HYDROGEN

FLEXIBLUE®

HYDROGEN

HyPOX

Casale & Technip Energies' POX process for large-scale low-carbon Hydrogen plants

T.EN TECHNIP ENERGIES

CASALE

We are a global partner
in the chemical industry,
offering **integrated technologies,**
engineering, contracting
and construction solutions
for over a century.

Our mission

Contribute to shape a new sustainable planet with our plants for the production of fertilizer, methanol, hydrogen, melamine and derivatives, and help our customers creating value respecting the environment.

We are a global company front leader in the energy transition: a key player in the sustainable transformation of the chemical and energy industry, from a social, economic and environmental point of view.

Our values

INNOVATION PEOPLE CARE **PROFESSIONAL EXCELLENCE**
QUALITY **SAFETY** ETHIC **SUSTAINABILITY**

HYDROGEN

HyPOX

HyPOX, a collaboration between Casale and Technip Energy, is the go-to solution for producing low-carbon hydrogen in small to medium-sized plants.
The process is based on partial oxidation (POX) of either natural gas or off-gases with pure oxygen and a standout feature is its very carbon capture efficiency, exceeding 99%.
HyPOX is very flexible and can be easily customized to meet the specific needs of each client.
Moreover, it seamlessly integrates with existing downstream production units, making it versatile and easy to implement.

Capacity

- Best suited up to **200'000 Nm³/h**

Performances

- Natural Gas Consumption consumption:
  < 15 MJ NG/Nm³ H_2 (LHV basis)
- Net Energy (Natural Gas + El. Power) efficiency: **> 65%**

Benefits

- Low Energy Consumption
- Very high carbon capture rate
- Reduced CAPEX
- The surplus steam can be adjusted from nil to maximum export or it can be utilized for power generation
- Compact and simple lay-out, minimizing the footprint and optimizing the connections across the different sections of the plant
- Low Levelized Cost of Hydrogen (LCOH)

Enviromental Impact

Carbon capture higher than 99%
Total emissions to atmosphere:
- less than 0.1 kg CO_2 / kg H_2
- Less than 140 mg/Nm³ of NOx or even lower than 50 mg/Nm³ installing the SCR in fired heater convection section.

Casale and Technip Energies technical assets

- Partial Oxidation reactor and burner
- Medium Temperature Isothermal Water Gas Shift Converter
- Technip Large Scale Vortex (LSV®) burners

PROCESS OUTLINE

HyPOX is designed to efficiently produce syngas rich in H_2 and CO with minimum process steam, while reducing the CO_2 content and the methane slip.
The process involves the partial oxidation of natural gas or off-gases using pure oxygen burners housed in a refractory lined pressure vessel.
The raw syngas generated in the POX reactor is further processed in a Casale medium temperature Isothermal Shift Converter where the bulk of CO is converted to CO_2 while generating more H_2.

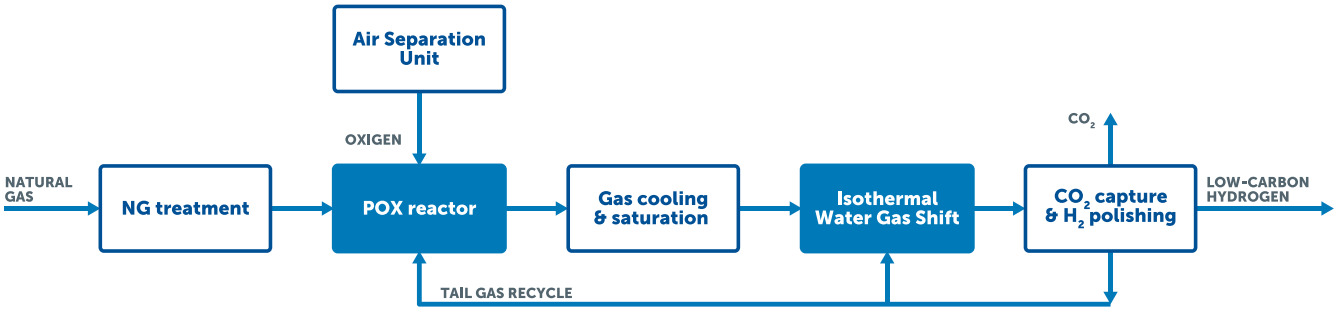
All CO_2 is then captured upfront, compressed, and delivered at the battery limits for other uses or definitive sequestration, contributing to a significant reduction in CO_2 stack emissions compared to conventional methods.
The final purification of the hydrogen is then accomplished using an appropriate unit, guaranteeing the production of high-purity, low-carbon hydrogen suitable for a wide range of applications.

HyPOX is based on a specific pre-combustion philosophy whereby all fuel requirements are met by burning part of the carbon-free syngas generated plus other tail gases. As a result, the natural gas consumption is reduced along with the associated CO_2 emissions, which is central to meet the low environmental impact target.

The whole scheme operates as a straightforward once-through process, achieving Carbon Intensities (CI) as low as 0.35-0.4 kg of CO_2 per kg of H_2. An advanced version of the process takes efficiency a step further, reducing CI to approximately 0.1 kg of CO_2 per kg of H_2.

