

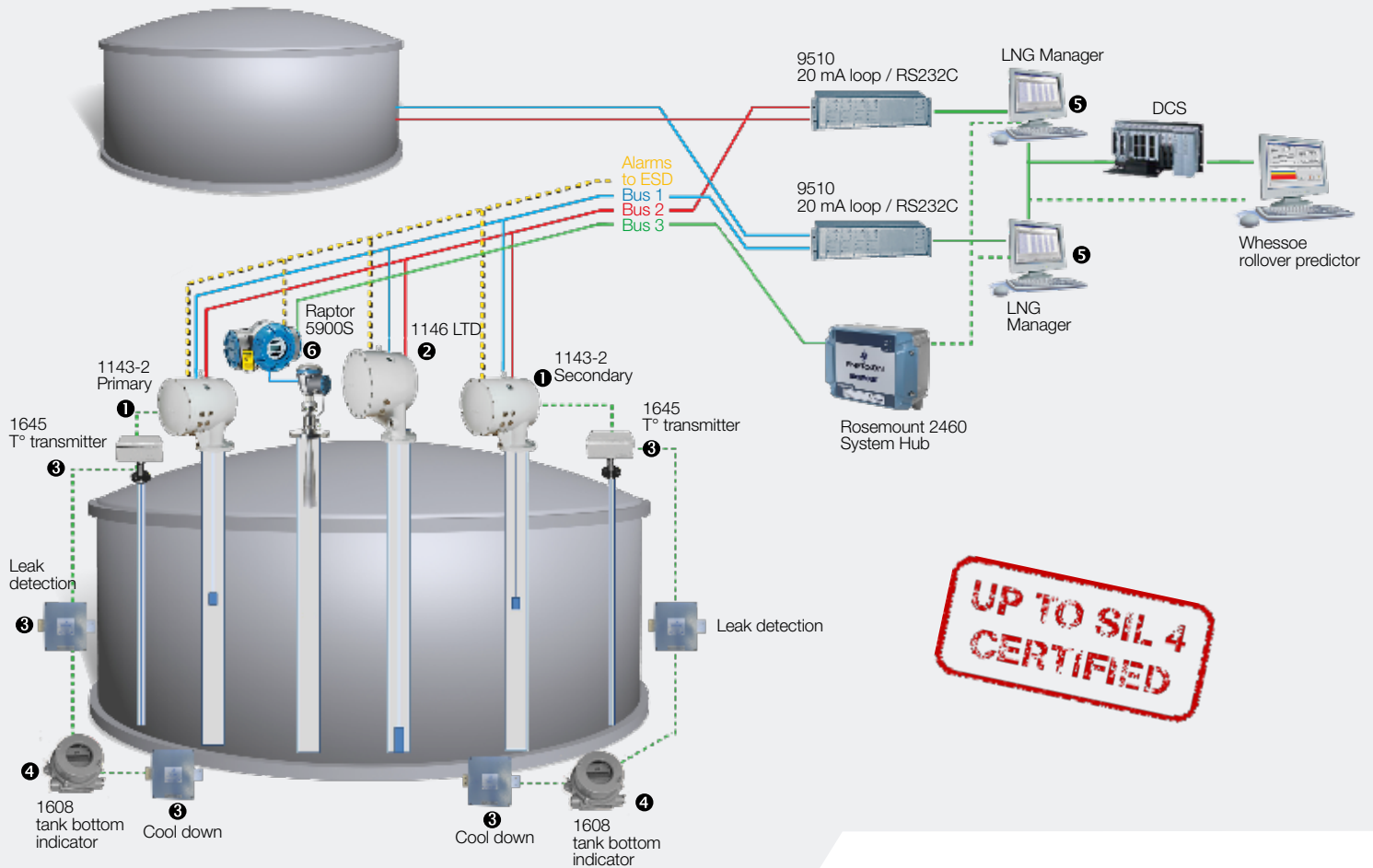
Tank gauging & rollover monitoring system for LNG storage tanks

- FIELD SERVICE IN KEY LOCATIONS
- VAST EXPERIENCE IN PROJECT MANAGEMENT
- MORE THAN 270 LNG TANKS EQUIPPED
- OVER 30 YEARS OF EXPERIENCE WITHIN THE LNG INDUSTRY

LNG Corporation



LNG STORAGE TANK GAUGING SOLUTION



Leading the industry in liquefied gas storage instrumentation and safety systems

Since the earliest days of liquid gas storage, Wärtsilä Tank Control Systems (formerly known as WHESSOE SA) has been at the cutting edge in developing technologies that increase the safety of LNG and LPG storage. In particular, the company's instrumentation and safety systems ensure that all hazardous aspects related to the storage are known and controllable.

