Hanwha Power

Hanwha Power

Profile 2025

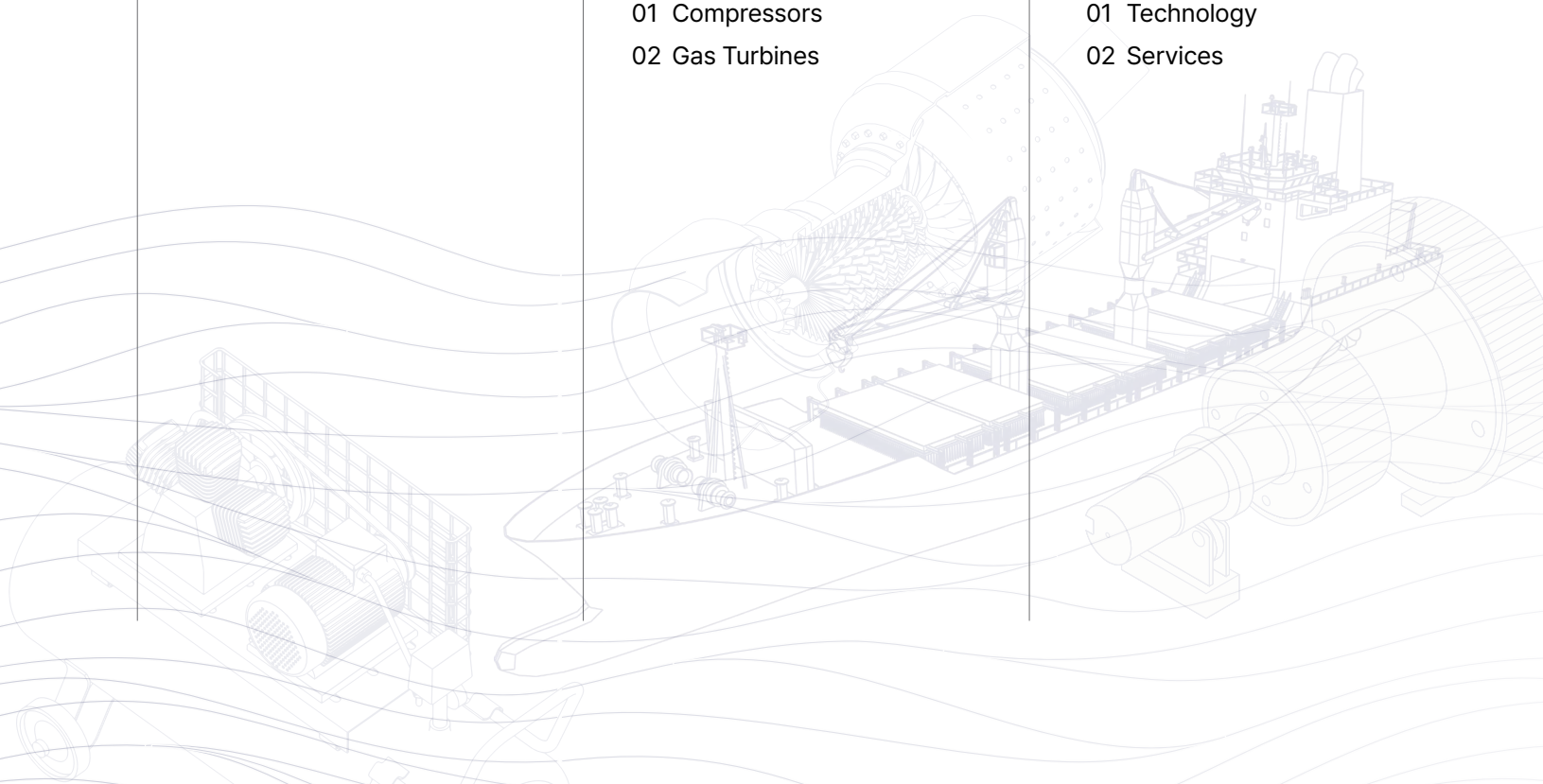
Contents

Mission

We drive a sustainable future through innovative energy equipment, smart technology and solutions.

Slogan

Your optimized lifecycle partner for energy equipment and solutions.



Introduction to Hanwha

Hanwha, always by your side on the path to a sustainable future for people and the planet.

Hanwha continues to grow by preemptively responding to rapidly changing business environments with a balanced business portfolio that includes aerospace & defense, energy, ocean & materials, finance, machinery and retail & services. Our affiliates are becoming global leaders in their arenas by strengthening core competitiveness and securing future growth engines based on sound financial structures.

Hanwha's Core Values

Hanwha's Spirit of 'Trust and Loyalty' lies at the foundation of our growth. Our core values of challenge, dedication, and integrity form the basis for the mindset and actions of all employees, strengthening our solidarity as Hanwha people.

Business Enterprise in South Korea
Total asset basis, as of end of 2024
Top 7

Total Sales
As of 2024
64.1B USD

Years of History
Founded in 1952
73

Global Networks
As of end of 2024
821

Ranking on Fortune Global 500® in 2024
372

One of the TIME100 Most Influential Companies
in 2024

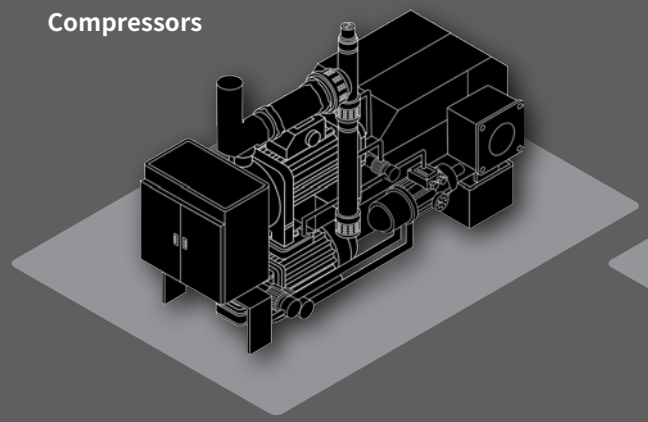
Core Values

Hanwha Power

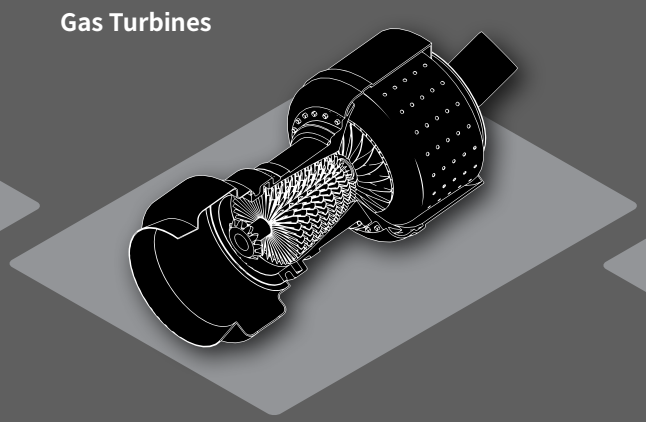
Hanwha Power has been a trusted provider of advanced energy equipment since 1997, building on its proven reliability and efficiency in gas turbine technology. With more than 9,000 units delivered worldwide, the company has established a strong global presence.
In 2023, the company expanded into its marine solutions business as part of its commitment to create synergies with Hanwha Group's shipbuilding and marine businesses. Hanwha Power develops and integrates energy efficiency improvement technologies and low-emission propulsion systems to support stable and sustainable navigation in ship maintenance, retrofit, and new buildings.
Hanwha Power will continue to be the best and optimal partner for energy equipment and marine navigation solutions.

Business Area

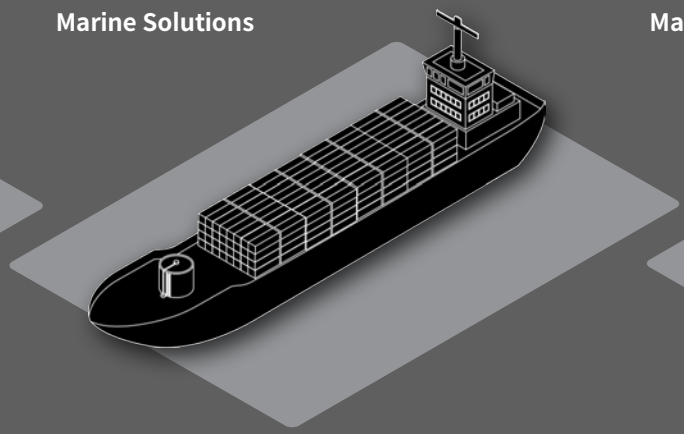
Compressors



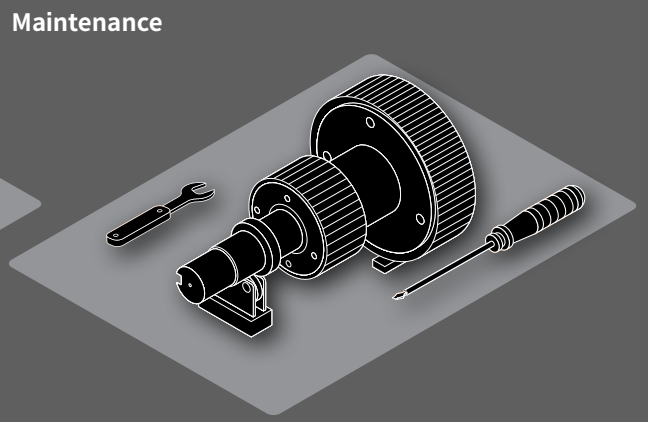
Gas Turbines



Marine Solutions



Maintenance



HISTORY

1977 Established Company, **Aircraft Gas Turbine Engine Maintenance**
1979 Commenced Aircraft Gas Turbine Engine Repair and Overhaul Business

