



## OUR STORY

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- Identification
- About CRYOS
- Location
- History
- Organization
- Certificates

## OUR BUSINESS

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- Business Field
- Customers
- Corporation Capability
- Design & Engineering
- Production Capability
- Facilities & Equipment

## OUR REFERENCE

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- Cryogenic Storage Tank
- Pressure Vessel
- Back-up System & Flatbottom Storage Tank
- Supply System Package
- Ship & Shore Tank
- Mobile Tank
- Hydrogen Equipment



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CRYOgenic System [kri:os]

Specialist of cryogenic system



Ultra Low Temperature



Tank, Pipe



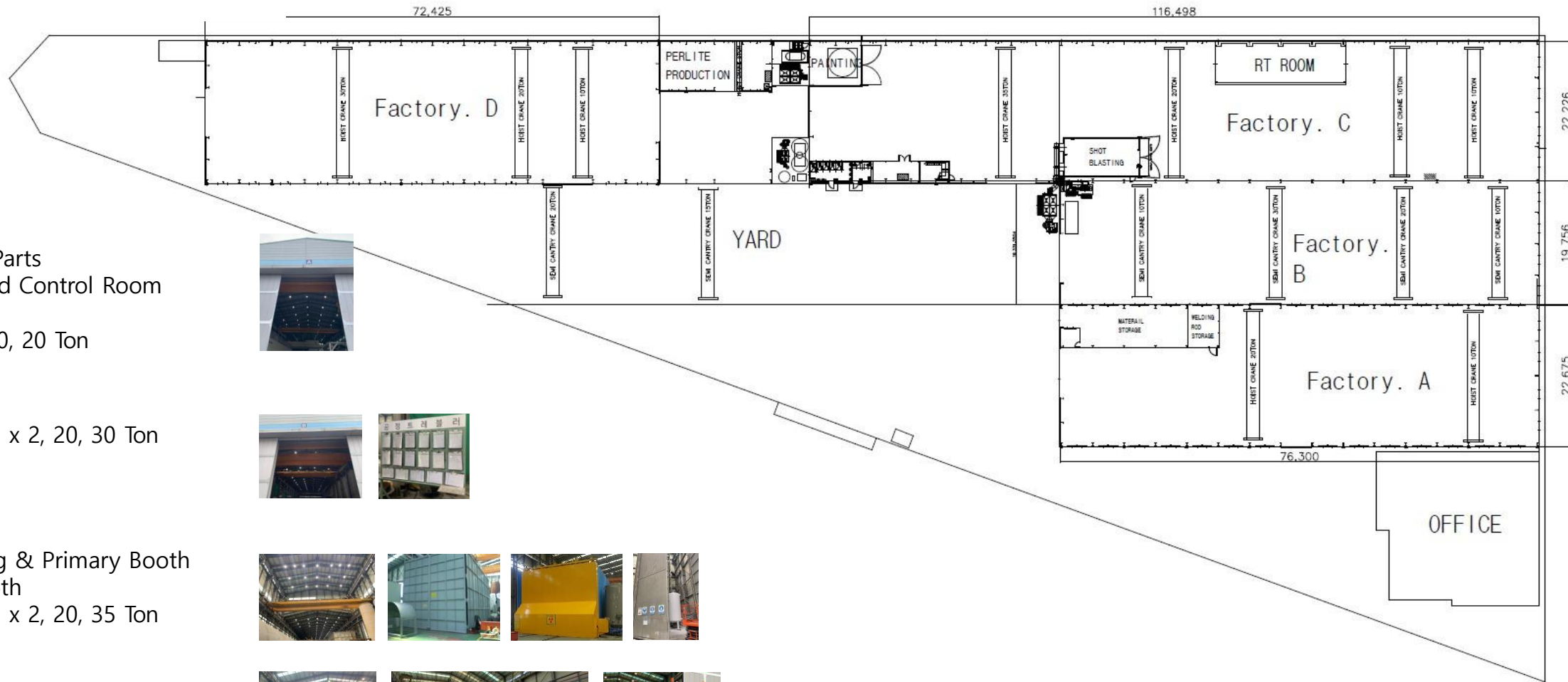
Liquefied gas



*The world most reliable cryogenic system provider*



Company Name	CRYOS CO.,LTD.				
CEO	Daeseong KIM				
Address ( office & factory )	Hawjeonsandan 1ro 155, Gangseo.gu, Busan 46741 Korea				
Area ( m <sup>2</sup> )	Total	Factory	Storage Yard	Open Area	Floor Space
	14,423	7,856	1,680	6,168	2,423



## A

- Storage of Parts
- Welding Rod Control Room
- MLI Room
- Cranes of 10, 20 Ton



## B

- Cranes of 10 x 2, 20, 30 Ton



## C

- RT room
- Shot Blasting & Primary Booth
- Painting Booth
- Cranes of 10 x 2, 20, 35 Ton



