Small scale LNG terminal and bunkering solutions

Jan Van Houwenhove

The Cryonorm consortium

Agenda

Cryonorm consortium
Cryonorm Systems - four major applications

- Maritime LNG fuel systems
  - Inland ships
  - Seagoing ships
- LNG and LCNG fill stations
- LNG bunkering systems
  - Land based
  - Installed on ship
- LNG regasification systems

LNG terminal and bunkering systems

- Different options
- Equipment
- Safety issues

Conclusion

The cryonorm consortium

four major companies.

cryonorm

Vaporization systems for cryogenic liquids with www.cryonorm.nl to be contacted via rpotters@cryonorm.nl.

TEKOMA B.V.
ENGINEERING &
SKID BUILDING

Engineering and building of skids for oil and gas industry to be contacted via ptel@tekoma.nl

cryonorm projects

Small scale LNG liquefaction and industrial gas production units with www.cryonormprojects.com to be contacted via hstuker@cryonormprojects.com

cryonorm systems

Small and mid scale LNG systems www.cryonormsystems.com

The cryonorm consortium

cryonorm

TEKOMA B.V.
ENGINEERING &
SKID BUILDING

cryonorm projects

cryonorm systems

Privately owned company
European based

Turn over 2011:	**25 mio Euro**
Employees:	**120**
Founded:	**1962**

Location Alphen a/d Rijn, NL



Location Hungary





cryonorm systems

TEKOMA B.V.
ENGINEERING &
SKID BUILDING







Tekoma – The Netherlands skid and coldbox manufacturing

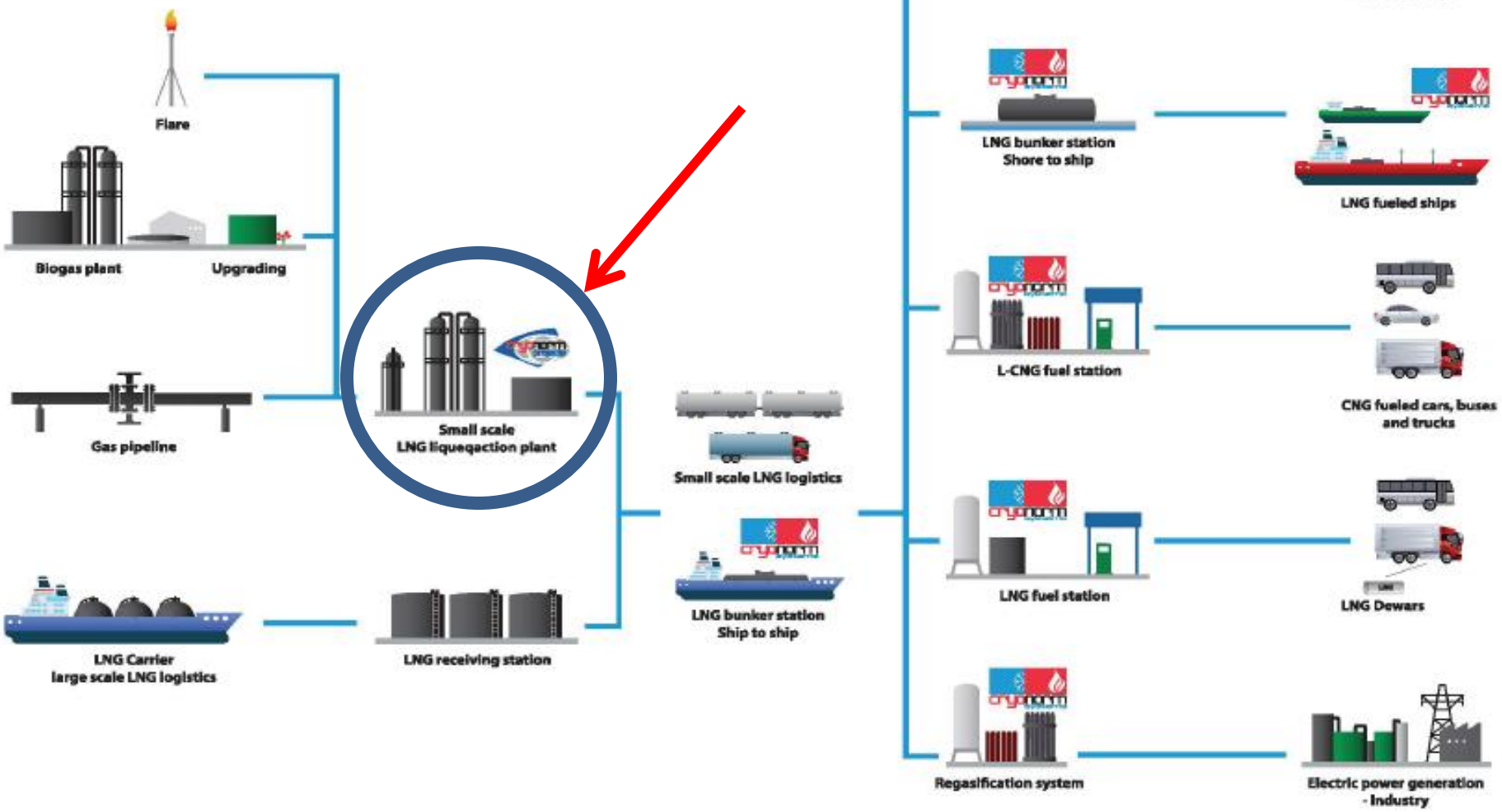
The Cryonorm consortium, serving the LNG market.

