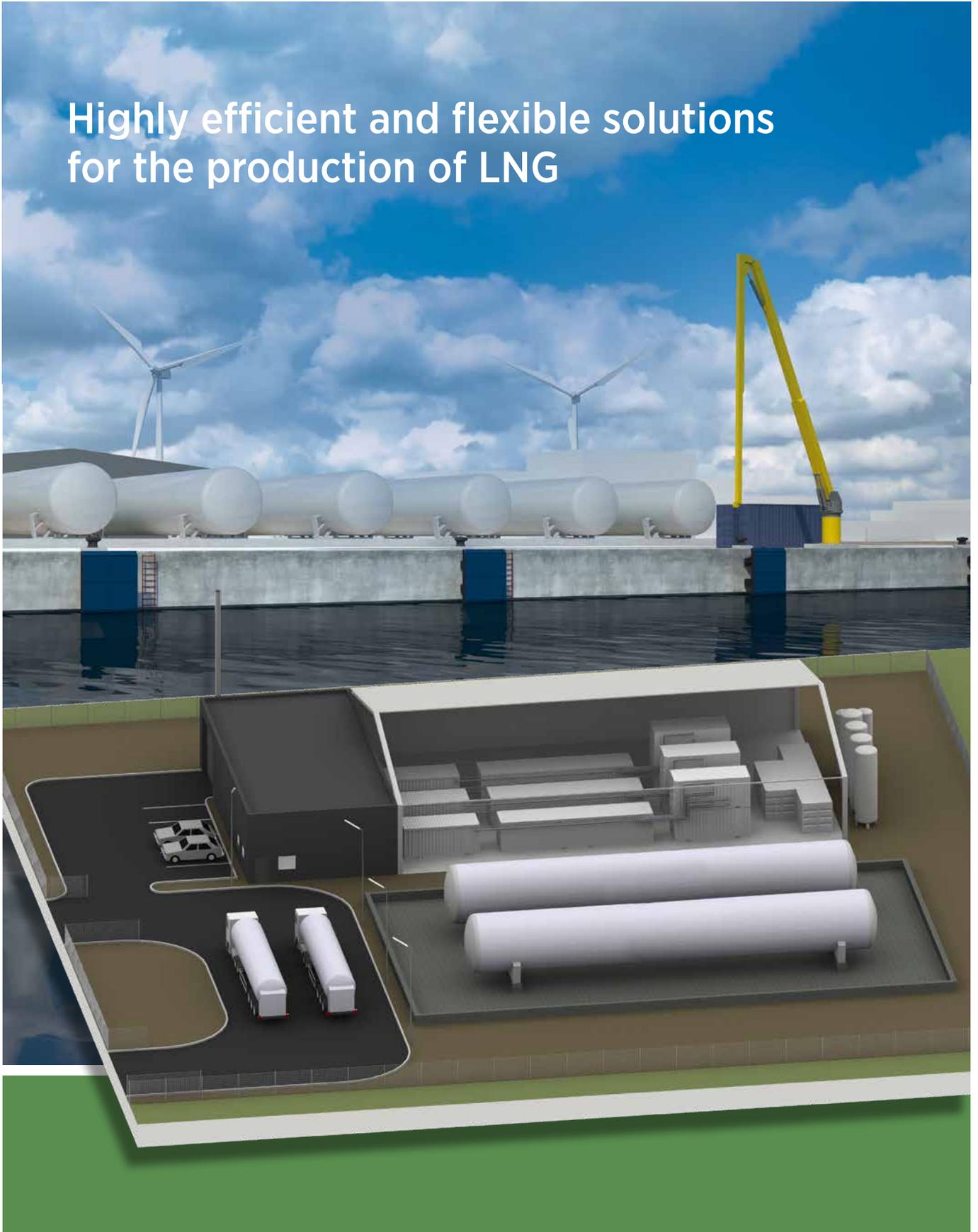


Highly efficient and flexible solutions
for the production of LNG



MAKEEN CRYO is MAKEEN Energy's LNG division. In co-operation with leading experts in the field, we have developed a small-scale liquefaction solution that is highly efficient and flexible. It makes the production of LNG both accessible and attractive – and gives you the chance to "grow as you go".

