

# HYUNDAI GLOBAL SERVICE LNGC RETROFIT



# RESPONDING TO EXPLOSIVE LNG DEMAND

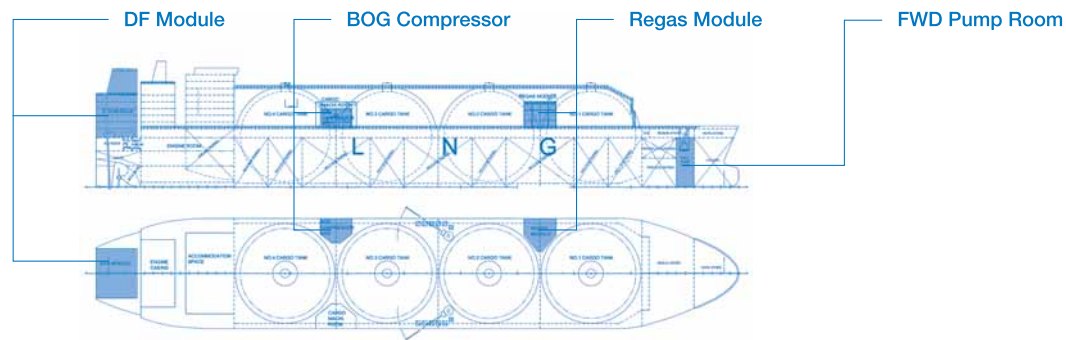
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LNGC TO FSRU CONVERSION

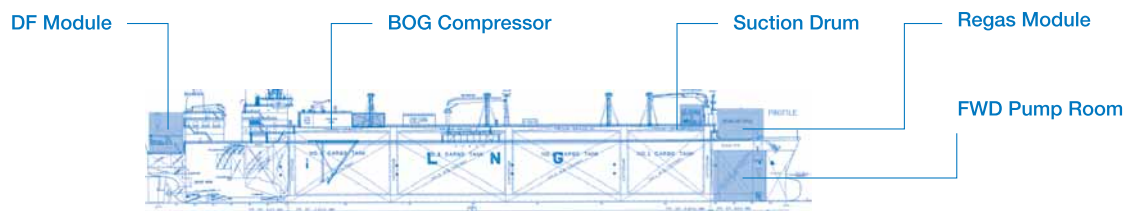
GENERAL ARRANGEMENT

Compared to the Newbuild FSRU, FSRU Conversion based on LNGC for Moss and Membrane types typically has less lead time and cost. It simply requires the installation of Regas modules and DF modules. The Regas module is usually built as a separate module or compartment and the retrofitted onto the LNGC in a shipyard to minimize time.

MOSS LNGC



MEMBRANE LNGC

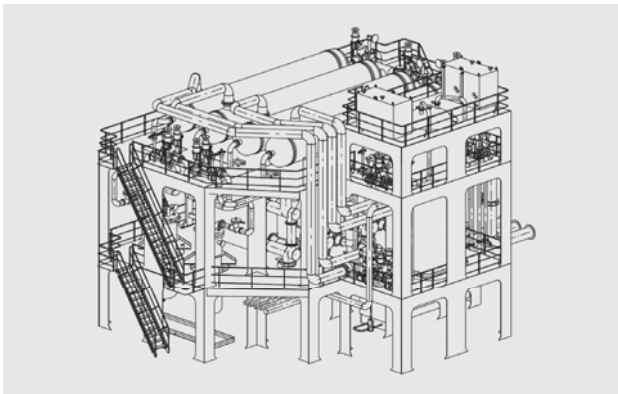


DEVELOPMENT OF MID-SIZE REGASIFICATION MODULE

HGS developed the regasification module with a precious participant and had a HAZID workshop with DNV. Finally, HGS got Approval in Principle for this Regas module. It contains four trains of HP pump and vaporizer unit with re-condenser will produce 400mmscfd high-pressure natural gas.

