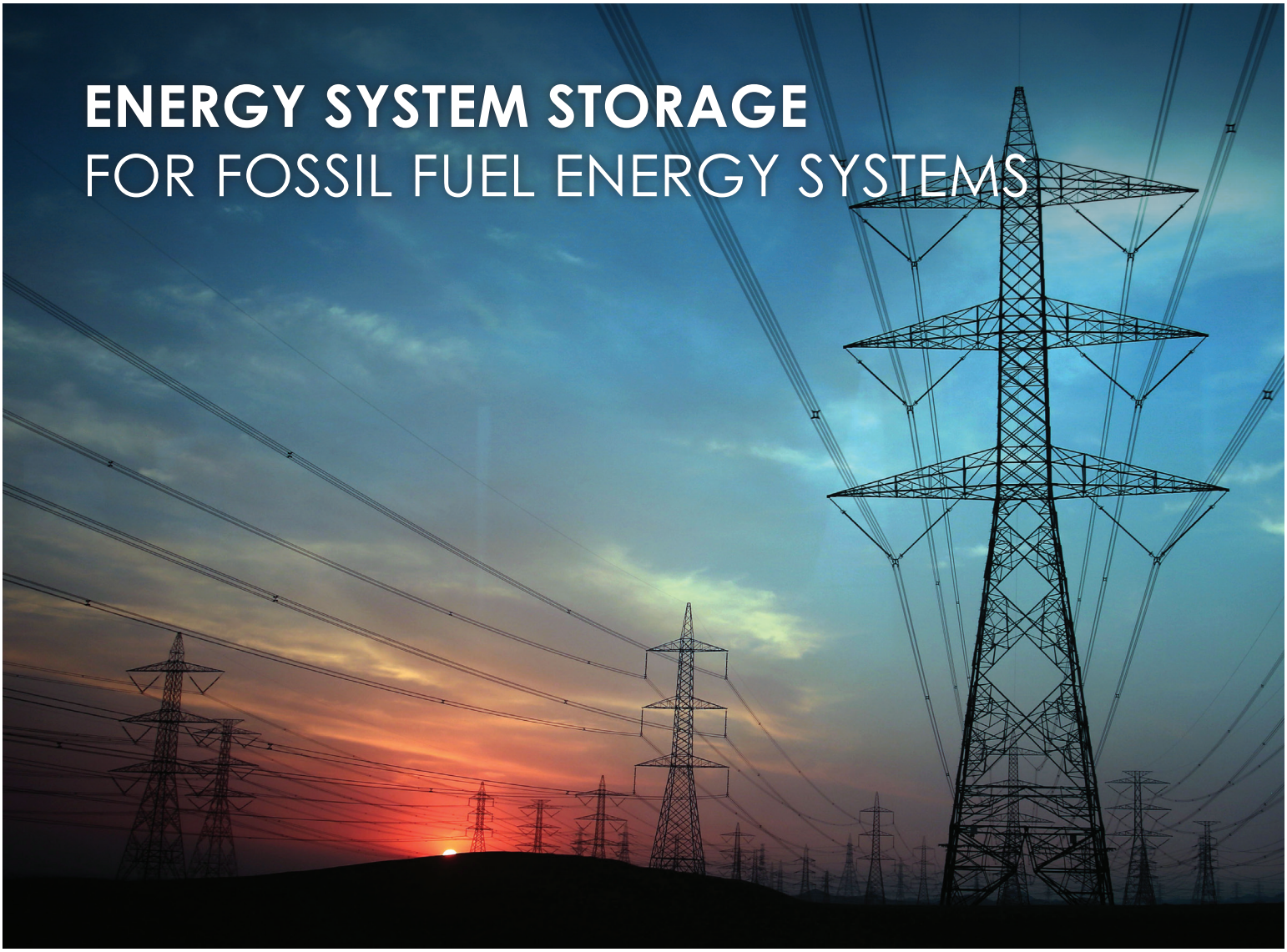
ENERGY SYSTEM STORAGE
FOR FOSSIL FUEL ENERGY SYSTEMS



NETL

NATIONAL ENERGY TECHNOLOGY LABORATORY

NETL will manage a new U.S. Department of Energy (DOE) program to accelerate the development of next-generation energy storage technologies to enhance the role of the nation's fossil fuel assets (both coal and natural gas) and ensure reliable supplies of affordable, clean energy.

As the lead research and development office for DOE's Office of Fossil Energy (FE), NETL is leading efforts to develop a comprehensive strategy to expand FE's current portfolio to include an FE Storage Technology Research Program.

This critical undertaking, announced in January 2020 by U.S. Energy Secretary Dan Brouillette as part of the Energy Storage Grand Challenge, is designed to position the nation for global leadership in energy storage technologies by the end of the decade. NETL will work with partners in private industry, operators of electricity generating stations and academia to develop a R&D roadmap to 2030 for a broad suite of storage technologies.

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NETL implements this effort as part of DOE's Crosscutting Research Program.

