

A comprehensive capability.

International plant construction for chemistry, gas supply, biotechnology and pharmaceuticals.



Extensive knowledge is the basis. Flexibility provides opportunities.

The successful realisation of large-scale projects on an international level depends on the efficient coordination of many factors. In order to develop complex process chains in an economical and time-saving manner, we offer our clients comprehensive know-how in project management and engineering. Our continuous quality awareness and professional contract management skills provide the basis for a smooth project flow. Linde Engineering Dresden GmbH is one of the leading companies worldwide in the design, delivery and construction of chemical, gas, biotechnological and pharmaceutical plants. Commissioned by private and national clients, our engineers and managers successfully carry out projects of various sizes.



Short paths and safe investments

Our corporate setup is an essential advantage. On the one hand, as a subsidiary of The Linde Group, we offer you the reliability needed for long-term investment decisions. On the other hand, the high flexibility of Linde Engineering Dresden GmbH allows for fast implementations. We realise Linde processes as well as licensed and customer-owned processes.

One-stop project realisation

At every stage of a project, dedicated customer focus has top priority. Starting from the very first contact, our project teams are at your disposal – to help you with almost anything from carrying out feasibility studies or obtaining a permit to handling complex logistical tasks or finding financing solutions for your plant. See for yourself.

Project development services

- Technical design
- Front-end engineering
- Feasibility studies
- Market analyses
- Financial models
- Procurement of licenses
- Profitability analyses

Our business activities

Project management

- Project control
- Quality assurance and cost control
- Scheduling and expediting
- Contract management
- Control
- QHSE management
- After-sales service

Engineering

- Basic and detailed engineering
- Process design
- Process calculation
- Safety analyses
- Authority permit engineering
- Equipment specification
- Material specification and strength calculation
- Automation
- Electrical engineering
- Construction engineering
- Civil and steel structure
- Plant design
- As-built documentation

Procurement

- Global sourcing and purchasing of all plant components
- Expediting and shipping

Construction and start-up

- Planning of construction and start-up
- Supervision of civil and construction works
- Construction
- Commissioning and start-up supervision
- Operator training

For pharmaceutical plants

- Qualification (DQ, IQ, OQ)

Networked engineering. From the initial idea to the hand-over of keys.

Engineering tasks are the main focus of project development. For each construction phase, our specialists work out complete solutions – from conceptual engineering, authority permit engineering as well as basic and detailed engineering and procurement through to construction logistics, construction and plant start-up. As we support our clients with proven and tested know-how in all technological, logistical and administrative concerns, Linde Engineering Dresden GmbH often acts as a general contractor.



More efficient and effective with IMS

The Integrated Management System (IMS) of Linde Engineering Dresden GmbH comprises the management of processes, quality (Q), health protection (H), safety (S) and environmental protection (E). Well-defined phase models with gates and hold points are used to optimise the organisation of the plant projects, providing a clearly structured work and document flow and gathering information. Into this complex and interdisciplinary process, we also integrate construction sites and subcontractors, thus obtaining solutions that are optimised in terms of time and quality. Our commitment to continuous improvement is supported with the aid of Six Sigma by internal improvement projects.

QHSE policy

In order to meet the high demands on QHSE during the implementation of projects all over the world, Linde has introduced a QHSE policy, which embraces the following objectives: zero incidents, safe and healthy working conditions for all employees and involved partners, prevention of environmental pollution and responsible use of natural resources.

Using design reviews to plan ahead

Virtual three-dimensional plant models help improve the coordination of our engineering processes, lending transparency and speed to each and every stage of planning. The early and regular involvement of our clients in PID, design reviews and HAZOPS allows for timely corrections or change requests in engineering. This prevents expensive changes later in the process.

Software for process optimisation

Project management/controlling

- Linde Project Management System
- SAP R/3, SAP-PS
- PRIMAVERA, MS Project
- Documentum, Lotus Notes
- ProCorr

Conceptual and basic engineering

- UniSim with Linde Physical Property Database and Aspen Plus
- HTRI, HTFS, MUSE, MULE
- Linde Process and Equipment Workbench
- PDS 2D/Smart Plant 2D
- MARIAN
- Microprotol

Detailed engineering

- PDS 3D
- Design Review
- Speedikon
- Isogen
- CAESAR II
- PLANEDS
- INTOOLS, Sigraph
- Logidoc, CONVAL

Procurement

- SAP-MM
- eProcure

Construction/start-up

Linde Site Management System
Welding Supervision Documentation

and other Linde-branded programs



Every nut, bolt and screw. Building chemical and gas plants with detailed knowledge means advance in quality.

