Creating the Modern Grid

Launching a National Effort to Accelerate Grid Modernization

Steve Bossart
Director, Intergovernmental Programs Division

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National Energy Technology Laboratory

The Challenge

Today

An electric grid facing shortcomings in capacity, reliability, security and power quality, costing the U.S. tens of billions of dollars each year and jeopardizing national security.

To Get There

The proposed program will significantly accelerate grid modernization by developing and demonstrating key technologies and processes through a 5-year, $200M federal and industry partnership.

Tomorrow

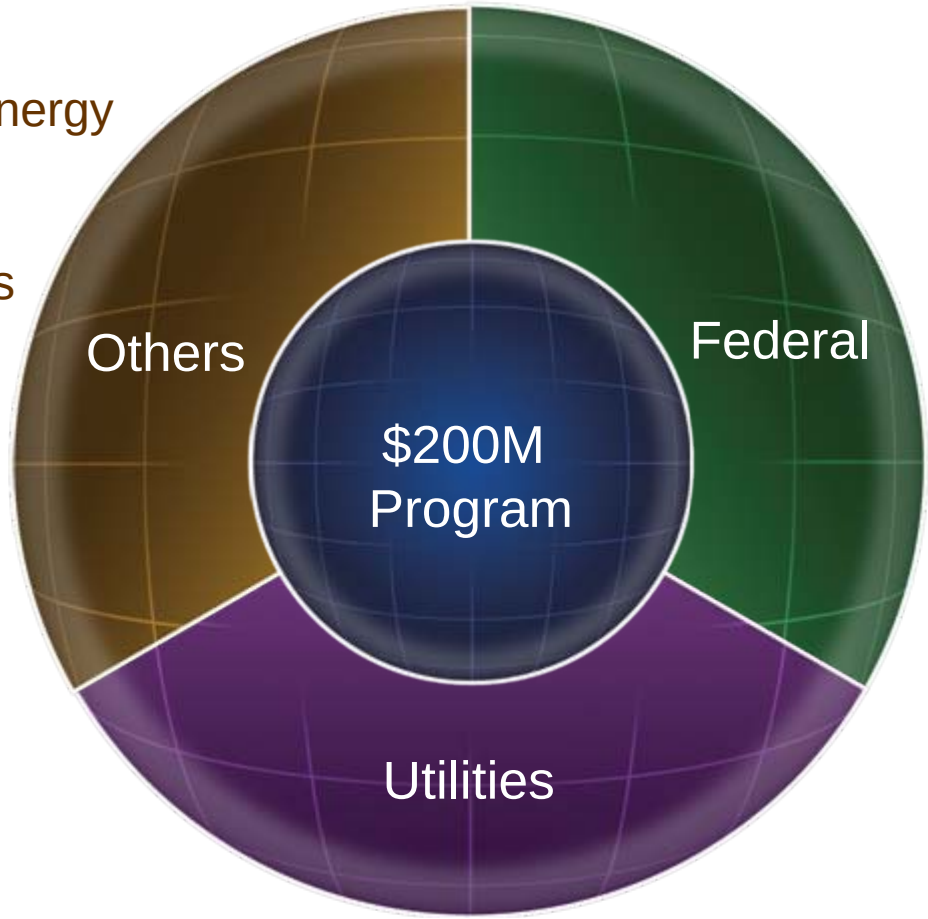
A modernized grid that will meet the increasingly sophisticated demands of today's businesses and consumers with greater security, fewer disruptions, and faster recovery and a growing economy.

Vision

Revolutionize the electric system by integrating 21st century technology to achieve seamless generation, delivery, and end-use that benefits the nation.

