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FUELS

- [x] fossil energy
- [ ] environmental
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Thermoacoustic Natural Gas Liquefier

States Impacted:
California, Florida, Louisiana, Oklahoma, Pennsylvania, New Mexico, Texas, West Virginia

Benefit Areas:
Remote Gas Utilization, Cost Savings

Participants:
Cryenco, Inc., Los Alamos National Laboratory

FETC Contact:

Bradley J. Tomer**

Office: (304) 285-4692
E-Mail: btomer@fetc.doe.gov

MAIL ADDRESS:

* U.S. Department of Energy
P.O. Box 10940
626 Cochrans Mill Road
Pittsburgh, PA 15236-0940

**U.S. Department of Energy
P.O. Box 880
3610 Collins Ferry Road
Morgantown, WV 26507-0880

WEBSITE:
www.fetc.doe.gov

Description

Although most natural gas is still carried from well to user as gas in pipelines, the use of liquefied natural gas (LNG) has been increasing by 10 to 15 percent per year. With a liquefaction temperature of -240 °F, LNG requires sophisticated refrigeration machinery. A typical, modern, large liquefaction plant costs almost a billion dollars, liquefies 109 billion cubic feet of gas per day (Bcf/d), and has substantial operating and maintenance costs.

The thermoacoustically driven (TAD) natural gas liquefier process uses direct gas burning to generate sound waves to drive an orifice pulse-tube refrigerator (OPTR). The thermoacoustically driven, orifice pulse-tube refrigerator TADOPTR) will have no moving parts and will require no electrical power. It will be maintenance-free, inexpensive, efficient, portable, and environmentally benign. The first TADOPTR system is expected to consume 30 percent of its gas input, in order to liquefy the remaining 70 percent. It will operate by converting some of the heat of combustion of natural gas to very-high-amplitude acoustic power in a helium-filled thermoacoustic engine. This acoustic power will then be used to power a helium-filled cryogenic refrigerator to liquefy natural gas. The plans are to (1) design, build, test, and debug a 500 gal/day prototype; and (2) to undertake research to improve efficiency to the 20-percent-used to 80-percent-liquefied level or better in a 1 million cubic feet per day (MMcf/d) plant (10,000 bbls) — including raw gas upgrading prior to the TADOPTR process.

Goals

The objective is to develop a small, simple natural gas liquefier that is powered by the combustion of natural gas.

Tangible Benefits

National: This technology is part of a suite of advanced technologies and projects under DOE sponsorship that are helping ensure an adequate supply of domestic natural gas. This process is designed for small-scale LNG production at offshore platforms and other remote well site locations that are not accessible by pipeline, at one-half the cost of traditional refrigeration. The widespread use of this technology will greatly reduce the amount of flared and reinjected gas at these remote sites, and thus, will make stranded reserves economical to produce while reducing environmental effects.

Many end users of natural gas could benefit from LNG produced from small, simple liquefaction equipment, including compressed and natural gas-powered fleet-vehicle fueling stations, LNG supplies for use at emergency locations (such as hospitals), and LNG for peak-shaving by utilities.

Regional: Coastal regions of the U.S. will benefit from the ability to economically produce LNG at large offshore oil wells. Regions of the U.S. in which small, remote oil wells produce associated natural gas will benefit from the ability to economically produce LNG and eliminate the costly reinjection process. In addition, coal producing regions will benefit by producing LNG from coalbed methane sources.

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