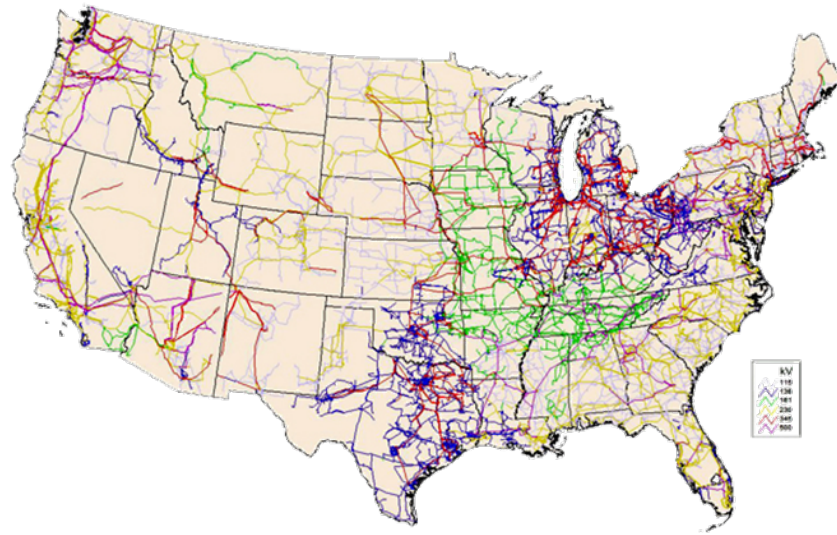


Visioning the 21st Century Electricity Industry: *Outcomes and Strategies for America*



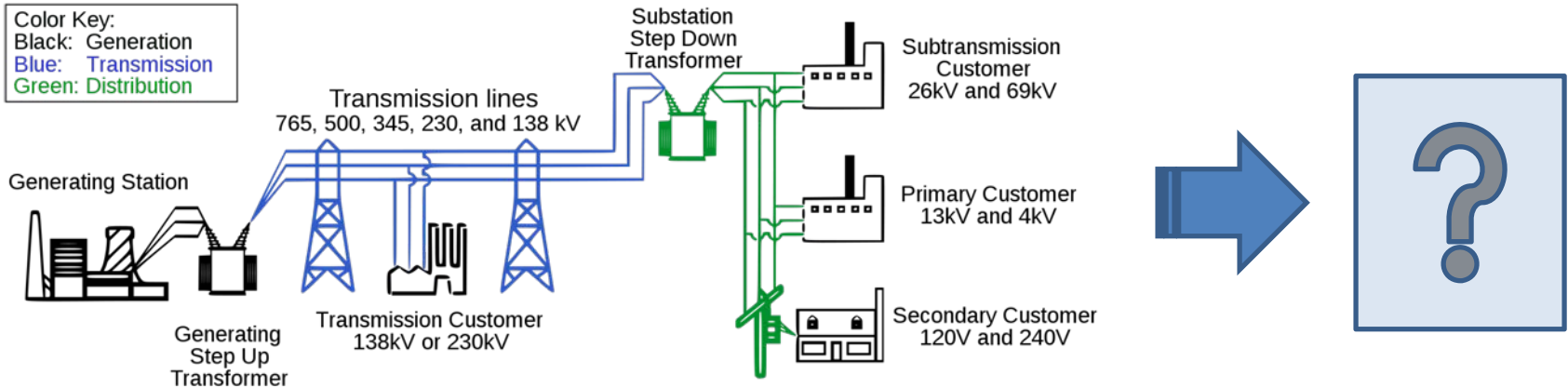
William Parks

U. S. Department of Energy

March 2012

The Future Grid

what should it look like?



It should be capable of:

- Enabling informed participation of customers
- Accommodating all generation and storage options
- Enabling new products, services, and markets
- Providing the power quality for a range of needs
- Optimizing asset utilization and operating efficiency
- Providing resiliency to disturbances, attacks, and natural disasters

How do we get there?

- Planning, Policy and other non-technical support (e.g., markets, regulations, environmental considerations)
- Analysis, standards and model development
- System integration and distributed technologies
- Grid energy storage and demand response
- Grid components and subcomponents; materials innovations

