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COMMENTS ON DRAFT SOLICITATION
ON
DEMONSTRATING INNOVATIVE SOLUTIONS
TO CONVERT
CALIFORNIA'S RESIDUAL FOREST BIOMASS RESOURCES
INTO
RENEWABLE NATURAL GAS

August 24, 2018

RE: Docket No: 19-ERDD-01

INTRODUCTION

Recovery of valuable products from waste forestry biomass resources provides a means to significantly impact both forest management and greenhouse gas reduction. However, as pointed out in the draft solicitation, the location of these potential resources provides a significant challenge to the economic recovery of energy products from the resources.

Technologies have been and are being developed that can provide viable, economic energy products from these resources. Primary among these is biomass gasification which, if configured properly, can produce a fuel that can directly substitute for natural gas, or a synthesis gas product that can be upgraded to produce liquid fuels or SNG. Alternatively, the produced gas can be used for the production of renewable power fed onto the grid or heat for combined heat and power applications or industrial applications.

There are many different types of gasification technologies: air-blown or oxygen-blown; atmospheric or pressurized; circulating or bubbling fluidized beds; fixed beds; entrained flow; updraft and downdraft; static and rotating kiln pyrolysis; and the list is growing as new concepts and hybrids of existing designs emerge. All these different technologies have their own advantages and disadvantages, and, more importantly from a gas turbine viewpoint, they all produce different gases – both in calorific value and composition. However, we are basically able to separate these technologies into 3 distinct groups: air-blown processes producing very low calorific value gases (3.5 – 7MJ/Nm3), oxygen-blown and hybrid processes producing low calorific value fuels (7 – 15MJ/Nm3) and indirectly heated processes giving a medium calorific value fuel (15 – 20 MJ/Nm3). Atmospheric pressure air-blown gasification systems are often viewed as being a simpler technology, particularly as they do not operate under pressure. These more "conventional" technologies will typically scrub the synthetic gas produced prior its end use as a fuel gas. This allows not only removal of contaminants which could affect the gas turbine performance or reduce its operating life, but also remove compounds which can contribute to exhaust emissions. However, these atmospheric pressure systems produce a fuel gas compression unsuitable for natural gas displacement. Medium calorific value gases can overcome this deficiency by significantly reducing the gas compression requirements as the nitrogen in the synthesis gas has been eliminated.

The Taylor Biomass Gasifier provides such a step by utilizing an indirectly heated process system to effectively convert the biomass into a medium calorific value synthesis gas. Unlike air- or oxygen-blown gasification technologies that have provided the "state-of-the-art", the Taylor Gasifier provides a synthesis gas that is substantially free of contaminants and has a chemical composition suitable as a direct substitute for natural gas in industrial applications, for synthesis applications or end use in a BIGCC system.

The Taylor Biomass Gasification Process as an indirectly heated gasification process, does not rely on the reaction of air or oxygen within the gasification reactor, but rather uses a hot circulating sand medium to convert the incoming biomass into the medium calorific value synthesis gas. Indirectly heated gasification has been demonstrated to be a flexible and reliable method for efficiently producing a medium heating value gas from biomass - based feedstocks. The Taylor gasification process, a patented process, provides an enhanced process over other indirectly heated gasification systems. Taylor's process provides improvements in operation by integrating innovative improvements to reduce issues with ash agglomeration and in-situ destruction of condensable hydrocarbons, an essential element in gas cleanup and environmental performance of the process. By providing in-situ removal of the condensable hydrocarbons, subsequent gas cleanup is greatly simplified as the gas may be cooled prior to final cleanup thus reducing the size of the cleanup equipment. Such cooling improves overall process efficiency by providing a means to more effectively recover sensible energy in the product gas stream.
In the Taylor Gasifier, a circulating heat carrying material is used to rapidly heat the incoming biomass and convey unconverted materials from the gasification reactor into an associated combustion reactor thereby utilizing all of the available energy in the biomass fuel.

SPECIFIC COMMENTS ON PROPOSED SOLICITATION

The stated objective of the proposed solicitation is to "improve efficiency, reduce costs, and reduce the environmental impact for the forest waste to RNG pathway." Based on the introductory discussion, it is also assumed that the CEC's goal is to implement selected technologies in as expedient a time frame as possible in order to reduce the wildfire risk as quickly as possible. In light of these overall objectives, the following comments are provided:

1. The stated objective is to produce RNG from an integrated system. Some gasification systems (including the Taylor Process) produce a syngas that can be directly substituted for natural gas in industrial applications. The syngas is not "pipeline quality" but has a composition and combustion properties so that equipment modification is near zero. These industrial applications are typically the largest consumers of natural gas in a given area, so the net augmentation of natural gas supplies can be significant.

2. Projects must perform a pilot scale demonstration – Pilot scale demonstration of technology is a part of the "conventional" pathway for technology implementation. Depending on the state of development of project components

and their individual state of development, integrated pilot demonstration may not be necessary. For example, syngas methanation is a well established commercial technology. If a suitable syngas can be produced by a given conversion system (as supported by laboratory data) and integrated pilot demonstration may not be necessary.

3. Gas quality, as discussed above, need not be 990 – 1150 BTU/scf to directly impact industrial operations. Other parameters (sulfur content specifically) can be readily met by medium calorific value syngas.

4. Length of pilot demonstration – If pilot demonstration is required, 500 hours of total operation is insufficient to evaluate critical process variables. 1000 hours of total operation would be recommended as a minimum operating period. Similarly, it is recommended that 100 hours of steady state operation be set as a minimum. These steady state hours of operation should be in minimum blocks of 8 hours each.

5. Location of pilot facility – The proposed solicitation requires the pilot facility be located in IOU territory. Such a requirement limits potential applicants and increases overall development costs. It could also significantly increase the process development time.

6. TRLlevel – To help insure rapid deployment of any proposed technologies a TRL minimum of 5 to 6 at project initiation is recommended. Levels 3 and 4 are very early in the development state and much more likely to not lead to commercial implementation.

7. Feedstock sourcing – In addition to the source of the feedstock proposed, and due to the nature of forestry wastes, a clear plan for transportation and the cost of such transportation should be addressed in any proposal.

8. Target levelized cost of methane – The stated target price is not likely to be met by biomass conversion technologies – even with a zero-cost biomass fuel. The number of unit operations required to convert biomass to RNG dictates significantly higher final RNG prices. Direct use of syngas as a natural gas substitute can help with this issue.

9. Stated funding levels will require significant proposer contribution. This contribution is likely to be well in excess of the 10% minimum cost share stated. If an integrated pilot plant of the required size were to be constructed with appropriate analytical support, an estimated project budget would be approximately $20 million. Such a budget would require a cost share of over 90%.

SPECIFIC ANSWERS TO QUESTIONS PROPOSED

1. Are the technical targets for the pilot demonstration clear and reasonable? Should they be narrowed further? If not, why not? Please identify the specific targets that should be changed and the recommended change.
   a. Please see #3 and #6 above Recommended change – TRL level 5 to 6, syngas heating value and composition suitable for direct natural gas substitution.

2. Are the target cost and technical specifications for a commercially-mature system clear and reasonable? Should they be narrowed further? If not, why not? Please identify the specific targets that should be changed and the recommended change.

   a. Please see #8 above. Recommended change – current natural gas selling price plus 20%.

3. Will a technology that achieves these targets have the characteristics required for a commercially-viable woody biomass to RNG system? What targets are missing that would help improve commercial viability?

   a. Yes

4. Are the feedstock requirements clear and reasonable?

   a. Feedstock requirements are clear and reasonable. As stated in #7 above transportation method and costs should be addressed.

5. Are the correct technologies being focused on (conversion, cleanup, and upgrading systems)? Are there components that offer more opportunity for cost reduction?

   a. Yes
   b. Include power production as co-product to help lower overall costs.

6. What is the best way to evaluate the levelized cost of methane presented by proposed projects? Would requiring a technical overview of the pathway, assumptions used, and economic estimates be sufficient?

   a. Full economic analysis of proposed system at commercial scale. Including first 1 to 2 year startup performance. Otherwise cost projections are not acceptable to project financiers.
   b. Independent engineer evaluation by engineering firm versed in the specific technology(ies) proposed should be required. Engineer familiarity with technology is critical to useful evaluation.

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