

# KOdeCO net zero

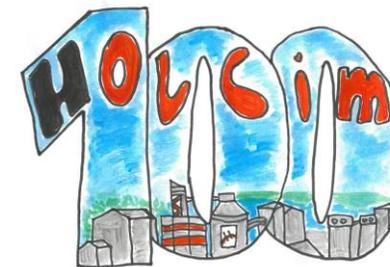
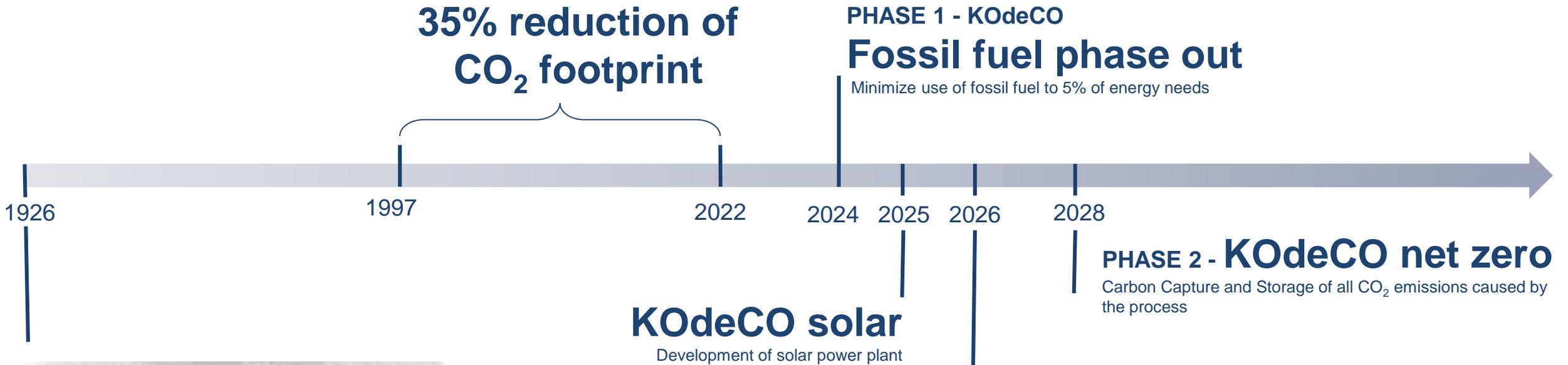
CCS KNOWLEDGE SHARING WORKSHOP BY THE INNOVATION FUND

Aalborg, Denmark, 28th of November 2023



# DECARBONIZING KOROMAČNO CEMENT PLANT

## ENABLING ISTRIA TO ALIGN INDUSTRY WITH TOURISM



years of the Koromačno cement plant 1926 - 2026

# „KodeCO net zero” PROJECT DESCRIPTION

## FIRST-OF-ITS-KIND, END-TO-END CCS VALUE CHAIN

**Location:** Koromačno, Croatia

**Actual / projected captured CO<sub>2</sub>:** 367,000 t CO<sub>2</sub>/year

**Technology:** CO<sub>2</sub> capture adsorption technology

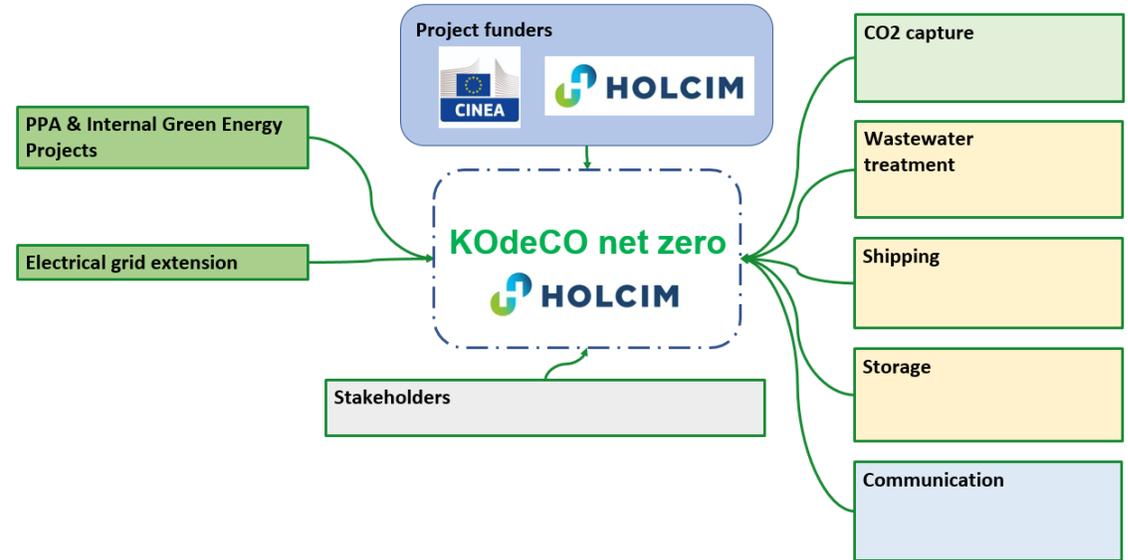
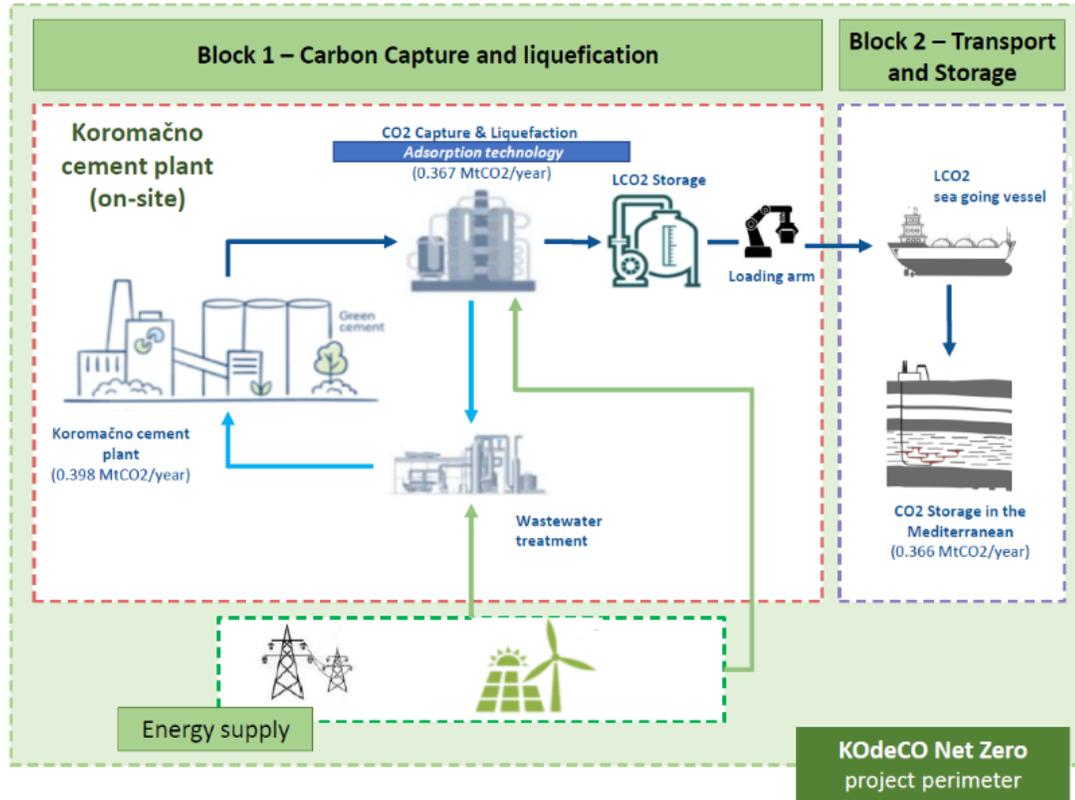
**CO<sub>2</sub> Usage/storage model:** Offshore sink