In close cooperation with leading gas companies, new technologies have been developed and extensively tested for endurance, accuracy, and reliability in the harsh environments associated with liquid gas storage. Our highly accurate instrumentation, control platforms, and emergency shut-off valve systems are installed worldwide to help protect personnel, the environment, equipment, and the product itself.

If your product is LNG, LPG or ammonia, Wärtsilä Tank Control

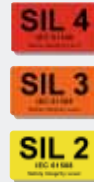


1 MODEL 1143 MARK II SERVO LEVEL GAUGE

Monitors level changes as small as 0.1mm. Incorporating a single body concept, it accommodates all electronics, including the main power connection and redundant Modbus communication. The gauge is fully SIL-2 certified and, in a multi-gauge system application, conforms even to SIL-4. The gauge has successfully passed seismic testing. Integrity and operability of the gauge remain after the event, ensuring a high level of plant safety.

The type approval of the WHESOE servo level gauge model 01143 Mark II, demonstrates that the product used standalone is suitable for safety related functions up to SIL 2 integrity level in low demand and SIL 3 in high demand modes of operation, according to IEC 61508 parts 1 to 7, second edition, 2010.

A redundant safety system, for level detection, using this level gauge can reach safety integrity level of SIL 3 or SIL 4 for "Over spill" (LSHH alarm level) and "Critical low level" (LSLL alarm level), depending on maximum operational lifetimes (10 or 20 years) and on the architecture of the system.



2 MODEL 1146 LTD GAUGE

The world's most advanced LTD gauge, this is also based on Wärtsilä Tank Control Systems's unique single body concept. It accommodates all electronics and wiring, and is mounted on a single flange. Travelling at user configurable speeds, it samples 250 data points to construct a detailed and accurate LTD profile. Communication is via redundant Modbus. As with all gauges, the LTD also features a local LCD display, showing current process and diagnostics data, while an inspection window is used to verify the sensor's "home" position. The gauge has successfully passed seismic testing. Integrity and operability of the gauge remain after the event, ensuring a high level of plant safety.

3 MODEL 1645 TEMPERATURE TRANSMITTER

Handles up to 16 RTD's and 32 RTD's in its doubled version. It is linked to the level gauges for power and the communication of all measured data. With a daisy chain connection of up to 5 units in a local intrinsically safe bus, it is capable of handling in-tank average temperature probes, as well as leak detection and cool-down elements.

4 MODEL 1608 LOCAL INDICATOR

Local, tank base indicator. Model 1608 and 1609 allows field operators to observe all measured data coming from the level gauge and LTD, respectively either from the local Intrinsically safe bus or communication field bus.

5 LNG MANAGER

All process data can be linked back to our PC-based, redundant, control and configuration platform, the LNG Manager, or alternatively directly linked to the site's DCS.

In instances where the LNG tank gauging instruments are being linked directly to the site's DCS system, configuration and maintenance tasks are handled through a portable PC, known as the LNG System Maintenance Supervisor.

6 EMERSON – ROSEMOUNT 5900S RADAR LEVEL GAUGE WITH LNG ANTENNA

SIL-2 and SIL-3 certified high precision radar level gauge for cryogenic applications. The antenna is mounted in a still-pipe which ensures reliable measurement under surface boiling conditions and long range. Unique 2-in-1 safety features offers measurement redundancy through one or multiple tank openings. Measurement verification while tank is in operation. The gauge has no moving parts, making it virtually maintenance free.

7 EMERSON – ROSEMOUNT 2460 SYSTEM HUB

The Rosemount 2460 System Hub is a data concentrator that continuously polls and stores data from field devices to ensure a high update rate. Whenever a request is received, the 2460 can immediately send data to all common Host/DCS systems. The 2460 System Hub offers flexible and configurable multiple port connectivity. Two 2460 System Hubs can be connected in parallel for redundancy and backup.

Systems can provide an application-specific solution for your business needs. Today, the liquid gas industry is driven by the economics of operational scale. In order to apply efficient business management, while adhering to stringent safety regulations, operations personnel must have access to correct information.

