



COPERNIC

COPERNIC CATALYSTS

A Drop-in HB Catalyst to Reduce Synloop OpEx by up to 47%

AEA Annual Conference: Startup Showcase

November 13th, 2024

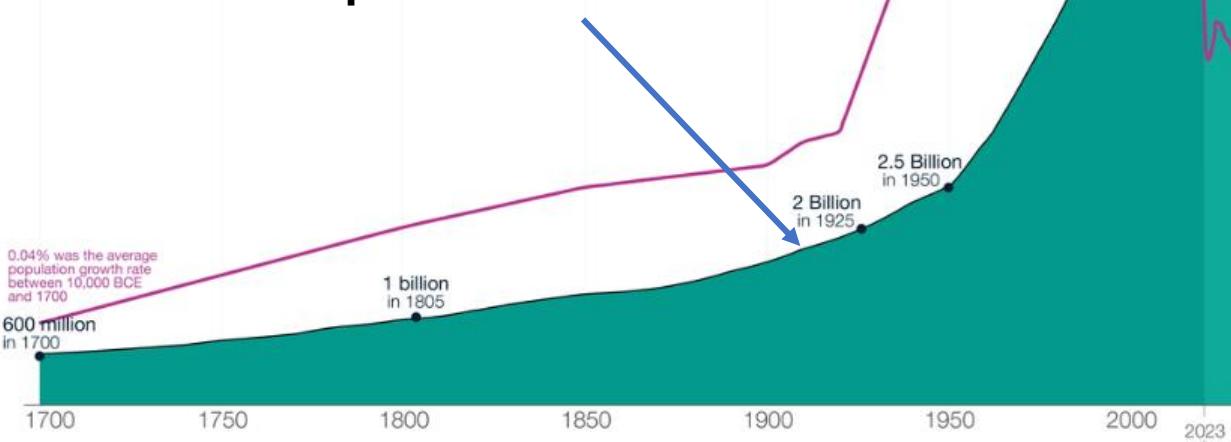
The first ammonia revolution: Agriculture

The most impactful discovery of the 20th century

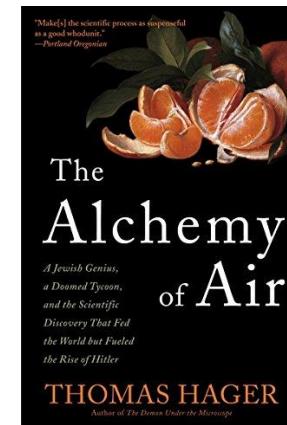
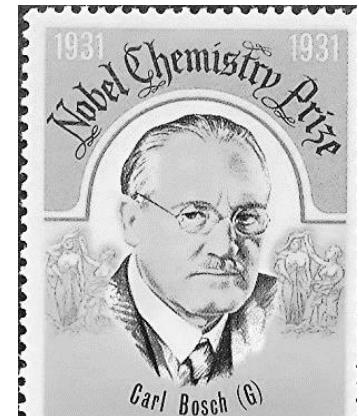
World population growth, 1700-2100

Annual growth rate of the world population
World population

1910: First commercial ammonia process invented



Data sources: Our World in Data based on HYDE, UN, and UN Population Division [2022 Revision]
This is a visualization from OurWorldInData.org, where you find data and research on how the world is changing.



The catalyst behind the first ammonia revolution



In 1909, a team working under Carl Bosch at BASF performed **20,000 experiments** to develop an ammonia catalyst based on iron oxide.

This century-old material is more-or-less the same catalyst that is used today because it is **made of an abundant metal (iron), is proven, and performs well enough.**



Why we need better



AGRICULTURE | CHEMICALS

Ammonia made from fossil fuels causes
>1% of global CO₂ emissions (~450 Mt/yr)

