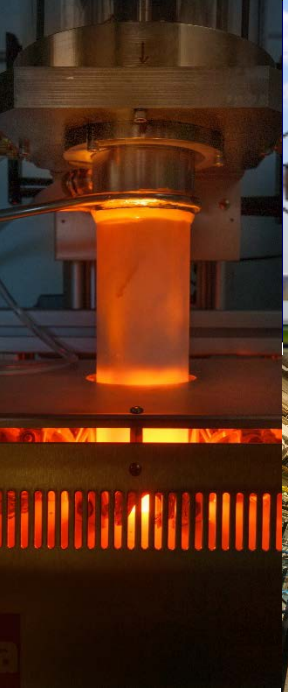
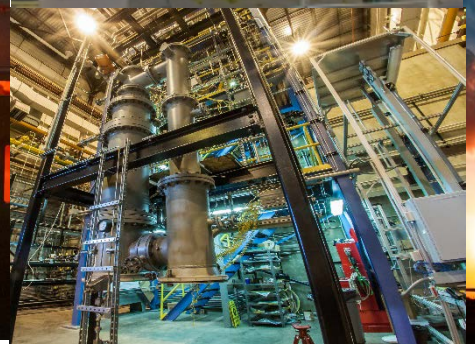





U.S. DEPARTMENT OF ENERGY | Office of Fossil Energy

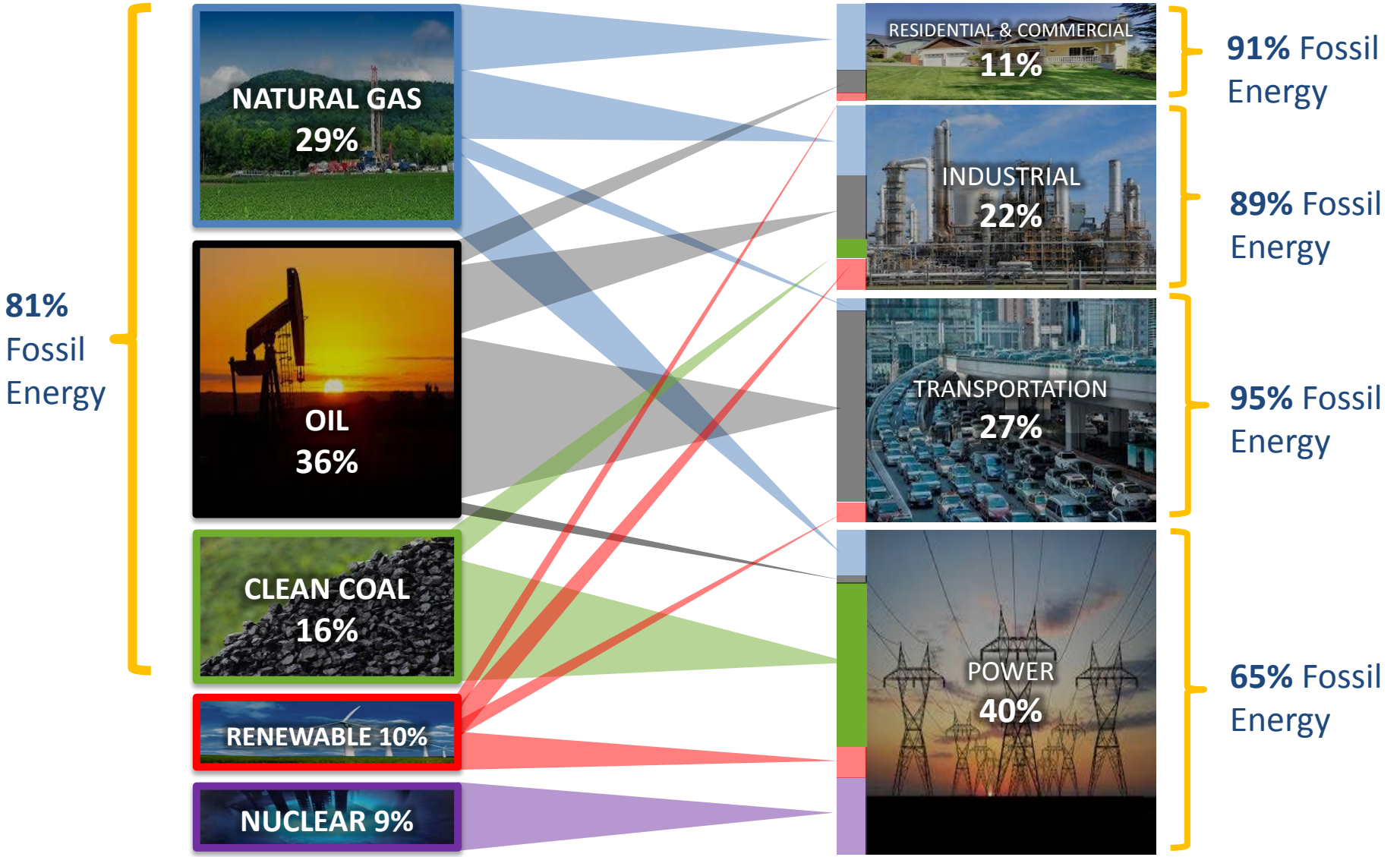
CCSI^2 Industry Advisory Board Program Review Meeting

