Summary for Public Release

Opus 12 Inc.

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Project Title: PEM CO_2 Electrolyzer Scaleup to enable MW-Scale Electrochemical Modules

Opus 12 has developed an efficient polymer-electrolyte membrane (PEM) CO_2 electrolyzer that couples directly to intermittent sources of renewable electricity and converts carbon dioxide emissions and water into high value chemical intermediates. This project will focus on producing carbon monoxide (CO), which can be used directly or in combination with hydrogen (as syngas) in commercial upgrading technologies such as biological conversion to produce drop-in bioproducts and biofuels. An integrated system of Opus 12's CO_2 to CO technology with biological conversion is a scalable solution for large scale bioproduct and biofuel production.

Opus 12 has achieved state-of-the-art performance and scale for CO_2 electrolysis to CO. The main contributor to Opus 12's success is our use of a PEM reactor architecture, which has been used commercially for water electrolysis for decades. In essence, we are converting a commercial PEM water electrolyzer into a PEM CO_2 electrolyzer. Opus 12's core technology is the membrane electrode assembly (MEA), a drop-in component to a PEM reactor. Opus 12 has partnered with a world-leading electrolyzer manufacturer to integrate our novel MEA into their commercial product line, enabling us to leverage their manufacturing capabilities and expertise, and accelerate our time to market.

This project will lay the groundwork for industrial CO_2-derived biofuel and bioproduct production at scale. PEM electrolyzers are modular, so the system can be scaled to match the size of a target CO_2 emissions stream. A biorefinery integrated with a CO_2 electrolyzer of 50-100 MW would convert 150,000-300,000 tons of CO_2 per year into CO (a good match for the CO_2 volumes from fermentation and biomass gasification; anaerobic digesters produce smaller volumes of CO_2), and corresponds to the size of many solar and wind installations. In combination with anaerobic gas fermentation, CO_2 electrolysis could enable 100% carbon utilization from conventional fermentation. CO_2 released during fermentation could be converted into CO, which would then be introduced to an anaerobic bioreactor for upgrading to bio-derived chemicals and fuels.

Critical to the success of this effort is collaboration with national laboratories and academics researchers. Opus 12 will partner with Lawrence Berkeley National Laboratory, the National Renewable Energy Laboratory, University of Connecticut, and University of Toronto to get a deeper understanding of how the MEA catalyst layer structure and properties relate to performance. Through this project, their expertise in characterizing and understanding PEM fuel cell and water electrolyzers can be applied to CO_2 electrolysis. This understanding will reduce the cost and time needed to scale up MEAs in this project and in future development.