

### Liquefied Natural Gas (LNG)

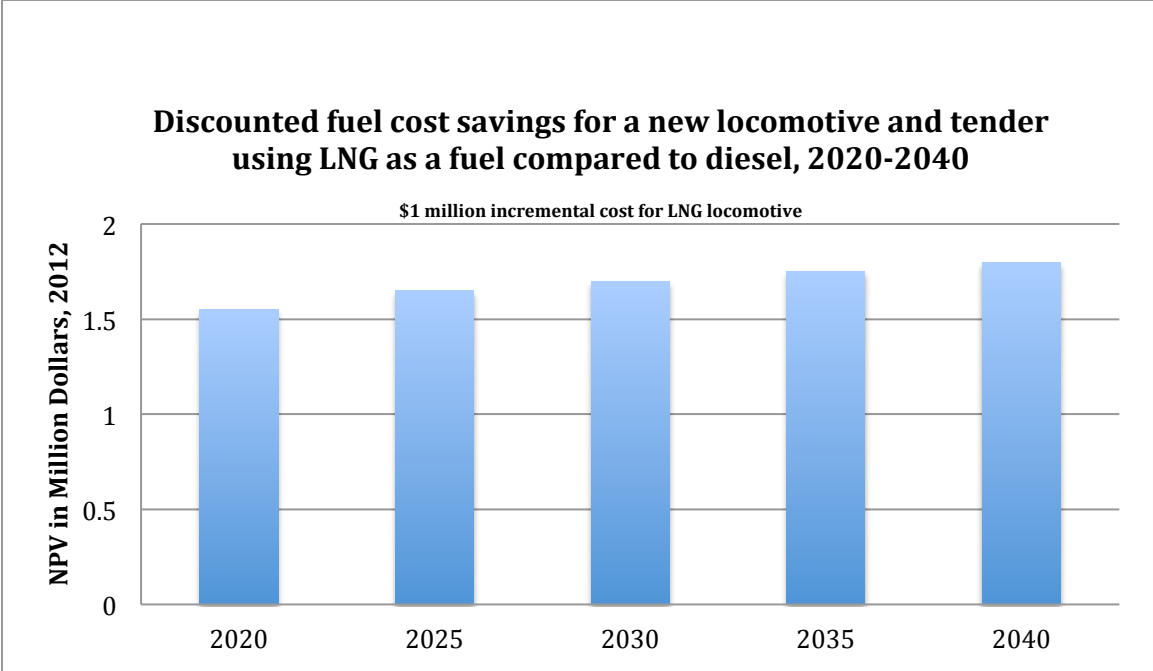
#### *Marine*

Growth in domestic natural gas production, improving technology, and regulatory compliance are just a few of the factors driving an evolution in the U.S. energy economy. The marine industry has explored LNG as the industry standard since the sixth annexation of the Marine Pollution act (MARPOL) in 2005. MARPOL originally limited the sulfur content of marine fuels on a global basis to 4.5%, which since has been reduced further to 2.5%. The limiting factors to LNG include the difficulty of retrofitting existing vessels, the inefficiency of LNG engine size/output ratios, and unique hazards relative to traditional petroleum. 2014 is quickly shaping up to be a landmark year for LNG proponents. Three significant events have signaled a move to change:

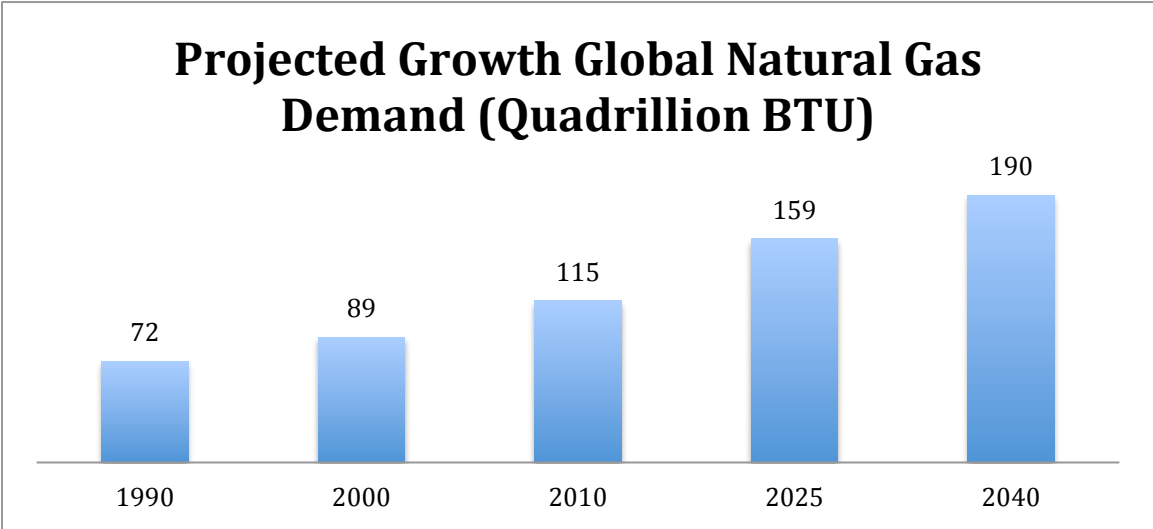
1. January 2014—Interlake Steamship Co., a major bulk carrier in the Great Lakes, struck a deal with Shell Petroleum to supply LNG to converted Interlake vessels. The goal is to convert the first vessel by the spring of 2015.
2. February 2014—Harvey Gulf International Marine unveils first full service natural gas marine fueling facility in the United States, making Harvey the largest owner and operator of LNG-powered offshore vessels in the world. Harvey Gulf committed \$400 million to build, own and operate six LNG-powered offshore support vessels and two LNG fueling docks. The sheer size of the investment is indicative of the high upfront cost structure that hampers LNG growth, but the willingness for Harvey, an industry leader, to pave the way is a strong sign.
3. May 2014—Caterpillar Marine shipped the first Cat 3500 series marine LNG-gas hybrid engine to power the world's first LNG-powered barge. Moving forward, Caterpillar expects to offer a complete line of propulsion and auxiliary engines with configurations capable of using 100% natural gas.