focusing on

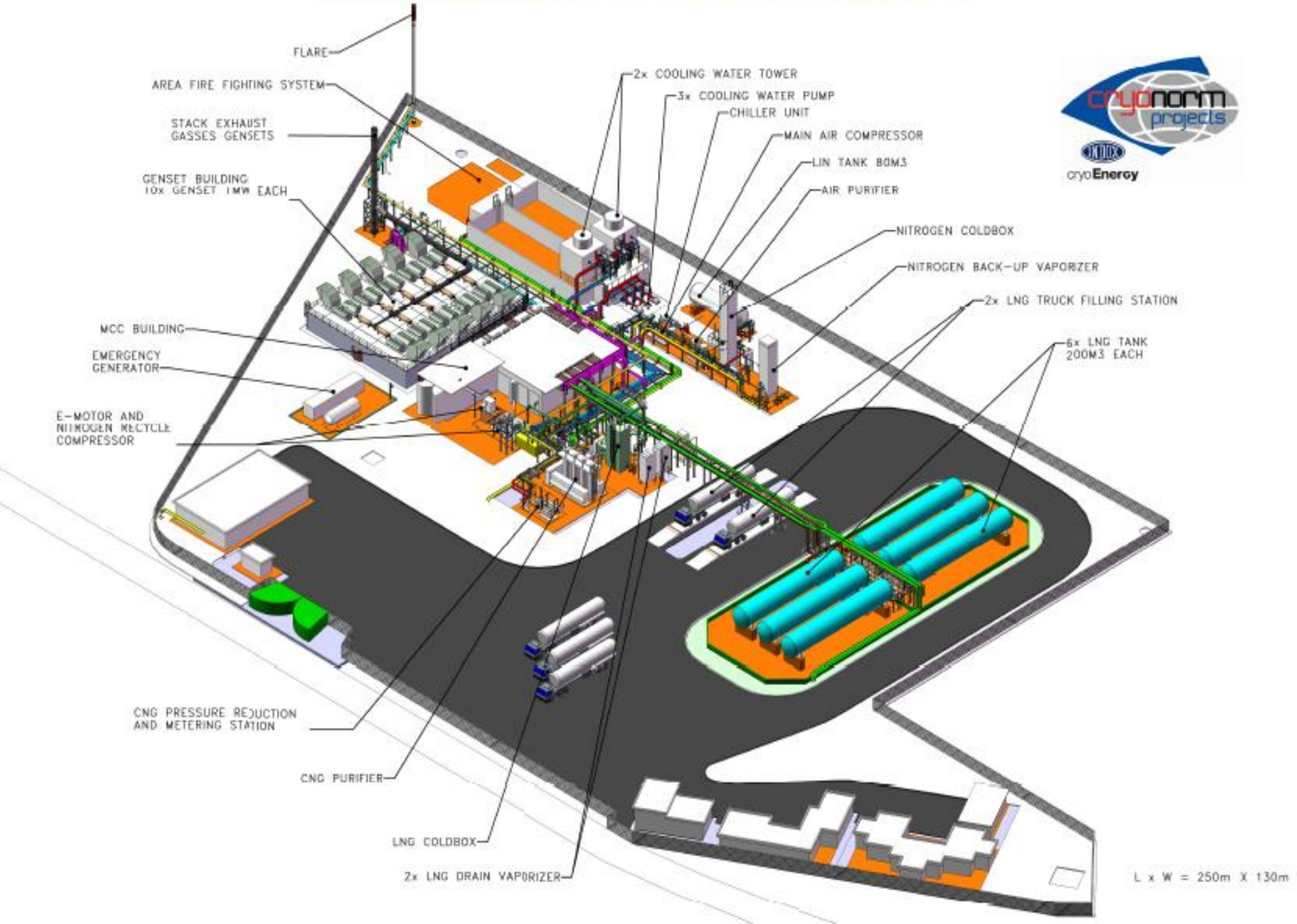
Small scale LNG liquefaction units (Gas to Liquid)

- Cryogenic Engineering
- Natural Gas Liquefaction Plants (LNG)