A solution that suits any situation

With MAKEEN CRYO's small-scale liquefaction solution, it is easy to adjust the LNG production to your needs.

By turning the output up and down, you can respond to and benefit from high demand as well as low prices on electricity. And by selling/transferring excess heat from your facility to the surrounding community, you can make the most of the resources. With such flexibility, it is possible to make your LNG production suit any situation.

Multi-refrigerant cooling

We use a multi-refrigerant technology to cool down and liquefy the natural gas. Based on a comprehensive study of different methods, this technology has several advantages.

Besides being highly efficient, our multi-refrigerant technology also has low operational costs (OPEX) and low investment costs (CAPEX) compared to other methods. And such features are vital when you want to provide your customers with the best solution.

"Grow as you go"

Scalability is a central feature of our small-scale liquefaction solution. Inspired by LEGO's building bricks, the MAKEEN CRYO system allows you to easily increase production as demand rises. The LNG liquefaction modules come in two sizes and can produce up to 25 or 50 tons/day respectively. By joining

more modules to your plant, you can get a total production capacity of 100, 150, 200 etc. tons/day.

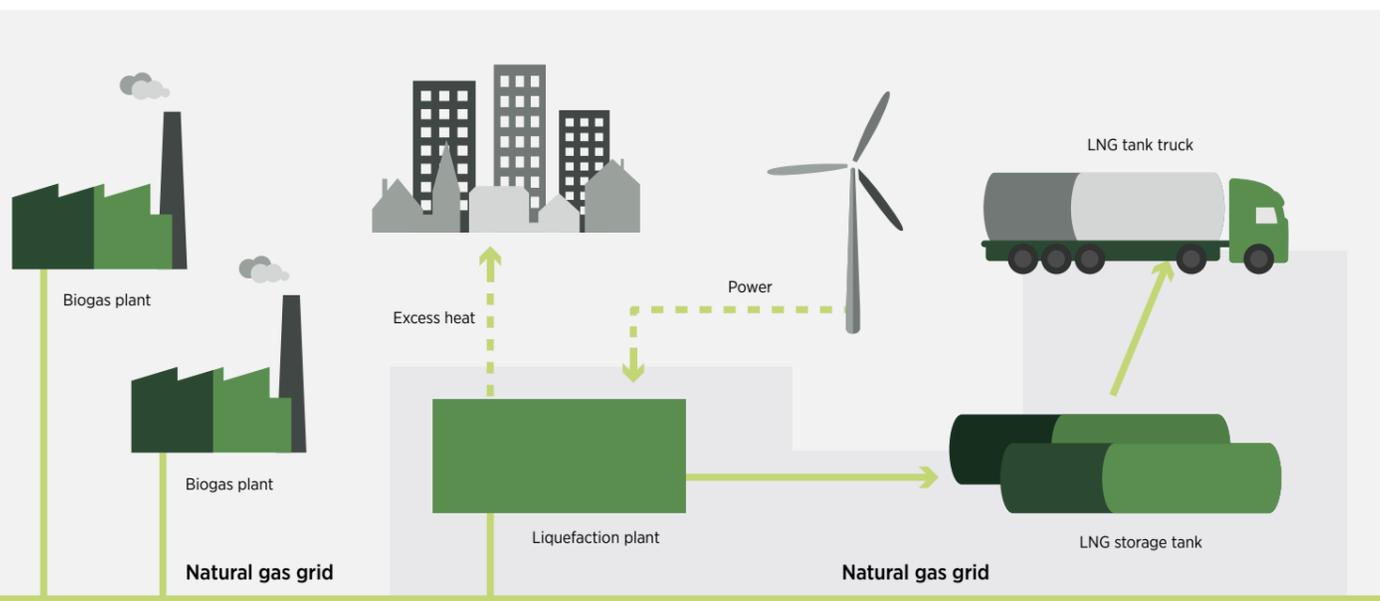
We call it "grow as you go", and it allows you to start small and upgrade when you need it.

No matter the size of your liquefaction solution, you will always be able to benefit from a fully automated production. So even though you grow your facilities, you never need to grow – nor even sow – a large group of staff to manage the operations.