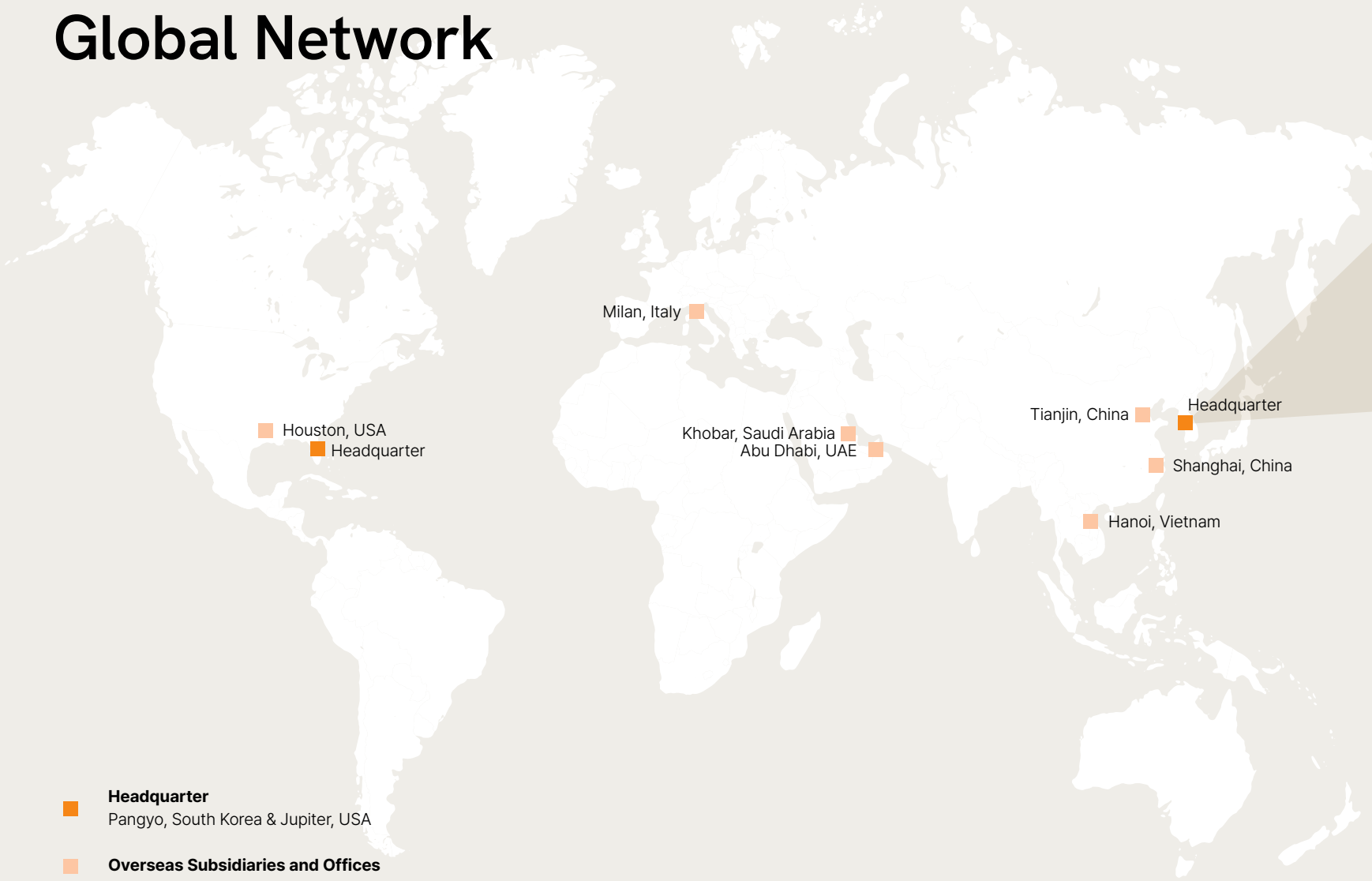
1996 **Developed Industrial Gas Turbine**
1997 **Commenced Industrial Air Compressor Business**
2011 **Entered Gas Compressor Market**

2013 Launched the World's Largest Capacity Air Cooled Compressor
2014 Entered the Vessel Compressor Market

2016 Registered as Saudi Aramco approved Vendor
2018 **Launched Turbo Expander Generator(TEG)**, an eco-friendly, **high-efficiency energy solution**
2021 Awarded and achieved sCO_2 power generation system DOE(Department of Energy) national project

2022 Engaged in combined cycle power generation project
Entered the Ethylene Compressor and **CO_2 Compressor Market**
2023 **Successfully demonstrated complete hydrogen combustion for the first time in the world, Commenced marine solution business**

Global Network



Headquarter
Pangyo, South Korea & Jupiter, USA

Overseas Subsidiaries and Offices

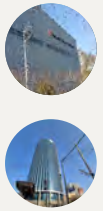
Domestic Business Sites

- **Pangyo Headquarter**
  Research & Development,
  Planning, Strategy, Marketing, Sales

- **Factory #1(Changwon)**
  Compressor Assembly & Test

- **Factory #2(Changwon)**
  Engineered and Large scale compressor
  & Gas Turbine Package Assembly & Test

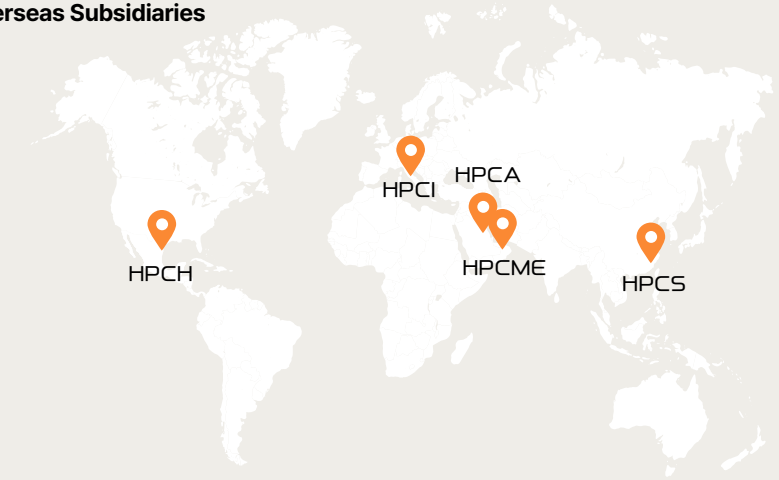
- **Factory #3(Busan)**
  Engineering and Large scale
  Compressor Assembly



- **Busan Business Center**
  For Marine Solutions Business
  Sales, Quality, PM, Engineering

Global Network

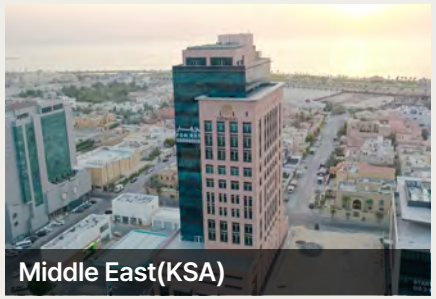
Overseas Subsidiaries



Company Name	HPCH	HPCS	HPCME	HPCA	HPCI
Location	Houston	Shanghai	Abu Dhabi	Khobar	Milan
Major Businesses	**Compressor and equipment sales + service center operation** •Out-facility repair and balancing of core parts •Overhaul of parts				

580 Westlake Park Blvd, Suite 500, Houston TX 77079, USA

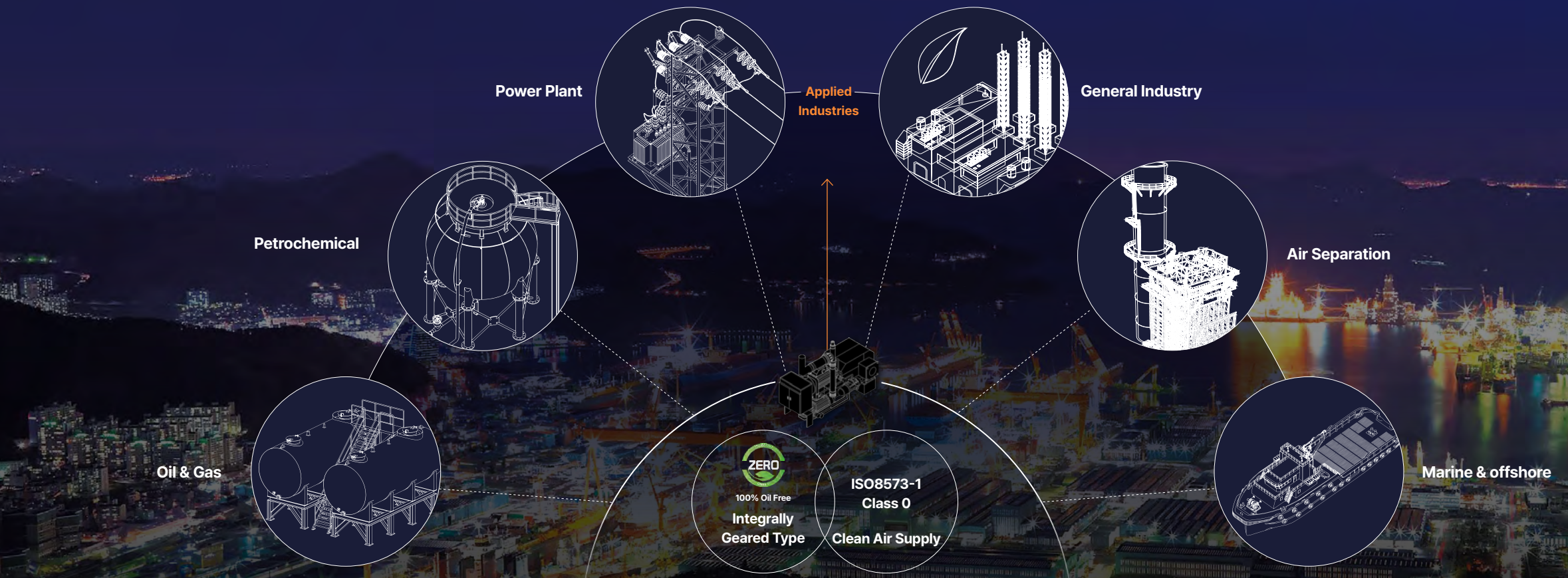
Via de Vizzi 93/95, Cinisello Balsamo 20092, Milan, Italy



Unit 4, 12TH Floor, Al fardan Tower, Khobar 31952, KSA

200233 20/F, New Caohejing International Business Center A, No391, Guiping Road, Shanghai, China

PO BOX 33586, Plot #35-WR43, ICAD 3 Musaffah South, Abu Dhabi, UAE



COMPRESSORS

Integrally Geared Type

Hanwha Power's integrally geared turbo compressors deliver exceptionalperformance and efficiency through our proprietary technology. They provide 100% oil-free, clean and dry air to maintain optimal production conditions while complying with strict environmental regulations. This is why we are trusted across a wide range of industries for the stability and reliability of our tailor-made, best-in-class solutions.

