



Maritime Solution for Our Sustainable Future
IMO 2050 Energy Solution



Zicom Private Limited is a total engineering solutions provider for Green Energy Solutions, Deck Machinery and Gas Equipment. Founded in 1978, we are a pioneer in Singapore delivering deck machineries and lifting solutions to the global market.

In 2010, we recognized the need for environmental sustainability in the shipping industry, confirmed by the legislation of IMO 2020, IMO 2030 and IMO 2050 regulations for reduced Greenhouse gas, particularly, Carbon Dioxide(CO₂) emissions. We started a technical innovation program to develop a suite of comprehensive Marine Green Fuel Solutions; Liquified Natural Gas(LNG), Ammonia(NH₃), Methanol, Electrical Drive (integrating Li-based Marine Battery Storage, Super Capacitors, and Fuel Cells). We have since conceptualized and delivered numerous systems contributing to the global drive for reduced greenhouse gas emissions.

Marine Engineering,

We specialize in the design and manufacturing of deck machinery. Our designs are built to all class requirements such as ABS, Lloyd's, DNV, CCS, BV and others. Our commitment to equipment safety and reliability is well-recognized in the marine industry. Our clientele consists of the China Salvage & Rescue Bureau under The Ministry of Transportation, and leading marine and offshore service providers such as Keppel, Tidewater, Bourdon Offshore, SMIT International, PT Freeport and many oil majors.

Precision Engineering & Automation

We are a one-stop solution for your precision engineering and automation needs. This includes automation of production flow, custom design engineering, electrical and electronic system integration, full modular assembly, and precision machining. Our customers include Forbes 500 companies in the pharmaceutical, biomedical, semiconductor, and electronics industries.

Soil Foundation & Construction

We are a well-established and reliable manufacturer of concrete mixers and foundation equipment for the construction industry. Our scope of work includes selling, renting and servicing foundation and construction equipment like concrete mixers, hydraulic vibratory hammers, vibroflots, jet grouting pumps, impact hammers, drilling rigs, and other related machinery and accessories. Our customers include building contractors, and global building materials companies from Australia, Southeast Asia, Hong Kong, China, India, and the Middle East.

Oil and Gas

We are an engineering procurement contractor for the oil and gas industry. We design and manage the construction of small to medium-sized energy infrastructures like power plants and gas fractionation plants. Key products that we manufacture as part of the projects include regulating and metering stations, and water tanks. Our customers are mainly the national oil and gas companies from India, Bangladesh, and Indonesia.



**Precision Engineering & Technologies
("PET")**

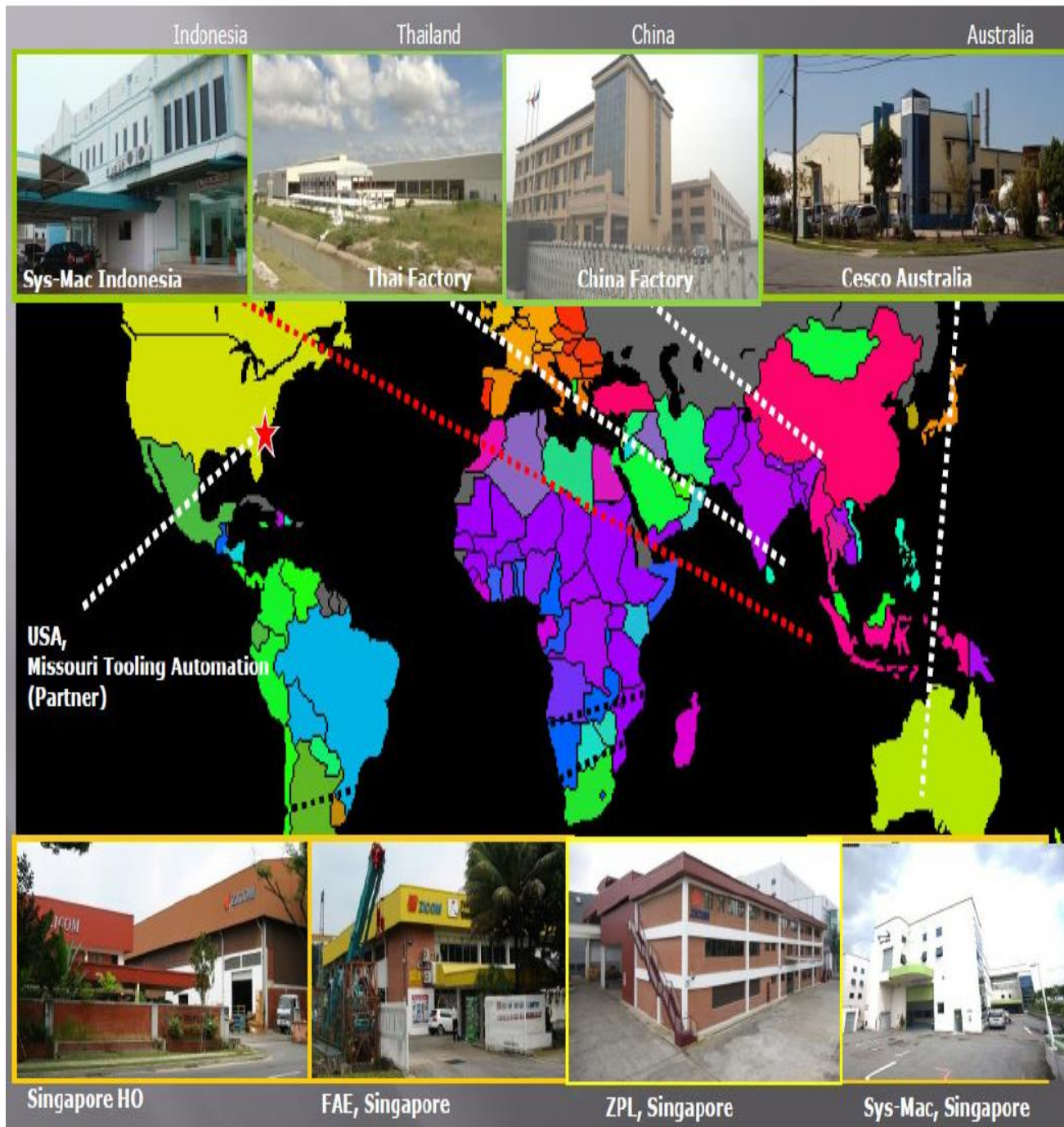


Construction Equipment



Green Energy, Gas, and Marine Equipment (GEGAME)







Construction Equipment Cluster

Construction and Soil Foundation

Principal Products

- ✓ Concrete Mixers: Capacity: 3m-12m on trucks and trailers.
- ✓ Special Mixers: tanning of leather, mixing of **explosives**.
- ✓ Foundation equipment: Vibro-Piling Machines, Construction Drilling Rigs, Micro-Piling Rigs – onshore and offshore.





