



Quadrennial Energy Review 1.2

An Integrated Study of the Electricity System

National Academy of Sciences
Rural, Isolated and Islanded Communities Workshop



February 8, 2016

PRE-DECISIONAL



QER Background and Process

THE WHITE HOUSE
Office of the Press Secretary

January 9, 2014

For Immediate Release

January 9, 2014

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

SUBJECT: Establishing a Quadrennial Energy Review

Affordable, clean, and secure energy and energy services are essential for improving U.S. economic productivity, enhancing our quality of life, protecting our environment, and ensuring our Nation's security. Achieving these goals requires a comprehensive and integrated energy strategy resulting from interagency dialogue and active engagement of external stakeholders. To help the Federal Government better meet this responsibility, I am directing the undertaking of a Quadrennial Energy Review.

- Presidential Memorandum stated the Administration will conduct a Quadrennial Energy Review to be led by the White House Domestic Policy Council and Office of Science and Technology Policy
- Supported by a Secretariat established at the Department of Energy
- Process involves the robust engagement of federal agencies and outside stakeholders
- Enables the federal government to translate policy goals into a set of analytically based, integrated actions for proposed investments over a four-year planning horizon



QER Process -General

Analysis

- Baselines
- Scenarios and modeling
- Analysis of disruptive events
- Synthesis of available work

Stakeholder Engagement

- Stakeholder meetings
- Stakeholder comments
- Technical workshops
- Regular briefings

Interagency Collaboration

- Technical expertise
- Data, studies, analysis
- Interim and final product reviews



QER Focus

- **Develop an integrated view** of the short-, intermediate-, and long-term objectives for Federal energy policy (economic, environmental, and security priorities);
- **Outline legislative proposals;**
- **Identify executive actions** (programmatic, regulatory, fiscal, etc.) coordinated across multiple agencies;
- **Identify resource requirements** for RD&D and incentive programs; and
- **Provide a strong analytical base** for decision-making, insights on industry trends and economic impacts



QER 1.1: Transmission, Storage and Distribution Infrastructure

Why Did we do Transmission, Storage and Distribution Infrastructure in QER 1.1?

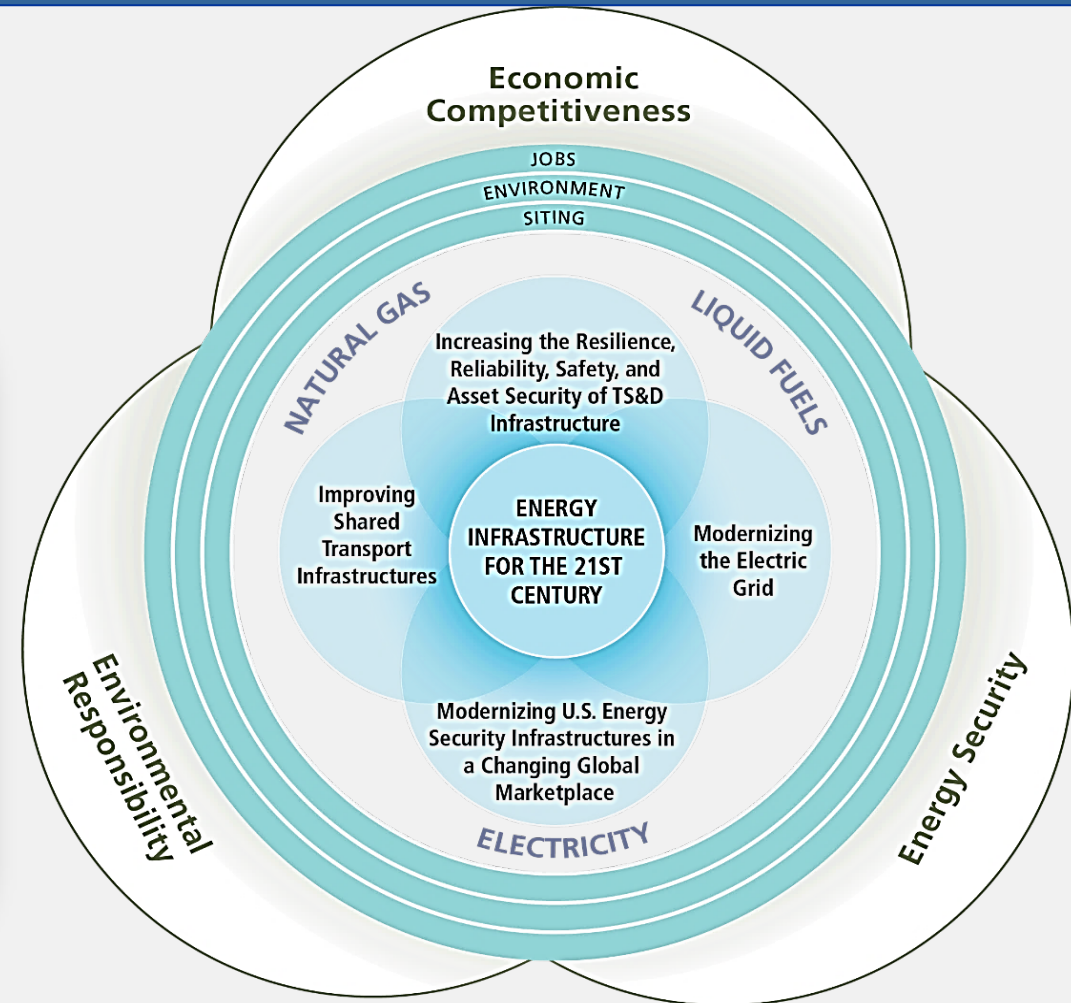
- Highly capital intensive
- Long-lived at the decadal scale
- “Connective tissue” of energy systems
- Decisions made today will strongly influence our energy mix for much of the 21st century

TS&D Infrastructure is the Limiting Factor in Transforming our Energy Systems



QER 1.1: 63 Recommendations

- Increasing Resilience, Reliability, Safety and Asset Security
- Modernizing the Electric Grid
- Modernizing US Energy Security Infrastructure
- Shared Transportation
- Integrating N. American Energy Markets
- Workforce
- Siting and Permitting





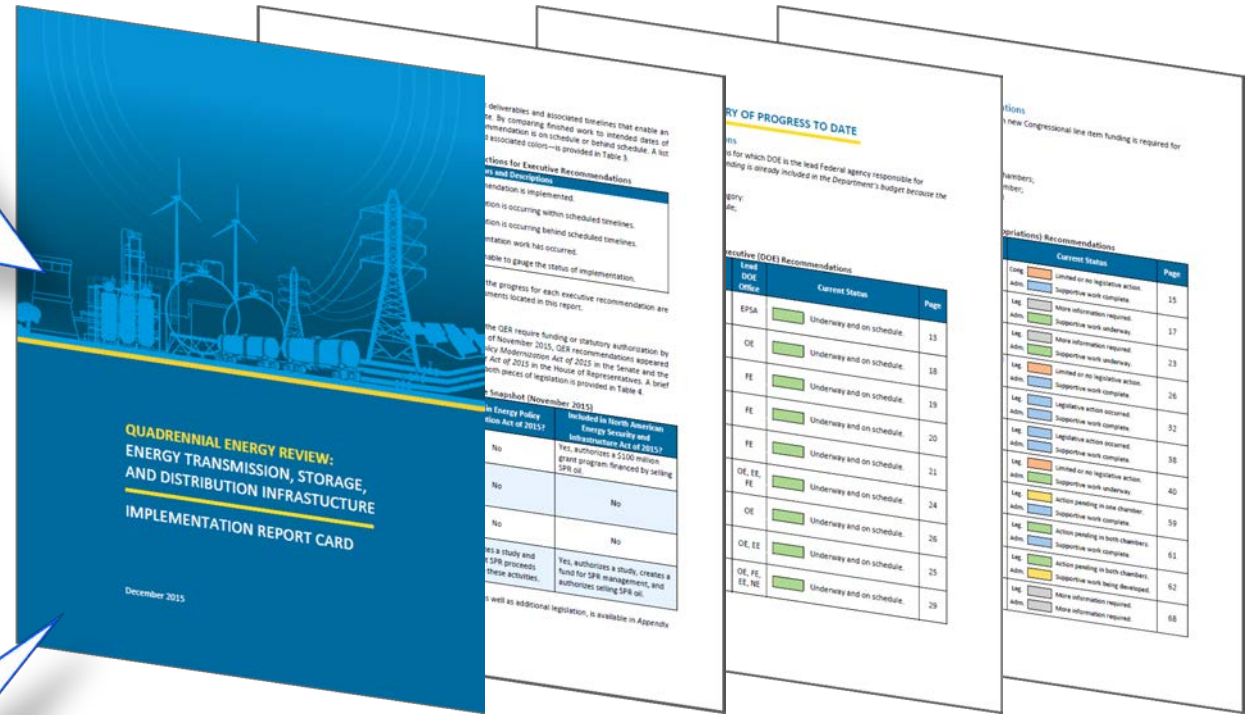
QER 1.1: Implementation

Implementation Breakdown:

- Executive Action (White House)
 - DOE – 35
 - Other Federal Agencies – 10
- Legislative Action (Congress)
 - New Appropriation – 13
 - New Statute – 5

Highlights:

- 3 recommendations are complete
- \$2 billion to modernize the Strategic Petroleum Reserve



QER 1.1 Implementation Report Card

- Detailed analysis of all 63 recommendations
- Shows where additional work is required



Current Work on QER 1.1 and 1.2

QER 1.1 TS&D Implementation

- Energy bill
- Appropriations
- Transportation bill
- Interagency/DOE work

QER 1.2 Electricity: Scoping

- Baselines
- National labs, consultants
- Framing documents
- Stakeholder consultations