400 MMSCFD REGAS MODULE

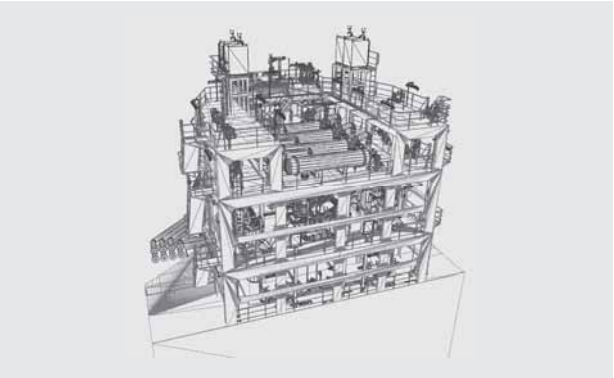
- Send-Out Pressure : 65~100 barg
- Number of Train : 4



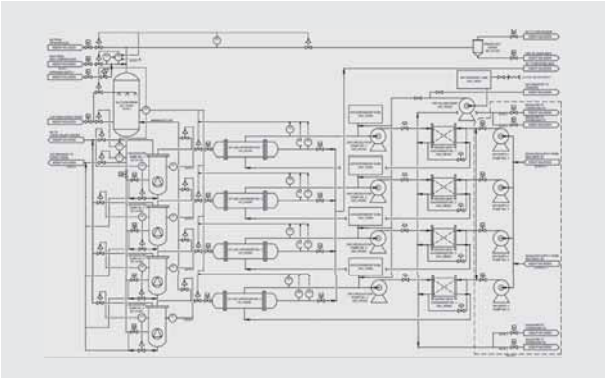
Approval in Principle Certificate from KR (Korea Register)

ENGINEERING CAPABILITIES

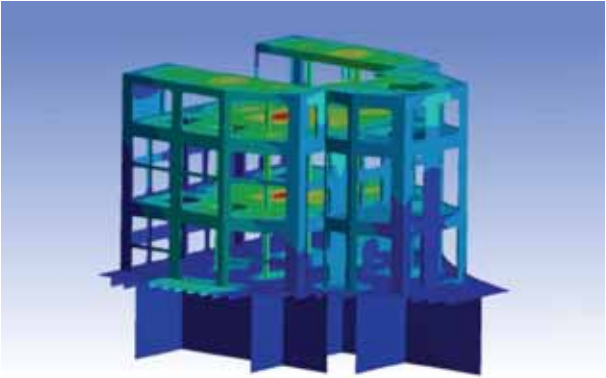
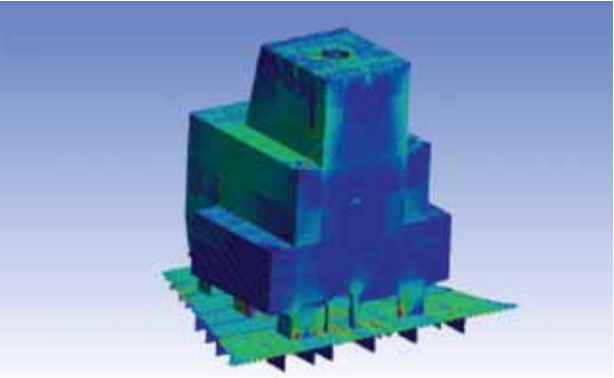
3D MODELING