Precision Engineering & Technology Cluster

Automation System

Principal Products

- ✓ Factory Automation Systems Integrator
- ✓ Contract Manufacturer
- ✓ Precision machining and fabrication

Customers

- ✓ Semiconductor, consumer electronics, healthcare etc.
- ✓ USA, Europe, Asia

Consumer Electronics & Semi-Con



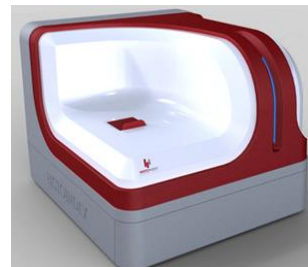
invent



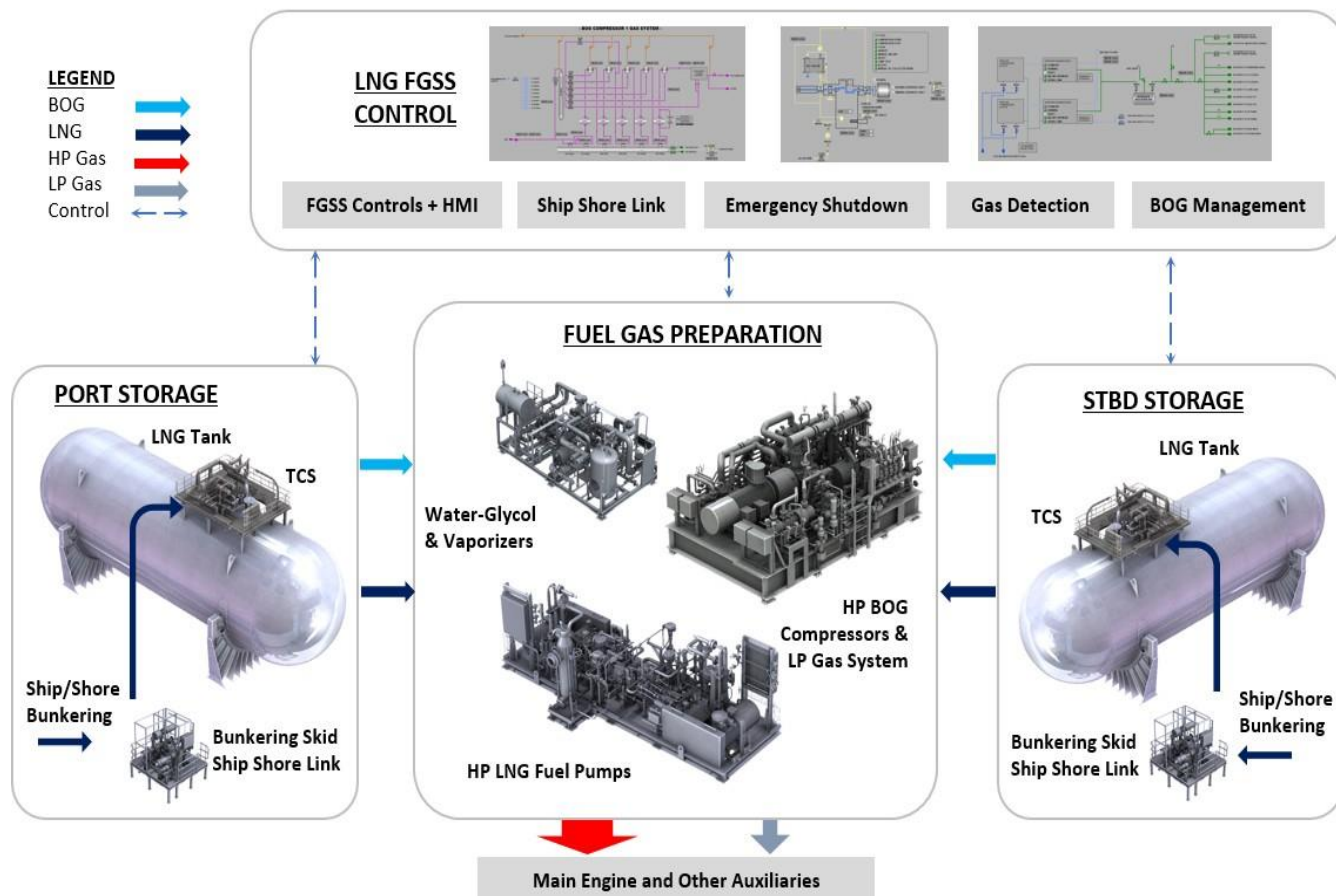
SIEMENS



Life Sciences & MedTech



HIGH PRESSURE LNG FGSS WITH HP BOG HANDLING SYSTEM



In 2010, we recognized the need for environmental sustainability in the Marine Industry and started the development of comprehensive green fuel solutions; **LNG, Ammonia, Methanol, and Electrical Drive** (integrating batteries, supercapacitors, and fuel cells). **ZICOM** conceptualized and delivered innovative solutions to support industry needs and the all-important global drive for reduced greenhouse gas emissions.

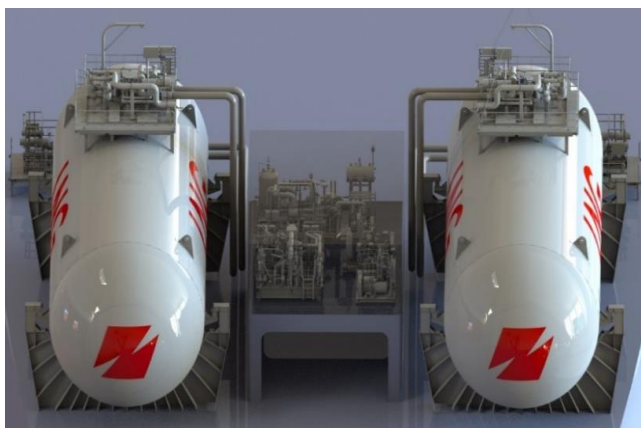
We deliver total life cycle solutions starting at project inception, we engineer the system for reliability, intuitive operation, end-of-life decommissioning and recycling (if possible). Together with our network of satellite offices and international partners, we deliver and support our mission-critical system for our clients worldwide.

We partner with established maritime research institutes and classification societies for research and development, validation and fine-tuning of our system design.



Green Energy, Gas & Marine Equipment (GEGAME)

Solution for the Operational Needs of Different Vessel Profile



LNG FGSS



GAS STATION



Deck Machinery



*Rescue and Salvage Towing
System*

Principal Products

- ✓ Deck Machinery: Winches/Windlass for Anchor Handling, Mooring, Towing, Pipe-laying and Other Load-handling system.
- ✓ LNG, Ammonia, Methanol and Electric Propulsion Systems
- ✓ Land-based Turnkey Gas Processing Plants and compressor Stations, Regulating and Metering Stations



Gas Handling System (GHS)

For Different Needs

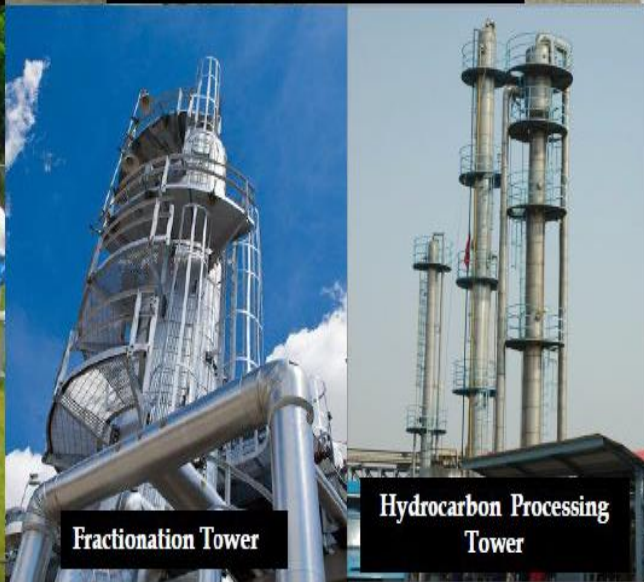


ZICOM is a source of technological excellence where nature and technology complement. **ZICOM's** proven engineering is enhanced with innovative technology and support; we make the environment that is the solution for the Energy Industry.

