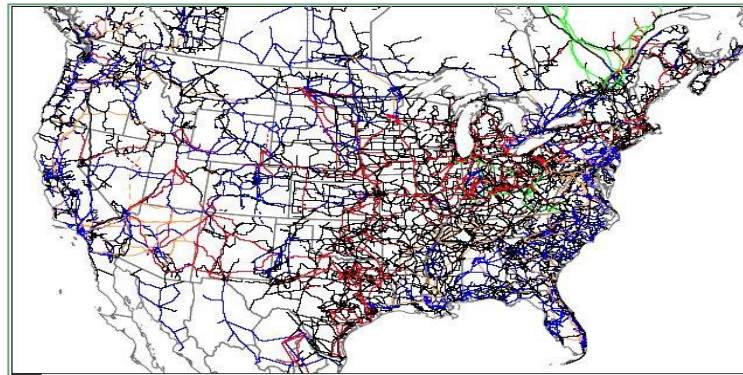




U.S. Department of Energy

Office of Electricity Delivery and Energy Reliability

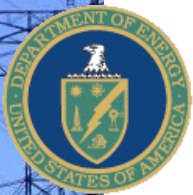
Electricity System Activities and Partnerships



William Parks

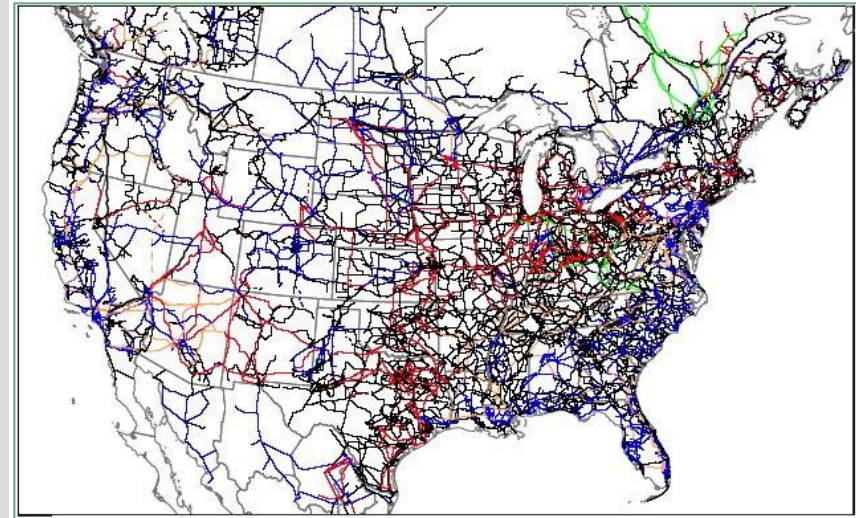
Office of Electricity Delivery and Energy Reliability

September, 2010



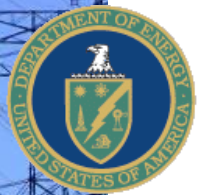
The Electric Grid

- **Physically**
- Never holistically designed, grid developed incrementally in response to local load growth
Today, there are:
 - 30,000 Transmission paths; over 180,000 miles of transmission line
 - 14,000 Transmission substations
 - Distribution grid connects these substations with over 100 million loads, i.e. residential, industrial, and commercial customers
- Diverse industry w/o a common voice
 - 3,170 traditional electric utilities
 - 239 investor-owned, 2,009 publicly owned, 912 consumer-owned rural cooperatives, and 10 Federal electric utilities
 -
- **Technically**
- Electricity flows within three major interconnections along paths of lowest impedance (at the speed of light); yet the grid is operated in a decentralized manner by over 140 control areas
- Demand is uncontrolled; electricity is the ultimate “just-in-time” production process

