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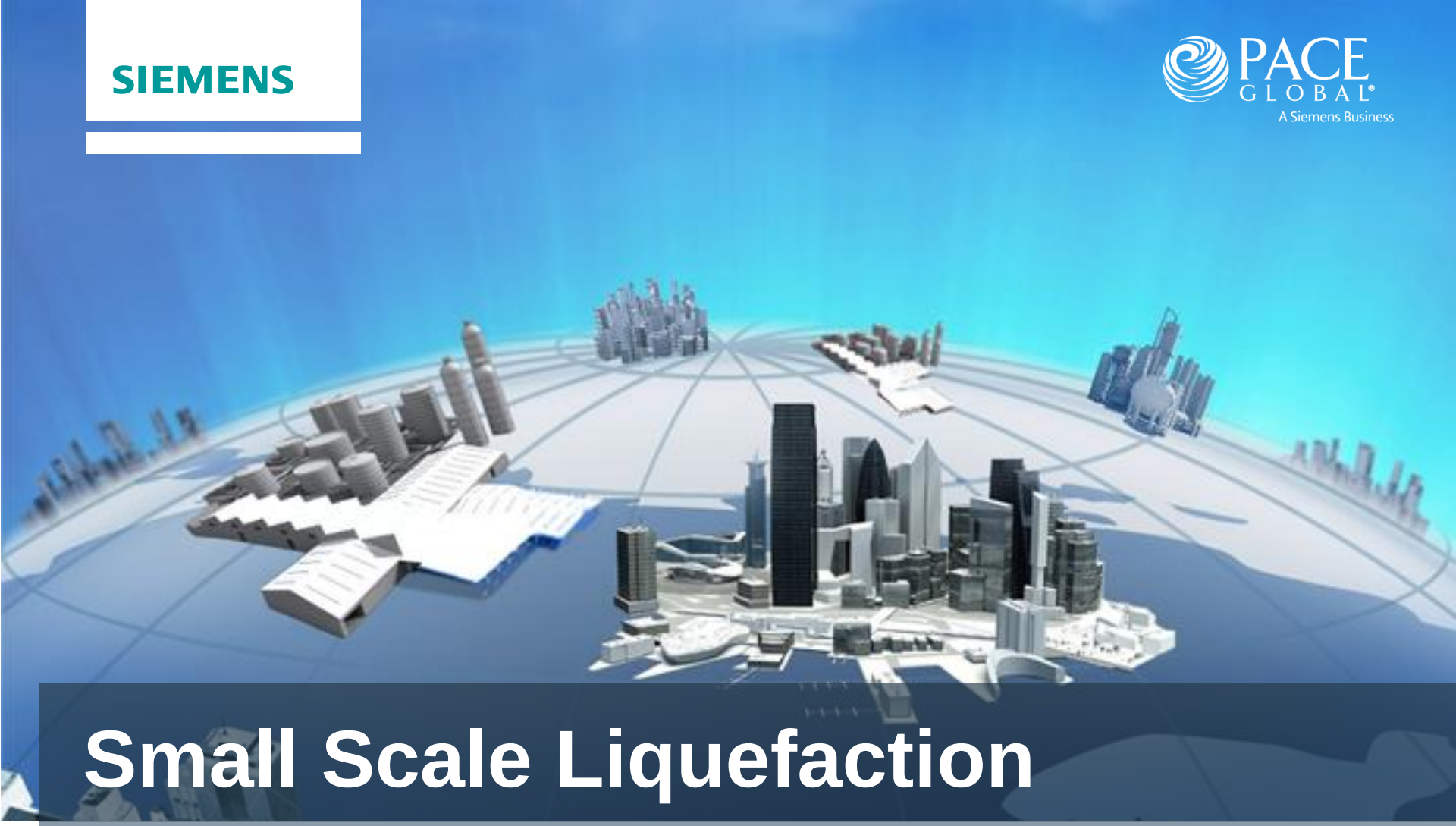

# Small Scale Liquefaction

Presented to: GLMRI May 2013

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Answers for infrastructure and cities.

# Topic Presenters

## Pace Global a Siemens Business

Driving business planning and development of small scale LNG for U.S. and European suppliers and consumers:

- Suppliers – Natural gas distribution companies, energy project developers
- LNG Consumers - Marine bunkering, heavy duty trucking, mine applications, and locomotives
- CNG Consumers – Medium duty trucking
- Development Enablers – Private equity, bankers, other financiers

Typical Activities

- Strategic Plan and Business Development
- Financial Modeling and Risk Assessment
- Partnership and Technology Options Assessment
- Tactical Planning and Implementation

Value delivered:

- Manage utility budget
- Reduce energy consumption
- Help meet mandates/goals
- Improve financial performance
- Protect against interruption in energy supply
- Incorporate sustainable practices

## ALLETE Clean Energy ("ACE")

Wholly-owned subsidiary of ALLETE, Inc., the Duluth area utility

- Launched August 2011 to establish a unregulated business to participate in and capitalize on the growing clean energy market in North America
- Priority areas:
  - Power Generation
    - Wind
    - Solar
  - Natural Gas
    - Midstream infrastructure
    - Petroleum replacement fueling
- Complements ALLETE, Inc. pursuit of energy-centric growth
- May include partners on a project-by-project basis
- Markets to large end-users using long-term off-take agreements