August 9, 2016

Doug Hollett

Principal Deputy Assistant Secretary

Fossil Energy Critical in All Domestic Sectors

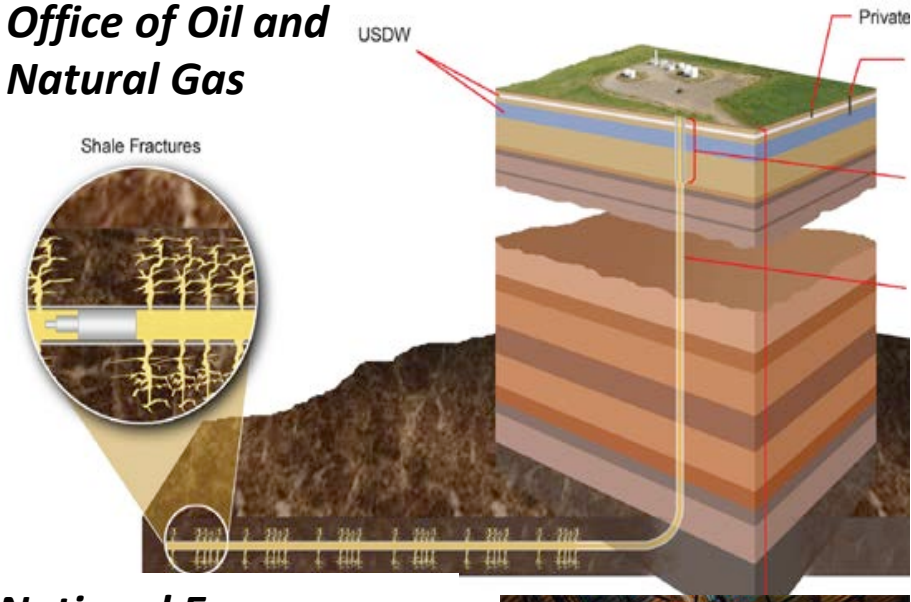


EIA, *Annual Energy Outlook 2015*, Reference Case.

