LNG Bunkering Opportunities
SNAME

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Overview of Today's Discussion

- Overview of Pace Global
- Case Study- Baltic and North Seas
  - What's happened in the Baltic and North Seas?
  - LNG as an Alternative Fuel
  - Business Case Development
- How is this Applicable to the Great Lakes?
  - Network Development
  - Infrastructure Requirements
  - Ancillary Markets
- Q&A

Overview: Pace Global

Actively driving business planning and implementation related to small scale CNG and LNG initiatives for market-leaders:

- Strategic Plan Development
- Financial Modeling and Risk Assessment
- Partnership and Technology Options Assessment
- Tactical Planning and Implementation
- Depth of global oil and natural gas market knowledge
- Relationships throughout the supply chain
- Technical capabilities and hands-on experience with NGVs

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Pace Global is a leading energy consulting and management company. We combine deep industry knowledge with commercial, technical, financial, and regulatory expertise to help organizations maximize value and manage risk in today's complex energy and environmental markets. For more than 35 years and in over 60 countries, we have worked closely with our clients to define strategies and implement solutions. We offer a unique, integrated perspective our clients have come to trust. Some call this synergy. We call it the Power of Integration.

Case Study-
Baltic & North Seas

Our Baltic and North Sea Experience

What we found:

- Compelling business case for ship owners and gas suppliers
- Specific ship classes and locations most advantaged by LNG
- Sizable market potential and key drivers for LNG adoption
- Scalable supply chain solution facilitating roll-out
- Genuine interest and progress in commercial development
- Opportunity for integrated LNG hub

Only LNG Meets SOx and NOx Regulations Without After Treatment

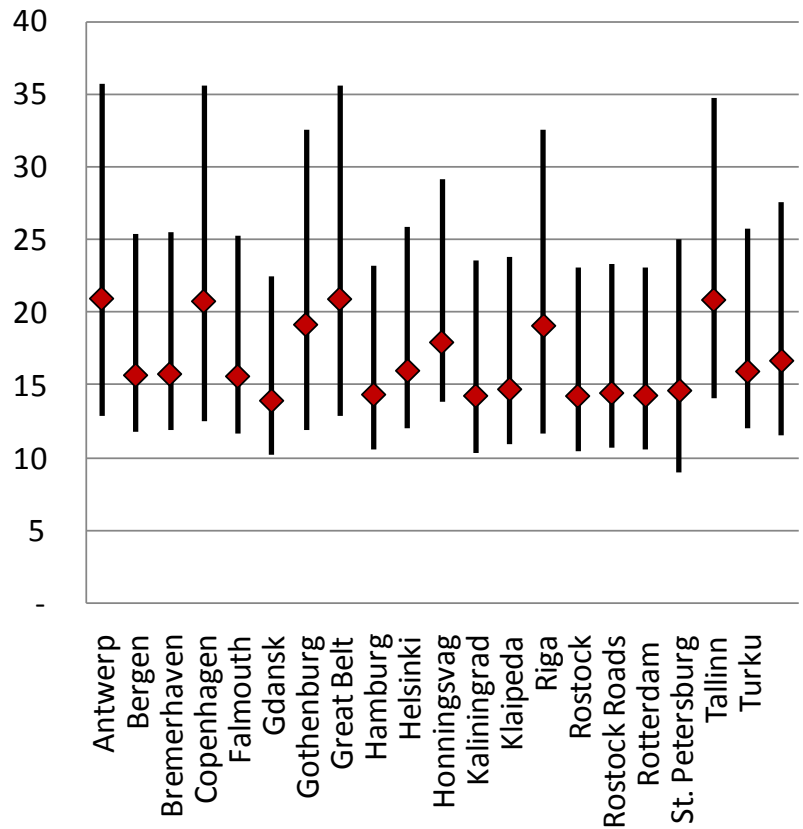
Strong economics provide incentive to overcome potential impact on cargo capacity or a lack of space for additional tankage.

Comparison of LNG vs. Traditional Fuels

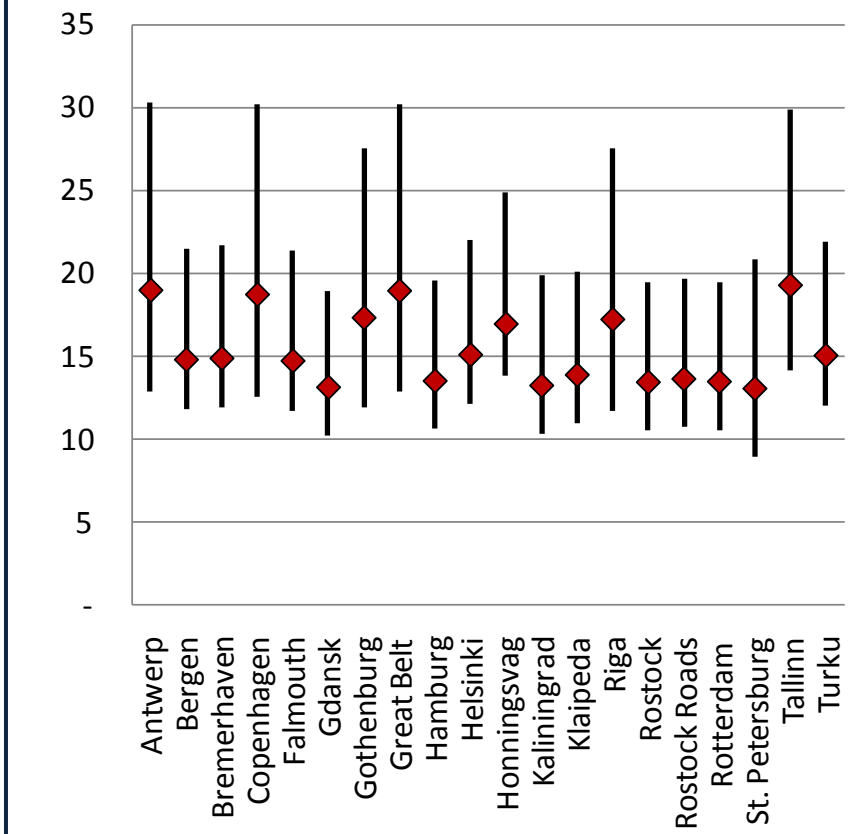
	HFO	MDO/MGO Distillates	Natural Gas
Advantages	• Low fuel cost • Increased demand from road transportation may lead to higher price of distillates • Benefits from existing fuel supply infrastructure and shipping fleet (inertial factor) • User familiarity • Standardized and widely available fuel supply	• Low emissions • No treatment required on board for SOx • Potential for reduced demand from road transportation, making price more competitive as bunker fuel	• Lowest fuel cost • Lowest operating costs (potential annual savings of $800k) • Least environmental impact • Highest efficiency • Improved engine technology promotes acceptance of LNG as ship fuel
Disadvantages	• High emissions – will require scrubbers (SOx) and SCRs (NOx) in ECAs • Scrubbers could add ~US$2MM to capital costs • Market may not accept exhaust abatement technologies • Potential engine problems caused by low-quality fuel oils	• Highest fuel cost, especially post-2015 • SCRs required to meet NOx limits • MGO has the highest combined capital, maintenance, and fuel cost • Potential long-term supply issues due to lack of refining capacity • The low viscosity of low sulphur fuel could cause excessive wear problems	• Energy density of LNG is 60% that of diesel fuel, requiring at least a doubling of storage tank capacity • Lack of existing LNG supply, distribution and refueling infrastructure • Requires engine and fuel tank modifications, making retrofitted vessel an unlikely market • Higher capital cost for newbuild – up to 20% compared with traditional ship

