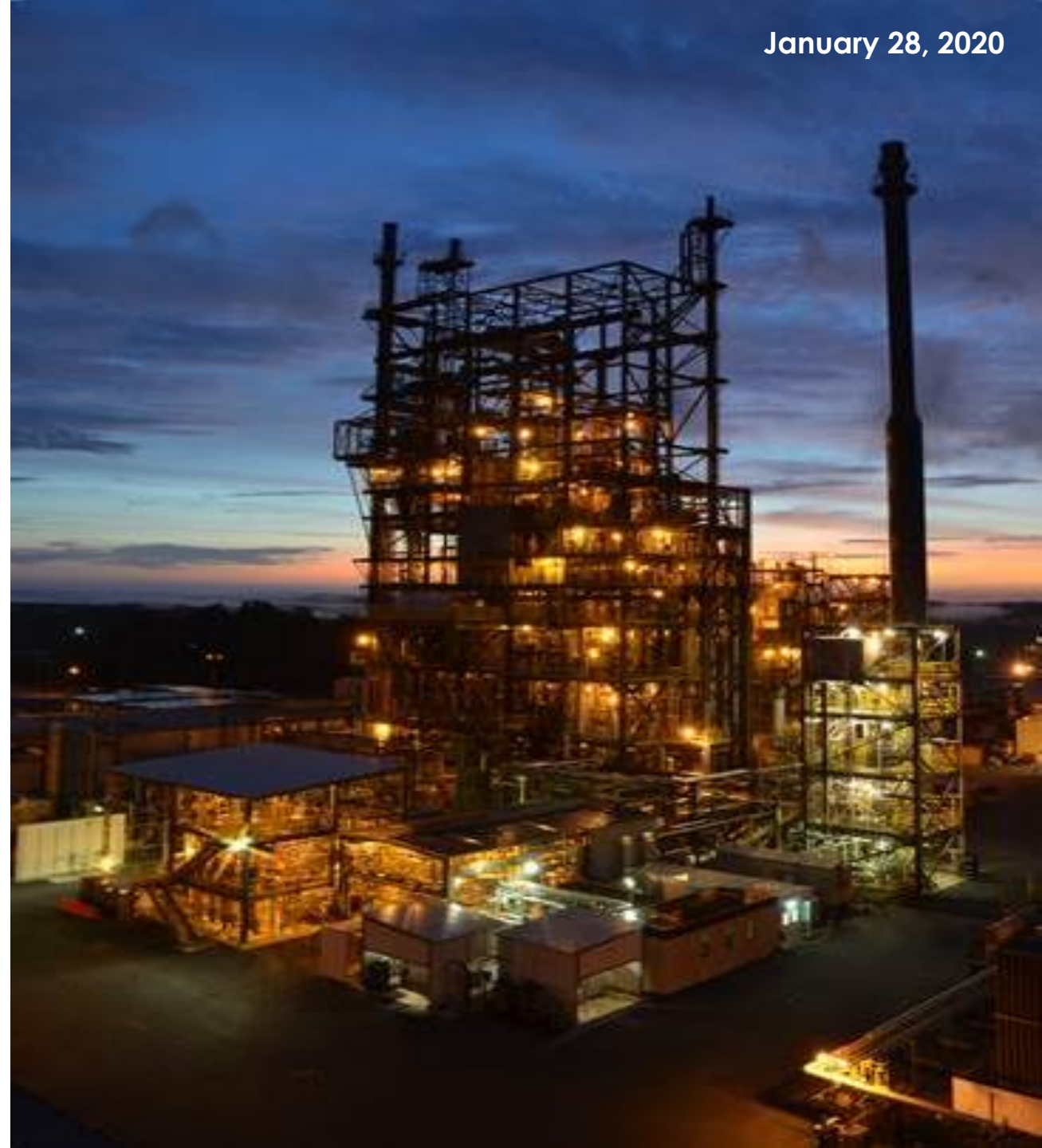


# Carbon Capture Technology Today and Over the Horizon

Ron Munson

USEA – Carbon Capture Utilization  
and Storage Roadshow

Washington DC

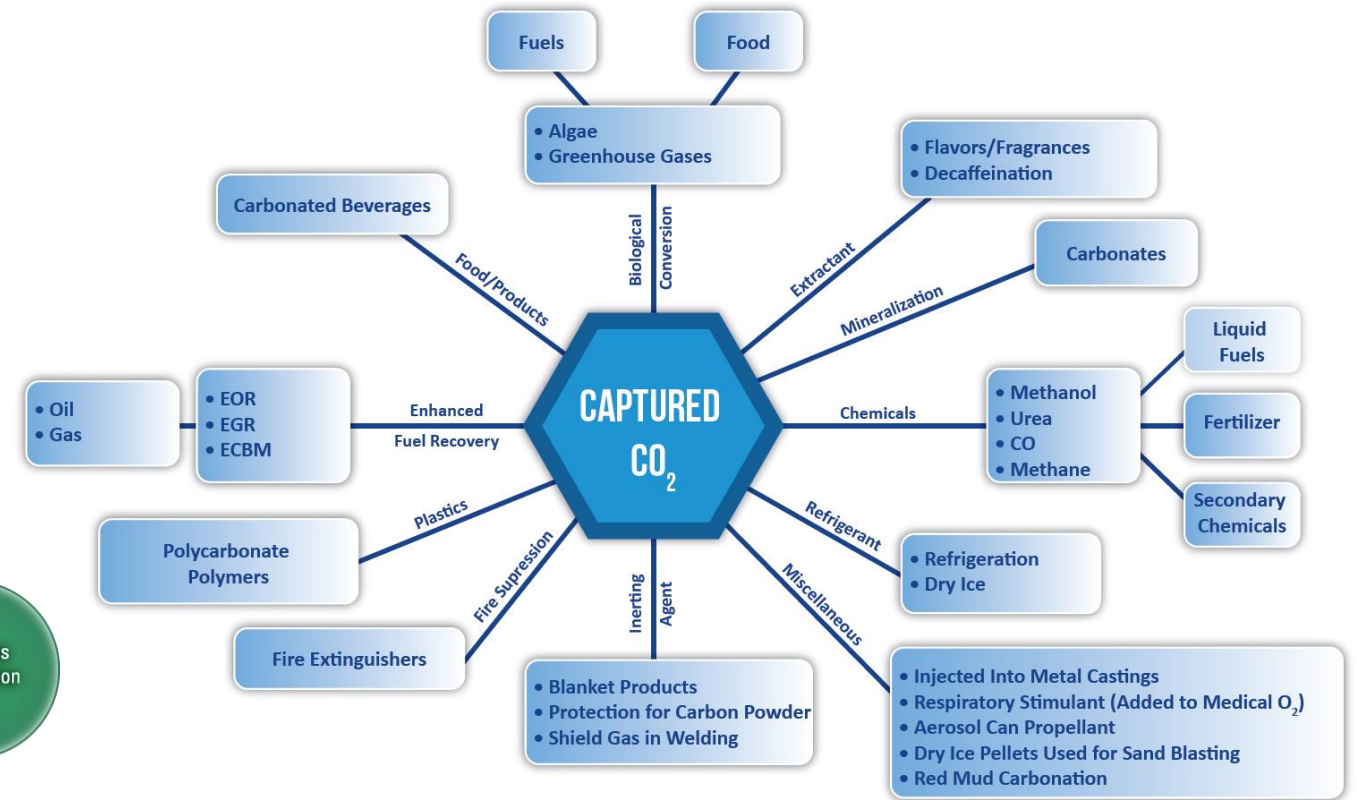


# Cogentiv Solutions

Carbon Energy and Environmental Management

## • Carbon Management

- Carbon Capture
- Carbon Utilization/Re-use
- Research Programs
- Project Development