**What's the role of industry? of regulators? of consumers?
of international initiatives? of DOE?**

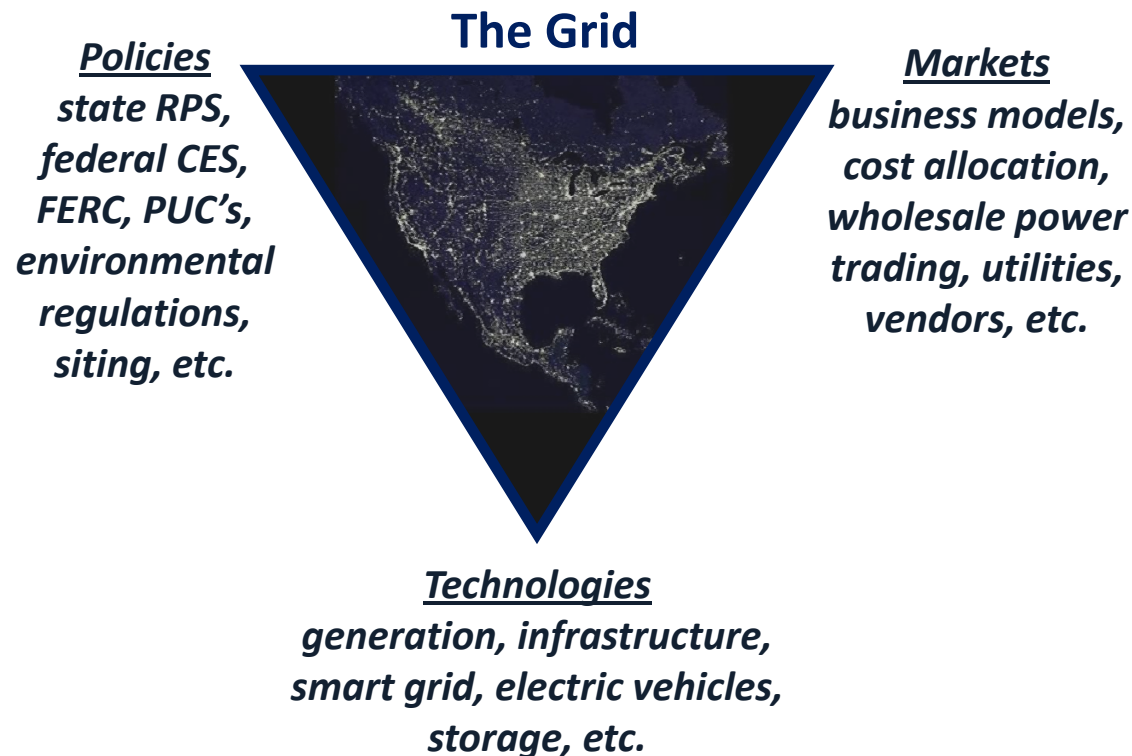
The Grid Tech Team Approach

policies · markets · technologies

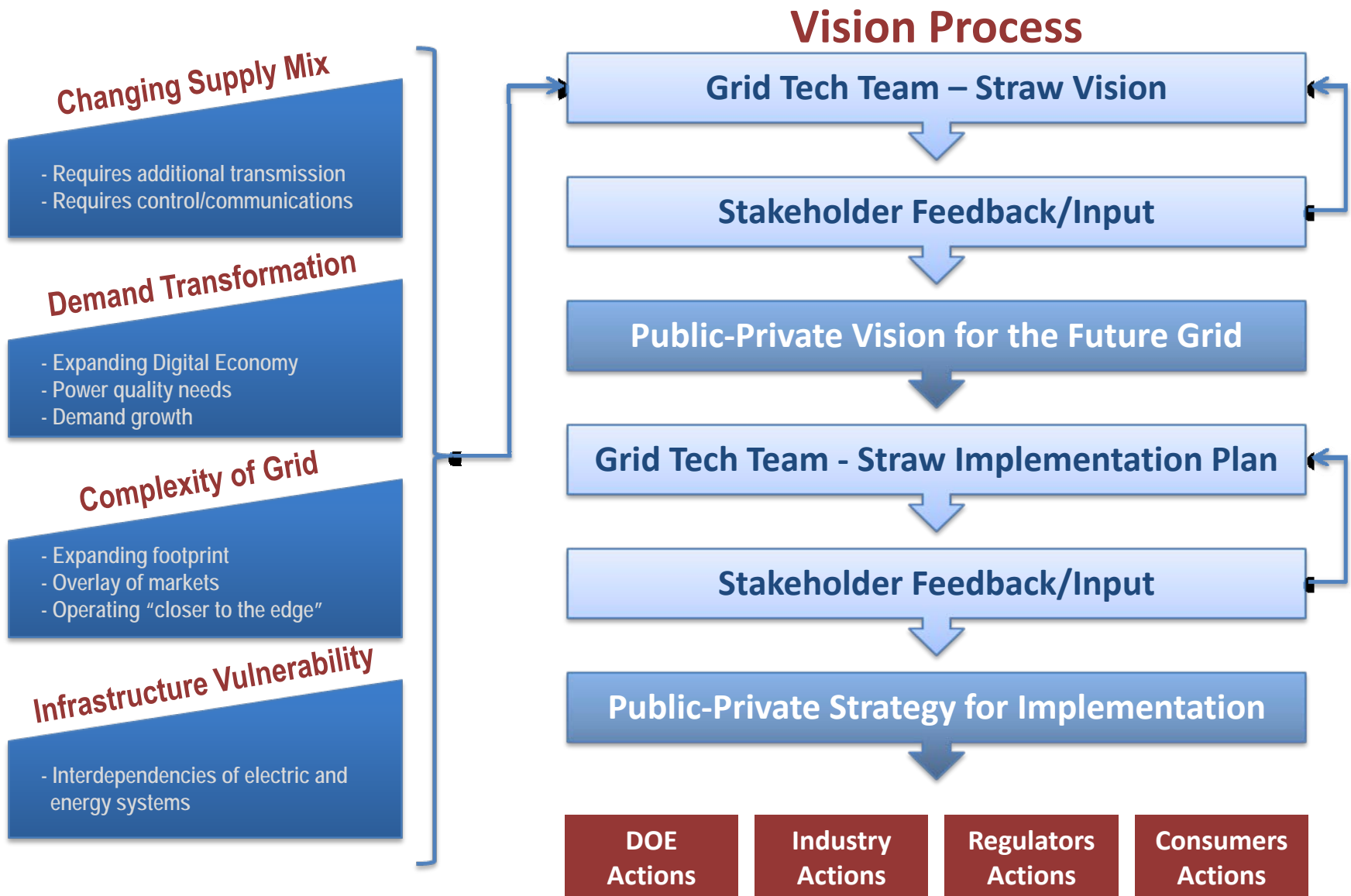
Changes to the grid require intricate, continuous balancing...

