AMMONIA

FLEXIGREEN®

AMMONIA

FlexAMMONIA

FlexAMMONIA, is the cutting-edge solution from Casale for large-scale green ammonia synthesis plants

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**

AMMONIA

FlexAMMONIA

FlexAMMONIA, is the cutting-edge solution from Casale for large-scale green ammonia synthesis plants. Designed with a paramount focus on energy efficiency, FlexAMMONIA stands as a forefront solution in sustainable ammonia production.
It utilizes hydrogen derived from water electrolysis with renewable energy and pure nitrogen from an air separation unit.
FlexAMMONIA boasts a remarkable capacity rangeability and the ability to operate reliably, even with fluctuating renewable power supplies. This is achieved through advanced control logic solutions, plant optimization techniques (Casale Optimizer), and dynamic analysis (Casale Dynamic Analysis Model), effectively mitigating the adverse effects of cyclic operation and fatigue.
The seamless integration of performance, mechanical integrity, and flexibility sets FlexAMMONIA apart.
To maximize performance, we highly recommend Casale-Clariant proprietary Amomax®-Casale synthesis catalyst, renowned for its superior performance compared to other catalysts available in the market.
A further advantage is its adaptability to meet the specific requirements of each client.

Enviromental Impact

The operation of the ammonia synloop is emission free.

Capacity

- Best suited from **300 MTD** to **7'000 MTD** of ammonia

Performances

- Clean Syngas consumption, per ton of ammonia produced: **~2650Nm³** (equivalent to less than **2000 Nm³** of H_2)
- Reaction heat recovery, per ton of ammonia produced: more than **600'000 Kcal**
- Plant turndown range: **10-100%**
- Ramp-up/down rate: up to **3%/min**

Benefits

- Very low energy consumption
- Reduced Low Cost of ammonia (LCOA)
- Compact lay-out, with all sections arranged in a way to reduce the overall footprint as well as minimize the connections across the different sections of the plant
- The design can be customized to specific Client's needs and integrated with other sections
- Possibility to optimize of other sections of the green ammonia plant

Casale technical assets

- Casale Axial-Radial® ammonia converter
- Loop's waste heat recovery train
- Amomax-Casale catalyst
- Casale electric Start-up heater

PROCESS OUTLINE

The fresh make up gas is compressed in a centrifugal compressor (typical) up to required pressure for ammonia synthesis and recycle gas stream from the circulator 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 Amomax®-Casale catalyst can be used to improve the activity and increase the resistance to poisoning.
The ammonia converter is the well proven 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 produced steam can be used to generate el. power in a steam turbine generator (STG), thus increasing the energy efficiency of the unit.

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 coolers leveraging the high ammonia concentration obtained in the highly efficient Casale ammonia converter thus limiting the energy consumption of the refrigeration section.

The use of a Casale electric heater inside the converter (instead of a traditional fired type) for the converter start up further enhances the sustainability of the process.

WASTE HEAT RECOVERY TRAIN

The recovery of the reaction heat downstream of the ammonia converter is contingent upon the design of the steam system. While many plants employ a waste heat boiler, alternatives 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.

CASALE OPTIMIZER

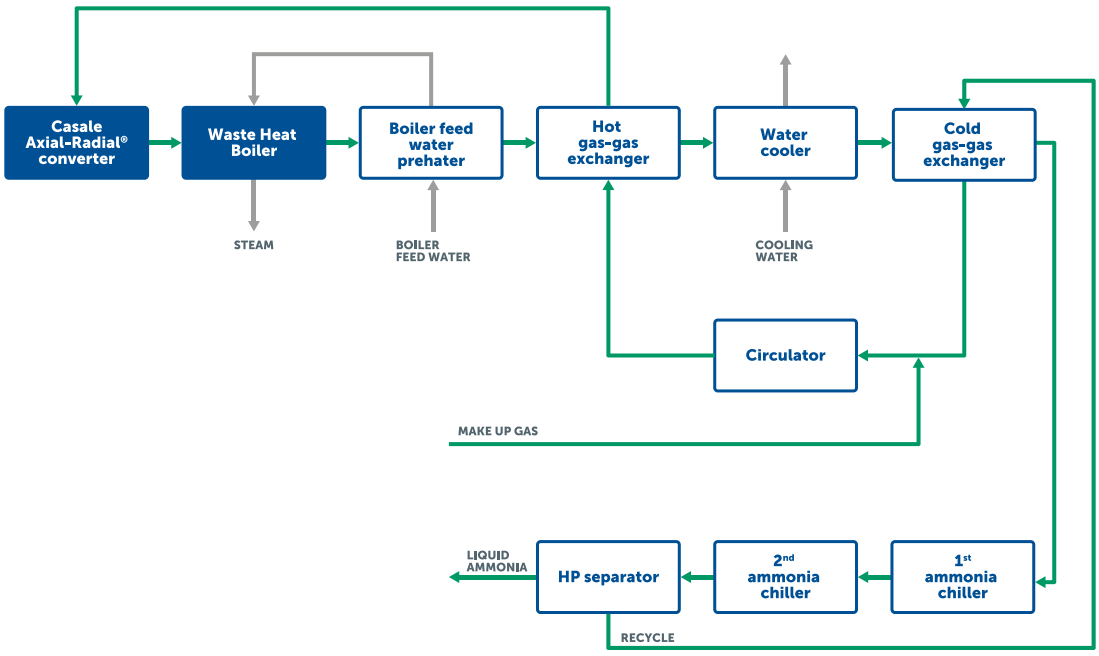
This tool optimizes the variable renewable energy utilization, minimizing the so-called "curtailed energy", and the pre-sizing of the whole plant components, including the SMART-N, the hydrogen storage and the water electrolyzers. It also optimizes the overall process control so that the plant operates at the highest possible output and the lowest possible Levelized Cost Of Ammonia (LCOA). Optimization takes account of the yearly profiles for the renewable power unit and exploits the flexible design features of Casale's SMART-N ammonia plant.

