

Navigation System

ASIA	
KOREA	SAMSUNG HEAVY INDUSTRIES
KOREA	DONGBO ELECTRIC
KOREA	KUMHO TECH
KOREA	Hanshin Electronics
JAPAN	TOKYO KEIKI
JAPAN	SHIN-EI ELECTRONIC CO.,LTD
SINGAPORE	JASON ASIA
SINGAPORE	SK SYSTEM ENGINEERS PTE LTD
PHILIPPINES	TECHSYS Corporation
CHINA	JASON ASIA
CHINA	COSCO GCNC
CHINA	HOSTMOST Engineering
CHINA	Seven Seas Electronic Co.,Ltd
INDIA	NAVICOM Technology
INDIA	ULTRA MARINE
TAIWAN	RESON Electronics
TAIWAN	EAGLES ELECTRONICS
HONGKONG	HOSTMOST Engineering
MALAYSIA	Jason, Johindah Malim Sdn Bhd.
INDONESIA	JASON ASIA
THAILAND	A&MARINE THAI
THAILAND	Jason Electronics (Thailand) Co. Ltd.
OCEANIA	
AUSTRALIA	NOVAMARINE
MIDDLE EAST	
U.A.E.	ELCOME INT.
U.A.E.	MARITRONICS
BAHRAIN	ELCOME INT.
EUROPE	
CYPRUS	RAYTECH
FRANCE	AVON Communications S.A
GERMANY	HOPPE
GREECE	MARVEL L.T.D
GREECE	D.C.S.I. International
GREECE	Automation Marine Syetem Ltd.
GREECE	ITS

UKRAINER	D.C.S.I. UKRAINE
ITALY	MASTER CONTROL
ITALY	TELEMAR
NETHERLAND	RADIO HOLLAND
NETHERLAND	I&G Services B.V.
BELGIUM	SPERRY MARINE
U.K.	MJR Controls Ltd
RUSSIA	MT Electronics LLC
SPAIN	AAGE HEMPEL
Gibraltar	Sandvik Marine Electronics
EGYPT	PAN ARAB
PORTUGAL	Assistemar, Lda
AMERICA	
USA	Mackay Communications, Inc.
USA	SPERRY MARINE
CANADA	MARITECH NAVAL
CANADA	OASIS MARINE
CERTRAL AMERICA	
VENEZUELA	RADIO MARINA DE VENEZUELA
PANAMA	PASRAS S.A.
SOUTH AMERICA	
ARGENTINA	Everthron Marine Systems SRL
CHILE	NAVAL RADIO
BRAZIL	AVANTIA TECNOLOGIA
BRAZIL	Orion Shiprepairs Ltda
BRAZIL	METALOCK Brazil Ltda
AFRICA	
SOUTH AFRICA	SMD TELECOMM.

Automation System

ASIA	
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KOREA	DONGBO ELECTRIC
KOREA	KUMHO TECH
KOREA	DEX
SINGAPORE	JASON ASIA

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VENEZUELA	RADIO MARINA DE VENEZUELA
PANAMA	PASRAS S.A.
SOUTH AMERICA	
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BRAZIL	AVANTIA TECNOLOGIA
BRAZIL	Orion Shiprepairs Ltda
BRAZIL	METALOCK Brazil Ltda
AFRICA	
SOUTH AFRICA	SMD TELECOMM.

Power System

ASIA	
KOREA	SAMSUNG HEAVY INDUSTRIES
SINGAPORE	CYCLECT
PHILIPPINE	WOJU INC.
INDIA	PENTA ELECTOMEC PVT. LTDD
OCEANIA	
AUSTRALIA	NOVAMARINE
MIDDLE EAST	
U.A.E.	MARITRONICS
EUROPE	
GREECE	NOVA ELECTRONICS S.A.
GREECE	Automation Marine Syetem Ltd.
ITALY	A . Santamaria S.p.A
BELGIUM	Electro Partners N.V.
U.K.	MJR Controls Ltd
SPAIN	AAGE HEMPEL
AMERICA	
USA	SEABOARD CONTROLS
SOUTH AMERICA	
BRAZIL	AVANTIA TECNOLOGIA
BRAZIL	METALOCK Brazil Ltda

SAMSUNG HEAVY INDUSTRIES

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http://www.shipcs.com	

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E-Mail	csas@samsung.com	
Web	www.digitalvessel.com/as	

