



Building, Owning & Operating Large Scale CO₂ Plants

CO₂ Capture, Storage & Reuse 2024

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Agenda



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Linde and growth strategy

02

CO₂ value chain & capabilities

03

Flexible business models

04

Experience into practice

A Leading Industrial Gases And Engineering Company



Over 140 Years of Technological Progress



Gases Business

World-class gases supply and operations of over 1,000 plants



- Presence where customers are and where end users' operations are growing
- Linde's industrial gases are used in countless applications
- Operating in >100 countries



Engineering Business

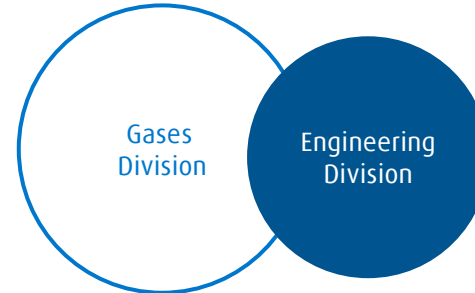
Technology-focused with more than 4,600 plants built



- Development and optimization of gases production, processing technologies
- Maximization of plant lifecycle productivity, efficiency and service life
- Proven critical project execution knowledge

Unique setup

Close to the customer with an integrated business model



2023 sales USD 33 billion

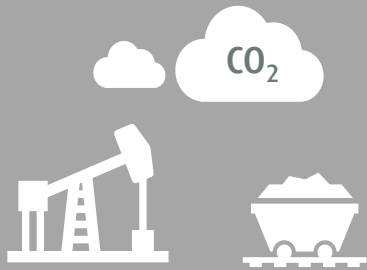
End markets includes chemicals & refining, food & beverage, electronics, healthcare, manufacturing and primary metals

Growth Strategy In The Clean Energy Market



Today's Energy Market

>80% is Fossil Fuel based
(coal, oil & natural gas)

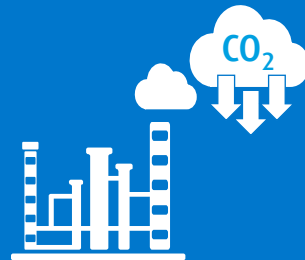


... with CO₂ footprint



Clean Energy Market

Blue Hydrogen
(incl. ammonia & methanol)



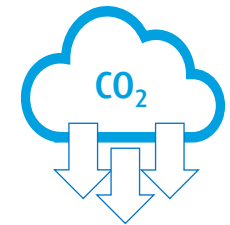
Grey H₂ production with CO₂ capture and permanent storage

Green Hydrogen
(incl. ammonia & methanol)