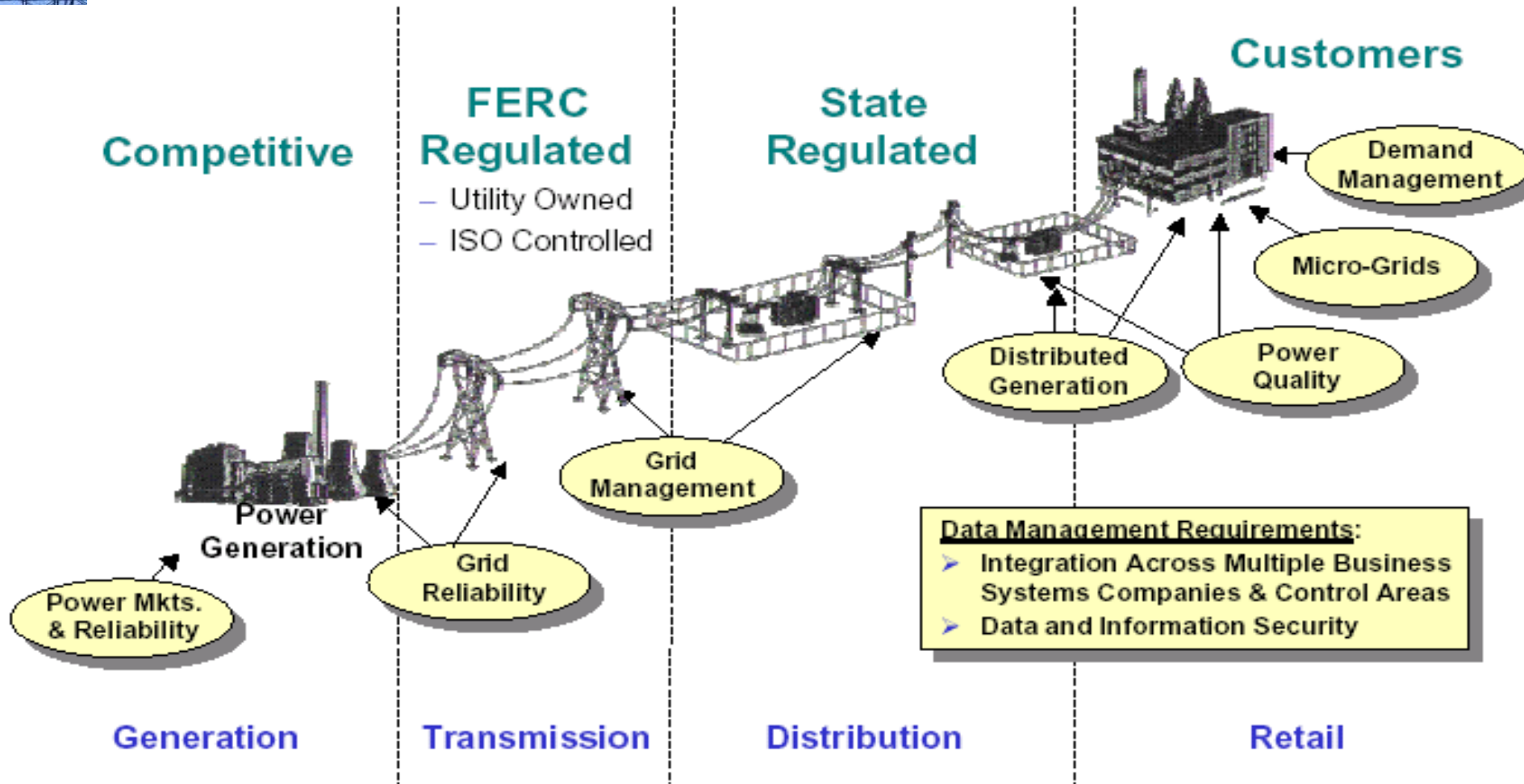


Uniqueness

- Two things make electricity unique:
 1. Lack of flow control
 2. Lack of large-scale energy storage

