

Making our world more productive



Hydrogen:

Serving You Is Our Business





Think Hydrogen. Think Linde



We offer reliable supply through our sophisticated fleet of cryogenic liquid tank trucks and gaseous tube trailers, as well as our network of more than 65 hydrogen distributor locations.

Linde offers a combination of commitment and capability to hydrogen users — including a full range of industrial gases, technologies, services and system support — dedicated to helping you succeed.

Whether your hydrogen supply is used to help achieve environmental target goals...for hydrogenation of chemicals or fats and oils...for heat treating steel...for fuel...or for another application, our broad experience enables us to know and understand your requirements, so we can supply in-depth services — as well as hydrogen with a lower carbon intensity.

Linde works with you to help you determine the most economical, flexible, reliable and safe supply options. We have the technological and process know-how to help you increase efficiency, save energy costs, and meet environmental compliance standards, all while providing you with the most dependable source of hydrogen in the industry. No other U.S. supplier can dedicate so many resources to giving you the edge you need.

With Linde, you draw on a wealth of resources:

- The largest North America supplier of industrial gases and gas services and leader worldwide
- A complete selection of hydrogen supply options
- Wide range of customer support services and industry experience
- Leading-edge application technologies

A Full Menu Of Customer Supply Options

Linde offers you a full array of energy-efficient hydrogen purification and supply options, which can be tailored to meet your needs and supply specifications. You can select from:

- Stationary and portable merchant liquid storage systems
- High-pressure liquid hydrogen systems
- Merchant gaseous storage systems (tube trailers and receiver modules)
- High-pressure cylinders
- On-site production systems such as steam methane reformers (SMRs), partial oxidation gasification, autothermal reforming and electrolysis
- Pipeline networks

Which system best suits your operation? Our hydrogen experts work closely with you to help you determine your required, flow rate, pressure, usage pattern, site location, available utilities and power costs. This analysis helps ensure that you receive the most reliable, cost-effective system sized to your requirements.

Once you select a system, our highly trained engineers and technicians design, install and maintain it for you. We retain ownership, so you don't have to make a major capital investment or worry about maintaining or staffing the system.

A Strong Record Of Safety And Reliability

Linde supply options reflect an outstanding record of safe, reliable, trouble-free operation, the result of:

- More than 70 years of production experience
- Highly skilled system design and engineering teams
- Some of the most stringent safety practices, equipment specifications and quality-control procedures in the industry
- A preventive maintenance program

Linde's U.S. system installations meet some of the most demanding criteria in the industry. All meet or exceed National Fire Protection Association, Occupational Safety and Health Administration, and state and local requirements. Periodic inspections help ensure continued safe, efficient performance and environmentally safe operating standards.

Once we bring your system on-stream, our commitment to customer service remains just as strong. We continually look for ways to improve our service and provide the most advanced supply and application technologies in the industry.



In-Depth Technical Application Support

Our customer relationship is further enhanced by our in-depth technical application support.