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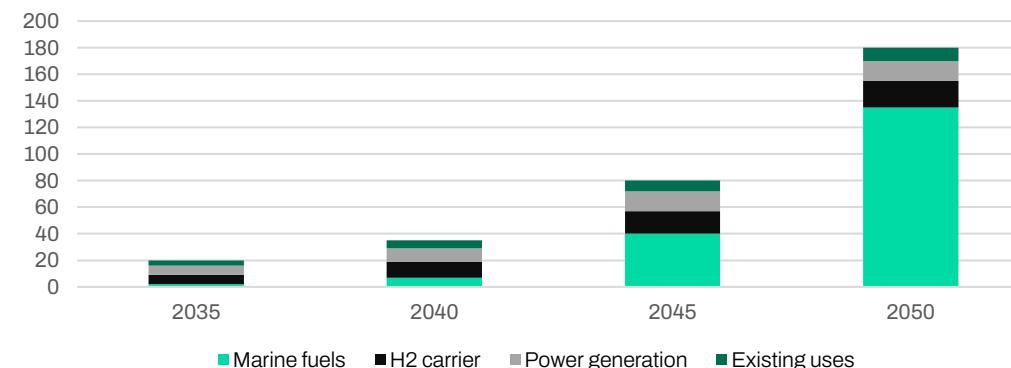
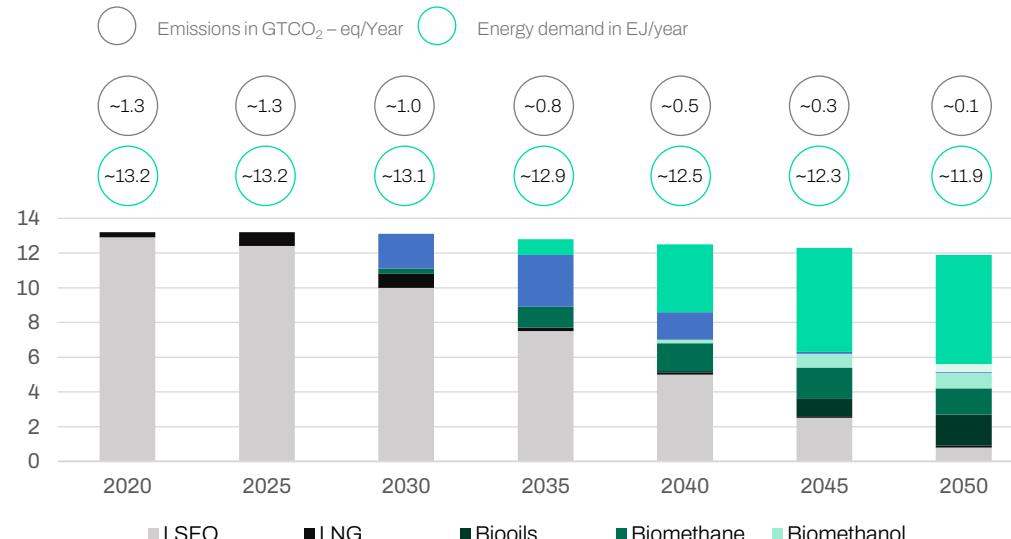


ENERGY | TRANSPORTATION

Maritime shipping causes
~3% of global CO₂ emissions (~1000 Mt/yr)



