

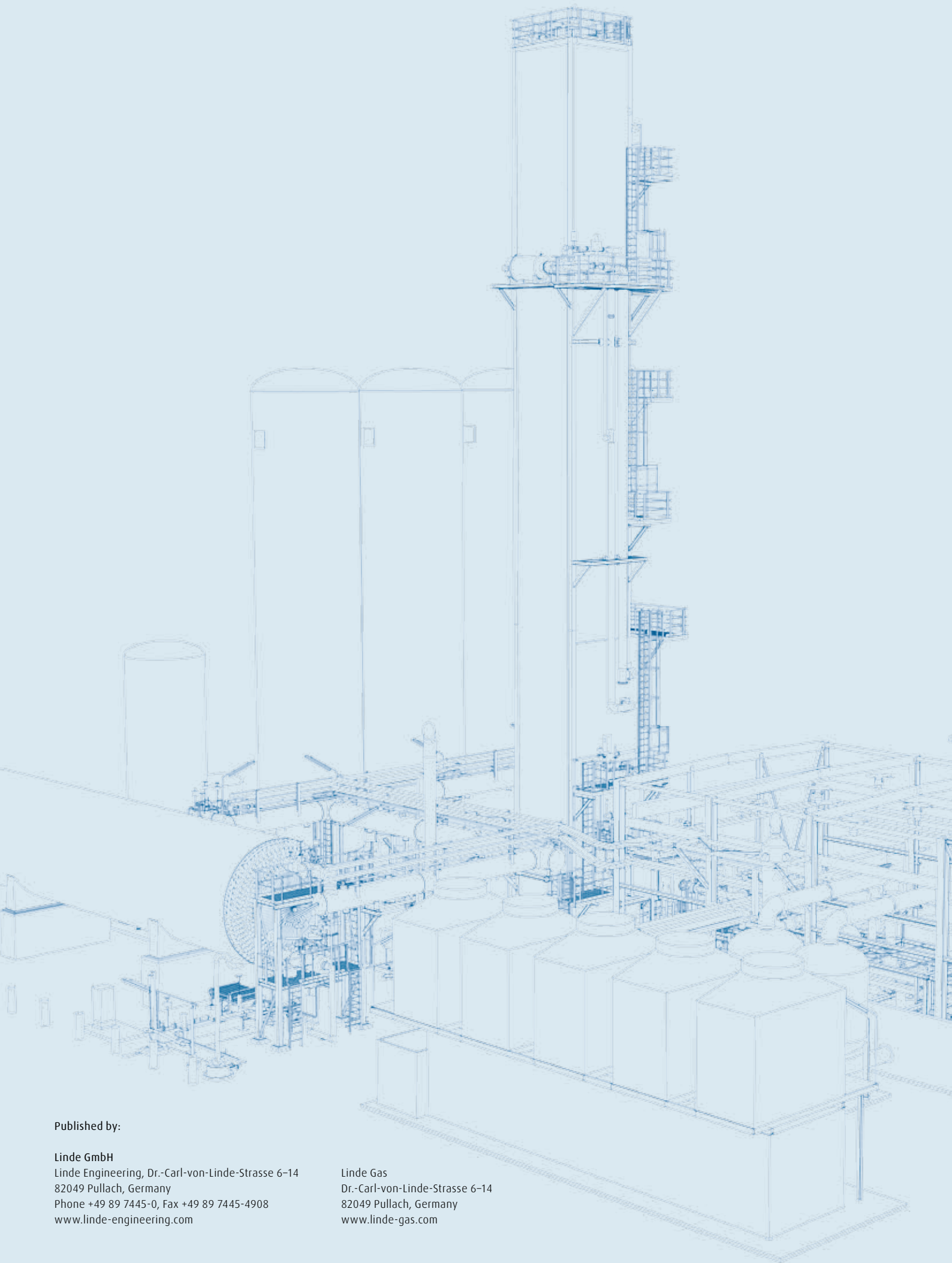
Making our world more productive



Setting new standards

Small and compact air separation units
tailored to the emerging markets





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Partner of choice for compact air separation units.