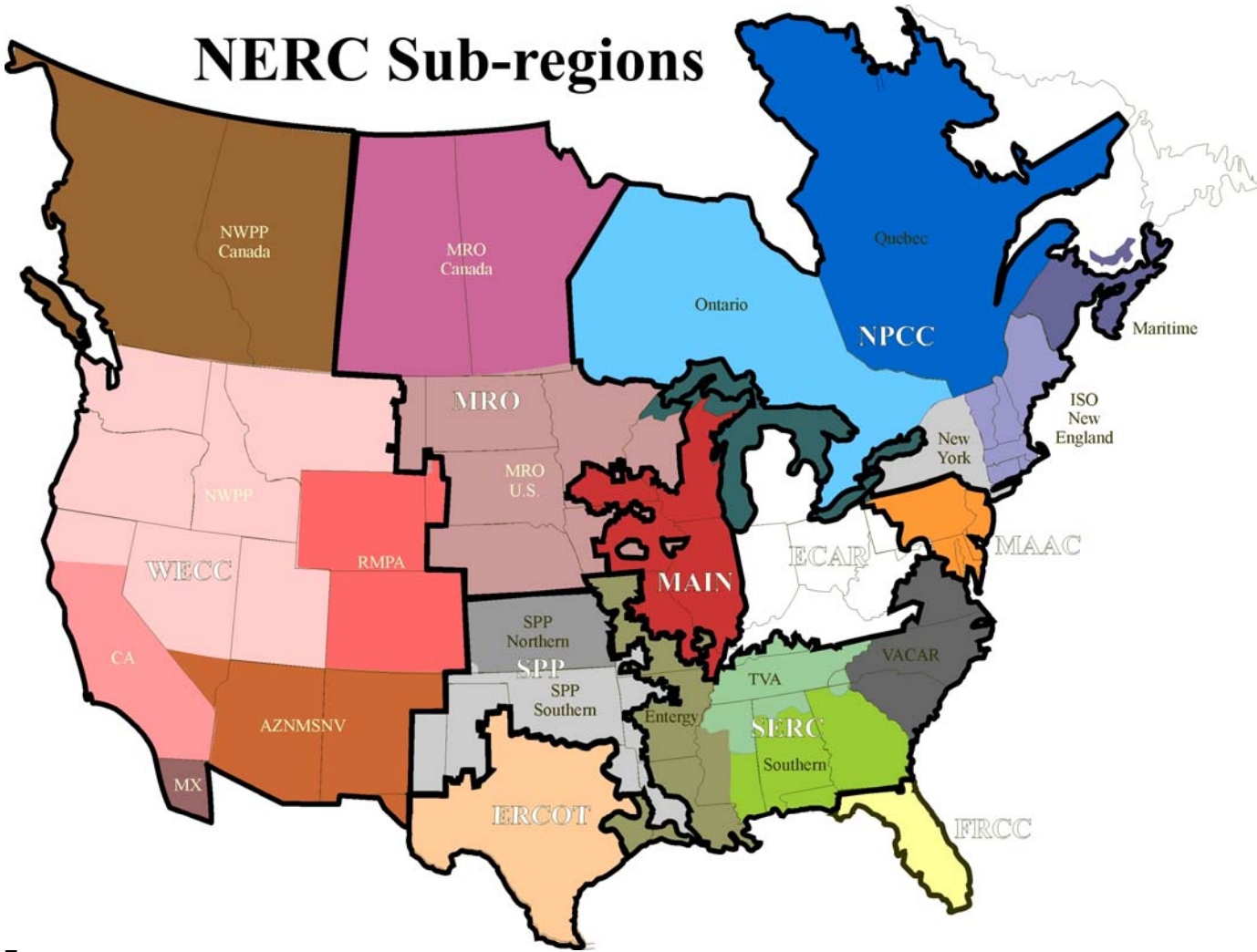
A Federal and Industry Partnership

- RTO's
- State Energy Offices
- EPRI
- Vendors

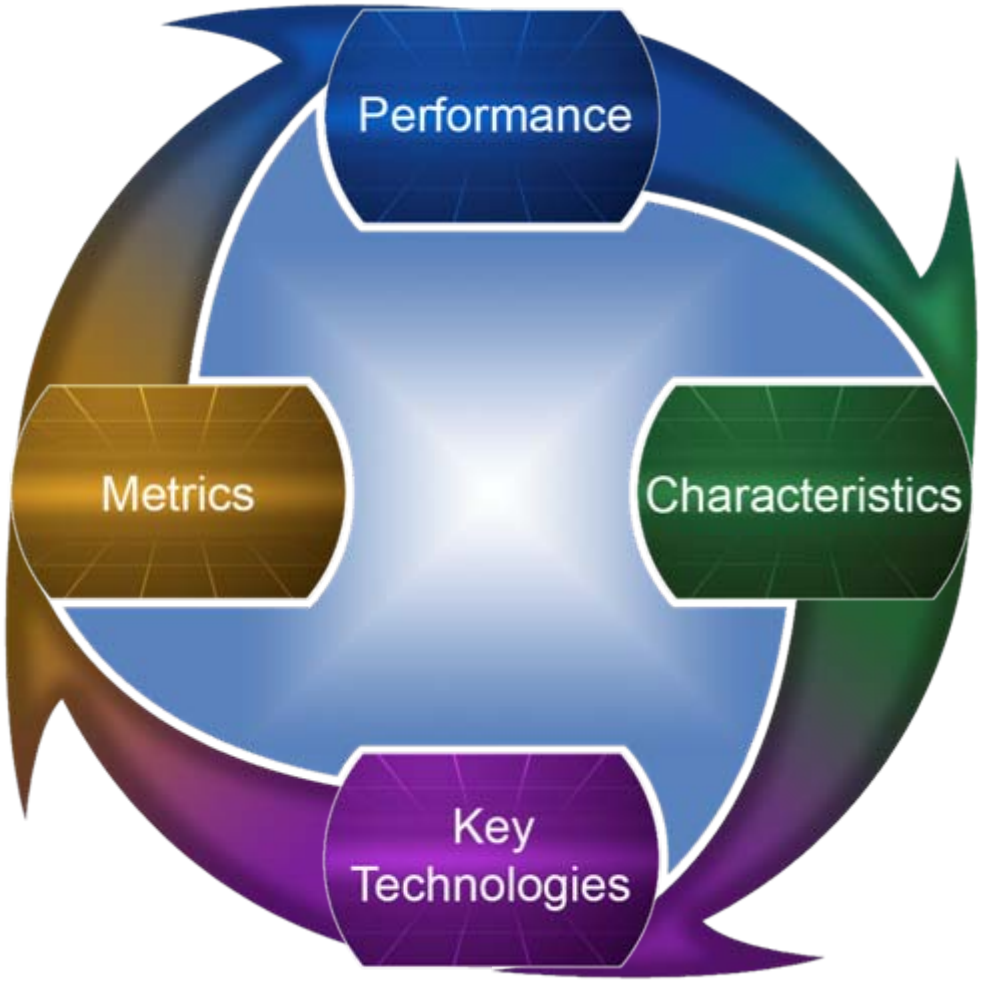


Modern Grid Stakeholders

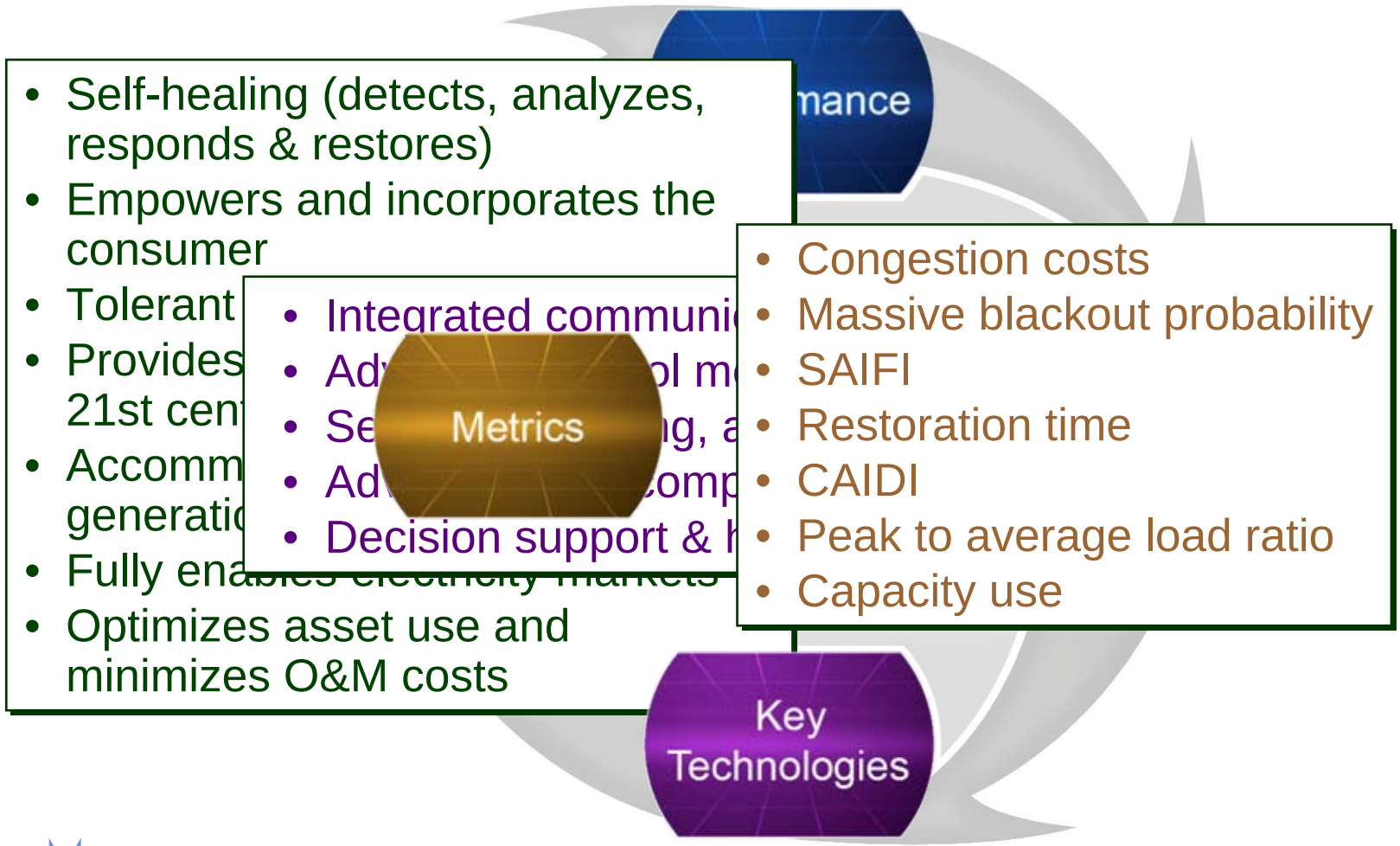
