

**JUNE 1 - 3**  
**SKAGEN**  
**DENMARK**

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**Keynote Speaker: Sustainable Production**  
**in Energy-Intensive Industries**





# REDUCTION OF CO2 EMISSIONS IN ENERGY INTENSIVE INDUSTRIES IN DENMARK

- FOCUS ON NEW TECHNOLOGIES FOR THE  
GREENING OF CEMENT

Michael Lundgaard Thomsen, Aalborg Portland

## Agenda:

### **1. Climate partnership – Danish Government and Energy Intensive Industries**

- **Organization and process**
- **Results**

### **2. Cement – challenge and solutions in CO2 reductions**

- **Impossible to abate ?**
- **New technologies**

A background image of an industrial setting, likely a metalworking shop, with a large amount of bright orange sparks flying from a grinding or cutting process. The sparks are concentrated in the lower right and middle sections of the image. The background is slightly blurred, showing parts of machinery and pipes.

# Regeringens klimapartnerskaber



Partnerskab for energitung industri

Climate Partnerships

# 6

## Characteristics for energy intensive industry



Production of critical products for building, energy, transportation and food sector – typical process industry

Intense national and international competition

High temperature processes, that uses fossil – not possible to electrify and hard to abate

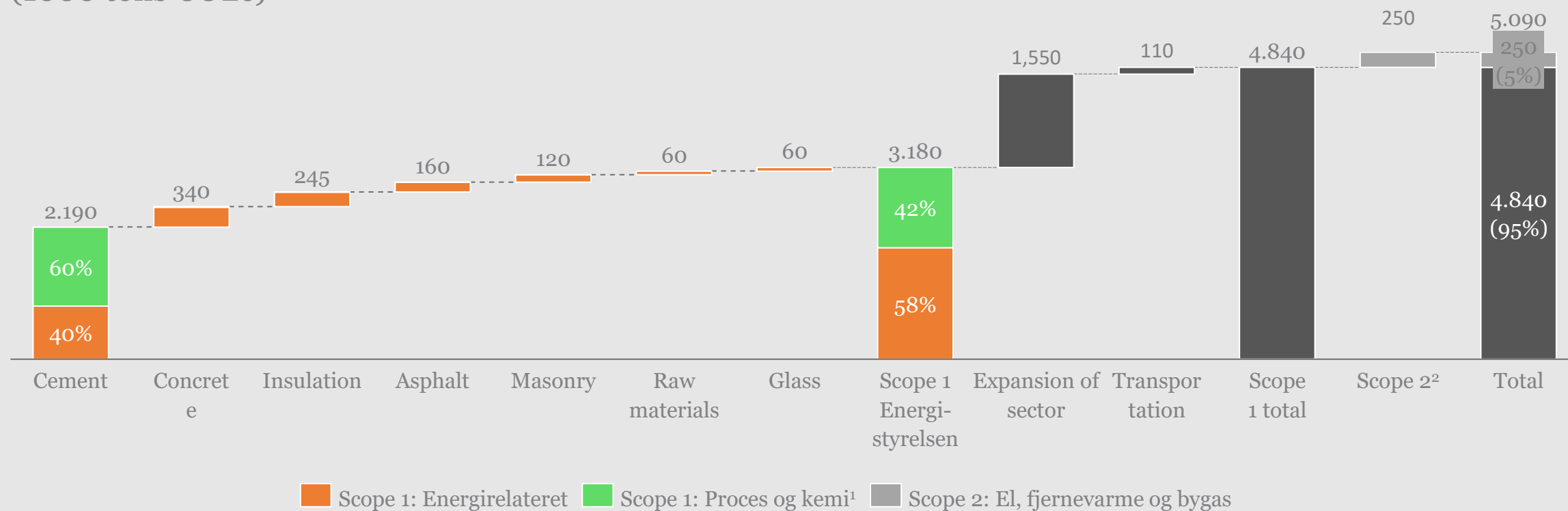
Energy is a mayor part of variable costs and therefor energy efficiency has always been in focus