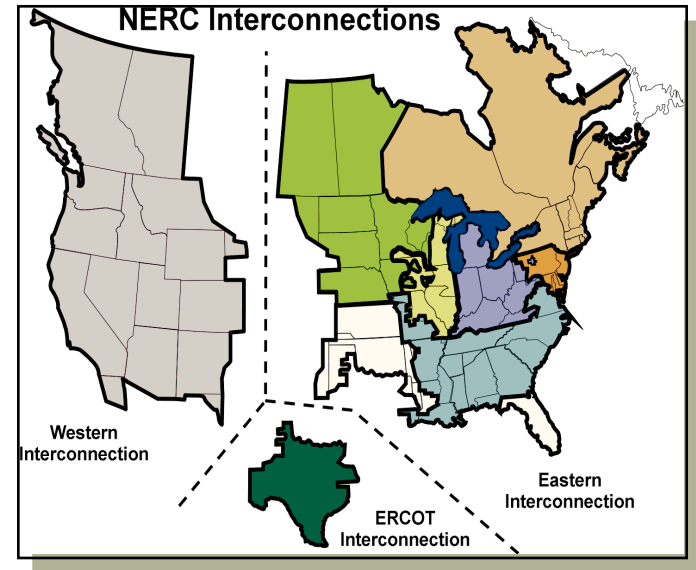
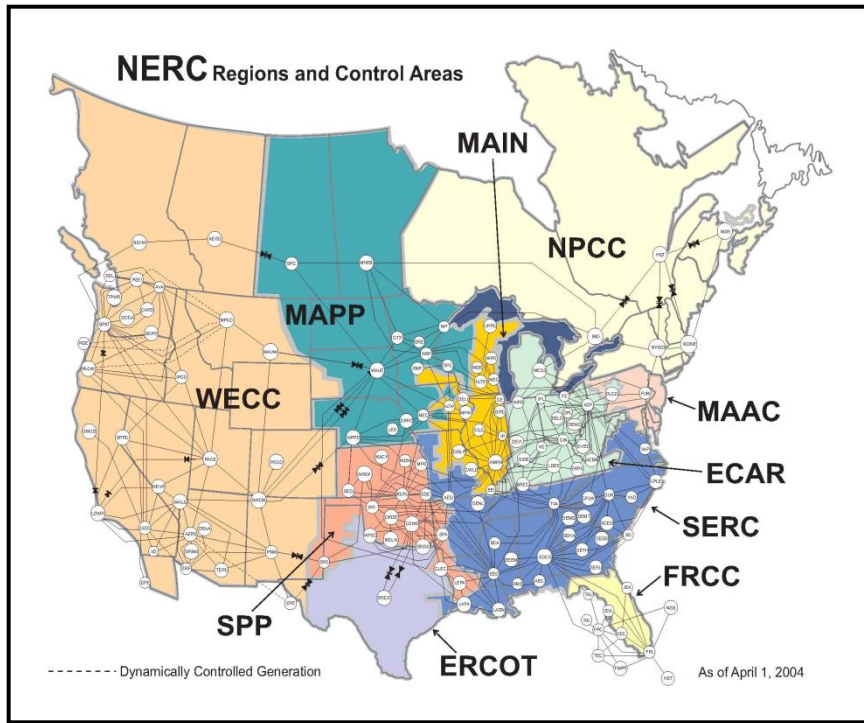


Regulation





We are moving to a scale that is well beyond anything currently being done



Changes Facing the System

- Adapting the electric grid to a low carbon future
 - Generation Diversity (size and make-up): developing & deploying abundant affordable zero/low carbon domestic resources
 - System Efficiency: catching up to today's grid needs *and* enabling a low-carbon future
- Consumer Energy Management
 - Demand-side: enabling the customer to participate (energy efficiency, demand response, energy storage, distributed energy -CHP, plug-in hybrids)
- Smart Grid (sensing-data collection- monitoring- automation)
 - Advanced monitoring and analysis (phase measurement units, real-time data simulators- operational modeling, advanced metering)
- Transportation – hybrids to plug in hybrids
- Security (availability and integrity)
 - Control System Security (vulnerabilities)
 - Diagnostics (intrusion detection, anomalies)
 - Recovery (resiliency)