For decades, Linde Engineering Dresden GmbH has been engineering and constructing chemical and gas plants worldwide with great success. Well-founded technical know-how and the free choice of the suitable processes on the basis of own or third party licenses provide our customers with the best possible flexibility and planning reliability. Thus, the application of the ideal technology is assured for every project, most notably to achieve the highest possible plant efficiency. Our wide range of services – ranging from technologies for gas separation and gas purification to air separation up to chemical and petrochemical plants – is the basis for a successful cooperation. Our core competence lies in polyolefin plants (polyethylene and polypropylene plants) and air separation plants.

Modernisation increases economic efficiency

In addition to the construction of new turnkey plants, we also modernise production complexes to increase economic efficiency. Using our process engineering know-how, we are also able to modernise older plants to state of the art. As we know every detail of our clients' plants, our customers benefit particularly from a long-term cooperation. In doing so, we are able to develop plant modifications or replace components to proven Linde quality standards without long familiarisation phases.

Our services provide relief

For a smooth project execution, a comprehensive general plan fulfilling all demands is essential. Additionally, our service package includes a range of services that provide verifiable benefits. We carry out feasibility studies, take care of time-consuming approval procedures with the help of our authority permit engineering and develop all necessary safety concepts. In international projects, we also manage the collaboration with local partners in consortiums or joint ventures. In this manner, we facilitate cooperation and achieve the best results. With our global procurement of plant components, we achieve cost-effective and time-optimised package solutions.

Our plant spectrum includes

- Polyolefin plants
- Air separation and liquefaction plants
- Gas purification and gas separation plants
- CO₂ plants
- Synthesis gas plants
- α -olefin plants and revamps of olefin plants
- Storage tank plants
- Plant revamps

Flowing smoothly. The implementation of complex procedures requires flexible processes.

Polyethylene plant in Litvinov





Polypropylene plant in Bratislava



Polyethylene plant in Al-Jubail

In a wide variety of projects, Linde Engineering Dresden GmbH demonstrates professional know-how, flexibility and customer-oriented project realisation. Taken from a multitude of constructed plants, the following examples account for the company's performance capability.

Polyethylene plant Chemopetrol, Litvinov, Czech Republic

This plant has a capacity of 200,000 tonnes of high-density polyethylene (HDPE) per year. The UNIPOL™ PE technology for the plant is licensed by Univation Technologies. Ethylene and the comonomers butene or hexene react in a UNIPOL™ fluidised bed reactor producing granular HDPE. Granular HDPE is mixed with additives, melted in the extruder and then processed into pellets. These pellets are used in the plastic processing industry for the production of consumer goods, such as plastic bags, packaging foil or yogurt cups.

Polypropylene plant Slovnaft, Bratislava, Slovak Republic

This project was executed by Linde Engineering Dresden on a turnkey basis. In addition to the process plant with the UNIPOL™ reactors and the extruder, the entire facility for pellet handling and various auxiliary facilities were

included in the scope of supply. The plant produces 255,000 tonnes of homopolymer as well as impact and random copolymer polypropylene every year. These are further processed into carpet fibres, packaging foils, breathable textiles or car bumpers. The fact that Linde Engineering Dresden GmbH could offer single point responsibility for all services provided the basis for the successful realisation of the project. Included in this responsibility was the coordination of all parties, particularly of Dow Chemical as the licensor for the UNIPOL™ PP technology. The plant was handed over in September 2005. Since then, it has been producing polypropylene of the highest quality.

Polyethylene plant Sharq, Al-Jubail, Saudi Arabia

In 2005, Linde Engineering Dresden was awarded the contract to construct a turnkey polyethylene plant (HDPE/LLDPE) in Saudi Arabia. The plant consists of two reactor lines, which each have a capacity of 400,000 tonnes per year. In addition to the process steps (pre-purification of the ethylene and polymerisation, degassing and extrusion of the product), the plant also incorporates the conditioning of the reaction catalyst. The finished product is temporarily stored in silos and is later packed in 25-kg bags or bulk packs or transported unpacked in containers.