QER 1.2: Electricity Generation to End Use

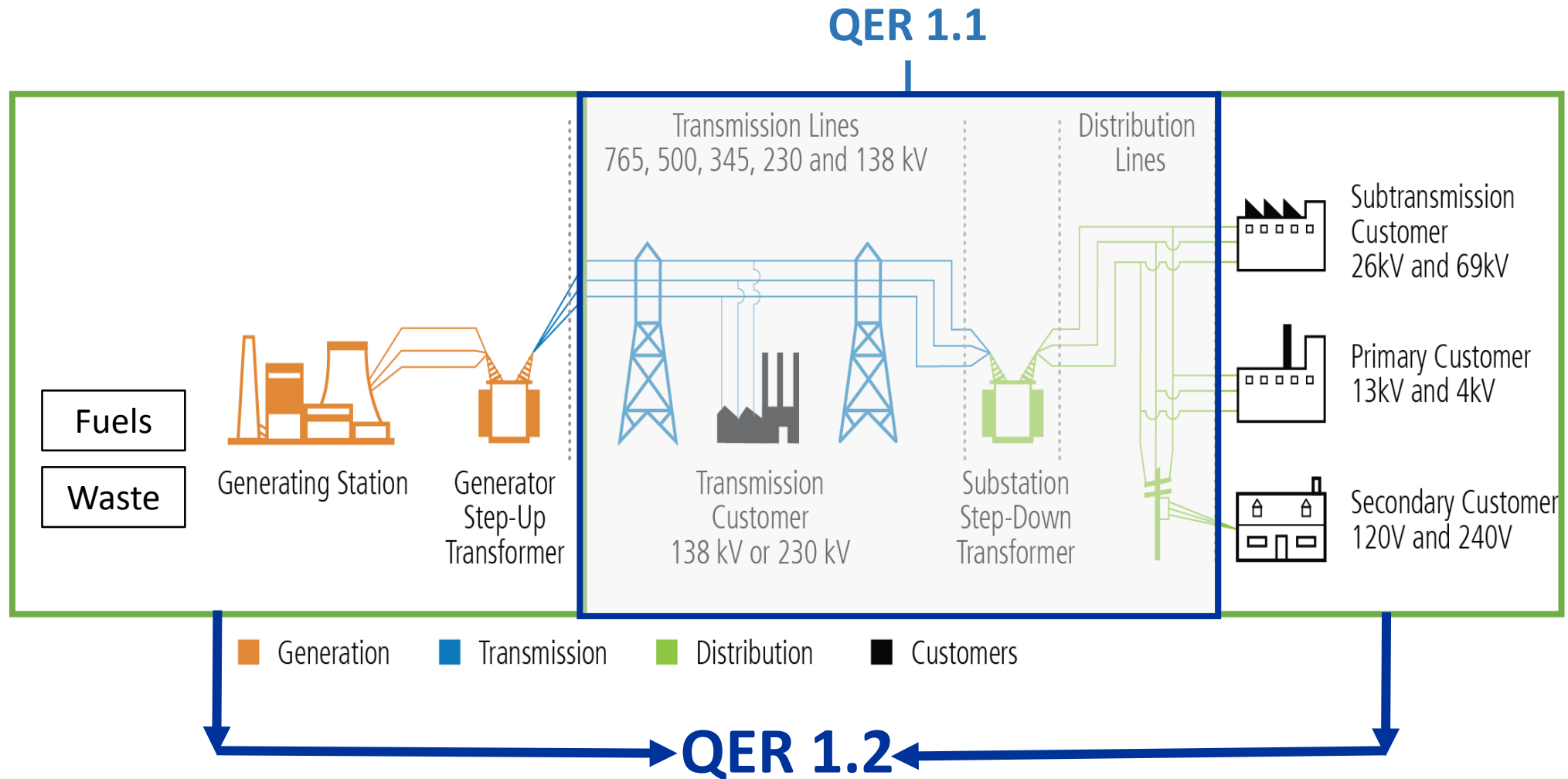
QER 1.1 documented major transformation of Electricity Sector:

- Changing generation mix
- Low load growth
- Increasing vulnerability to severe weather/climate
- New technologies, services and market entrants
- Cyber/physical threats
- Aging infrastructure and workforce
- Growing overlap between jurisdictions

Given the centrality of electricity to the Nation, this transformation merits a closer examination in the next installment of the QER.

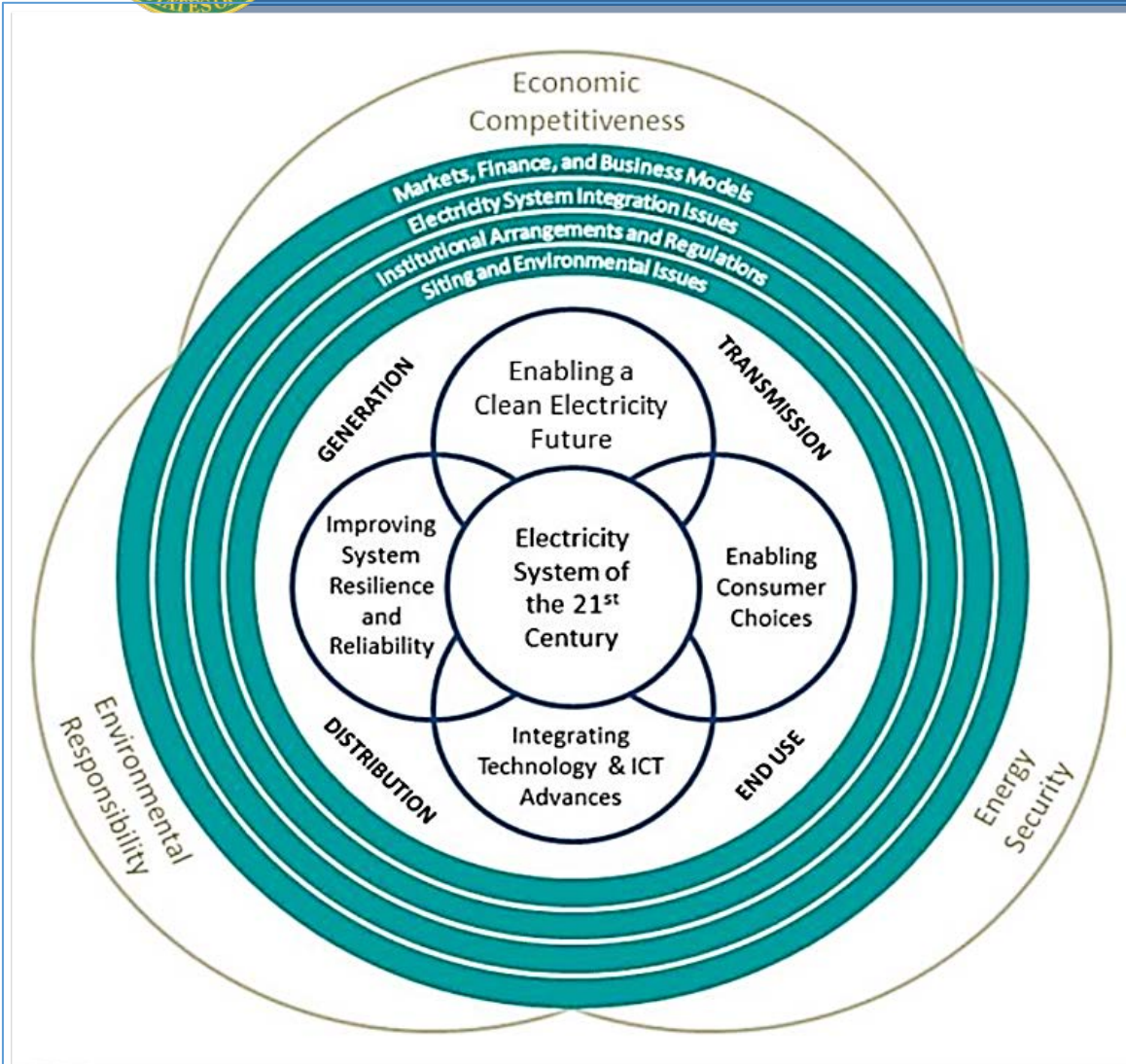


Linking QER 1.1 and 1.2





The QER Lens

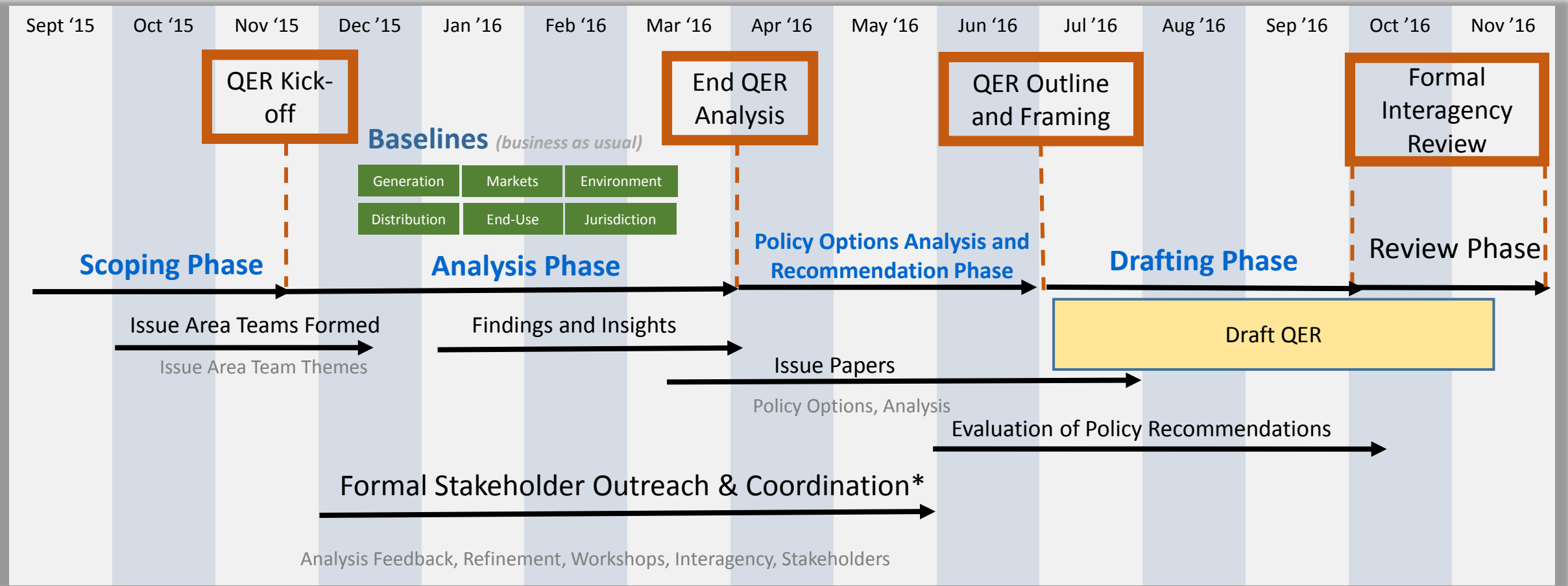


QER Secretariat

- **QER 1.2 will analyze how the electric power system as a whole is evolving, including:**
 - Integrating new technologies
 - Changing market conditions
 - Grid operations
 - Financing and valuing
 - Changing role of the customer
- **Physical structures and the roles of a range of actors, institutions and industries are being analyzed, vis-à-vis:**
 - Maintaining reliability of supply
 - Ensuring electricity affordability
 - Adapting to dramatic changes in technology and services
- **QER analyses are underway to consider issues such as:**
 - Fuel choice
 - Distributed and centralized generation
 - Physical and cyber vulnerabilities
 - Federal, state, and local policy direction
 - Expectations of residential and commercial consumers
 - Reviewing existing and evolving business models for a range of entities, throughout the system