Office Of Electricity Delivery and Energy Reliability



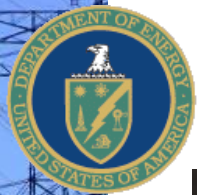
OE Mission: Lead national efforts to modernize the electric grid, enhance the security and reliability of the energy infrastructure, and facilitate recovery from disruptions to the energy supply

OE

**Research &
Development (R&D)**

**Permitting,
Siting,
& Analysis
(PSA)**

**Infrastructure Security &
Energy Restoration
(ISER)**



Implementing our Mission



Public – Private partnership:

- Stimulate investment in electric and energy infrastructure;
- Advance the state of scientific development;
- Improve grid analytic and visualization capabilities;
- Deepen consideration of security and resiliency measures in energy infrastructure; and
- Expand partnerships with States and Regions.





American Recovery and Reinvestment Act- \$4.5 Billion

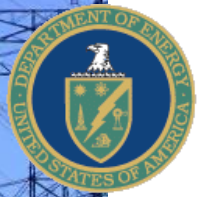
1. Smart Grid Investment Program/≈\$3,443M

This program promotes smart grid investment projects to use digital technology to improve reliability, security, and efficiency of the electric system from generation to the consumer. These investments will include projects in phasor measurement, to help monitor grid performance, and the cyber-security aspects of control systems. Competitive grants will be used to implement the program.

2. Smart Grid Regional and Energy Storage Demonstrations/\$700M [*\$615M for new grants and up to \$85M to complete existing, previously competed demonstration projects.*]

Projects will be developed to show the applicability of smart grid technology and validate smart grid business case models on a scale that can be readily planned and replicated around the country. The demonstration projects will showcase those advanced digital technologies – such as microprocessor-based measurement and control, communications, computing and information – for use in planning for the future of the electric power system and electricity markets. Financial assistance will be provided through a competitive grant process.

American Recovery and Reinvestment Act- \$4.5 Billion



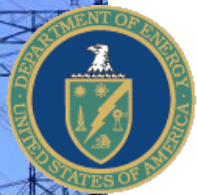
3. Interoperability Standards and Framework/\$10M

As specified in the ARRA statute, this activity will develop a unique and consistent set of interoperable smart grid standards and framework so that they can be implemented uniformly throughout the U.S. electric industry. It will be implemented via execution of an Interagency Agreement with the National Institute of Standards and Technology (in the Department of Commerce).

4. Interconnection Transmission Planning and Analysis/\$80M

As directed in the Recovery Act, OE will conduct a resource assessment and analysis of future demand and transmission requirements in the three regional interconnections in the US. This initiative will develop or greatly expand resource assessments, strengthen interconnection-level transmission analysis and planning, provide additional support for integration of renewables, and ensure a more reliable and efficient electrical system. The funds will enable state and local governments, regional electricity organizations, and non-governmental organizations (NGOs) to collaborate in planning modern, next-generation high-voltage transmission networks.





American Recovery and Reinvestment Act- \$4.5 Billion

5. State Assistance on Electricity Policies/\$50M

Funds will be used by States and their public utility commissions to hire staff to accelerate review of the expected large number of time-sensitive requests to approve electric utility expenditures undertaken as part of the ARRA. It is anticipated that new hires will be made or existing staff retrained to serve in this function for two to four years, depending on case load. Funds will be dispersed through a formula grant to the States.

6. State and Local Governments' Energy Assurance Capabilities and Planning to Build Grid Resiliency/\$55M

Funds will be used by the States and local governments to hire or retrain staff to prepare them for issues such as dealing with integrating smart grid technology into the grid, critical infrastructure interdependencies, and cyber-security. Throughout this process, the emphasis will be on building regional energy assurance capabilities where States and cities can help and learn from one another. Funds will be dispersed through a formula grant to States and through a competitive process for the local governments.

7. Workforce Training/\$100M

As specified in the ARRA statute, \$100 million will support the training and retraining of unemployed workers into the workforce quickly. The details of this activity is under development.