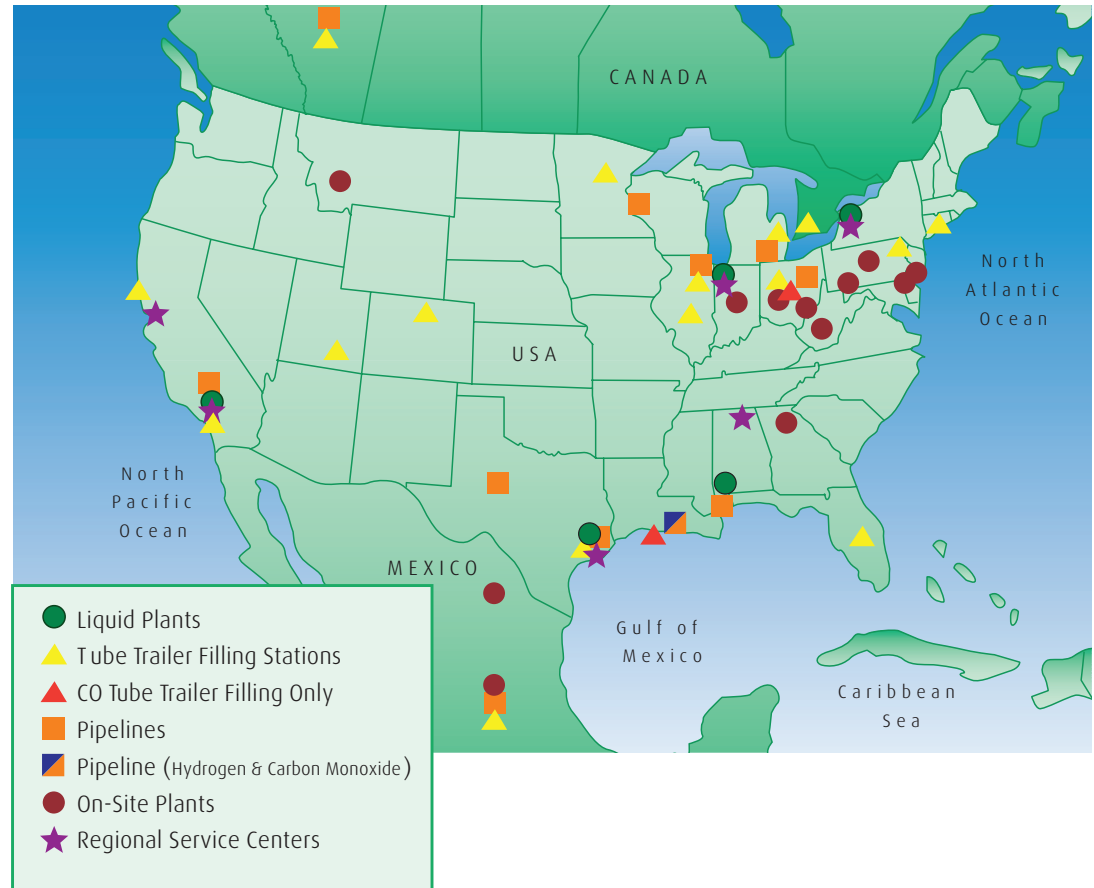
- The staffs at our technology centers have extensive field experience working directly with customers
- Our research and development groups continually strive for new and improved application technologies, such as the advanced gas reactor for hydrogenation
- Our engineering specialists focus on meeting the hydrogen supply needs of a variety of markets. These markets include chemicals, aerospace, metals, electronics, fats and oils, glass, and utilities
- We provide alternative fuels such as low carbon intensity hydrogen

A Highly Versatile Distribution Network

To deliver our hydrogen supply, we maintain a sophisticated fleet of cryogenic liquid tank trucks and gaseous tube trailers. More than 210 hydrogen experienced drivers operate this extensive fleet.

In addition, we can supply cylinders from more than 65 hydrogen distributors locations.

Linde's North American Hydrogen Distribution Network



Strategically Located Production Facilities

Linde's production centers are strategically located to optimize hydrogen supply to our customers. Our liquid hydrogen production plants include storage facilities that can provide 361 million cubic feet of hydrogen at any time. North American facilities include:

- Five liquid plants
- Twenty-one tube trailer filling stations
- Eleven pipeline complexes
- Hydrogen coproduct production, including carbon monoxide and synthesis gas

In addition to these North American locations, Linde also provides hydrogen globally with facilities in Europe, Asia, Central and South America.

Linde's Multiple Supply Options

Linde can help you determine the most economical hydrogen supply choice to meet your needs. If your facility requires liquid or gaseous hydrogen, you'll find that we offer several economical supply options at your required purity level. Dependent on your location, Linde can offer hydrogen with lower carbon intensity to help achieve carbon footprint reduction goals.

Merchant Liquid Hydrogen

Linde delivers liquid hydrogen from Compressed Gas Association (CGA) Grade A — 99.995 percent purity — to the highest electronics grade. Choose from our three liquid hydrogen supply options:

- Horizontal and vertical cryogenic storage tanks in a variety of sizes
- Pressurized liquid systems that provide up to 6,000 psi gas from a low-pressure liquid source, with fully automatic operation
- Portable liquid hydrogen units, consisting of cryogenic trailers connected to trailer mounted atmospheric vaporizers, which act as short-term, temporary or backup hydrogen supply.



Linde's Hydrogen facilities are strategically located throughout North America to ensure reliable supply. Our newest plant in LaPorte, Texas is one of five Linde liquid hydrogen facilities in the U.S.

Pressurized Liquid Trailers

We provide reliable liquid hydrogen delivery by operating a fleet of metered and pressurized cryogenic tank trucks that:

- Help conserve hydrogen
- Increase safety during transfills by eliminating pumps or power sources that can cause potential hazards
- Reduce fill time
- Provide immediate, accurate delivery records using built-in off-loading meters

Merchant Gaseous Hydrogen

To meet your merchant gaseous hydrogen needs, we also offer four options:

- Tube trailers
- Receiver modules
- Tube trailers combined with receivers, with trailers as your primary supply, and receivers providing backup storage capacity
- High-pressure cylinders
- High-pressure tube trailer for the transportation cylinders

No matter which option you choose, our fleet of more than 140 hydrogen tube trailers ensures on-time delivery of gaseous hydrogen from CGA Grade B — at a 99.95 percent purity level — through electronics grades.

