Aerleum

Seed Round Fundraising Pitch Deck

DAC-TO-METHANOL

Transforming air into methanol.

Green Methanol Emerges As Top Contender For Achieving Industrial Decarbonization Goals Of This Decade.

Methanol has the essential attributes needed by heavy industry.

CH_3OH It can be used as an **alternative fuel** or **chemical building block**.

- It fits current supply chain, it's safe to store and easy to handle.
- It burns cleanly: reducing SOx, NOx, PM.
- It can be produced from renewable CO2 and green H2 to reduce up to 95% of GHG in high emitting industries.

Green methanol can play an essential role to slash their GHG emissions.

Whether it's complying with regulations or meeting customer demands, heavy industries feel the heat to cut GHG emissions by 2030.

Shipping	**Chemicals**	**Aviation**
3% of GHG	2.5% of GHG	2% of GHG
		
Alternative to marine fossil-fuels.	Methanol derivatives.	Methanol to Jet fuel.

Combined, it represents 800 Mtep burned per year and over 3.5 GtCO2 emitted annually.

Yet, Current Pathways For Green Methanol Production Face Structural Limitations.

>385Mt[1] green methanol needed per year by 2050. Production must overcome some massive hurdles.

99.8% of methanol is produced from fossil fuel (natural gas; coal), emitting 0.3 Gt/y.

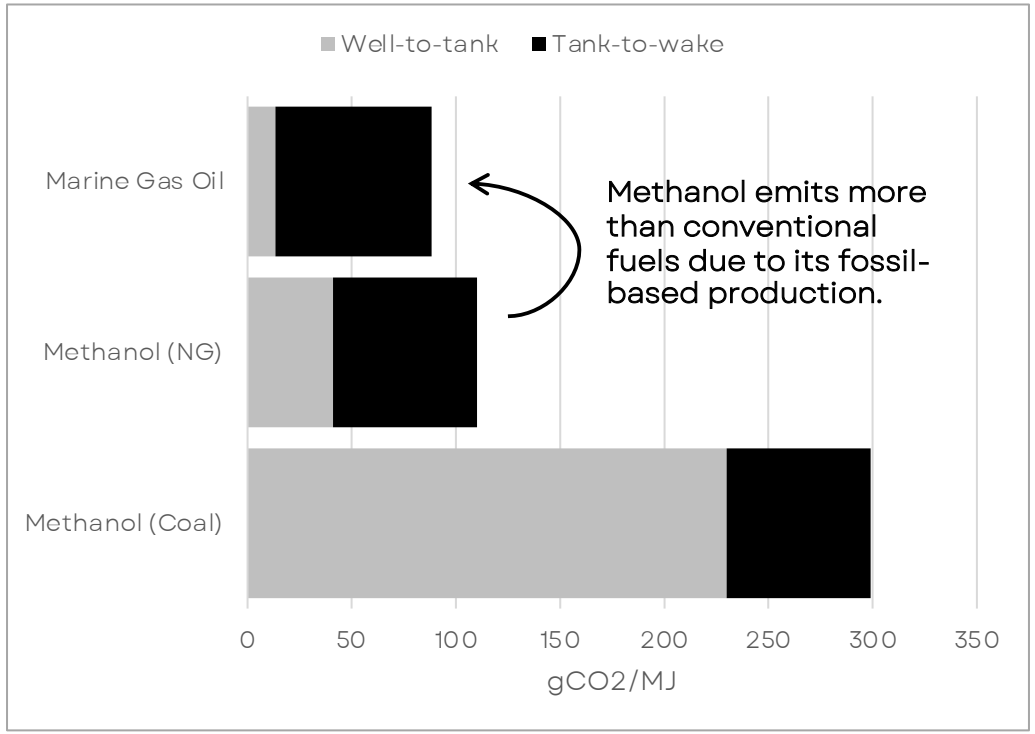
Renewable CO2 is limited.

Limited feedstock availability, source, and price represents an issue at scale.

High costs in green production processes due to poor energy efficiency. Costs are 3-5X higher.

CAPEX and energy intensive.

Low speed of mass deployment.. They're not ready now, nor for 2030.



[1]Projected green methanol demand by 2050 (source: IRENA).

Meet Aerleum: Introducing A Novel Pathway To Enable Green Methanol Supply At Cost Parity And Large Scale.

A unique technology.

1

Cutting out the most energy intensive steps.

Reactive DAC.

Integrated DAC and CO2 conversion, a single step approach for direct methanol synthesis, starting from air.

Independent and unlimited access to feedstock,

Built to meet market demand.

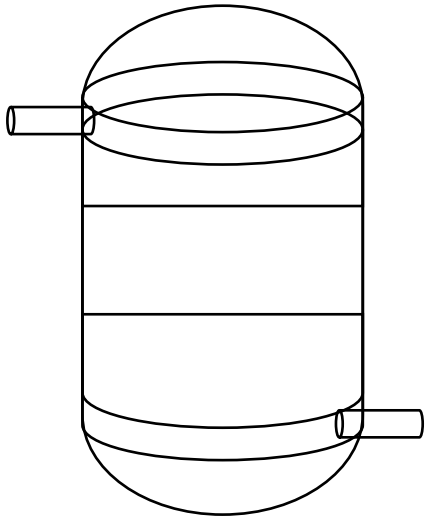
2 **Scale fast:** **300,000** tons of green methanol production capacity in 2029.

3 **Competitive:** we target price parity with fossil fuels, below **600 $/tMeOH.**

4 **Carbon neutral:** we combine renewable CO2 and green H2 to produce **green methanol**.

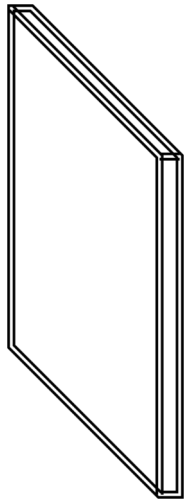
1 Reactive DAC: We Are Pioneering The Approach With Three Core Technological Ingredients.

A Custom engineered reactor



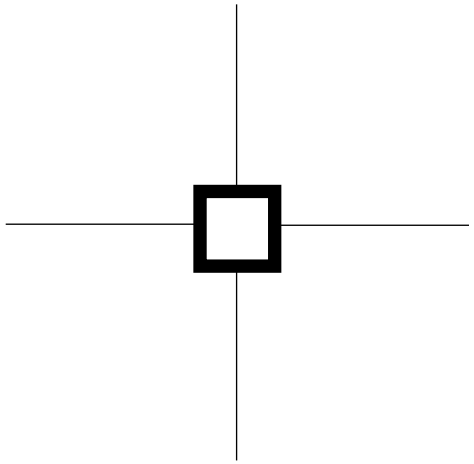
Designed for integrated atmospheric CO2 capture and conversion.
+ scalable.
+ optimized mass/heat transfer.
+ T°/pressure control.

B Proprietary reactive sorbent



Enhanced capture/conversion properties.
+ maximum CO2 contact surface.
+ no desorption.
+ high selectivity.

