

## Technology Advisory

### Wyoming Integrated Test Center–Carbon (ITC-C) and NRG COSIA CARBON XPRIZE

## Update: XPRIZE Finalists' Innovative Approaches to Converting CO<sub>2</sub> Waste to Sellable Products

### What has changed?

#### XPRIZE Competition Finalists Announced

Ten (10) finalists have been selected by the NRG COSIA Carbon XPRIZE and each is taking home an equal share of a \$5 million milestone prize. This was revealed April 9 at the [Bloomberg New Energy Finance's Future of Energy Summit in New York City](#). Five of the finalists are focused on treating CO<sub>2</sub> from coal power plants, and five on treating CO<sub>2</sub> from natural-gas power plants.

Dr. Marcius Extavour, XPRIZE senior director of Energy and Resources and prize lead said "These teams are showing us amazing examples of carbon conversion and literally reimagining carbon. The diversity of technologies on display are an inspiring vision of a new carbon economy. We are trying to reduce CO<sub>2</sub> emissions by converting them into useful materials, and do so in an economically sustainable way."

#### Technologies for CO<sub>2</sub> from Coal Power Plants

The five finalists with technologies focused on converting CO<sub>2</sub> from coal plants will now proceed to the Wyoming Integrated Test Center-Carbon (ITC-C) at the Basin Electric Cooperative Dry Fork plant in Gillette, WY:

➤ **Breathe** (Bangalore, India)

Led by Dr. Sebastian Peter, this team is proposing a new strategy to design promising panelists and materials for the efficient and selective conversion of CO<sub>2</sub> into methanol. Using combined information obtained from experiments and first-principles calculations on alloys/intermetallic/bimetallics/core-shell materials based on low cost Cu, Ni, Fe catalysts, they will identify descriptors of catalytic activity using machine-learning algorithms. They will convert the CO<sub>2</sub> into methanol using H<sub>2</sub>, which will be generated via photocatalytic water splitting producing H<sub>2</sub> and oxygen.

➤ **C4X** (Suzhou, China)

Led by Dr. Wayne Song and Dr. Yuehui Li, the team is producing chemicals and bio-composite foamed plastics. They are currently making Wood–Plastic Composites (WPC), whose foam profiles are made with supercritical CO<sub>2</sub>.

- **Carbon Capture Machine** or CCM (Aberdeen, Scotland)  
Led by Dr. Mohammed Imbabi, the team is producing solid carbonates with applications for building materials. The CCMs that will be demonstrated and commercialized dissolves CO<sub>2</sub> directly into slightly alkaline water that is then mixed with a suitable brine source containing dissolved Ca, Mg, and other ions. A proprietary multi-stage precipitation technology is used to selectively separate and produce nearly insoluble Ca and Mg carbonate minerals that have useful properties, and hence, commercial value in existing established and new markets.
- **CarbonCure** (Dartmouth, Canada)  
Led by Jennifer Wagner, the team is producing stronger, greener concrete. Their retrofit process uses existing concrete production equipment and Portland cement chemistry to react with CO<sub>2</sub> emissions to produce in-situ nano sized mineral carbonate embedded within the concrete, which enhances the material properties and economics of concrete manufacturing without impacting the normal plant operations or supply chain.
- **Carbon Upcycling UCLA** (Los Angeles, CA, USA)  
Led by Dr. Gaurav Sant, the team is producing building materials that absorb CO<sub>2</sub> during the production process to replace concrete. The central technology involves a novel carbonation process (patent pending) that captures CO<sub>2</sub> from flue gas mixtures and embeds it via mineralization into limestone; a well-known natural cementation agent. The CO<sub>2</sub>NCRETE™ solution will be used to manufacture a wide array of components that can be readily substituted into conventional construction practice.

### **Technologies for CO<sub>2</sub> from Natural Gas Power Plants**

The five finalists that will demonstrate conversion of CO<sub>2</sub> emissions at a natural gas-fired power plant in Alberta, Canada are as follows:

- **C2CNT** (Ashburn, VA, USA)  
Led by Dr. Stuart Licht, the team is producing carbon nanotubes.
- **Carbcrete** (Montreal, Canada)  
Led by Dr. Mehrdad Mahoutian, the team is producing cement-free, carbon-negative concrete that uses waste from steel production as an alternative to traditional cement.
- **Carbon Upcycling Technologies** (Calgary, Canada)  
Led by Apoorv Sinha, the team is producing enhanced graphitic nanoparticles and graphene derivatives with applications in polymers, concrete, epoxies, batteries and pharmaceuticals.

- **CERT** (Toronto, Canada)  
Led by Dr. Alex Ip of the Sargent Group at the University of Toronto, the team is producing building blocks of industrial chemicals.
- **Newlight** (Huntington Beach, CA, USA)  
Led by Mark Herrema, the team uses biological systems to produce bioplastics.

The finalists will meet with XPRIZE management on May 22-25 in Banff of Alberta, Canada and those focusing on CO<sub>2</sub> from coal plants will have access to the ITC-C in Gillette, WY starting in June.

### What Is The Impact On Cooperatives?

The Wyoming ITC-C will soon begin commercial operations demonstrating five technologies. Electric cooperatives will receive unique benefits from the ITC-C by virtue of their financial commitment<sup>1</sup>. Soon, this state-of-the-art and pioneering research will look at converting the CO<sub>2</sub> into marketable commodities, such as useful chemical and building materials. Routine reports will be published indicating the status of the tests and shared with the ITC Host and Board members. This information will allow Cooperatives to understand the potential of the selected 5 finalists.

### Additional Resources

#### April 9<sup>th</sup> Announcement of Finalists

- [Bloomberg Article](#)
- [Video](#)

#### XPRIZE and the Wyoming ITC-C

- <http://www.wyomingITC.org>
- <http://carbon.xprize.org>
- April 2016 - [press release](#)
- June 2016 - [Technology Advisory](#)
- June 2016 - [video](#)
- September 2016 - [Technology Advisory](#)
- March 2017 - [Technology Advisory](#)
- March 2018 - [Technology Advisory](#)

### Contact for Questions

Dan Walsh, Senior Power Supply and Generation Director – Generation, Environment and Carbon: [Daniel.Walsh@nreca.coop](mailto:Daniel.Walsh@nreca.coop)

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<sup>1</sup> In addition to Basin providing the power plant site, the state of Wyoming is contributing \$15 million; Tri-State \$5 million; and NRECA \$1 million.