21CPP – Accelerating the Transition to Clean, Efficient, Reliable and Cost-Effective Power Systems

21st Century POWER PARTNERSHIP
Accelerating the transformation of power systems

Evolving Generation Portfolios

Electric Vehicles

Smart Grid, EE & Demand Response

Cross Cutting Issues: Operations, Transmission, Distributed Generation Market Design

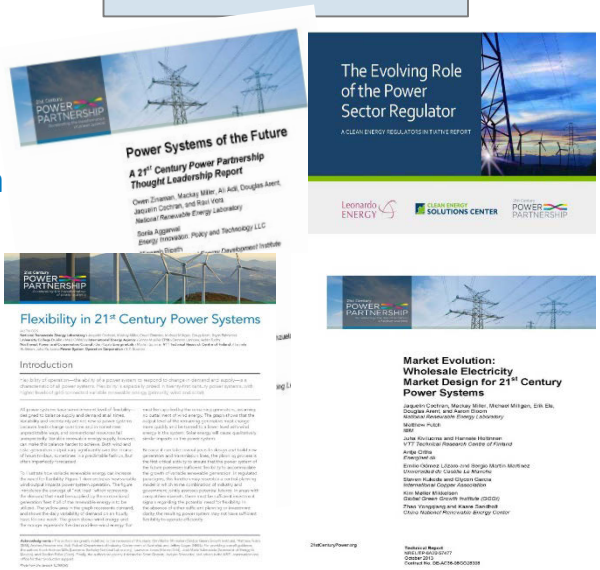
Coordinated Power System Planning, Policy, and Regulation

In-country Technical Assistance

- Brazil, China, India, Mexico, South Africa
- Similar PST programs with USG and foundation support with Colombia, Indonesia, Morocco, Vietnam, others

Thought Leadership

Information Exchange & Capacity Building



Select Funders and Partners

CIFF Children's Investment Fund Foundation

U.S. Department of Energy

german cooperation — Implemented by giz

SENER Secretaría de Energía

Danish Energy Agency

USAID From the American People

IRENA International Renewable Energy Agency

iea International Energy Agency

The World Bank

CSIR our future through science

EEI Edison Electric Institute

Analyzing Driving Factors and Enabling Policies for Future Power Transformation Pathways

Business as Usual

- Goal: replace aging assets with same, newer assets; meet existing fed/state policies
- Impact: Trans. grid improved, but not modernized (same updated equip.), increase carbon
- Tomorrow: central gen. dominates, slightly improved T interconnectivity (one-way system communications; some DER), same wholesale/retail markets, objective = least-cost

Low-Carbon, Centralized Generation

- Goal: replace aging generation w/low-carbon, centralized gen.: 1) utility-scale RE, 2) natural gas, 3) nuclear, and/or 4) clean coal; (but what can/will utility own differs by region)
- Impact: Slower/decreased carbon output; some DER; curtailment likely; better Trans. grid
- Tomorrow: Low-carbon, centralized generation dominates in 20 years, improved T interconnectivity, updated 5-min. markets, objectives = lowest risk, lowest carbon

Rapid Growth of DER

- Goal: Growth of distributed energy resources (DER: non-dispatchable DG, distr. storage)
- Impact: Shift towards DG PV (primarily) and storage; some distribution grid improvements
- Tomorrow: Measurable energy and capacity needs met with DER in 20 years, improved D interconnectivity, updated wholesale/retail markets, objective = resilience

Interactivity: Grid and Demand

- Goal: Fully interactive T&D grid and substantial interactive demand (including DR) in 20 yrs
- Impact: Fully optimized, communicating, and modernized T&D grids (planning and ops)
- Tomorrow: Max. grid flexibility (gen., loads, storage, new T&D, power systems ops.); updated wholesale /retail markets; Consumer control; objectives=grid flexibility, consumer desires

Grid Defection

- Definition: Past a tipping point – measureable grid defection in next 20 years;
- Impact: Rising costs (same cost over fewer customers) leads to more defection;
- Tomorrow: consumers tired of escalating electricity rates, so decide to disconnect from the grid. Assumes full grid defection (not using grid as backup)

Thank you

www.nrel.gov

NREL/PR-6A50-73691

This work was authored by the National Renewable Energy Laboratory, managed and operated by Alliance for Sustainable Energy, LLC for the U.S. Department of Energy (DOE) under contract No. DE-AC36-08G029308. Funding provided by the Joint Institute for Strategic Energy Analysis (JISEA). The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, Irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.