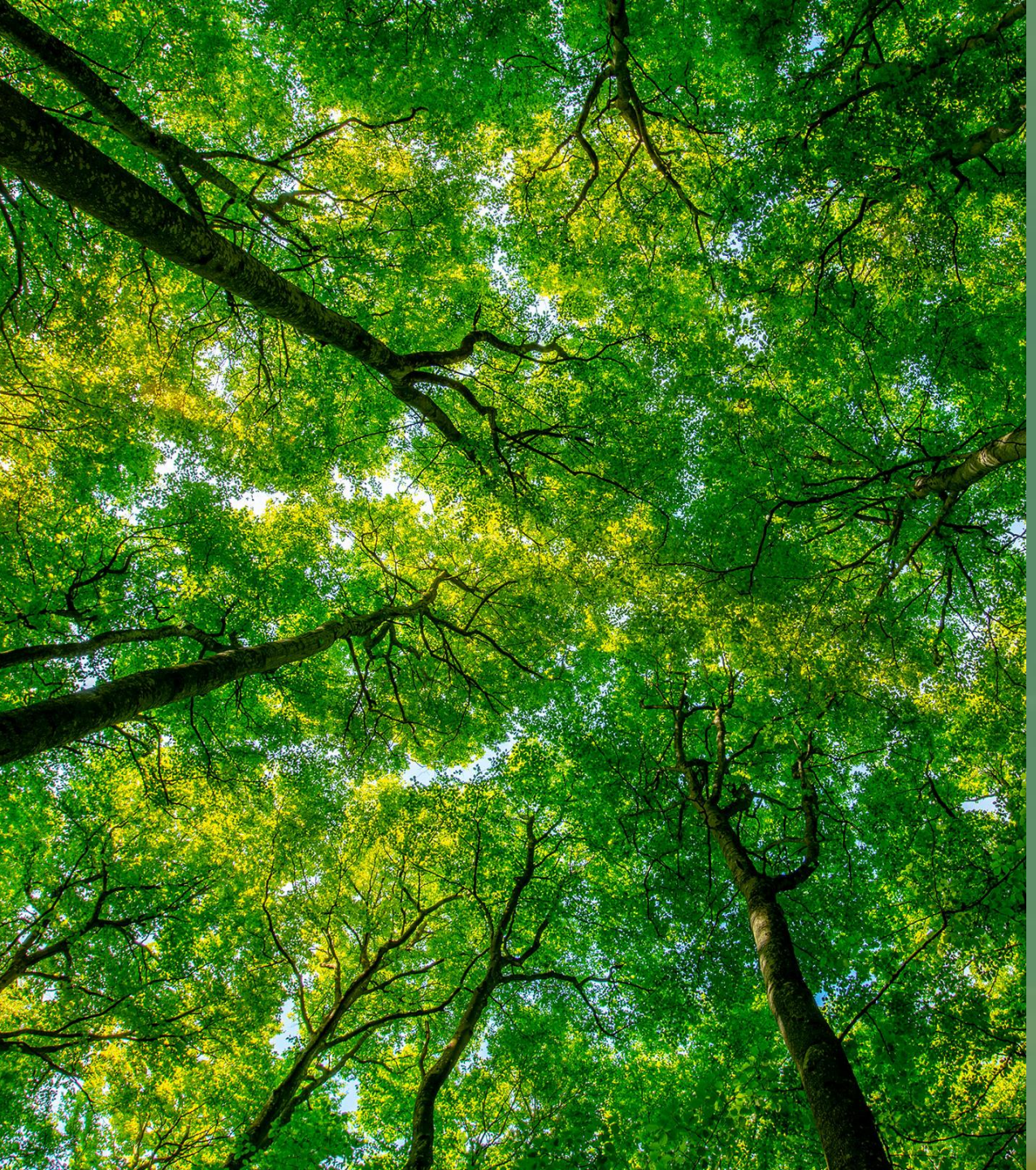
Elif Erdinç Arca

R&D CCUS Product Owner

April 26th 2024



HIGHLIGHTS

Number of projects focused on energy efficiency; 52.

Energy savings; 1,320 TJ.

Energy intensity index value in 2022; 94.9%.

The 30th largest refining company in the world

30th

LARGEST N THE WORLD

The 7th largest refining company in Europe

7th

LARGEST IN EUROPE

Turkey's largest industrial company

1st

INDUSTRIAL COMPANY

Tüpraş has a refining capacity of 30 million tonnes.

30

MILLION TONNES REFINING CAPACITY

Tüpraş has 75% of Turkey's current refining capacity.

75%

SHARE IN REFINING

Our total share in Turkish petroleum products market is 63%

63%

MARKET SHARE

*Based on the measurements carried out in 2022.

Increase in the number of women employees; 14%.