Policies drive markets which drive technologies

Solutions to grid challenges should consider all aspects simultaneously



The Evolution of a National Vision



PSERC Future Grid Initiative Workshop

- PSERC is conducting research and facilitating public forums on the “Future Grid to Enable Sustainable Energy Systems” including a series of webinars this Spring
- Public workshop held on Dec. 7, 2011, at the University of California at Berkeley
- 140 attendees from industry, government, national labs, and academia (students and faculty) provided their perspectives on research, workforce and policy issues in developing the future grid, and on PSERC’s project activities.
- Presentations, posters and feedback will be posted on the PSERC Future Grid Initiative web page at www.pserc.org.
- Feedback examples:
 - What are credible scenarios for the future grid?
 - What will the future grid architecture be?
 - Do we need “super engineers” and how do we educate them?



National Vision for the Grid of the Future must address multiple goals

DOE's Clean Energy Goals:

- By 2035, 80% of America's electricity will come from clean energy sources
- Put 1 million electric vehicles on the road by 2015
- Energy related GHG emissions will reduce 17% by 2020 and 83% by 2050

Targeted Outcomes for the Grid:

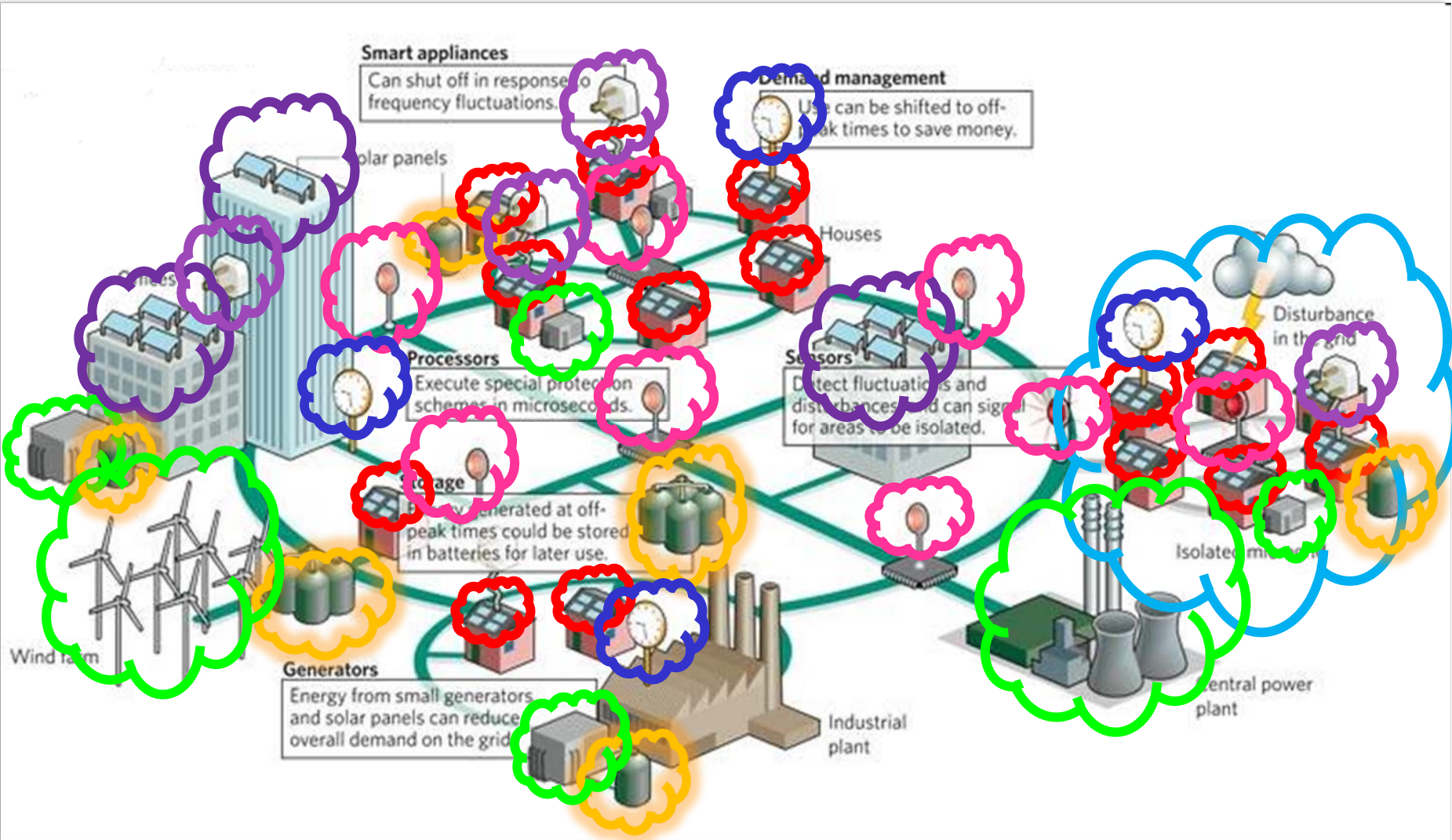
- Enable better understanding and control of our electric grid by installing more than 1000 synchrophasor measurement units by 2013.
- Deploy more than 26 million smart meters in American homes and businesses by 2013.
- Reduce utility-scale energy storage costs 30% by 2015.

