MAN Cryo

MAN Energy Solutions
Future in the making

Cryogenic solutions for onshore and offshore applications

Future in the making

The story of MAN Cryo

MAN Cryo, formerly known as Cryo, became a subsidiary of MAN Energy Solutions in 2016. Based in Gothenburg, Sweden, we are now one of the world's leading designers and providers of engineering solutions for cryogenic equipment for the storage, distribution, and handling of liquefied natural gas (LNG) and hydrogen (H_2) at sea and on land.

Drawing on more than 50 years' experience at the service of the gas industry, including milestones such as the first LNG-fueled ship in 1999, MAN Cryo can rely on long-standing proven experience. Our reference projects range from passenger ferries to offshore platform supply vessels, tugboats, bunker barges, and even icebreakers.

MAN Cryo is a single-source provider of efficient and economical cryogenic equipment for even the most demanding applications. Our systems are the perfect complement to MAN dual fuel engines. We offer holistic solutions for environmentally friendly cryogenic solutions for fuel gas supply systems (FGSS), offshore and onshore bunkering systems, and stationary distribution systems for regasification or fuel filling.

System solutions

Single-source provider of solutions for the energy transition

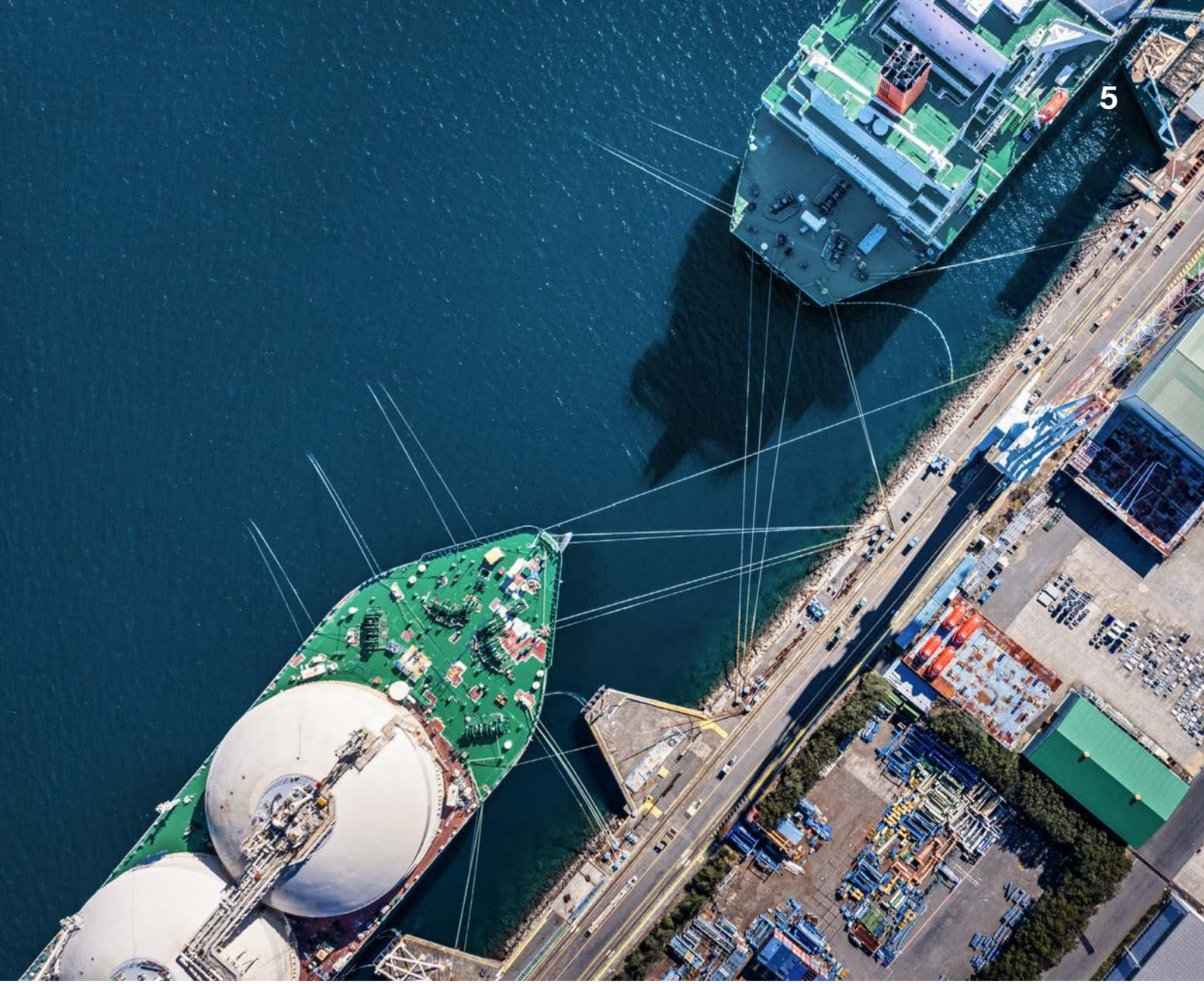
As well as customized engineering solutions for ships and power plants to run on LNG, hydrogen, and liquefied hydrogen (LH_2), we provide all services, such as design, quality assurance, project management, and commissioning. Our products are certified according to ISO 9001, ISO 14001, OHSAS 18001, and ISO 3834-2.

LH_2 gas supply system

MAN Cryo provides a class-approved fuel gas supply system that includes bunkering, LH_2 storage, vaporization, control and safety systems, all from one supplier. The system is compatible with both fuel cells and H_2 internal combustion engines. LH_2 is seen as one of the most promising future fuel types. It is produced by wind, water or solar power plants and then used onboard vessels, emitting only water and thus supporting the maritime energy transition.

LNG gas supply system

The LNG gas supply system consists of a vacuum-insulated or polyurethane-insulated storage tank, with auxiliary equipment, such as an LNG vaporizer, a pump, and a bunker station. The purpose of the system is to fill, store, and vaporize LNG/LBG, and to supply natural gas to engines on a ship, at the correct temperature, quantity, and pressure. The system is designed for minimum heat loss through leakage to guarantee the maximum holding time. The gas is fed to low- or high pressure gas consumers.



Power plants

MAN gas-powered, four-stroke engines are now H_2-ready and can be operated in stationary mode with a hydrogen content of up to 25 % by volume in a gas/fuel mix. This means that, in combination with our modular skid-mounted supply and storage solutions, we can provide gas supply and storage solutions for any type of consumer. Our services include engineering, project management, and commissioning.

