Zefira decarbonization solution

Pioneering the Future of Energy & Circular Economy

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About Our Company

Who are we?

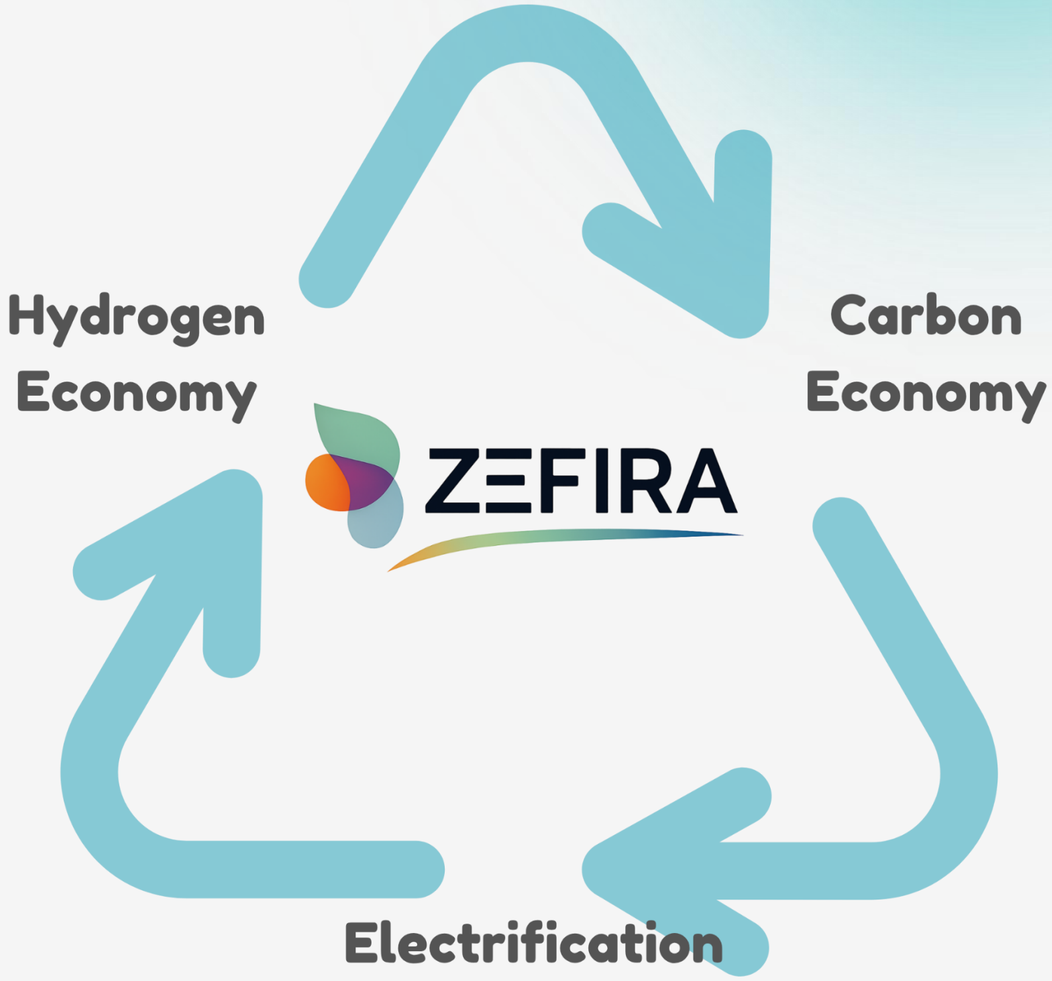
ZEFIRA B.V. is a cleantech company created in 2025 and based in Eindhoven, building on over 15 years of pioneering R&D conducted at TU/Eindhoven (NL)

Ambition

We combine advanced technologies to build the next generation of compact, efficient, and modular systems for CO_2 valorization.

Why it matters?