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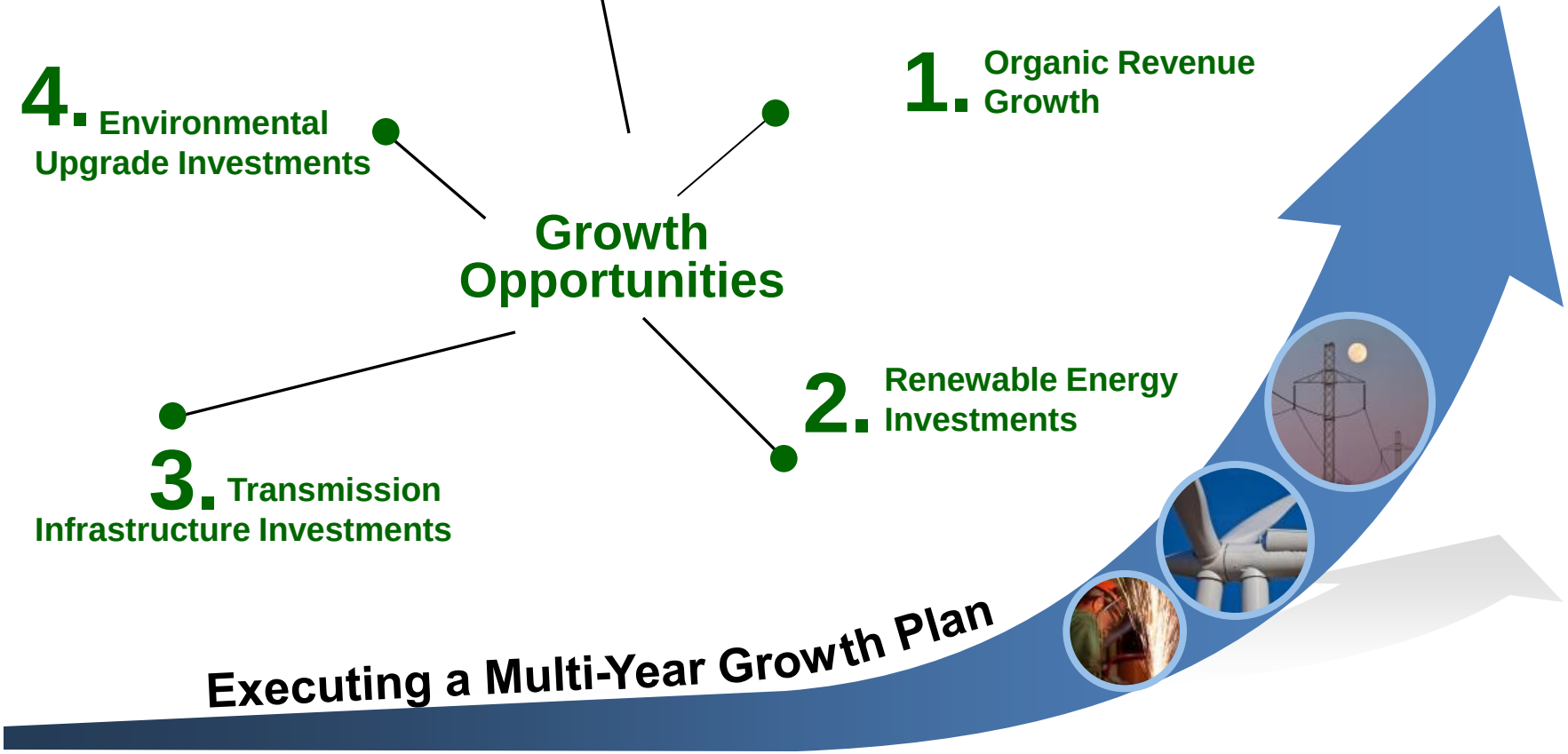
# Allete Multi-Year Growth Opportunities:

Pursuing growth in regulated and unregulated operations

**Growth Opportunities**

1. Organic Revenue Growth
2. Renewable Energy Investments
3. Transmission Infrastructure Investments
4. Environmental Upgrade Investments
5. Energy-centric Investments





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# Allete Unregulated Focus:

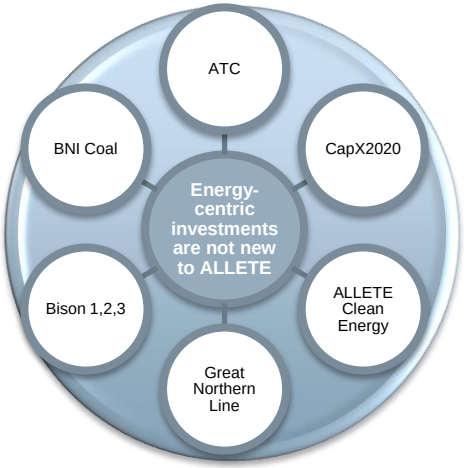
## Pursuit of new energy-centric opportunities that enhance ALLETE's long-term earnings growth potential

Electric/Gas utilities, mid-stream oil/gas: gathering, processing, storage and transport

Oil/gas shale service providers: water treatment/recycling, maintenance

INFRASTRUCTURE

INFRASTRUCTURE SERVICES



Transmission, Renewables

Power/gas plant O&M services, mining services

**KEY CRITERIA:** complementary, strong cash flow/margin, recurring revenue

Will further enhance the company's long-term growth prospects, support the company's strong credit rating and competitive dividend payouts

