

## SBIR/STTR SUCCESS

# OPUS 12

For the industrial sector to embrace low-carbon business models, the nation needs innovative, cost-competitive carbon-removal technologies. With help from DOE SBIR as well as private investment and other government grants, OPUS 12, a Berkeley-based startup is playing a major role in this incredible challenge. If implemented on large scale, Opus 12 core invention holds the promise to address nearly 10% of global carbon emission by recycling industry carbon dioxide emission into valuable chemicals and fuels. In this way, while reducing the carbon footprint of the world's heaviest emitters, the company creates a new revenue stream from what is discarded today as a waste product.

## FACTS

### PHASE III SUCCESS

Five years after its start, Opus 12 has successfully leveraged DOE SBIR to raise nearly \$19M in VC and private sector investment.

### IMPACT

Opus 12 technology uses renewable electricity and water to recycle industry CO<sub>2</sub> into valuable chemicals. This process could theoretically address one third of global energy-related CO<sub>2</sub> emissions.

### DOE PROGRAM/OFFICE

Office of Energy Efficiency and Renewable Energy (EERE).

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Opus 12 core technology is a proprietary CO<sub>2</sub> Polymer Electrolyte Membrane (PEM) electrolyzer that uses electricity to convert water and CO<sub>2</sub> into valuable gases such as syngas, pure CO, ethylene, ethanol, or methane in one step. These hydrocarbons building blocks are identical to those normally derived from fossil fuels. They can be fed into existent downstream processes to yield jet fuel, plastics, and specialty chemicals. The technology bolts onto any source of CO<sub>2</sub> emission and produces oxygen as the main byproduct. In addition, Opus 12 process is designed to use electricity from renewable sources, offering an alternative way to store this intermittent energy.

Opus 12 was founded by three Stanford's graduate students in 2016. Two of them, Dr. Kendra Kuhl and Dr. Etosha Cave received their PhDs following world-recognized research in electrochemical conversion of carbon dioxide in the well-known Jaramillo Research Group. Co-founder Nicholas Flanders had successfully led a tech startup in New York City after working in cleantech at McKinsey & Company, contributing invaluable entrepreneurial experience to the team. In addition to combined technical and business experience, Opus 12's founders shared a strong passion for innovation and a bold vision for the future, which led them to enthusiastically pursue federal, state, and private resources to fund their R&D and promote their progress. For example, the team was selected for the first cohort of the prestigious Cyclotron Road program at Lawrence Berkeley National Laboratory, and was awarded SBIR grants from DOE, ARPA-E, NSF, and NASA.

Although Opus 12 is located in one of the biggest hubs for Venture Capital (VC) in the world, fundraising was hard, commented Dr. Cave, Chief Scientific Officer of Opus 12. "We thought we would be able to tap into venture capital funding like many other startups in the Bay Area. However, we soon learned that VCs tend to avoid backing R&D intensive companies. We had to look for incubators and government grants to obtain lab space, built the first prototype and begin de-risking our technology to the point that we could attract private investments", said Dr. Cave."

Following technical validation from Cyclotron Road and an SBIR grant, Opus 12 began receiving seed venture capital. Today, after nearly 5 years from its birth, the company has received a total of \$19M in VC and private sector investment and has moved from the 3 original employees to more than 40 employees and wants to double the number of employees over the next year.

According to Dr. Cave, continued SBIR support while the company was receiving initial VC rounds of investment was crucial to its survival. VC funds accelerate market entry while government grants allow R&D to proceed. "VCs welcome SBIR grants as long as the R&D stays focused on the product", says Dr. Cave.

When asked for suggestions to first-time DOE SBIR awardees, Dr. Cave acknowledged four important opportunities the DOE SBIR/STTR programs offered to her company.

The first one was a means to build a world-class team by working with several DOE National Laboratories to utilize their expertise and unique R&D facilities, which a startup cannot afford on its own.

The second opportunity was establishing collaborations with larger companies, either manufacturers or system integrators, which then led to formal joint agreements. Opus 12 worked as subcontractor on other companies' STTR grants and leveraged the need to acquire letters of support for its own SBIR applications as a way to establish a non-legally binding relationship with potential partners.

In addition, the SBIR awards gave Opus 12 an opportunity to build its tech roadmap, creating meaningful milestones to optimize performance and scale up prototypes. "The SBIR roadmaps helped us in attracting private investors and gave us a sense of where we were headed" said Dr. Cave.

Finally, because SBIR supports technologies at different maturity stages, Opus 12 was able to leverage multiple DOE SBIR grants to fund the R&D required to build systems at each scale. “We didn’t have to wait for revenues from our smaller systems before we could start working on a larger system”, explains Dr. Cave.

Opus 12 has been collaborating with utility companies Southern California Gas Co. (SoCalGas) and Pacific Gas and Electric Company (PG&E) to reshape the future of carbon capture and CO<sub>2</sub> repurposing. Recent work done within the partnership has demonstrated that Opus 12 technology can dramatically improve the conversion of carbon dioxide in raw biogas to pipeline-quality renewable natural gas, a strong step towards a net-zero carbon economy.

*Written by Claudia Cantoni, Commercialization Program Manager, DOE SBIR/STTR, May 2021.*