The second ammonia revolution: Energy



50%

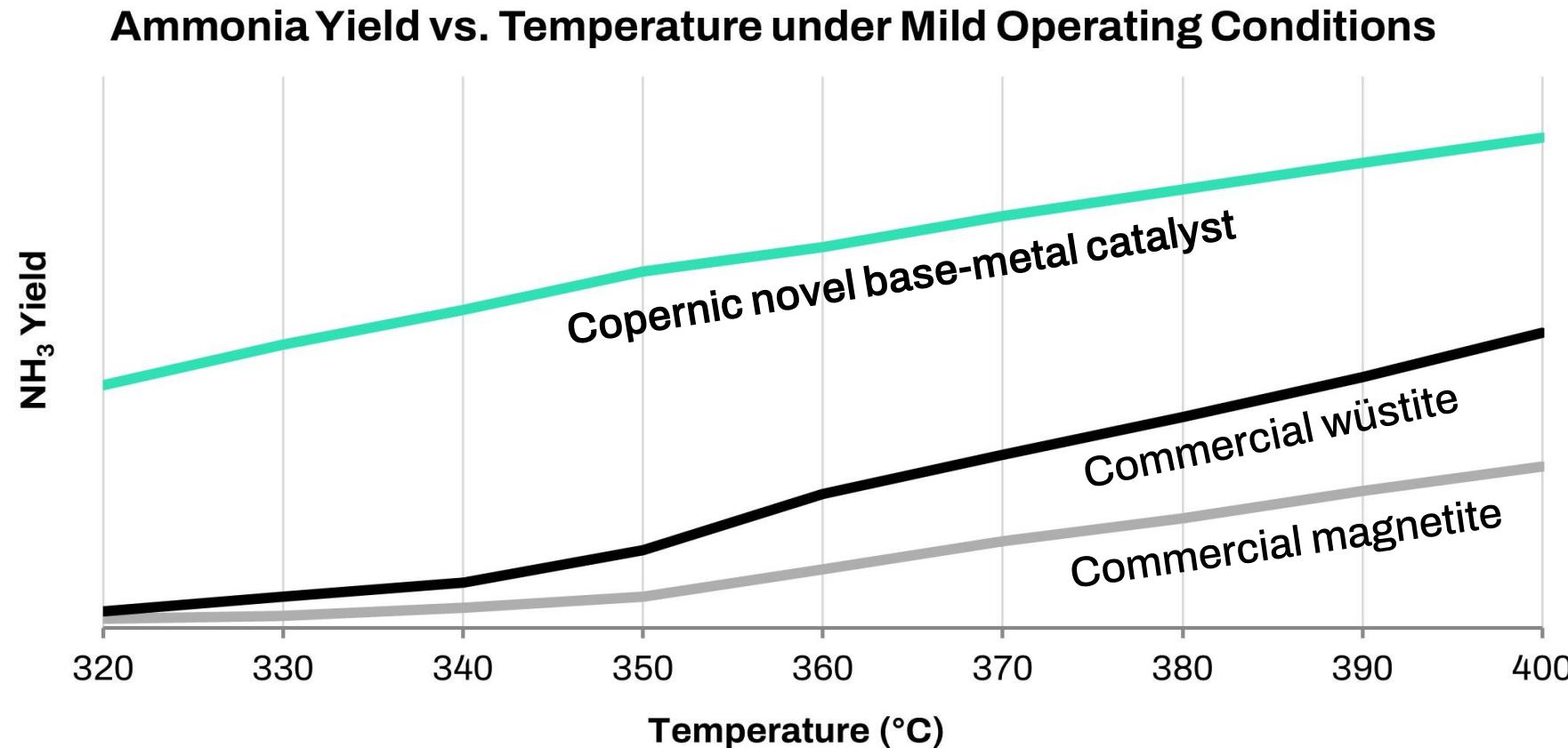
of all shipping fuel to
be zero-carbon
ammonia by 2050

x2

Requires a doubling
of the world's
ammonia production

**Low- and
zero-carbon
ammonia
must be
cheaper**

Breakthrough base-metal catalyst for all colors of ammonia production



- **Copernic's catalyst strongly outperforms the best ammonia catalysts on the market**
- **100% scalable base-metal formulation** using standard manufacturing techniques
- **Drop-in replacement** for standard Haber-Bosch ammonia catalyst

Wide range of economic benefits, depending on retrofit/greenfield scenarios

Benefits to syn. loop	Scenario 1A: Simple 'low-CapEx' retrofit to reduce OpEx	Scenario 1B: Simple 'low CapEx retrofit to reduce Opex	Scenario 2: Retrofit/greenfield to significantly increase plant throughput	Scenario 3: Retrofit/greenfield for the lowest possible OpEx
Operating T/P	350-400 °C/No change	Lower RX inlet T only/No change	350-400 °C/No change	350-400 °C/~90 bar
Plant throughput vs baseline (retrofit)	Same as base case	Same as base case	Up to 53% increase	Same as base case
Opex (CO₂) per unit NH₃	Up to 10% decrease	~0-10% decrease (not yet modeled)	Up to 10% decrease	Up to 47% decrease
Capex needed for retrofit	Small (HX only)	Very small (HX only)	Medium (HX plus feed/feed compressor upgrade if no slack)	Medium (HX plus downsize feed/recycle compressors)
Capex per unit NH₃ (greenfield)	Same as base case	Same as base case	Moderately (mid-scale) to significantly lower (large-scale)	Significantly lower
Cost per unit NH₃	Slightly lower	Slightly lower	Moderately lower	Significantly lower
Engineering feasibility	High	High	High	Moderately high



Executive team with deep industry experience



Jacob E. Grose, Ph.D.

Co-founder and CEO

- Former Investment Manager, BASF Venture Capital
- 12+ years of business experience in chemicals industry
- Technical background: Ph.D. in physics (Cornell)



Aruna Ramkrishnan, Ph.D.