LNG Supply chain



200MTD LNG PLANT - MACHALA - ECUADOR



Machala, 200 tpd LNG liquefaction plant



Poland, 100 tpd LNG liquefaction plant



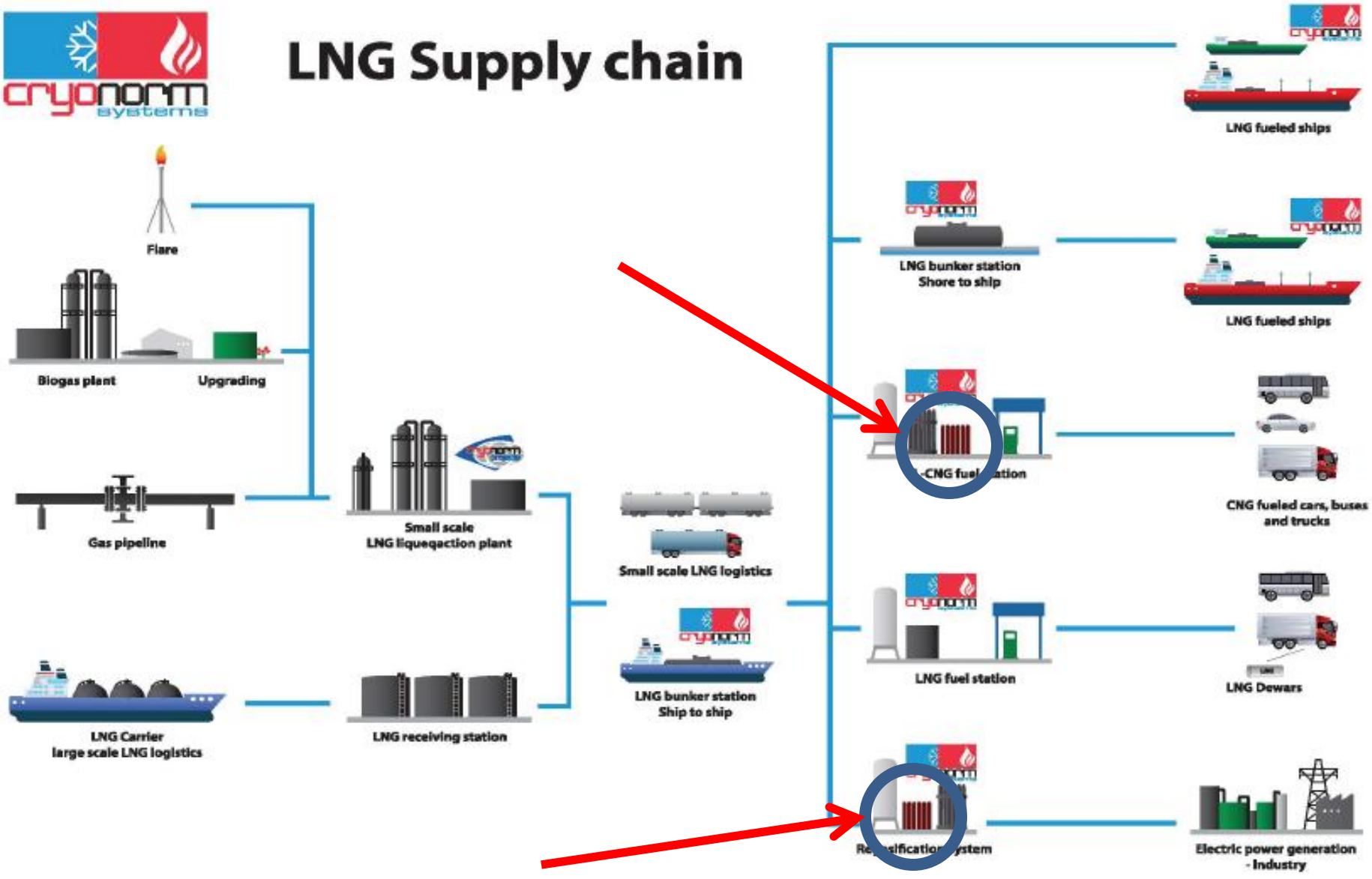
The Cryonorm consortium, serving the LNG market.

focusing on

Vaporization systems

- Ambient type vaporizers
- Forced Draft Vaporizers
- Hot Water Vaporizers
- Steam Driven Vaporizers
- Gas fired / Diesel fired Vaporizers

LNG Supply chain



The Cryonorm consortium, serving the LNG market.







The Cryonorm consortium, serving the LNG market.



Gas fired vaporizers

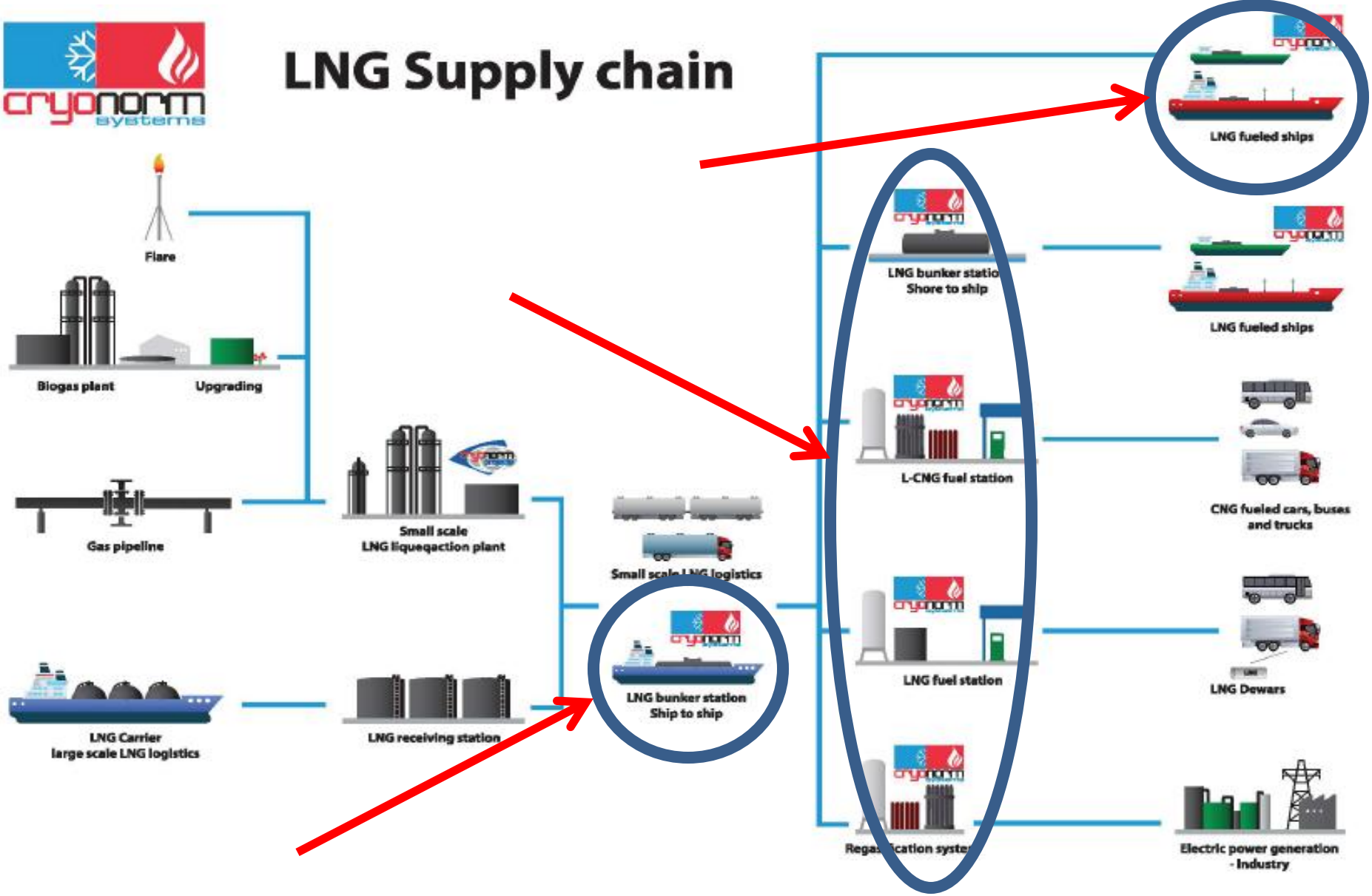
The Cryonorm consortium, serving the LNG market.