CASALE DYNAMIC ANALYSIS MODEL

This tool is a dynamic process model of the plant which can simulate the process using scenarios from real fluctuations in the renewable power profile. It allows fine tuning of the system, troubleshooting and scheduling.

The tool can dynamically analyze and determine the following:

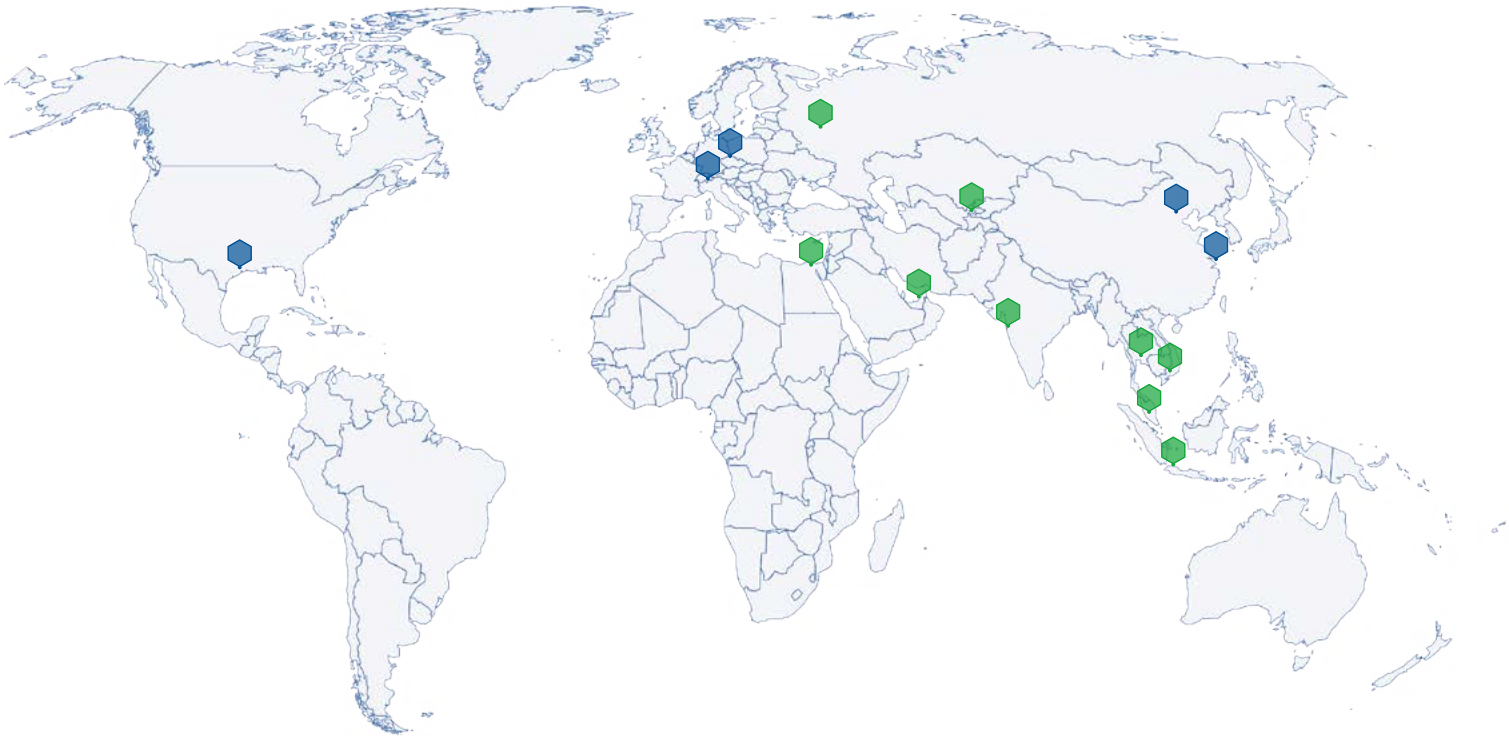
- renewable power profile
- grid power, if available, although 'off grid' island mode generation can also be an option
- electrolysers: specifies their optimal size
- hydrogen storage: including sizing, control philosophy and plant integration
- ammonia plant: its unique and independent controls
- nitrogen generation: suggests the optimal N_2 profile.



PLANTS FOR
A NEW PLANET.
SINCE 1921.

v.02.04.24

Casale in the world



Headquarter

CASALE SA
Via Giulio Pocobelli, 6
6900 Lugano | Switzerland

Branch offices

Switzerland | Lugano
Czech Republic | Prague
China | Beijing, Shanghai
North America | Houston

Network of Representatives

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

CASALE

Casale.ch