PROCESS FLOW DIAGRAM

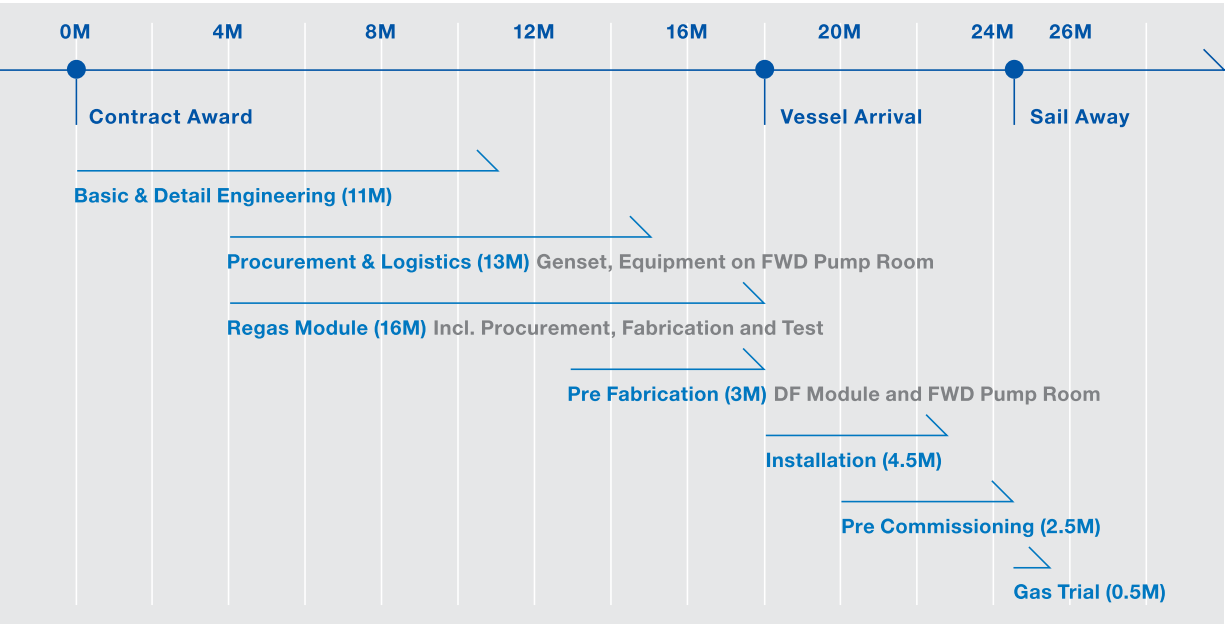


STRUCTURE ANALYSIS



PRELIMINARY SCHEDULE

AROUND 24 MONTHS REQUIRED

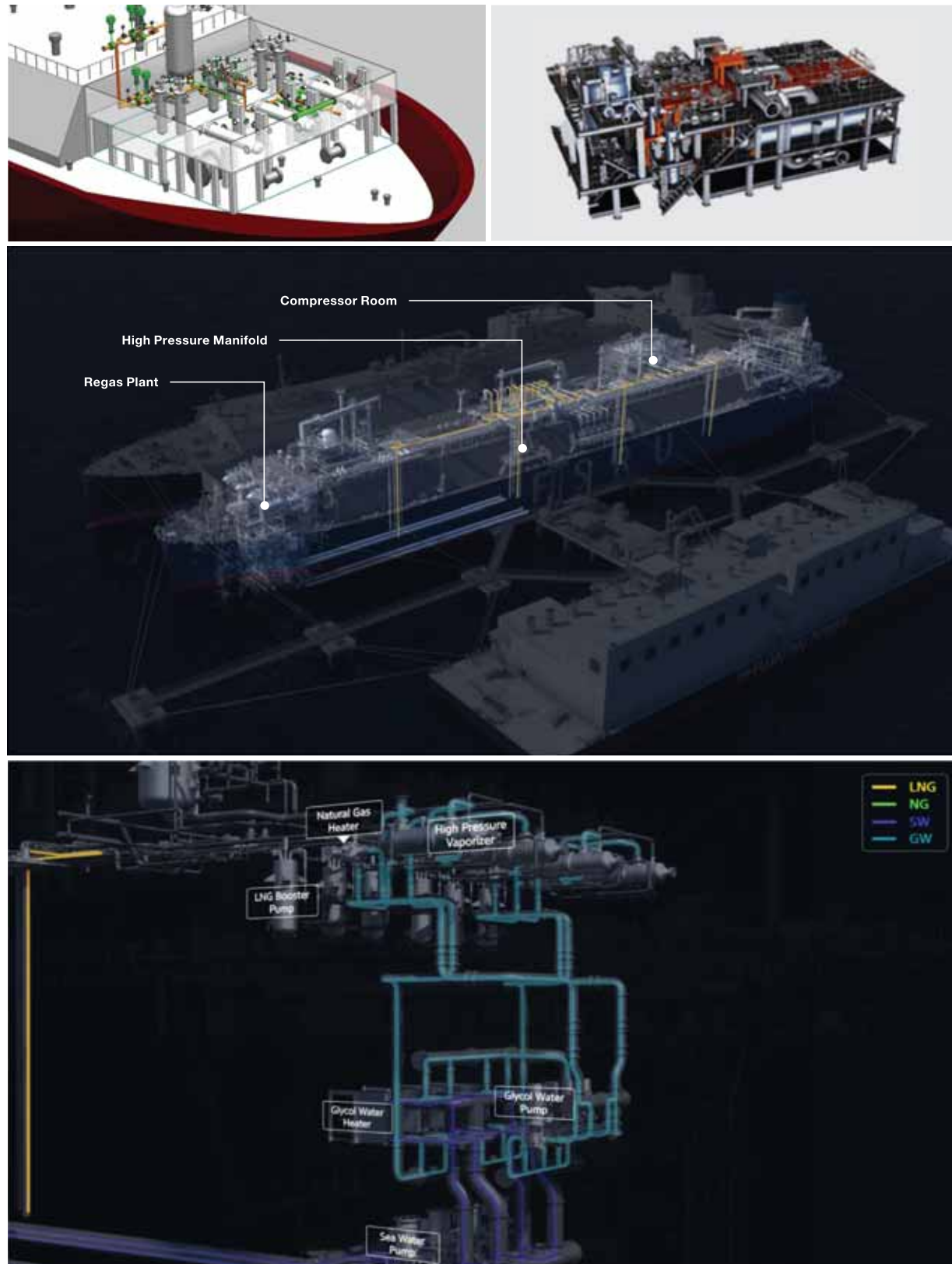




# LNGC RE-LIQUEFACTION PLANT RETROFIT

## REGAS MODULE BY QUALIFIED SUPPLIER

HHI Patented Hi-ReGAS (Hyundai integrated ReGASification System)



If BOG is more than gas consumption, a re-liquefaction plant is the best option for saving costs.

## RE-LIQUEFACTION PLANT

### TURBO-BRAYTON SYSTEM



Image Source : "Air Liquide"