What is LNG?

Liquefied natural gas, LNG, is natural gas in its liquid form. When natural gas is cooled down to -162°C (-259°F) in a process known as liquefaction, it becomes a clear, odourless liquid. It takes up 600 times less space than the gas and is easy to store and transport.

No matter the material state, natural gas is the most environmentally friendly fossil fuel. It is composed of primarily methane and emits significantly lower amounts of CO₂, SO_x, NO_x and particulate matters into the atmosphere than e.g. coal and oil. That makes LNG a responsible source of energy for both people and planet.



1 Natural gas from the grid

The liquefaction plant will be connected directly to the local natural gas grid and intake gas at 20°C (68°F) and 30-40 bars pressure. In addition to natural gas, the plant can also use biogas and thereby produce liquefied biogas, LBG.

2 Cleaning

Before it is possible to liquefy the gas, it is necessary to clean it. This process removes H₂O and THT (gas odorant) from the gas. In addition, the CO₂ content is reduced from between 1-2.5% to 0.005% (also known as 50 ppm). This is a critical procedure in order to avoid dry ice accumulating in the system and clogging up heat exchangers, pumps etc.

3 Pre-cooling

The first step of the cooling process is the pre-cooling. It brings down the natural gas

temperature to approximately -35°C (-31°F).

4 Cold box

The second step of the cooling process takes place in the cold box. Using a multi-refrigerant technology, the LNG here reaches a temperature of -150°C (-238°F).

5 LNG storage tanks

After finishing the second step in the cooling process, the now liquefied natural gas is sent onwards to on-site LNG storage tanks. The temperature inside these tanks is -162°C (-259°F).

6 LNG tank trucks

The on-site storage tanks are connected to a truck loading point. Here it is possible to load LNG onto tank trucks that can transport and deliver it to off-site customers.

Biogas as a substitute

It is possible to substitute the natural gas with biogas. The end product is then called liquefied biogas, LBG. Biogas is, like natural gas, a very environmentally friendly fuel – it is actually completely CO₂ neutral – and much cleaner than fossil alternatives like oil, coal and diesel.