focusing on

Turn-key small and mid scale LNG systems – engineering and installation

- Maritime LNG fuel systems
  - Inland ships
  - Seagoing ships
- LNG and LCNG fill stations
- LNG bunkering systems
  - Land based
  - Installed on ship
- LNG regasification systems

LNG Supply chain



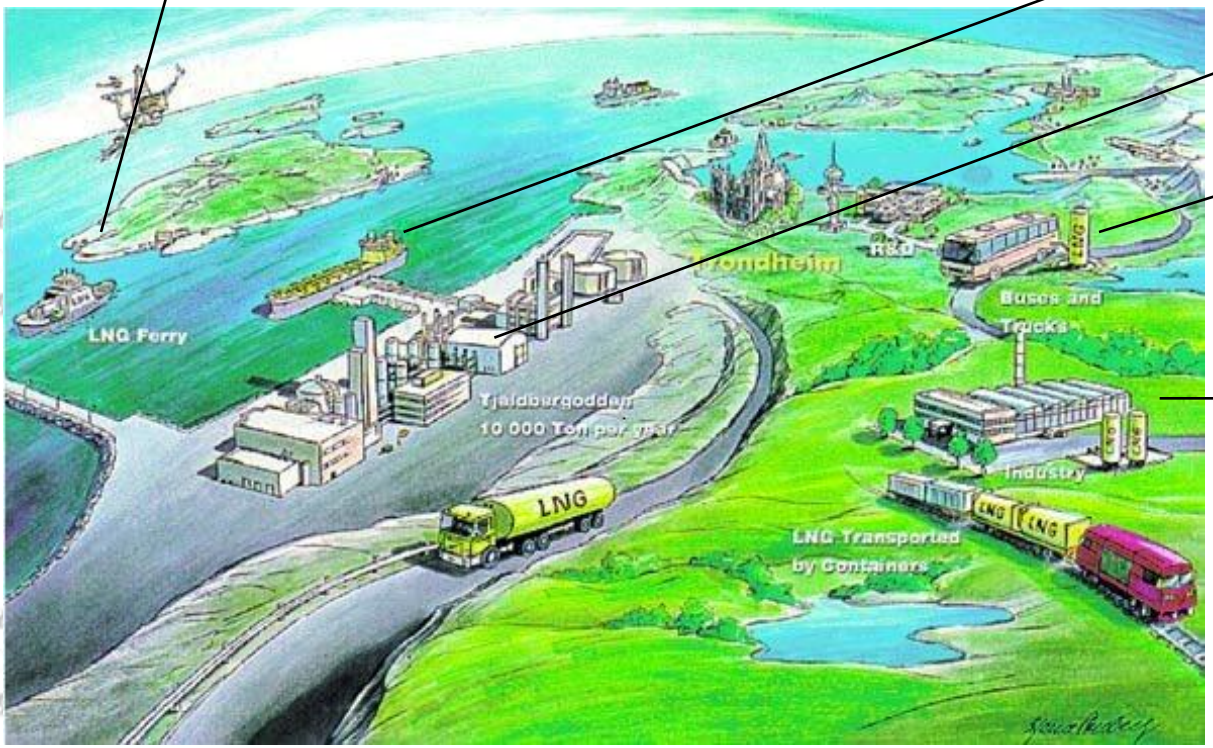
Cryonorm systems – Solution provider for mid and small scale LNG applications downstream the seaterminal/liquifier

LNG units for maritime applications

LNG bunkering stations

LNG terminals

LNG LCNG Stations



LNG regasification stations (industry – household – municipalities)

LNG system for truck filling
Simon Loos – Zaandam NL





Land based regasification systems for industry or municipalities.



