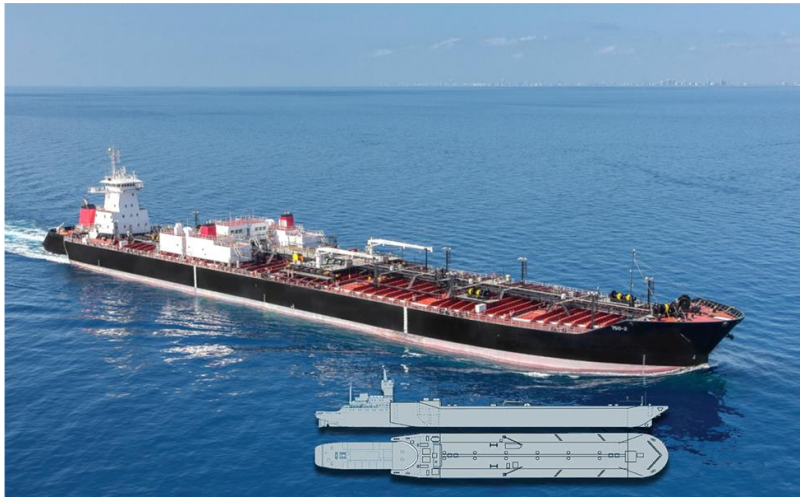
CNGmotive Inc.

Alternative Energy for Railroads



Information Presentation

LNG Logistics

September 20, 2021

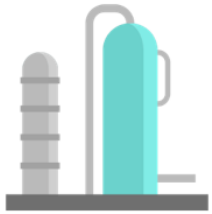
Presentation Topics

- Background on existing transport modes for LNG
  - LNG supply chain
  - Getting LNG to market
- Economics of LNG transport
  - Comparison to crude by rail and gas pipelines
  - Making LNG
- Crossmodal transportation comparison
  - Economics
  - Safety
- LNG by rail markets in the US
  - Marine bunkering
  - Seasonal gas markets