Liquefaction plant – the liquefaction process

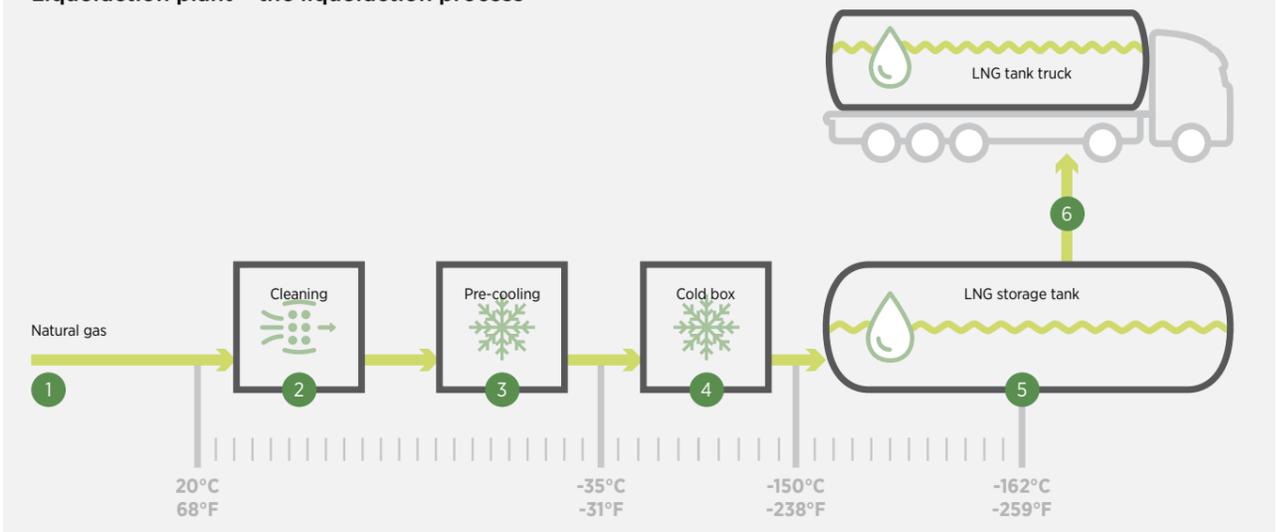