DOE Office of Fossil Energy

Office of Clean Coal and Carbon Management

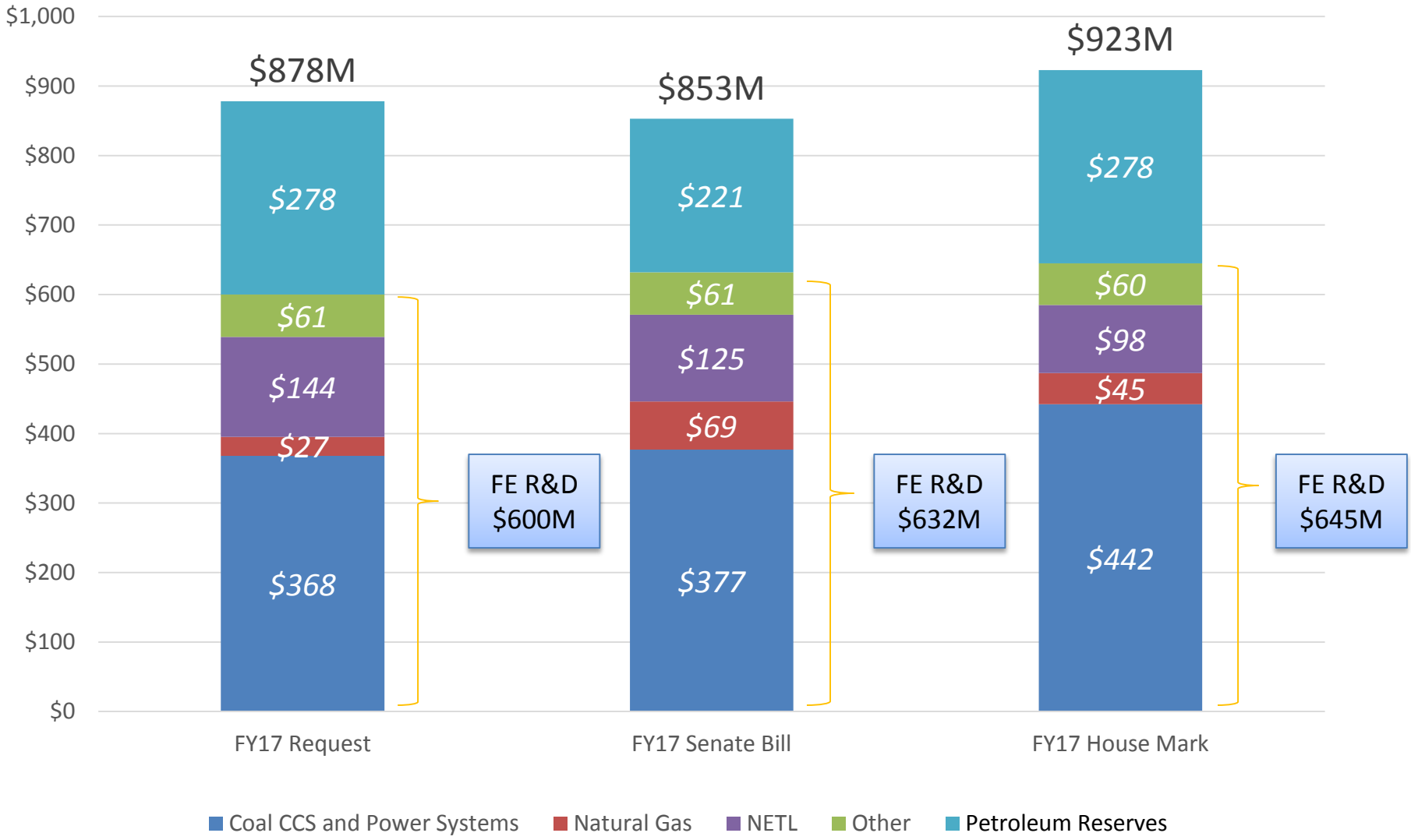
Office of Oil and Natural Gas



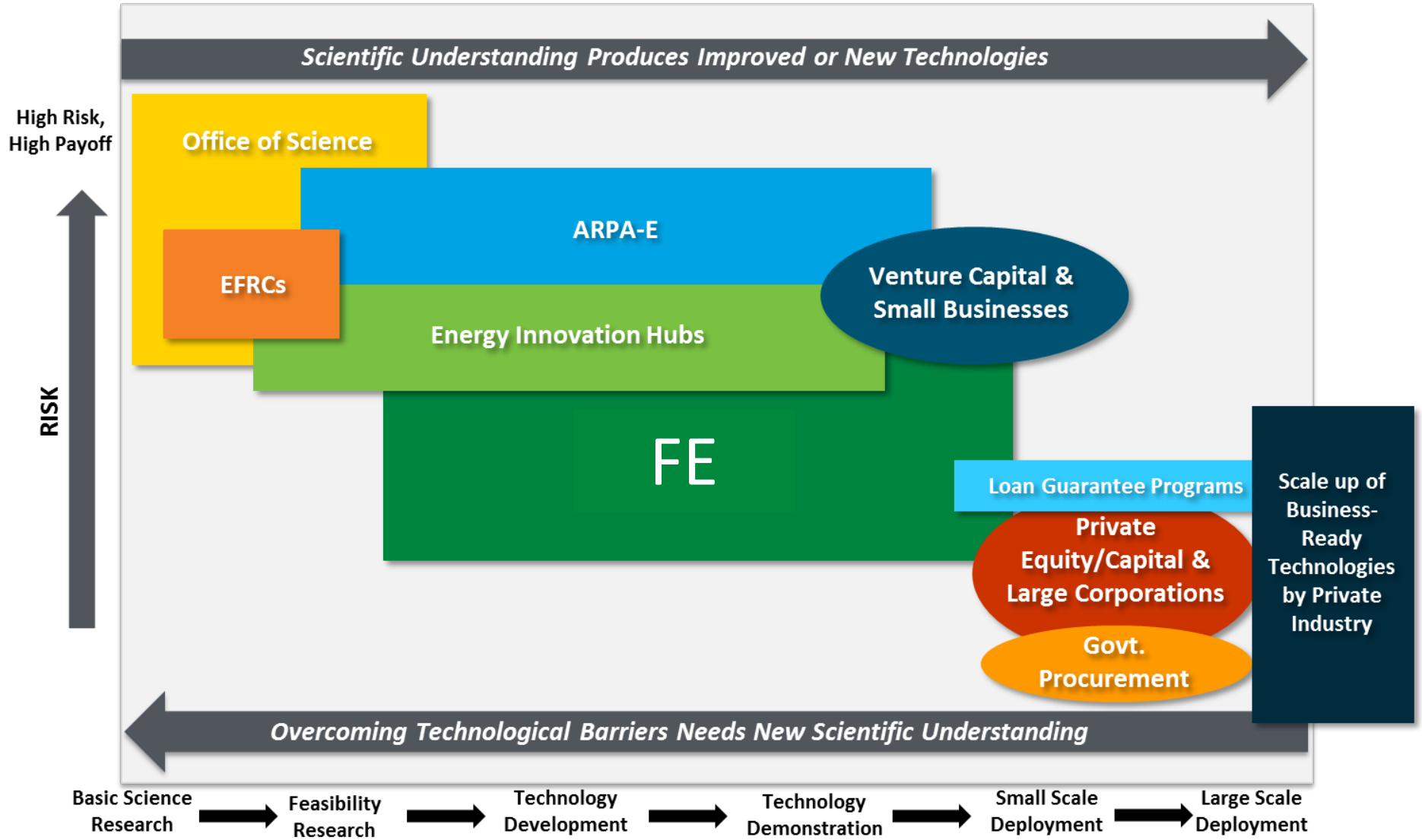
Strategic Petroleum Reserves

National Energy Technology Laboratory

Fossil Energy FY17 Budget Request *(in millions)*



The Department of Energy and FE



FE Key Goals and Priorities

Accelerate a Commercial Pathway to CCS

- Innovation CCS
- Advanced Carbon Technologies R&D
- Domestic and international partnerships
- Reduce deployment barriers

Advance Safe and Environmentally Prudent Oil & Gas Resource Production and Transport

- R&D on water and air quality, induced seismicity
- Emissions mitigation and quantification