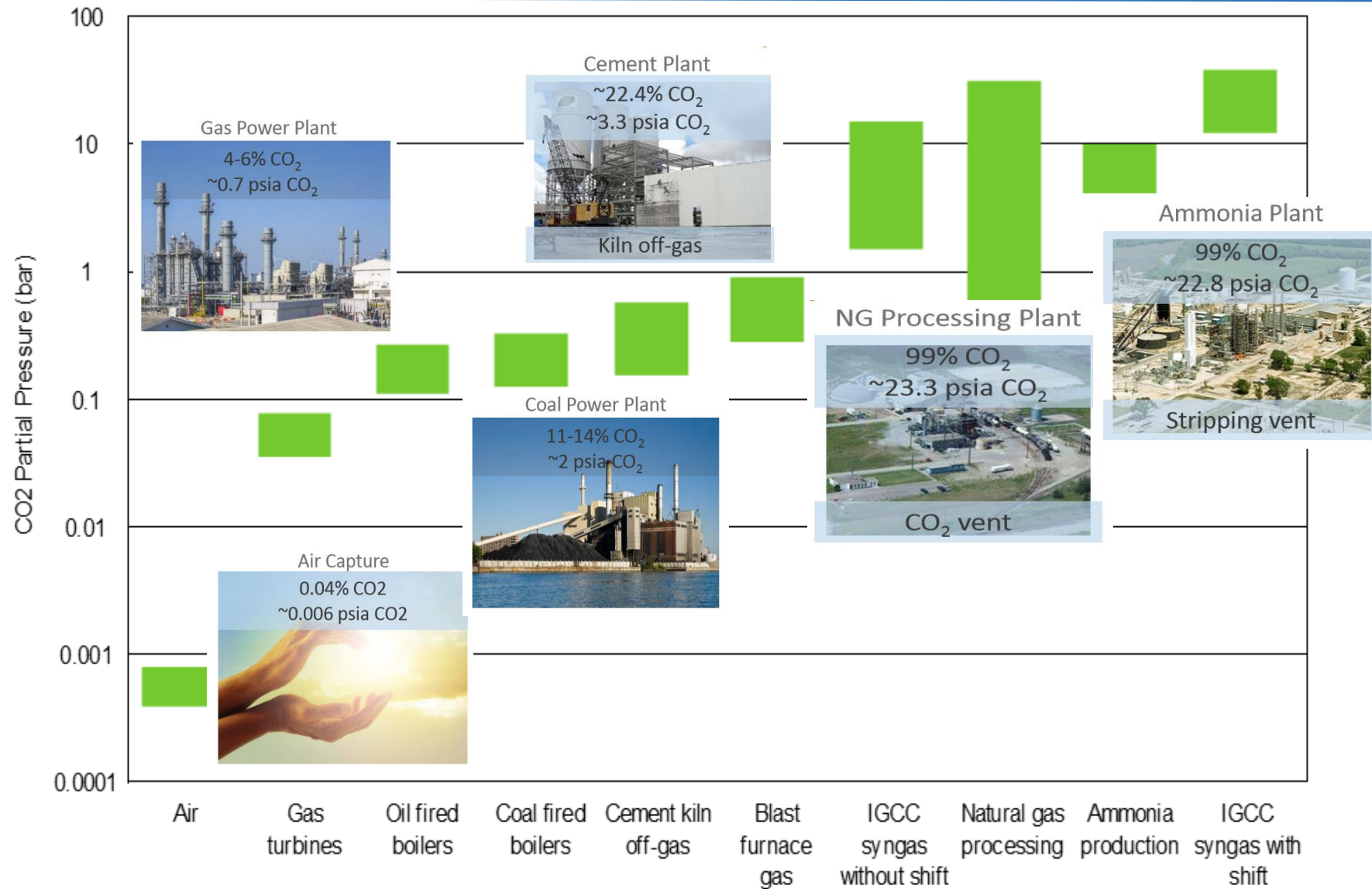


# Overview

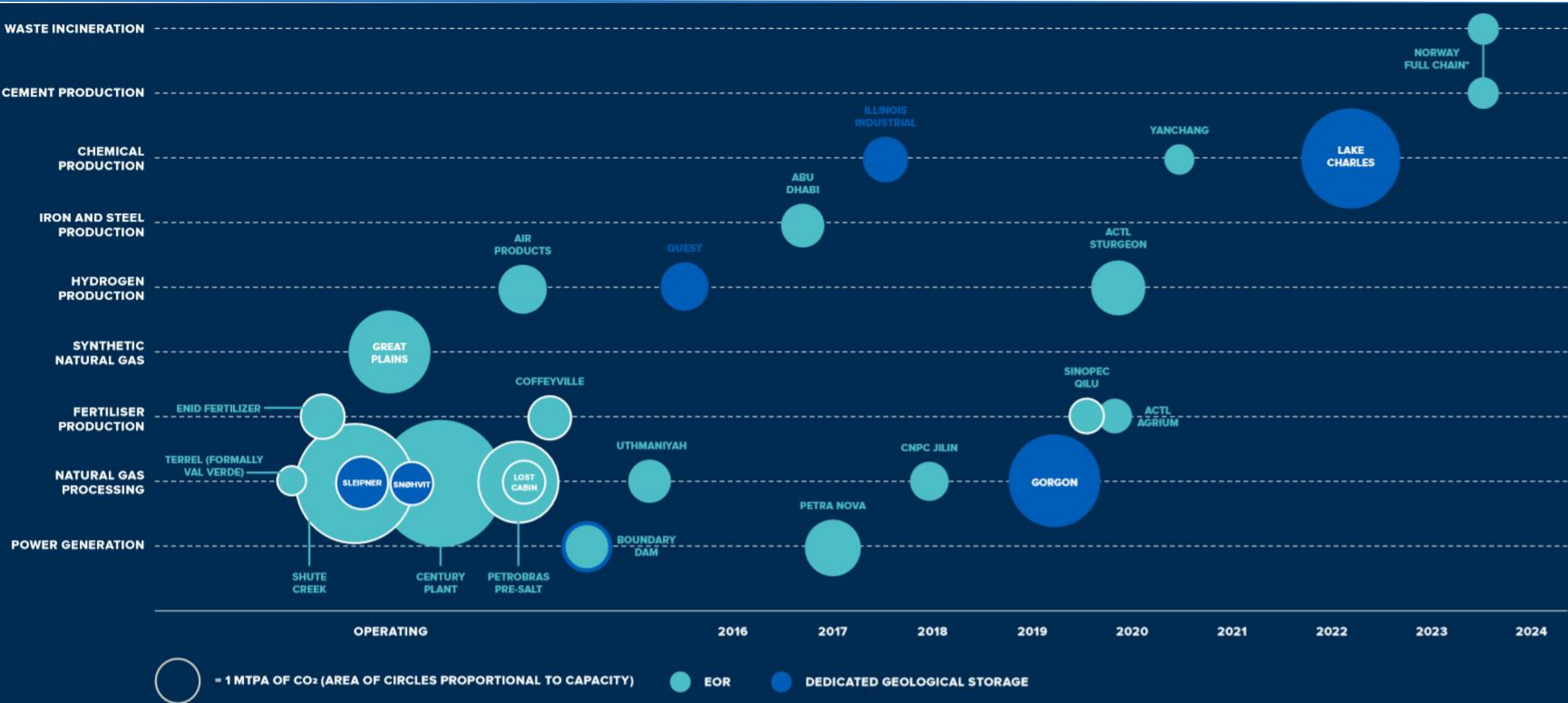
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- Industrial Systems
- Transformational Technologies
- Discovery of Carbon Capture Substances and Systems Initiative