Marine & Offshore Solution | Fuel Gas Storage & Supply System



S-FUGAS

SAMSUNG FUGAS (Fuel Gas Storage & Supply System) is one of the most ecofriendly systems meeting international environmental demands. Many countries, governments, and international organizations nowadays are concerned about maritime air pollution, such as NOx and SOx emissions. As a result, strict regulations are set up to preserve national environments. We believe that FUGAS is one of the best solutions in relation to green shipping projects, and is the key to resolve environmental matters within regulations. Based upon our experience of LNG, we provide the safest and the most reliable system, which is cost-effective at the same time.



“EcoNuri”

- The first LNG fuelled ship in Asia
- Delivered at the end of 2012



Contents

Background of Environmental Issue _4

- MARPOL, Annex VI
- International Maritime Regulations

Why FUGAS? _6

- Specification
- LNG Fueled Ships
- Emission Performance by Fuel Type

System Configuration _8

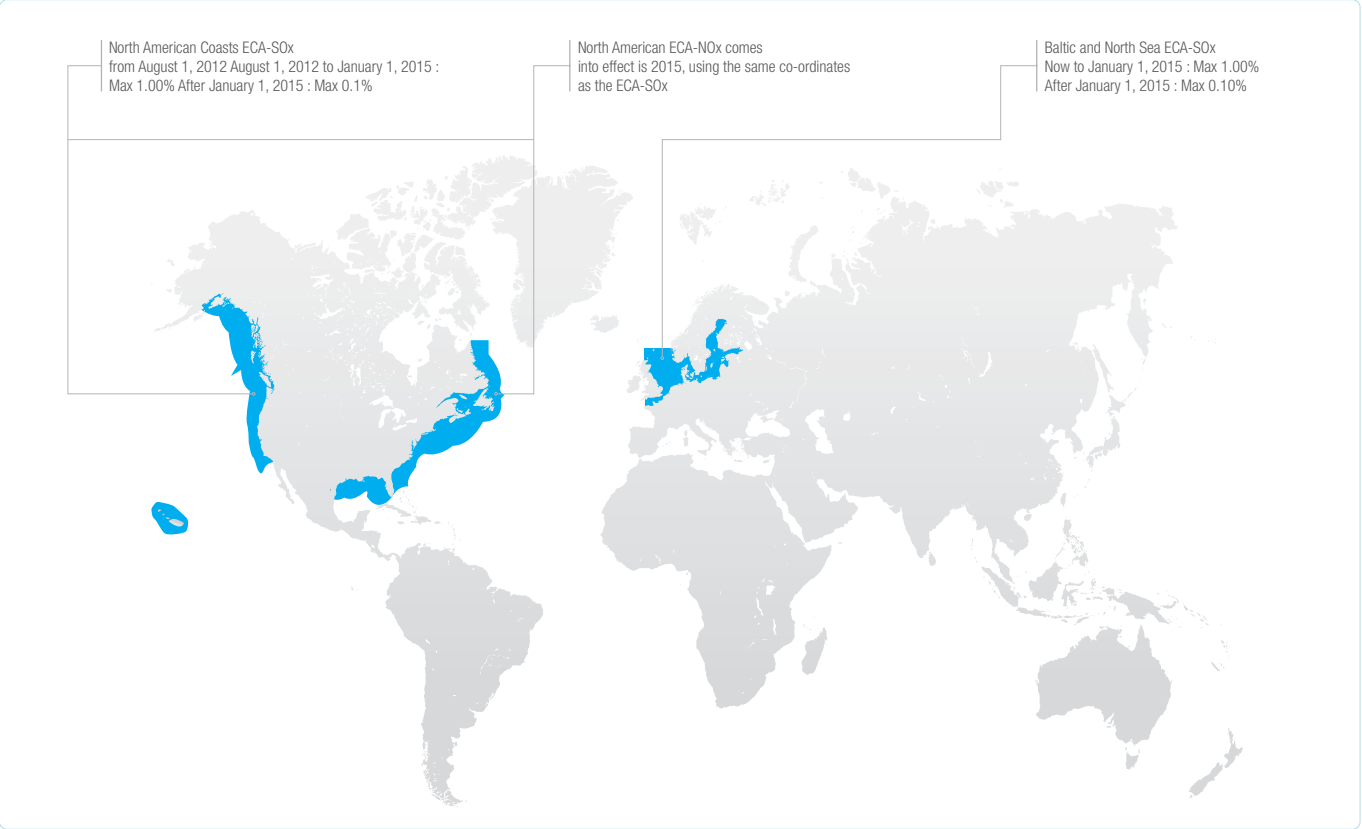
- Component
- System Configuration

System Component _10

- LNG Storage Tank
- Tank Room (Fuel Gas Supply Room)
- Vaporizer
- Control & Monitoring Mimic