- Gas hydrates

Modernizing the Strategic Petroleum Reserves Program

Natural Gas Trade Regulation

Department of Energy RD&D Crosscuts

- Intra-agency efforts to address common science and engineering challenges across the energy spectrum
  - Subsurface Technology and Engineering (SubTER)
  - Supercritical CO2
  - Energy Water
  - Advanced Materials
  - Grid Modernization

Meeting the President's Energy Goals

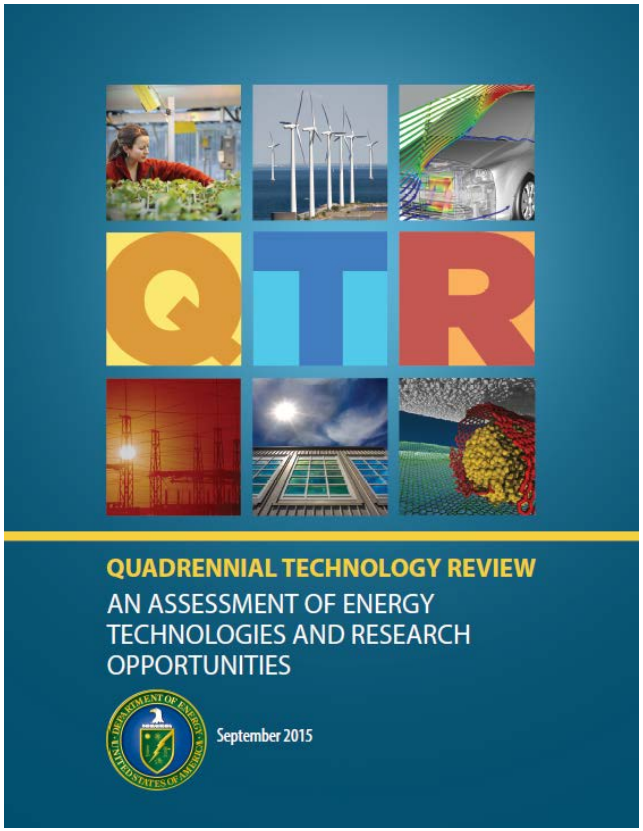
- "I committed this country to the tireless task of **combating climate change and protecting this planet for future generations**….a strong global agreement….that reduces global carbon pollution and sets the world on a course to a low-carbon future….[W]e succeeded.

