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SB SUNBO

A COMPANY THAT CREATES VALUE OF
ECO-FRIENDLY TECHNOLOGY





CEO's Message

SUNBO family is a key provider of “HAPPINESS” in the shipbuilding and on/offshore plant industries to meet evolving customers’ needs in the world energy sector.

Gaining a substantial position in the global energy market while developing our own modularized product – so called “Premium modules” – that has wide application over various environmental conditions.

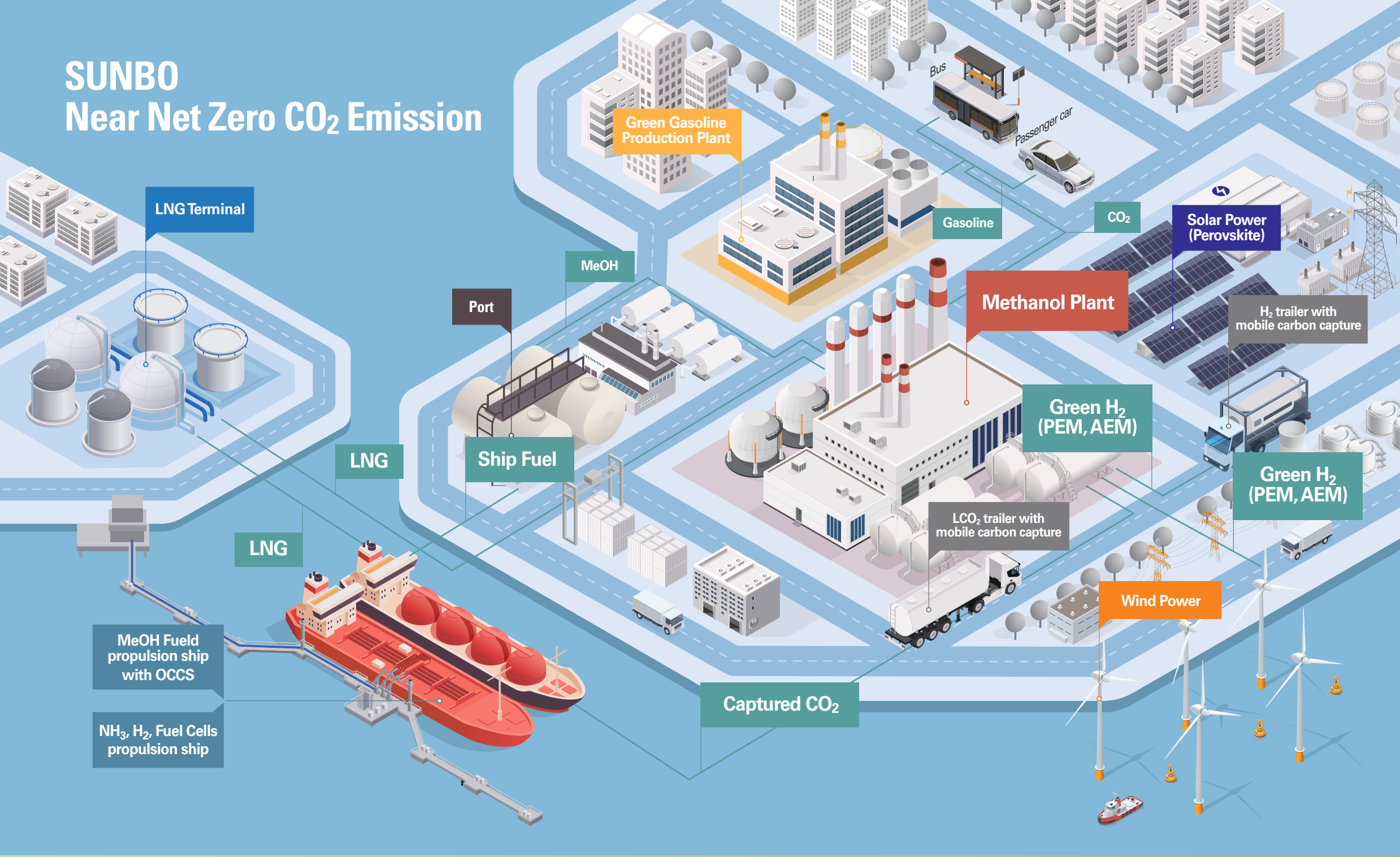
We are committed to conducting all our business activities in a safe, environmentally sustainable and economically optimal way with a team that puts customer value first, keeping delivering excellence.

Table of Contents

06	SUN-COM®	22	H ₂ -GEN®
08	SUN-RS®	24	SUN-FGMS®
10	COSMOS®	25	On/offshore Module
12	SUN-FGSS®/LFSS®	26	Marine Module
14	SUN-REGAS®	28	Gas System Test Facility
16	SUN-SUBC®	29	Network for SUNBO Family
18	CHS	30	Corporate Social Responsibility
20	OCCS/CCUS	31	SB SUNBO Family

