



Northeast Diesel Collaborative Ports Workgroup LNG Fueling for Marine Vessels, April 16, 2014

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BY PEOPLE FOR PEOPLE

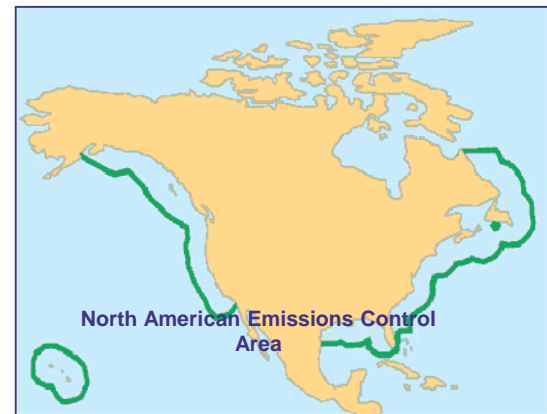


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Environmental Drivers for Marine

- International emissions regulations, technology development, and shipping economics are making using LNG as fuel attractive to the marine sector
- LNG is particularly a draw for ships traveling with strict SOx and NOx emissions limits, such as the North American Emissions Control Area
 - Beginning in 2015, vessels operating in the ECA must use fuel oils not exceeding 0.10% sulfur content (current limit is 1.0%)
 - LNG, with effectively no sulfur content, offers the best compliance option
- Compliance with North American ECA SOx reductions requires low-sulfur fuel oil (ULSD), scrubbers or natural gas
 - Scrubbers are relatively new and unproven in the market
 - ULSD is expensive
 - LNG meets current and future emissions regulations, and has a favorable ROI compared to other technologies
- In 2020, further sulfur reductions will impact large ocean-going vessels by broadening the sulfur cap to global waters

