

Method 2B Application
Element Markets Renewable Energy
Pennsylvania Landfill Gas to Liquefied Natural Gas and
Liquefied Compressed Natural Gas (LNG016 and CNG013)

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Pathway Summary

Element Markets Renewable Energy, LLC (hereinafter Element Markets), a marketer of renewable natural gas and environmental asset management services, has applied for Low Carbon Fuel Standard (LCFS) pathways for the production of liquefied and liquefied-compressed natural gas (LNG and L-CNG) from landfill gas (LFG) originating in Pennsylvania. The LFG is upgraded to biomethane at the extraction sites in Pennsylvania and conveyed by interstate pipeline to Topock, Arizona, where it is liquefied at a plant operated by Applied Natural Gas Fuels (ANGF). The LNG produced by ANGF is transported to customers and LNG dispensing stations in Barstow and Ontario, California. Some LNG is re-gasified and compressed to L-CNG at both stations.

Element Markets purchases the LFG from Johnstown Regional Energy LLC (JRE), an operator of LFG processing facilities at three Eastern Pennsylvania landfills: Raeger Mountain Landfill, Southern Alleghenies Landfill, and Shade Landfill. Element Markets purchases the processed LFG after it is injected into an interstate pipeline system operated by Dominion Transmission Inc. This system primarily collects natural gas from North American wells in the region. Gas is withdrawn from the interstate pipeline system in Topock, Arizona—located at a distance of 3,000 miles from the point of biogas injection—where it is liquefied to LNG transportation fuel. LNG is then transported by truck to customers and two refueling stations in Ontario and Barstow, California.

Carbon Intensity of LNG and L-CNG Produced

Each facility separately collects, processes, and compresses LFG to pipeline quality biomethane. The resulting biomethane is transmitted by pipeline from each landfill to a central collection point, from which it is injected into a primary interstate pipeline and subsequently withdrawn at the ANGF liquefaction facility in Arizona. The carbon intensities (CIs) of the LFG extraction, processing, and pipeline injection phases of this pathway were calculated using the U. S. EPA's eGRID electrical energy generation database. JRE operations are located within the RFC East eGRID region, which includes eastern Pennsylvania. The

liquefaction in Arizona occurs in the WECC Southwest eGRID region¹. The eGRID database reports *average* electrical energy generation mixes when *marginal* mixes are more appropriate for LCFS pathways. eGRID average mixes are converted to marginal mixes because additional demand would be met primarily by natural gas rather than by hydroelectric or nuclear generation capacity.

The biomethane Element Markets purchases from JRE is commingled with fossil natural gas when it enters both the regional and the interstate pipeline systems. Further commingling occurs at the ANGF liquefaction plant. As such, Element Markets will be obligated to retain records that unequivocally demonstrate that the credits it earns under the pathway described in this summary correspond directly with the volumes of biomethane it purchased from JRE.

The CIs of these pathways, as calculated by Element Markets, are 25.87 gCO₂e/MJ of LNG produced and 26.27 gCO₂e/MJ for L-CNG produced. These CIs are based on energy consumption records covering 2011 and 2012 at JRE and ANGF. By comparison, the Lookup Table CI for North American LFG liquefied in California are 26.31 gCO₂e/MJ (LNG006) and 15.56 (LNG007)² for 80 percent and 90 percent liquefaction efficiencies, respectively. The Element Markets pathway CIs are higher than the LNG006 and LNG007 CIs due to a longer pipeline transmission distance, transport of LNG via heavy-duty diesel truck, and a regional electricity generation mix characterized by higher GHG emissions.

¹ The U.S. Environmental Protection Agency's Emissions and Generation Resource Integrated Database (eGRID) can be found at

http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2012V1_0_year09_SummaryTables.pdf.

² Landfill Gas (Biomethane) to LNG in California (LNG006 and LNG007):

http://www.arb.ca.gov/fuels/lcfs/092309lcfs_lfg_lng.pdf

Table 1: Proposed Lookup Table Entry

Fuel	Pathway Identifier	Pathway Description	Carbon Intensity in gCO ₂ e/MJ (Including Indirect Effects)		
			Direct Emission	Land Use or Other Indirect Effect	Total
LNG from LFG	LNG016	2B Application: (Specific Conditions Apply) Pennsylvania Landfill gas to pipeline-quality biomethane, delivered to Topock, AZ via pipeline for liquefaction; transported by truck to CA	25.87	0	25.87
CNG from LFG	CNG013	2B Application: (Specific Conditions Apply) Pennsylvania Landfill gas to pipeline-quality biomethane, delivered to Topock, AZ via pipeline for liquefaction; transported by truck to CA; re-gasified and compressed to L-CNG	26.27	0	26.27

Operating Conditions

1. Actual pathway energy consumption (both thermal and electrical) shall remain at or below the levels specified in Element Markets' application. In addition, the recovery and processing efficiency levels at the landfill, the liquefaction efficiency at ANGF plant, and the compression efficiency level

at the L-CNG stations shall remain at or above the levels specified in the application. This condition applies to the JRE landfill gas extraction, processing, and compression facilities in Pennsylvania, and the ANGF-owned liquefaction and dispensing stations in Arizona and California. Energy consumption values for these facilities are classified by the applicant as confidential business information.

2. Because the biomethane supplied under this pathway is commingled with fossil NG when it enters both the regional and the interstate pipeline systems, and at the LNG plant, Element Markets must maintain an accounting system that will enable it to demonstrate unequivocally at any time that every unit of biomethane-based transportation fuel sold and reported under the LCFS can be associated with an equal unit of biomethane purchased and injected into the interstate pipeline system.

Staff Analysis and Recommendation

Staff has reviewed the Element Markets application for the production of LNG and L-CNG from LFG originating in Pennsylvania and has replicated, using the CA-GREET spreadsheet, the CI values calculated by Element Markets (25.87 gCO₂e/MJ for LNG and 26.27 gCO₂e/MJ for L-CNG). Element Markets has provided documentation of the JRE plant's energy use, LFG production, and LFG transportation, as well as ANGF's energy use, LNG production, and LNG transportation. These records cover calendar years 2011 and 2012. Staff therefore recommends that Element Markets' application for Method 2B LNG and CNG pathways be approved, subject to the operating conditions stipulated above.