# Designing and Deploying the Modern Grid of the Future

*Challenges & Solutions*

# Executive Summary

The global energy landscape is undergoing a seismic transformation, driven by a convergence of national security needs, climate goals, evolving technology, and community resilience demands. Microgrids are rapidly emerging as foundational building blocks for the grid of the future—localized, intelligent, and adaptive systems capable of operating independently or in concert with the broader grid.

This report distills insights leaders shared with ASI across government, utilities, and commercial innovators to present a comprehensive picture of how modern grid systems are being designed, funded, and deployed across military, industrial, and community settings. It identifies common barriers, commercial opportunities, and technological advancements that are enabling scalable, resilient energy infrastructure.

## Challenge 1: Legacy Infrastructure and High-Risk Vulnerabilities

The Problem: Much of today's grid was built for a one-way flow of electricity. It is brittle in the face of cyber threats, weather disruptions, and rising demand. Military installations and critical facilities are particularly vulnerable to High-Impact, Low-Probability (HILP) events.

### Commercial Solutions:

- Modernize grid architecture with modular microgrid building blocks.
- Prioritize cyber-secure microgrids with layered protection and rapid isolation.
- Integrate SCADA, real-time analytics, and predictive maintenance tools.
- Leverage Energy Savings Performance Contracts (ESPCs), Utility Energy Service Contracts (UESCs), and third-party financing for rapid deployment.

Key Insight: Redundancy, diversity of energy sources, and advanced controls significantly improve resilience. Tools like XENDEE and RAVENS enable stakeholders to model lifecycle cost and resilience outcomes before construction.

## Challenge 2: Scaling Resilience in Remote, Harsh, and High-Stakes Locations

The Problem: Bases in the Arctic, Pacific islands, or OCONUS environments face extreme logistics, fuel costs, and grid instability. These locations cannot afford energy failure.

### Commercial Solutions:

- Design hybrid microgrids with renewables (solar, wind, landfill gas), battery storage, and minimal diesel backup.
- Introduce immersion-cooled BESS systems to mitigate fire risk and maximize uptime.
- Deploy modular nuclear microreactors, geothermal systems, and containerized solutions.
- Build multi-node, networked microgrids that island and self-heal as needed.

Key Insight: Systems like those at Camp Lejeune, MCAS Miramar, and Fort Eustis demonstrate the power of DER integration, smart controls, and pre-tested operational models to achieve 14+ days of off-grid capability.

## Challenge 3: Bridging Regulatory, Financing, and Deployment Barriers

The Problem: Despite strong demand, project timelines are hampered by utility coordination, permitting delays, and jurisdictional complexity. Non-standard systems increase risk and cost.

### Commercial Solutions:

- Standardize microgrid architectures and accelerate permitting through early utility engagement.
- Promote Commercial Solutions Openings (CSO) and Other Transaction Authorities (OTAs) to bring non-traditional vendors into the fold.
- Expand access to DOE programs like C-MAP, ETIPP, and Clean Energy to Communities (C2C).
- Offer fully self-performed EPC and owner's engineering services to reduce points of failure.

Key Insight: Programs led by DIU, DOE, and DLA Energy are reshaping procurement, testing, and rollout frameworks to favor speed, scalability, and proven commercial innovation.
hybridized energy portfolios with storage, controls, and advanced analytics achieve the highest resilience at lowest long-term cost.

## Challenge 4: Aligning Resilience, Carbon Reduction, and Cost Objectives.

The Problem: Projects that maximize carbon reduction don't always align with reliability or ROI. Stakeholders must navigate trade-offs.

### Commercial Solutions:

- Co-optimize systems using advanced tools like REopt, MG-RAVENS, and LCOED models.
- Use demand response and virtual power plant platforms (e.g., CPower) to monetize flexibility.
- Prioritize resilient systems with lifecycle value—not just initial cost metrics.
- Design for value stacking: grid support, emissions reduction, and operational continuity.

Key Insight: As demonstrated at San Nicolas Island and other Navy and Air Force installations, hybridized energy portfolios with storage, controls, and advanced analytics achieve the highest resilience at lowest long-term cost.

## Conclusion: The Grid of the Future is Being Built Now

Microgrids are no longer pilots or science experiments—they are fully funded infrastructure tools supporting national defense, energy justice, and commercial resilience. As capital flows into decarbonization and grid modernization, developers and technology providers that offer flexible, cyber-secure, and replicable microgrid solutions will lead the transformation.

Success depends on public-private collaboration, standardized design frameworks, and innovative funding pathways. From high-density urban campuses to remote island bases, the future grid is distributed, intelligent, and built for mission continuity.

To lead in this market, organizations must be ready to deliver at scale, navigate complexity, and continuously adapt to the fast-evolving needs of energy consumers and operators alike.

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