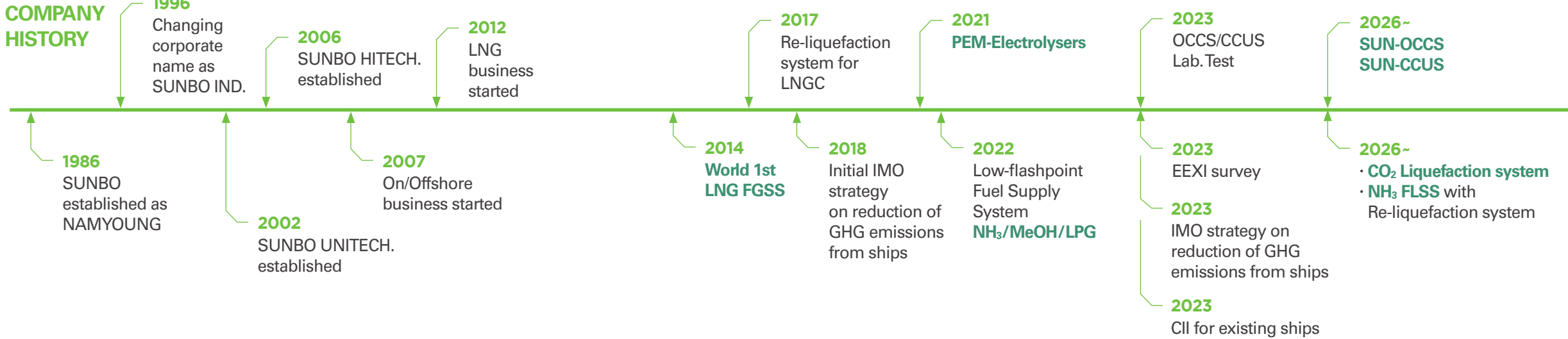
SUNBO

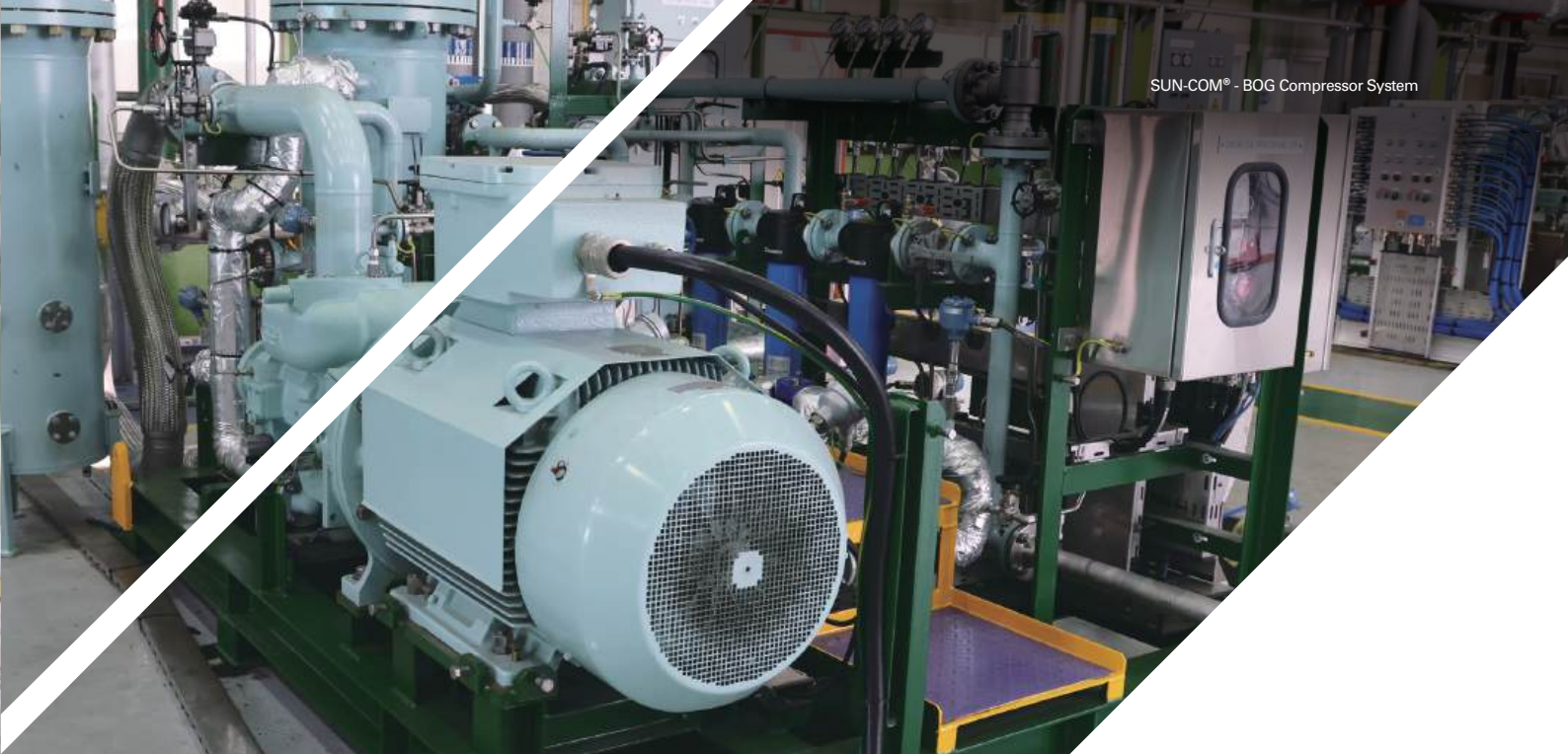
Near Net Zero CO₂ Emission



BUSINESS MODEL

- SUN-COM®**
BOG Compressor System
- SUN-RS®**
BOG Recondensing System
- COSMOS®**
FGSS Control/ESDS System
- SUN-FGSS®/LFSS®**
LNG, NH₃, MeOH, LPG Fuel supply system
- SUN-REGAS®**
Regasification System For FSRU
- SUN-SUBC®**
Sub-cooling System
- CHS**
Cargo Handling System
- H₂-GEN®**
SUNBO PEM-Electrolysers
- SUN-FGMS®**
SUNBO Fuel Gas Mixing System
- ON/OFFSHORE MODULE**
Modules for On/offshore
- MARINE MODULE**
Modules for Shipbuilding
- TEST FACILITY**
Gas System Test Facility (onshore FGSS)





SUN-COM® - BOG Compressor System

System specification

- Type: Oil-injected Screw Compressor
- Fluid: Boil Off Gas (CH₄, N₂, etc.)
- Capacity: 300~1,000 kg/h
- Discharge pressure: ~16 barG
- Suction/Discharge temperature: 10/45°C
- Load control by: Slide valve and/or VFD
- Heat exchanger: Gas intercooler and oil cooler
- Oil content: <0.01 mg/m³ (complying with DF engine requirement)

Product Line-up

Series	Swept volume (m ³ /h)			Max. design pressor (barG)	Load control
	2940 rpm	3550 rpm	4500 rpm		
SC-300	321	388	491	28	Slide valve and/or VFD
SC-350	372	449	569	28	Slide valve and/or VFD
SC-400	471	569	721	28/52	Slide valve and/or VFD
SC-450	471	569	721	28/52	Slide valve and/or VFD
SC-600	708	855	1084	28/52	Slide valve and/or VFD
SC-800	805	972	-	28/52	Slide valve and/or VFD
SC-1000	1290	1558	-	28/52	Slide valve and/or VFD

Efficient Design

- High-efficiency rotor design
- Compact and robust system design

Reliable and Safe Design

- High-performance bearings and hydraulic axial force compensation for long-lifetime
- Standardized and hermetically sealed slide position indicator

Maintenance

- Easy replacement of bearings and seal
- User & maintenance friendly design

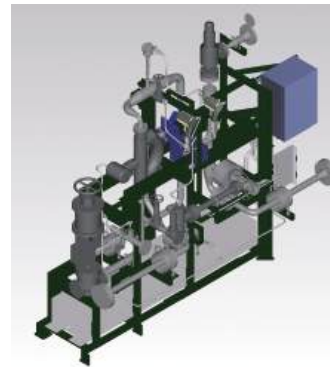
Other

- High efficiency and compact footprint
- Bare compressor supplied by market proven suppliers
- Slide valve control and less control valves
- Control integrated into FGSS control system





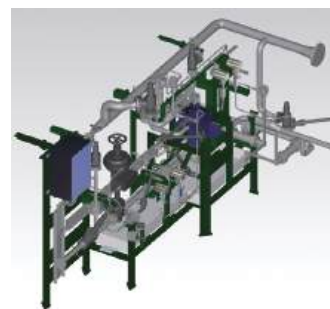
Pre-cooler



Main Equipment

- One (1) BOG pre-cooler PCHE
 - Temperature: -165/40°C
 - Design Pressure: BOG-side 15 / LNG-side 350 barG
- One (1) BOG Recondenser PCHE
 - Temperature: -165/40°C
 - Design Pressure: BOG-side 15 / LNG-side 150 barG
- One (1) Control valve

Recondenser

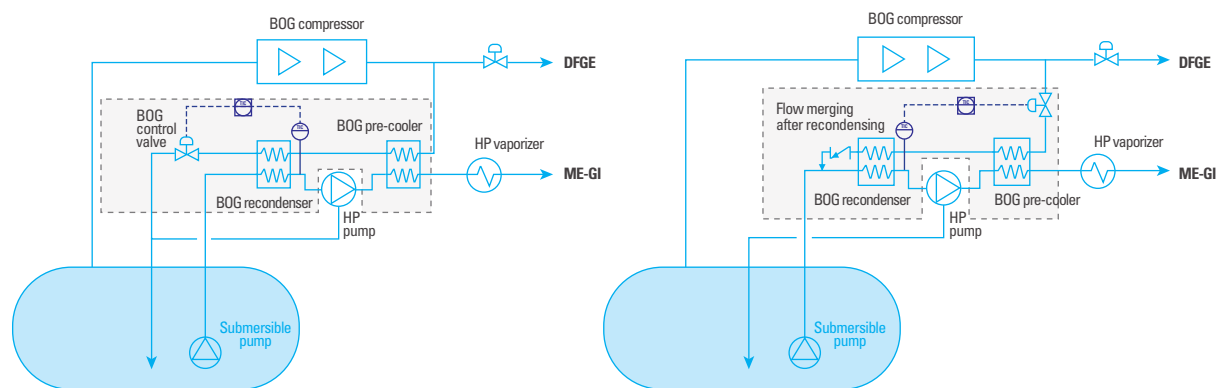


Product Line-up

Series	LNG consumption in engine	HX Type	Cooling duty		Recondensing amount
			BOG pre-cooler	Recondenser	
SUN-RS® 2000	2,000 kg/h	PCHE	20 kW	30 kW	210 kg/h
SUN-RS® 4000	4,000 kg/h	PCHE	45 kW	75 kW	470 kg/h
SUN-RS® 6000	6,000 kg/h	PCHE	70 kW	115 kW	730 kg/h