Co-founder and CTO

- Held technical leadership positions at ExxonMobil and Linde
- Expertise in emissions mitigation technologies, sustainable materials and processes
- Ph.D. in Chemical Engineering (University of Minnesota)



Current non-executive board members



Mike Kearney

- Board Member and Seed Investor, Copernic
- Partner, The Engine

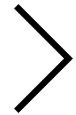
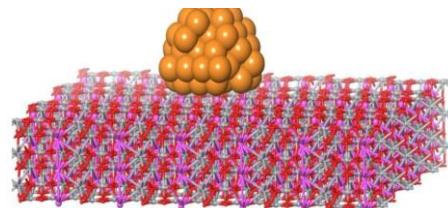


Michael LoCascio

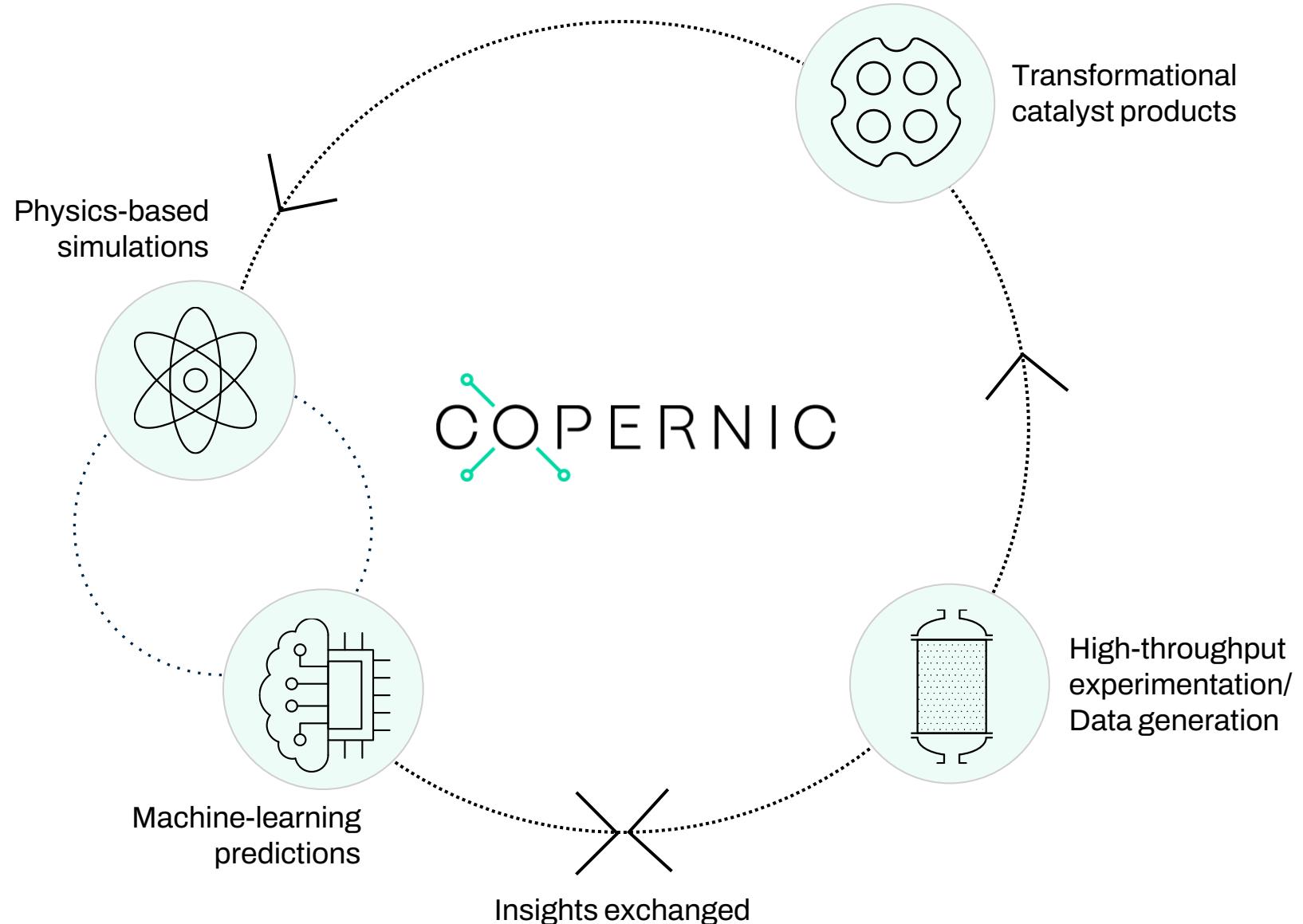
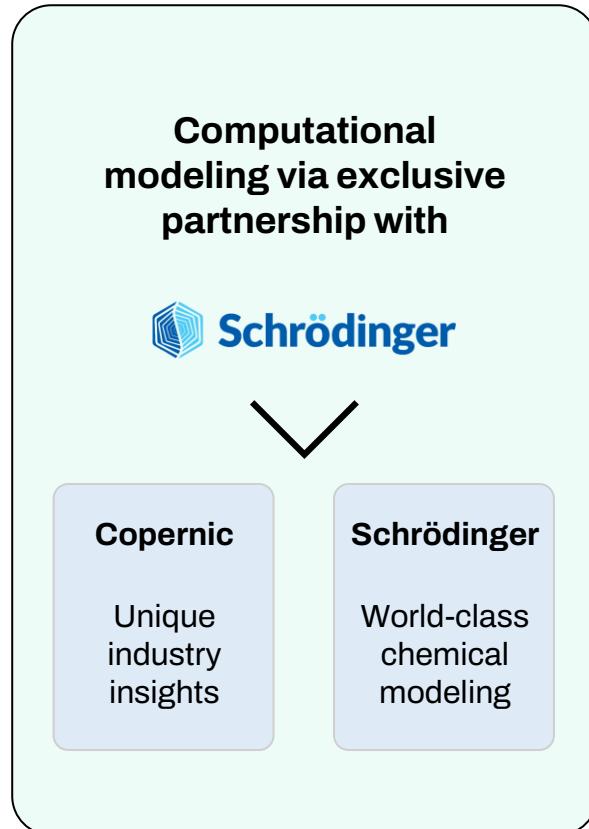
- Independent Board Member, Copernic
- Global Sustainability Strategy Leader at BASF Environmental Catalysts and Metal Solutions