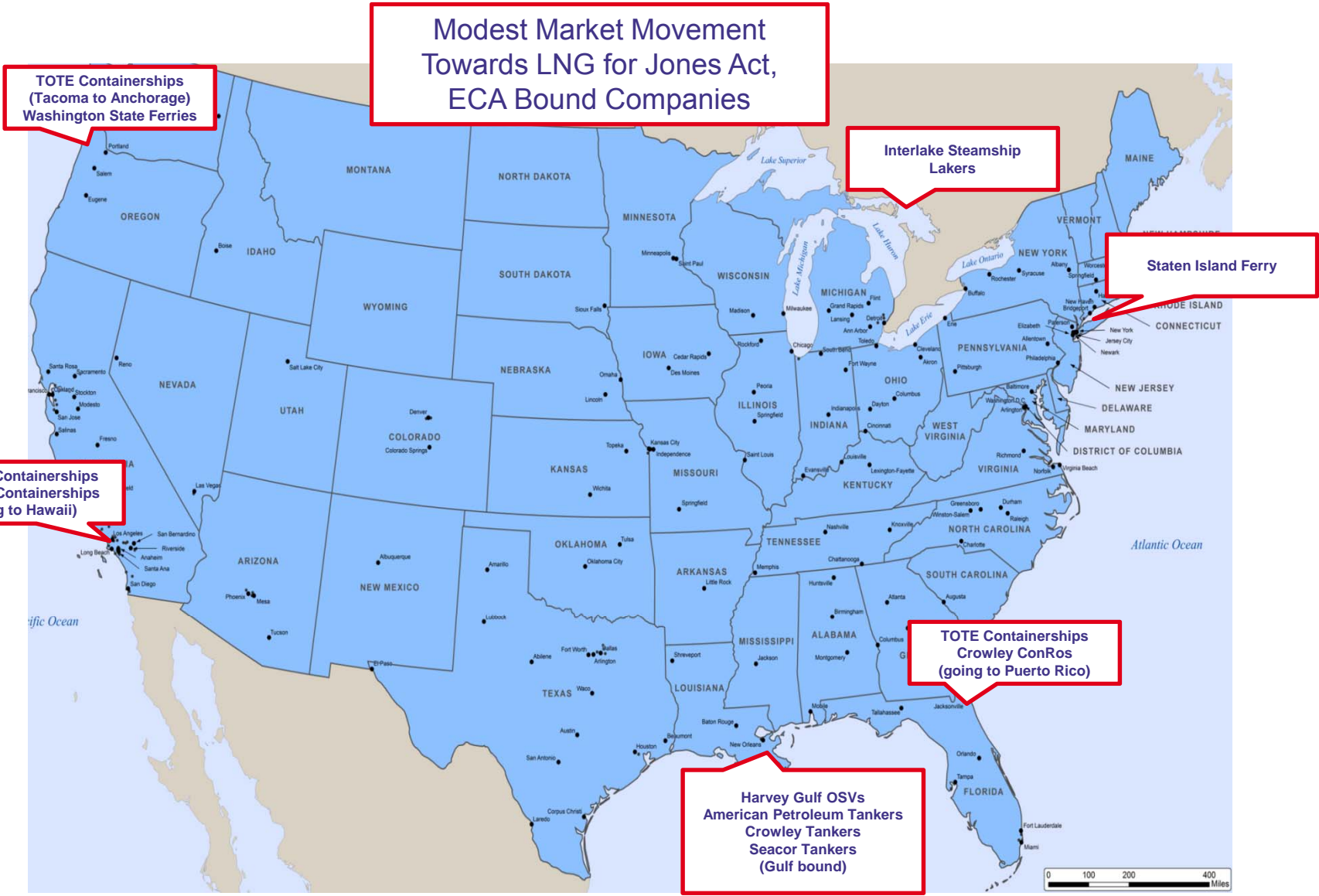


Fossil Fuel Emission Levels
- Pounds per Billion Btu of Energy Input

Pollutant	Natural Gas	Oil	Coal
Carbon Dioxide	117,000	164,000	208,000
Carbon Monoxide	40	33	208
Nitrogen Oxides	92	448	457
