



Lessons from ERGIS: Integrating Renewables into the Grid

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WHY GRID MODERNIZATION?

The existing U.S. power system has served us well...
but our 21st Century economy needs a 21st Century grid.



Security Threats



Extreme Events

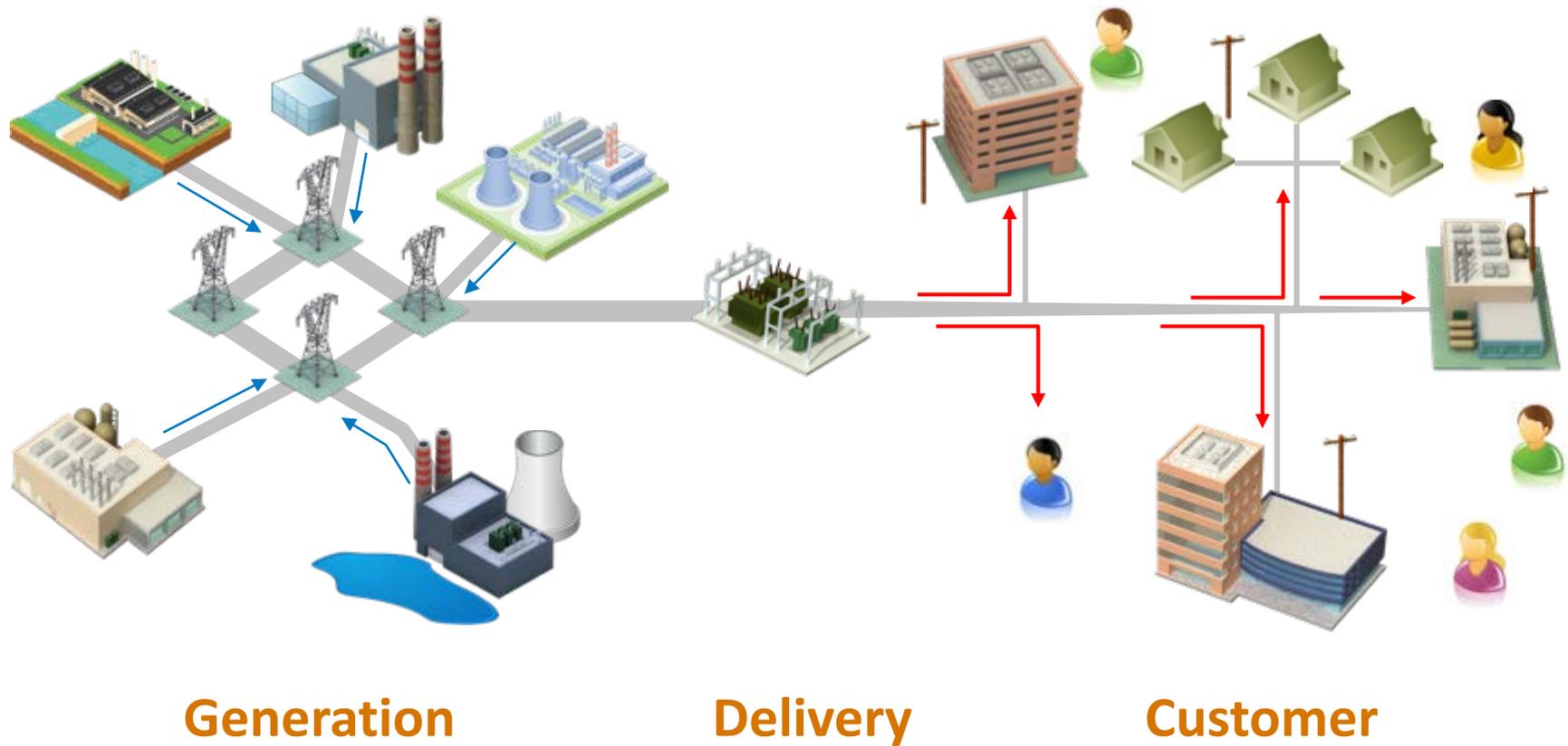


Changing Supply Mix



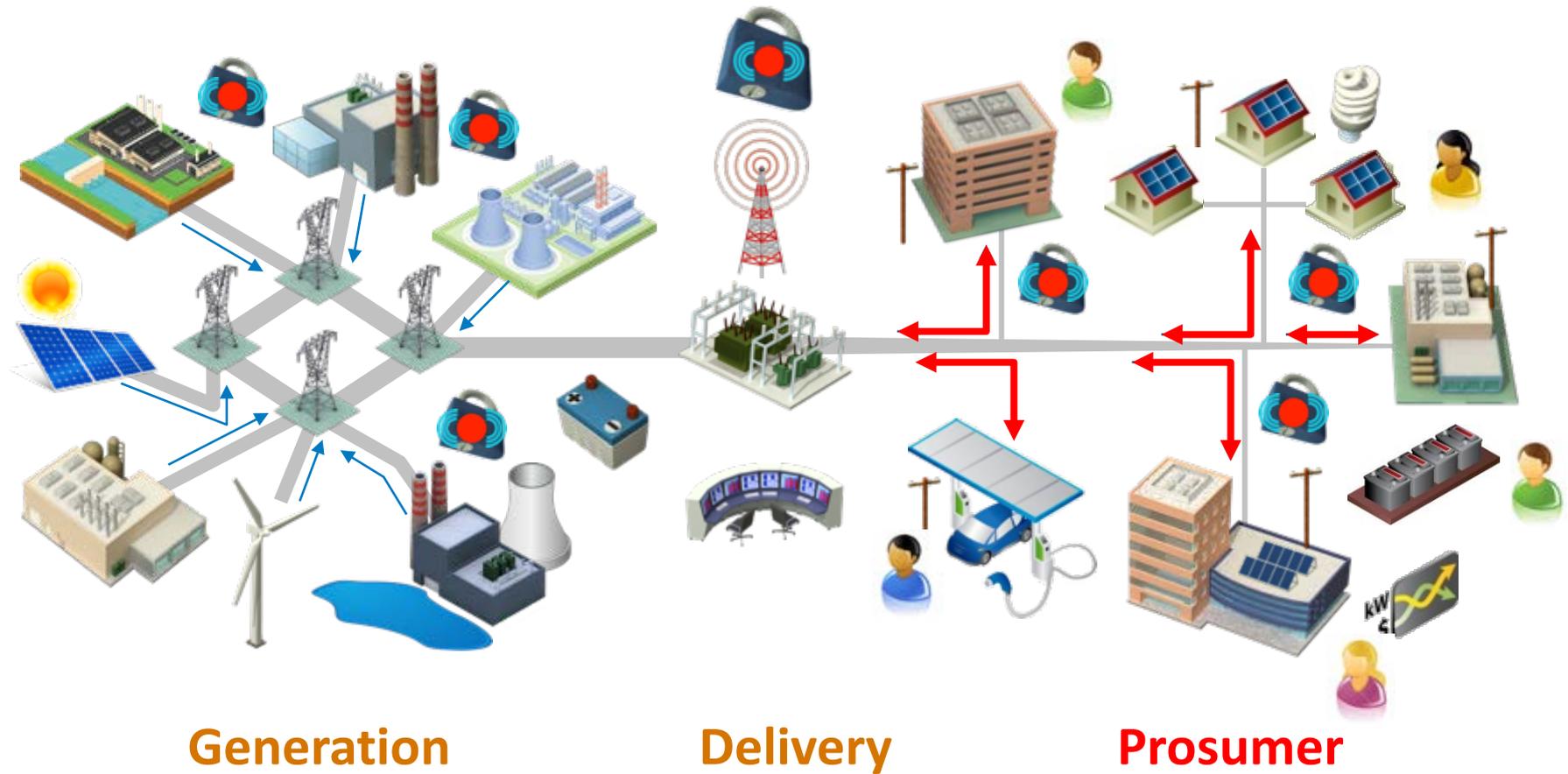
New Markets

THE GRID OF THE PAST



Source: EPRI, 2009

THE GRID OF THE FUTURE

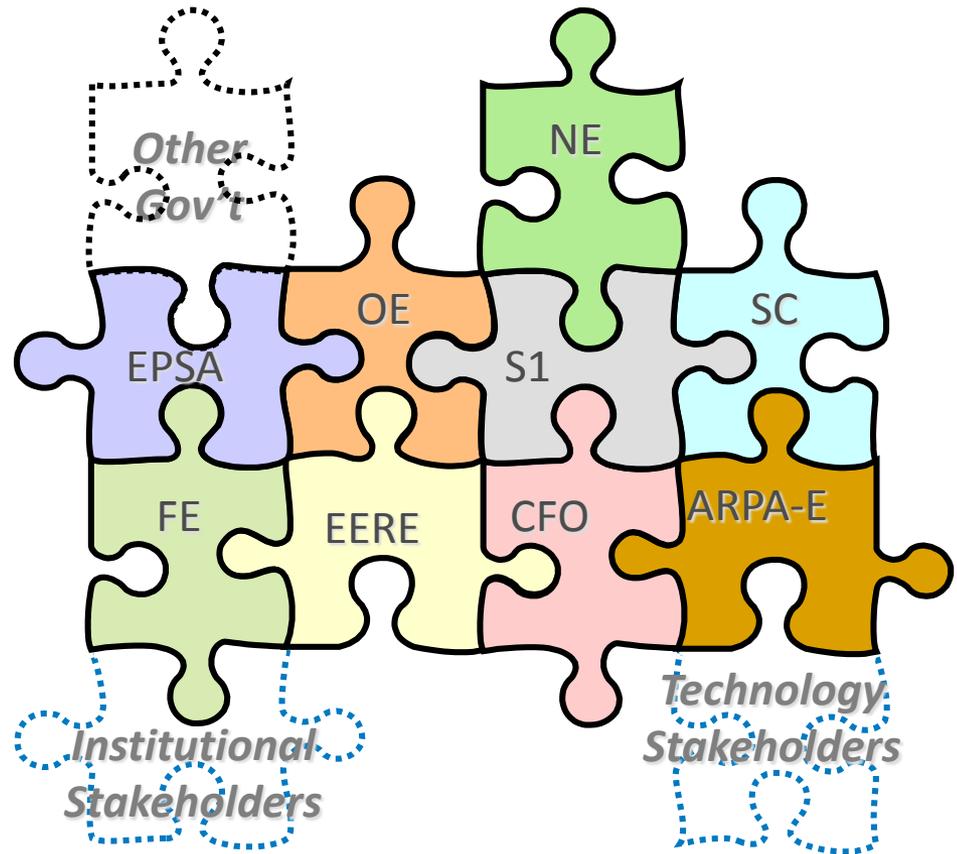


Source: EPRI, 2009

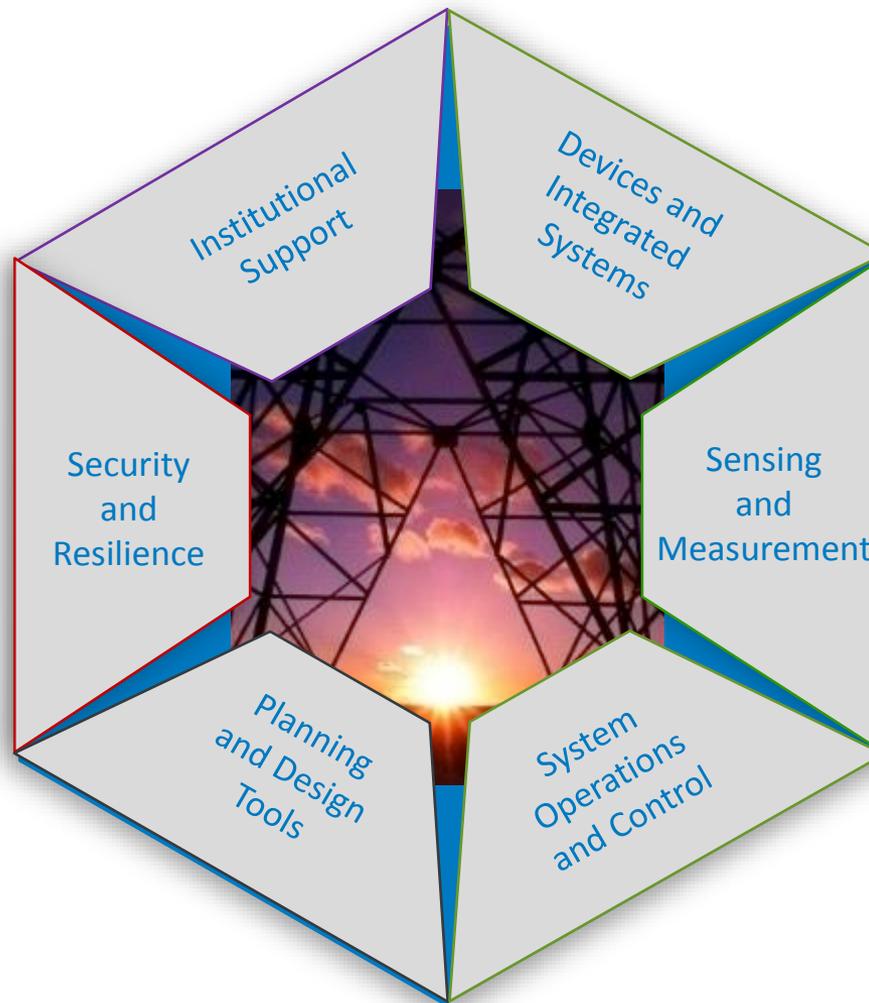
DOE GRID MODERNIZATION INITIATIVE