ISO8573-1 Class 0-certified Clean Air Supply

Our products are certified to ISO8573-1 Class 0, the highest quality highest standard for compressed air purity. They are trusted in demanding applications across steel, chemicals, and food, as well as in advanced sectors such as semiconductors and batteries, where uncompromising reliability is essential.

Compressors

Building on air compressors used in various industrial manufacturing processes, we have developed a rich lineup of high-value products. Our lineup covers gas compressors for oil& gas, air separation, and power plants. Also Boil-Off Gas(BOG) compressors for LNG terminals and plants, cryogenic compressors, companders, and marine compressors.

Line-up

Air/ N_2 Compressor

SM100 Pro

- Air / N_2
- 700~35,000Nm³/hr
- Instrument Air or Plant Air
- API 672

Engineered(SE-A/N)

- Air / N_2
- ~200,000Nm³/hr
- Air Separation or Petrochemical
- API672 or API617

Gas Compressor

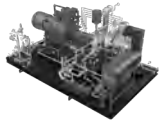
Gas

- Various gas
- ~169,000 m³/hr
- Oil & gas process (up to 6 stage)
- API 617

CO_2

- L-CO_2
- CO_2 Sequestration
- Up to 8 stage
- API617

VRU



- Lethal(Sour Gas)Service
- Vapor Recovery Unit
- API617

Fuel Gas

- CH_4(Natural gas)
- Gas Turbine for Power plant
- API 617

Gas Compressor

Ethylene

- Demethanizer process
- Cryogenic Gas
- API617

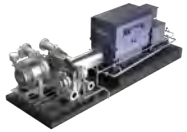
HP

- CH_4(Natural gas)
- LNG Terminal
- API617

BOG

- LNG BOG(Boil Off Gas)
- LNG Terminal
- API 617

Steam



- Steam(superheated)
- Mechanical Vapor
- Re-Compression
- API617

Expander

Cryogenic

- LNG Liquefaction or Hot process gas
- API617 CH_4

Handling GAS

CO	Carbon Monoxide
CO_2	Carbon Dioxide
CH_4	Methane
C_2H_4	Ethylene
C_3H_6	Propylene
C_3H_8	Propane
N_2	Nitrogen
NH_3	Ammonia

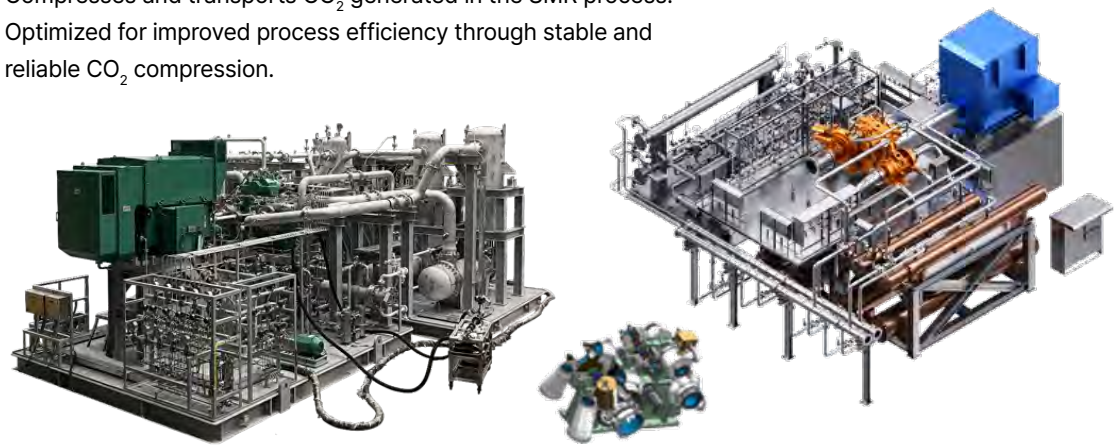
+ more

Representative Products and References

CCS

CO_2 Compressor

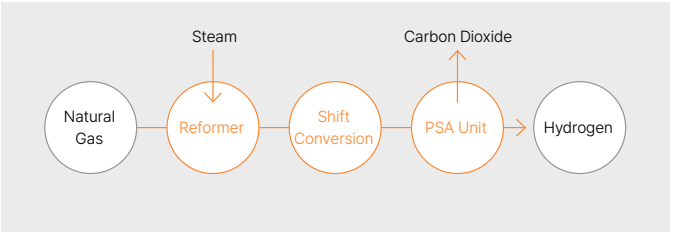
- Compresses and transports CO_2 generated in the SMR process.
- Optimized for improved process efficiency through stable and reliable CO_2 compression.



Major Reference

Location	Korea
Application	Dry ice production
Model Name	SE-65(Capacity : 300TPD)
Applied Process	CO_2 compression/ transportation
Features	CO_2 Treatment in SMR Process

SMR Process Diagram



Major Reference

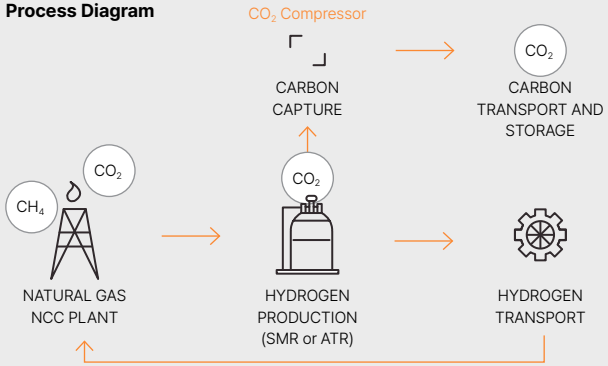
Location	Korea
Application	Dry ice production
Model Name	SE-65(Capacity : 450TPD)
Applied Process	CO_2 compression/ transportation
Features	CO_2 Treatment in SMR Process

Major Reference

Location	Korea
Application	CO_2 compression and transportation
Model Name	SE-65
Applied Process	CO_2 compression/ transportation
Features	CO_2 capture in the SMR process of NCCs

- Captures and transports CO_2 generated in the blue hydrogen production process.
- Used in the main processes in Naphtha Cracking Centers(NCCs).

Process Diagram

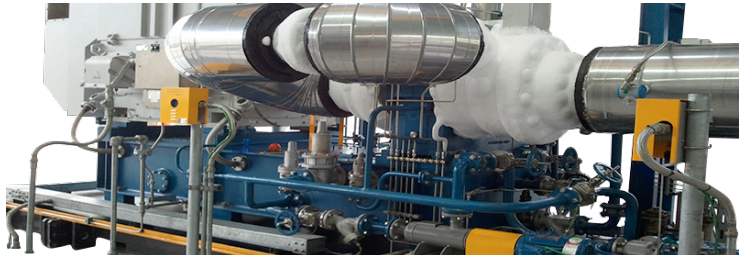


Representative Products and References

Marine & Offshore

BOG(Boil Off Gas) Compressor

- Boil-off gas(BOG) forms due to the temperature difference with the surrounding environment because LNG is stored at a cryogenic temperature of -162°C. Hanwha's BOG compressor is critical equipment which compresses and re-liquefies the generated boil-off gas.
- Proven reliability based on its track record of supplying BOG compressors to numerous LNG terminals across Korea.
- Reduces installation space by up to 60% compared to traditional reciprocating compressors, while offering high-efficiency operation.



Major Reference

Location	Korea
Application	Boil Off Gas compression/reliquefication
Model Name	SE-45
Applied Process	Reliquefies boil-off gas and stores in LNG tanks
Features	Optimized installation space, high-efficiency product response
	High reliability(stable operation experience)

Natural Gas Liquefaction Compressor

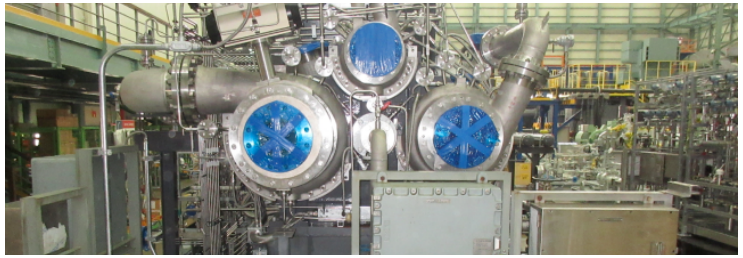
- A nitrogen refrigerant liquefaction compressor LNG supply and utilization in off-grid remote areas.
- Compact footprint and easy installation for enhanced customer convenience.
- Supporting new developments with optimized investment efficiency, easy maintenance, and a wide range of tailored designs.

Major Reference

Location	US
Application	Small Scale LNG
Model Name	SE-45
Applied Process	Natural gas liquefaction
Features	Provides a variety of solutions for liquefaction processes
	Efficient installation space and single-lift installation

C3 & MR Compressor

- Used in the liquefaction process of conventional LNG plants with high liquefaction efficiency.
- Used in liquefaction processes utilizing C3 & MR(propane and mixed refrigerants).
- Successfully tested and validated, allowing for flexible product development tailored to customer-specific requirements.



Major Reference

Location	Korea
Application	C3 & MR Refrigerant compressors
Model Name	SE-65 & SE-65
Applied Process	C3/MR process
Features	Pilot substantive test complete
	Process solutions for LNG terminals

Representative Products and References

Petrochemical

Vapor Recovery Compressor

- Applied in vapor recovery units for capturing and reusing flare gas.
- Aligns with global environmental policies(contributing to reducing flare gas emissions and lowering production costs).
- Optimal solution for offshore platforms which are requiring proven reliability.

Major Reference

Location	UAE
Application	Gas treatment plant(Offshore)
Project Progress	In commercial operation(2018~)
Model Name	SE-45
Applied Process	Vapor recovery process

Major Reference

Location	UAE
Application	Gas treatment plant(Offshore)
Project Progress	In commercial operation(2018~)
Model Name	SE-45
Applied Process	Vapor recovery process

Regeneration Gas Compressor

- Utilized in sweet gas dehydration processes in gas treatment plants.
- Featuring optimized designs to handle diverse gas compositions in large-capacity, high-pressure applications.

* SWEET Gas: Natural gas free from corrosive components such as hydrogen sulfide or mercaptans

Major Reference

Location	Saudi Arabia
Application	Gas treatment plant
Model Name	SE-45
Applied Process	Dehydration(moisture removal process)
Features	Offers highly reliable compressor solutions for chemical and gas processes

Representative Products and References

Power Plant & General Industry

Fuel Gas Compressor

- A key component in gas power plants. Extensive experience in ensuring stability under diverse operating conditions .
- Optimized for gas power plants worldwide for many years.
- Strong track record of supplying multiple gas turbine OEMs, with tailored fuel gas supply solutions for each turbine model.