- "[T]his agreement sends a powerful signal that the world is firmly committed to a low-carbon future. And that has the potential to **unleash investment and innovation in clean energy** at a scale we have never seen before. "

- President Obama, December 12, 2015

Opportunities in Carbon Capture and Storage

Assessment of the DOE Quadrennial Technology Review

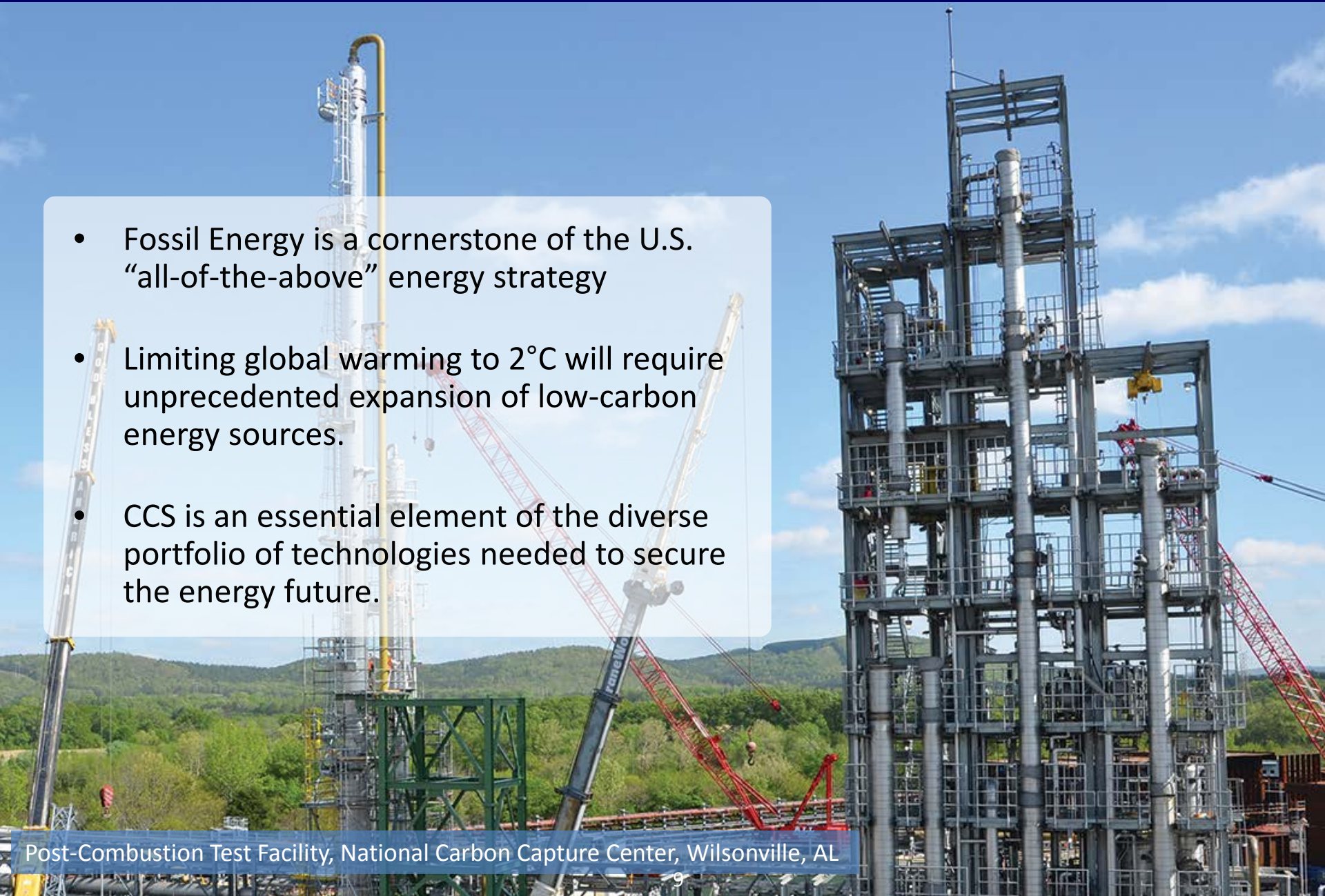


http://www.energy.gov/qtr

- **Pilots:** 2nd-generation pilot demonstrations of **carbon capture and advanced energy systems** for **new build and existing plants** and **field tests** addressing critical challenges such as pressure management, induced seismicity, and storage permanence
- **Demonstrations:** CCS technologies on **retrofit fossil fuel burning plants**
- **New applications:** Applying CCS to **natural gas and industrial plants**, and addressing differences in CO_2 and O_2 concentrations and the effects on CCS technologies
- **International partnerships:** Continued opportunities for shared knowledge, expanded demonstration, and broad impact
- **Crosscuts: Utility-scale biopower with CCS** to improve power production efficiency and offer a cost-competitive GHG reduction alternative

