U.S. DEPARTMENT of ENERGY | Office of Electricity

U.S. DOE Efforts to Accelerate Grid Innovations to Impact

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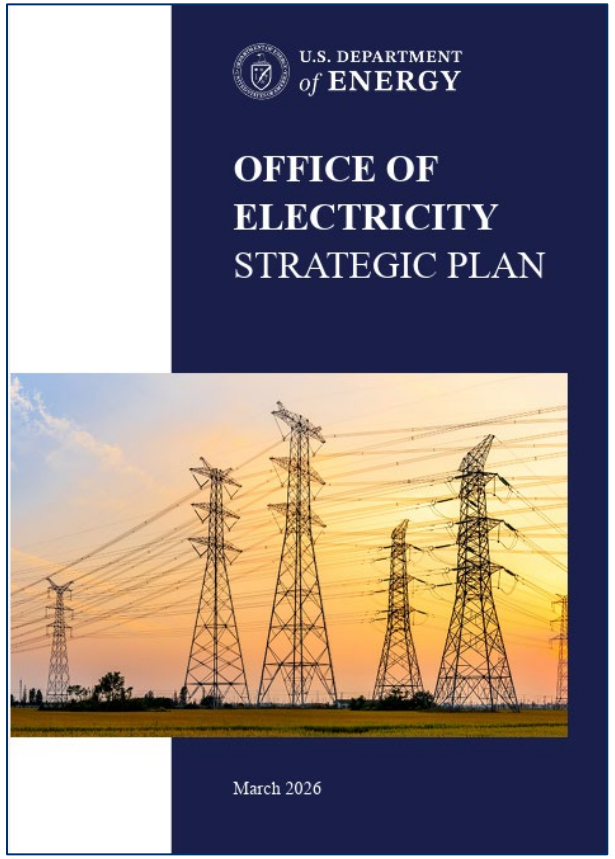
Office of Electricity

- **Mission:** To stabilize, optimize, and grow the electricity system to ensure the grid delivers affordable, reliable, and secure energy to the American people
- **Vision:** A seamless electricity system, capable of meeting all energy demands, powering the U.S. on a pathway of prosperity, national security, and energy dominance
- **Goals:**
  - Strengthen, enhance, and expand the electric system's capacity to reliably and affordably meet growing demand
  - Ensure reliability and security of the electricity grid under increasingly complex, dynamic conditions
  - Catalyze onshore production and availability of critical grid components, such as high-voltage transformers, large-scale energy storage, and grid power electronics to reduce reliance on foreign suppliers
  - Accelerate innovation through the leveraging of cutting-edge scientific initiatives



https://www.energy.gov/sites/default/files/2026-05/DOE-OE-Strategic-Plan-2026-05-21.pdf

Deployment Programs

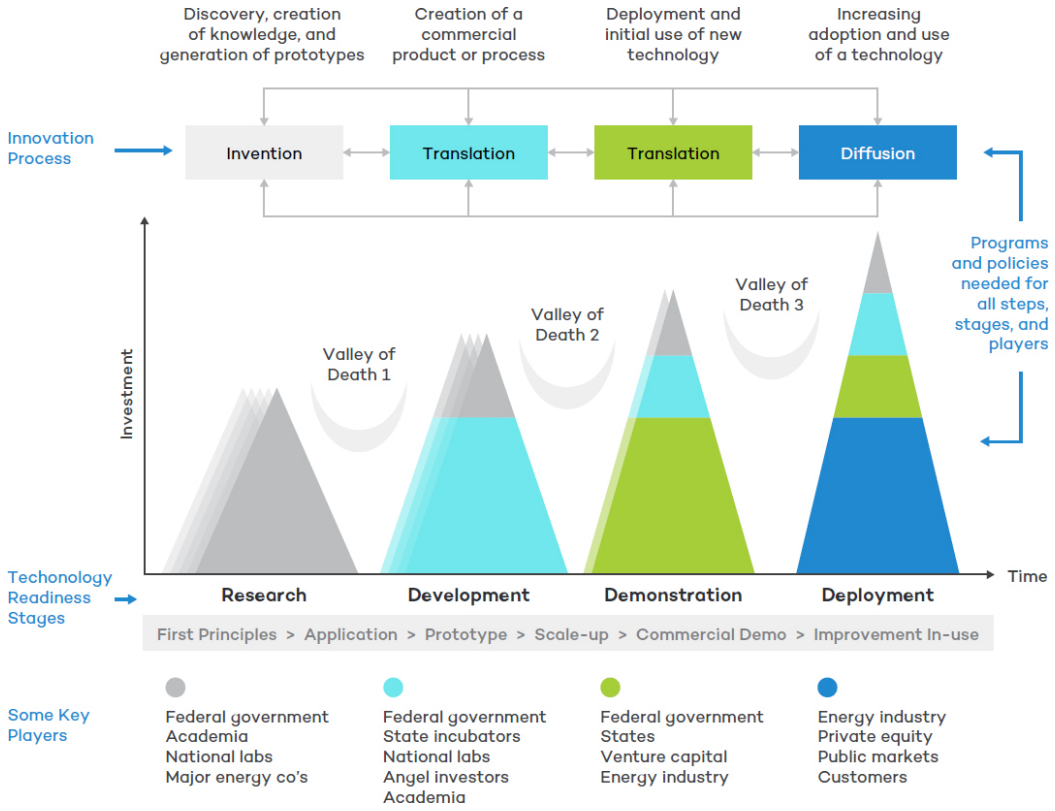
- Grid Resilience and Innovation Partnerships (GRIP) Programs
  - **Grid Resilience Utility and Industry Grants ($2.5 billion):** supports activities that will modernize the electric grid to reduce impacts due to extreme weather and natural disasters.
  - **Smart Grid Grants ($3 billion):** focuses on increasing capacity of the transmission system, preventing faults that may lead to wildfires or other system disturbances, integrating new generation at the transmission and distribution levels, and facilitating the integration of advanced transmission technologies and smart grid devices.
  - **Grid Innovation Program ($5 billion):** provides financial assistance to one or multiple states, Tribes, local governments, and public utility commissions to collaborate with electric sector owners and operators to deploy projects that use innovative approaches to transmission, storage, and distribution infrastructure.
- Speed to Power through Accelerated Reconductoring and other Key Advanced Transmission Technology Upgrades (SPARK) NOFO (~$1.9 billion)
  - Successful applications will highlight how reconductoring and other Key Advanced Transmission Technologies (ATTs), as complementary technologies, expand the ability to transfer power between regions of the country, strengthen reliability and resource adequacy, and reduce consumer cost impact while utilizing existing rights of way.

Applied Grid Transformation Solutions (AGTS) Program

Challenge: The speed and diversity of technological innovations integrating into a complex system with risk-adverse institutions slows grid transformation.

Mission: Accelerating grid innovations to impact.

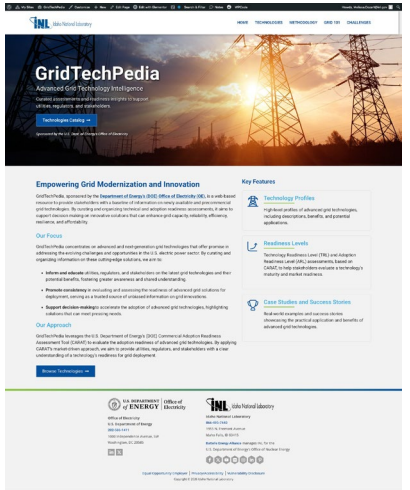
- Transformation Toolkit
  - Develop tools, resources, and programs to empower grid stakeholders with actionable information.
- Testbed Network
  - Identify and assemble grid testbed facilities, capabilities, and resources across the U.S. to test, stress test, validate, and evaluate advanced grid technologies.
- Strategic Pilots and Evaluation
  - Assess pilot demonstrations that fill strategic knowledge gaps, integrate innovations into operational environments, and systematically document project results to inform scaling, replication, and/or extension.

