

Grid Modernization



Dr. Bryan Hannegan
Associate Laboratory Director

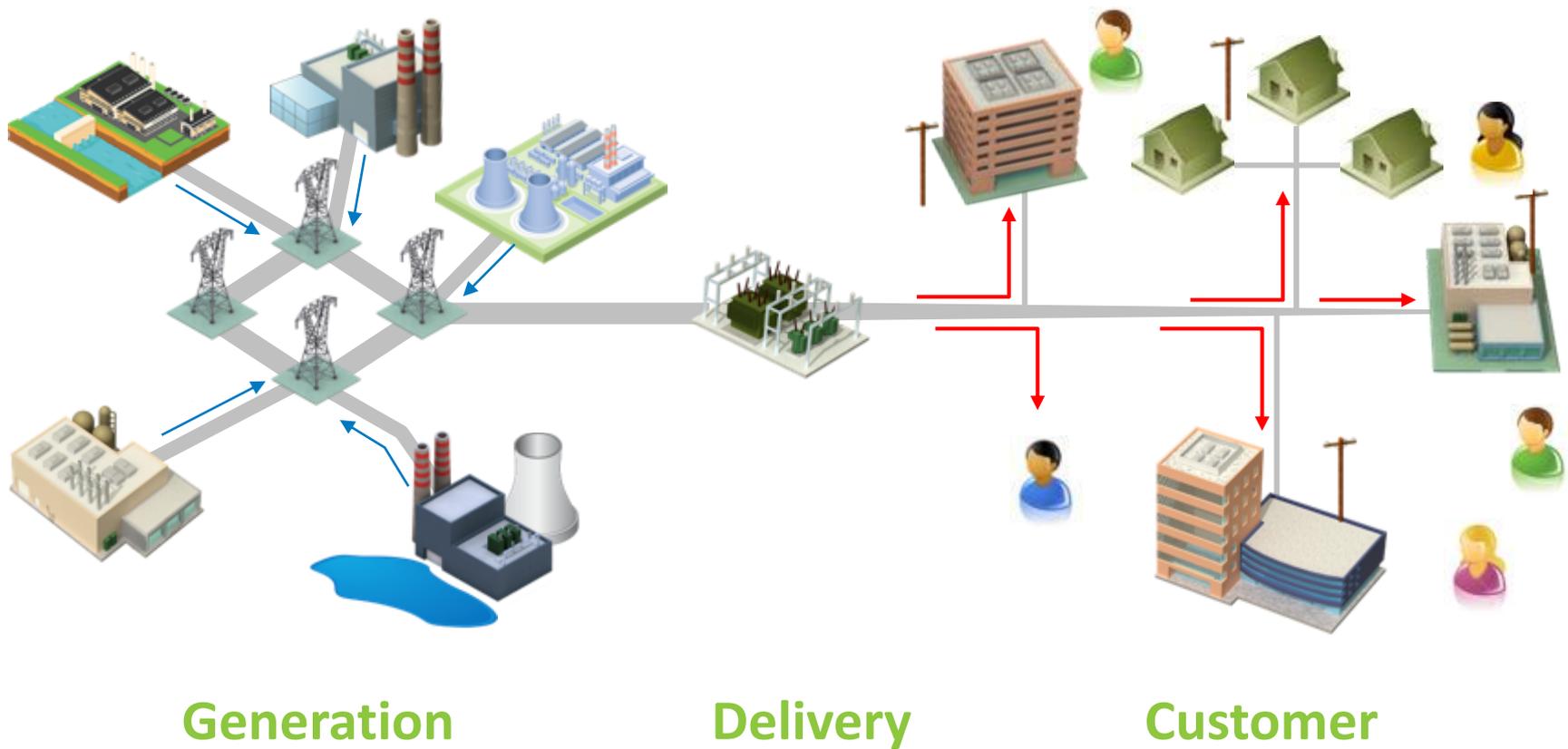
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Why Grid Modernization?