Background of Environmental Issue

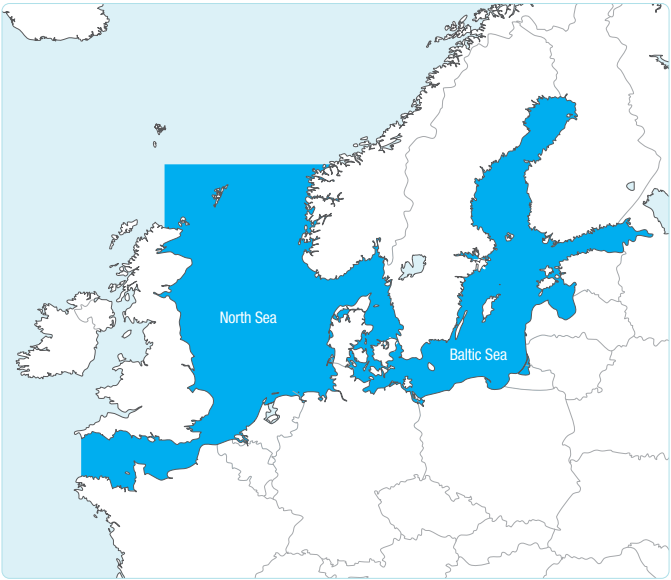
MARPOL, Annex VI



World Wide



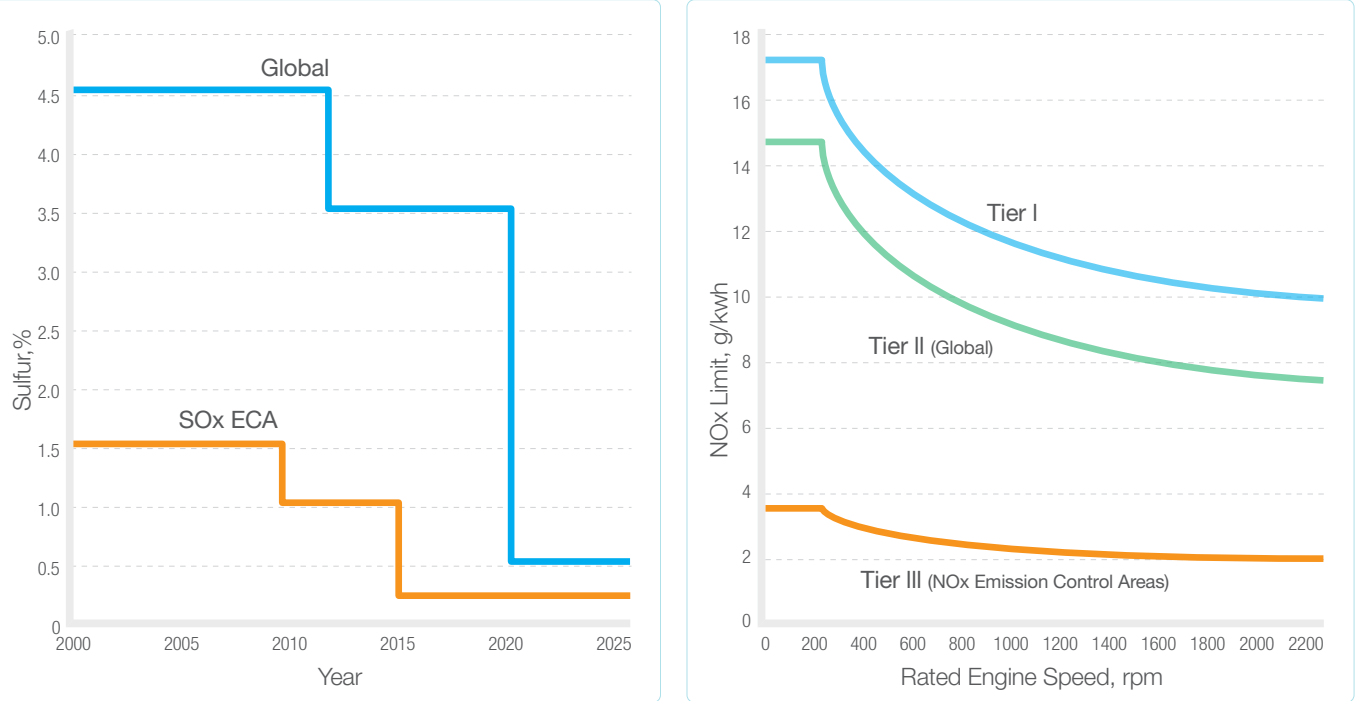
North America



North Sea, Baltic Sea



International Maritime Regulations



	Year	Fuel Sulfur	NOx
Emission Control Area	Today to July 2010	15,000 ppm	-
	2010	10,000 ppm	-
	2015	1,000 ppm	-
	2016	-	Tier III (Aftertreatment-forcing)
Global	Today to January 2011	-	Tier I (Engine-based controls)
	2011	-	Tier II (Engine-based controls)
	Today to January 2012	45,000 ppm	-
	2012	35,000 ppm	-
	2020 a	5,000 ppm	-
Adaptation	<ul style="list-style-type: none">Baltic Sea (SOx, adopted : 1997 / entered into force : 2005)North Sea (SOx, 2005/2006)North American ECA, including most of US and Canadian coast (NOx & SOx, 2010/2012)US Caribbean ECA, including Puerto Rico and the US Virgin Islands (NOx & SOx, 2011/2014)		

Why SAMSUNG FUGAS?

Specification

Accumulated Knowledge & References

- SHI is world's No.1 high tech shipbuilder
- Many references of gas fueled ship