#### *Rail*

The rail industry has not been as active as their marine counterparts in their pursuit of using LNG as a fuel for locomotives. The curbing factors are similar to those the marine industry faces—capital investment, diesel fuel entrenchment, and supply chain logistics. The transition to LNG, however, may be looming. Class 1 railroads, for example, consumed more than 3.6 billion gallons of diesel fuel in 2012, representing 23% of their total operating expense. The potential for significant cost savings is the primary impetus for the evolution of the energy economy in rail. The following chart shows the potential savings for LNG powered locomotives versus diesel:



The graph largely assumes high oil prices moving forward, which presents a far more appealing case (significantly shorter payback period) for switching to LNG and committing to risky upfront capital investment. Uncertainty about future oil prices suggests risk for some companies to make these fundamental changes. Other challenges to LNG as freight rail fuel include operational, regulatory and mechanical issues. Operational challenges pose some of the greatest obstacles because of the need to build new infrastructure that requires large financial investment on top of the large investments made in locomotives. The new refueling infrastructure also complicates the inter-operability of the rail network. Weakening the flexibility of the fueling network could have a broader impact on the costs of product delivery and therefore the cost of product and supply chain management.



Source: Maritime Journal; Marine Technology; Maritime Reporter

Overall, the time for LNG has come, both in terms of cost, low emissions, and demand. In 2012, the U.S. became the number one natural gas producer in the world. Shale gas accounts for a significant portion of U.S. natural gas production, and is predicted to account for roughly half of U.S. gas output by 2040. The fracking revolution is a major driver in the advent of LNG. Abundant supply should keep natural gas costs at bay, and the regulatory environment will continue to spur demand for low-emission propulsion that LNG can provide. Creating a competitive market around natural gas applications should drive down costs and make it more accessible to marine vessel or railroad operators. We continue to have strong interest in the non-automotive transportation because of evolving dynamics like this.

## **Aerospace**

Backlog orders for Boeing and Airbus of over 9,000 commercial aircraft demonstrate a surge in demand and bode well for original equipment manufacturers and their suppliers. The industry consistently creates a trading surplus (\$71.1 billion in 2012) as one of the nation's largest net exporters, and is one of the largest employers in manufacturing with over 500,000 employed. Boeing's latest outlook shows demand for 35,280 new jet aircraft from 2013-2035 valued at \$4.8 trillion. The 1,700 aircraft per year average through 2035 is a 40% increase over the record 1,200 produced in 2012. These lofty expectations are largely spurred by growth in Asia Pacific, where the expected aircraft deliveries over the next two decades, 12,820, are nearly as many as North America and Europe combined. The Asia-Pacific region is expected to be responsible for nearly a third of global passenger traffic by 2032. Rapid development of Asia's air transport infrastructure will continue to be carried out to accommodate the increased demand, further spurring the growth of global suppliers.

We have recently started dialogue with a prominent commercial and defense aircraft system manufacturer that is an excellent representation of business practices that promote domestic competitiveness. The company was acquired by its current owner with less than ten employees, and in just over a decade has grown to over 150 employees. It has demonstrated a commitment to continuously invest in its workforce, leading to superior quality and high retention. Through innovation in technology and people management practices, the company is able to achieve superior margins and pay above industry standard wages. The owner has shared ownership with key employees, and provides them with the autonomy that allows the company to manage its growth and international presence. If the U.S. aerospace industry wants to maintain its position as a global leader, educators, policymakers, and business owners have to lead those efforts, especially on developing high potential employees.

Specific areas of focus within aerospace for our group are:

Globally			
Industry	CAGR 2013-2018 (%)	\$ Value (2013-2018)	Reason for Growth
Ground Handling Systems	5.40%	\$347.5M -- \$456.75M	Increase in number of airlines and airports
Electrical & Environmental	6.50%	\$5.23B -- \$7.13B	Fuel efficiency and passenger comfort
Aircraft MRO	3.20%	\$56B - \$68.5B	Passenger to freight conversion, engine maintenance and growth of twin-aisle aircraft

Source: PWC; Markets to Markets; Bloomberg