Program 154, January 2020

ENERGY SYSTEM STORAGE

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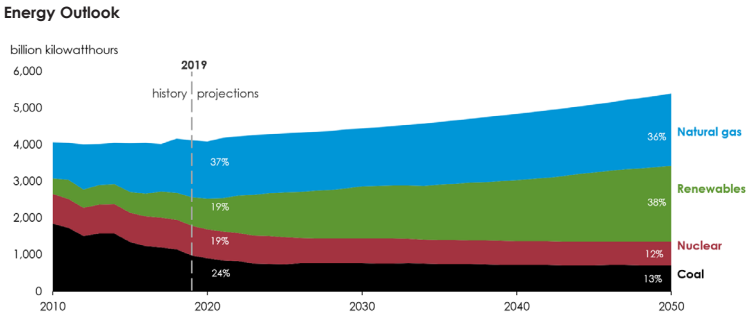
THE CURRENT ENERGY LANDSCAPE

As variable renewable energy penetration increases, energy storage at fossil fuel-based generation sites will be essential to enable the successful development of a resilient and flexible electricity network.

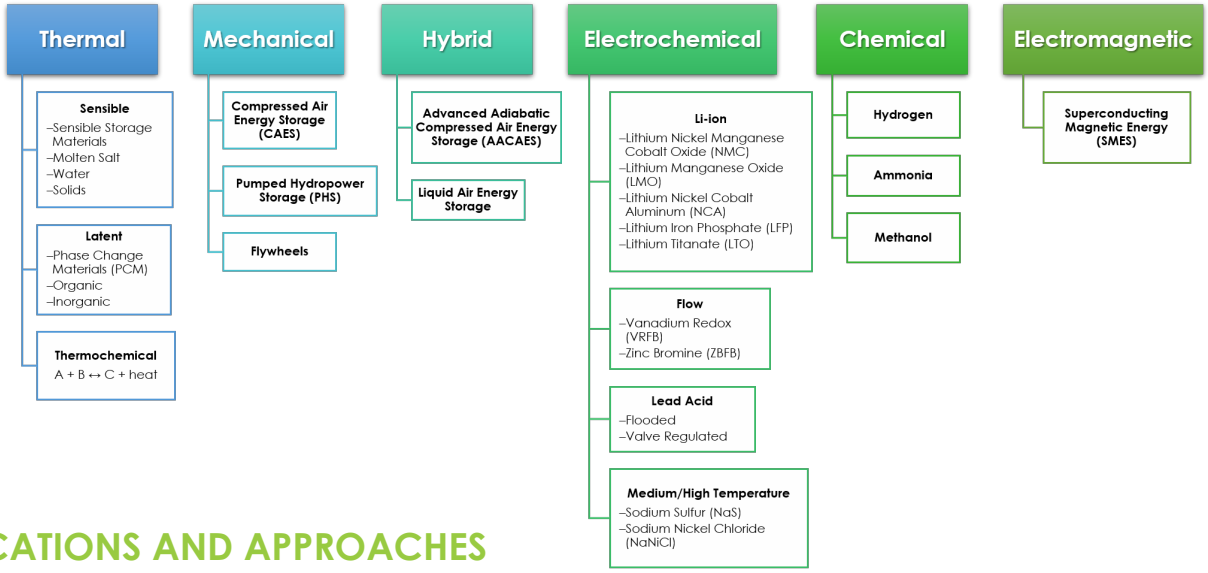
Today's fleet of existing coal-fired plants is operating at approximately 50% capacity. Energy storage provides the opportunity to take advantage of this underutilized capacity. Using energy storage, fossil-fueled plants can run at high efficiency and store power until it's needed by the grid.



NETL recognizes that the development of a robust energy storage system faces unique challenges. For instance, cost-competitive technologies are needed to store energy from power generation stations. Additionally, analytical tools or models to predict the economic and environmental impact of energy storage systems should be identified or developed. Finally, storage solutions should be integrated to serve the diversity of existing plants while enabling these plants to operate at maximum efficiency.

THE CASE FOR ADVANCING ENERGY STORAGE TECNOLOGY

The FE Storage Technology Research Program will focus on thermal, mechanical and chemical energy storage technologies that may be particularly suited to integration with fossil fuel assets. Coal-fired power plants are designed to generate power while operating at continuous maximum capacity and efficiency. However, with intermittent renewables on the energy grid, conventional coal-fired plants are required to operate at minimum loads for periods of times. Deviation from maximum efficiency increases fuel consumptions and emissions. Reduced turndown of fossil energy plants also causes extreme stress and wear to steam-raising equipment.



APPLICATIONS AND APPROACHES

NETL is leading the development of energy storage technologies and is currently supporting several initiatives to meet this goal. These include a project with the Electric Power Research Institute to design, construct and test a pilot-scale concrete thermal energy storage (CTES) system to demonstrate the energy storage potential of the technology when applied to coal-fired power units. The project aims to demonstrate that a CTES system can be integrated with a coal power plant to enable low-cost energy storage that will eliminate the needs for excessive operational flexibility and ultimately improve the profitability of the plant.

In another NETL-supported project, Lehigh University is developing a prototype of a solid media thermal energy storage concept for thermal management applications in coal-fired plants. The project will involve design, engineering, optimization and testing of the concept at laboratory- and prototype-scale at a coal-fired power plant.

Additionally, the West Virginia University Research Corporation will evaluate the transient response to various system concepts that minimize the levelized cost of electricity of thermal, chemical, mechanical, and electro-chemical storage technologies.

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