



Pathway to Commercial Lifftoff

Regional electricity demand is growing substantially for the first time in decades due to broader end-use electrification and the rapid expansion of data centers and manufacturing. However, the grid increasingly serves as a bottleneck to this economic development, as well as to advances in decarbonization and progress toward an equitable energy transition.

Deploying advanced grid solutions could better enable the existing grid to accommodate these transformations in the short-term by increasing its effective capacity while also enhancing reliability, resilience, and affordability.

National transmission and distribution systems are utilized on average at only 40-50% of their total capacity. This latent capacity could be unlocked via a set of technologies that are commercially available today but under-deployed relative to their potential value. These solutions can bridge the gap to address near-term capacity needs as new transmission and other grid infrastructure is built out over time. Immediately deployable options include advanced transmission technologies that expand firm line capacity (e.g., advanced conductors), situational awareness and system automation solutions that improve visibility and decision-making (e.g., Advanced Distribution Management Systems (ADMS), Fault Location, Isolation, and Service Restoration (FLISR)), grid-enhancing technologies that improve system utilization and performance (e.g., dynamic line ratings (DLR), topology optimization, advanced power flow control), and the foundational systems necessary to enable these advanced technologies (e.g., communications infrastructure, data management systems).

The majority of these solutions can be deployed within one to three years at lower cost, greater value, or both compared to conventional technologies. For example, DLR has been deployed within 1-3 years and increases effective transmission capacity by an average of 10-30% at less than 5% of the cost of rebuilding the line.

At least 91 GW of peak demand growth is expected within the next decade. These advanced grid solutions, if deployed to their full potential, could increase the effective capacity of the existing grid to support 20-100 GW of incremental peak demand when installed individually. Significant additional capacity potential is possible when installed in strategic combination. Lifftoff will be achieved when these solutions become part of utilities' and regulators' core planning and operational toolkit and are fairly considered alongside conventional options used today. Lifftoff can be achieved within 3-5 years by executing 6-12 large-scale deployments across diverse utility contexts for each advanced grid technology while pursuing four priorities: 1) building and sharing technology deployment outcomes, 2) developing execution know-how, 3) refining planning approaches, and 4) aligning economic models and incentives.

Market Status

Metric	Value	2030 Target
Total Annual IOU Investment in Advanced Grid Solutions ¹ Source: EEI 2023	\$5.8B	-
Number of States with Grid Modernization Requirements ² Source: LBNL 2024	20	All 50 states and territories

1. Investor-owned utility (IOU) investment tracked as proxy for total industry investment 2. Or equivalent distribution, integrated grid, or transmission and distribution improvement plan

Possible Near-term Actions

Stakeholders	Potential Priority Actions to Pursue Today
Grid Operators & Utilities	<ul style="list-style-type: none"> Deploy "no regrets" solutions to address grid hotspots and support lifftoff Transparently share deployment outcomes and best practices Develop grid modernization strategies using emerging best practices
Regulators & Governance Boards	<ul style="list-style-type: none"> Update grid modernization strategy & planning process requirements to adopt best practices Require consideration of advanced grid solutions in current planning and investment processes Align utility incentive structures with the value of advanced grid solutions Develop efficient cost recovery mechanisms
State & Federal Policymakers	<ul style="list-style-type: none"> Collaborate with regulators to ensure advanced grid solutions are considered in current processes Establish clear policy goals to inform grid investments at the state level Coordinate multi-stakeholder grid modernization collaborations
Solution Providers	<ul style="list-style-type: none"> Proactively articulate and value technology benefits Share performance risk for proven but sub-scale solutions Integrate advanced grid solutions into core services