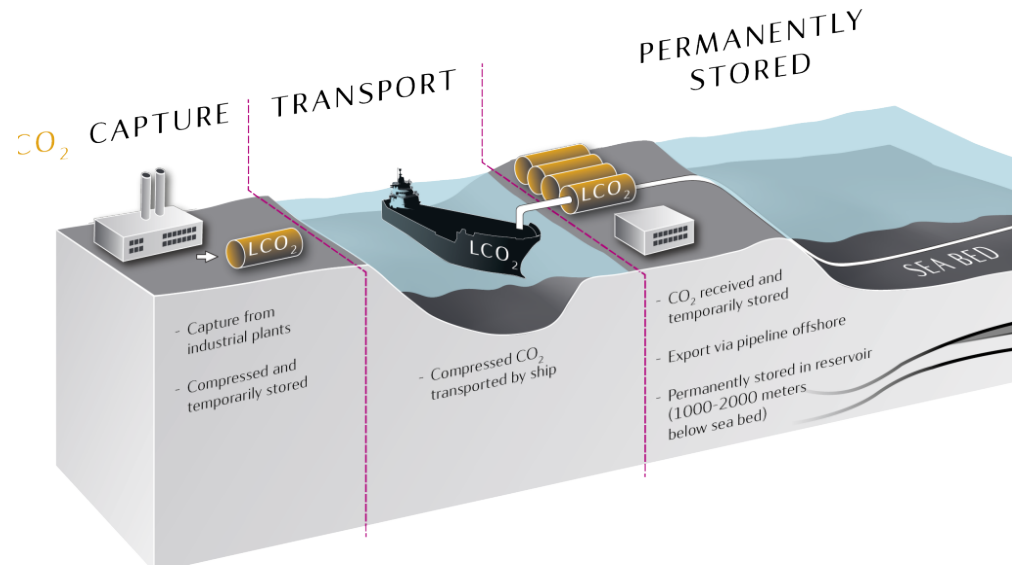
Norcem del av det norske fullskala CCS demonstrasjonsprosjektet



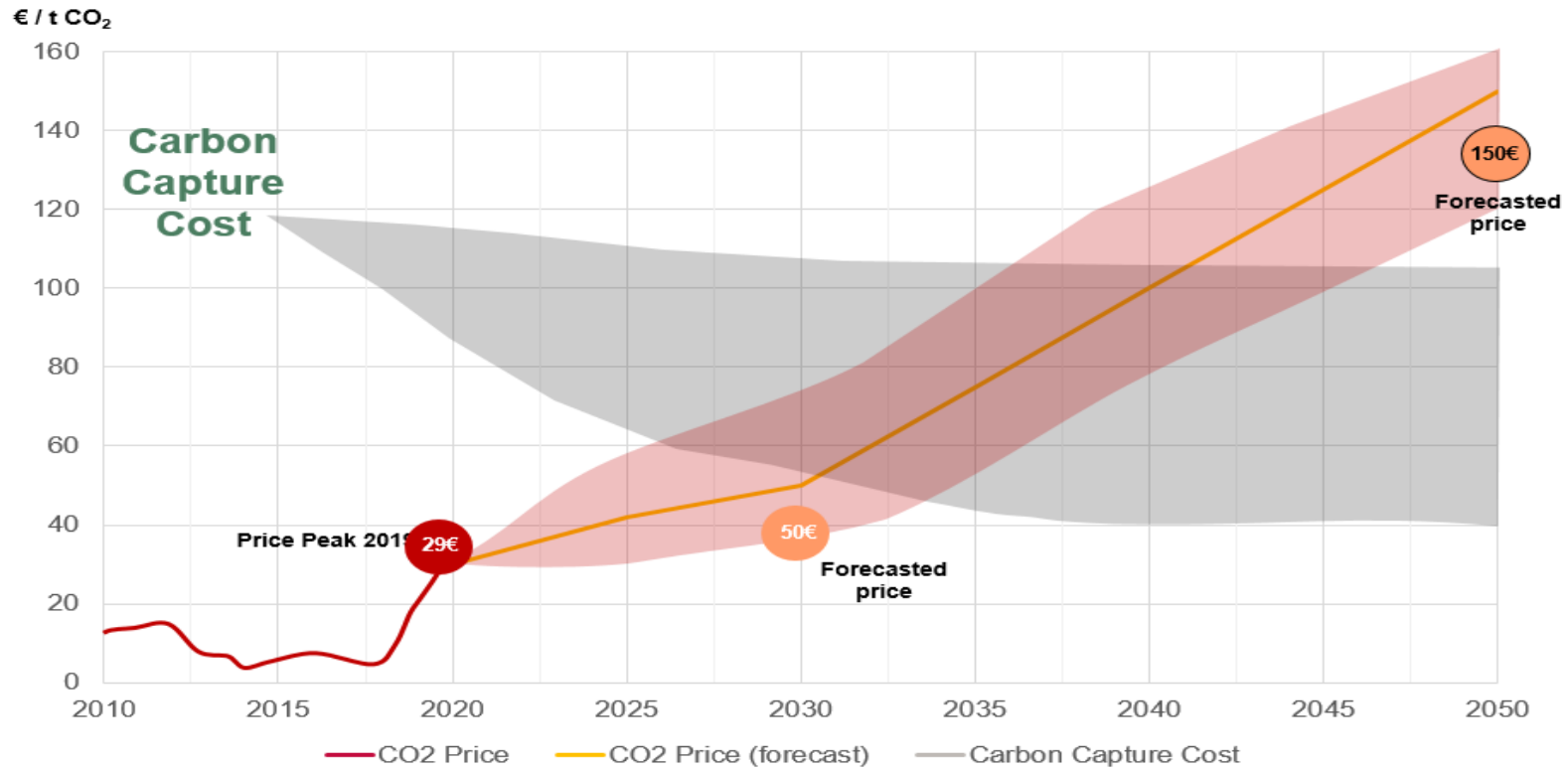
Demonstrating the full CO₂ value chain – Norcem project an important part