Process Timeline



*Need to specify dates of interagency, DOE WG, S1, external stakeholders following finalization of outreach strategy

Final Report Rollout and Release (Nov '16-Jan '17)



Stakeholder Engagement Outreach Strategy

	Dec 2015	Jan 2016	Feb 2016	Mar 2015	April 2016	May 2016
Stakeholder Meetings		1 st Public Stakeholder Meeting (DC) 5-6 Meetings around country				
Technical Workshops	Number, subjects and locations TBD NAS Workshop on Rural, Islanded and Isolated Communities Feb 8-9					
Comment Period	February 4 – July 1, 2016 Submit comments at energy.gov/qer					
DC Briefings	3-5 to introduce QER 1.2 and also upon completion Small group meetings and individual stakeholder meetings throughout process					



Cross-Cutting Teams *(Pre-Decisional)*

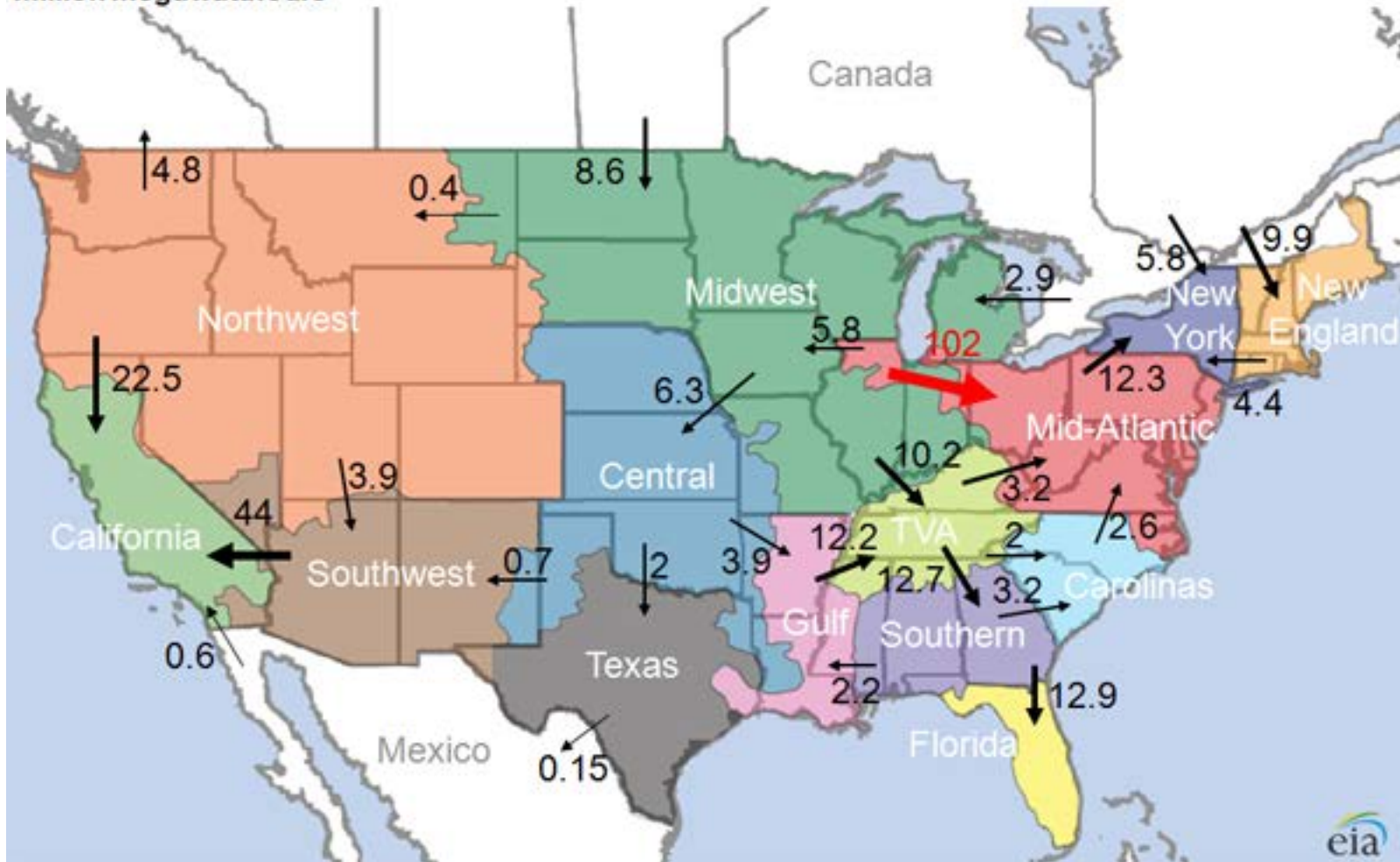
Issue Areas / Work Streams	Other Federal Agencies
End-use	HUD, FERC, EPA, DOD, DHS, USDA, DOT, DOC, DOL, DOI, GSA, Treasury
Grid Operations (Transmission/ Distribution)	FERC, DOT, USDA, DHS, DOI, DOD, EPA, NERC, FCC
Generation	FERC, EPA, USDA, DOD, HUD, DHS, NERC, NRC, GSA, DOI
Markets	DOC, Treasury, FERC, DOI, CFTC
Jurisdictions (Institutional Arrangements, Planning, Business Models)	FERC, DOI, NERC, EPA
Environment (Water, Carbon, Waste,, Land-use, end use, etc.)	EPA, DOI, USDA, EOP, DOI/USGS/BOR, USACE
Finance	Treasury, USDA, DOC, HUD
Innovation / Technology*	NSF, DOD, DOC (NIST)
Resilience	NOAA, EPA, USDA, USACE, DOI, DHS (IP, Policy, OCIA, OIP), DOD, HUD, EOP/CEQ
Security (Phys/Cyber)	DHS (NPPD: IP/OCIA, Policy), DOD, FBI, FERC
North America	DOS, DOC, EPA, FERC, HUD, NOAA
Jobs/Workforce	DOL, Ed, Treasury, VA, NSF
Valuation	FERC, EPA, DHS

*Technology covered by QTR



Regional Characteristics of Electricity System

Annual net power flows among regions in North America, 2010
million megawatthours





US Transmission Network

About This Map »

Click on the links below to switch layers on and off.

EXISTING LINES

- 345-499 kV ?
- 500-699 kV ?
- 700-799 kV ?
- 1,000 kV (DC) ?

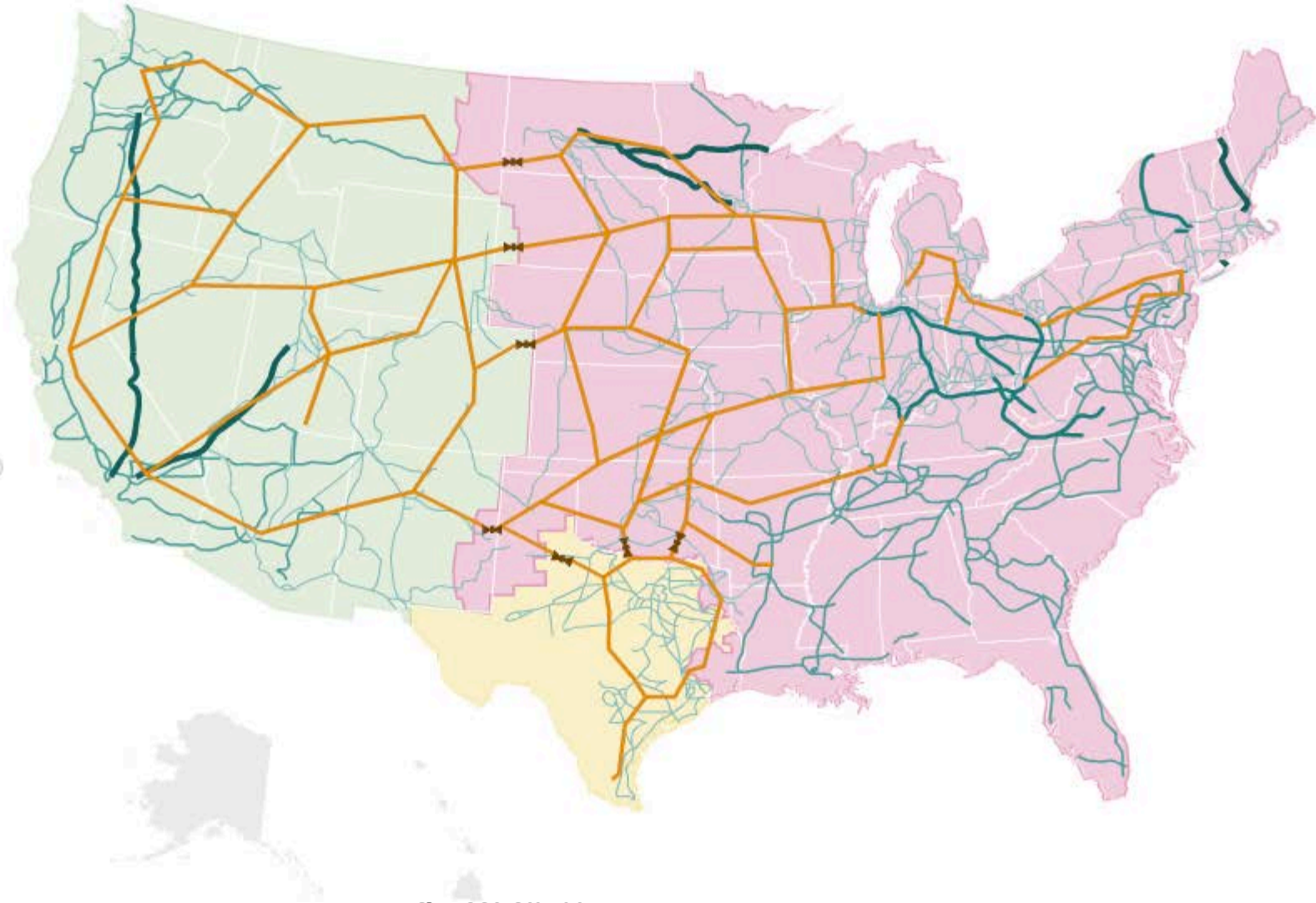
PROPOSED LINES

- New 765 kV ?
- AC-DC-AC Links ?