An aggressive five-year grid modernization strategy for the Department of Energy that includes

- Alignment of the existing base activities among DOE offices
- An integrated Multi-Year Program Plan (MYPP)
- New activities to fill major gaps in existing base
- Development of a laboratory consortium with core scientific abilities and regional outreach



GRID MODERNIZATION LABORATORY CONSORTIUM



87 projects, \$220M over 3 years

DESIGN AND PLANNING TOOLS

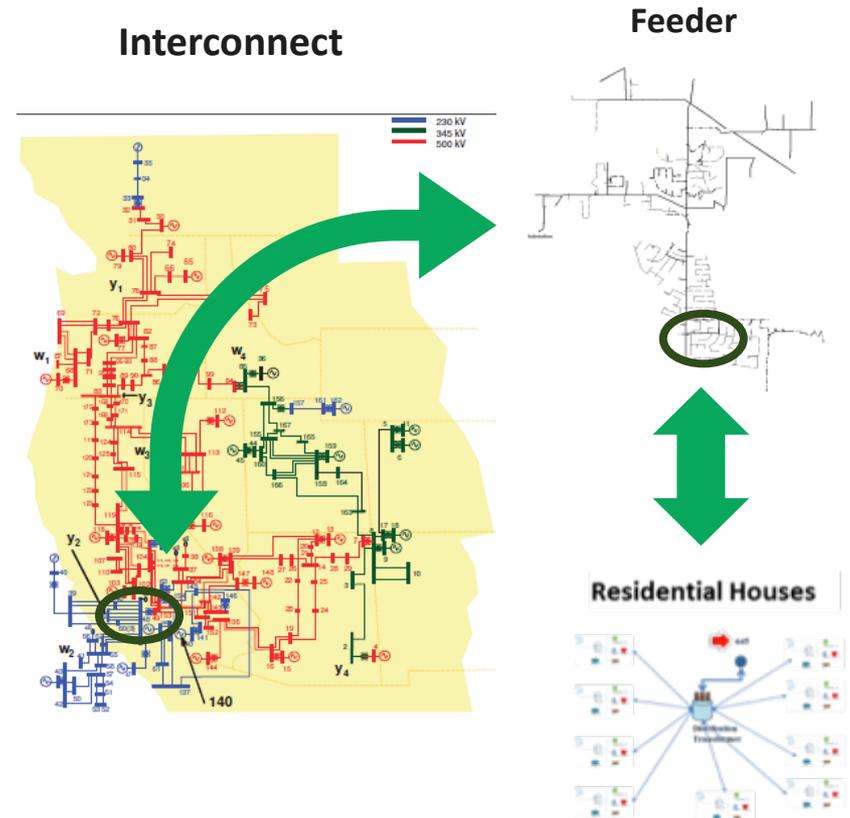
Next generation tools to accurately perform cost-benefit trade-offs and improve reliability of design for deployment of smart grid and renewables

Expected Outcomes

- Incorporate uncertainty and system dynamics into planning tools to accurately capture effects of renewable generation
- Computational tools, methods and libraries that enable 1000x improvements in performance for analysis and design
- Couple grid transmission, distribution, and communications models to understand cross-domain effects

Current Projects

- Develop multi-scale production cost models with faster mathematical solvers;
- Integrate transmission, distribution and communication planning models; and
- Explore new approaches for load modeling using available sensor data.



Eastern Renewable Generation Integration Study

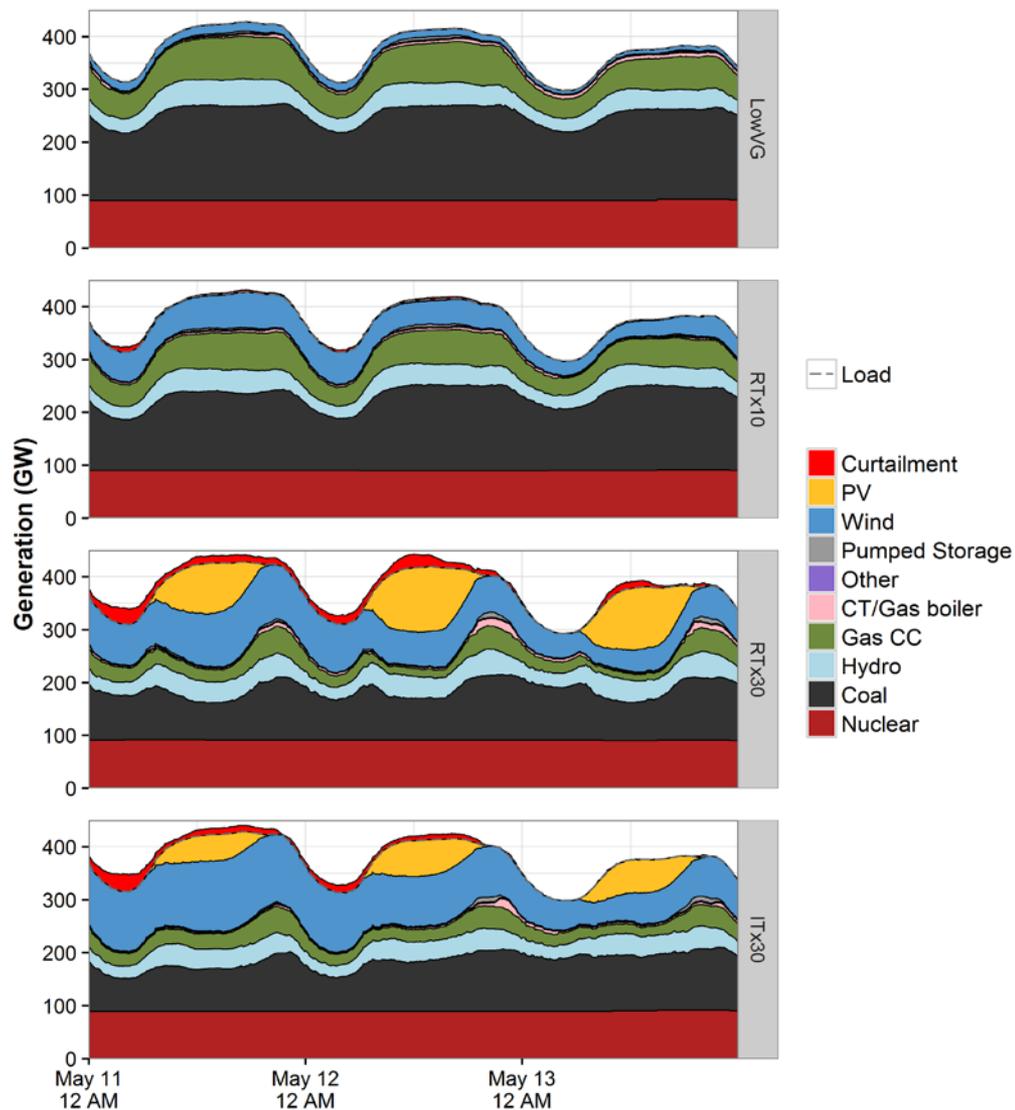
Model the operations of the Eastern Interconnection
for the year 2026 under four different scenarios

Hourly day-ahead unit commitment
5-minute real-time economic dispatch

7,000 generators; 60,000 transmission nodes

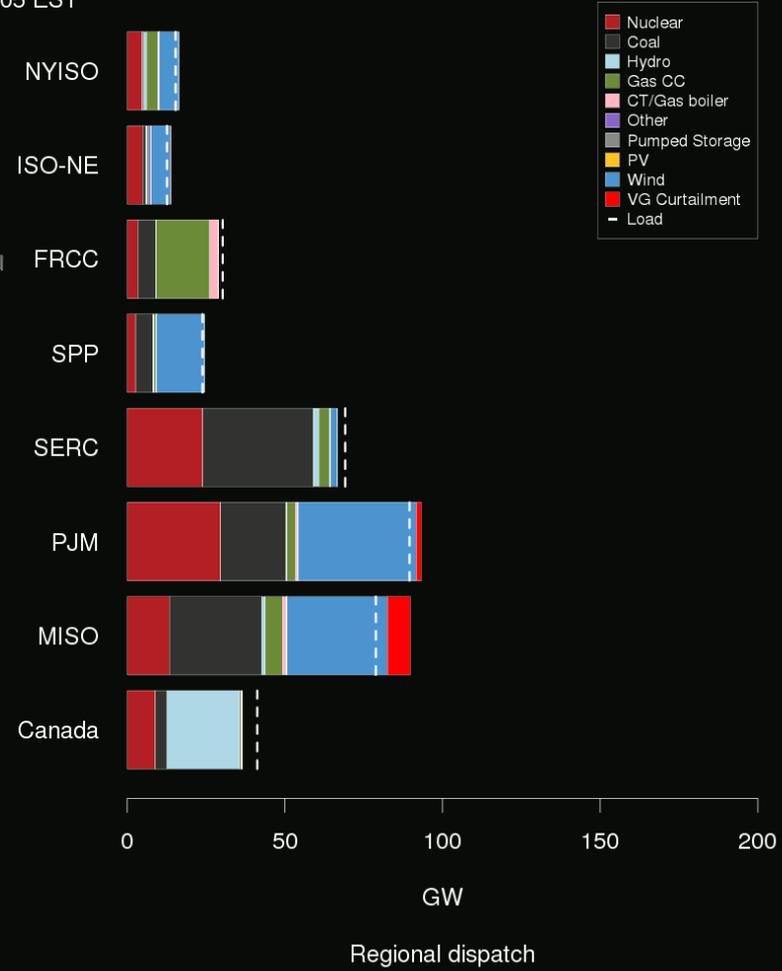
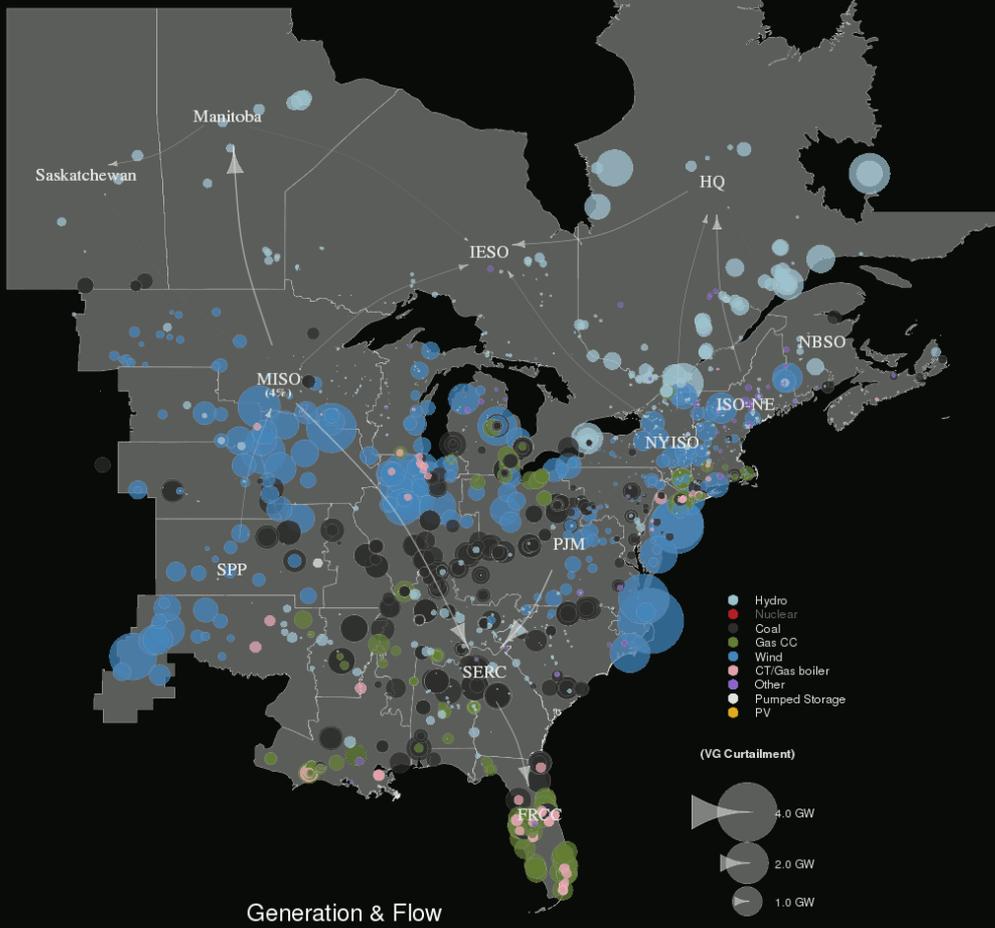
ERGIS – FOUR SCENARIOS ANALYZED