One or few companies per sector

Part of the EU quota system ETS

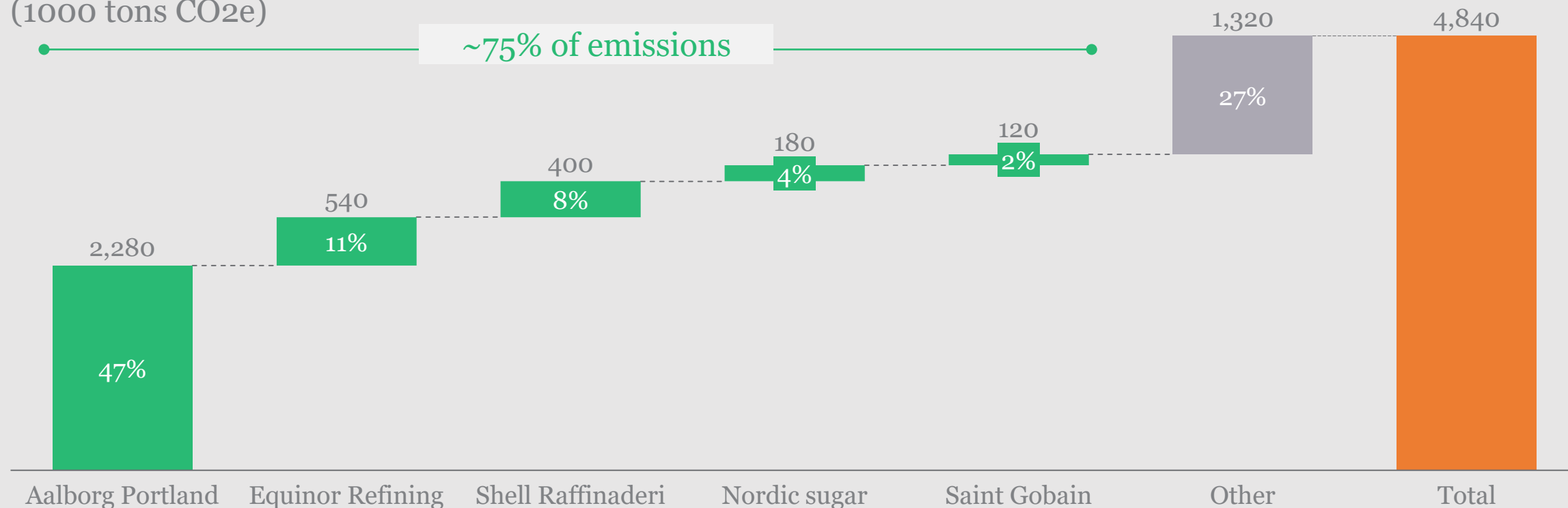
# The emissions is mainly from the cement industry

2017 CO<sub>2</sub>e emissions  
(1000 tons CO<sub>2</sub>e)



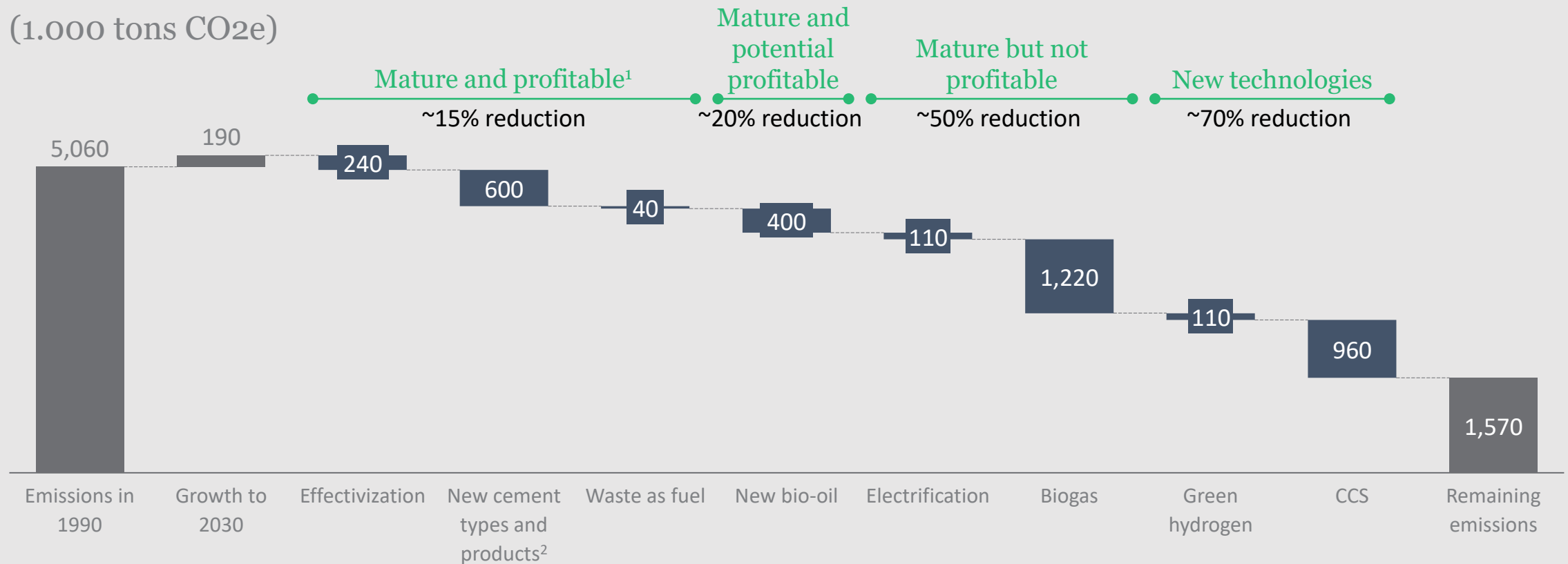
# 5 enterprises account for ~75% of the emissions

