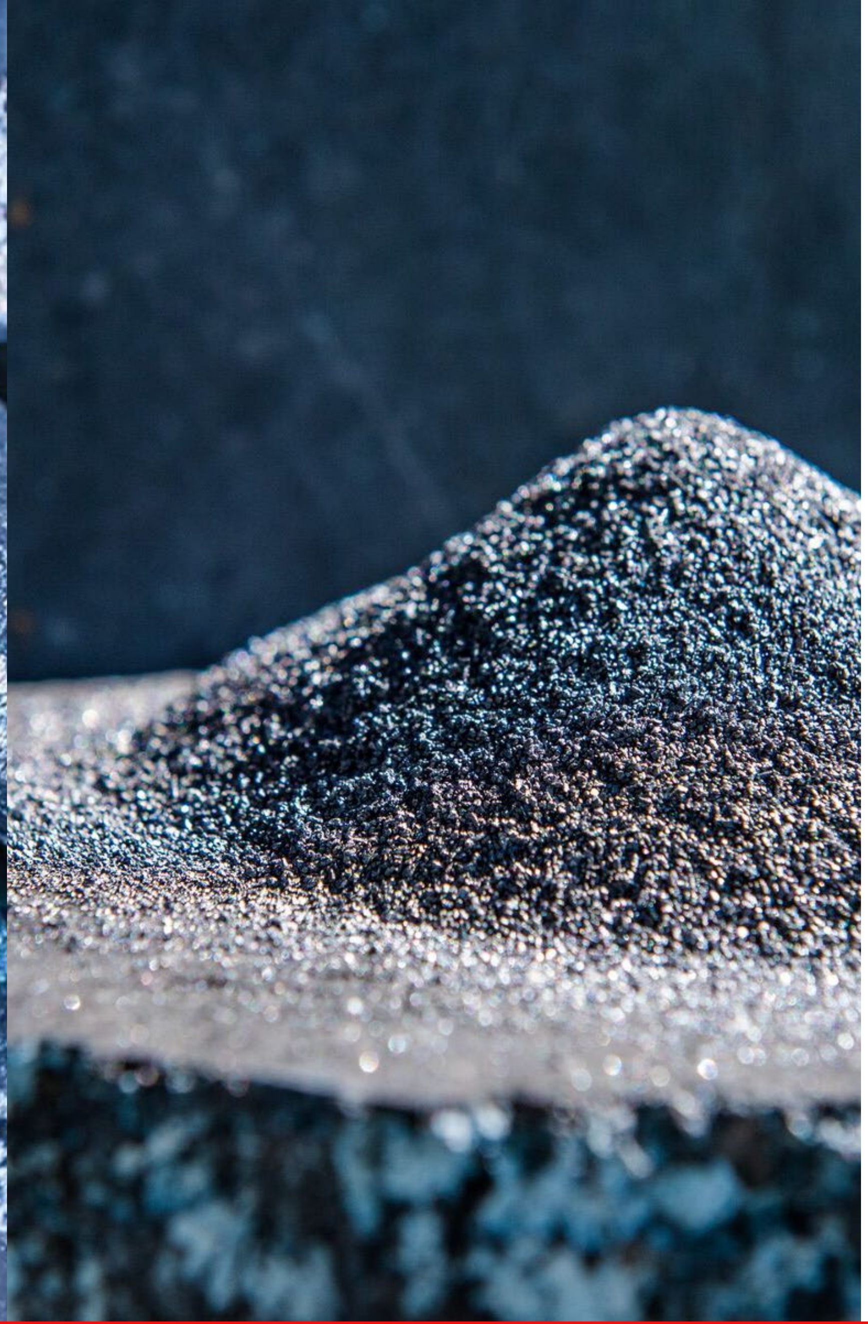



MECALO

This project has received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement No. 101122101. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority (HaDEA) can be held responsible for them.

