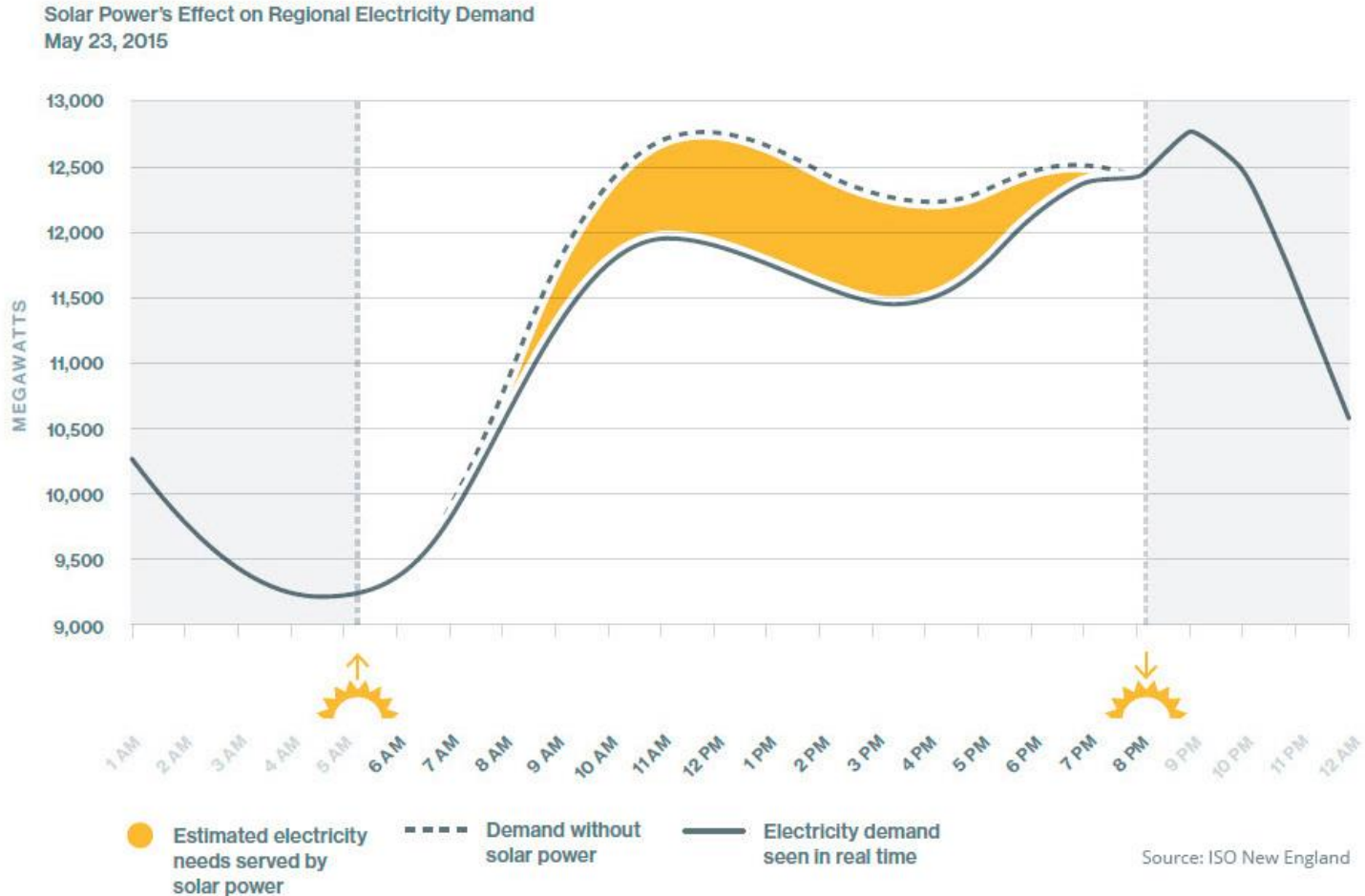


# Fostering Regulatory Partnerships and Engagement in the Natural Gas Markets

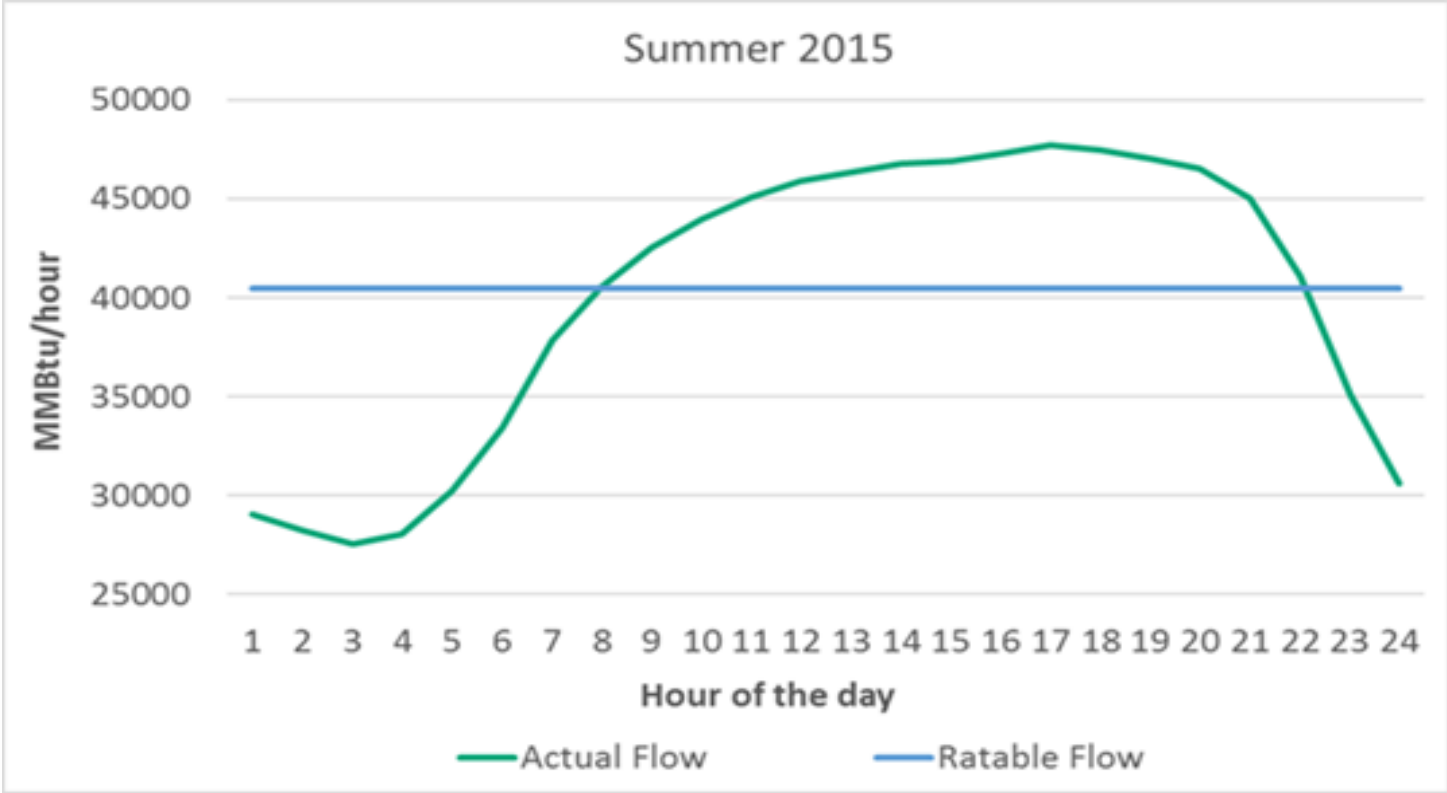
NARUC Gas Committee – November 12, 2018



# Natural Gas and Renewable Integration: Opportunities



# Natural Gas and Renewable Integration: Challenges



# Need for Flexible Gas Deliveries

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**S&P Global**

## **Pipelines need to offer flexible gas deliveries as renewables' role grows**

Wednesday, October 10, 2018 11:14 AM ET

By Gene Laverty

As the electric grid relies more on renewable power sources, particularly in California, natural gas pipeline companies increasingly have to respond to significant and quick changes in demand from gas-fired power plants serving as a backstop to intermittent electricity sources.

Fast responses to power generation demand shifts means pipelines will need to be able to enhance gas deliverability and increase market storage within their service areas, Will Brown, an executive with Kinder Morgan Inc., told the LDC Gas Forums Rockies and West conference. As the California market moves to increased use of solar and wind on its grid, gas "is the only technology that, today, can back up renewables," he said.


"California has made significant strides toward renewable power," Brown said at the Los Angeles gathering Oct. 9. "It becomes increasingly important for natural gas-fired generation to follow this load ... to ensure that grid resilience for reliability."