Potential LNG Bunker Price Varies Significantly by Port

Retail LNG Price Variation by Ship Type - All Ships, USD/MMBtu

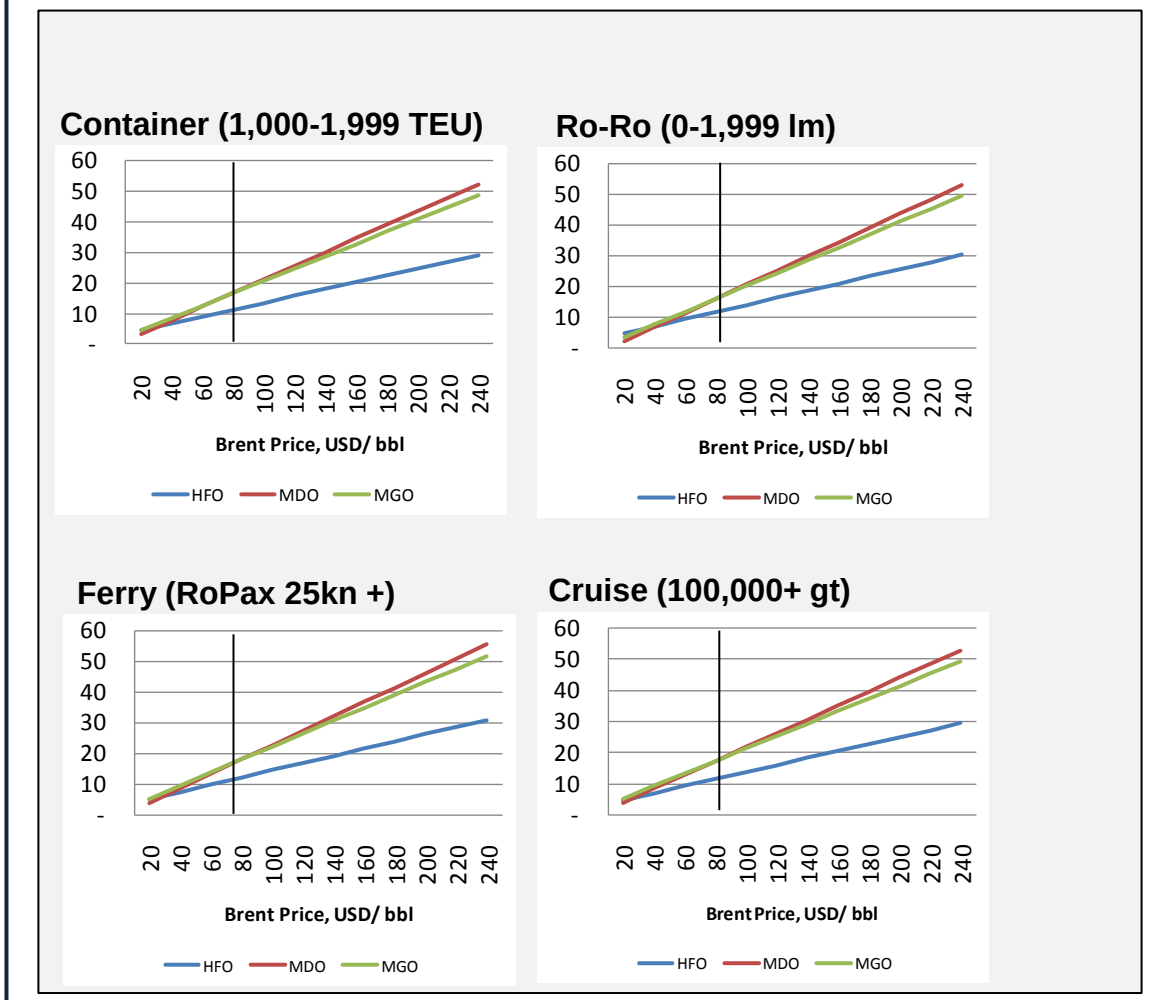


Retail LNG Price Variation by Ship Type – Non-Ocean Going Ships, USD/MMBtu



Retail LNG Prices by Ship Type

Sample Retail LNG Pricing, USD/ MMBtu



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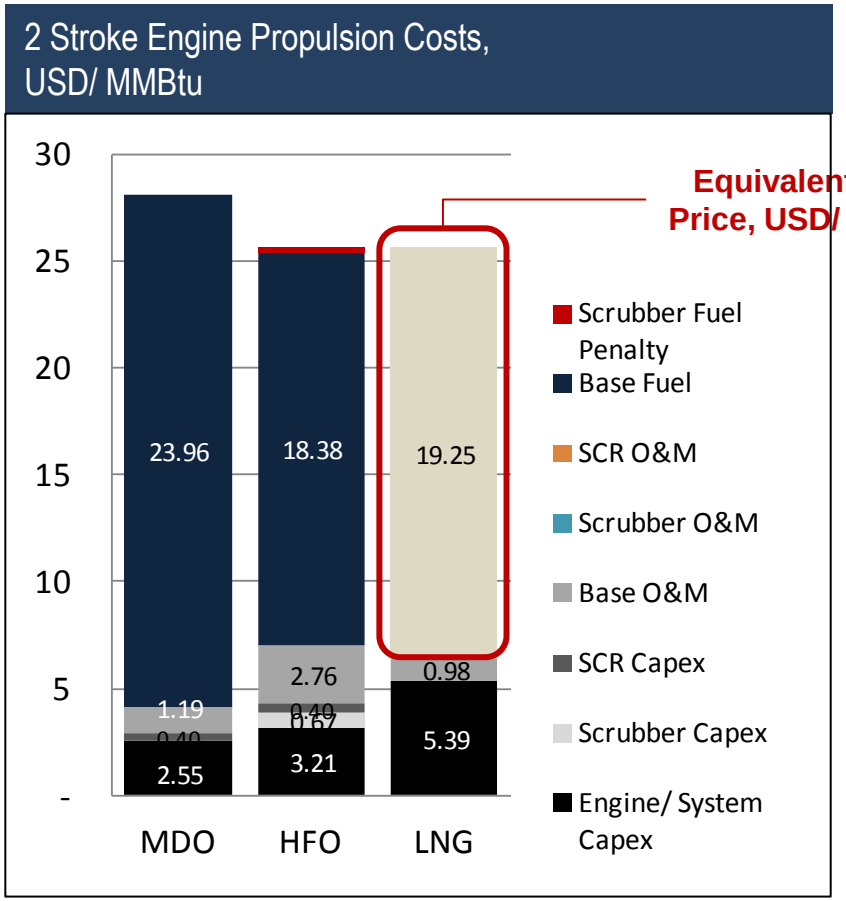
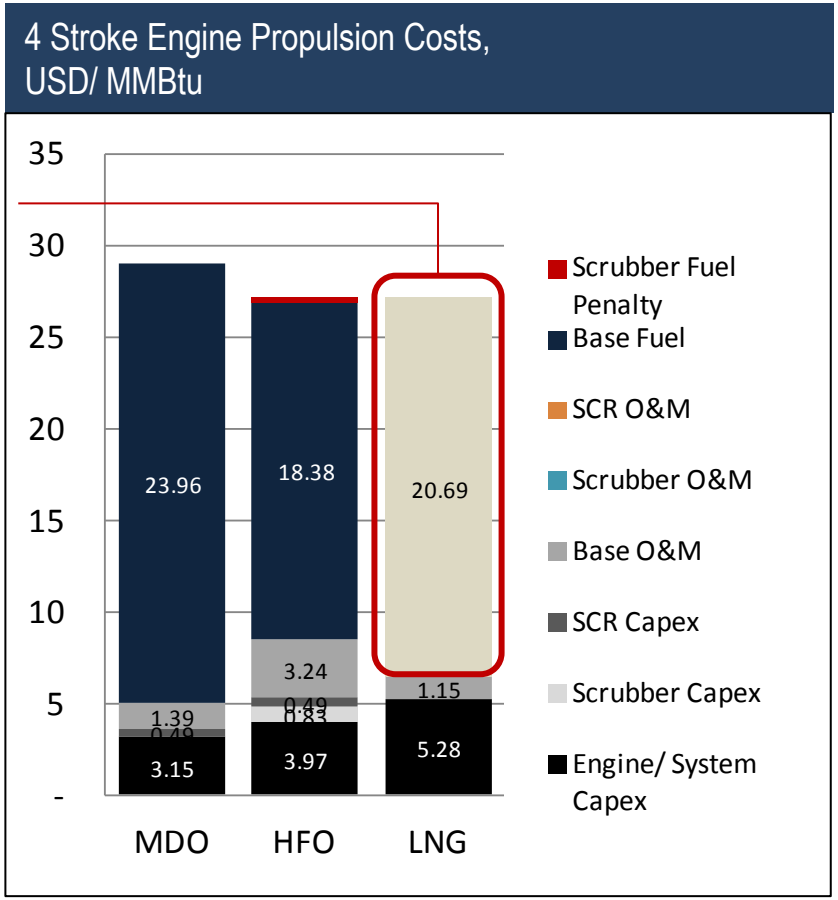
Indicative Ship Owner Economics Show Large LNG Headroom

Fuel options: HFO power plant with scrubber and SCR, Distillate fuel with SCR, or LNG fueled propulsion and auxiliary systems.





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LNG Bunkering Value Chain

- Supply and bulk sale of LNG represents the "sweet spot" in the value chain for suppliers

- Control of some significant portion of the distribution and sales infrastructure will help accelerate market acceptance and maximize market share
- Agency agreements or partnerships with established players (such as ship fleet owners/operators and bunkering companies) will facilitate market entry and sales growth

- Long-term sales agreements and physical supply create cross-market and cross-fuel trading opportunities

FEEDSTOCK SUPPLY & LIQUEFACTION

- Equity liquefaction plant to be supplemented by interim supply

LNG TRANSPORT

- Small-scale LNG tankers deliver to refueling stations, lightering vessels or storage hubs