**Estimated CAPEX (rough estimate):** 237 mil. EUR



# SYNERGY WITH EXPERIENCED STRONG PARTNERS

## RESULT IS INNOVATIVE AND SCALABLE PROJECT WITH HIGH MATURITY



<b>PUBLIC FUNDING</b>	EU InnovFund
	JTF
<b>PRIVATE FUNDING</b>	Holcim Group

Q3 2023  
EU IF Results

Q4 2025  
Financial Closure

Q4 2028  
Entry into operations

Application to  
EU InnovFund-2022-LSC

- FEED and basic engineering
- EIA
- Contract negotiation and finalization
- Permitting and compliance
- Preparation for FID

- Site preparation and energy delivery preparation
- EPC execution
- Transportation and storage contract monitoring
- Integration, operational and maintenance plans
- Commissioning

Operations; reporting and  
continuation of knowledge sharing

# JUST TRANSITION TERRITORY

WE ARE PROUD TO SUPPORT OUR COMMUNITY IN THE TRANSITION

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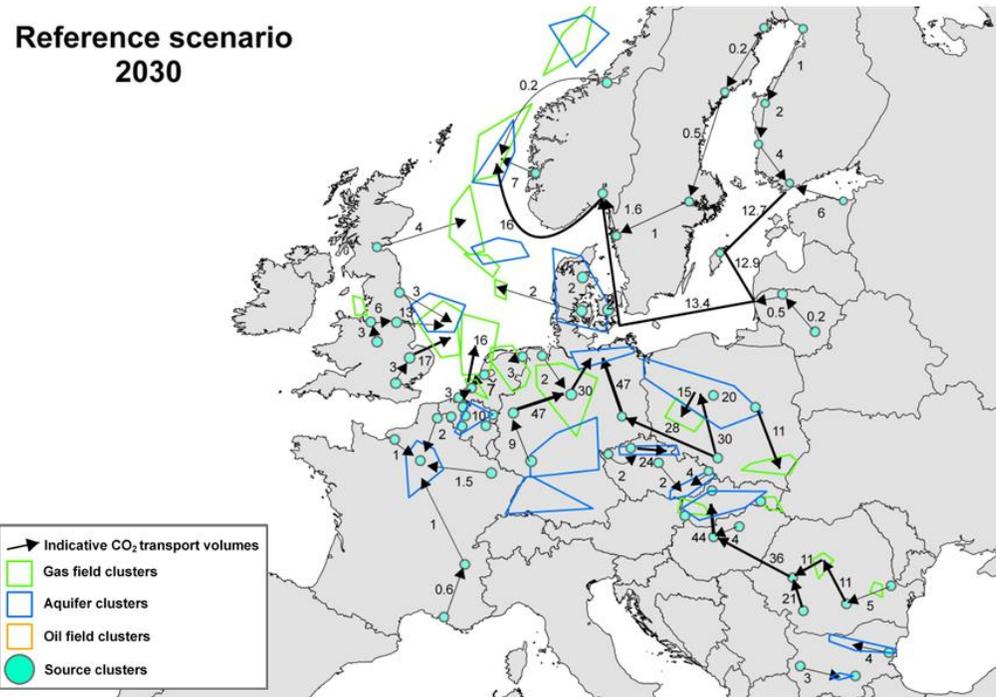


**Istria** and **Sisačko-Moslavačka** counties are only territories in Croatia identified by Just Transition Fund (JTF) and included in Croatian Integrated Territorial Program