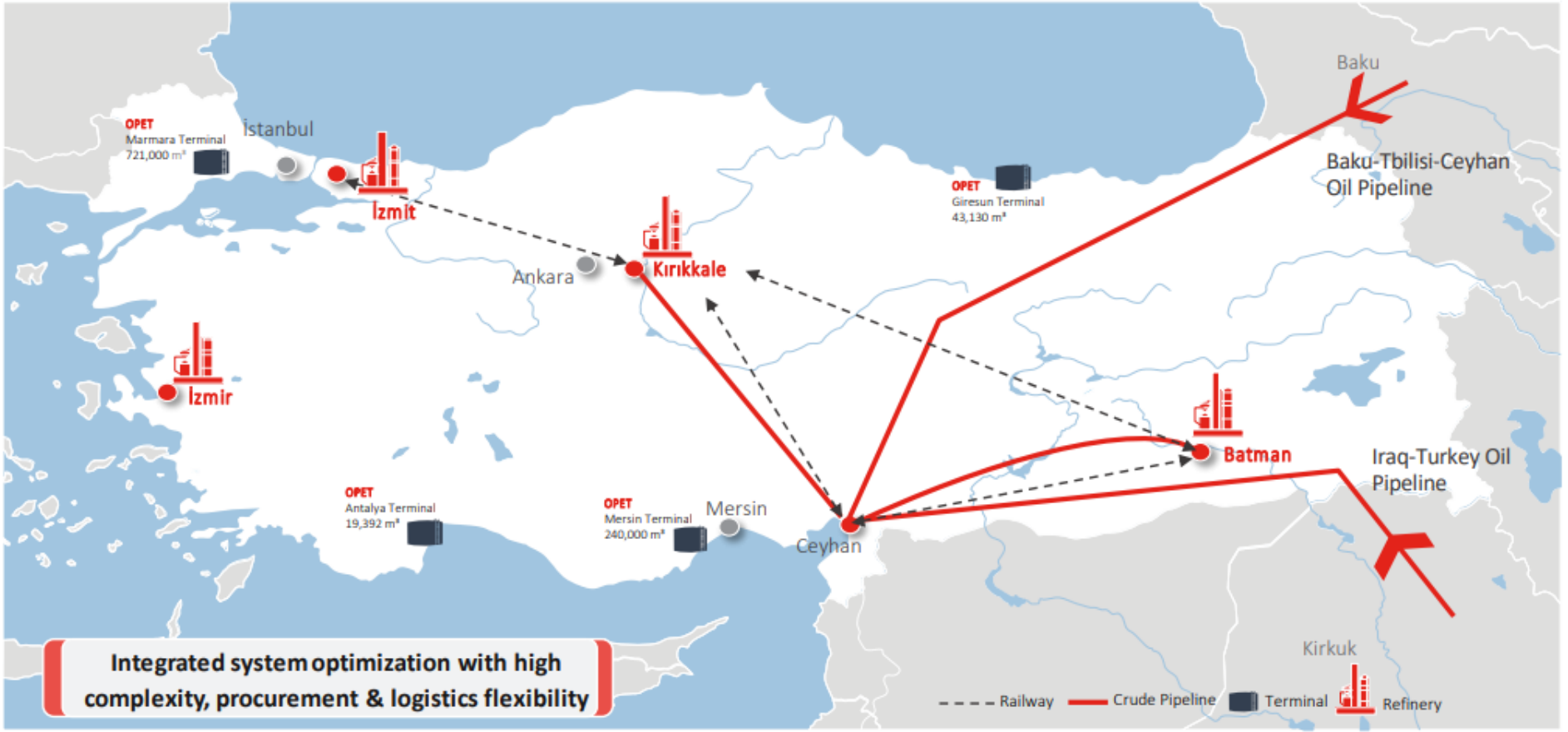
Corporate governance rating in 2022; 9.65.

OHS training hours in 2022; 312,860.

Total investment undertaken in donations and sponsorships in 2022; TL 288 million.

Tüpraş' Refining Assets & Distribution Network

	İzmit	İzmir	Kırıkkale	Batman	Total
Capacity (mn tons)	11.3	11.9	5.4	1.4	**30**
Nelson Complexity	14.5	7.66	6.32	1.83	**9.5**
Storage Capacity (mn m³)	3.0	2.5	1.3	0.3	**7.0**



Tüpraş' Subsidiaries

Tüpraş holds 79.98% of Ditaş's shares.
With a total of 14 tankers and about 543 thousand DWT carriage capacity Ditaş has Turkey's largest fleet of fuel products and provides significant operational and cost advantages to Tüpraş.

Tüpraş holds 41.7% of Opet's shares.
With its 1,857 stations and storage capacity of 1.1 million m3, Opet operates a wide service area in Turkey with five terminals, and provides superior products and services to customers

Tüpraş holds 100% of Körfez Ulaştırma A.Ş.'s shares.
Körfez Ulaştırma A.Ş., whose all shares belong to Tüpraş, is the first private railway operator in Turkey.

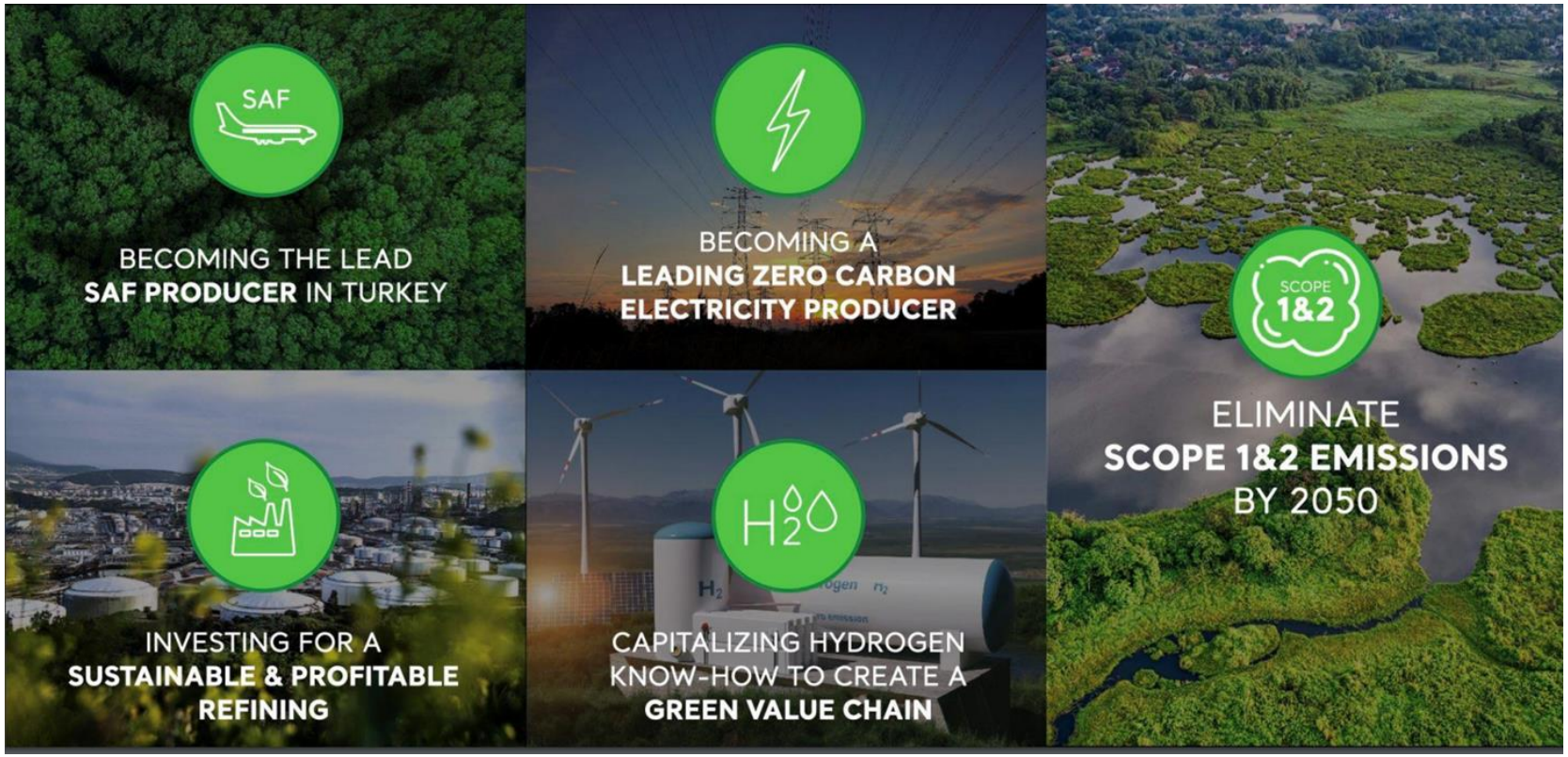
Tüpraş holds 100% of Tupras Trading Ltd's shares.
Tupras Trading Ltd closely follows up international market opportunities through its activities, thus supporting Tüpraş's existing foreign trade operations.

