Natural Gas Liquefaction - LNG

Description

Inlet stream for Dry / Wet Gas:

- Flare / APG
- Pipeline
- Syngas
- Stranded well
- Coal bed methane (CBM)

Ecospray provides **on-site gas liquefaction and separation solutions**, enabling the recovery of waste gases from flare or APG, as well as the creation of a virtual pipelines for the widespread distribution of LNG. This technology eliminates the need to distribute LNG from large storage terminals, significantly reducing logistics costs, risk of unforeseen events, and emissions associated with road transportation.
The liquefaction system is a fully scalable solution built around an in-house designed **cryogenic chiller based on reverse Brayton closed-cycle technology**. The system can be configured to match desired LNG demand characteristics for **bunkering, power generation or transportation**.

Each module has the capacity to produce:

- 9.5 tpd of LNG @ -160°C/-256°F processing 550 Nm^3/h or 0.5 MMSCFD;
- 12.0 tpd of LNG @ -150°C/-238°F processing 620 Nm^3/h or 0.6 MMSCFD.

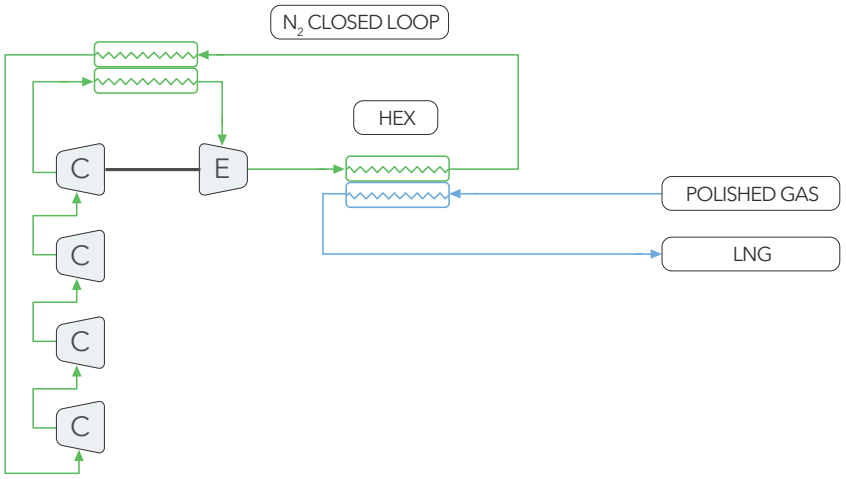
Features

- **Compact & modular design** – skid/container (40-45 ft) with a flexible design to adapt to the user's available space, easy to transport, install and relocate.
- **Reliable** – separating the cooling media (nitrogen) and inlet feed gas ensures the maximum reliability by avoiding any contamination, corrosion and wear.
- **Efficient** – moderate energy consumption for liquefaction, with operating costs mainly due to power comsumption.
- **Flexible** - possible to turndown the production of LNG to 40% of the maximum capacity and at desired LNG commercial specs (pressure and temperature).
- **Safe** – operational with self-generated nitrogen cooling media to avoid explosion or jet fire dangers. It can be used in classified or safe areas.
- **Complete** – containers come complete with insulation, lighting, air conditioning, doors and ventilation to facilitate operating activities.
- **Unmanned** – a remote control of process variables is provided, including web based access and proper database storage, allowing remote parameters control and proper maintenance scheduling. Plant data, including alarms, are available via OPC from the operator interface system (HMI).

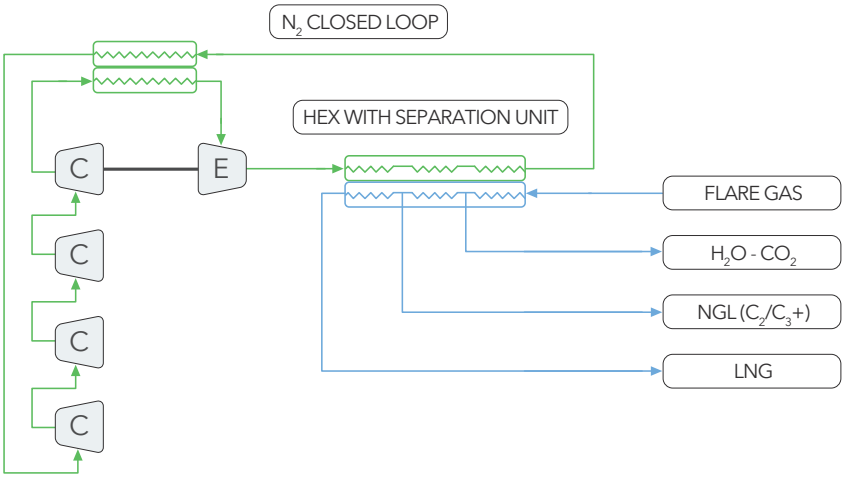
Process

The liquefaction system comprises fully integrated units that are consistent with specific processes and can be configured for any type of inlet gas (wet or dry gases).