2017 CO<sub>2</sub>e emissions  
(1000 tons CO<sub>2</sub>e)



# 70% reduction in 2030 is technical possible but requires use of not profitable, new technologies

Potential reduction  
(1.000 tons CO<sub>2</sub>e)



1. Profitable with current CO<sub>2</sub>-price. 2. If the market demands new cement types





**2020**

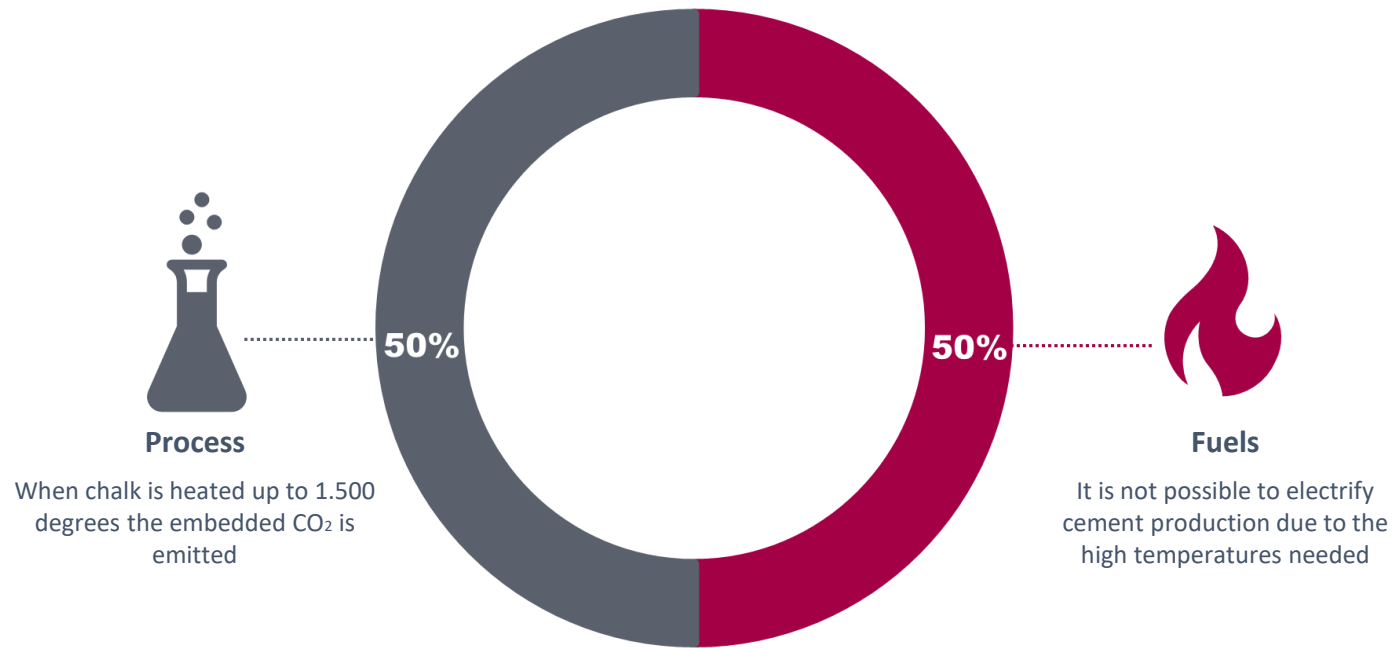
**Grey cement: 1.7 million tons**

**White cement: 0.8 million tons**

**Turnover: 2.0 billion DKK**

**Aalborg Portland  
cement plant**

The CO<sub>2</sub>-emissions from cement production comes from both the fuels and from the chalk itself