ZICOM designs and builds process equipment systems and plants for the gas, chemical and refining industries. **ZICOM** employs state-of-the-art computer-aided design and process simulation packages, enabling predictable and realistic plant performance forecasting.

As an **EPCI (Engineering, Procurement, Construction and Installation) company**, we believe in continuous collaboration with Strategic partners to enhance our technical capabilities in technology-based projects; such as ***Process Automation, Well Head Control Systems, and Flare Systems etc.*** We provide Operation and Maintenance and Project Management Services through this Strategic Alliance; we add synergy in meeting the varied clients' technical expectations.

EPC of turnkey gas processing plants and gas metering stations; flow computers, control valves; drilling equipment



Whether a grassroots plant, expansion or modification, **ZICOM** provides engineering services for projects involving Balancing, Modernization, Rehabilitation and Expansion, capacity increase, new process parameters, adequacy checks for existing units and recommending optimum design for various oil and gas applications including the following.

- Gas Plants
- Oil Treating
- Condensate Fractionation
- Dehydration
- Separation
- Heat Transfer
- H₂S and CO₂ Removal
- Control & Automation (PLC or DCS)



Fuel Gas Supply System (FGSS)

For Different Needs



Tankers, Bulk Carriers & Container Vessels

Long Voyage and Route Flexibility requiring efficient High-Pressure FGSS with Active Boil Off Gas Handling System.



AHTS, Tugs, Crew boats & LCT

Dedicated operational profile with compact and simple Low-Pressure FGSS.

LNG Fuel Gas Supply System

We offer solutions catering for the operational needs of different vessel profiles. These range from larger vessels with a longer sailing time as well as smaller compact harbour crafts, and offshore support vessels and configure our modular FGSS system to match each vessel's unique chartering needs. Our patented FGSS is available for low-pressure, high-pressure and dual-fuel gas engines and is augmented with an efficient boil-off gas (BOG) management system.

Our High-Pressure System delivers Revolutionary Performance via a Dual High-Pressure Compressor System feeding BOG to the Main Engine providing limitless vessel Deployment Flexibility and operational Reliability. As such, LNG Tank can always be kept at low pressure ensuring a cold LNG Tank under all conditions.

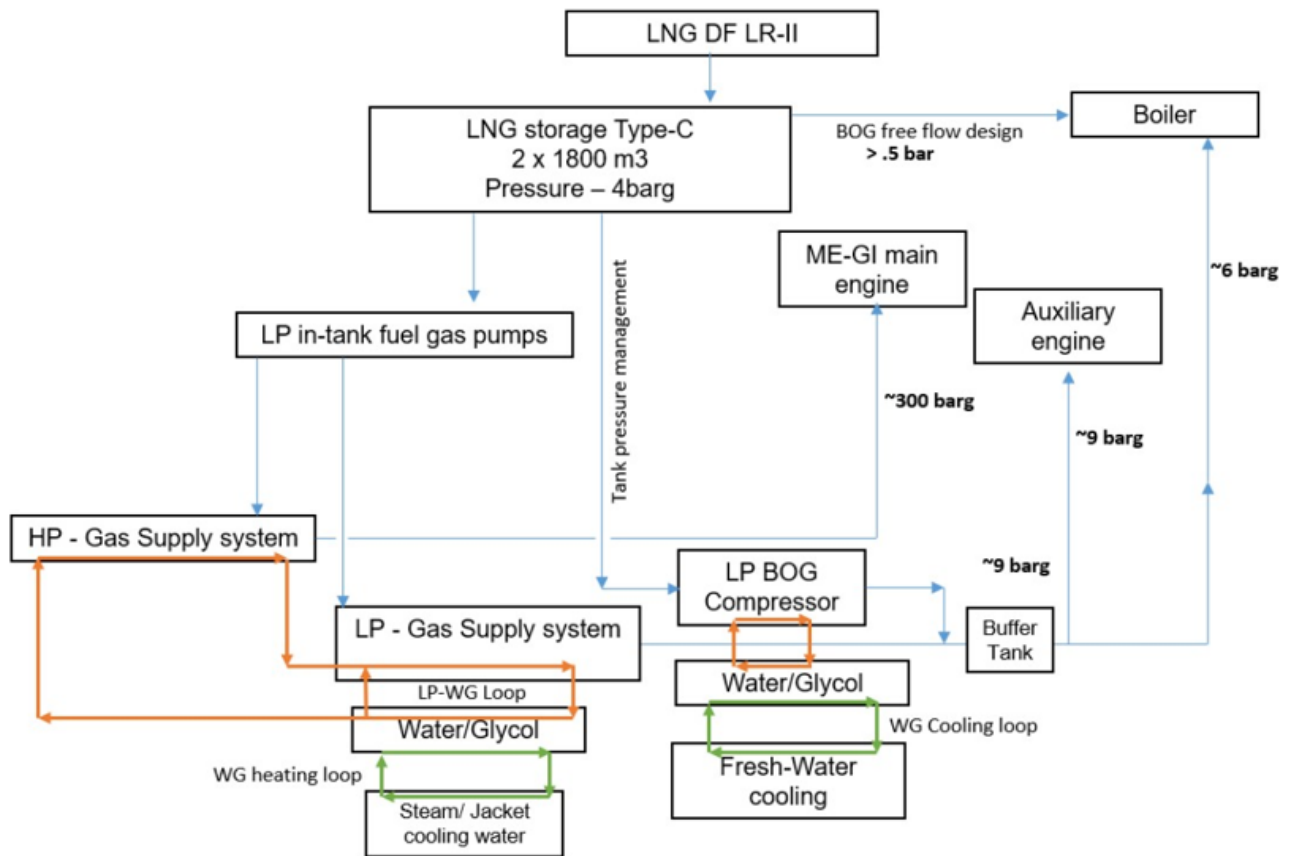
FGSS Scope of Supply:

- ✓ Storage Tank & TCS
- ✓ Tank Instrumentations
- ✓ High & Low-Pressure Cryogenic Pumps
- ✓ Bunkering System
- ✓ Bunkering Quick Coupling
- ✓ Gas Detection
- ✓ Ventilation and Venting
- ✓ Nitrogen Purging
- ✓ Integrated Safety, Control and Monitoring.
- ✓ Emergency Shutdown
- ✓ Vaporizer/Heaters
- ✓ Water Glycol System



Standard High-Pressure LNG FGSS

BOG Handling Issues



Boil of Rate (BOR)

Gas consumption Rate of AE/Boiler during sailing



Excess BOG inside the tank that keeps increasing the tank pressure.