SYSTEM CONFIGURATION

SUNBO PATENTED



SUN-RS® Gen.1 advantage

- Efficiency: Simply designed with highly robust PCHEs and NO rotating machine required
- Reliability: BOG stream and LNG stream are separated

SUN-RS® Gen.2 advantage

- Compared to the Gen.1
- Recondensed BOG can be utilized for M/E fuel
- More recondensing amount achievable

SUN-RS® PATENTS

SUN-RS® Gen. 1



Patent in China



Patent in Japan



Patent in Korea

SUN-RS® Gen. 2



Patent in China



Patent in Japan



Patent in Korea

COSMOS®

FGSS Control/ESDS System



Typical FGSS Communication Scheme

CAMS

- Dual communication
- MODBUS TCP
- Signals, status, alarm
- Receiving other system information (SWBD, GSP, main components, etc.)
- Critical data must be exchanged (FGSS failure, blackout, M/E signal & Status)

BOG compressor

- Dual communication
- MODBUS TCP
- Receiving status
- Remote control command (remote start/stop)

FGSS/FLSS Control

- Dual connection for interfaces
- MODBUS TCP
- Indicators, status, alarm
- Combining with fire detection, it can be used for safety

- Dual communication with control system
- TCP/IP
- Signals, status, alarm
- Hardwired for I/O (loop monitored)
- Safety shutdown command out

OTS and Education

- Crew training
- System verification for new contents



✓ Smart web diagnosis

✓ Remote program update

✓ Central data storage

✓ Real-time monitoring & Fast CPU cycle time

✓ Smart management for major equipment

✓ Interface with programming environment (AMS & LC)

Worldwide service & spare part delivery
(B & R commercial software)

Around 200 offices in 75 countries





FGSS (Fuel Gas Supply System) & LFSS (Low-flashpoint Fuel Supply System)

- PLUG and PLAY design (For easy on-board installation of each module)
- Performed cryogenic test using SUNBO cryogenic test facilities before the system delivery to shipyard
- Manufacturing/Assembling by SUNBO (Not outsourcing fabrication) in the specialized clean factory (Dadae 2 factory), not mixed works with carbon steel
- Stand-alone control system (Interface with ship's AMS and loading computer)
- Abundant project reference as EPCC

LPG & Ammonia LFSS



Commonly to be used for supplying ammonia without any modifications to ammonia fueled main engine.

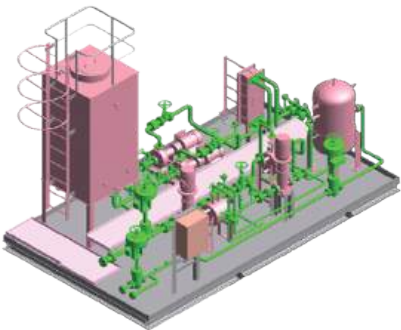
Engine Type	Supply Pressure (barG)	Design Pressure (barG)
ME-LGIP	53	100
ME-LGIA	83	100

LPG & Ammonia Reliquefaction System



- Reduced size and weight compared to existing products
- Overall design support for Cargo Handling System for LPG reliquefaction and Ammonia reliquefaction system
- Ship: 91K VLGC & VLGA
- Cooling capacity: 510 kW at C₃H₈
- Size (mm): (W) 6,800 x (D) 4,600 x (H) 4,400
- Weight: Around 28 tons

Methanol LFSS



1st Generation

- **Case 1 as supplier of methanol LFSS only**
 - Bidding stage: OS for methanol supply unit including schematic piping diagram
 - Detail design stage: FS for methanol supply unit including P&IDs



2nd Generation

- **Case 2 as EPCC provider of methanol LFSS (IMO MSC.1/Circ 1621 & related to class rules)**
 - Bidding stage: OS for methanol LFSS with schematic piping diagram and total scope of supplies for LFSS
 - Detail design stage: FS for methanol LFSS with P&IDs & related systems

LNG FGSS



HIGH PRESSURE LNG
PUMP SYSTEM



LNG FUEL TANK



LNG BUNKERING
STATION (P&S)



BOG COMPRESSOR
SYSTEM



RE-CONDENSING
SYSTEM



GLYCOL WATER
SYSTEM

Reference List

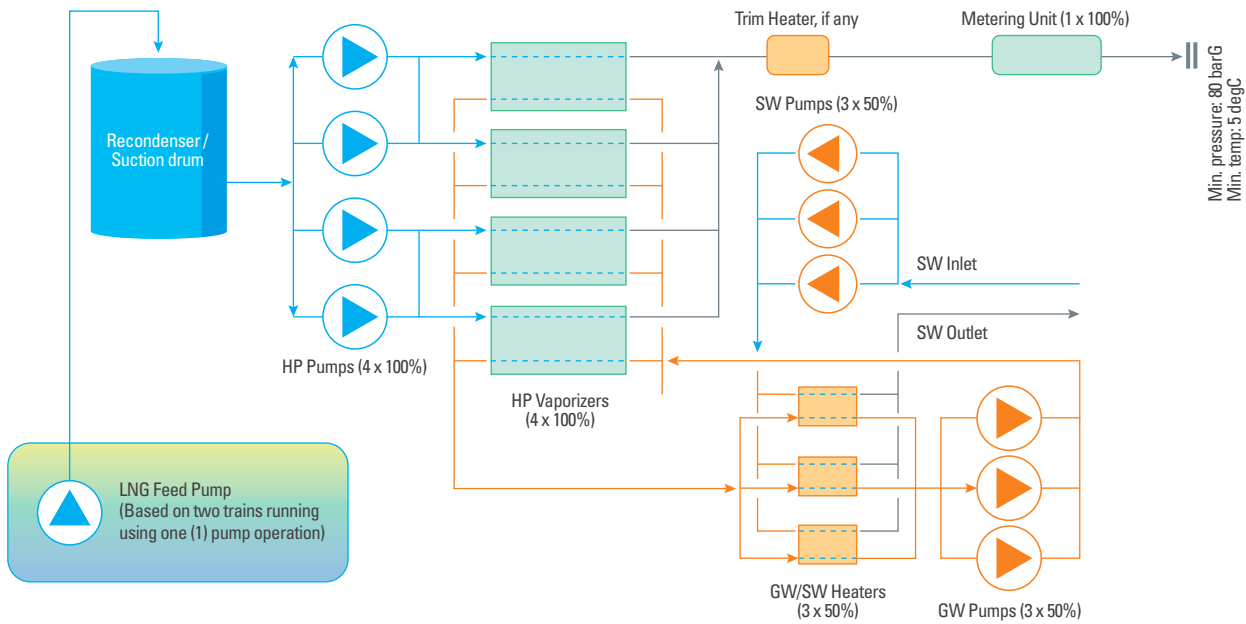
Client	Owner	Ship	Status	Class	Scope	Remark
DSME	MOL	Pilot Plant	2021 Delivered	KGS	EPC	Regasification with Cold Generation system Size 8 x 6 x 5
KARMOL	KARMOL	127.5K FSRU	2025 On-going	BV	EPC	Capa. 150 MMSCFD (50MMSCFD x 3Train)