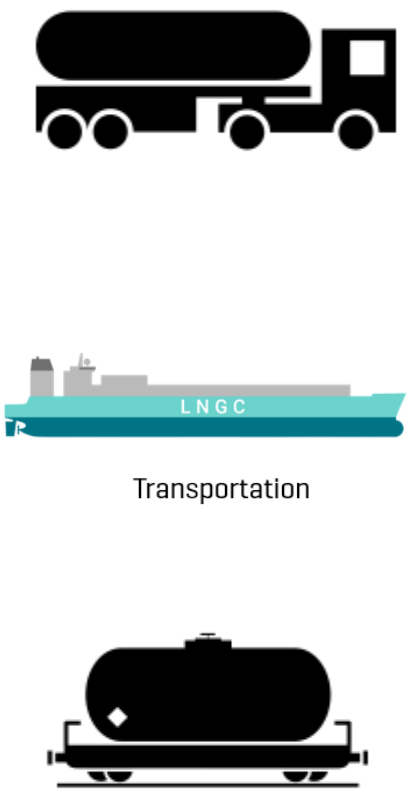
CNG MOTIVE

LNG Supply Chain

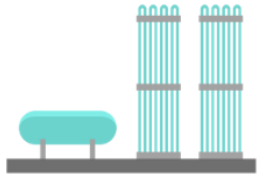
Upstream development



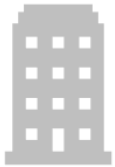
Refrigeration & liquefaction



Transportation

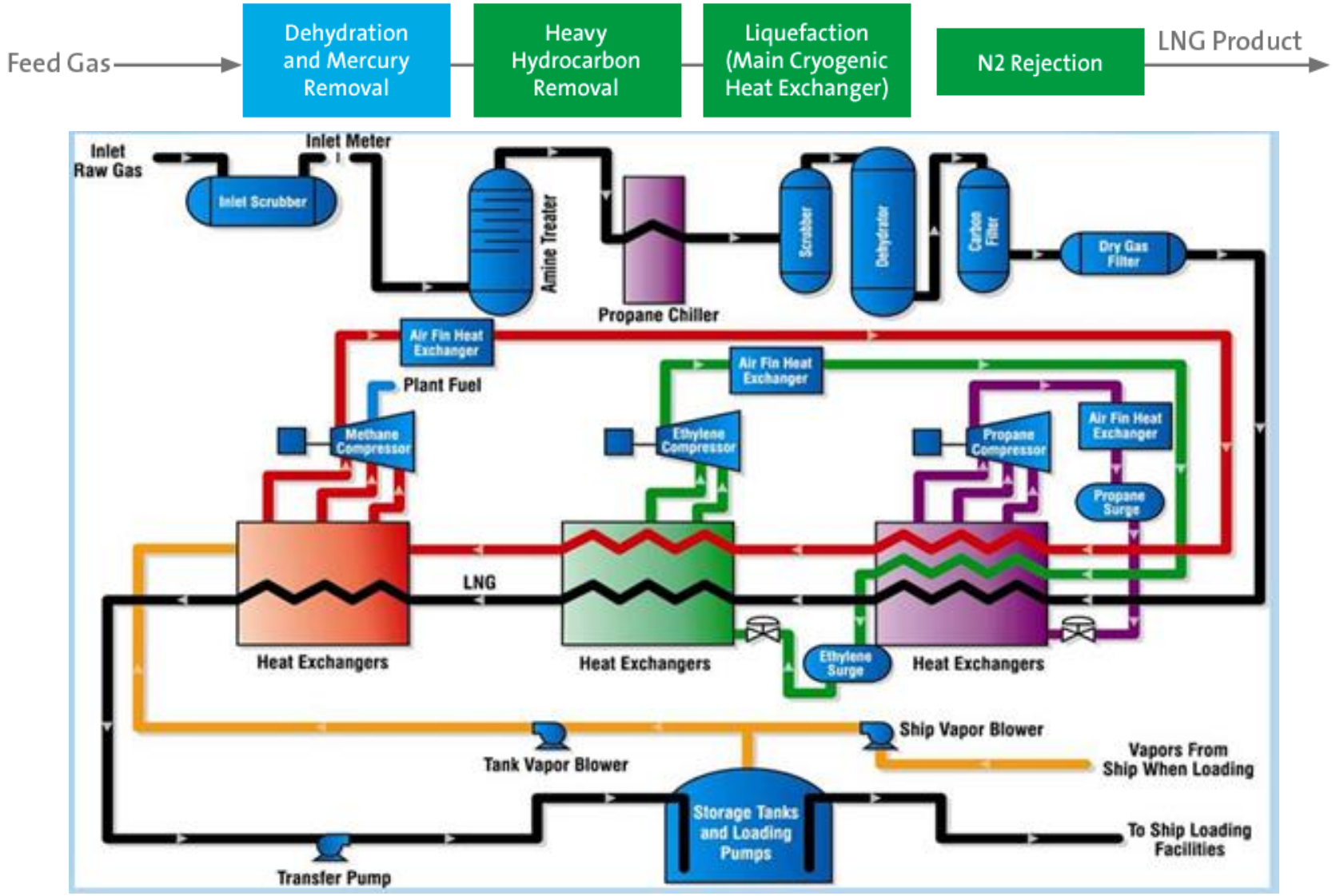


Regasification & distribution



Consumers

What is LNG Liquefaction



Comparing Transportation Modes (Crude by Rail vs Gas Pipeline vs LNG)

Transportation Mode	Typical Facility Capacity	Origin Facility Cost	Destination Facility Cost	Variable Transport Costs of Total Transport Cost
	130,000bpd ~7 million tpa	<$30/tpa	Mostly brownfield	>70%
	2bscfd 15 million tpa 300 miles	$3.5B Construction Cost 42in Pipe (~$275K/in-mi) ~$230/tpa		<3%
	**Small Scale** 100,000tpy **Export Scale** 7 million tpa	**SS** $500/tpa **ES** $1,000/tpa	**Baseload** >$100/tpa **Seasonal** >$500/tpa	<20%

Liquefied Natural Gas Transportation Modes

LNG Ship (LNGC)

Typical Operator – IGC Ship Manager
Ship Size ~1,000ft x 150ft x 42ft
Cargo ~135,000-215,000m3 per Ship
Typical Routes US GoM to Asia/Europe
~10,000nmi to East Asia markets
Ship Cost ~$180M or ~$65,000/day charter rate
Cargo Value >$20M per shipment

LNG by Rail

Typical Operator – Class 1 Railroad
Cargo ~30,700gal max (116m3) per railcar
~5,000-10,000m3 per unit train (practical)
Typical Routes US Small Liquefiers >300mi to end users
Railcar Cost <$600K
Cargo Value >$300K per shipment

LNG Road Tankers

Typical Operator – Hazmat Truck Driver
Truck Size ~53ft length typical
Cargo ~12,700gal max (48m3) per road tanker
Typical Routes US Small Liquefiers ~300mi to end users
Trailer Cost ~$150K or ~$120/hr LD rates
Cargo Value >$6K per shipment