Vessel Sailing Time

Tank Holding Time

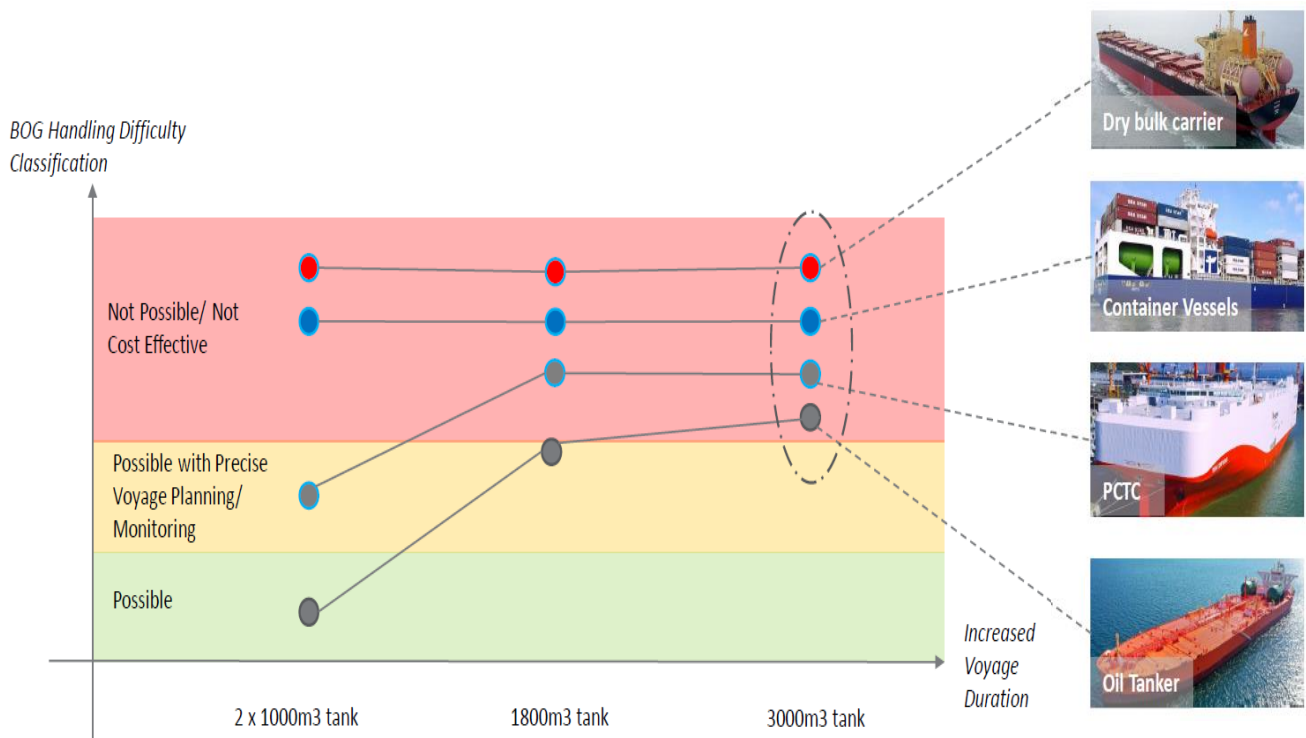


BOG handling is critical for vessels with longer sailing times.



Problem with Current LNG FGSS

The Reality of BOG Management Difficulties Across Vessel Types



LNG FGSS WITH PASSIVE BOG MANAGEMENT(AUXILIARY ENGINES AND BOILERS TO CONSUME BOG AND LOWER TANK PRESSURE) CANNOT COPE WITH INCREASING AMOUNT OF BOG GENERATED AS VOYAGE DURATION IS INCREASED

Our System Advantages:

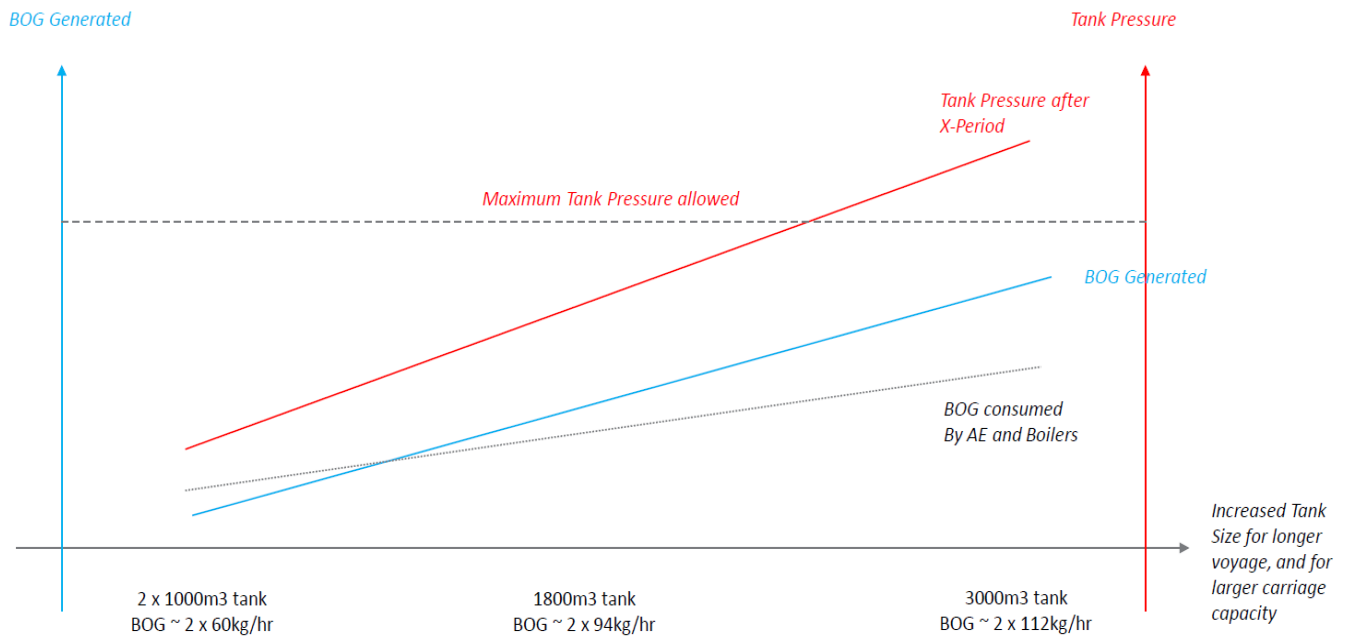
1. With one compressor the tank can be constantly kept at a shallow pressure of ~ 1 barg. This ensures that the LNG inside the tank is at a low temperature of $\sim -150^{\circ}\text{C}$.
2. Allows easy BOG management by consuming BOG in MEGI thus providing full flexibility during sailing.
3. The system can be used for all kinds of vessels with any tank size and smaller LP consumers
4. Tank pressure can be kept very low thus keeping the LNG at a low temperature and the tank cooler.
5. Superior control system implementation requires no LNG recirculation to the tank
6. Utilization of just a peak-shaving valve ensures minimum gas recycling back to the tank during MEGI load change.
7. Bunkering time was significantly reduced due to tanks arriving at convenient conditions. Less BOG production during bunkering and hence no wastage.