- Knowledge and skill for gas fueled system

Quality Assurance & HSE

- Strict quality control process
- World 1st OHSAS 18001 certified shipyard

R&D Capability

- Ship, System design & analysis
- Static & dynamic simulation

Frontier of Unknown Field

- First in new solution of LNG-FPSO
(100% market share out of total 6 vessel order)

Global Network Services

- 66 service agents in 35 Countries

HAZID Workshop

- DNV(2010), LR(2012)
- FUGAS with Low Pressure DP Engine
- Risk Assessment for System Design, LNG Charging, Vaporizing and ESD

HAZOP Workshop

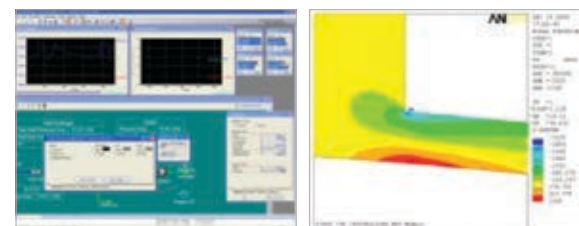
- ABS, BV(2011)
- FUGAS with High Pressure Engine
- Risk Assessment for FUGAS Operation and ESD Procedure

Pilot Test

- LR, ABS, LR, KOGAS
- FUGAS with Low Pressure DP Engine, Electric Type Heat Exchanger
- Fuel Gas Engine Load : 100%

Gas Fueled Ship	
LNG Carrier	Steam Turbine
	Others
LNG Producer	Azimuth Thruster
LNG SRV	Dual Fuel EP

(As of December-31-2009, contained under construction)



