

Burney-Hat Creek Bioenergy

GFO-15-325: Abstract

Introduction

Fall River Resource Conservation District (Fall River RCD)—in partnership with Hat Creek Construction & Materials (HC Construction), West Biofuels, WM Beaty & Associates, Del Logging, and UC San Diego—seek to develop one of the State’s first commercial-scale biomass gasification facilities using forest-sourced feedstock from Tier 1 and Tier 2 High Hazard Zones (HHZ). The proposed project—Burney-Hat Creek Bioenergy—is the culmination of two years of pre-development work that has accelerated this project to a high degree of project readiness. The Project Team has completed CEQA approval as of August 18, 2016 as an Addendum to the site’s Environmental Impact Report (EIR); identified feedstock suppliers for the life of the facility; completed a System Impact Study with Pacific Gas & Electric (PG&E); and is eligible to participate in the Biomass Market Adjusting Tariff (BioMAT) queue.

Burney-Hat Creek Bioenergy builds upon the successes of two on-going publicly-funded programs. The first program, an Energy Commission-funded research and development (R&D) program titled “*Modular Biomass Power Systems to Facilitate Forest Fuel Reduction Treatments*” (Contract No. EPC-14-024), is evaluating the ability for West Biofuel’s CircleDraft technology to process and manage forest-sourced fuels. The project began in May 2015 and is scheduled for completion by September 2017. Preliminary data has confirmed suitability of the West Biofuels system with forest-sourced feedstock and continued testing will validate operational parameters that will directly apply to the Burney-Hat Creek Bioenergy facility.

The second program, a US Forest Service funded pre-development program titled “*Northeastern California Community Biomass Energy Cluster*,” provides pre-development funding to complete the civil, mechanical, structural, and electrical engineering along with the facility’s Authority to Construct. This \$249,350 program was awarded to the Fall River RCD in May 2016. The project will bring the project to a fully-permitted, shovel-ready stage and is scheduled for completion by December 2017.

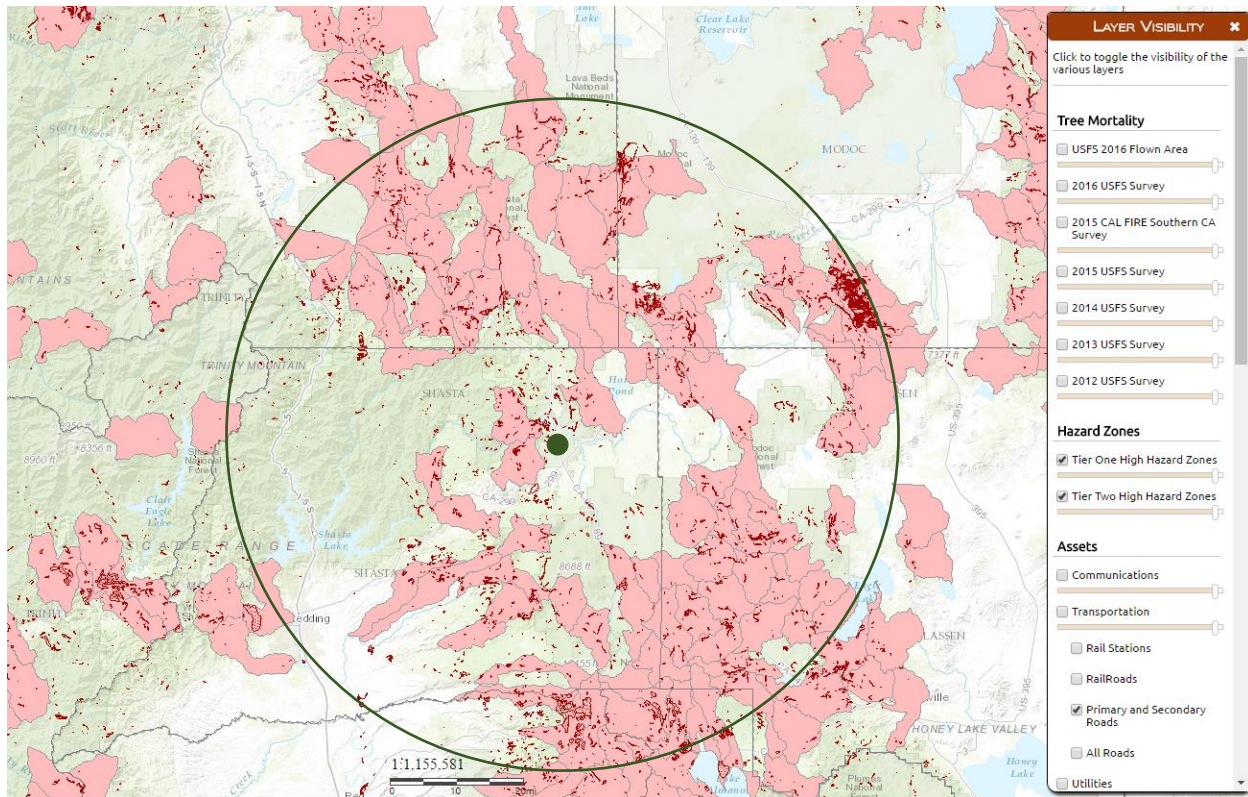
Burney-Hat Creek Bioenergy lies within one of California’s most sensitive forest landscapes that is surrounded by Tier 1 and Tier 2 HHZs and is nationally recognized as a priority treatment area under the 2014 Farm Bill and the Healthy Forest Restoration Act (2014). Burney-Hat Creek Bioenergy will support the additional management of over 35,000 acres of public and private forestlands throughout this region.