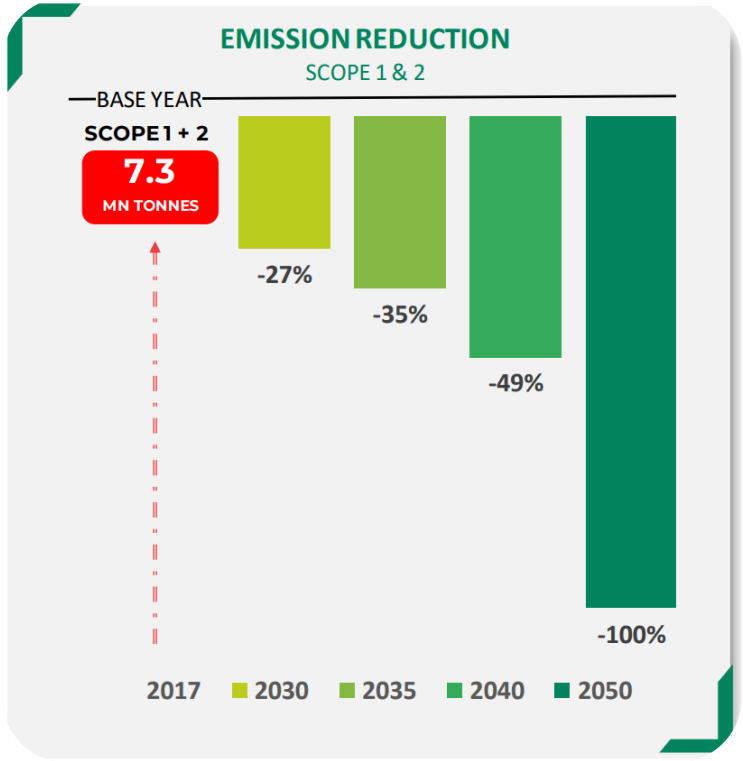
Tüpraş holds 99% of Entek.
Entek aims to grow in renewable energy and diversify its hydroelectric resource-intensive portfolio.

Tüpraş holds 100% of Tupras Ventures.
Tüpraş established Tupras Ventures in September 2022 for direct investment in start-ups by furthering its open innovation efforts

Strategic Transition Plan

WITH A FOCUS ON BECOMING A LEADING ENERGY COMPANY OF THE FUTURE, WE ARE RAPIDLY AND STRONGLY ADVANCING TOWARDS OUR GOAL OF BEING CARBON NEUTRAL BY 2050





