AMMONIA

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SynPOWER-N

Casale combined reforming-based ammonia process
for very large 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

SynPOWER-N

To maximize cost efficiency, it's best to establish the largest feasible, single-train plants. However, current world-scale plants are limited to around 3,500 MTD of ammonia due to constraints in conventional processes. To overcome this limitation, Casale developed the SynPOWER-N process, significantly increasing single-train capacity to 10,000 MTD. This innovative scheme enables the optimization of economies of scale without compromising critical operational aspects.

Capacity

- From **3500 MTD** to **10000 MTD**

Performances

- Net Energy Consumption: **6.5 Gcal/MT** on LHV basis

Benefits

- Compared to a traditional, SMR-based, ammonia plant:
  - Reduced CAPEX
  - 30% less plot area due to its compact and streamlined layout
  - 50% less catalyst amount needed
  - Half the number of operators required
- Optionally, ammonia and CO_2 can be balanced for total conversion to urea

Casale technical assets

- Casale Axial-Radial® prereformer
- Casale designed primary reformer
- Casale ATR reactor
- Casale Axial-Radial® CO shift converters
- Casale Axial-Radial® ammonia converter converter
- Ammonia loop waste heat recovery section
- AmoMax®-Casale ammonia synthesis catalyst

Enviromental Impact

Casale SynPOWER-N process minimizes its environmental impact effectively.

- Less than 110 mg/Nm³ of NOx, below the European Community limit for new plant
- 25% lower CO_2 stack emissions compared to traditional SMR-based plant.

PROCESS OUTLINE

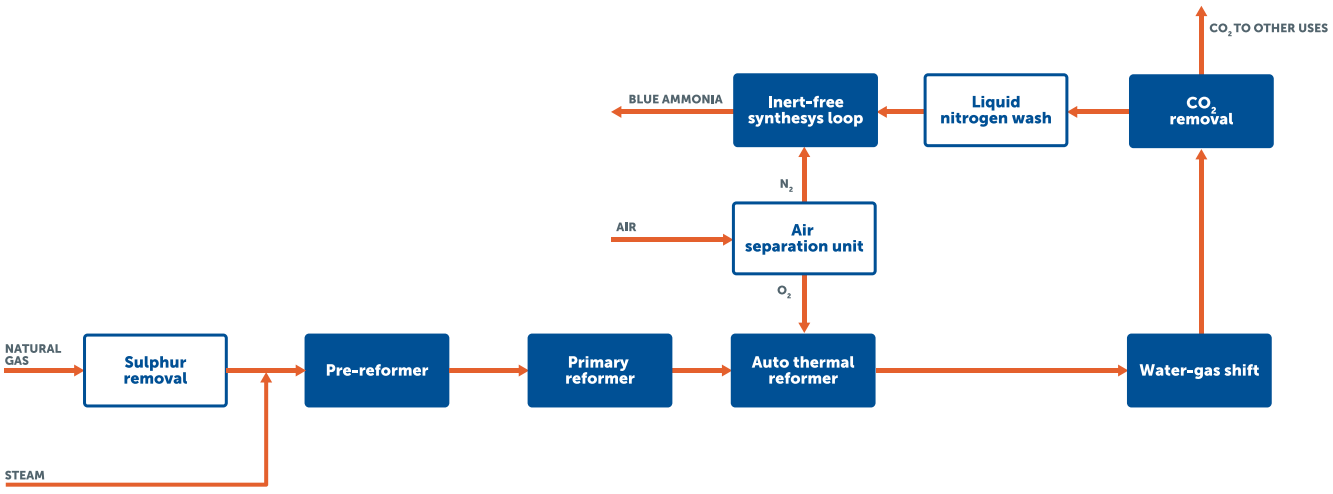
Conventional ammonia production hits maximum capacity at around 3,500 t/d on a single line due to critical limitations in the sizes of key equipment like steam reformers, boilers, and compressors.
SynPOWER-N boosts this limit by debottlenecking critical items and achieving higher capacity through three main design concepts:

- a nitrogen-free front-end,
- improved CO_2 removal and purification using Liquid Nitrogen Wash,
- an inert-free ammonia synthesis loop with Casale synthesis converter solution.

SynPOWER-N's syngas generation combines:

- proprietary pre-reformer,
- steam reformer,
- oxygen-fired auto-thermal reformer technologies.

This setup allows for mild reformer temperatures, benefiting downstream processes like CO_2 removal and compression. Heat recovery via a process boiler (RG boiler) and Boiler Feed Water (BFW) preheater cools the syngas, enhancing overall plant efficiency and reducing CO_2 emissions.
The relatively small duty of the fired primary reformer and the overall plant efficiency are key factors to achieve a substantial reduction of the CO_2 stack emissions, compared to a conventional process.