C Precision heating



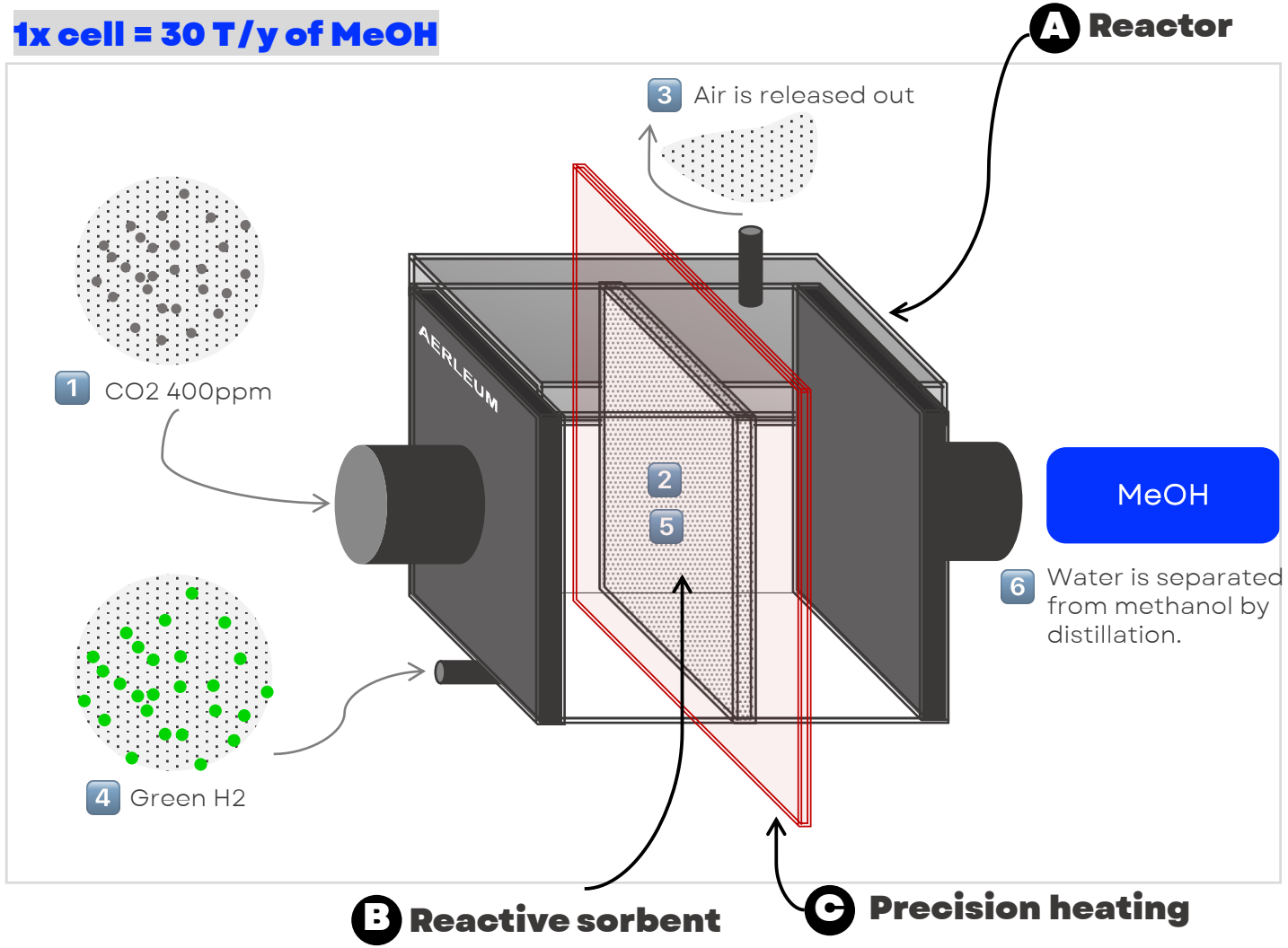
Tailor-made for successive capture/conversion cycles.
+ electrified heating.
+ fast on/off switch.
+ lower energy demand.

1 We Have Built The Most Efficient System To Transform Directly Air To Methanol.

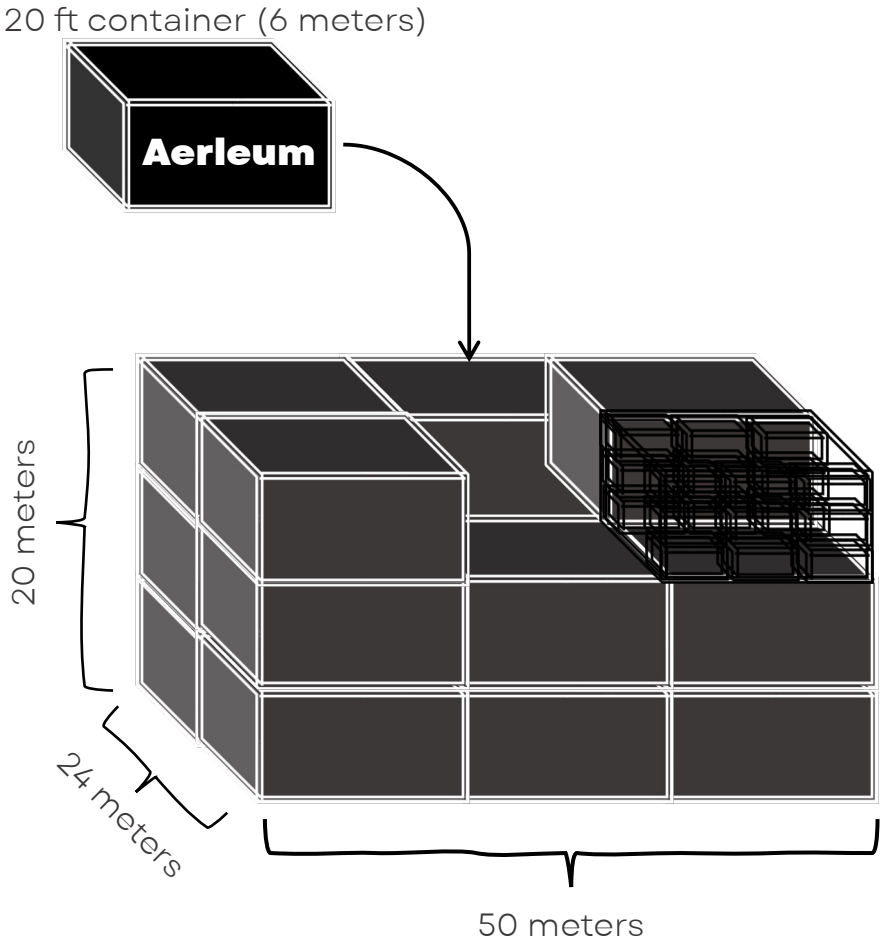
1. Atmospheric CO2 absorbed
2. Reactive sorbent is saturated with CO2
3. Air (free from CO2) released
4. Green H2 introduced in
5. Reaction initiated on reactive sorbent
6. Distillation for product separation

Methanol

1x cell = 30 T/y of MeOH

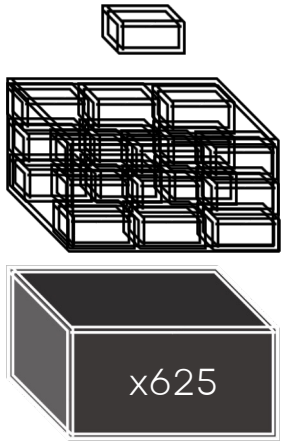


2 Since Day One We Are Derisking Science And Industrialization To Unlock Fast Go-to-market.



Simplified plant design (number of containers is not representative).

A modular approach to scale production capacity.



