Energy &
Homeland Security
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GRID MODERNIZATION RESEARCH AT SANDIA: DEFENSE ENERGY

Sandia's world-class technologies, experience, software, and facilities provide support to military customers to address and solve national security energy needs.

SANDIA'S GRID MODERNIZATION PROGRAM VISION

The U.S. electricity grid is central to the nation's infrastructure, security, and economy. Modernizing this complex system of interconnected networks and enhancing its resiliency ensures seamless, efficient availability of low-cost, reliable, and secure electricity. Sandia National Laboratories supports this effort as a national research leader in cross-disciplinary fields including grid integration, cybersecurity, power electronics, microgrids, microsystems, materials science, energy storage, and transportation.

Sandia combines custom modeling, simulation, analysis, and optimization capabilities and tools to provide a unique value to U.S. defense agencies through world-class capabilities, innovative technologies, and proven experience. We focus on energy security challenges for military installations as well as equipment modernization, decision support analytics, and energy security analytics for the U.S. Department of Defense (DoD) and each of the military services: Army, Marine Corp, Navy, and Airforce. The U.S. Department of Energy (DOE), invests, collaborates, and leverages many of the analytic capabilities to address analogous energy security and resiliency challenges for other federal agencies as well as the commercial and civilian sectors.

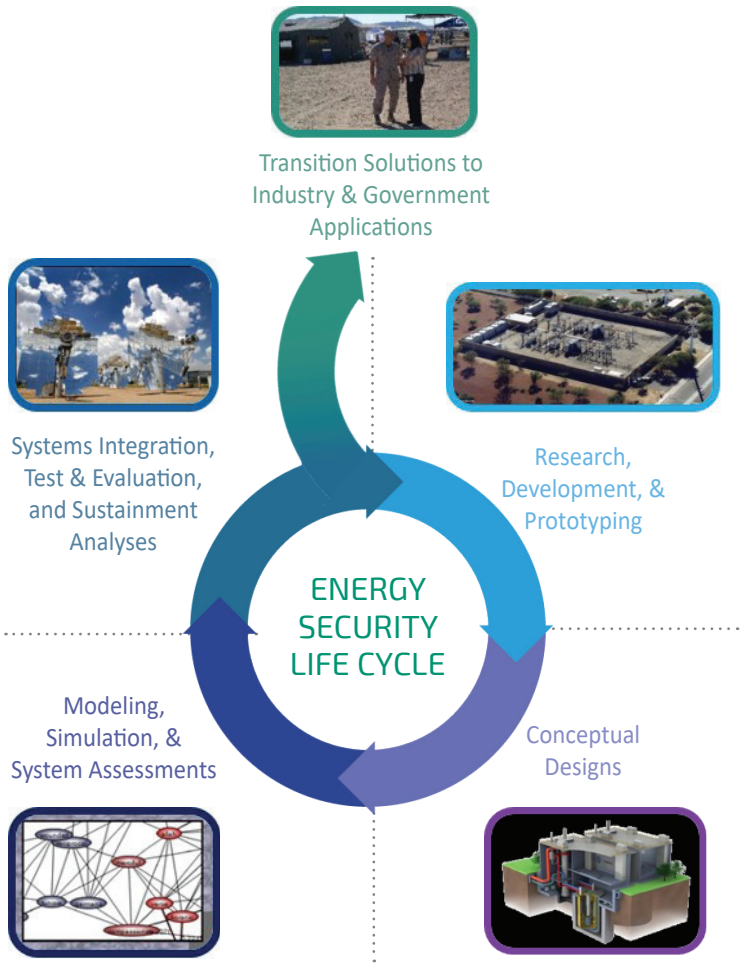
THE CHALLENGE

The DoD and DOE recognize the importance and critical role of energy as a mission enabler for their operations at home and abroad. Informed decisions that will guide research and development (R&D) investments for enhancing energy security and resiliency are the key to our future national security.

SANDIA'S SOLUTION

Sandia has the technology expertise and complex analytics to inform key decisions needed to achieve the greatest benefit for our nation's energy security and resiliency. Sandia is focused on providing DOE and DoD collaborative R&D to accelerate energy technology transition and commercialization, with the DoD and military services as early adopters for some of their highest priority needs, including:

- Cyber-Secure Resilient Microgrids
- Energy Harvesting
- Thermal Management



U.S. DEPARTMENT OF ENERGY | NNSA National Nuclear Security Administration

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Sandia National Laboratories

Sandia has the capabilities to address defense energy security challenges throughout the technology life cycle, beginning with research, development, and prototyping through the transition to industry and government.

RESEARCH AREAS

Energy Technologies

Sandia uses innovative energy technologies to provide energy solutions to our nation's defense agencies both at home and abroad, including advanced photovoltaics, concentrated solar power, innovative wind energy, water/wave energy, and advanced energy storage.

Bagram Airfield, Afghanistan

Unique Research, Development, Test and Evaluation Facilities

- **Distributed Energy Technologies Laboratory (DETL):** Conducts research with industry and academic partners to integrate emerging energy technologies into new and existing electricity infrastructures.
- **Photovoltaic Systems Engineering Laboratory (PSEL):** A multi-user, multi-sponsor facility that conducts research in PV cells, modules, and arrays and performs detailed, comprehensive analysis in PV systems design, optimization, and characterization in real-world scenarios. PSEL conducts research on behalf of DOE, DoD, and other customers, often in collaboration with industry/academic partners.
- **Supervisory Control & Data Acquisition (SCADA) Test Bed:** Combines state-of-the-art operational system testing facilities with research, development, and training to discover and address critical security vulnerabilities and threats to the energy sector.
- **Scaled Wind Farm Technology (SWiFT) Facility:** A unique facility that gives the U.S. an opportunity to address wind farm under performance, much of which can be attributed to turbine-to-turbine interaction.
- **Combustion Research Facility (CRF):** An internationally recognized DOE SC-sponsored collaborative research facility. CRF scientists, engineers, and technologists conduct basic and applied research aimed at improving our nation's ability to use and control combustion processes.

Advanced Modeling, Simulation, Analytic & Optimization Capabilities and Tools

- **Whole System Trade Analysis Tool:** Understanding trade-space across multiple dimensions.
- **Capability Portfolio Analysis Tool:** Optimal fleet-level management and investment.
- **System-of-Systems Analysis Toolset:** Analyzing integrated System of Systems mission scenarios.
- **Energy Surety Design Methodology:** Risk assessments for assessing energy security, reliability, safety, sustainability, and costs for military and civilian applications.
- **Microgrid Design Tool:** Multi-objective and multi-constraint optimization decision support.
- **Technology Management Optimization:** Planning and optimizing technology changes.

PARTNERS

Sandia utilizes a "best of breed" approach to bring our customers the most knowledgeable and capable team to address energy challenges. We partner with and support U.S. government agencies, other national laboratories, and commercial organizations. We leverage our internal capabilities from across the lab in critical infrastructure systems, system readiness and sustainment technologies, electrical science and experiments, technical analysis, geomechanics, and systems research to create a robust and complete team.

IMPACT

New analytics, metrics, and R&D labs and testbeds are being developed and used for supporting critical defense energy security assessments along with corresponding R&D and acquisition decisions. Through collaboration with DOE, DoD, and the military services, Sandia is addressing defense energy R&D strategies and capability needs. These capabilities and resources can then be leveraged to address our nation's energy security needs.

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