Funded by the European Union

Silicon production with carbon looping

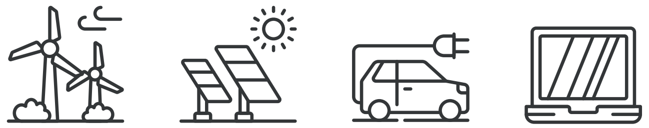
Elkem

CRU Silicon Market day 24.09.2025

Anne Gry Messenlien

Silicon
A critical raw material for the green and digital transition

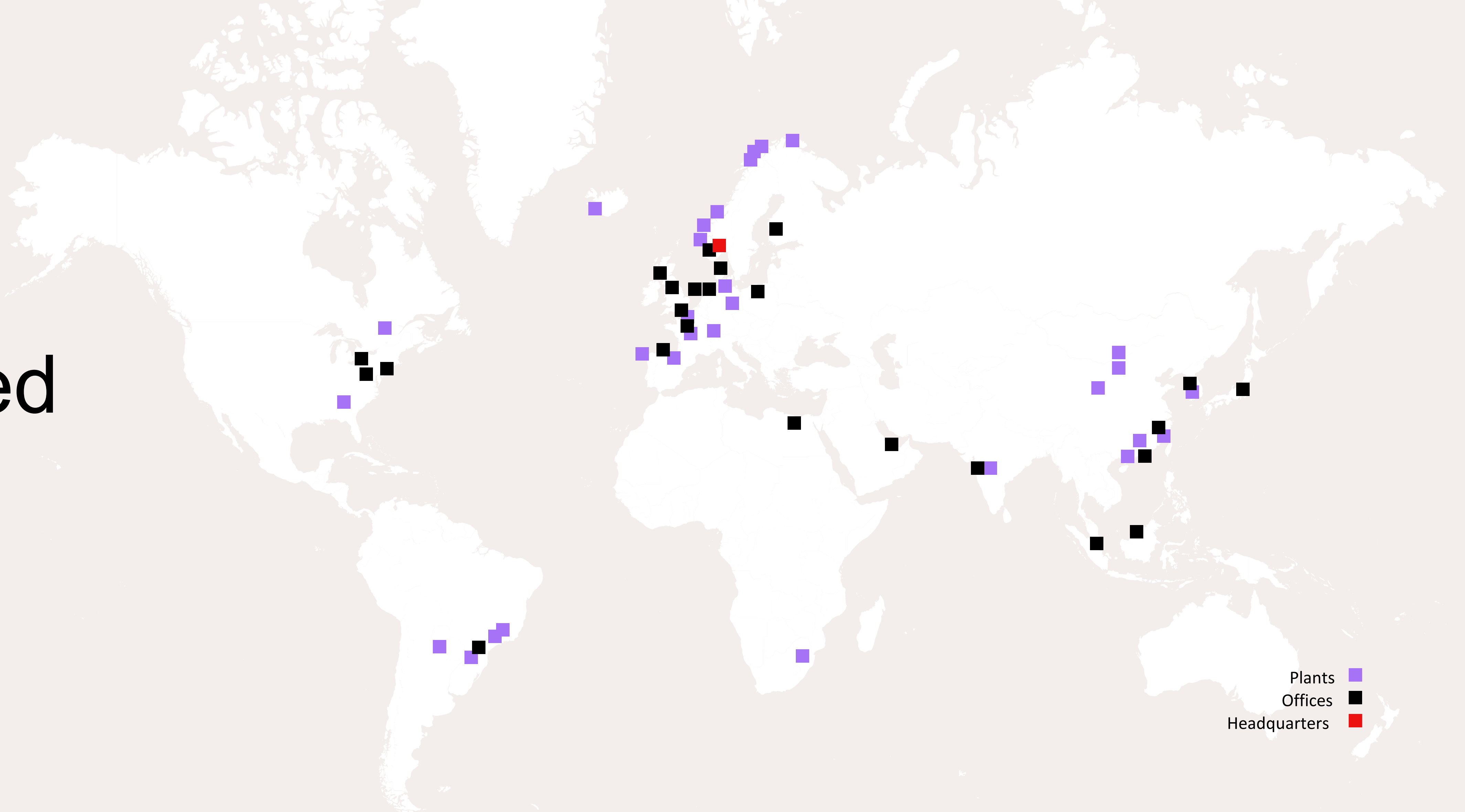
	14
Si	
silicon	



When the solution is part of the problem

We are Elkem

Advanced silicon-based materials for a more sustainable world



~7.200 employees at 30 locations

~600 employees at 14 R&D centres

Listed at Oslo Stock Exchange since 2018

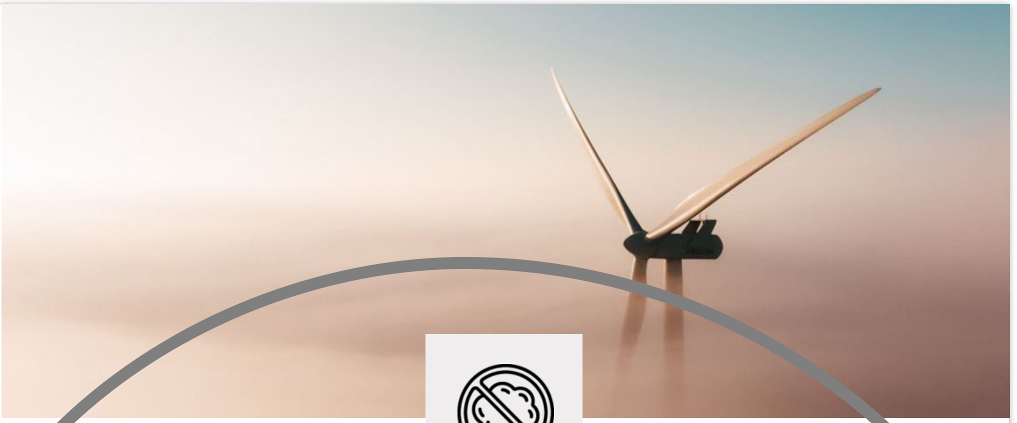
NOK ~33 bn in total revenues 2024

Silicones

Silicon Products

Carbon Solutions

Elkem will contribute to limit global warming through three key levers



Achieve fully climate-neutral production throughout our value chain

By 2031:

- Reducing scope 1 & 2 emissions by 25%
- Reducing carbon footprint by 32% (scope 1–3)

By 2050:

- Carbon neutral production (zero fossil emissions)

Supply key input factors required to **enable the green transition**

- Increase development and supply of advanced materials to green industry, incl. EVs, renewable energy and low-energy buildings

Drive **circular economies** in our operations, products and markets

- Increase recycling in our own operations
- Develop circular loop with our customers and suppliers
- Adopt eco-design approach to new products

Carbon in silicon production

Carbon is used for removing the oxygen from quartz in electric submerged-arc furnaces ("reductant").

The overall (ideal) chemical reaction in the furnace is:

$$SiO_2 + 2C \;=\; Si + 2CO$$

The CO gas burns at the furnace surface, forming CO_2:

$$SiO_2 + 2C + O_2 = Si + 2CO_2$$

Total <u>direct</u> CO_2 emissions (fossil + bio)

from silicon smelters:

~ 5 kg CO_2/kg Si

Note: Product carbon footprint also includes emissions related to electricity production (scope 2) and indirect emissions from raw material production and transport (scope 3).

Figure 1: Silicon furnace with todays raw materials

5

Possible ways to reduce carbon emissions in silicon production

Challenge:

Develop a carbon-neutral production technology for silicon alloys that can be **realised industrially by 2050.**

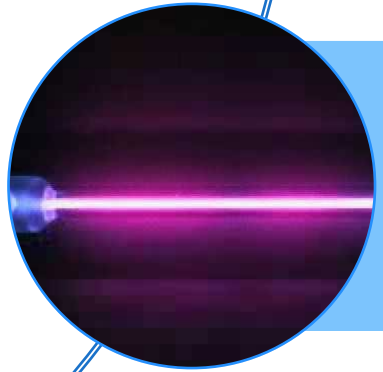
Replace all fossil reductants with biocarbon.

⚠ Biocarbon is a scarce resource with a strongly increasing demand.

Carbon capture & storage (CCS).

Requires use of carbon sources with foreseeable access.

⚠ Coal supply uncertain.

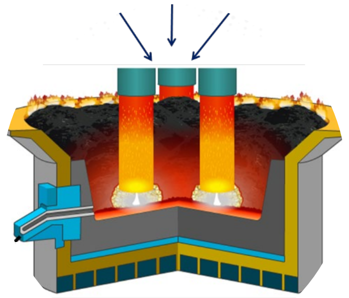


Use hydrogen as reducing agent? $SiO_2 + 2H_2 = Si + 2H_2O$

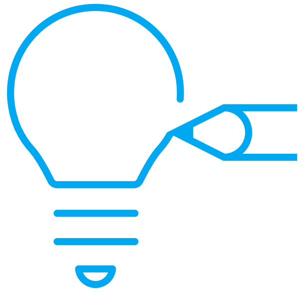
⚠ Not thermodynamically feasible.

Another way …….. ?

Capture the carbon from the off-gas and **reuse** as reductant

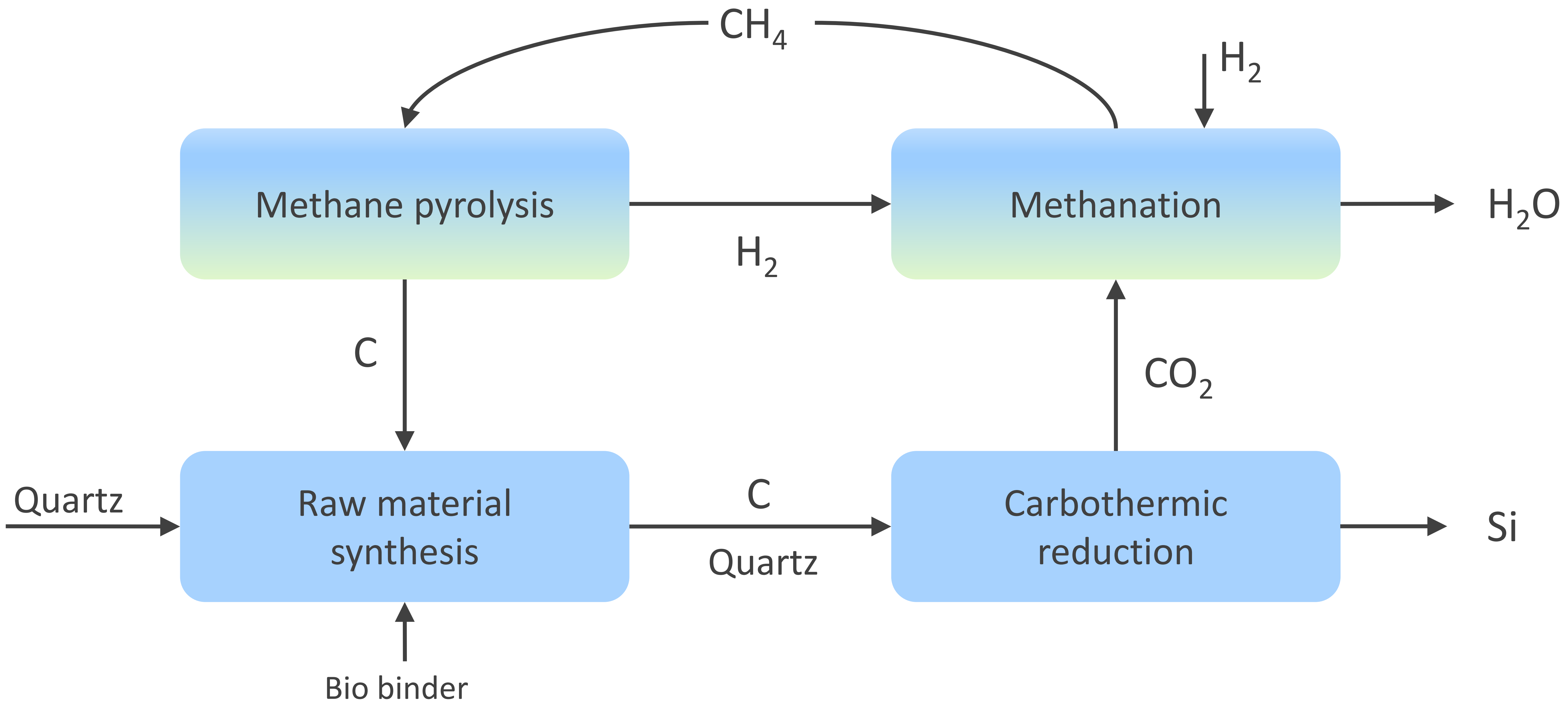


