Linde EDHOX™ ethylene technology
New catalytic on-purpose ethylene dehydrogenation concept with low emissions
Linde EDHOX™ technology
Alternative path for ethylene

The growing market for petrochemicals is driving demand for light olefins such as ethylene, which is mainly obtained by steam cracking technology. This mature and well-established technology is considered state-of-the-art in this sector. However, it is relatively energy-intensive, requiring furnaces that operate at high temperatures (above 900 °C).

Linde’s EDHOX technology for the oxidative dehydrogenation of ethane offers a high-performance and cost-efficient solution for ethylene production, operating at moderate temperatures (lower than 400 °C) and enabling comparatively low CO₂ emissions.

EDHOX is an excellent fit for ethylene producers, as well as processes requiring both ethylene and acetic acid such as VAM (Vinyl Acetate Monomer), EVA (Ethylene Vinyl Acetate) copolymer, PVOH (Polyvinyl alcohol products), PET (Polyethylene Terephthalate), ethyl acetate and similar derivatives.

**Technology highlights**

→ Catalytic conversion of ethane into ethylene and acetic acid under mild conditions
→ Exothermic oxidative process with lower energy consumption than current state-of-the-art technologies
→ Multitubular catalytic fixed-bed reactor (no steam cracking furnaces and decoking required)

**EDHOX with zero Scope 1 and 2* CO₂ emissions**

→ Significant Scope 1 CO₂ emission reduction relative to ethane steam cracking applying conventional energy
→ Using renewable energy, net zero Scope 1 and 2 CO₂ emission achievable with low-cost impact
→ Purified CO₂ inherently generated as by-product for storage or downstream processing

*Scope 1 emissions are direct emissions from owned or controlled sources. Scope 2 emissions are indirect emissions from the generation of purchased energy (www.ghgprotocol.org)

**Scope 1 and 2 emissions***

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<th>CO₂ emissions</th>
<th>Conventional ethane steam cracking Scope 1 emissions</th>
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<td><strong>Conventional</strong></td>
<td><strong>Fully-electrified renewables</strong></td>
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<td>Scope 2</td>
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C₃H₆ + 0.5 O₂ → C₂H₄ + H₂O ΔHₑ= −105 kJ/mol

C₃H₆ + 1.5 O₂ → C₂H₄O₂ + H₂O ΔHₑ= −590 kJ/mol
Gearing up for commercial readiness

→ Successful demonstration plant operation since 2017 (Pullach, near Munich)
→ Linde’s EDHOX™ technology has completed the lab and pilot phases and has now been successfully validated in a demonstration plant for commercial use
→ Confirmed commercial plant design by demonstration plant with reaction section, separation-purification and closed-loop operation to recycle ethane improving performance results from lab and pilot reactor phase:
  - High combined ethylene + acetic acid yield, with overall selectivity > 93% in demonstration plant
  - Applied catalyst and reactor tube dimensions correspond to commercial-scale geometry
  - Affirmed ranges of ethylene to acetic acid production ratio
  - Verified long-term catalyst stability

Benefits to your ethylene operations compared to ethane steam cracker

→ Lower investment costs for the EDHOX ethylene plant
→ Decreased production cost by additional cash generation provided by acetic acid co-production resulting in higher return on investment (ROI)
→ Higher potential for reduction of CO₂ emissions, mitigating economic risks linked to emission taxes and supporting transition to a greener economy
→ Attractive business case for adding ethylene capacity to existing ethane steam cracking facilities at low investment cost
→ Integration with downstream ethylene and acetic acid consuming technologies allows for further cost reduction and increase of profitability
→ Available renewable energy usage flexibility with Linde’s FlexASU®, able to operate with a decentralized electric grid

Published by:
Linde GmbH
Linde Engineering, Dr.-Carl-von-Linde-Strasse 6–14
82049 Pullach, Germany
Phone +49 89 7445-5963
www.linde-engineering.com
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Core competencies at a glance

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- LNG and natural gas processing plants
- Petrochemical plants
- Hydrogen and synthesis gas plants
- Adsorption plants
- Cryogenic plants
- Carbon capture and utilization plants
- Furnaces, fired heaters, incinerators

Component manufacturing
- Coldboxes and modules
- Coil-wound heat exchangers
- Plate-fin heat exchangers
- Cryogenic columns
- Cryogenic storage tanks
- Liquidfied helium tanks and containers
- Air-heated vaporizers
- Water bath vaporizers
- Spiral-welded aluminum pipes

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- Plant relocations
- Spare parts
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- Long-term service contracts
- Expert reviews for plants, operations and spare part inventory
- Operator training