INTERCONNECTIONS

Major sectors of the U.S. electrical grid

- Eastern
- Western
- Texas (ERCOT)

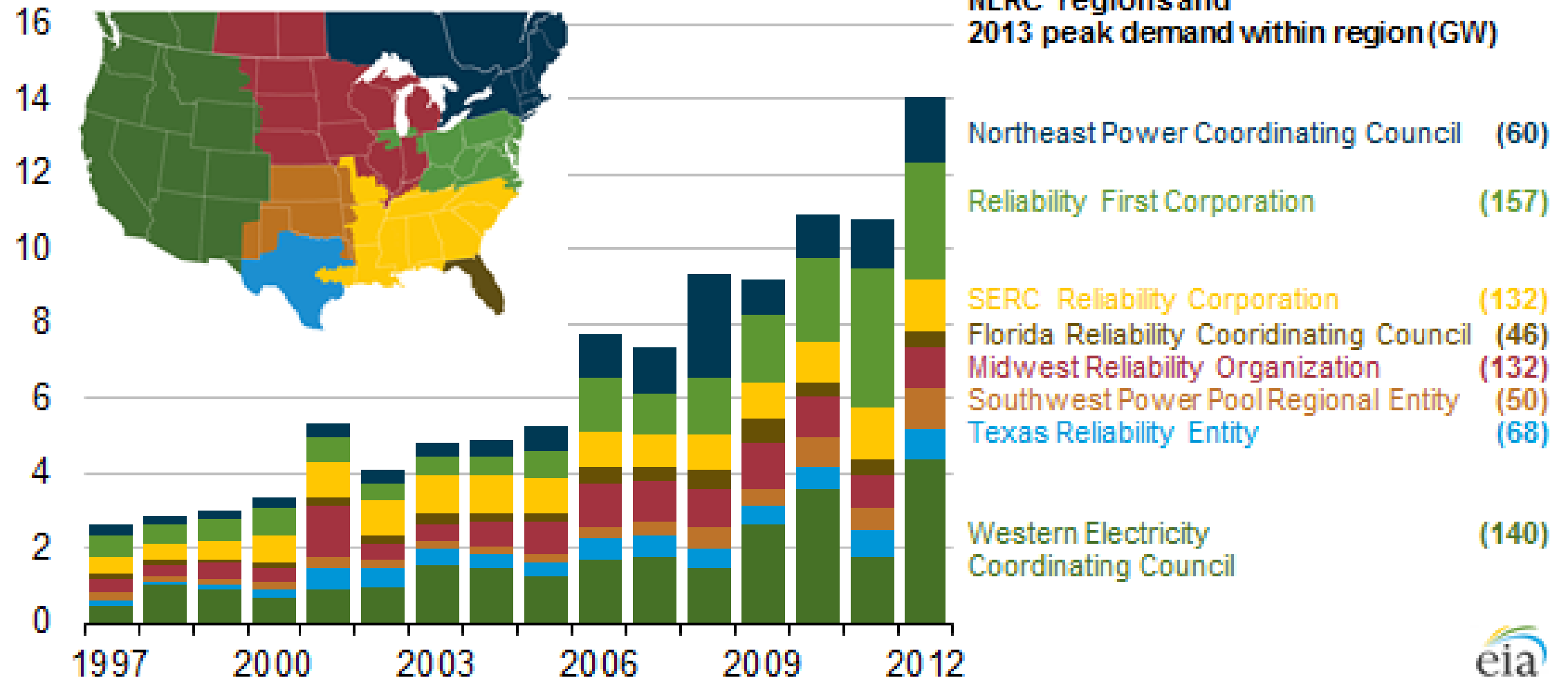




US Electricity Transmission Investment

U.S. electricity transmission investment by NERC region

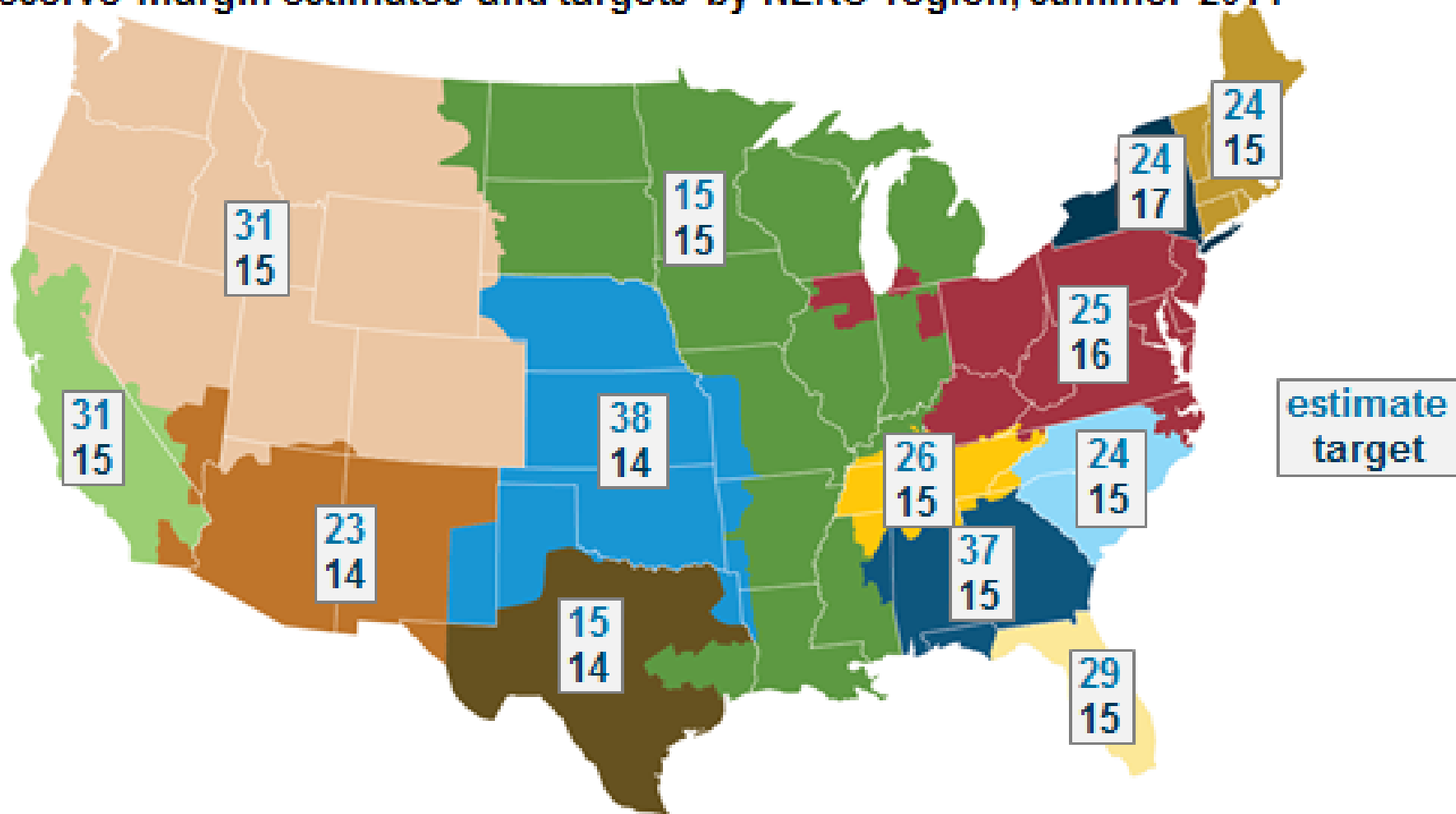
billions of 2012 dollars





Reserve Margin Estimates and Targets

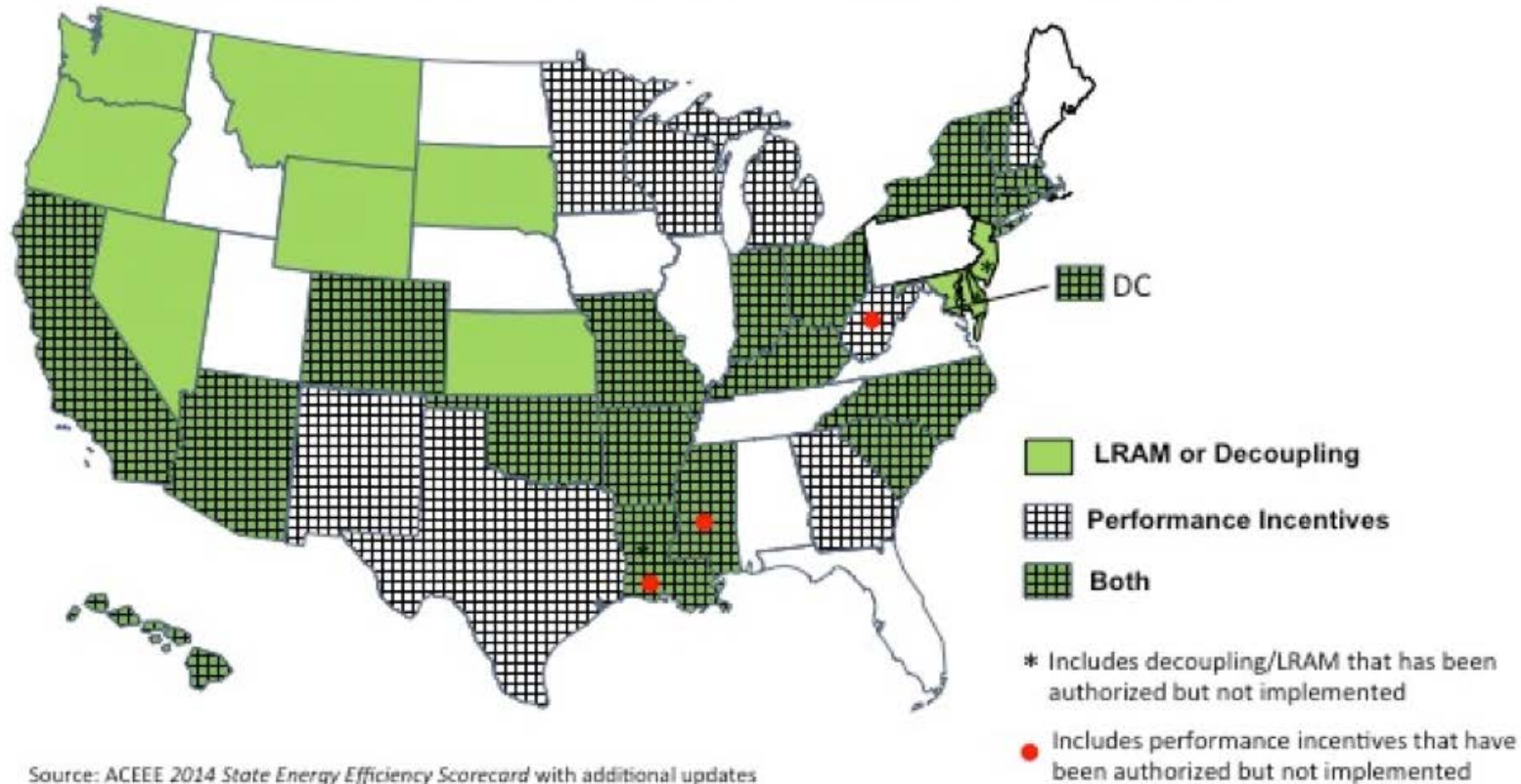
Reserve margin estimates and targets by NERC region, summer 2014