Throughout the production cycle, from storage to distribution, the availability of precise data is essential, and it needs to be relayed to the control room in real time. Whether your operation is large or small, to best suit your requirements. They can operate independently, or be interconnected within a plant-wide system. Our vast experience, research, instrumentation technology, and service support will add value to your business. Our network of sales offices, application specialists, service facilities, and our training centre in France provide local support to customers in key locations worldwide – Wärtsilä Tank Control Systems.

OUR SOLUTION FOR LIQUIFIED GAS STORAGE TANKS

For those highly specialised applications*, whereby safety, accuracy, reliability, and repeatability are of prime importance, you need look no further than Wärtsilä Tank Control Systems.

Our LNG storage tank instrumentation solution is compliant to NFPA 59A and comprises the following, fully integrated system components:

- Up to SIL-4 certified servo level gauges
- High/high level alarm gauges
- Product temperature probes
- Fully automatic LTD gauge
- Leak detection and cool-down temperature system
- PC based SCADA package
- Roll-over predictive alarm software

The entire system communicates via a redundant communication link.

Our instruments are suitable also for use in refrigerated tanks (butane, propane, ethane, ethylene, propylene).

CONTROL PLATFORMS LNG MANAGER

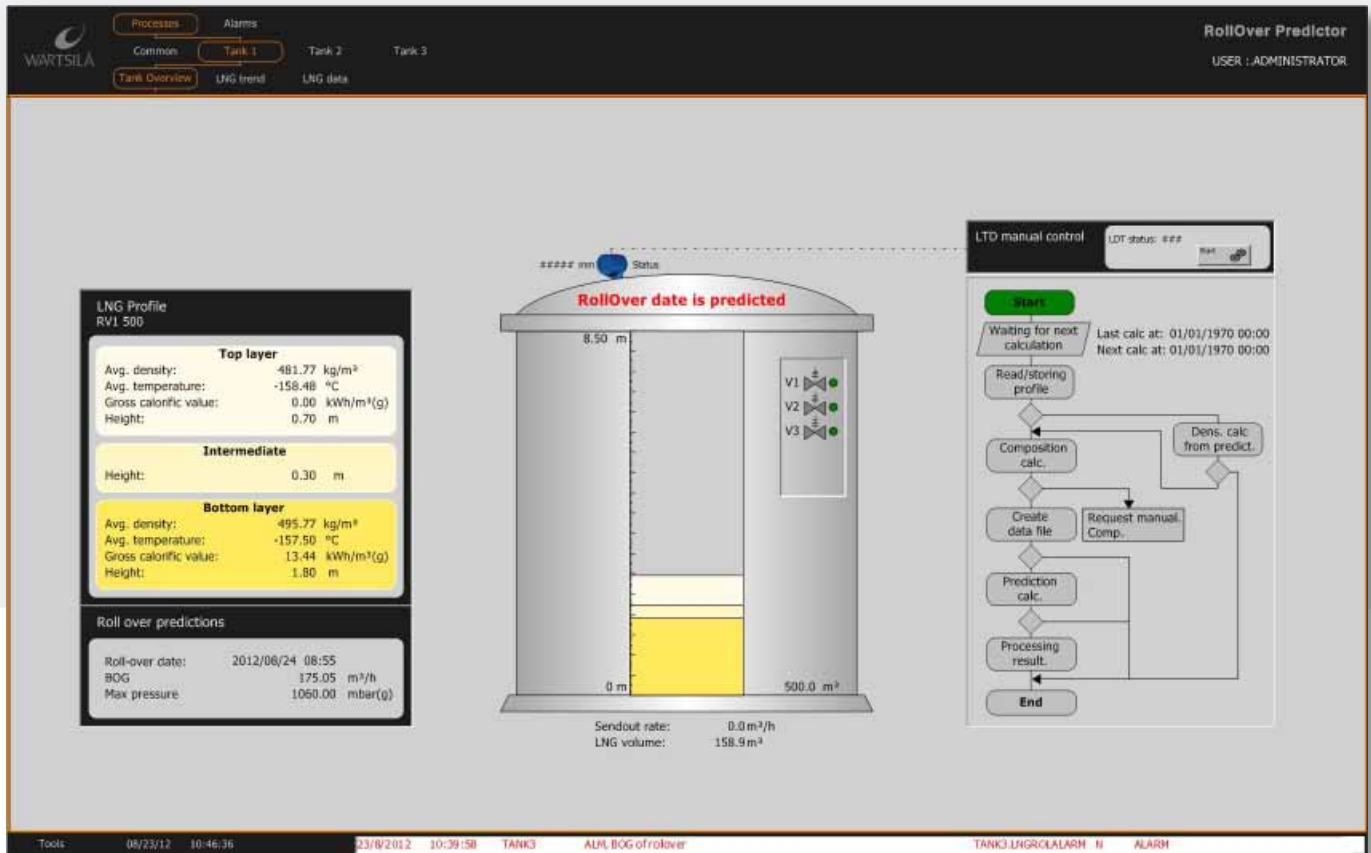
All process data can be linked back to our PC based, redundant, control and configuration platform, LNG Manager®, and can be directly linked to the site's DCS.