The existing electricity grid has served us well... **but a clean energy future needs a modernized and integrated infrastructure.**

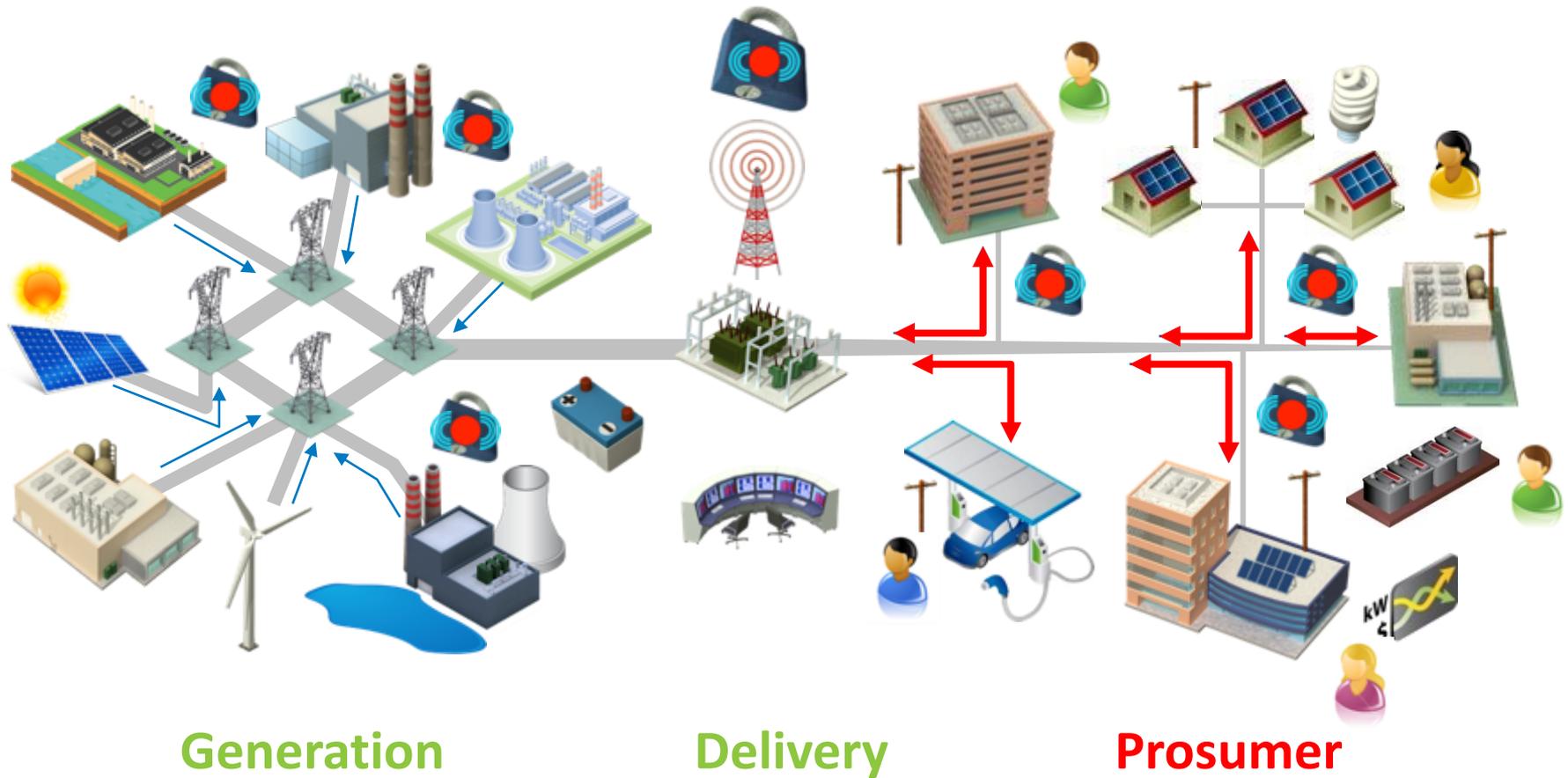


Today's Electricity Grid



Source: EPRI, 2009

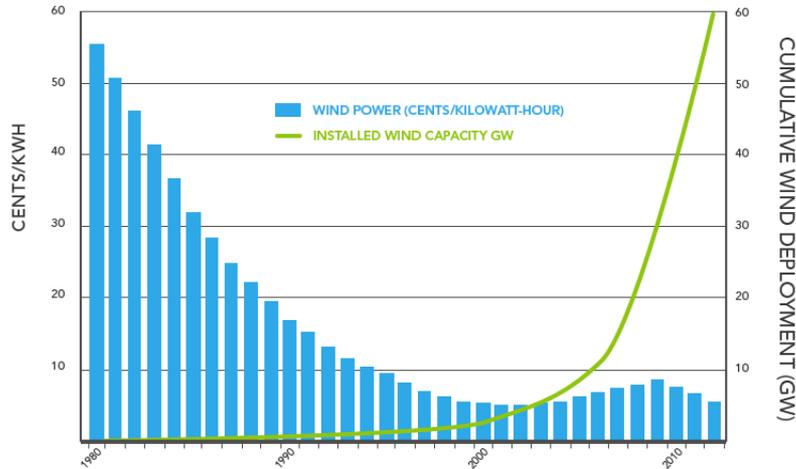
Tomorrow's Power System



