

THE LINDE GROUP

Linde

Linde Engineering Division in South Africa



Introduction.

Who is The Linde Group?

The Linde Group is a world leading gases and engineering company with almost 52,000 employees working in around 100 countries worldwide. In the 2008 financial year it achieved sales of EUR 12.67 billion.

Gases Division

The Gases Division is active in the production and sales of industrial gases as e.g. oxygen, nitrogen, argon, helium, hydrogen, carbon dioxide, medical gases, specialty gases, calibration gases and gas mixtures according to client specification.

Engineering Division

The Engineering Division is successful throughout the world, with its focus on promising market segments such as olefin plants, natural gas plants and air separation plants, as well as hydrogen and synthesis gas plants. With around 5,900 employees across the globe it achieved sales of EUR 3.016 billion in 2008. More than 4,000 plants in 100 countries and over 1,500 process engineering patents bear testament to the exceptional scope of this business area.

Engineering Division in South Africa

Linde Process Plants was established in 1984 as representation and sales office for the Engineering Division.

Our services comprises a wide range such as licensing, engineering, procurement, commissioning and start-up of single components to complete turn-key plants and can be split in off-shore and on-shore parts to fulfill legal and BBBEE requirements.

Linde has a long history in Southern Africa with more than 40 major references over the past 40 years covering most of the following Linde products:

- Petrochemical plants
- Furnaces and fired heaters
- LNG evaporation units
- Gas processing plants
- Synthesis gas / hydrogen plants
- PSA plants
- Air separation plants

Linde fabricates components such as

- Aluminium plate-fin heat exchangers
- Coil-wound heat exchangers
- Cryogenic liquid storage tanks
- Evaporators



Linde plants.

Petrochemical plants

Linde provides technologies for a wide range of petrochemical plants comprising:

- Turn-key olefin plants
- Linear alpha olefin plants (LAO)
- Polymer plants (PE, PP)
- Components for petrochemical and refinery processes

Major references in Southern Africa

are for the CTL and GTL refineries of Sasol and PetroSA and cover e.g.

- Ethylene plants
- Ethylene and propylene purification and recovery plants
- Hexene plants
- Octene plants
- Various other gas separation and cleanup facilities

Furnaces and fired heaters

Our 100 % Linde subsidiaries, Selas Fluid Processing Co., SELAS-LINDE GmbH, Linde Impianti Italia S.p.A. and since 2008 Bertrams Heatec AG have sold over 4,000 furnaces and fired heaters world-wide. The companies supply pyrolysis furnaces, steam reformers, EDC cracking furnaces, refinery heaters, waste heat recovery heaters and incinerators for gaseous and aqueous waste streams.

Major references in Southern Africa are e.g.

- Steam boilers
- Fired heaters
- Ethylene cracking furnaces

Alpha olefin plants for Sasol, Secunda, South Africa
 3 octene plants (248,000 t/a)
 4 hexene plants (259,000 t/a)
 Last octene train on stream 2008





LNG (liquid natural gas) plant for Moss gas (now PetroSA)
Mossel Bay, South Africa

Gas separation plants and natural gas plants

The Engineering Division is well experienced in the separation of natural gas components, and in the removal of unwanted components or recovery of high-grade products from any kind of mixed gas streams.

Linde's modern plant design comprises chemical and physical scrubbing processes, cryogenic processes and pressure swing adsorption.

The Engineering Division is also a licensor and turn-key contractor for LNG peak-shaving and LNG base-load plants.

Major references in Southern Africa

- LNG plant and LNG tank in Mossel Bay
- Various gas separation plants for PetroSA and Sasol

Synthesis gas plants

Based on steam reforming or partial oxidation technology, Linde built over 90 large scale tailor made plants and over 150 modular plants for the production of synthesis gas, hydrogen, carbon monoxide, carbon dioxide, methanol and ammonia. Linde is world leader in the market of naphtha gasification units.

Project references in Southern Africa

are mainly in the synthesis gas treatment, e.g. various wash systems incl. Rectisol.

PSA - pressure swing adsorption plants

Linde has built over 300 PSA plants worldwide for hydrogen purification, methane purification and carbon monoxide purification as well as production of nitrogen and oxygen.

Major references in Southern Africa

- Linde supplied various oxygen and nitrogen plants to countries like Guinea, Ghana, Nigeria, DR Congo, Kenya, Zambia, Zimbabwe and RSA
- Hydrogen purification (e.g. Sasol)
- Carbon monoxide purification (e.g. ArcelorMittal Steel)

Air separation plants

Linde supplied over 3,000 air separation plants for the production of oxygen, nitrogen, argon and rare gases (krypton and xenon) world-wide. The Linde portfolio ranges from modular designed plant with 50 Nm³/h oxygen capacity to tailor made single unit tonnage plants of 110,000 Nm³/h oxygen capacity.

The largest parallel unit plant under construction will have a capacity of 860,000 Nm³/h oxygen.

Major references in Southern Africa

Linde supplied several air separation plants to clients like

- Sasol
- PetroSA (2 x 63,000 Nm³/h oxygen for GTL)
- Afrox (since 2006 a member of The Linde Group)

Air separation plants for Moss gas (now PetroSA)
Mossel Bay, South Africa





Coil-wound heat exchangers

Coil-wound heat exchangers (CWHE) have been used in the industry since the early days, when Carl von Linde liquefied air on an industrial scale for the first time in May 1895.

Until today, more than 1,000 coil-wound heat exchangers have been manufactured in Linde's fabrication facilities in Germany.

Coil-wound heat exchangers are compact and reliable with a broad temperature and pressure range and suitable for single phases as well as two phase streams. Multiple streams can be accommodated in one heat exchanger.