In anticipation of power sector shifts, Houston-based Kinder Morgan has been adapting its suite of services to meet sudden peaks in demand for gas, said Brown, who is vice president of business management for Kinder Morgan's natural gas pipelines unit in the West. While California is investing heavily in battery storage, the technology is not yet at a level to meet interruptions that could occur as the state works toward tough emissions-reductions goals. California recently enacted legislation setting a planning goal of zero-emissions power by 2045.

"As you rely more on intermittent sources of energy, you've got to have backup," Brown said. "When the sun stops shining, the technologies have got to ramp up to be able to meet the load."

Pipelines have to be able to deliver large volumes of gas on short notice, a major shift from traditional model of supplying gas to industrial and local distribution markets. "Natural gas deliverability is the ability to deliver gas at the required location, time, pressure and quantity," Brown said. "The higher deliverability requires more capacity reservation, more known notice, more hourly service, and more reliance on linepack and market area storage."

# **Solution: Establish Means to Transact for and Reflect Value of Non-ratable Flows in Electric Markets**

- Define “Shaped Nomination” so that generators and pipelines can contract by mutual agreement and establish pricing benchmarks for flexible flows
  - Develop tariff provisions whereby pipelines offer firm or interruptible shaped flow service
  - Subscribing generators would get predictable hourly flows that can be “bid to the grid”
- 

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## COMMITTEE ON GAS

Fostering Regulatory Partnerships &  
Engagement in the Natural Gas Markets

# “YOU’RE GONNA NEED A BIGGER BOAT”: LNG CHALLENGES FROM A SHIPPING PERSPECTIVE

George J. Tsimis, Director  
GJT Marine Consultants LLC  
NARUC Conference – Nov. 11, 2018  
Orlando, Florida