500 kW commercial demonstration plant at West Biofuels running forest-sourced feedstock as part an Energy Commission funded R&D project (EPC-14-024)

A. Project Description

Burney-Hat Creek Bioenergy will utilize approximately 22,000 bone-dry tons of forest-sourced biomass residue annually. All biomass utilized by the project will meet the requirements for feedstock eligible under Category 3 of the BioMAT program and based on the California Department of Forestry and Fire Protection's (CAL FIRE) current evaluation of Tier 1 and Tier 2 HHZs, the Project Team anticipates that the majority of feedstock utilized by the facility will come from Tier 1 and Tier 2 HHZs.¹



High Hazard Zone Map with Site Location and 50-Mile Radius

Burney-Hat Creek Bioenergy lies within the Burney Basin Collaborative Forest Landscape Restoration Program (CFLRP) area. This CFLRP, one of three in California, consists of approximately 350,000 acres of land within the Hat Creek and Burney sub-watersheds and includes the town of Burney. This area is also a sub-watershed of the Pit River, an area designated as a priority treatment area under the 2014 Farm Bill and Healthy Forest Restoration Act (2014). This designation was the result of collaboration between CAL FIRE and the US Forest Service that identified areas in California that meets the Section 602 criteria which considered other social, political, practical, and infrastructure aspects in the region.

A current example of how important this new facility is to the region is the Burney Gardens Meadow Restoration Project (Burney Gardens Project)—a novel 2,530 acre forest and meadow restoration project on Pacific Gas & Electric (PG&E) lands developed through the CFLRP that was permitted in January of 2012. The Burney Gardens Project proposed many treatments, one of which would generate approximately 49,000 DBT of biomass residue that meets Category 3

¹ CAL FIRE has indicated that it will regularly update the HHZ maps, so the Project Team cannot definitely commit that all feedstock will be from these zones over the life of the project.

definition of byproduct from sustainable forest management. However, even though the project was only 10 miles from the nearest utility-scale biomass power plant that accepts outside deliveries—Burney Forest Power—the project has remained idled for four years because of the lack of biomass capacity in the area. This project still awaits additional biomass demand before it can be implemented and the Burney-Hat Creek Bioenergy facility will provide that much-needed demand.