Keep today's production process



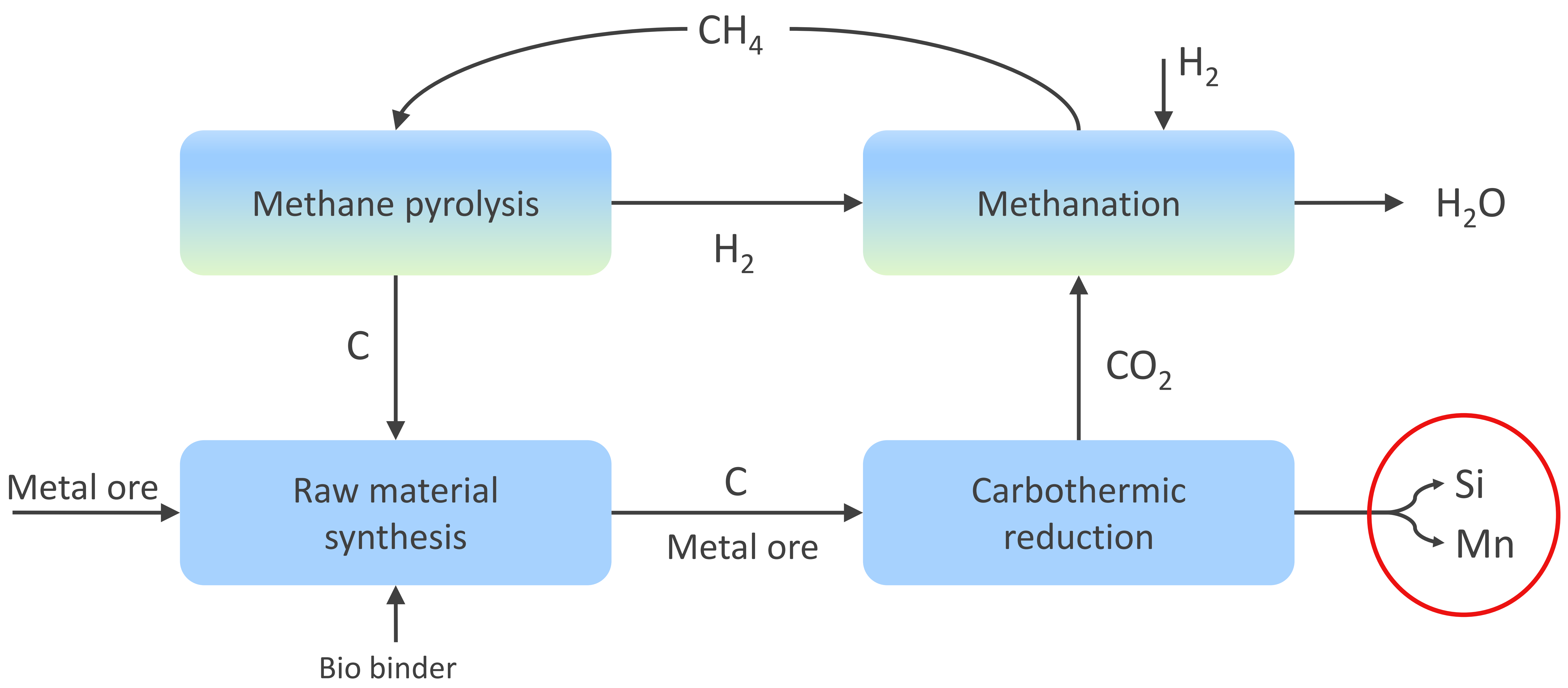
Is this possible?