- Indirect liquefying BOG
- Refrigerant :  $N_2$
- Suppression of BOG

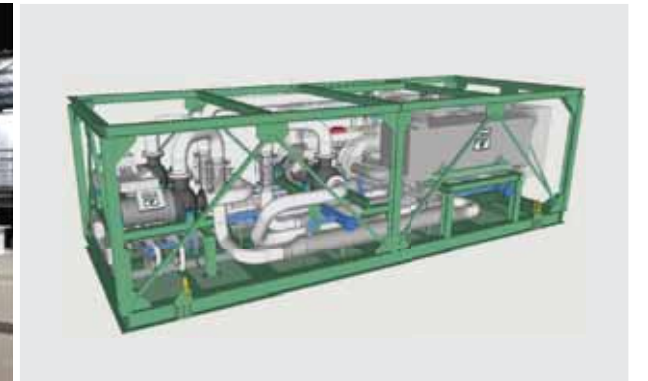


Image Source : "CRYO STAR"

- Using sub-cooled LNG
- Major Equipment
  - 1) Motor-Turbo Compressor-Expander
  - 2) Cold Box

### SMR SYSTEM



Image Source : "Babcock ecoSMRT System"

- Single Mixed Refrigerant
- Direct liquefying BOG
- Refrigerant : MR ( $C_1 + C_2 + C_3 + N_2$ )
- Major Equipment : Compressor, Cold Box