Air separation plant Linde Gas Romania, Valcea, Romania

The production of technical gases from air is carried out without further feedstocks and is therefore very environmentally friendly. In the process, air is compressed, cooled, purified and separated into individual gases through cryogenic rectification. The plant in Valcea supplies, amongst others, the adjacent chemical plant with gaseous nitrogen and oxygen. An emergency supply system ensures that gas is continuously supplied to the chemical plant even during production failures. The control of the plant is basically automated. Moreover, a load adjustment system compensates for fluctuations in gas demand in order to ensure an energetically optimised operation.

Linde Engineering Dresden was responsible for the engineering, procurement, construction and start-up. Delivery and construction was mainly performed using local companies.



Air separation plant in Valcea



Oxy-fuel plant at the Schwarze Pumpe site



LAO plant in Al-Jubail

Oxy-fuel plant, Vattenfall Power Generation, Schwarze Pumpe, and CO₂ flue gas wash unit, RWE Power AG, Niederaussem, Germany

From now on, power plants have to intensify their efforts to bring their technologies in line with the prevention of climate-relevant greenhouse gases such as carbon dioxide. In many respects, Linde Engineering Dresden GmbH is also involved in the development of eco-friendly processes. Good examples are the air separation unit and the CO₂ plant for the world's first pilot installation of a CO₂-reduced lignite coal power plant according to the oxy-fuel process, which was built in Germany by Vattenfall. Another example is the pilot plant for CO₂ washing (PCC process) in Niederaussem, which is constructed in cooperation with RWE and BASF and will be commissioned in summer 2009.

The CO₂ separated in the oxy-fuel plant at Schwarze Pumpe is purified and liquefied in the Linde-built plant and is stored in specially insulated bulk tanks. The CO₂ can later be compressed deep beneath the surface of the earth in another pilot installation. For the company Gaz de France, Linde Engineering Dresden designed a plant for the intermediate storage, compression and evaporation of CO₂ and built it in Maxdorf.

Linear Alpha-Olefins plant (LAO plant) Jubail United Petrochemical Company, Al-Jubail, Saudi Arabia

This plant with a capacity of 150,000 tonnes/year was designed and built by Linde Engineering Dresden as the world's first large-scale plant according to the "α-Sablin" process from Sabic and Linde. The scope of supply included the process plant as well as a surface flare system and a tank farm for the LAO products and toluene. Linear Alpha-Olefins (LAO) serve as copolymers in plastics manufacturing, as raw material for detergents and synthetic lubricants, and as plasticisers. On the one hand, the distinctive features of the "α-Sablin" process are based upon the use of two special catalysts which allow the highly flexible control of the distribution between the LAO products. On the other hand, the process is characterised by low operating temperatures (60–100 °C) and operating pressures (20–30 bar) as well as by a high product purity.

Expertise in red and white. We build innovative biotechnological plants.

In the 19th century, Linde made a groundbreaking contribution to the technological advancement of the biotechnological plants of that time – the breweries – by developing and constructing refrigerating machines. Today, we can provide first-class references for biotech plants in the pharmaceutical industry (“Red”) and other industry sectors (“White”). The expertise of Linde’s plant construction in the area of biotechnology is concentrated in the hand of Linde Engineering Dresden GmbH.

Using potentials for White Biotechnology

Price changes and availability, especially of oil-based resources, as well as the “technological revolution” in the life sciences are the driving forces of the technological advancement in industrial biotechnology. Linde supports this process actively as a technological company. As a renowned plant manufacturer, we can rely on the expertise gathered in our traditional fields of activity – chemical, pharmaceutical and biopharmaceutical plants. Our clients can thus benefit from knowledge synergies in planning and process handling. Our broad range of references regarding the type of plants and the size of projects allows us to handle your project with the highest technical and organisational efficiency.

Focus on time to market

In the design and construction of biotechnological plants, the key factors time to market and product quality assurance are the focus of our work. From early on, parallel to research and development, we support you in process development and the creation of functional and economical plants. During feasibility studies, we analyse the process transfer risks and estimate the investment cost to provide a solid basis for your investment decision.