Onshore and offshore bunkering systems

With an onshore bunkering system, LNG is transferred to the end customer at the quay, pontoon or jetty. The standard concept of the onshore bunkering system includes high-flexibility hoses, safety breakaway couplings, and a ship-to-shore safety system. We offer customized bunkering solutions, based on pressurization or via pump supply, depending on the application, required transfer rate, and volume.

Cryogenic solutions

Efficient and economical equipment for the most demanding applications

MAN Cryo can count the first LNG bunkering vessel in the world and the first LNG terminals in Sweden among its many achievements. Together with MAN's engine and GenSet expertise, we can offer a holistic solution for an extensive range of engines and FGSS.

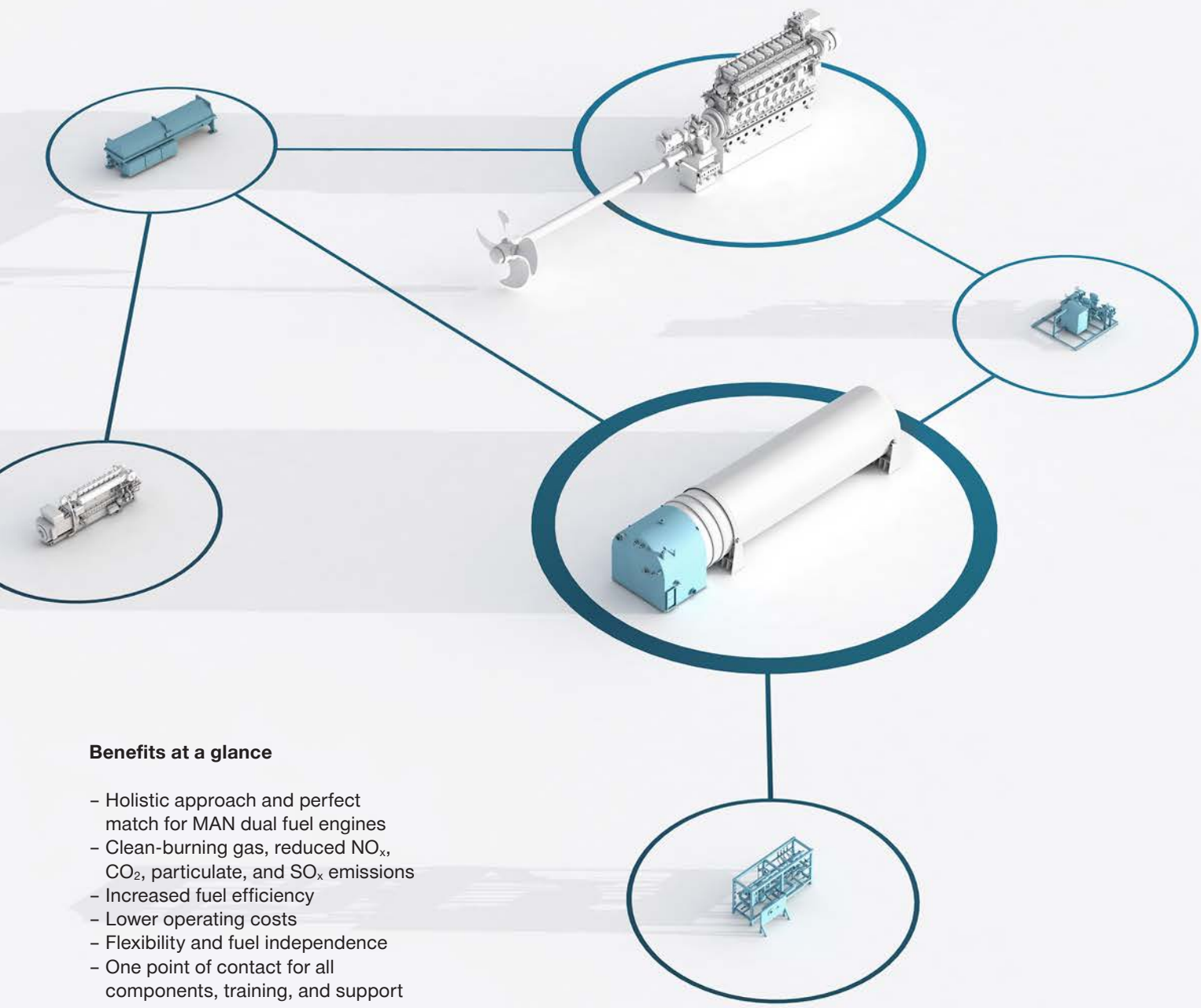
Fuel gas supply systems

Combining MAN dual fuel engines with our FGSS allows natural gas to be used efficiently. Being able to switch over seamlessly from gas to diesel operation and vice versa ensures full flexibility in terms of costs and emissions.

As MAN Energy Solutions supplies both the engines and the complete FGSS equipment, we can work with ship and power plant designers to perfectly integrate holistic propulsion solutions, including automation systems for both four- and two-stroke engines.

MAN Cryo has recently developed an FGSS for liquid hydrogen (LH_2) systems. It is a risk-based design, as there are no existing regulations for hydrogen as a marine fuel, but it has been reviewed and approved by several classification societies.

MAN Cryo equipment can also be found in land-based power plants. Often located in countries with less developed infrastructure, the issue of their remoteness was overcome with attention to detail in contracts and the local knowledge of MAN Energy Solutions staff.



Benefits at a glance

- Holistic approach and perfect match for MAN dual fuel engines
- Clean-burning gas, reduced NO_x, CO_2, particulate, and SO_x emissions
- Increased fuel efficiency
- Lower operating costs
- Flexibility and fuel independence
- One point of contact for all components, training, and support

Suitable applications for MAN Cryo

- Liquid hydrogen
- Four-stroke marine
- Two-stroke marine
- Power plants

Fig. 1
Low-pressure fuel gas supply system (LP FGSS) based on LNG supply and bunkering systems

Liquid hydrogen applications

LH_2 FGSS for zero-emission vessels

With a liquid hydrogen FGSS, you can run a zero-emission vessel, since no CO_2 is generated when using hydrogen in either fuel cells or internal combustion engines. With MAN Cryo, you have a single-source solution for bunkering, storage, and regasification.

Certified system

Our liquid hydrogen system has obtained the necessary certification of seaworthiness, and our fail-safe designs are based on the results of risk assessments. As there are no current IMO standards or regulations for LH_2 FGSS, the approval was obtained by analyzing the risks together with the classification societies.