Goals and Objectives

The goals of this project are consistent with EPIC funding priorities and include:

- Goal 1: Develop a community-scale, 3MW forest biomass project that directly addresses the Governor's 10-30-2015 Proclamation of a State of Emergency to protect communities against unprecedented tree die-off.
- Goal 2: Demonstrate environmentally and economically sustainable woody biomass-to-electricity systems.
- Goal 3: Install and operate at commercial scale a biomass gasification system that has successfully demonstrated at the pilot-scale utilization of forest biomass residue.

To track the project goals and validate success, the Project Team has identified a series of quantifiable and measureable objectives:

- Objective 1: Execute a BioMAT power purchase agreement (PPA) in Category 3 at a financially-viable price.²
- Objective 2: Secure long-term feedstock contracts with project partners and local forestland managers.
- Objective 3: Install and commission a biomass gasification system with rated capacity of 2.88 MW (consistent with the completed System Impact Study). Specific targets include:
 - Feedstock consumption rate of 22,000 BDT per year
 - Power generation at full rated capacity: 2.88 MW
 - Capacity factor: ≥ 75% (~6,500 hours per year)

Development Stage

Burney-Hat Creek Bioenergy Site

The Project Team has conducted significant pre-development work to prepare the project site. HC Construction—a project partner—will be the site host and operator providing land on the company's headquarters for the development of the project. WM Beaty & Associates and Del Logging—each project partners—have committed to providing Category 3-eligible feedstock to the facility and particularly that much of their upcoming work will occur in Tier 1 and Tier 2 HHZs within an economic haul distance from the site.

Most importantly, the Project Team has completed the CEQA review for the project which was approved by the Shasta County Board of Supervisors on August 18th as an Addendum to the site's EIR. The site has also completed a System Impact Study with PG&E and has thus met all of the requirements to participate in the BioMAT program. The Project Team has also received

² The Project Team does not believe it can share the required price that it seeks as part of the abstract since the abstract will become public information. Disclosure of the required price would be anti-competitive and could be considered price collusion for the purposes of the BioMAT auction. The Project Team will share detailed economic information confidentially with the Energy Commission if awarded funds, but the GFO instruction explicitly restrict an applicant from providing confidential information in any part of the application.

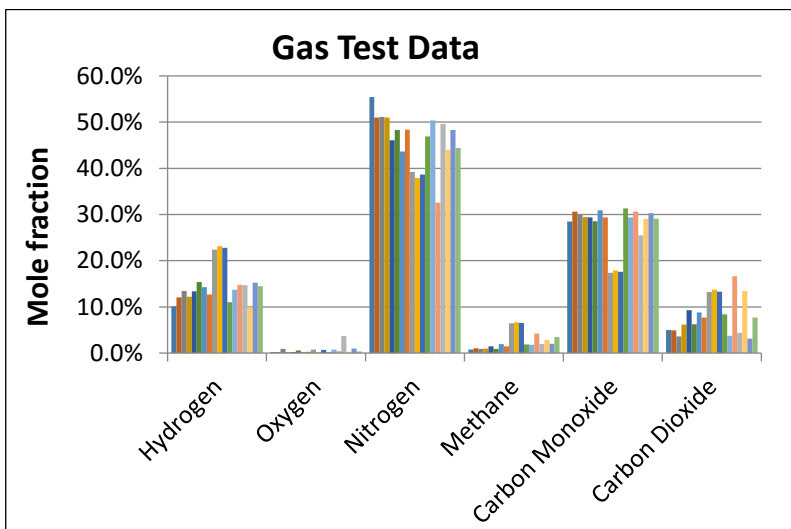
a US Forest Service grant—the Wood Innovations Grant—to complete all remaining pre-development work, specifically civil, mechanical, structural, and electrical engineering along with the Authority to Construct air permit from Shasta County Air Quality Management District. This funded project commenced in July 2016 and is scheduled for completion by December 2017.

West Biofuels CircleDraft Gasification Technology

The Grant Funding Opportunity (GFO) defines Technology Demonstration and Deployment (TD&D) as projects which involve the installation and operation of pre-commercial (or not widely used in California) technologies or strategies at a scale sufficiently large and in conditions sufficiently reflective of anticipated actual operating environments to enable appraisal of operational and performance characteristics and of financial risk. The technologies, processes, and strategies must have been successfully demonstrated at pilot scale or shown to be technically feasible at commercial scale.

