Demonstration Project: Emission Reduction Conversion of a Marine Vessel to Natural Gas

Clean Fuels Clean Rivers CONSORTIUM

The Environmental Protection Agency (EPA) instituted new air emissions requirements for marine vessels operating in the United States. Owners of our Nation's aging, inland waterway fleets must now make the financial decision to retrofit, convert, or retire their diesel-powered vessels to meet the new EPA guidelines.

In response, the Pittsburgh Region Clean Cities (PRCC), a non-profit organization, developed Clean Fuels/Clean Rivers, a non-profit consortium initiative focused on building an innovative natural gas marine corridor that extends from the Morgantown, West Virginia area, through Pennsylvania, and down the Ohio River.

The Consortium's ultimate goal is to expand the use of natural gas as a replacement for diesel fuel for the inland waterway system, a river system that encompasses nearly 12,000 miles of navigable waters. Natural gas offers marine operators a cleaner burning alternative with significant reductions in particulate matter and greenhouse gas emissions, while also eliminating diesel discharges into the water. This natural gas use expansion not only benefits the environment, it also spurs on economic development in the Appalachia region by increasing the use of gas produced in the Marcellus/Utica Basin.

The PRCC team is capitalizing on the opportunity presented by the low cost, readily available supply of natural gas by launching a demonstration project to retrofit a marine vessel to natural gas. The project's focus is to educate and encourage marine operators to be innovative and convert/retrofit their vessels, which in turn allows them to meet the new EPA emission requirements while also reducing environmental impact to our inland waterways.

There is already a global movement toward conversion of ferries and similar vessels to compressed natural gas (CNG) and liquefied natural gas (LNG), particularly for vessels operating in environmentally sensitive areas. We believe the PRCC initiative in the Appalachia region is the first inland waterway effort in the United States.

It makes sense to begin here in the Appalachia region, in our Nation's second largest inland waterway, located in the middle of the Marcellus and Utica natural gas development area that produces 36% of our Nation's natural gas per the most recent Department of Energy, Energy Information Agency statistics.

The demonstration project could not have come at a better time. For the last year, the PRCC and Port of Pittsburgh have been studying the feasibility of a regional natural gas marine highway. One of the study results reveal there are more than 500 inland towing vessels operating in the region; these include both regional and non-regional towboat operators. There are 261 regional towboats operating in the Pittsburgh area, and almost 65% (169) are in the harbor vessels category with less than 1,200 horsepower.

While there are larger mid-range and long-range line haul towboats also operating on the waterways, it is obvious that in order to make a significant difference, the key is to develop a cost-effective method of converting the smaller harbor towboats to natural gas.

There are design challenges associated with converting the smaller harbor towboats that abound in the Appalachia Region. This demonstration will help innovate and develop scaled technology solutions for smaller vessel operations to benefit our regional operators, all within regulatory requirements. It will also help to answer key operational questions essential for natural gas conversion, especially for small-scale development.

The actual project will consist of converting a dual-engine harbor towboat to natural gas with LNG as the chosen method of on board fuel storage. All necessary fueling infrastructures will be in place, and applicable regulations followed. Throughout the project, conversion performance and evaluation points will be publicized, and educational outreach to vessel operators and other key stakeholders will take place. Finally, at the end of the demonstration, the team will publish a detailed report that will assist marine operators with making decisions necessary to meet the EPA emissions mandates. The entire demonstration project from acquisition of permits, to physical retrofit and vessel operation, will be approximately 24 months.

In addition to meeting EPA emissions standards and providing a cost-effective fuel alternative to marine operators, we anticipate the demonstration project will create economic development opportunities in the region. The siting of LNG production and refueling infrastructure along the riverfronts opens new markets for the growing supply of shale gas. Along with job creation, potential economic benefits include such things as: conversions of adjacent diesel-powered dray equipment (cranes, conveyors, etc.) and over the road vehicles; expansion of rail lines that serve the docks and multimodal systems; power generation along the waterways including dual fuel at existing coal-fired plants and utilization of LNG for peak shaving periods; LNG reinjection and revaporization into rural distribution systems by utilities for heat/power at 100% pure methane versus 95% methane on most pipeline quality gas; conversions of natural gas to clean diesel (Gas To Liquids – GTL) that does not require retrofit of existing engines and new refueling infrastructure; cracker plants that make ethylene pellets from ethane in wet gas production for numerous chemicals, plastics (PVC), and downstream applications that are half the cost and much cleaner than conventional refineries processing crude oil as the feedstock; and converting drilling rigs, earth moving equipment, mobile water treatment, and “yellow iron” equipment can all take place.

However, conversion from diesel to natural gas is not a straightforward process and requires the collaboration of multiple entities such as natural gas producers, fuel distributors and retailers, engine manufacturers, fuel storage vessels, motor-generator sets, and vessel owners and operators. Conversions also require close coordination with, and adherence to local, state, and federal regulatory requirements and significant investment on the part of all of the participants; but the return on investment could be swift, especially with a 50% or more projected fuel cost savings for vessel operators.

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