Advanced Carbon Technologies

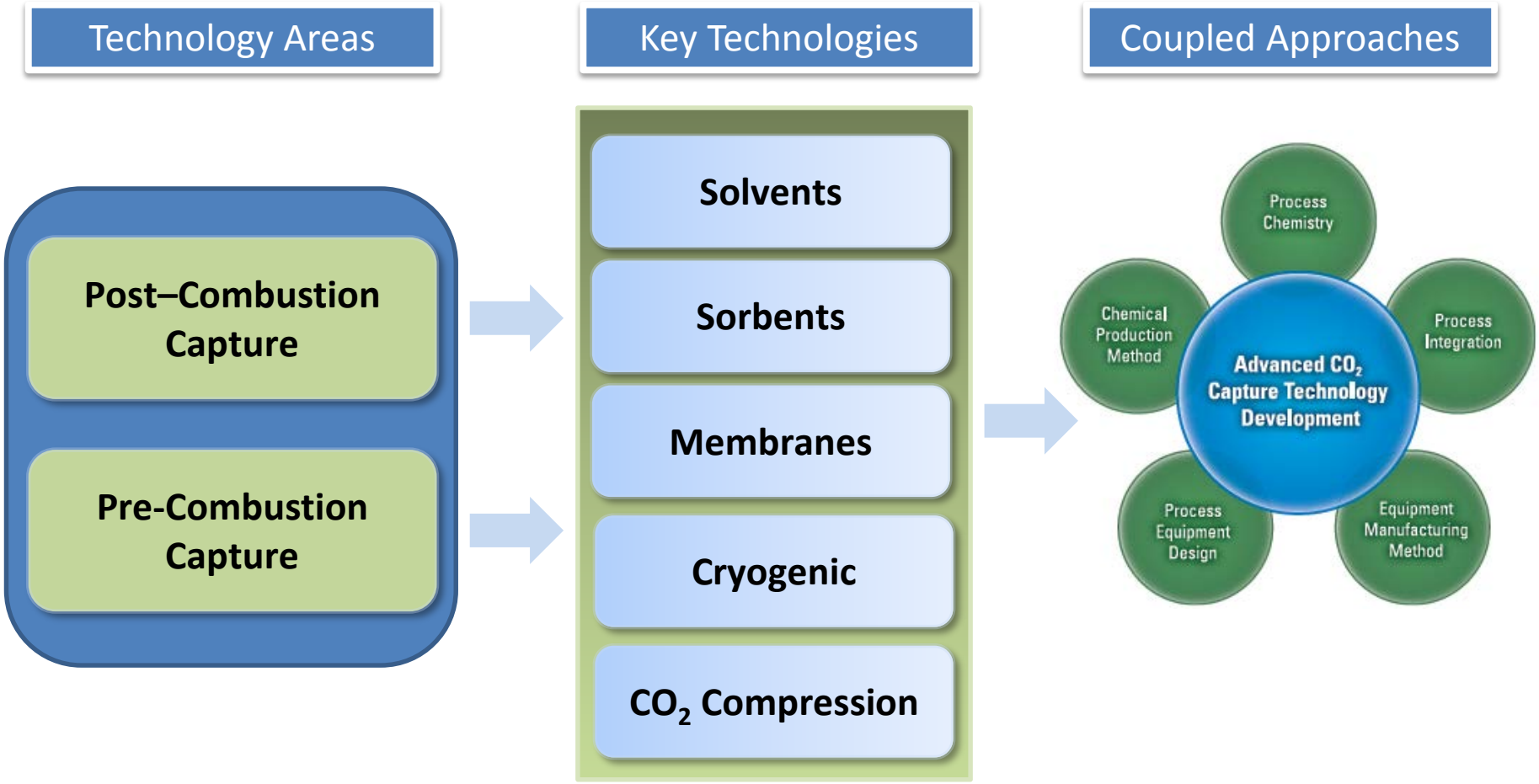
Low Carbon, Affordable, Accessible Energy



- Fossil Energy is a cornerstone of the U.S. "all-of-the-above" energy strategy
- Limiting global warming to 2°C will require unprecedented expansion of low-carbon energy sources.
- CCS is an essential element of the diverse portfolio of technologies needed to secure the energy future.