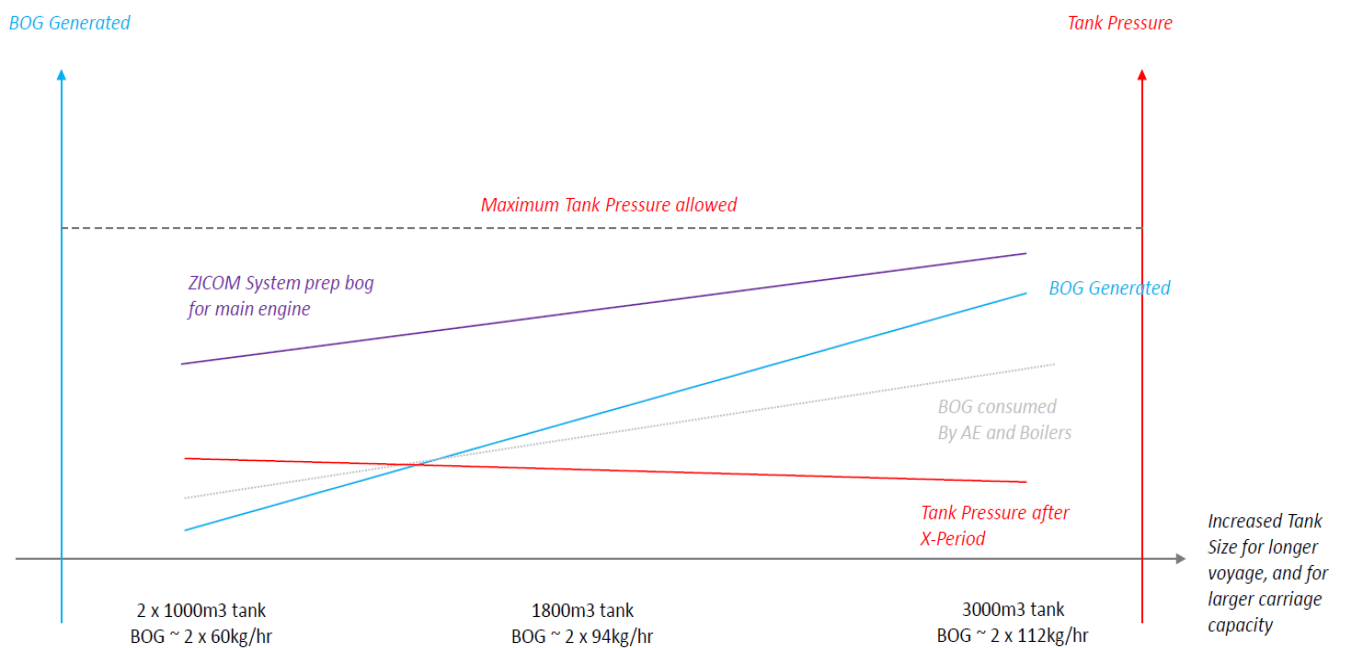
Problem and Solution Analysis

Root Cause and Increasing the BOG Consumption, Lowering Tank Pressure

PROBLEM ANALYSIS (ROOT CAUSE)