The system usually includes:

- Bunker stations
- Hydrogen storage tank
- Tank connection space
- Vaporizer
- Glycol water system
- Control and safety system
- Nitrogen generator for inert gas

Bunker stations

LH_2 is transported to the storage tank from a truck, bunker terminal, or bunker ship via the bunker station on the ship side. The bunker station is connected to the tank connection space on the tank via bunker pipes.

Vacuum-insulated C-type tank

The cryogenic LH_2 tank consists of two tanks, i.e. the inner vessel, which contains the liquid hydrogen, and the outer vessel, which is regarded as a secondary barrier. The annular space between the inner and outer vessels is vacuum-insulated.

Tank connection space

This includes equipment such as product vaporizer and pressure build-up vaporizer, valves, and instruments for controlling the LH_2 tank and process.

Hydrogen vaporization

The LH_2 is evaporated by the dedicated product vaporizer of the glycol-/water-heated type and supplied to the engine or fuel cell as gas. The LH_2 supply to the vaporizer is ensured by the inner pressure of the storage tank. The pressure build-up unit (PBU) guarantees a constant pressure level.

Control and safety system

The LH_2 system is governed by a stand-alone control system. It includes a PLC and an OP panel normally installed in a control room and wheelhouse.

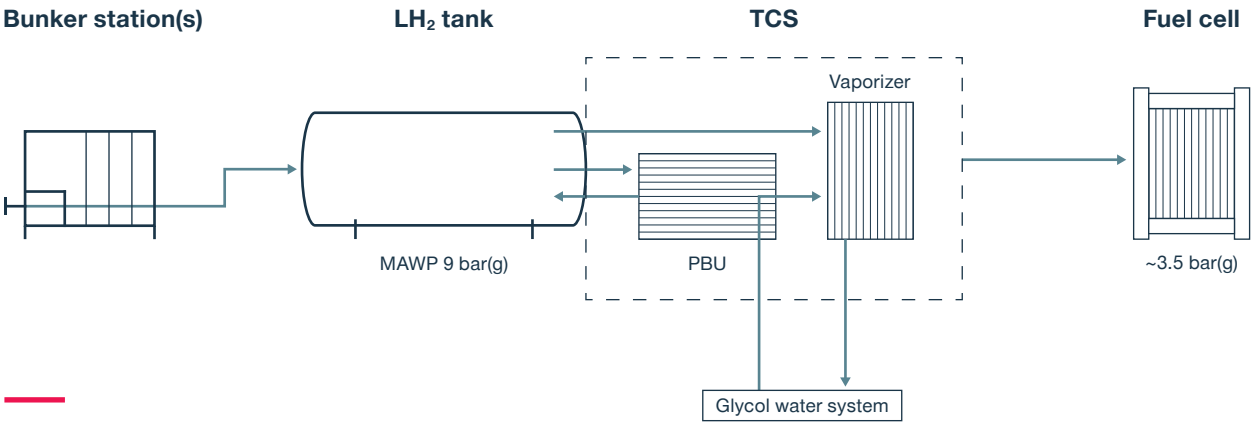


Fig. 2
LH_2 FGSS with pressure build-up unit

Fig. 3
Hydrogen storage tank and tank connection space

Four-stroke marine applications

Low- and high-pressure LNG FGSS

MAN Cryo developed the very first FGSS more than 20 years ago. Since then, we have worked with all major classification societies and gathered valuable experience. Our designs now ensure the highest levels of automated system functionality.

Tank pressure and pumps

Gas can be fed to the engines using the tank pressure or with a pump. A low-pressure tank (below 6 bar) needs a pump. This generally reduces the weight of the tank and can be more effective for large tanks. A high-pressure tank (e.g. 9 bar) with a PBU does not need a pump. The advantages include improved reliability and lower maintenance costs, because there is no rotating equipment, and improved holding times.

The system usually includes:

- One or more LNG fuel tanks
- Water-heated vaporizer units converting LNG into gas
- PBU units for increasing the tank pressure
- Pumps
- Bunker stations
- Control and safety system
- Piping for bunkering LNG and gas feed lines for supplying natural gas to the engines
- Nitrogen generator for inert gas
- Gas detection system
- Glycol water system

Bunkering LNG in storage tanks

LNG is transported to the storage tanks from a truck, bunker terminal or bunker ship via the bunker station on the ship side. The bunker station is connected to the tank connection space via bunker pipes. Depending on the pressure in the tank, the flow can be routed to the bottom or top of the tank. If the tank has a high pressure, LNG can be discharged into the tank gas phase to recondense the gas phase and consequently lower the pressure.

Vacuum-insulated C-type tank

The cryogenic LNG tank consists of an inner vessel, which contains the liquid LNG, and an outer vessel, which is regarded as a secondary barrier. The annular space between the inner and outer vessels, which is filled with perlite, is vacuum-evacuated. The tank is designed to prevent sloshing when operating in rough conditions and to ensure the maximum holding time.

Tank connection space

The tank connection space includes equipment such as product vaporizers, and pressure build-up vaporizers, valves, and instrument valves for controlling the LNG tank.

LNG vaporization

In order to supply gas to the engines, LNG is evaporated by the dedicated water-heated product vaporizer. The vaporizer unit can deliver gas to engines at the required power and temperature of approximately 10–40 °C. The LNG is supplied to the vaporizers by a cryogenic pump or by the pressure in the tank. The PBU guarantees a constant pressure level. We use only the highest quality vaporizers of European quality.

Control and safety system

The LNG system is governed by a stand-alone control system including an operator panel installed in a cabinet. The control system receives signals from instruments and performs the necessary activities depending on which mode of operation is chosen.