S-FUGAS

LNG Fueled Ships



Car Ferry



Tug



PSV / OSV



Tanker



Fast Ferry



Coast Guard



Guidanship



Cruise



Ro-Ro

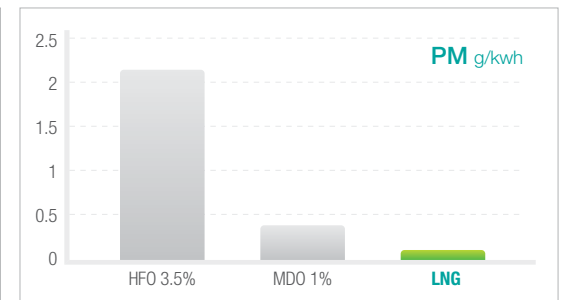
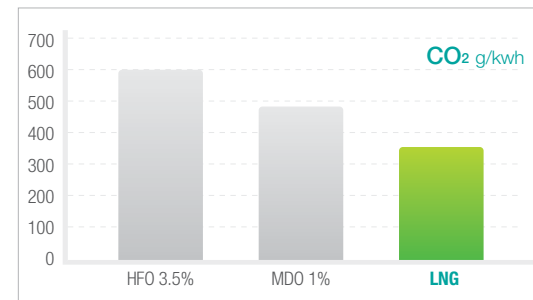
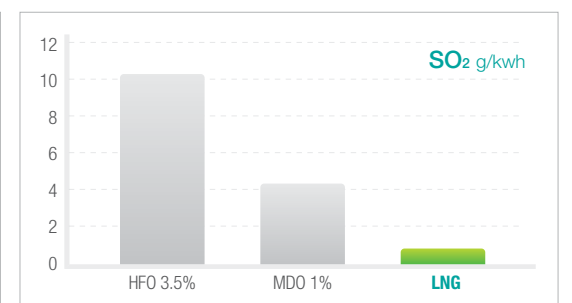
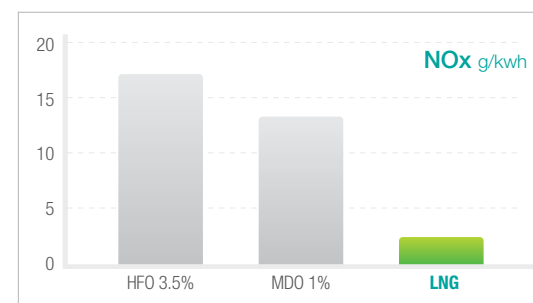