Sulfur Dioxide	1	1,122	2,591
Particulates	7	84	2,744
Mercury	0.000	0.007	0.016

Source: EIA - Natural Gas Issues and Trends 1998

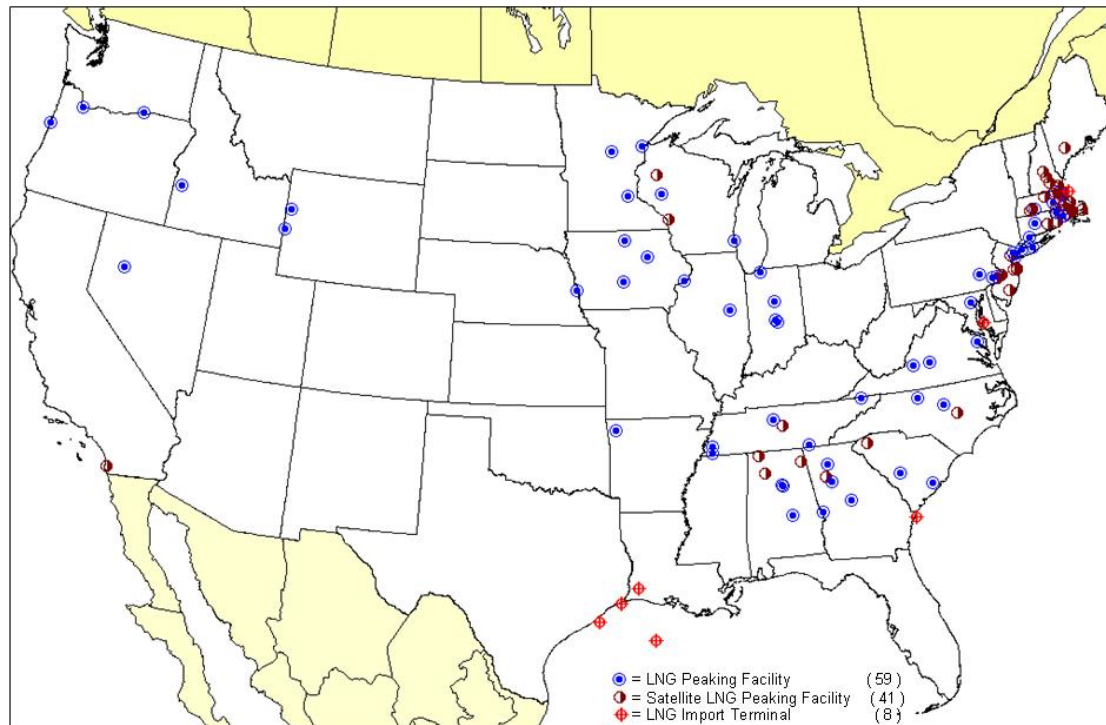
Current Marine Activity with LNG in the U.S.