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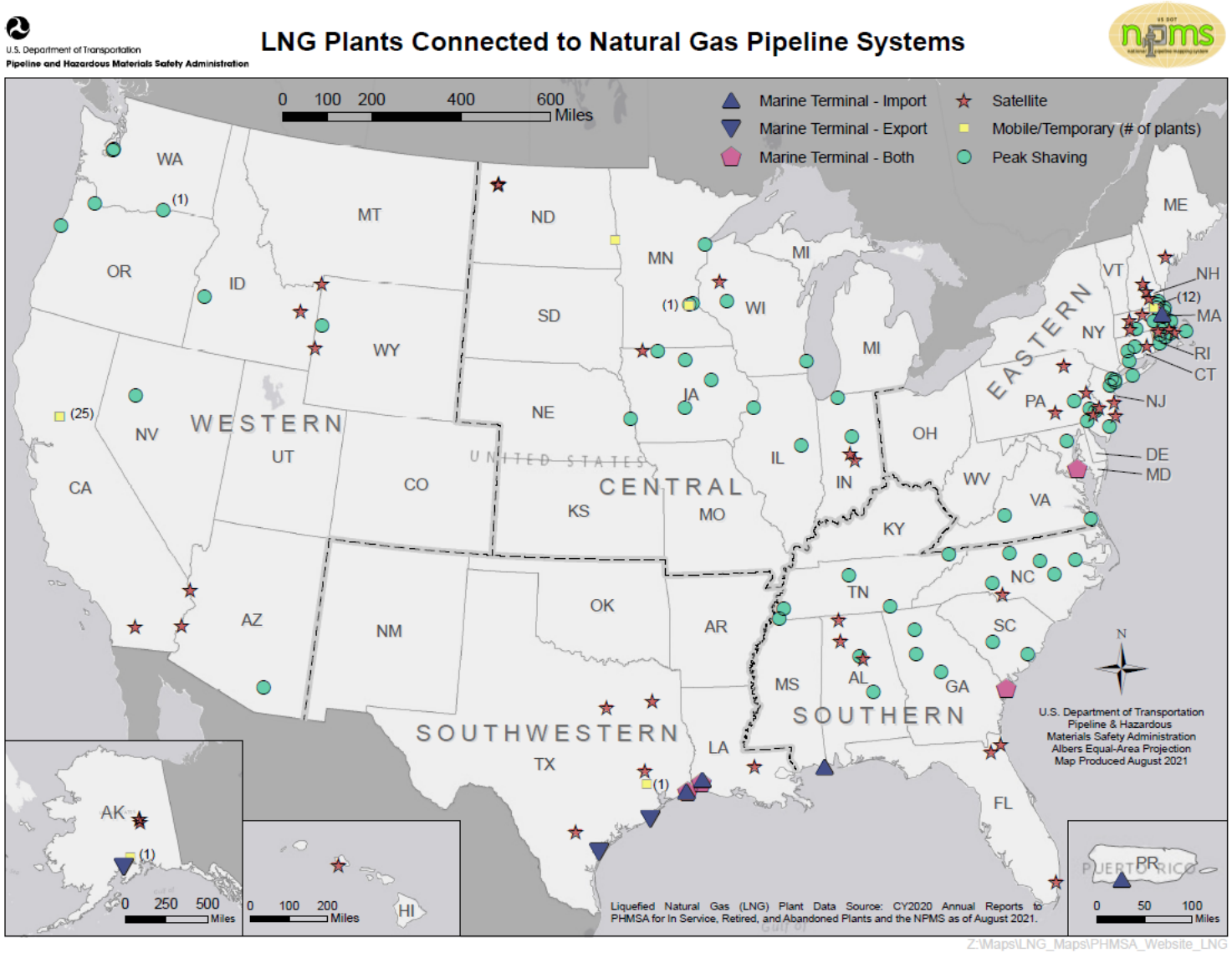
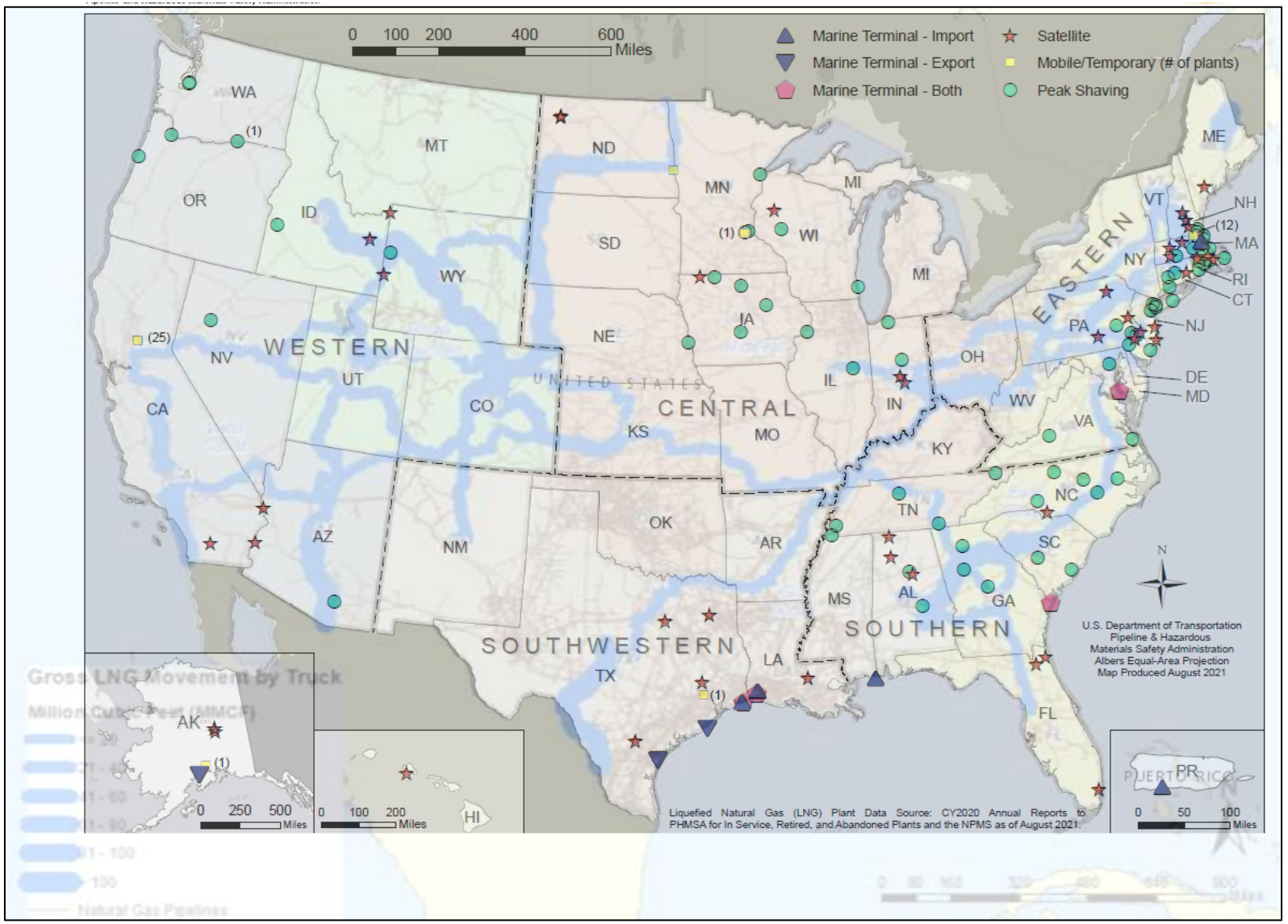
LNG Interstate Movements by Trucks

Source: Energy Information Administration, “2016 Annual Energy Outlook”

Locations of LNG Liquefaction Facilities in the United States



LNG Liquefier Locations vs Truck Transport Densities



LNG Movements by Rail

Source: Federal Railroad Administration, Office of Technical Oversight,

~350mi (570km) – Alaska
Anchorage to Fairbanks
2015 Permit and 2016 Test

~60mi (90km) – Spain
Huelva to Sevilla
2018 Test Multimodal Huelva to Melilla

~500mi (800km) – Germany
Bruensbuttel to Ingolstadt
2021 Power Generation Test

~170mi (280km) – Japan
Tomakomai to Kushiro (Hokkaido)
Regular commercial freight since 2000
Up to 40 LNG ISO containers per train