Regasification Module



Regasification system For FSRU

The regasification system on a FSRU converts LNG stored at -163°C back into natural gas for delivery to the grid. This process uses high-efficiency vaporizers, such as Open Rack Vaporizers (using seawater) or Submerged Combustion Vaporizers (using combustion heat), to warm and gasify the LNG. Booster pumps increase the LNG pressure, and control systems ensure stable flow and delivery. Safety features like emergency shutdown, gas detection, and automated monitoring are integrated. This technology allows FSRUs to provide flexible and rapid natural gas supply in various locations, supporting energy demand and grid stability

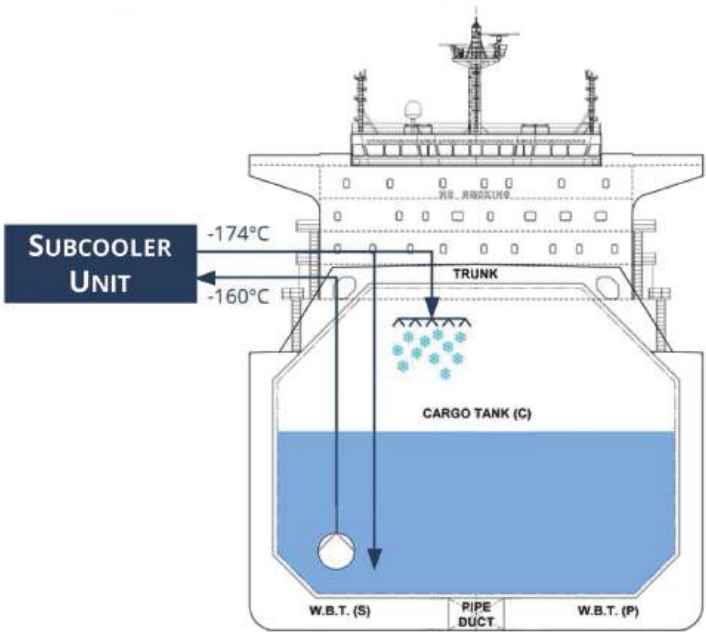


SUN-SUBC®

Sub-cooling System

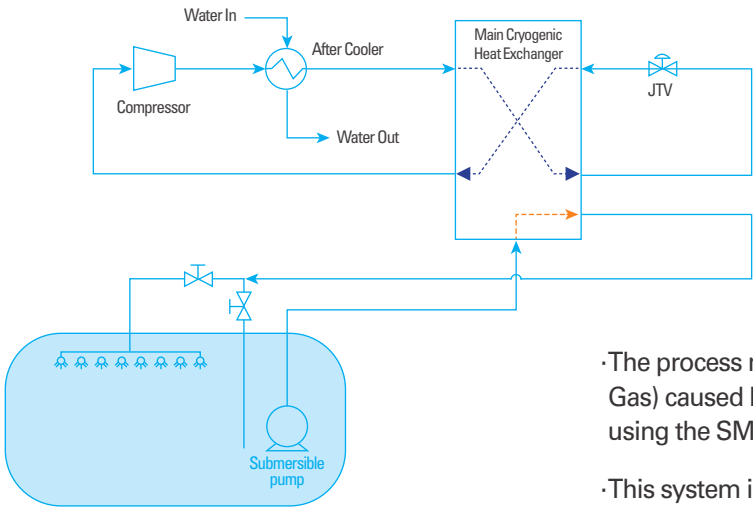


SUNBO+CRYOSTAR SUB-COOLING SYSTEM



Sub-cooling system

The sub-cooling system for BOG (Boil-Off Gas) re-liquefaction in LNG carriers is the system employs sub-cooling to chill LNG below its saturation temperature (-162°C) to -165°C, creating thermal headroom. This subcooled LNG is sprayed into the tank, where it absorbs heat from BOG via direct contact, inducing re-liquefaction.

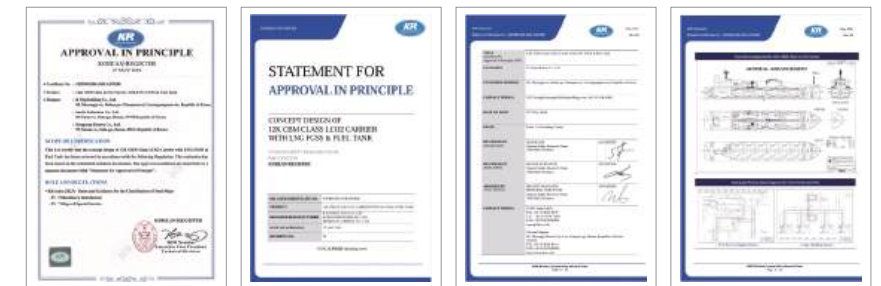


- The process minimizes the generation of BOG (Boil-Off Gas) caused by external Heat ingress by sub-cooling LNG using the SMR refrigeration cycle
- This system is currently under development for an LNG carrier (1.5t/h of re-liquefaction capacity) and a bunkering ship (a bit smaller capacity)

Target for	Model	Re-liquefaction Capacity	Motor rate (MCM)
Bunkering	EcoChill 70-170	Near 1.0 t/h	1 x 650 kW

Cryostar developed new sub-cooling system designed for an application of LNG carrier Re-liquefaction solution. The process is based on the compression of a refrigerant ($N_2 + He$). The system is able to adjust the cold produced based on LNG flow coming from the pumps.

The system consists of MCM, MTC (Turbo expander), and APFHE (Aluminum Plate Fin Heat Exchanger). Two companies, SUNBO and CRYOSTAR, collaborates together with for the market of near 1 ton/hr re-liquefaction capacity either Retrofit or NEW building business in the shipbuilding business sector.

Cargo Handling System for LCO₂AIP of CHS for LCO₂ CarrierLCO₂ Temperature/Pressure

Low temperature/Low pressure (7-10 barG, -50°C)

- Novel operation
- Allow larger cargo tanks and reduced cost for shipping
- High density of cargo
- Increased cost for liquefaction and conditioning

Medium pressure (15-20 barG, -30°C)

- Mature technology - Decades of operational experience
- Limitations to cargo tank size
- Selected regime for northern light initial phases

Ambient temperature/High pressure (40-50 barG, >0°C)