# NORTH EUROPE CREATED OPPORTUNITIES

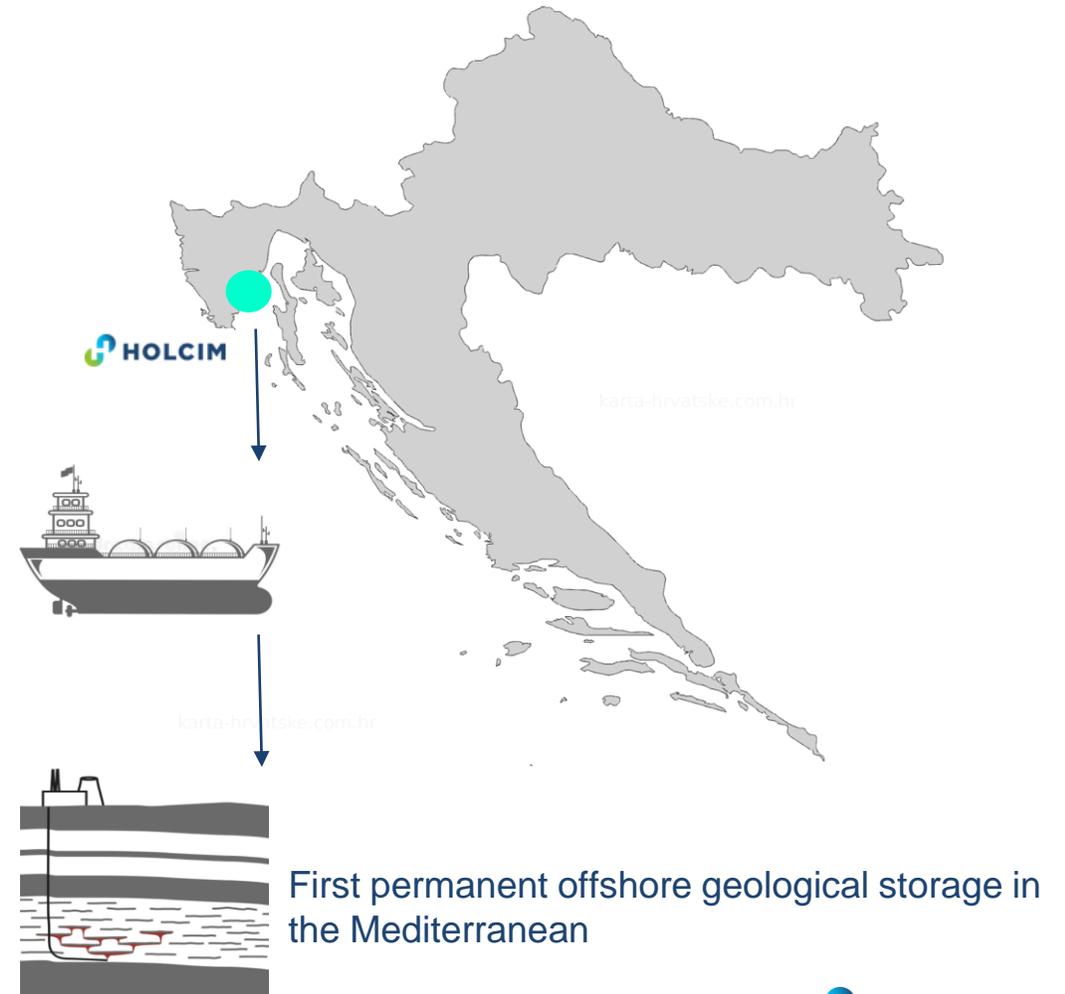
## WE CARE ENABLING SOLUTIONS FOR INDUSTRY IN SOUTH EUROPE

### TRANSPORTATION AND STORAGE NORTH - EU COUNTRIES



Source: CO2Europe; WP2.2 Report – Development of a large-scale CO<sub>2</sub> transport infrastructure in Europe: matching captured volumes and storage availability