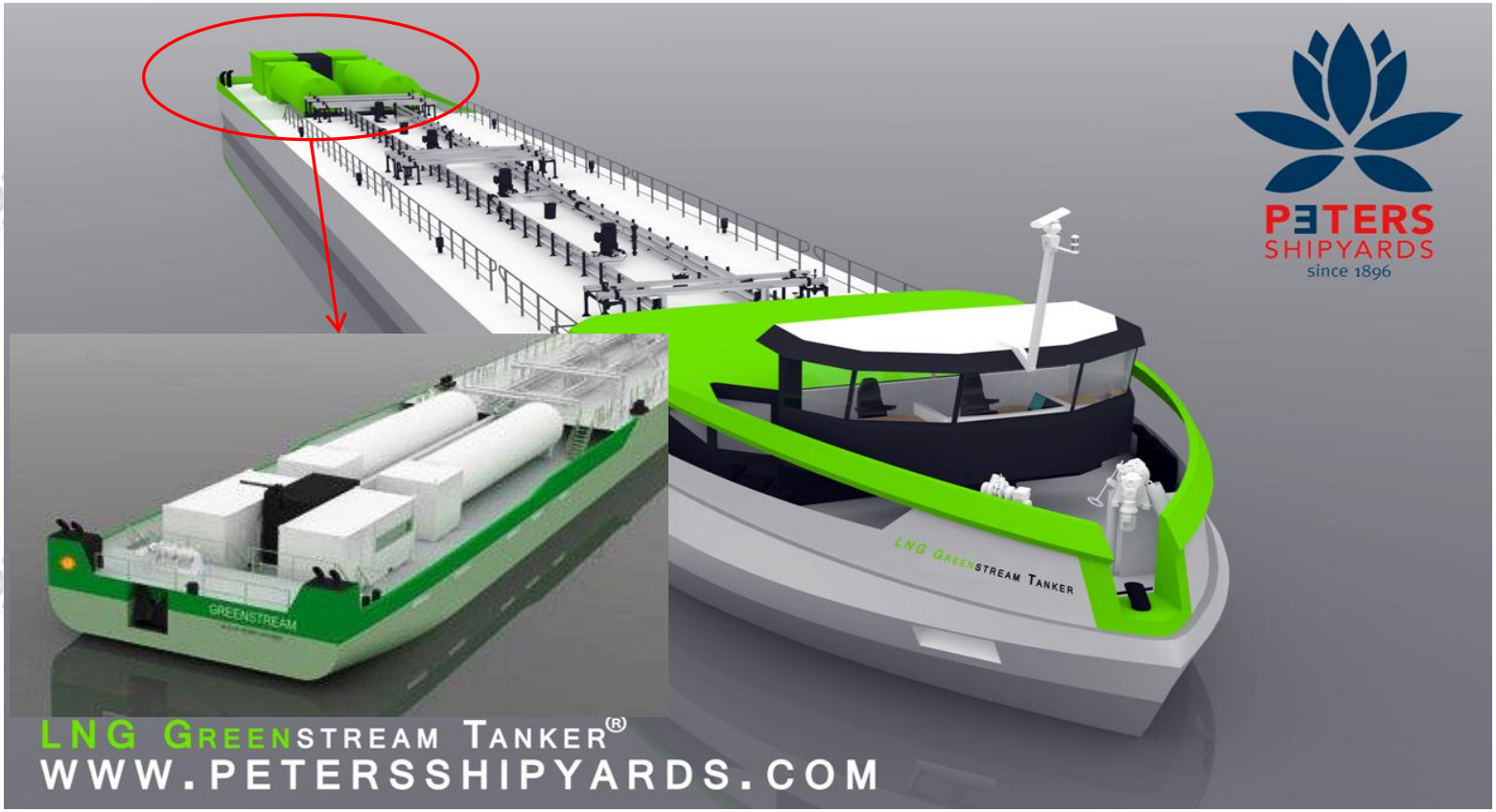


Maritime regasification systems – first inland ship in the world equipped with an LNG system (for dual fuel propulsion)





Maritime regasification systems – mono fuel inland ship (gas/electric)



Cryonorm Systems receives order to install the LNG fuel system on two gas carriers of Anthony Veder.

The order consists of a turn key LNG fuel system for two gas tankers. Cryonorm Systems will engineer, produce and supervise the installation of the LNG system. Anthony Veder and Cryonorm Systems reached an agreement to partner in this important project. "This is a milestone for both companies" says Jos Glorie, business development director at Cryonorm Systems.



About Anthony Veder Group:

Anthony Veder was established in 1937 as a ship-owner and port agent. Ever since acquiring its first gas tanker in 1969, the company has been involved in gas shipping. As an integrated shipping company, it aims to develop long-term customer relationships by offering a safe, reliable and flexible service through a wide range of high quality gas carriers. The group is involved in all segments of the gas market, from CO2 to ethylene and LPG to LNG. Furthermore, it provides comprehensive and efficient technical and commercial ship management services to third parties. www.anthonyveder.com

About Cryonorm Systems:

Cryonorm Systems is part of the Cryonorm consortium and is a leading designer and installer of turn-key small and medium LNG Systems. The LNG systems are developed to meet the international standards as well as the applicable regulations. Our scope ranges from project design, manufacturing and detailed engineering to installation and commissioning of complete LNG systems for the increasing market of small and mid scale LNG . www.cryonormsystems.com

The Cryonorm consortium

Cryonorm Systems receives order to install LNG bunkering system for Risavika harbour from Skangass.

The order consists of a turn key LNG bunkering system for ferries going from Norway to Denmark. Cryonorm Systems will engineer, produce, install and supervise the installation of the complete system. Skangass and Cryonorm Systems reached an agreement to partner in this important project. "This is another milestone for both companies" says Jos Glorie, business development director at Cryonorm Systems.