## D

- Large Equipment Manufacturing
- Cranes of 10, 20, 30 Ton



## Other

- Perlite Production Facility

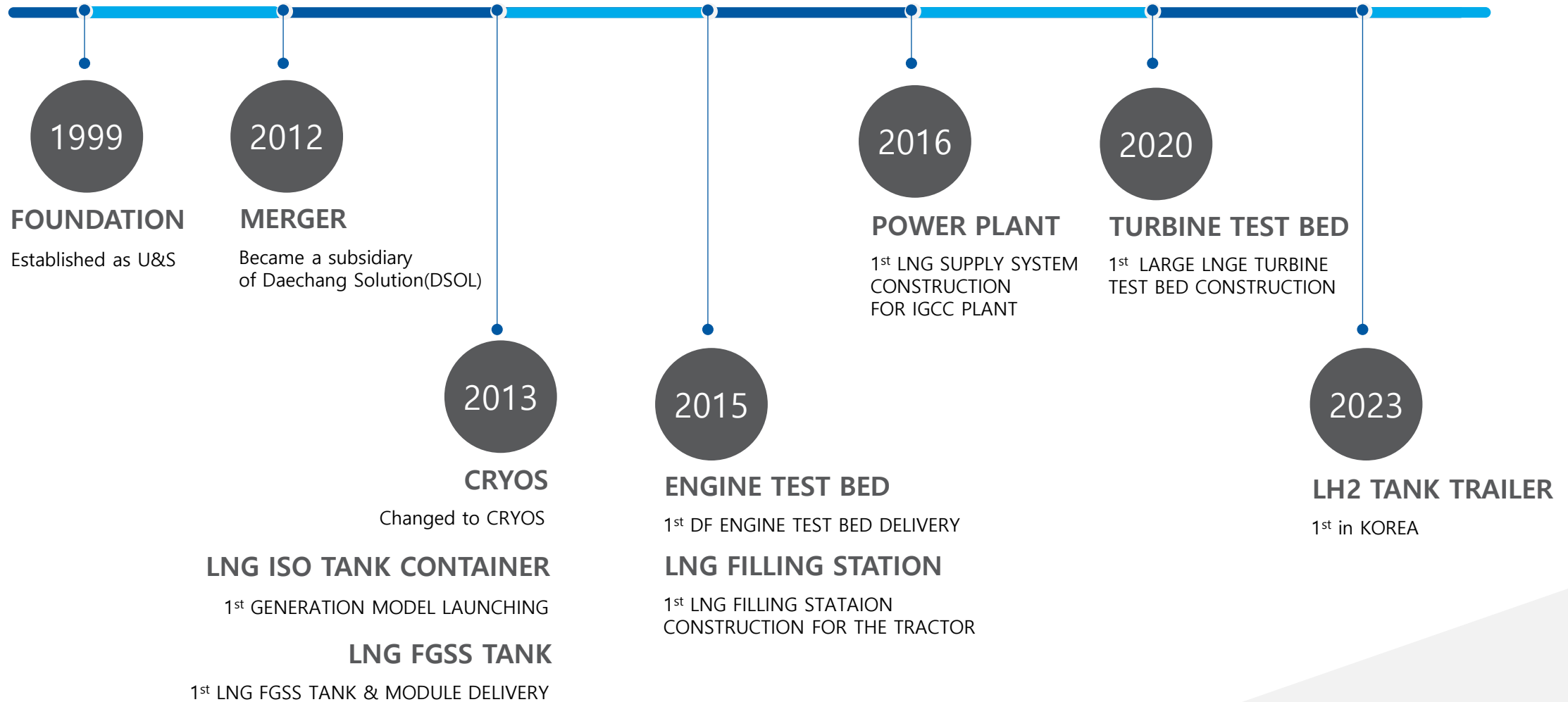
## Yard

- Gantry Cranes of 15, 20 Ton
- LIN, LAr, LCO2 Storage System

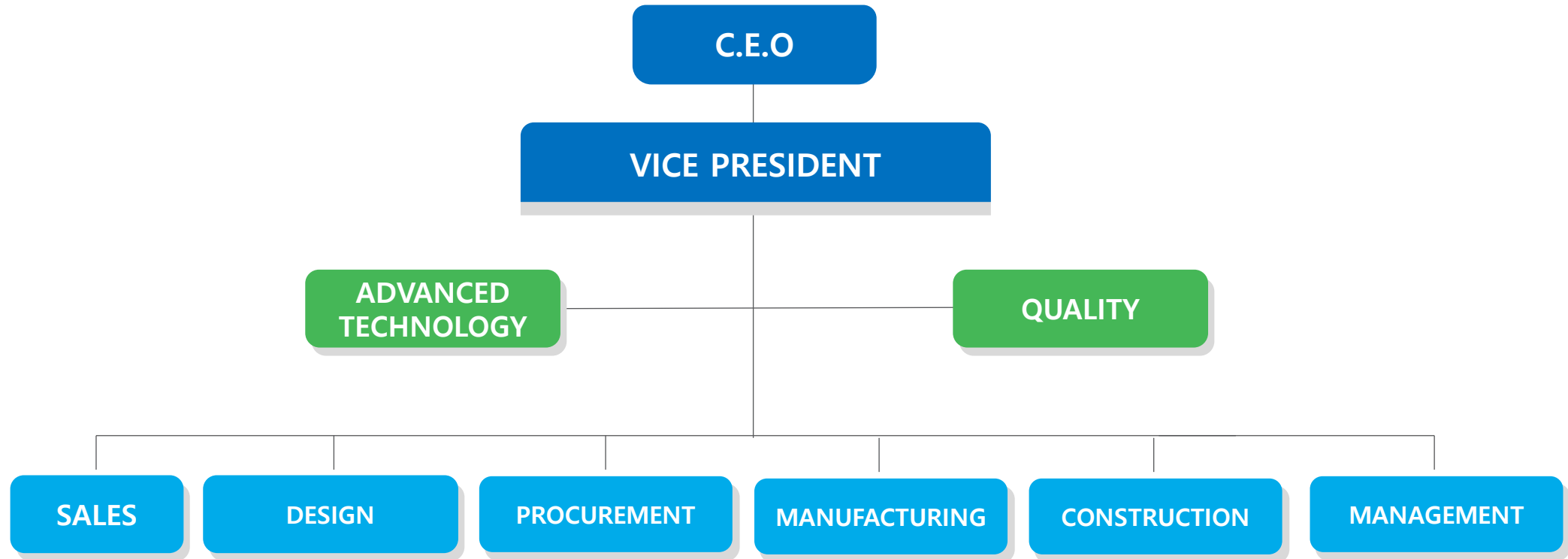












## ➤ MANAGEMENT SYSTEM

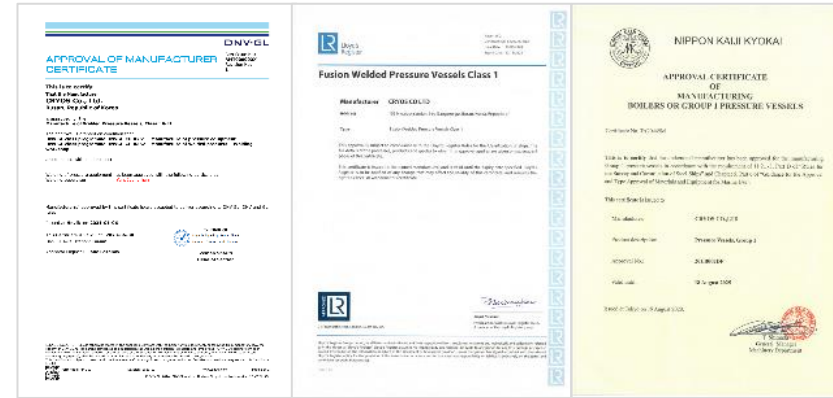


QUALITY  
ISO 9001:2008

ENVIRONMENTAL  
ISO 14001:2004

SAFETY & HEALTH  
ISO 18001:2004

## ➤ CLASSIFICATION



DNV

LR

NK

## ➤ ASME



ASME "U, U2, S, T" STAMP

NB

## ➤ TYPE APPROVAL



KR  
/ Pressure  
Vessel

KR  
/ Containers

BV  
/ Containers

CSEL  
/ Containers

## **OUR BUSINESS**

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- Business Field
- Customers
- Corporation Capability
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➤ **BUSINESS CONSTRUCTION**