Major Reference

Location	Americas
Application	Gas power generation
Model Name	SE-45
Applied Process	Fuel gas compressor
Features	Proven track record with multiple gas turbine manufacturers

Plant Air for General Industries

- Tailor-made solutions solution tailored to the operating conditions and environments of various industries and customers.
- Customized, high-performance, high-reliability turbo compressors providing 100% oil-free, clean, dry air.
- The standard for industrial air compressors based on high stability and operational reliability.

Major Reference

Application	Steel
Model Name	SMX Series
Applied Process	Plant Air(Industrial Air)

Combo Compressor

- A combo compressor integrates two or more compression processes into a single compressor.
- Its advanced design enables two processes in one, significantly reducing installation footprint.
- Enabling flexible product development to deliver tailored compression systems for diverse customer requirements.

Major Reference

Location	Europe
Application	Air Separation
Model Name	SE-90
Applied Process	Dual services(Feed & Recycle)
Features	Product development tailored to customer needs / Incorporation of two separate processes into a single product / Energy savings through high-efficiency implementation

Representative Products and References

Power Plant & General Industry

Main Air Compressor

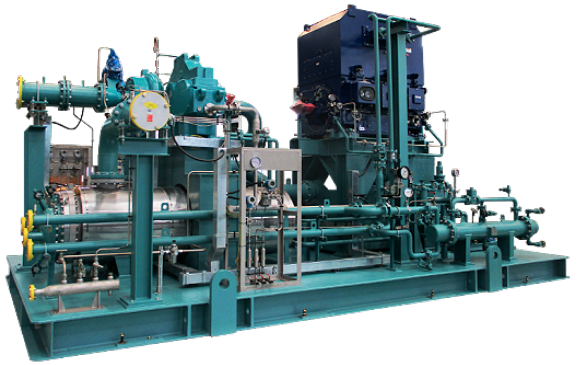
- MAC(Main Air Compressor) is a core component in Air Separation Units(ASU), compressing incoming air to a typical pressure of 6 barA(87 PsiA) and delivering it to subsequent processes.
- A high-efficiency, low-power product that ensures cost-effective and reliable plant operation.
- With a proven track record of over 1,000 units delivered and operating worldwide.

Design Capability

Flow rate	m^3/hr	~180,000	Discharge pressure	BarA	1.2 ~ 200
	CFM	~105,950		PsiA	17 ~ 2,900
HP	HP	~ 33,500			

Boosting Compressor

- A Boosting Air Compressor(BAC) boosts pressure, typically above 25 BarA for processes requiring high-pressure compressed air.
- Possible to provide ultra-high pressure compressed air to meet various compressed air requirements.
- Over 100 compressors delivered and operated worldwide.

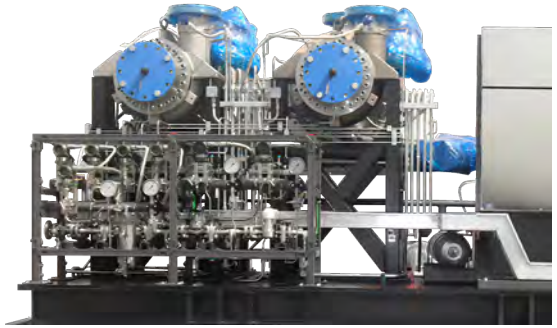


Major Reference

Application	Air separation	Features	A high-efficiency solution helping customers save their electricity costs.
Model Name	SE-45		Diverse design and operation experience.
Applied Process	Air boosting process		Providing customers with high reliability.

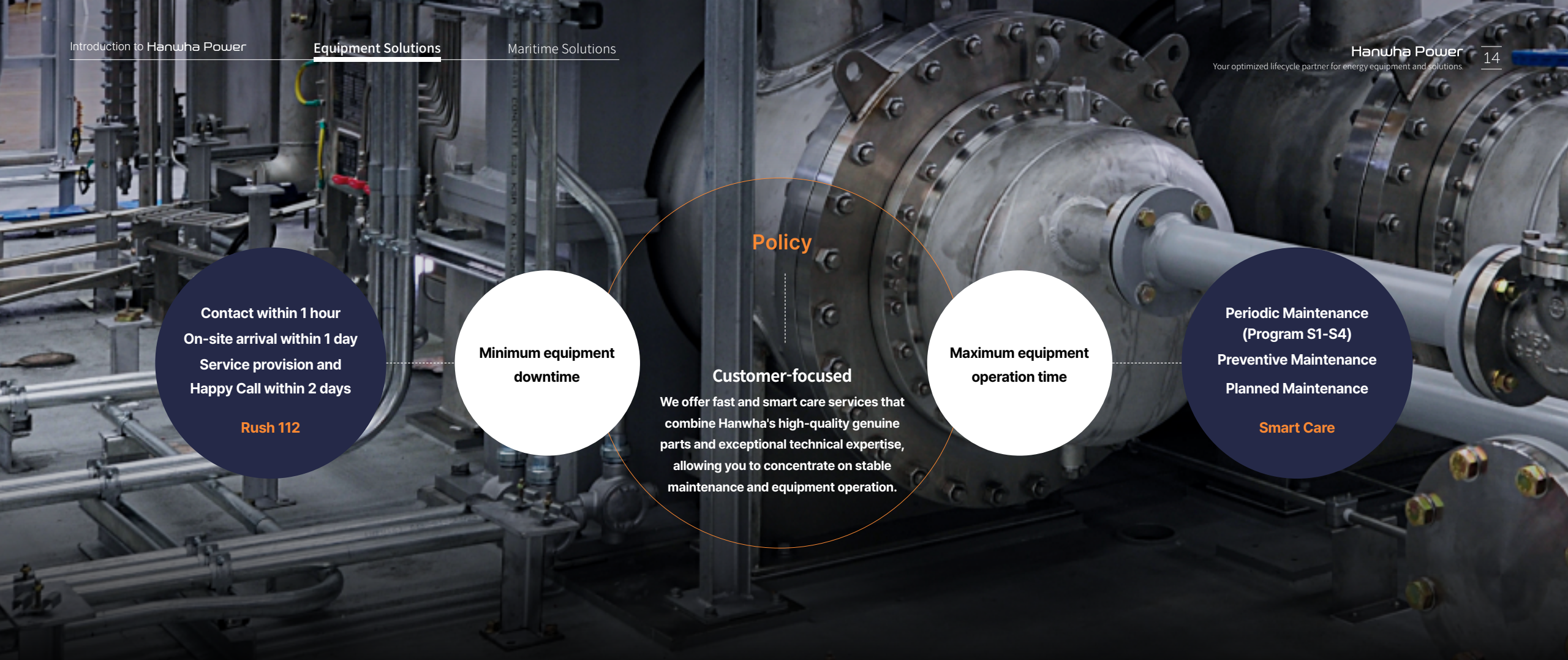
Cryogenic Expander

- Applied in a special process that liquefies natural gas(NG) using nitrogen as a refrigerant.
- Configured as a warm/cold expander, achieving optimal efficiency.
- Primarily used in small and medium-sized plants, and able to develop various product lineups tailored to customer-specific requirements



Major Reference

Location	South America, Asia
Application	For natural gas reliquefaction
Model Name	SE-45
Applied Process	Natural gas liquefaction
Features	Cryogenic expanders
	Combined configuration(warm/cold expanders)



Contact within 1 hour
On-site arrival within 1 day
Service provision and
Happy Call within 2 days

Rush 112

Minimum equipment downtime

Policy

Customer-focused

We offer fast and smart care services that combine Hanwha's high-quality genuine parts and exceptional technical expertise, allowing you to concentrate on stable maintenance and equipment operation.

Maximum equipment operation time

Periodic Maintenance
(Program S1-S4)
Preventive Maintenance
Planned Maintenance

Smart Care

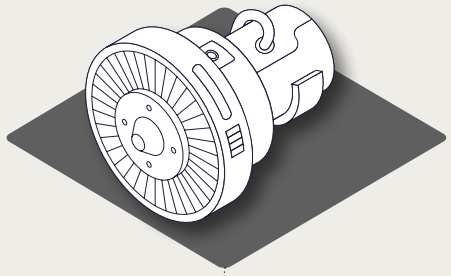
AFTER MARKET SOLUTIONS

Compressor Room Services

Stable plant operations depend on maintaining equipment in the best possible condition. Regular maintenance optimizes performance, prevents unexpected accidents, and extends equipment lifespan. Periodic inspections ensure components are functioning properly, enabling timely replacement and repairs. Addressing even minor issues consistently reduces the risk of equipment failure, ensures the safety of technicians, and prevent fatal accidents.

AM Solutions

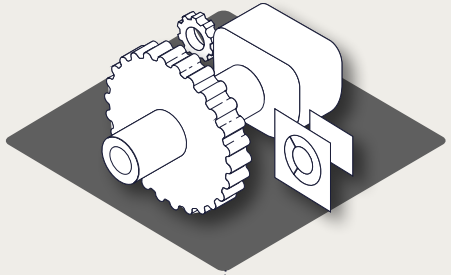
Operational Service



Parts

Parts Supply

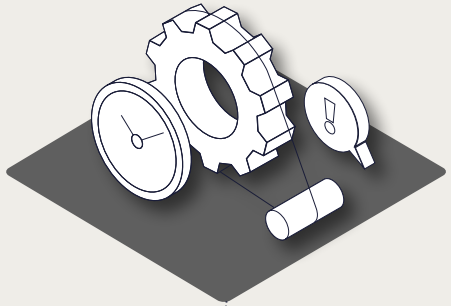
Parts replacement and delivery due to consumption or malfunction



Maintenance

Inspection/ Maintenance

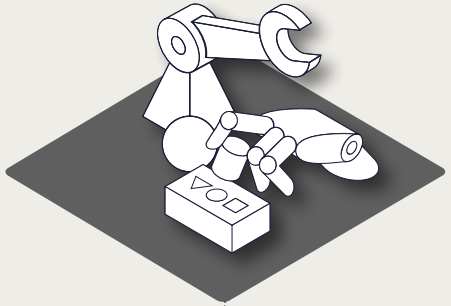
Providing appropriate solutions upon identifying product performance issues



Long-Term Service Agreement

Integrated equipment lifecycle management

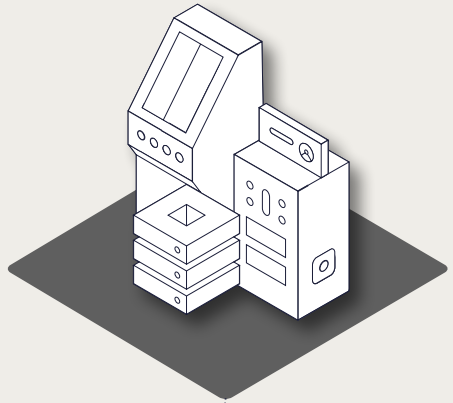
Proactive risk prevention and appropriate measures to ensure stable operation



Monitoring

Preemptive response service through real-time management

Preventive maintenance and enhanced operational efficiency through monitoring



Total Compressor Room Solutions

Facility efficiency improvement services

Comprehensive management of customer-owned compressor equipment, including operating equipment

Operational Goals

Establishment of Management System

Designated managers for fast and accurate system operation

Risk Management

Comprehensive management through regular inspections and diagnostics

Cost Savings

Increased equipment efficiency and extended lifespan

Services

Parts & Maintenance

Global	Genuine	Fast
We provide optimal service and parts through our global network of subsidiaries/offices, service centers, and warehouses.	We provide genuine parts that guarantee optimal compressor performance, maximum service life, high quality, and the best reliability.	We achieve customer satisfaction through quick and prompt handling of requests and after-sales follow-ups.