Tüpraş R&D Center

2010 — Establishment of the R&D Center

2011 — First EU Project

SEVENTH FRAMEWORK PROGRAMME

2014 — Opening of new R&D Campus

2016 — SPIRE

2019 — Most Successful Turkish Company in HORIZON 2020

HORIZON 2020

2020 — First Commercial Sales of R&D developed products

SPRINT ROBOTICS

2022 — 19 EU Project
35 Tübitak Project

Hydrogen Europe

Water Europe
Technology & Innovation

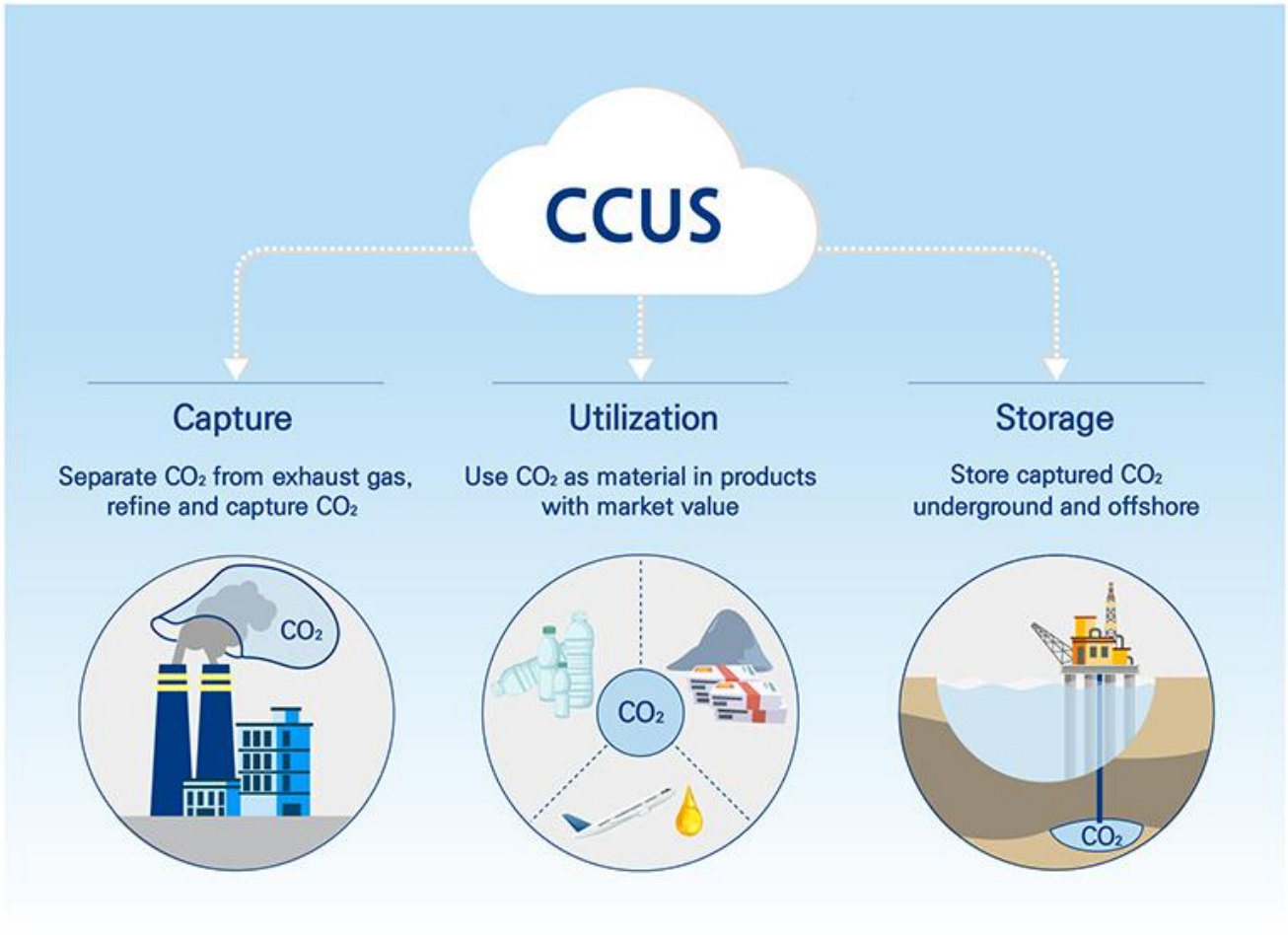
THE 9 FOCUS AREAS OF THE R&D CENTER

The R&D Center works in harmony with the refinery teams within the framework of strong national and international collaborations and common goals. The R&D Center has nine focus areas.

HORIZON 2020

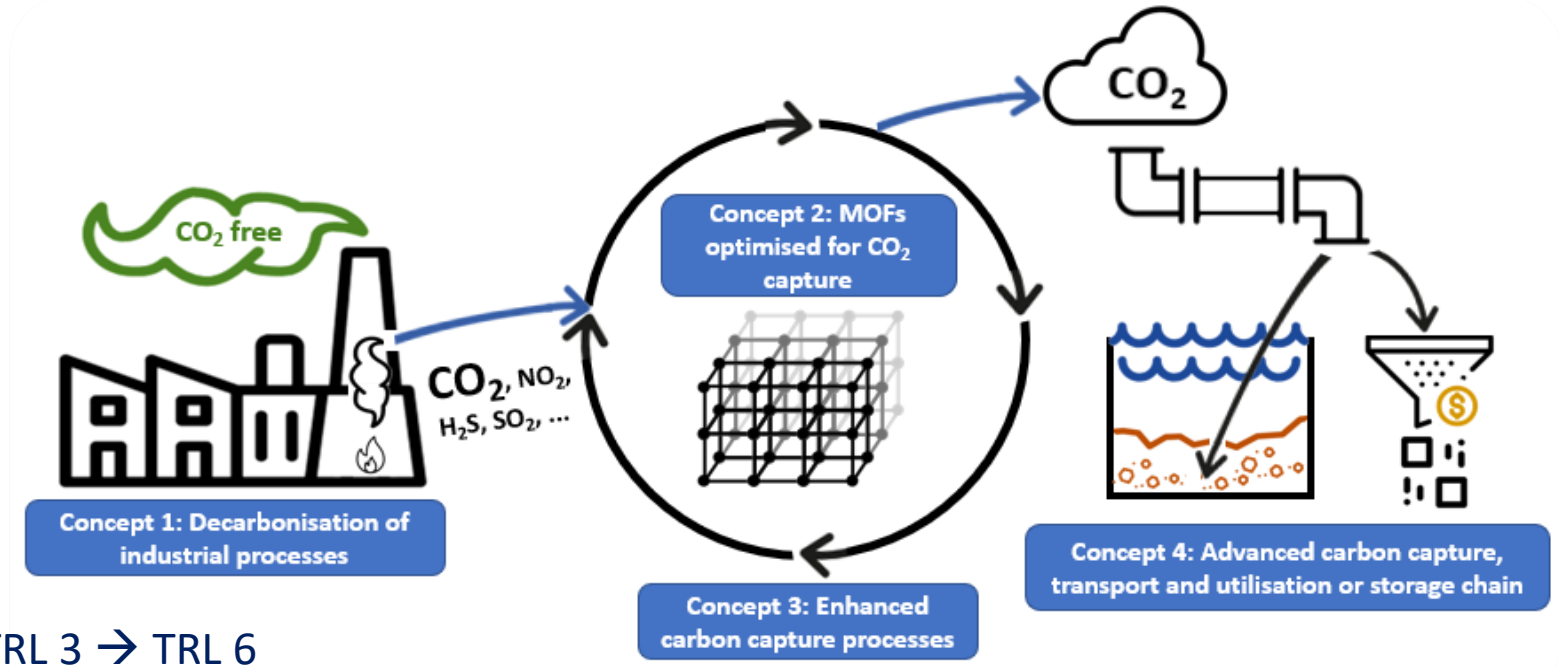
Horizon Europe

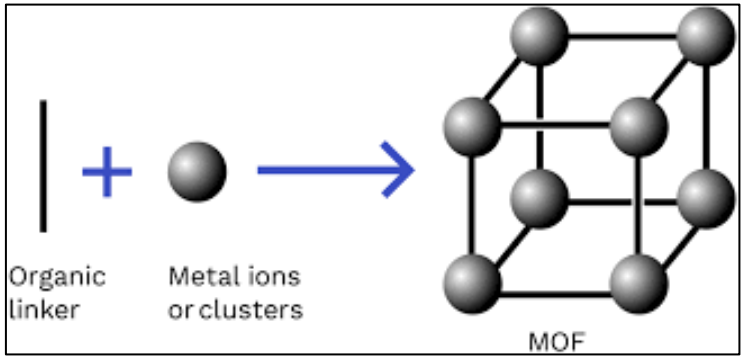
CCUS Team



- **Capture**
  - MOF4AIR
  - MOFAC2CAP
- **Utilization**
  - COZMOS
  - IS2H4C
  - CO2toFuels
  - PSAtoFuels
  - SyntoJet
- **Storage**
  - Eastern Lights
  - Batman - EOR

Metal Organic Frameworks for Carbondioxide Adsorption Processes in Power Production and Energy Intensive IndustRies





- TRL 3 → TRL 6
- May 2019 – July 2024
- Design a Metal Organic Frameworks (MOF) for capture of CO_2 in post-combustion flue gas

Technology Centre Mongstad (TCM) site for Residue Fluid Catalytic Cracker – refinery (Norway)