Transport Profiles and System Statistics

- Road transport
  - Everett, MA
    - 45yrs with 300,000 deliveries
    - Typical radius of 150 miles
  - Overall crash rates similar to LPG
- Gas Pipelines (2020)
  - Gas distribution main >1,300,000mi
  - Gas distribution service >950,000mi
  - Gas transmission & gather >310,000mi

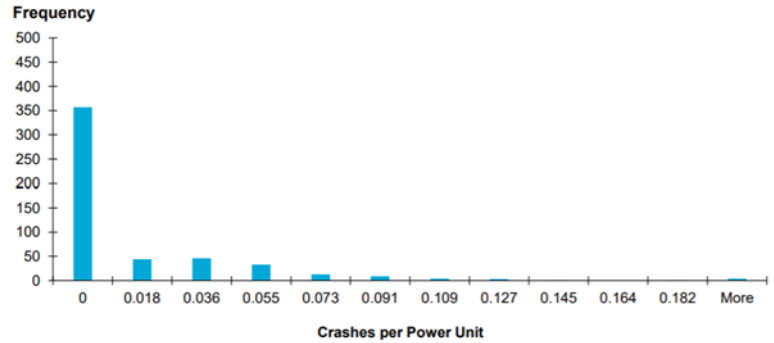


Figure 7.2 Distribution of Crash Rates across LNG Carriers

Source: FMCSA and Cambridge Systematics

PHMSA Pipeline Incidents: (2001-2020)
Incident Type: All Reported **System Type:** LIQUEFIED NATURAL GAS

Calendar Year	Number	Fatalities	Injuries	Total Cost As Reported
2012	1	0	0	$20,000
2013	1	0	0	$2,500
2014	3	0	1	$92,626,519
2015	2	0	0	$60,479
2016	1	0	0	$823
2017	2	0	0	$300,160
2018	3	0	0	$68,377,783
2019	5	0	0	$874,435
2020	5	0	0	$5,388,091
Grand Total	**23**	**0**	**1**	**$167,650,790**

PHMSA Pipeline Incidents: (2001-2020)
Incident Type: All Reported **System Type:** GAS TRANSMISSION

Calendar Year	Number	Fatalities	Injuries	Total Cost As Reported
2001	75	2	5	13,731,347
2002	73	1	4	25,369,331
2003	93	1	8	48,815,101
2004	103	0	2	35,759,907
2005	160	0	5	298,074,982
2006	130	3	3	41,118,273
2007	110	2	7	61,625,942
2008	122	0	5	256,011,440
2009	105	0	11	55,911,891
2010	107	10	61	594,031,047
2011	118	0	1	123,710,870
2012	104	0	7	55,860,855
2013	106	0	2	51,044,739
2014	133	1	1	55,567,727
2015	144	6	16	59,839,826
2016	94	3	3	106,887,884
2017	107	3	3	79,617,650
2018	111	1	5	63,722,482
2019	119	1	8	100,315,971
2020	118	2	1	60,624,537
Grand Total	**2,232**	**36**	**158**	**2,187,641,802**

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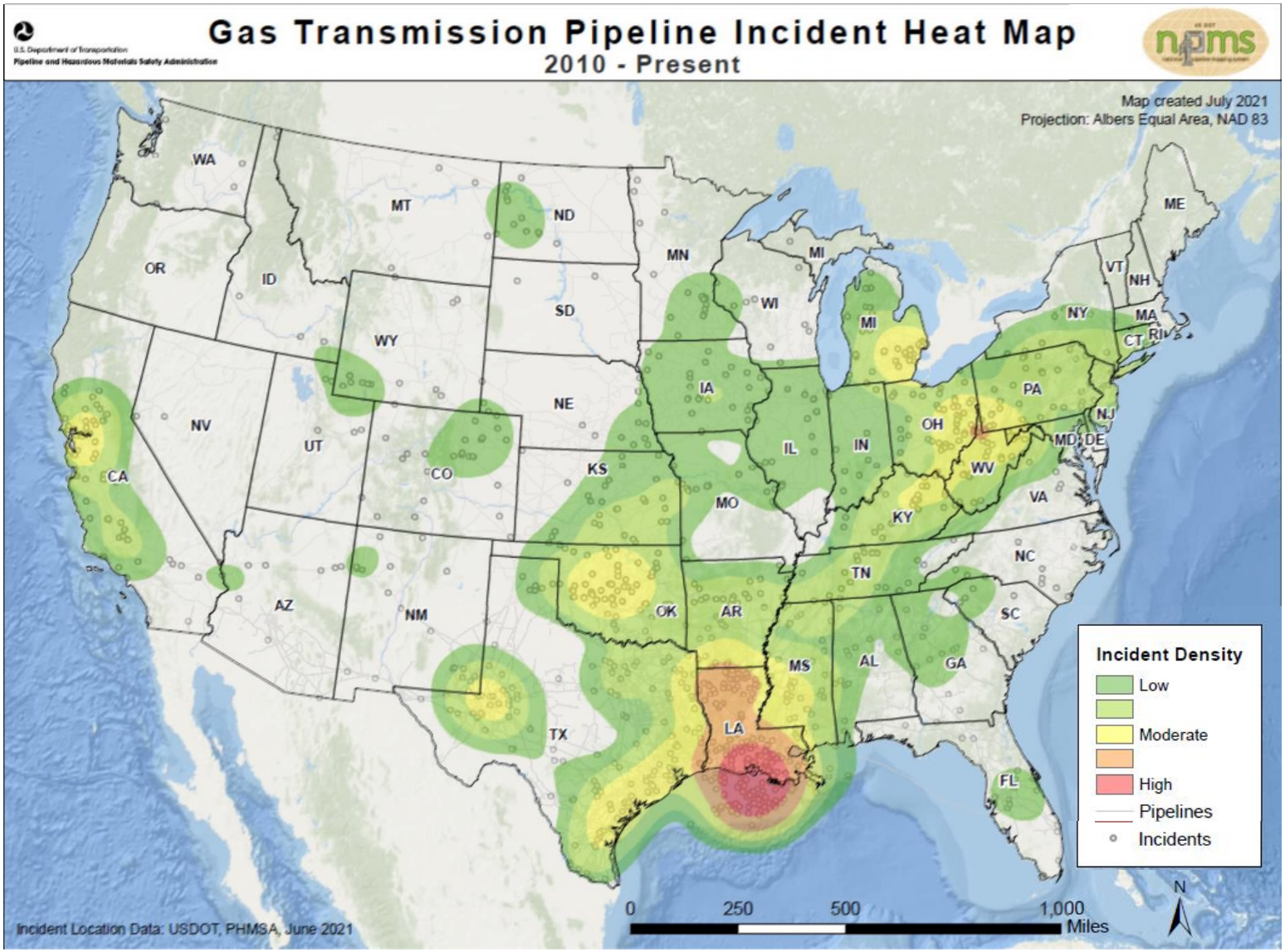
Map with Pipeline Incidents and Intensity (Heat Map)