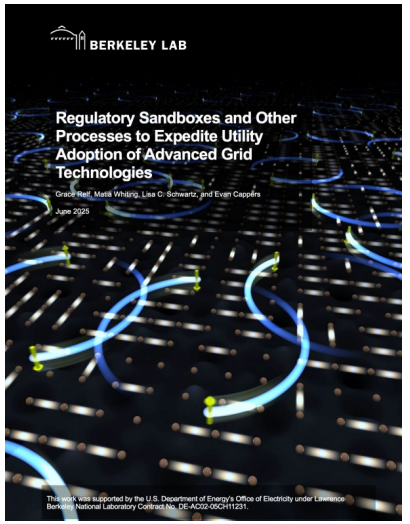


Effective, Efficient, and Informed Research, Development, and Demonstration for the Electricity System: Issue Paper | The National Academies Press

Transformation Toolkit

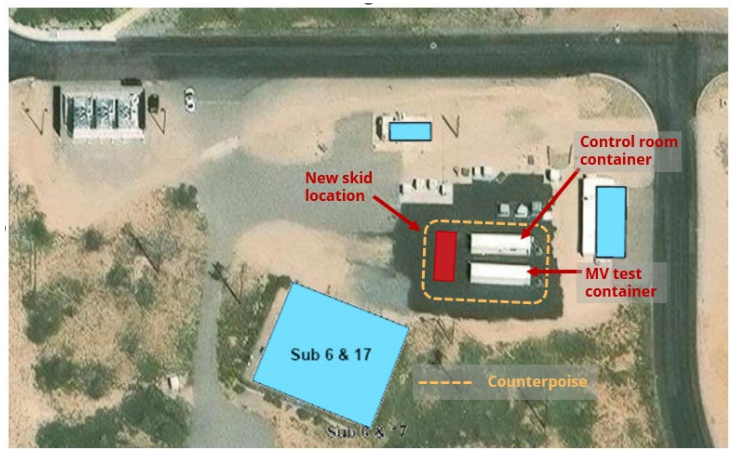
- Information and Decision Support
  - Reconductoring Economic Financial Analysis (REFA) Tool
    - Supports evaluation of options for transmission capacity upgrades and understanding of costs and benefits of conductor selection in each application.
    - Free online tool and underlying code has been made open-source.
  - GridTechPedia (GTP)
    - Web-based resource to provide stakeholders with a baseline of information on newly available and precommercial grid technologies.
- Industry Insights
  - ESIG Advanced Grid Solutions User Group
- Ecosystem Innovation
  - Regulatory Sandbox Report and Navigator
    - Supports mechanisms that provide a structured environment for testing new technologies and business approaches under modified rules to increase speed of adoption.

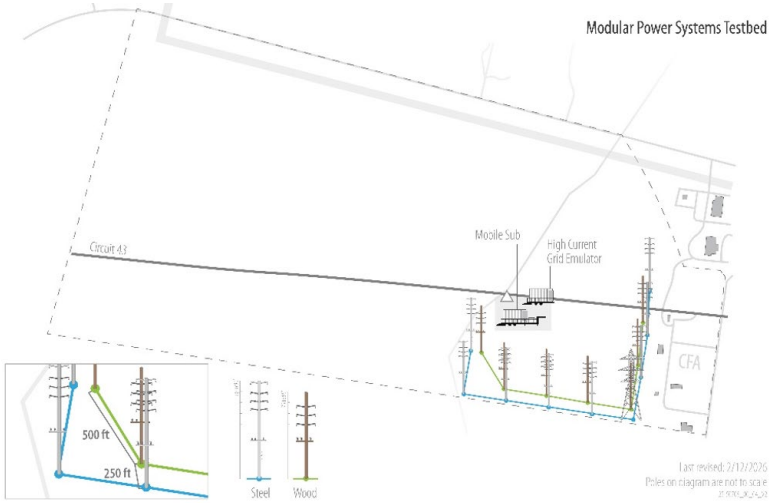




Testbed Network

- Federated Connectivity
  - U.S. Electric Grid Test Bed Inventory – 52 facilities to-date
  - SuperLab 2.0 Demonstration – emulated a notional 500-MW power system with assets integrated across 5 DOE national labs (NLR, INL, LBNL, SNL, NETL)
  - Control Room of the Future Testbed (CROFT) Scoping
- Testbed Enhancements
  - SNL – MV Fault Robustness Evaluation (30kA @ 480V; 10kA @ 10kV)
  - INL – Modular Power System Testbed (Poles)
- Advanced Technology Testing
  - Advanced Conductor Testing – INL, NEETRAC, EPRI
  - Grid Innovations Facility and Testing Voucher Opportunity (VO-12)