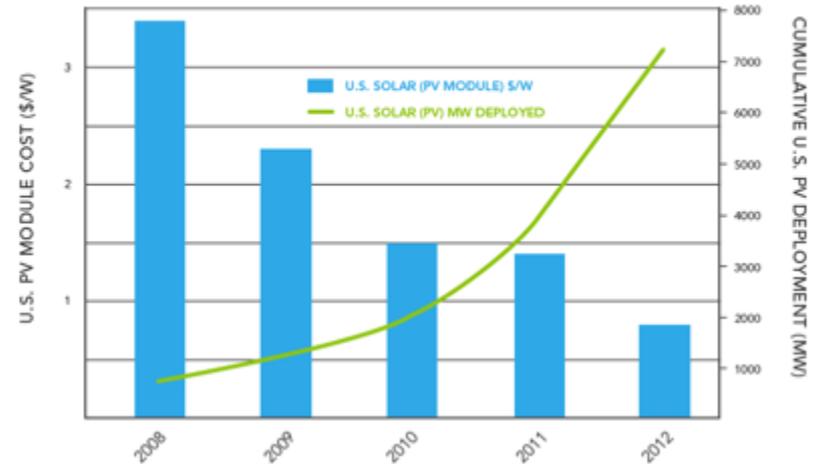
Source: EPRI, 2009

The Revolution is ... ~~Coming~~ Now

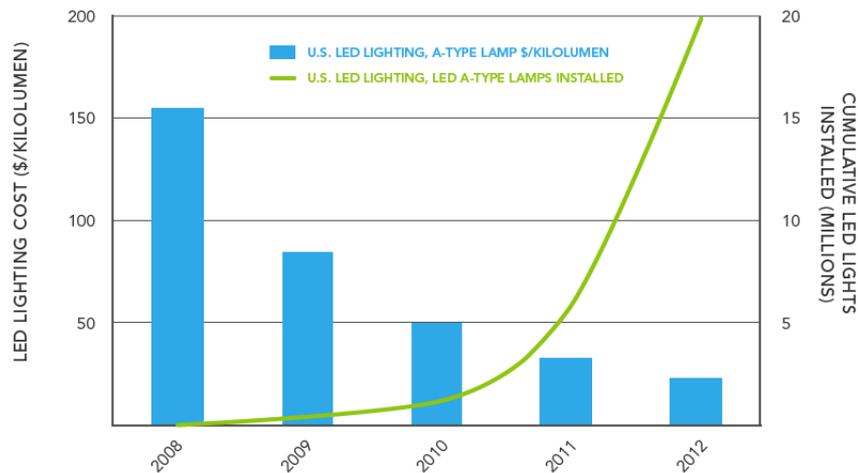
Deployment and Cost for U.S. Land-Based Wind
1980-2012



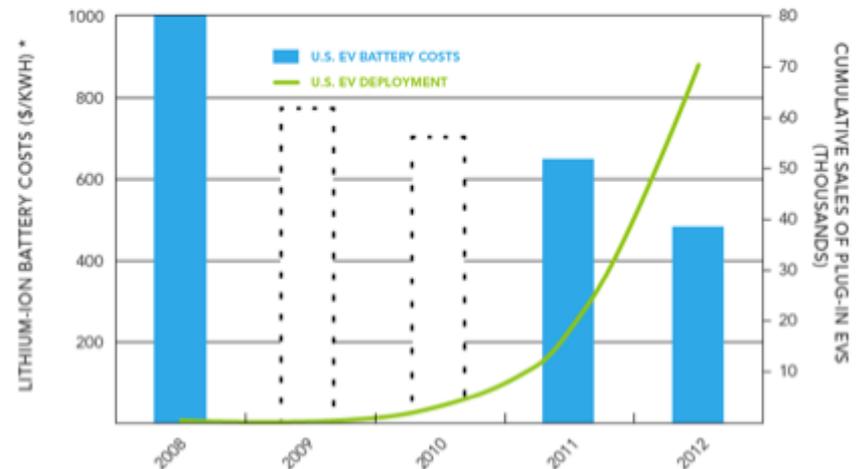
U.S. Deployment and Cost for Solar PV Modules
2008-2012