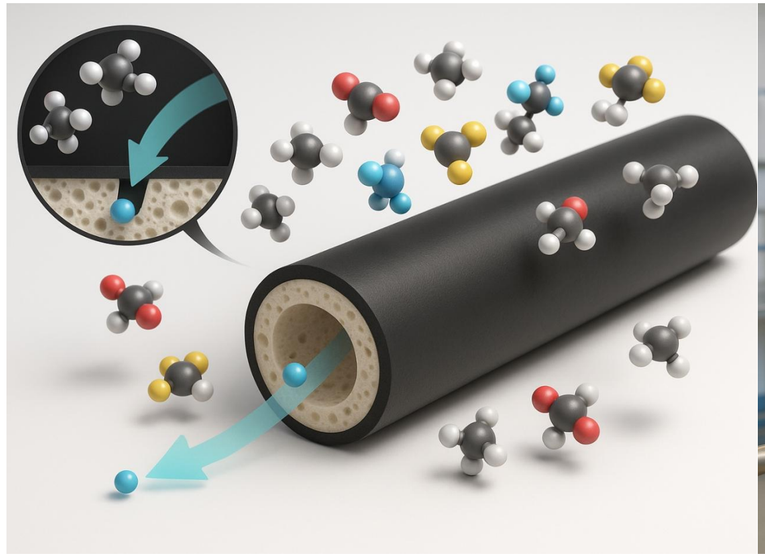
Our solutions target the hardest-to-abate sectors e.g shipping, aviation, and heavy industry, where scalable, sustainable fuels are urgently needed.



ZEFIRA

Our product

Capturing CO_2. Recovering hydrogen. Producing circular fuels.



THREE MEMBRANE PRODUCT FAMILIES

- Dedicated to renewable gas recovery and membrane reactor (e/bio molecules) applications
- Patented technology
- TRL 6-7 at system level

EXTREME CHEMICAL STABILITY

- Tolerates pH of 0 to 14, sulfur tolerant
- Temperature range of -20°C to 700°C
- Wide pressure range, from ultra vacuum to 120 bar

TUNABLE PROPERTIES

- Pore size distribution
- Hydrophobicity / hydrophylicity

SUSTAINABLE WITH LOWER COST

- No critical raw material needed
- Easy to recycle

WIDE RANGE OF APPLICATIONS

- Tested for more than 22 applications related to the Hydrogen and carbon economy

Bio & e-methanol plant challenges

ZEFIRA's Membrane Pathway

CO2 capture and gas recycle

- CO_2 capture units are sensitive to water, sulfur, and organics, requiring heavy gas cleaning.
- High impurity load leads to large, energy-intensive pretreatment.
- Valuable CO_2/H_2 purge gases are flared or vented, wasting carbon and energy.

Result: High treatment cost and loss of recoverable feedstock.

Process Scale & Equipment Limits

- Conventional methanol plants rely on large compressors and distillation units for up to 10 000 t/day throughput.
- Small bio/e-methanol plants lose this economy of scale.

Result: CAPEX per tonne skyrockets when plants are downsized.

Operational Flexibility & Dynamics

- Pressure-driven synthesis loops are constrained by compressor turndown limits, restricting operation below 50% load.
- Variable H_2/CO_2 supply from renewables causes off-spec operation and excess recycle.

Result: Low load-following capability, poor energy efficiency, and frequent downtime under intermittent conditions.