Integrated and efficient project handling

As a result of globalisation, mergers and the successful market launch of innovative products, the size and requirements of projects have steadily increased in recent years. We are able to meet these economic challenges as we profit from the synergies of our company-wide experience, the combination of our competencies as well as the strong and close cooperation with investors and planning partners. Our experts not only take over the complete process planning but also lead and coordinate all skills involved in plant design and construction.

Our spectrum includes plants for

- Industrial (White) Biotechnology
- Pharmaceutical (Red) Biotechnology
- Active pharmaceutical ingredients
- Fractionation of blood plasma
- Pharmaceutical finished dosage forms
- Food additives
- Fine chemicals



White Biotechnology for industrial plants. The key for the future.

In White Biotechnology, industrial production takes advantage of the toolkit of nature. Across many industry sectors, this technology gains more and more importance. Generally, it is applied wherever it is economically superior to purely chemical processes – due to the utilisation of renewable resources as well as its highly specific reactions, efficiency and eco-friendliness.

Driving force for technological developments

The highest economic potential lies in the production of organic bulk chemicals, which, up to now, were predominantly produced petrochemically. White Biotechnology requires the application of alternative technologies, whose common distinguishing feature is a close interlocking of biotechnological and chemical process steps. The task of engineering, therefore, is to actively participate in the development of new processes and combinations of process steps.

Pioneer driven by innovations

With all its strength, Linde is committed to the urgently needed thrust of innovation. In addition to our interdisciplinary experience, the know-how of our engineers and biotechnological experts particularly provides the basis for the development and implementation of novel processes. On this basis, our goal for the future will be to advance White Biotechnology with economical processes and to continually extend its range of applications.



Plants for the production of carbohydrates

Carbohydrates, such as cellulose, starch and sugar, are dominant resources for both White Biotechnology and the chemical industry of the future. Plants for the production of various carbohydrates from plant material therefore form the backbone of the advancement of this key industry. In this area, Linde built a turnkey, large-scale plant for the production of functional carbohydrates for a member of the Cargill Group in Malchin, Germany.

Starch is a very versatile resource. It is either separated into glucose molecules and fermented or processed directly into technical products such as biodegradable plastics. Linde Engineering Dresden demonstrates its expertise in this area with the construction of innovative starch factories as well as plants for the biotechnological and chemical processing of starch.

Biorefineries with high potential

The processes in biorefineries constitute an integrated production of chemical products and energy carriers. In biorefineries, sugar, starch, cellulose, fats, proteins and others are converted into intermediates by biotechnological and chemical processes and are then used as components for synthesis of chemical products. Particularly the renewable raw material lignocellulose will be the dominant resource for biorefineries. This is available in vast amounts almost all over the world and does not compete with the food industry. Various processes are applied for its utilisation, from chemo-physical decomposition to enzymatic degradation. In cooperation with research institutes and the manufacturing industry, Linde Engineering Dresden will develop own subprocesses for biorefineries and construct complete plants.



Turnkey monoplant for the production of pectin in Malchin, Germany

Plants for the food, animal feed, textile, detergent, paper, cosmetics, agricultural and energy industry etc.

In these areas, White Biotechnology is a traditional and very diverse application. However, today it also functions as a driving force for technological advancement. In multiple processes, improved micro-organisms or highly specific and resistant enzymes are applied as catalysts by means of biomolecular methods. The construction of plants for the large-scale production, processing and application of special micro-organisms and technical enzymes is one of our core competencies. We can therefore offer our clients a wide range of innovative processes for the design and construction of these plants.

Red Biotechnology for pharmaceutical plants. State-of-the-art high-tech plants from Linde.



Production of monoclonal antibodies in Basel



Insulin plant in Frankfurt

In the area of Red Biotechnology, Linde Engineering Dresden can provide a wide range of first-class references, including the already classic biotechnology, e.g. antibiotics production and stereospecific steroid transformation as well as conventional plants for vaccines, animal insulin and large-scale protein fractionation from human blood plasma. In addition, we offer state-of-the-art plants for innovative top products, such as recombinant human insulin, erythropoietin or monoclonal antibodies for cancer therapy and diagnostics. We construct such plants based on customer-owned processes or the technologies of established licensors.

