



An Overview of Clean Coal Technologies in the DOE Transformative Power Generation Program

John Rockey
National Energy Technology Laboratory

The U.S. Department of Energy's Office of Fossil Energy initiated the Transformative Power Generation Program, which is focused on the research and development (R&D) needed to enable generation of efficient, cost-effective electricity from coal with near-zero atmospheric emissions. This can be achieved through the development of impactful, near-term technologies to improve the existing fleet and transformational technologies that will modernize the coal-fired fleet. Research efforts focus on three areas: Coal Plant of the Future – Coal FIRST (Flexible, Innovative, Resilient, Small, Transformative); Improvements for Existing Plants; and Advanced Combustion Technologies. The Transformative Power Generation Program uses a multi-pronged and coordinated approach to identify and perform research through in-house R&D conducted at one or more of the National Energy Technology Laboratory's three research campuses, and cost-shared R&D with external partners in academia, industry, and other national laboratories.

The Transformative Power Generation Program is funding an R&D initiative to advance modular coal-based power plants of the future. This effort—the Coal FIRST initiative—will develop the coal plant of the future needed to provide secure, stable, and reliable power. This R&D will underpin coal-fired power plants that are capable of flexible operations to meet the needs of the grid; use innovative and cutting-edge components that improve efficiency and reduce emissions; provide resilient power to Americans; are small compared to today's conventional utility-scale coal; and will transform how coal technologies are designed and manufactured.

Through Coal FIRST, the Transformative Power Generation Program is seeking to enable U.S. manufacturers to create the cleanest, highest performing, and most cost-effective coal-fired power plants in the world. The goal of this area is to develop mid-term technology options (2030 timeframe) that will help even today's best coal power plants improve efficiency and flexibility over the next decade.

Through R&D for Improvements to Existing Plants, the Transformative Power Generation Program is supporting near-term research to improve the efficiency, flexibility, and reliability of existing coal-fueled plants. The existing coal power generating fleet plays a critical role providing





reliable, on-demand power generation required for power grid stability, and it is important that these existing units continue to operate in an efficient and reliable manner. The Transformational Power Generation Program is pursuing R&D that focuses on impactful, near-term technologies applicable to the needs of the existing fleet.

Current R&D focused on existing plants include condition-based monitoring of coal-fired plants to actively monitor the condition of equipment to predict and prevent failures, maximizing availability, reliability, and generating capacity while saving cost. Other projects look to improve plant efficiency and flexibility of operations through improvements in combustion efficiency, emissions, component improvement, and extending boiler operations to lower loads.

The Advanced Combustion R&D area is developing chemical looping and pressurized oxy-combustion technologies that will enable combustion-based, coal-fueled power plants to capture carbon dioxide at higher efficiency and reduced cost compared to today's state-of-the-art post-combustion capture technologies.