STRAW VISION

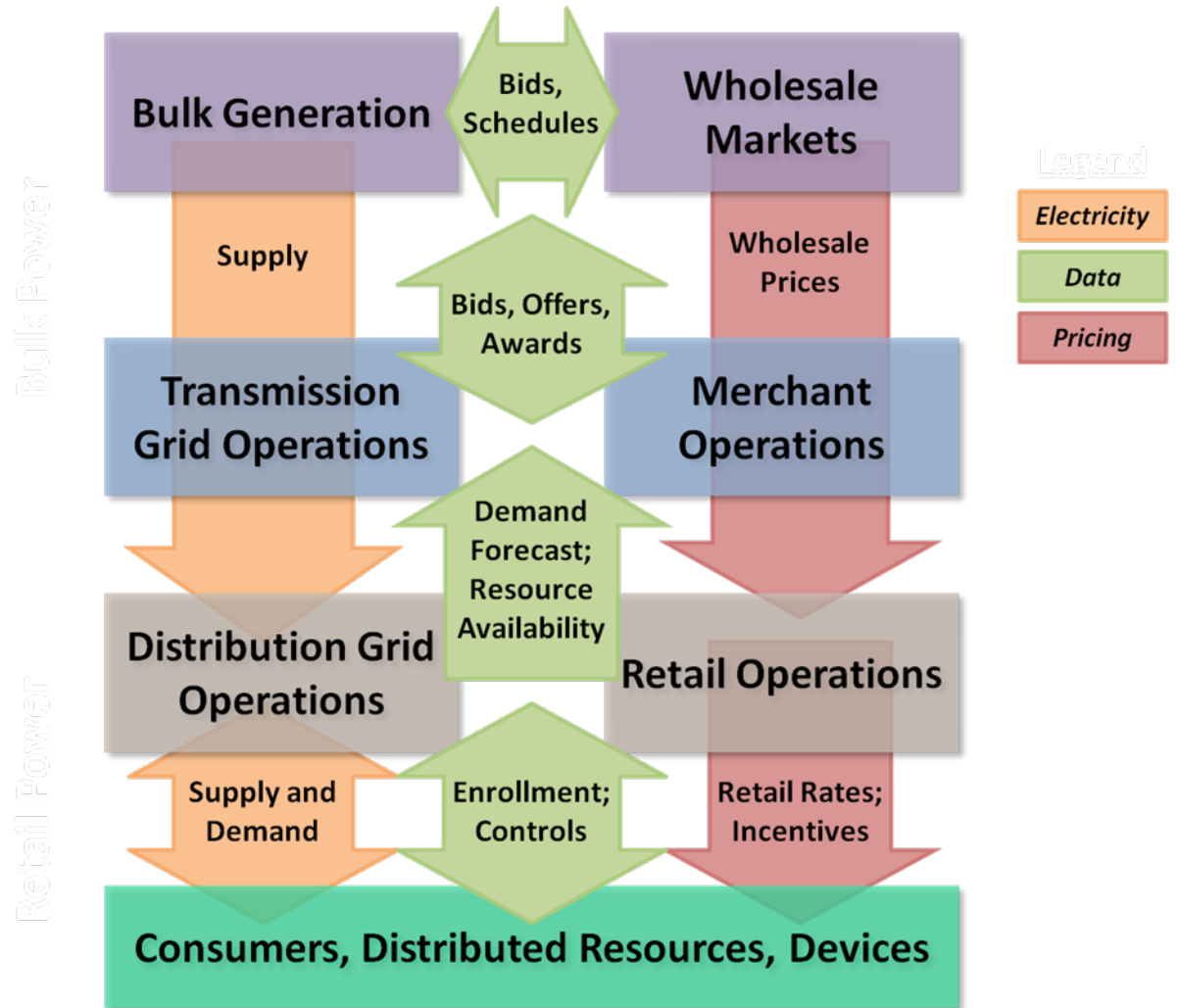
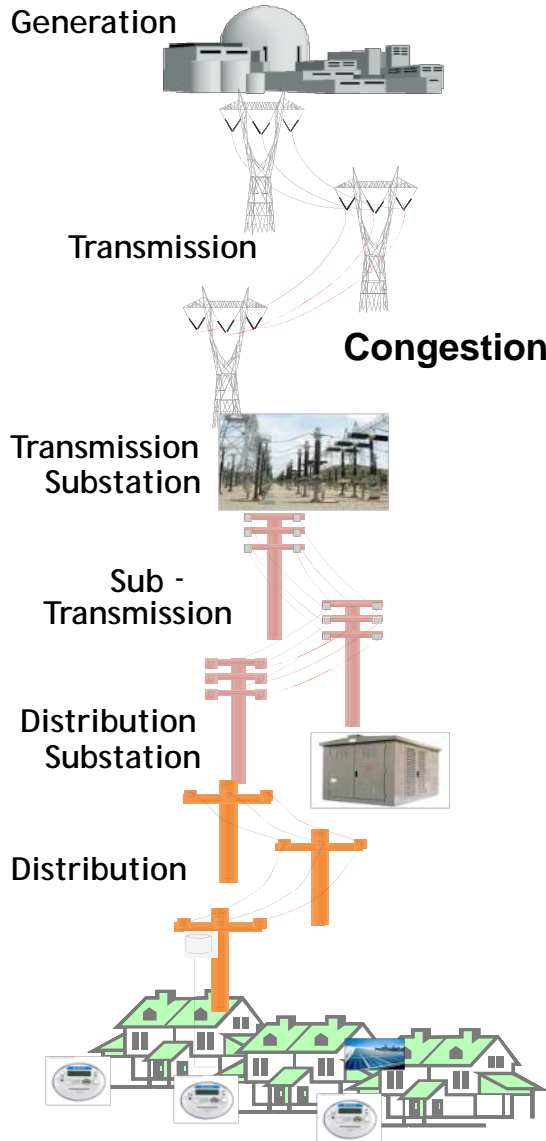
Enable a **seamless, cost-effective** electricity system, from generation to end use, capable of meeting the **clean energy demands** and capacity requirements of this century, while allowing **consumer participation** and electricity use as desired:

- ✓ Significant scale-up of Clean Energy (*80% by 2035*)
- ✓ Allows 100% customer participation and choice (including distributed generation, demand-side management, electrification of transportation, and energy efficiency)
- ✓ A 100% *holistically* designed system (including AC-DC hybrid configurations)
- ✓ Global competitiveness and leadership
- ✓ A reliable, secure, and resilient grid

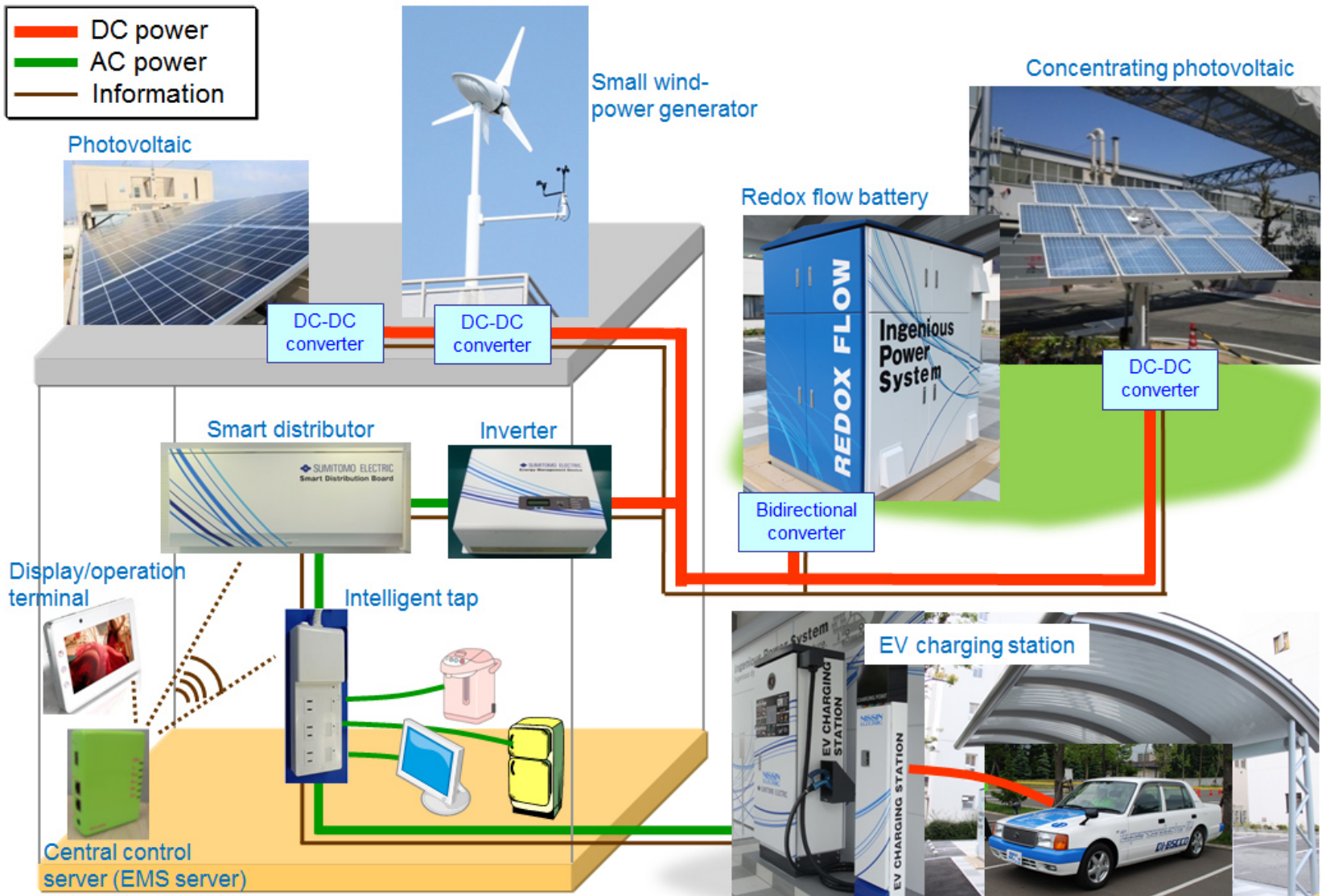
Our Future?