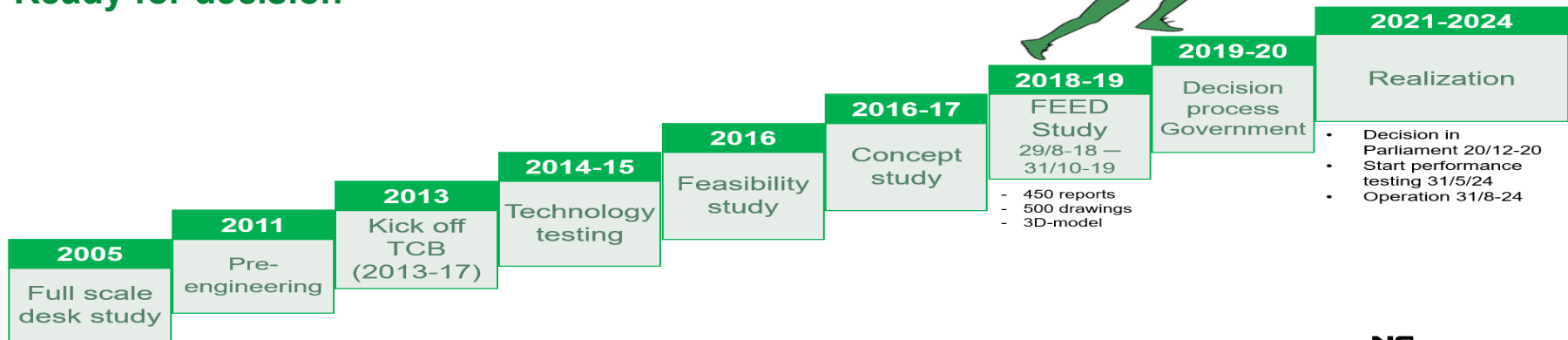
The Northern Lights project offers huge future storage capacities



The challenge is the cost



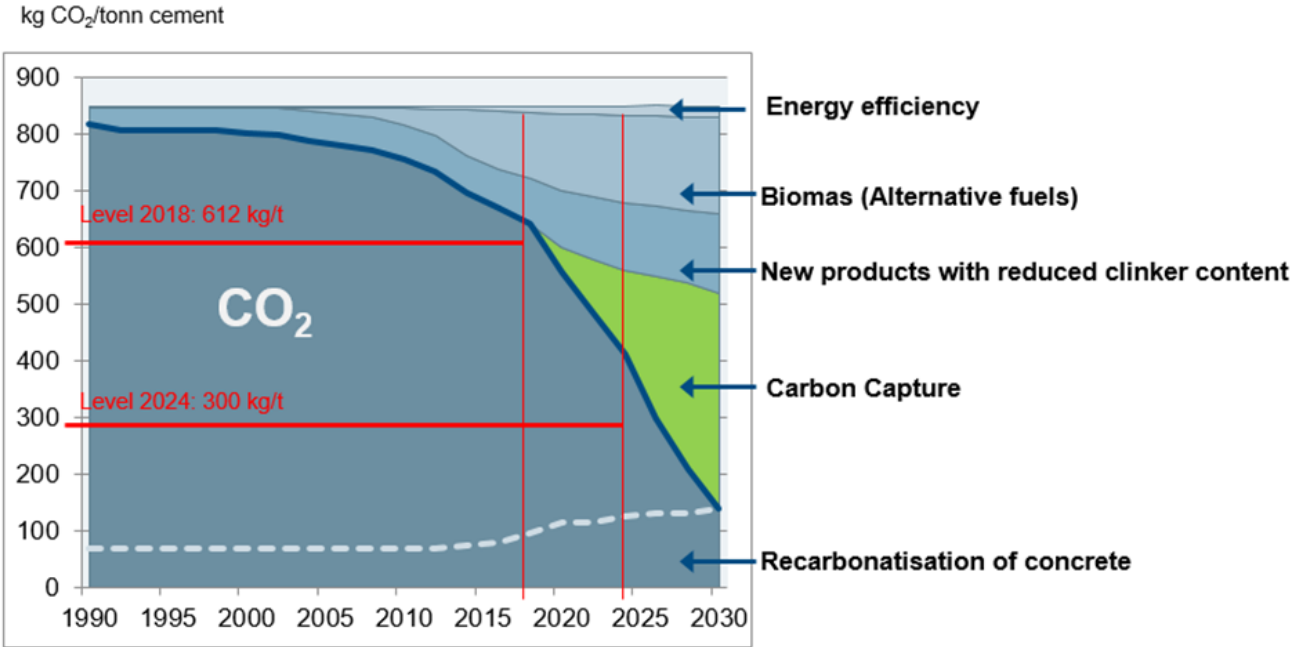
Full Scale Carbon Capture at Norcem Brevik Ready for decision



NFC

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Norcem Zero Vision



HeidelbergCement
Zero vision

With CCS it can
be a reality