In instances where the LNG tank gauging instruments are being linked directly to the site's DCS system, configuration and maintenance tasks are handled through a portable PC, called LNG System Maintenance Supervisor®.



* Specific applications can be studied on request.

Wärtsilä Whessoe LNG Rollover Predictor



Liquefied natural gas (LNG) terminals need to be able to store multiple grades of LNG, and to have sufficient storage capacity available for all of these. Managing storage to ensure availability and to optimise the use of storage capacity is therefore essential.

With the increasing diversification of LNG supply sources, an increase in short-term trade, and a general global trend towards the liberalisation of gas markets, reception terminals need to be able to deal with a greater variety of incoming LNG qualities. Furthermore, with the need to reduce capital and operating costs, the capacity of both existing and new storage tanks must be utilised to their fullest extent.

At the same time, while the LNG is in storage, boil-off will result in a continuous change of its chemical composition. Consequently, storing different grades of LNG in receiving tanks, together with the ongoing modification of the chemical characteristics, calls for

certain proactive measures. In particular, monitoring of the possible development of stratification is needed, and warning must be given should unstable stratifications that might evolve into a rollover of the layers be detected.

A level temperature density gauge alone is simply not capable of monitoring the stratification evolution. Therefore, in collaboration with ENGIE, Wärtsilä has developed the Wärtsilä Whessoe LNG Rollover Predictor software. Thanks to the software you are able to make the right decisions at the right time, and to manage the storing of LNG in a safe, timely and optimal way.

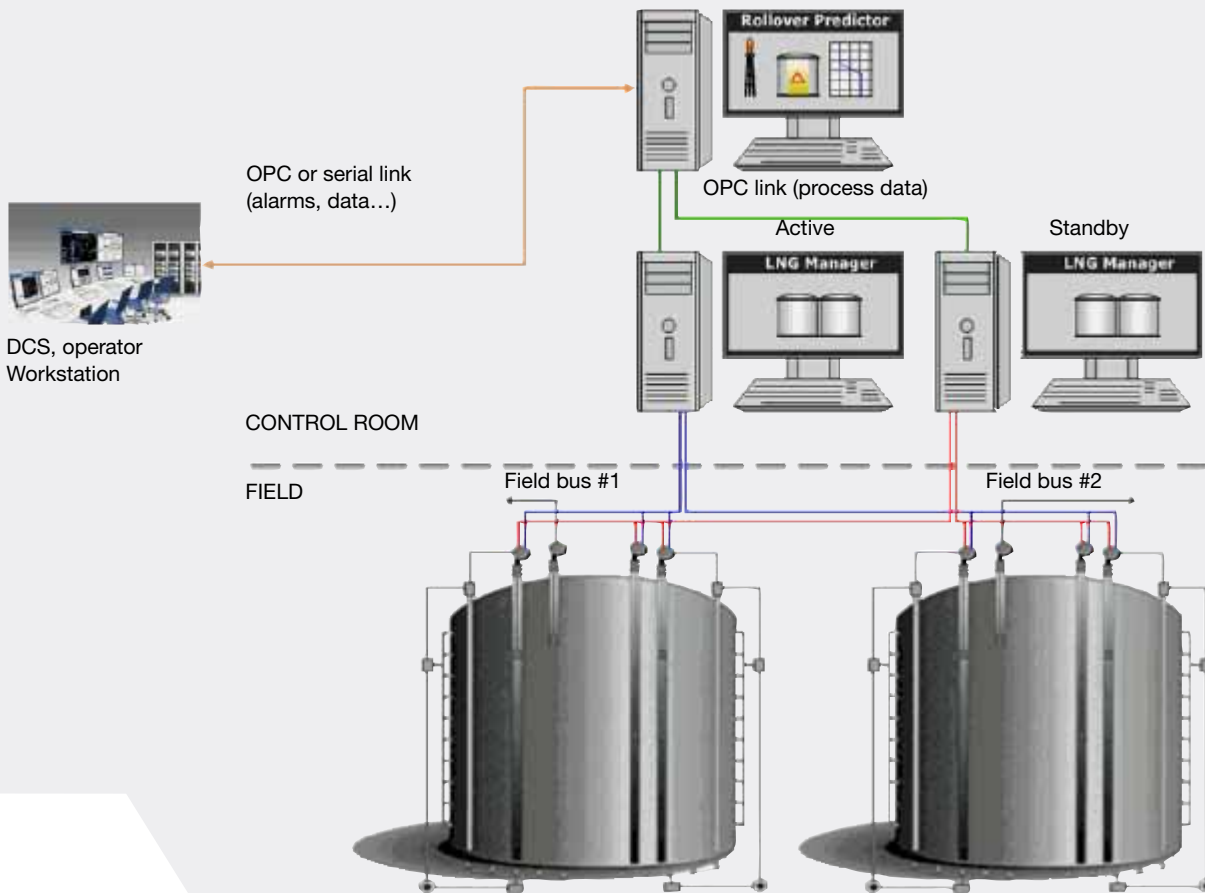
The Wärtsilä Whessoe LNG Rollover Predictor provides the user with