Effective grid modernization requires seamless, end-to-end integration

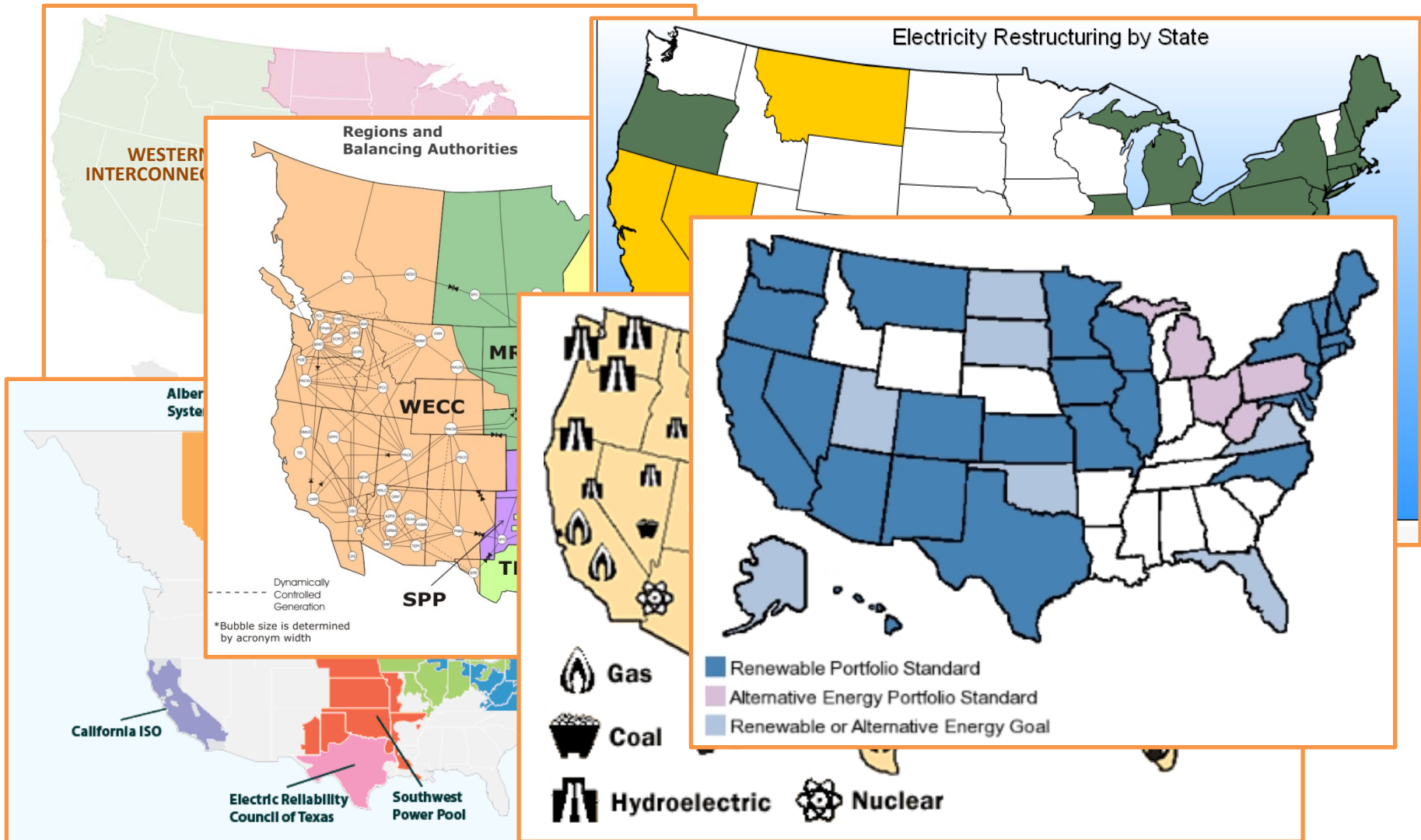


AC-DC Hybrid System



Sumitomo Electric Micro Grid System

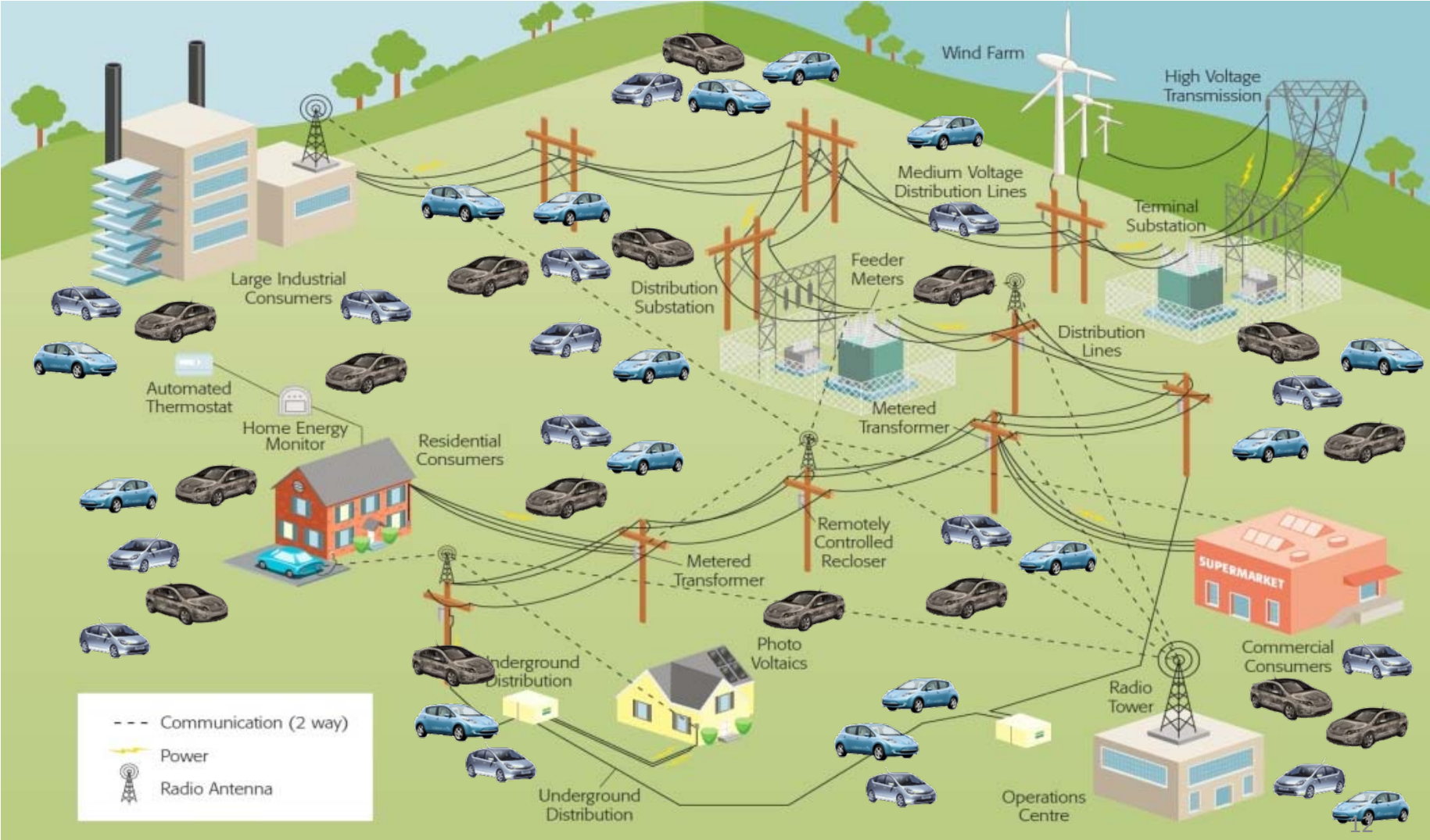
Regional Diversity: Regulatory...Resource...Policy



Significant scale-up of Clean Energy (80% by 2035) + Accommodating all Generation & Storage & End Use Tools



Smart & Efficient Homes, Distributed Generation ... and Electric Vehicles