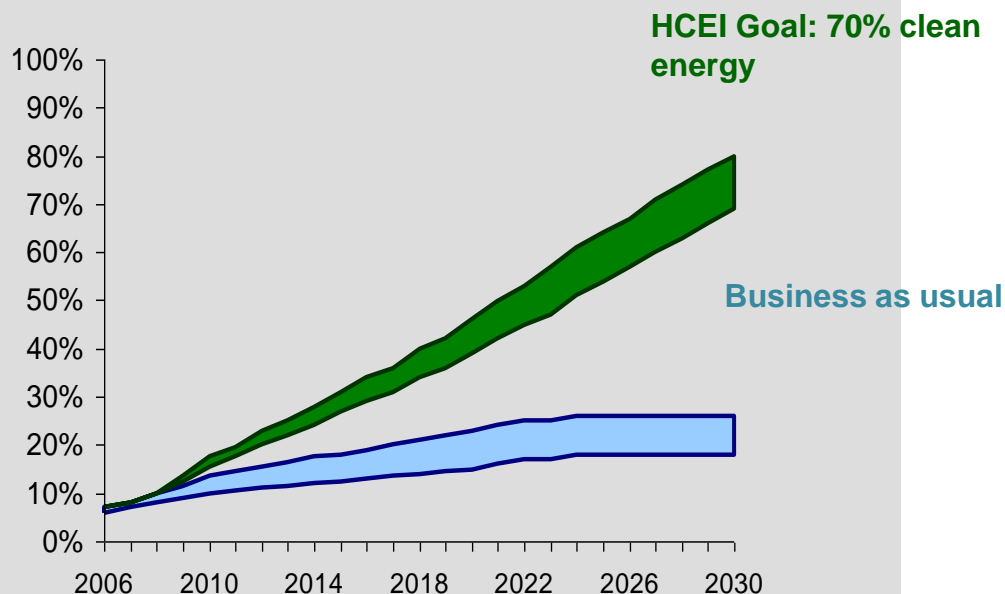


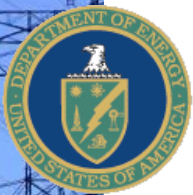
Hawaii Clean Energy Initiative Example of What Partnerships Can Do

- The Hawaii Clean Energy Initiative is a partnership between DOE and the State of Hawaii
- The goal is to **transform an economy** based predominantly on oil to one based on clean energy – specifically, to reach 70% clean energy by 2030

DOE's Vision for Hawaii Clean Energy Initiative

To partner with Hawaii and serve as a global model for creating a sustainable, flexible, and economically vibrant path to a carbon-free energy future



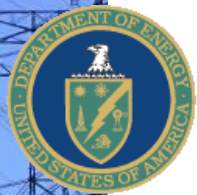


Hawaii has great resources for renewable energy



	Solar
	Ocean
	Bioenergy
	Geothermal
	Hydro
	Wind
	Waste

Energy efficiency and advanced vehicles are possible on every island



A Formula for Success with Electricity

- Achieve a balance :
 - A financially healthy utility system
 - Open the market to RE and EE developers
 - Protect consumer interests

Renewable-energy wave hits Hawai'i

State sorting through dozens of power plans from all over the globe

BY GREG WILES
Advertiser Staff Writer

In what may be a sign of things to come for Hawai'i's economy, the state Energy Planning and Policy Branch is adding workers while most of state government is shrinking.

The office is hiring 18 workers with the help of federal funding and is an oasis of sorts within the Department of Business, Economic Development and Tourism, where 40 out of 96 positions are being eliminated.

Indeed, Hawai'i's energy industry has been a bright spot in an otherwise dour time for the state's economy, with solar photovoltaic installation companies doing well and renewable energy firms looking at adding many megawatts of projects here. Energy may be a stealth economic engine for the state, one that has relied on tourism and military spending as its main locomotives.

"This is a big opportunity," said Ted Peck, head of the Energy Planning and Policy office, who says he is being approached several times a week by companies exploring setting up shop here.