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# LNG: SHIPPING PERSPECTIVE

▶ **TWO PRIMARY TOPICS FROM A SHIPPING PERSPECTIVE:**

- 1. LNG EXPORTS FROM US - DOMESTIC LOGISTICS / INFRASTRUCTURE**
- 2. LNG USE AS ALTERNATIVE FUEL - BUNKERING**

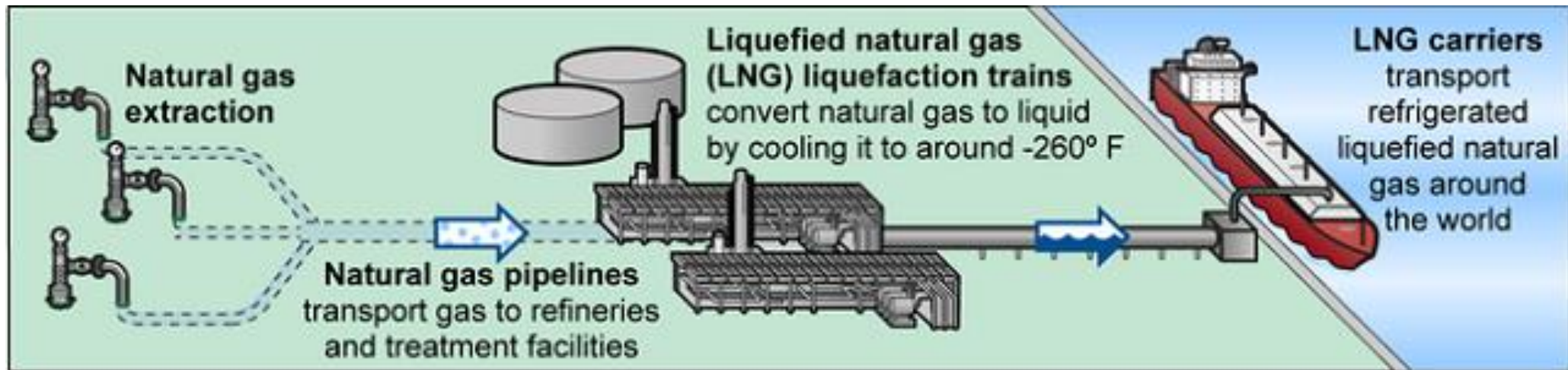


# LNG: SHIPPING PERSPECTIVE – GLOBAL SNAPSHOT

- ▶ **NATURAL GAS USAGE WORLDWIDE HAS INCREASED – CLEANER THAN COAL AND OIL ENERGY SOURCES; REGULATORY LANDSCAPE**
- ▶ **NATURAL GAS LIQUEFACTION PROCESS COOLS (-260° F), COMPRESSES AND TRANSFORMS GAS INTO A COMMODITY THAT CAN BE FERRIED AND SHIPPED AROUND THE WORLD IN SPECIALIZED COMPRESSION TANKERS**
- ▶ **COUNTRIES WORLDWIDE IMPORTING LNG CONTINUE TO GROW**
  - ▶ **2011 – 25 COUNTRIES; 2015 – 35 COUNTRIES; 2016 – 40 COUNTRIES**
- ▶ **MORE ECONOMICAL FOR MANY COUNTRIES TO IMPORT LNG INSTEAD OF BUILDING PIPELINES / OTHER INFRASTRUCTURE**



# LNG: SHIPPING PERSPECTIVE - LOGISTICS



Source: GAO. | GAO-16-104



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# LNG: SHIPPING PERSPECTIVE - INFRASTRUCTURE

- ▶ **U.S. SHIPPING CAPABILITIES HAVE NOT GROWN COMMENSURATELY WITH U.S. LNG PRODUCTION**
- ▶ **U.S. IS IN NEED OF DEVELOPING ADDITIONAL MARITIME INFRASTRUCTURE TO HANDLE INCREASING DEMAND FOR LNG EXPORTATION**
- ▶ **DIFFICULTIES AND CHALLENGES IN TRANSPORTING GAS / LNG FROM ITS INLAND SOURCES TO COASTAL AREAS**
- ▶ **INCREASED DEVELOPMENT OF LNG POWERED VESSELS ADDING TO THESE CHALLENGES – CRUISE SHIPS, CONTAINER SHIPS, TUGS AND ULTIMATELY OTHER CARGO VESSELS**

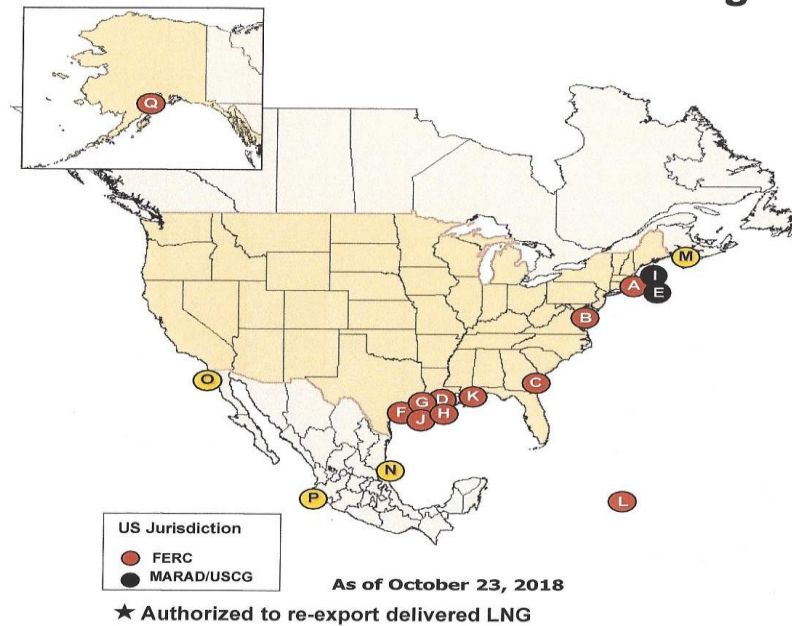


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# LNG: SHIPPING PERSPECTIVE – U.S. EXPORTS

- Only two operational LNG export terminals
- 1 on Atlantic coast and 1 on US Gulf coast
- Nothing on the Pacific coast at this time

## North American LNG Import/Export Terminals Existing



### Import Terminals

#### U.S.

- A. Everett, MA: 1.035 Bcfd (GDF SUEZ - DOMAC)
- B. Cove Point, MD: 1.8 Bcfd (Dominion - Cove Point LNG)
- C. Elba Island, GA: 1.6 Bcfd (El Paso - Southern LNG)
- D. Lake Charles, LA: 2.1 Bcfd (Southern Union - Trunkline LNG)
- E. Offshore Boston: 0.8 Bcfd (Excelerate Energy - Northeast Gateway)★
- F. Freeport, TX: 1.5 Bcfd (Cheniere/Freeport LNG Dev.)★
- G. Sabine, LA: 4.0 Bcfd (Cheniere/Sabine Pass LNG)★
- H. Hackberry, LA: 1.8 Bcfd (Sempra - Cameron LNG)
- I. Offshore Boston, MA: 0.4 Bcfd (GDF SUEZ - Neptune LNG)
- J. Sabine Pass, TX: 2.0 Bcfd (ExxonMobil - Golden Pass) (Phase I & II)
- K. Pascagoula, MS: 1.5 Bcfd (El Paso/Crest/Sonangol - Gulf LNG Energy LLC)
- L. Peñuelas, PR: 0.3 Bcfd (EcoElectrica)

#### CANADA

- M. Saint John, NB: 1.0 Bcfd (Repsol/Fort Reliance - Canaport LNG)

#### MEXICO

- N. Altamira, Tamulipas: 0.7 Bcfd (Shell/Total/Mitsui - Altamira LNG)
- O. Baja California, MX: 1.0 Bcfd (Sempra - Energia Costa Azul)
- P. Manzanillo, MX: 0.5 Bcfd (KMS GNL de Manzanillo)

### Export Terminals

#### U.S.

- B. Cove Point, MD: 0.82 Bcfd (Dominion-Cove Point LNG) (CP13-113)
- G. Sabine, LA: 2.8 Bcfd (Cheniere/Sabine Pass LNG - Trains 1, 2, 3 & 4)
- Q. Kenai, AK: 0.2 Bcfd (ConocoPhillips)