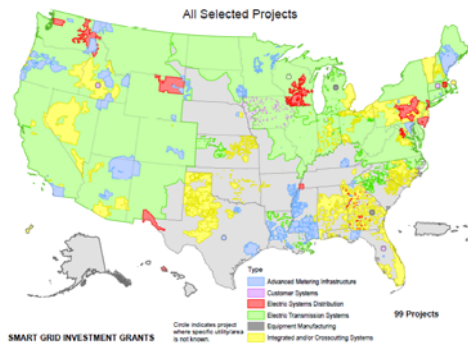


Adapted from Environmental Commissioner of Ontario

Technical Areas to Achieve a National Vision

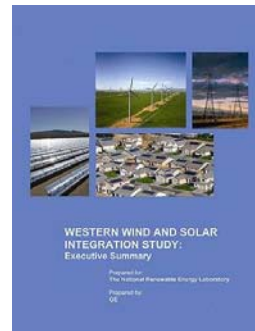
what's the challenge? · where are we today? · need for collaboration? · where are we going?

Smart Grid



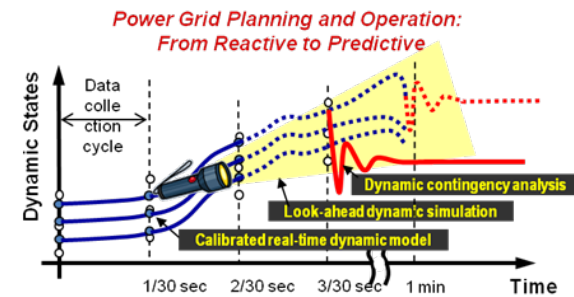
SC · OE · EERE · ARPA-E

Renewables Integration



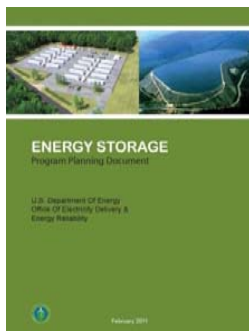
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Advanced Modeling