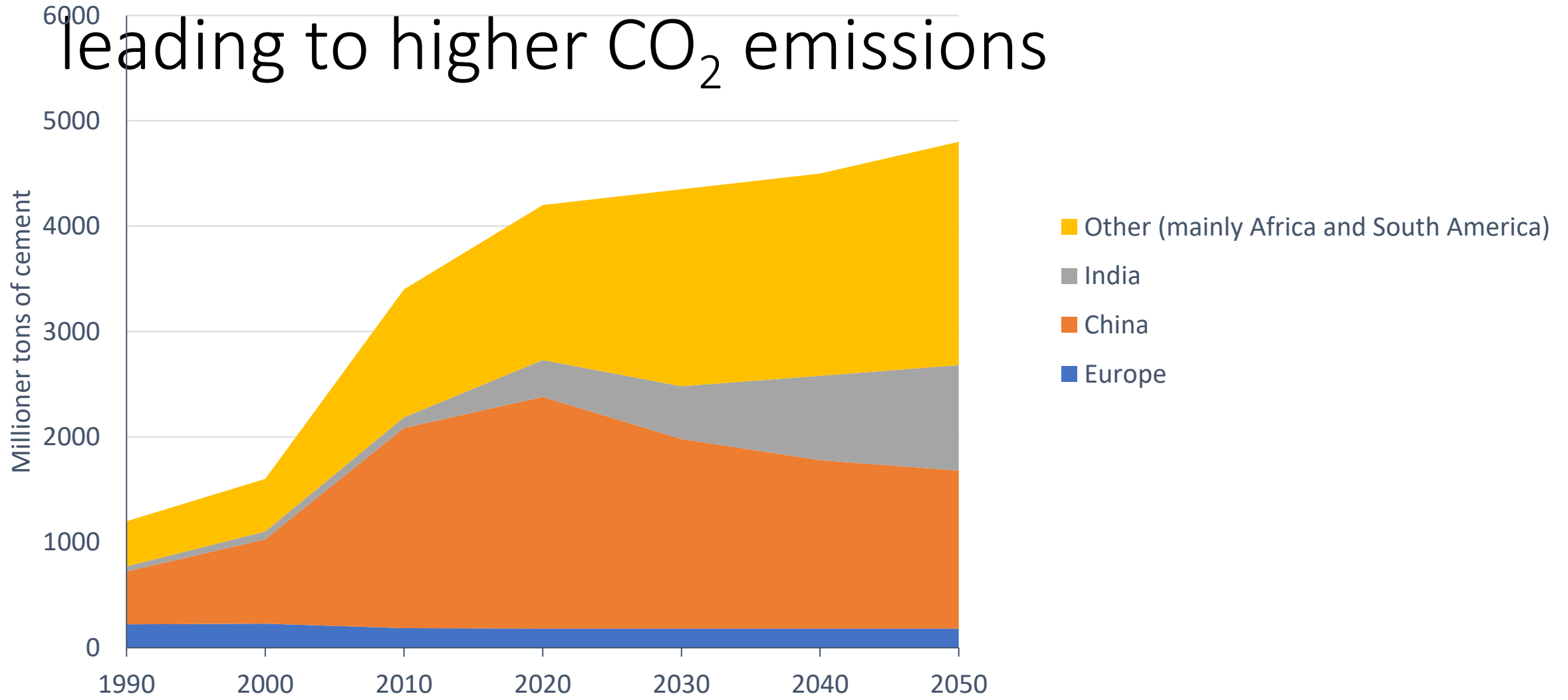
# Why do we need cement?

**Cement** is the basic ingredient in concrete.

Concrete is an essential material for our infrastructure to house people and build roads and bridges.