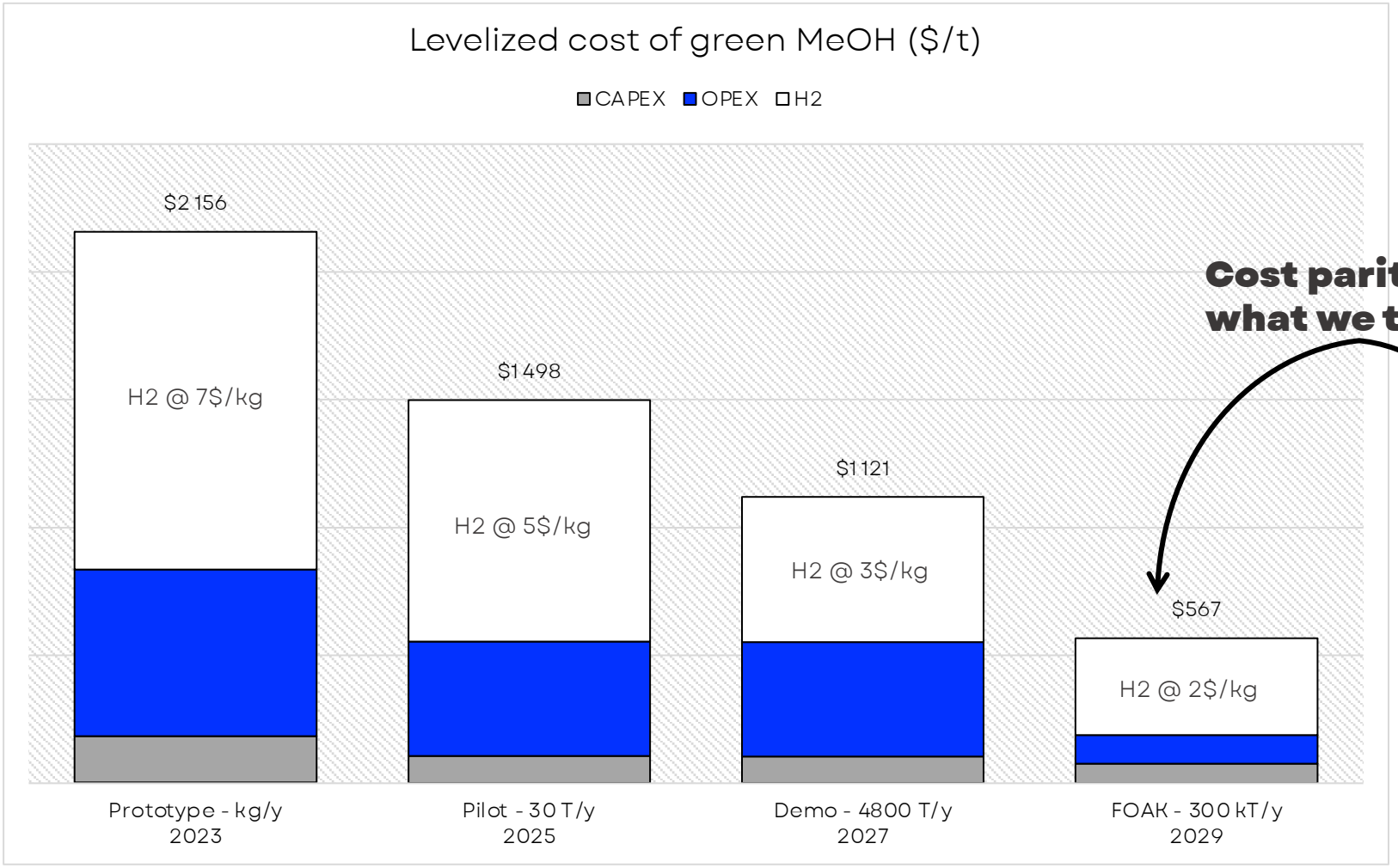
1x cell = 30 T/y

1x container = 16 cells = 480 T/y

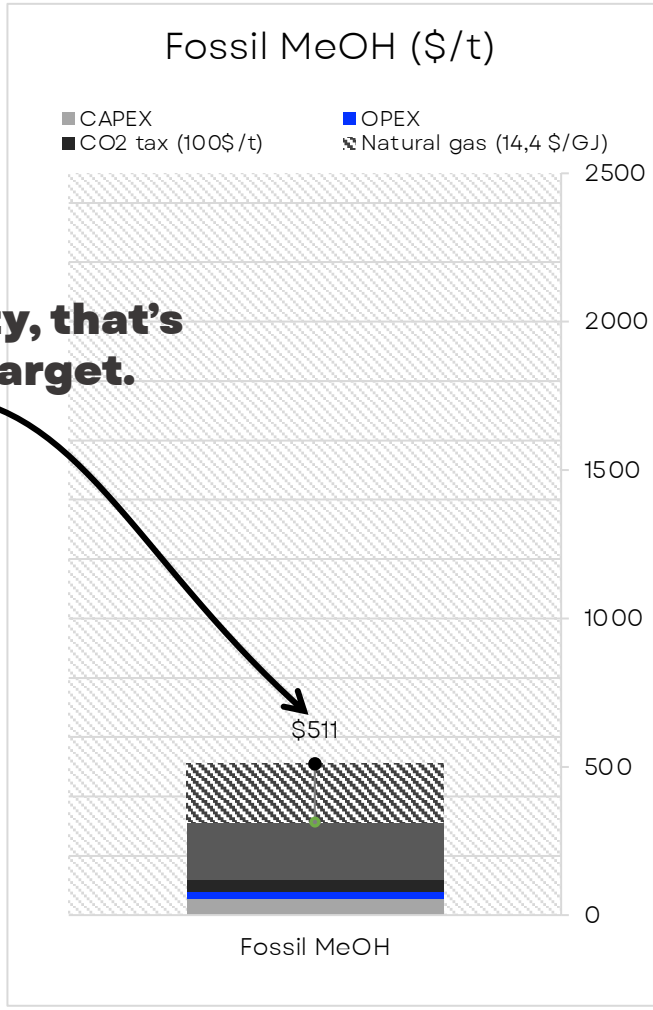
1x plant = 625 containers = 300 kT/y

- **Lower CAPEX**: standardized units designed for mass manufacturing.
- **Fast and versatile**: modulable plant size and layout, low physical footprint, independent for optimal siting.
- **Continuous innovation**: upgrading cells and subsystem such as reactive sorbent; interchangeable modules.