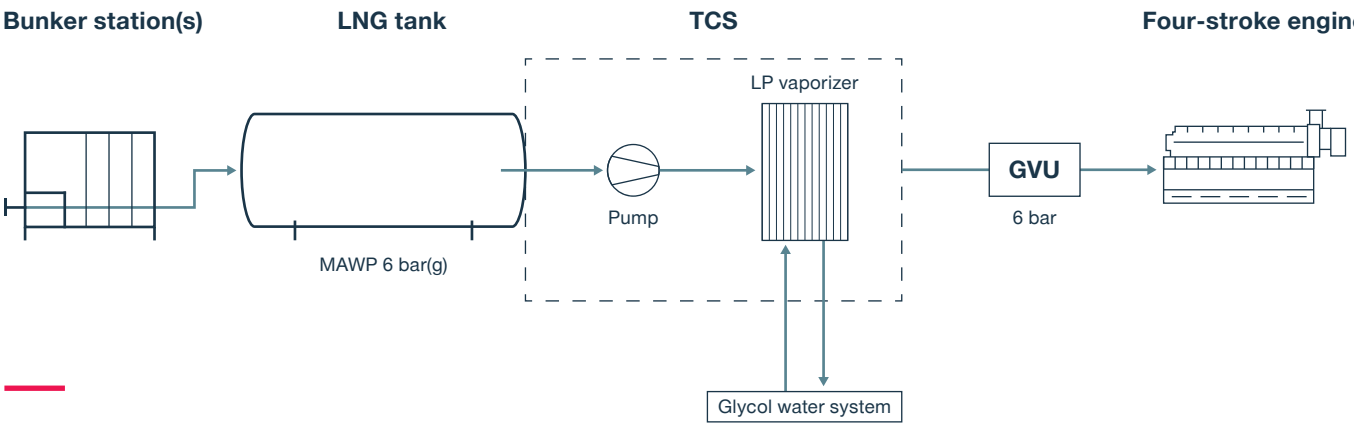


Fig. 4
Four-stroke FGSS with LNG pump

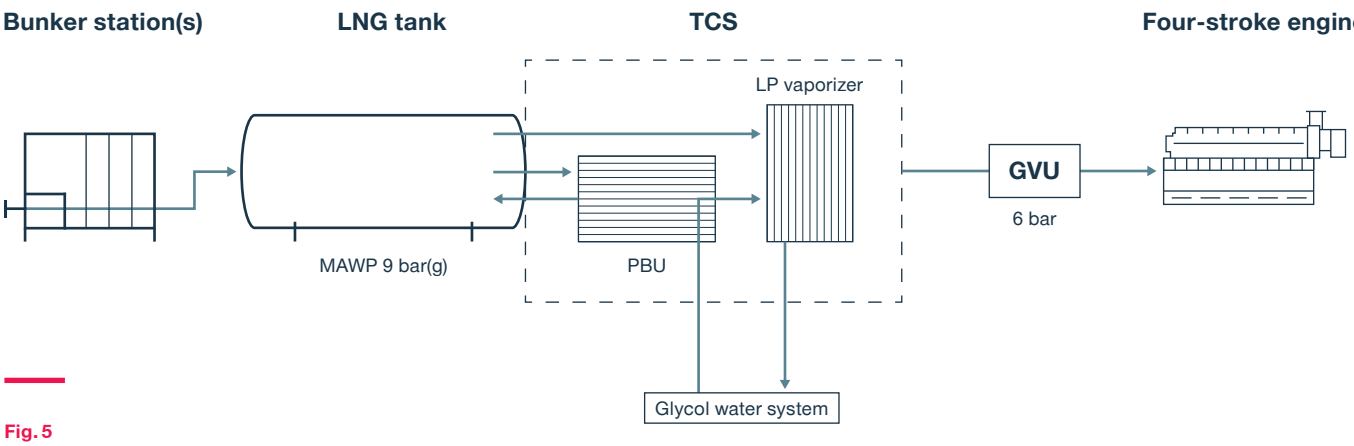


Fig. 5
Four-stroke FGSS with pressure build-up unit

Two-stroke marine applications

High-pressure LNG FGSS

MAN Cryo offers a complete LNG fuel gas system for MAN B&W ME-GI two-stroke engines. Our systems have been proven in many different types of vessels.