Growing LNG Application in Ship Bunkering – A Potential Match for Rail?

Railcar ~100m3 net volume LNG

Typical Ship 3,000-15,000m3

~30-200 DOT 113 railcars

Largest Containership on LNG as Fuel
CMA CGM Jacques Saade – 23,000 TEU
18,600M3 LNG tank onboard

~30% of new tonnage in 2021 consisted of LNG-fueled ships

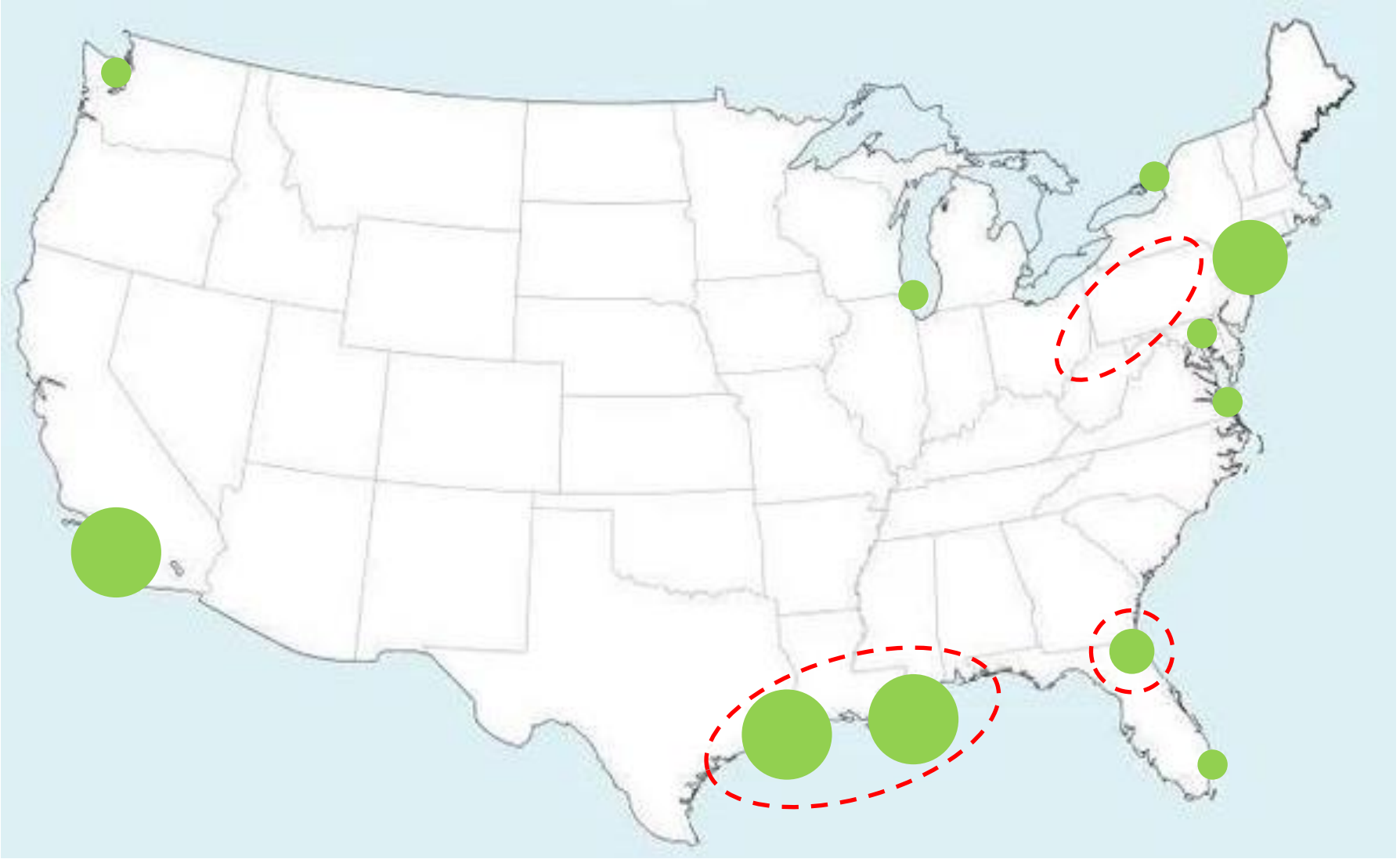