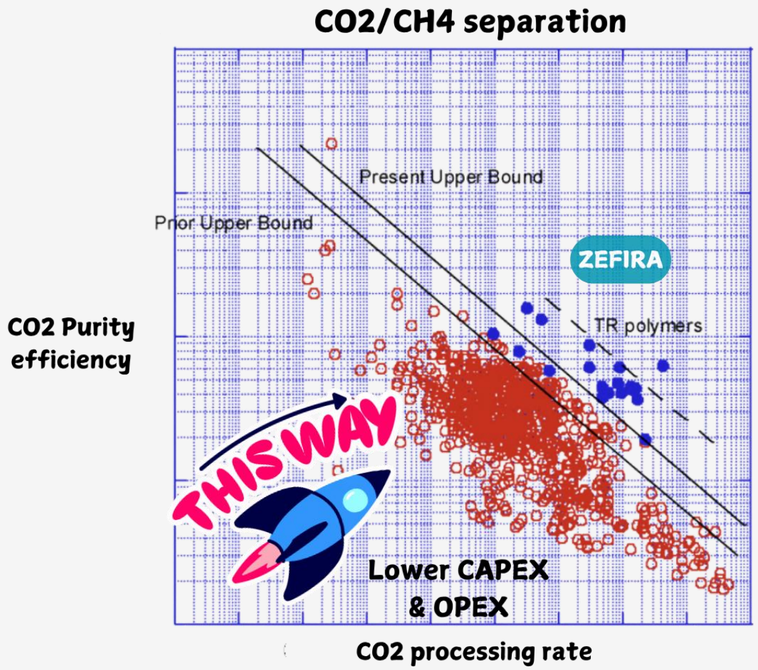
ZEFIRA : Closing the Carbon & Hydrogen Loops

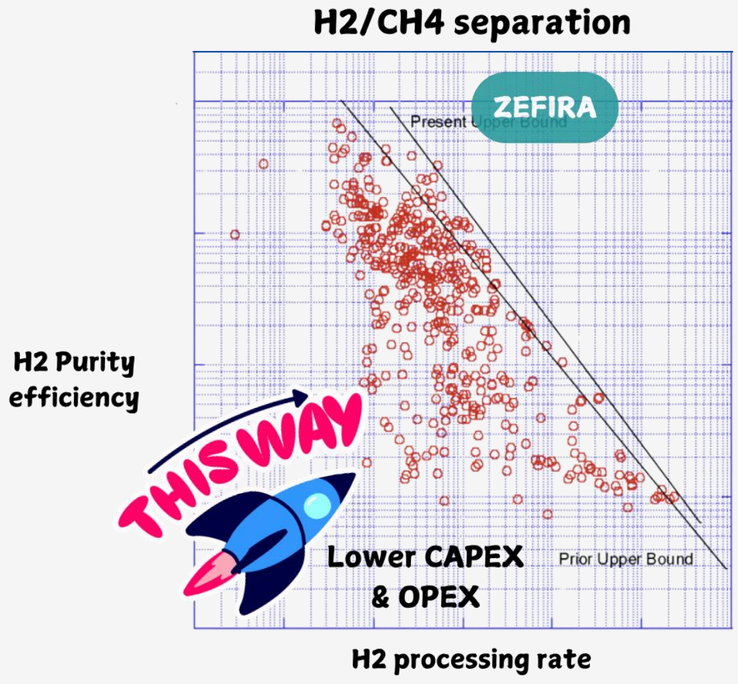
CO2 capture membrane

- Stable under real-gas conditions — humidity, sulfur, organics.
- High CO_2 flux and selectivity beyond polymer limits.
- Enables compact, low-energy capture from biogas or process exhausts.
  Result: Ready CO_2 feed for e-fuel synthesis with minimal pretreatment.

H2 recovery membrane

- ZEFIRA`s H_2-selective membranes deliver high permeance, superior selectivity, and resistance
- Recover H_2 from methanol, ammonia, or FT loops, and from external industrial purges.
  Result: reduced recycle compression, lower energy use, and near-zero H_2 loss — turning waste gas into feedstock.