Photo: Wetteland Foto

About Skangass:

Skangass was founded in 2007. The company is owned by Lyse and is responsible for the operation of the LNG plant in Risavika outside Stavanger. The plant is built to produce 300000 tons of LNG annually, corresponding to the energy needs of two towns the size of Stavanger. Skangass supplies LNG to industry and shipping throughout Northern Europe. More info on www.skangass.no

About Cryonorm Systems:

Cryonorm Systems is part of the Cryonorm consortium and is a leading designer and installer of turn-key small and medium LNG Systems. The LNG systems are developed to meet the international standards as well as the applicable regulations. Our scope ranges from project design, manufacturing and detailed engineering to installation and commissioning of complete LNG systems for the increasing market of small and mid scale LNG . www.cryonormsystems.com

LNG Terminal and LNG Bunkering terminology

A terminal for LNG is typical a storage of LNG including equipment to serve customers (either on land or maritime)

Sizing of terminals can go from 500 m3 to 500.000 m3 of storage.
Typical a terminal is used in co junction with a vaporization system to serve local municipalities with natural gas for combustion.

A terminal can also have an LNG truck filling station in order to bring LNG to remote (off grid) customers.

Bunkering of LNG is filling a marine vessel (inland or sea going) with LNG

LNG Terminal – typical example – with example of vaporizer



Bunkering of LNG – the principle

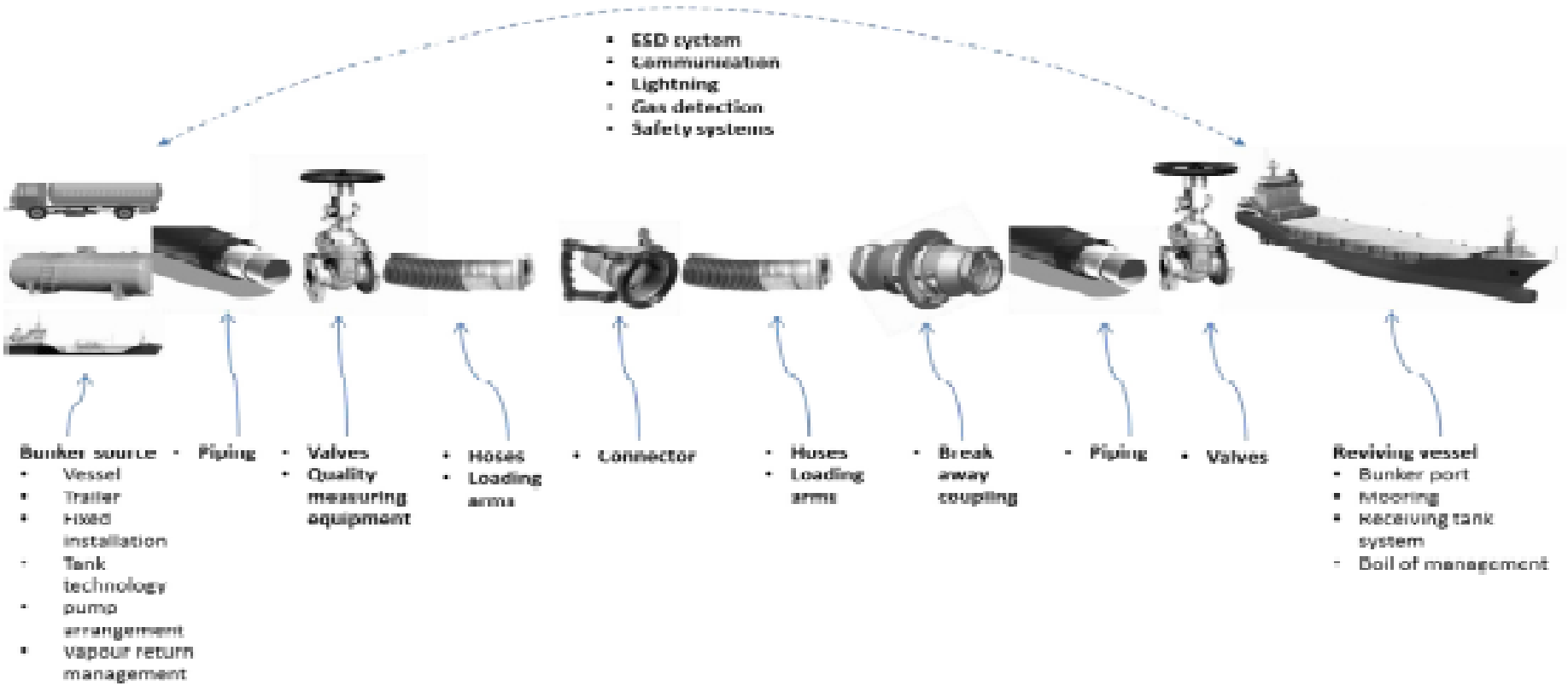


Figure 1 Bunkering transfer chain
Source: Courtesy of Mikael Johansson, DNV Advisory Services

Bunkering of LNG – different methods

1. Bunker vessel – bunker boat
2. Fixed installation
3. Mobile container - Trailer solution

Bunkering of LNG – different technologies – bunker vessel

- Bunker vessel of bunker boat transports LNG from the main or local storage tank to the ship that needs LNG as fuel.
- The bunker vessel receives LNG from a LNG terminal
- Bunkering to end user is done from the buker vessel through a flexible hose.
- The bunker vessel can also be used as a feeder vessel for short distances, depending on the operational limitations.
- A bunker vessel can be a river ship or a sea going ship.



