QUADRENNIAL ENERGY REVIEW:
Scope, Goals, Vision, Approach, Outreach

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PM on the Quadrennial Energy Review

THE WHITE HOUSE

Office of the Press Secretary

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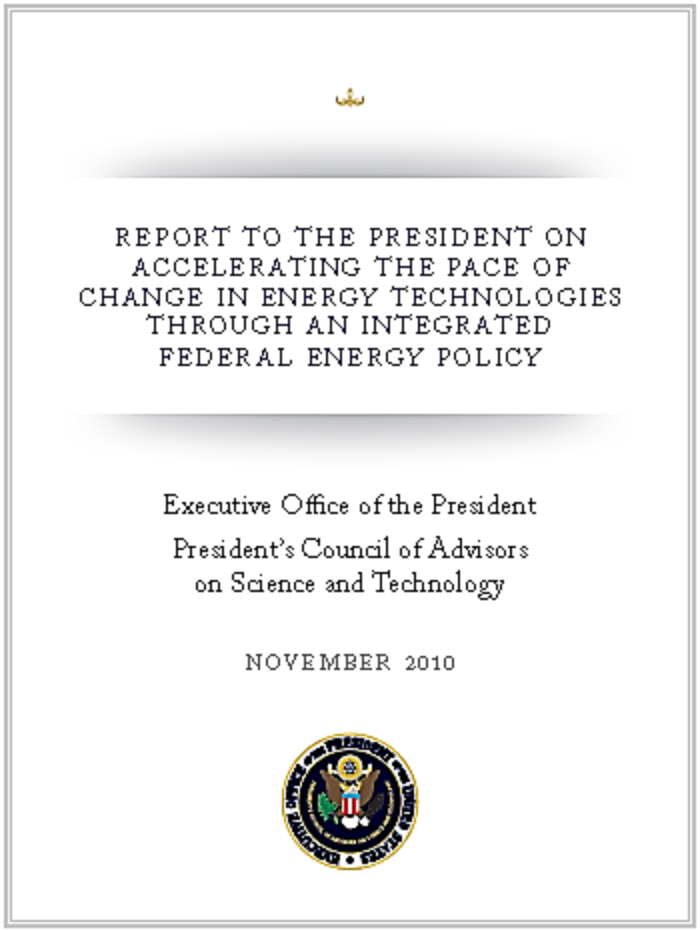
"Affordable, clean, and secure energy and energy services are essential for improving U.S. economic productivity, enhancing our quality of life, protecting our environment, and ensuring our Nation's security.

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."

President Barack Obama
January 9, 2014

PCAST Recommendations for QER



REPORT TO THE PRESIDENT ON
ACCELERATING THE PACE OF
CHANGE IN ENERGY TECHNOLOGIES
THROUGH AN INTEGRATED
FEDERAL ENERGY POLICY

Executive Office of the President
President's Council of Advisors
on Science and Technology

