

# Adding measurable value to the petrochemical industry.

Partner of choice for revamps  
and downstream integration.



# Improving plant profitability and reliability with Linde.

Over

80 %

of all petrochemicals  
are derived from  
ethylene plants.

## Petrochemical plants in focus.

Petrochemical plants convert crude oil and natural gas into raw materials and base products for a wide range of applications. They produce many important building blocks for industry processes, including ethylene, propylene, polyolefins and more. Over the last decade, petrochemical plants have increased in size and complexity.

At Linde Engineering, we have the technological know-how and EPC execution excellence to meet the challenges involved in building these complex facilities – whatever the scale. We are a world-leading provider of the technologies required to steam-crack gaseous and liquid hydrocarbons and separate cracking products into important raw materials for downstream petrochemical processes.

## Adding value by revamping

Not only have we extensive experience in the planning and construction of new petrochemical plants and complexes, we also have a proven track record in revamps.

Whether you are considering revamping for technological, economical or operational reasons, we can advise you on the solution best suited to your individual requirements. Our experts have the know-how and experience to manage everything from fine-tuning to complex plant modifications.





UNIPOL™ PE plant in Litvinov, Czech Republic.



Borouge 2, Linde has built world's largest ethane cracker with a capacity of 1.45 million MTA of ethylene.

Over

65

ethylene revamp projects  
successfully executed.

#### Full service offering across entire plant lifecycle

We cover the full revamp spectrum – supporting everything from debottlenecking to legislative compliance:

- Capacity increases/de-bottlenecking
- Changes in feedstock and products (e.g. feed change from light to heavy naphtha)
- Retrofitting of plant components
- Energy savings, optimisation of energy consumption
- Plant modernisations, operational and availability improvements
- Compliance with environmental protection regulations governing, e.g. carbon emissions

- Compliance with the results of integrity investigations
- Lifetime extensions

When you partner with Linde Engineering for your revamp needs, you can look forward to:

- Detailed upfront feasibility studies
- Safe and reliable execution by an experienced technology and execution partner
- An optimal solution that aligns with your specific needs – from small to very large modifications

## Typical revamp phases



### Flexible execution concept for revamps

To suit individual needs, we also offer flexible execution concepts – scaling from quick assessment studies to start-up support. Full execution across all phases enables us to accelerate the project timeline overall.

### Proven track record in revamp projects

Since 1980, we have successfully managed more than 65 ethylene plant revamp projects in addition to 150 ethylene furnace revamps plus numerous modification projects for other petrochemical units such as polyolefin, butadiene or ethylene glycol plants.

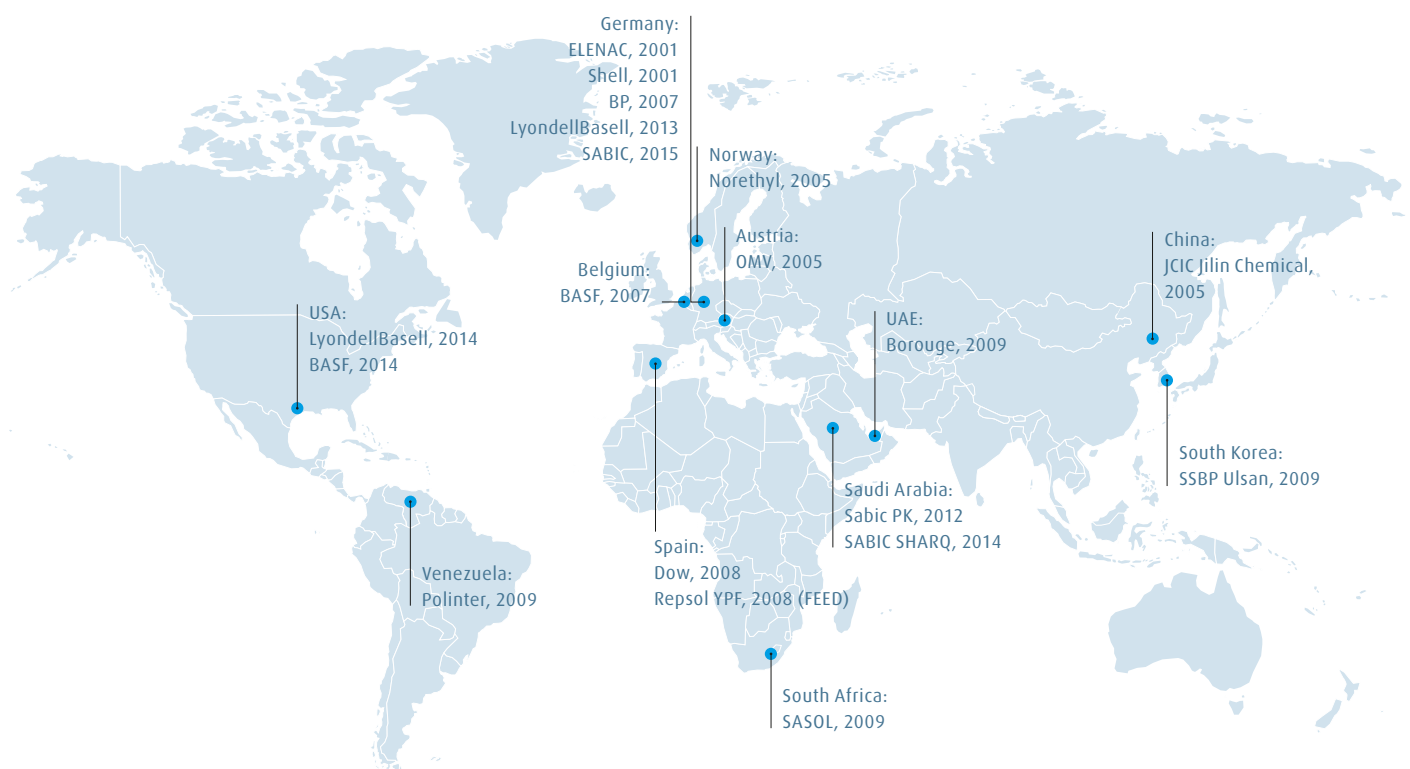
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revamp studies on olefin and petrochemical plants carried out by Linde.