# Global consumption of cement is increasing - leading to higher CO<sub>2</sub> emissions



Producing cement is a dilemma

**On the one side the product is indispensable and will be used even more.**

**On the other hand the energy-intensive production and mineralogical process emits large quantities of CO<sub>2</sub>**

**So, the question isn't not to use cement and concrete.**

**But to make the production sustainable.**

**But how?**

# Global Cement and Concrete Association

## Savings in clinker production

- thermal efficiency
- savings from waste fuels ("alternative fuels")
- use of decarbonated raw materials
- use of hydrogen as a fuel

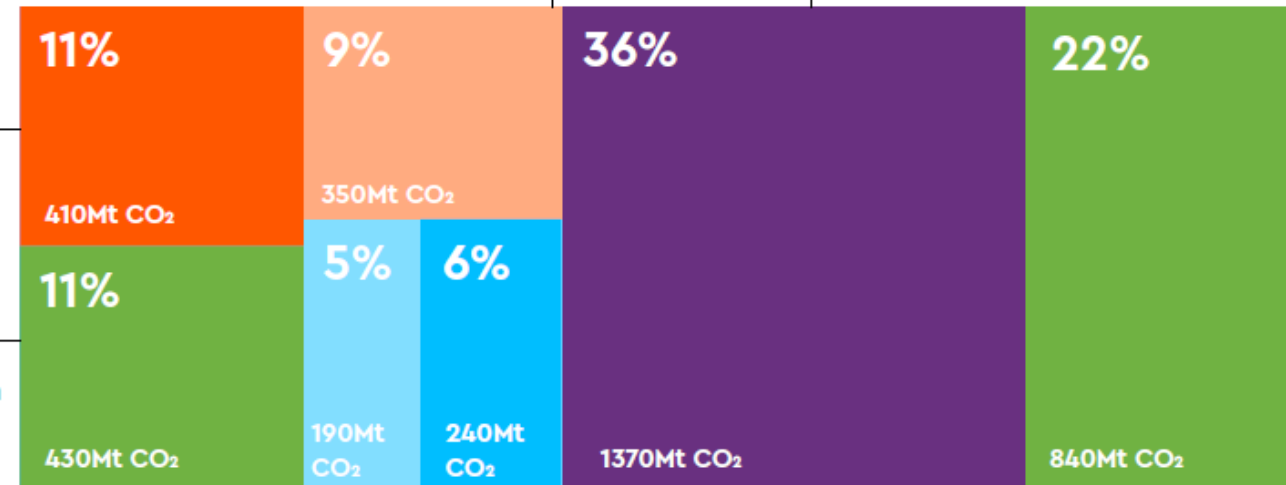
## Savings in cement and binders

- Portland clinker cement substitution. Also expressed through clinker binder ratio
- alternatives to Portland clinker cements

## Carbon capture and utilisation/storage

- carbon capture at cement plants

PERCENTAGE CONTRIBUTION TO NET ZERO AND CO<sub>2</sub> EMISSION SAVINGS IN 2050



## Efficiency in concrete production

- optimised mix design
- optimisation of constituents
- continue to industrialise manufacturing
- quality control

## Decarbonisation of electricity

- decarbonisation of electricity used at both cement plants and in concrete production