**CRYOGENIC STORAGE TANK**



STATIC  
LAND PLANT



MOBILE  
TRANSPORTABLE

**SYSTEM CONSTRUCTION**

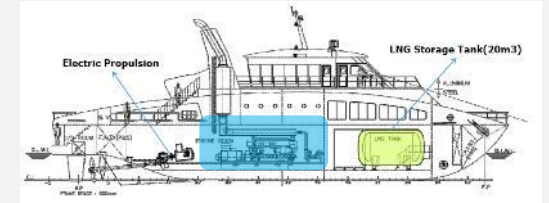


LNG, INDUSTRIAL  
GAS SUPPLY  
SYSTEM



MINI SCALE LNG  
POWER PLANT

**FGSS LNG STORAGE TANK**

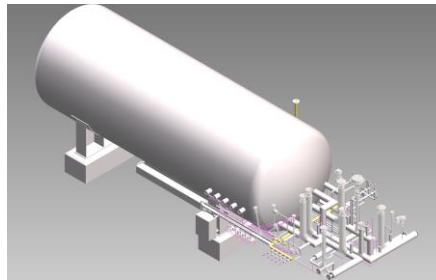


LNG STORAGE TANK  
FOR LNG FUELED SHIP

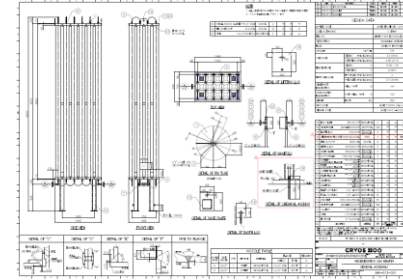
➤ **LIQUIDE HYDROGEN (LH2)**



LH2 TANK TRAILER



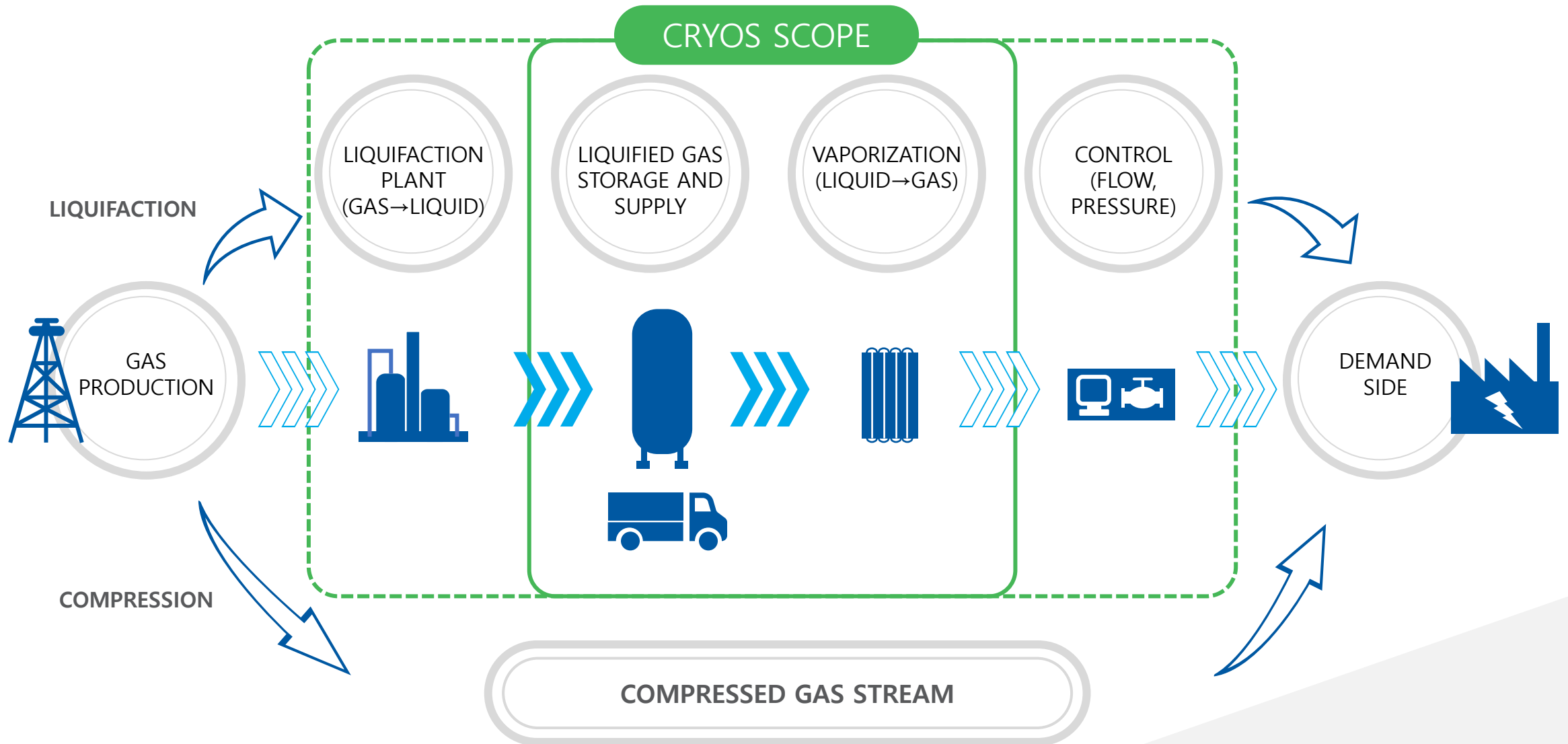
LH2 STORAGE TANK



LH2 VAPORIZER



LH2 FILLING STATION



## ➤ ENERGY



## ➤ INDUSTRIAL GAS





- . AUTO CAD
- . Solid Edge, Inventor
- . Compress (Vessel calculation)
- . HYSYS
- . Auto cad 3D Plant, Cadwox
- . HMI

Code  
&  
Standard

- . ASME (Sec.VIII Div.1&2 & Sec.I)
- . KGS, KHK Code
- . KS / JIS /ISO Code
- . Classification (USCG / ABS / DNV / Lloyd)
- . IMDG, CSC, DOT, ADR, RID
- . Others (BS 5500, TEMA, API 620 / 650 10th, KOSHA)