Among our many supply options, receiver modules can safely and efficiently store gaseous hydrogen on your premises.

On-Site Plants

For those requiring larger volumes of hydrogen, or coproducts such as carbon monoxide, synthesis gas and/or steam, on-site hydrogen or synthesis gas generators are an excellent option.

Linde's on-site system designs are based on a full range of technologies, including steam methane reforming, partial oxidation gasification, autothermal reforming and electrolysis. To produce hydrogen or synthesis gas, these units react natural gas or hydrocarbons. For added reliability, Linde's extensive liquid hydrogen network can provide backup to on-site hydrogen supply.

ITM Linde Electrolysis* can provide on-site hydrogen production. Using water and electricity the electrolyzer stack units split water into oxygen and hydrogen. The hydrogen is stored in high pressure receivers.

* ITM Linde Electrolysis is a joint venture of ITM Power and Linde Engineering

- Vaporizers** On-site plants offer a number of advantages:
- Linde owns and operates every system, so you don't have to invest capital or worry about maintenance and staffing
 - You have the assurance of a time-tested, proven process
 - Each system reflects years of design and operating experience
 - We use a precision, computer-aided engineering system to assess and satisfy your requirements
 - The systems include the latest materials, packaging concepts, heat recovery and control methods available

Pipelines: Your Continuous Link

Linde pipelines supply more than 1.3 billion cubic feet of hydrogen each day to customers in the chemical, petrochemical and refining industries, and other customers requiring large quantities of hydrogen.

Linde operates pipeline networks in the Gulf Coast area of Texas; Whiting, IN; Ontario, CA; Theodore, AL; Geismar, LA; Ecorse, MI; Salt Lake City, UT; Toledo, OH; and Edmonton, AB, Canada, to supply hydrogen to customers in these areas.

We control and monitor each of our pipeline streams to ensure purity and meet process variables such as flow rates and required pressures. Sources for these pipelines include:

- Pressure swing adsorption, the principal process to recover and purify byproduct feedstock
- Membrane gas separation, which provides hydrogen at 95 percent purity or higher, using membranes that separate and remove impurities from hydrogen-containing streams
- Steam methane reformers
- Partial Oxidation gasification
- Autothermal reformers

Steam methane reformers, partial oxidation gasification, autothermal reforming and electrolysis units can meet your hydrogen and coproduct requirements.

Your Link To Our Logistics Center

Our National Logistics Center in Tonawanda, NY, controls all of our fleet dispatching operations. This award-winning, state-of-the-art facility:

- Stores customer-specific data, based on previous usage patterns, to provide accurate reordering information
- Dispatches more than 30,000 deliveries each month
- Remains staffed 24 hours a day, 365 days a year
- Offers a toll-free 844-44LINDE number for easy access
- Offers the *Tracker*TM remote monitoring system

Some customers choose to link their facilities directly to the National Logistics Center through our *Tracker* remote monitoring system. This system continuously monitors your supply level and places orders automatically.

Whether you use the *Tracker* system or place your own orders, you can still rely on a supply network staffed by dedicated professionals committed to customer satisfaction and on-time delivery.

To support on-time, reliable delivery around the clock, we closely monitor all of our distribution activities from our state-of-the-art National Logistics Center.

Conversion Table

Kilograms	Normal Meters (Gas ¹)	Standard Cubic Feet (Gas ²)	Gallons (Liquid)	Tons
1	11.12	423.2	3.733	0.0011
0.0899	1	38.04	0.3355	9.906 x 10 ⁻⁵
0.002363	0.026	1	0.00882	2.604 x 10 ⁻⁶
0.2679	2.981	113.4	1	2.96 x 10 ⁻⁴
907.2	10,094.6	384,000	3386	1

¹Gaseous normal meters at 0° C and 14.7 PSIA

²Gaseous standard cubic feet at 70° F and 14.7 PSIA

The Highest Level Of Customer Service

You'll find our dedication to our customers most evident in the high quality and broad scope of services we provide. These services include:

- Technical assistance available to all of our liquid and gaseous customers nationwide
- Twelve regional service centers, and service technicians located throughout the country, on call to help you 24 hours a day, 365 days a year
- Scheduled system safety inspections
- Preventive maintenance programs to help systems run smoothly
- Local representatives who respond rapidly to your inquiries and concerns
- Safety training materials for customer programs, Linde YouTube channel links, literature and seminars

Local Linde representatives respond quickly to your concerns and conduct system safety inspections and preventive maintenance.

Think Linde, Think Hydrogen

For total hydrogen supply capabilities, large production capacity, and a wealth of hydrogen supply options.

For experience, system safety and reliability, technical application support, and commitment to customer service and satisfaction...make the right choice. See why more and more companies are turning to Linde for their hydrogen requirements.

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