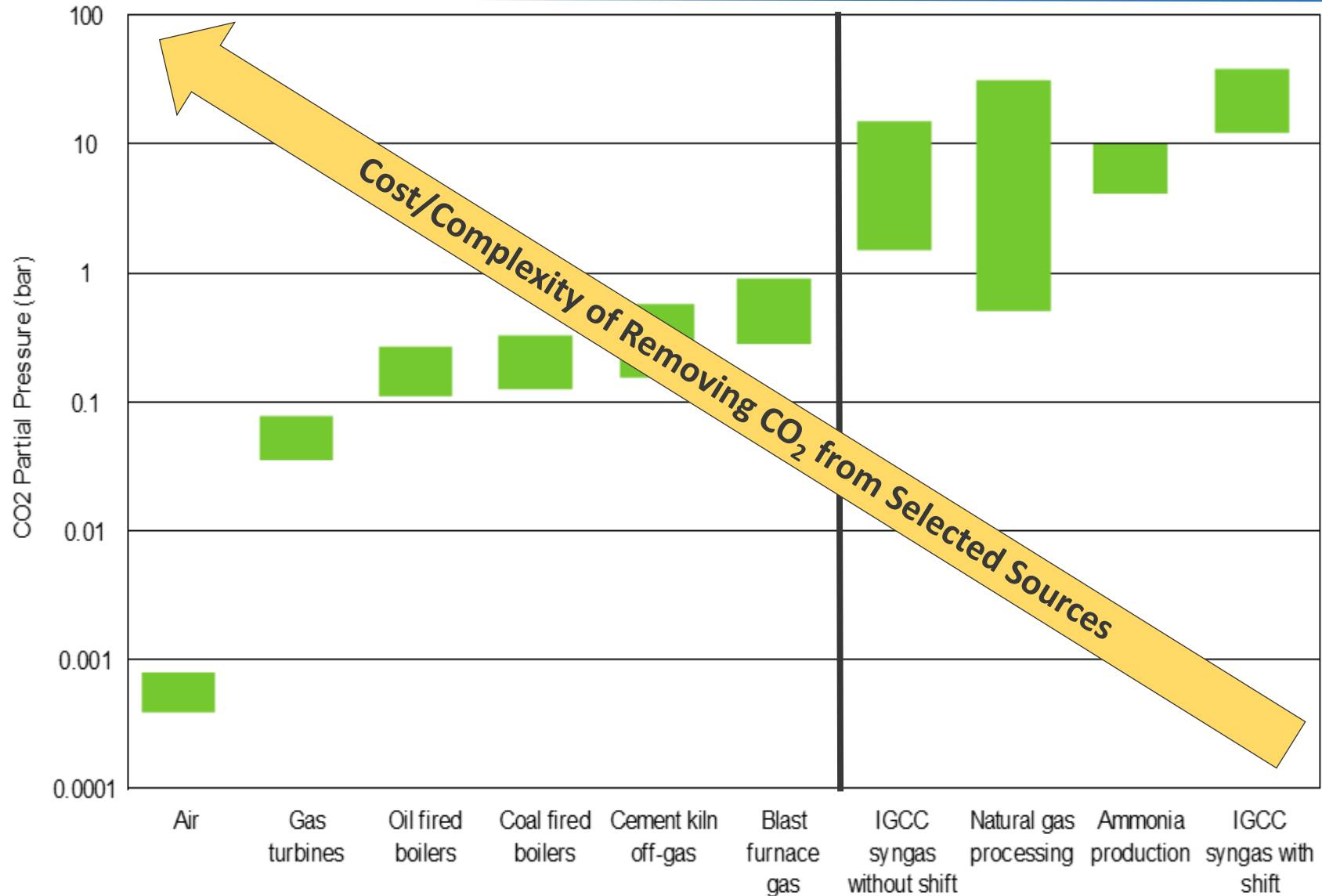
# CO<sub>2</sub> Concentrations: Select Sources



# Large-Scale Projects



# Large-Scale Projects



# Transformational Technologies

## Levers that can be used to drive cost reductions

- Improving Thermodynamics
- Improving Kinetics
- Reducing Capital Cost
- Improving Durability
- Improving Scalability