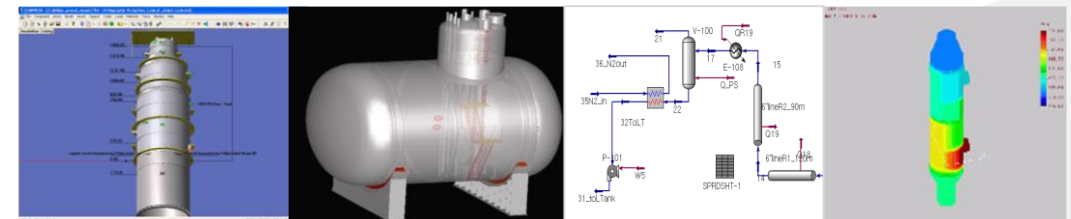
Computati  
on Design

Finite  
Element  
Analysis

- . Midas NFX(static/ heat/ dynamic, trans heat...)
- . ABAQUS
- . ANSYS & NISA

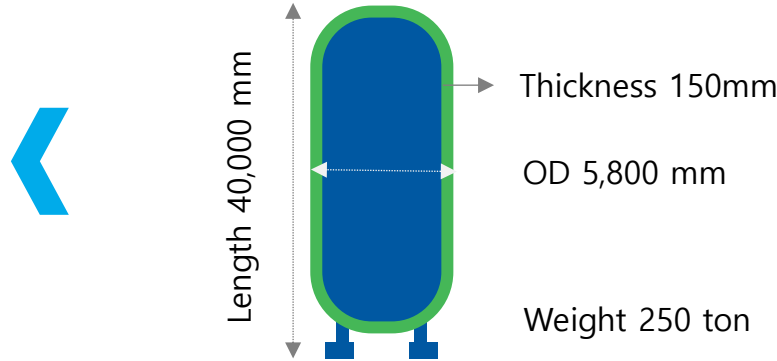
Wind &  
Seismic  
Analysis

Thermal  
Calculation



## FABRICATION MOBILIZATION

IN-HOUSE FABRICATION



ON-SITE FABRICATION

## MATERIAL

- . Austenitic Stainless Steel
- . Carbon Steel
- . Nickel Alloy Steel
- . Aluminum & Alloy
- . High Tensile Strength Steel (600MPa)

### Special Alloy Materials for LNG

- . 9% Nickel Steel : Type C. Vacuum Type
- . High Mn. Steel : Type C



High-Mn Cryogenic IMO Type-C Tank (2015)

## COLD-STRETCHING

- . TUV certified  
(PED 97/23/EC & AD2000, EN13458-2 C, #CS-TI-18)
- . Korean Patent #10-1892023
- . High Mn. Steel Mock-up Tank
- . Cooperated with POSCO, DSEC, CRYOS
- . Cold Stretch Procedure for Cryogenic Inner Vessel
- . Design Temperature : -196~50°C,
- . ID: 1000~2500mm /L: 1000~25000mm /T: max. 12t

## WELDING MACHINE <

- . ARC WELDING
- . AUTO WELDING
- . CO2 WELDING
- . ARGON TIG WELDING



## INSPECTION & TEST <

- . Helium Detector
- . Vacuum Gauge
- . Dry Film Thickness Tester
- . (Elocometer)
- . Pressure Recording Meter
- . Perlite Moisture Meter

. **RT Room**  
**6M\*6M\*30M**



## > SURFACE TREATMENT & PAINTING

- . Shot Blasting Room
- . 6M\*6M\*12
- . Painting Room
- . 10M\*10M\*L10M



## > PERLITE & VACUUM

- . Vacuum Pump
- . In-house Perlite Mfg. Equip



## > INSULATION WORK-OUT ROOM

- . MLI & Vacuuming Works
- . Temperature & Humidity Control
- . No Dust & Oil

## OUR REFERENCE

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- Cryogenic Storage Tank
- Pressure Vessel
- Back-up System & Flatbottom Storage Tank
- System Package
- Ship & Shore Tank
- Mobile Tank
- Hydrogen Equipment

# PART 3. CRYOGENIC STORAGE TANK

## Bahrain LNG Import Terminal



LOCATION	Bahrain
EPC	GS E&C
CUSTOMER	Air Liquide Engineering
DELIVERY	2018
SUPPLY	30m3 LIN Storage Tank 1 unit

## POSCO ESM



LOCATION	Korea
OWNER	POSCO CHEMICAL
CUSTOMER	Air Products Korea
DELIVERY	2020
SUPPLY	222m3 LIN STORAGE TANK 1 unit 333m3 LOX STORAGE TANK 1 unit

## NSRP Complex



NGHI SON REFINERY AND PETROCHEMICAL LLC



TAIYO NIPPON SANSO  
The Gas Professionals



LOCATION	Vietnam
EPC	SK E&C, JGC
CUSTOMER	TAIYO NIPPON SANSO
DELIVERY	2015
SUPPLY	500m3 LIN Storage Tank 4 units

## SK Hynix M16



LOCATION	Korea
OWNER	SK HYNIX
CUSTOMER	SK Airgas
DELIVERY	2019
SUPPLY	270m3 LAr STORAGE TANK 2 units 270m3 LOX STORAGE TANK 2 units 200m3 LIN STORAGE TANK 2 units

## > SK Hynix M14&15



LOCATION	Korea
CUSTOMER	Air Liquide Engineering Japan
DELIVERY	2017~2018
SUPPLY	Catalytic Reactor Molecular Silver Tower Water Separator Drain pot Trim Heater Vessel Electrical Reactivation Heater Vessel CnHm Purge Vaporizer

## > National Organization



LOCATION	Korea
OWNER	National Organization
DELIVERY	2019
SUPPLY	High Pressure Air Tank 3 Units . Volume : 367m3 . D.P : 4.95MPa

## > SHI\_SHE PJT



LOCATION	JAPAN(HIROSHIMA)
OWNER	SUMITOMO HI
DELIVERY	2024
SUPPLY	. SOFT WATER TANK 128.5M3 * 2.5Mpa . SOFT WATER TANK 27M3 * 1.2Mpa . MOLTEN SALT TANK 109M3 * 0.2Mpa . MOLTEN SALT TANK 109M3 * 0.2Mpa



# C BACK – UP SYSTEM & FLATBOTTOM STORAGE TANK

## > HYUNDAI STEEL LOX Back-up System



LOCATION	Korea
ASU PLANT	Daesung Industrial Gas
CUSTOMER	Hyundai Rotem
DELIVERY	2013
SUPPLY	6,000m3 LOX Flat Bottom Tank 2,000m3 LIN Flat Bottom Tank 1,000m3 LAr Vacuum Insulated Tank 50m3 LOX Cryogenic Storage Tank 50m3 LIN Cryogenic Storage Tank

## > KOREA ZIN LOX Back-up system



LOCATION	Korea
ASU PLANT	Air Liquid
CUSTOMER	Korea Zinc
DELIVERY	2016
SUPPLY	940m3 LOX Flat Bottom Tank 400m3 LAr Cryogenic Storage Tank) 30m3 LOX Cryogenic Storage Tank 20,000Nm3 Steam Heated Vaporizer LOX Transfer Pump 3 Units (Cryostar)