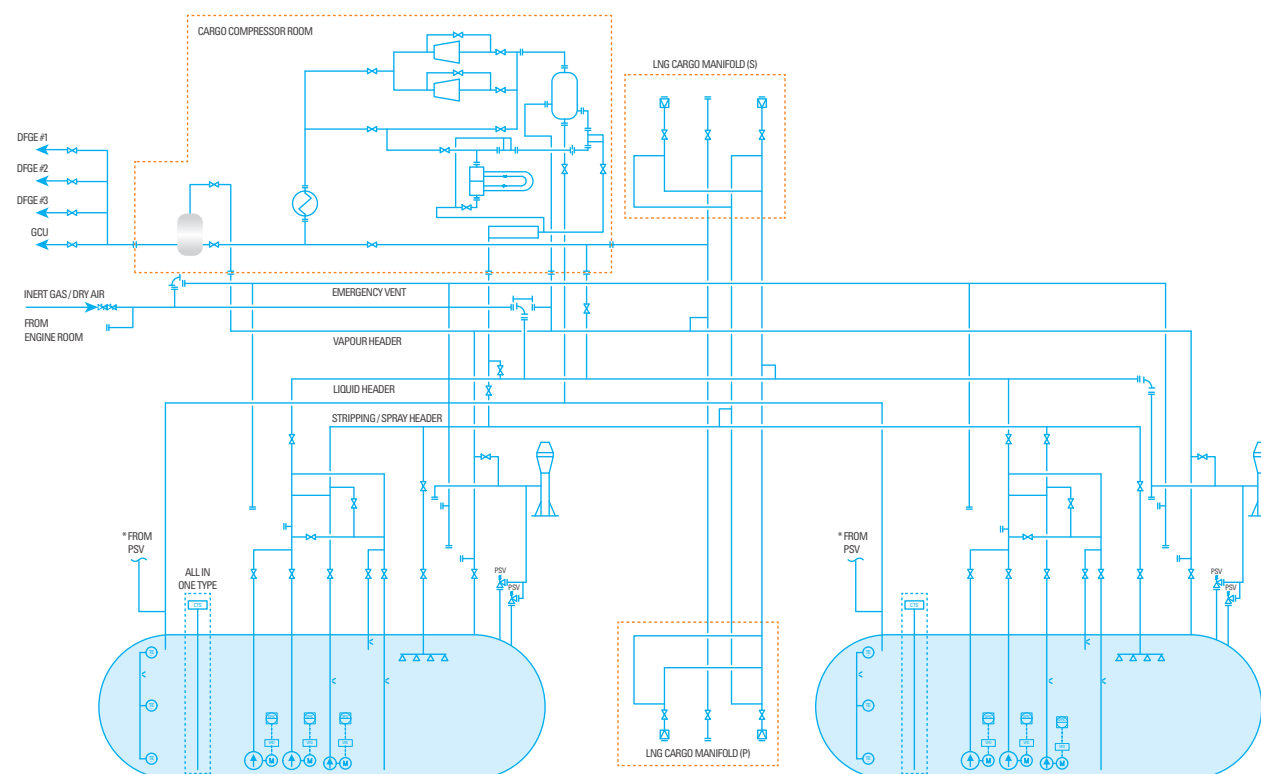
- Novel design
- Scalable and flexible design
- Reduced cost for liquefaction and conditioning
- Low density of cargo

The liquid CO₂ cargo handling system is designed to safely store, transfer, and manage liquefied carbon dioxide under controlled temperature and pressure conditions to prevent solidification (dry ice formation). It includes insulated cargo tanks, cryogenic pumps, pressure-controlled piping, vapor management, and safety devices. The system ensures efficient loading and unloading operations, maintains cargo integrity, and incorporates emergency shutdown and monitoring systems to comply with safety and environmental standards.

Cargo Handling System for Bunkering Vessel

The Cargo Handling System on a bunkering vessel is an integrated system designed to safely store, transfer, and manage LNG between the vessel and receiving ships. It includes cargo tanks, cryogenic pumps, insulated piping, vapor management, and safety controls to ensure efficient and environmentally compliant LNG operations.

SUNBO Preliminary Design – Unauthorized Copying is Strictly Prohibited



OCCS/CCUS

On-board Carbon Capture System



SUNBO RPB type Onboard Carbon Capture

Conventional wet type carbon capture

Conventional Type

Absorption and Stripper packed column.
Gravity-driven system,
that requires height for efficient separation.

Gravity scrubbing



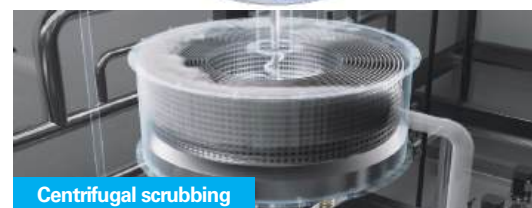
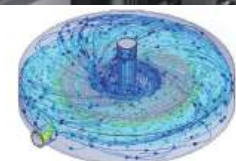
RPB capture system

Next Generation

Rotational Packed Bed capture Centrifuge-driven system, that can process large gas flowrates in a compact volume due to enhanced mass transfer.



1/10
downsizing



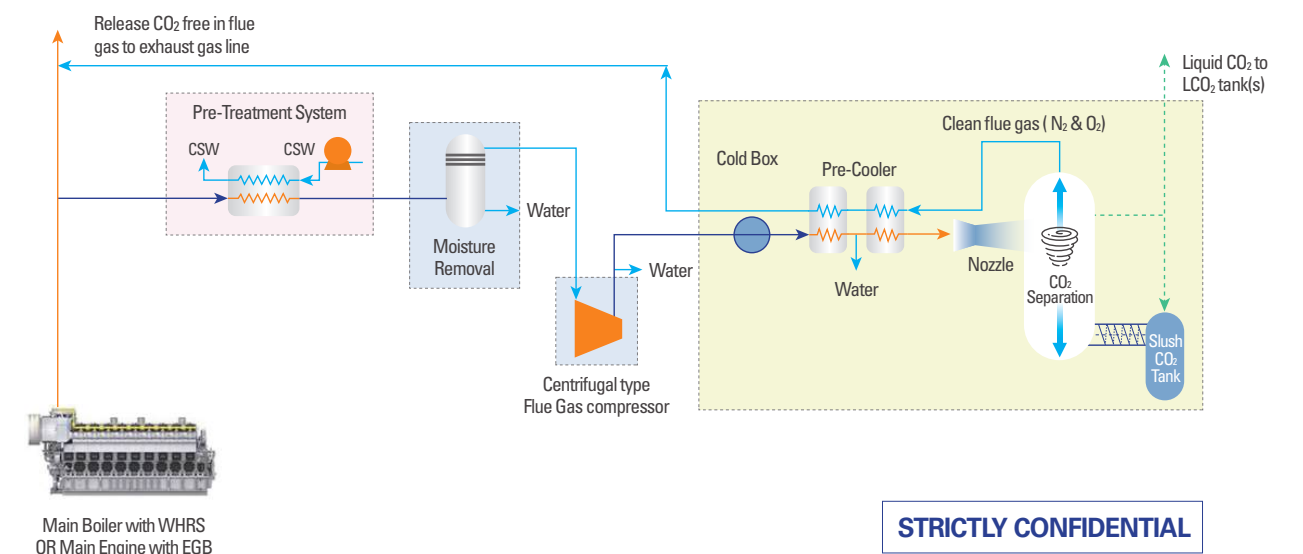
Centrifugal scrubbing

RPB vs Conventional system

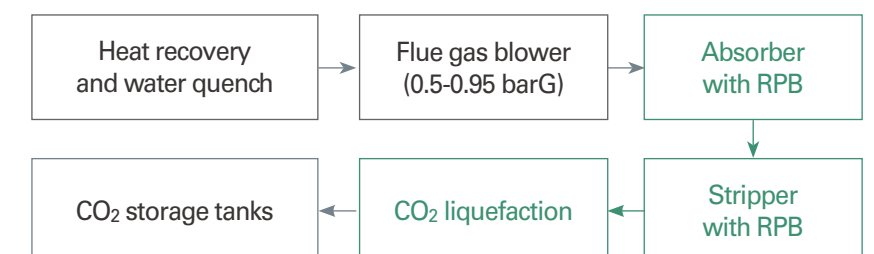
- 10 x reduction in processing volume for the same amount of gas
- Process not affected by gravity (more suitable for offshore).
- Improved overall separation **energy efficiency by 35% on average.**

Carbon Value RPB-CC is a fully containerized carbon capture module based on Rotating Packed Bed chemical absorption technology. Contrary to conventional scrubbing towers CO₂ is captured using a rotational force, greatly reducing total space and height required. CO₂ is captured from exhaust gas via chemically selective solvent. CV's RPB absorber design is such that no high pressures are required to drive the exhaust gas through the absorber (i.e., no compressor only blower). Highly concentrated CO₂ is released from RPB stripper where it is ready for utilization or storage.