### TRANSPORTATION AND STORAGE - K0deCO net zero





**HOLCIM**

# Project IFESTOS

Scaling Carbon Capture & Storage in Greece



CCS Knowledge Sharing workshop, EU Innovation Fund

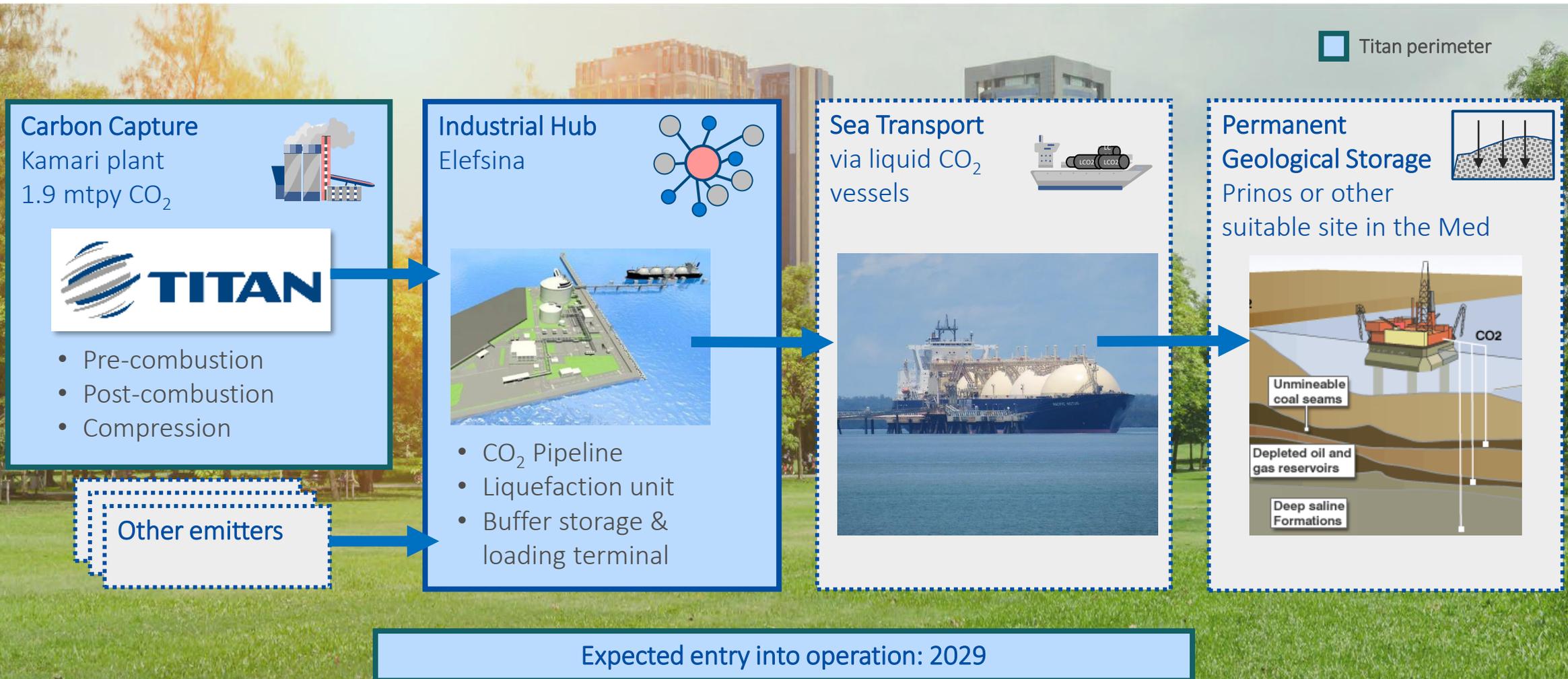
Aalborg, November 28, 2023

Aris Tsikouras, Titan Cement

# Value chain

## Overview

iFESTOS



# Regulatory challenges

- ✓ Provide open & non-discriminatory access to logistics & storage infrastructure
- ✓ Ensure unbundled, cost-based, transparent tariffs
- ✓ Establish Carbon Contracts for Difference
- ✓ Determine licensing & certification framework
- ✓ Define technical / safety standards
- ✓ Enable cross-border transportation

**Thank you**

# **IRIS**

*Innovative low carbon hydrogen and methanol production  
by large scale carbon capture*

*CCS Knowledge Sharing workshop by the Innovation Fund – Realising opportunities along the value chain*

*27-28 November 2023*



# IRIS | Innovation Fund



IRIS project **comprises a novel, heavily integrated point-source CCUS technology solution**, applied on its current hydrogen production process and its coupling to a small-scale methanol production unit, which will utilize part of the captured CO<sub>2</sub> as feedstock.  
MOH's innovative project IRIS, seeks to couple **the production of ultra-low carbon hydrogen and methanol by integrating point-source carbon capture**, applied on its current Steam Methane Reforming unit, electrolytic H<sub>2</sub> production and a catalytic process of high selectivity.

**Coordinator:** Motor Oil (Hellas)  
Corinth Refineries S.A.

**Location:** Agioi Theodoroi,  
Corinth, Greece

**Sector:** Refineries

**Amount of IF grant:** €126.790.000

**Duration:** 168 months

**Volume of CO<sub>2</sub> captured for storage by 2030 (Mtpa):** 1.2Mt

**Starting date – Ending date:**  
January 2024 – June 2037

**Planned date of entry into operation:** July 2028



MOH Refinery, Agioi Theodoroi, Corinth, Greece

# IRIS | Key project aspects

IRIS constitutes a significant step:



- (a) in the decarbonization plan of MOH carbon capture project implemented in the Steam Methane Reforming Unit of the refinery with post-combustion capture technology scheme which allows maximization of the CO<sub>2</sub> captured
- decreases the total carbon footprint of the refinery by 25% (~495,000 t/y of CO<sub>2</sub> captured)
  - achieves very high energy integration with the existing refinery operations, further reducing its total energy requirements
  - will lay the foundation for the future expansion of the CO<sub>2</sub> capture technology to two more refinery units, that could further decrease the total refinery carbon footprint by 50%



- (b) for the production of low CO<sub>2</sub> energy carriers for mobility purposes and other industrial usage
- 55,280 t/y of blue hydrogen produced - ~37% lower than the EU Taxonomy threshold
  - 10.000 t/y e- methanol as part of the captured CO<sub>2</sub> will be combined with green hydrogen produced by a 30MW electrolyzer (EPHYRA), materializing the principles of circular economy



- (c) to lever the development of the very few CO<sub>2</sub> storage facilities in the Mediterranean Sea



- (d) for the creation of a wider ecosystem of projects that promote the development of hydrogen market, namely the EU-backed projects EPHYRA\* and TRIERES\*