Genuine parts to guarantee optimal performance and equipment lifespan.

With over 40 years of expertise in aircraft engine design and manufacturing, we provide stable and reliable genuine parts.

Rotor Assembly	Gear Set	Bearing Set	Seal Set	Oil Pump & Hanwha Genuine Oil
				
Pinion Assembly, Impeller	Bull & Pinion Gear	Pinion Bearing, Main Driver Bearing	Air/Gas Seal (Carbon, Dry), Oil Seal, Bull Gear Seal	Main Oil Pump, Auxiliary Oil Pump

LTSA(Long Term Service Agreement)

Periodic Maintenance (S1~S4)

S1	S2	S3	S4
Recommending replacement cycles based on the inspection and diagnosis of compression equipment or device operating parameters, and analysis of inlet/outlet pressures, and system pressure.	Inspecting the oil cooling system status, checking the condition of the main rotor and bearings, preemptively identifying potential issues, and examining the status of the drive unit.	Checking for damage to the air-end components caused by the usage environment, removing impact factors in advance, and inspecting the progress, pressure, and temperature sensors.	Minimizing aerodynamic losses through core decomposition tests and key component replacements, rotor balancing, and more.
4,000hrs 0.5y	8,000hrs 1.0y	24,000hrs 3.0y	40,000hrs 5.0y

S1
Preventive Services/ Monitoring

S2~4
Planned Maintenance

Benefit

Estimate costs based on periodic inspections and diagnostics.
Established unit price during the contract period.

Systematic management of compressors and auxiliary equipment.
Real-time management through Hanwha's proprietary Remote Monitoring System (RMS).

Accident management based on accumulated data.
Planned and preventative services based on the customer's shutdown schedule.

Providing the latest compressor technology information and networking opportunities.
Project plan management.

Efficient equipment operation and lower operating expenses(OPEX)

Extending equipment lifespan and maintaining performance

Minimizing various risk factors and risks

Customer-centric technical service support

Services

Monitoring

We extend compressor lifespan, maximize availability, and minimize downtime through remote monitoring.

Local HMI	Remote Status Monitoring	AM product recommendation
Dashboard (Local HMI)	SMS & Email, Web & Mobile	• Operational information analysis • Periodic reports • Customized parts replacement • Regular inspections • Energy saving measure suggestions
M2M Gateway Serial, Ethernet	**Cloud Server** Secure Connect Manager	**Hanwha Monitoring Center** Smart Care Monitor

Total Compressor Room Solutions

We assess the overall operation of the customer's compressor room air system and recommend the most efficient equipment operation strategies. By measuring and analyzing actual operational data, including flow rates and power consumption, we recommend energy-saving and cost-effective compressor operation measures. Diagnostics typically take up to two weeks.

Process

Reception
Diagnosis introduction, request reception
Subject to the entire compressor room

Diagnosis
On-site inspection
Installation and operation status, P&ID, VOC submission, etc.

Data collection
Flow/pressure/current measurement
Developing energy-saving measures

Reporting
Improvement suggestions and presentations
Deriving improvement solutions through performance efficiency calculations

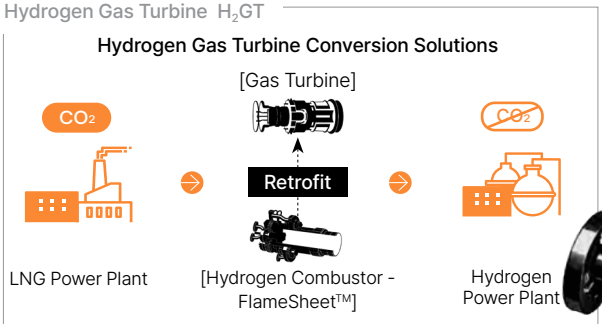
Data Analysis
Operational patterns, non-power calculations
Analyzing the correlation between compressor operating conditions and energy consumption

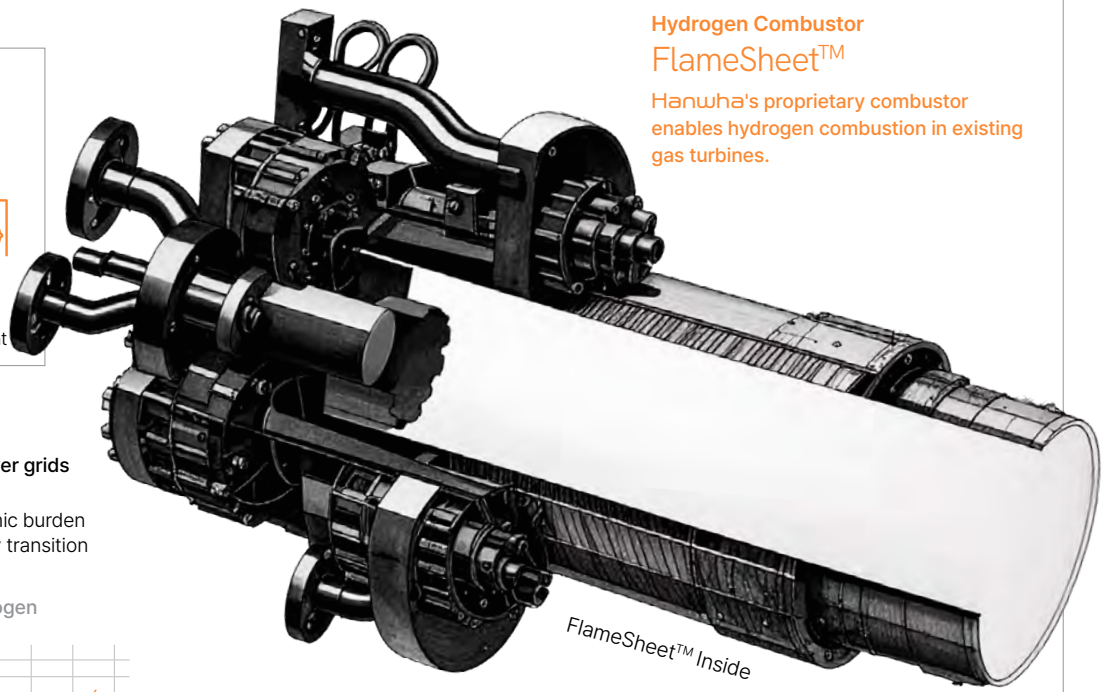
GAS TURBINE HYDROGEN SOLUTION

Hanwha Power offers a hydrogen turbine solution that retrofits gas turbines combustors fueled by LNG, enabling full hydrogen combustion or co-firing with natural gas. This solution reduces CO_2 emissions while utilizing existing gas turbines.

H_2 Turbine Power Generation Solutions

Hydrogen Gas Turbine H_2GT





Hydrogen Combustor

FlameSheet™

Hanwha's proprietary combustor enables hydrogen combustion in existing gas turbines.

Key Benefits

Advantages of utilizing existing assets

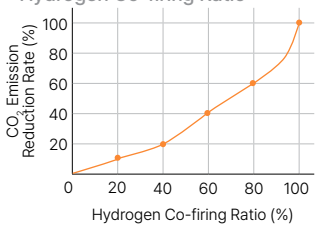
Minimal equipment investment, such as replacing combustors

- Transition to low-cost, eco-friendly hydrogen power generators

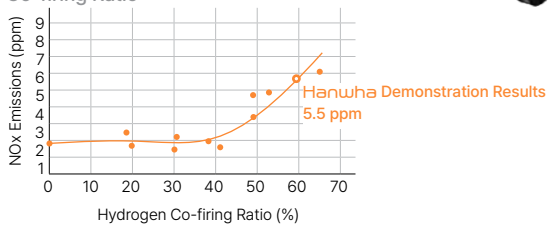
Leveraging existing power grids and infrastructure

- Reducing socioeconomic burden associated with energy transition

CO_2 Reduction Rate by Hydrogen Co-firing Ratio



NOx Emissions by Hydrogen Co-firing Ratio



Hanwha Power's hydrogen turbine technology has already been proven in numerous international sites and has successfully increased the co-firing ratio in a short period through domestic demonstration projects.

Turbine Retrofit Demonstration Cases

30%
Hydrogen co-firing operational site
(Netherlands, 2018-)

40%
Hydrogen co-firing operational site
(US, 2023-)

100%
Successful hydrogen combustion demonstration site
(Daesan, 2023-)

GAS TURBINE INDUSTRIAL SOLUTION

We offer comprehensive services(Long Term Service Agreement) for power generation gas turbines, including parts manufacturing, repairs, planned maintenance, routine maintenance, and rotor maintenance, leveraging more than 30 years of our expertise in aircraft gas turbine manufacturing and maintenance technologies.

1 Part supply

Development and manufacturing of upgrades that circumvent patents and improve the vulnerabilities of OEM products.