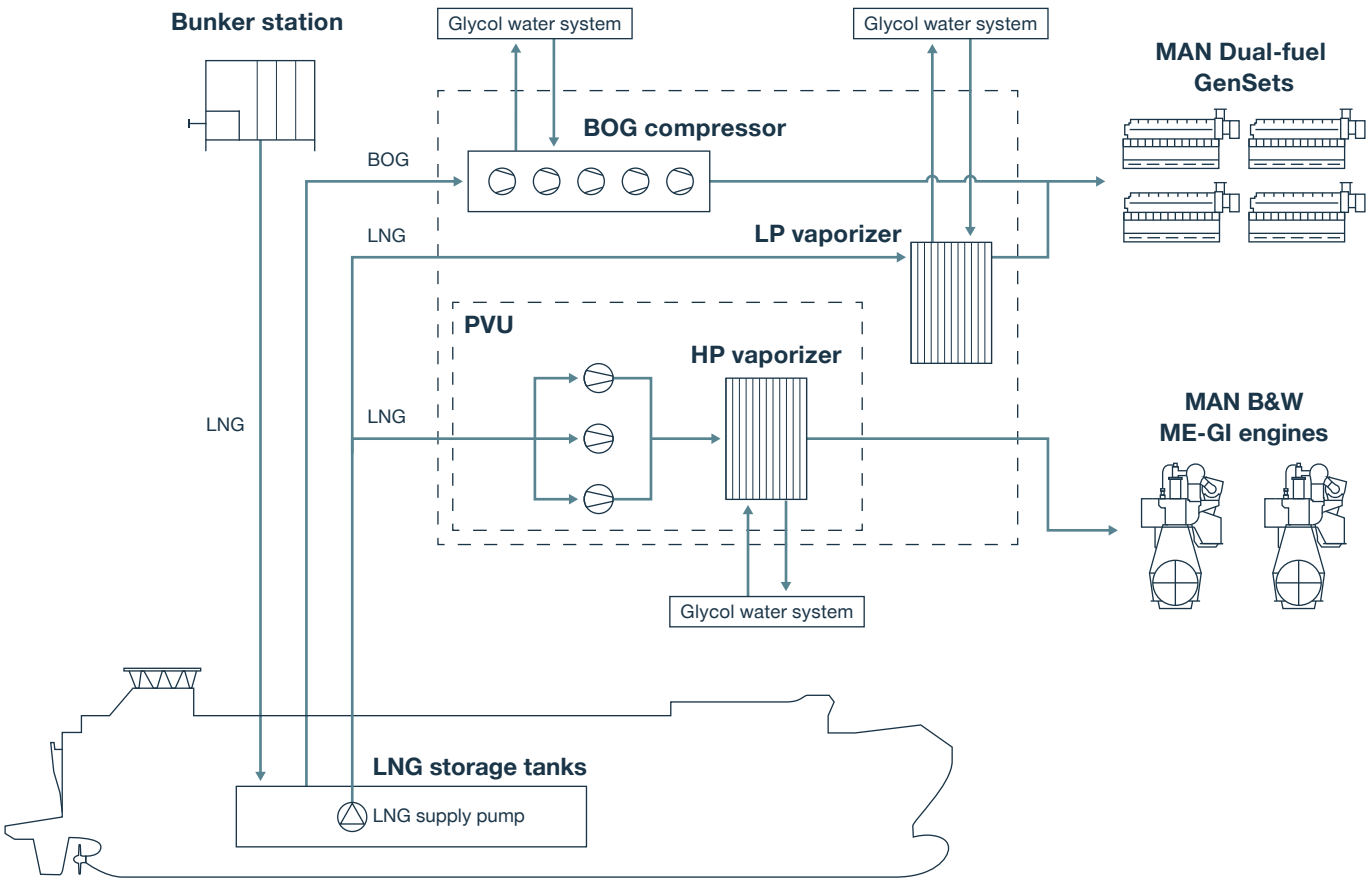


Fig. 6
Example of two-stroke FGSS with pump vaporizer unit, for car carrier application

Fig. 7
Two-stroke dual-fuel MAN B&W ME-GI

FGSS for two-stroke engines

Our solutions include C-type tanks, boil-off gas (BOG) handling systems and compressors, glycol water handling systems, and LNG bunkering. The pump vaporizer unit is designed in-house. We use acid-proof stainless steel for all media pipes and work with renowned suppliers.

The system usually includes:

- LNG storage tank
- Pump vaporizer unit (PVU)
- Pumps
- Bunker stations
- Control and safety system
- BOG handling system
- Gas detection system
- Inert gas system
- Glycol water system

LNG storage tank

We offer a wide range of tank solutions, specifically designed for each project, depending on the ship design and the required storage capacity.

The basic design types are:

- Vacuum-insulated C-type tank
- Polyurethane-insulated C-type tank
- Membrane tank

Each tank design has its own benefits, and we will support you with selecting the best fit for each individual project.

Pump vaporizer unit (PVU)

The MAN PVU supplies LNG at the pressure and temperature required by the MAN B&W ME-GI engine. The PVU receives LNG from a cryogenic centrifugal pump, and subsequently the high-pressure (HP) reciprocating pump pressurizes the LNG. The HP pump shown in Fig. 6 has three cylinders actuated by linear hydraulic pistons. The pressurized LNG flows through a compact printed circuit heat exchanger in which it is heated by warm glycol water. An HP filter catches fine particles present in the gas before the gas is directed toward the GVT and the engines.

Pumps

Centrifugal pumps are used to transfer LNG to the customer or consumer. The pump can be placed either directly into the storage tank, submerged into the LNG, or in an insulated container outside of the tank.

Bunker stations

Bunker stations include a fixed valve and piping skid to receive LNG from the shore side or the bunkering ship, and to route the LNG to the storage tank. Bunker stations are standardized regardless of what tank type is selected. All necessary communication links, gas-tight couplings, and monitors can be selected as options.

Control and safety system

The LNG system is governed by a stand-alone control system. It includes a PLC and an OP panel installed in a cabinet. The control system receives signals from instruments and performs the necessary activities depending on which mode of operation is chosen.

Power plant applications

Complete modular designs with regasification systems

Our LNG power plant solutions are standardized but scalable, and cover outputs from 10–200 MW. We provide extended equipment supply and electrical control, including process design, control and ESD systems, installation verification, and commissioning.

Cryogenic equipment for power generation

MAN Cryo equipment allows you to store LNG in a controlled way at the power plant, vaporize the LNG into the gaseous phase, and manage functions such as pressure control, gas supply pressure and temperatures, automatic control, and emergency shutdowns. Our regasification systems are modular for cost-effectiveness and we ensure access for remote operation through wireless networks.

The system usually includes:

- LNG trailer unloading
- Pumps
- LNG storage tank
- LNG vaporizer
- Control and safety system

LNG trailer unloading

The truck unloading station is used to fill the storage tank from trucks or containers. Two hoses are connected to the truck; one for liquid and one for gas. An LNG pump is installed as a part of the unloading station.

Pumps

Pumps are used to transfer LNG to the customer or consumer. The pump can be placed either directly into the storage tank, submerged into the LNG, or in an insulated container outside of the tank.

LNG storage tank

We offer a wide range of tank solutions, including vacuum-insulated C-type tanks, polyurethane-insulated C-type tanks, and flat-bottom tanks. Each tank design has its own benefits, and we will support you with selecting the best fit for each individual project.

LNG vaporizer

LNG vaporization can be based on engine cooling water or ambient air heating. Using the cooling water from the engines is the best way, since it removes the need for other fan systems or ways to cool the engine water. Our product needs heat, the engines need cooling water – it's a perfect match. If it is not possible to use the engine water, a special vaporizer design can be used that takes heat out of the ambient air.

Control and safety system

The LNG system is governed by a stand-alone control system. It includes a PLC and an OP panel installed in a cabinet. The control and safety system receives signals from instruments and performs the necessary activities depending on which mode of operation is chosen.