"We have had a half dozen states and four countries call us and say we want to partner with you and learn with you."

Hawai'i currently gets 90 percent of its energy from oil, a percentage that's greater than any other state. That includes paying about \$3.5 billion for 50 million barrels of oil imported into the state.



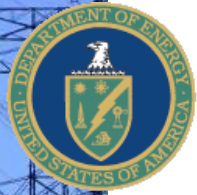
HAWAII'S ENERGY COSTS

Energy type	Hawai'i average	National average
Regular gasoline	\$3.252	\$2.501*
Diesel fuel	\$3.869	\$2.653
Natural gas	\$19.14	\$5.69**
Residential electricity	22.99 cents	11.96 cents***
Commercial electricity	31.94 cents	10.72 cents***
Industrial electricity	17.07 cents	7.12 cents***

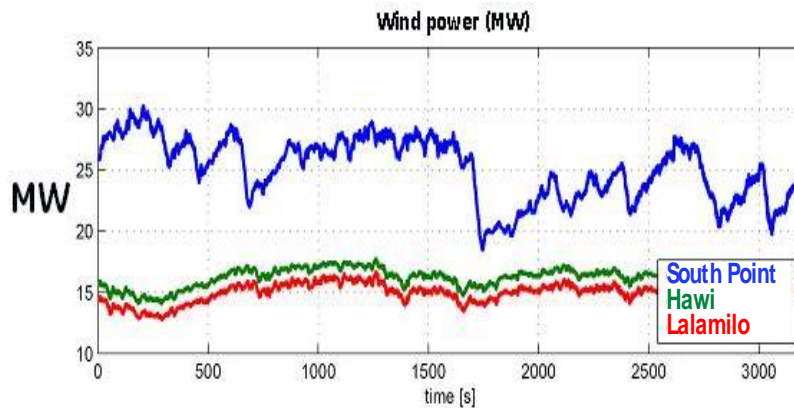
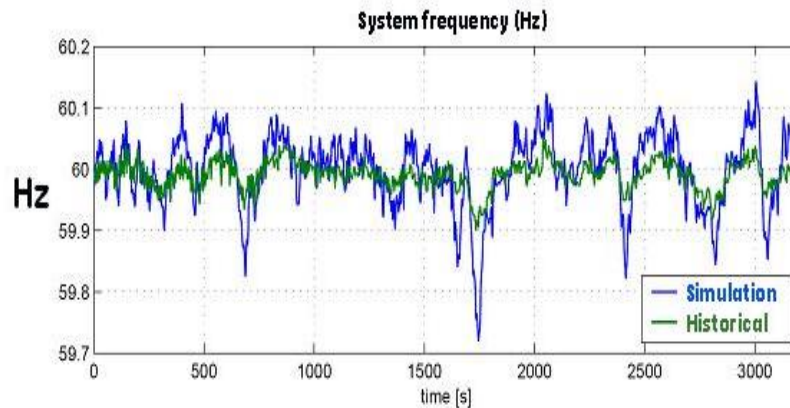
37 Provisions of the HCEI Energy Agreement

1. Wind power for Hawaii
2. Renewable energy commitments
3. The technology of inter-island renewables
4. The solar opportunity
5. Biofueling
6. Avoided energy contracts
7. Feed-in tariffs
8. Coal
9. Renewable Portfolio Standards (RPS)
10. Greening transportation
11. Displacement of fossil fuel energy and “retirements”
12. Energy efficiency
13. Demand response programs
14. Advanced metering infrastructure (AMI)
15. Pricing principles and programs
16. Meeting the military’s needs
17. Seawater air conditioning (SWAC)
18. Distributed generation (DG) and Distributed energy storage (DES)
19. Net Energy Metering (NEM)
20. Lifeline rates
21. The Gas Company
22. Green contracting
23. Resource attributes: the loading order
24. Public Benefits Fund (PBF)
25. Investment in infrastructure
26. The smart grid
27. Transmission planning
28. Decoupling from sales
29. Clean energy infrastructure surcharge
30. Energy Cost Adjustment Clause (ECAC)
31. Preferred stock/hybrid securities
32. Clean energy scenario planning (CESP)
33. Clean energy scenario plan
34. Federal laws and rules
35. Greenhouse gas (GHG) issues
36. Telling the energy story
37. How we stay on track