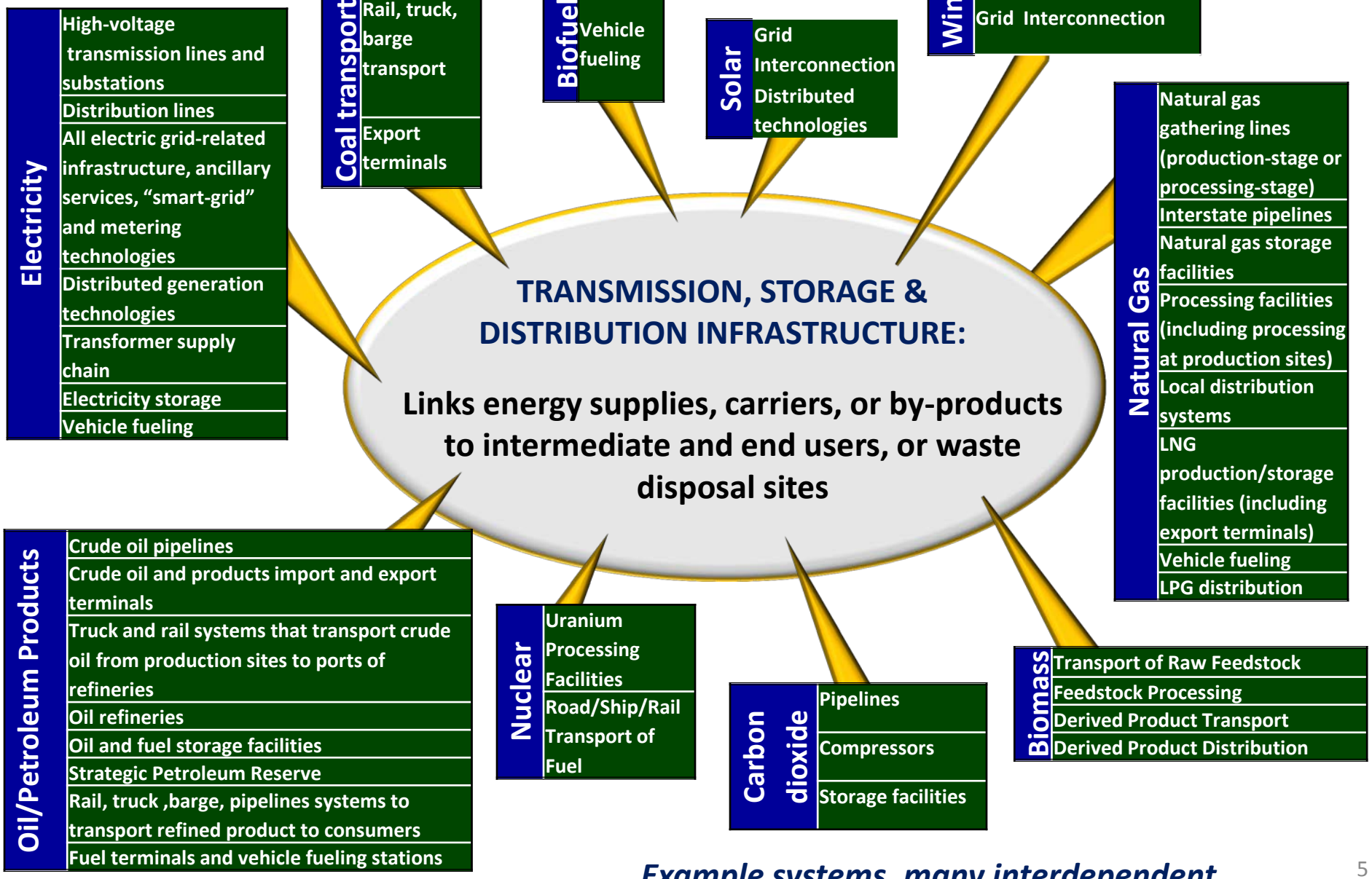
NOVEMBER 2010

- **Integrated view** of the short-, intermediate-, and long-term objectives for Federal energy policy;
- **Outline of legislative** proposals to Congress;
- **Executive actions** coordinated across multiple agencies;
- **Resource requirements** for RD&D and incentive programs; and
- **Strong analytical base** for decision-making.

Why Focus on Infrastructure?

- Fundamental to:
  - Economic advancement & prosperity
  - International competitiveness
- Investments last multiple decades
- Increasing vulnerabilities dictate modernization
- Multiple challenges warrant federal policy

Proposed TS&D Systems to Cover



Example systems, many interdependent

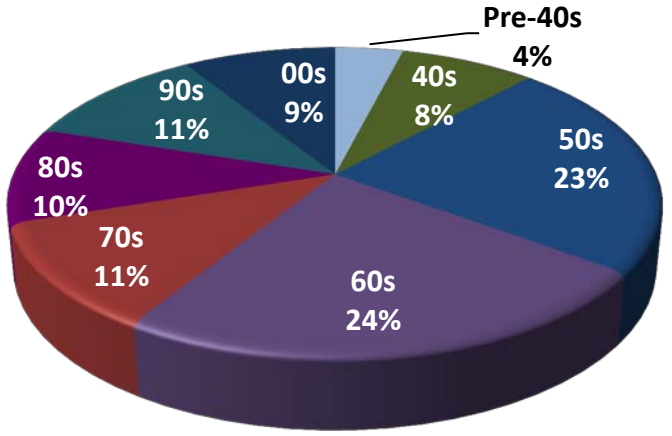
TS&D Systems have Limitations, Face Growing Vulnerabilities