a watchdog that monitors all the site components which impact and influence the formation and evolution of LNG stratification. The software continuously monitors all data and calculates the expected development of stratification, if any.

Should a certain stratification appear likely to evolve into a rollover situation in any of the tanks linked to the same vapour space, the software automatically generates an alarm, leaving sufficient time for the operators to take corrective action.

The Wärtsilä Whessoe LNG Rollover Predictor detects the occurrence of a rollover for up to 30 days at a time (configuration from 1 to 30 days), to provide the operator with information as to:

- Tank where rollover is expected
- Remaining time to rollover
- Predicted boil-off gas level during rollover
- Predicted pressure (rise) during rollover



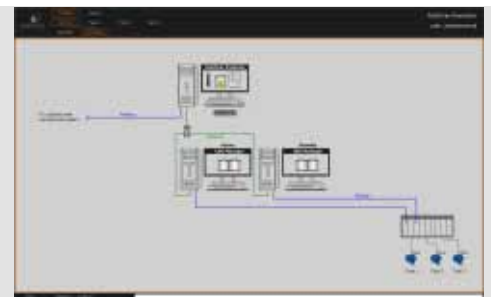
The Wärtsilä Whessoe LNG Rollover Predictor handles all grades of LNG and estimates the evolution of the chemical composition in real time.

The Wärtsilä Whessoe LNG Rollover Predictor

- Predicts stratification and rollover phenomena accurately
- Generates automatic alarms in case of rollover without any operator intervention
- Estimates the LNG layer's composition every 4 hours based on initial composition manual input
- Displays tank level, layer heights, average density and temperature per layer
- Indicates the status of plant safety devices.

AUTOMATION VIEW

- Automation system overview
- Communication status - LTD status



PLANT VIEW

- Tank overview with alarm information
- Site Safety devices status



LOG FILE VIEW

- Complete log file
- Archive



LIFECYCLE SUPPORT

Our philosophy is to serve customers throughout the lifecycle of their installation.

We provide OEM spare parts, modernisation and upgrading solutions, technical support, training, and maintenance on site.



INTEGRATED SOLUTIONS

With its extensive product and solutions portfolio Wärtsilä is able to offer full turnkey solutions from engineering, installations on site and commissioning, to full lifecycle support solutions including services, spare parts and upgrading solutions.

To support the lifecycle of our installations, Wärtsilä's after market services offers a knowledge-based "one-stop-shop" for our customers, including:

- **Spare Parts handling** for the entire gas installation with expert recommendations and obsolescence management.
- **Remote support.**
- **Field service support.**
- **Training.** E-learning and class room training as well as customer tailored training courses can be offered.

Wärtsilä's service network reaches almost all corners of the world and ensures fast response when maintenance is needed.