LNG STORAGE

- At local LNG production plant, storage hubs or floating units

LNG BUNKERING

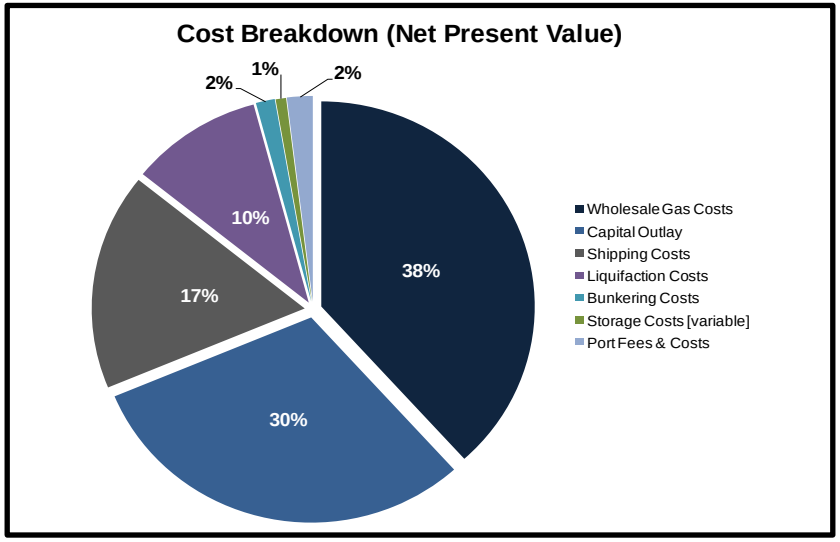
- Bunkering barges deliver fuel to end-user via ship-to-ship bunkering or refuelling at port

FUEL SALES

- End-user refuels at ports of call or via ship-to-ship bunkering at sea

Notional Business Case: Small Scale Liquefaction

KEY PARAMETERS		
Roll-out Start Date	Year	
LNG Demand - year 15	MM tonnes per annum	
Feedstock Gas Cost	$/MMBtu	
Retail LNG Price	$/MMBtu	
LNG tanker Capacity	lcm	
Annual LNG Charter Costs	$/lcm	
Bunkering Fee	$/MMBtu	
Net BOG losses	%	
Average Ship Utilization	%	
Number of Ships for network (in year 15)	#	
CAPEX of mid-scale LNG plant	$/tonne installed	
OPEX mid scale	$/MMBtu	
Storage CAPEX	$/lcm	
Storage OPEX	$/MMBtu	
Initial Cash Outlay	$MM	
15-year Financial Returns		
IRR	%	
NPV	$MM	
Netback NG Price (feedstock)	$/MMBtu	



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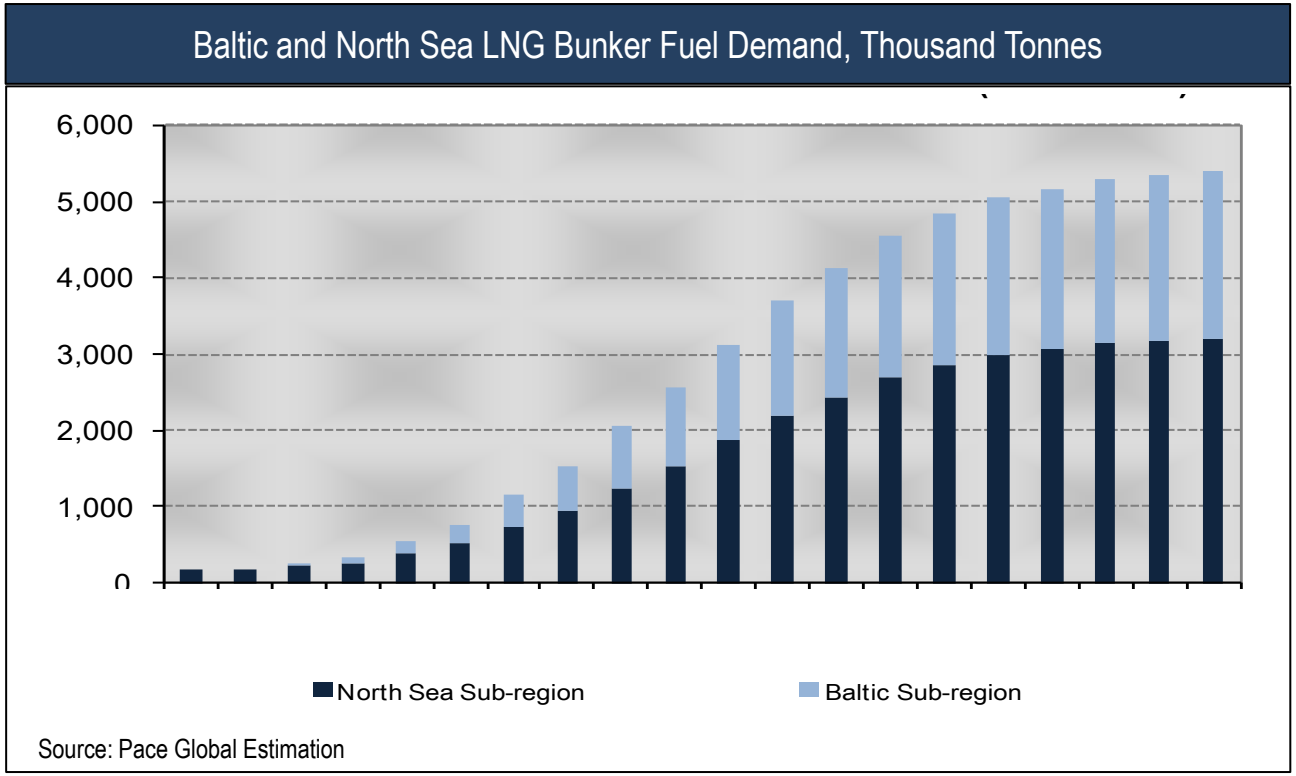
Potential Demand for LNG Bunkering in Baltic and North Sea

Estimated Worldwide LNG Bunkering Demand by:

- Region: Baltic, North Sea, Mediterranean, Black Sea, North America/ Caribbean, Asia, and the rest of the world
- Vessel type: Current LNG fueled, Replacement Ships, New ships to meet shipping demands
- Vessel class: Container, Tanker, Passenger, etc.