Coil-wound heat exchangers are used for a wide range of applications as for example:

- Coolers / heaters
- Liquefiers
- Vaporizers
- Isothermal reactors



Cryogenic standard tanks

Linde fabricates a wide range of standard vacuum-insulated cryogenic storage tanks for storage of liquefied gases.

The current range of standard tanks covers operating temperatures from $-196\text{ }^{\circ}\text{C}$ up to $+20\text{ }^{\circ}\text{C}$, pressures up to 18, 22 and 36 bar and liquid volumes from 3,000 litres up to 80,000 litres.

The Linde cryogenic standard tanks are typically used for the storage of:

- Liquid oxygen
- Liquid nitrogen
- Liquid argon
- Liquid helium

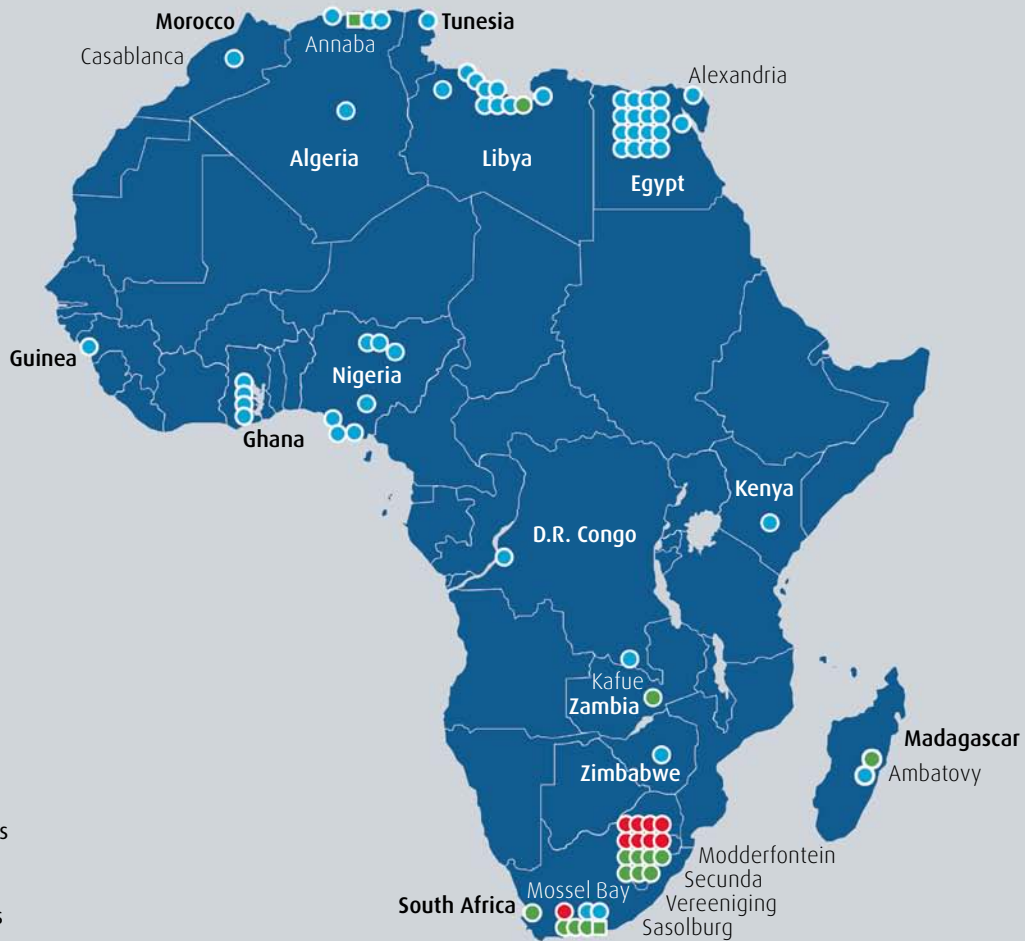


Aluminium plate-fin heat exchangers

The fabrication facility of Linde in Germany is well known as a highly competent supplier for aluminium plate-fin heat exchangers, a quite sophisticated type of cryogenic equipment. These aluminium plate-fin heat exchangers have been manufactured by vacuum brazing technology since 1981. Since that time more than 6,000 heat exchanger cores have been produced. Linde plate-fin heat exchangers can be used for a wide range of applications, especially for low temperature services and treatment of clean fuels.

Beside others the main applications are:

- Petrochemical plants
- Gas treatment plants
- Natural gas liquefaction plants
- Helium liquefaction plants
- Air separation plants



Linde references

- Air separation plants
- Gas processing plants
- Natural gas plants
- Petrochemical plants

Designing Processes – Constructing Plants.

Linde's Engineering Division continuously develops extensive process engineering know-how in the planning, project management and construction of turnkey industrial plants.

The range of products comprises:

- Petrochemical plants
- LNG and natural gas processing plants
- Synthesis gas plants
- Hydrogen plants
- Gas processing plants
- Adsorption plants
- Air separation plants
- Cryogenic plants
- Biotechnological plants
- Furnaces for petrochemical plants and refineries

Linde and its subsidiaries manufacture:

- Packaged units, cold boxes
- Coil-wound heat exchangers
- Plate-fin heat exchangers
- Cryogenic standard tanks
- Air heated vaporizers
- Spiral-welded aluminium pipes

More than 3,800 plants worldwide document the leading position of the Engineering Division in international plant construction.

Linde Process Plants (Pty) Ltd.

Afrox House, 23 Webber Street, Selby, 2001, South Africa

PO Box 5404, Johannesburg, 2000, South Africa

Phone +27.11.490-0510, Fax +27.11.490-0412, E-Mail: linde.za@linde-le.com, www.linde-process-engineering.com