The operating conditions for a pure oxygen burner for partial oxidation are severe due to the extremely high temperature needed to achieve a high conversion of natural gas to CO and H_2: the reformed gas temperature at the reactor outlet is in the range of 1,200-1,400°C, while the maximum flame temperature is around 2,800-2,900°C.

The design of Casale POX burners minimizes the methane slip under all plant conditions, including when operating with heavy natural gas.
An accurate mechanical design together with the presence of a water-cooling system ensuring maximum cooling efficiency of both the burner casing and the oxygen injector is essential for the burner's long and safe operating life in such harsh conditions.



Block flow diagram of HyPOX Low-Carbon hydrogen process

Casale and Technip Energies: a renewed partnership

Technip Energies and Casale have a long relationship, going back to the 1980s, with numerous achievements in the syngas and hydrogen fields. A new partnership is formed to jointly license oxidative reforming-based technologies. As part of this collaboration, Technip Energies and Casale are co-licensors of the technology and Process Design Packages (PDP's), the associated proprietary equipment, or entire plants on an EPC basis. Technip Energies and Casale together bring unique strengths for improved project performance.

CASALE

T.EN TECHNIP ENERGIES

PLANTS FOR
A NEW PLANET.
SINCE 1921.

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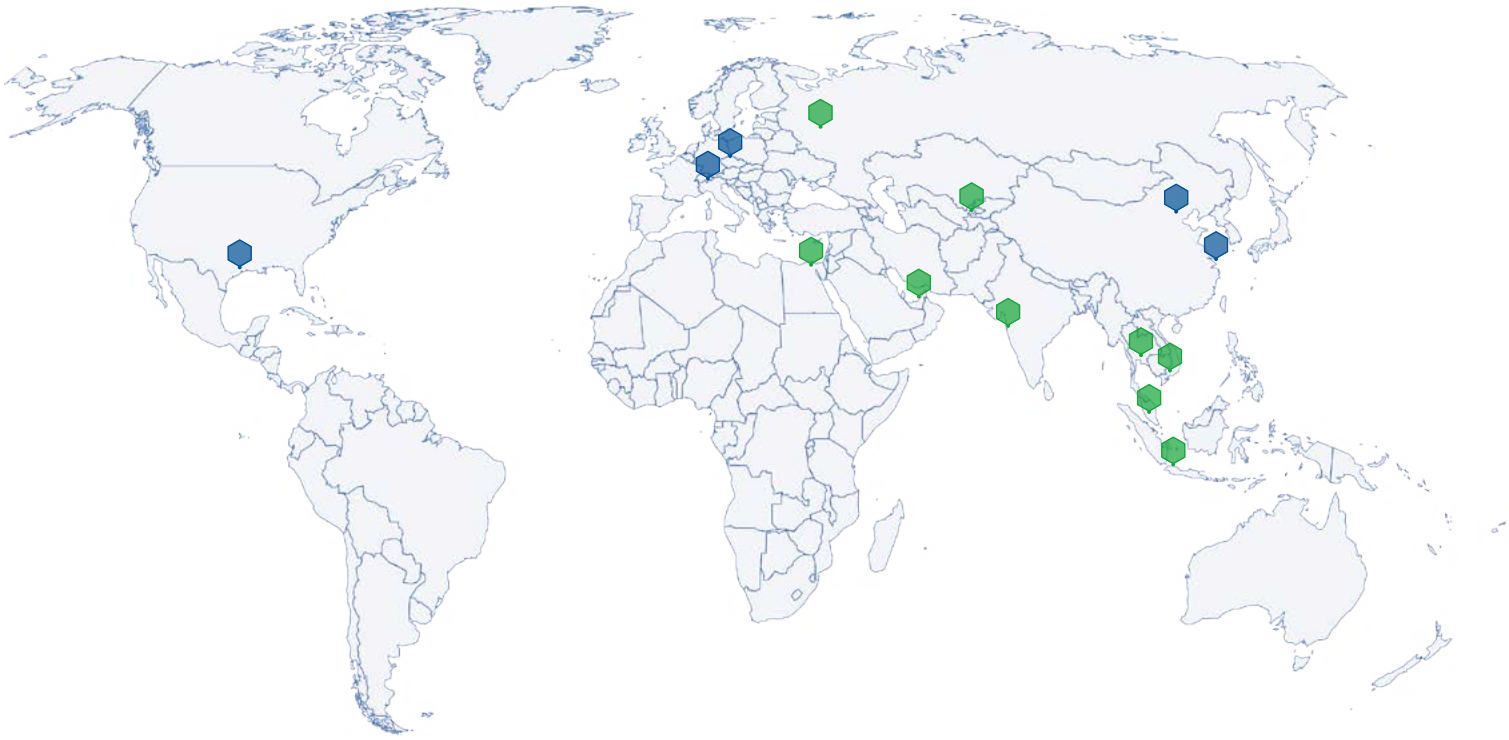
Casale in the world



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