

DOCKETED

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EPIC 4 - Carbon removal through waste biomass conversion focus

Please find attached research concept regarding carbon removal through waste biomass conversion for consideration under Electric Program Investment Charge 2021-2025 (Epic 4) from the Lawrence Livermore National Laboratory.

Additional submitted attachment is included below.



**ELECTRIC PROGRAM INVESTMENT CHARGE 2021-2025 (EPIC 4)
RESEARCH CONCEPT PROPOSAL FORM**

The CEC is currently soliciting research concept ideas and other stakeholder input for the EPIC 4 Investment Plan. For those who would like to submit an idea for consideration, we ask that you complete this form and submit it to the CEC by 5:00 p.m. on **July 2, 2021**.

To submit the form, please visit the e-commenting [link](https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=20-EPIC-01), <https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=20-EPIC-01>, enter your contact information, and then use the “choose file” button at the bottom of the page to upload and submit the completed form. Thank you for your input.

1. Please provide the name, email, and phone number of the best person to contact should the CEC have additional questions regarding the research concept:

George Peridas, peridas1@llnl.gov, 925-422-3763

2. Please provide the name of the contact person’s organization or affiliation:

Lawrence Livermore National Laboratory

3. Please provide a brief description of the proposed concept you would like the CEC to consider as part of the EPIC 4 Investment Plan. What is the purpose of the concept, and what would it seek to do?

FOCUS: Waste Biomass Use for Carbon Removal. Non-combustion conversion (e.g. pyrolysis, gasification) or anaerobic digestion of waste from forest fuel reduction efforts, agriculture, and households, to hydrogen and other useful carbon-negative fuels and products.

Removing carbon from the air is a necessary strategy in almost every scenario for California to achieve its goal of becoming carbon neutral by 2045. Carbon removal is also a critical need for businesses wanting to achieve carbon neutrality, usually because they have limited ability to reduce emissions in their supply chains or end products. Making reliable, robust and permanent carbon removal readily available in California will do more than help meet neutrality goals: it will also enable wildfire prevention and mitigation efforts, improve air quality, and spur economic activity where the state needs it most in the Central Valley and rural counties.

Demonstrating a variety of carbon removal approaches in the short term will build confidence and refine the state's ability to appropriately regulate and quantify the carbon benefit of these technologies. Tangible projects allow transparent and evidence-based evaluation of the merits of these approaches. Hosting demonstration projects in California can also provide access to sizeable federal research funds being made available by the Biden administration.

4. In accordance with Senate Bill 96, please describe how the proposed concept will **"lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory energy goals."** For example, what technical and/or market barriers or customer pain points would the proposed concept address that would lead to increased adoption of clean energy technologies? Where possible, please provide specific cost and performance targets that need to be met for increased industry and consumer acceptance. For scientific analysis and tools, what data and information gaps would the proposed concept help fill, what specific stakeholders will use the results, and for what purpose(s)?

Utilization of waste biomass enables large-scale carbon removal at low cost. In addition, it displaces fossil fuel use, improves air quality, support efforts to reduce wildfire risk and severity, and provide economic stimulus to poor and rural areas of the state.

The barriers that need to be overcome relate to feedstock aggregation, supply contracting, transportation, distribution and sorting of waste biomass; process scale up; and integration of CO₂ removal and storage. Collecting and sorting biomass of reliable and uniform consistency from diverse sources is not yet an established practice. Some of the major sources are managed by entities with whom contracting is difficult, e.g. Federal agencies. To get the feedstock from its origin to the right processing location will entail transportation logistics that are both feasible and do not increase the state's carbon or non-CO₂ pollution footprint. These barriers need to be studied and addressed.

5. Please describe the anticipated outcomes if this research concept is successful, either fully or partially. For example, to what extent would the research reduce technology costs and/or increase performance to improve the overall value proposition of the technology? What is the potential of the technology at scale?

Utilization of waste biomass enables large-scale carbon removal at low cost. In addition, it displaces fossil fuel use, improves air quality, support efforts to reduce wildfire risk and severity, and provide economic stimulus to poor and rural areas of the state. These practices and technologies are available today, but are in need of being kick-started,

taken up more broadly and standardized. Every demonstration at this stage would add considerable learning value. The potential for carbon removal through waste biomass conversion is on the order of 10s of millions of carbon dioxide annually.

6. Describe what quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed research concept.

Metrics would include size and number demonstration plants deployed/assisted, number of technologies involved, types of biomass processed, replicability of concept.

7. Please provide references to any information provided in the form that support the research concept's merits. This can include references to cost targets, technical potential, market barriers, etc.

S. Baker et al., "Getting to Neutral: Options for Negative Carbon Emissions in California." Lawrence Livermore National Laboratory, August 2020.
https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf