

Hydrogen and fuel cells

Tomorrow's energy, today

POLE
^
HIGH
TECH



The commitment for a high-potential, secure and environmentally-



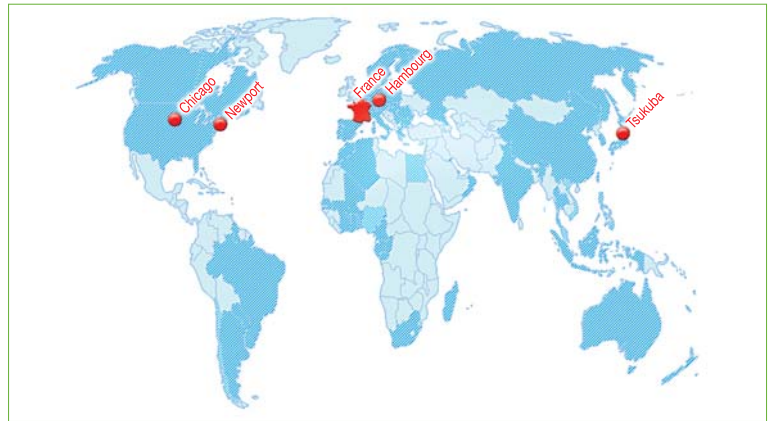
Air Liquide, an international group.
A half-century of hydrogen supply chain expertise.

World co-leader in industrial and medical gases, the Air Liquide group is present in more than 70 countries.








Founded in 1902, Air Liquide has more than **36,000 employees worldwide**, generates more than **10 billion euros** in revenue and operates **8 Research and Development centers**.

Hydrogen, a clean energy carrier

Hydrogen can be produced from a wide variety of sources. Hydrogen is one of the energy solutions of the future, from both an environmental and economical point of view. Used in a fuel cell, it offers a tremendous potential for the production of clean, silent energy with high efficiency. Air Liquide is present throughout the entire hydrogen "chain", designing innovative solutions for the production, storage, distribution and supply of hydrogen to fuel cells. Air Liquide currently operates 200 hydrogen production units (50 of which are large-capacity facilities) and the largest hydrogen pipeline network (1,700 km) in the world.



 Air Liquide's presence throughout the world.  8 R&D Centers, including 4 in France.

THREE HYDROGEN DISTRIBUTION METHODS		HYDROGEN ENERGY INNOVATION	
H₂	<p>Piping: The largest hydrogen transport pipeline network in the world. Northern Europe: nearly 1,100 km. United States: Texas and Louisiana, approximately 600 km.</p>	 <p>Large volume</p>	<p>Hydrogen stations: Air Liquide designs, builds and operates high pressure hydrogen service stations (350 and 700 bar) in Madrid, Kawasaki, Luxembourg, Singapore, and Sassenage...</p> 
	<p>Trucks: In compressed gas or liquid form (in isothermal tanks). More than a thousand vehicles in Europe and North America.</p>	 <p>Medium volume</p>	<p>Storage: Air Liquide develops all kinds of storage tanks for high pressure gaseous hydrogen (350 to 700 bar) and for liquid hydrogen at very low temperature (- 253°C).</p> 
	<p>Cylinders: Hundreds of thousands of compressed gas cylinders of variable capacity throughout the world.</p>	 <p>Small volume</p>	<p>Connecting systems Clip'On patented high pressure "Plug and Play" hydrogen cartridge system integrates all gas components (regulator, safety and connecting components) and allows an empty cartridge to be exchanged with a full one.</p> 
		<p>Fuel cell: Axene has been designing and producing innovative PEM type fuel cell systems since 2001.</p> 	



Axane, a wholly owned subsidiary of the Air Liquide group, develops hydrogen fuel cell systems.

Axane

Axane supplies complete and innovative energy solutions: portable energy and backup power for various applications and prime power for remote sites. Modular Axane generators, in the 0.1 to 5 kW range, provide energy solutions to address time of operation, volume, reliability and noise problems...