Limitations of Current System

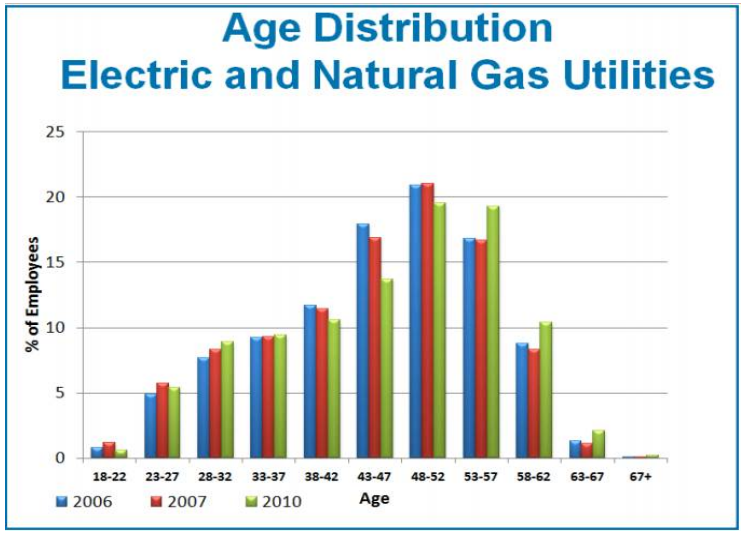
Age: Over 50% of the nation's gas transmission and gathering pipelines were constructed in the 1940s, 1950's and 1960's.

Cost: By 2030, electric utility industry investment will need to total $1.5-$2.0 trillion (EEI). Natural gas infrastructure investment needed: $19.2 billion/ yr. by 2030.

Workforce: Over 60% of the workers in areas like electric and gas utilities are likely to retire or leave the industry within a decade.



Age by decade of gas gathering/ transmission lines



Age Distribution of Gas/Electric Utility Employees

Near and Long-term Infrastructure Vulnerabilities Are Growing

Climate Change: Weather related power outages have increased from 5-20 each year in the mid-1990s to 50-100 per year in the last five years.

Cyber-security: 53% of all cyber-attacks from October 2012 to May 2013 were on energy installations.

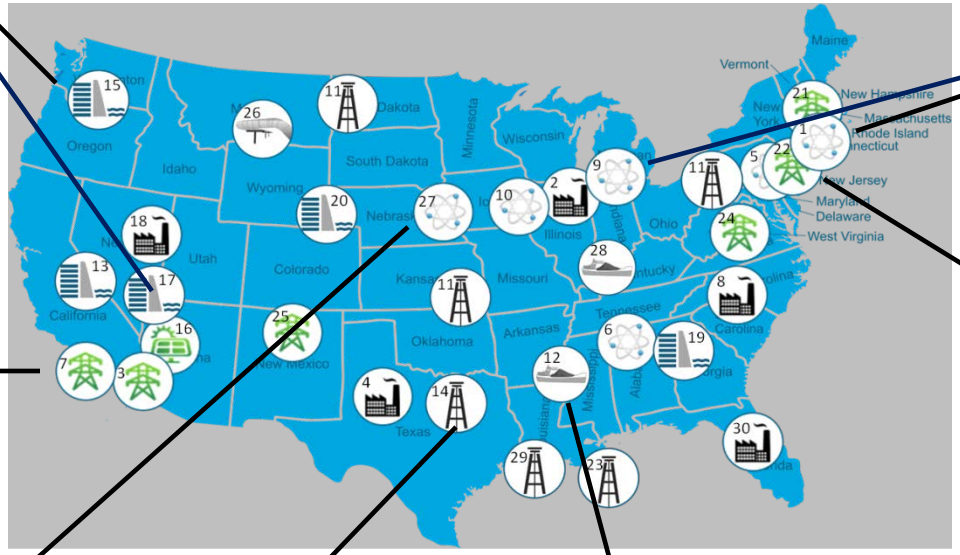
Physical Threats: There were three highly visible attacks on grid infrastructure in 2013. Supply chains for key components of grid infrastructure are not robust.

Interdependencies: The interdependencies of the electric and fuel infrastructures seen in Superstorm Sandy greatly complicated the response and recovery.