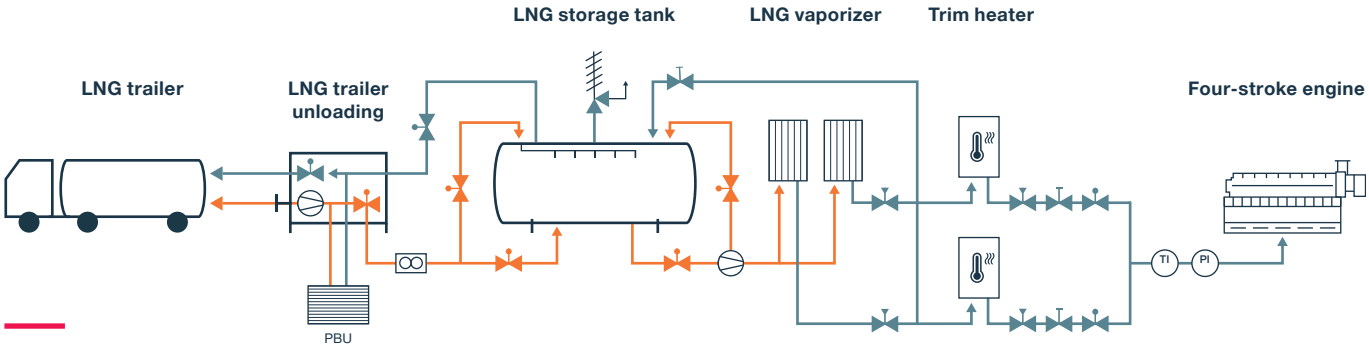


Fig. 8
Process flow diagram with vaporizers heated by ambient air

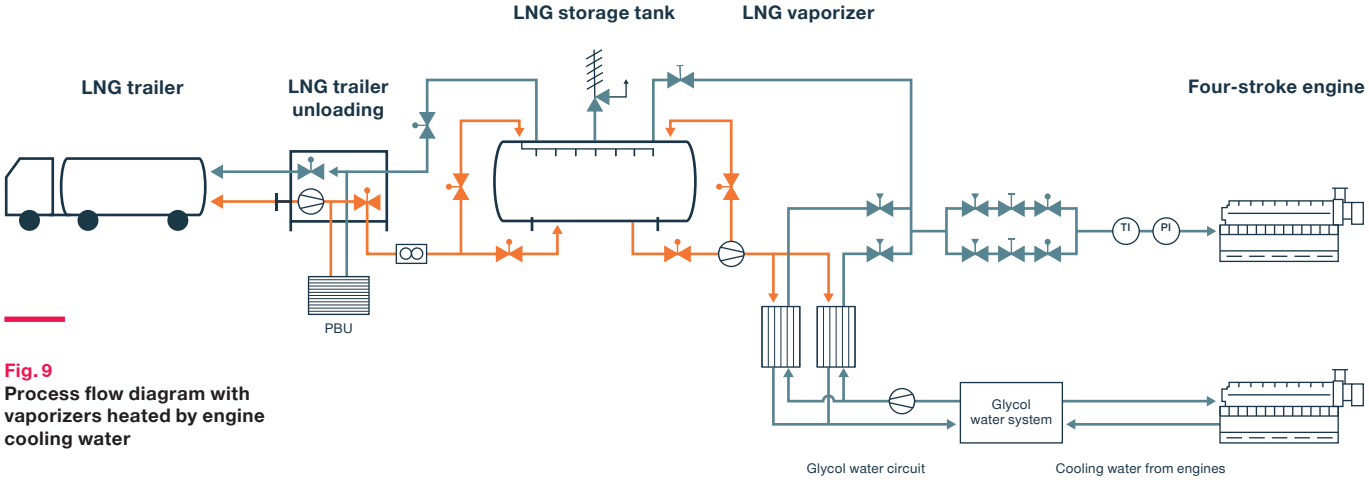
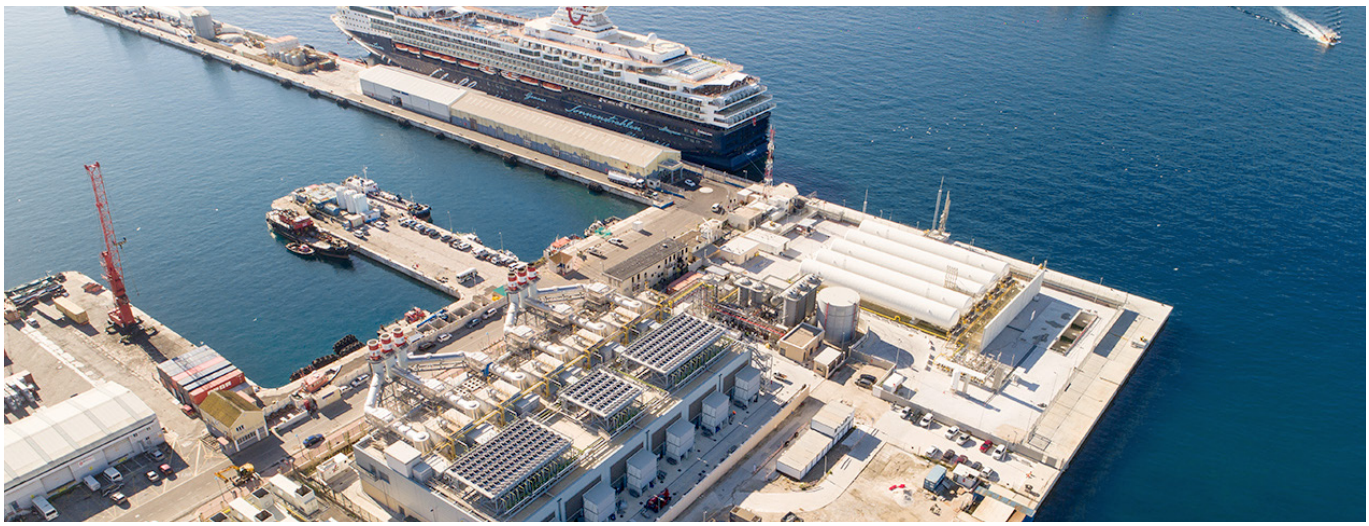