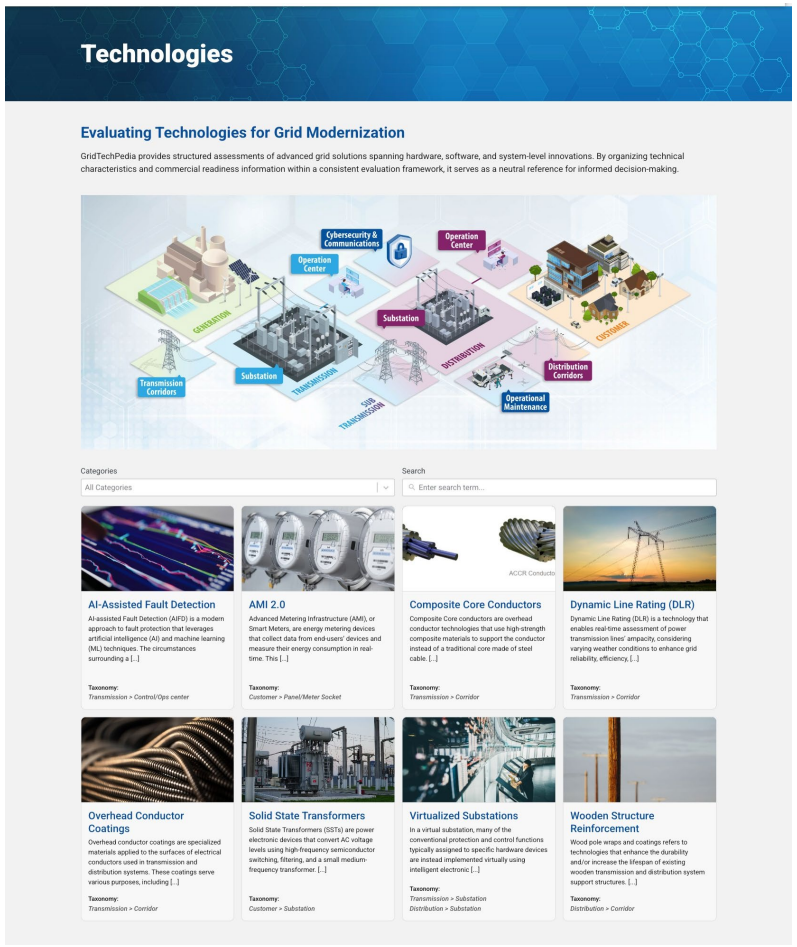


Strategic Pilots and Evaluation

- Grid Architecture and Evaluation
  - Grid Architecture Mapping to Understand Transformation (GAMUT) Tool
    - “Turbo Tax” leveraging grid architecture to develop “cliff notes” for pilot demonstration projects
- Technology Integration and Demonstration
  - Grid Enhancing Technologies (GETs) FOA (4 projects)
  - Flexible Innovative Transformer Technologies (FITT) FOA (8 projects)
- Systems Capability Development and Demonstration
  - Real Time Grid Emulation and Advanced Research (RT-GEAR) Testbed (ORNL)
    - Scalable, interoperable HIL testbed architecture to understand multiple power electronic interactions
  - StableGrid Platform (NLR)
    - Leveraging ARIES infrastructure, testbed enhancements enable study of wide area controls and grid stability with more grid power electronics including large digital loads and the impact of communication delays