- Low VG
 - Renewables in service in 2010, modest transmission upgrades
- RTx10
 - Regional Transmission, 10% VG penetration, mostly wind
- RTx30
 - Regional Transmission, 30% penetration, 20% wind, 10% solar, within region resources
- ITx30
 - Inter-regional Transmission, 30% penetration, 25% wind, 5% solar



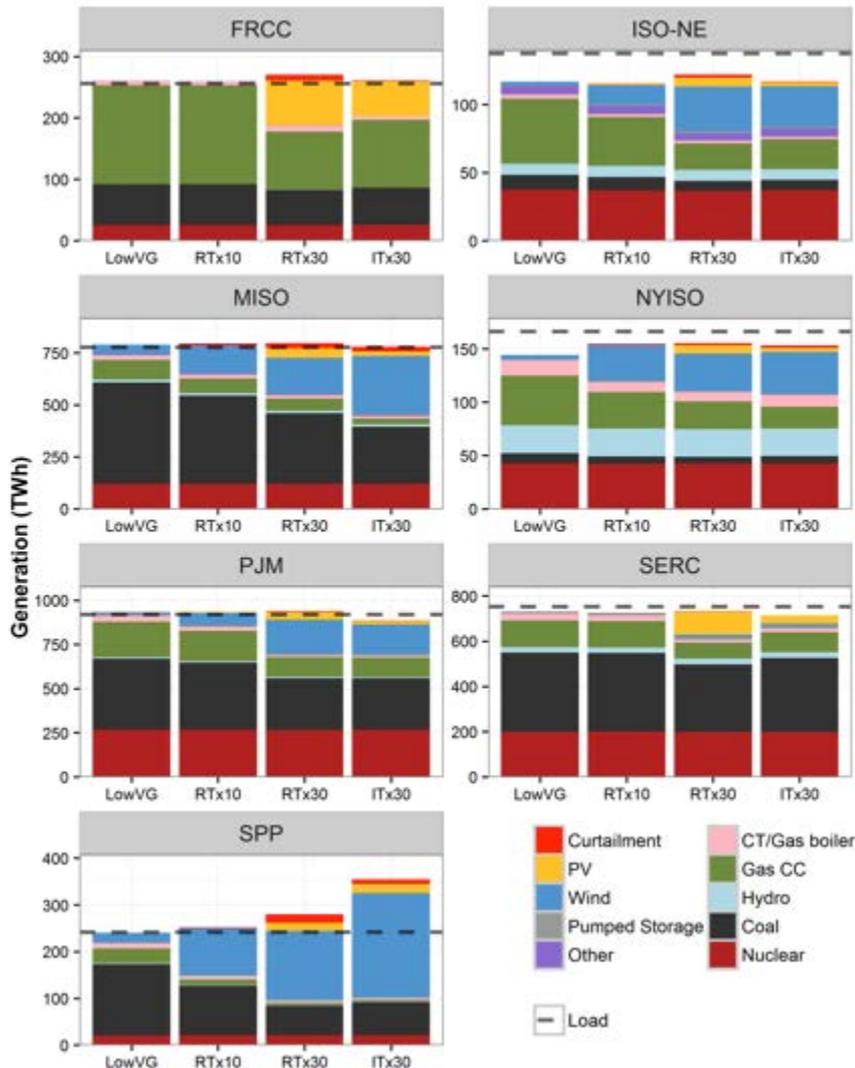
Eastern Renewable Generation Integration Study (RTx30)