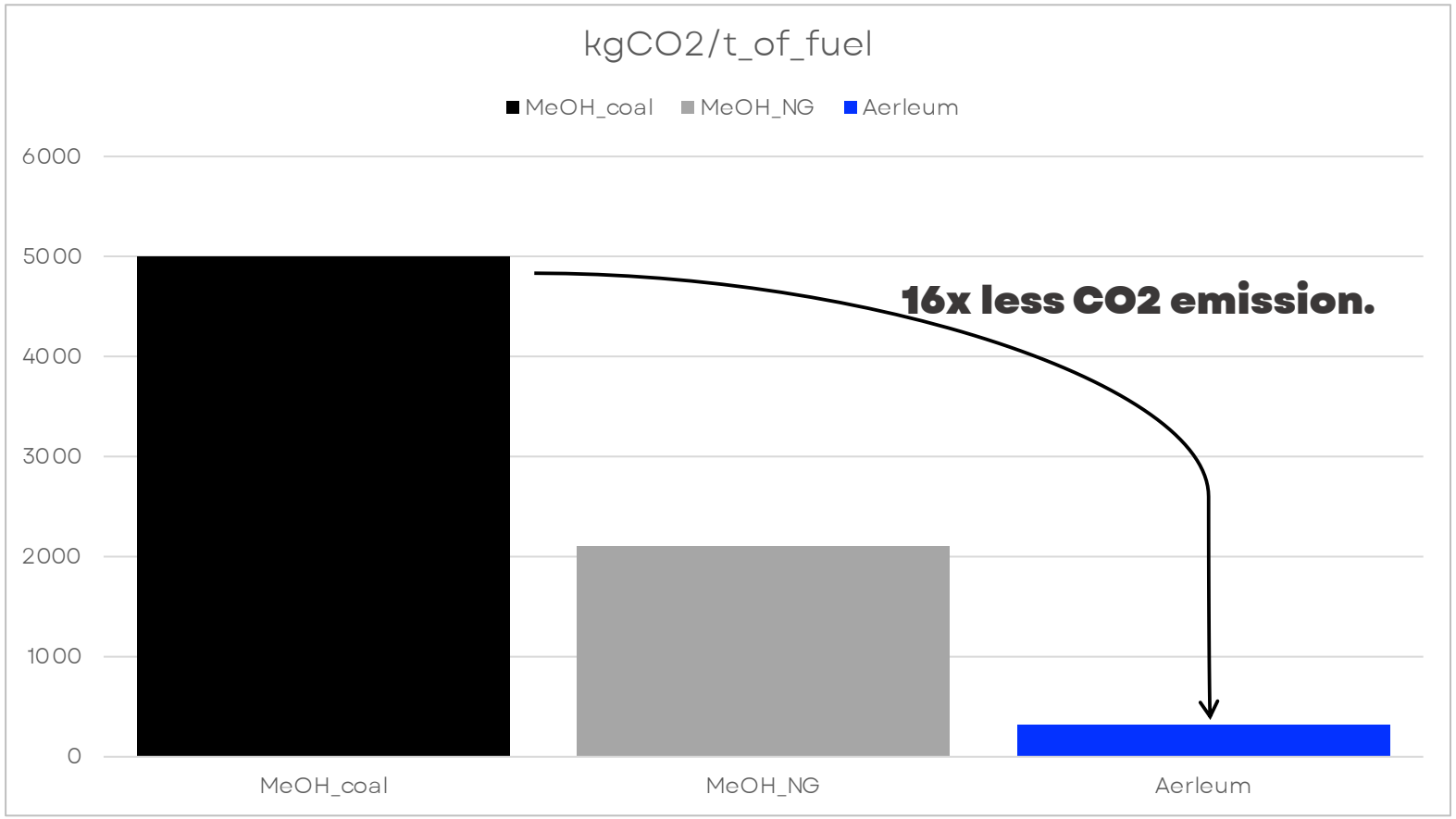
3 Our Technology Enables The Fastest Path To Competitiveness Against Fossil Methanol, Without Compromise On Scale.



Cost parity, that's what we target.



4 A Best-in-class Process To Engage Fast Decarbonization: Aerleum Emits 16x Less Than Methanol From Coal.



% of Methanol 2022 supply

35% From coal

65% From Natural Gas

If green MeOH replaces diesel in marine industry.

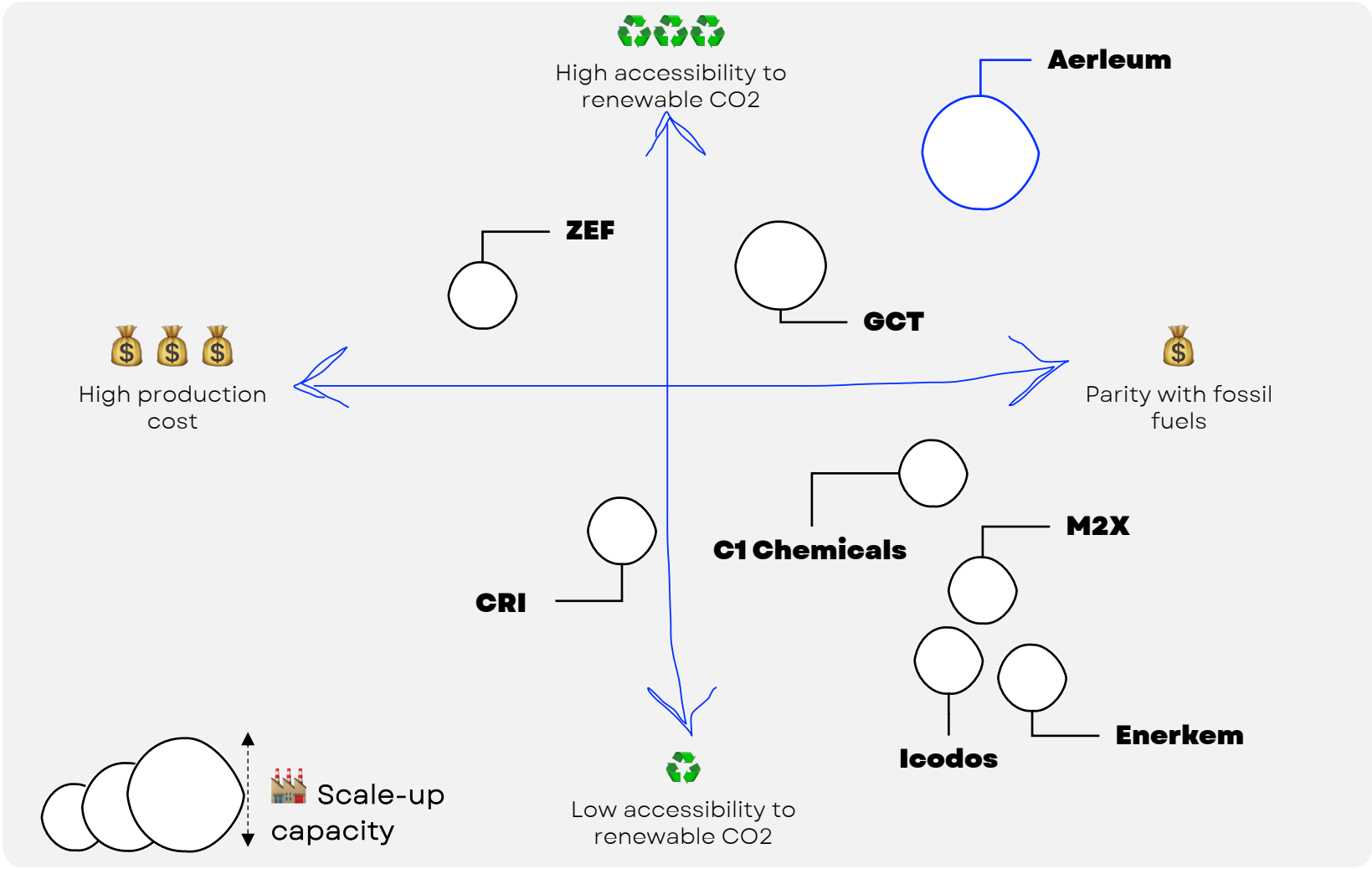
-84%
Reduction of GHG[1]

-99%
Reduction of SOX emitted[2]

-60%
Reduction of NOX emitted[2]

[1]Adjusted for heating value; [2]Wartsila: Methanol in Shipping report (2023).

It's All About Accessing To An Unlimited And Independent Source Of Renewable CO2 And Slashing Costs.



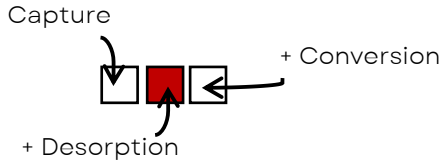
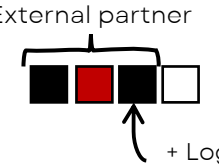
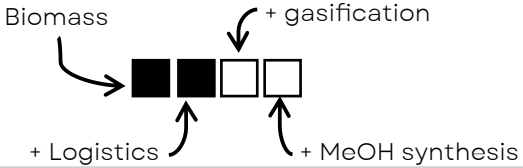
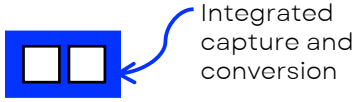
We have a unique stance to lead the way.