Energy Efficiency Policies

Electric Decoupling, Lost Revenue Adjust Mechanisms, and Performance Incentives



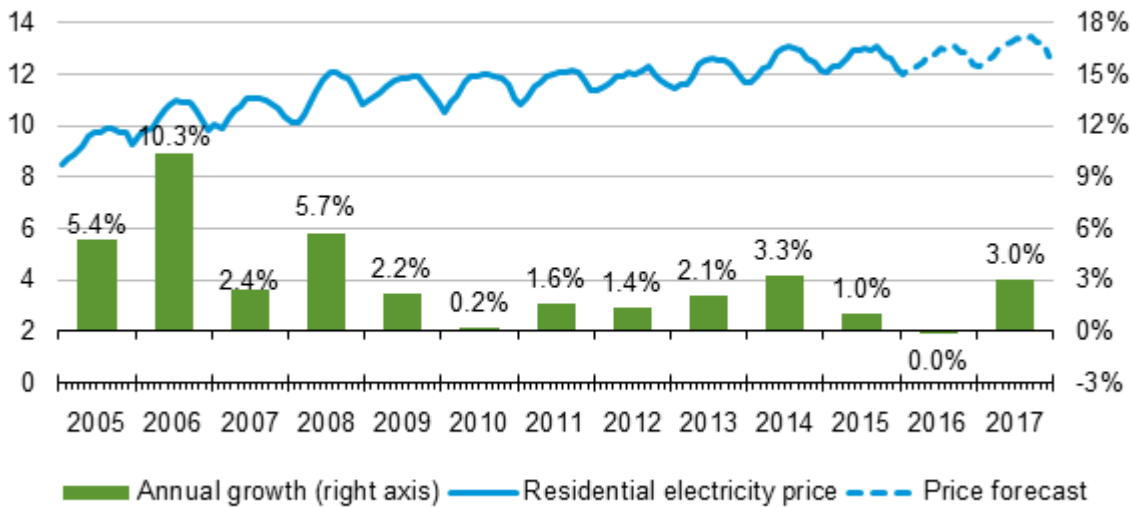
Source: ACEEE 2014 State Energy Efficiency Scorecard with additional updates



Electricity Prices, Consumption and Bills

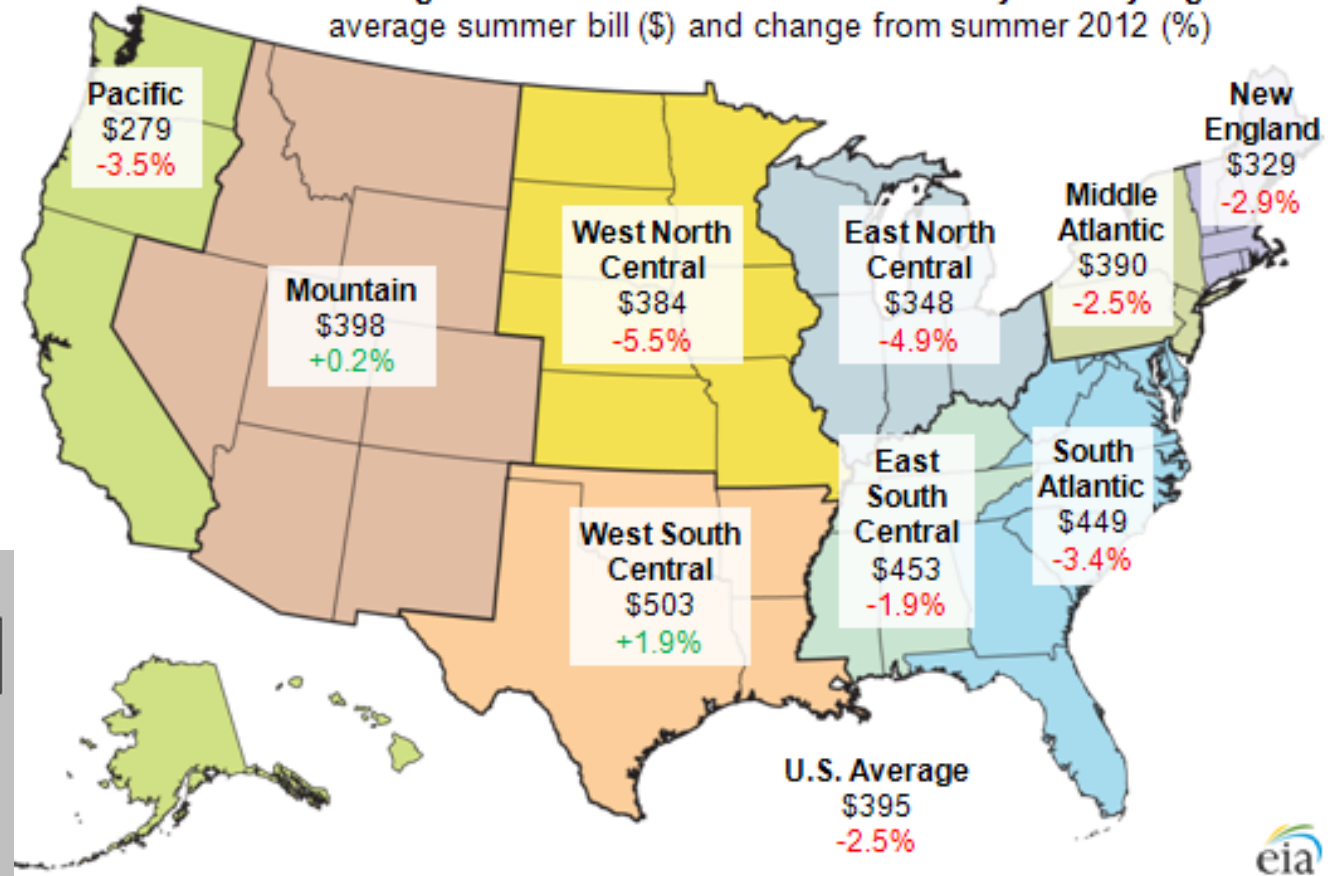
U.S. Residential Electricity Price

cents per kilowatthour



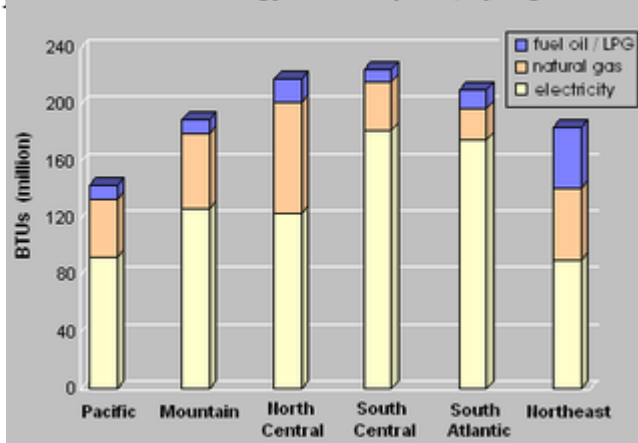
Estimated average summer 2013 residential electricity bills by region

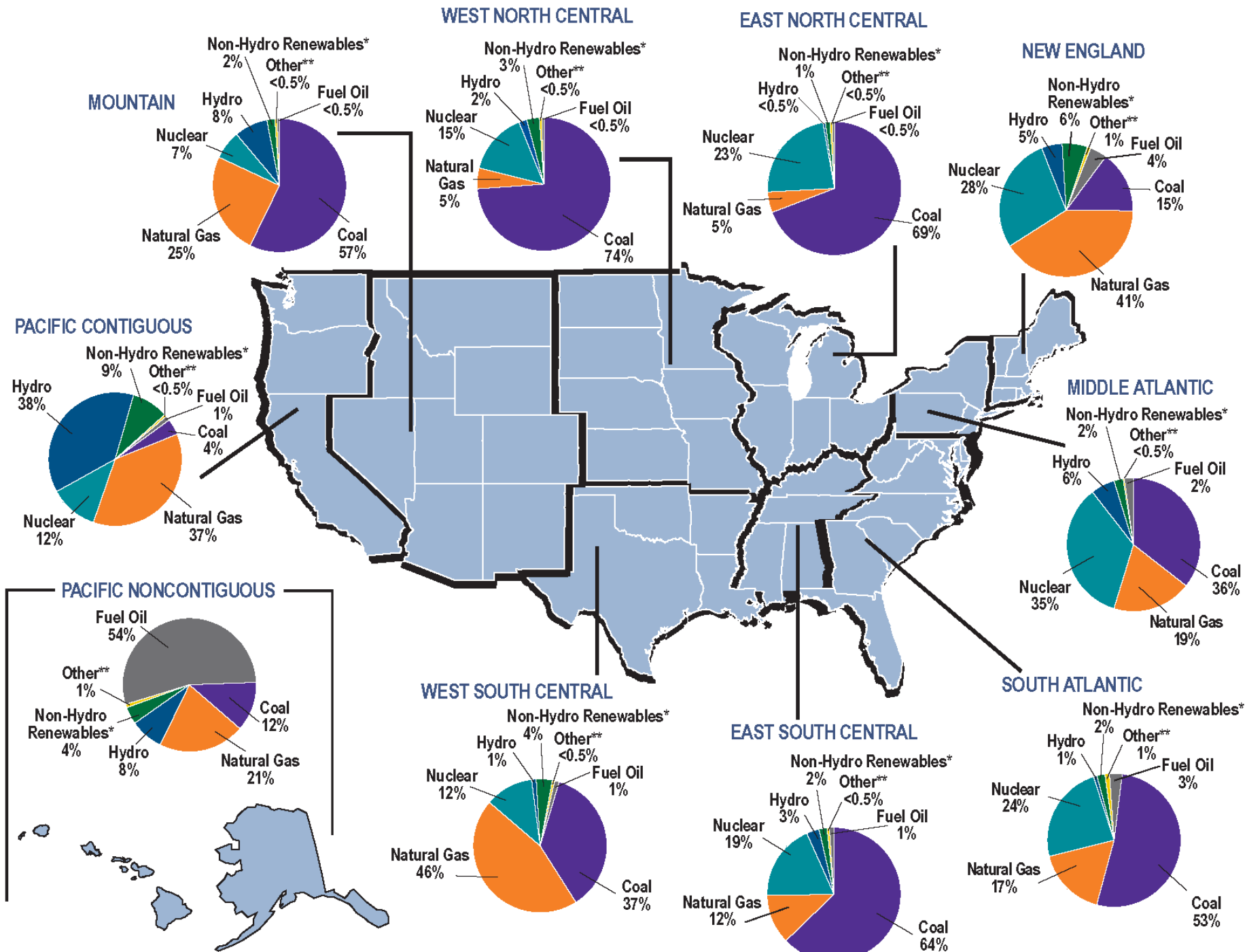
average summer bill (\$) and change from summer 2012 (%)