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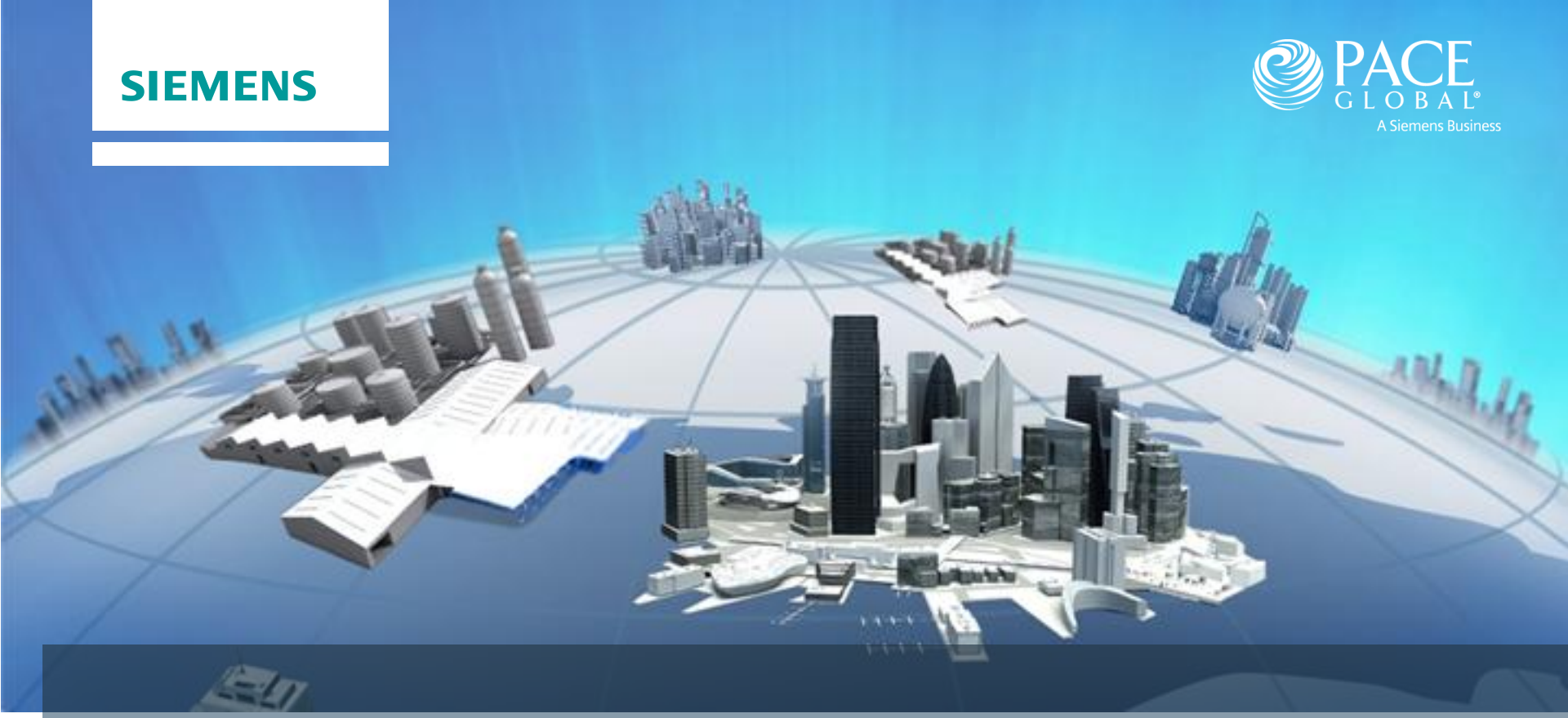

# Liquefaction Development

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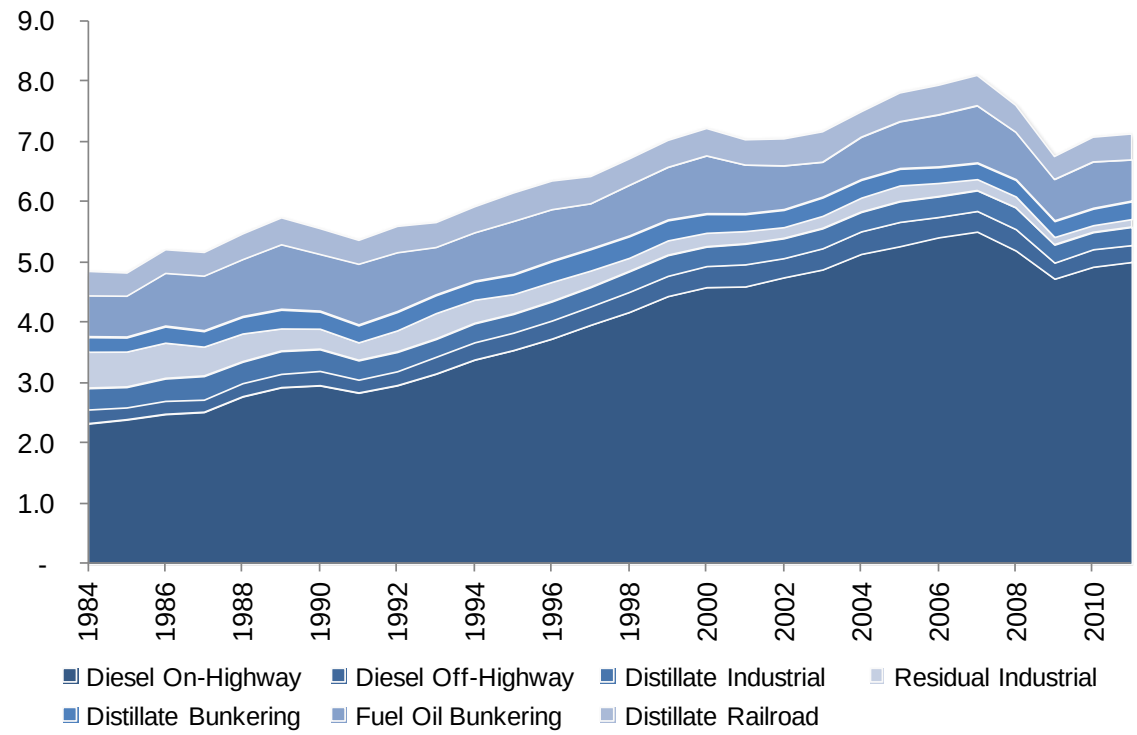
Answers for infrastructure and cities.