Project Highlight: GridTechPedia

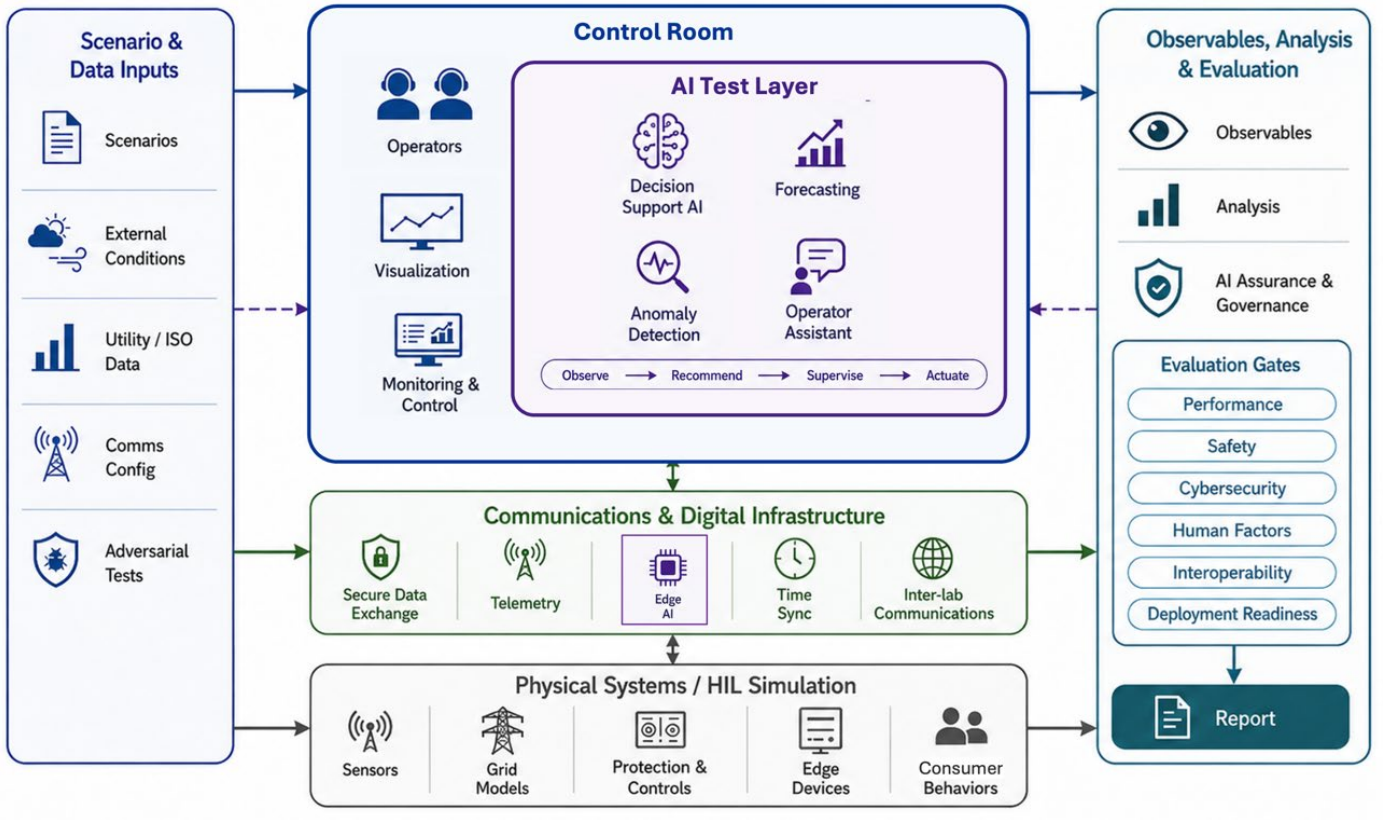
- Curating and organizing technical and adoption readiness assessments support decision making on innovative solutions.
- Leverages DOE's Commercial Adoption Readiness Assessment Tool (CARAT) to evaluate adoption readiness
  - Value Proposition
  - Market Acceptance
  - Resource Maturity
  - License to Operate
- Tech pages include case studies and implementations as references



- AI-Assisted Fault Detection
- AMI 2.0
- Composite Core Conductors
- DC Microgrids
- Dynamic Line Rating
- Grid-forming Inverters
- High Temperature Superconductors
- Overhead Conductor Coatings
- Overhead Conductor Wraps
- Solid State Transformers
- Tower Raisers
- Transmission Topology Optimization
- Virtualized Substations
- Wooden Structure Reinforcement

Project Highlight: Control Room of the Future Testbed

- Conclusions from engagements:
  - **Holistic Modernization:** Control room evolution is a systems-level transformation, not a simple software upgrade, requiring coordinated alignment across technology, workforce capability, regulation, and culture.
  - **Human-Centered AI Integration:** While AI is essential to manage growing grid complexity, widespread adoption depends on human-in-the-loop implementation and rigorous validation frameworks that build operator trust.
- Next steps:
  - Document functional requirements, conduct lab capabilities assessment, and identify gaps



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