## ➤ Madd'en LAr, LCO<sub>2</sub> Package



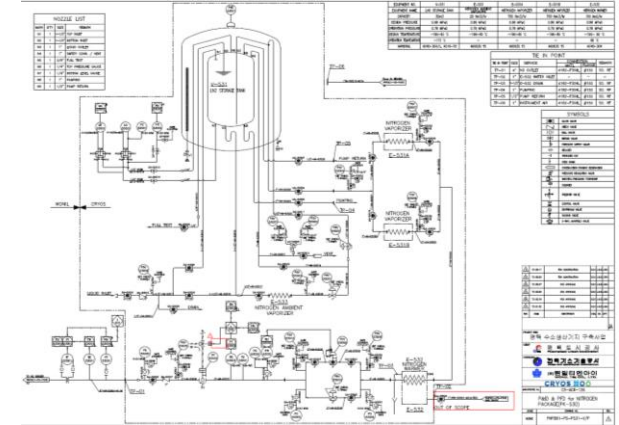
LOCATION	Saudi Arabia
CUSTOMER	Samsung Engineering
DELIVERY	2012
SUPPLY	20m <sup>3</sup> LCO <sub>2</sub> Storage Tank 1,850Nm <sup>3</sup> LCO <sub>2</sub> Ambient Vaporizer 30m <sup>3</sup> LAr Storage Tanke 300Nm <sup>3</sup> LAr Ambient Vaporizer G.S.U

## ➤ Panama Colon 380MW CCPP LIN Package



LOCATION	Panama
OWNER	Costa Norte LNG Terminal
EPC	POSCO E&C
CUSTOMER	ASPE
DELIVERY	2017
SUPPLY	44.5m <sup>3</sup> LIN Storage Tank 1,000Nm <sup>3</sup> LIN Ambient Vaporizer G.S.U

## ➤ Pyeong-Taek Hydrogen Production LIN Package



LOCATION	Korea
OWNER	Pyeongtack Urban Corporation
EPC	KOREA GAS TECHNOLOGY
CUSTOMER	Wonil T&I
DELIVERY	2021
SUPPLY	30m <sup>3</sup> LIN Storage Tank 700Nm <sup>3</sup> LIN Ambient Vaporizer 2Units 700Nm <sup>3</sup> LIN Steam Heated Warm-up Vaporizer 1Units G.S.U Loading System

## ➤ ME-GI Engine Test Bed Hanwha Engine



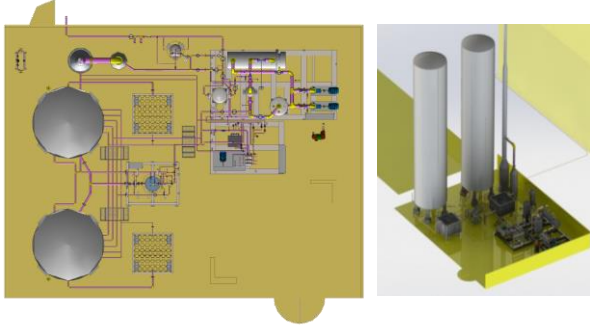
LOCATION	Korea
CUSTOMER	Hanwha Engine
DELIVERY	2013 (1 <sup>st</sup> ), 2023 (2 <sup>nd</sup> )
SUPPLY (EPC)	175m <sup>3</sup> LNG Storage Tank 250L Odorant Buffer Tank Existing Equipment Removal and Re-arrangement Construction Piping Skid Structure

## ➤ DF Engine Test Bed Hanwha Engine



LOCATION	Korea
CUSTOMER	Hanwha Engine
DELIVERY	2015
SUPPLY (EPC)	NG Buffer Tank : 20 m <sup>3</sup> Electric Vaporizer : 400 Nm <sup>3</sup> /hr Pressurized Vaporizer (PBC) : 130 Nm <sup>3</sup> /hr Existing Equipment Removal and Re-arrangement Construction & Installation(Compressor, GVU, etc) Piping Skid Structure

## ➤ ME-GI Engine Test Bed



LOCATION	Korea
CUSTOMER	STX Heavy Industry
DELIVERY	2016
SUPPLY (EPC)	120m3 LNG Storage Tank 300 Nm3/hr Ambient Vaporizer 250L Odorant Tank GSU FGSS(LP&HP Pump, HP Vaporizer, Glycol Water System) Piping Skid Structure

## ➤ ME-LGPI Engine Test Bed



LOCATION	Korea
CUSTOMER	STX Heavy Industry
DELIVERY	2020
SUPPLY (EPC)	30Ton LPG Storage Tank 300 Nm3/hr Ambient Vaporizer LPG Compressor & Pump N2 Purge System Piping Skid Structure



## ➤ LNG FILLING STATION



- PNC (Busan New Port)
- HJNC (Busan New Port)
- PNIT (Busan New Port)
- HPNT (Busan New Port)
- BPT (Gamman Port)
- BPT (Sinsundae Port)
- Supplies (EPC)
  - . Tank
  - . Vaporizer
  - . Pump
  - . Piping (VIP)
  - . Dispansor
  - . Erection & Commissioning

## ➤ LNG SATELITE STATION

Total 10 Stations  
in Korea



Indonesia Sambera (40MW)



- Supplies (EPC)
  - . Tank
  - . Vaporizer
  - . Pump
  - . Piping
  - . Erection & Commissioning (Korea only)

## ➤ LNG FGSS ENGINE & TURBINE TEST BED



- Doosan Heavy Industries 460MW Large LNG Turbine Test Bed
- HSD ME-GI LNG Engine Test Bed
- STX HI ME-GI LNG Engine Test Bed
- Doosan Engine DF LNG Engine Test Bed

- Supplies (EPC)
  - . Tank
  - . Vaporizer
  - . Pump
  - . Piping
  - . Governer
  - . Erection & Commissioning

## ➤ 20,000 DWT CLASS ROLL-ON/ROLL-OFF CARRIER



FLAG	MALTA
CLASS.	DNV
SHIPYARD	Hyundai Mipo
CUSTOMER	Dongsung LTS
DELIVERY	2021
SUPPLY	320m3 LNG Tank 4 unit

## ➤ BUNKERING LIN COOL DOWN TANK



FLAG	KOREA
CLASS.	KR
SHIPYARD	SAMSUNG HI
CUSTOMER	SAMSUNG HI
DELIVERY	2023
SUPPLY	350m3 LIN Tank 2 unit



## ➤ TOTE 3,100 TEU CONTAINER SHIP



FLAG	USA
CLASS.	ABS, USCG
SHIPYARD	NASCO
CUSTOMER	DSEC
DELIVERY	2016
SUPPLY	900m3 LNG Tank 4 unit



## ➤ PRELUDE FLNG PMR TANK



LOCATION	AUSTRALIA
CLASS. & REGUL.	ABS, USCG
CLIENT	SHELL
CUSTOMER	SAMSUNG HI
DELIVERY	2013
SUPPLY	1,085m3 LNG Tank 2 unit

## ➤ ZLNG FLNG



LOCATION	MALAYSIA
CLASS. & REGUL.	ABS, DOSH, ASME-U
SHIPYARD	SAMSUNG HI
CUSTOMER	JGC & SAMSUNG HI JV
DELIVERY	2024 (E)
SUPPLY	93.7m3 Ethylene Tank 1 unit