- **Bio-based comps** are price competitive but are limited by feedstock.
- **Non-integrated e-fuels players** are facing energy penalties and competitive access to renewable CO2.
- **Integrated players** master independent CO2 access but lack of price competitiveness due to highly energetic process.

1 Aerleum direct competitors. Deep dive next slide.

Deep dive

We Are Outcompeting Our Direct Competitors. We Make No Compromise On Price, Scale, And Time.

	Pathway	Process	Feedstock	Cost	Supply
ZEF	Electro-chemistry		Proprietary DAC (Solvent)	$$$ $	High Low
GCT Greenlyte Carbon Technologies	Electro-chemistry		Proprietary DAC (Solvent)	$$$ $	High Low
CIRCULAR CARBON CHEMISTRY	Thermo-catalysis		External	$$$ $	High Low
Enerkem	Bio-based		Biomass, MSW, waster wood, etc.	$$$ $	High Low
AERLEUM	Thermo-catalysis		Proprietary DAC (RS/Sorbent)	$$$ $	High Low

1 Numbers Speak Louder: Aerleum Streamlines Energy Efficiency

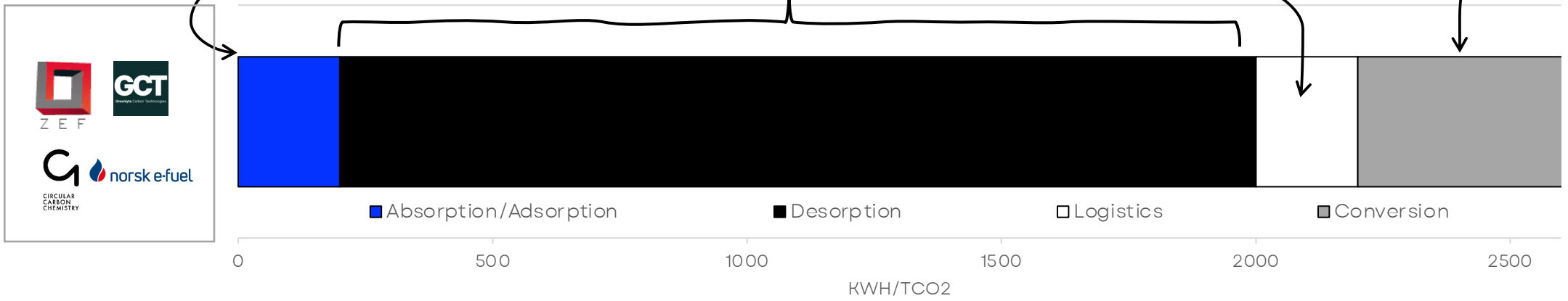
Deep dive

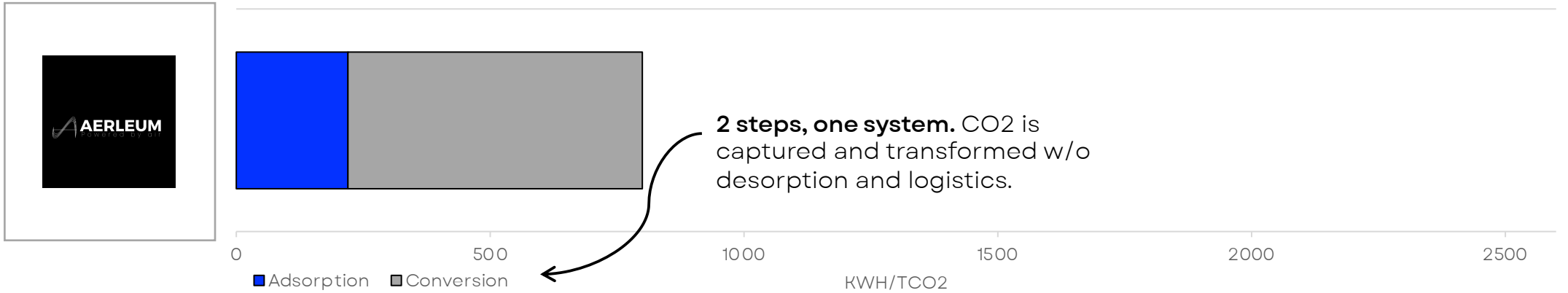
STEP 1 – Energy required to **capture CO2 from the air.**

STEP 2 – Energy used to release CO2 out of material.[1]

STEP 3 – Compression and transport.

STEP 4 - Additionally, CO2 is converted.



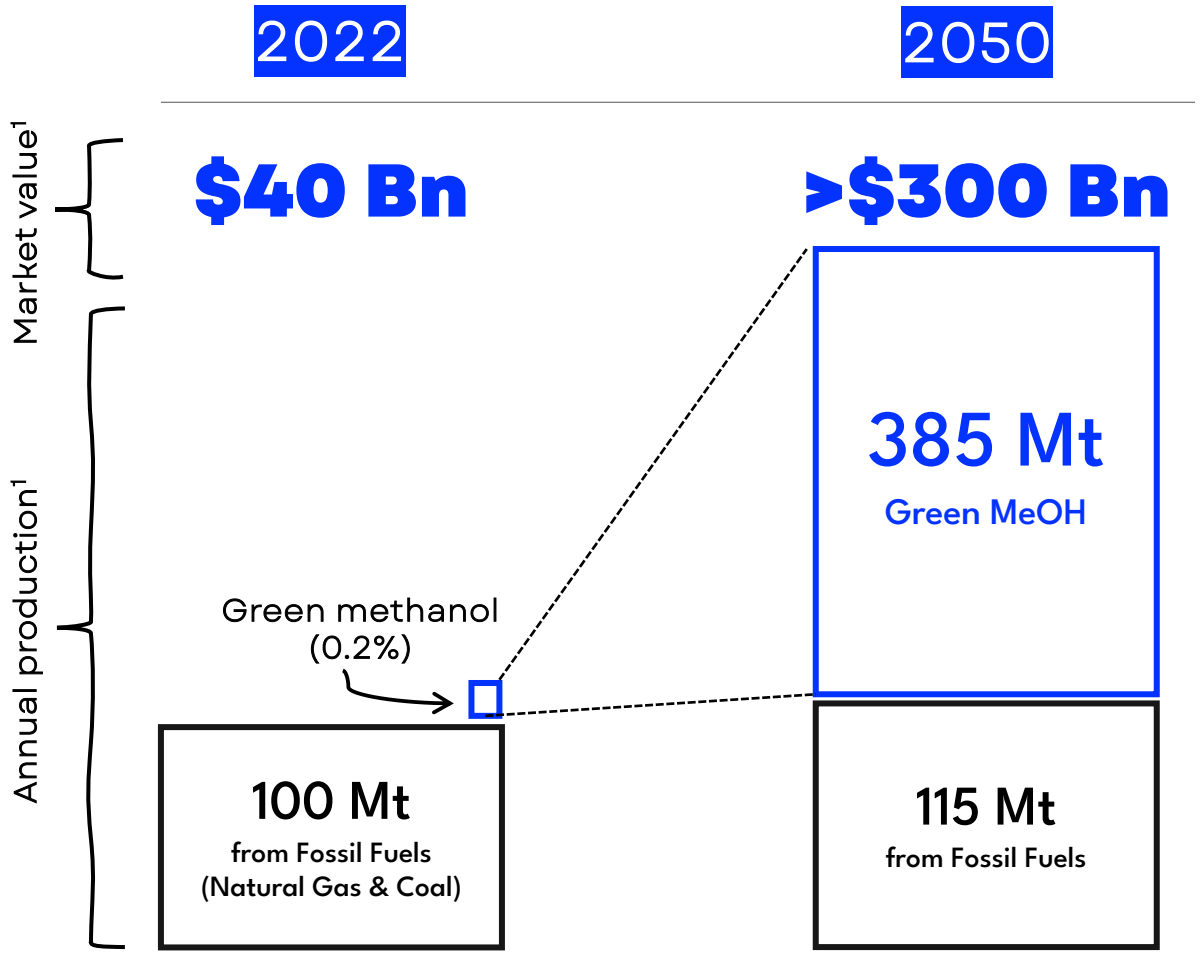


2 steps, one system. CO2 is captured and transformed w/o desorption and logistics.