Water electrolysis powered by renewable energy with no CO₂ emission

Carbon Solutions



CO₂ capture from industrial processes with permanent CO₂ storage

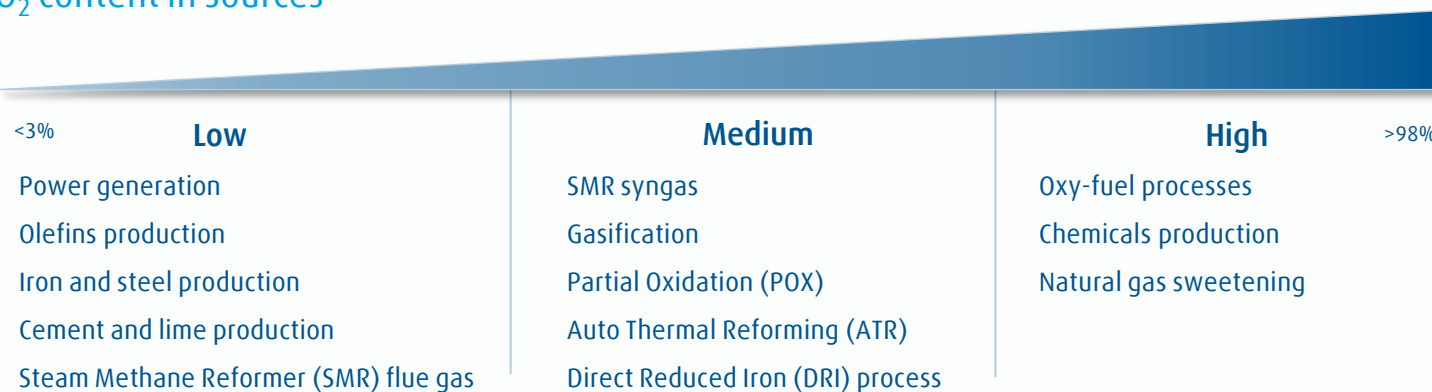


Operating More Than 150 CO₂ Plants Globally

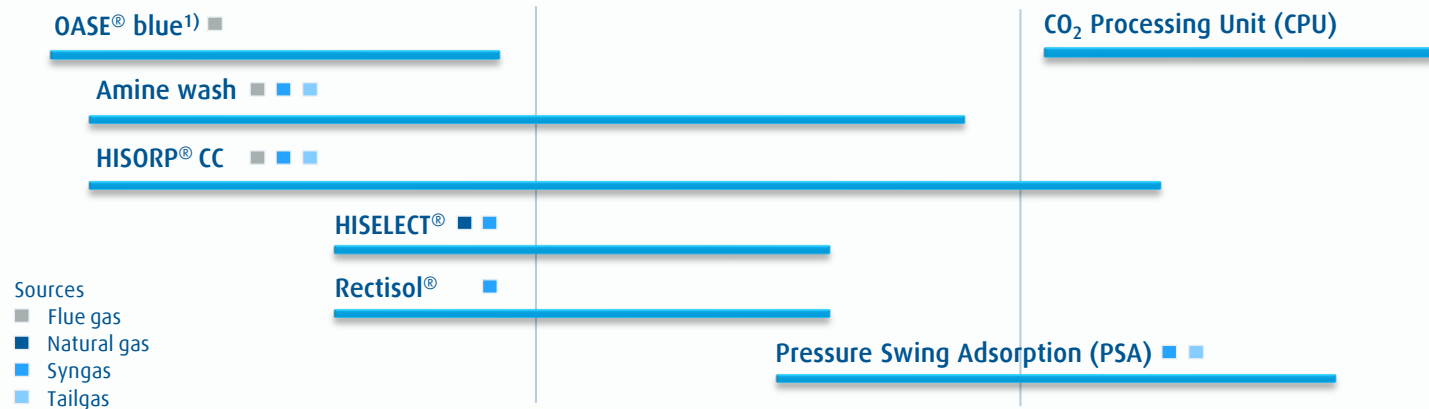
One-stop for the complete CO₂ value chain

Capture and processing

CO₂ content in sources



Linde technologies cover a broad range of CO₂ containing gas streams



Conditioning



Compression and dehydration



Liquefaction



Tank farms & loading stations

Logistics and application



Logistics and distribution



Storage (CCS)



Industrial



Synthesis



Food and beverage



Electronics

Flexible Business Models

Adapted for customer needs



- Manchester/UK -

**Build – Own – Operate
(BOO)
“as a service”**



- 100% Linde investment
- Linde responsible for cost & performance risk for technology deployment & operations
- Linde revenue from sale of molecules &/or recur. facility fee



- Lengfurt/GER -

**Joint Venture
(JV)**



- Joint customer & Linde investment
- Contract for feedstock & products with JV
- Joint technology expertise and know-how based on individual industrial background



- Sluiskil/NL -

**Sale of plant
(SOP)**



- Linde Engineering as EP/EPC solution provider (incl. feasibility and FEED)
- Proven competence in standardization & modularization
- Potential implementation of services from Linde Gas
- After sales services (e.g., remote operation and support)

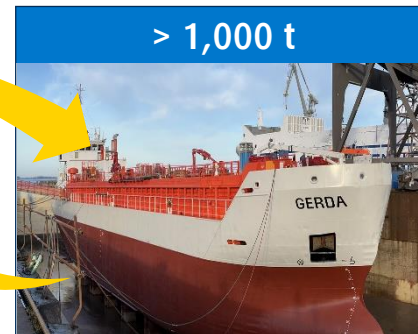
Linde CO₂ Infrastructure

Transportation and logistic



OACAP pipeline/NL

- 0,6 Mton gaseous CO₂ supply to 600 greenhouses
- 100 km transport pipeline, 250 km distribution grid
- Future connection to Porthos & Aramis CCS infrastructure



Follow GERDA:

<https://www.marinetraffic.com/en/ais/details/ships/shipid:305115/mmsi:257206000/imo:9279410/vessel:GERDA>

Lengfurt/GER

CO₂ Capture, Liquefaction & Storage

- **Customer** JV Linde Gas & Heidelberg Materials
- **Location** Lengfurt, Germany
- **Capacity** 220 TPD CO₂
- **CO₂ Source** Cement plant
- **Process** OASE[®] blue¹, purification, liquefaction and storage
- **Purity** Food grade
- **CO₂ utilization** Merchant market
- **Scope of work** EPC Turnkey plant, offtake, O&M
- **Start-up** Q3/2025

¹) BASF SE Technology

Note: For the implementation of this project, Heidelberg Materials and Linde applied for and were granted funding of almost €15 million under the Decarbonization of Industry funding program of the Competence Centre on Climate Change Mitigation in Energy-Intensive Industries (KEI).