## ➤ T75 LNG TANK CONTAINER



PROJECT	Sambera Power Plant
CUSTOMER	Hyoseong
LOCATION	Indonesia
APPLICATION	LNG Transport for LNG Power Plant
DELIVERY	2018
SUPPLY	20FT LNG TANK CONTAINERS 40FT LNG TANK CONTAINERS



PROJECT	LNG Trade Pilot Test
CUSTOMER	Sehyun
LOCATION	China
APPLICATION	LNG Trade
DELIVERY	2018
SUPPLY	40FT LNG TANK CONTAINERS

➤ **T50 AMMONIA TANK CONTAINER**

**HIGH PURITY  
AMMONIA SERVICE**

- ✓ *Single Wall*
- ✓ *PUR Insulation*
- ✓ *Heater*
- ✓ *Pump*



PROJECT	Samsung Electronics
CUSTOMER	Wonik Materails
DELIVERY	2017~ On going
SUPPLY	20FT LNH3 TANK CONTAINERS



PROJECT	Samsung Electronics
CUSTOMER	DIG (Daesung Industrial Gas)
DELIVERY	2020~ On going
SUPPLY	20FT LNH3 TANK CONTAINERS

➤ **TANK LORRY AND TRAILER**



✓ **LNG TANK TRAILER**

LT CNG

✓ **LCO2 TANK TRAILER**

SK MATERIALS

WONIK MATERIALS  
TAEKYUNG CHEMICAL

✓ **LNH3, LC2H4 TANK LORRY**

WONIK MATERIALS

CORETECH  
KOREA SPECIAL GAS

✓ **LIN,LOX TANK LORRY**

PKG  
PSG  
TAEKYUNG CHEMICAL

KOREA SPECIAL GAS  
MILSUNG  
DONGSIN INDUSTRY  
DAEYOUNCORE



## Qstec



LOCATION Qatar  
CUSTOMER Air Liquide Engineering  
DELIVERY 2012  
SUPPLY 150m<sup>3</sup> GH<sub>2</sub> Pressure Vessel

## SK GEP 1



Korea  
Air Liquide Engineering  
2022 / 2022  
1.55m<sup>3</sup> Purification Vessel 6 Units  
22.75M<sup>3</sup> Adsorber 10 Units

## SK GEP 1 / Doosan Changwon H<sub>2</sub> Production



Korea  
Air Liquide Engineering  
2023  
395Nm<sup>3</sup>/h LH<sub>2</sub> PBC 2 Units  
430Nm<sup>3</sup>/h LH<sub>2</sub> PBC 6 Units  
90Nm<sup>3</sup>/h GH<sub>2</sub> Boil Off Vaporizer 2 Units

## Hi-Changwon



NER TEST BY LH<sub>2</sub>

LOCATION Korea  
CUSTOMER Hi-Changwon  
DELIVERY 2025  
SUPPLY 2.5Ton LH<sub>2</sub> Tank Trailer 1 Unit

## DEVELOPMENT (KGS STANDARD VARIFICATION)



## GH<sub>2</sub>+LH<sub>2</sub> COMBINED FILLING STATNION (RETROFIT)

1 Ton LH<sub>2</sub> STORAGE TANK (2025)  
3 Ton LH<sub>2</sub> TANK TRAILER (E 2025)



## ➤ PORT ARTHUR HPU



LOCATION	USA
OWNER	Port Arthur Petrochemicals & Refining
CUSTOMER	Air Liquide Global E&C
DELIVERY	2020
SUPPLY	H2 PSA Skid



## ➤ LOTTE BP H2 PSA SKID & OFF GAS DRUM



LOCATION	Korea
OWNER	Lotte Ineos Chemical
CUSTOMER	Air Liquide Global E&C
DELIVERY	2022
SUPPLY	H2 PSA Skid 200m2 Off Gas Drum



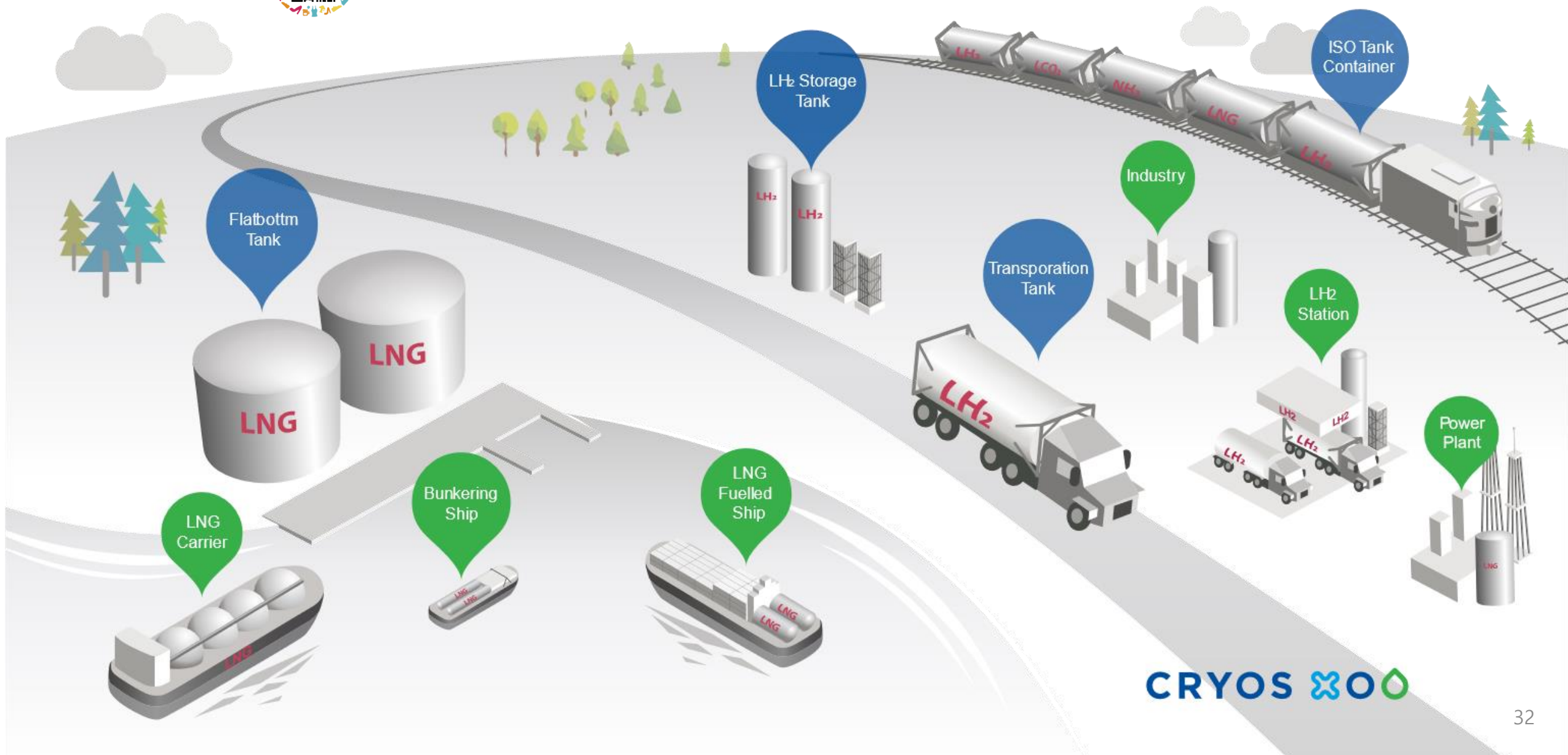
## ➤ SK GEP 1 H2 PSA VESSEL & OFF GAS DRUM