# Target LNG Fuel Replacement Market Trends:
Sizable market recovering from economic downturn

**U.S. LNG Fuel Replacement Target,** Quadrillion Btu




Source: EIA, Pace Global.

- 1.4% compound annual growth rate
- Trend follows economy
  - Steep decline starting mid 2006 extending until 2009
  - Slight recovery and stabilization since bottom
- 2011 7.14 quadrillion Btu
  - 70% of volume driven by on highway diesel consumption
  - Bunkering and rail rank 2nd then 3rd
- Future growth of traditional fuels expected to be slower than recent past
  - Combined impact of energy efficiency efforts and increasingly stringent emissions constraints will slow the growth of traditional fuels for transportation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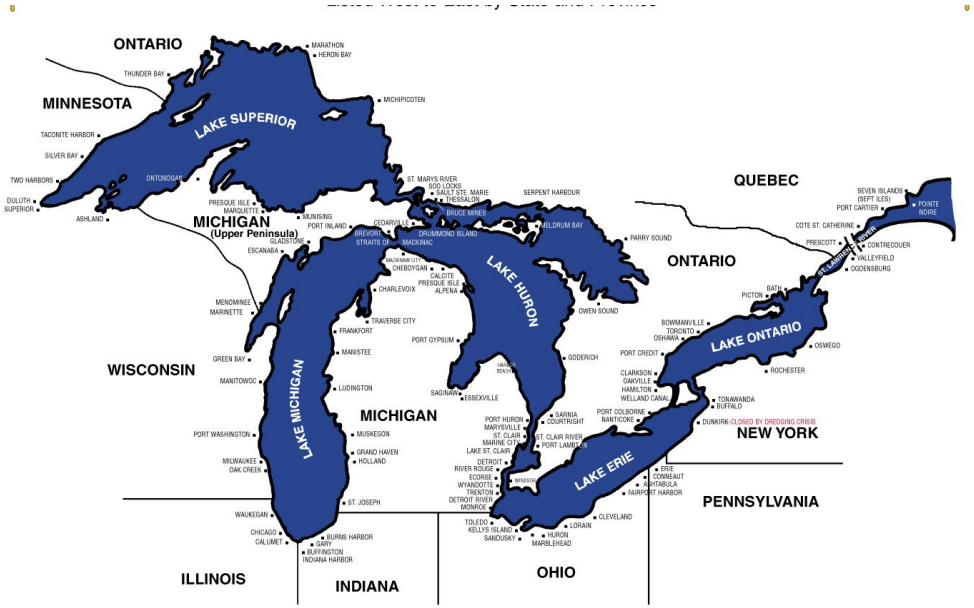
# Great Lakes LNG Fuel Replacement Opportunity:

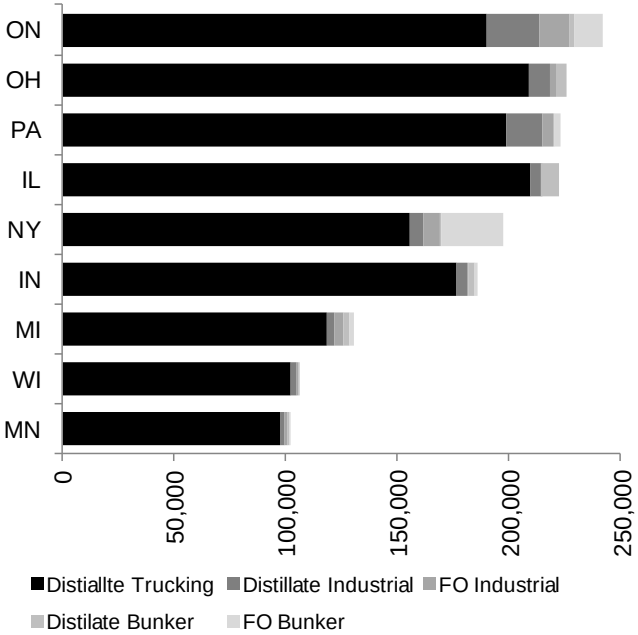
Over 1,500 vessels and 650,000 heavy duty trucks consuming almost 12.5 billion gallons of diesel and heavy fuel oil

## Great Lakes LNG Fuel Replacement Potential




Source: Lake Carrier's Association.