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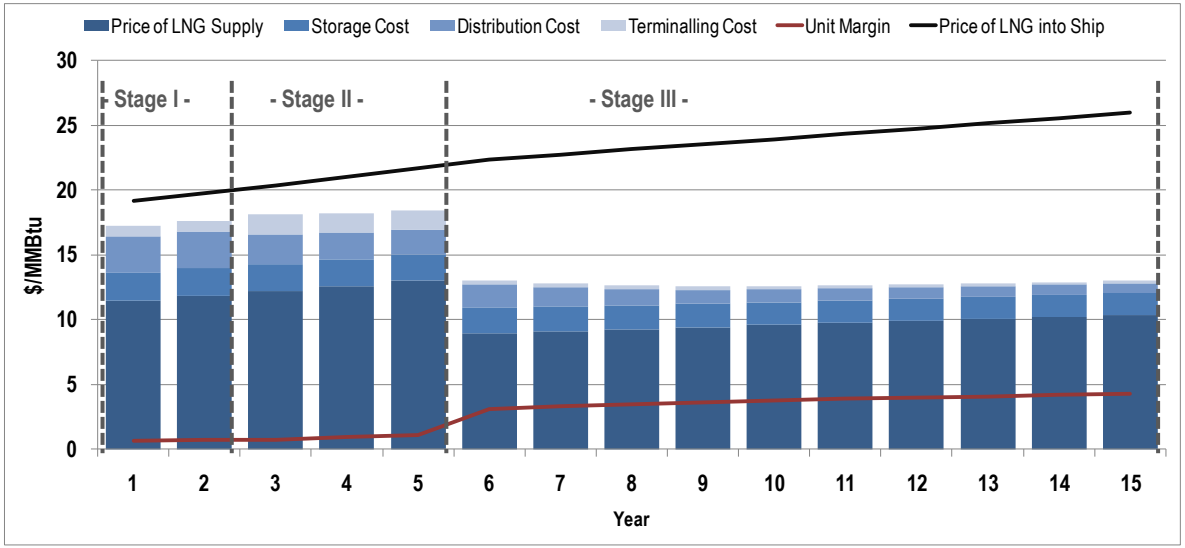
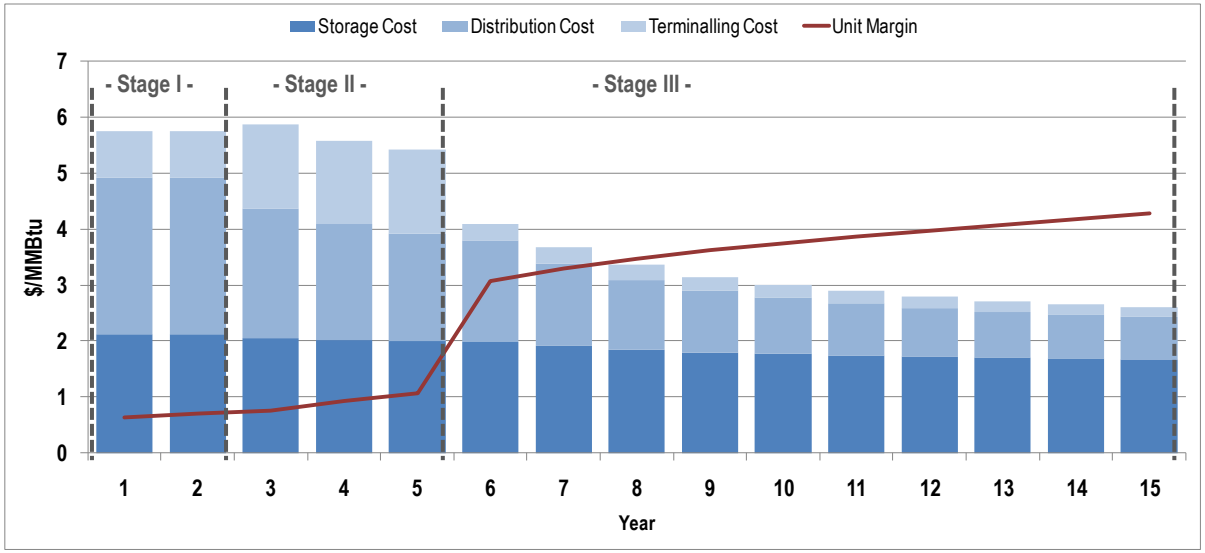
Market Entry Business Case Economics

Business Case Economics across the Three Market Development Stages:



LNG Bunker Storage and Distribution Cost Build-up



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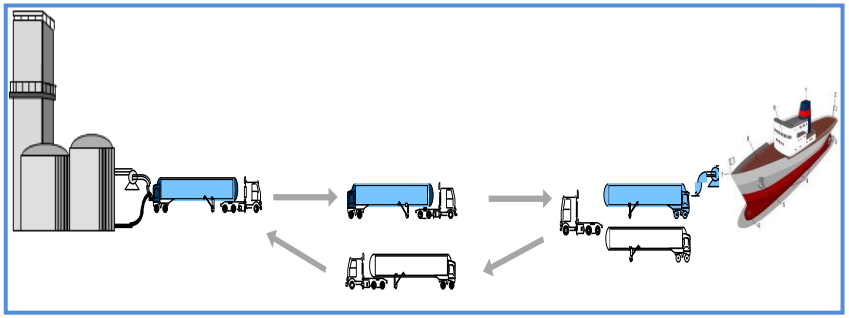
LNG Bunkering – Commercialization Activities

Case Study 1: Baltic Sea ferry operator issues RFP for 405 tons per month of LNG to supply three ferries. Gas marketer hired Pace Global prepare to business case and structure commercial terms.

Solution:

- Worked with gas marketer to secure LNG supply
- Obtained quotes from LNG truck transport vendors and supported negotiations for trailer lease agreements
- Prepared business case to support project
- Structured LNG supply contract, pricing, and Ts & Cs



Case Study 2: North Sea ferry operator planning to build LNG-fuelled ferry and solicit proposals for supply of 600 tonnes per week and fuel tank design recommendation. Gas marketer hired Pace Global to prepare business case.