Deployment and Cost for A-Type LED Lights
2008-2012



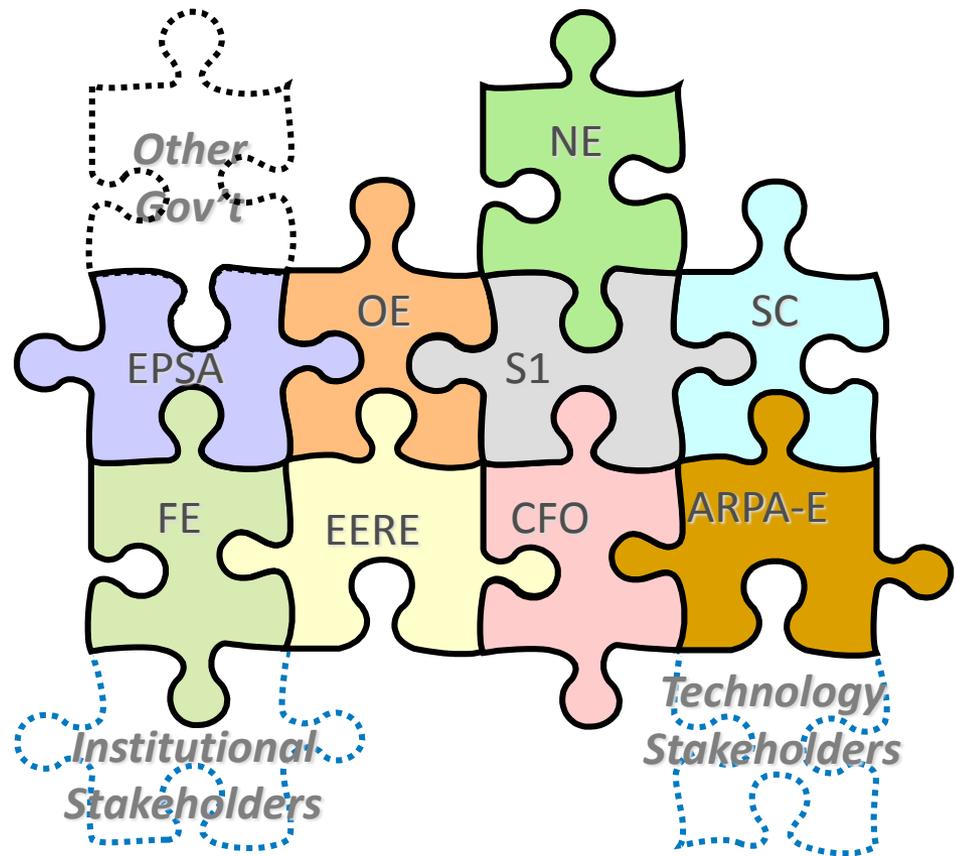
Deployment and Cost for Electric Vehicles and Batteries*
2008-2012



Grid Modernization Initiative

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

- Alignment of the existing base activities among the 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



Foundational R&D Areas

Sensing and Measurements

- Visualization tools that enable complete visibility of generation, loads and grid dynamics across the electric system

Devices and Integrated Systems

- Establish common test procedures and interoperability standards for devices that can provide valuable grid services alone and/or in combination

System Operations and Power Flow

- Develop advanced real-time control technologies to enhance the reliability and asset utilization of T&D systems

Design and Planning Tools

- Create grid planning tools that integrate transmission and distribution and system dynamics over a variety of time and spatial scales