**Target Market Fuel Composition by State,** Billion Btu




Source: EIA, NRCAN, Pace Global,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# Duluth/ Superior LNG Fuel Replacement Opportunity:
Location offers attractive intersection of marine, rail, road, and natural gas infrastructure

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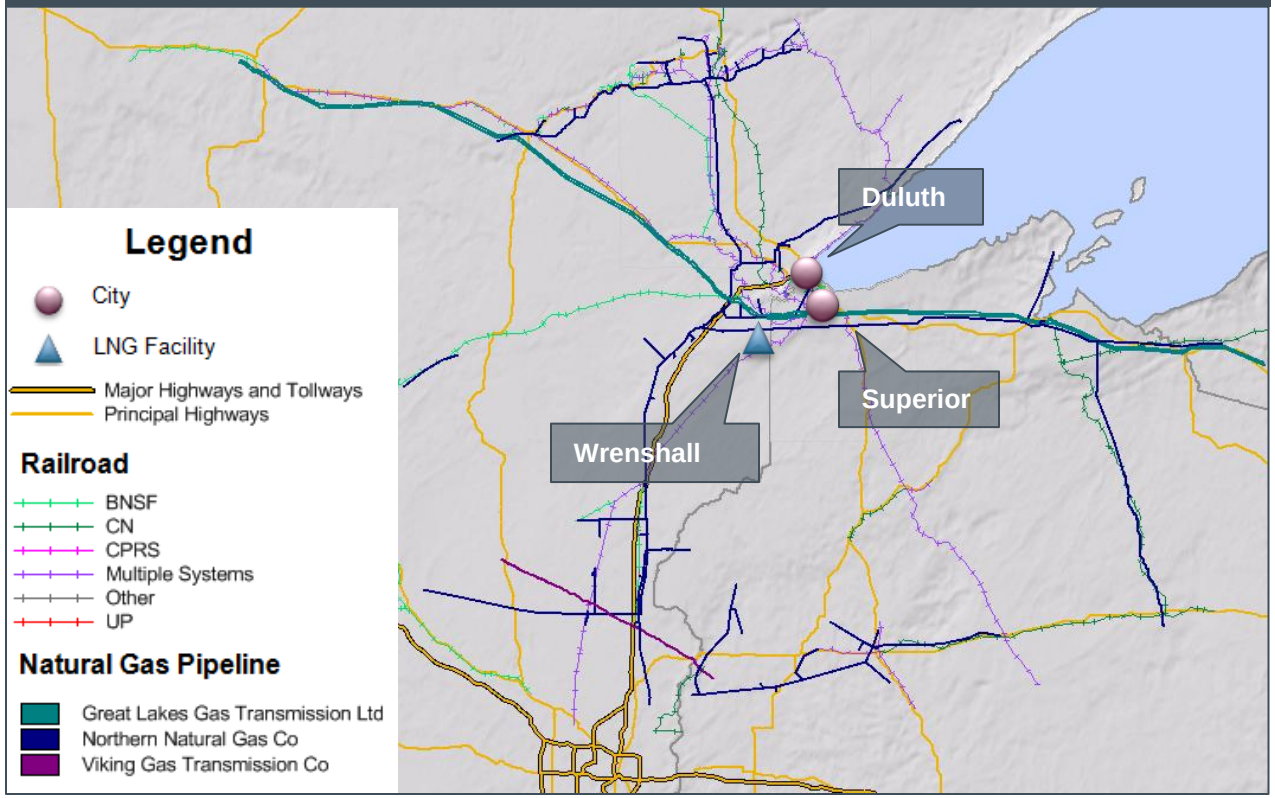
## Duluth/ Superior Local Energy Infrastructure




### Networked Demand
- Port provides intersect of marine, rail, and trucking

### Networked Competitive Supply
- Great Lakes Gas and Northern Natural Gas provide intrastate capacity
- Existing local liquefaction capacity at Wrenshall

### Potential Consumers
- Rail – BNSF, UP, CN, CPRS
- Marine – Lakers and tugs at Duluth and Two Harbors
- Port – Duluth and Two Harbors drayage vehicles
- Gas Utility - Great Lakes Gas, Northern Natural Gas, Viking Gas peak support
- Long Haul Trucking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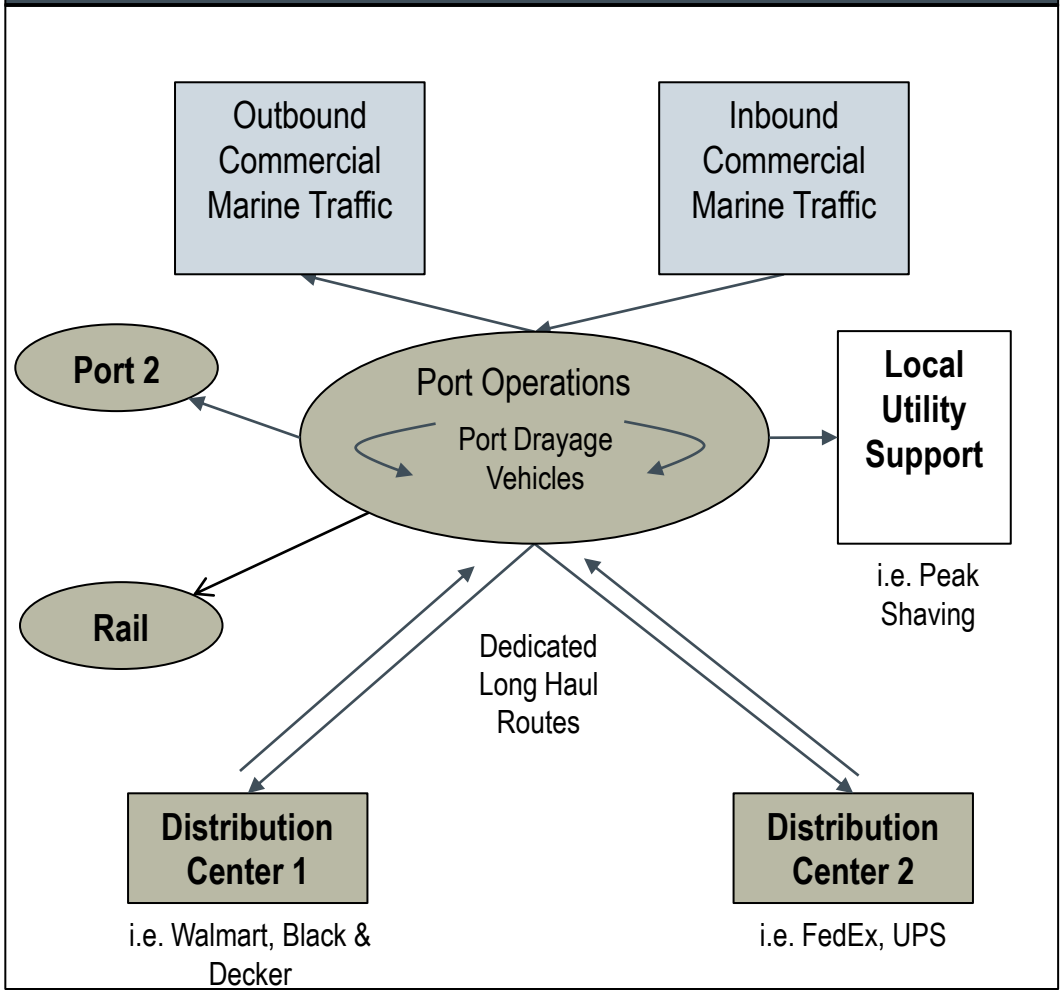
# Land and Sea Integration Concept:

An integrated hub and spoke supply chain, perhaps centered on the Port of Duluth-Superior can supply many markets

## Integrated LNG Transport Concept




**Natural intersection of natural gas transport customers**

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

**LNG used by each customer group, but no one had integrated and optimized supply**

**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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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


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# Indicative LNG Fuel Replacement Value Chain:

Even with each value chain participant earning target margins, fuel spreads remain attractive

## LNG Fuel Replacement Supply Chain Model and Indicative Economics

Commodity Price and Risk Passed Through to End User

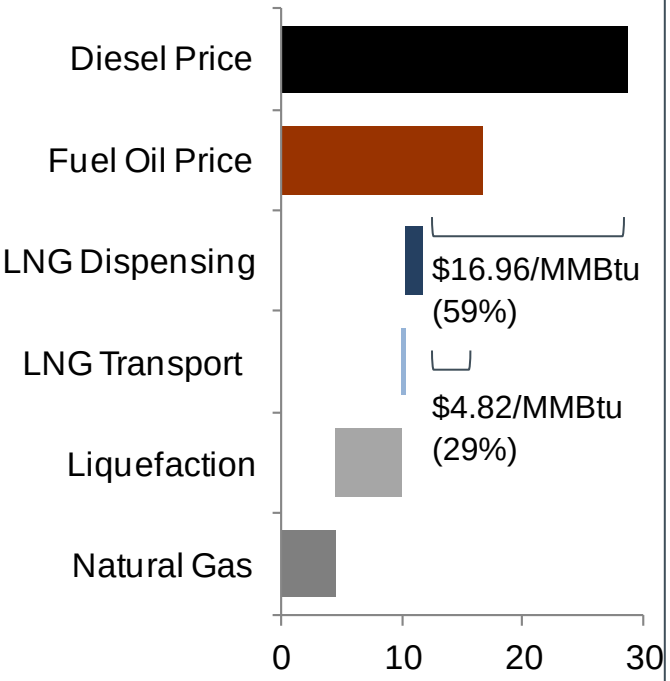
**LNG Supply Chain** → **Natural Gas Supply** | **Liquefaction** | **LNG Transportation and/or Storage *** | **LNG Dispensing**

| | | | | |
|---|---|---|---|---|
| **Revenue Model** | Nat. Gas Price Recovery + Transportation Adder | Liquefaction Adder Per Unit Volume Processed | $ Per Unit Volume Transported/ Stored | $ Per Unit Volume Dispensed |
| **Indicative Target Margin** | 2-6% | 10-18% | 8-16% | 10-15% |

← Payments

* LNG may be delivered by rail, barge, small dedicated vessel (micro shuttle) or truck