TUPRAS Izmit site for SMR (Türkiye)

SOLAMAT-MEREX for hazardous industrial waste incineration (France)

Challenges

- Shaping MOF powder into pellets
- Running demo units in real industrial environment
- Keeping demo units operational

June 2019

Start

FAT

March 2023

April 2023

The demo unit arrived at TUPRAS

SAT

June 2023

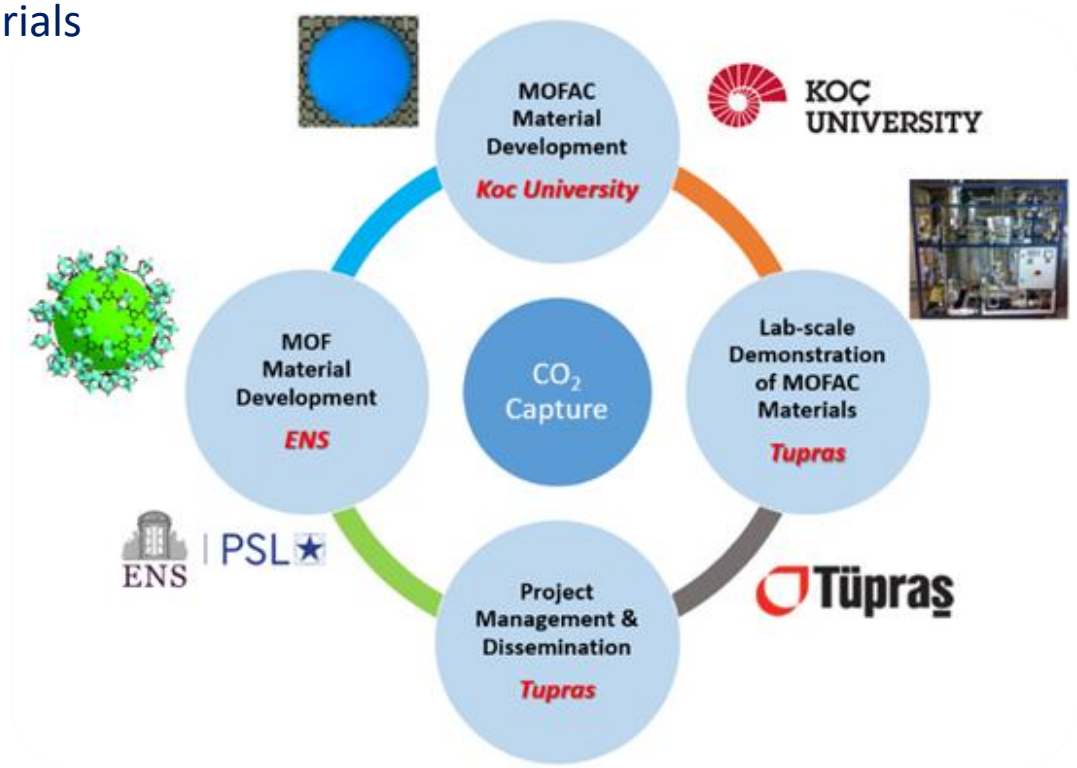
Next steps

- Plant start-up & Flue gas supply
- Test with MOFs
- Optimization of operating conditions

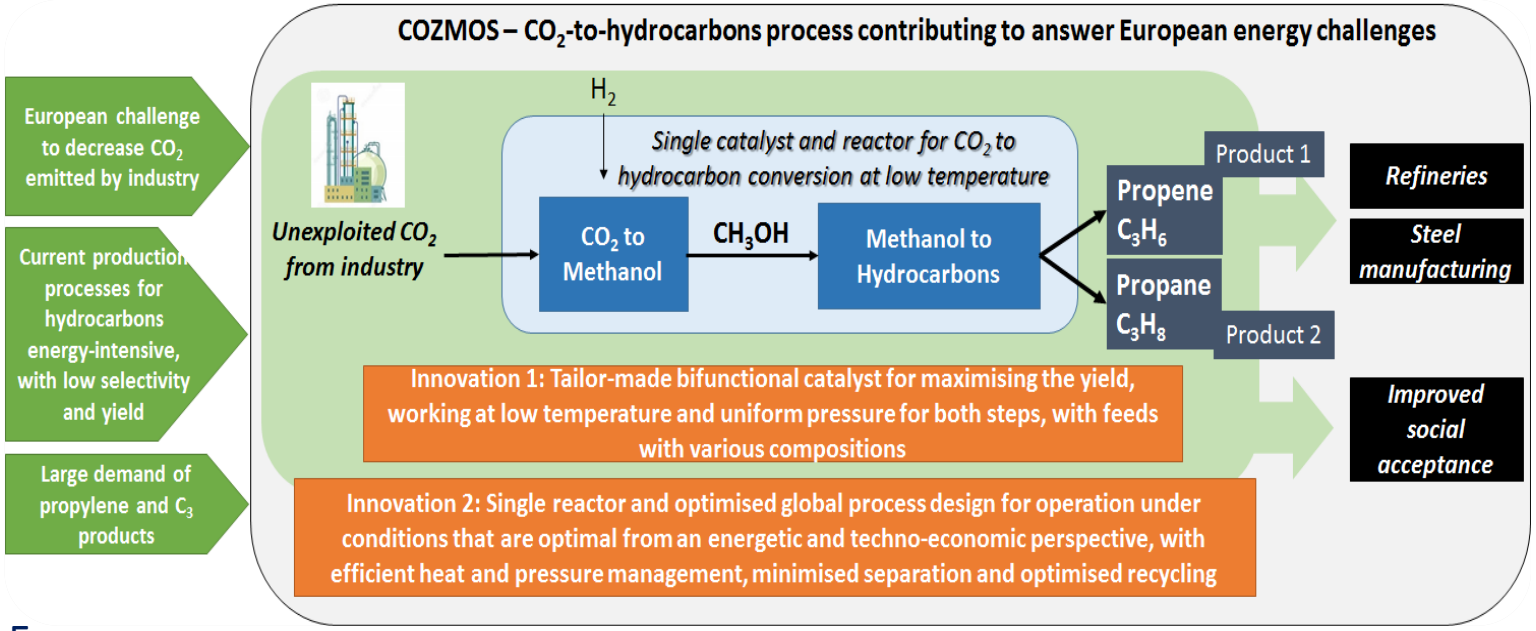
End of 2024

Development of Novel MOF Aerogel Composites to CAPture CO_2

- TRL 2 → TRL 4
- December 2021 – November 2025
- Material synthesis (MOF and MOFAC) & performance evaluation of composites in a tailor-made sorption unit
- Assessment results of developed composites for efficient CO_2 capture from multicomponent gas mixture with respect to the current materials