2 Part repair

General repairs, residual service life prediction, and replacement of vulnerable parts

3 Plan/Regular Maintenance

Systematic maintenance services by dispatching expert supervisors

4 Rotor Life Extension

Lifespan extension through rotor balancing and maintenance of steam and gas turbines

5 Long Term Service Agreement

Reduced customer lifecycle costs through comprehensive and flexible long-term service agreements.

MARITIME SOLUTIONS
FOR OCEAN, FOR EARTH

Hanwha Power provides technologies and solutions to address various environmental regulations and support the advancement of eco-friendly marine industries.

① Eco-friendly retrofits

② Fuel transition

③ Carbon-reducing solutions

④ Cargo loading optimization

Marine Solutions Business

Hanwha Power provides tailored, competitive solutions to address the environmental challenges of the marine industry, driving the success of every project.

① Optimized Solutions

Providing analysis and customized solutions for vessels.

② Market Insight

Market analysis and technical solution development.

③ Sustainable Support

Warranty services and vessel lifecycle support.

Fast and reliable warranty services

Optimal solutions complying with environmental regulations and economical operational guidance, while reducing Total Cost of Ownership(TCO)*

Maximized convenience by supplying necessary parts and top-tier technical services

Implementation of smart ship solutions based on diverse IT technologies

*Total Cost of Ownership

Turnkey Execution

Design and engineering expertise	Procurement capabilities	Quality and risk management	Comprehensive project management

Core Technologies

Hanwha Power proactively responds to the rapidly growing green solutions market driven by tightening environmental regulations, offering innovative and competitive solutions that enhance vessel performance. Our goal is to provide customers with cost-effective, optimized solutions that contribute to achieving environmental sustainability.

① Energy-Saving

BOG Re-liquefaction Air Lubrication System Rotor Sail	Propeller Optimization Bulbous Bow Wind Saver Cap

We reduce fuel consumption during vessel operations, contributing to both economic efficiency and environmental protection. To improve energy efficiency, we utilize various methods such as replacing aging facilities and equipment and improving hull design.

② Conversion

LNG/MeOH/NH_3 Dual Fuel LNGC to FSRU	Ammonia Gas Turbine

We can minimize environmental pollution and secure fuel flexibility according to stricter vessel emissions regulations. We are constantly driving innovation to shift toward low-carbon fuels.

③ General Retrofit

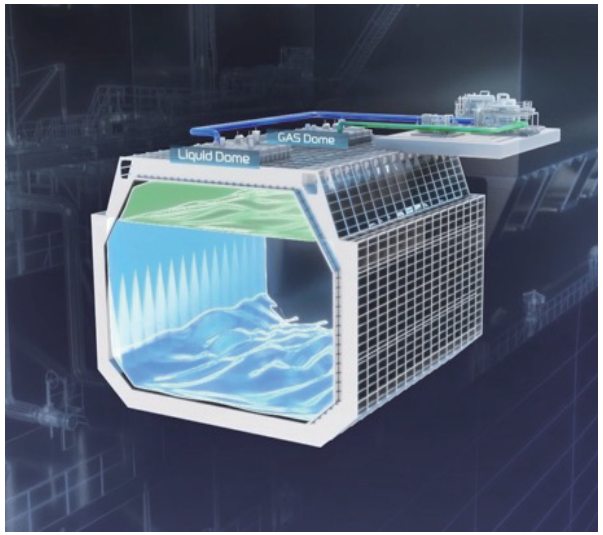
OCCS	Cargo Capacity Improvement

We improve the structure of existing vessels to enhance overall performance and maximize fuel recycling to increase vessel efficiency. Our goals include improving fuel efficiency, reducing carbon emissions, and cutting costs.

① Energy-Saving

BOG Re-liquefaction

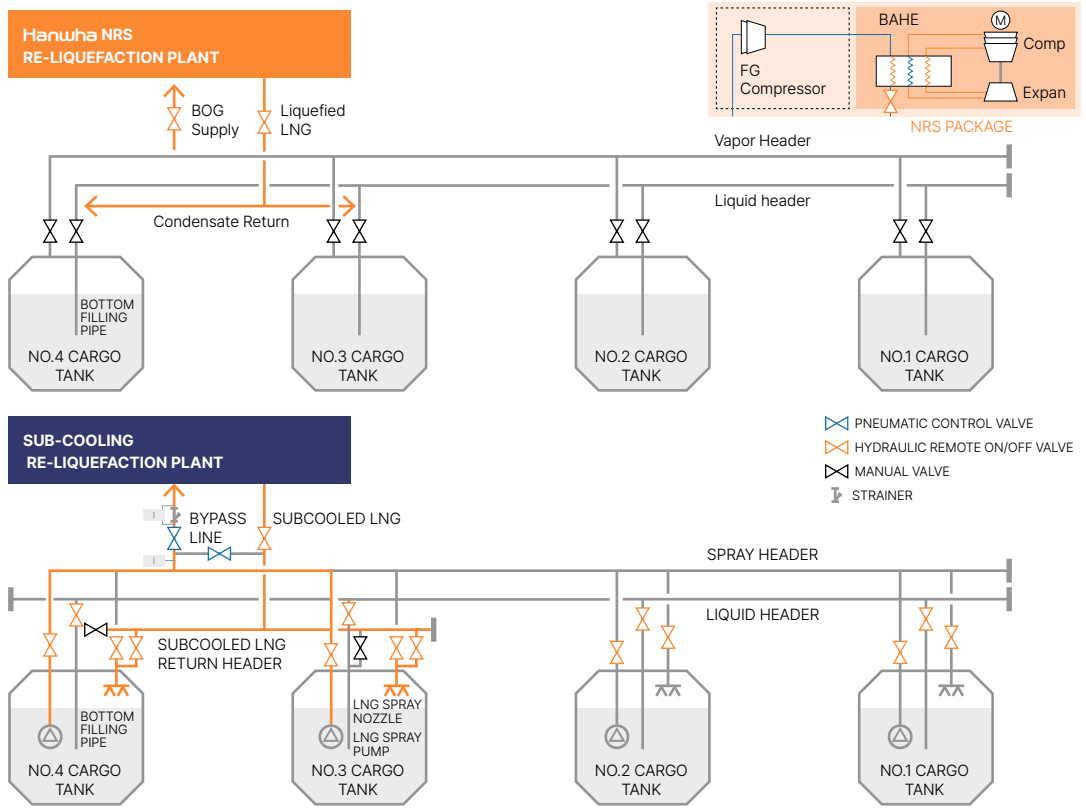
Re-liquefaction systems offer a more efficient and cost-effective way to manage boil-off gas (BOG) generated from existing LNG carriers. This solution saves costs while supporting environmental compliance. Hanwha's proprietary NRS® (Nitrogen Refrigerant System), specially designed for LNG carriers, reliquefies BOG using the cooling efficiency generated through N_2 compression and expansion via N_2 Reverse Brayton cycle.



Retrofit Concept(Scope of Work) :

① Re-liquefaction System
(Hanwha NRS / Sub-cooler)
② Cooling Sea/Fresh Water Pump/Cooler in Engine Room
③ Electrical Modification

Re-liq. Capacity :
Hanwha NRS(2.1/2.8 TPH),
Sub-cooler(1.5/2.1 TPH)



① Energy-Saving

Air Lubrication System(ALS)

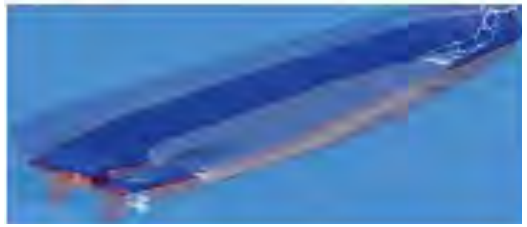
Air Lubrication System(ALS) is a technology that reduces friction between the hull and the water by creating a layer of microbubbles beneath the hull.
Reduced friction significantly improves operational and fuel efficiencies.

Principle of ALS

Air is effectively delivered from the air compressor to the air outlet, and the discharged air effectively creates a layer of air beneath the hull and the free-flowing liquid.

Air Outlet Hole

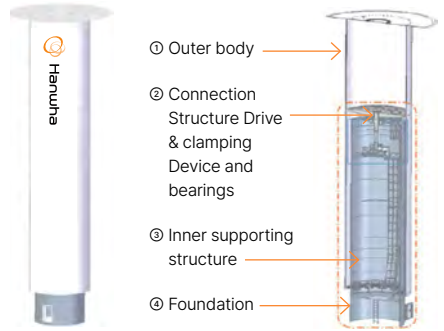
Air Layer



Rotor Sail

The rotor sail system is a device using the Magnus effect(a phenomenon that generates thrust) to create pressure differences between the front and rear of the rotor. This technology is recognized as one of the leading eco-friendly solutions that satisfies GHG regulations. Hanwha is spearheading the field by establishing the world's first Rotor Sail System demonstration center.

Design Review



Power & Fuel saving and EEDI

LNGC
25M (L) X 5M (D)
Number of Rotor sail

Power saving @17.0knots
2.7%[1] ~ 11.2%[2]
5.1%[1] ~ 22.4%[2]

VLCC
35M (L) X 5M (D)
Number of Rotor sail

Power saving @12.0knots
3.7%[1] ~ 13.4%[2]
7.4%[1] ~ 26.8%[2]
10.8%[1] ~ 39.1%[2]

* Regular Inspection Period for Hanwha Rotor Sail : Every 2.5 years
* Consumable item (Timing belt) : Every 2.5 years

* Calculation according to MEPC 76 Guidance based on global wind probability
* Calculation under the most favorable wind condition

① Energy-Saving

Propeller Optimization/Bulbous Bow

Hanwha Power offers a range of energy-saving device solutions that help reduce fuel costs, comply with regulations, and improve efficiency.

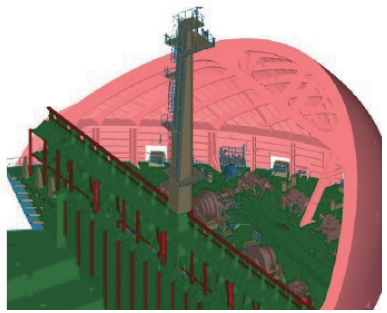
ESD	
Bulbous Bow Retrofit ① Reduced hull resistance ② Increased propulsion efficiency ③ Decreased carbon emissions and fuel consumption **Net Power Saving : 4~5%**	**Propeller Optimization** ① Reduced fuel consumption through improved efficiency ② Reduced carbon emissions by optimizing fuel consumption ③ Reduced vibration and noise **Net Power Saving : 3~5%**

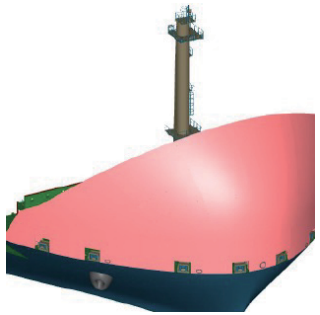
Wind Saver Cap

- Evaluates wind direction cover design using a numerical wind tunnel.
- Effectively reduces wind resistance of container stacks.
- Measures wind speed and direction under full load conditions, considering wind speed and direction.