**Indicative SSLNG Fuel Spreads,** $/MMBtu




Source: Pace Global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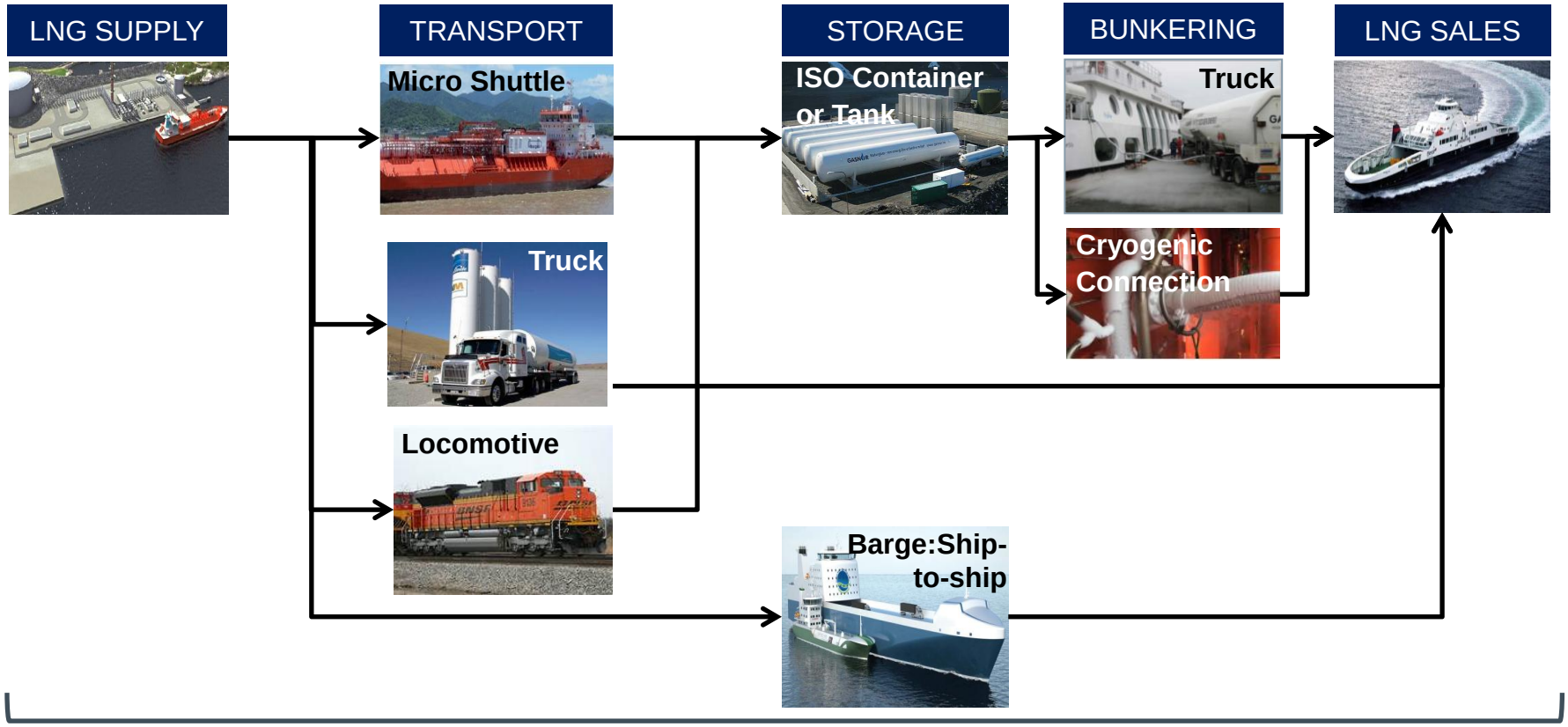
# LNG Supply Participants:

Successful industry development will rely on participants working in concert with each other

## LNG Fueling Supply Chain – Marine Sample




**Finance Enables**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# ACE - Development Criteria and Strengths

| Project Attributes | ACE is adaptable in the market to take advantage of opportunities |
|---|---|
| Mature technology<br>• Engine development phase<br>• Off-engine design<br>• Retrofit technology<br>• Infrastructure requirements<br>Late-stage development and/or operating assets<br>• Timing to market<br>Predictable cash flow streams<br>• Long-term off-take contracts<br>  – Volume/timing commitments<br>Ability to utilize project financing<br>Synergies with existing core competencies/assets | Strategic<br>• Location - regional assets/resources<br>• Strong local, state, and regional connections<br>• Navigation and management of the regulatory process<br>Flexible<br>• Project ownership structures and roles<br>• Partners have option to redeploy capital<br>Experienced<br>• Land and asset management<br>• Energy Infrastructure construction/security<br>• Transportation contracting |


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# LNG Fuel Replacement Enablers & Considerations:

Market drivers and enablers strongly outweigh considerations which can be overcome

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**Drivers and Enablers**

- Significant new natural gas supply driving durable natural gas/ petroleum price spread
- Demand decline in core natural gas markets
  - Suppliers seeking means to replace lost demand and grow business
- Marine regulatory compliance requirements
- Marine environmental compliance requirements
- Crushed shipping margins driving competitive urgency
- Finance community actively seeking attractive investments
  - i.e. Companies, infrastructure, equipment conversion
- Declining equipment costs
  - Driven by technical development and increasing competition

**Considerations**

- Availability of local natural gas infrastructure
  - Impacts ultimate cost to extend infrastructure/ supply alternatives
- Consuming equipment operating patterns
  - i.e. route predictability, fueling locations and frequency, impact on cargo capacity, etc.
- Equipment ownership concentration
  - Who to approach and how fast can they be attracted
  - What will it cost to build a business?
- Country/ local economics and politics
- Risk appetite of infrastructure developers and equipment owners must align
  - Developers need reasonable revenue certainty (contracts) to invest
  - Equipment owners commit to technology and supplier, both new to them


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# Sample North American Market Activities:

Robust activity in vehicles spreading to marine and just beginning in rail

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## Vehicles

## Marine and Rail


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# LNG Fuel Provide Benefits for All Participants