Fig. 9
Process flow diagram with vaporizers heated by engine cooling water



Marine references

Accomplishments in shipping

Shipowner	Shipyard	Volume	Classification society	Ship type	Ship name	Remark
MRF	Langsten Slip & Båtbyggeri	30 m³	DNV	Car pax ferry	Gluttra	-
Møkster Shipping	Kleven Verft AS	234 m³	DNV	PSV	Stril Pioneer	-
Eidesvik Offshore	Kleven Verft AS	234 m³	DNV	PSV	Viking Energy	-
Fjord1	Søviknes Verft	2 x 125 m³	DNV	Car pax ferry	Bergensfjord	-
Fjord1	Søviknes Verft	2 x 125 m³	DNV	Car pax ferry	Stavangerfjord	-
Fjord1	Brattvaag Verft	2 x 125 m³	DNV	Car pax ferry	Fanafjord	-
Fjord1	Brattvaag Verft	2 x 125 m³	DNV	Car pax ferry	Raunefjord	-
Fjord1	Søviknes Verft	2 x 125 m³	DNV	Car pax ferry	Mastrafjord	-
Eidesvik Offshore	Westcon NO, West Contractors AS	234 m³	DNV	PSV	Viking Queen	-
Eidesvik Offshore	Westcon NO, West Contractors AS	234 m³	DNV	PSV	Viking Lady	-
Remøy Management/ Kystvakt	Myklebust NO, Myklebust Verft AS	234 m³	DNV	Patrol vessel	Barents Hav	-
Remøy Management/ Kystvakt	Myklebust NO, Myklebust Verft AS	234 m³	DNV	Patrol vessel	Sortland	-
Remøy Management/ Kystvakt	Myklebust NO, Myklebust Verft AS	234 m³	DNV	Patrol vessel	Bergen	-
MRF	Molde/Remontowa	2 x 125 m³	DNV	Car pax ferry	Moldefjord	-
MRF	Molde/Remontowa	2 x 125 m³	DNV	Car pax ferry	Fannefjord	-
MRF	Molde/Remontowa	2 x 125 m³	DNV	Car pax ferry	Romsdalsfjord	-
MRF	Molde/Remontowa	2 x 125 m³	DNV	Car pax ferry	Korsfjord	-
Tide Sjø	Aker Yards Lorient	29 m³	DNV	Car pax ferry	Tidekongen	-
Tide Sjø	Aker Yards Lorient	29 m³	DNV	Car pax ferry	Tidedronningen	-
Tide Sjø	Aker Yards Lorient	29 m³	DNV	Car pax ferry	Tideprinsen	-
DOF	STX Søvik (Aker Yards)	201 m³	DNV	PSV	Skandi Gamma	-
FosenNamsos Sjø	Fiskerstrand BLRT AS	2 x 125 m³	DNV	Car pax ferry	Selbjörnsfjord	-
Fjord1	Fiskerstrand BLRT AS	2 x 125 m³	DNV	Car pax ferry	Boknafjord	-
Eidesvik Offshore	Kleven Verft Ulsteinvik	234 m³	DNV	PSV	Viking Prince	-
Eidesvik Offshore	Kleven Verft Ulsteinvik	234 m³	DNV	PSV	Viking Princess	-
Olympic Shipping	STX Aukra	201 m³	DNV	PSV	Olympic Energy	-
Rem Offshore	Kleven Verft Ulsteinvik	234 m³	DNV	PSV	Rem Leader	-
Island Offshore	STX Brevik	2 x 115 m³	DNV	PSV	Island Crusader	-
Island Offshore	STX Brevik	2 x 115 m³	DNV	PSV	Island Contender	-
Solstad Offshore	STX Langsten	201 m³	DNV	PSV	Normand Arctic	-
Buksér og Berging	Sanmar	86 m³	DNV	Tug	Borgøy	Vertical tanks
Buksér og Berging	Sanmar	86 m³	DNV	Tug	Bokn	Vertical tanks
Eidsvaag AS	Aukra	115 m³	DNV	Fish feed carrier	Eidsvaag Pioner	-
AGA/Sirius	Fiskerstrand	187 m³	DNV/PED	Bunker vessel	Seagas	Seagas
Finnish Border Guard	STX Rauma	230 m³	GL	Patrol vessel	ULV 10 Turva	Vertical tanks
Simon Møkster Shipping	Vard Aukra	201 m³	DNV	PSV	Stril Barents	-
Finnish Transport Agency	Arctech	2 x 400 m³	LR	Icebreaker	Polaris	Vertical tanks
Tallink	Meyer Turku	2 x 300 m³	BV	Car pax ferry	Megastar	-
SeaRoad	Flensburger Schiffbau	-	DNV	RoRo cargo	Searoad Mersey II	Trailer-based tanks
Caronte & Tourist	Sefine	150 m³	RINA	Car pax ferry	ELIO	-
Caronte & Tourist	Sefine	150 m³	RINA	Car pax ferry	ELIO	-
Torghatten	Vard	175 m³	DNV GL	Car pax ferry	-	-
Torghatten	Tersan	175 m³	DNV GL	Car pax ferry	-	-

Shipowner	Shipyard	Volume	Classification society	Ship type	Ship name	Remark
Torghatten	Vard	175 m^3	DNV GL	Car pax ferry	-	-
Torghatten	Tersan	175 m^3	DNV GL	Car pax ferry	-	-
Torghatten	Tersan	175 m^3	DNV GL	Car pax ferry	-	-
Liegruppen	Cemre	352 m^3	DNV GL	Fishing vessel	-	-
Nordlaks	Tersan	2 x 143 m^3	DNV GL	Live fish carrier	-	Vertical tanks
Nordlaks	Tersan	2 x 143 m^3	DNV GL	Live fish carrier	-	Vertical tanks
Seaspan	Damen	209 m^3	BV	RoRo cargo	-	-
Seaspan	Damen	209 m^3	BV	RoRo cargo	-	-
TT-Line	Jinling	2 x 500 m^3	DNV GL	Ropax	-	-
TT-Line	Jinling	2 x 500 m^3	DNV GL	Ropax	-	-
Ulvan	Tersan	364 m^3	DNV GL	Multipurpose	-	Vertical tanks
Hapag-Lloyd	HRDD	6,400 m^3	DNV GL	Container vessel	Sajir	Retrofit, membrane tank from GTT
Wallenius SOL	Yantai CIMC Raffles	2 x 685 m^3	LR	RoRo cargo	-	-
Wallenius SOL	Yantai CIMC Raffles	2 x 685 m^3	LR	RoRo cargo	-	-
Not disclosed	Not disclosed	-	LR	Not disclosed	-	LH_2 FGSS
Not disclosed	Royal IHC	-	-	Not disclosed	-	Pre-study LH_2 propulsion
MAN PrimeServ	Not disclosed	-	-	Not disclosed	-	Manufacturing of 8 pcs of PVU 8000
MAN PrimeServ	Not disclosed	-	-	Not disclosed	-	Manufacturing of 6 pcs of PVU 4000
Frontline	GSI	2 x 1,675 m^3	DNV	PCTC	-	-
Frontline	GSI	2 x 1,675 m^3	DNV	PCTC	-	-
Frontline	GSI	2 x 1,675 m^3	DNV	PCTC	-	-
Frontline	GSI	2 x 1,675 m^3	DNV	PCTC	-	-
Wallenius	Yantai CIMC Raffles	2,300 m^3	DNV	PCC	-	-
Wallenius	Yantai CIMC Raffles	2,300 m^3	DNV	PCC	-	-

