

Air Products and Technip Hydrogen Alliance

Working together to enhance refining
industry productivity for over 20 years.

The year 1992 marked the beginning of a new era in supplying hydrogen to the global refining industry. That's when Air Products and Technip formalized their Hydrogen Alliance to collectively design, construct, and operate hydrogen and synthesis gas production plants. Today, 20 years and 35 projects later, the Air Products and Technip worldwide Hydrogen Alliance continues to create value for its customers by providing safe, efficient, and reliable over-the-fence hydrogen supply.



This steam methane reformer (SMR) will produce over 90 million standard cubic feet per day (scfd), or 100 thousand normal meters cubed per hour (NM³/hr), of hydrogen and syngas to support PetroChina's Sichuan refinery and petrochemical facilities in 2013. Significantly, this represents the first time a state-owned refinery in China outsourced its hydrogen requirements.

THEN:

Alliance established to meet refinery hydrogen demand growth

At a time when the refining industry needed to increase hydrogen capacity to produce clean fuels and to ensure that plants met environmental standards, the Air Products-Technip Hydrogen Alliance became a trendsetter for the sale-of-gas (SOG) business model. The Alliance provided refiners with reliable and cost-effective hydrogen, along with reduced risk and capital investment. Air Products and Technip combined their strengths and expertise to design, build and operate hydrogen plants to help customers reach their goals.

The H₂ Alliance combines Technip's industry-leading expertise in steam methane reformer (SMR) design and construction with Air Products' strength in gas separation technology and plant operations. The Alliance's first two plants were built to serve refineries in Martinez, California. One plant was engineered to maximize hydrogen generation with judicious pre-investment for a 40% future capacity increase. The other was custom-designed to process a blend of up to eight different refinery fuel gas streams for either feed or fuel.



This plant in Martinez, California, was among the first H₂ Alliance projects in 1992.

NOW:

Still providing innovative and strategic solutions

Two decades later, efficiency, environmental, and economic drivers keep pushing the need for continuous improvement and innovation, making over-the-fence SOG agreements attractive to refiners around the world. Air Products' fleet of facilities includes over 60 hydrogen plants, most built as part of the H₂ Alliance, with a total onstream capacity of 2.5 billion scfd (BSCFD) (or 2.8 million NM³/hr) of hydrogen, serving clients worldwide. In addition, Air Products operates 0.3 BSCFD (or 0.3 million NM³/hr) of hydrogen off-gas facilities that supplement hydrogen supply to our pipeline systems, for a total capacity of 2.8 BSCFD (or 3.1 million NM³/hr).

Technological developments have resulted in increasingly efficient, reliable, compact, and cost-effective plants, with high health, safety, and environmental standards. In many of our SMR plants, low-NO_x burners and selective catalytic reduction (SCR) units are deployed to meet strict environmental regulations in specific regions.



The above photo, taken in 2000, is an aerial view of our Port Arthur I hydrogen plant located in Texas.



In 2006, our Port Arthur II hydrogen plant was constructed which, along with the Port Arthur I plant, provides innovative power, hydrogen, and steam cogeneration solutions for the adjacent refinery.



In Edmonton, Alberta, Canada, two SMRs enabled this refiner to meet clean diesel regulations and complete a total oil sands conversion from bitumen to refined products. The H₂ Alliance's value-added solution provided significant economies of scale—including pipeline infrastructure, steam and innovative water reuse.

In 2013, we will innovate further via our ground-breaking commercial-scale carbon dioxide (CO₂) capture demonstration project in Port Arthur, Texas. The project is designed to capture approximately 1 million tons per annum of CO₂ from the two SMRs pictured left, compress and purify it, and then transport it to Denbury Resources for enhanced oil recovery (EOR) operations in Texas oilfields. This project will help determine an effective commercialization strategy for this emerging technology.



The H₂ Alliance's world-scale SMR came onstream in late 2011 in the Netherlands. Compared to the refinery's previous hydrogen supply, overall energy efficiency is improved by over 15% and CO₂ emissions lowered by 200,000 tons per year, comparable to taking 90,000 cars off the road annually, thanks to the most advanced processes and technologies being used in this plant.

Air Products-Technip H₂ Alliance offers numerous advantages

The H₂ Alliance helps customers reduce risk and capital requirements while improving operations and complying with environmental regulations through:

- **Extensive experience**—since 1992:
 - 30+ projects completed together, many being > 80 mmscf (or 90 thousand NM³/hr) H₂
 - 40+ hydrogen supply contracts
 - 60+ SMR/POx facilities operated worldwide with 1,500+ operating years
- **Continuous improvement**—Operating and previous project experience fed back into design of each new facility
- **Commitment to safety**—Consistently excellent safety record with American Chemistry Council
- **Cost efficiencies**—Proven track record of reduced capital costs—while maintaining reliability—through:
 - Schedule reduction
 - Design standardization
 - Leveraged purchasing agreements
 - Reduction in field construction/start-up risks
 - Application of technology advances

About Air Products

With operations in more than 50 countries, Air Products is the world's leading supplier of outsourced hydrogen, with extensive experience serving petroleum refineries and chemical facilities. Air Products operates 60+ SMR/POx facilities worldwide in addition to many off-gas plants, all of which deliver hydrogen directly or via pipeline networks to more than 80 customers worldwide. Air Products is recognized for its innovative culture, operational excellence and commitment to safety.

About Technip

As a worldwide leader in engineering, project management and technologies, Technip with its presence in over 48 countries and 30,000 employees, has served the oil and gas, refining and petrochemical industries for more than 50 years. Technip is known for delivering the best solutions to our clients, safely and successfully. Technip is a global leader in the supply of hydrogen plant and SMR technology, with the experience and expertise necessary to manage all aspects of major projects. Technip plants for refinery applications feature state-of-the-art technology for optimizing production costs while focusing on health, safety, the environment and reliability.

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