



# AMMONIA

## N-LOOP

Casale's Ammonia synthesis loop for inert-free syngas



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**

# N-LOOP

N-LOOP is an advanced synthesis technology that draws upon the extensive knowledge accumulated by Casale over more than 100 years of experience. The design is optimized to utilize hydrogen from various raw materials, such as natural gas, coal, or other chemical processes.

For coal-based plants N-LOOP ammonia synthesis technology can be complemented by the optional integration of the Axial-Radial® CO-shift section in the purification section of the front-end.

The use of the proprietary Amomax-Casale catalyst for ammonia synthesis complete the offering, for improved efficiency and performances.

## Capacity

- Best suited from **1000 MTD** to **7000 MTD** of ammonia

## Performances

- Clean syngas consumption, per ton of ammonia produced:  
~**2'650Nm<sup>3</sup>** (or <**2'000 Nm<sup>3</sup>/MT** of H<sub>2</sub>)
- Reaction heat recovery: more than **600'000 Kcal/MT** of ammonia

## Benefits

- Low Energy Consumption
- Reduced CAPEX
- Compact and optimized lay-out, with all sections arranged to reduce the overall footprint as well as minimize the connections across the different sections of the plant
- The design can be customized to meet specific Client's needs and integrated with other sections

## Casale technical assets

- Casale Axial-Radial® ammonia converter
- Loop's waste heat recovery train
- Axial-Radial® sour CO-shift converter
- AmoMax®-Casale ammonia synthesis catalyst
- Casale electric start-up heater (optional)



## Environmental Impact

The operation of the ammonia synloop is emission free.

# PROCESS OUTLINE

## AMMONIA SYNTHESIS LOOP

The fresh make up gas is compressed up to required pressure for ammonia synthesis and recycle of unreacted gases from the circulating compressor is added.

Before entering the ammonia converter, the combined stream is fed to the hot gas-gas heat exchangers, where it is heated by the hot converter effluents.

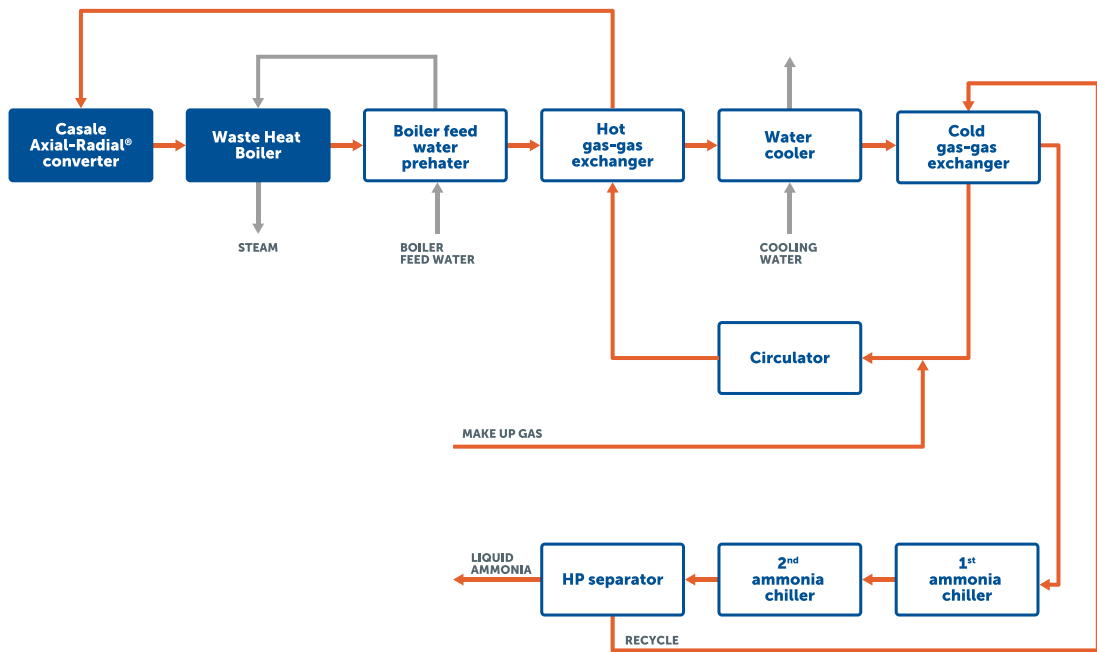
The preheated gas then enters the ammonia converter, in which it reacts over an iron-based ammonia synthesis catalyst. In particular the use AmoMax-Casale® catalyst is recommended to for its higher activity and better resistance to poisoning.

The ammonia converter is the well-proven, highly-efficient Casale Axial-Radial® type incorporating three adiabatic, beds, with intermediate cooling by two inter-bed heat exchangers.

At the converter outlet, the product gas is cooled in the hot waste heat recovery train, generating either saturated or superheated steam (according to specific needs) and then in the hot gas-gas heat exchangers,

The product ammonia is condensed first in a water cooler, then in the “cold” gas-gas exchanger and lastly in the ammonia chillers.