Notional Regional Demonstration Concept



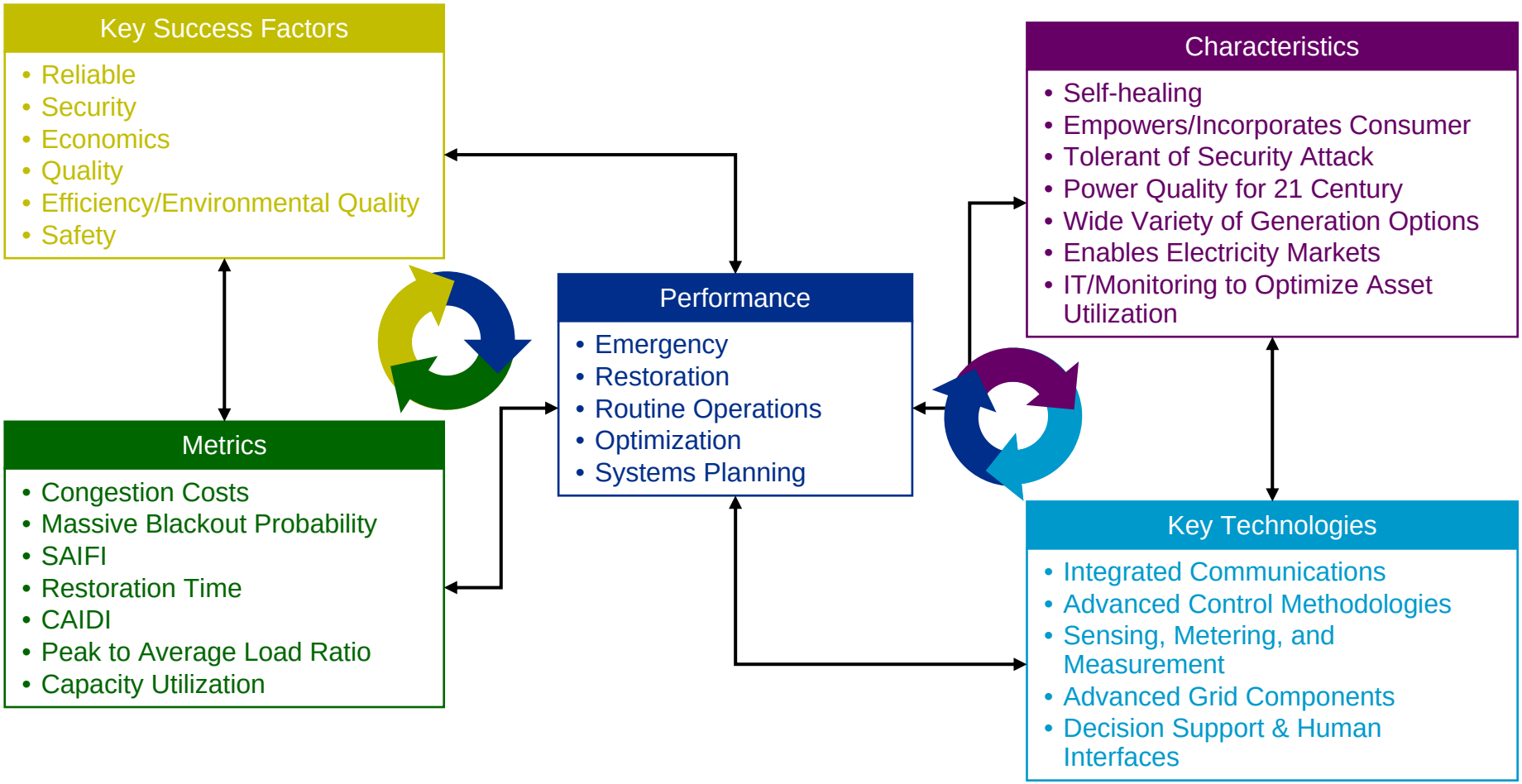
Tomorrow's Modern Grid



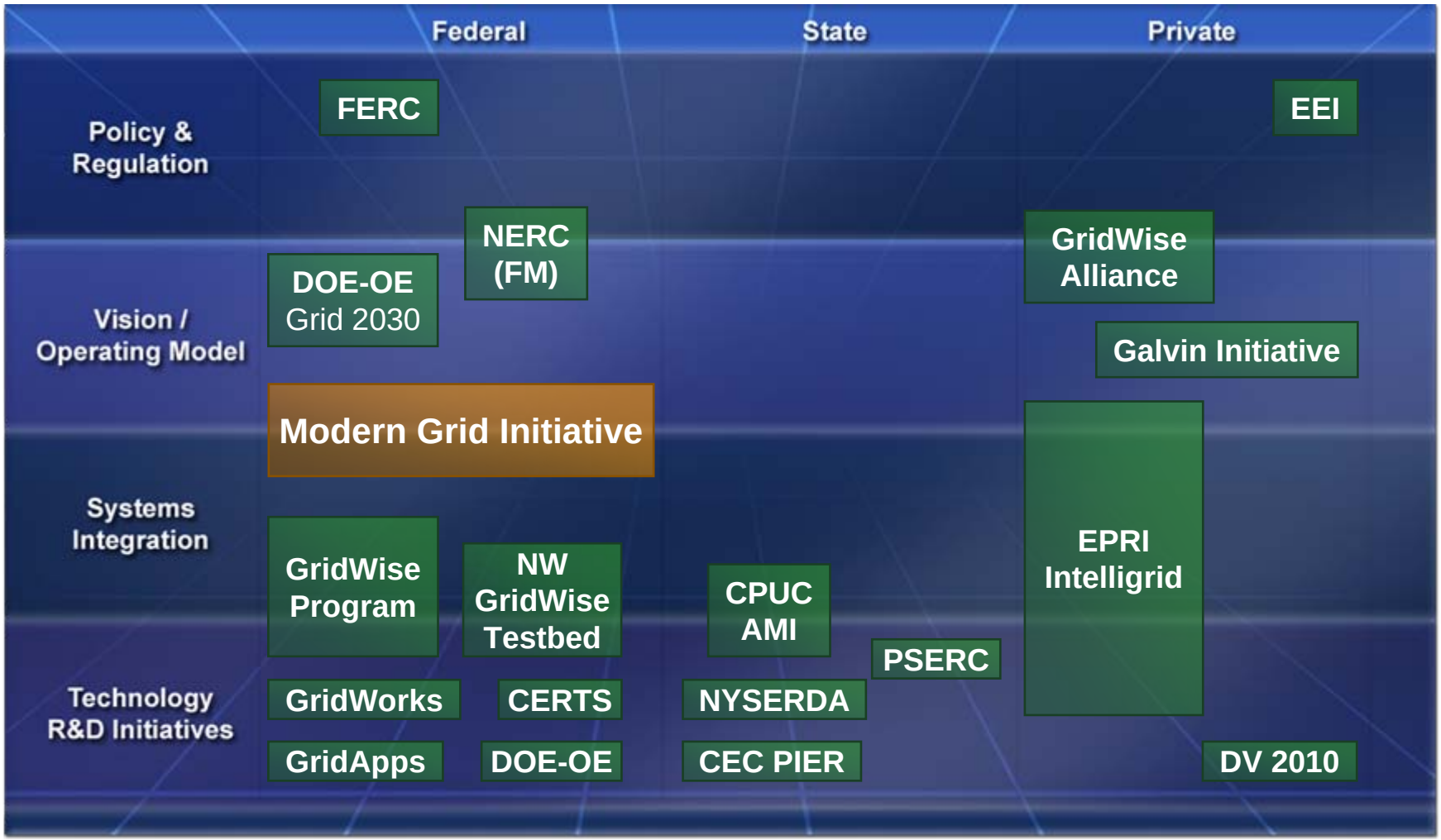
Tomorrow's Modern Grid



A Systems View of the Modern Grid



Developers of the Modern Grid



Principal Characteristics

- **Self-Healing:** The modern grid will perform continuous, on-line assessments of the state of the T&D grid, detect existing and emerging problems, predict future problems and initiate instantaneous response to prevent, mitigate, and restore from undesirable consequences.

- **Empowers and Incorporates the Consumer:** The modern grid will integrate the consumer as an integral element of the electric system, primarily through the use of price signals to influence consumption patterns and self-generation behavior; consumer loads will become intelligent elements of the grid, responding to electrical conditions in a synergistic manner.