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# Project OLYMPUS

Milaki Cement Plant Decarbonization



**HIRACLES**  
GROUP OF COMPANIES

# Milaki Cement Plant

## Operating in Evia

Since 1982

## 2 Owned Quarries

Limestone & Schist  
50 Years Reserves

## Bagging Facilities

Ground Cement, Solid Fuels  
and Raw Solid Fuels

## Capacities

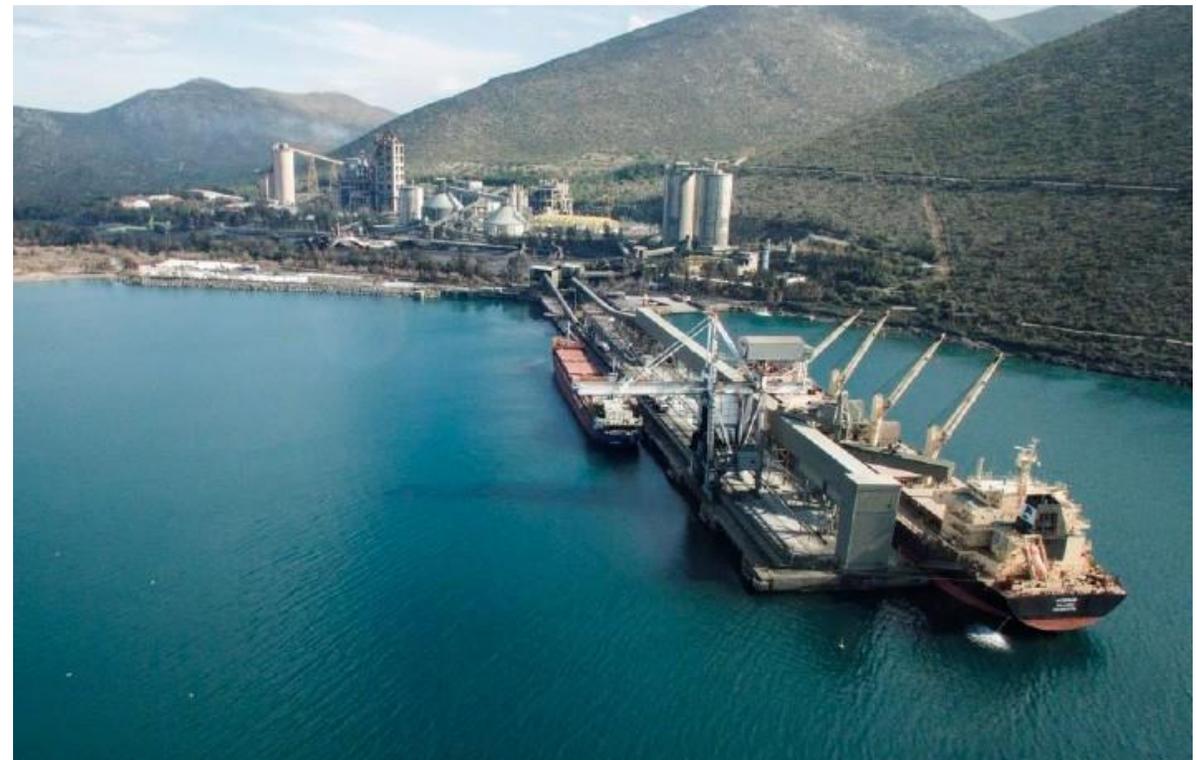
Clinker : 1,600 kt/a  
Cement : 1,700 kt/a

## 2 Alternative Fuel Workshops

for Biomass  
and SRF

## Bulk Material Yard

400kt Storage  
Capacity



# Innovation & Differentiation

## Cement & Clinker



- | Cement exports worldwide
- | 24/7 simultaneous loading & unloading ability
- | Up to 150 kt dead weight capacity

## Oil Well Cement



- | API certified manufacturer of Well Cement for the Oil & Gas Industry (Class G)
- | Deliver Oil Well Cement to end customers (Europe, Middle East, Africa, Oceania)
- | Bagging facilities specifically designed to meet O&G industry needs

## Solid Fuels



- | Trading of tailor-made SF satisfying customer requirements (ability for a variety of processes e.g. grinding, screening, bagging, mixing)
- | Increased flexibility to manage different fuel types for customers