### Revamp references

#### Overview of recent projects

● Operating plant



# Univation-Linde Alliance. Connecting Leading Technologies. Delivering Proven Solutions.

*“Our combination of technology and engineering, procurement and construction capabilities is a key driver to deliver competitive solutions to the petrochemical industry.”*

**Dr Christian Bruch**  
Member of the Executive Board of Linde AG

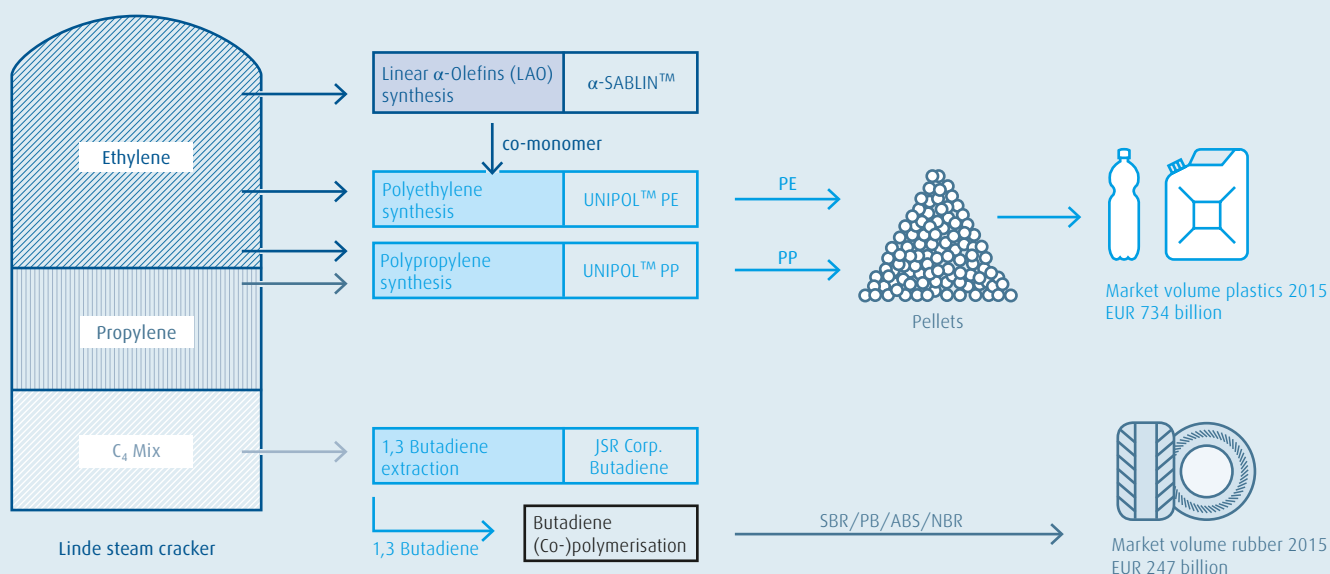
## Downstream integration for greater process efficiencies

Looking beyond our own steam cracker technology, we are committed to optimising the entire value chain for our customers by integrating our technology and engineering, procurement and construction (T-EPC) capabilities with downstream process technologies.