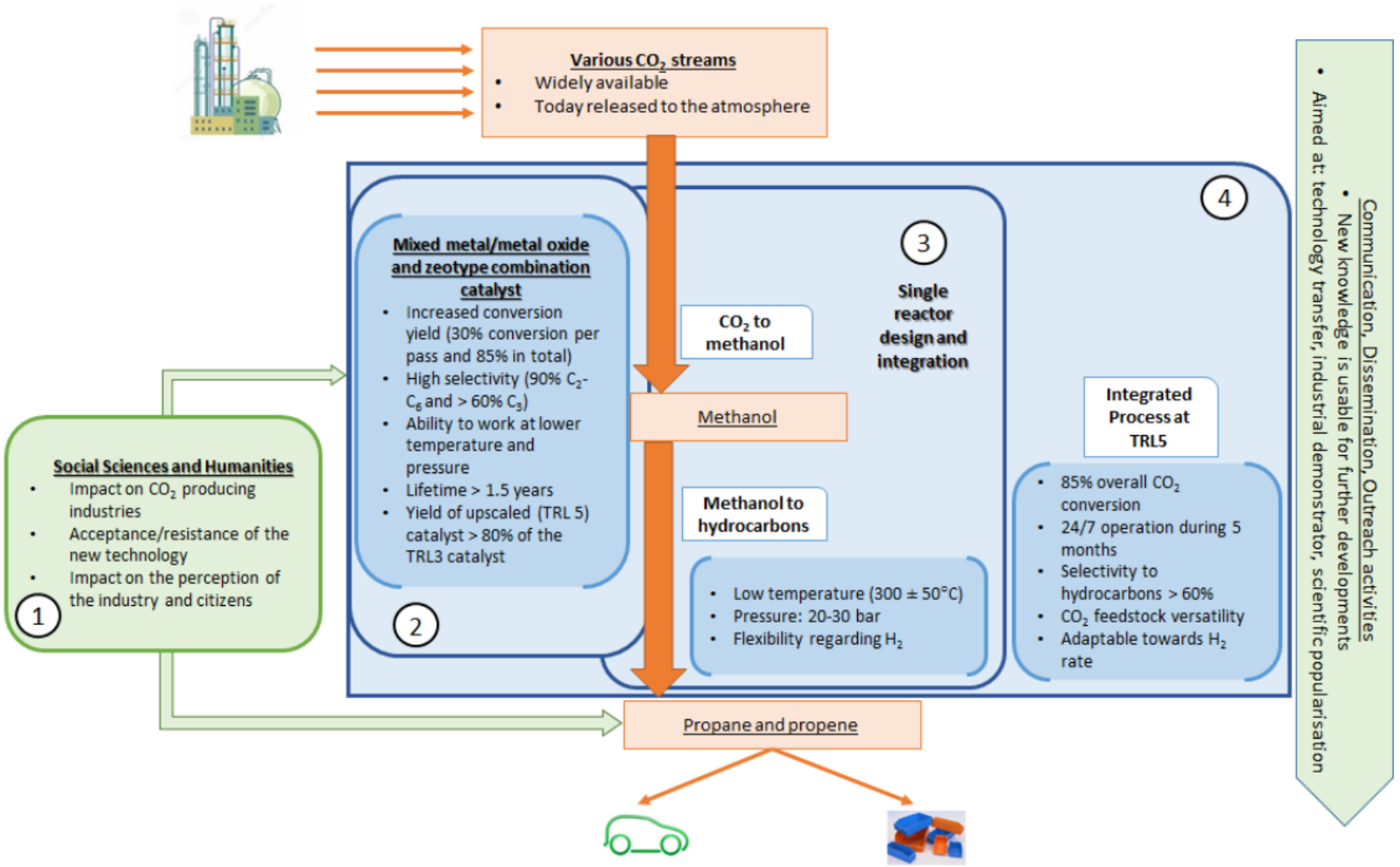


Efficient CO_2 conversion over multisite Zeolite-Metal nanocatalysts to fuels and OlefinS