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U.S. Domestic LNG Production – Three Main Categories

- Utility Peak-shavers for dedicated utility customers only
 - They do not have the ability to do anything with their LNG other than serve their commitments
- Utility Peak-shavers with excess capacity that sell interruptible gas
 - Not reliable supply because their first priority is to serve their utility customer's needs – not other contracts
- Purpose-built LNG facilities for new markets

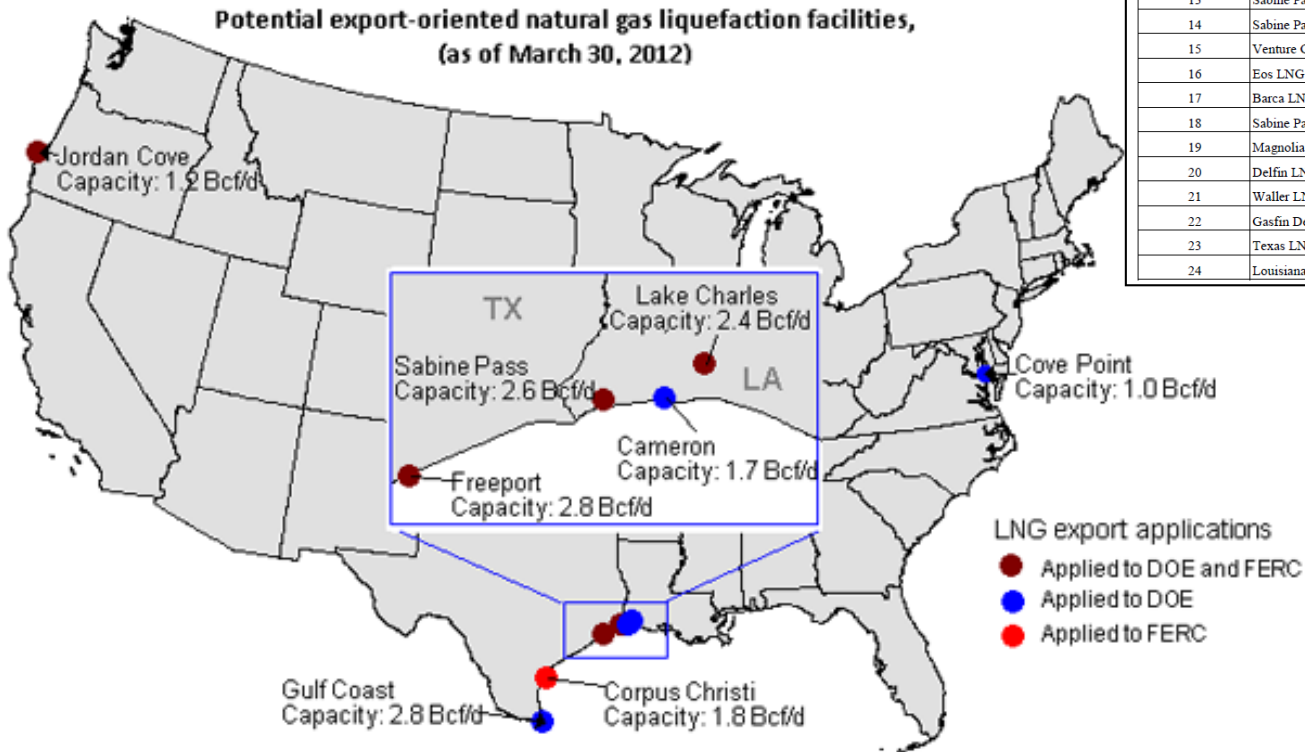


Note: Satellite LNG facilities have no liquefaction facilities. All supplies are transported to the site via tanker truck.
Source: Energy Information Administration, Office of Oil & Gas, Natural Gas Division Gas, Gas Transportation Information System, December 2008.

U.S. LNG Export Production

Pending Long-Term Applications to Export LNG to Non-FTA Countries
Listed in Order DOE Will Commence Processing
Last Revised 3/24/14

Current Processing Position	Company	DOE/FE Docket No
1	LNG Development Company, LLC (d/b/a Oregon LNG)	12-77-LNG
2	Cheniere Marketing, LLC	12-97-LNG
3	Excelerate Liquefaction Solutions I, LLC	12-146-LNG
4	Carib Energy (USA) LLC	11-141-LNG
5	Gulf Coast LNG Export, LLC	12-05-LNG
6	Southern LNG Company, L.L.C.	12-100-LNG
7	Gulf LNG Liquefaction Company, LLC	12-101-LNG
8	CE FLNG, LLC	12-123-LNG
9	Golden Pass Products LLC	12-156-LNG
10	Pangea LNG (North America) Holdings, LLC	12-184-LNG
11	Trunkline LNG Export, LLC	13-04-LNG
12	Freeport-McMoRan Energy LLC	13-26-LNG
13	Sabine Pass Liquefaction, LLC	13-30-LNG
14	Sabine Pass Liquefaction, LLC	13-42-LNG
15	Venture Global LNG, LLC	13-69-LNG
16	Eos LNG LLC	13-116-LNG
17	Barca LNG LLC	13-118-LNG
18	Sabine Pass Liquefaction, LLC	13-121-LNG
19	Magnolia LNG, LLC	13-132-LNG
20	Delfin LNG LLC	13-147-LNG
21	Waller LNG Services, LLC	13-153-LNG
22	Gasfin Development USA, LLC	13-161-LNG
23	Texas LNG LLC	13-160-LNG
24	Louisiana LNG Energy LLC	14-29-LNG



Source: U.S. Energy Information Administration, based on U.S. Department of Energy (DOE), Office of Fossil Energy Applications Received, and Federal Energy Regulatory Commission (FERC).

Notes: Each capacity in the map indicates the larger of either the LNG capacity to free trade agreement (FTA) countries from the DOE application or the capacity from the FERC application. The map includes all projects with pending or approved applications with either DOE, FERC, or both. Carib Energy and Cambridge Energy are not on the map because they are planning to use their currently-operating liquefaction facilities to liquefy domestic natural gas for exports. Corpus Christi has not applied to DOE for authorization to export domestic LNG.



Port Opportunities & Considerations

■ Opportunities:

- Ferry service
- Tug service
- Ship bunkering – likely first movers will be Jones Act trade
- Cold ironing