The following selected reference plants demonstrate the ability of our experts to ensure on-time performance and cost-optimised solutions even under such difficult circumstances as narrow space conditions or construction during ongoing production.

Plant for the production of monoclonal antibodies F. Hoffmann-La Roche AG, Basel, Switzerland

When Milstein, Köhler and Jerne were awarded the Nobel Prize in Medicine for their groundbreaking invention for the production of monoclonal antibodies, no one could imagine the dimensions of today's plants for monoclonal antibodies. In this technology of the future, Linde Engineering Dresden can present an outstanding reference: the design of the new MAB plant in the city centre of Basel as main contractor for F. Hoffmann-La Roche.

This project is an impressive example of successful transfer of innovative ideas from molecular biology in laboratory scale into large-scale production plants utilising groundbreaking inventions for medicine. The realisation of the large-scale production would not have been possible without the extraordinary multidisciplinary cooperation of engineers, technicians and natural scientists. This example is able to demonstrate the flexibility of Linde Engineering Dresden to adapt their own scope of performance to the current requirements of a new technology within a short period of time.

Plant for the production of insulin Sanofi-Aventis, Frankfurt, Germany

Nowadays, more and more biotechnologically produced pharmaceuticals, so-called biopharmaceuticals, are among the top products of the pharmaceutical industry. The production plant for insulin in Frankfurt is one of the world's most modern plants for recombinant human insulin. With insulin glargin (tradename Lantus®), this plant produces one of the most important products of Sanofi-Aventis for the world market. The starting point for the realisation of this tailor-made Lantus® plant was a customer-owned process which had to be transformed from a pilot plant scale to a large-scale plant. The scope of Linde Engineering Dresden was the general planning of the project, including basic and detailed engineering as well as procurement, civil engineering, construction, commissioning and qualification.

Multi-purpose pilot plant (kilo lab) for the production of new active pharmaceutical ingredients F. Hoffmann-La Roche AG, Basel, Switzerland

The development of new pharmaceuticals from research to market readiness is usually long, full of risks, expensive and under high pressure in terms of time to market. Plants of the kilo lab type play a key role in this process. Active pharmaceutical ingredients (APIs) – which are, at first, only available in tiny amounts – are produced in kilogram scale in kilo labs in order to have sufficient material for toxicological testing and clinical trials on human beings. Only after its efficacy and safety has been verified, the product can gain authorisation and permission for large-scale production. Only a small number of all the substances that pass through the kilo lab actually will reach the market as a new drug. That's why flexibility has top priority. The new kilo lab was designed as a multi-purpose pilot plant and integrated into the existing building of a previous plant. Narrow space conditions and the construction during ongoing production posed special challenges. Our plant development using 3-D CAD offered decisive benefits: planning optimisation with the operators directly in front of the screen, improvement of planning reliability, integration of existing piping and parts of the old plant into the 3-D model and accurate off-site prefabrication of piping.



API plant in Basel

Planting seeds for the future.

Our customers' success is our success. With innovative technologies and our employees' extensive know-how, we are consistently turning our customers' goals into our own – in a fair, transparent and cost-conscious manner. Therefore, every plant we build is a reference for the next one – creative in its concept, efficient in its implementation.

As one of the leading companies in the planning and construction of chemical, gas, biotechnological and pharmaceutical plants, we offer our customers the security of consistently high quality standards. In cooperation with reliable business partners, we combine capacity and expertise in order to realise projects of any dimension.

We regard every assignment as a chance to define a new market standard and to expand our strong international position. Driven by our own performance capability, it is our goal to make the name Linde a globally recognised seal of quality, with plants that speak for themselves – and for us.

Linde Engineering Dresden GmbH

Postal address:
Postal office box 210353
01265 Dresden
Germany

House address:
Bodenbacher Strasse 80
01277 Dresden
Germany
Phone +49.351.250-30
Fax +49.351.250-4800
ledd.dresden@linde-le.com
www.linde-engineering.com

Moscow Office:
115054, Moscow
Paveletskaya Square 2/2
Russia
Phone +7.495.6426242
ledd.moscow@linde-le.com



Linde Engineering Dresden GmbH

Bodenbacher Strasse 80, 01277 Dresden, Germany

Phone +49.351.250-30, Fax +49.351.250-4800, www.linde-engineering.com