geoconvention
Virtual Event
September 21-23
2020
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# Solid Carbon: A Climate Mitigation Partnership Advancing Stable Negative Emissions

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## Solid Carbon Summary

Lowering atmospheric CO2 is essential to balance CO2 emissions and represents one of today's greatest challenges. Renewables and energy efficiency improvements are not enough. We need to permanently remove CO2. Geologic storage provides a vital option to mitigate climate change and a recent and successful land-based demonstration of CO2 rapidly and permanently converting to stable rock was carried out in Iceland where CO2 was injected into basalt - volcanic rock, which occurs mainly in the ocean.

This newly funded project, Solid Carbon, builds on this success by combining existing technologies that will pull CO2 from air and inject it into basalt in oceanic crust to transform into a stable carbonate. The proposed demonstration location has capacity for 100x annual US emissions. Replicating this technology globally by mid-century sets a path towards pre-1960's CO2 levels, thus providing a vital large-scale solution that could allow today's children, and future generations, to maintain a stable environment.

## Solid Carbon Approach

Solid Carbon is a project that is preparing a detailed systems integration plan for an offshore negative emissions technology to permanently remove CO2 from the atmosphere and turn it into carbonate safely and securely in the deep oceanic crust. The project involves co-locating an accessible and monitored storage site with direct CO2 capture, using offshore renewable energy [1]. Carbon dioxide mineralization has been demonstrated to permanently sequester CO2 in basalts [2], including a demonstration of direct CO2 air capture [3]. The process is scalable given over 90% of the Earth's basaltic rock occurs in the global oceanic crust [4] and is remote from human activity and inconvenience [5].

Terrestrial technologies exist for CO2 air capture [6]; they will be adapted and optimized to perform offshore. CO2 extraction from seawater is also a feasible technology to reduce atmospheric CO2 [7]. Key to demonstrating the impact of this project is monitoring using ONC's world-leading sensor systems, providing real-time information over the Internet, including live video feed of the seafloor.

To power this negative emissions technology for global scalability in deep water, a design will be delivered that integrates the advanced technology developed by the oil and gas industry for Shell's Stones 2900m production system [8] with wind, wave [9], and solar [10] energy [11].

## Description of the Funded Project

The project, which started in October 2019, has three main activities over the next four years:

(1) assessment of options for an offshore CO2 direct capture facility;
(2) a carbon mineralization demonstration project plan to be conducted offshore Canada's west coast; and
(3) advancement of social, regulatory, and investor acceptance.

These three activities provide key elements for delivering on the overall goal of a negative emissions technology that has good potential to scale globally.

Activity 1 also includes the assessment of a range of technological systems for sequestering CO2 into basalt. In addition to the demonstration project plan, Activity 2 includes the development of a tool for assessing basalt reservoir capacity (rates and volumes) for sequestering CO2. This is an important design constraint on a full system that drives the overall costs per Mt of CO2. The Activity 3 acceptance research spans important socio-economic areas essential for a new technology to advance.

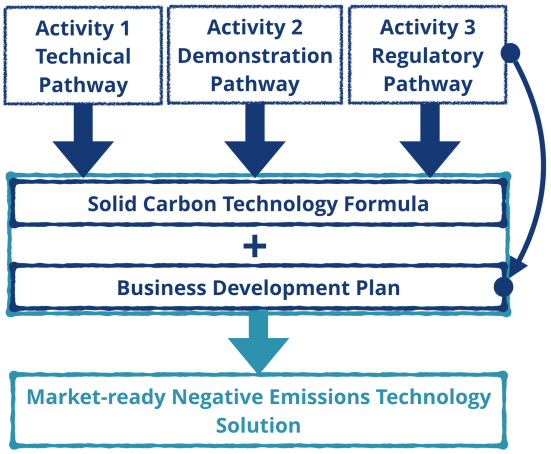


*Figure 1. Schematic diagram showing the key pathways that sets Solid Carbon on a track toward a negative emissions technology solution.*

## Acknowledgements

The Pacific Institute for Climate Solutions funds the Solid Carbon project and is an active partner along with Ocean Networks Canada, the Universities of Calgary, British Columbia, and Victoria, Columbia University, Carbon Engineering, and Carbon180.

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