ZEFIRA unique defossilized fuel technology

A Technology enhancing Process Efficiency & Yield

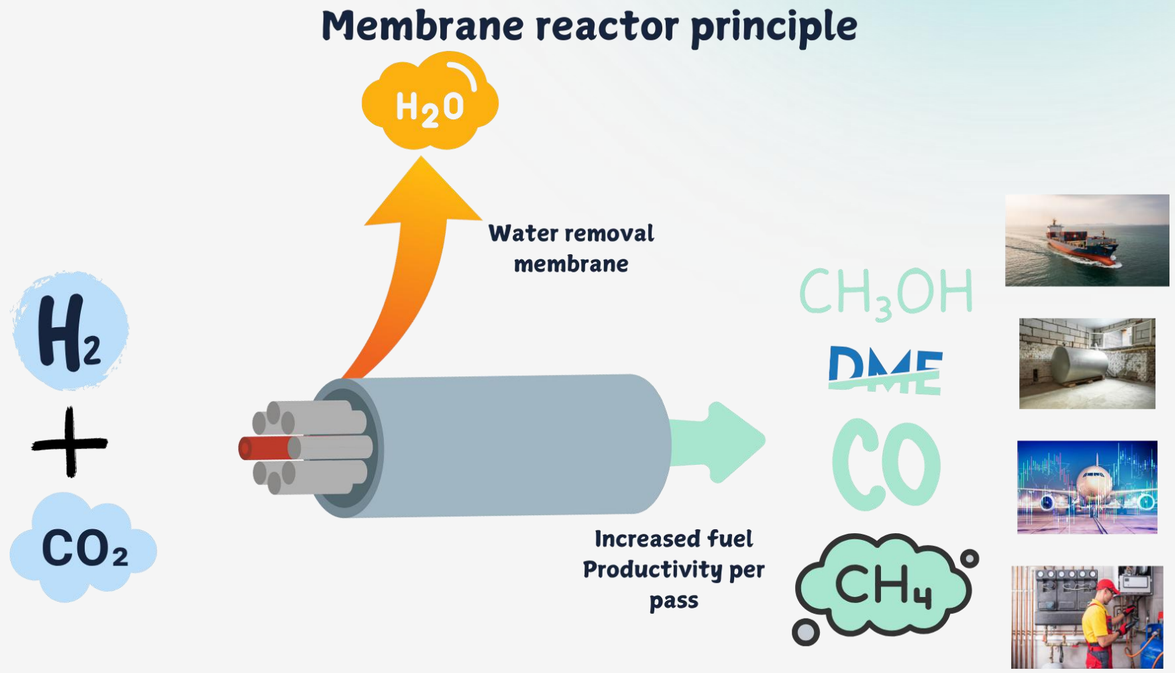
- Continuous removal of efficiency limiting side product shifts reaction equilibrium toward higher conversion.

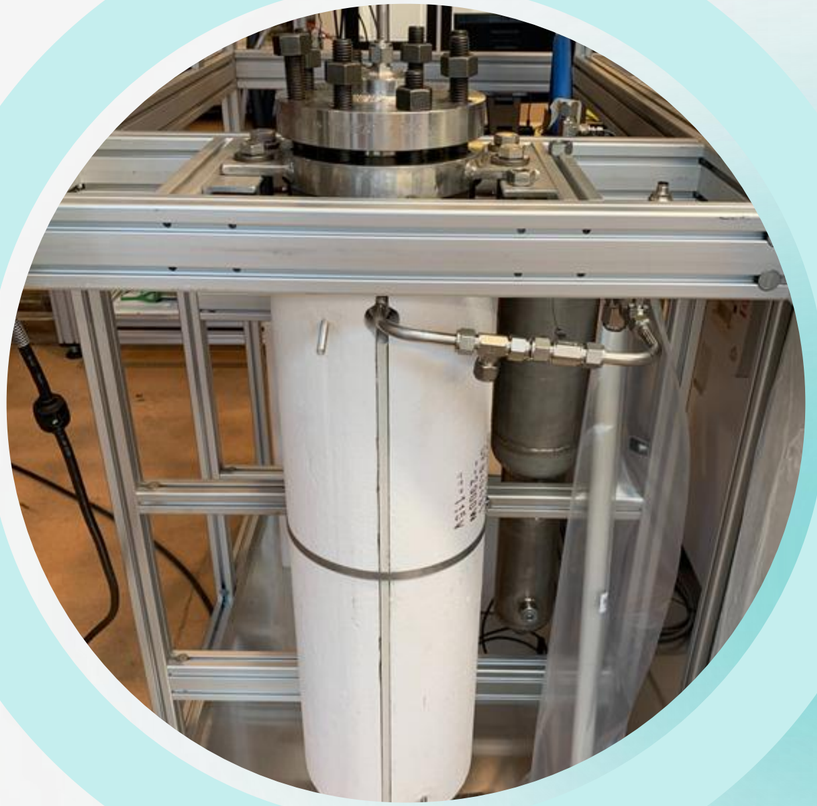
Lower Operating Pressure & Reduced Gas Recycle

