## Request for Proposals

## On Marine Macroalgae Cultivation and Utilization

## July 2020

A 10-month contract up to $150,000 USD will be awarded to build a sensitivity model that estimates net CO2 removal and emission reductions associated with marine macroalgae cultivation and utilization.

The project requires a deep understanding of seaweed biology, physical and biological oceanography, industry trends, supply chains, applied economics, marine infrastructure, diffusion of innovation, and life cycle analysis, to name just a few. We therefore strongly encourage collaborations between expert groups.

## CONTEXT

The utilization of farmed macroalgae is gaining popularity as a potential strategy to reduce atmospheric CO2 levels. On the one hand, seaweed could be used to sequester carbon directly by sinking biomass to the deep ocean where organic carbon remains isolated from the atmosphere for centuries or even millennia, or by harvesting biomass and integrating it into long-lived bioproducts (e.g., building materials). On the other hand, seaweed biomass can be used as an alternative raw material for a suite of products (e.g., bioplastics, biofuels, cattle feed), for which markets currently exist or are slowly emerging, and so mitigate emissions from existing product pathways. The viability of seaweed as a nature-based carbon dioxide removal (CDR) strategy will depend on a long list of variables, including production potential, profitability and net carbon removal potential.

Recent R&D investments (e.g. ARPA-E’s MARINER program) and academic efforts have vastly improved our technical and technoeconomic understanding of yield potential and profitability, as well as seaweed’s potential role in sequestering atmospheric CO2 or mitigating emissions. However, it remains difficult for policy makers, entrepreneurs, investors, philanthropic donors, NGOs, and even experts in the field to assess the merits of this technology in an evolving market, evaluate trade-offs, and explore the levers that determine the profitability, ecological impact, and CO2 footprint of farmed seaweed.

## SCOPE OF WORK

The objective of the sensitivity analysis is threefold.

First, to identify key variables that will drive the economically viable and environmentally safe potential of marine macroalgae to remove or mitigate >1Gt of CO2 per year. Since some model outputs are dependent on location (geographic region, onshore vs. offshore, water depth, temperature, nutrient availability, sunlight intensity, wave/wind energy), and time (diffusion of innovation, market demand, carbon prices), a spatially and temporally explicit model is likely going to be the best approach to realistically capture constraining factors and project uptake of various cultivation techniques, but we’re open to other approaches.

Second, to characterize the quantitative relationship between these variables in a model. Importantly, the final model will be translated into a web-based simulation similar to the [NYT buy or rent simulator](https://www.nytimes.com/interactive/2014/upshot/buy-rent-calculator.html). An output dataset or model would therefore have to be compatible with JSON or similar.[[1]](#footnote-1)

Third, to parameterize the quantitative relationship with best available data from literature and/or expert interviews. In the web-based simulation, users should be able to explore how model outputs change as a function of variable parameterization.[[2]](#footnote-2) The seed value should be the “most trusted” value or a median value from literature review. A thorough literature review and complementary expert interviews will be required to parameterize the model.

The goal of the model should not be to calculate the exact amount of CO2 that can be removed or mitigated as a result of macroalgae utilization, nor is it intended to serve as a pitch for specific cultivation methods. Rather, the goal of the model is to allow users to i) approximate the biological, technical and economic potential of seaweed as a CDR approach, and ii) explore the driving factors that determine the CDR potential (space? nutrients? market demand? carbon prices? farm design? photosynthetic rate?). As such, the focus of this analysis should be the realistic characterization of the quantitative relationship between biological, oceanographic, logistic, infrastructure, innovation, markets etc. variables.

## DELIVERABLES

1. JSON compatible model or dataset, ready for translation into web-based simulation (the web-based tool/app will be developed by a web design firm, with some input from analytical team).
2. Concise technical summary of the model, including detailed methodological write-up, presentation of the ranges of parameters for key variables as presented in the literature, and the rationale for selecting seed parameters.

## Application process

Application is a two-step process: completion of a short preproposal, followed by an invitation to submit a full proposal which will be extended to 3-4 finalists.

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| 31 July 2020, 17:00 PST | Preproposal submission deadline. Please email the preproposal to [SeaweedRFP@climateworks.org](mailto:SeaweedRFP@climateworks.org), using the submission form on page 4-5. |
| 4 August 2020, 17:00 PST | Invitation to submit full proposal |
| 21 August 2020, 17:00 PST | Submission deadline of full proposal |
| 28 August 2020 | Award decision made |

## ABOUT THE FUNDERS

The ClimateWorks Foundation created its Carbon Dioxide Removal (CDR) Program in 2018 to help catalyze and promote the carbon dioxide removal field. The Initiative focuses on CDR approaches in both the natural (forestry and agriculture) and technical (energy and industry) space, as well as approaches that combine the two, such as engineered wood. The new Ocean CDR Initiative supports the scientific rigor that is required to vet each promising approach; builds a community of actors to accelerate the solution-oriented discourse across scientists, entrepreneurs and policy-makers; and steers the attention of decision makers to the ocean as a potential contributor to carbon dioxide removal.

## Marine Macroalgae Cultivation and Utilization

## Research Proposal Submission Form

### Instructions

Please submit a brief proposal via email to [SeaweedRFP@climateworks.org](mailto:SeaweedRFP@climateworks.org).

The submission deadline is 5:00pm PST on July 31, 2020.

### Contact Details

Institutional Affiliation(s)

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Name(s) of Researcher(s)

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**Project Lead Contact Information**

First and Last Name:

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E-mail:

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Telephone number:

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### SCOPE OF WORK

Please provide a high-level overview of planned approaches/methodologies and a brief description of the expert team, highlighting the team’s competitive advantage to deliver on the desired outputs. **The content should be no more than 2 pages, please attach CVs of key team members.**

1. JSON is a text-based data format following JavaScript object syntax <https://www.json.org/json-en.html> [↑](#footnote-ref-1)
2. Model outputs should, at a minimum, include: Net CO2 removed and/or mitigated, tons of dry weight produced, area of ocean used. If artificial fertilizer is considered as an input, include indicator for environmental risk. [↑](#footnote-ref-2)