Burney-Hat Creek Bioenergy fits precisely into this definition. The proposed technology, the West Biofuels CircleDraft gasification system is a pre-commercial technology with one pilot-scale demonstration facility at the company's headquarters in Woodland, CA. The West Biofuels technology is based on the CircleDraft technology developed by INSER, an Italian company with two commercial deployments in Europe. In 2014, West Biofuels brought the technology to the U.S. and began to "Americanize" the design by converting the equipment engineering to meet U.S. material standards, North American electrical standards, and California fire code standards and air emission standards. The pilot plant in Woodland was designed, fabricated, assembled, and installed in California. During commissioning in 2015, West Biofuels has made design modifications to the CircleDraft gasifier to adapt the system to address feedstock material common in California, particularly feedstock processed in a horizontal or tub grinder. Beginning in May 2015, West Biofuels commenced an R&D project funded by the Energy Commission "*Modular Biomass Power Systems to Facilitate Forest Fuel Reduction Treatments*" (Contract No. EPC-14-024) to evaluate the technical and economic feasibility of the CircleDraft system specifically using forest sourced materials. The R&D project, which is on track and scheduled to be completed in September 2017 has yielded significant positive results, most recently an eight-day test run with forest-sourced feedstocks that confirmed syngas production at target design levels.

Gas Composition	Design Range Low - High	
Hydrogen	10	20
Oxygen	0	1
Nitrogen	40	55
Methane	1	3
Carbon Monoxide	20	30
Carbon Dioxide	5	15



The Burney-Hat Creek Bioenergy project will be the first installation of the proposed technology at commercial-scale in the U.S. which is a scale sufficiently large and in conditions that are exactly reflective of actual operating environments across the forested landscape, particularly in Tier 1 and Tier 2 HHZs. The Burney-Hat Creek Bioenergy project will enable the appraisal of operational and performance characteristics and of financial risk.

Technological and Scientific Knowledge Advancement and Innovation

The proposed project will bring this innovative and transformative technology from Technology Readiness Level (TRL) 7 defined as full-scale demonstration of an actual system in a relevant environment to TRL 9 defined as actual system operations over the full range of expected operating conditions. The TRL 7 work is ongoing in Woodland, CA and the Burney-Hat Creek Bioenergy facility will represent the first full-scale integrated operations in the forested setting. This facility will validate technical performance, project finances, and the sustainable economic business model. When successful, this California designed, manufactured, assembled, and installed system will be broadly available for commercial operations.

Generating Renewable Electricity

Burney-Hat Creek Bioenergy will primarily make renewable electricity with byproducts of heat and biochar. The proposed facility has a rated export capacity of 2.88 MW after station load and will target a minimum of 6,500 hours per year (75% capacity factor) after startup. The Project Team will seek a 20-year fixed price contract through the BioMAT program under Category 3 using forest-sourced feedstock from sustainable forest management practices. Over the life of the facility, Burney-Hat Creek Bioenergy is expected to produce more than 355,000 MWh of renewable electricity.

Measurement and Verification (M&V) Plan

The Project Team is highly qualified to perform the proposed project. UC San Diego, which has worked closely with West Biofuels throughout the development of CircleDraft gasification systems, will provide third-party measurement and verification of performance of the installed system during commissioning.

B. Project Permitting

Burney-Hat Creek Bioenergy has completed the CEQA review with the Shasta County Board of Supervisors approving the Addendum to the site's EIR on August 18, 2016 (State Clearinghouse number 2000062079). The Notice of Determination filing is in process.

As part of the US Forest Service funded pre-development work, the Project Team will secure an Authority to Construct. The Project Team expects the permit to be based on Best Available Control Technology (BACT) and the testing conducted through EPC-14-024 using forest-sourced fuels at the pilot plant in Woodland, CA.

Additional information is included as part of Attachment 8.