### $N_2$ COMPANDER SYSTEM

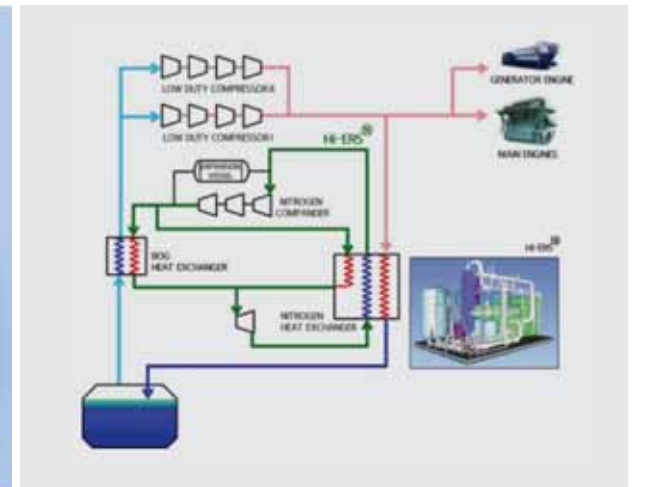


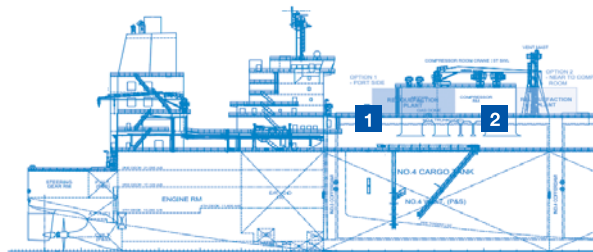
Image Source : "HHI Hi-ERS(n)" System

- Direct liquefying BOG
- Refrigerant : BOG,  $N_2$
- Major Equipment
  - 1)  $N_2$  Compander
  - 2) Heat Exchanger

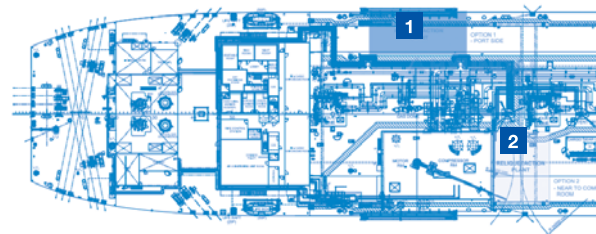
## GENERAL ARRANGEMENT

Compared with newbuilding, the Turbo-Brayton system is suitable for retrofit vessels since this system can be replaced anywhere and has a low impact on an existing ship's cargo handling system. Generally, the Turbo-Brayton system can be applied to both Moss and Membrane type LNGC, and it is a built-in port or starboard side with an electric cabinet room.