Expected Efficiency (increased efficiency) : 1.5~2%

3D View for Wind Saver Cap





② Conversion

LNG Dual Fuel Conversion

Dual Fuel Conversion of vessels involves retrofitting the propulsion system, including the main engine and fuel system, to enable it to run on alternative fuels. This process ensures regulatory compliance by improving fuel flexibility, reducing emissions, and lowering operational costs. Dual-fuel conversion is the most efficient and reliable solution for meeting both IMO and regional decarbonization regulations.

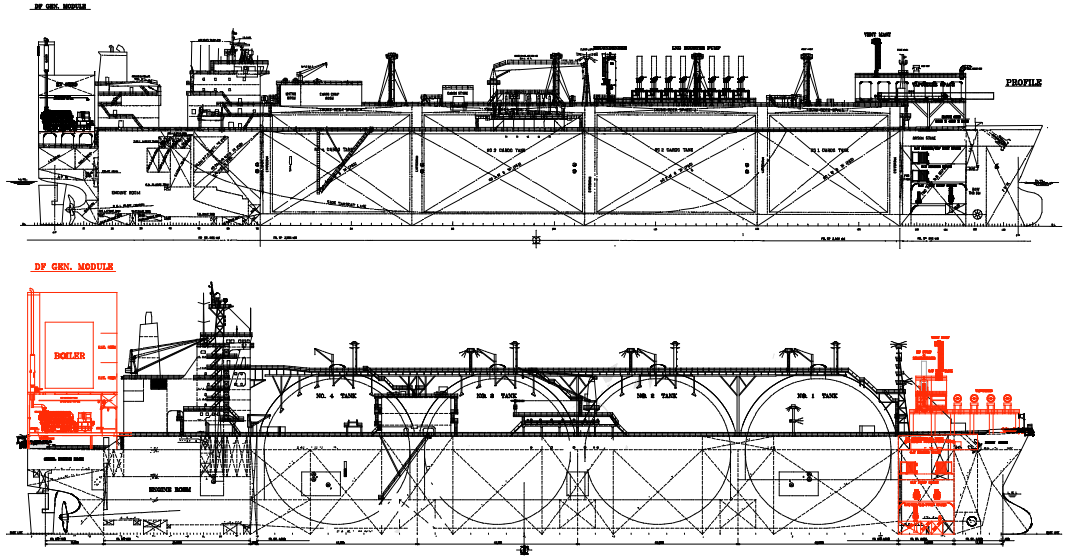
Retrofit Concept(Scope of Work) :
① Main Engine Retrofit
② Fuel Gas Supply System with Bunker Station
③ Alternative Fuel(LNG, Methanol, Ammonia) Tank

Technical Benefit :
Compliance with GHG regulations, Fuel Flexibility

Reference(incl. new building & Retrofit) : Total 7 vessels

LNGC to FSRU Conversion

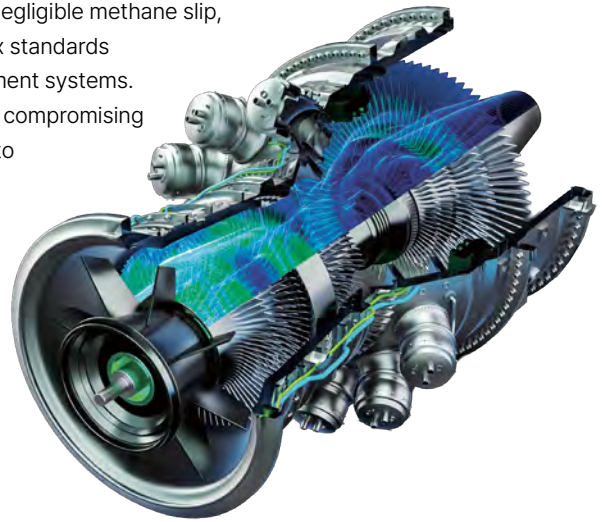
The FSRU conversion market is growing, driven by rising LNG demand, cost and time efficiencies, and the need for flexible energy solutions amid geopolitical uncertainties. The advantages of FSRU retrofits include reduced capital expenditures(CAPEX), shorter lead times compared to new builds, and the ability to utilize older vessels. This not only reduces environmental impact but also allows operators to adapt efficiently to changing market conditions, maximizing return on investment(ROI).



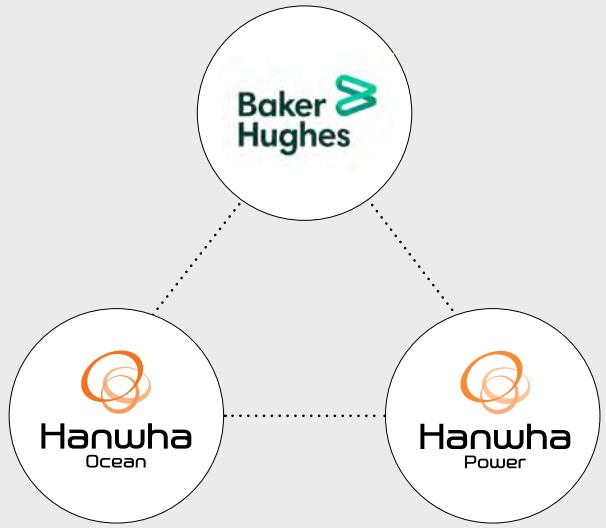
② Conversion

Ammonia Gas Turbine

Leveraging Hanwha Group's proven strengths in sustainable solutions and broadening our scope, we are fully committed to developing next-generation ammonia gas turbines in partnership with energy technology leader Baker Hughes. These turbines are designed for use on 174K LNG carriers as well as container ships of various sizes. They are capable of running on 100% ammonia — with zero pilot oil— enabling truly carbon-free operations.
In addition, they offer outstanding fuel flexibility, operating on 100% ammonia, 100% natural gas (NG), or any ammonia-NG blend. This versatility ensures cost-effective performance in line with future fuel prices and emissions regulations. Emissions are kept to an absolute minimum, with negligible methane slip, ammonia slip, and NO emissions, while still meeting Tier III NOx standards for large low-speed engines - without the need for after-treatment systems. Their compact design allows for ammonia fuel storage without compromising cargo capacity, and they include dedicated safety enclosures to address the unique handling requirements of ammonia fuel.



Applicable to All Commercial Vessels	**Full Carbon-Free Operation**	**Negligible CH_4, NH_3 slip and N_2O emissions**	**Increased Fuel Flexibility and Affordable Costs**

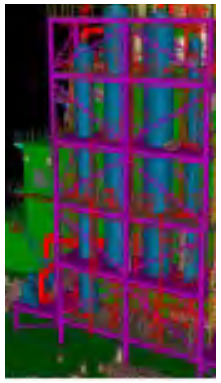


Joint development between three companies in progress

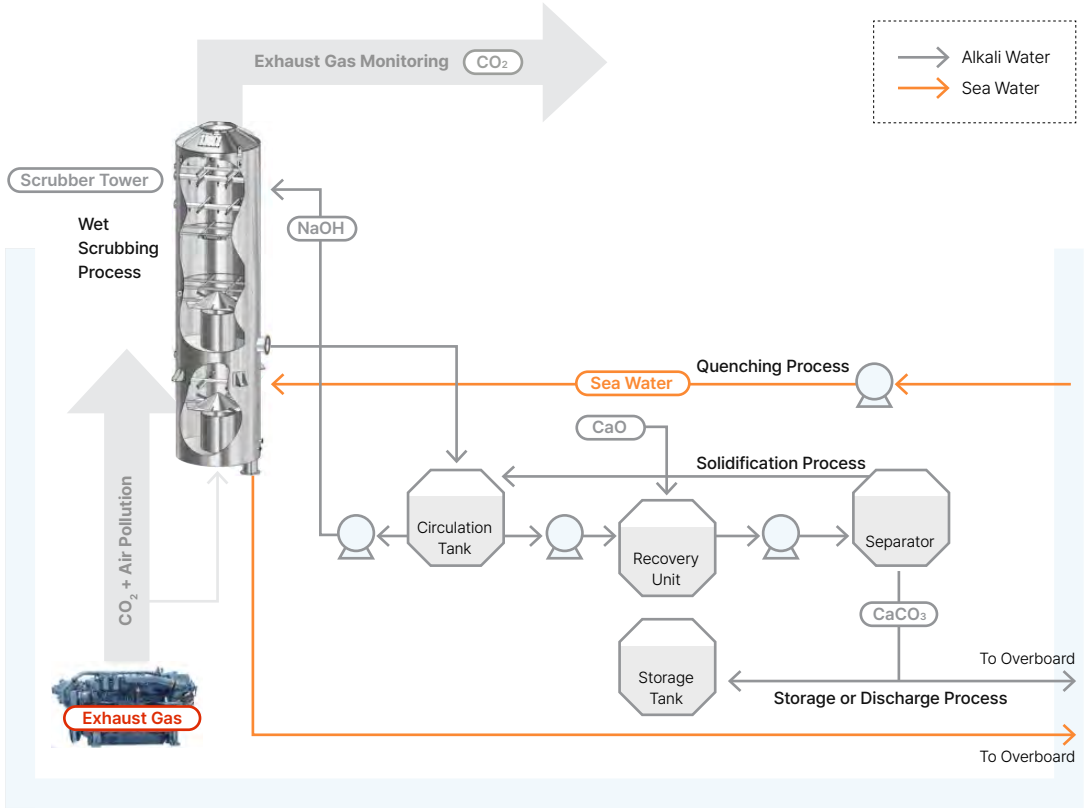
③ General Retrofit

OCCS(Onboard Carbon Capture & Storage)

Onboard Carbon Capture & Storage(OCCS) is a technology that captures carbon dioxide emitted during vessel operations and stores it onboard or transports it to land for storage. This is a key technology that reduces carbon emissions from vessels and contributes to achieving the maritime industry's carbon neutrality goals.