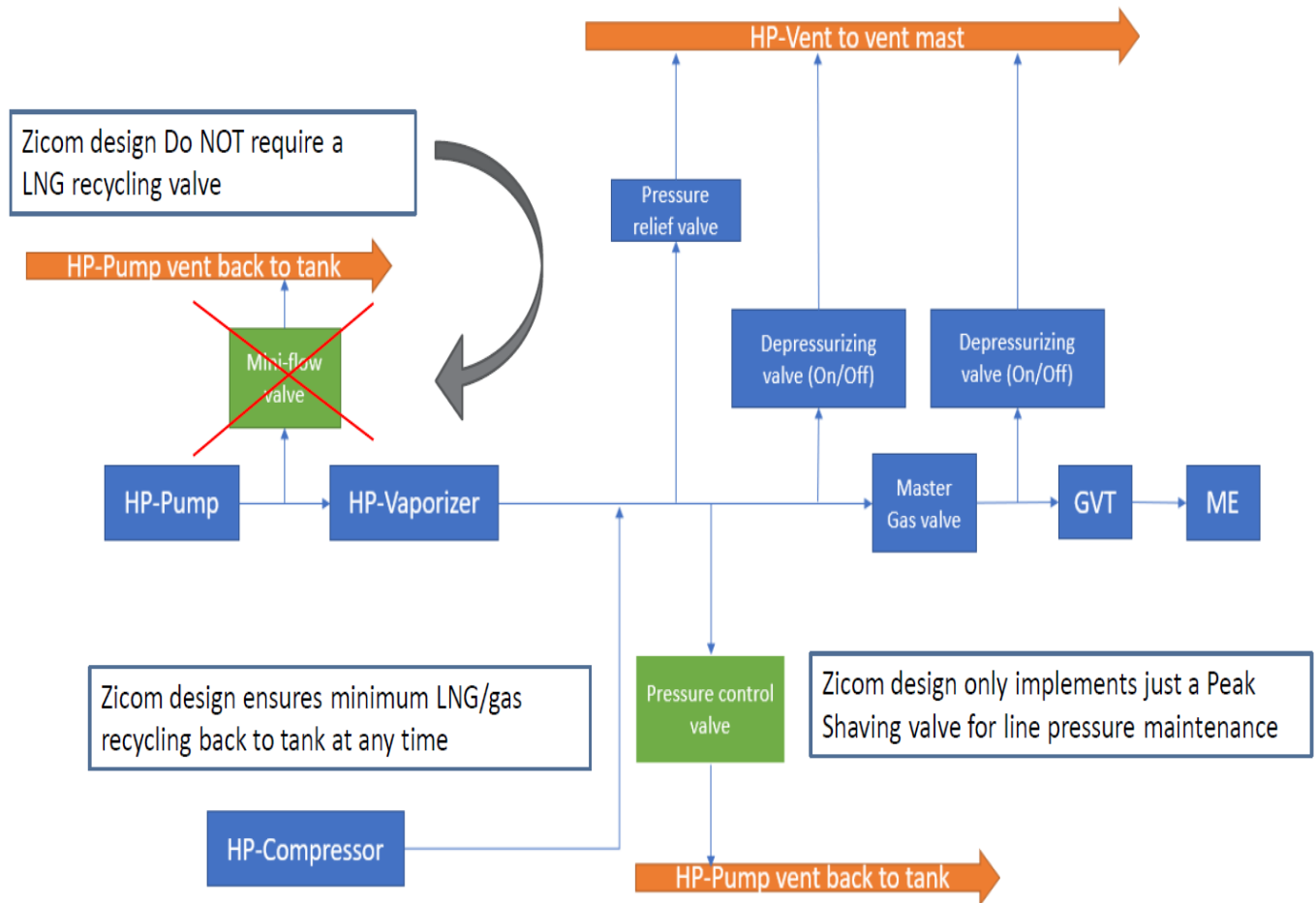
ZICOM SOLUTION ANALYSIS





Zicom Solution Analysis

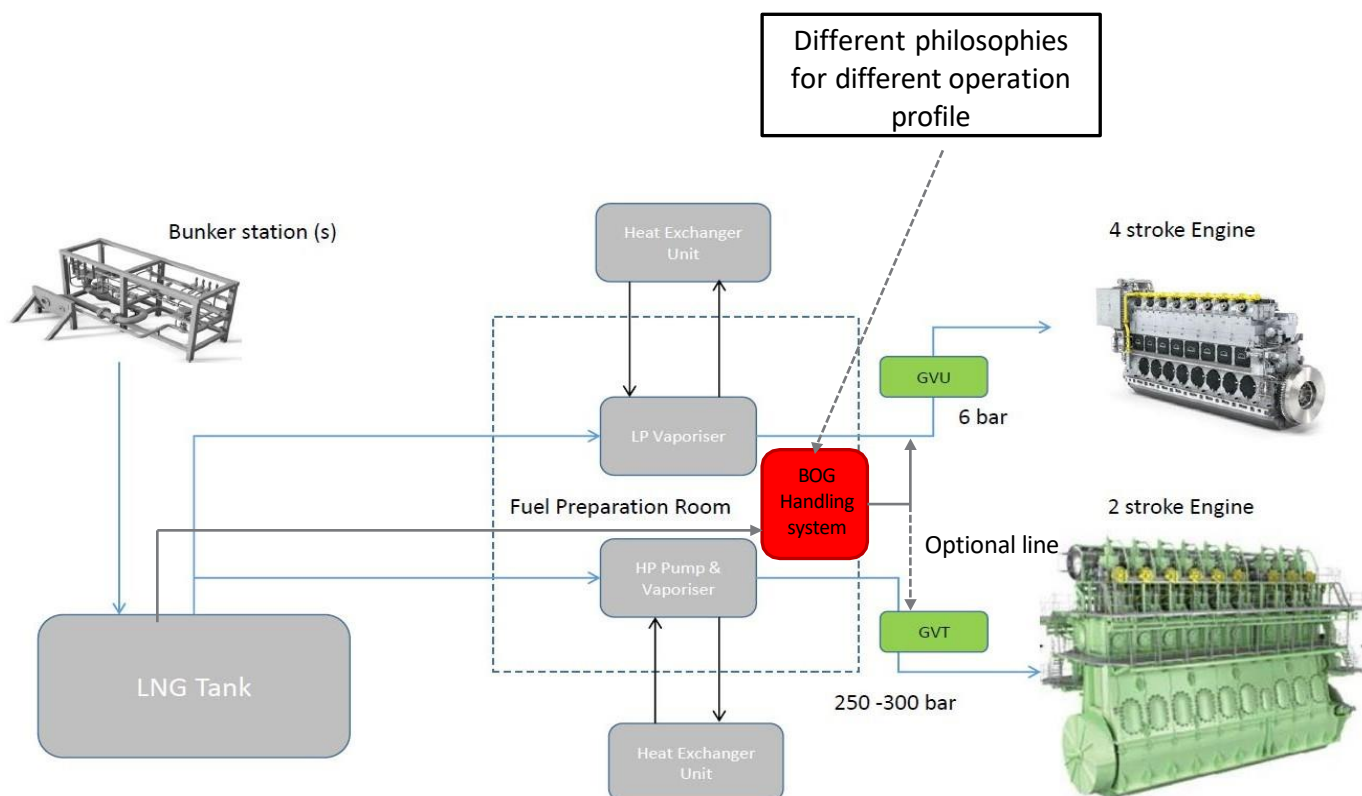
Innovative Design to decrease the BOG further





LNG High-Pressure Fuel Gas Supply System (FGSS)

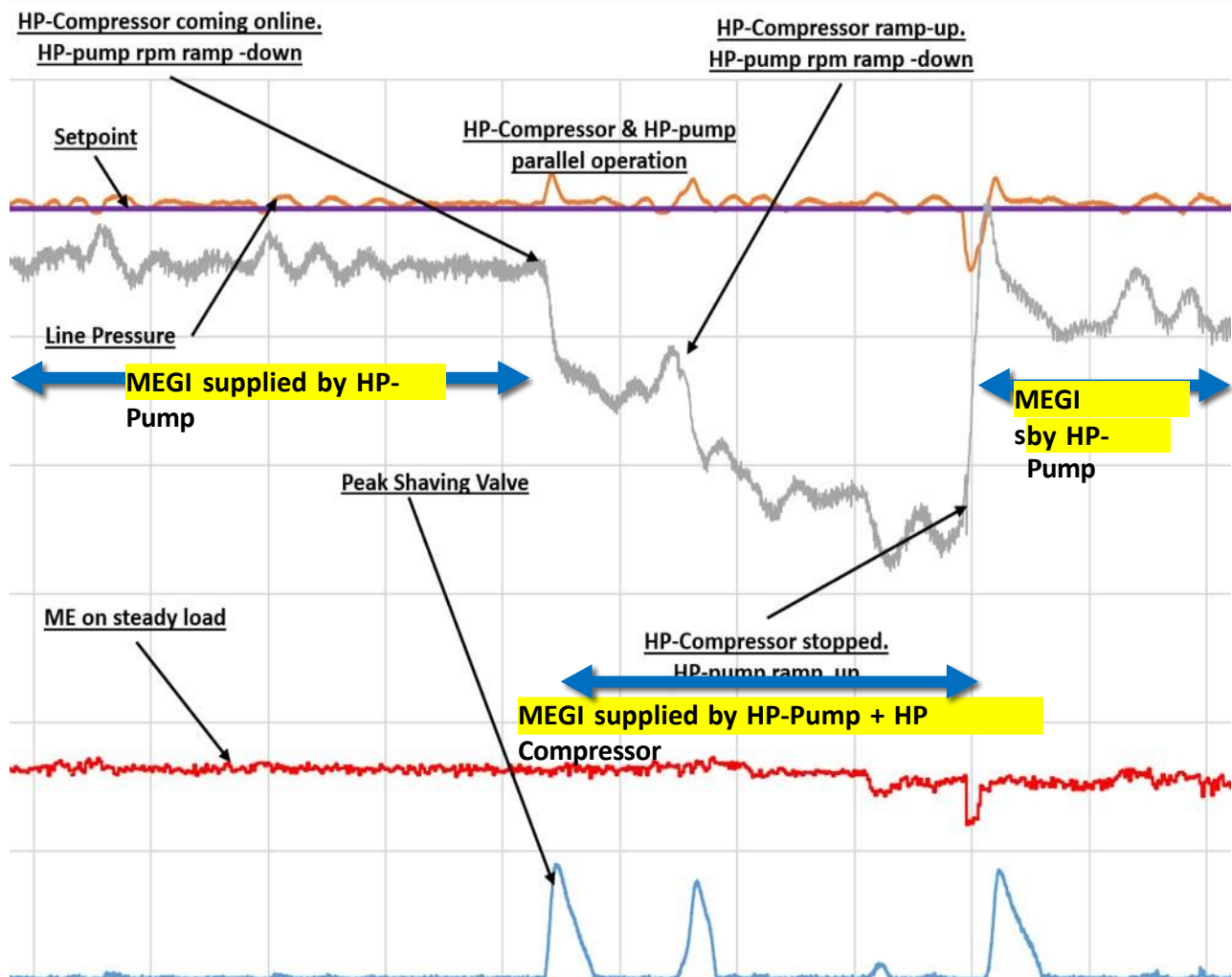
Solution for the Operational Needs of Different Vessel Profile