Early adopters in Europe and Asia

Many expected to call on US

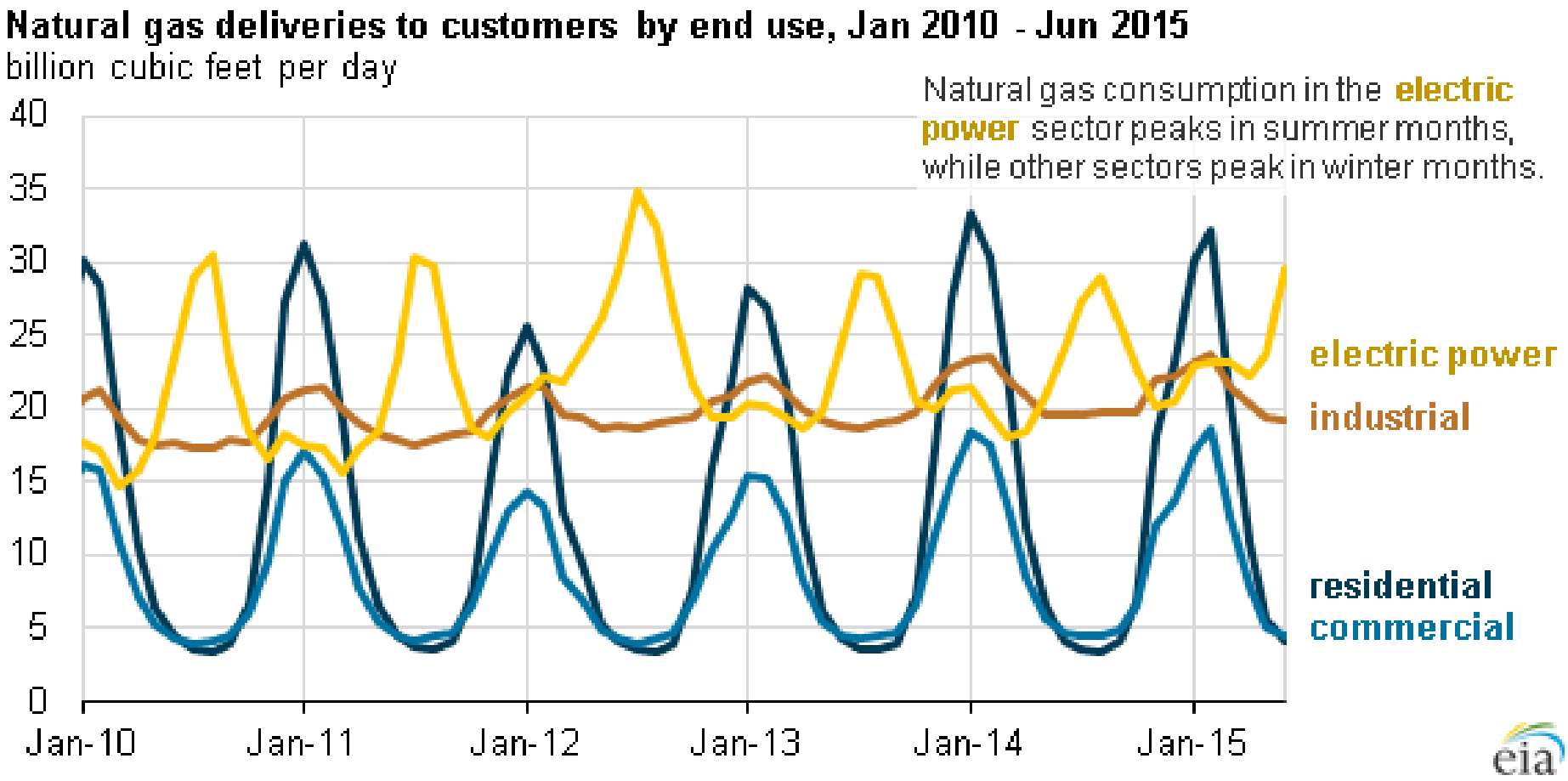
Rail may be an early catalyst for US LNG bunkering infrastructure

CNG MOTIVE

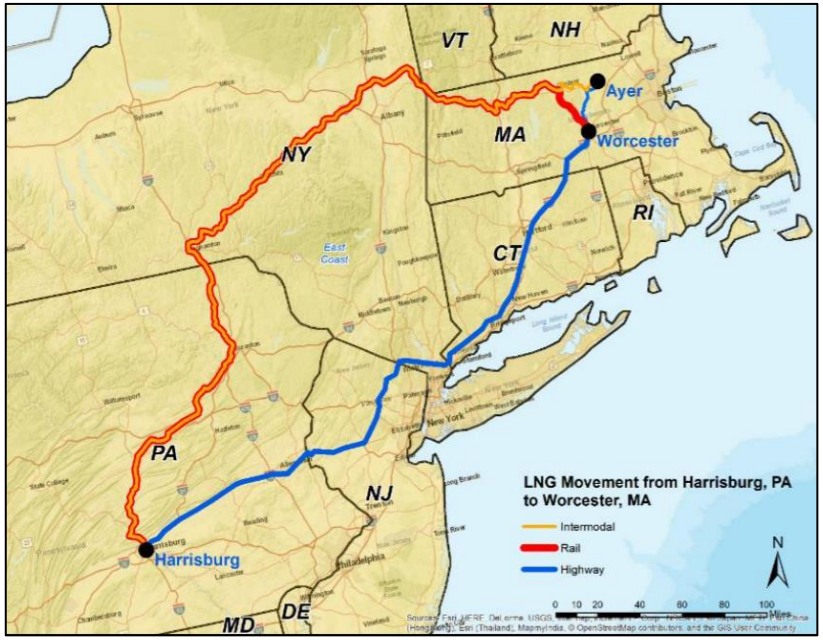
Key LNG Bunkering Opportunities in the US



Managing Seasonality of Natural Gas Demand - A Rail Opportunity?