The main steps are:

Combined Reforming - Natural gas undergoes desulfurization before being mixed with steam and then sent through a series of reforming stages. This includes a Casale axial-radial® prereformer, a conventional primary reformer, and an oxygen-blown autothermal reformer (ATR). An Air Separation Unit (ASU) generates the oxygen and nitrogen required.

CO-Shift Conversion - Residual CO in the raw syngas is converted to CO_2 using a Casale isothermal Medium Temperature Shift (MTS) converter, simultaneously increasing the amount of H_2.

CO_2 Removal - A third-party CO_2 removal system eliminates all CO_2, recovering it in a concentrated form for other applications.

Syngas Purification - Oxygenated compounds, ammonia synthesis catalyst poisons, and inerts are removed through a purification system, including Liquid Nitrogen Washing. Nitrogen necessary for the ammonia synthesis reaction is also added at this stage.

Ammonia Synthesis - Purified syngas, free of inerts, is compressed and directed to a Casale ammonia synthesis loop equipped with two axial-radial® ammonia converters. The high efficiency of these converters and the reactivity of the inert-free gas ensure that equipment sizes in the synthesis loop and refrigeration section align with industrial standards.

PLANTS FOR
A NEW PLANET.
SINCE 1921.

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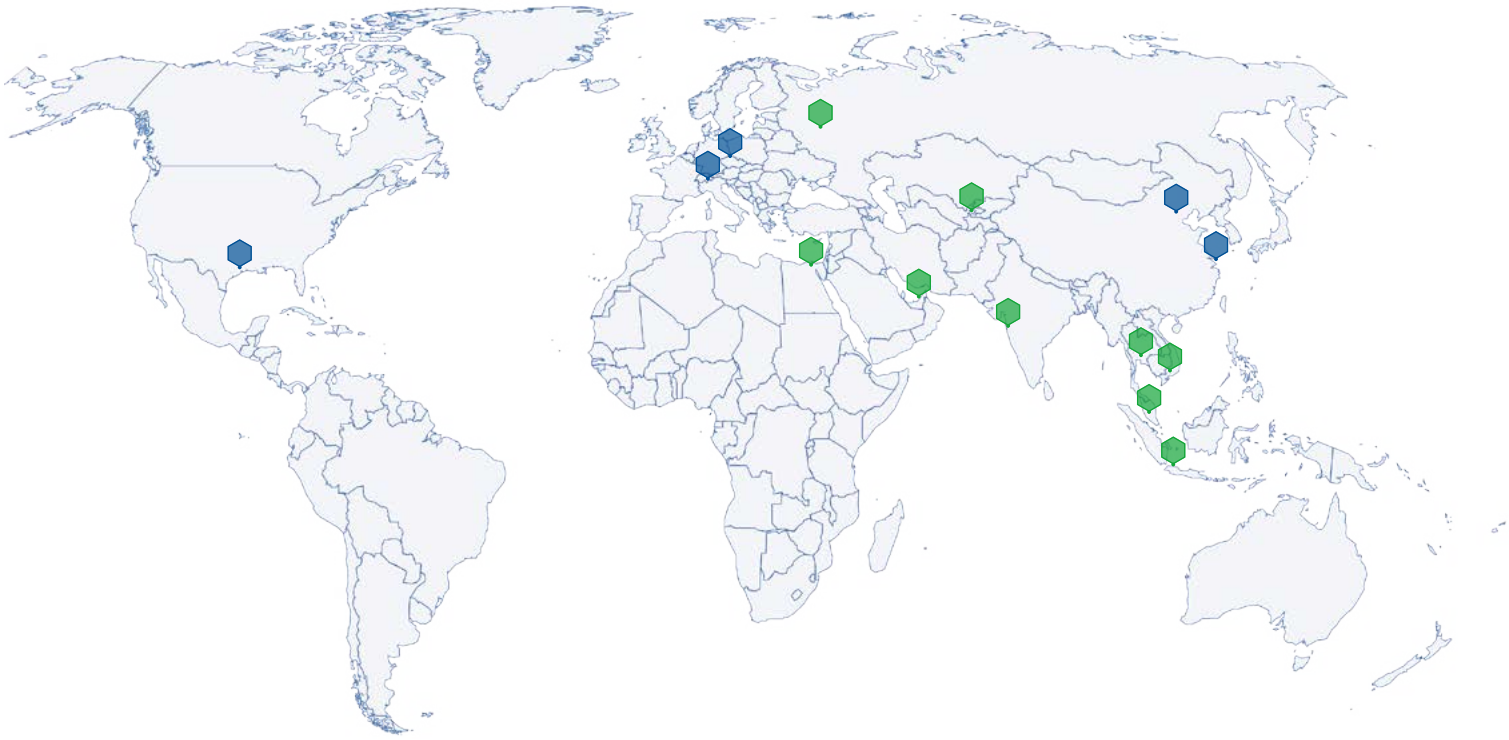
Casale in the world



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