Solution:

- Originated third-party LNG supply
- Assessed bunkering options and determined that intermodal tanks were optimal solution given port and ship parameters
- Solicited quotes from intermodal tank suppliers and transport vendors
- Prepared business case

LNG Bunkering – Lessons Learned

- LNG offers ship owners a means to meet compliance mandates and reduce fuel costs
- Economics are attractive for both ship owners and gas suppliers – room to negotiate
- Securing LNG demand for sufficient economies-of-scale *(chicken and egg)*
- Smaller scale infrastructure required for early stage market development (liquefaction, truck/trailer transport) puts pressure on LNG price advantage to fuel oil
- Customers demand a variety of fuel pricing options, contract terms, and commitments
- LNG reliability concerns will drive customers to dual-fuel solutions in the near-term
- Initial capital commitments of LNG equipment will continue to restrict widespread adoption, despite LNG's price advantage and lower overall cost of ownership
- Regulatory uncertainties continue to limit LNG as a bunker fuel - *"wait-and-see"*
- Tight conversion economics and slow new-build rate (from slow economic growth) also limits LNG demand
- Experience shows adoption will occur ***one-deal-at-a-time*** in the near-term***,*** with individual customer/fleet solutions required in the near-term

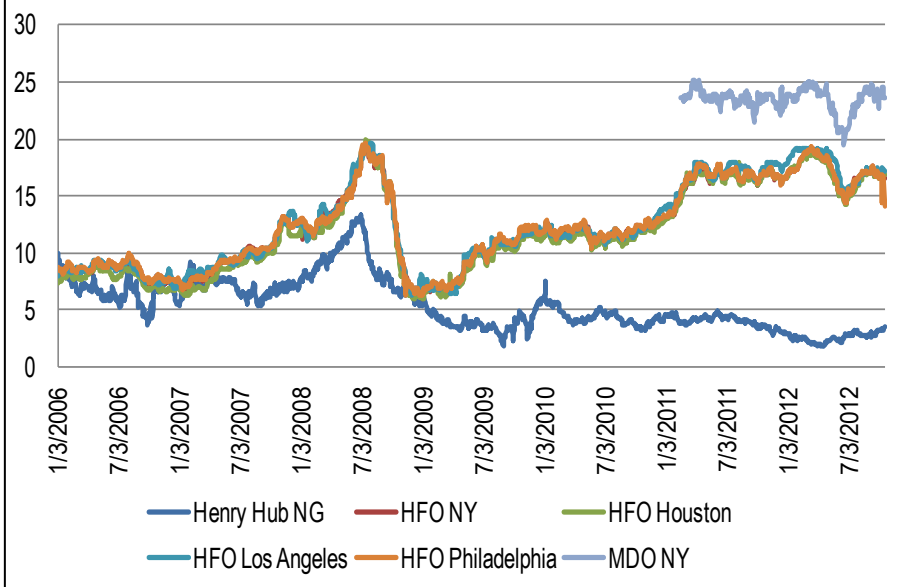
Applicability to the Great Lakes

Why Will LNG Bunkering Work Along the Great Lakes?

- Regulatory requirements are essentially the same forcing capital outlays in the next several years
- Fuel spreads are even larger than in Europe and are expected to remain attractive
- Significant shipping traffic
- Funding is becoming available for ship conversions/ new builds and infrastructure development for strong partners and long term investments
- Natural Gas infrastructure is generally available, though some development will be needed
- Push for LNG fueled trucking further supports the investment scale required

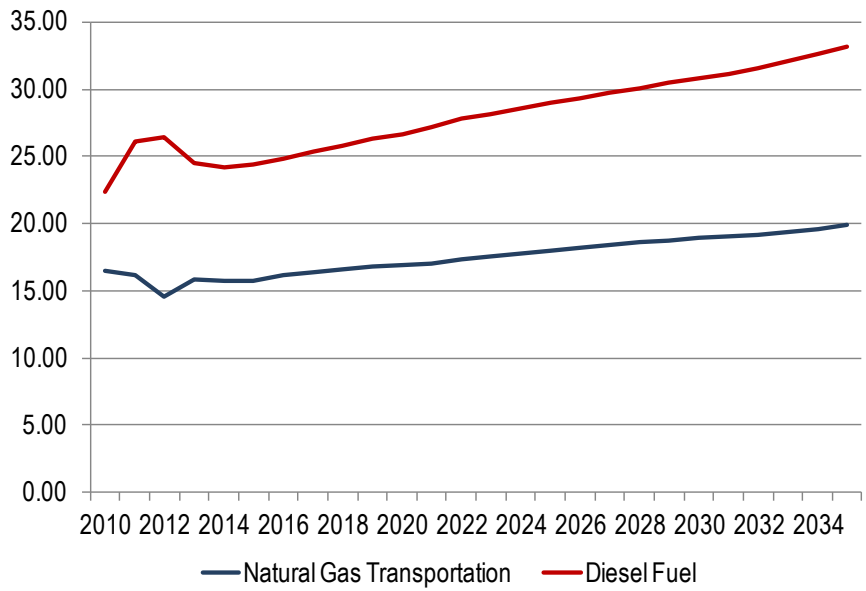
Widening Fuel Oil to Natural Gas Spread Supports LNG Bunkering

Natural Gas Vs. Marine Fuel Prices, USD/ MMBtu



Source: Bloomberg
Note: Fuel prices though 10/22/2012; Spread calculated based on NY fuel oil prices