Demand for small, flexible air separation units is rising in India and South East Asia, especially in regions where regular cylinder or truck deliveries over long distances can be challenging. Regional operators face stiff competitive pressures. Hence they are looking for cost-effective, reliable and flexible solutions that can be deployed quickly and easily. In addition, these air separation units must be designed for ease of operation and low maintenance over a long service life.

Positioned at the forefront of international plant engineering and a pioneer in air separation, Linde has been successfully engineering air separation plants for over a century and delivering these to a global customer base. In fact, Linde has already built more than 4,000 air separation plants around the world. Its leadership in this area is built on a combination of innovative process technologies, state-of-the-art components and end-to-end engineering services extending from design and planning through to construction and operation. Linde is now bringing this technology excellence and its unique insights to the compact segment.

The aim is to meet rising market demand for small, high-quality ASUs, offering attractive total cost of ownership and zero-hassle installation and operation. The Project Engineering Division (PED) of Linde India Ltd. achieves this by manufacturing plants locally in India. Key components for these plants such as brazed aluminium exchangers, expansion turbines and distillation columns are supplied from Linde works outside India. This gives customers access to high-quality Linde products at competitive prices.



In tune with local needs.

Since 1972, the Project Engineering Division (PED) has been building air separation units (ASUs) for the Indian market. Reflecting the vast experience we have gained in the world-class ASU segment, our newly developed compact units LION™ 1, LION 2 and NOVON™ 3 are perfectly tailored to local market dynamics. In particular, they are designed to meet the cost, reliability, manageability and safety targets that you face as a regional operator.

Best of both worlds

A modular design standardises all the main plant components for maximum cost efficiencies and ease of deployment. These modules are pre-fabricated at both our German and Indian workshops to the maximum possible extent. PED's manufacturing workshop in Kolkata is responsible for most of the packaged components, with Schalchen, Germany, engineering and delivering the central plate-fin heat exchanger. The successful combination of German engineering excellence and local production capabilities gives you the best of both worlds.

Performance highlights of package ASU plants

Advanced technology

Plant designs are created using advanced process simulation tools as well as sophisticated engineering design tools. A proven control concept with cutting-edge software ensures reliable, convenient and economical plant operation. The control equipment is supplied in a plug-and-play container for easy installation.

Modularised design for rapid delivery and start-up

Key components such as the air compressor, molecular sieve valves, turbine and coldbox are delivered completely pre-packaged and tested. The exchangers and columns are installed in self-supporting coldboxes. In addition, the sizes of the coldboxes are designed for road transportation, which also eases on-site installation. Other modules such as the valves and pumps are installed in skids to the maximum degree possible for pre-fabrication and testing.

Electrical and instrumentation equipment is delivered in plug-and-play containers. The plant control system together with the operator station(s) and analysis equipment



Typical design of a LION/NOVON plant.

come in an air-conditioned container, ready-cabled and shop-tested, with the DCS pre-configured for rapid start-up. A separate shop-assembled container is supplied for all electrical medium-voltage switchgear, transformers and low-voltage switchgear, including VFDs for pumps and other electrical equipment. All of these modules and skids are equipped with remote I/O modules for easy bus connection. This pre-assembled, packaged design minimises on-site erection timelines.

Safe operation with highest quality standards

At PED, we are firmly committed to the highest quality, safety, health and environmental (QSHE) standards. You expect us to supply safe and economical plants equipped with the latest technology and we deliver on that expectation – worldwide.

In addition, sophisticated interlock functions protect our ASUs against any unforeseen failures or maloperation. They also ensure the plant remains in a safe condition even in the event of a power failure. Protective measures are applied wherever the safety of operating personnel may be jeopardized by the process, rotating machinery or exposure to extreme temperatures.

All of our projects are executed to the following rigorous standards to ensure the highest levels of quality:

- Local Indian legislation and norms
- EN ISO 9000 : 2000
- ISO 9001
- ISO 14001
- PED 97/23/EC
- OHSAS 18001
- ASME code, (U Stamp)
- SCC checklist
- Work safety and environmental protection legislation

Competitive costing with in-house manufacturing

Our packaged plants are designed to minimise total cost of ownership over the entire lifecycle. This starts with the cost efficiencies of local production, backed by the technology leadership of our German-engineered coldboxes.