LOCATION	Korea
OWNER	SK E&S
CUSTOMER	Air Liquide Global E&C
DELIVERY	2023
SUPPLY	22.75m3 H2 PSA Vessel 10 Units 210m2 Off Gas Drum



미래를 지키는 청정에너지 설비, 크리오스가 함께 합니다.





# LH2 STORAGE TANK & VAPORIZER

SAFTY



STABILITY

LOW BOG



RELIABILITY

MAINTENANCE



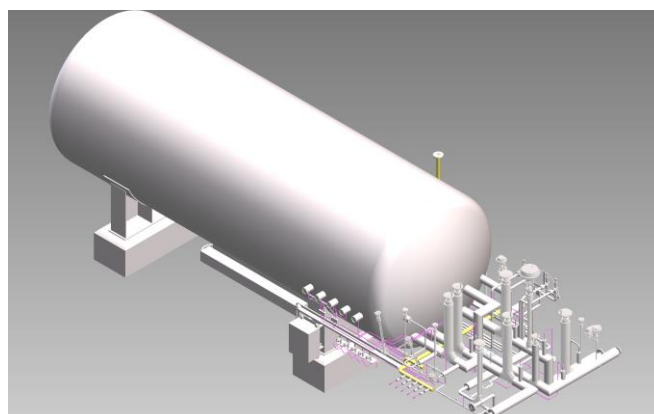
DURABILITY



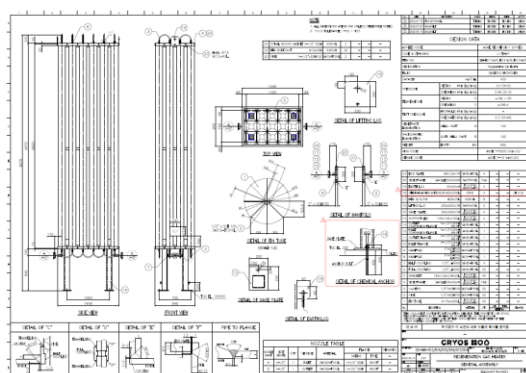
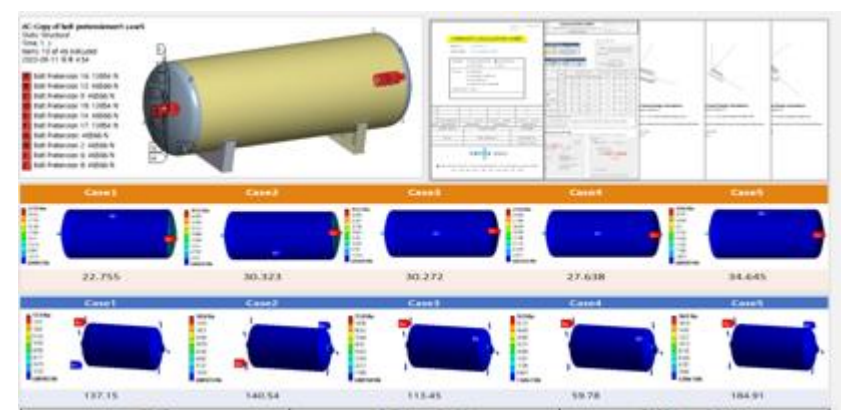
## LH2 STORAGE TANK

CRYOS is the representative party verifying all process of engineering, manufacturing and its test to establish Korean Gas Safety Standards for liquid hydrogen storage tank & supply system. We are undertaking numerous national projects and has the extensive expertise in designing and manufacturing liquefied hydrogen tanks under various design conditions, while ensuring compliance with KGS and possessing design and manufacturing know-how. .

### DESIGN & MODELING



### FINITE ELEMENT ANALYSIS



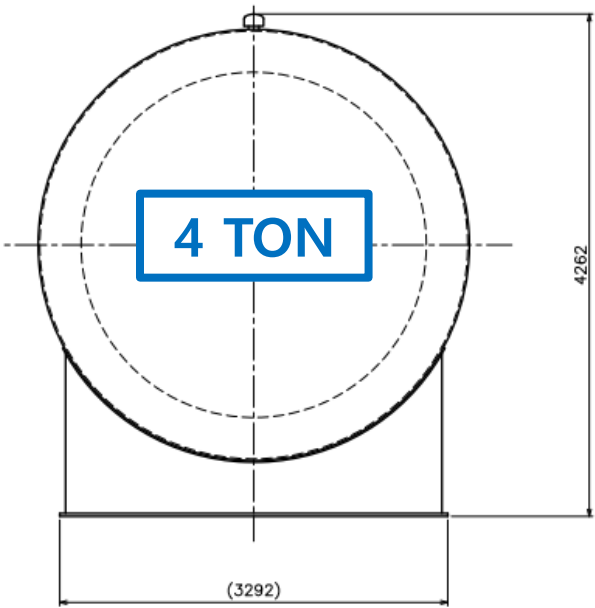
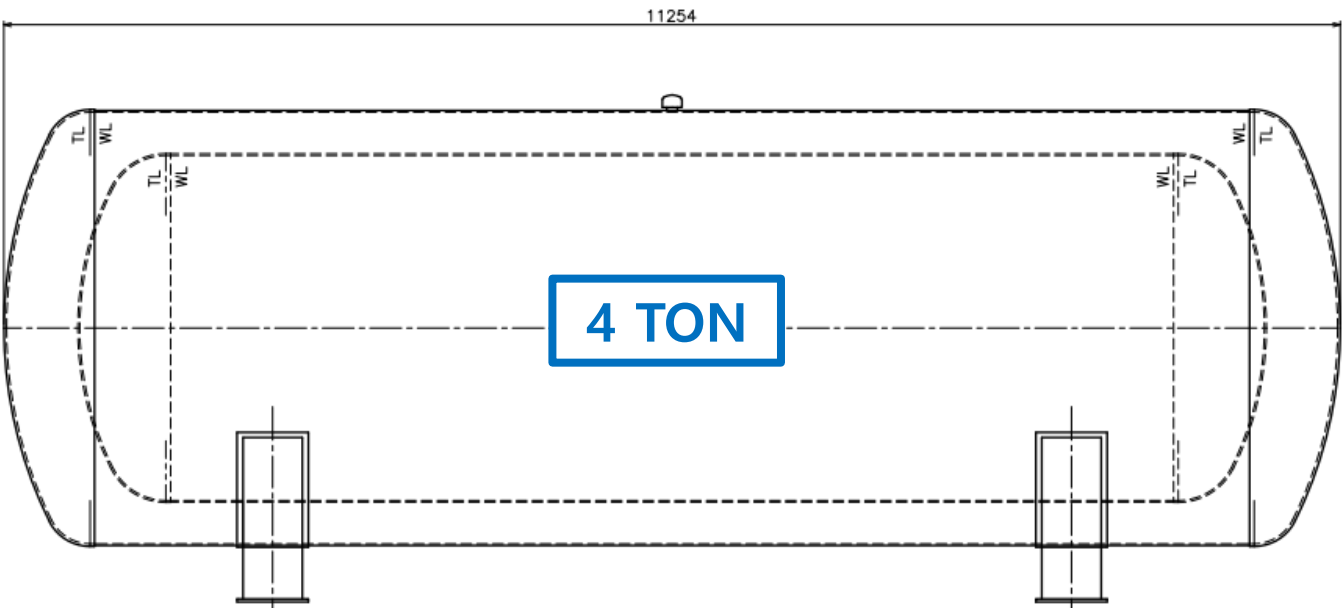
## LH2 VAPORIZER

