

# Technologies for the Future, Expectation by Investment



Brian J. Anderson, Ph.D.  
NETL Director

3rd International Conference on Carbon Recycling 2021

October 4, 2021

*Driving Innovation and Delivering Solutions*

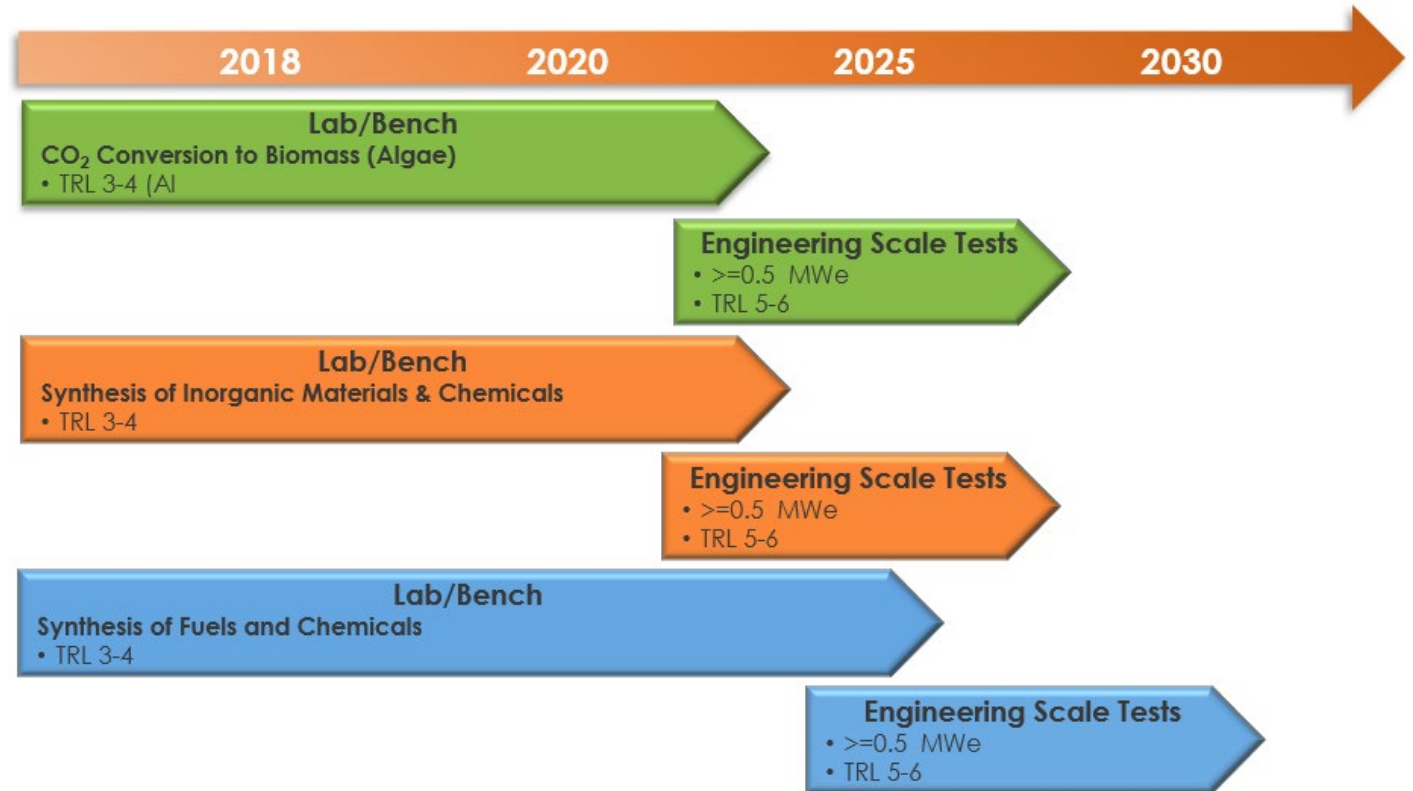
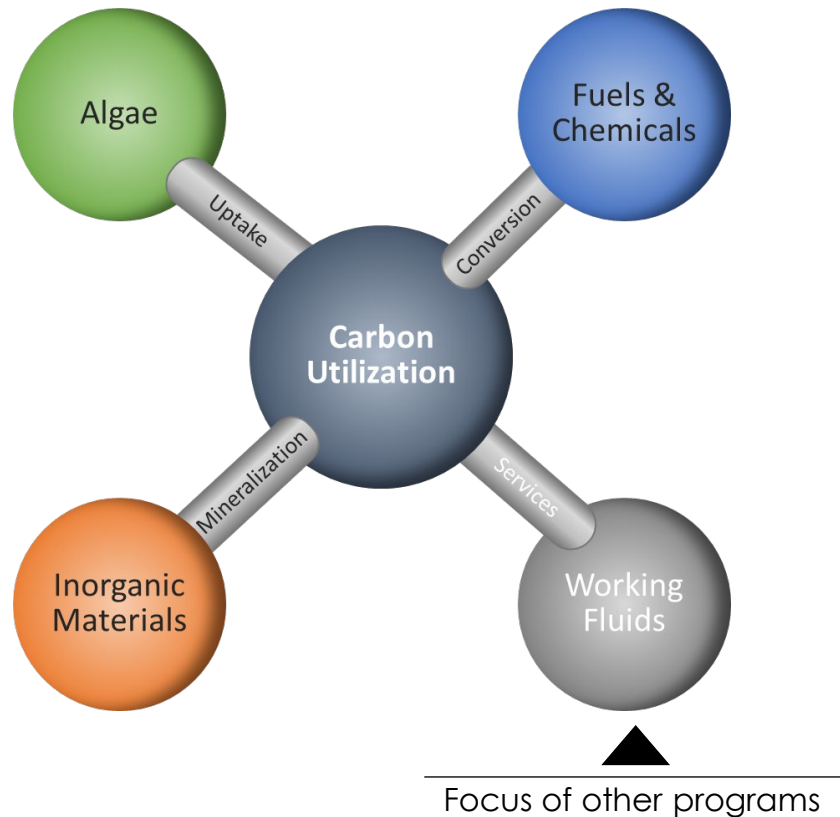


U.S. DEPARTMENT OF  
**ENERGY**



# Carbon Utilization Program Structure

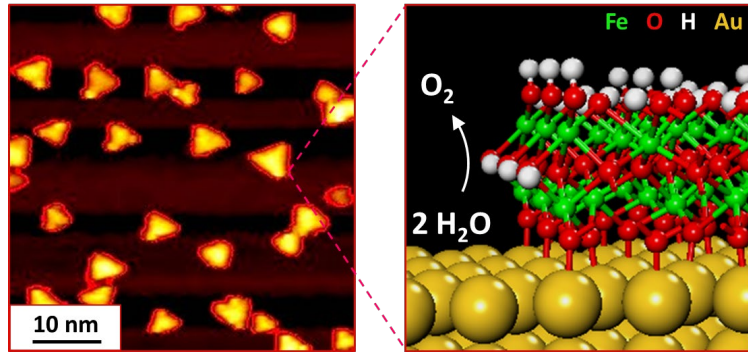
## Carbon Utilization Program R&D Areas



# Accelerating Technology Development

## NETL's In-House CO<sub>2</sub> Utilization Efforts

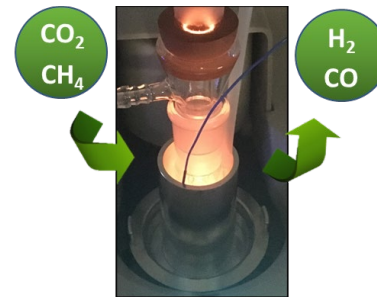
### Understand and Control Chemistry



Identify which parts make the catalyst “work” to optimize performance

- Bench-scale prototypes
- Intellectual property, papers & patents
- Techno-economic & lifecycle analysis