SIDE VIEW



TOP VIEW

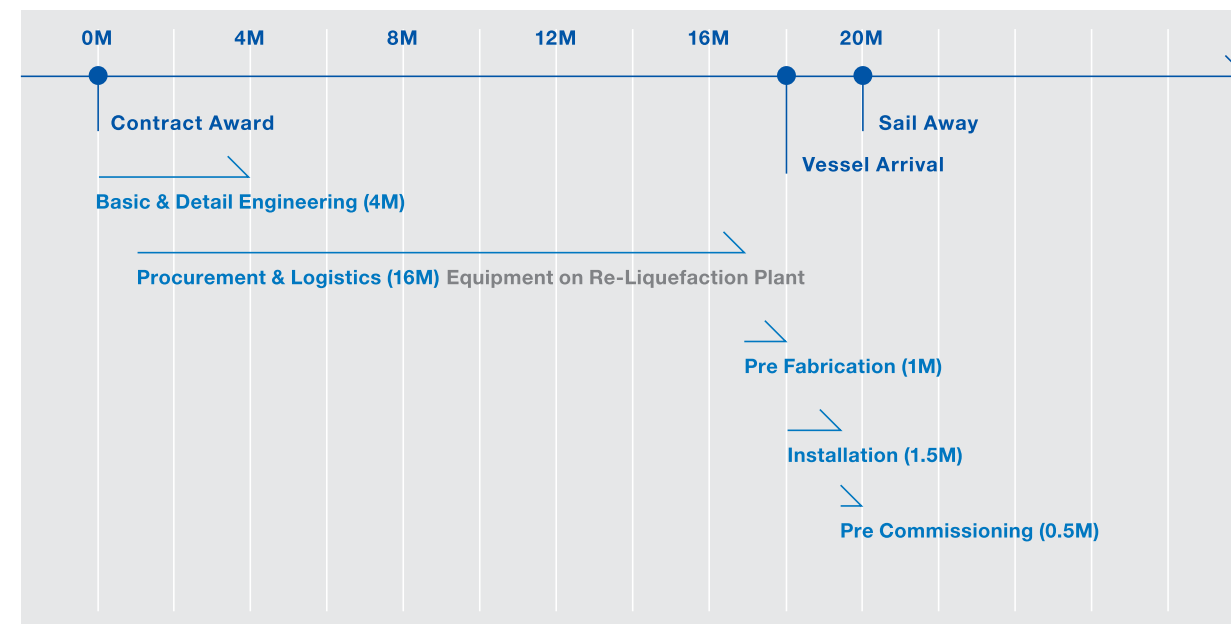


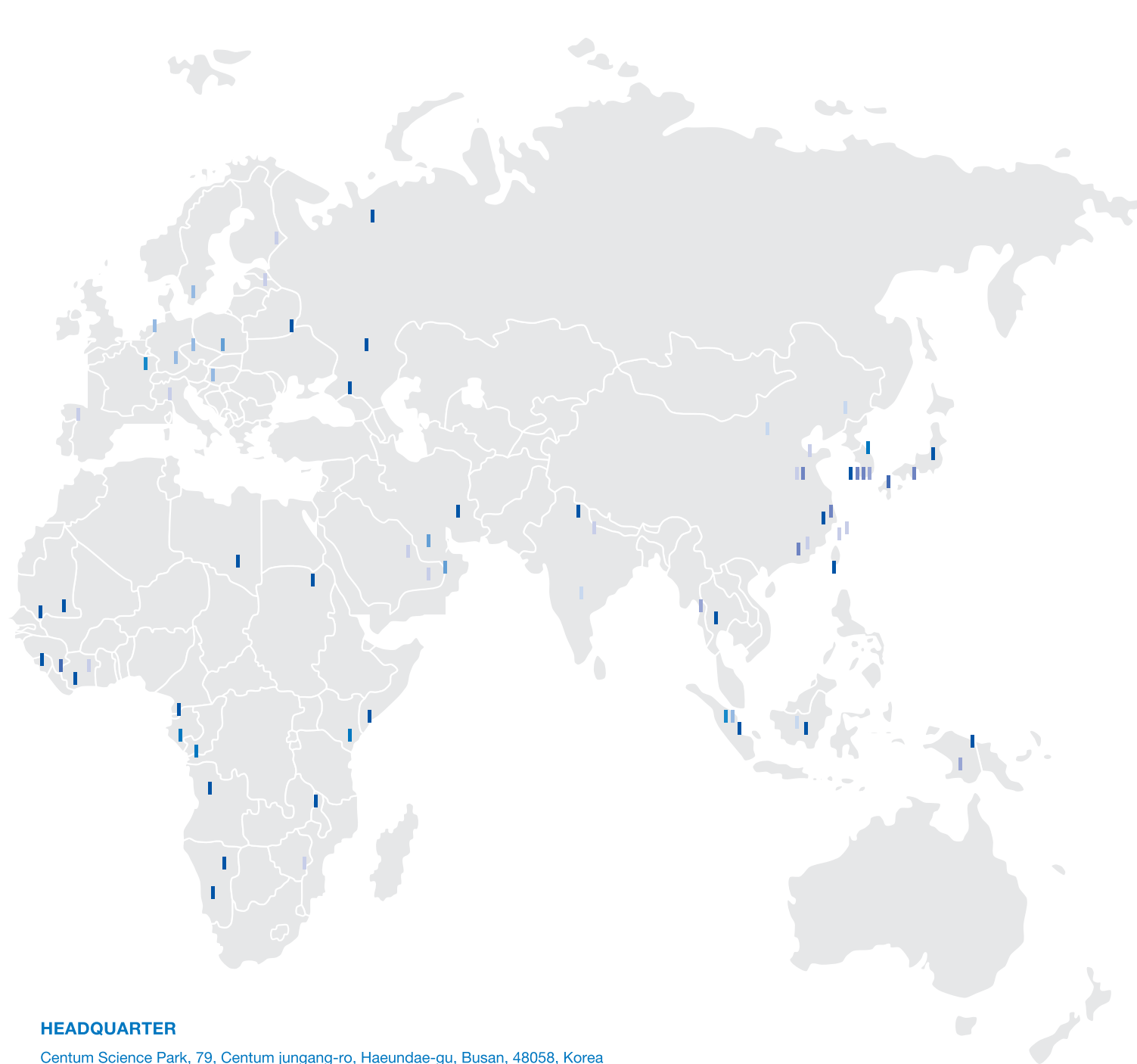
## RELIQUEFACTION PLANT

- Option 1. Port Side
- Option 2. Near to Comp. Room

