CHIYODA INTERNATIONAL CORPORATION

CHIYODA GROUP

ADVANCING EXPORT TERMINAL TECHNOLOGY: AN OPTIMIZED PROCESS FOR THE REFRIGERATION OF CRYOGENIC HYDROCARBONS

SEPTEMBER 14, 2018

70 Years Of Excellence

QUALITY SYSTEM CERTIFICATION DNV·GL ISO 9001

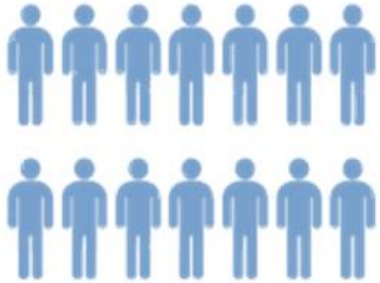
Chiyoda Group Overview

70 Years Of Excellence

People

60+

Countries



8,300+*

*Including subsidiaries

Tokyo Stock Exchange
TYO:6366

Financials

$4.8B

Revenue
2017 FY

Backlog
2017 FY

$6.1B

$2.8B

New Orders
2018 FY

Global EPC Track Record

Over **800**
Refinery Units Constructed

Over **500**
Petrochemicals Plants Constructed

World's **No.1**
LNG Contractor
40% of LNG Projects Worldwide Since 2000

Over **1,800**
Projects in Non-Hydrocarbon and Infrastructure

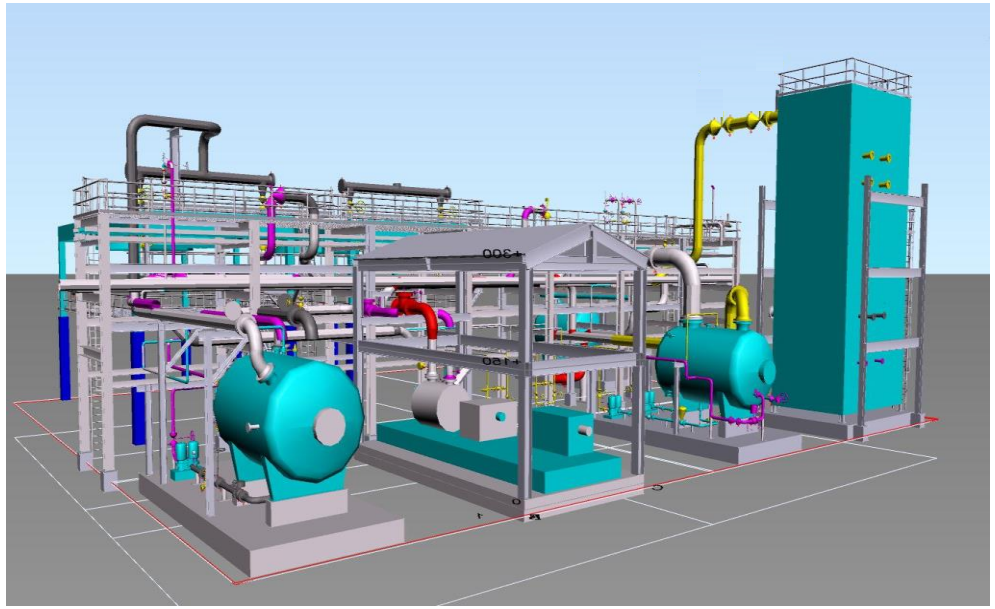
Executed **75**
LNG Receiving Terminal Projects