In-house manufacturing of the heat exchangers, columns, coldboxes, skids and electrical and instrumentation containers allows us to combine the benefits of competitive costing with high quality standards. Aluminium and/or stainless steel is used for piping and columns.

Ease of operation

Our new compact plants are designed for ease of operation. Made by internationally renowned manufacturers, all instruments are engineered to the highest standards of quality and reliability. The instrumentation panel is connected to a safe and sophisticated process control system, using the latest proven digital control technologies for optimum reliability.

Advanced control functions can support fully unattended operation, automatic start-up from cold conditions, automatic load changes and production adaptations. Ease of operation and remote control functionality contribute to the lowest possible total cost of ownership.

“Our aim is to offer our customers small, compact air separation plants tailored to their needs at globally competitive prices.”

Kanai Ghosh

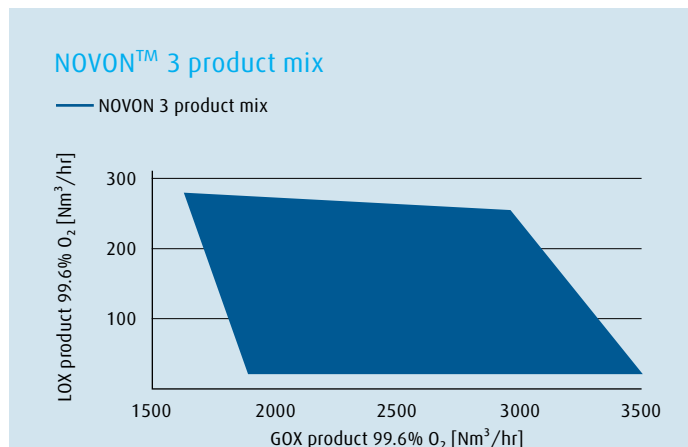
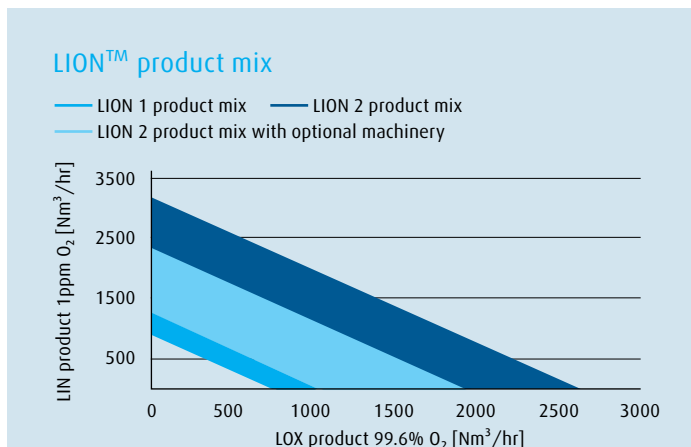
Head of Project Engineering Division (PED)
Linde India Limited



Column manufacturing in Kolkata.

The solution you need at a price you like.