Copernic platform designed for industry needs

Focus on designing drop-in, scalable catalyst solutions that solve urgent needs

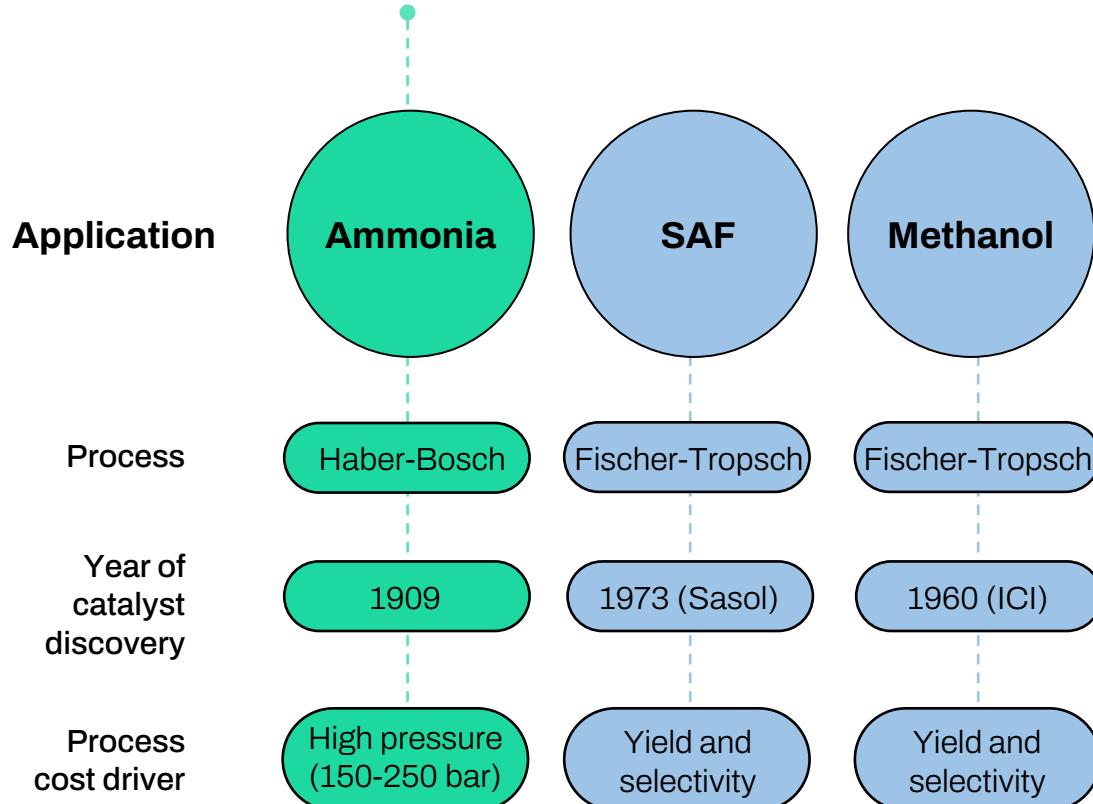


Copernic's proprietary discovery platform



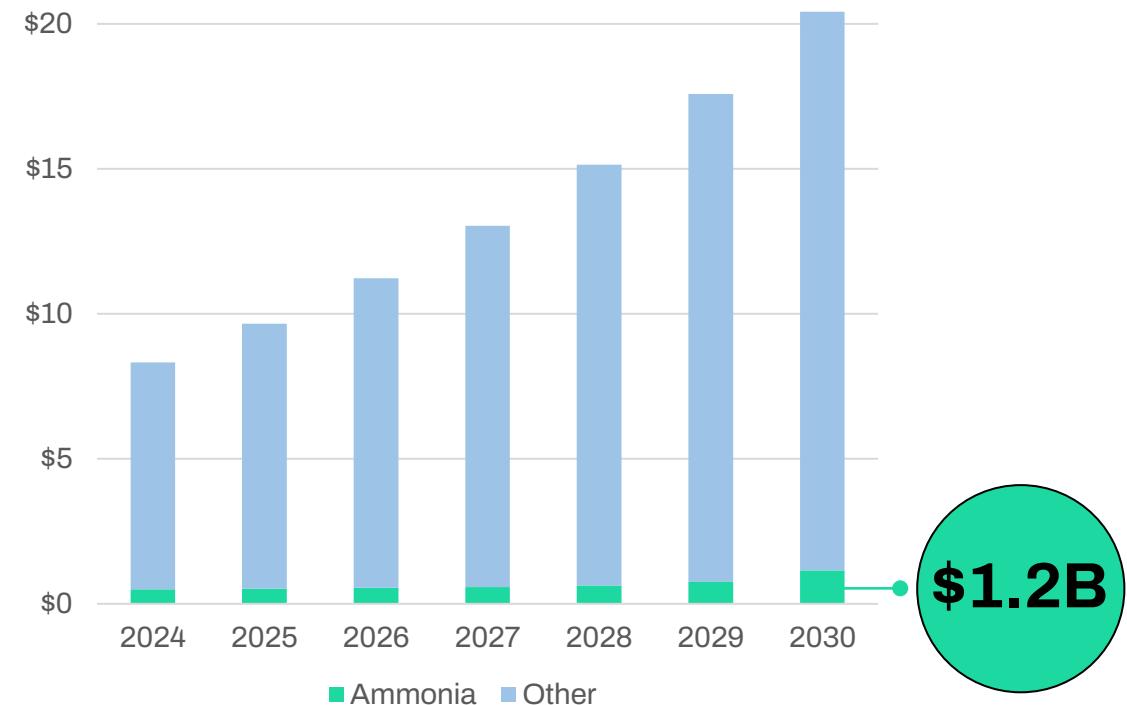
A platform company selling catalysts critical to decarbonization

Copernic's first product is a drop-in solution transforming ammonia production



Copernic's portfolio of proprietary catalysts will be the “picks and shovels” of the decarbonization rush

Target Catalyst Markets (\$B)



High-level proposal for a partnering plan

4 years

Jul '24-Dec '24

Initial discussions

Role of customer:

- Get documentation in place/agree on targets

Customer inputs:

- Team support

Success metric:

- Partnership agreements in place (LOI, NDA, MTA, Testing agreement)

Jan '25-Jun '26

Gram-scale powder testing

Role of customer:

- Gram-scale performance testing (optional)

Customer inputs:

- Fully-loaded cost of samples (\$1,000)
- Testing costs (internal)

Success metric:

- Performance meets pre-agreed technical targets

Jul '26-Dec '27

Kg-scale granule testing

Role of customer:

- Kg-scale stability testing
- Parallel testing at Copernic

Customer inputs:

- Fully-loaded cost of samples (TBD)
- Testing costs (internal)

Success metric:

- Performance/stability meet pre-agreed technical targets

Jan '28-Jun '28

Commercial/ scale-up

Role of customer:

- Testing of first catalyst in a plant

Customer inputs:

- Fulfilling terms of commercial contract

Success metric:

- Catalyst meets customer needs

unlocks

unlocks

unlocks



The logo for COPERNIC, featuring the word "COPERNIC" in a bold, black, sans-serif font. Above the letter "C", there is a white icon consisting of three small circles connected by lines, forming a triangular shape.

Jacob Grose, CEO/Co-founder
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