[1]This is what an EV need to drive 6000 miles.

The Energy To Produce H2 Is Shared Across The Industry; Other Energy Penalties Along The Value Chain Needs To Be Removed.

Green Methanol Gains Momentum in Heavy Industries' Decarbonization Strategy, Fueling Market Growth.



An alternative fuel and building block for the chemical industry.

From plastics, to paints, electronics, solvents, textile and cars, methanol is present **across many industries.**

Highly versatile, known for its: **high energy content, clean burning properties, and existing supply chain**.

Heavy industries are interested by its decarbonizing potential (**fuel replacement / blending**) and ease of integration.

[1]IRENA: Innovation Outlook Renewable Methanol (2021) / D. Saygin & D. Gielen: Zero-Emission Pathway for Global Chemical and Petrochemical Sector (2021).

Green Methanol Is Paving The Way For Decarbonization In Three Critical Industries.

Target Markets	CO2 Emissions	Fuel Demand	Market Value	2030 Goals	Methanol readiness
Shipping	3% of GHG	330 Mt Fossil fuel	> $200 Bn	15% of low-carbon fuel	• Fossil-methanol replacement, and new build. • Strong regulation. • Price premium acceptance.
Chemical	2.5% of GHG	215 Mtoe Fossil fuel	> $700 Bn[2]	4% of low-carbon fuel	$$$ • Widely used as feedstock. • Price elasticity very low. • Green MeOH costs need to drop.
SAF	2% of GHG	>250 Mt Fossil fuel	> $225 Bn	10% of low-carbon fuel	• Methanol to SAF pathway. • High premium with SAF off-take up to 4500 $/T. • Lack of regulatory framework.

Aerleum go-to-market: in discussion with 3 leaders of the marine industry, representing 800 ships in total.

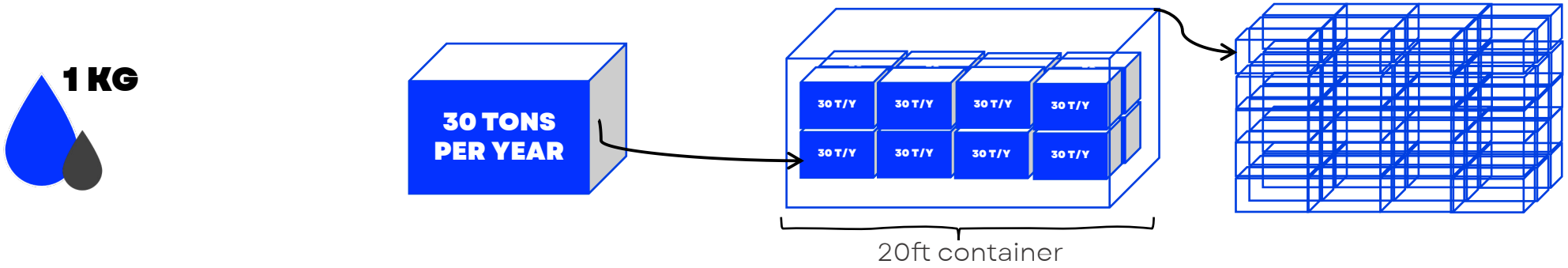
Fossil methanol is the 2nd largest contributor in chemical industry.

Regulation

[1]IEA Energy System: International Shipping, Chemicals, Aviation. [2]ResearchandMarkets: Global Specialty Chemicals Market (2023).

A Not-so-distant Future, We Have The Fastest Pathway To Reach Industrial Scale.

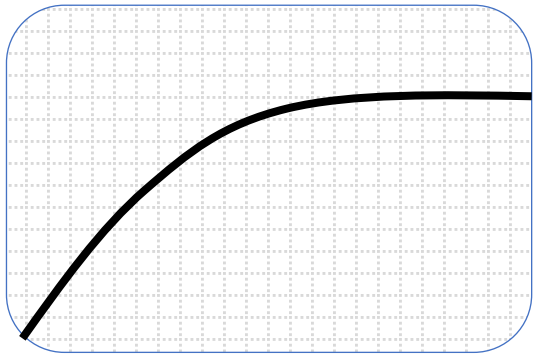
POC 🧪	PILOT ⚙️	DEMO 🎛️	FOAK 🏭
APR 2023-DEC 2023	JAN 2024-DEC 2025	JAN 2026-JUL 2027	AUG 2027-AUG 2029



Lab scale unit	1 cubic meter cell	10 containers = 4800 T/Y	625 containers = 300 KT/Y
We have validated the science; we have set the ground to build our pilot unit.	We have validated the cell for industrialization and engage into pre-off-take agreement.	We have built 10 containers with 16 cells each: heading towards mass industrialization.	We have built the FOAK plant and supplied 300 Kt/y of green methanol at 800$/T.

Technical Proof-of-concept Successfully Validated.

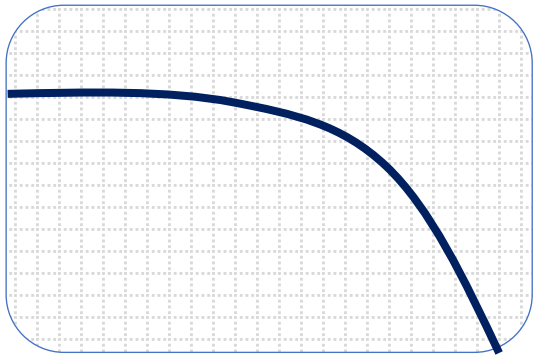
CO2 Adsorption



Confidential data, not representative

1. Adsorption confirmed (CO2 uptake)
2. High micro porosity
3. High surface area

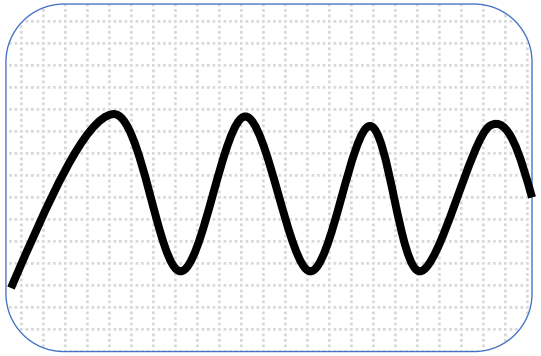
Methanol Production



Confidential data, not representative

4. Conversion rate on track w/ 70% conversion in one-path.

Precision Heating



Confidential data, not representative

5. Reached desired T ° in < 1 min.

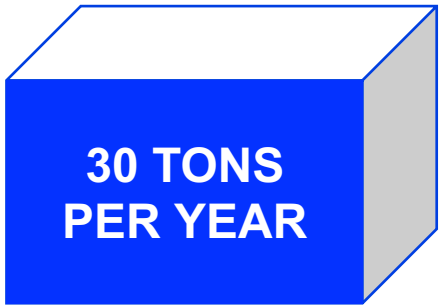
1 Integrated capture and conversion

2 Precision heating

We Are Technically Ready, And The Market Is Waiting. It's Time To Build Our First Pilot.