SUNBO Cryogenic type Onboard Carbon Capture



OCCS/CCUS with Cryogenic Carbon Capture



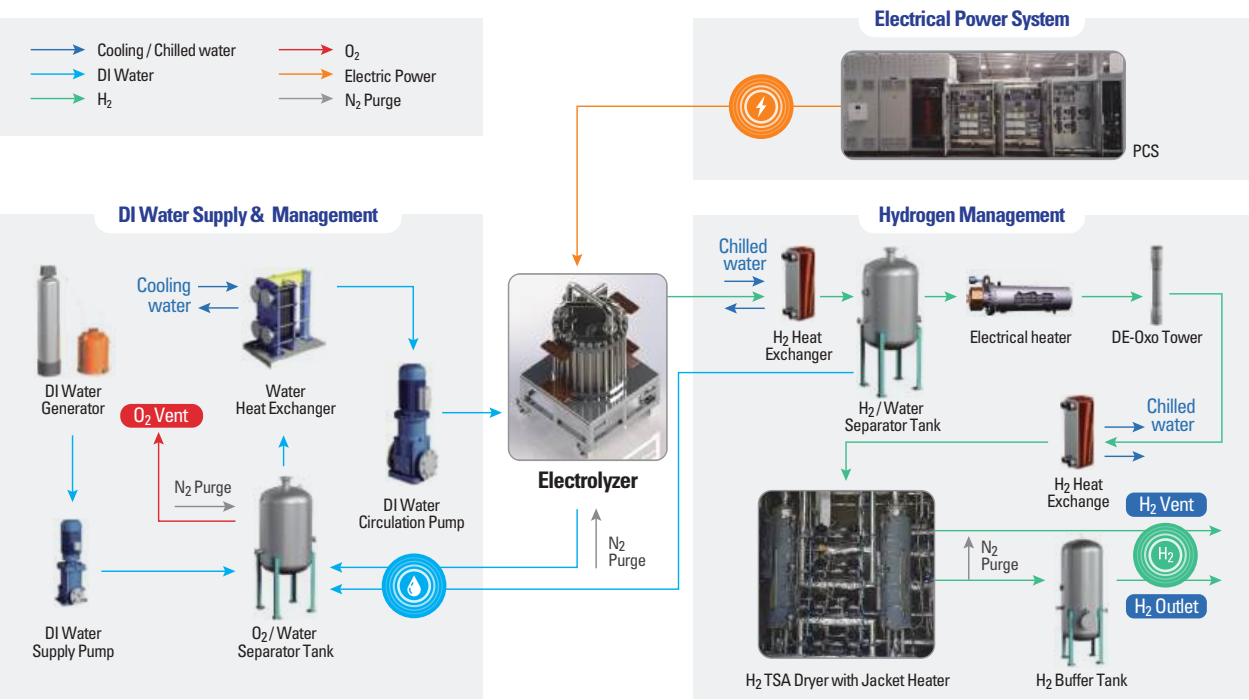
- System development in collaboration with Carbon value, UNIST (Ulsan National Institute of Science and Technology), SUNBO.
- RPB achieves efficient gas / liquid contact through centrifugal force.
- It is more energy and space efficient relative to conventional packed columns.
- Novel solvents are developed which increase the energy performance of the system and reduce OPEX losses due to chemical degradation (e.g., oxidative and thermal degradation).

A Suitable Hydrogen Production Method for the Era of Renewable Energy



H₂-Gen[®] is a hydrogen generator based on PEM (Proton Exchange Membrane) Technology. Unlike conventional hydrogen production methods, it produces hydrogen using only water (H₂O) and electricity. H₂ and O₂ are the only by products generated through electrolyzer, and harmful gases like CO₂ are not produced, making it an environmentally friendly hydrogen generator. It is the ultimate hydrogen generation device capable of handling 100% of the load fluctuations characteristic of renewable energy sources.

Conceptual process for hydrogen production (PEM)



SCOPE OF SUPPLY

Technical specification as per capacity

Division	Specification	H ₂ Generator Model No. (PEM Electrolyzer System)					
		H ₂ Gen 100	H ₂ Gen 200	H ₂ Gen 600	H ₂ Gen 1000	H ₂ Gen 2000	H ₂ Gen XMW
PEM Stack	Rated Power	50kW	100kW	300kW	500kW	1MW	2MW
Hydrogen Production	Volume (Nm ³ /hr) @ system outlet	10	20	60	100	200	400
Water Consumption (Liter/hr)	Tap Water for DI Water	25	50	140	240	480	1,000
	DI Water	11	22	66	110	220	440
	DI Water (Conductivity)	0.05 ~ 0.1μs/cm (Up to 6 barG)					
Utility (Option)	Cooling Water (kg/h) [based on closed loop]	6,400	12,800	38,000	64,000	128,000	256,000
	Chilled Water (kg/h) [based on closed loop]	90	180	530	880	1,750	3,500
Installation Footprint	Installation Footprint (m ²)	28	28	31	31	62	62
	Containerized Size	30ft x 1ea	30ft x 1ea	40ft x 1ea	40ft x 1ea	40ft x 2ea	40ft x 2ea

Reference list

50kW

- 10Nm³ per hour
- Delivery: 2022
- H₂ Purity: 99.999%

100kW

- 20Nm³ per hour
- Delivery: 2023
- H₂ Purity: 99.999%

300kW

- 60Nm³ per hour
- Delivery: 2023
- H₂ Purity: 99.999%

500kW

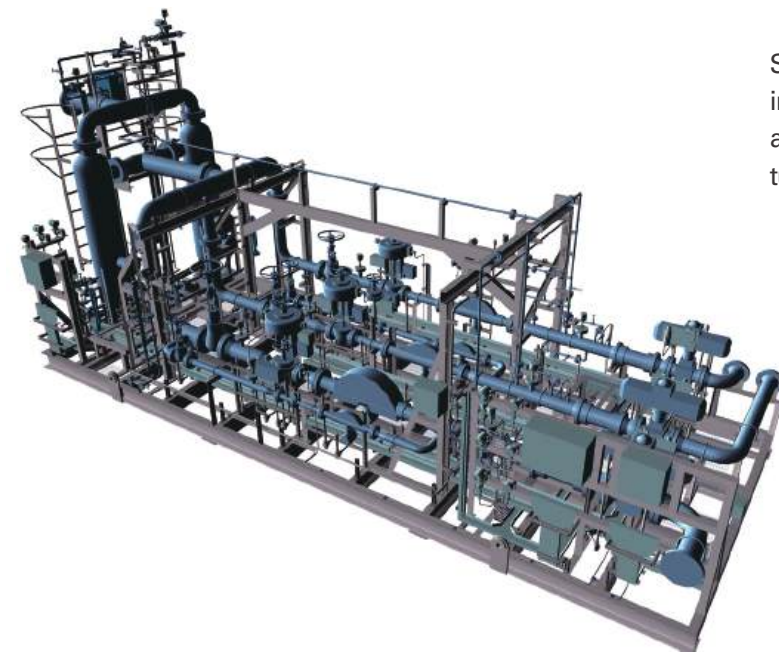
- 100Nm³ per hour
- Delivery: 2023
- H₂ Purity: 99.999%