ZICOM System Performance

Parallel Running of HP Pump and HP Compressor to Supply Gas to ME



- **Zicom's** innovative design allows BOG to be fed to MEGI together with HP-Pump.
- This allows BOG to be consumed during sailing by the MEGI
- The tank can always be kept at low pressure ensuring a cold LNG in all conditions



High-Pressure Compressor Advantages

Solution for the Operational Needs of Different Vessel Profile

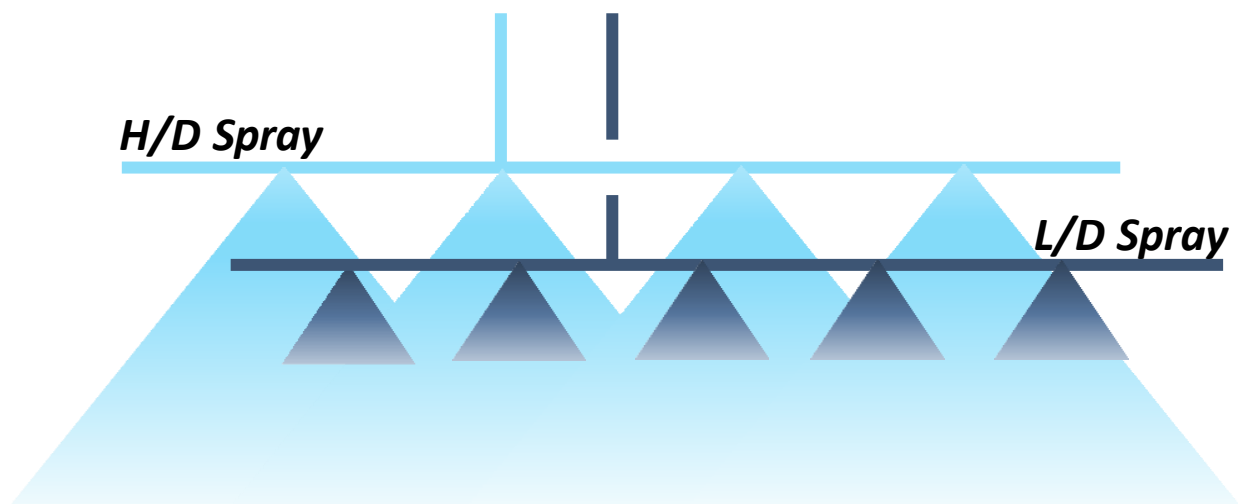
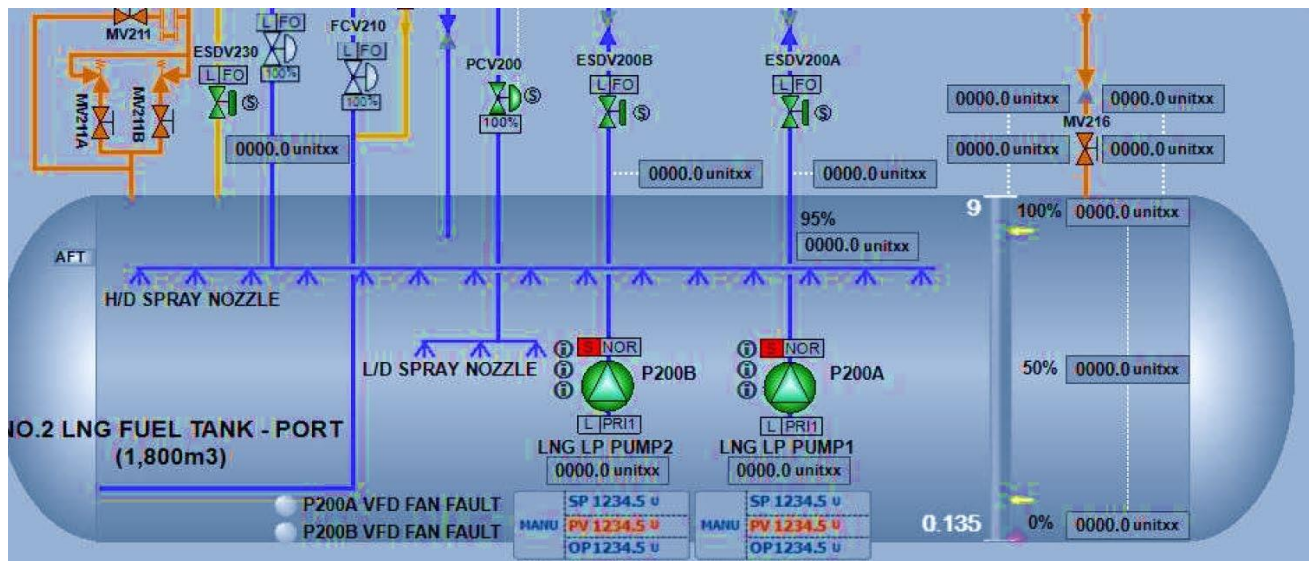


- 2 x 500kg/hr capacity of compressor installed on a LRII vessel
- Installed tanks are 2 x 1800m³ with max BOG production of 2 x 100kg/hr
- With just one compressor the tank can be constantly kept at a very low pressure of ~1barg
- This ensures that the LNG inside the tank is well at a low temperature of ~ -150°C



Efficient Utilization of Top Filling

Reducing Operational Cost by Reducing Bunkering Time



Top – Spray Profile

- Dedicated High-Duty Top spray for faster tank cooldown before bunkering
- Redesigned nozzle orientation and arrangement to ensure higher efficiency
- Substantial decrease in pre-bunkering preparations