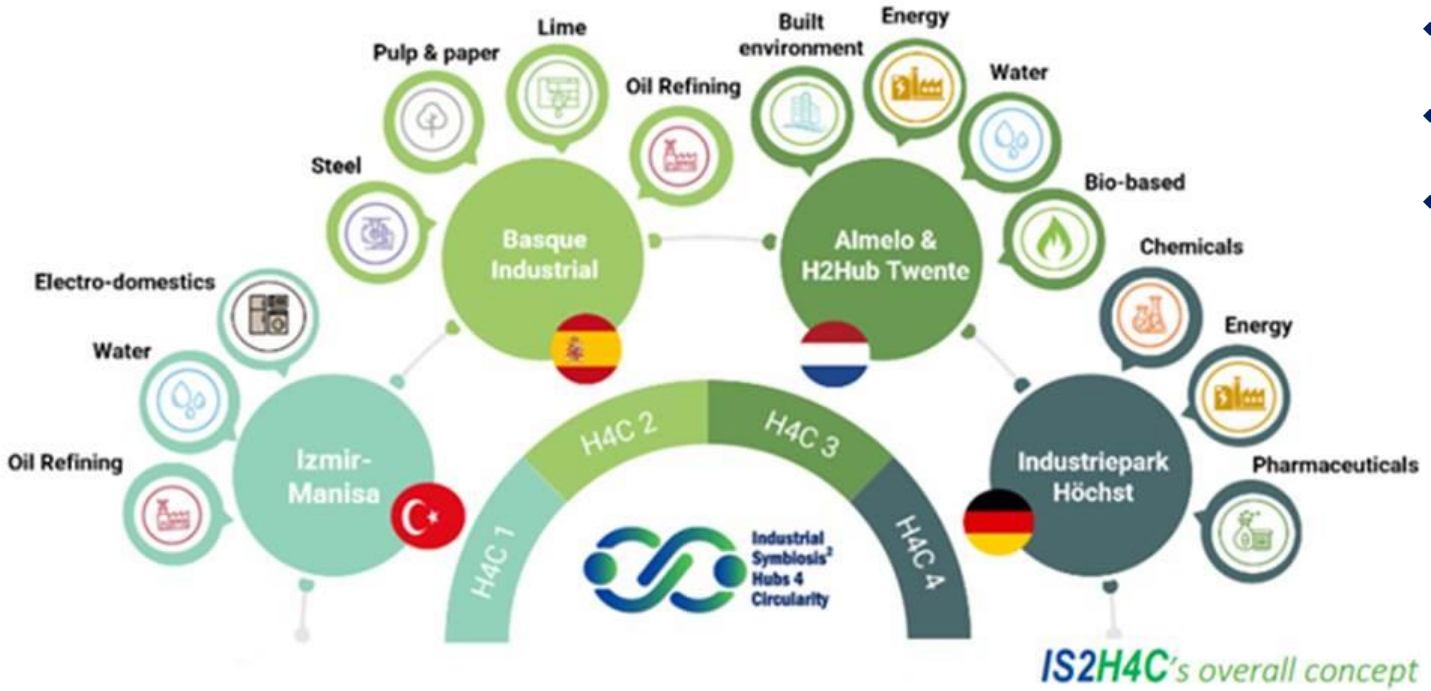


- TRL 3 → TRL 5
- May 2019 – October 2023
- Design a single catalyst and reactor for conversion of CO_2 to hydrocarbons
- Use a simulated CO_2-H_2 mixture, CO_2-rich gas stream from PSA units in a SMR process in refinery and from steel industry.
  - ✓ allowing the synthesis of the **propane/propene** products
  - ✓ by changing the catalyst and adapt operating conditions
  - ✓ at one direct step approach

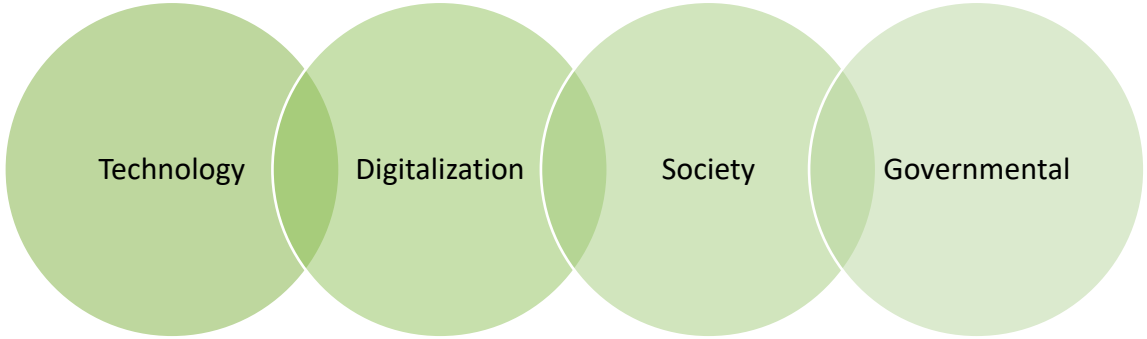
Efficient CO_2 conversion over multisite Zeolite-Metal nanocatalysts to fuels and OlefinS



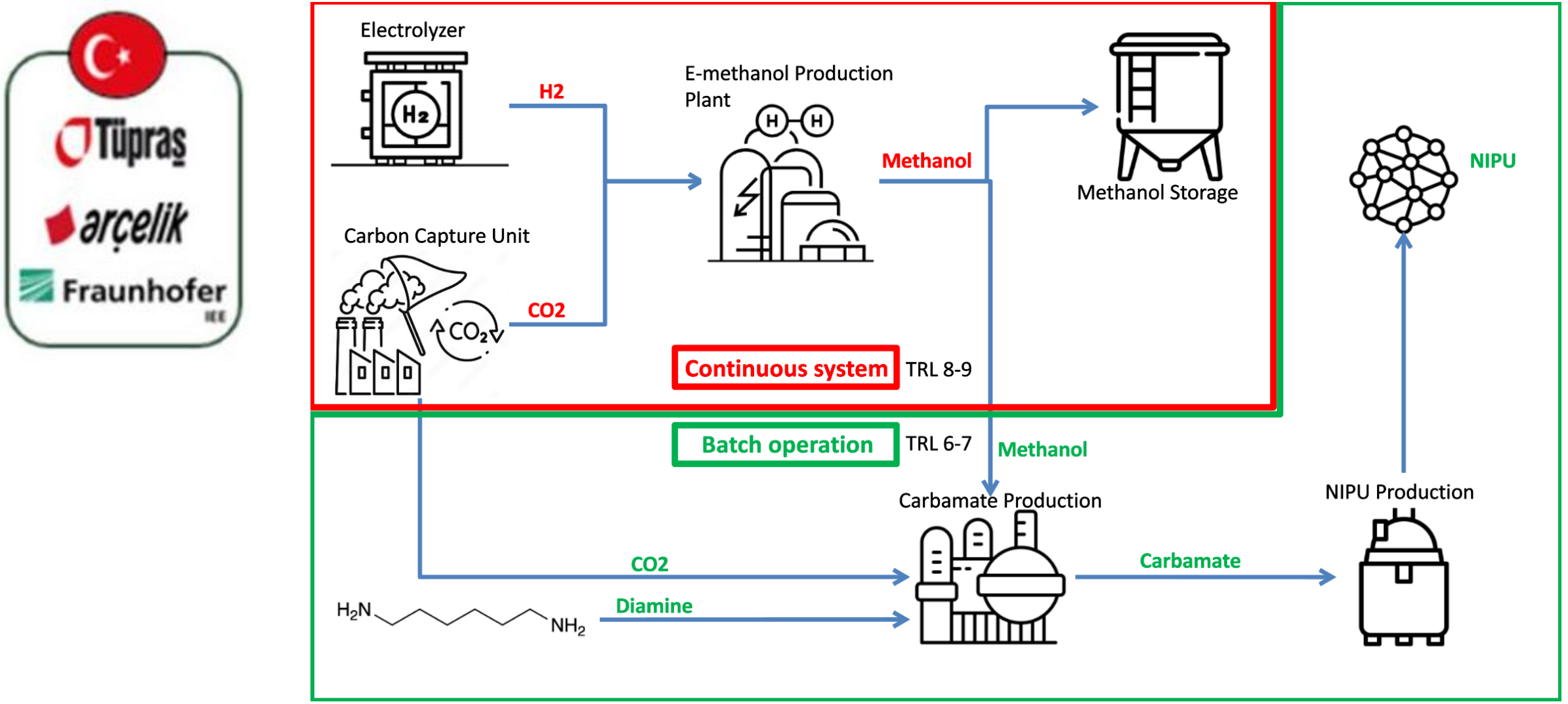
IS2H4C - Sustainable Circular Economy Transition: From Industrial Symbiosis to Hubs for Circularity