■ Considerations: Storage of LNG

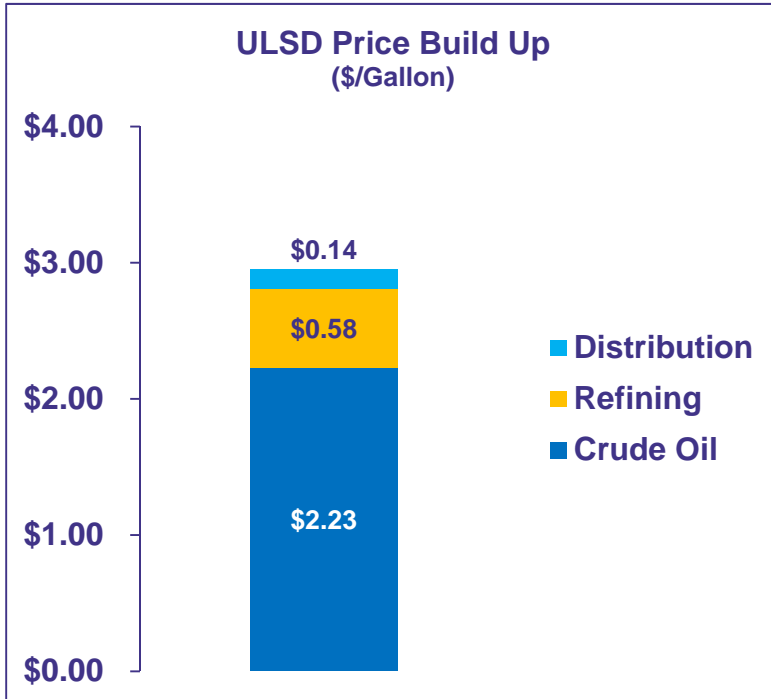
- National Fire Protection Association (“NFPA”) standard 59A (“NFPA 59A”), establishes the requirements for the “Production, Storage, and Handling of Liquefied Natural Gas”
- Under NFPA 59A, the storage of LNG may be limited by the total amount of land under the control of the facility
 - For LNG storage of up to a maximum of 280,000 U.S. gallons (1060 m³), the minimum setback from “offsite buildings and property lines that can be built upon” is 100 feet (but could be more)
 - For storage in excess of 280,000 U.S. gallons, land requirements will be determined by vapor dispersion and thermal radiation studies



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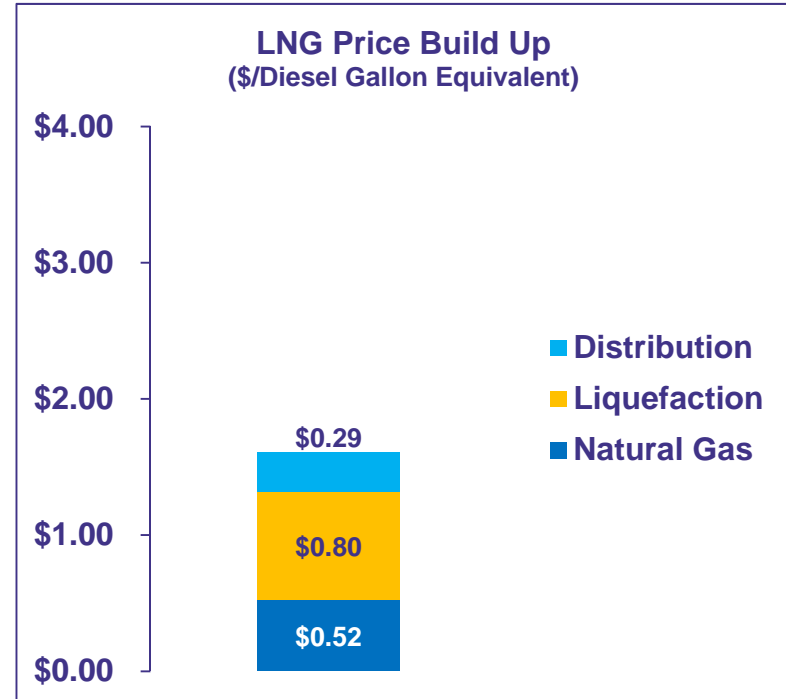
ULSD & LNG Price Build Up