1MW

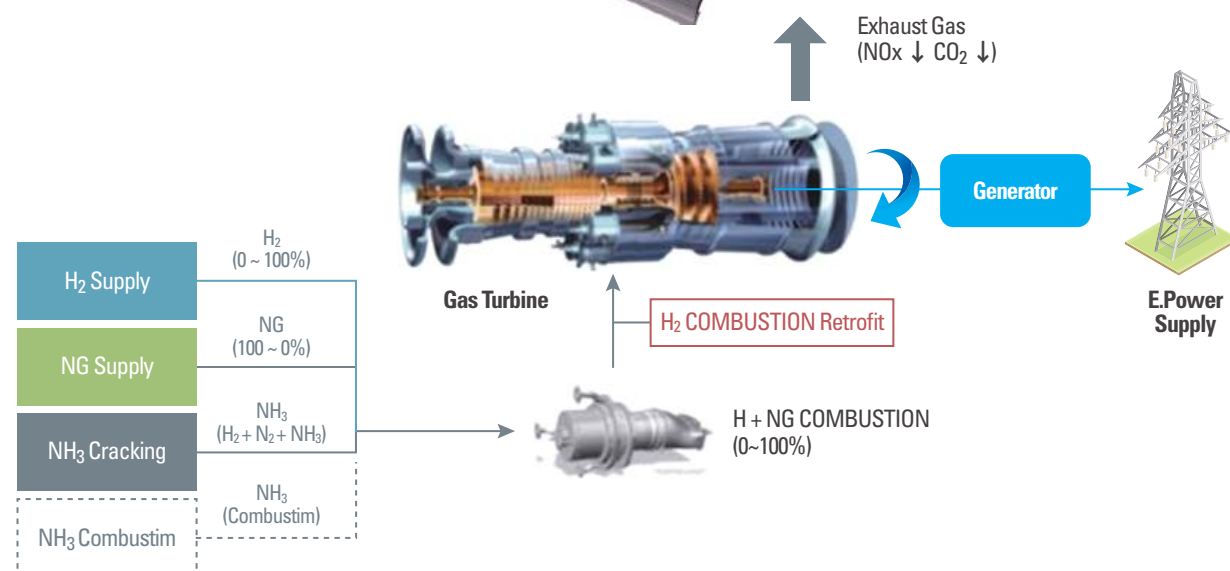
- 200Nm³ per hour
- Delivery: 2024
- H₂ Purity: 99.999%

2MW

- 400Nm³ per hour
- Delivery: 2025
- H₂ Purity: 99.999%



SUNBO's Mixing Station is a facility that injects and mixes hydrogen and LNG gas and supplies the mixed gas to the gas turbine through the control module.



ONSHORE & OFFSHORE MODULE

REGASIFICATION MODULE

Product	PADUS FSRU	SWAN FSRU	BOTAS FSRU
Client	HHI	HHI	HHI
Delivery	2018	2018-19	2018-19



LIQUEFACTION MODULE

Product	LNG SYSTEM TEST PLANT
Client	SHI
Delivery	2020



HANWHA TOTAL CHEMICAL PLANT Project

Product	Cold Box Package
Client	KSL
Delivery	2018



EGINA FPSO Project

Product	Slop Water Treatment System
Client	GEA WESTFALIA
Delivery	2007



SHWE PLATFORM Project

Product	Produced Water Treatment System
Client	GPS
Delivery	2011



PETRONAS FLNG Project

Product	Pipe Process Module
Client	DSME
Delivery	2014



MARINE MODULE

FLUID TREATMENT SYSTEM

We develop and design our own systems that can process and supply fuel and fluids to various engines and other components.



H.F.O & L.O Purifier Unit



C.F.W Pumps Unit



M/E & G/E & F.O Supply Unit



M/E L.O Filter Unit



NaOH Dosing Supply System



N/G Supply Control System



Main Central Cooler Unit



Mixing Station (H₂ + N/G)

MODULARIZATION

We integrate various equipment, valves, instruments and pipings into modules according to client's requirements. We also provide production design and procurement services.



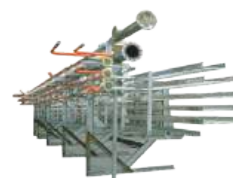
TANK TOP Unit with Block



E/R TANK TOP Unit



Under Deck Unit in ER



Passageway Unit for LNGC



Regasification Module



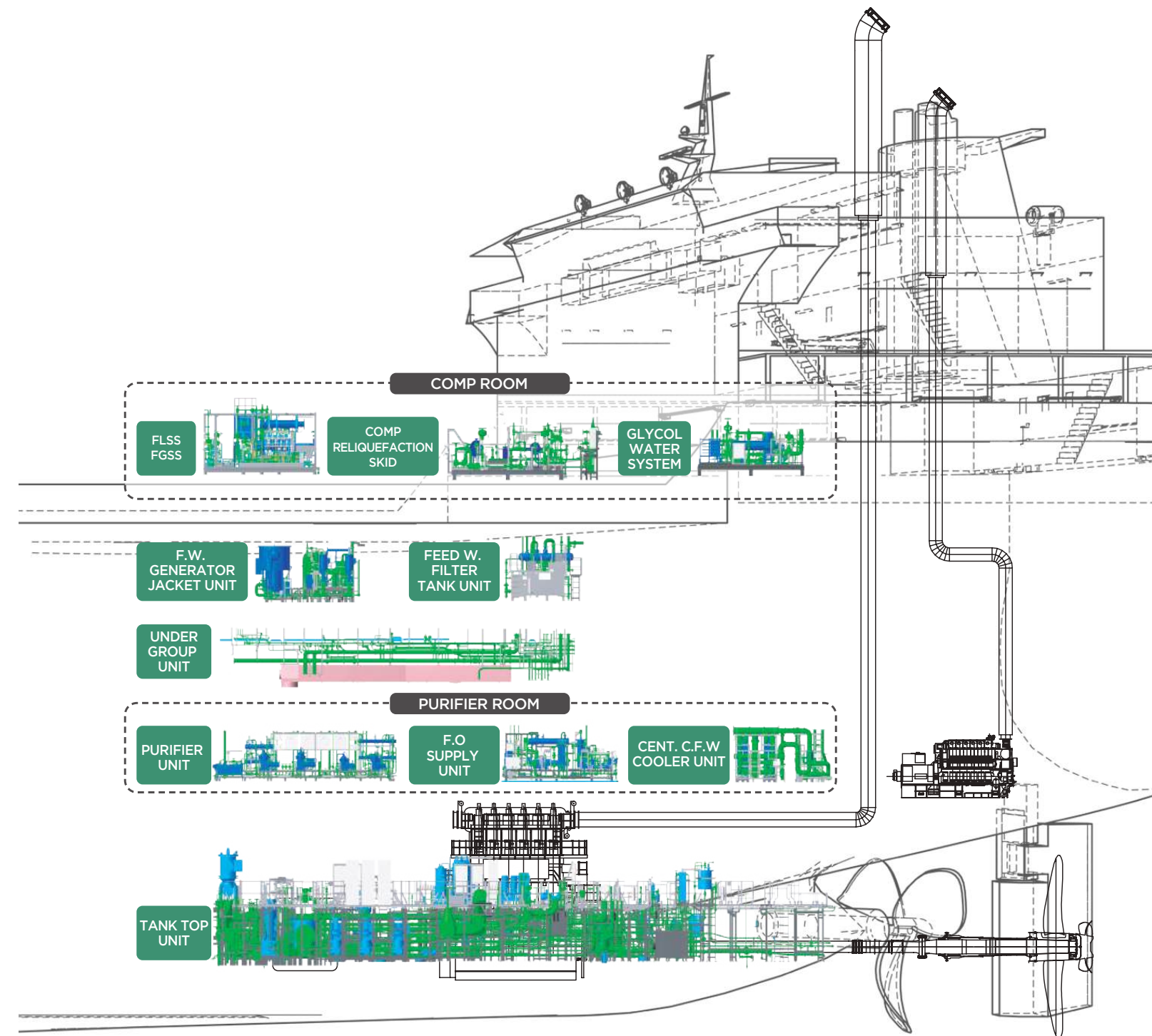
Deoxygenation Package



Pipe Process Module



Cold Box



GAS SYSTEM TEST FACILITY

NETWORK For SUNBO FAMILY

Test Facility (LN2 Tanks)