Source: Short-Term Energy Outlook, January

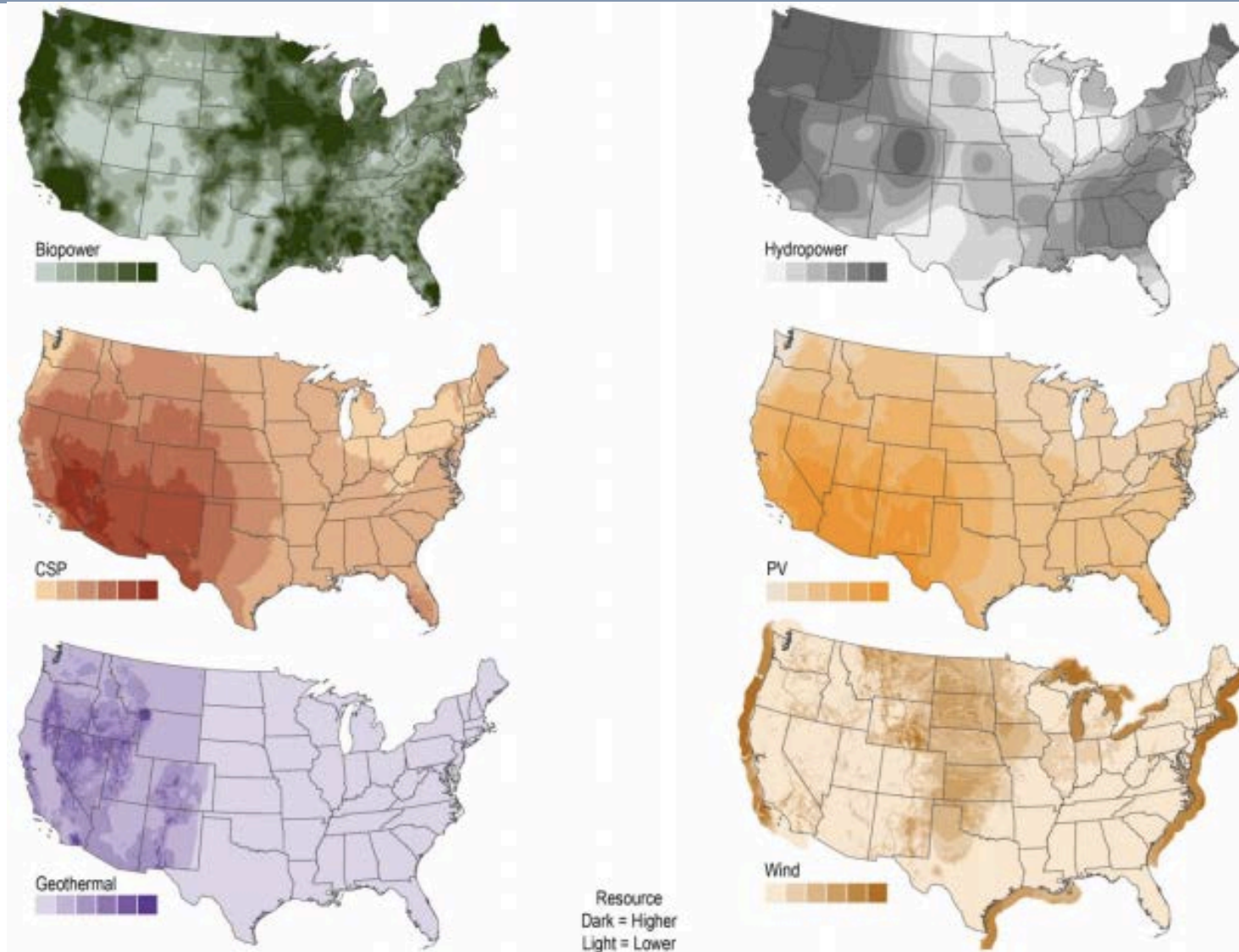
Household Energy Consumption, by region





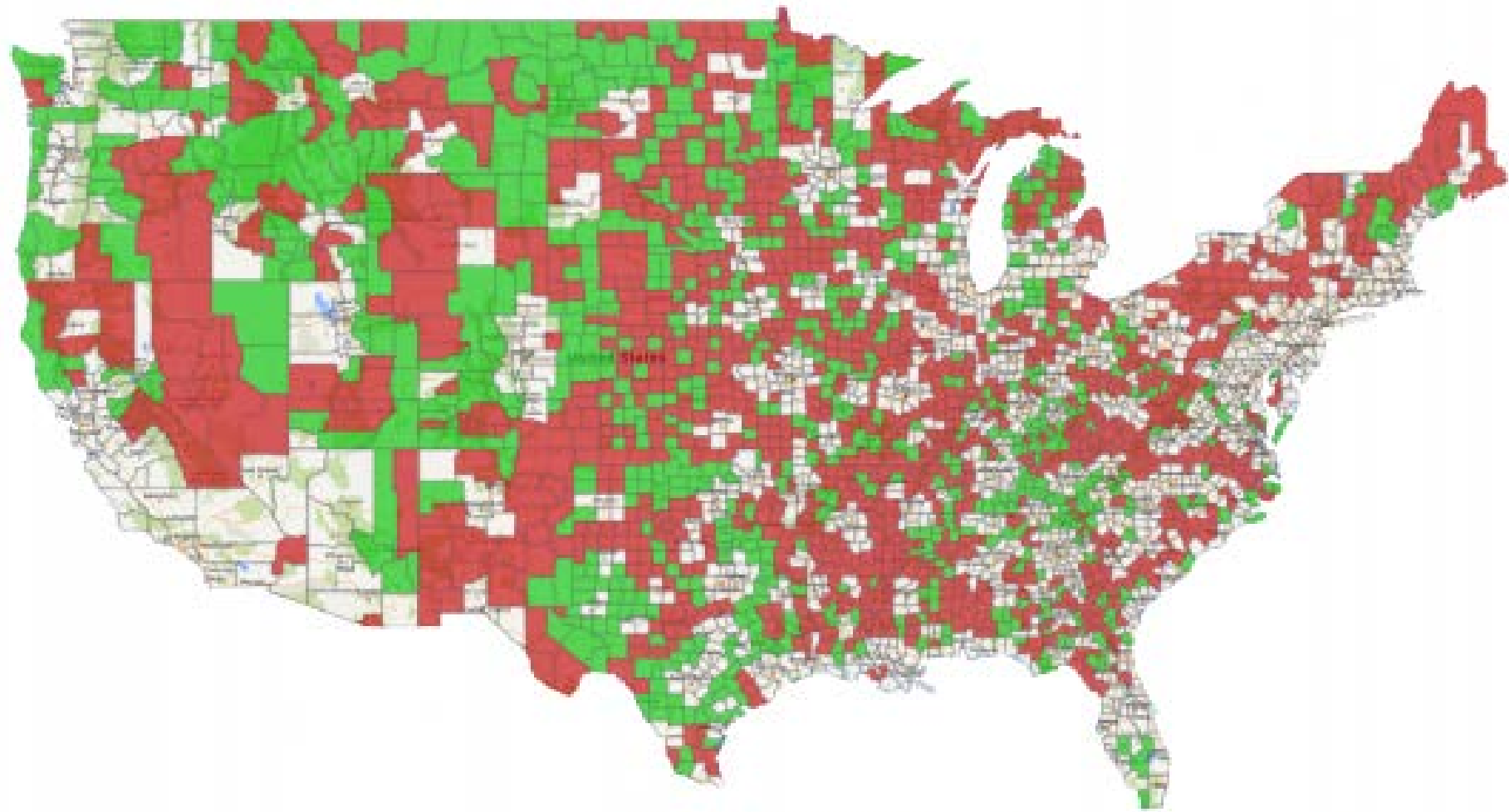


Geographic Distribution of Renewables

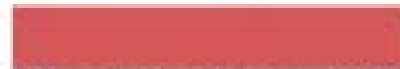




Rural Population Change 2013-14



Metropolitan



Rural lost population

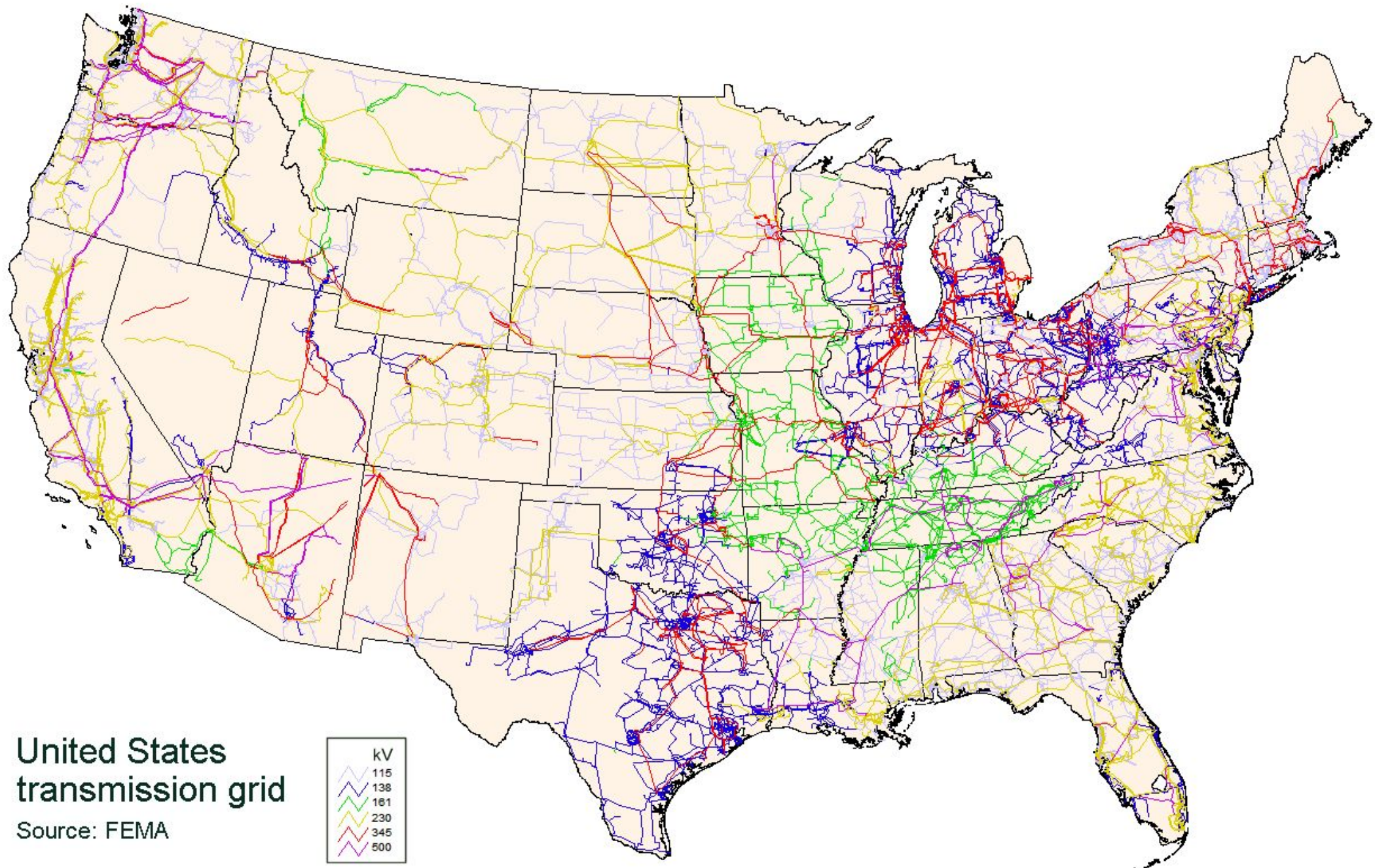


Rural gained population



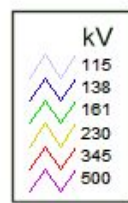
QER 1.2: Novel Ideas Welcome