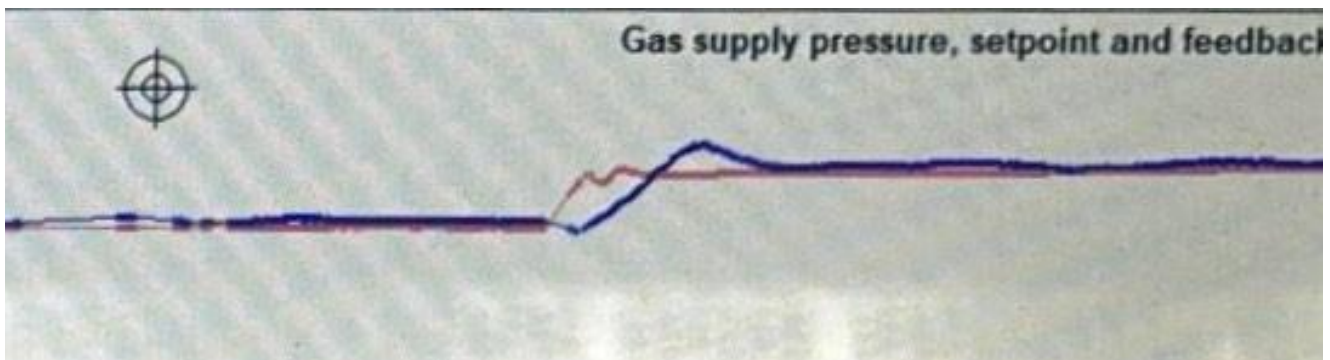
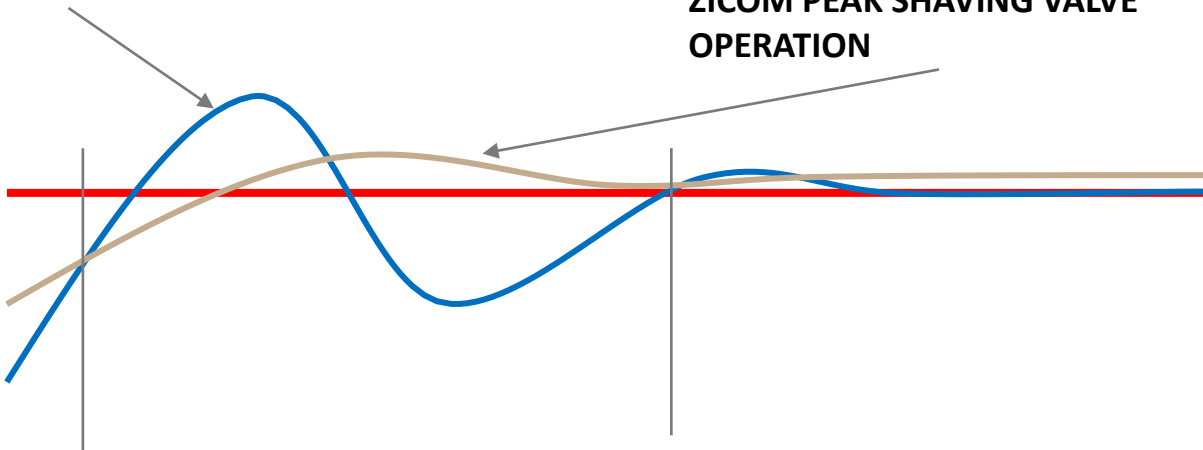


Standard High-Pressure LNG FGSS

An efficient way to maintain the line pressure with the least recycling

**COMPETITION OVERPRESSURE
VALVE (OPV) OPERATION**

**ZICOM PEAK SHAVING VALVE
OPERATION**



MAN-MEGI screen showing setpoint and line pressure

- ✓ Peak shaving valve provides better performance
- ✓ Valve control opening algorithm lessens gas recycling back to the tank
- ✓ Less BOG production



LNG Bunkering

Solution for the Operational Needs of Different Vessel Profile



Due to the efficient and flexible utilization of BOG, the vessel can come for bunkering with a very low pressure of ~1barg.

As the pressure is low, the LNG temperature is also lowered during the process.

This allows the possibility of self-cooling with the cold LNG at the tank bottom to cool the tank top. The produced BOG can be fed to the MEGI.

- ✓ Tank comes from bunkering cold
- ✓ Less LNG is required from the bunkering barge to cool down the tanks
- ✓ Faster and more efficient overall bunkering process.



ZICOM Superior Skid Designs

Solution for the Operational Needs of Different Vessel Profile



LNG TANK



BUNKERING SKID



FGPR ROOM



HP VAPORIZER

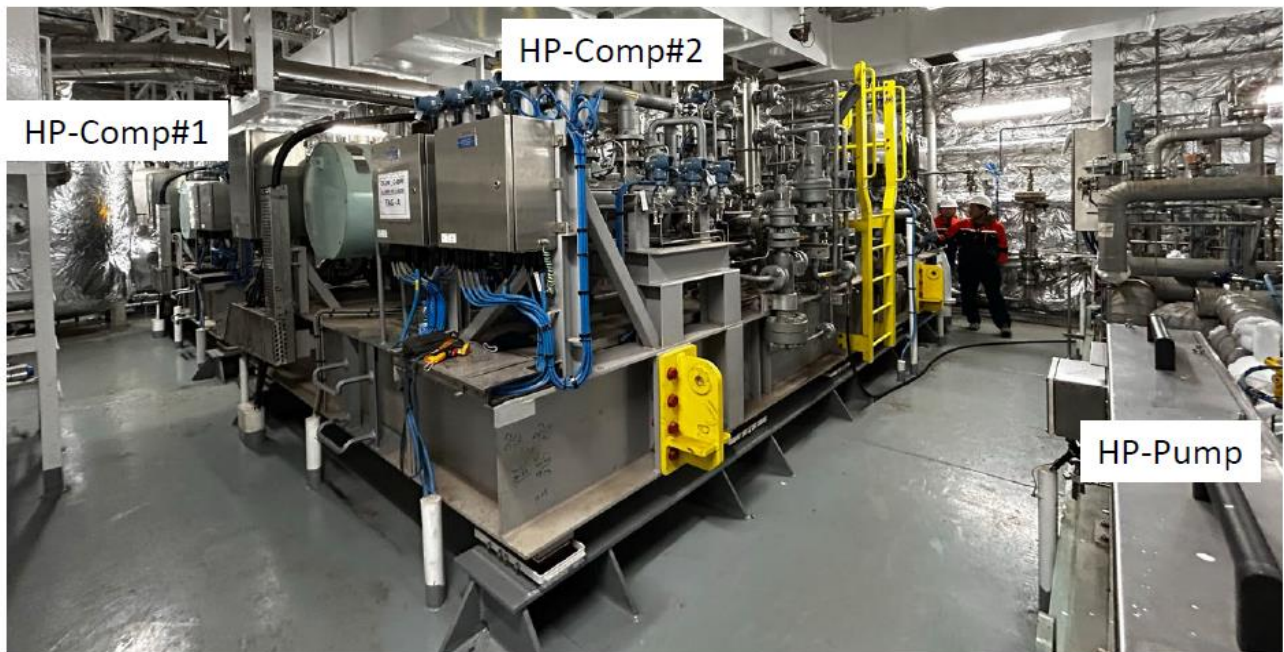


HPWG SKID



Operational ZICOM LNG (LRII) - FGSS

No Recycling of LNG back to the tank



ZICOM has the experience and **existing vessel references** to provide such a system
High-Pressure Pump + High-Pressure Compressor



- The HP pump is designed with a cold standby. The pump does not need to run during MEGI gas standby. Thus, decreasing further the gas recycling back to the tank.
- Implementation of coil-wound type vaporizer for more efficient and robust design.





ZICOM Global Service & Support



Provide Yearly Health Check Service Program to ensure equipment keeps running optimally.



Provide Global Warranty & Service Support for faster response and reduce customer downtime with the presences of worldwide regional offices and service centers.



Provide Bunkering Supervision.



Provide Product training to help customer improved products knowledge and enhanced user experience.



Provide complete onboard and in-house overhaul service by ZICOM well-trained Service Personnel.



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