Courtesy of Qatargas Operating Company Limited

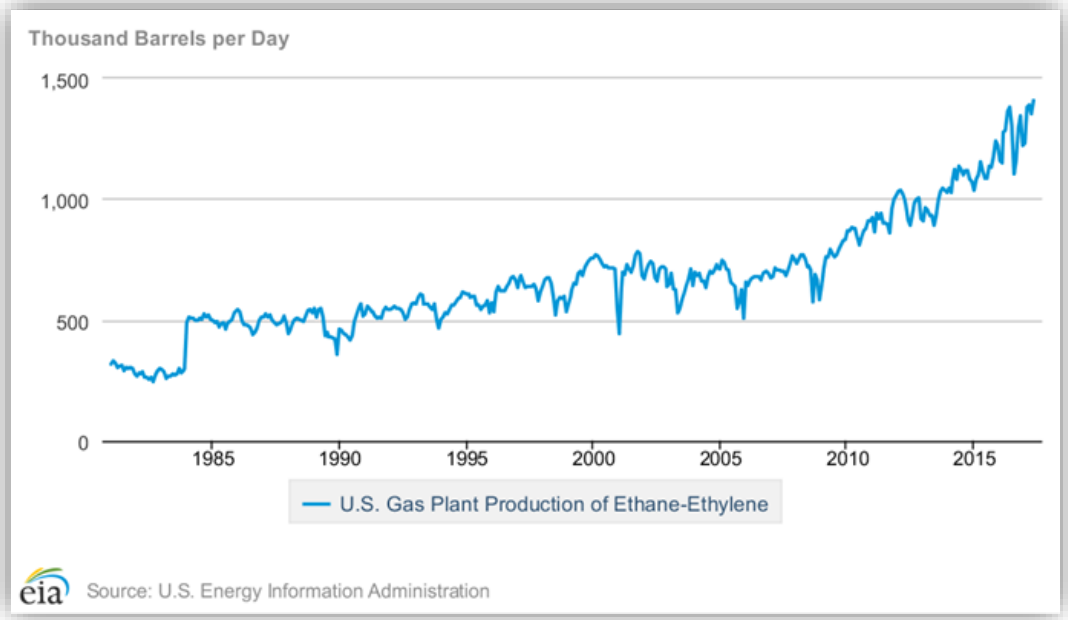
CMR-XP Presentation

Agenda:

- Ethylene Markets and Trends
- Economics of Ethylene Export
- Schematic of Open Cycle and CMR-XP™
- Basis of Ethylene Refrigeration Unit Comparison
- Comparison Between Open Cycle and CMR-XP ™
- CMR-XP ™ Multi-Product Option
- Questions

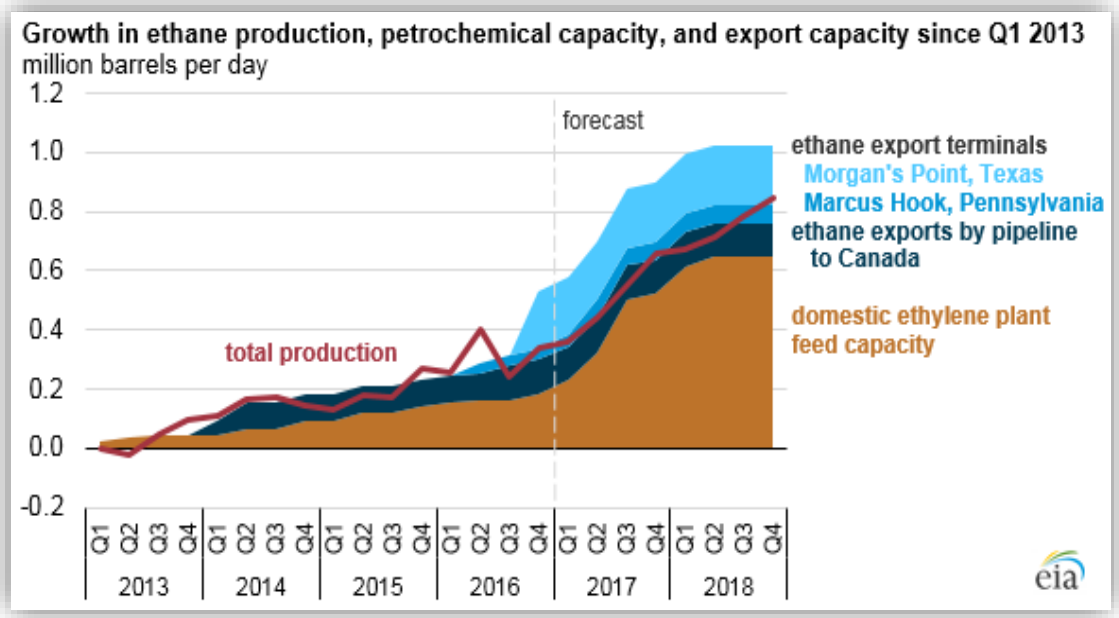


Ethylene Markets and Trends



- "Hydraulic fracking" changed the ethane market
- Traditionally, ethane concentration was four (4) to seven (7) percent in associated gas; with fracking, not uncommon to have ten (10) percent.
- Price hit low of $0.20/gallon; recovered to around $0.38/gallon.

- Ethane markets:
  - Blended into Natural Gas Streams
  - Petrochemical Feedstock
  - Exported



North America Ethylene Projects

Company	Location	Size (tonnes)	Status
OxyChem / Mexichem	Ingleside, Texas	550,000	Start-Up in Q1 2017
Dow Chemical	Freeport, Texas	1,500,000	Start-Up Q2 2017
ExxonMobil Chemical	Baytown, Texas	1,500,000	Under Construction
Chevron Phillips Chemical	Cedar Bayou, Texas	1,500,000	Under Construction – Q4 2017
Formosa Plastics	Point Comfort, Texas	1,590,000	Q2- 2018
Sasol	Lake Charles, Louisiana	1,500,000	Under Construction – 2018
Axiall / Lotte Chemical	Lake Charles, Louisiana	1,000,000	Under Construction - 2019
Shintech	Plaquemine, Louisiana	500,000	Under Construction – Q2 2018
Shell	Monaca, Pennsylvania	1,500,000	Starting Construction – Q1 2020
Dow Chemical	Plaquemine, Louisiana	250,000	Expansion– Startup Q4 2016
LyondellBasell	Corpus Christi, Texas	363,000	Start-Up - Q3 2017
Westlake Chemical Corp	Calvert City, Kentucky	32,000	Q1 - 2017
Indorama	Carlyss, Louisiana	370,000	Start-Up - Q4 2017

- US adding 12 million metric tonnes per year (Phase 1); Phase 2 to start in 2020
- US production to increase from 32.2 metric tonnes to 44.6 metric tonnes by 2026

Economics of Ethylene Export

August 2018 Pricing	$/Gallon	$/Lb	$/metric Tonnes
Ethane (Mont Belvieu)	**$0.38**	$0.08	$184
Ethylene (Mont Belvieu)	$0.71	**$0.15**	$330
Ethylene (Shanghai, China)	$2.43	$0.51	**$1130**