# LNG: SHIPPING PERSPECTIVE – U.S. EXPORTS

- ▶ **U.S. EXPORTED LNG TO 30 COUNTRIES IN 2017\***
- ▶ **53% WENT TO CHINA, S. KOREA & MEXICO**
- ▶ **U.S. WAS THE SIXTH LARGEST LNG EXPORTER WORLDWIDE IN 2017**
- ▶ **QUADRUPLED ITS 2016 EXPORTS**
- ▶ **LNG CARGOES TRADITIONALLY SOLD ON SPOT BASIS**

\* - Data provided by the U.S. Energy Information Administration



# LNG: SHIPPING PERSPECTIVE - INFRASTRUCTURE

- ▶ **SABINE PASS, LA LNG TERMINAL (CHENIERE) IS THE MAIN PORT OF EXPORT FOR U.S. LNG CARGOES (SEE PREVIOUS SLIDE)**
- ▶ **COVE POINT, MD LNG TERMINAL (DOMINION) OPENED IN MARCH 2018; \$4 BILLION PROJECT; REDUCES SAILING TIME TO EUROPE BY 3 DAYS**
- ▶ **THESE TWO FACILITIES EXPORT 3.6 BILLION CUBIC FEET PER DAY (Bcf/d) \***

\* - Data provided by the U.S. Energy Information Administration



# LNG: SHIPPING PERSPECTIVE: INFRASTRUCTURE

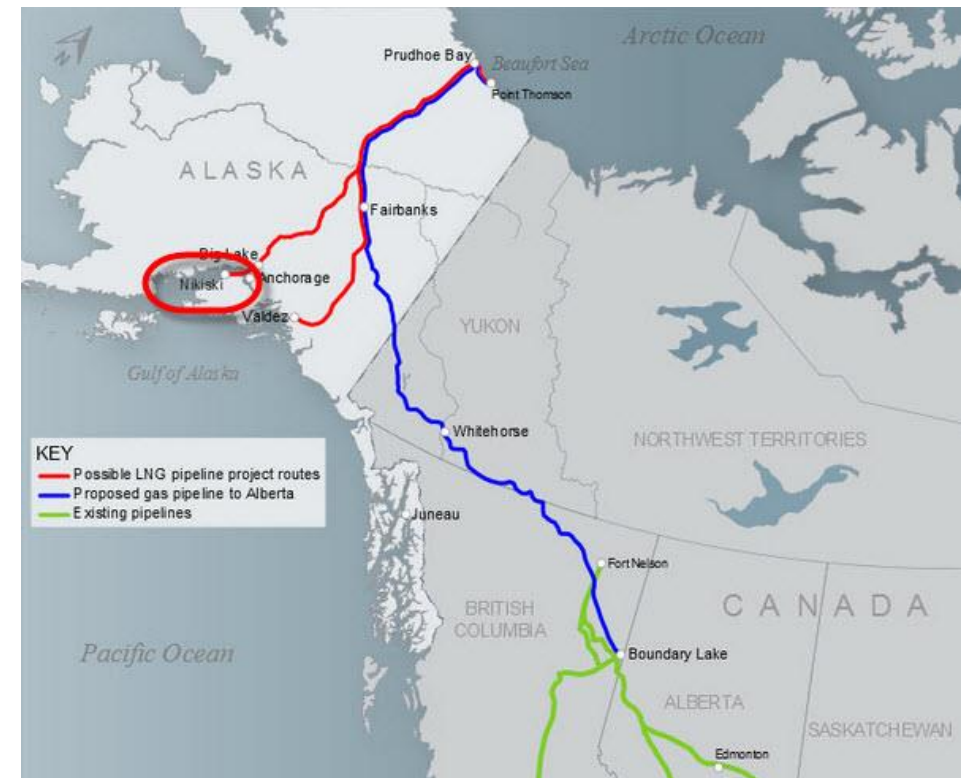
- ▶ **FOUR NEW PROJECTS EXPECTED TO COME ON LINE BY 2019-2020:**
  - ▶ ELBA ISLAND LNG IN GEORGIA
  - ▶ CAMERON LNG IN LOUISIANA
  - ▶ FREEPORT LNG IN TEXAS
  - ▶ CORPUS CHRISTI LNG IN TEXAS
- ▶ **BY 2020, U.S. LNG EXPORT CAPACITY IS EXPECTED TO REACH 9.6 Bcf/d, WHICH WOULD MAKE THE U.S. THE 3<sup>RD</sup> LARGEST LNG EXPORTER IN THE WORLD\***