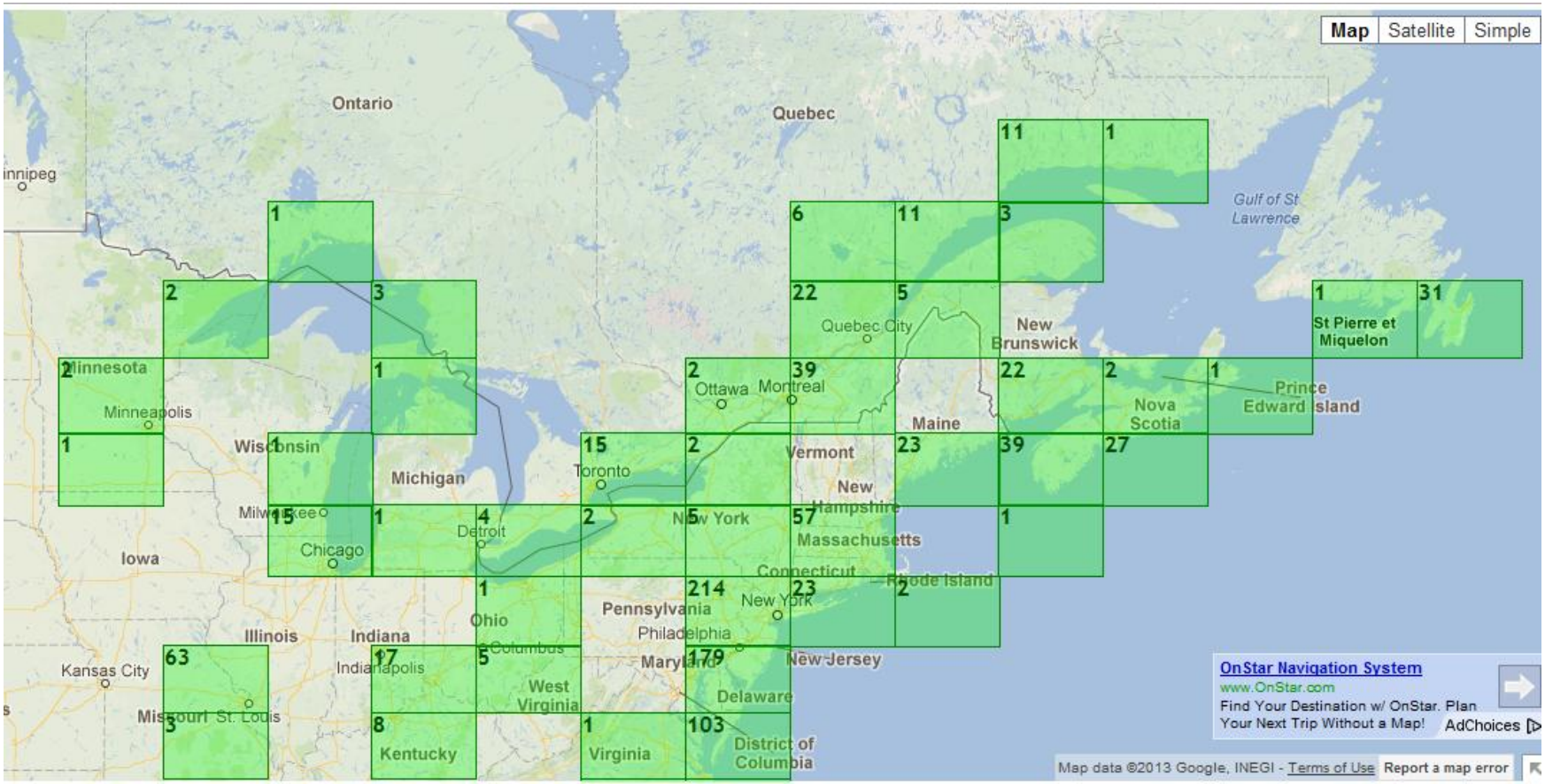
Fuel Price Forecast, $/ MMBtu



Source: Pace Global analysis, Annual Energy Outlook 2012, DOE

Network Development Allows for Sustained LNG Demand & Growth

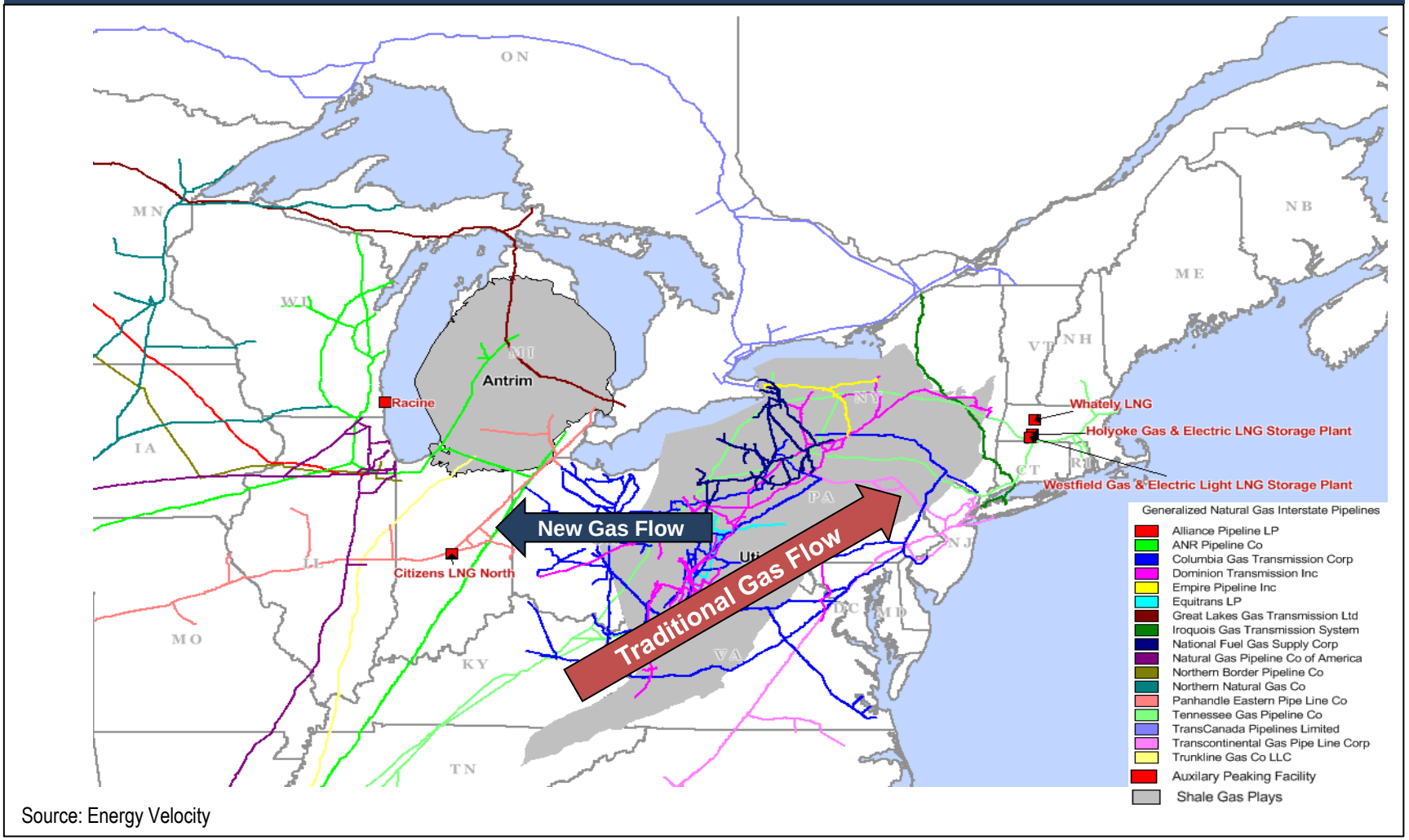
Great Lakes Ship Traffic



Source: http://www.marinetraffic.com/ais/

Significant Natural Gas Infrastructure Near the Great Lakes

Great Lakes Natural Gas Infrastructure



Source: Energy Velocity

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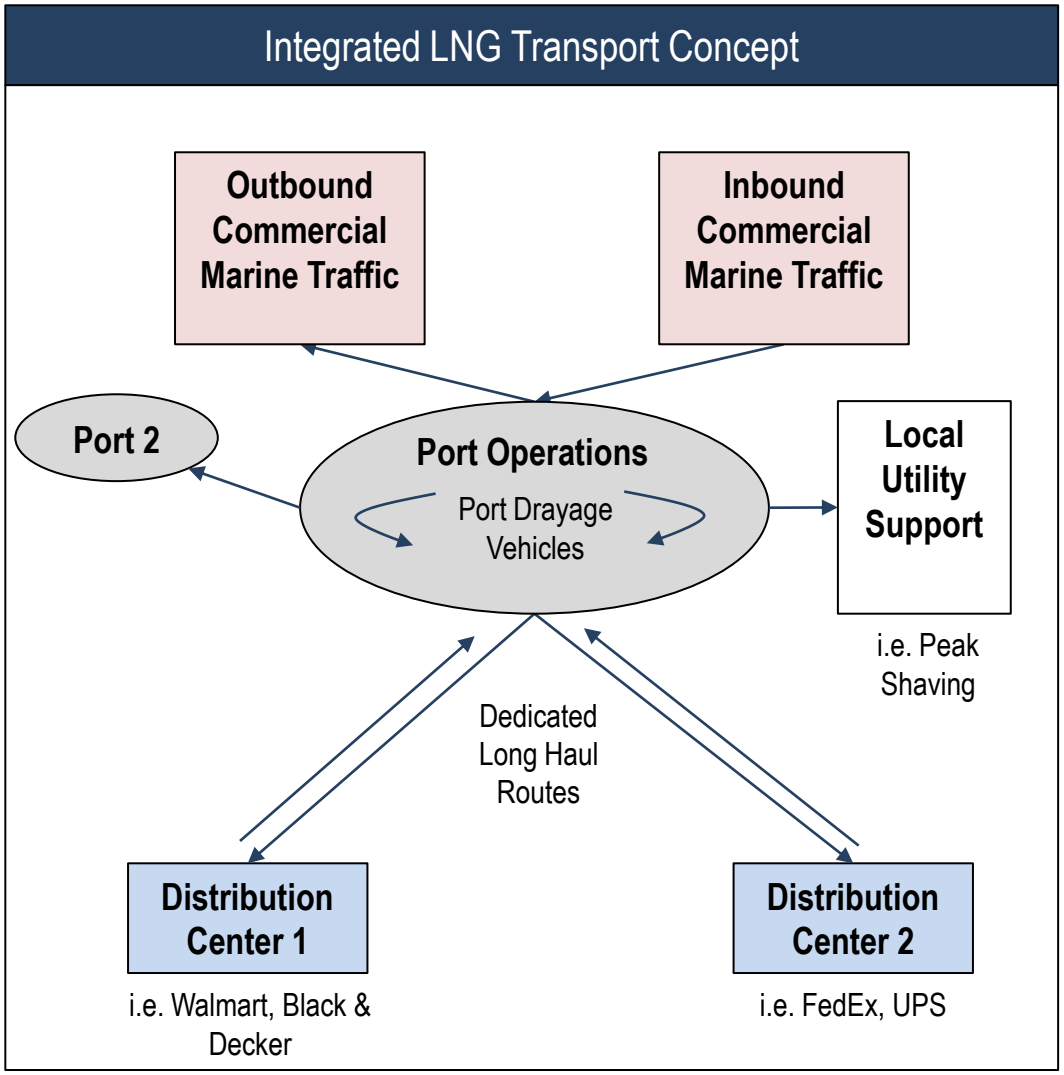
Opportunity to Combine Marine & Land Transport LNG Markets



Natural intersection of natural gas transport customers

- Marine Bunkering
- Port Drayage
- Heavy Duty Long Haul Transport
- Local Gas/ Electric Utility Support

Leverage LNG/ CNG infrastructure requirements

- Small scale liquefaction & storage at primary port supports all customers
- Bunkering service providers in place
- Waterborne LNG transport to neighboring ports
- Port drayage requirements a captive market
- Underutilized port acreage often located within localities proximate to demand
- Ports key trade intersection with large retailers with large long haul truck fleets

Questions?