PILOT

JAN 2024-DEC 2025



1 cubic meter cell

We have validated the cell for industrialization and engage into pre-off-take agreement.

Key goals

Technical

Enhance performances:

- CO2 Uptake in DAC Conditions ($mol_{CO2}/kg_{sorbent}$)
- MeOH production rate ($g_{MeOH}/min/kg_{catalyst}$)

Industrial

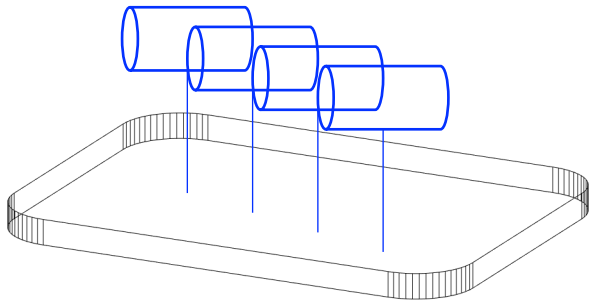
- Design-freeze of the modular unit; ready for industrialization.
- Sitting validated.
- Having secured suppliers and partners for scale-up.

Commercial

Sign 1 or 2 off-take agreement for green methanol.

Three Innovative Platforms Ensuring A Seamless Milestone Achievement.

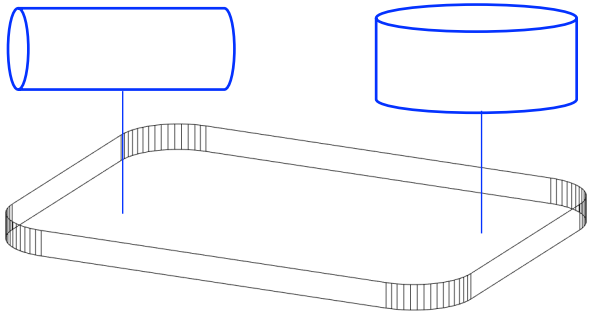
Materials



Screening platform
+ Reactive Sorbent R&D
+ Catalysts discovery
+ Sorbents discovery

3-5x reactor set-up for RS discovery; continuously testing materials and selecting top performers.

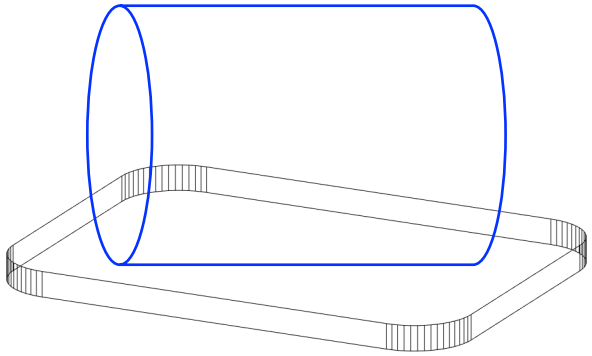
Reactor



Reactor design and scale-up
+ Size and shape R&D
+ Performances and conditions

3 different reactor designs and a thousand of configurations that will be simulated and tested on this platform.

End-to-end process



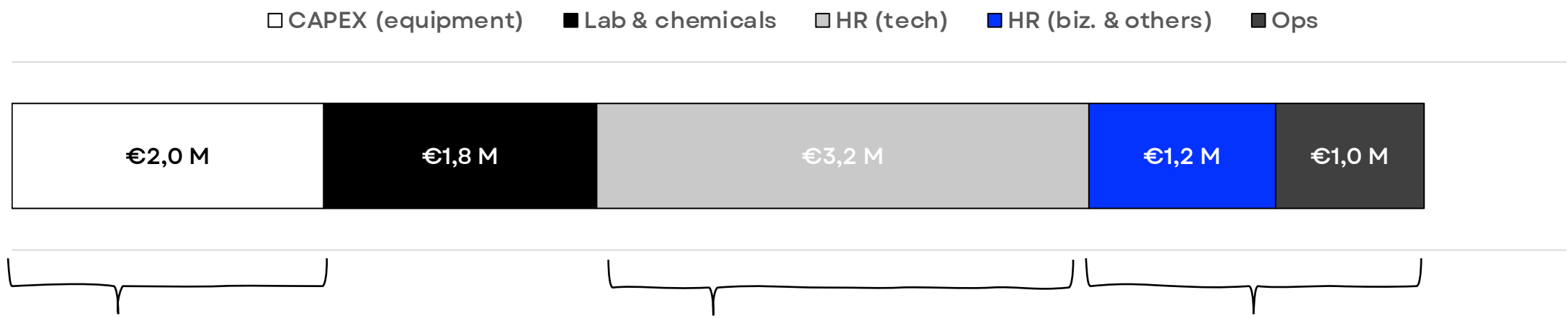
Scale 1:1
+ Target of 1 m3
+ Including peripherical equipment

Thousands of configurations will be simulated and tested on this platform to find optimal operating conditions.

The Required Fuel To Build Aerleum's Pilot Unit In 24 Months. We Are Raising €5 M.

Use Of Proceeds

January 2024 – December 2025.
€8 M total raise across dilutive and non-dilutive.



Discovery platform.
Scale 1 prototype.
Scale 2 prototype.
Scale 3 demo unit.

