By: KEVIN WARNER, Ph.D.
Chief Technology Officer
Mustang Sampling

Unique chapters in the book of gas analysis

Mustang Sampling

The demand for renewable fuels has never been higher and continues to grow into new areas. The combination of diverse end users and energy sources is creating new questions in gas analysis, demanding answers in instrument and sample conditioning supply.

An ordinary Tuesday took an interesting turn after only a few sentences of a conversation with a long-time customer. "I'm looking for a source of LNG from a totally renewable provider that I can blend with conventional LNG to provide bunker fuel for a marine fleet," he said. "One of our customers is asking for it and we'll need to verify the entire supply chain. Can you provide a sampling and analysis plan for something like that?" Without hesitation I responded positively, hung up the phone, and then began to think about the problem.

The only viable source currently available for renewable LNG, if that is even a term, is Renewable Natural Gas (RNG). RNG is not really natural gas, but rather biomethane that has been upgraded to at least pipeline quality specifications. The most common sources are from gathered masses of deteriorating waste products at farms, landfills, wastewater plants, food production facilities or other growers. Each production type is unique, but the analysis chain follows a familiar path from raw gas collection, to dehydration, sweetening or hydrogen sulfide removal, upgrading — removal of carbon dioxide and nitrogen — and finally pressurizing.

Analyzers within production facilities range from very simple electrochemical cells for specific chemical analysis, for example H_2S levels, to process gas chromatographs for sophisticated suites of measurements. At the end of the custody transfer line, the conventional tariff measurements are common: Energy Value, Wobbe Index, CO_2, H_2S, nitrogen, oxygen and moisture levels. Additional analysis for some sources may include siloxanes, mercury VOCs and other organic compounds. Current total RNG production in the U.S. is about 200 million cuf/day, so supply and the associated analysis should be easily solved.

The second part of the problem is the production, measurement and analysis of LNG from the verified RNG. The production of LNG requires a small-scale cryogenic plant — essentially a large, complex refrigerator that lowers the temperature of the methane from ambient to below its boiling point, or -259°F. The heat exchangers and other equipment within cryogenic plants are extremely sensitive to contaminants. Mercury concentration, siloxanes and sulfur compounds must be eliminated from the feedstock to prevent severe damage. Custom, small-scale LNG facilities are manufactured by a handful of companies, so finding a suitable one, or an existing plant that could be used, should not be a problem. Sampling and analysis for LNG is described in detail by ISO 8943 for large-scale applications, and similar methods are usually employed for smaller endeavors.

Blending LNG streams is a common practice at production facilities in order to achieve energy density targets for specific customers. The simplest case is two supply streams with different compositions. In the case of regassified LNG, the entire energy contribution is from methane. The only ethane or propane present in the final mixture comes from the conventional LNG source, which we can assume has been previously identified. A mixture can be obtained to meet composition targets, usually by mass measurements and a final analysis of the blended LNG.

The final wrinkle in this particular problem is attributable to the end-use, marine bunkering. Marine vessels operating on LNG are driven essentially by diesel engines modified for use with compressed natural gas. Sampling and analysis of the LNG is carried out during the loading process, and sometimes onboard as well, with an additional step of Methane Number calculation — to determine a fuel's suitability in a diesel engine — added to the Energy and Wobbe Index values.

The diversity of sources, end-users and applications for natural gas and similar mixtures will continue to grow for the foreseeable future. The ongoing energy transition is driving consumers toward more creative solutions as the pressure to meet both environmental and climate goals grow.

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