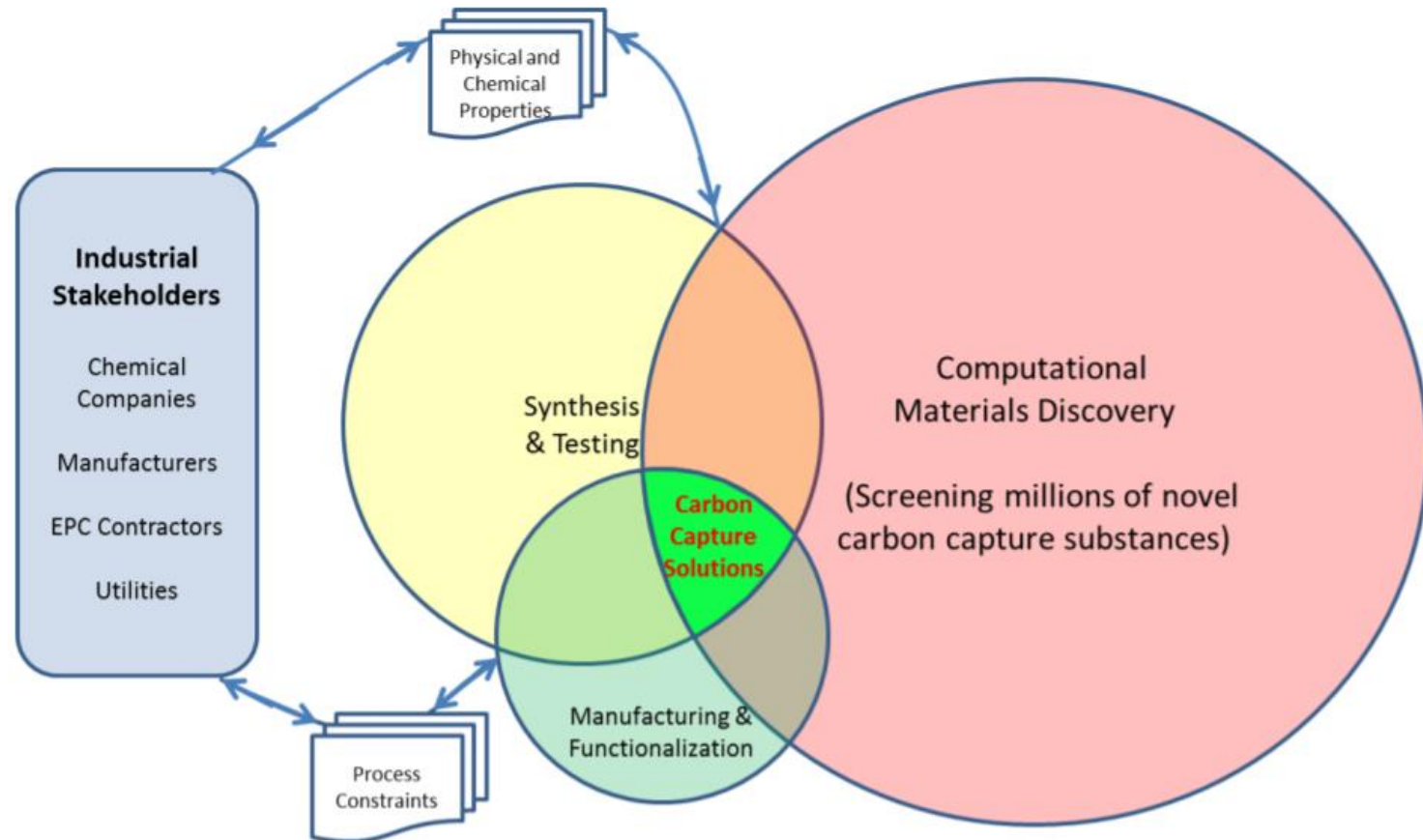
## Innovation Pathways

- Materials
- Processes
- Equipment

# Discovery of Carbon Capture Substances and Systems

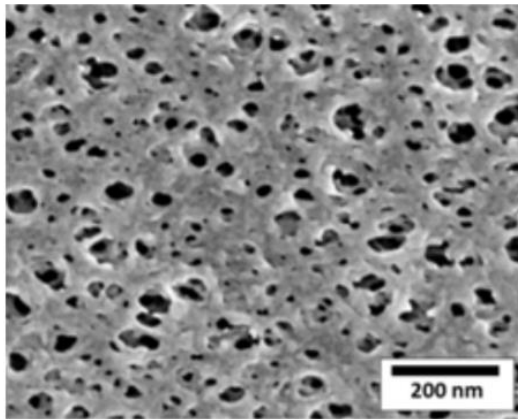
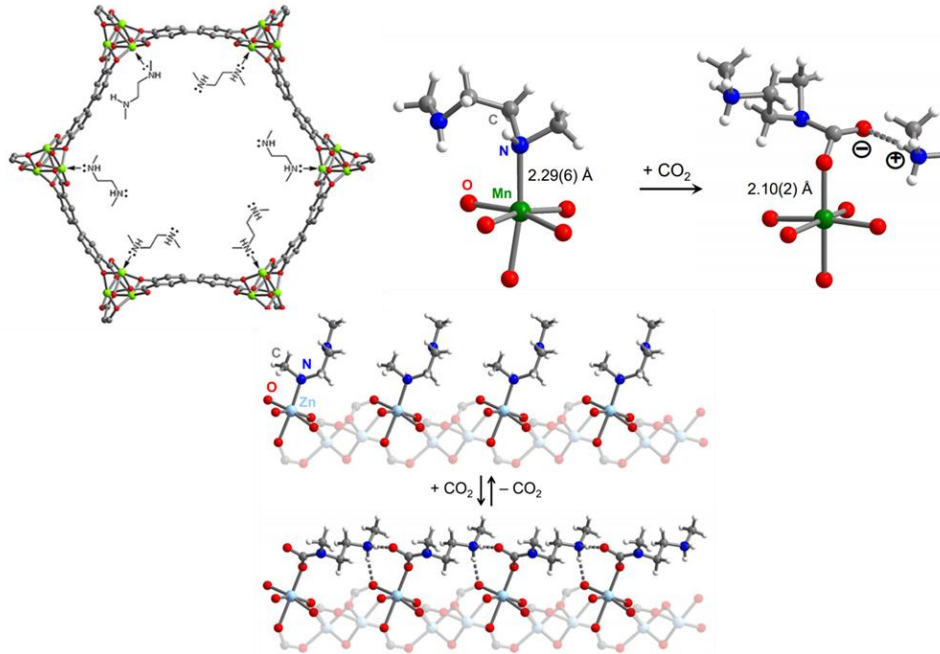
## Selected Efforts

- High-Efficiency, Integrated Reactors for Sorbents, Solvents and Membranes using Additive Manufacturing, LLNL
- Novel Geometry Design for Intensified CO2 Absorbers, Carnegie Mellon Univ
- Low-Viscosity, Water-Lean CO2-Binding Organic Liquids (CO2BOL) with Polarity Swing-Assisted Regeneration, PNNL
- Amine-Appended Metal-Organic Frameworks as Switch-Like Adsorbents for Energy-Efficient Carbon Capture, LBNL
- Contactor Design for Transformational Sorbents, West Virginia University

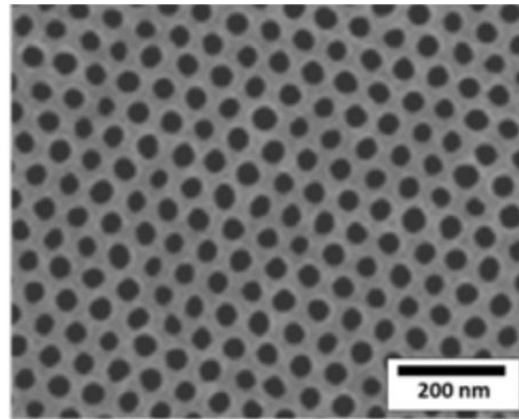




# Examples



Surface of Conventional Support



Surface of Isoporous Support

CO<sub>2</sub>

## Advanced Manufacturing to Drive Down Capture Costs

### Improving Performance Through Additive Manufacturing

Additive manufacturing, using 3D printing, enables the development of components for carbon capture equipment that intensify heat and mass transfer, improve process performance, and reduce overall equipment size, lowering capital and operating costs.

3D-printed gyroid structure

DOE/FE/NETL is currently supporting three projects that are using 3D printing to produce rapid prototypes with the potential to capture CO<sub>2</sub> more efficiently and economically.

Designing and fabricating high-efficiency reactors using novel geometries that support transformational solvent-based capture technologies.

Progress to Date

Silicon-based gyroid structures have been created with one micron resolution using stereo-lithography.

Developing a 3D-printed absorber with integrated packing and internal cooling capabilities to help optimize solvent-based capture.

Progress to Date

Both plastic and metal absorbers have been 3D-printed for testing and analysis.

Producing intensified devices that combine heat and mass transfer operations to drive down costs of solvent-based capture processes.

Progress to Date

An aluminum version of a column packing structure with built-in heat exchange has been successfully 3D-printed.

# QUESTIONS?

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