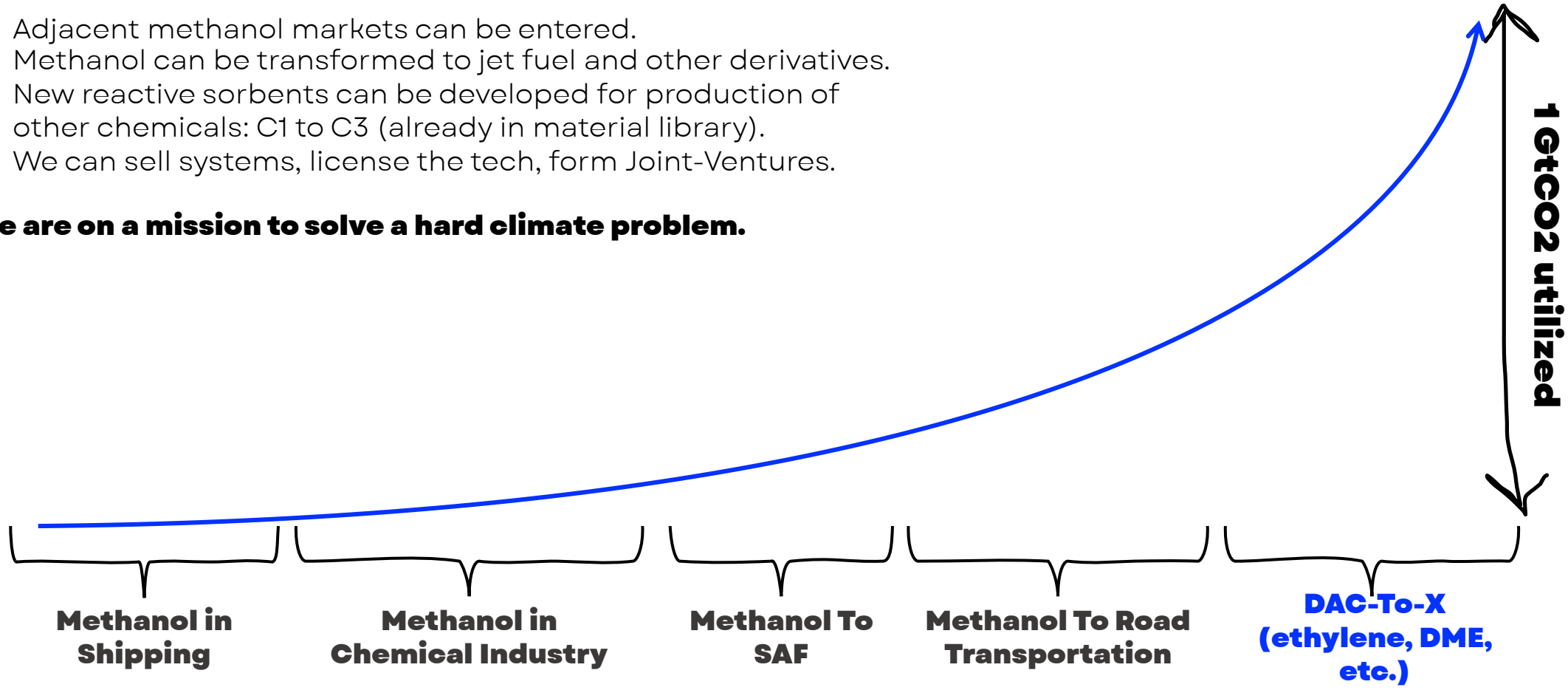
<u>18x FTE.</u>
6x FTE for Reactive Sorbent Screening.
1x FTE for Precision Heating.
1x FTE for Process (Simulation).
8x FTE for Process Scale-Up.
2x FTE Technicians.

3 Senior Hires: COO, Biz. Dev, Regulatory/Legal.
Option for Head of Industrialization.

This Is Just The Start. We Aim To Transform 1 GtCO2 To Essential Products.

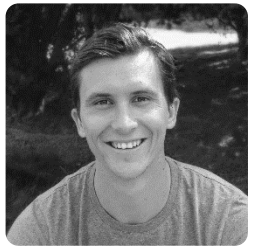
- Adjacent methanol markets can be entered.
- Methanol can be transformed to jet fuel and other derivatives.
- New reactive sorbents can be developed for production of other chemicals: C1 to C3 (already in material library).
- We can sell systems, license the tech, form Joint-Ventures.

We are on a mission to solve a hard climate problem.



We Are Climate Warriors.

Two Co-founders.



Sébastien Fiedorow / CEO
5 years of XP in climate tech VC @ Bpifrance. Invested in 10+ companies (RE, H2, CCU, Maritime), exited 2. Graduated from Columbia BS, and Skema in Corp. Finance.

Steven Bardey / CTO
Holds a PhD in CO2 photo-catalysis (IFPEN x ICPEES), and a Master in Material Science from Strasbourg University. Expert in CO2 catalysis and novel process.

A group of seasoned advisors.

Christophe Coperet
CO2 Catalysis
ETH Zürich

Cuong Pham Huu
Prec. Heating
cnrs BLACKLEAF

Mijndert V. der Spek
Reactor/DAC
HERIOT WATT UNIVERSITY

Burçin T. Mckenna
FOAK/Business
RAMBOLL TOPSOE

Key talents.

Matteo Pietracinni
PhD, Process Engineer

Eva Rubin
Material Scientist

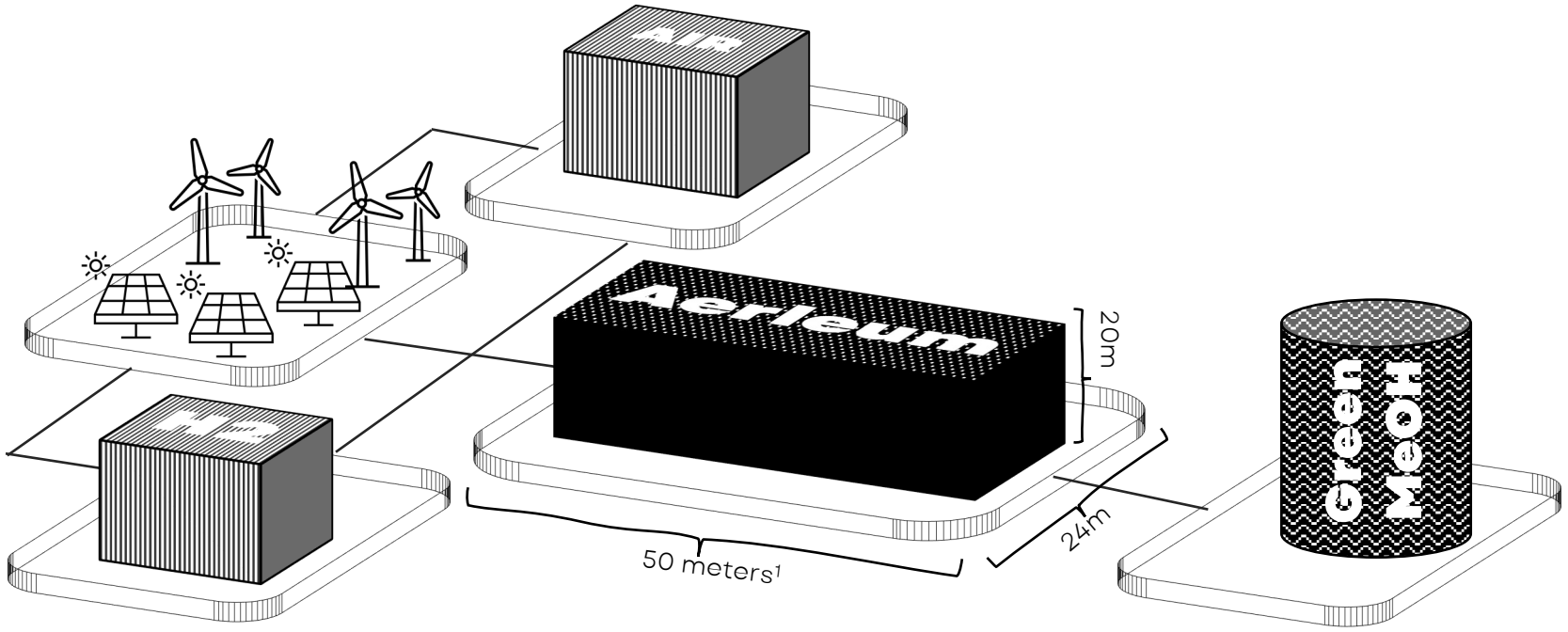
2x Material Scientist
1x Process Engineer

Hired / Joining Q1-24

Backed by top partners.

marble bpifrance SEMIA Air Liquide

After The Demo Unit, We Are Set To Launch With A 300.000 Tons Per Year FOAK Plant.



The numbers behind a FOAK plant.

- Build 20 cells/day for 2 years.
- Secure 0.8 GW of electrolyzer capacity.
- Capture over 0.4 Mt of CO2 per year.
- Power 10 cargo vessels of 15.000 TEU capacity for a full year of operation.
- $ 240.000.000 revenues per year at 800 $/t methanol.

[1]Excluding piping and surrounding equipment.

This is where we start.

Aerleum

DAC-TO-METHANOL

Petroleum

This is our vision.