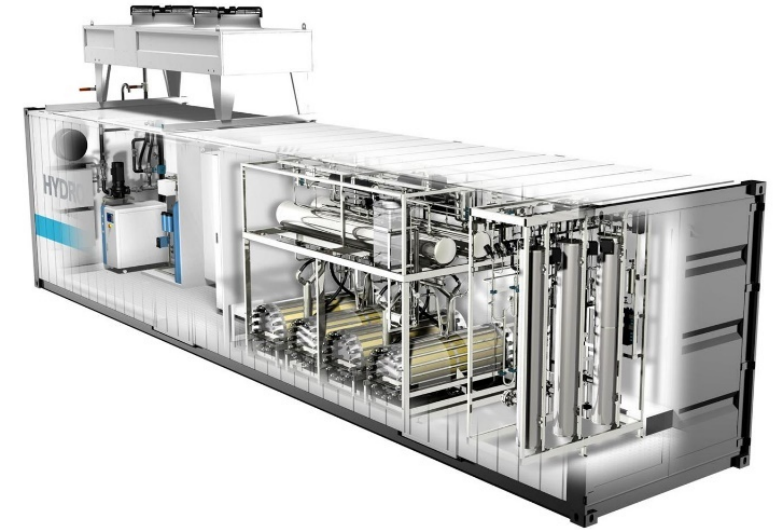
### Microwave Reactors



### Carbon Neutral CO<sub>2</sub> Electrolyzers



### Partner with industry to scale and deploy technology



Fundamental Understanding

Large Scale Deployment

# Microwave Catalysts Produce Carbon Neutral Chemicals and Hydrogen

**Microwave reactors use electricity to produce carbon-neutral H<sub>2</sub> and CO with record setting energy efficiency.**

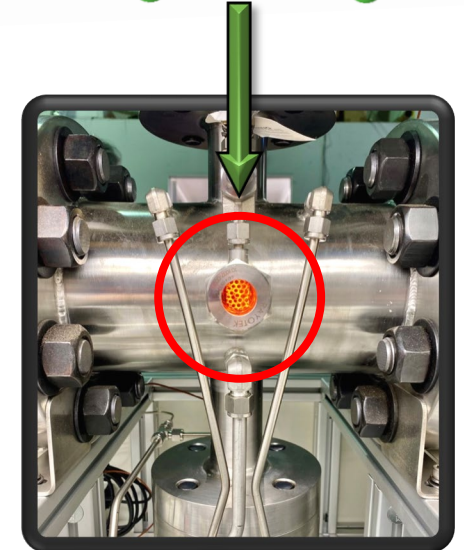
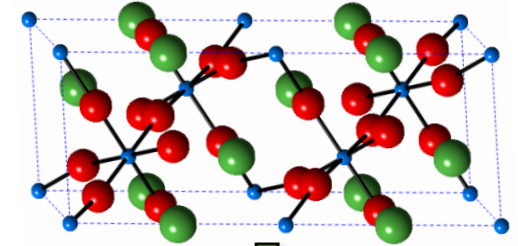
Accomplishments:

- Convert captured CO<sub>2</sub> and natural gas into sustainable, value-added chemicals.
- Scaled materials development from fundamental design to kilogram scale synthesis.
- Energy efficiency superior to electrochemical approaches.
- Engaging industry partners for pre-pilot scale evaluation.
- Full US Patent application and peer reviewed publication.

Impact:

- Allow sustainable use of natural gas and captured CO<sub>2</sub> to produce carbon neutral H<sub>2</sub> and industrially-relevant chemicals.
- Unique microwave catalysis will allow development of modular reactors that use excess electricity for on-demand chemical production.
- Demonstrates NETL's ability to translate technology from atomic-level materials design

Fundamental Materials Design



Pre-pilot Scale Microwave Demonstration

# Carbon Utilization Program Accomplishments

## XPRIZE winning R&D of UCLA Carbon Built

- In a collaboration between NETL and the UCLA's CarbonBuilt team, more than 1,200 hours of field testing was completed at the Wyoming Integrated Test Center, successfully demonstrating a process to create concrete masonry units using CO<sub>2</sub> from power plant flue gas without the need for a carbon capture step.
- The UCLA technology is helping to mitigate emissions through a unique carbonation process known as mineralization, which transforms gaseous CO<sub>2</sub> from power plant flue gas and other sources into stable carbonate solids that bind the components in the concrete.
- One of two winners out of forty-seven submissions from seven countries.



*CarbonBuilt concrete blocks coming off of the production line. Each CarbonBuilt concrete block stores about three-quarters of a pound of carbon dioxide.*