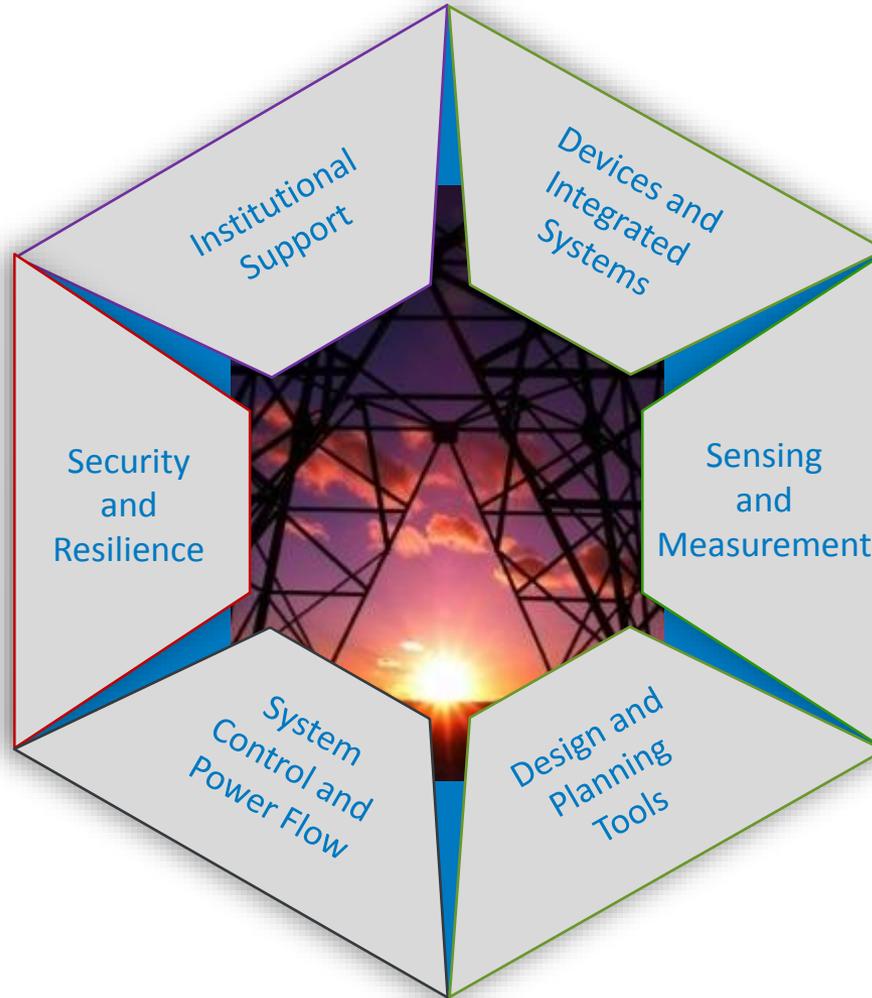
Security and Resilience

- Develop advanced security (cyber and physical) solutions and real-time incident response capabilities for emerging technologies and systems

Institutional Support

- Provide tools and data that enable more informed decisions and reduce risks on key issues that influence the future of the electric grid/power sector

Grid Modernization Laboratory Consortium



Energy Systems Integration Facility (ESIF)



Addressing the challenges of large-scale integration of clean energy technologies into the energy systems infrastructure

<http://www.nrel.gov/esif>

“This new facility will allow for an even stronger partnership with manufacturers, utilities and researchers to help integrate more clean, renewable energy into a smarter, more reliable and more resilient power grid.”
- Energy Secretary Ernest Moniz

NREL | ENERGY SYSTEMS
NATIONAL RENEWABLE ENERGY LABORATORY | INTEGRATION FACILITY
U.S. DEPARTMENT OF ENERGY

- NREL’s largest R&D facility (182,500 ft²/20,000 m²)
- Space for ~200 NREL staff and research partners
- Petascale HPC and Data Center supports all research at NREL
- Labs focus on R&D of integrated energy systems
 - Electricity
 - Fuels
 - Transportation
 - Buildings & Campus
- Integrated electrical, thermal, fuel, and data infrastructure

For More Information

Bryan Hannegan

Associate Lab Director, Energy Systems Integration

National Renewable Energy Laboratory

Mail Stop RSF 050, 15013 Denver West Parkway

Golden, CO 80401 USA

+1-303-275-3009 (phone)

bryan.hannegan@nrel.gov (email)

<http://www.nrel.gov/esi>