STATE OF CALIFORNIA
EPIC TRIENNIAL INVESTMENT PLAN 2015-17
Proposed Energy Research Initiative
Questionnaire

CALIFORNIA ENERGY COMMISSION

Title of Proposed Initiative (Short and concise): ***Feedstock opportunities and flexible biorefineries for producing fuels, heat, and power in California***

Investment Areas (Check one or more) – *For definitions, see First Triennial Investment Plan, page 12*:

☒ Applied Research and Development
☒ Technology Demonstration and Deployment
☐ Market Facilitation

Electricity System Value Chain (**Check only one**): *See CPUC Decision 12-05-037, Ordering Paragraph 12.a. http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF.*

☐ Grid operations/market design
☒ Generation
☐ Transmission
☐ Distribution
☐ Demand-side management

Issues and Barriers:

Bioenergy has the potential to contribute substantially to California's greenhouse gas (GHG) emissions reduction goals, both in the transportation and power generation sectors. However, California is likely to rely on a wide variety of feedstocks ranging from municipal solid waste to crop residues, and even grasses capable of growing on saline land. These feedstocks will then be converted to a suite of products including ethanol, drop-in fuels, electricity, biogas, and chemicals. However, determining the optimal mix of feedstocks and mechanisms for collecting, pretreating, and converting these feedstocks to final products requires 1) detailed knowledge of feedstock availability or cultivation opportunities, 2) The impact of bioenergy production on soil carbon fluxes, other GHG emissions, and water availability, and 3) existing energy infrastructure and geospatially-disaggregated energy demand.

Initiative Description and Purpose:

Although existing biorefinery models and logistics studies focus on single-feedstock biorefineries that produce one or two products, future biorefineries in California are likely to accept a variety of feedstocks that change year-by-year for conversion to liquid fuels, power, heat, and chemicals. By assessing a series of bioenergy production scenarios in California, including feedstock cultivation/collection, transportation and storage, pretreatment, conversion, and use, we will identify key opportunities for using bioenergy to reduce in-state GHG emissions. This study will also help to identify gaps in pretreatment and conversion technology necessary to facilitate local sustainable bioenergy production. Establishing a feedstock-flexible bioenergy industry in California, will allow the state to be more resilient in the face of drought and minimize the impact on land use.

Stakeholders:

- Utilities who must plan for integration of bioenergy into their generation mix
- State, regional, and local governments who permit bioenergy facilities and incentivize bioenergy production

- State policy makers tasked with helping to achieve California's air quality standards and GHG emission targets

Background and the State-of-the-Art:

- Biomass plays a substantial role in California's GHG emissions reduction plans, particularly for near-term reductions that cannot be achieved by sectors that require new infrastructure or vehicles. The goal of this research is to facilitate the use of existing crop residues and low-impact dedicated biomass crops to help decarbonize the transportation sector and electrical grid.
- Biomass can be burned as a solid fuel or gasified and combusted to produce heat and power. A typical cellulosic biorefinery also produces electricity by burning lignin alongside biogas from wastewater treatment, yielding approximately 8 MJ of net electricity output for every 100 MJ ethanol produced. A single commercial scale biorefinery can produce approximately 13 MW of power for the grid. A large bioenergy industry in California can be a major contributor to power generation.
- This research will identify the unique challenges associated with bioenergy production in California, specifically those related to creating an industry that can make use of a variety of feedstocks and produce a suite of products including heat, power, ethanol, drop-in fuels, and chemicals.
- The results of this research will provide guidance for building bioenergy facilities and infrastructure that is adaptable to shifting feedstock supplies and responsive to shifting energy demand. The results will reveal tradeoffs between large centralized facilities, small decentralized facilities, and hybrid approaches that involve intermediate pretreatment locations prior to diversion to centralized conversion plants.

Justification:

Describe how this technology or strategy will provide California IOU electric ratepayer benefits and provide any estimates of quantified annual savings/benefits in California, including:

- This research applies to all California energy production and end-use sectors.
- This research will provide specific and geographically resolved scenarios for bioenergy production for heat, power, and fuels
- The research will identify key opportunities for early investments in feedstock collection/cultivation and pretreatment/conversion to achieve GHG emissions reduction goals
- The work will evaluate the land use, energy, and GHG impacts of bioenergy production in California and help determine the most sustainable paths to achieving in-state production goals

Ratepayer Benefits (Check one or more)**:**

☒ Promote greater reliability

☒ Potential energy and cost savings

☐ Increased safety

☒ Societal benefits

☒ Environmental benefits – specify—protection the California population from extreme climate and assuring reliability of energy supply during extreme climate events

☒ GHG emissions mitigation/adaptation in the electricity sector at the lowest possible cost

☒ Low emission vehicles/transportation

☐ Waste reduction

☐ Economic development

Describe specific benefits (qualitative and quantitative) of the proposed initiative

This project will lead to an improved understanding of bioenergy production potential in California and identification of the key technical and logistical challenges (and solutions) for utilizing diverse crop residues, municipal solid waste, and dedicated biomass crops. The project will also reveal tradeoffs for bioenergy production strategies involving fuels, heat, power, and chemicals based on cost, GHG emissions, and water use.

Public Utilities Code Sections 740.1 and 8360:

Please describe how this technology or strategy addresses the principles articulated in California Public Utilities Code Sections 740.1 and 8360. The California Public Utilities Code is available online at www.leginfo.ca.gov/cgi-bin/calawquery?codesection=puc.