C. Technical and Implementation Barriers

There are substantial technical and implementation barriers associated with the development of community-scale forest biomass energy projects in California.

Technical Barriers

In the 1980's and 1990's, the majority of today's California biomass energy infrastructure was developed based on large-scale, centralized plants (10MW to 50MW) using a variety of direct

combustion boiler technologies (e.g. stoker, bubbling fluidized bed, circulating fluidized bed). These technologies, for the most part, have proven to be a robust and functioning part of California's renewable energy portfolio. However, today, the emphasis has shifted to community-scale distributed energy projects to reduce the pollution associated with long-haul transportation and to better serve local and regional needs. The proven direct combustion technologies do not generally cost-effectively scale down to community-scale solutions. Gasification, while not a new technology, can provide utility-scale efficiencies for community-scale projects through the use of internal combustion engines, which provide a high-efficiency, clean-burning option.

Gasification technology at the micro-scale (sub 150 kW) has proven successful in several application in the U.S. and worldwide. Micro-scale gasification have been able to take advantage of exemptions for small-scale engines that avoid standard air permits and limited tar production due to low feedstock consumption rates that has avoided traditional hazardous material handling regulations.

In Europe, gasification technology has advanced dramatically with utility-scale projects that can amortize large capital expenses for syngas cleaning systems across large production capacities.

In California, the biomass market sits in the middle of these two areas of growth. Community-scale distributed energy generation requires technologies that are sufficiently large that they cannot utilize exemptions to dodge environmental regulations. The West Biofuels CircleDraft system was designed to bridge the divide offering a syngas conditioning system that effectively cleans the produced gas to meet high-efficiency engine specifications (engines that meet California's strict air quality standards) while managing contaminants with a robust closed-loop recycling system that captures the non-gasifier fraction of the syngas stream and reinjects it back to the hottest portion of the gasifier for thermal tar cracking.

Implementation Barriers

The state of California is known worldwide for its leading environmental policies, which have, at times, created barriers to development across the state. CEQA, the state's cornerstone environmental safeguard, is designed to ensure that a wide variety of factors are evaluated before a project moves forward. This process can substantially delay, or completely stop, a project from moving forward. The Project Team has completed its CEQA review process, which represents an important achievement that has greatly accelerated project readiness.

This solicitation is well-timed to fit within the framework of the BioMAT program, an important policy objective recognizing the benefits of bioenergy infrastructure across the state. The Project Team has positioned the project to succeed in the BioMAT program by completing all of the project eligibility requirements, including the System Impact Study with PG&E.

The third most important hurdle in project development is the Authority to Construct. Novel technologies pose additional uncertainty due to a lack of data supporting the technical capabilities of the proposed system. West Biofuels has worked closely with regional air districts across the state to demonstrate technical performance across a variety of feedstocks and possesses the data needed to ensure compliance with the state's most strict air emissions requirements.

Lastly, feedstock availability can be one of the most challenging issues for biomass projects, particularly in the forested area. Fall River RCD, along with project partners WM Beaty &

Associates and Del Logging, have a deep history managing forested lands across California. This project team represents some of the region's most accomplished experts in the field with more than sufficient feedstock combined to fuel the facility for the life of the project.

D. Consistency with Energy Commission Funding

Burney-Hat Creek Bioenergy (1) is not commercially available in California; (2) is unique one of the state's first BioMAT projects in Category 3; (3) is not duplicative of past projects funded by the Energy Commission, utilities, or any other entities but leverages and advances existing projects; and (4) is needed to promote adoption of innovative gasification technologies in the market by improving technical certainty and investment confidence.

Pre-Commercial

There are a very limited number of successfully installed and operating gasification facilities across the state and none in the forested setting. The West Biofuels CircleDraft technology is installed and operating in Woodland, CA and is undergoing important R&D on forest-sourced material. Burney-Hat Creek Bioenergy will be the first commercial installation of this promising technology.

Uniqueness

Burney-Hat Creek Bioenergy is unique. There are no operating gasification facilities in the forested area of California. R&D funding to test forest-sourced material has validated the technical capabilities of the facility and represents an important proof-of-concept milestone.