Besides driving integration of our own innovative technologies such as  $\alpha$ -SABLIN™, the oligomerisation of ethylene to linear  $\alpha$ -olefins (LAOs), we are also working in close collaboration with our licensing partners. Our recent cooperation with Univation Technologies for the downstream integration of the UNIPOL™ PE Process is the latest example.

## Optimised value chain solutions are a result of combining best in class technology and engineering.

● Linde technology, ● Linde/Licensors cooperation, ● Other technology







UNIPOL™ PE plant in Al-Jubail Industrial City, Saudi Arabia

## Adding measurable value to the petrochemical industry

We teamed up with Univation Technologies, the global leader in licensed polyethylene technologies, to bring new value to petrochemical producers worldwide. The cooperation agreement integrates Linde Engineering's T-EPC capabilities with Univation's UNIPOL™ PE Process platform to bring cost, quality and efficiency gains to new and retrofit ethylene cracker and polyethylene projects.

To find out more about our experience in petrochemical revamps or how you could benefit from our downstream integration capabilities, please contact our petrochemical plant team:

Phone: +49 89 7445-2486  
E-mail: [petrochemicals@linde-le.com](mailto:petrochemicals@linde-le.com)

## Benefits at a glance

- Powerful alliance strategy giving you a single point of contact
- One-stop service from initial project scoping study to start-up support
- Synergised experience in transferring your business case for polyolefin into a real plant meeting the highest quality and reliability standards
- Project synergies for new builds and revamps covering the entire UNIPOL™ PE Process platform and back-integration
- Full exploitation of integration potential between Linde cracker technology and the UNIPOL™ PE Process platform
- Full synchronisation with Univation's engineering tools and database for accelerated project lifecycle
- CAPEX savings through improved process and engineering alignment at early stage design
- Operational savings through optimised design package

**Univation**  
TECHNOLOGIES

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# Collaborate. Innovate. Deliver.

Linde's Engineering Division is a leading player in the international plant engineering business. Across the globe, we have delivered more than 4,000 plants and cover every step in the design, project management and construction of turnkey industrial facilities. Our proven process and technology know-how plays an indispensable role in the success of our customers across multiple industries – from crude oil, natural gas extraction and refining to chemical and metal processing.

At Linde, we value trusted, lasting business relationships with our customers. We listen carefully and collaborate closely with you to meet your needs. This connection inspires us to develop innovative process technologies and equipment at our high-tech R&D centres, labs and pilot plants – designed in close collaboration with our strategic partners and delivered with passion by our employees working in more than 100 countries worldwide.

From the desert to the Arctic, from small- to world-scale, from standardised to customised builds, our specialists develop plant solutions that operate reliably and cost-effectively under all conditions.

You can always rely on us to deliver the solutions and services that best fit your needs – anywhere in the world.

Discover how we can contribute to your success at [www.linde-engineering.com](http://www.linde-engineering.com)

Get in touch with our petrochemical plant team:

Phone: +49 89 7445-2486, e-mail: [petrochemicals@linde-le.com](mailto:petrochemicals@linde-le.com)

## Core competencies at a glance

### Plant engineering

- Air separation plants
- LNG and natural gas processing plants
- Petrochemical plants
- Hydrogen and synthesis gas plants
- Chemical plants
- Adsorption plants
- Cryogenic plants
- Carbon capture and utilisation plants
- Furnaces, fired heaters, incinerators

### Component manufacturing

- Coldboxes and modules
- Coil-wound heat exchangers
- Plate-fin heat exchangers
- Cryogenic columns
- Cryogenic storage tanks
- Liquefied helium tanks and containers
- Air-heated vaporisers
- Water bath vaporisers
- Spiral-welded aluminium pipes

### Services

- Revamps and plant modifications
- Plant relocations
- Spare parts
- Operational support, troubleshooting and immediate repairs
- Long-term service contracts
- Expert reviews for plants, operations and spare part inventory
- Operator training