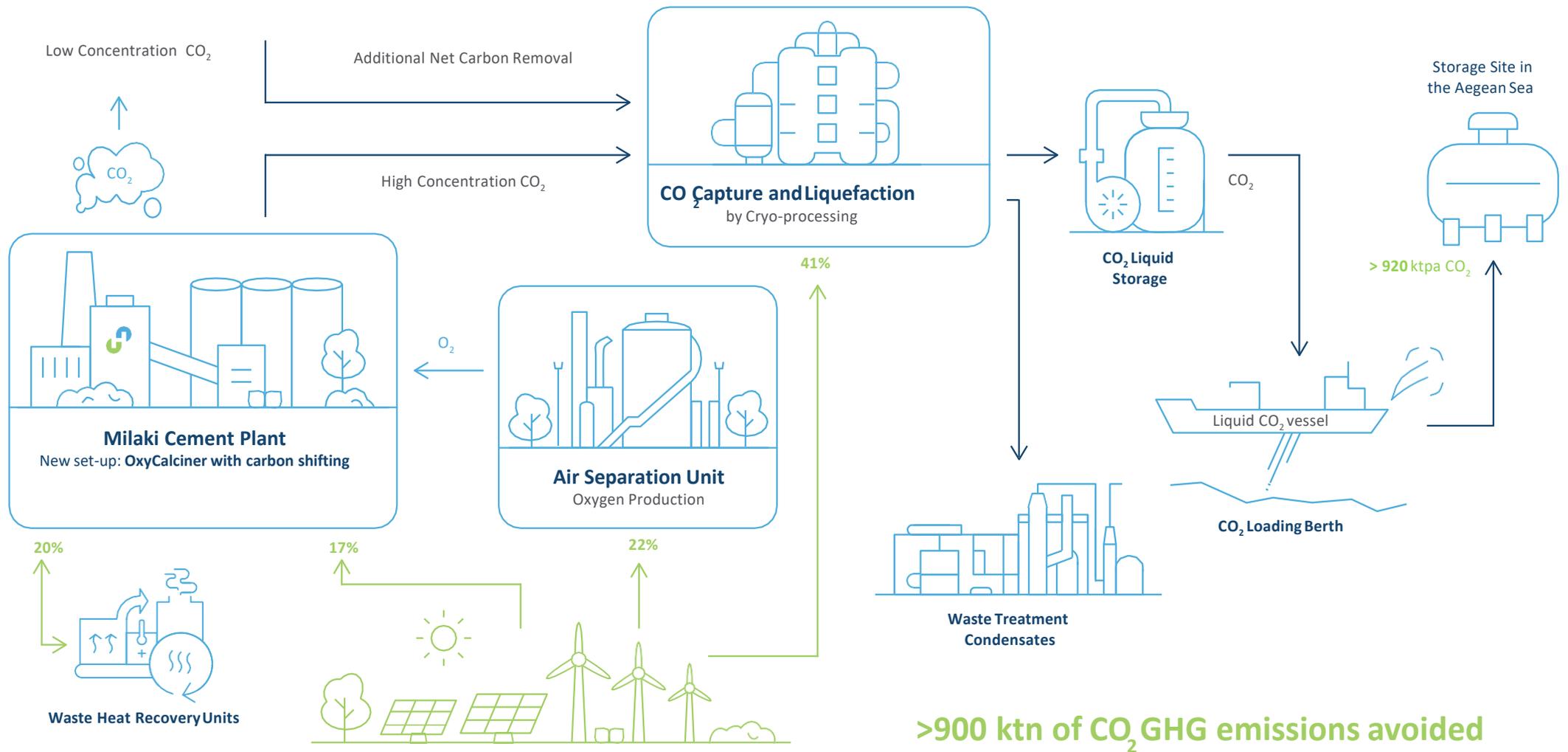
## Aggregates



- | Sales to greek islands through plant port

# OLYMPUS Project

# 2028 Milaki Cement Plant Carbon Capture & Storage



## Main benefits

- 1  
Greece enacting a leadership role in **climate action**, turning the latter to an **opportunity for growth** and **moving the needle on sustainability**.
- 2  
Establishing Greece as a friendly operating environment for forward- looking enterprises; thus, reinforcing its **investment potential**.
- 3  
Not only safeguarding current **job positions** but also **creating new** and more specialized ones, especially in regions where underemployment prevails, such as Central Greece.
- 4  
Kick-starting the technology race to a **CO<sub>2</sub> circular economy & netzero transition** in the cement sector across Europe with **Greece** being **in the spotlight**.
- 5  
Serving as a blueprint for the conversion of cement plants both for Greece and the whole Europe towards a sustainable constructions sector with multiple benefits to the **environment** and the **society**, but also to the **profitability** and **competitiveness** of the Greek and EU cement industry.
- 6  
Contributing to the significant **reduction of GHG emissions through net carbon removal** and paving the way for **green growth**, not limited to cement sector, but for the rest of CO<sub>2</sub> intensive industry as well.
- 7  
**CO<sub>2</sub> avoidance represents 2% of total Greece's CO<sub>2</sub> emissions**



**HIRACLES**  
GROUP OF COMPANIES



# BECCS at Växjö Energi, Sweden

Julia Ahlrot, Project leader Växjö Energi AB [julia.ahlrot@veab.se](mailto:julia.ahlrot@veab.se)

Daniel Eidenskog, Senior Process Engineer Växjö Energi AB, [daniel.eidenskog@veab.se](mailto:daniel.eidenskog@veab.se)

# Växjö Energi, a public owned energy company

Founded

1887

Employees

222

Owner



Växjö  
kommun

## Power Grid

Number of customers

37 700

Total grid

152.000 km

## Broadband

Number of customers

43 000

Total grid

435.000 km

## Combined Heat&Power

Number of customers

10 100

Total grid

46.000 km

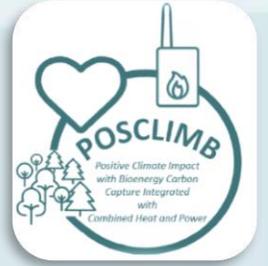


Växjö, a municipality in southern Sweden

# EXISTING COMBINED HEAT AND POWER AT THE SANDVIK PLANT

100 % Fossil fuel free!  
Biomass from forest  
residues

# BECCS value chain



Uptake of carbon dioxide in the air through forest photosynthesis



**1**  
Collection of residual streams from nearby forestry, wood products industry and pure recycled wood

**2**  
Biomass storage

**3**  
Energy recovery for renewable electricity, heating and cooling

**4**  
Capture of carbon dioxide from the flue gas

**5**  
Condensation to liquid carbon dioxide for temporary storage

**6**  
Transport by train

**7**  
Carbon buffer storage

**8**  
Transport by ship

**9**  
Permanent storage / mineralization in the bedrock under the seabed

ca 3 000 m

260,000 biogenic tonnes/year captured at Sandvik

# CLUSTER COOPERATION IN SOUTHERN SWEDEN FOR CARBON LOGISTICS

Subsidied by



# CNetSS

CARBON NETWORK SOUTH SWEDEN



COPENHAGEN MALMÖ PORT



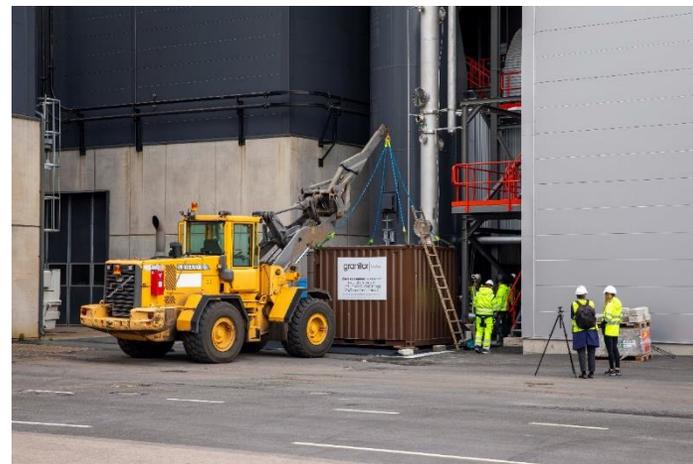
storaenso



EN DEL AV DIN VARDAG

# PILOT PROJECT FOR CARBON CAPTURE IN COOPERATION WITH LUND UNIVERSITY

Subsidied by



Amine technology  
AMP/DMSO



**VEAB**  
VÄXJÖ ENERGI



# Thank you!

Julia Ahlrot, Project leader Växjö Energi AB [julia.ahlrot@veab.se](mailto:julia.ahlrot@veab.se)