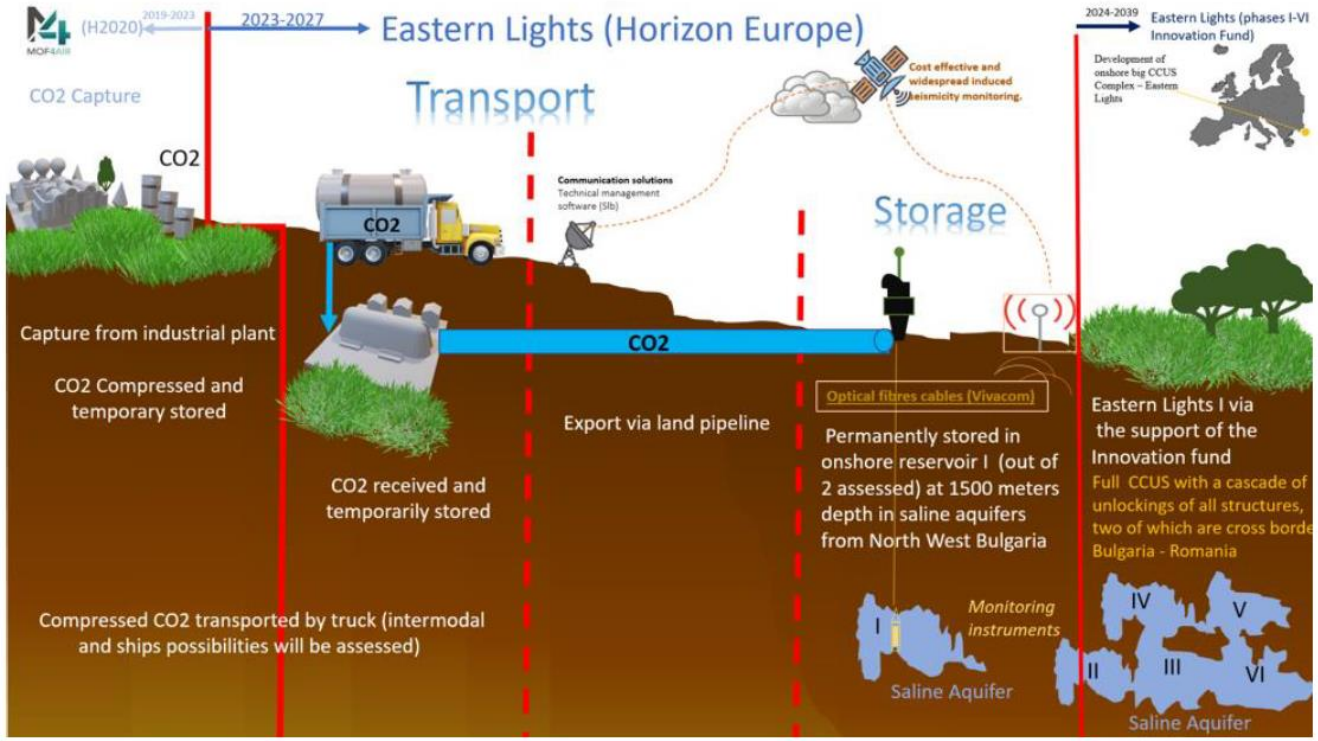
IS2H4C's overall concept



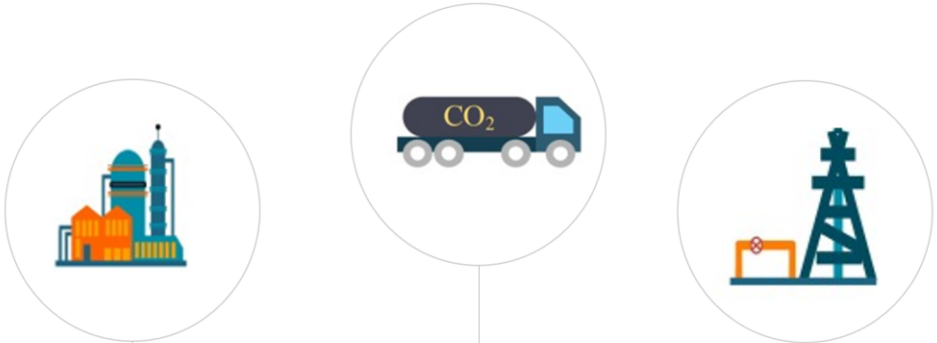
- TRL 5 → TRL 7
- January 2024 – December 2027
- Development of H4C covering existing and future industrial zones and their surrounding ecosystems by **prioritizing resource efficiency, maximizing use of renewable energy, prevention of waste, and promoting industrial/urban/rural symbiosis via reuse and recycling of unavoidable solid, liquid, and gas waste streams**.
- The ambition of reducing the energy use by 10 %, waste emissions by 20%, and carbon emissions by 30%


Electrolyzer
H2
E-methanol Production Plant
Methanol
Methanol Storage
NIPU
Carbon Capture Unit
CO2
Continuous system
TRL 8-9
Batch operation
TRL 6-7
Methanol
Carbamate Production
NIPU Production
CO2
Carbamate
Diamine

Eastern Lights - Development of CO2 transport and storage demo project in Eastern Europe



- TRL 5-6 → TRL 7-8
- Initiate the first on-shore storage site in Europe
- Demonstration T&S site consisting (1) two 1.5 km deep wells, (2) a 1 km long pipe, and (3) a CO2 conditioning station
- Cross-border CO2 transportation



CO2 Capture

CO2 will be captured via **MOF4AIR Demo Unit** from **SMR Plant** as a result of approx. **6 months of operation**

CO2 Transportation

Specialized **trucks** to carry CO2 from Izmit Refinery to Bulgaria storage site **(-20 °C & 20 bar, approx. 20 tons)**

CO2 Storage

On-shore storage in Bulgaria, which will be operating by the end of the project

Conclusions

- Aligned with Tüpraş' 2050 Strategic Transition goals
- Learning & firsthand experience via multidisciplined & international environment
- Improving our infrastructure for upcoming projects
- Keeping the portfolio diverse to find the most promising and effective solutions
- Getting prepared for upcoming national & international carbon regulations


Tüpraş
THANK YOU
Koç