United States transmission grid

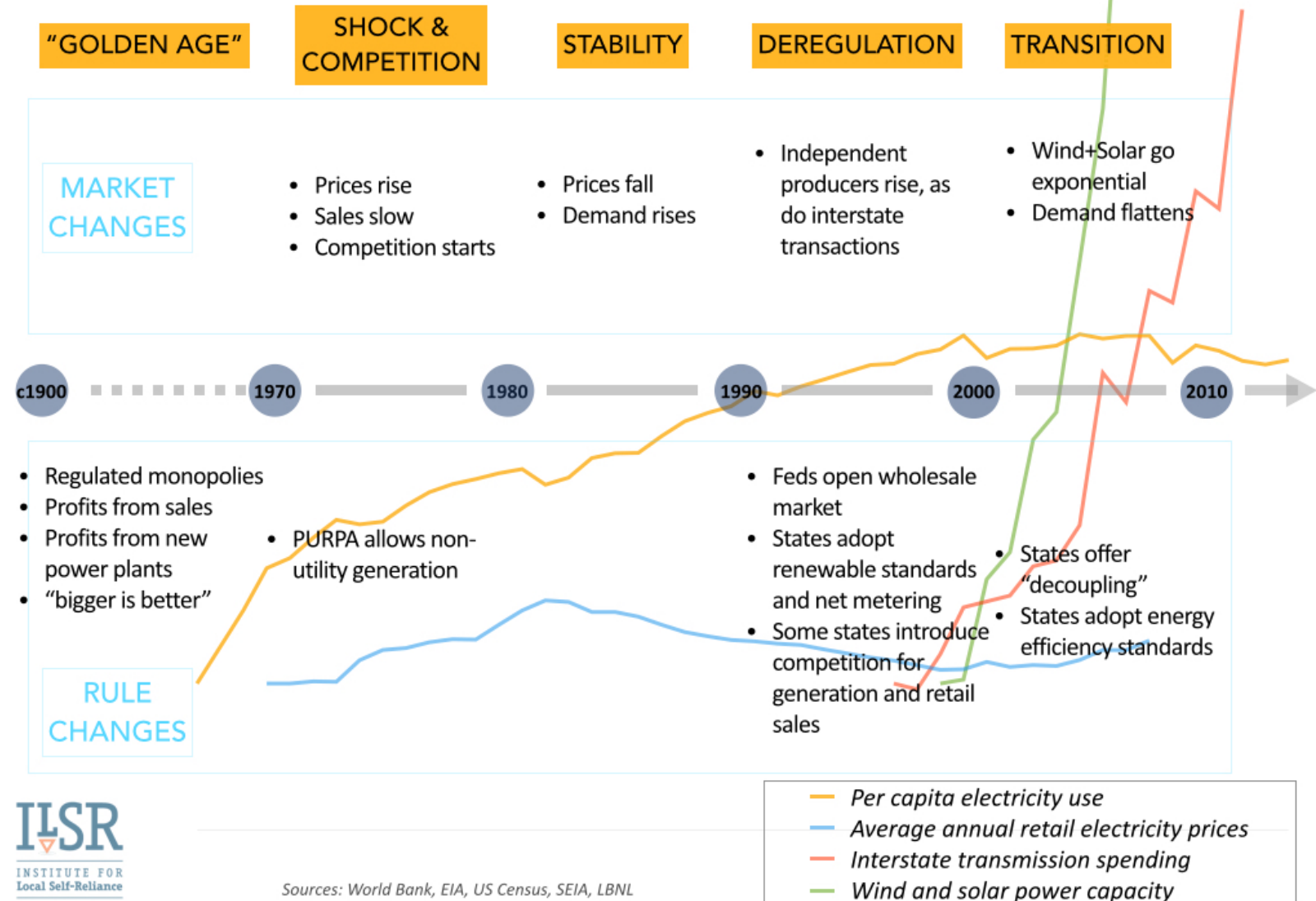
Source: FEMA





Sub-Set of Issues We Anticipate Addressing

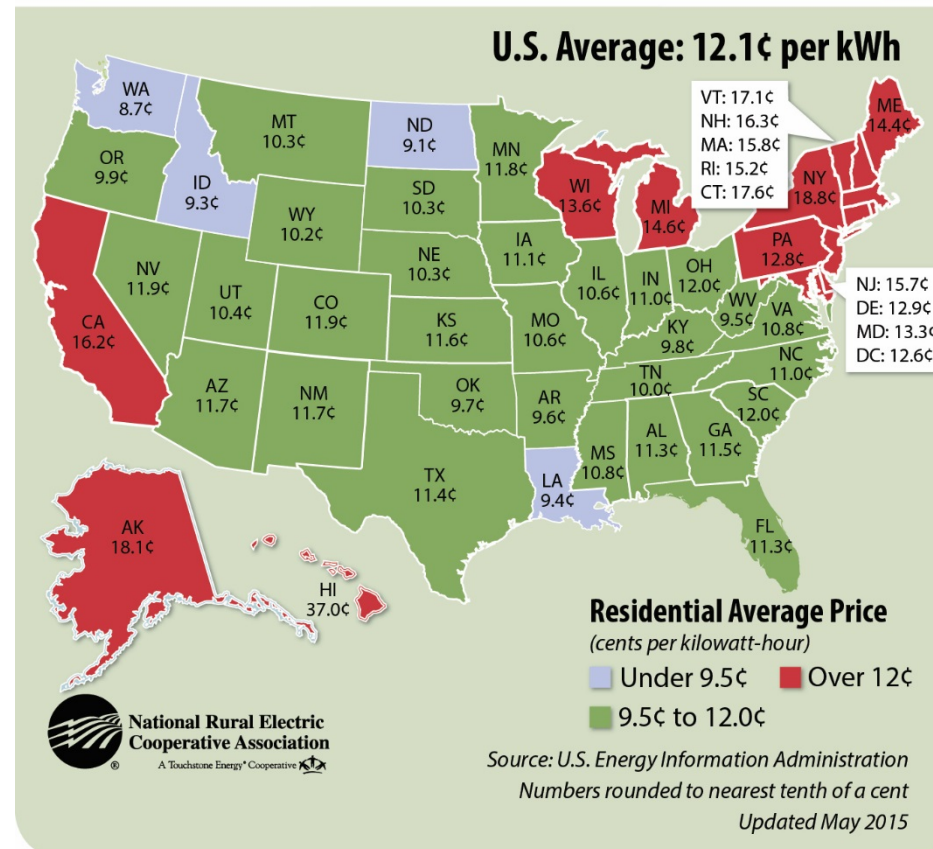
The U.S. Electricity Timeline





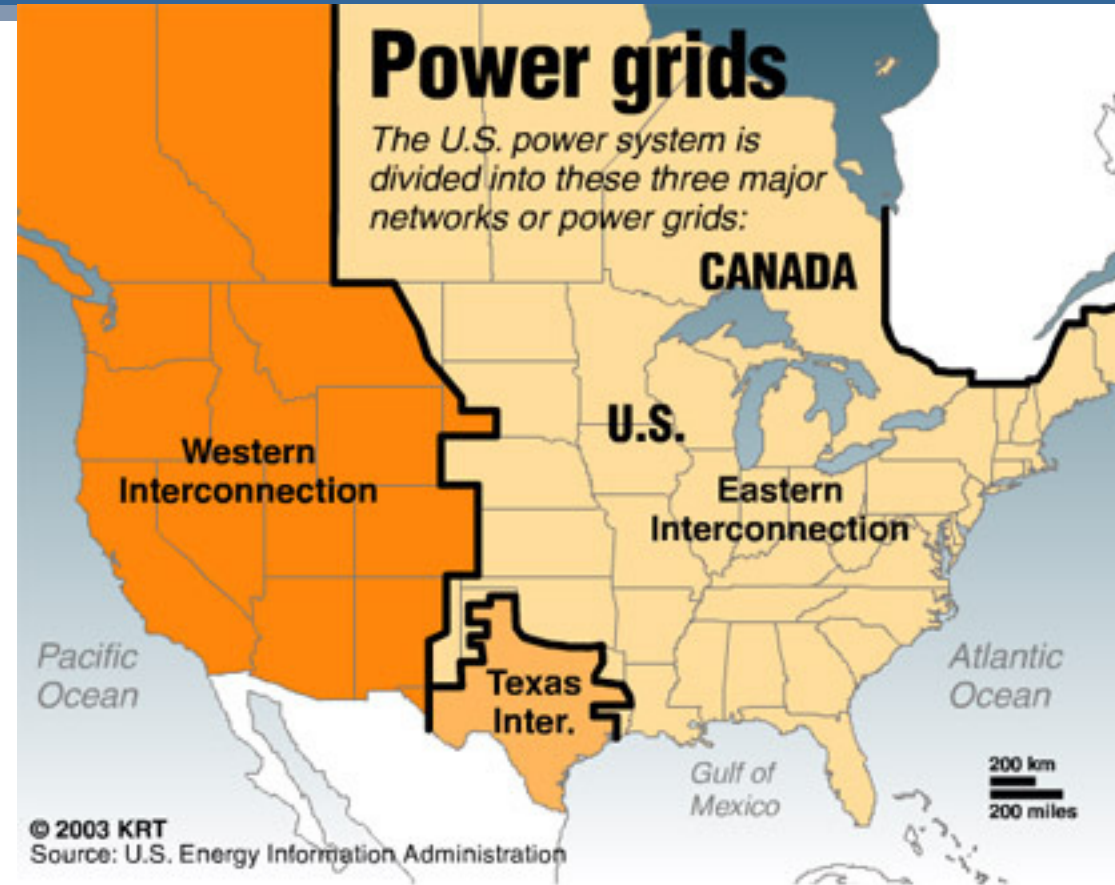
Average Prices for Residential Electricity

2015 figures, in cents per kWh





Sub-Set of Issues We Anticipate Addressing



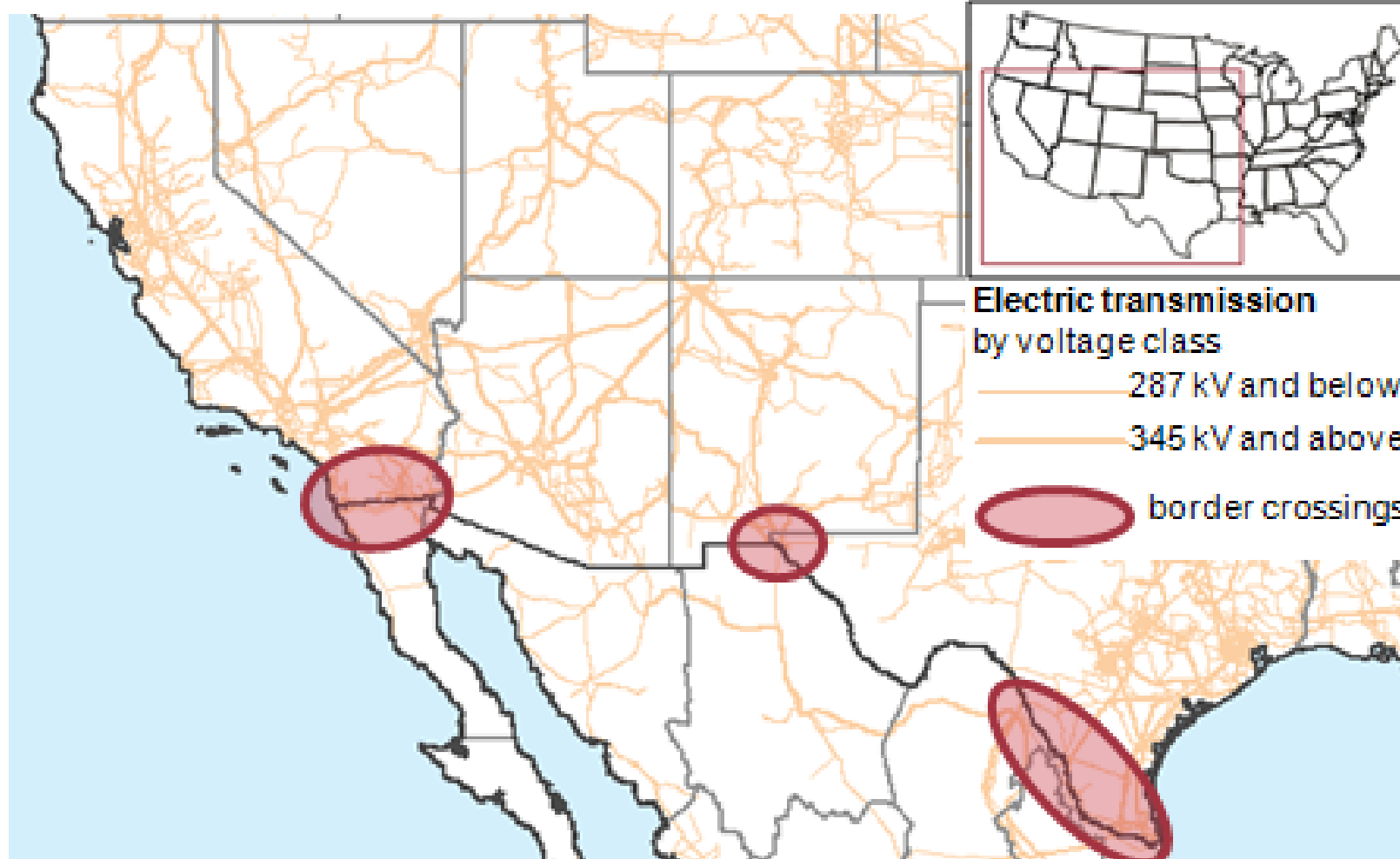


- <https://m.youtube.com/watch?v=j2oDtcSkV38>