Differential $700-800/mt

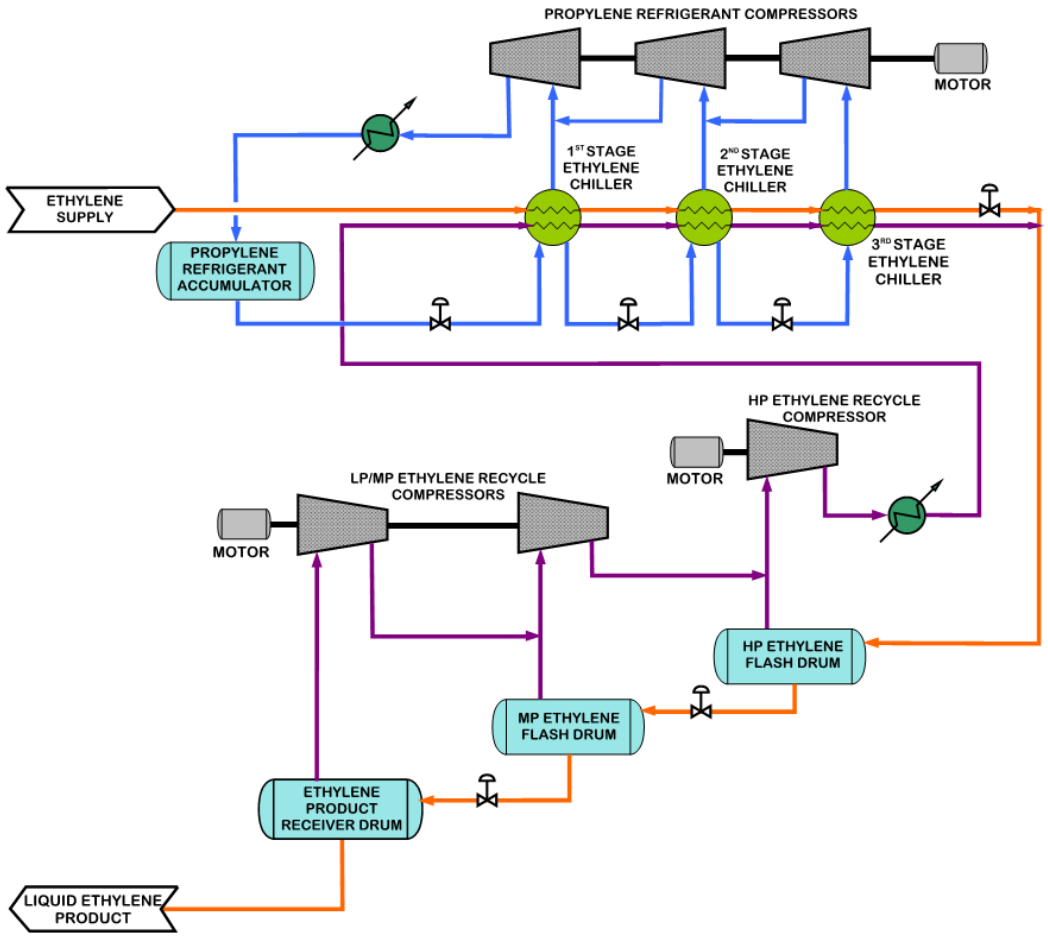
Estimated Shipping Costs is approximately $120/mt

- Baytown to Shanghai through Panama Canal
- 24,000 m3 gas carrier
- 15 knots average speed
- Includes transit costs through the Panama Canal
- Includes empty dead-head return voyage