Supply/demand Shifts: The lack of pipeline infrastructures for associated gas in the Bakken has resulted in large-scale flaring of this gas, in amount sufficient to be seen from space.

Recent Events Illustrate U.S. Energy Sector Vulnerability to Climatic Conditions

Lower water levels: Reduced hydropower



Cooling water intake or discharge too hot: Shutdown and reduced generation from power plants

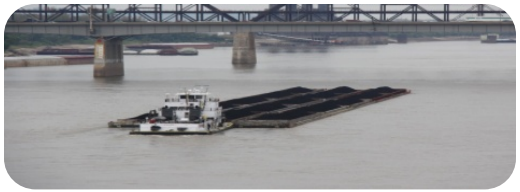
Wildfires: Damaged transmission lines

Intense storms: Disrupted power generation, distribution and oil and gas operations

Flooding: Impacts on inland power plants

Water restrictions due to drought: Limiting shale gas and power production

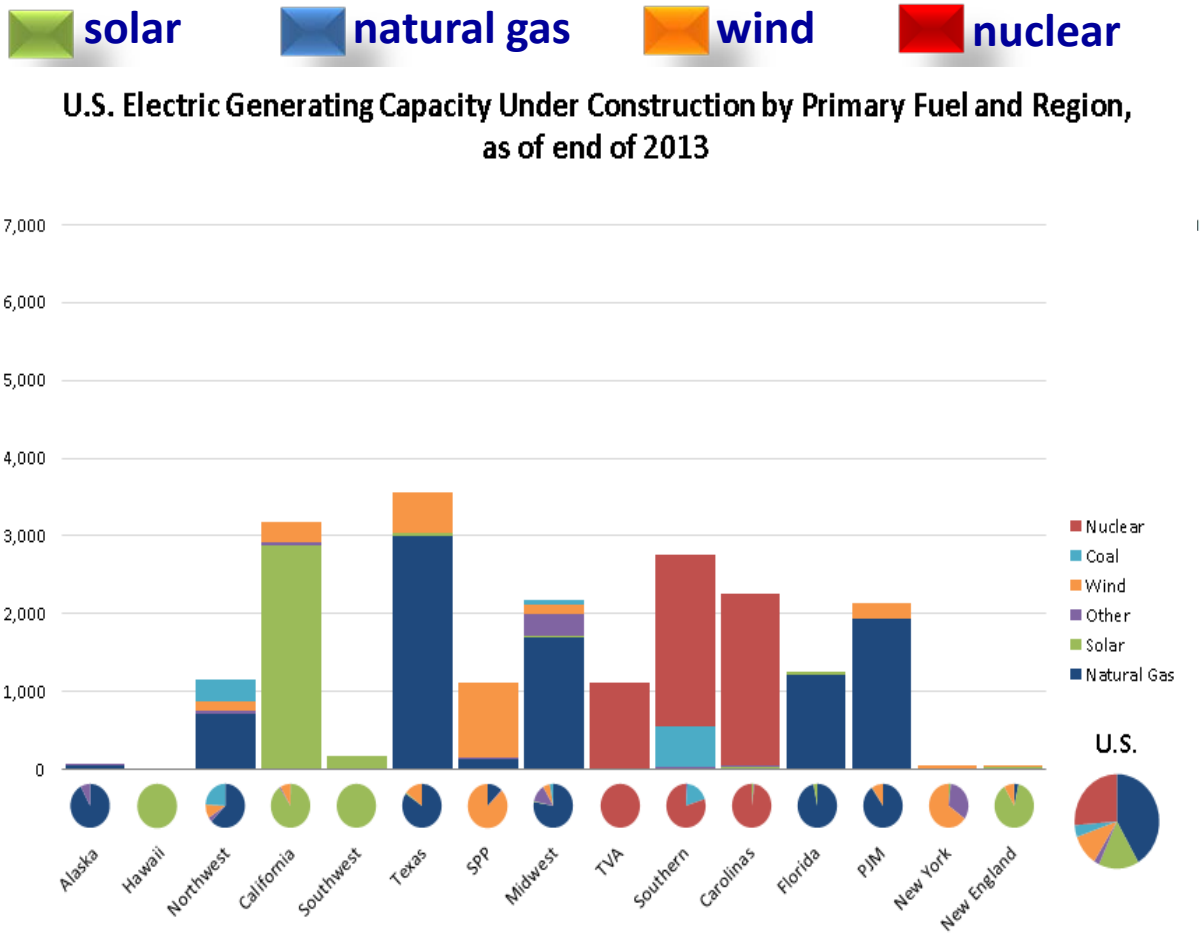
Lower river levels: Restricted barge transportation of coal and petroleum products



Source: U.S. DOE (2013), U.S. Energy Sector Vulnerabilities to Climate Change and Extreme Weather.