Ro-Pax

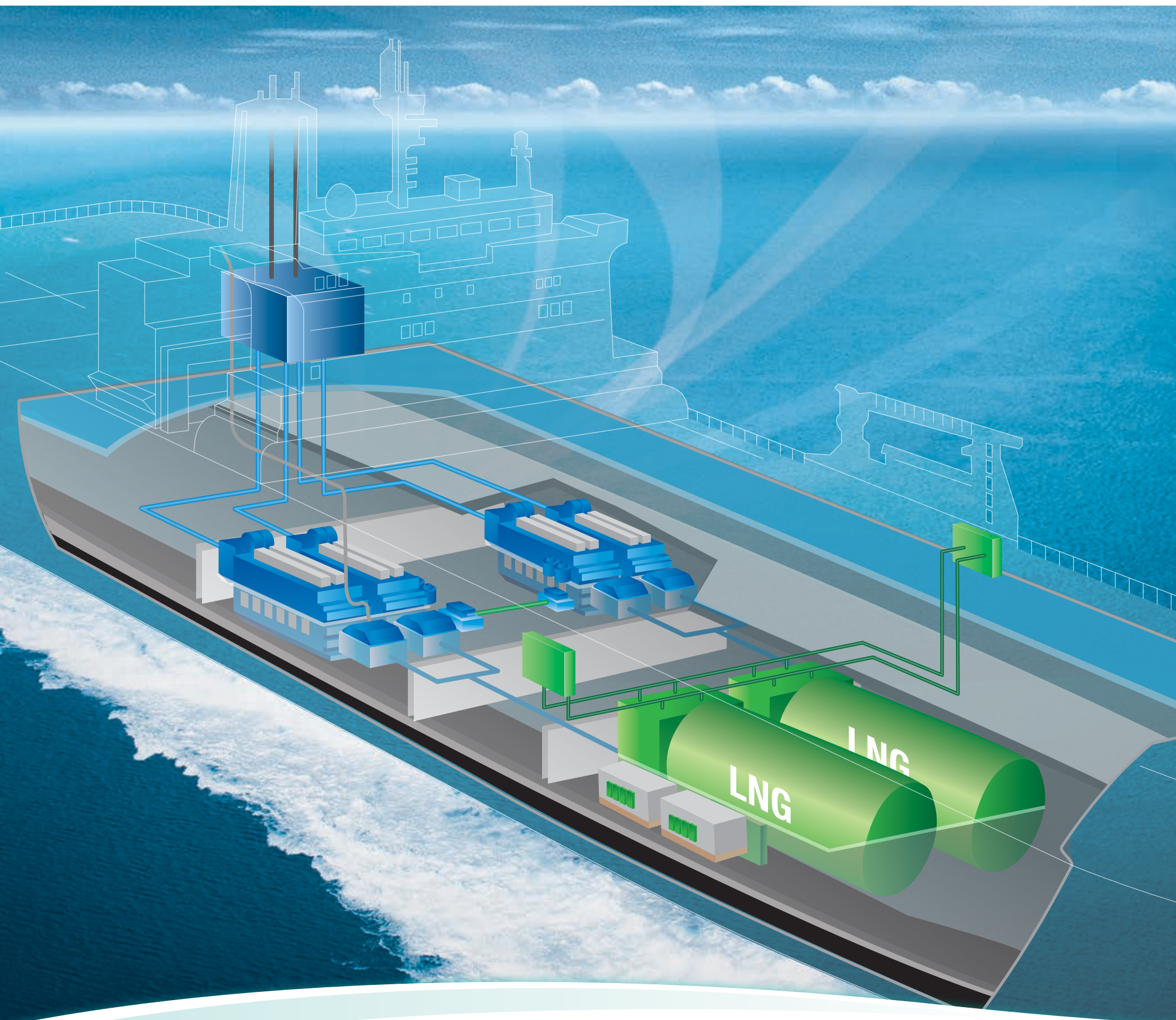


Container

Emission Performance by Fuel Type



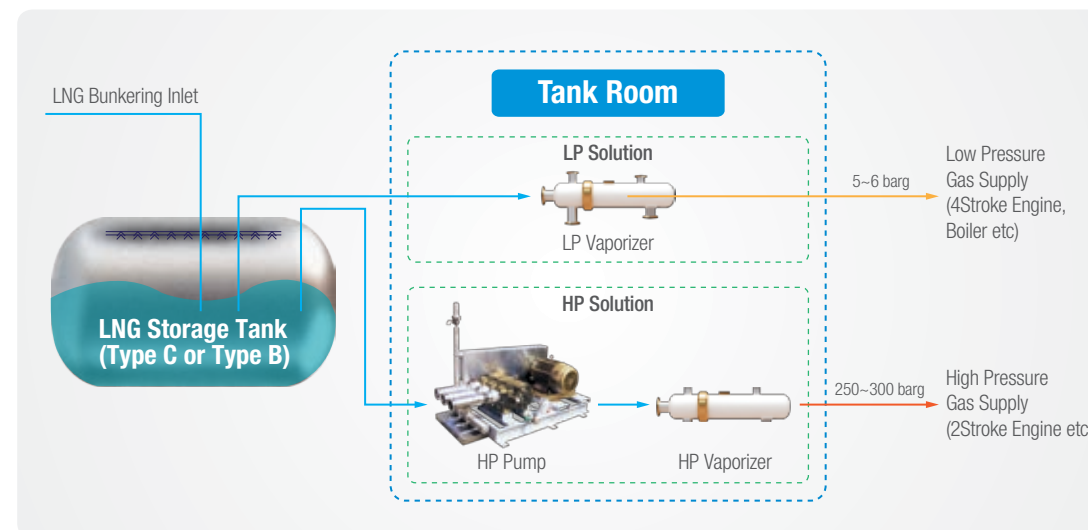
System Configuration



S-FUGAS

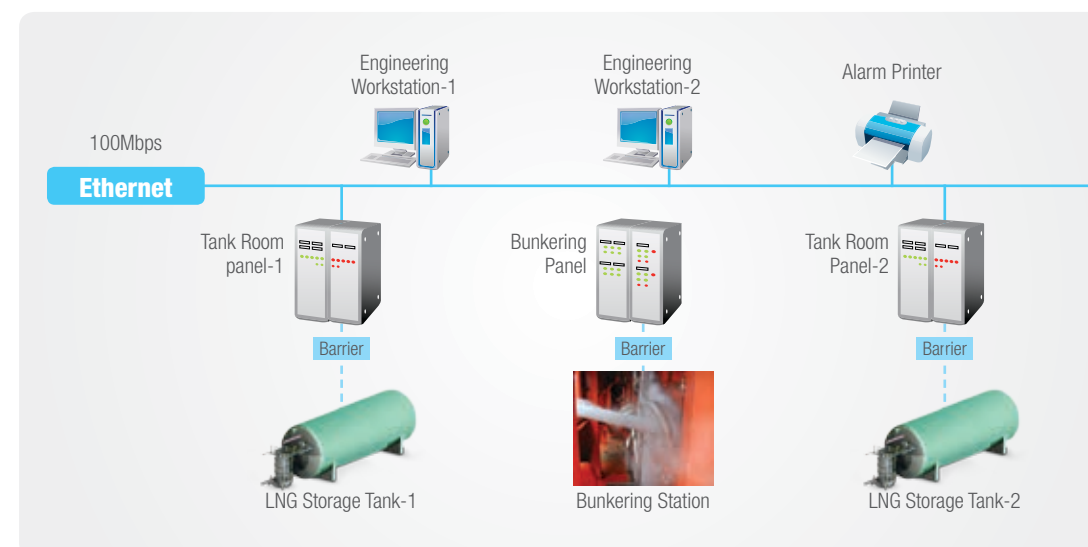
Component

- Bunker Station
- LNG Storage Tank
- Operation Station
- Low Pressure Solution
- High Pressure Solution
- Local Control Panel



System Configuration

- LNG should be gasified by vaporizer to be sent to engine (as for Natural Gas)
- NG temperature of vaporizer outlet is controlled by glycol flow
- The inside tank pressure is controlled by pressure build-up unit

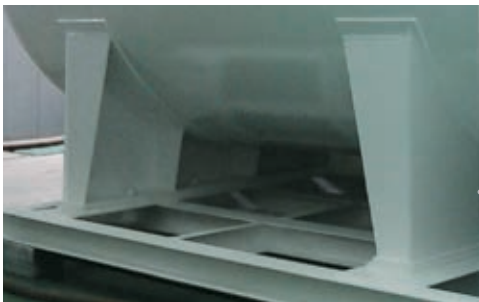


System Component

LNG Storage Tank

LNG Tank Specification

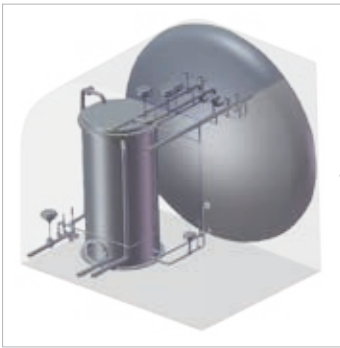
- Independent Type-C tank (IMO/IGC)
- Double shell (Barrier space with Perlite)
- Vacuum insulation
- Design pressure : 9 bar.G