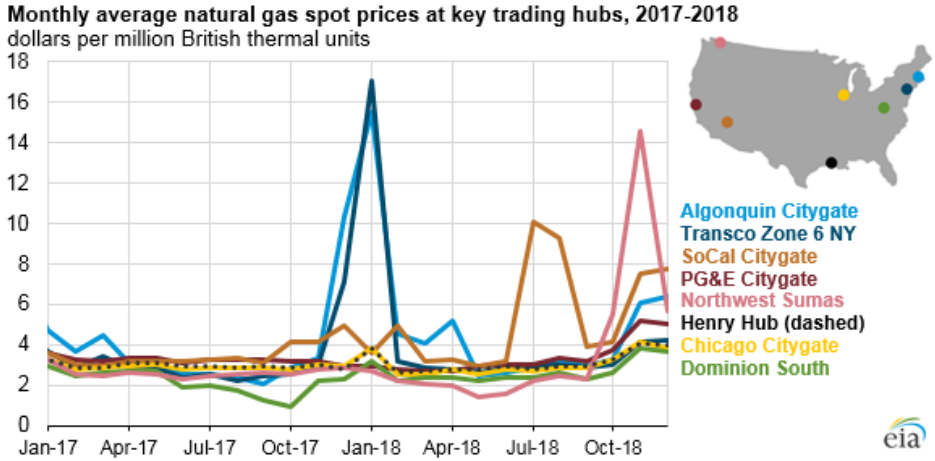
Market Need Example – New England Pipeline Capacity Winter Shortages

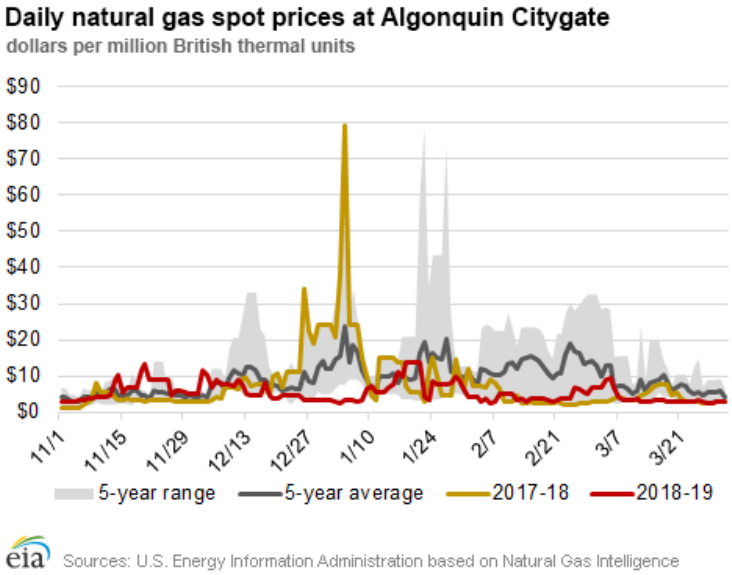


Source: Cambridge Systematics Inc.
"Risk Assessment of Surface Transport of Liquid Natural Gas"

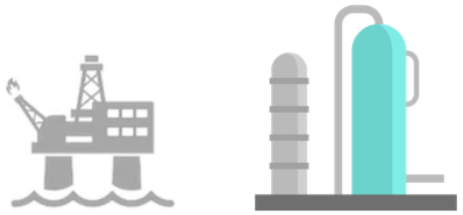
Scenario	Mode 1	Mode 2	Mode 3	Cost	Transport. Cost per MMBtu	Liquefaction, Gasification, and Storage Costs per MMBtu1	Total Cost per MMBtu
1a—Truck	Truck (MC-338)	–	–	$61,494	$0.85	$4.52	**$5.37**
1b—Truck	Truck (ISO)	–	–	$61,183	$0.85	$4.52	**$5.37**
2—Intermodal	Truck (ISO)	Rail (ISO)	Truck (ISO)	$54,733	$0.76	$4.52	**$5.28**
3—Rail	Rail (DOT-113C120W)	Truck (MC-338)		$46,098	$0.64	$4.52	**$5.16**

Sources: Cambridge Systematics Inc., Norfolk Southern Railway, Chart Industries.



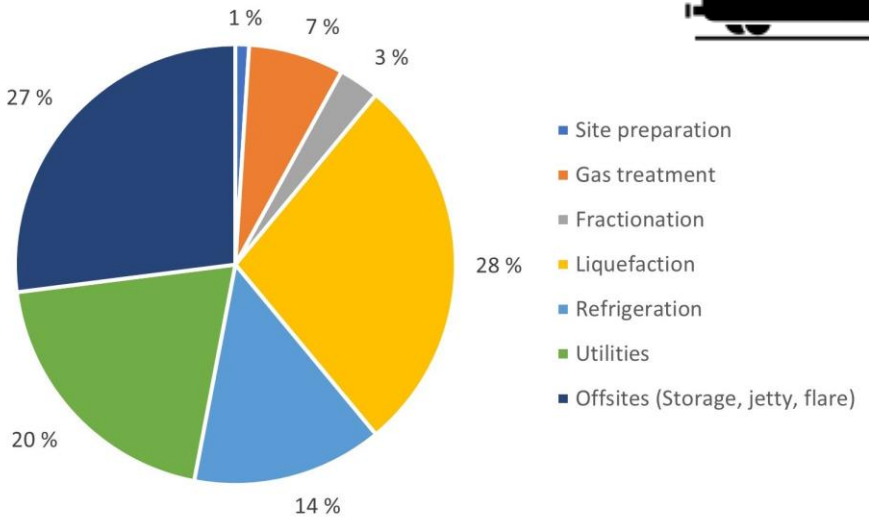


Cost of Liquefaction – Estimates for Rail Facilities



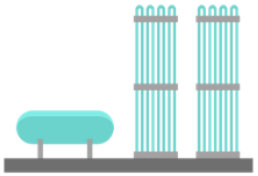
Upstream development

Refrigeration & liquefaction



$3-$5 Commodity
$4-$5 Liquefaction
$1-$2 Rail Transport
$2-$3 Delivery Facilities