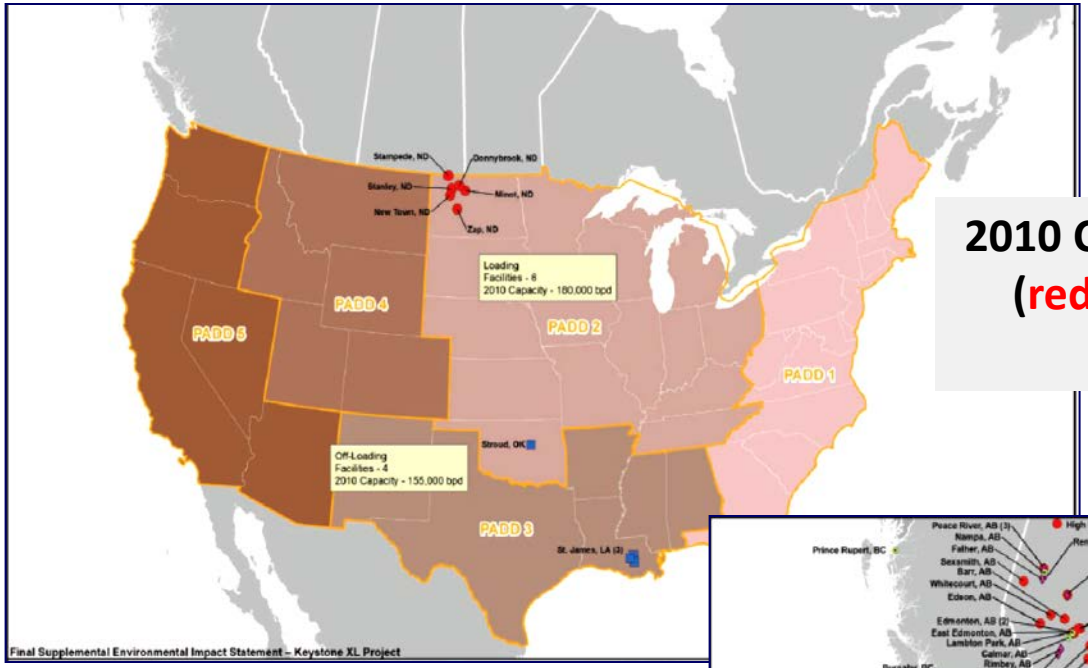
Regional Differences in New Generation Capacity

- At the end of 2013, natural gas was the most common fuel source for expanding generation capacity under construction.
- Southwestern states seeing the majority of solar construction, while wind developments are occurring in Texas/ SPP/Midwest/NY/Northeast.
- Recent nuclear developments occurring exclusively in the Southeast.
- The average new generation unit is much larger in Southeast than in other regions of the country.