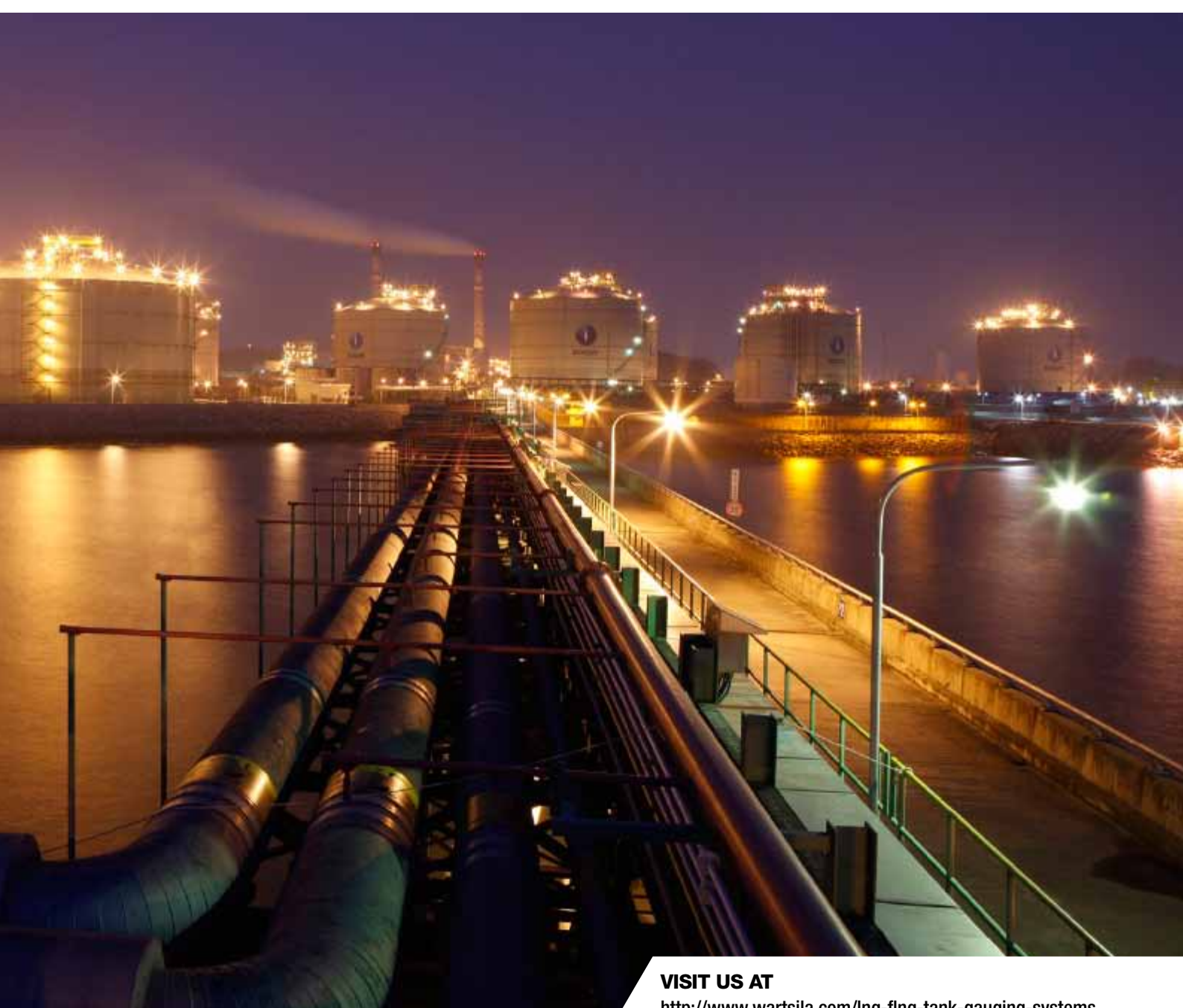
PROJECT MANAGEMENT

Wärtsilä Tank Control Systems has vast experience in serving customers around the world with expert project management.

We have an extensive background in customizing projects in line with international standards, local regulations and the specifications of each individual project.

Our project team is committed to delivering on time, with full conformity to the technical specifications, and to the quality expected by our global customers.

The overall objective in everything we do is to ensure customer satisfaction.



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<http://www.wartsila.com/lng-flng-tank-gauging-systems>



Wärtsilä is a global leader in complete lifecycle power solutions for the marine and energy markets. By emphasising technological innovation and total efficiency, Wärtsilä maximises the environmental and economic performance of the vessels and power plants of its customers.

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