\* - Data provided by the U.S. Energy Information Administration



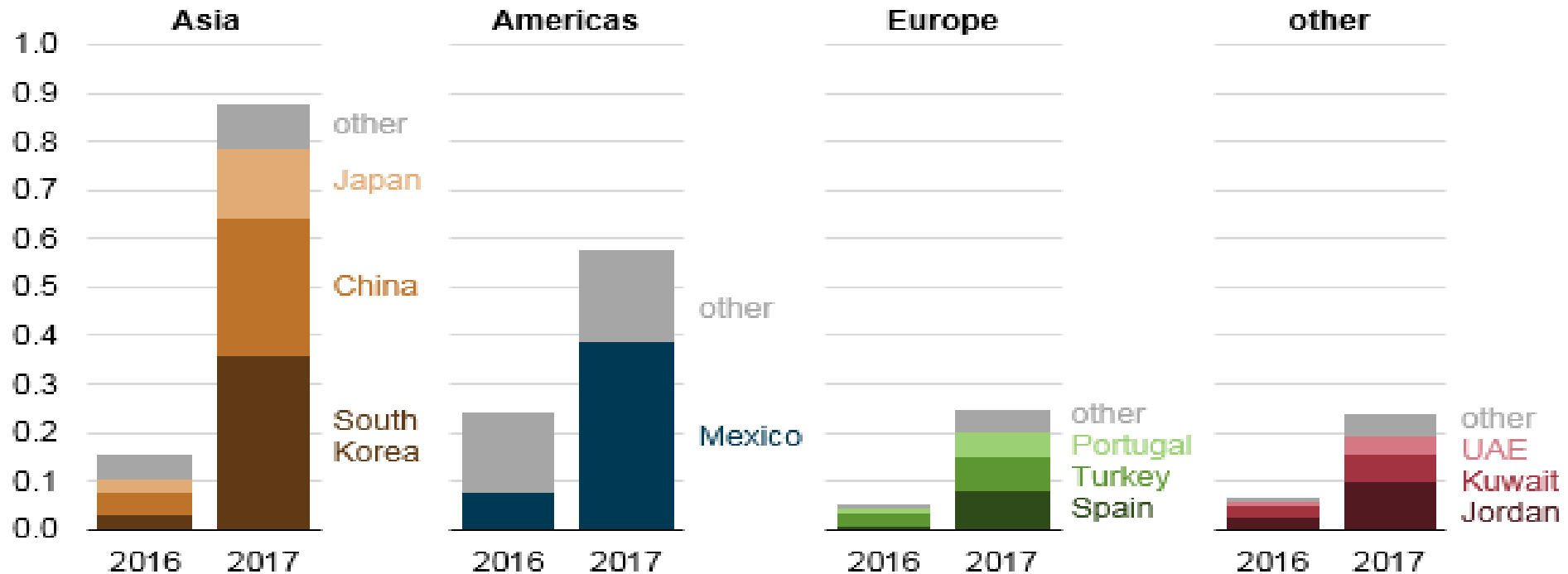
# LNG: SHIPPING PERSPECTIVE - INFRASTRUCTURE

- ▶ **ALASKA – NIKISKI, KENAI PENINSULA**
  - ▶ **ORIGINALLY BUILT IN 1969**
  - ▶ **SOLD IN EARLY 2018 BY CONOCO PHILLIPS TO ANDEAVOR**
  - ▶ **BANK OF CHINA ACTIVELY SEEKING TO INVEST**
- ▶ **HOPING TO BECOME MAIN U.S. LNG EXPORTATION HUB FOR CHINA / FAR EAST**
- ▶ **\$43 BILLION PRICE TAG TO BUILD PIPELINE AND LNG PLANT**
- ▶ **AIMING TO PRODUCE 15 MILLION TONS/YR OF LNG**
- ▶ **EXPECTING TO BECOME OPERATIONAL BY 2025**



# LNG: SHIPPING PERSPECTIVE - U.S. EXPORTS

**U.S. exports of liquefied natural gas**  
billion cubic feet per day



\* - Data provided by the U.S. Energy Information Administration

# LNG: SHIPPING PERSPECTIVE: INFRASTRUCTURE

- ▶ **WORLDWIDE LNG VESSEL FLEET IN 2017 – 478 VESSELS WITH 27 NEWBUILDINGS ORDERED**
- ▶ **IN 2017, ALL LNG CARRIERS WERE FOREIGN FLAGGED; NO U.S. FLAG LNG CARRYING TONNAGE – JONES ACT CONSIDERATIONS**
- ▶ **IN 2017, 60% OF U.S. LNG CARGOES WERE SOLD ON SPOT BASIS; REST SOLD PURSUANT TO LONG-TERM SUPPLY CONTRACTS**



# SHIPPING PERSPECTIVE: LNG AS ALTERNATIVE FUEL

## SECOND TOPIC: LNG AS A MARINE FUEL

- ▶ VESSELS PRESENTLY CONSUME 4 MILLION BBLs PER DAY OF HIGH SULPHUR FUEL OIL
- ▶ FUEL COSTS MAKE UP 50% OF DAILY VESSEL OPERATIONAL EXPENSES
- ▶ HEAVY FUEL OIL & MARINE DIESEL OIL ARE MOST COMMON FUELS USED BY VESSELS



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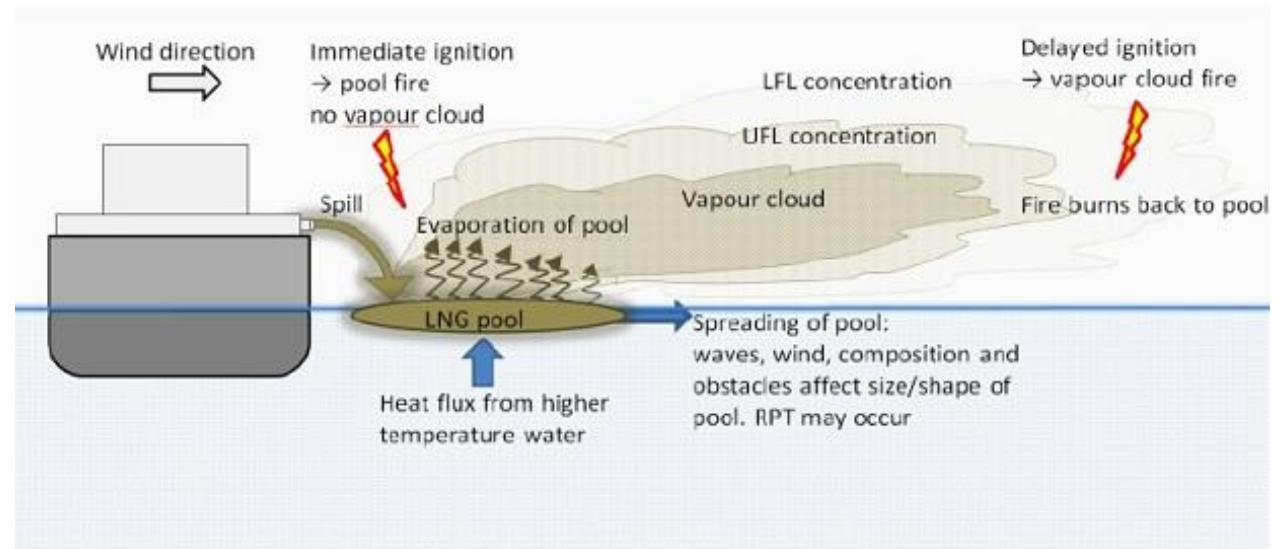
# SHIPPING PERSPECTIVE: LNG AS ALTERNATIVE FUEL