Figure 2 LNG Bunker Vessel

Source: FKAB

Bunkering of LNG – different technologies – land based installation

The LNG is stored on land in a permanent storage (LNG terminal
Transport to the ship is via pipes.
A flexible hose or loading arm is the coonection point to the receiving ship
Investment costs from 2 mio Euro (500m3) to 20 mio Euro (10.000 m3)



Figure 4 LNG storage tank
Source: Courtesy of Liquiline AS

Bunkering of LNG – different technologies – trailer - container



Figure 3 Truck and trailer for LNG distribution
Source: Gasum OY



Figure 5 LNG transport tank, ISO container 20'
Source: Chart-Ferox, DE

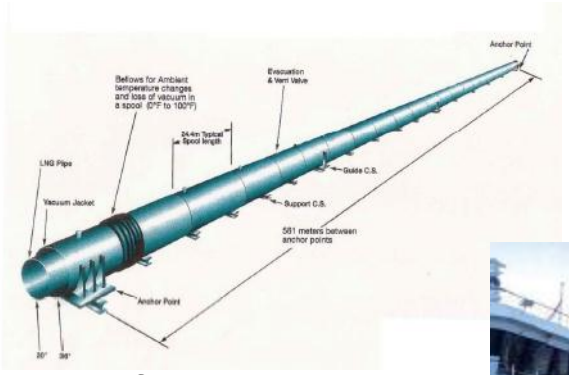
Bunkering of LNG – different technologies – trailer - container

- Economic espects: 300 – 500.000 Euro per unit
- It is a very flexible way of transport of LNG on land and on port,
- Low volumes and high transportation costs
- Can function as back up system for bunkering in case of emergency





Bunkering of LNG and the LNG terminal– other technical considerations to be taken into account



LNG piping
LNG Valves
LNG Hoses and handling of hoses
LNG Loading arms
LNG connectors and couplings