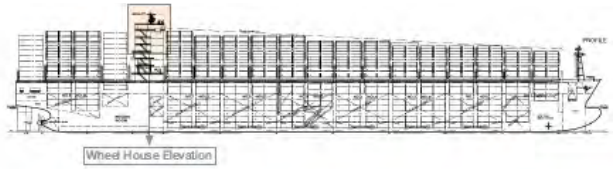
- CO_2 absorption using NaOH solution
- Continuous carbon absorption and energy regeneration
- Physical separation of $CaCO_3$ using a filter



③ General Retrofit

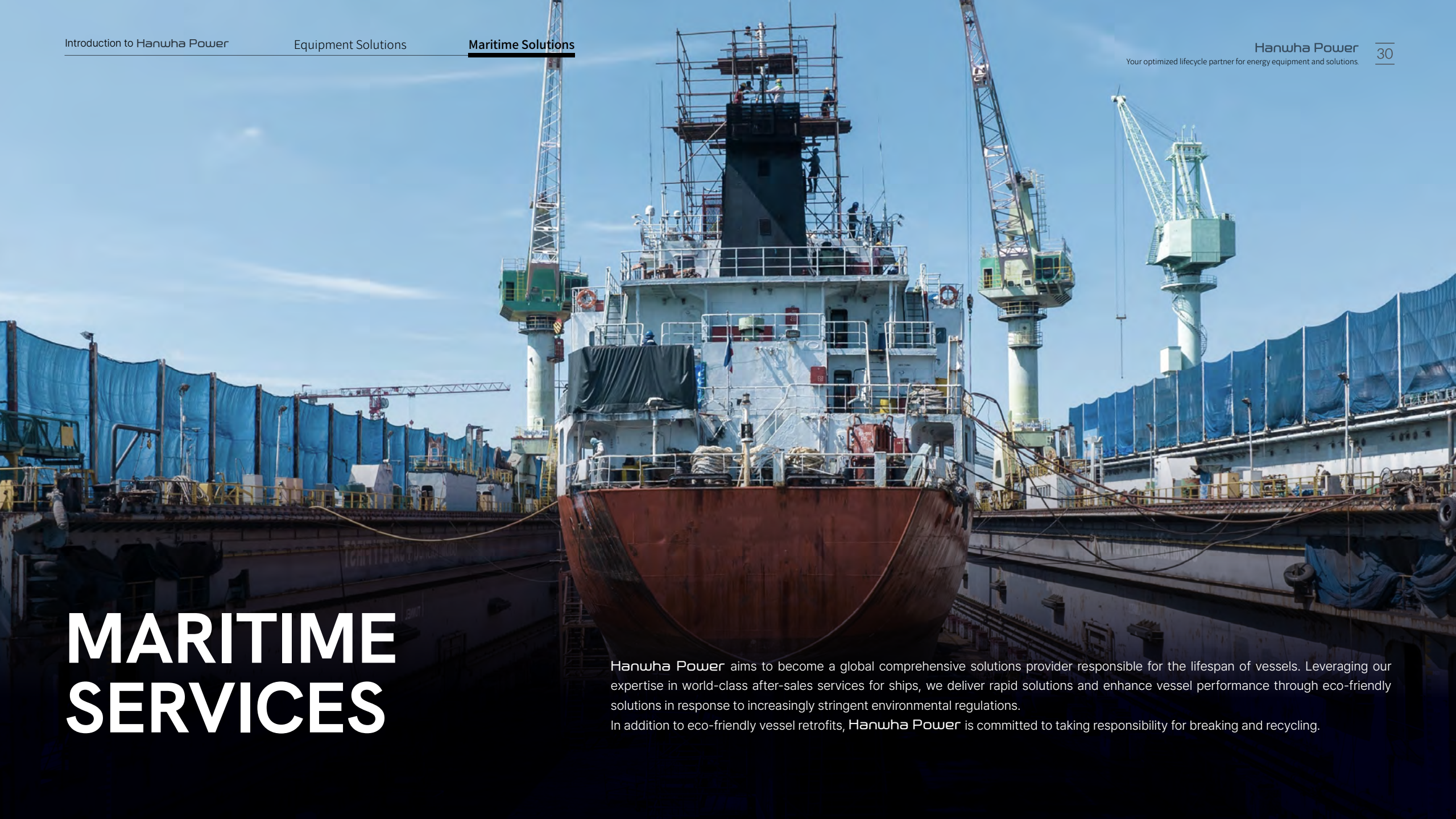
Cargo Capacity Improvement

Hanwha Power offers solutions that maximize shipping companies' profits from container ships.
We maximize transport capacity by increasing the cargo capacity and number of units. This can be achieved with relatively low costs and a short construction period compared to other retrofit projects.



Accommodation (Deck House) Elevation

Higher Lashing (Additional Tier) With Mickey Mouse

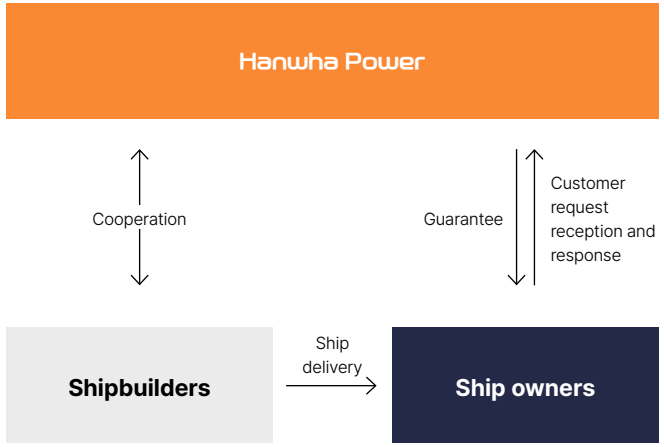


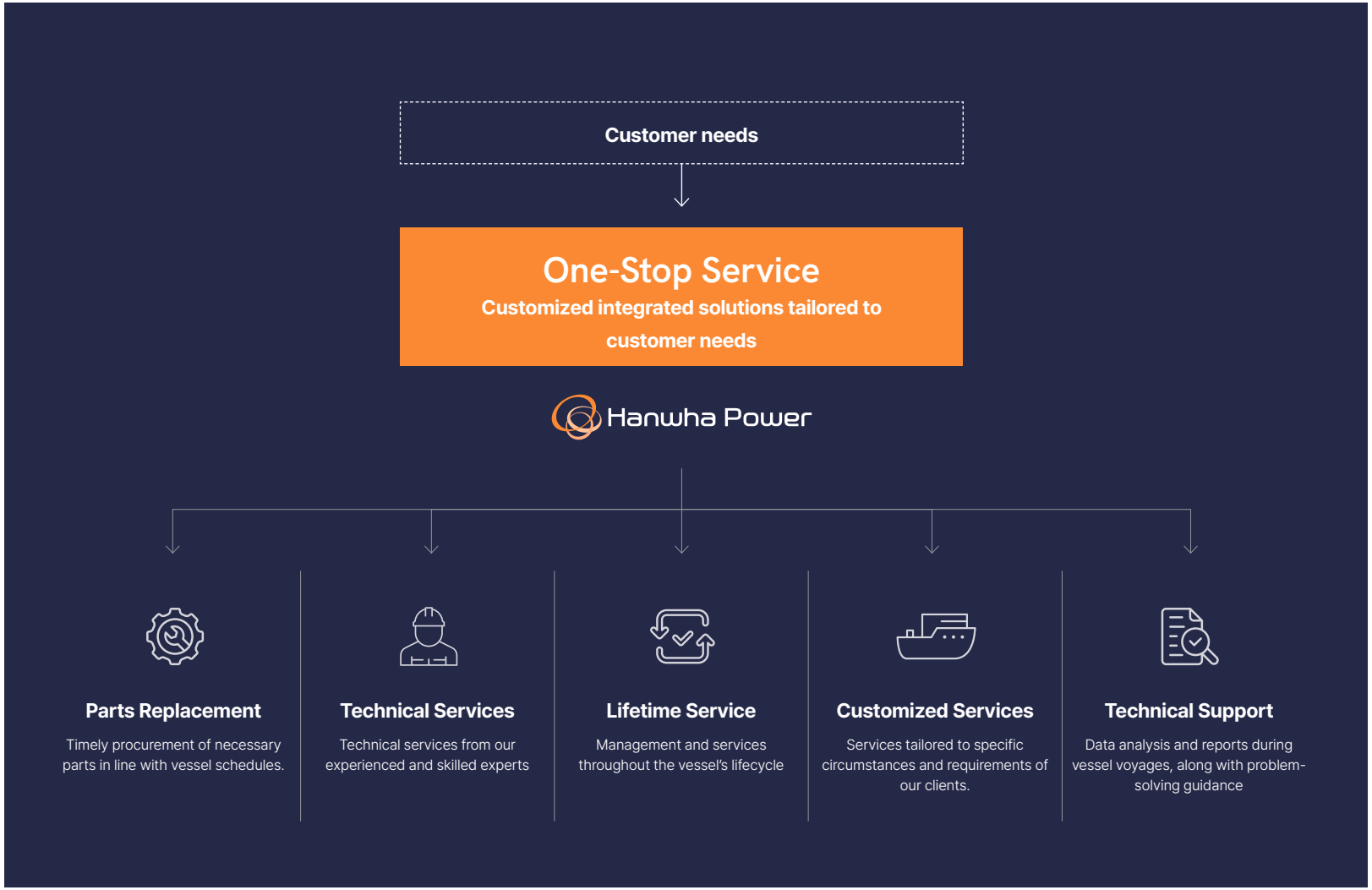
MARITIME SERVICES

Hanwha Power aims to become a global comprehensive solutions provider responsible for the lifespan of vessels. Leveraging our expertise in world-class after-sales services for ships, we deliver rapid solutions and enhance vessel performance through eco-friendly solutions in response to increasingly stringent environmental regulations.
In addition to eco-friendly vessel retrofits, Hanwha Power is committed to taking responsibility for breaking and recycling.

One-Stop Service

Hanwha Power provides post-warranty services for various types of vessels(LNGCs, tankers, containerships, LPGCs, etc.) and specializes in proactively addressing customer demands.
Hanwha Power provides flexible and rapid solutions that prioritize safe and efficient operation of vessels. Our goal is to offer a comprehensive care service that minimizes customer inconvenience by delivering high quality technical support.





Hanwha Power