- Working pressure : 5 ~ 8 bar.G



Tank Room (Fuel Gas Supply Room)

Design Specification

- Located at the end of LNG tank
- Vaporizer and valves are installed in Tank Room
- Gas & Fire detection (Option)
- 30 air change / hour



Vaporizer

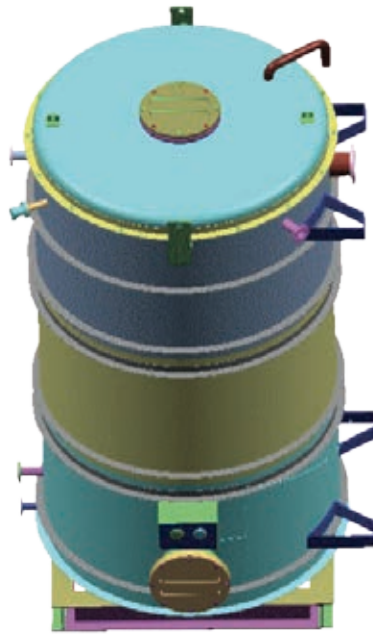
Water Bath Tube Type

- Vertical cylinder shape
- Bended tube type
- Baffle support for anti-vibration

Merit

- Minimize area and size of heat exchange
- Maximize heat transfer efficiency
- Convenient maintenance

Item	Type
Type	Vertical
Tube	UBEND-Tube
Tube Sheet	None
Tube Material	316 A312-TP316



Control & Monitoring Mimic

Design Specification

- Using SAMSUNG's ship automation system (SSAS-Pro / SSAS-Master)
- Integration & stand alone, both types possible
- Two engineering workstations
- One alarm printer
- Two local control panels (Bunker station / LNG storage tank)