Principal Characteristics

- **Tolerant of Security Attack:** The modern grid will demonstrate resilience to attacks by determined, well-equipped individuals and groups. The design and operation of the grid will minimize consequences of attacks and improve the capability to restore service.

- **Provides Power Quality for the 21st Century:** The modern grid will provide the quality of power needed by each consumer, as determined by jointly-developed industry standards. Since perfect power quality is not obtainable, these standards will balance load sensitivity and delivered PQ requirements to achieve an acceptable technical and economic result. Utility investments in PQ will be recovered in rates.

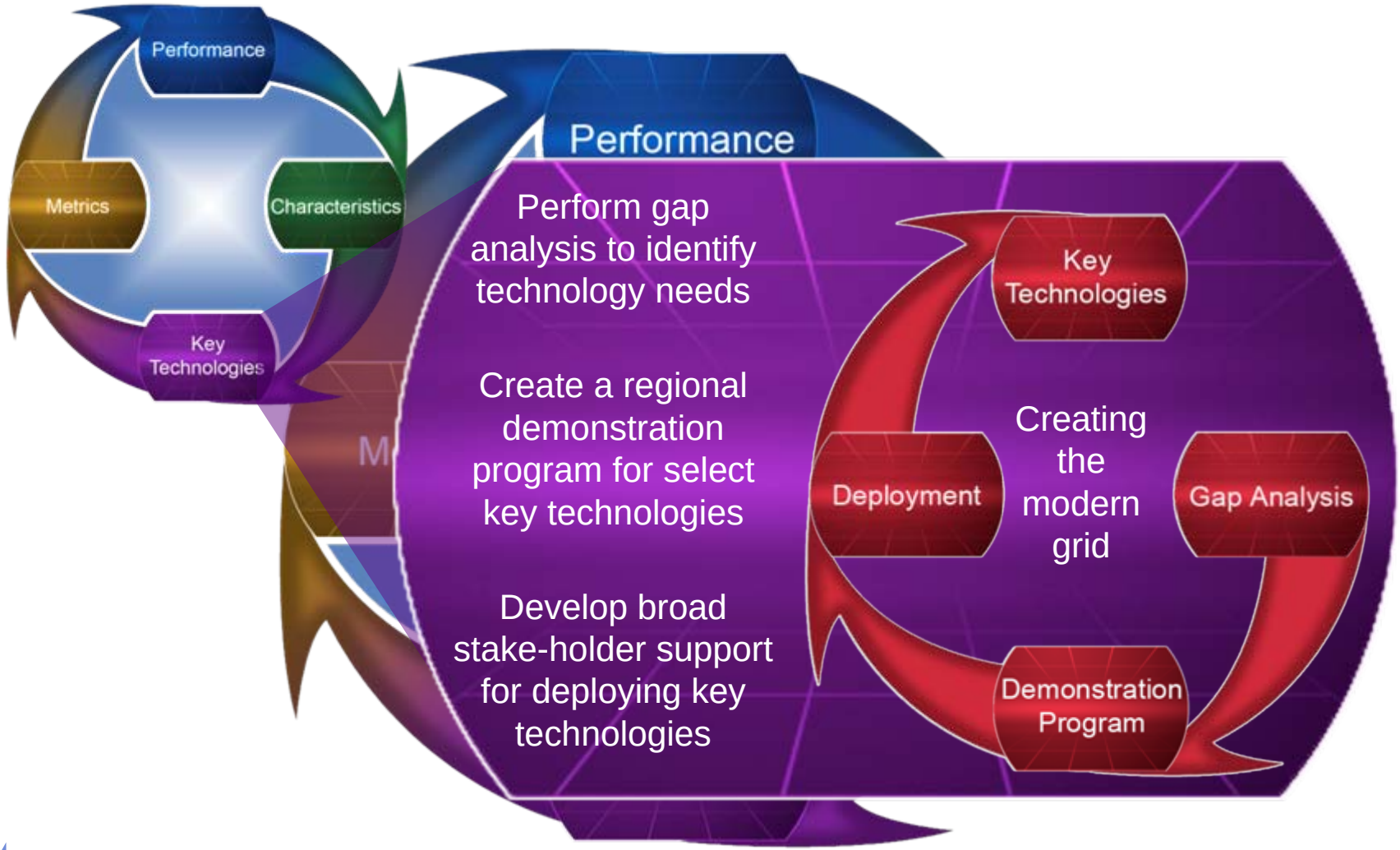
Principal Characteristics

- **Accommodates a Wide Variety of Generation Options:** The modern grid will enable and encourage a substantial increase in investment of new energy sources, types and configurations, including substantial consumer involvement, in collaboration with system stakeholders.

- **Fully Enables Electricity Markets:** Weave electricity markets into the fabric of the electrical system because operations, planning, pricing, and reliability are dependent upon how regulated and competitive markets are designed and instituted.

- **Optimizes Asset Utilization:** The modern grid will integrate real-time data with T&D operational algorithms to improve decision making and with asset management processes to optimize the use of assets from both a capacity and condition perspective.

Integrating Key Technologies



Key Technology Areas

- **Advanced Grid Components:** The next generation of infrastructure elements will exploit new or improved materials, advanced digital hardware and software, and other emerging technologies that will allow higher power densities, better reliability and power quality, reduced environmental impact and improved system diagnostics. Such technologies include superconducting transmission cable, fault current limiters, composite conductors, FACTS, advanced energy storage, improved wind and solar generation, distributed generation, advanced transformers and circuit breakers, super computers and broadband communications, power electronics and smart loads.

Key Technology Areas