A considerable amount of ammonia is condensed in the first cooler leveraging the high ammonia concentration obtained in the highly efficient Casale ammonia converter thus limiting the energy consumption of the refrigeration section.



### WASTE HEAT RECOVERY TRAIN

The recovery of the reaction heat downstream of the ammonia converter depends on the design of the steam system. While many plants employ a waste heat boiler, alternatives may include a steam superheater or, in some cases, a boiler feed water (BFW) preheater.

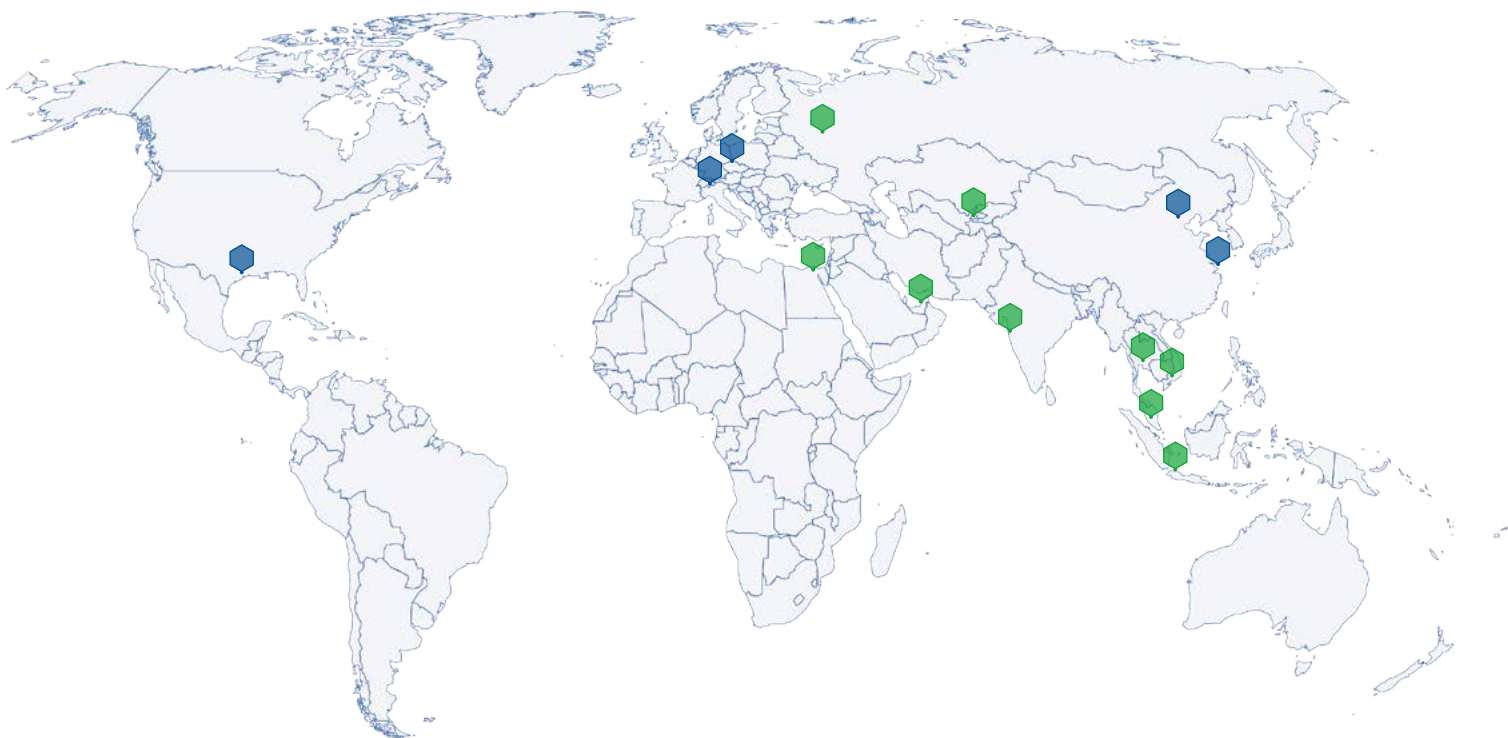
One notable advantage of Casale's design is that the waste heat boiler or superheater or BFW preheater is flanged directly to the converter outlet nozzle. This feature eliminates the need for a large and expensive connecting gas outlet pipe, which could be prone to nitriding due to the hot, high-pressure converter effluent, and therefore it improves the safety of the loop.

### CO SHIFT SECTION

The raw syngas generated from coal gasification contains an excess of carbon monoxide (CO), which needs therefore to be converted into H<sub>2</sub> to obtain a more balanced gas for ammonia synthesis.

For this purpose, one or two Casale Axial-Radial® shift converters are typically installed downstream the gasifier. They are designed to withstand the presence of sulfur and excess CO<sub>2</sub> in raw syngas before it being removal downstream.

## Casale in the world



### Headquarter

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Switzerland | Lugano  
Czech Republic | Prague  
China | Beijing, Shanghai  
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### Network of Representatives

Egypt, India, Uzbekistan,  
Indonesia, Thailand, Malaysia,  
Russia, United Arab Emirates,  
Vietnam