Our high-purity products at a glance

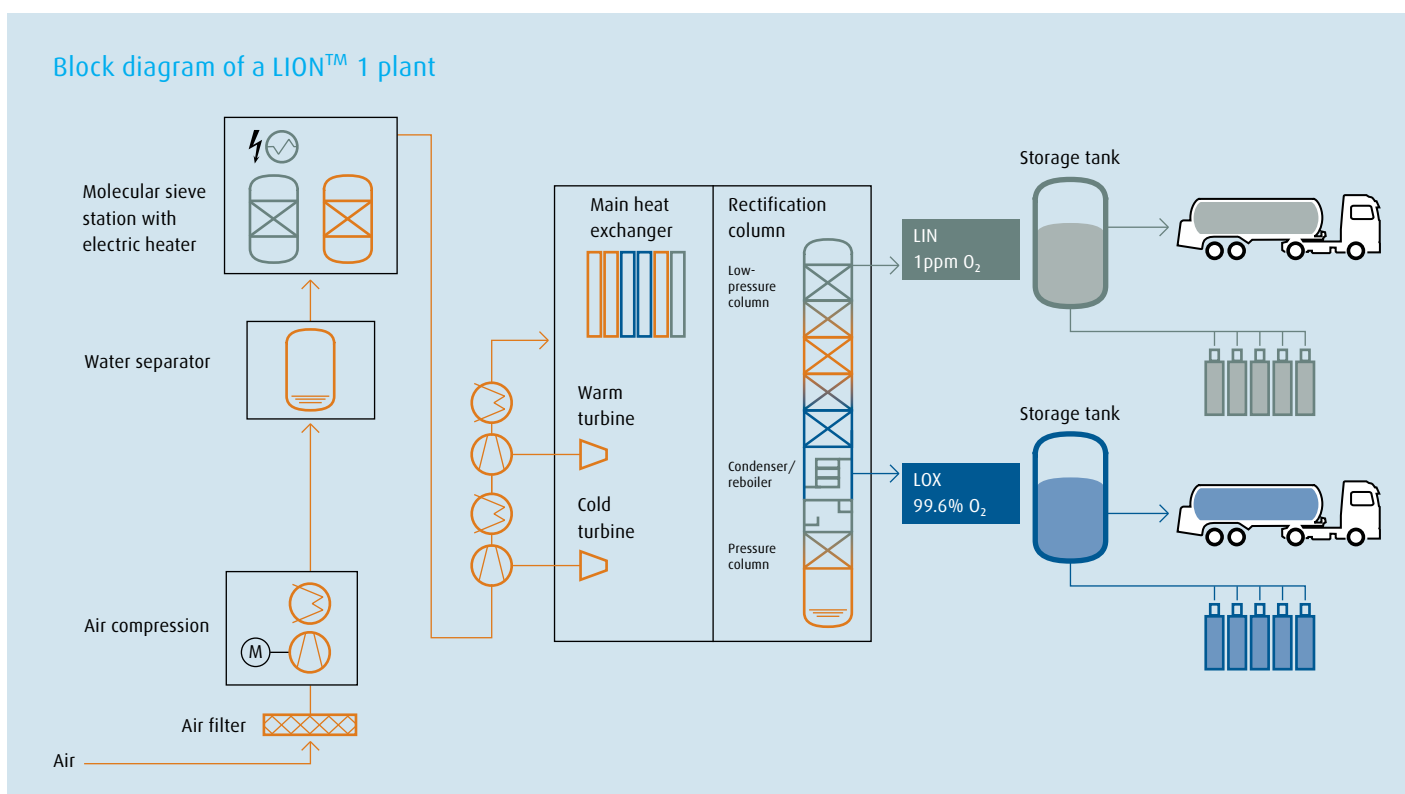


Our compact ASU family comprises the LION™ 1, LION 2 and NOVON™ 3 models to ensure the perfect fit for your needs. LION 1 produces liquid oxygen and nitrogen, with LION 2 adding liquid argon to this list. All gases are generated with purity rates of up to 99.9%. Both ideal for the merchant market, LION 1 is perfect if you are based in a remote location and wish to keep gas distribution costs to a minimum. LION 2 is the solution of choice for international as well as local industrial gas suppliers.