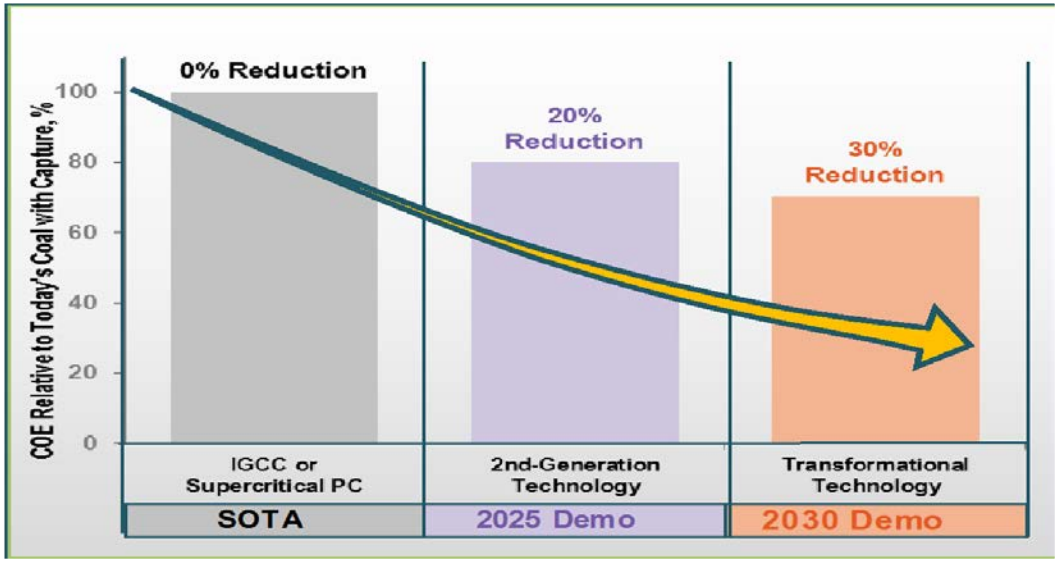
Post-Combustion Test Facility, National Carbon Capture Center, Wilsonville, AL

Carbon Capture Key Technologies



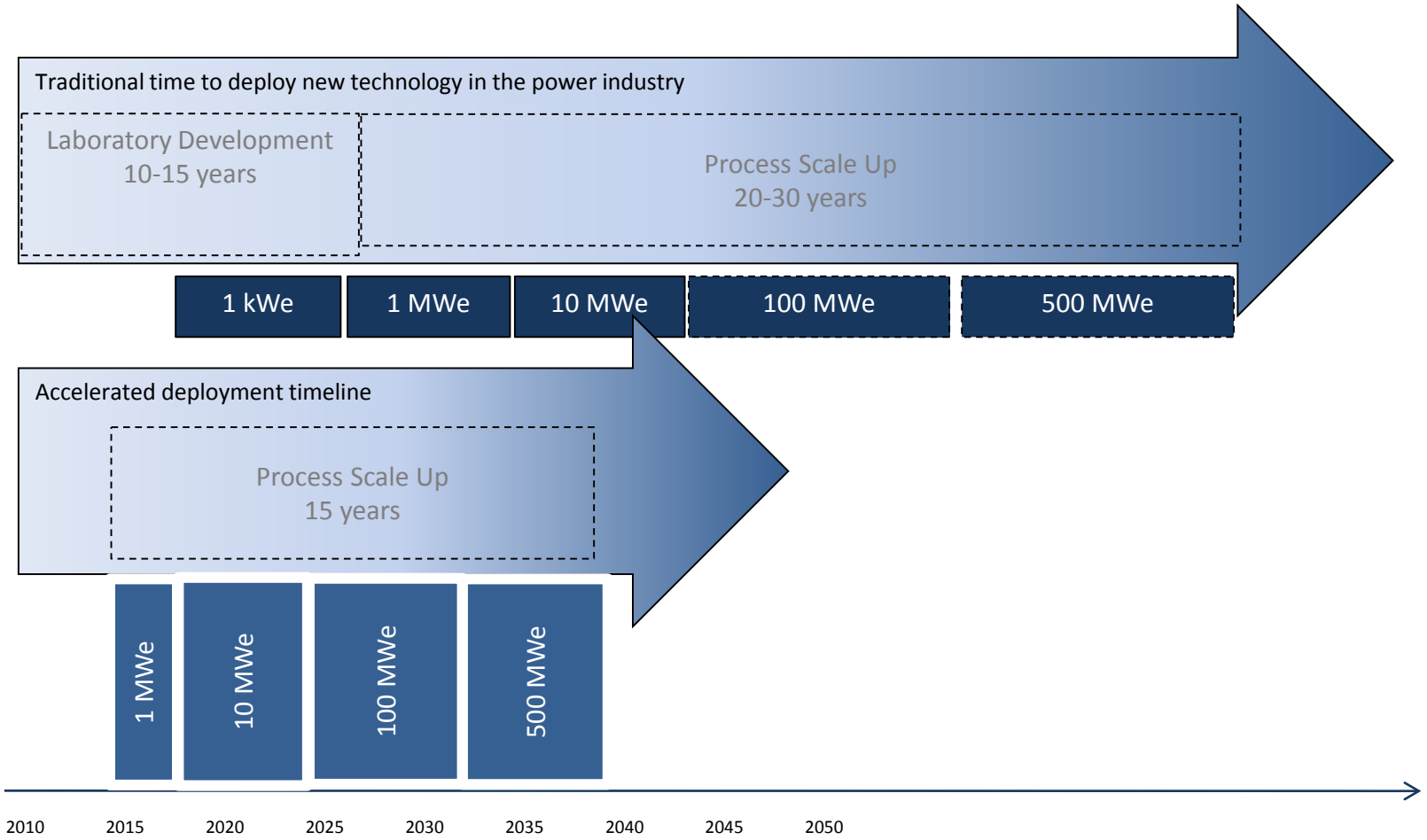
Carbon Capture RD&D Timelines

	2nd Generation	Transformational
R&D Completed through large-scale pilot testing (10 to 25MWe)	2020	2025
Permitting and Construction of 1st-of-a-kind, demonstration projects (100+MWe)	2020-2025	2025-2030
Startup of commercial-scale FOAK demonstration projects initiated	2025	2030
Commercial deployment begins	2030	2035



Goals shown are for greenfield plants. Costs include 90% CO_2 capture and compression to 2215 psia but exclude CO_2 transport and storage costs.

Challenge: Accelerate Development/Scale Up



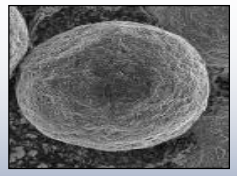
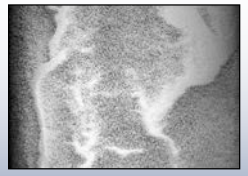
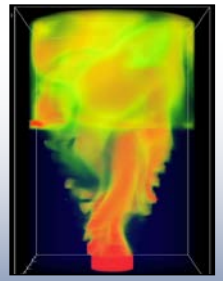
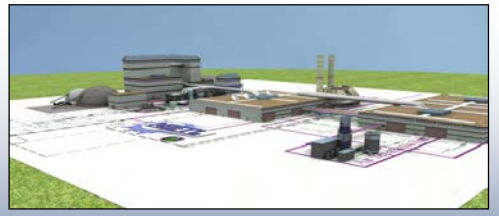
Challenge Accepted: CCSI

Computational Tools for Accelerating Development

CCSI

Carbon Capture Simulation Initiative

Computational Tools for Accelerating Development

Rapidly synthesize optimized processes to identify promising concepts → Better understand internal behavior to reduce time for troubleshooting → Quantify sources and effects of uncertainty to guide testing & reach larger scales faster → Stabilize the cost during commercial deployment

National Labs

Berkeley Lab; Pacific Northwest National Laboratory; NETL; Los Alamos National Laboratory; Lawrence Livermore National Laboratory

Academia

Carnegie Mellon; Princeton University; West Virginia University; Boston University; The University of Texas at Austin

Industry

GE; ADA; Alstom; B&W; EPRI Electric Power Research Institute; Southern California Edison; Phillips 66; Chevron; Southern Company; RTI International; ExxonMobil; AEP American Electric Power; URS; aspentech; Air Products; ANSYS; Eastman; esi get it right; Fluor; Clean Energy Systems, Inc.; ASU Arizona State University; GSE Systems; Schneider Electric; Linde; PSE; SRI International; WSC Innovative Simulation Solutions