## PRELIMINARY SCHEDULE

AROUND 20 MONTHS REQUIRED





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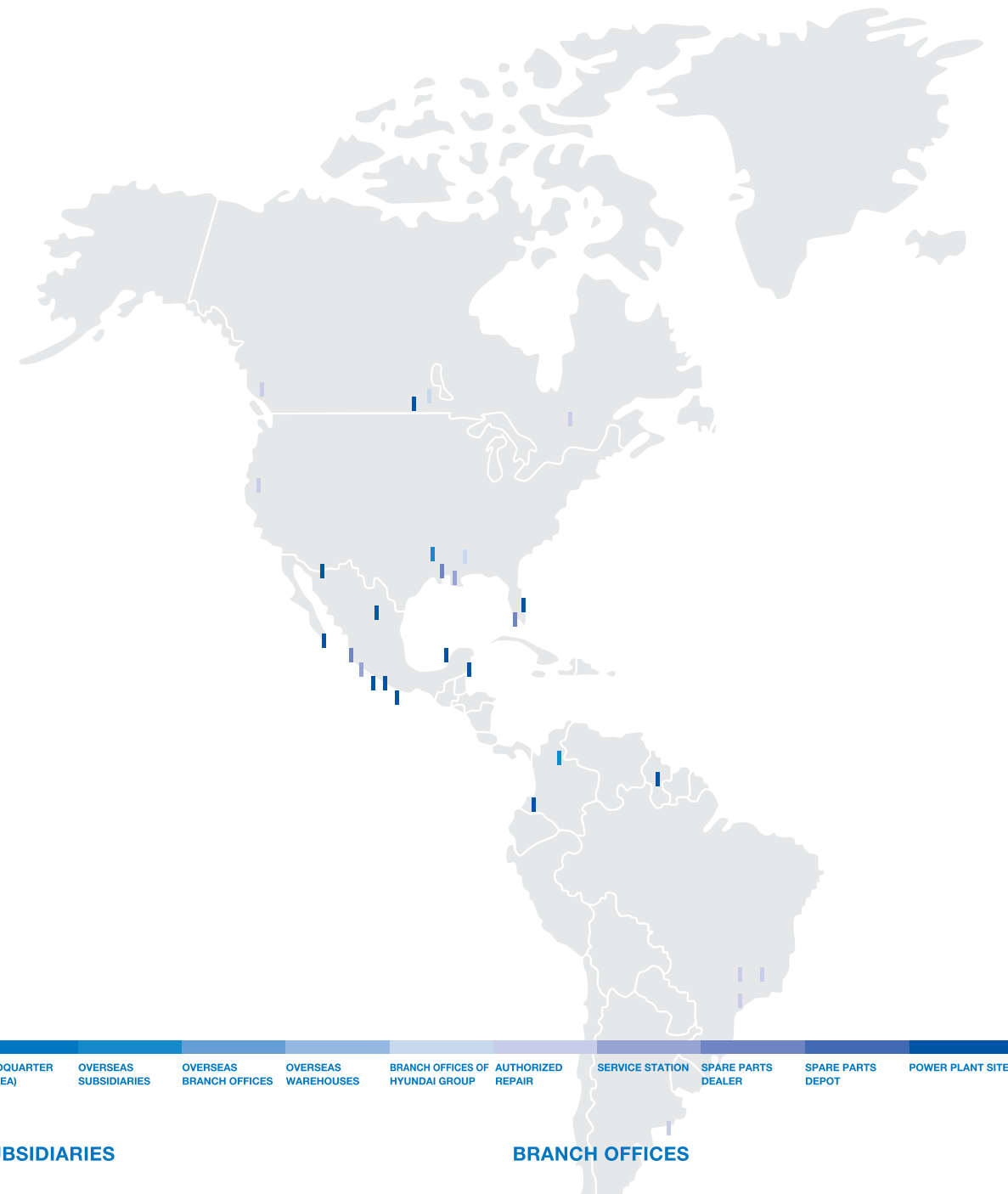
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