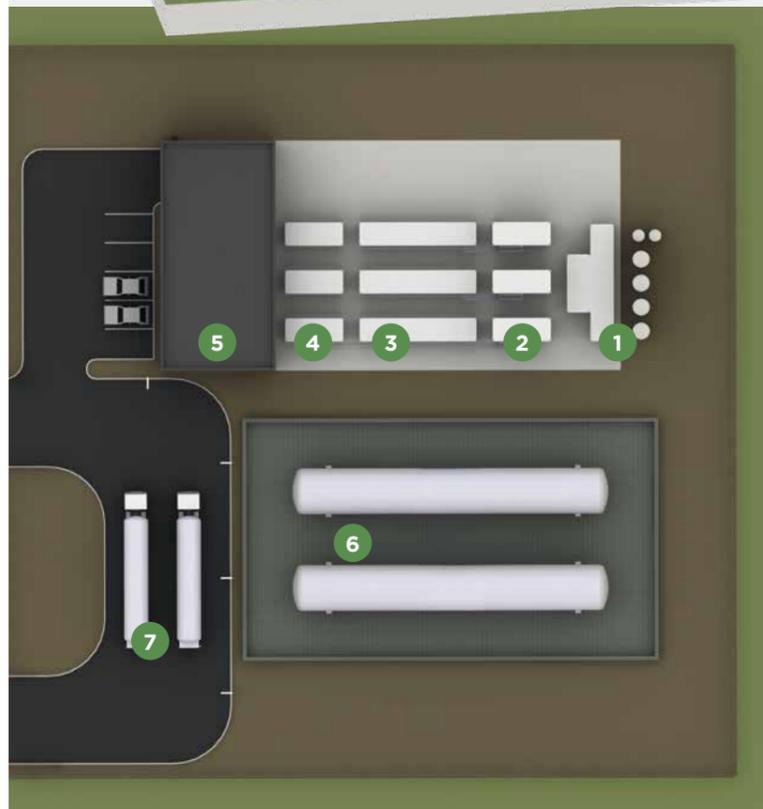
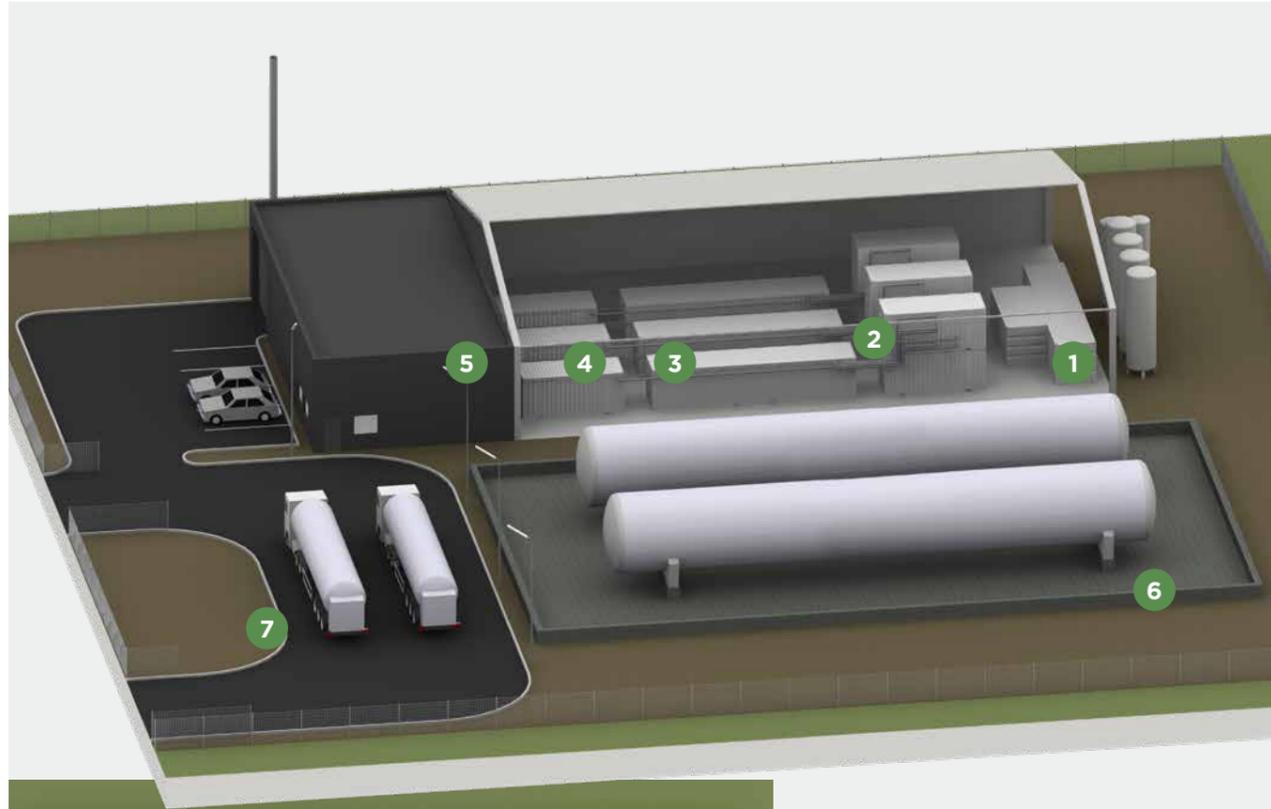