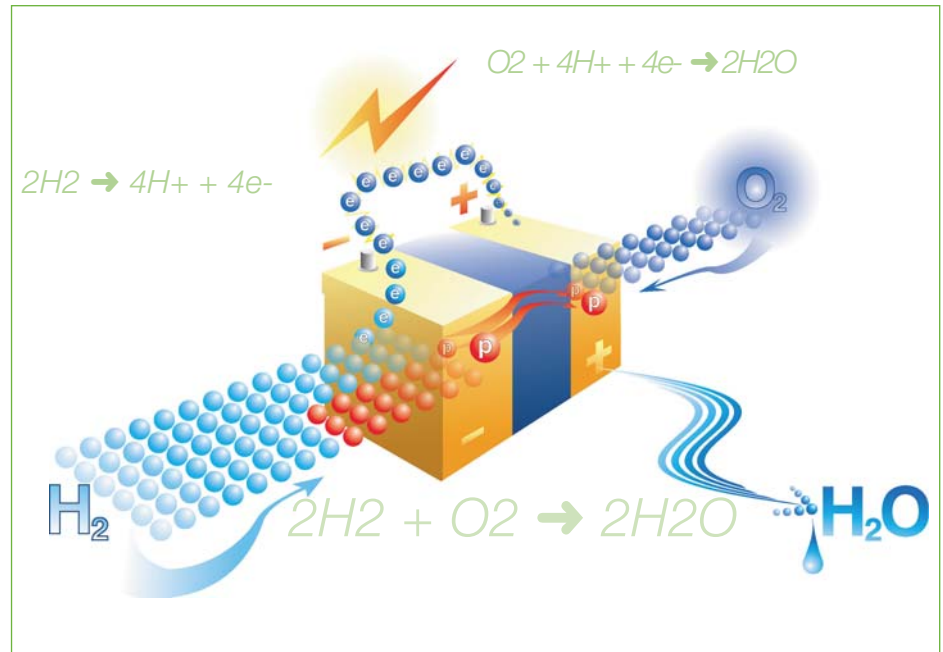
Axane offers a range of 4 fuel cell products:

- Multipurpose portable generators
- Stationary generators for continuous power supply
- Backup generators and/or UPS
- Plug-in power generators

Air Liquide creates AXANE in May 2001.

AXANE and the Air Liquide group together propose a unique overall energy solution that combines fuel cells and hydrogen.

The combination of skills, technological advances and expertise of the team is supported by 8 R&D centers. Air Liquide and AXANE bring together significant research and development capability of unparalleled strength.



The principle of the fuel cell was demonstrated in 1839 by Sir William Grove. He achieved the reverse reaction of water electrolysis. A fuel cell enables the conversion of chemical energy directly into electrical energy. This conversion produces electricity, heat and water simultaneously, in an universally known chemical reaction.

The advantages of the hydrogen and fuel cell solution:

- Silent
- No polluting emissions
- High quality of electrical current
- Simplified maintenance
- Extended operation time
- Compactness
- High efficiency



The Air Liquide-Axane “integrated energy” solution



Axane's know-how associated with Air Liquide's expertise: a global and unique offer.
A single provider and an optimized system adapted to your business.

Today, Axane is the only fuel cell supplier that integrates a hydrogen logistics package into the core of its offer, to propose high-performance and reliable solutions.

With your assistance, we study and determine the most appropriate solution to your energy requirements. Our commitment is based on providing our customers permanent support to ensure that their projects are successfully executed. Axane and Air Liquide offer a complete line of associated services, from engineering to commissioning, including maintenance and remote monitoring to operate the systems.

Present in more than 70 countries, the Air Liquide-Axane offer guarantees complete service including simple hydrogen logistics adapted to your project.



peace of mind Solution

Air Liquide proposes a global reliable energy offer:



Fuel cell and hydrogen installation



Appropriate hydrogen logistics: energy “on demand”



Maintenance and remote monitoring



Studies and safety training



A range of 4 products adapted to all types of use



Axane: a wide range of multipurpose modular fuel cells from 0.1 to 5 kW.