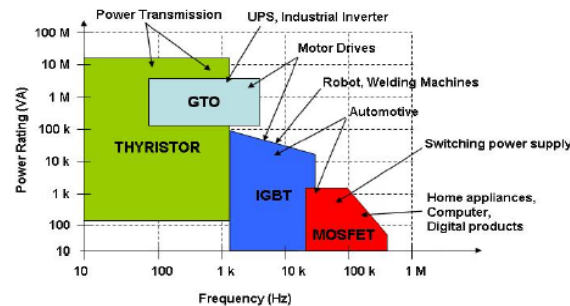
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Energy Storage



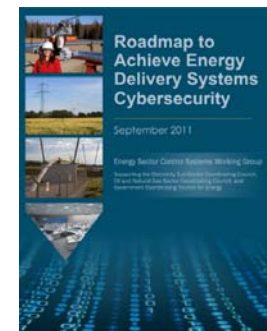
SC · OE · EERE · ARPA-E

Power Electronics



SC · OE · EERE · ARPA-E

Cyber Security



S1 · OE

Other Opportunities for DOE

GTT Workshop • Electricity Advisory Committee • MIT Future Grid Study • PSERC Future Grid Meeting

Economics

- New business models
- Market design, research & simulations
- Cost recovery for transmission, R&D
- Societal value of transmission retrofits, benefits and new technologies

Regulations

- Certainty in regulations/jurisdiction (overlapping regs; “de facto” policies)
- Tax code reform (reduce standard depreciation life of assets)
- Paradigm shift (sales to service, consumers)
- Education of state regulators

Consumers

- Education (benefits and opportunities)
- Inform DSM decision making
- Impacts of new consumer uses (EVs)

Analysis

- Cost-benefit analysis (technologies and policies)
- Distribution analytic capabilities (DR, ancillary services, distributed resources)

Planning

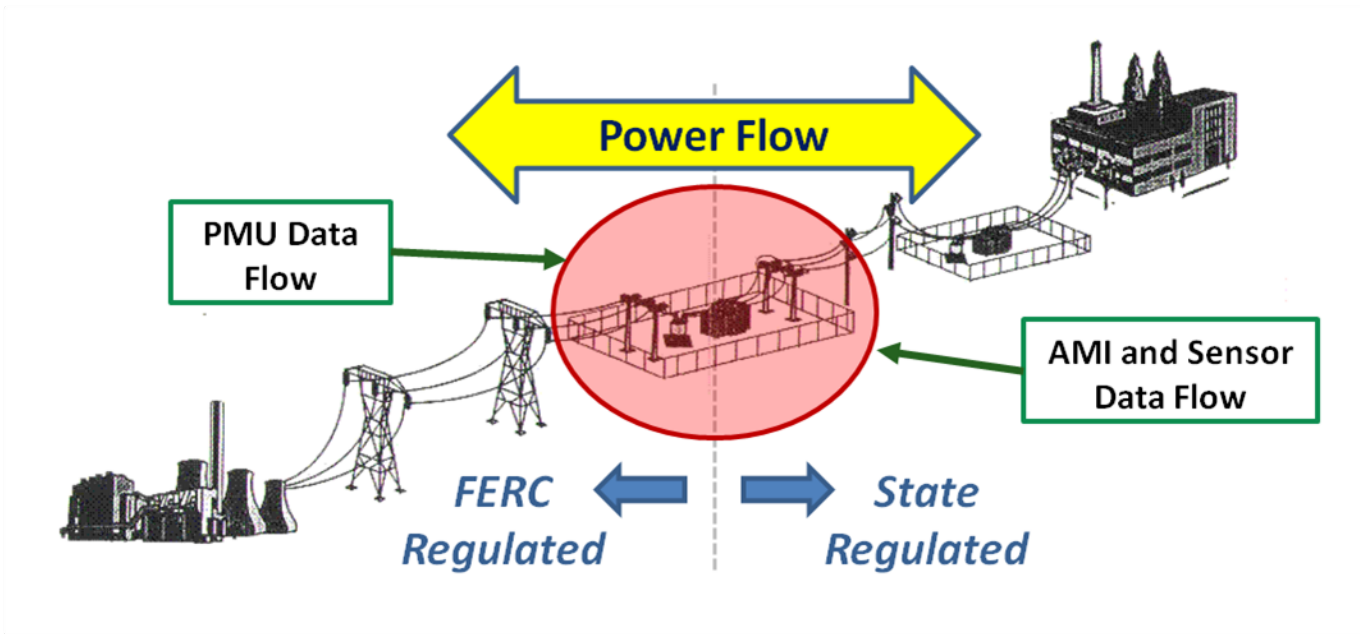
- Improved mechanisms for regional planning and resource needs (leveraging current interconnection and regional planning efforts)
- Expanded scenario planning (multiple markets)

Other

- Workforce development
- Broader stakeholder engagement in policy discussions
- Leverage current projects (lessons learned/best practices)
- Commercialization strategies for new technologies

One Implementation Option: Electricity Systems Hub

*New functionalities, protocols, designs, and operations required at the **substation level** will be the “pinch point” for end-to-end integration*



Blurring of transmission and distribution presents numerous challenges and opportunities for innovation and outreach

Next Steps?

- **Continue the dialogue towards a Public-Private Vision of the Future Grid**
- **Develop Public-Private Vision document**
 - Stakeholder input from workshops, webinars, conferences
 - Regional input for common problems, needs, solutions
- **Develop Implementation Strategy for Coordinated Grid Activities/Priorities**