**OIL CAN BE A FOUR LETTER WORD**



# SHIPPING PERSPECTIVE: LNG AS ALTERNATIVE FUEL

- ▶ **LNG POSES DIFFERENT THREATS TO VESSEL, ITS CREW AND THE ENVIRONMENT**
- ▶ **WOULD APPEAR TO BE LESS DESTRUCTIVE TO ENVIRONMENT THAN A CRUDE OIL SPILL**
- ▶ **GREATER DANGERS TO CREW AND THE VESSEL / TERMINAL**



Possible outcome of LNG spill over water



# SHIPPING PERSPECTIVE: LNG AS ALTERNATIVE FUEL



- ▶ 90% OF WORLD TRADE IS CARRIED ON SHIPS
- ▶ PRIOR TO 2005, VESSELS BURNED FUEL THAT CONTAINED 10,000 TIMES MORE SULPHUR THAN FOUND IN CAR FUEL
- ▶ SHIPPING ACCOUNTS FOR 2.7% OF THE WORLD'S CO<sub>2</sub> EMISSIONS AND 14% OF WORLD'S SULPHUR OXIDE POLLUTION
- ▶ SIGNIFICANT EMISSIONS REDUCTION POTENTIAL
- ▶ POST-*EXXON VALDEZ* REGULATIONS FOCUSED ON OIL SPILL POLLUTION PREVENTION AND SAFETY
- ▶ LATEST INT'L ENVIRONMENTAL REGULATIONS TARGET VESSEL EMISSIONS



# SHIPPING PERSPECTIVE: LNG AS ALTERNATIVE FUEL

- ▶ **MARPOL ANNEX VI & SULPHUR CAP 2020 WILL LIMIT EMISSIONS**
  - ▶ 0.1% OR 1,000 PARTS PER MILLION IN ECAs COASTAL & PORT AREAS
  - ▶ 0.5% OR 5,000 PARTS PER MILLION GLOBALLY
- ▶ **MOST SIGNIFICANT REGS SINCE OPA 90**
  - ▶ INTERNATIONAL MARITIME ORGANIZATION (IMO)
  - ▶ U.S. - EPA & U.S. COAST GUARD / DEPT. OF TRANSPORTATION – Title 40 CFR Part 1043



# SHIPPING PERSPECTIVE: LNG AS ALTERNATIVE FUEL

- ▶ DESIGNATION OF EMISSIONS CONTROL AREAS (ECAs)
- ▶ FINES WOULD BE LEVIED BY MEMBER STATES / PORT STATE CONTROL BODY
- ▶ COMPLIANCE WITH IMO REGS MAY NOT SATISFY U.S. REGS
- ▶ SOME U.S. STATES MAY HAVE STRICTER REQUIREMENTS SUCH AS CALIFORNIA OGV FUEL REGS (ALREADY 0.1% WITHIN 24 nm OF STATE)



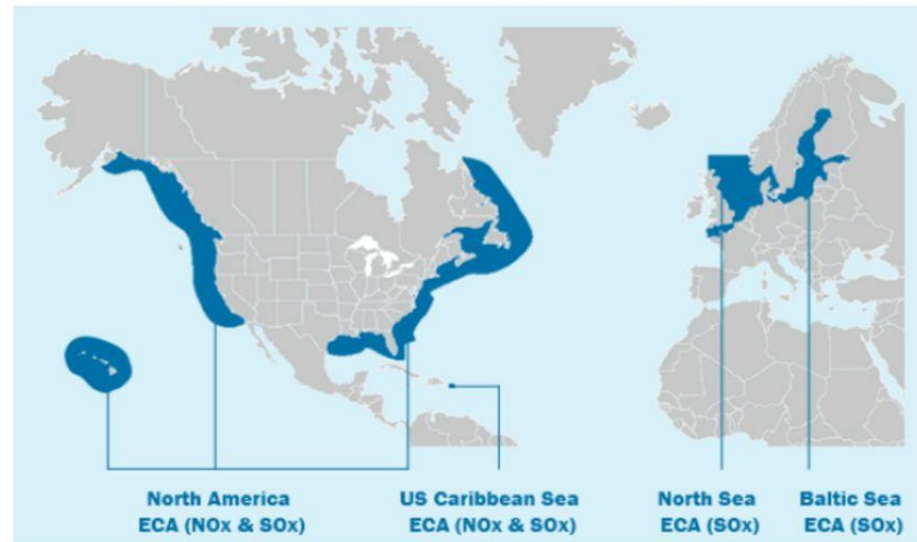
# SHIPPING PERSPECTIVE: LNG AS ALTERNATIVE FUEL

- ▶ VESSEL OPERATORS HAVE DOCUMENTARY OBLIGATIONS WITH FLAG STATE - INTERNATIONAL AIR POLLUTION PREVENTION CERTIFICATE (IAPP)
- ▶ VESSEL MUST OBTAIN BUNKER DELIVERY NOTE FROM SUPPLIER LISTING SULPHUR CONTENT OF SUPPLIED FUEL
- ▶ VESSEL GENERAL PERMIT PROGRAM UNDER U.S. MARITIME LAW ALSO COMPLEMENTS EMISSION REGS AND OTHER POLLUTION LIABILITY REGIMES
- ▶ TREND SINCE *EXXON VALDEZ* SPILL TO CRIMINALIZE SEAFARERS AND VESSEL OPERATING COMPANIES FOR VIOLATIONS OF ENVIRONMENTAL REGULATIONS; MAJOR RISK EXPOSURE / CONCERN



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## Emission Control Areas (ECAs)



Leading the way; making a difference

# SHIPPING PERSPECTIVE: LNG AS ALTERNATIVE FUEL

## SULPHUR CAP 2020

- ▶ IN 2005, IMO REGS INITIALLY CAPPED SULPHUR EMISSIONS AT 4.5%
- ▶ SULPHUR CAP LIMIT REDUCED TO 3.5% IN 2012
- ▶ ON JAN. 1, 2020, THIS CAP WILL BE REDUCED TO 0.5%
- ▶ LNG IS A COMPLIANT FUEL AND VIRTUALLY SULPHUR FREE
- ▶ TODAY'S OIL-BASED FUELS (IFO, MDO & MGO) ARE NOT; LOW SULPHUR VARIANTS REQUIRE FURTHER REFINING WHICH INCREASES COST