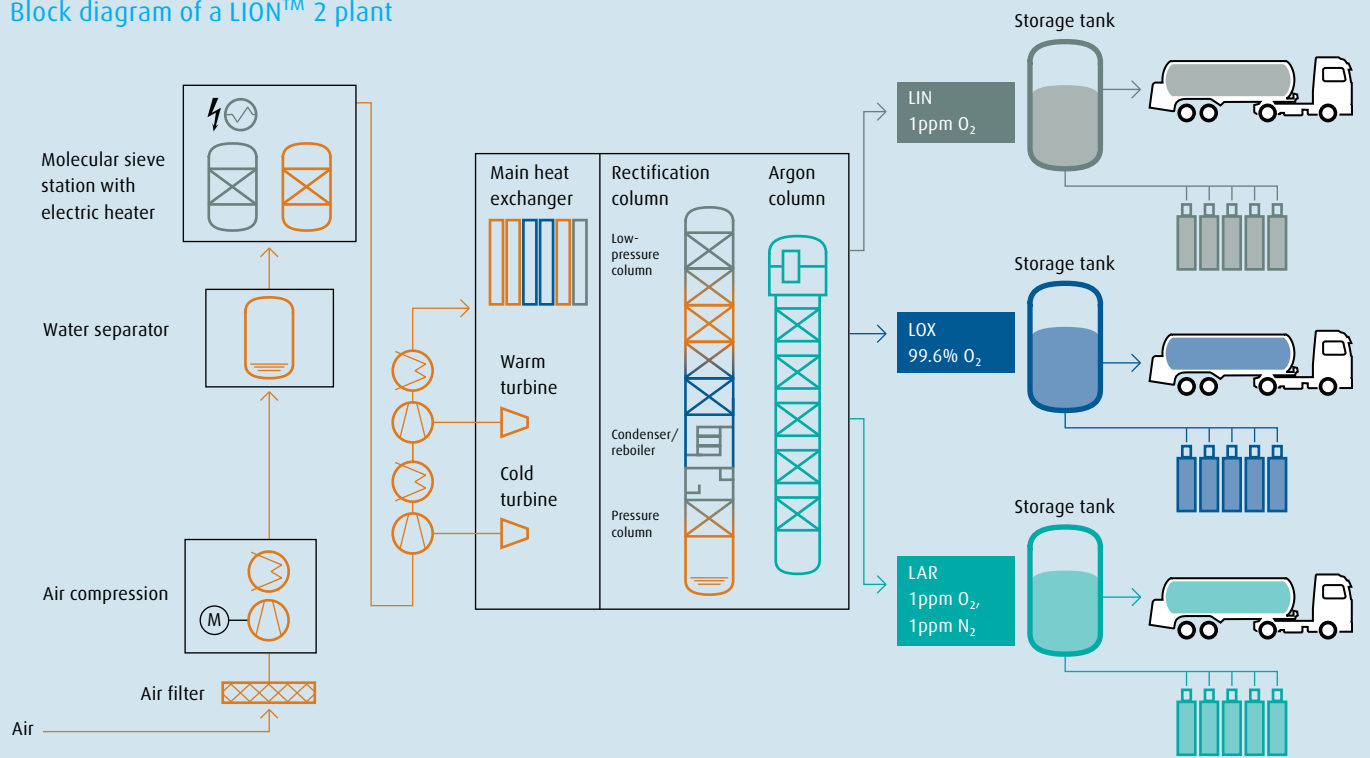
NOVON 3 is the ASU for you if you require no more than 120 tonnes of oxygen gas per day. These plants support numerous industrial process flows requiring nitrogen and oxygen in this volume range. Typical customers include small steel and paper plant operators. NOVON 3 delivers purity levels of up to 99.9%.