On-shore references

Success stories on land

Client	Country	Storage volume	Plant type	Contract	Year	Remark
Scottish Gas	Scotland	-	Equipment	Equipment	1985	-
Dresser-Rand	Norway	108 m³	Regasification	EPC	1996	Gas turbine test
TLF	Norway	250 m³	Trailer loading	EPC	1997	Located close to air separation plant
AGA Gas	Norway	50 m³	Regasification	EPC	1998	Gas turbine test, mobile unit
Wärtsilä	Finland	50 m³	Regasification	EPC	1998	Extension of existing plant
TVL	Sweden	50 m³	Regasification	EPC	1999	LNG backup for biogas plant
TLF	Norway	250 m³	Trailer loading	EPC	2000	Extension of existing plant
Alstom	Sweden	100 m³	Regasification	EPC	2000	Rebuilt in 2010 with increased capacity
Kungsängsverket	Sweden	50 m³	Regasification	EPC	2001	Backup
Linde Engineering	Norway	1,000 m³	Bunkering/trailer loading	EPC	2003	Storage at liquefaction plant
Linde Engineering	Norway	4 x 175 m³	Regasification	Equipment	2003	LIN backup system at the LNG reliquefaction plant at Melkøya, Statoil plant
YIT	Sweden	50 m³	Regasification	EPC	2004	Backup for biogas
Naturgass Vest	Norway	450 m³	Bunkering	EPC	2004	First ship bunkering
Naturgass Vest	Norway	2 x 250 m³	Regasification	EPC	2004	NG for local heating
Naturgass Vest	Norway	60 m³	Regasification	EPC	2004	NG for local heating
Naturgass Vest	Norway	250 m³	Regasification	EPC	2004	NG for local heating
AGA Gas	Norway	120 m³	Regasification	EPC	2005	Local heating
Stockholm Vatten	Sweden	2 x 50 m³	Regasification/backup	EPC	2006	Backup for biogas
Statoil	Norway	-	Basic engineering	Basic eng.	2007	-
BEWI	Norway	120 m³	Regasification/backup	EPC	2008	-
Gässlösa	Sweden	58 m³	Regasification/backup	EPC	2008	Back up for biogas
Borlänge	Sweden	58 m³	Regasification	EPC	2008	-
AGA Gas	Sweden	108 m³	Equipment	Equipment	2008	Tank for LNG installation
AGA Gas	Sweden	27 m³	Equipment	Equipment	2008	Tank for LNG installation
AGA Gas	Sweden	30 m³	Equipment	EPC	2009	Gas turbine test
Wärtsilä	Finland	22 m³	Regasification	EPC	2009	Engine t Melkøya est
AGA Gas	Sweden	61 m³	Equipment	Equipment	2009	Tank for LNG installation
AGA Gas	Sweden	61 m³	Equipment	Equipment	2009	Tank for LNG installation
AGA Gas	Sweden	61 m³	Equipment	Equipment	2009	Tank for LNG installation
Statoil	Norway	250 m³	Trailer loading	EPC	2009	At Melkøya
Siemens	Sweden	250 m³	Regasification	EPC	2010	Gas turbine test
FordonsGas	Sweden	60 m³	Regasification/fueling	EPC	2010	First truck fueling with LNG
Göteborg Energi	Sweden	125 m³	Trailer loading	EPC	2010	LBG liquefaction (by AL) storage and eq. installation by Cryo
AGA Gas	Sweden	40 m³	Equipment	Equipment	2010	Tank for LNG installation
AGA Gas	Sweden	40 m³	Equipment	Equipment	2010	Tank for LNG installation
AGA Gas	Sweden	20,000 m³	LNG terminal	EPC	2011	Sweden's first receiving and regasification terminal
Jönköping Energi	Sweden	72 m³	LCNG fueling	EPC	2011	CNG filling of buses
Upplands Lokaltrafik	Sweden	2 x 71 m³	LCNG fueling	EPC	2011	CNG filling of buses, LNG filling
FordonsGas	Sweden	72 m³	Regasification	EPC	2011	Backup for CNG filling of buses
AGA Gas	Sweden	27 m³	Equipment	Equipment	2011	Tank for LNG installation
AGA Gas	Sweden	40 m³	Equipment	Equipment	2011	Tank for LNG installation
Eskilstuna Energi och Miljö	Sweden	108 m³	Regasification/fueling	EPC	2012	CNG filling
Studsvik Nuclear AB	Sweden	61 m³	Regasification	EPC	2012	Local heating
AGA Gas	Sweden	-	Equipment	EPC	2012	Subcooling of recondensed NG

Client	Country	Storage volume	Plant type	Contract	Year	Remark
FordonsGas	Sweden	61 m^3	Regasification/fueling	EPC	2013	CNG and LNG filling
AGA Gas	Sweden	250 m^3	Regasification	EPC	2013	Local heating
Bomin Linde	Germany	-	Ship & trailer bunkering	Engineering	2013	Ship and trailer bunkering
Bomin Linde	Germany	-	Ship & trailer bunkering	Engineering	2013	Ship and trailer bunkering
Bomin Linde	Germany	-	Ship & trailer bunkering	Engineering	2013	Ship and trailer bunkering
Skangass	Sweden	30,000 m^3	LNG Terminal	EPC	2014	Receiving and resgasification terminal incl. bunkering 500m^3/h
AGA Gas	Sweden	2 x 250 m^3	Regasification/backup	EPC	2014	Supply to local gas grid
Volvo Trucks	Sweden	0.6 m^3	LCNG fueling	EPC	2014	Test equipment for LNG filling of trucks
Öresundskraft	Sweden	84 m^3	LCNG fueling	EPC	2014	LNG filling of trucks
LKAB	Sweden	150 m^3	Regasification	EPC	2014	NG supply to steel mill
Bomin Linde	Germany	500 m^3	Ship & trailer bunkering	Engineering	2014	Ship and trailer bunkering
Processkontroll	Sweden	12 m^3	Equipment	Equipment	2015	Development
Skangass	Sweden	-	Ship bunkering	EPC	2017	Extension of existing plant with bunkering system
Swedegas	Sweden	-	Ship bunkering	EPC	2017	New installation for LNG bunkering in Gothenburg harbor
AGA Gas	Sweden	-	Ship bunkering	Engineering	2017	Basic design for extension of existing plant with bunkering system
Siemens	Sweden	-	Equipment	Equipment	2018	Additional vaporizer for the existing plant
Forchem	Finland	200 m^3	Regasification	EPC	2018	LNG storage and vaporization plant
MAN PrimeServ	Denmark	-	Test rig for marine equipment	Engineering	2018	Pre-study process evaluation
MAN PrimeServ	Denmark	-	Test rig for marine equipment	EPC	2018	New installation at MAN Cryo in Gothenburg
Terna	Greece	-	Trailer loading system	Equipment	2020	New installation for existing LNG terminal

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