Test Facility (Onshore FGSS)



FGSS/LFSS Control



OTS for FGSS/LFSS



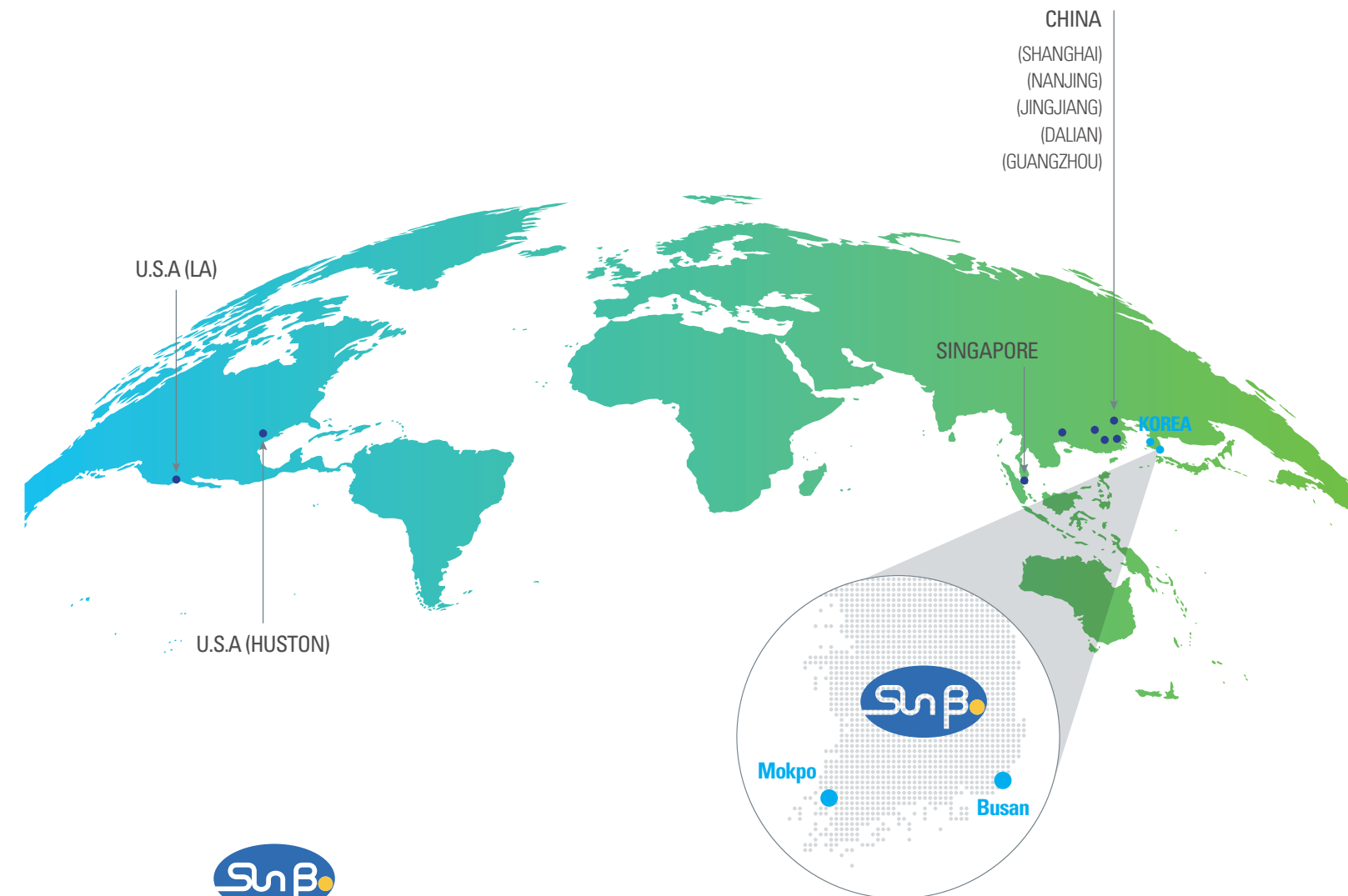
Test Facility



Utility system for Test



Our test facility at the Dadae 2nd factory allows us to test and verify various systems, including the FGSS, reliquefaction system, recondensing system, and BOG compressor system. This onshore FGSS facility is capable of generating both high-pressure and low-pressure cryogenic gas flows, enabling the testing of diverse gas systems. By utilizing this state-of-the-art facility, we ensure the reliability and operability of our systems before developing products to our clients, providing them with confidence in the quality and performance of our solutions.



KOREA

- Busan
- Mokpo

CHINA

- Shanghai
- Nanjing
- Jingjiang
- Dalian
- Guangzhou

SINGAPORE

- SUNBO Partners PTE Ltd.

U.S.A

- Huston
- LA
- SUNBO Angel Partners LLC
- SUNBO Angel Energy Innovation II LLC

CORPORATE SOCIAL RESPONSIBILITY

SB SUNBO FAMILY

WE AS A GOOD NEIGHBOR
SUPPORT VULNERABLE SOCIAL GROUP
AND DANGER ENCOUNTERED HOUSEHOLDS.



DADAE #1 (Head Office)

- 8,265m³
- System Packages
- Purifier Room Unit
- FO Supply Unit
- Package Unit
- Stern Tube Unit



DADAE #2

- 16,530m³
- LNG FGSS
- LNG HP Pump System
- Reliquefaction System
- Under Group Unit / Passage Unit / T/TOP Unit



GIMHAE

- 26,446m³
- Piping - Carbon Steel
- Piping - Stainless Steel and Alloys



GUPYEONG (Head Office)

- 21,500m³
- 145m long Quay
- System Packages
- T/TOP Unit of large size
- Main Deck Unit



DAEBUL

- 103,905m³
- LNG System packages (BOG Comp., Regas etc.)
- Shipbuilding unit (Main Deck, Tank Top etc.)
- Energy Solution (H₂ Production, Carbon Capture, Waste Recycle)



YEONGAM

- 11,250m³
- T/TOP Unit
- Purifier Room Unit
- Package Unit
- Under Group Unit

SUNBO ANGEL PARTNERS



- Established in 2016
- Startup investments
- ICT
- Biotechnology
- S/W and H/W Technology
- Joint Ventures
- Company buildings
- M & As

LIGHTHOUSE COMBINED INVESTMENT



- Venture Capital with
- 7 investment funds
- \$100M AUM
- 60 Portfolio companies
- Industrial & Energy
- Bio & Healthcare
- Consumer IT & Fintech
- Content

SUNJAE SCHOLARSHIP FOUNDATION



- India-1 Kindergarten
- Congo-1 Elementary School
- Nepal-4 Elementary School
- Uganda-3 Elementary School
- Bangladesh-2 Education Center
- Ghana-Under Construction