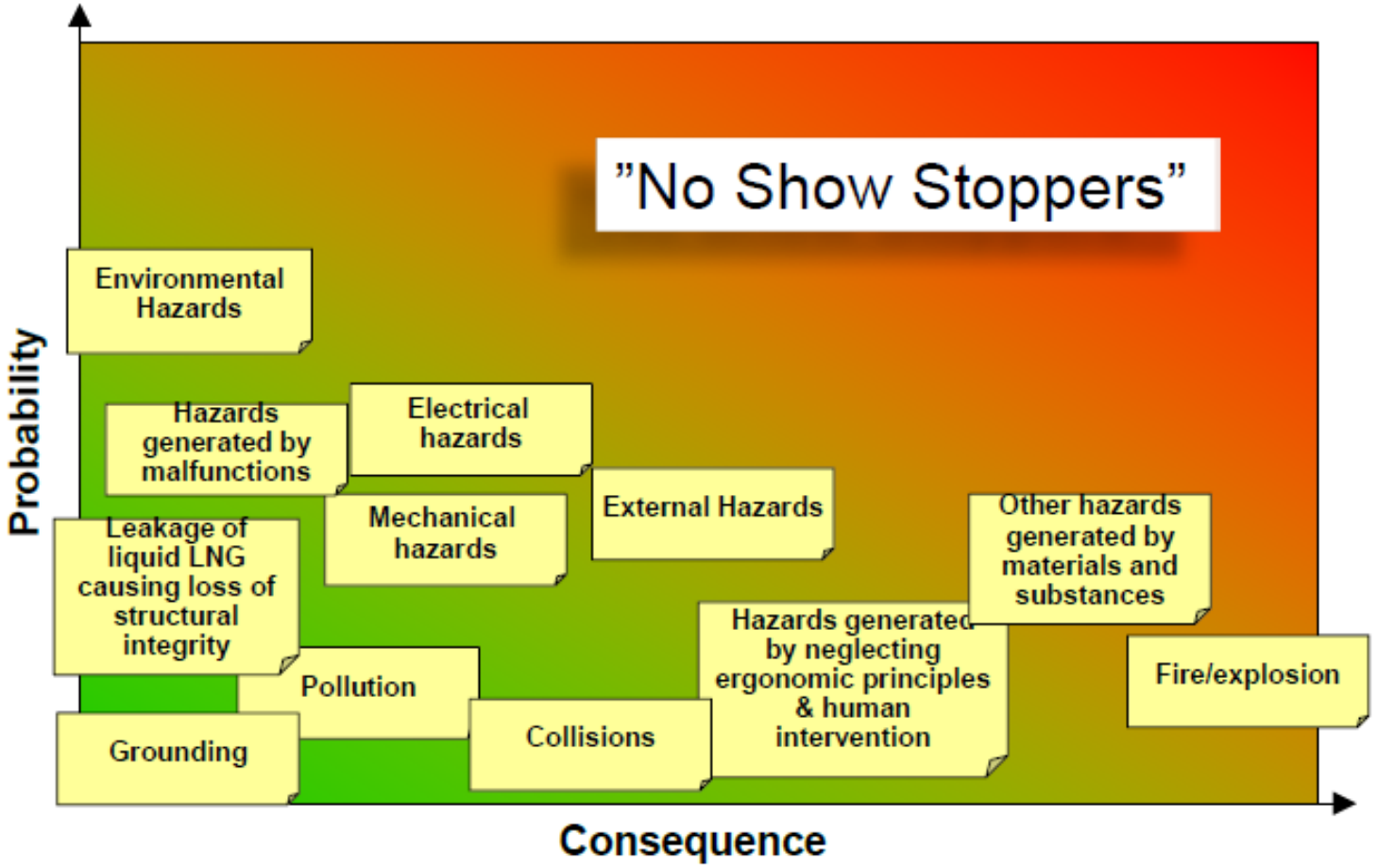




Bunkering of LNG and the LNG terminal application– safety management

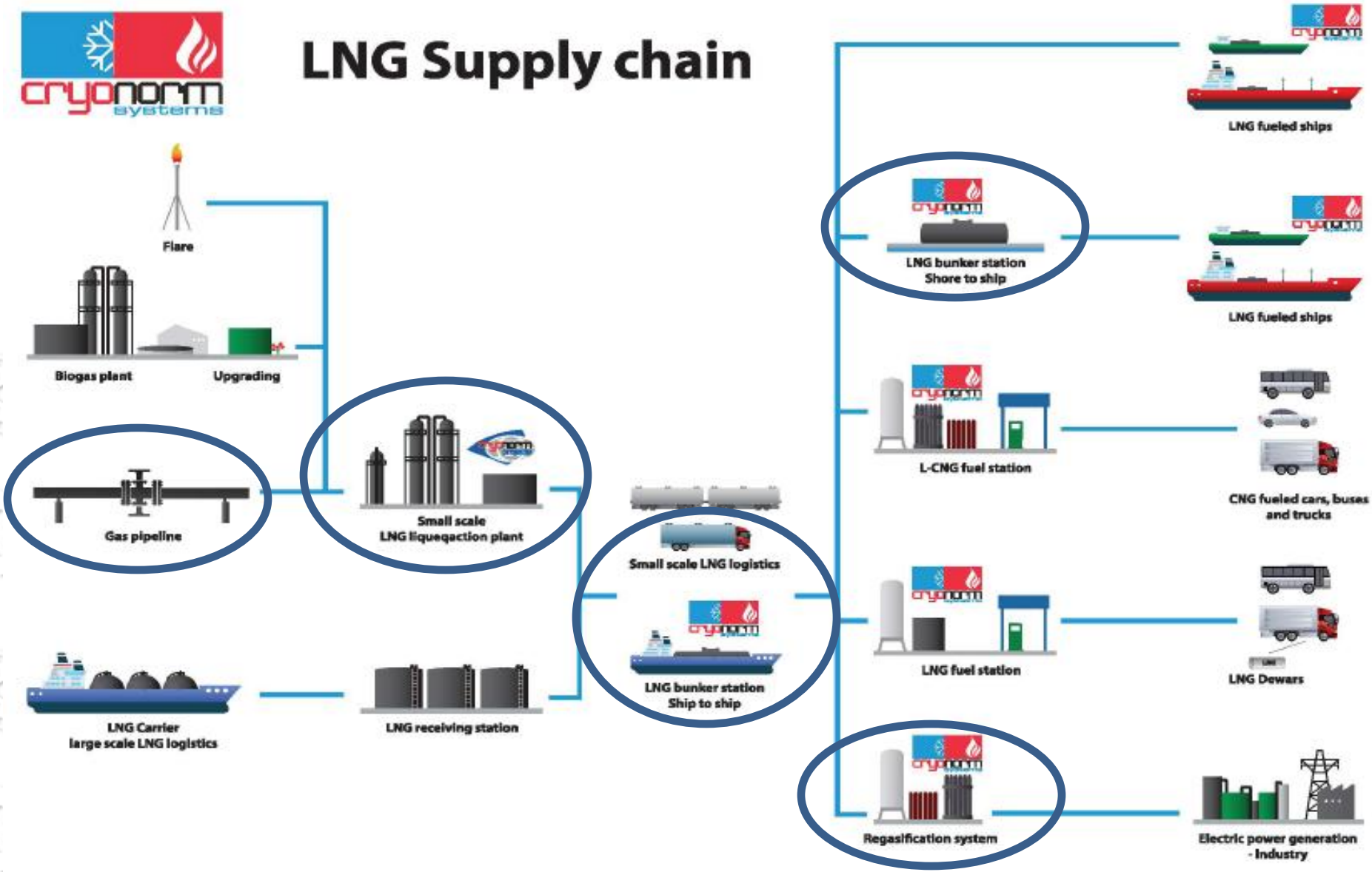
- ESD system and communication
- Regulation for bunkering system onboard a gas fuelled ship
- Filling procedures for trucks
- Emergency shutdown system
- Control, monitoring, and data links
- Gas detection

Bunkering of LNG – safety management



Case study – Stavanger harbour in Norway – fully integrated LNG supply chain.

LNG Supply chain





constantza port

pro DANUBE INTERNATIONAL

The Cryonorm consortium

Conclusion

All challenges/hurdles have been overcome in order to put LNG systems in the market – there are no show stoppers.

Economical and environmental drivers of the industry are making the choice for small and mid scale LNG and easy choice.

Classification agencies are taking their responsibility to make sure that maritime and land based LNG systems can be put in operation.

Most legal frameworks are in place.

Cryonorm Systems has experience with maritime and land based LNG systems for the supply of natural gas to various applications

Turn-key small and mid scale LNG systems

Jan Van Houwenhove
jan.vanhouwenhove@cryonormsystems.com
+32 474 290188

The Cryonorm consortium