# SHIPPING PERSPECTIVE: LNG AS ALTERNATIVE FUEL

## SULPHUR CAP 2020: THREE WAYS TO COMPLY WITH SULPHUR CAP

1. USE LOW SULPHUR VERSIONS OF MDO, MGO, LSHFO
2. INSTALL “SCRUBBERS” WHICH CLEAN EXHAUST / EMISSIONS
3. USE ALTERNATIVE FUELS: LNG (OR LPG, METHANE, BIO FUELS)



# SHIPPING PERSPECTIVE: LNG AS ALTERNATIVE FUEL

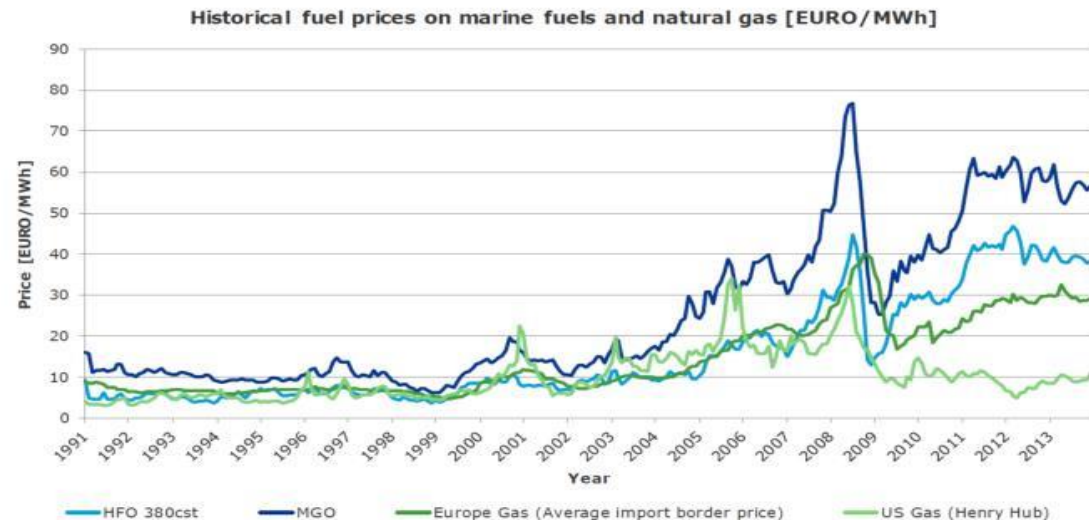
## SULPHUR CAP 2020

- ▶ **TRADITIONAL FUEL OILS ARE RATHER EXPENSIVE**
  - ▶ **INTERMEDIATE FUEL OIL (IFO 180): \$525/MT**
  - ▶ **INTERMEDIATE FUEL OIL (IFO 380): \$495/MT**
  - ▶ **MARINE GAS OIL (MGO) - \$745/MT**
- ▶ **COST OF LNG BUNKERS ARE SIGNIFICANTLY LOWER THAN TRADITIONAL FUELS, ESPECIALLY IN THE U.S. – ABOUT 60% OF HEAVY FUEL OIL**
- ▶ **LOWER SULPHUR OIL FUELS CAN STRESS / DAMAGE TRADITIONAL ENGINES AND INCREASE NAVIGATIONAL / ENVIRONMENTAL RISKS**
- ▶ **ALL OF THESE FACTORS PROMOTE USAGE OF LNG AS AN ALTERNATIVE FUEL**

# SHIPPING PERSPECTIVE: LNG AS ALTERNATIVE FUEL

- ▶ INCENTIVE IN U.S. IS EVEN GREATER DUE TO LOWER PRICE OF LNG
- ▶ LNG IS MORE EXPENSIVE ELSEWHERE SUCH AS E.U.

## Fuel price – HFO, MGO, LNG



Sources: Clarkson, Worldbank



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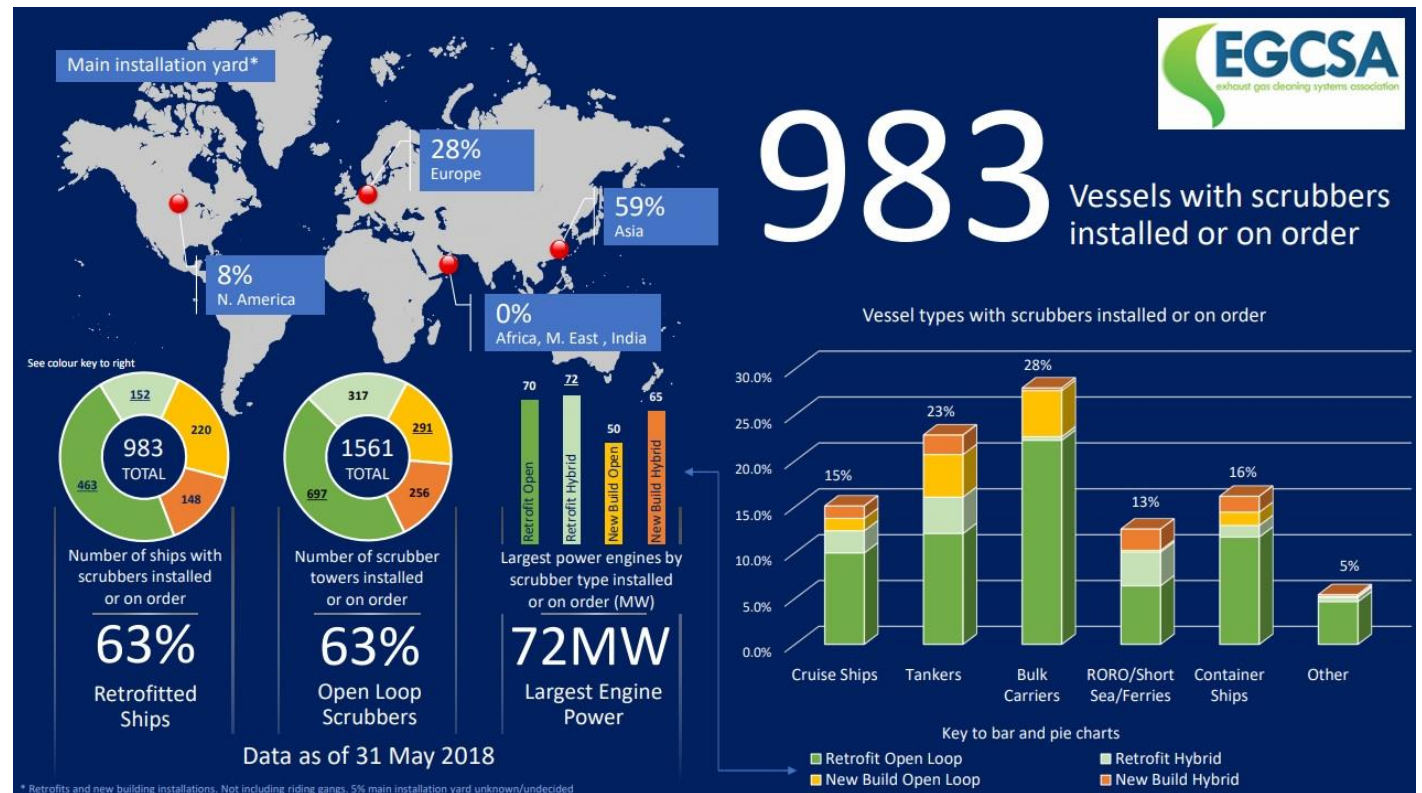
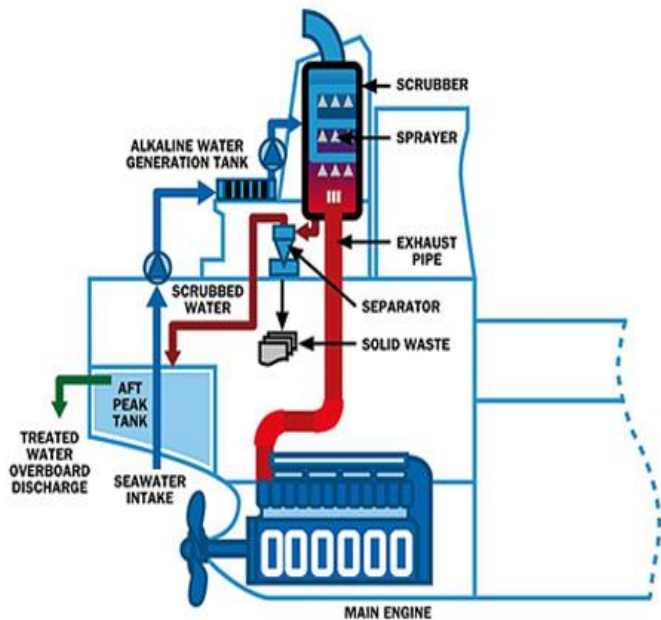
# SHIPPING PERSPECTIVE: LNG AS ALTERNATIVE FUEL