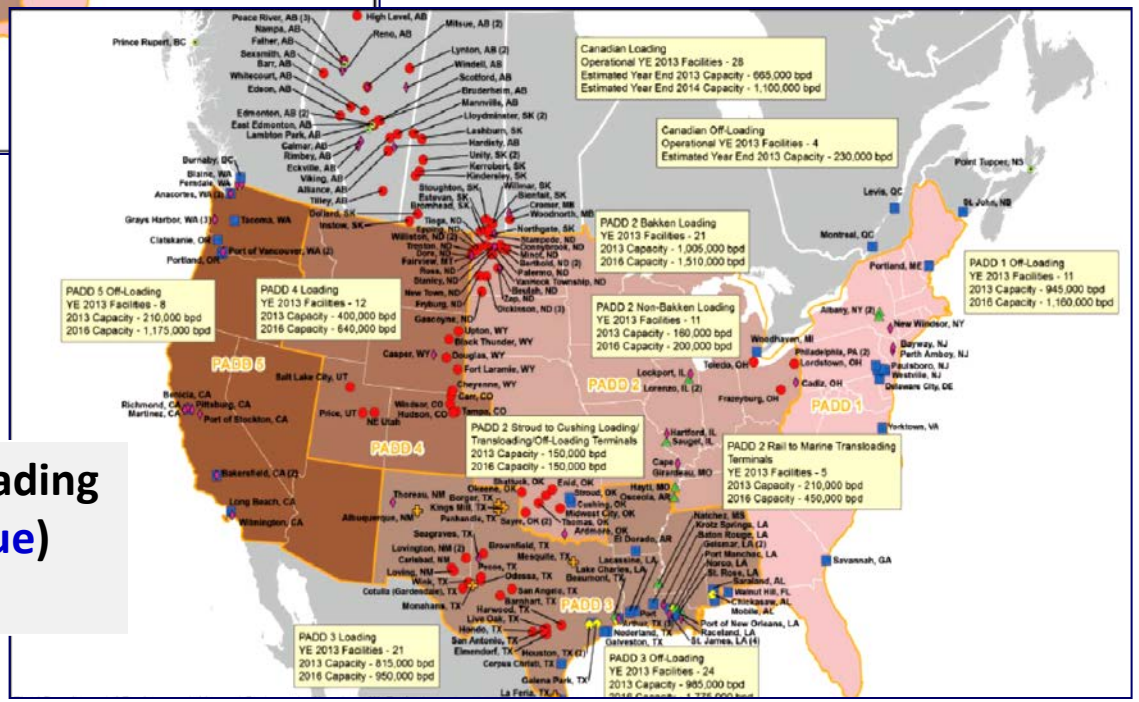


Source: EIA *Electric Power Annual*

Supply/Infrastructure Geography Changing Rapidly



2010 Crude Oil by Train Loading (red) and Offloading (blue) Facilities



2013 Crude Oil by Train Loading (red) and Offloading (blue) Facilities

Source: Final SEIS, Keystone XL Project; Chapter 1.4, Market Analysis.

National Goals, Desirable Characteristics for Infrastructures in 2030

National Energy Goals

Economic Competitiveness: Energy infrastructure should enable the nation to produce goods and services which meet the test of international markets while simultaneously maintaining and expanding jobs and the real incomes of the American people over the longer term.

Environmental Responsibility: Energy infrastructure systems should take into consideration a full accounting (on a life-cycle basis) of environmental costs and benefits in order to minimize their environmental footprint.

Energy Security: Energy Infrastructure should be minimally vulnerable to the majority of disruptions in supply and mitigate impacts, including economic impacts, of disruptions by recovering quickly or with use of reserve stocks. Energy security should support overall national security.

Desirable Characteristics, 2030

QER: Will provide four year planning horizon to enable these energy infrastructure characteristics in the future

Minimal-environmental footprint. Energy systems should low carbon, and have minimal impact to the air, water, land and ecosystems.

Safety & Public Health. Energy systems should be designed, constructed, operated and decommissioned in a manner that reduces risks to life or health.

Affordability. Ensures system costs and needs are balanced with the ability of users to pay. Three potential balancing points: overall system costs, system needs/benefits, and system cost allocation