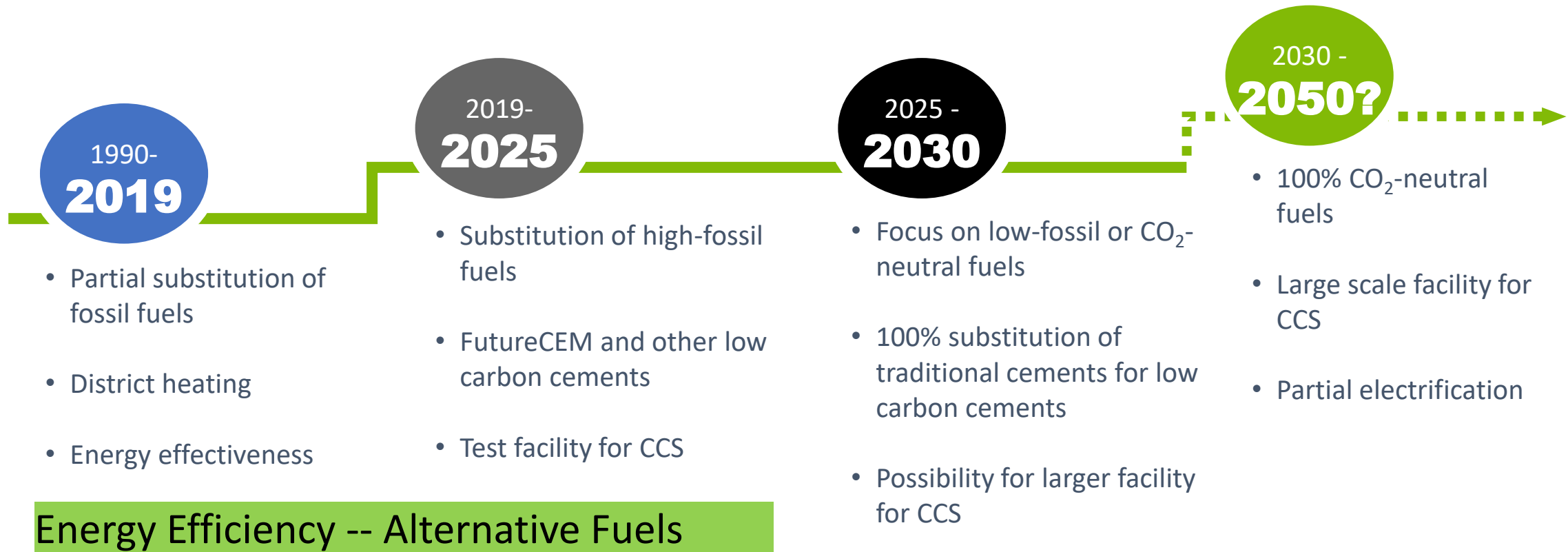
## CO<sub>2</sub> sink: recarbonation

- natural uptake of CO<sub>2</sub> in concrete – a carbon sink

## Efficiency in design and construction

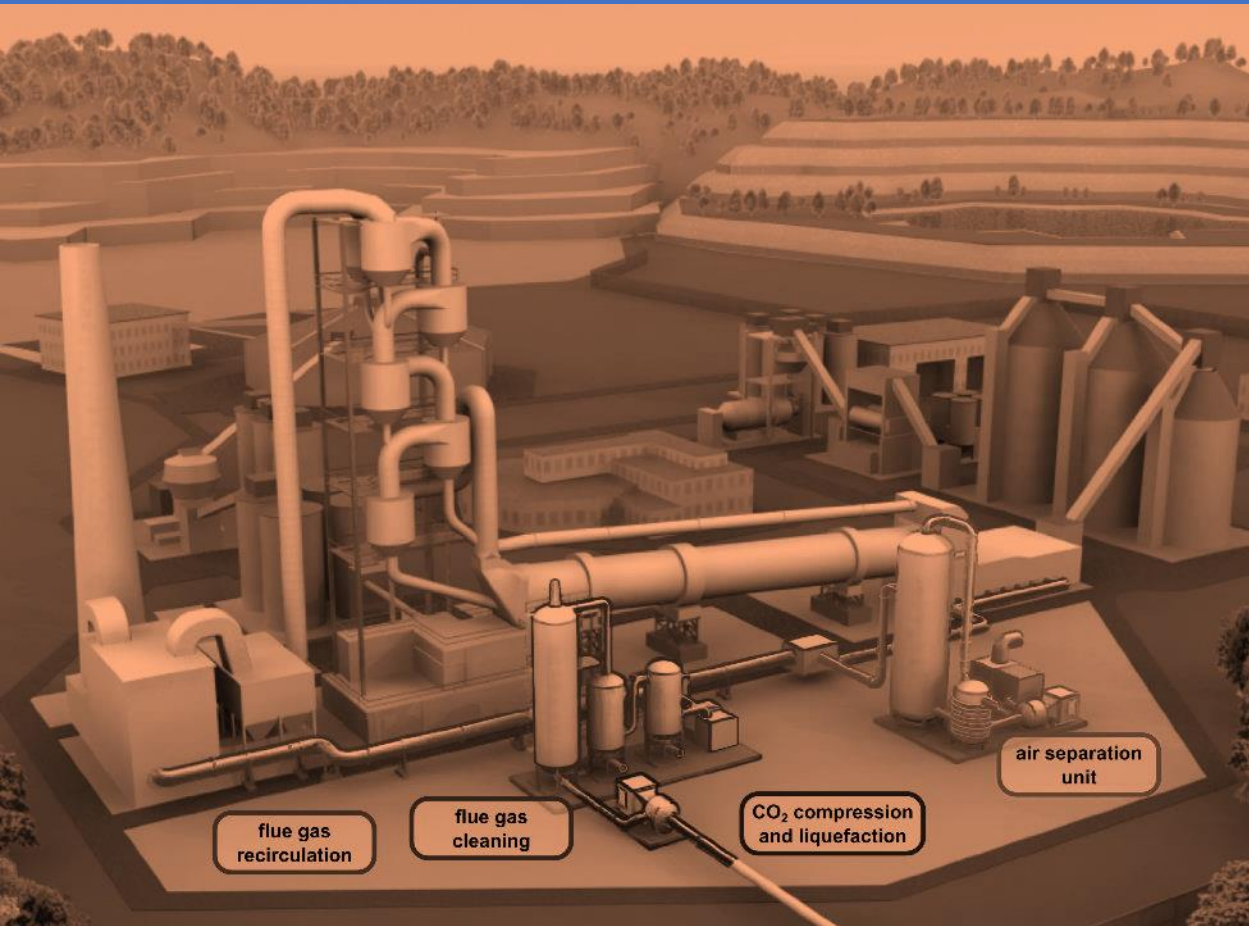
- client brief to designers to enable optimisation
- design optimisation
- construction site efficiencies
- re-use and lifetime extension