\$2.95/DGE



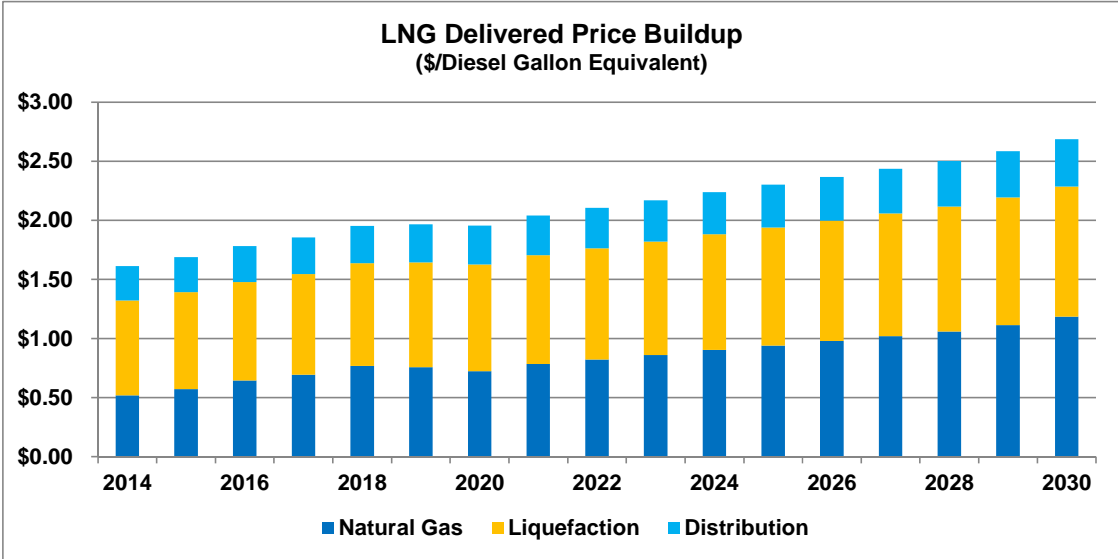
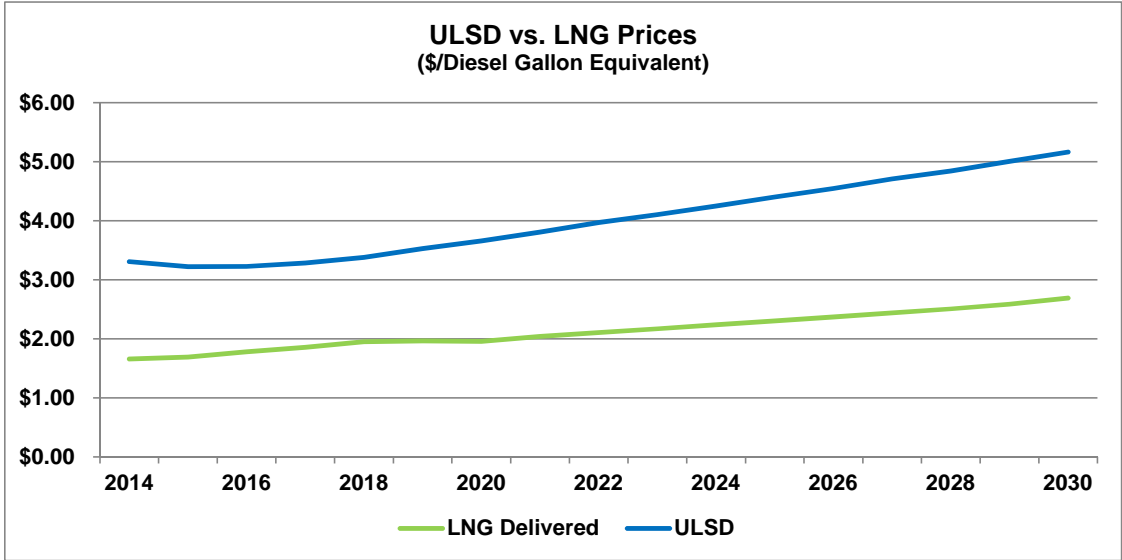
Source: U.S. EIA, New York Harbor ULSD, November 2013 average

\$1.61/DGE



Source: U.S. EIA; TETCO M3 November 2013 average gas price; GDF SUEZ estimates of liquefaction and distribution costs

Forecasted USLD & LNG Prices



Source: U.S. EIA 2014 Forecast; GDF SUEZ estimates of liquefaction and distribution costs

