DOCKETED

Docket Number:	17-IEPR-10
Project Title:	Renewable Gas
TN #:	220206
Document Title:	Genifuel Response to Request for Comments on SB1383
Description:	N/A
Filer:	System
Organization:	Genifuel/James Oyler
Submitter Role:	Public
Submission Date:	7/14/2017 3:29:38 PM
Docketed Date:	7/14/2017

Comment Received From: James Oyler
Submitted On: 7/14/2017
Docket Number: 17-IEPR-10

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Additional submitted attachment is included below.

BRIEF DESCRIPTION OF GENIFUEL HYDROTHERMAL PROCESSING

Background

The Genifuel technology is called Hydrothermal Processing, or HTP. HTP is a wet process, in which the dry solids are converted to biocrude oil and/or methane gas in a water slurry with approximately 20% solids and 80% water. The feedstock is never dried--using dry weights is simply a convenient and consistent way to measure the solids content of the feedstock. HTP consists of two steps, which can be used alone or together. It is a continuous-flow process, with the total time through the system of less than one hour.

The HTP process can be configured to produce biocrude oil, methane gas, or a combination of the two. For this response, the system would be assumed to produce only methane gas, but the same considerations could be applied to a system producing oil, or both oil and gas.

The first step is the initial oil-forming step, called Hydrothermal Liquefaction (HTL), which produces biocrude oil. Approximately 45% of the organic content of the feedstock goes into the oil (dry weight basis). Phosphorus is also removed from the system during the oil stage and can be sold as a separate byproduct. The remaining organic content can be further processed via the second step, called Catalytic Hydrothermal Gasification (CHG). If only gas is desired, then the oil produced in the first step is not removed, but is allowed to flow along with the residual water to the second (gasification) stage. In this way the final product is only gas, and the output of gas is maximized.

The CHG stage produces a gas composed of approximately 65% methane and 35% carbon dioxide. The carbon dioxide can be stripped from the mixture by conventional technologies to give pure methane, which is Renewable Natural Gas (RNG). Once the carbon dioxide is removed from the gas, the methane is exceptionally clean, with no sulfur, siloxanes, or other impurities typically found in other types of biogas.

A key advantage of HTP is that it can work efficiently and effectively with almost any organic material that can be made into a water slurry. A chart slowing potential feedstocks is attached as Exhibit 1 below. Genifuel is currently working on a system using dairy waste as the feedstock for the Southern California Gas Company which is partially funded by the CEC, entitled "Dairy Waste-to-Bioenergy via the Integration of Concentrating Solar Power and a Hydrothermal Conversion Process, EPC-14-047".

HTP is highly efficient both in converting the feedstock to fuel and in using very low energy for system operation. Specifically, HTP can convert more than 85% of the feedstock carbon to fuel, and needs less than 14% of the fuel energy produced to run the system. No other biofuel technology currently available is capable of anywhere near these combined figures. The technology was originally developed by the US Department of Energy through its National Laboratories, so data has been published supporting the statements in this submission and is readily available. Genifuel is the exclusive worldwide licensee from the Pacific Northwest National Laboratory, which holds the technology patents.

Exhibit 1

ANNUAL WET AND GASEOUS FEEDSTOCKS
(USA AVAILABILITY AND UNITS)

Feedstock	Millions dry US tons/y	Oil + Gas via HTP Trillions BTU/y	Gas via CHG Trillions BTU/y
Animal Waste	**41.0**	**698.0**	**568.9**
Food & Food Proc. Waste	**15.3**	**284.7**	**232.0**
Wastewater Solids	**14.8**	**286.7**	**233.7**
Organic Portion of MSW	**14.3**	**266.2**	**217.0**
Fat, Oil, Grease (FOG)	**6.1**	**214.3**	**174.7**
TOTALS	**91.5**	**1,749.9**	**1,426.3**

- ***Wet wastes can supply 5.9% of US transportation fuel***
- ***Wet wastes can supply 5.2% of US natural gas consumption***

Because of its higher efficiency, HTP compares very favorably with other biofuel processes. In particular, HTP will produce roughly twice the methane as an Anaerobic Digestion (AD) system using the same feedstock. In addition, HTP is feedstock-agnostic, and does not need any special adjustment when changing feedstocks or feedstock compositions, as long as it is made into the desired wet slurry. Related to this greater gas formation is the fact that HTP converts over 99% of the feedstock organic matter, compared to roughly 50% for an AD system. This means there is no residual sludge to remove and transport, and no off-gas which would come from the eventual decay of the residual sludge.