Daniel Eidenskog, Senior Process Engineer Växjö Energi AB, [daniel.eidenskog@veab.se](mailto:daniel.eidenskog@veab.se)

**CO<sub>2</sub>NTESSA**

**nexe**

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# **CO<sub>2</sub>NTESSA PROJECT**

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# PROJECT BACKGROUND

## PROJECT BACKGROUND

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CO<sub>2</sub>NTESSA

Cement plant NEXE in Našice accounts for 1/3 of cement production in Croatia - more than 1 million t of cement per year, out of which more than 50% of production is exported to the countries of the region.



 nexe

## PROJECT BACKGROUND

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CO<sub>2</sub>NTESSA

Cement production represents energy-intensive process with large amount of CO<sub>2</sub> emission as by-product. More than 70% of CO<sub>2</sub> emissions is a result of chemical process of decomposition of carbonate raw material at >1400°C and Carbon Capture technology represents the only long-term solution for reduction of CO<sub>2</sub> emissions.

The production of 1 million tons of cement requires >900 GWh of energy



 nexa



CO<sub>2</sub>NTESSA

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# CO<sub>2</sub>NTESSA PROJECT



 **nexen**

## CO<sub>2</sub>NTESSA PROJECT

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CO<sub>2</sub>NTESSA

**Project: CO<sub>2</sub>NTESSA**

**Industry: Cement**

**Location: Našice/Slavonia/Croatia**

**Investment: EUR 391.7 mil**

**Entry into operation: 2029**

**Category: Carbon Capture and Storage (CCS)**

**Technology: Thyssenkrupp Polysius® pureoxyfuel Carbon Capture**



**March 2023: Applied on InnovFund-2022-LSC-01-GENERAL**

**July 2023: The European Commission (CINEA) proposed to the European Investment Bank (EIB) that, for the CO<sub>2</sub>NTESSA project, the allocation of EIB technical assistance (EIB PDA) should be considered.**

**October 2023: The CO<sub>2</sub>NTESSA project is included in the list of strategic investment projects of the Republic of Croatia.**

The logo for Nexe, consisting of a stylized 'N' made of four small squares followed by the word 'nexe' in a bold, lowercase, sans-serif font.

## CO<sub>2</sub>NTESSA PROJECT

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The cement industry is very energy intensive and one of the most significant emitters of CO<sub>2</sub>, responsible for around 4% of all emissions at the EU level. The need to decarbonise cement industry is urgent to prevent the risk of locking in CO<sub>2</sub> emissions beyond 2050, when the EU plans to achieve full carbon neutrality.

**The CO<sub>2</sub>NTESSA project will lead to implementation of an innovative carbon capture technology at NEXE cement plant in Našice, Croatia.** Existing plant will be modified based on the Polysius PureOxyfuel technology developed by thyssenkrupp. **Based on this, the CO<sub>2</sub>NTESSA project will allow capture 739 000 t CO<sub>2</sub>/year, making cement production at NEXE close to zero emissions. Moreover, the CO<sub>2</sub>NTESSA project will unlock the potential for NEXE to become the first negative emitter of CO<sub>2</sub> in the EU because of use of alternative fuels.**

Geologically highly appropriate, onshore storage location Bockovci is located only 38 km away, allowing energy and cost-efficient injection of the captured CO<sub>2</sub> into the saline aquifer. The CO<sub>2</sub>NTESSA project will achieve synergy with the GT CCS project which includes renewal of the existing out-of-function pipeline for transport of captured CO<sub>2</sub> from the NEXE cement plant. The GT CCS project is expected to be included into the EU's list of Projects of Common Interest (PCI), with potential to become a regional hub for CO<sub>2</sub>, making the CO<sub>2</sub>NTESSA project an important milestone of carbon capture and storage development in Croatia and beyond.

Carbon capture technologies in cement production require massive investments, making high costs the main barrier to wide roll out of carbon capture solutions, so public funding is crucial in reaching energy and climate objectives within the cement industry. **Total investment cost in the CO<sub>2</sub>NTESSA project will be EUR 391.7 million, making it one of the largest planned investments in industry in Croatia.** Project CO<sub>2</sub>NTESSA enables capturing of CO<sub>2</sub> in more cost-effective way in comparison with similar Carbon Capture projects, securing the long-term competitiveness of cement products abroad.





CO<sub>2</sub>NTESSA

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# INNOVATIVENESS OF THE PROJECT

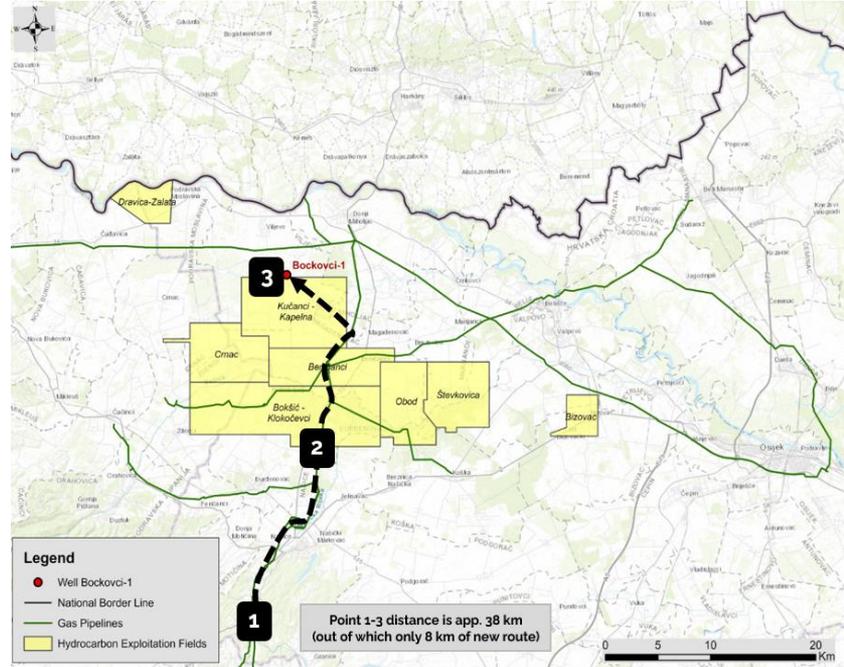


 **nexe**

# INNOVATIVENESS OF THE PROJECT

A unique, fully rounded, cost-effective CCS project in Southeast Europe. One of few in the EU that has efficient solution for disposal of captured CO<sub>2</sub> by transport pipeline up to location Bockovci-1, where CO<sub>2</sub> will be injected into the deposit-saline aquifer (connection to the project Croatia GT CCS).