We have been working on sustainability for many years. The current agreement with a 30% reduction is the result of a targeted effort over longer periods of time

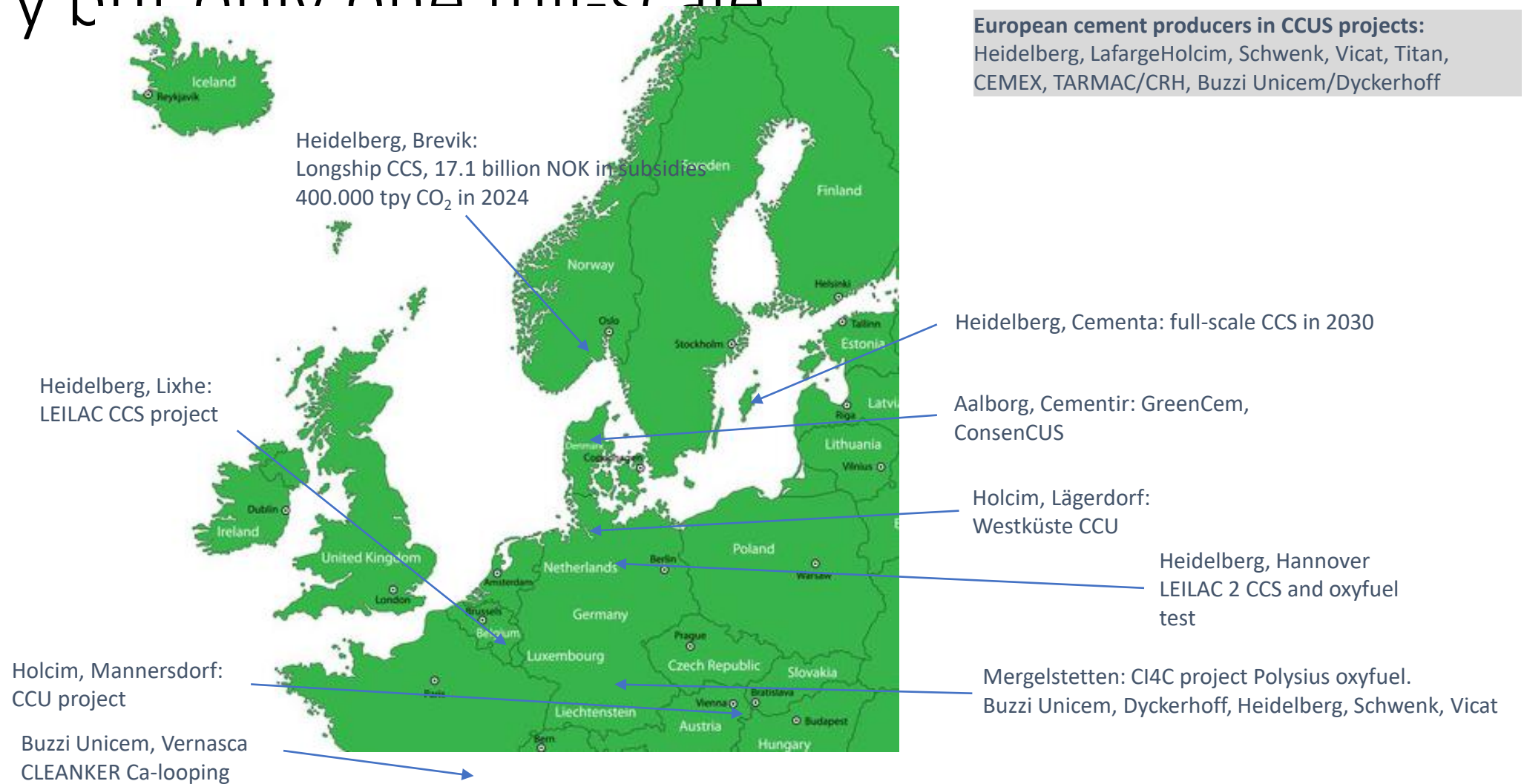




# Carbon Capture in the production of cement



# CCUS pilot tests are under way in the European cement industry but only one full-scale



# On-going activities in Aalborg about Carbon Capture, Usage and Storage

## GreenCem

- Funded through the Danish Energy Technology Development and Demonstration Program
- 7 partners
- Focus on capture and utilization
- Concept study for two options
  - 200.000 tons per year CO<sub>2</sub> demo plant
  - 1 mill. tons per year CO<sub>2</sub> full scale plant



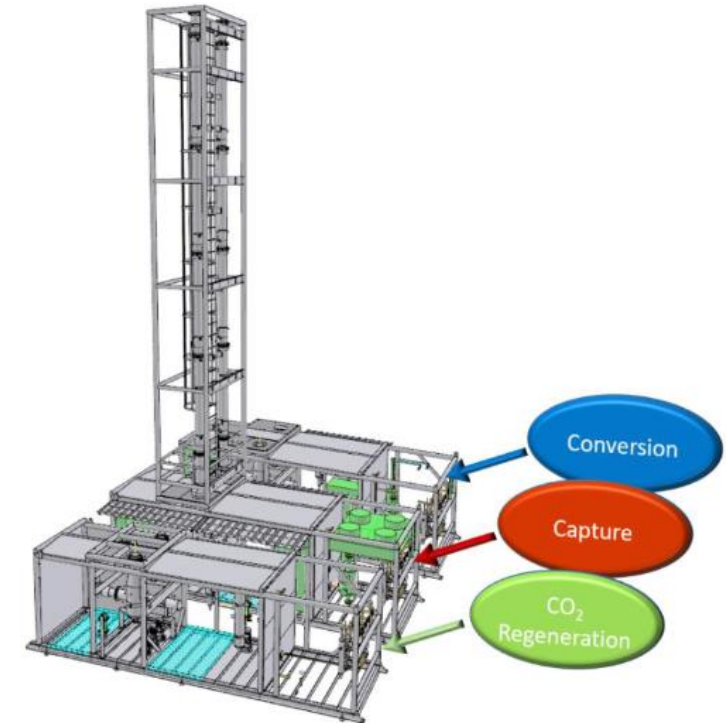
## Greensand II

- Part of Advisory Board
- 29 partners
- Pilot carbon capture and storage in the North Sea
- Separate application for CO<sub>2</sub>-capturing at Aalborg Portland



## ConsenCUS

- Funded through the EU Horizon 2020 program
- 19 partners
- Both use and storage



# Current status on CO<sub>2</sub>-capturing at Aalborg Portland

- We have had continuous focus on CCUS for the past years.
- Besides involvement from existing organization (management, production, public affairs and R&D) we have employed a full-time CCUS-resource and have engaged a PhD on CCUS
- Currently a public CCS-pool will open for prequalification and potential negotiations – resulting by the end of 2022 in an agreement with one CO<sub>2</sub>-emitter to capture and store 400.000 tons of CO<sub>2</sub> before 2025.
- We are presently investigating the tender criteria and hope to be in play for this funding.



QUESTIONS?