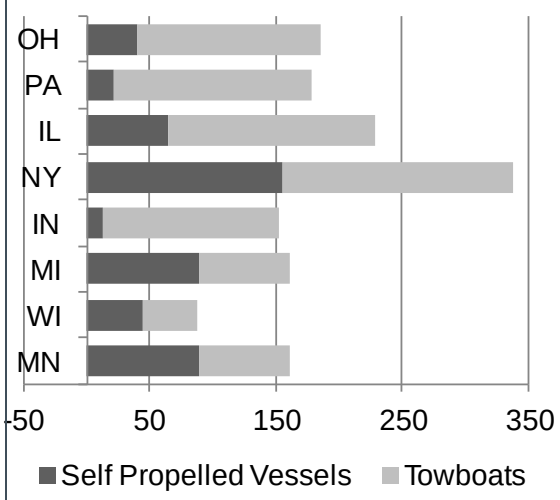
Small Scale LNG is in its infancy and poised to become mainstream

**A Large Potential Market with Substantial Fuel Savings Opportunity …**

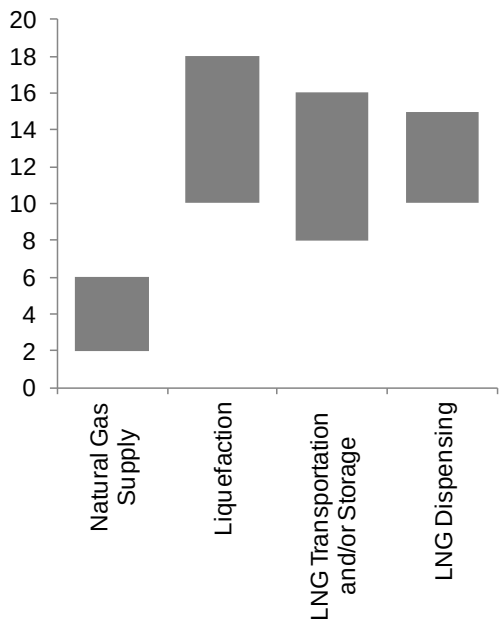
**… Which is Sufficient to More Than Meet Investors Target Requirements …**

**… Is Beginning to Overcome the Few Remaining Obstacles.**

**Great Lakes Fleet Composition,** No. Ships




**Target Return on Investment by Value Chain Segment,** %




**Sample LNG Vehicle, Marine, and Rail Activities**

- **Royal Dutch S**hell – investing more than $300 million in supply infrastructure
- **Clean Energy Fu**els - working to build "America's Natural Gas Highway" with $150 million investment
- **China's ENN Group -**. Spending about $50 million this year to build 50 natural gas fueling stations.
- **UPS -** Confirmed plans to purchase approximately 700 additional LNG vehicles and to invest $18 million to build fueling stations.
- **TOTE** - Converting two ocean cargo vessels to LNG and purchasing two more.
- **BNSF** – testing LNG locomotives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# A Collaborative Path Forward:

Pace Global and ACE actively collaborating to evaluate market potential and develop business.

PACE GLOBAL A Siemens Business + ALLETE clean energy = **A disciplined and structured approach is required to ensure complete solution development**

*Working with all participants in the value chain throughout the Great Lakes to develop the Small Scale LNG market*

*Continued engagement and evaluation of specific market potential and business opportunities*


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# Thank You

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# Appendix of Recent Activity:

## Vehicles

- **UPS** - expects to have the most extensive private liquefied natural gas fleet in the U.S. by end of 2014. UPS confirmed plans to purchase approximately 700 additional LNG vehicles and to invest $18 million to build fueling stations.
- **Clean Energy Fuels –** working to build "America's Natural Gas Highway" with $150 million investment
- **China's private ENN Group -** quietly rolling out plans to establish a network of natural gas fueling stations for trucks along U.S. highways. plans to build 50 stations this year. Owns Transfuels LLC, which operates as Blu LNG.
- **Volvo Trucks** - to collaborate with Royal Dutch Shell to use LNG as a transport fuel focused on North America and Europe
- **Gulf Oil Limited Partnership (LP)** - added 34 Peterbuilt Model 386 LNG-fueled tractors to its own distribution fleet
- **YRC Freight** - completed an agreement with Clean Energy Fuels Corp. to buy four liquefied natural gas (LNG) trucks to operate in Southern California.
- **Ryder –** Ordered 202 heavy-duty natural gas vehicles
- **Daimler Trucks North America (DTNA)** - announced that more than 2,000 natural gas-powered trucks and tractors since 2008, plus 565 more on order and quotes out on 1,000 more.

## Marine

- **Washington State Ferry –** redesigned existing 144 Car Ferries to use LNG, gaining funding and classification.
- **Staten Island Ferry** will receive $2,340,000 in federal funding for a pilot program for conversion from diesel fuel to liquefied natural gas…"The pilot program is designed to cut fuel costs for that ferry by nearly half".
- **BC Ferries** - BC Ferries hopes to convert more than half its fleet from marine diesel oil to liquefied natural gas over the next decade…" New fuel system would replace diesel and cut costs by 40 per cent".
- **The Société des traversiers du Québec (STQ)** – the Quebec Ferries Company – contracted for three new LNG ferries. Gaz Métro Transportation Solutions will be supplying LNG.
- **Harvey Gulf International** contracted for 4 LNG powered offshore supply vessels supporting Shell Gulf coast assets.
- **Royal Dutch S**hell - set to invest more than $300 million to build out a series of LNG filling stations at America's biggest chain of truck stops.
- **Totem Ocean Trailer Express Inc. (TOTE)** - will convert its two large ocean cargo vessels to LNG, the first conversions for U.S. large general cargo vessels. TOTE is also purchasing two new LNG fueled cargo carriers.


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