Axane proposes a range of 4 products that can be adapted to all professional applications

Mobixane™



Portable electric power source



Mobixane™ offers extensive advantages in numerous portable applications: **maintenance work** (telecom, local communities, building construction, networks), **emergency services** (firemen, rescue teams, emergency medical assistance...), **cinema, entertainment** (sporting and cultural events...)

Comm Pac™ Base



Stationary electric power source



In its different versions, **COMM PAC™ BASE** demonstrates its advantages in numerous power supply applications for isolated sites such as telecommunications antennas, sensors, beacons, or isolated residential areas...

Comm Pac™ Backup/UPS



Extended backup power source



COMM PAC™ UPS BACKUP is designed for emergency backup applications in health care facilities, banks, remote telecommunications sites, and data-centers...

Auxipac™



Integrated multipurpose generator



AUXIPAC™ offers far-reaching advantages in numerous applications: **small electric vehicle propulsion** (wheelchair, bicycle, scooter...), **APU for special vehicles** (command post...), **boating, health services** (organ transport, ambulance...), **industrial vehicles** (forklifts...).

Our fuel cell generators offer users numerous benefits:



Technical strengths:

- Extended operation time
- Quick start less than 5 seconds
- High efficiency
- Simplified maintenance
- Possible hybridation with renewable energy sources (solar, wind...)
- Indoor* or outdoor use

* with adequate ventilation

Technical strengths



Operating features:

- Silence
- No pollutants or greenhouse gas emissions
- Ease of use
- No vibrations
- Compactness

Comfort

AXANE displays its expertise in fuel cell technology



A few examples of Axane and Air Liquide installations throughout the world.



Bouygues Telecom - Menville (France)



A mobile GSM antenna (Bouygues Telecom) is powered by an Axane COMMPAC fuel cell. All of the energy required by installation (1.8 kW - 24/7) is continuously supplied by a fuel cell and a gaseous hydrogen storage unit.

Telecom

Several mobile telephone operator sites are equipped with Axane fuel cells combined with Air Liquide hydrogen logistics, and some are coupled with solar panels at certain installations. The Axane-Air Liquide offer: a solution to the BTS (Base Transceiver Station) power supply issue for GSM remote sites that are difficult to connect to the electrical grid or as an extended backup solution.



GSM Telecom site (Greece)



COMMPAC Base coupled with solar panels - 4 kW.

This solar panel and fuel cell installation cleanly produces the electric power required for operating a Telecom GSM antenna disconnected from the conventional electrical network. The solar panels provide electrical power during the day, while the fuel cell provides the necessary power at night or in the winter.



Telefonica - Villarejo de Salvanes (Spain)



A COMMPAC secures a GSM tower for a Telefonica installation. In the event of a power outage, the COMMPAC provides half day of operation at 5kWatt - 48VDC.

Service station



Use of Mobixane™ for urban maintenance work



Total in Berlin - Hydrogen Service Station. COMMPAC Base - 5kW.

In continuous, the COMMPAC fuel cell supplies part of the electrical energy of the hydrogen service station in Berlin.

Expeditions.

A loyal partner since Axane was founded, the french explorer Dr Jean-Louis Etienne was equipped with an Axane fuel cell during his two last expeditions: "Banquise Mission" and "Clipperton Expedition".



Hychain.



A full-scale "test" initiated by Air Liquide and Axane and supported by the European Commission to promote the development of hydrogen energy for small transport applications, in 4 European countries. www.hychain.org

Several awards for the Axane fuel cells

Axane fuel cells received several awards to acknowledge an innovative technology, initially awarded by the Design Observer, then by SIEMENS.



Axane received the 2004 Observer design award with special mention from the ADEME.



In 2004, Siemens awarded Axane the design Grand Prize for Innovation for its innovative fuel cell.



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