- Methanol synthesis at pressure between 25 and 40 bar (electrolyzer pressure) instead of conventional high pressure synthesis loop (80-100 bar)
- Dimethylether synthesis in one unique step
- Minimizes energy consumption and CAPEX, simplifies process control.
- Compact design reduces the need for large separation units.
- Reduces equipment size leading to lower Total capital investment and operational costs

High Turn-Down Ratio & Dynamic Operation

- Enables flexible operation, adapting to variable energy inputs (e.g., from renewable sources).
- Reduces reliance on oversized hydrogen storage and electrolyzers power E-fuel synthesis project.





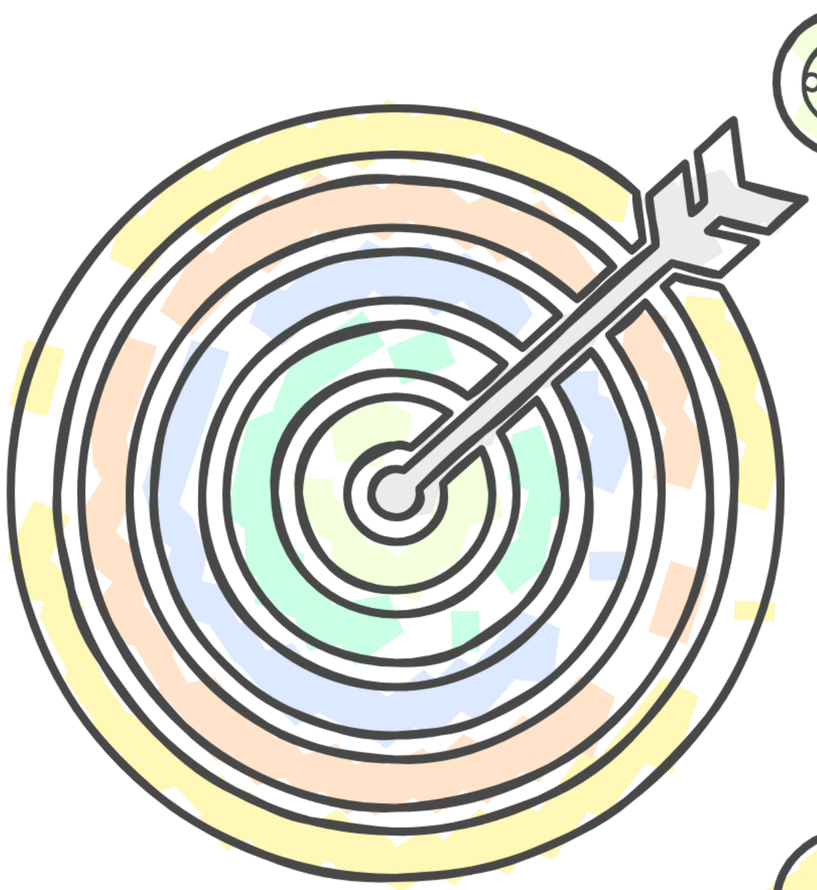
Ammonia cracking

(TRL6)

Methanol and DME production

(TRL6-7)

What we are looking for



ZEFIRA

Core technology and innovation

Strategic Partnerships

Collaboration for technology development

Pilot Projects

Testing ZEFIRA in industric settings

Technical & Commercial Feedback

Insights for scalability and deployment

Funding / Co-Investment

Financial support for growth

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Rethinking CO_2 valorisation