

# CCUS TECHNOLOGY TODAY AND OVER THE HORIZON

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Shannon Angielski, Executive Director, CURC  
CCUS Roadshow  
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# Carbon Utilization Research Council (CURC) Members

## Equipment Suppliers

### General Electric

Mitsubishi Heavy Industries America,  
Inc. (MHIA)

## Labor Unions

International Brotherhood of Boilermakers  
International Brotherhood of Electrical  
Workers

## NGOs

ClearPath Action  
EnergyBlue Project

## Producers

Consol Energy  
Lignite Energy Council  
Peabody Energy

## Technology Developers

ION Engineering  
Jupiter Oxygen Corporation  
NET Power

## Research Organizations

Battelle  
Electric Power Research Institute (EPRI)  
Gas Technology Institute  
University of North Dakota Energy &  
Environmental Research

## State Organizations

Kansas State Geological Survey  
Southern States Energy Board  
Wyoming Infrastructure Authority

## Trade Associations

American Coal Council  
American Coalition for Clean Coal  
Electricity (ACCCE)  
Edison Electric Institute (EEI)  
Energy Policy Network  
National Rural Electric Cooperative  
Association (NRECA)

## Universities

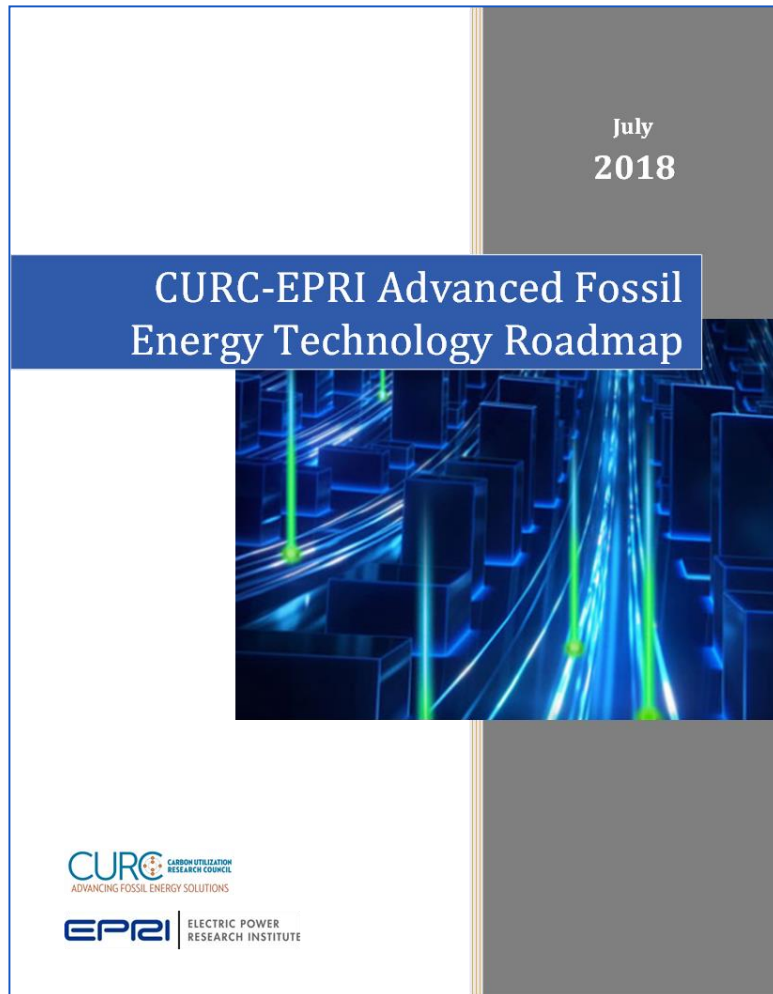
Lehigh University  
Ohio State University  
Pennsylvania State University  
Southern Illinois University  
University of Illinois/PRI  
University of Kentucky/CAER  
University of Wyoming  
West Virginia University

## Utilities

Basin Electric Power Cooperative  
Duke Energy Services  
Great River Energy  
Nebraska Public Power District  
Southern Company  
Tri-State Generation &  
Transmission Association

Orange = Steering Committee Members

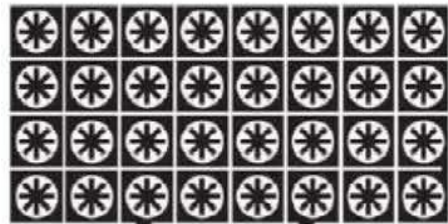
# The 2018 CURC-EPRI Advanced Fossil Energy Technology Roadmap



- Represents a plan for delivering cost-competitive, low to zero-carbon emission fossil-fueled technologies between 2025-2035.
- Identifies RD&D priorities, including carbon capture, and the public-private sector investments needed to bring technologies to the commercial marketplace.
- Informs policymakers on technology direction and annual budget needs to achieve Roadmap goals.
- Analyzes and communicates the potential benefits of U.S. fossil energy innovation.