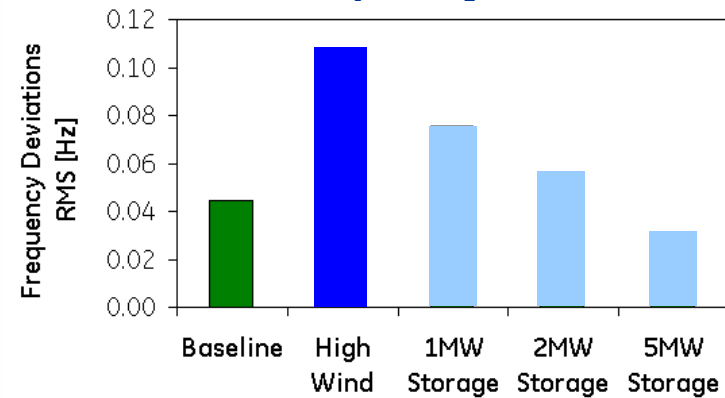
The Impact of 40% Wind Penetration Need for Coordination With Fast-Reacting Resources



At 40% wind penetration, system frequency is severely affected



Incremental additions of
“fast” energy storage
increasingly stabilizes system
frequency

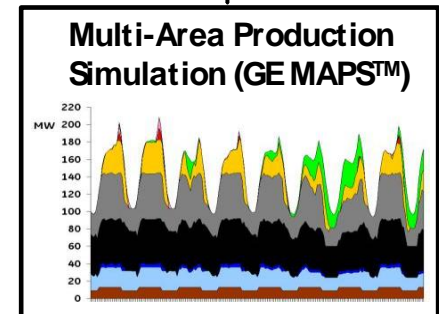
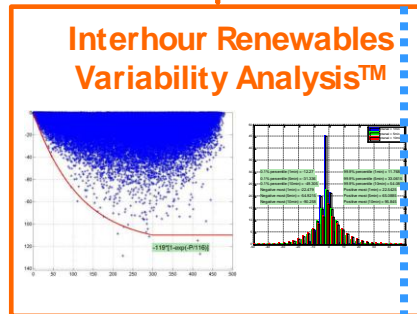
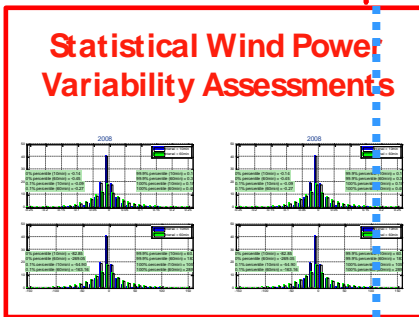
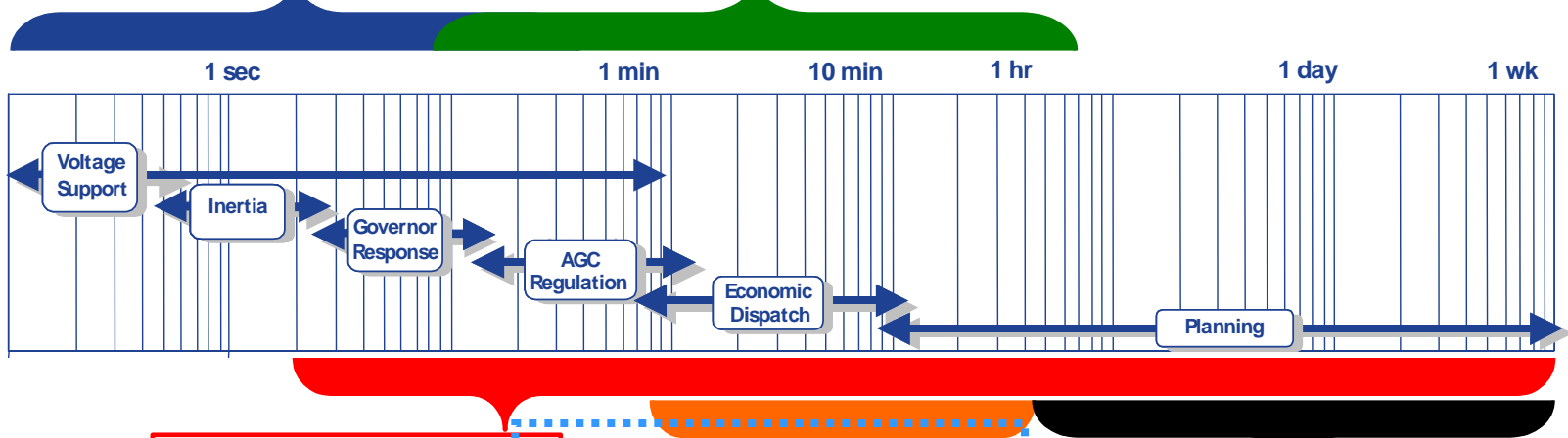
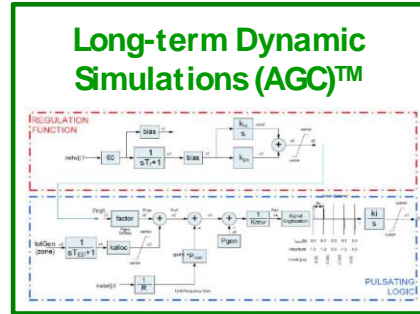
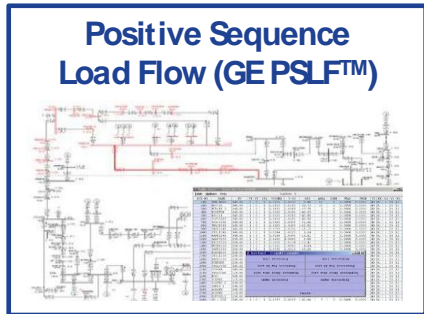