Sluiskil/NL

CO₂ Liquefaction & Storage

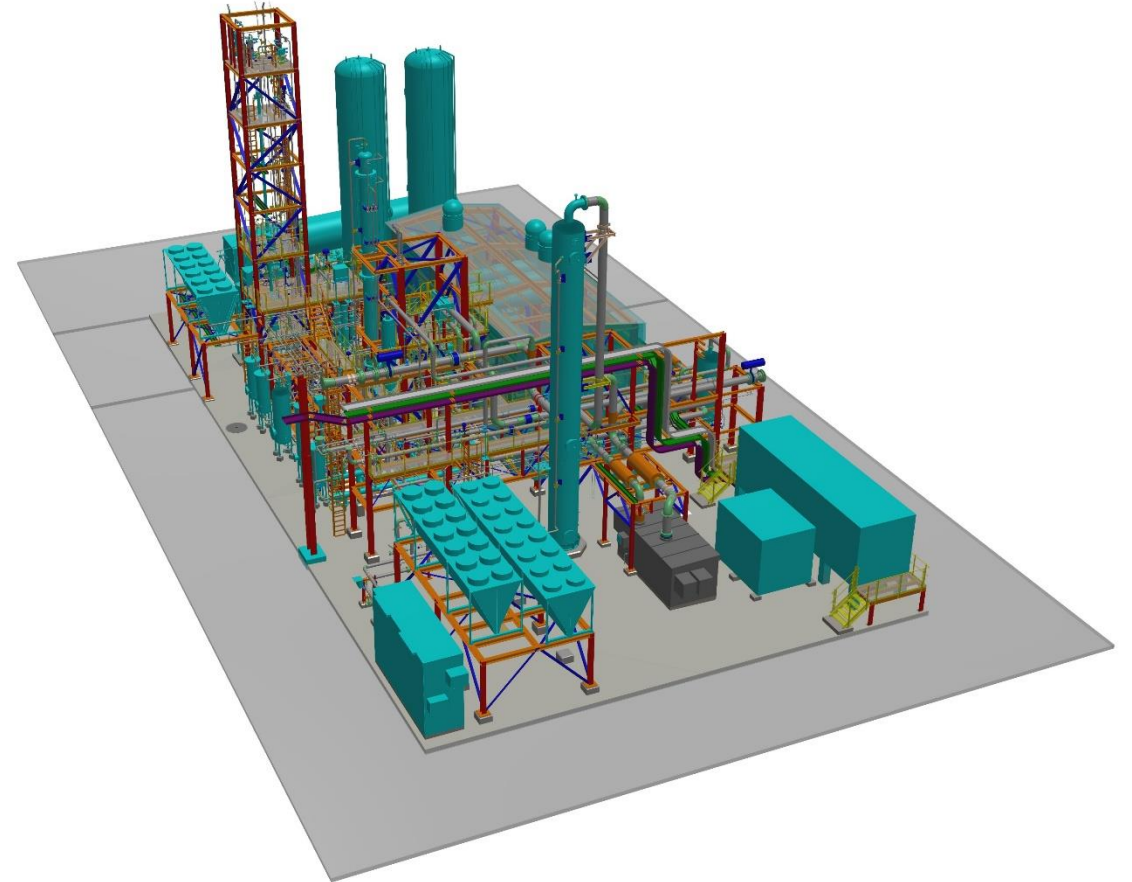
- **Customer** Yara Belgium
- **Location** Sluiskil, Netherlands
- **Capacity** 3 000 TPD liquid CO₂
- **CO₂ Source** Ammonia plant
- **Process** Purification, compression, dehydration, liquefaction and liquid storage
- **Purity** > 99.99 vol % CO₂
- **CO₂ utilization** Ship transport and sequestration via Northern Lights
- **Scope of work** EP + services
- **Start-up** Q1/2026



Mergelstetten/GER

Pilot second generation oxyfuel

- **Customer** CI4C
- **Location** Mergelstetten, Germany
- **Capacity** 24 TPD liquid CO₂
- **CO₂ Source** Oxyfuel cement plant
- **Process** Purification, compression, liquefaction
- **Purity** ≥99.99 vol % CO₂
- **CO₂ utilization** Merchant market
- **Scope of work** EPC turnkey
- **Start-up** Q3/2025



Lägerdorf/GER (Carbon2Business)

CO₂ Processing & ASU

- **Customer** Holcim
- **Location** Lägerdorf, Germany
- **Capacity** 3.600 TPD gaseous CO₂
- **CO₂ Source** Oxyfuel cement plant (kiln line)
- **Process** Purification, compression
- **Purity** ≥99.99 vol % CO₂
- **CO₂ utilization** Methanol synthesis/Sequestration
- **Scope of work** Concept engineering and permitting
- **Start-up** 2028

Note: The Carbon2Business project is funded by the European Union with almost 110 million euros from the Innovation Fund.



Key Take-Aways

Building, Owning & Operating Large Scale CO₂ Plants



CCUS can serve as a tool to reach climate targets



Strong partnerships are needed



Flexible business models



Thank you for
your attention



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