Relationship to Past Energy Commission Funded Projects

Burney-Hat Creek Bioenergy is the natural next step following West Biofuel's existing R&D program evaluating modular forest-sourced bioenergy solutions. The proposed project is not duplicative of any publicly-funded project that the Project Team is aware of. The Watershed Center's funded TD&D project awarded last year for a biomass gasification system in North Fork, CA which is using a different gasifier with no proven experience in California or with forest-sourced feedstock. None of the Project Team members are affiliated with that project.

Market Adoption

With over 50 MW of capacity in the BioMAT program, 66 million dead and dying trees, and a Tier 1 and Tier 2 HHZ that covers millions of acres of forested landscape across the state, California needs TD&D projects to validate technology performance and business model viability for community-scale renewable production of electricity. Without TD&D projects, these projects are seen as high risk from the investment community, which directly translates to higher capital costs for equity and debt along with contingency budgets. Successful TD&D projects will lower project costs by instilling investor confidence, validating business models, and reducing capital expenditures through production economies of scale.

E. Market Support

Market support of this technology relies on TD&D projects to validate technical performance and financial risk. A successful project requires a diverse array of project partners with the expertise to lower project capital costs, guarantee feedstock, and secure offtake agreements. The Project Team has all off these qualities including a construction company, a California-based technology manufacturer, feedstock suppliers, and a market-based long-term electricity offtake option through the BioMAT program.

Bioenergy projects in the forest sector are important because they (1) create local clean energy jobs, (2) transform a waste residue into an economic resource, (3) produce renewable electricity, (4) improve local and regional air quality, (5) reduce GHGs, (6) protect and maintain watershed health, (7) reduce the chance of catastrophic wildfire, and (8) address the state's largest source of short lived climate pollutants—black carbon.

F. Project Team Qualifications

Fall River RCD has gathered a powerful project team to maximize the chance of success for the program. Abbreviated organizational qualifications and key personnel are provided here and will be expanded upon in the full proposal.

Todd Sloat – Fall River RCD: Todd Sloat is an independent consultant and contractor who specializes in biological surveys, habitat and geomorphic assessments, compliance and permitting, multi-stakeholder collaboration, and design-build stream restoration projects. Mr. Sloat currently conducts most of his work within northeastern California where he develops restoration projects on private and public lands working through the Fall River and Pit RCDs.

Perry Thompson – Hat Creek Construction & Materials: Perry Thompson is the vice president of Hat Creek Construction & Materials, a local and regional leader in construction including road building, commercial building, metal building construction, structural concrete, and landscaping since 1972. Mr. Thompson has years of experience with industrial facilities. Mr. Thompson is the lead developer for Burney-Hat Creek Bioenergy and will lead effort to provide cost estimation for the construction of the facility and for the other facilities in the Cluster.

Dr. Matthew Summers – West Biofuels: Matthew Summers, P.E. is the Chief Operating Officer of West Biofuels and is a certified mechanical engineer. With West Biofuels, Dr. Summers has designed and constructed three gasification facilities utilizing wood wastes in California.

Russ Hawkins – Del Logging: Russ Hawkins is the owner of Del Logging, one of the two largest local logging companies in the Burney region and a major supplier to all of the regional biomass facilities.

Scott Carnegie – WM Beaty & Associates: Scott Carnegie is a project manager for WM Beaty & Associates which manages approximately 100,000 acres of private forestlands with an economic haul distance of Burney-Hat Creek Bioenergy.

Dr. Reinhard Seiser – UC San Diego: Reinhard Seiser is an assistant research professor at UC San Diego and has been deeply involved in cutting-edge biomass gasification research including syngas cleaning, internal combustion engine performance, mixed alcohol synthesis, and syngas methanation. Dr. Seiser has deep experience testing operating parameters on West Biofuels gasification technologies.

G. IOU Territory

The proposed project is located within PG&E territory and has completed the System Impact Study validating the ability to interconnect to the PG&E distribution system with 24 months.