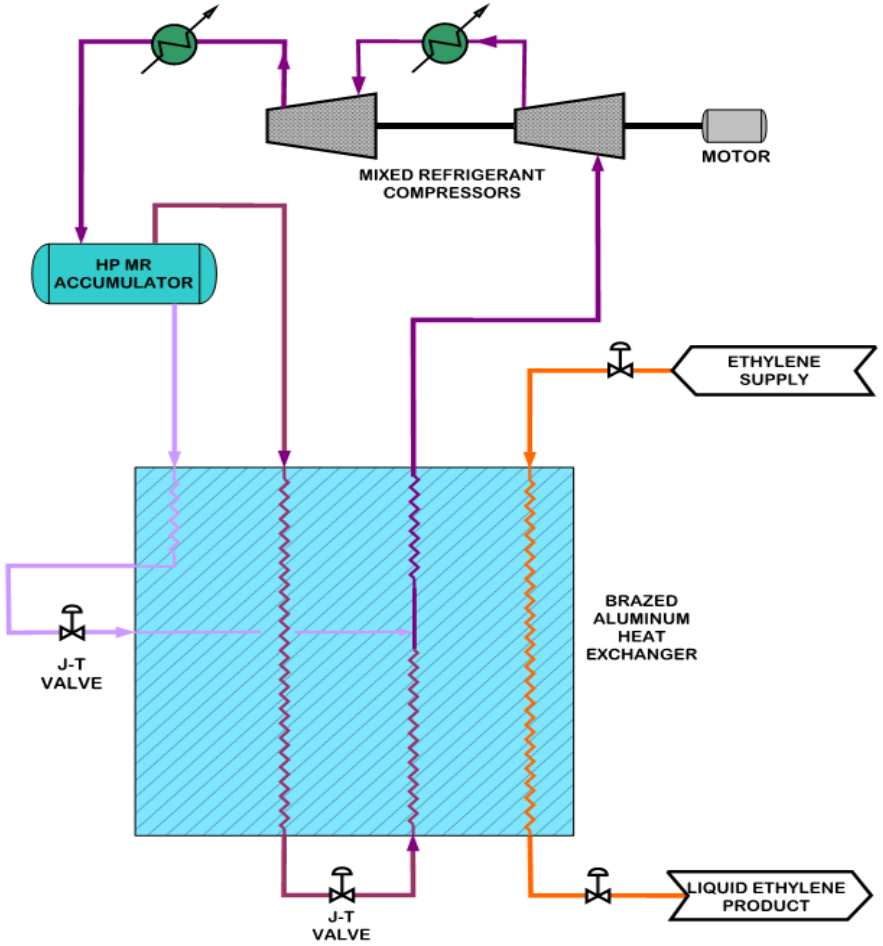
Margin for Domestic Refrigeration Facilities (Export Terminal)?

Schematic of Open Cycle and CMR-XP™

Traditional Open Cycle Refrigeration Unit



CMR-XP™ Refrigeration Unit



Basis of Ethylene Refrigeration Unit Comparison

- Size of Facility: 100 mt/hr (800 gpm or 0.876 mtpa)
- Chilled ethylene to saturated conditions @ 16.7 psia (-152°F)
- Can be used with on-site storage or direct carrier load-out
- Ethylene composition: 99.7% Ethylene, 0.3% Methane
- Ethylene inlet conditions: 1000 psig, 80°F (dense phase)
- Site Ambient conditions: 95°F, 60% Humidity, 10’ above MSL
- Air Cooler design information: 20°F approach @ 20’ above MSL
- Electric motor drives (Gas Engine /Gas Turbine if permits are available)

Comparison Between Open Cycle and CMR-XP™

Item	Open Cycle	CMR-XP™
Description	Propane Pre-Cool with Three Stages of Open Cycle Ethylene Flash	Single Mixed Refrigeration (SMR) Technology
Compressor(s)	Combination Screw Compressors (Propane) and Cryogenic Centrifugal Compressors (Ethylene Flash)	Two Stage, Non-Cryogenic Centrifugal Compressor
Equipment	Simplicity of Overall Standard Equipment (i.e. no “Special” Items)	Brazed Aluminum Heat Exchanger in Cold Box
Insulation	Insulation on all Piping and Equipment Downstream of 1st Stage Propane Pre-Cooler	Insulation around Cold Box only
Refrigerant Import	Yes - Propane	Yes – Methane, Propane, and Normal Butane
Long Lead Item	Compressor	Compressor

Comparison Between Open Cycle and CMR-XP™, Cont'd

Comparison Metrics	Open Cycle	CMR-XP™
Total Electrical Consumption (relative)	1.07	1.00
Process Efficiency (kWh/tonne)	84.3	78.9
Yearly Electrical Consumption (ISBL) (1)	$5.84MM	$5.28MM
Equipment Piece Count	18	10
Number of Process Skids	Ten (10)	Six (6)
Overall Layout Dimensions (relative)	1.5	1.0
Capital Expenditures (relative) (2)	1.7	1.0

Notes:

1. Electrical consumption based on $0.06/kWh, operating 350 days/year (~96% availability).
2. Capital expenditures based on budgetary vendor equipment costs (Bare equipment estimiate; FOB fabrication shop). Does not include installation at site.