- **Sensing, Metering, & Measurement:** New metering technologies with two-way communications for pricing signals, time of day tariff, RTO curtailments for congestion relief, real time consumption data, PQ, and other electric parameters. This includes the ability to remotely connect / disconnect loads, interface with generators, grid operators, and customer portals to enhance power measurement, provide outage detection and response, provide energy theft protection, as well as enable consumer choice, demand-side management, price mitigation, and reserve satisfaction. Advanced sensing and measurement technologies are needed to assess the condition of grid elements, capacity, failure probability, sag, EMI, etc to reveal previously hidden weaknesses.

Key Technology Areas

- **Communications Integrated Across T&D:** An effective, fully-integrated communications infrastructure is an essential component of the modern grid enabling it to become a dynamic, interactive "mega-infrastructure" for real-time information and power exchange.

- **Advanced Control Methodologies:** Computer based algorithms that collect data from and monitor all essential grid components, analyze the data to diagnose and provide solutions from both deterministic and predictive perspectives, determine and take appropriate actions autonomously, provide information and solutions to human operators, and integrate the data with enterprise wide processes and technologies

Key Technology Areas

- **Decision Support & Human Interfaces:** With the time horizon for operator decisions having moved to seconds, the Modern Grid requires the wide, seamless, real-time use of applications and tools that transform the grid operator and manager into knowledge workers. This includes the role of AI to support manpower, operator decision support (alerting tools, what if tools, course of action tools, etc), semi-autonomous agent software, visualization tools and systems, performance dashboards, advanced control room design, and real-time dynamic simulator training.

Achieving Program Benefits

- Higher initial costs
- Business focused on short term
- Inadequate performance standards
- No security standards

Provide data and analysis to

- Show economic, technical and commercial viability
- Influence federal and state policies

- Efficient and cost-effective coordination of technology development
- High likelihood of successful deployment of the RIGHT technologies
- Enhanced DOE leverage of industry-based technologies
- Credible basis for policies, standards and incentives
- National program that includes clear regional benefits including new technology deployment and inter-regional processes

Program Benefits