CRYOS entered into the contract with Air Liquide (France) and delivered the first liquefied hydrogen vaporizers and gaseous hydrogen re-vaporizers complying with KGS to Doosan Enerbility in Changwon and the SK E&S hydrogen plant in Incheon.



# LH2 STORAGE TANK

CRYOS provides customized services  
in various conditions  
to suit the intended purpose of the storage tanks.



## DATA FOR PLANT

Item	Specification
Construction Type	Double Wall Vacuum Insulated Vertical / Horizontal
Gross Volume	59,998 Liter
Net Volume)	53,998 Liter
Loading	3,781 kg
M.A.W.P	1.03 MPa
Design Temperature	-253 ~ 40 °C
Insulation	Multi Layer Insulation (MLI)
Materials of Inner Vessel	Stainless Steel
Nozzle	Vacuum Insulated Type
Safety Device	Safety Valve O.S.D E.S.V

## DATA FOR FILLING STATION

Item	Specification
Construction Type	Double Wall Vacuum Insulated Vertical / Horizontal
Gross Volume	62,701 Liter
Net Volume)	56,430 Liter
Loading	3,995 kg
M.A.W.P	1.03 MPa
Design Temperature	-253 ~ 40 °C
Insulation	Multi Layer Insulation (MLI)
Materials of Inner Vessel	Stainless Steel
Nozzle	Vacuum Insulated Type
Safety Device	Safety Valve O.S.D E.S.V



CRYOS, the specialized company in liquid hydrogen tank and facilities, cryogenic gas equipment comes along with you.

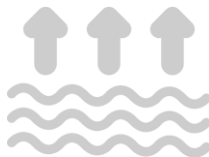




### SAFETY

LH2 tank trailers have been manufactured under CRYOS's strict quality control system, optimized for hydrogen embrittlement and extremely cryogenic conditions.

- . Emergency Shut-Off System
- . Secure support structure designed for cryogenic shrinkage conditions of -253°C



### LOW BOG

CRYOS LH2 tank trailers maximize insulation performance as well as ensure long-term storage, minimizing the loss of liquefied hydrogen gas.

- . Proprietary insulation & high-vacuuming technology
- . Vacuum Insulated Pipe with High-performance
- . Manufactured in the temperature & humidity controlled CLEAN ROOM



### MAINTENANCE

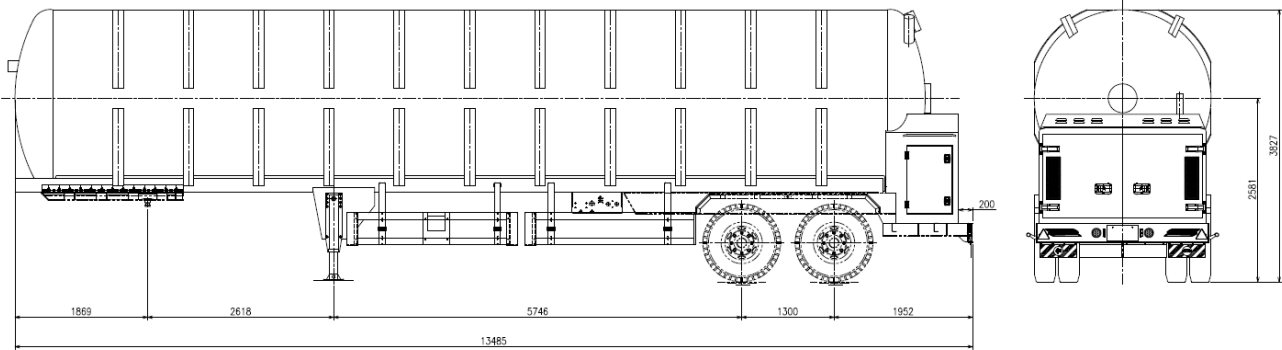
CRYOS provides regular & irregular maintenance services by experts to ensure long-term safe and efficient operation.

- . In-house maintenance service system
- . Experiences in maintenance services for liquefied helium tank containers





SAVE TRANSPORTATION COSTS BY OVER 80%  
BY TRANSPORTING 3 TONS OF LIQUEFIED HYDROGEN GAS.



STORAGE TANK		CHASSIS		
Item	Specification	Item	Specification	
Construction Type	Double Wall Vacuum Insulated	Length of Trailer	13,485 mm	
Gross Volume	47,138 Liter	Width	2,478 mm	
Net Volume	42,424 Liter	Heigh	3,827 mm	
M.A.W.P	1.0 MPa	Wheel Base	8,364 mm	
Design Temperature	-253 ~ 40 °C	Tare Weight	21,504 kg	
Insulation	Multi Layer Insulation (MLI)	Payload)	3,004 kg	
Materials	Stainless Steel	Gross Weight of Trailer	24,504 kg	
Nozzle	Vacuum Insulated Type	Safety Device	EBS	Electronic braking system
Safety Device	Safety Valve O.S.D E.S.V		ABS	Anti-lock braking system
			TPMS	Tire pressure monitoring system
			RSS	Roll-over prevention system
			ATS	Anti-tow protection system