- https://www.youtube.com/watch?feature=player_detailpage&v=j2oDtcSkV38



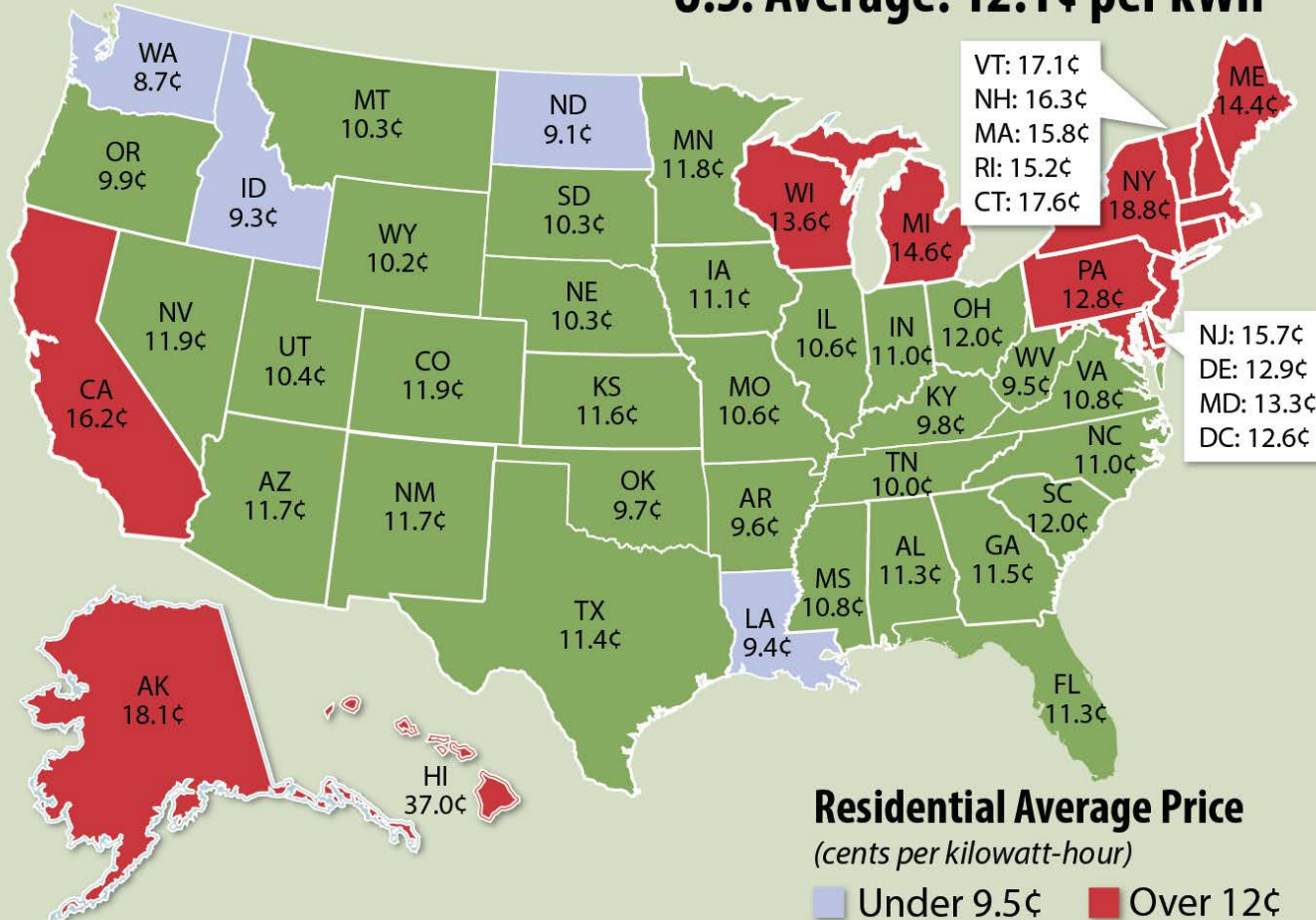
Sub-Set of Issues We Anticipate Addressing

Electric transmission crosses U.S.-Mexico border in only a few places





U.S. Average: 12.1¢ per kWh



Residential Average Price

(cents per kilowatt-hour)

- Under 9.5¢
- 9.5¢ to 12.0¢
- Over 12¢



Source: U.S. Energy Information Administration
 Numbers rounded to nearest tenth of a cent
 Updated May 2015