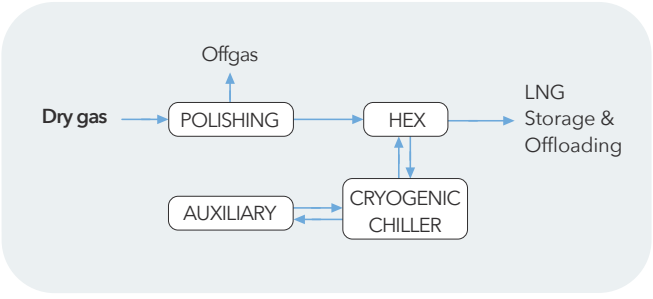
Dry gas (pipeline & well) liquefaction process

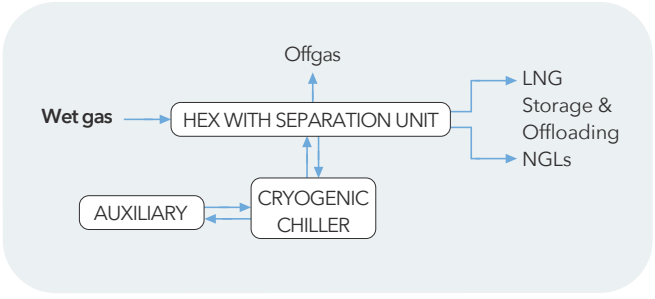


Wet gas (flare & well) liquefaction process



Flow diagrams





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Wet Gas	Dry Gas
Heat exchanger with separation unit to remove H_2O, CO_2, HHC from the inlet gas and producing NGLs and LNG from -160°C/-256°F to -150°C/-238°F	**Polishing** to remove H_2O and CO_2 from the inlet stream
Auxiliary (Dry cooler or evaporative tower, methane pre-cooler, water chiller, water pumps)	**Auxiliary** (Dry cooler or evaporative tower, methane pre-cooler, water chiller, water pumps)
Cryogenic chiller self-production and chilling of the cooling media (nitrogen) to temperatures as low as -165°C/-265°F	**Cryogenic chiller** self-production and chilling of the cooling media (nitrogen) to temperatures as low as -165°C/-265°F
	Heat Exchanger unit to produce the LNG
Electrical/control room hosting plant PLC, inverters, power distribution, HMI	**Electrical/control room** hosting plant PLC, inverters, power distribution, HMI

Polishing

The polishing unit refines the purity of dry gas to ensure it meets stringent liquefaction specifications below 50 ppmv and 1 ppmv for CO_2 and H_2O respectively. To achieve this, the system employs **three fixed-bed adsorption columns**, which are filled with synthetic zeolites (specifically, 13X and 3A) that have been selected for their high selectivity and adsorption capacity. The three columns are operated in a staggered cycle, with one bed always in adsorption, one in regeneration and one in standby. This guarantees an **uninterrupted polishing process and minimises the risk of off-spec gas breakthrough**.
Each column undergoes a cycle comprising:

1) Adsorption phase
2) Desorption (regeneration) phase
3) Stand by (pressure equalization or idle)

Heat exchanger with separation unit

The heat exchanger with separation unit purifies the feed gas by removing excess H_2O, heavy hydrocarbons (HHC) and carbon dioxide. This equipment is a **special engineered heat exchangers** (shell & tube with drains) that, depending on the composition of the feed gas, performs the following functions:

- Deep drying out of moisture in icy form
- Extract an HHC blending (C5+, C4, C3 and C2) in liquid form
- Separate CO_2 in liquid/solid form
- Produce LNG

This unit comprises two sets of heat exchangers which operate alternately during cryogenic cooling. While one set is in operation, the other undergoes a regeneration phase to sublimate any accumulated water ice and/or CO_2 (dry ice) ensuring that the system remains efficient and highly resilient to inlet gas composition fluctuations.

The **heat exchanger with separation unit** ensures compliance with classified area regulations.

Cryogenic chiller

The cryogenic chiller unit provides cooling energy through a reverse Brayton cycle, utilizing nitrogen as refrigerant in a closed-loop system.

This cryogenic cycle (compression, cooling and expansion) lowers the temperature of the nitrogen below the liquefaction point of the gas stream allowing **LNG production** in the heat exchanger to the desired commercial standard for **transportation, bunkering and power generation**.

The cryogenic chiller unit is designed to avoid the need for an external nitrogen supply; any minor leakage in the circuits is automatically refilled by self-generation.