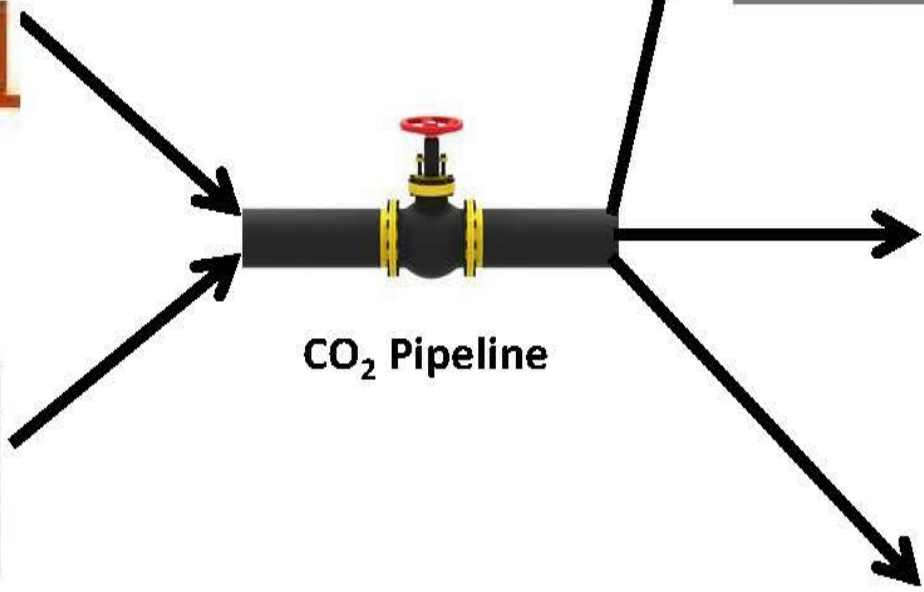


Point Source

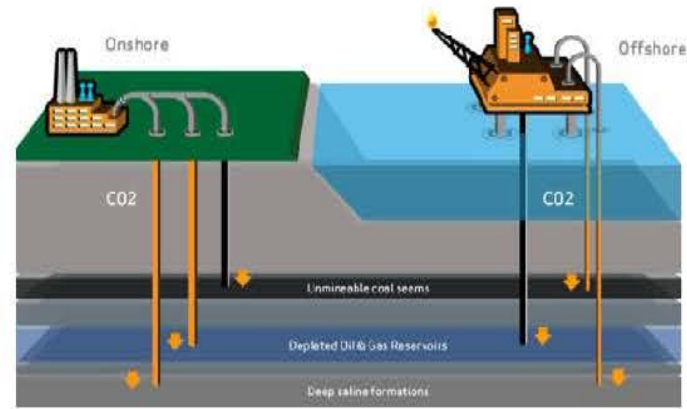


Direct Air Capture

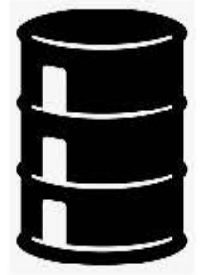
# CAPTURE



## Geologic Storage



## CO<sub>2</sub> Stored Via EOR



## Utilization

-  Food & Beverage
-  Chemicals
-  Cements & Aggregates
-  Carbon Fiber

# TRANSPORT

# STORAGE

# Carbon Capture RD&D in the Power Sector –

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- New power cycles with carbon capture:
  - Chemical Looping (CLC)\*
  - Pressurized Oxy-Combustion\*
  - Supercritical CO<sub>2</sub> cycles (sCO<sub>2</sub>)\*
  - Gasification
  - Hydrogen Generator (type of pre-combustion capture)
- Post-combustion and pre-combustion carbon capture
- High temperature and pressure materials
- Turbines
- Fuel cells
- Blue hydrogen production for power generation
- Energy storage from fossil fuel systems

# Technology RD&D Costs Outlined in Roadmap

## Public and Private

Funding (\$M/year)		2018-20	2021-25	2026-35
R&D	Total (Industry and Federal)	288	188	105
	Federal (80%)	231	150	84
Pilots	Total (Industry and Federal)	403	395	133
	Federal (80%)	323	316	106
Demos	Total (Industry and Federal)	204	995	985
	Federal (50%)	102	497	493
Total (Public/Private) Annual Funding		895	1578	1223
Annual Federal Budget		656	963	683
Annual Industry Budget		239	615	540

# Thank you and Questions

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For More Information:

- Roadmap: <http://curc.net/curc-epri-advanced-technology-roadmap-1>
- Making Carbon a Commodity: <http://curc.net/making-carbon-a-commodity-the-potential-of-carbon-capture-rdd>