Genifuel has also built an HTP system to process algae as the feedstock, producing both oil and gas. This system is currently operational, is installed in India, and is shown in Exhibit 2 below. . Two other systems are in the design phase for processing wastewater solids, one in Canada for the City of Vancouver, and one for the Central Contra Costa Sanitary District ("Central San") in Martinez, CA. The Vancouver system will serve a satellite community with 30,000 people, while the Central San facility is projected to process a flow equivalent to 60,000 people. These will be the first larger-scale systems in the wastewater industry worldwide. Both the Vancouver and Central San projects are receiving 50% of their funding through government grants.

These projects and many similar ones in discussion throughout the world have given Genifuel a deep understanding of the roadblocks and hurdles which must be overcome to implement HTP on a substantial commercial scale in California, the USA and worldwide. Some key conclusions from this process are described below.

Exhibit 2

An Installed and Operating HTP System

Observations and Issues

Three major restraints have hindered HTP technology from faster commercial adoption.

1. Until fully commercial systems are in operation 24/7 at user sites, most users adopt a wait-and-see approach. Therefore, some incentive is needed to attract the pioneer adopters and break this "Catch-22" situation.
2. Early units are more expensive because they have not progressed far enough down the learning curve. Costs are dropping very quickly on the first several units described above, and will continue to decline as more units are built and standard configurations emerge. However, raising the capital for these early systems has proven difficult and has required government support.
3. Engaging offtake partners has proven difficult. Typical offtake partners would be a refining company for the oil (if the HTP system is configured to make oil) and a gas company for the RNG that is produced. The only fully-committed offtake partner that has worked with Genifuel so far is the Southern California Gas Company ("SoCalGas"), which has partly funded the aforementioned CEC project as well as the project with Central San. Other than that, offtake partners are in the same "wait-and-see" posture as potential users.

Solving these three issues would accelerate HTP adoption and thereby contribute to the goal of reducing short-lived climate pollutants (SLCPs) as envisioned by Senate Bill 1383. Recommendations to address these issues are listed below.

Recommendations

1. The most viable and powerful recommendation is to fully engage gas utilities to support the production and offtake of RNG. The single most powerful mechanism to accomplish this is to allow the gas utility to finance the RNG system and place the production equipment into its rate base as soon as it is operational. The definition of production equipment should include the equipment to upgrade raw biogenic gas to pipeline standards, for example by removal of carbon dioxide, moisture, and sulfur. Mechanisms to support construction financing for the RNG system should also be put into the regulatory framework. The rate-base provision needs to be allowable regardless of the scale of the biogas system. This allowance is needed because even a system for (say) 10,000 dairy cows will not make very much gas in the scale of the full pipeline deliveries of even a modest gas utility. However, over time a large fleet of such systems could make a substantial contribution to the goals of SB 1383.
2. To incentivize gas utilities to seek opportunities for HTP systems, even with the rate base allowance, mandates requiring a certain percentage of RNG in the system are needed. Such mandates already exist and could be expanded as the opportunities for RNG production are more fully recognized.
3. A technical roadblock is the cost and difficulty of inserting biogenic gas into the existing pipeline system. The insertion equipment can cost several million dollars, or even more. Every gas utility has a different set of requirements and equipment for this purpose, and in almost every case the specified equipment is intended for fossil gas interconnection and is far too large for the distributed systems operating on renewable feedstocks. A technical standard and equipment description need to be developed for small interconnect systems to feed biogenic gas into a pipeline. This standard system should be skid-mounted and portable, and available in several stock sizes. It should accomplish the full range of requirements, such as pressure regulation, gas composition monitoring, and odorant insertion. Such small standardized systems are starting to appear in Europe, so some learning from there may be possible. This piece of equipment should also be eligible for the rate base and financed by the gas company.

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