Illustration of a 150 tons/day setup



MAKEEN CRYO's small-scale liquefaction solution is made of modules that come in two sizes and produce up to 25 or 50 tons/day respectively. This illustration shows a complete setup for a liquefaction plant with a production capacity of 150 tons/day.

- 1 Cleaning
- 2 Cold boxes
- 3 Pre-cooling
- 4 Compressors
- 5 Technical control and supervision building
- 6 LNG storage tanks
- 7 Loading point for LNG tank trucks

Advantages of a local liquefaction solution

Producing LNG locally provides you with several advantages. Compared to other LNG supply chains or other fuel solutions, the 4 benefits below stand out as particularly profitable.

Firstly, local production of LNG will make the price of LNG lower than if the fuel was imported from external terminals.

Secondly, it will secure you an LNG supply with a shorter reaction/delivery time. External fac-

tors such as the activity level in the terminals, road conditions and/or traffic situation do not impact your supply.

Thirdly, a plant with modules producing 50 tons/day will enable partial load production. In that way, it is always possible to adjust the production to meet the current demand.

Fourthly, a liquefaction plant offers the possibility of developing a base load. An LNG provid-

er would be able to use this to establish a first-mover advantage with only limited risks and CAPEX.



The modular design allows you to "grow as you go"

1 50 tons/day module



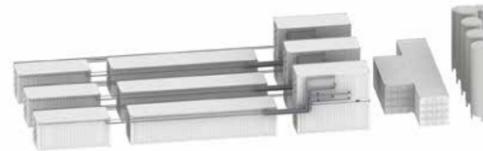
2 50 tons/day module with cleaning



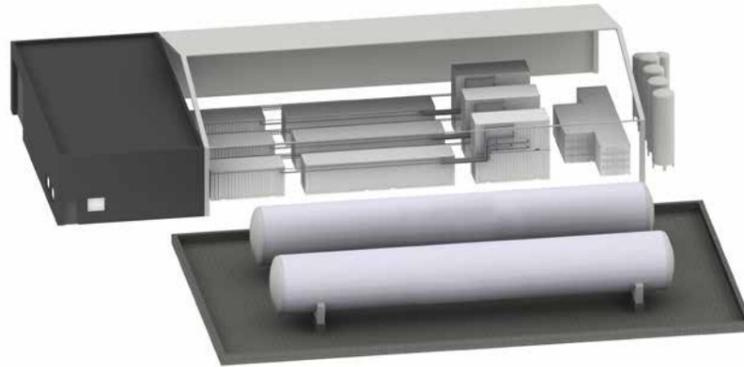
3 100 tons/day module with cleaning



4 150 tons/day module with cleaning



5 Complete 150 tons/day plant with cleaning and storage

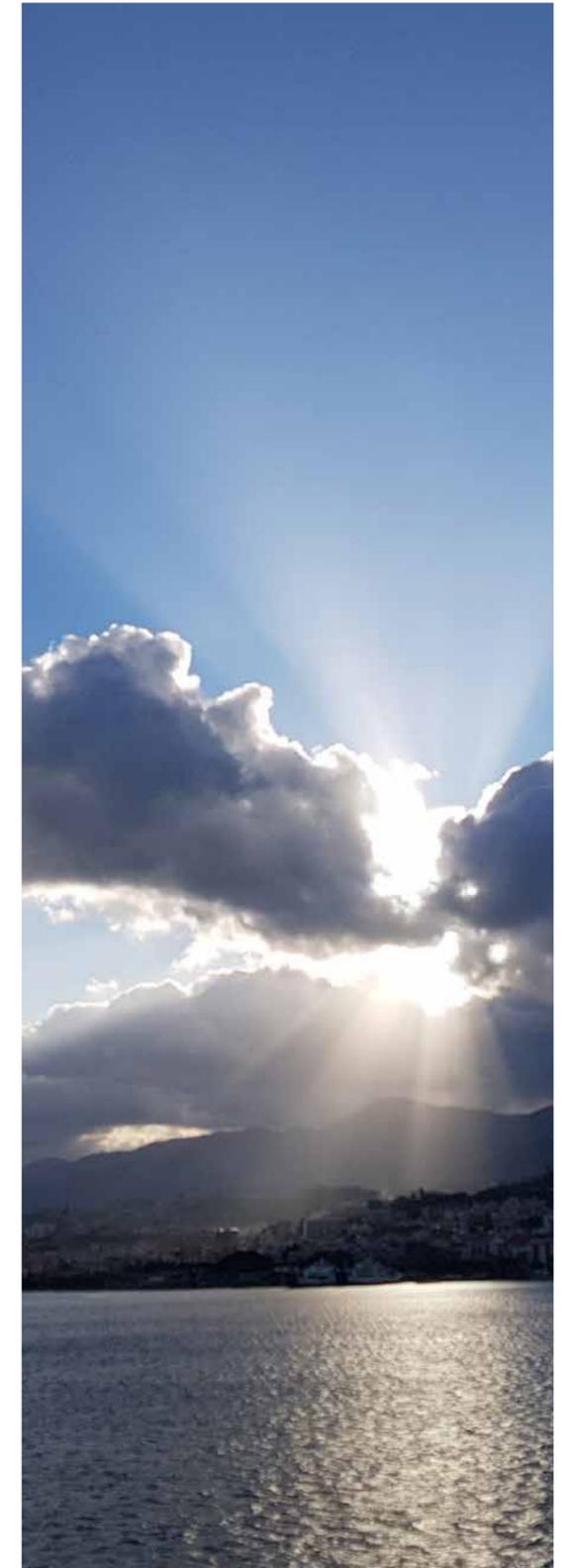


A flexible small-scale liquefaction solution from MAKEEN CRYO allows you to:

- Build a plant with modules of 25, 50, 100, 150 etc. tons/day
- "Grow as you go" by adding more modules to your plant
- Produce LNG and LBG locally
- Keep up a fully automatic production without staff
- Start or stop the facilities in less than 30 minutes
- Run with variable output
- Reduce OPEX with a low power consumption
- Turn production up/down to benefit from high demand as well as low prices on electricity/gas
- Hedge and reduce the risk of adverse price movements with an LNG stock
- Export LNG fast and easily with self-service truck loading points
- Transfer/sell excess heat to plants and local homes nearby
- Limit the ground area needed (approximately 10,000 m²)

LNG liquefaction plant production capacities

	CRYO 25	CRYO 50	CRYO 100	CRYO 150	CRYO 200	CRYO 250	CRYO 300
Tons/day	25	50	100	150	200	250	300
m ³ /day	53	106	213	319	426	532	639
1,000 US gal. / day	14	28	56	84	112	141	169