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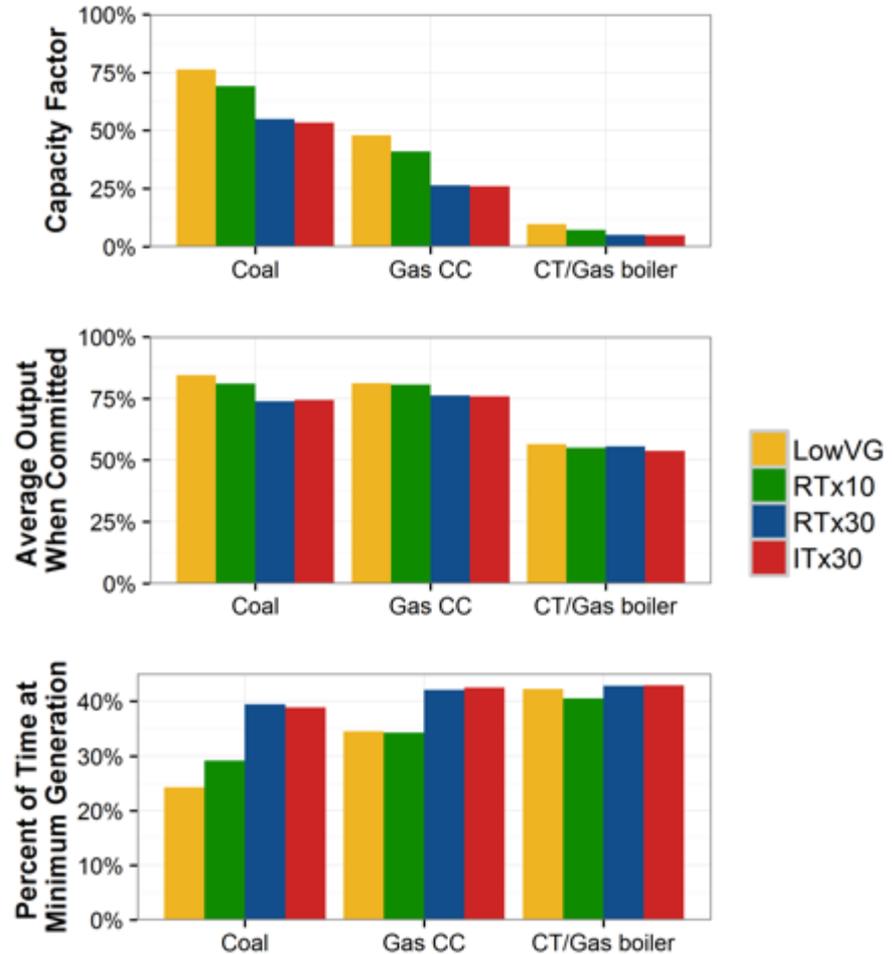


