THE FEASIBILITY OF RENEWABLE NATURAL GAS AS A LARGE SCALE, LOW-CARBON SUBSTITUTE

I. OBJECTIVE

Alternative fuels that have low GHG and criteria pollutant emissions, such as renewable natural gas, are essential for California to meet its climate change and air quality goals. This project's goal is to determine the technological and commercial feasibility of producing large quantities of renewable natural gas fuels for use in California. Such an analysis should also address the costs, regulatory and infrastructure barriers, and environmental impacts associated with producing these fuels on a commercial scale. Results will provide essential data that will inform further refinements to the State's LCFS program and other climate change and air quality initiatives.

II. BACKGROUND

ARB adopted LCFS regulation in January 2010, and its carbon intensity (CI) standards entered into effect in 2011. The LCFS is designed to reduce GHG emissions from the transportation sector in California by about 16 MMT in 2020. These reductions account for almost 10 percent of the total GHG emission reductions needed to achieve the State's mandate of reducing GHG emissions to 1990 levels by 2020. In addition, the LCFS is designed to reduce California's dependence on petroleum, create a lasting market for clean transportation technology, and stimulate the production and use of alternative, low-carbon fuels in California. This includes the use of renewable natural gas as a transportation fuel, both for light duty and heavy duty vehicle applications.

The LCFS incentivizes the production and sale of low carbon-intensity transportation fuels. The regulation does this by establishing a set of performance standards in the form of declining carbon-intensity levels that fuel producers and importers must meet each year for their fuel pools beginning in 2011. One set of carbon intensity standards is established for gasoline and the alternative fuels that can replace it; a second set of similar standards is set for diesel fuel and its replacements. Each standard is set to achieve an average 10 percent reduction in the carbon intensity of the statewide transportation fuels mix by 2020. Fuels generate deficits when they are sold in California with carbon intensities that are above the standard for a given year; such deficits must be reconciled within a year. By contrast, fuels generate credits, which can be banked indefinitely or bought or sold as the need arises, when the fuels have carbon intensities below the standard for that year.

The standards are "back-loaded;" that is, there are more reductions required in the last five years of the program than the first five years. This schedule allows for the development of advanced fuels that are lower in carbon than today's fuels and the penetration of plug-in hybrid electric vehicles, battery electric vehicles, fuel cell vehicles, and flexible fuel vehicles.

In order to be commercially viable, renewable natural gas needs to be available in sufficient quantities and at competitive prices relative to its conventional counterparts, both petroleum diesel and fossil natural gas. This is particularly true given the currently low market prices for conventional natural gas due to substantial increases in the use of innovative gas extraction techniques, such as hydraulic fracturing ("fracking") and horizontal drilling. The LCFS regulation already incorporates a number of pathways for renewable natural gas (as CNG or LNG) derived from landfill gas and dairy digesters, and there's a pending pathway for renewable natural gas derived from high solids anaerobic digestion of organic wastes (HSAD). All these renewable natural gas pathways have substantially lower carbon intensity that both conventional diesel and fossil natural gas. Because renewable natural gas has a much lower carbon intensity than both of these conventional fuels, the value of LCFS credits associated with its production and sales in California, particularly in the latter phases of the LCFS program, will likely improve the competitiveness of renewable natural gas.

To maximize the market penetration of renewable natural gas, it is essential that technical, commercial, financial, marketplace, and regulatory barriers that are specific to renewable natural gas production be identified. The ARB's 2011 LCFS Program Review Report indicates that barriers to expanded natural gas usage include infrastructure, conversion of existing vehicles to use natural gas, the higher cost and more limited selection of original equipment manufacturer (OEM) vehicles, and vehicle conversion. Such barriers would presumably also apply to the use of renewable natural gas as a transportation fuel. However, there are barriers to the expanded production and use of renewable natural gas that are specific to this fuel. Such barriers include, but are not limited to, prohibitive interstate pipeline standards, lack of centralized biogas production facilities, uncertainty in biomass volume that realistically would be available for renewable natural gas production, and capital and recurring costs.

A current example of successfully producing renewable natural gas at scale for transportation use can be found at the Altamont landfill (California). The landfill gas-to-liquefied natural gas (LFG) facility is operated by High Mountain Fuels, LLC, a joint venture of Waste Management and The Linde Group. Waste Management, one of the largest waste collection operators, has over 1,000 natural gas waste collection vehicles in their fleet, a number of which are now fueled with very-low carbon intensity LFG produced at the landfill. Waste Management is currently in the process of constructing a second landfill natural gas facility in southern California.

III. SCOPE OF WORK

As noted above, the feasibility of widespread, large-scale production of renewable natural gas, especially for transportation use, remains uncertain, with a number of knowledge gaps that need to be filled to assist with appropriate policymaking. Accordingly, the primary goals for the project investigators are as follows:

- Review the literature to compile existing and developing information related to renewable natural gas production and distribution, particularly for transportation fuel use in California and elsewhere.
- With the literature review as a starting point, provide a workplan to:

  (1) Develop a map of current and potential sources for renewable natural gas production, both in California and elsewhere in the U.S., identifying, analyzing and comparing the technology and production methods involved, feasibility, costs, environmental impacts, advantages/disadvantages, volumetric capacities, and distribution methods to bring the fuel into California for vehicular use. The analysis should also include an assessment of issues with the pipeline or other transport systems for feeding biomass to a renewable natural gas production facility, and co-siting or other optimization strategies for maximizing renewable natural gas production among separate biomass/renewable natural gas sources located near each other.
  (2) Identify or estimate where such facilities could be located in order to maximize production of renewable natural gas while minimizing potential environmental impacts.
  (3) For the significant actual or potential sources of renewable natural gas identified above, provide a preliminary estimate using CA-GREET, GREET, or other appropriate model(s) of the lifecycle GHG emissions as well as localized emissions of criteria and toxic air pollutants. Provide preliminary assessments of other potential environmental and public health impacts that are of significant concern.
  (4) Identify barriers to the successful expansion of renewable natural gas production, and where applicable, strategies to overcome these barriers, including but not limited to, suggested refinements to the LCFS regulation itself.
  (5) Identify additional areas of research to help fill the growing need for data related to technological advancement, costs, and environmental impacts.

Results of this study will provide essential data needed to inform future refinements to the LCFS program, as well helping to inform other air quality or environmental programs.

IV. Deliverables

- Quarterly progress reports
- Final report
- Additional deliverables to be determined in consultation with ARB

V. Timeline

It is anticipated that projects will be completed in 36 months from the start date. Note that this allows 30 months for completion of all work through delivery of a draft final report; the last 6 months are for ARB and RSC review of the draft final report and delivery of a revised final report and data files to the ARB.