$10-$15/mmbtu
~$400-$600/toe



Regasification & distribution

Consumers

LNG Business is Different in US vs International

US LNG Business

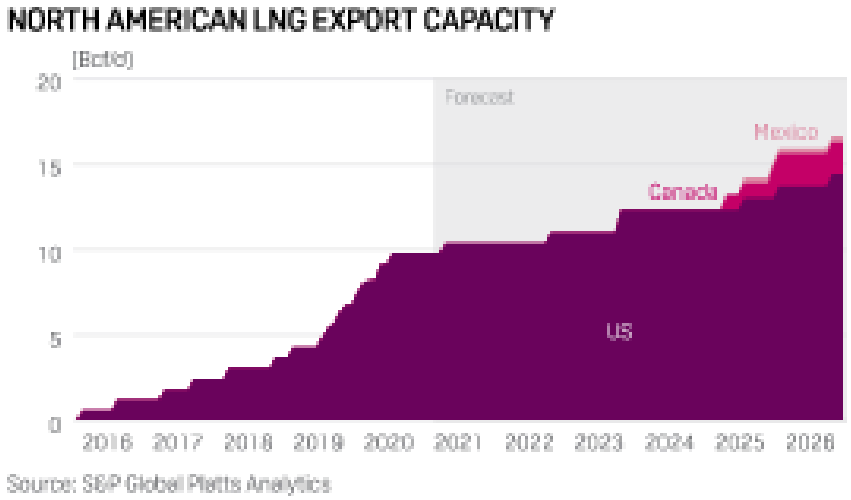
- Domestic pipeline gas sets the market price
- $5+/mmbtu cost adder to liquefy and transport
- Very expensive to bunker ships

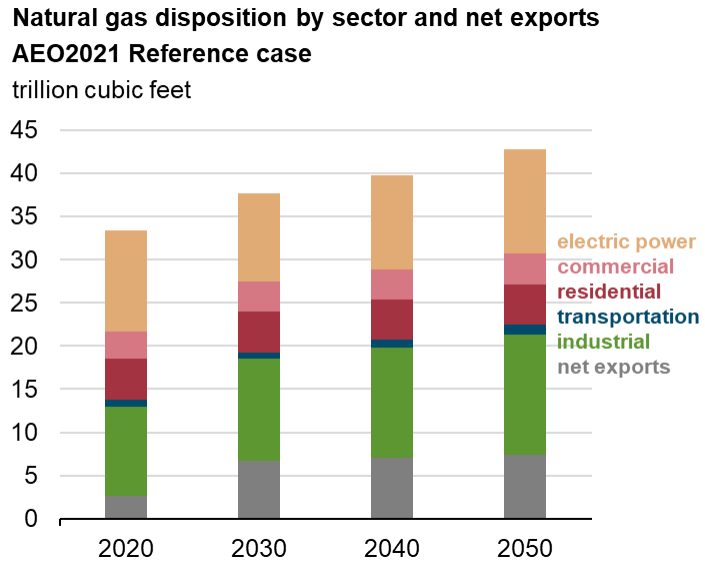
Europe/Asia LNG Business

- LNG imports set the market price
- No cost adder to “liquefy”
- Bunker vessel charter costs <25% US

LNG Exports in Perspective – Liquefaction Capacity to the World

- US LNG exports (2020)
  - 34.4% Korea, Japan, China
  - 15.1% Spain + UK
  - 23.3% Europe Other
  - 10.4% Asia Other
  - 8.9% South America
  - 1.44% Mexico (ship)
  - 0.03% Mexico (truck)
- LNG Export 15.54bcf/d by 2022 (~100 million tpa)
  - Addtl 27.4bcf/d approved
  - >>100bcf/d proposed
- LNG export premium (liquefaction fees) ~$3.54/mmbtu (2020)

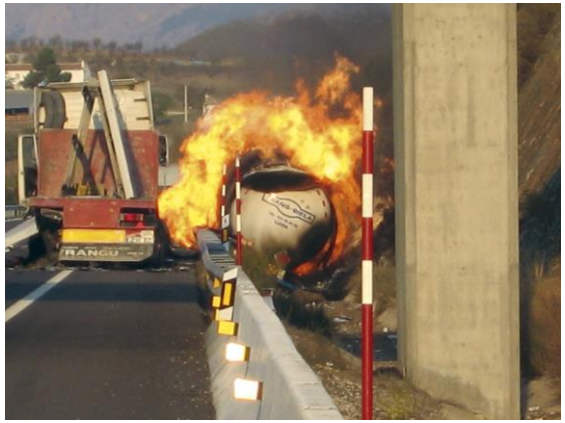




Source: US Energy Information

Safety in Road Transport of LNG

Murcia Spain 2015 BLEVE Incident (12,700 gal)



Dominican Republic 2018 Leak & Explosion (16,300 gal)

Safety in Marine Transport of LNG

Barcelona 2015 LNGC Release Incident

Spills during unloading

Date	Vessel	Description
May 1965	Methane Princess 27,400 m³ Conch tanks	LNG leaked during disconnection of the loading arms. Small crack on
April 1966	Methane Princess 27,400 m³ Conch tanks	Cargo leakage; no details
April 1979	Mostefa Ben Boulaid 125,000 m³ Membrane tanks	Equipment failed while unloading at Cove Point, US, spilling small amount of LNG on deck plate which cracked
April 1979	Pollenger 87,600 m³ Spherical tanks	Equipment failed while unloading at Boston, US, spilling small amount of LNG on tank weather cover plate, which cracked
1985	Isabella 35,500 m³	LNG tank overflowed while vessel was being unloaded, causing a crack to the deck plate.
2015	Fuwairit 138,000 m³	LNG Carrier experienced an overflow of cargo from No 1 cargo tank vent mast whilst engaged in ramping up during discharge operations.

Source: GIIGNL LNG Information Paper #9 – 2019 update