SICALO: SILICON PRODUCTION WITH CARBON LOOPING



Elkem

MECALO: METAL PRODUCTION WITH CARBON LOOPING

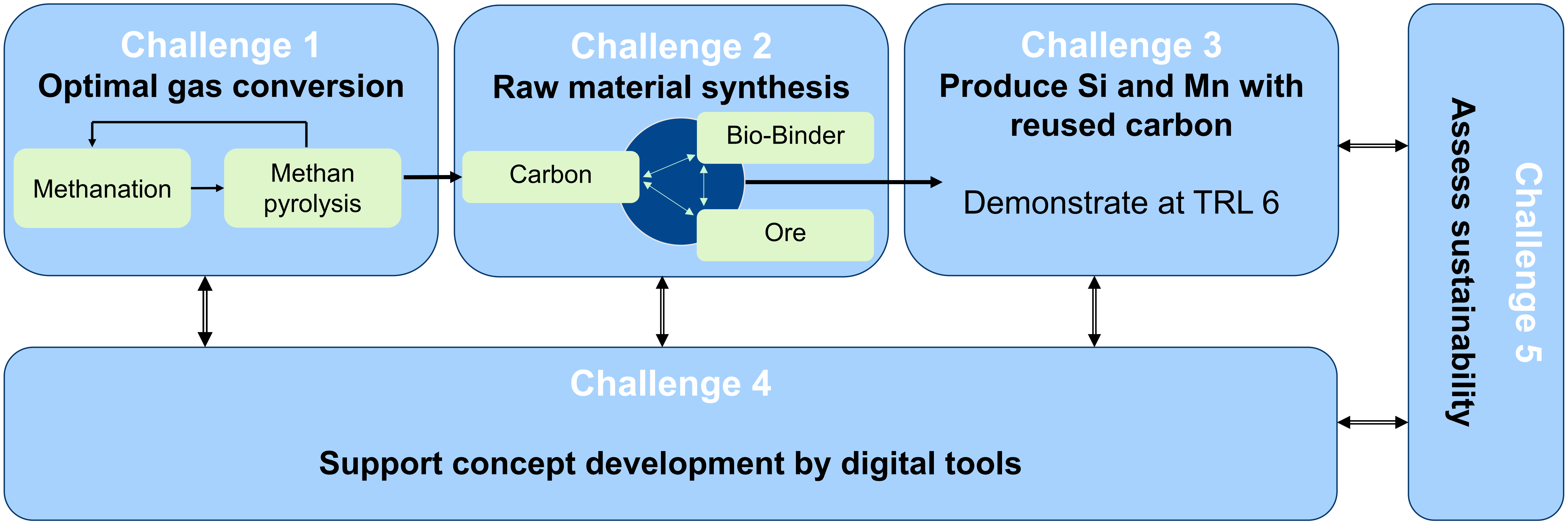


MECALO project

Total grant:	9.92 M€
Duration:	3.5 years
Project start-up:	1st October 2024
Project end:	31st March 2028
Initiated by:	Elkem
Coordinator:	SINTEF
N° partner:	12
N° country:	8

Funding from European Union's Horizon Europe Research and Innovation Programme

MECALO Challenges



MECALO across Europe

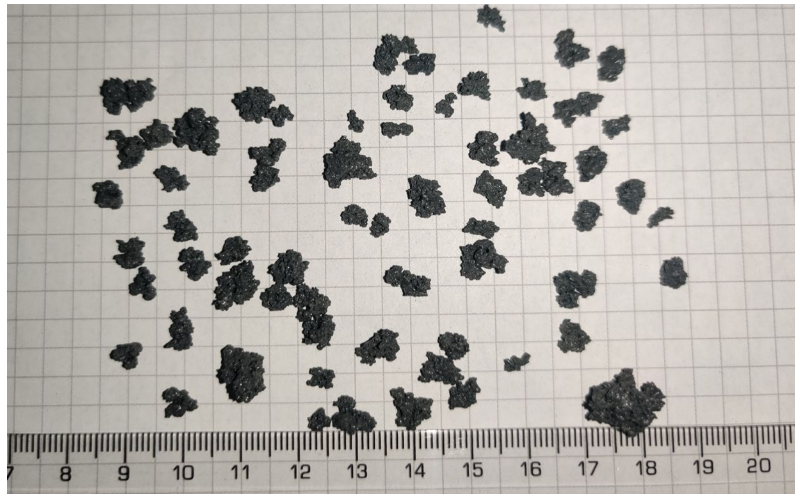












MECALO partners

Gas conversion	Circular raw materials	Process & resources optimisation	Carbothermic metal reduction & business cases
Methanation & renewable hydrogen integration	Biobinder	Dynamic simulation model and energy recovery	Silicon production
Pyrolysis & densification	Reducing agent synthesis	Optimized process designs	Manganese production
			Other carbothermic processes

Roadmap towards deployment

Technoeconomic assessment

Hydrogen value-chain

LCA and env. assessment

Safety/ workplace

Dissemination, Communication, Networking and Exploitation

Project coordination and management

Thank you!

MECALO

anne.gry.messenlien@elkem.com

Contact

info@mecaloproject.eu

mecaloproject.eu

MECALO Project

MECALO Project

Subscribe to our newsletter

Funded by
the European Union

This project has received funding from the European Union's HORIZON Research and Innovation Actions under Grant Agreement No. 101177480. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Health and Digital Executive Agency (HADEA). Neither the European Union nor the granting authority can be held responsible for them.

Elkem