## SULPHUR CAP 2020 – THE “SCRUBBER” OPTION

- ▶ USING EXHAUST GAS CLEANING SYSTEM (EGCS) OR “SCRUBBER” TECHNOLOGY WITH CURRENT TRADITIONAL OIL FUELS (IFO, MDO, MGO) TO COMPLY WITH 0.1% EMISSIONS SULPHUR CAP
- ▶ COSTLY WAY TO COMPLY WITH EMISSIONS REGULATIONS AND 0.5% SULPHUR CAP (installation, operation, sludge removal, water disposal, added repairs/maintenance and insurance)
- ▶ SCRUBBER INSTALLATION CAN COST \$2 MILLION PER VESSEL
- ▶ ALL OF THESE FACTORS PROMOTE USAGE OF LNG AS AN ALTERNATIVE

# SHIPPING PERSPECTIVE: LNG AS ALTERNATIVE FUEL

▶ THE SCRUBBER OPTION IS BEING PURSUED BY MOST OF THE SHIPPING INDUSTRY



# SHIPPING PERSPECTIVE: LNG AS ALTERNATIVE FUEL

- ▶ **LNG POWERED CRUISE SHIPS ARE ON ORDER; 13 OF 73 NEWBUILDS WILL BE LNG POWERED**
- ▶ **NEW LNG POWERED U.S. FLAG CARGO VESSELS ARE BEING BUILT BY TOTE, CROWLEY AND OTHERS**
- ▶ **FIRST U.S. FLAG BUNKER BARGE WAS LAUNCHED EARLIER THIS YEAR**



# SHIPPING PERSPECTIVE: LNG AS ALTERNATIVE FUEL

- ▶ **LNG POWERED VESSELS WILL NEED LNG BUNKERING INFRASTRUCTURE**
- ▶ **CONRAD SHIPYARD IN LOUISIANA RECENTLY BUILT AND DELIVERED THE *CLEAN JACKSONVILLE* TO TOTE MARITIME**
- ▶ **1<sup>ST</sup> U.S. FLAG BUNKER BARGE AND 1<sup>ST</sup> NORTH AMERICAN LNG BUNKERING BARGE**
- ▶ **2,200 CBM LNG CAPACITY AT A RATE OF 500 CBM/HR**



# LNG: SHIPPING PERSPECTIVE – “BIGGER BOAT”

## CONCLUSIONS/ RECOMMENDATIONS

- ▶ U.S. EXPORTATION OF LNG IS BOOMING REQUIRING A BALANCED APPROACH TO INFRASTRUCTURE DEVELOPMENT (PIPELINE, SHIPPING & TRUCKING ALIKE)
- ▶ CREATE COST-EFFICIENT SOLUTIONS TO LOGISTICAL PROBLEMS; SEEK PARTICIPATION OF ALL STAKEHOLDERS ALONG THE TRANSPORTATION CHAIN
- ▶ IDENTIFY OPPORTUNITIES CREATED BY BOTH EXISTING AND EVOLVING ENVIRONMENTAL REGULATORY LANDSCAPE
- ▶ DEVELOP A FEASIBLE U.S. DOMESTIC SHIPPING POLICY TO FOSTER DEVELOPMENT OF FAMILIARITY AND EXPERTISE FOR HANDLING LNG AS CARGO AND FOR BUNKERING
- ▶ INCREASE AND PROMOTE USE OF LNG AS ALTERNATIVE MARINE FUEL; CLEANER, ARGUABLY SAFER, AND COMPLIANT WITH DOMESTIC AND INTERNATIONAL EMISSIONS REGULATIONS



# LNG: SHIPPING PERSPECTIVE – “BIGGER BOAT”

## THANK YOU



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In the Natural Gas Sector