How LION 1, LION 2 and NOVON 3 work

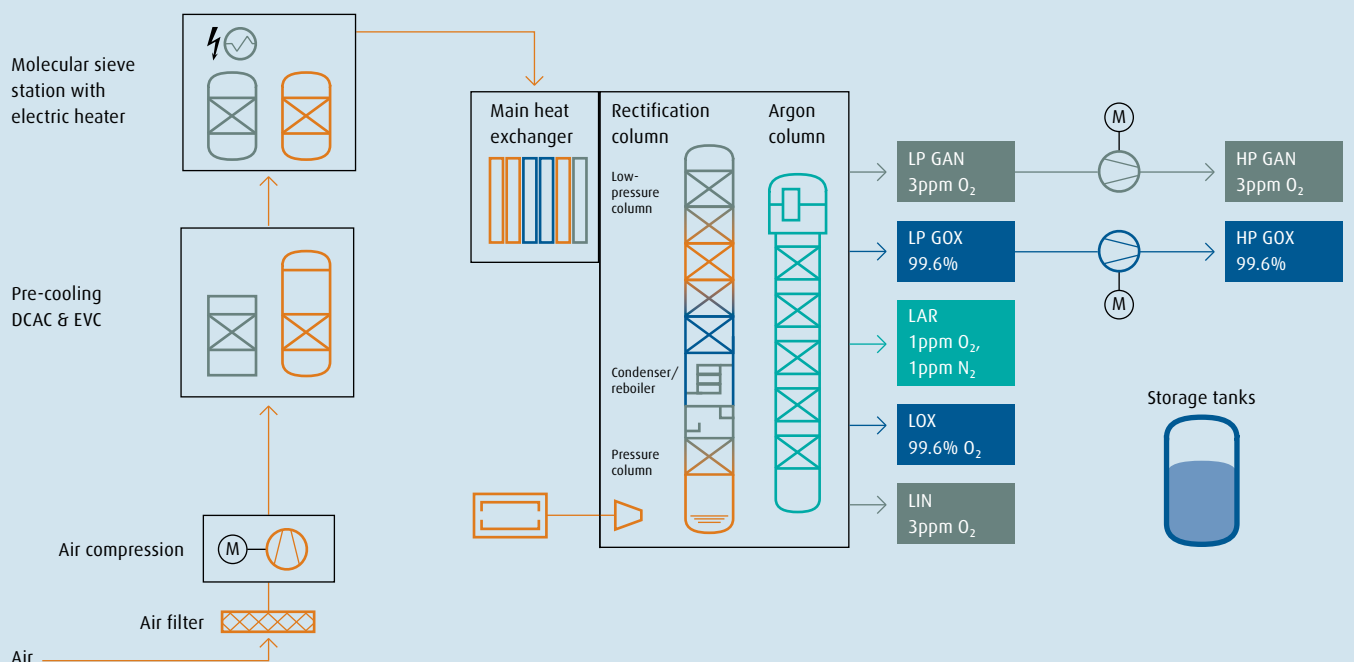
The following block diagrams give you a closer look at our different compact ASU models and their respective process flows, productivity rates and energy efficiency performance.



Block diagram of a LION™ 2 plant



Block diagram of an NOVON™ 3 plant



Your partner for the production and processing of gases

Delivering reliable process plants for maximum capital efficiency

Linde has been optimizing gas processing technologies for 140 years, successfully delivering more than 4,000 plant engineering projects around the globe. Favoring trusted, lasting business relationships, the company collaborates closely with customers to enhance plant lifecycle productivity and innovate process flows. The company's proven gas processing expertise plays an indispensable role in the success of customers across multiple industries – from natural gas and oil refining through petrochemicals and fertilizers to electronics and metal processing.

Operational excellence along the entire plant lifecycle

We work closely with our customers to gain an in-depth understanding of individual needs. Building on the unique synergies of Linde as an integrated plant operator and engineering company, Linde offers innovative process technologies and services to exceed our customers' reliability and profitability expectations. This commitment to innovation extends along the entire plant lifecycle. The LINDE PLANTSERV® service team supports customers every step of the way – from maintenance and repairs to full revamps. Leveraging the latest digital technologies to offer on-site and remote operational and support services, we consistently take asset performance to the next level.

Making the impossible possible

From the desert to the Arctic, from small- to world-scale, from standardized to customized designs, Linde's engineering specialists develop solutions that operate under all conditions. The company covers every step in the design, project management and construction of gas processing plants and components. Customers can always rely on Linde to deliver the plants, components and services that fit their needs best – anywhere in the world.

Discover how we can contribute to your success at www.linde-engineering.com

Get in touch with the Project Engineering Division team of Linde India Ltd.:

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Core competencies at a glance

Plant engineering

- Air separation plants
- LNG and natural gas processing plants
- Petrochemical plants
- Hydrogen and synthesis gas plants
- Adsorption and membrane 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
- Liquefied helium tanks and containers
- Air-heated vaporizers
- Water bath vaporizers
- Spiral-welded aluminum 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