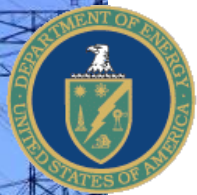
5MW of power resulted in similar
frequency performance as the
baseline scenario; near-term potential
project



A Tool For Each Timescale of the Power System

New data and tools are needed to properly model and assess system impacts within operational time constraints.

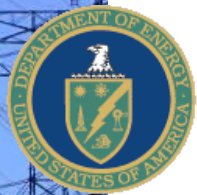




HCEI Achievements

- **1st in nation in solar water heater installed capacity**
- **Photovoltaic solar energy**
 - Second in the nation in per-capita generation
 - Doubled capacity in 2009 – new tax benefit
- **Bioenergy Master Plan fulfilling purpose of kick-starting industry**
- **Renewable and smart grid projects being developed on most islands**
 - Over 600MW Renewable projects in the pipeline
- **1st in nation in energy performance contracts per capita**
- **Clean Energy Standards among highest in the nation**

- **Clear and maturing plan to reach objectives – transformation is real and within reach**
- **Broad set of partnerships – Federal, State, County, NGO, Industry**



GHG Emissions Changes Under HCEI

Work Plan or case	Description	Emissions in 2020 (CO ₂ e)	Amount Below 1990 Target CO ₂ e	% Below 1990 Target Level
Work Plan 1	HCEI & added proposed policies are met on time	8,377 kt	5,280 kt	38.7%
Work Plan 2	State Carbon Tax used w/ Work Plan 1	8,327 kt	5,330 kt	39.0%
Work Plan 3	Federal Cap & Trade system used with Work Plan 1	8,324 kt	5,340 kt	39.1%
Reference Case	Existing laws & policies met on time	13,122 kt	538 kt	4.0%

HCEI can reduce Hawaii Greenhouse Gases by 50% by 2020