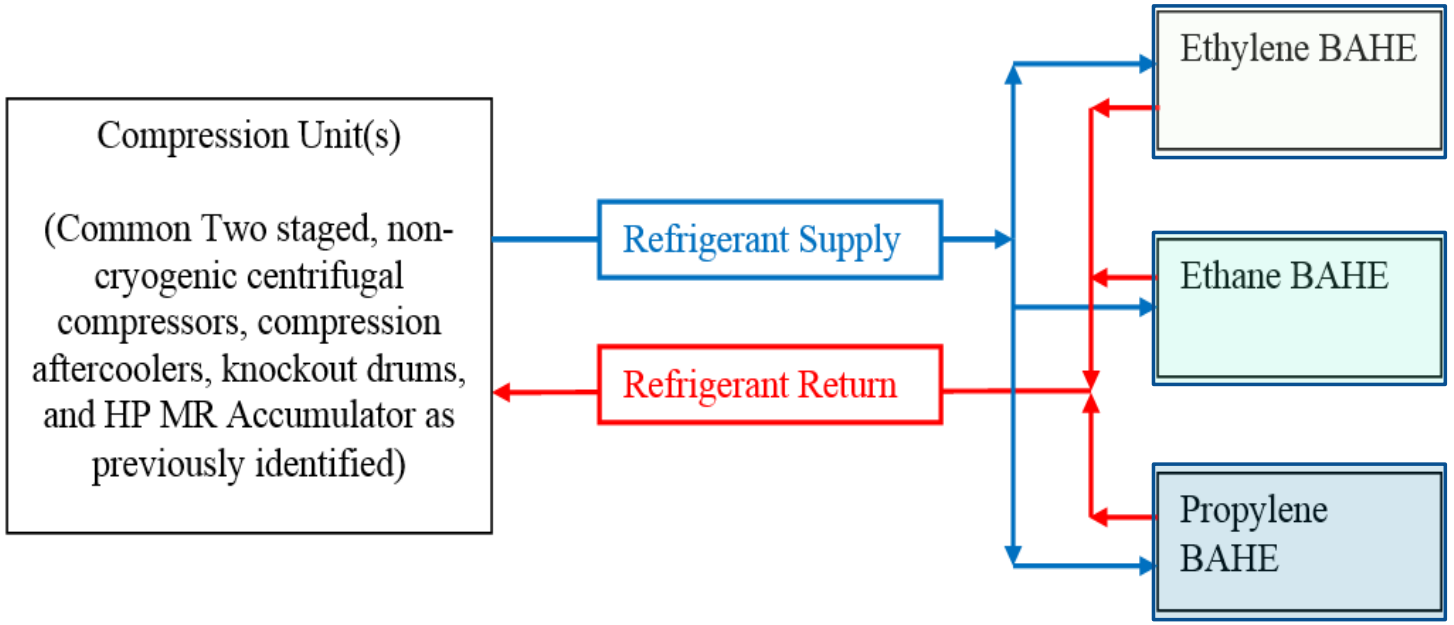
CMR-XP™ Multi-Product Option

- Open Cycle is Designed for a Specific Product (Temperature and Pressure Driven)
- CMR-XP™ is Adaptive to Other Products: Ethylene, Ethane, Propylene, Propane, (even LNG)

Item	Ethylene	Ethane	Propylene
Molecular Weight	28.06	30.08	42.09
Temperature @ Atm. Pressure	-155	-128	-54.4
Expansion Ratio (Vapor to Liquid)	< 500:1	< 450:1	< 350:1
Estimated Production Capacity	100 mt/hr	110 mt/hr	125 mt/hr

CMR-XP™ Multi-Product Option, Continued

- Refrigerate Multiple Products
- Closed Cycle Refrigeration Process with Top to Bottom; Once-Through Flow
- Optimize Refrigerant Make-Up, Produce Sub-Cooled Liquids, or Decrease Electrical Demand on Compressors



Q&A

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