ERGIS – IMPLICATIONS FOR GENERATION

Annual Generation

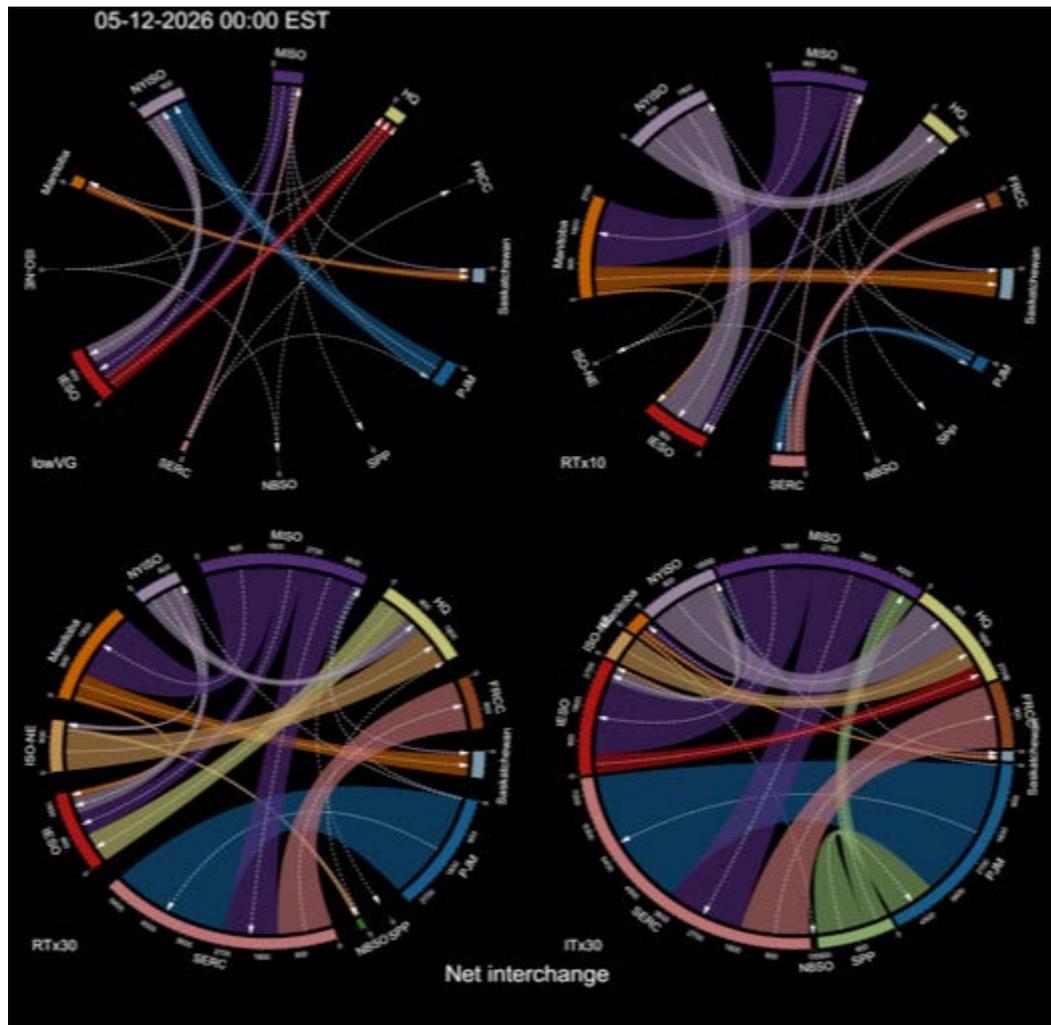


Thermal Plant Operations

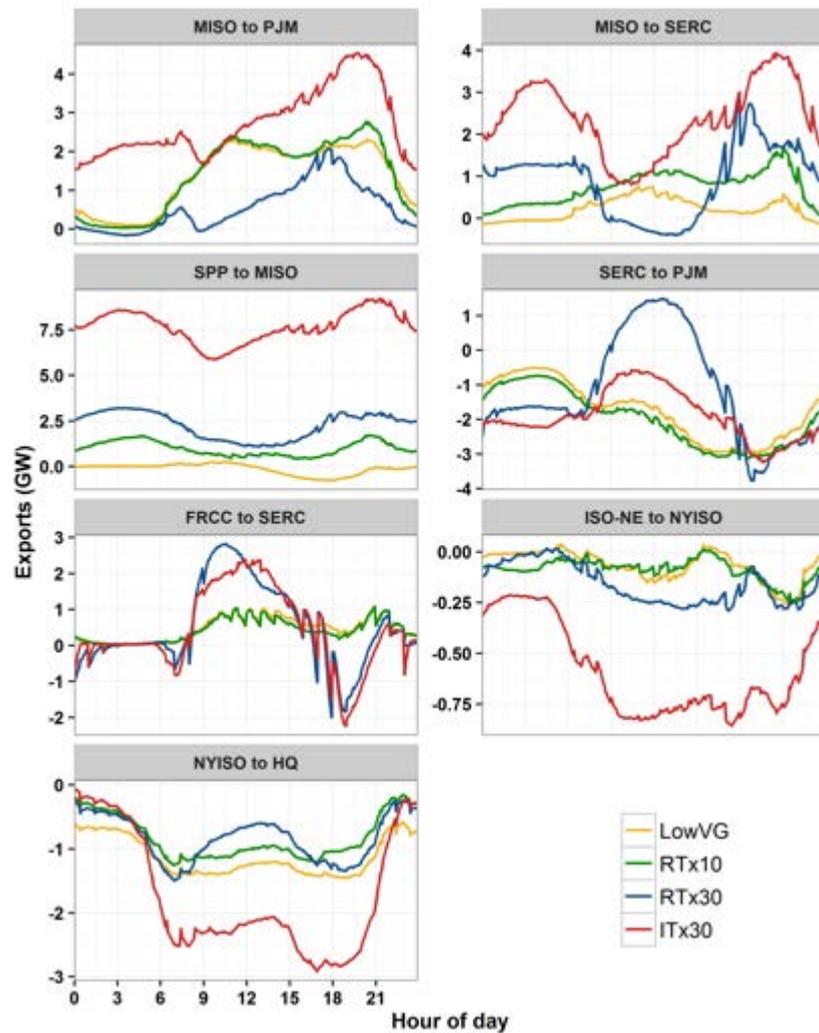


ERGIS – IMPLICATIONS FOR TRANSMISSION

Net Interchange

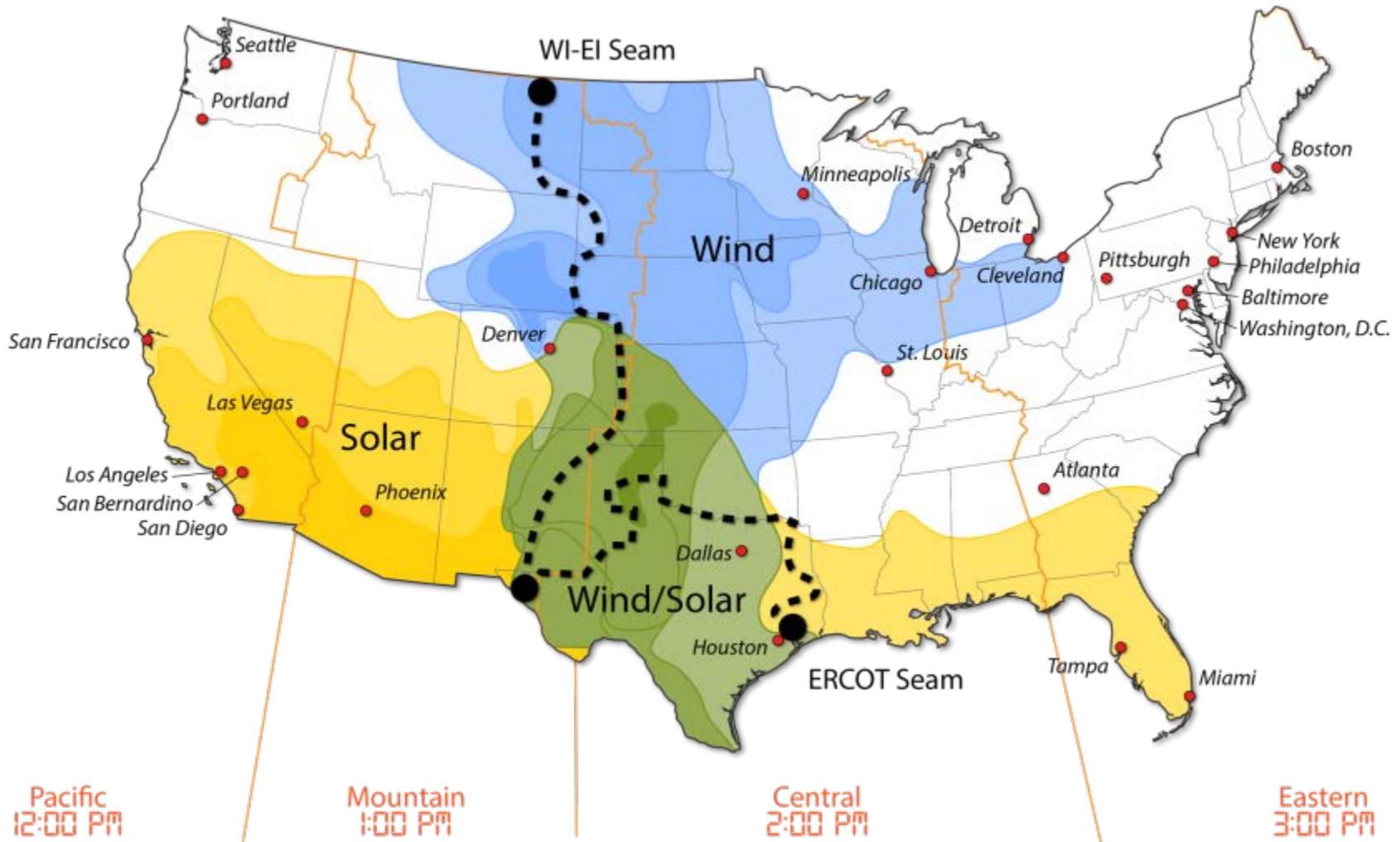


Inter-Regional Flows



NEXT: INTERCONNECTION SEAMS STUDY

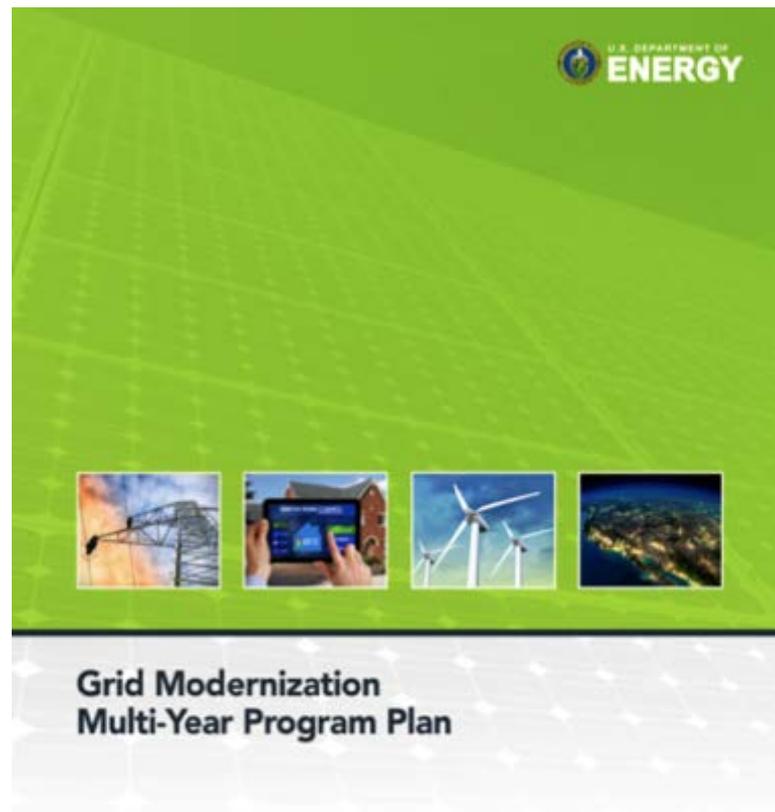
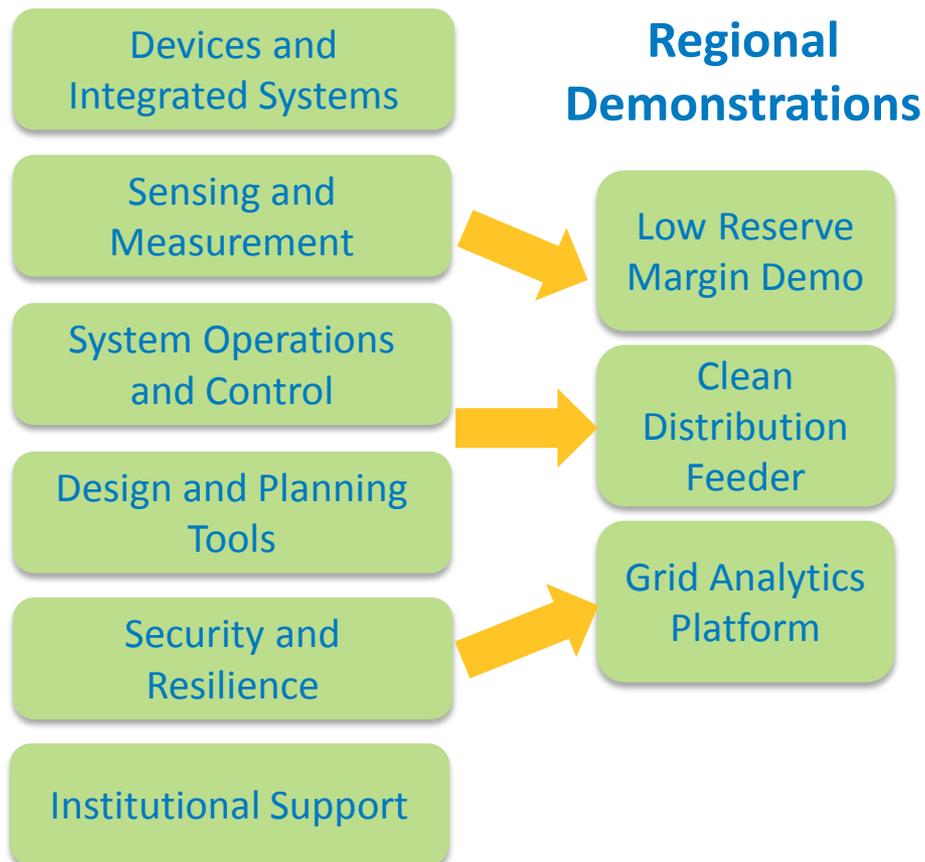
How do you take the system you've got, and turn it into the system you want?



GRID MODERNIZATION MULTI-YEAR PROGRAM PLAN

<http://energy.gov/downloads/grid-modernization-multi-year-program-plan-mypp>

Foundational R&D



Our path to a modernized grid to power American leadership in the 21st Century

FOR MORE INFORMATION

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