1.	CO <sub>2</sub> NTESSA PROJECT	NEXE	CO <sub>2</sub> CAPTURE
2.	GT CCS CROATIA	PLINACRO	TRANSPORT OF CO <sub>2</sub>
3.	GT CCS CROATIA	CROATIAN HYDROCARBON AGENCY	STORAGE OF CO <sub>2</sub>



# INNOVATIVENESS OF THE PROJECT



Carbon Capture industrial large-scale project which do not need additional energy-intensive CO<sub>2</sub> purification for further transport and injection/storage of CO<sub>2</sub>, as CO<sub>2</sub> purity of app 90% is enough.



Unique completely rounded CCS project in south-east Europe, that includes CO<sub>2</sub> capture, transport of CO<sub>2</sub> by pipeline and injection of CO<sub>2</sub> in saline aquifer Bockovci-1 (on-shore storage) which is only 38 km far from cement plant.



Cost efficiency through significant less CAPEX and OPEX (per tonne of CO<sub>2</sub> avoided) in comparison with similar projects.



NEXE cement plant in Našice becomes a negative CO<sub>2</sub> emitter with capture of >700.000t CO<sub>2</sub> per year (100% CO<sub>2</sub> emissions from production process) and use of alternative fuels (enables continued substitution of alternative fuels with a substitution coefficient >90%).



Implementation of carbon-neutral and cost-efficient production as guideline for other plants in industry that have low quality raw materials and low level of CO<sub>2</sub> concentration in exhaust gases from production processes (cement plants, power plants, refineries...) as an example of green transition for long-term sustainable operations.







**BOCKOVCI**





CO<sub>2</sub>NTESSA

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# PROJECT IMPLEMENTATION



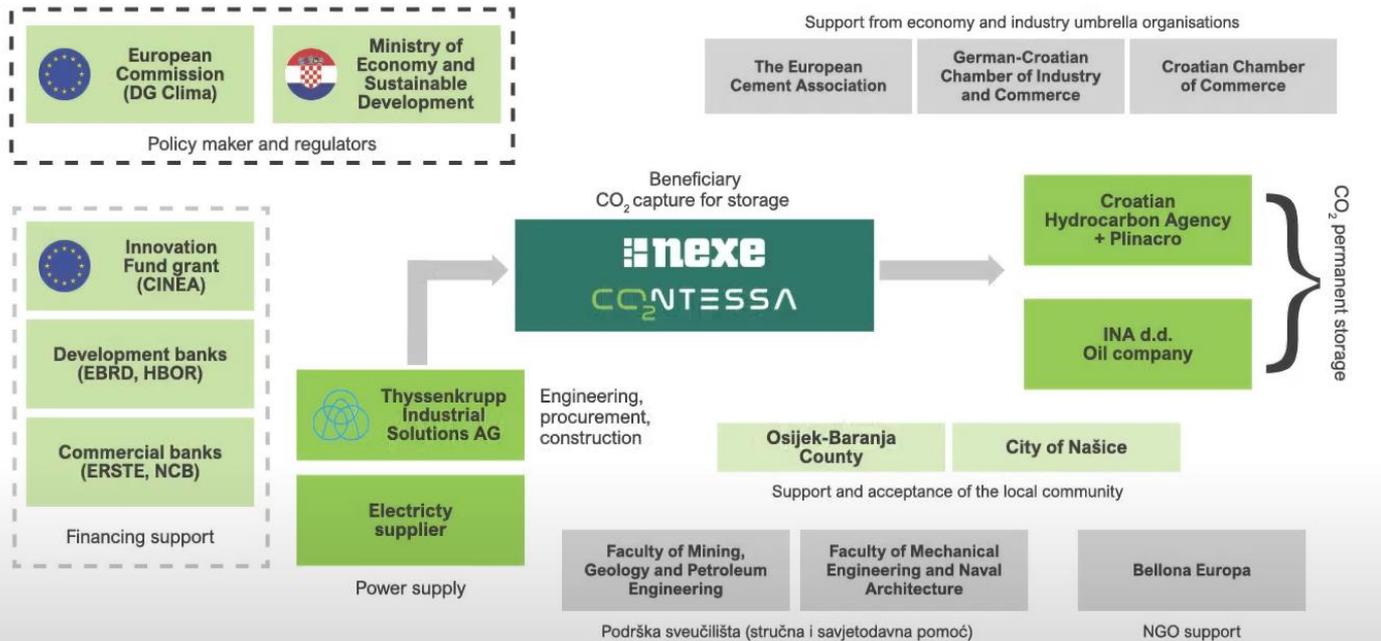
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# PROJECT IMPLEMENTATION



# INFORMATION ON PROJECT APPLICATION TO THE INNOVATION FUND

CO<sub>2</sub>NTESSA



Accelerating the transition to climate neutrality and the production of CO<sub>2</sub> neutral cement is planned from 2029

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CO<sub>2</sub>NTESSA

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**More information available on:**

**[www.nexe.hr/en/co2ntessa/](http://www.nexe.hr/en/co2ntessa/)**



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