MAKEEN CRYO

Alsvej 21
8940 Randers SV
Denmark

Tel +45 8740 3000

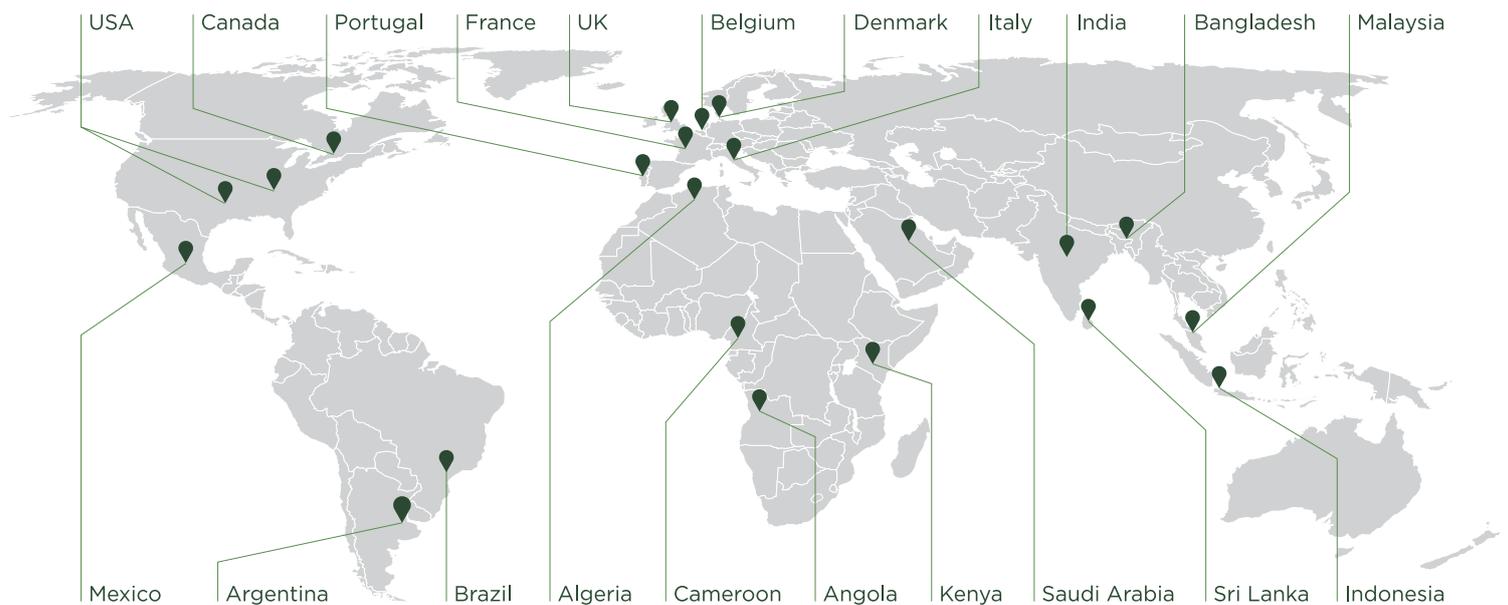
info@makeenenergy.com
www.makeenenergy.com

MAKEEN CRYO is a MAKEEN Energy division dedicated to liquefied natural gas (LNG) solutions. We design, manufacture and deliver liquefaction, bunkering and refuelling solutions, e.g. facilities for both the production and transfer of LNG – a clean and highly cost-efficient fuel. Besides turnkey installations, we can assist you with service offers, after-sales packages, consultancy, engineering and facility management.

Scalability, zero-emission, automation and mobility are our four core principles which we focus on implementing in every solution. No matter what kind of solution or service we provide, we always make sure to tailor the product exactly to your needs.

MAKEEN ENERGY

MAKEEN Energy is a global, market-leading corporation that delivers equipment, solutions and services to the energy industry. We employ approx. 3,000 people across 6 continents and operate in over 140 countries. With our global reach, local presence and decades of experience, we can deliver responsible solutions that make a difference to people and planet.



MAKEEN CRYO is part of **MAKEEN Energy** – Responsible energy solutions for people and planet