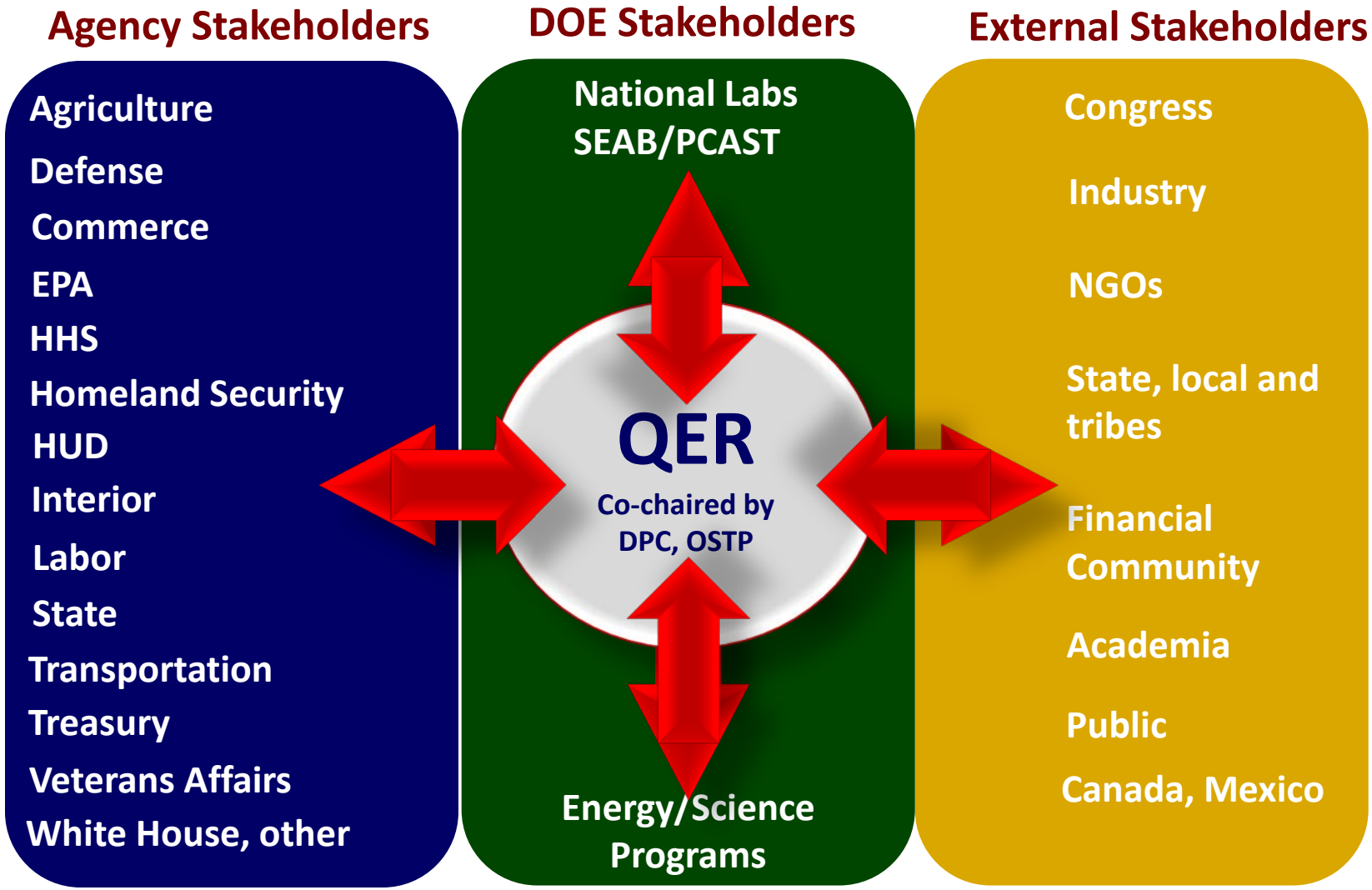
Robustness. A robust energy system will continue to perform its functions under diverse policies and market conditions, and has its operations only marginally affected by external or internal events. Sub-characteristics of robustness include: *Reliability & Resiliency.*

Flexibility. Energy infrastructure that accommodates change in response to new and/or unexpected internal or external system drivers. Sub-characteristics include: *Extensibility, Interoperability* & *Optionality*

Scalability. Energy infrastructure should be able to be sized to meet a range of demand levels.

Interagency, DOE, and External Stakeholder Coordination

Interagency Consultation, Stakeholder Engagement



Planned Public Events

- **Vulnerabilities (Cyber, Physical, Climate, Interdependencies)** *Washington, DC (April 11)*
- **Infrastructure Constraints—New England** *Providence, RI & Hartford, CT (April 21)*
- **Petroleum Product TS&D** *New Orleans, LA (May 27)*
- **Electricity TS&D—West** *Portland, OR (July 11)*
- **Infrastructure Constraints—Bakken** *North Dakota (August 8)*
- **Electricity TS&D—East** *New Jersey*
- **Rail, Barge, Truck Transportation** *Chicago, IL (August 8)*
- **Water-Energy Nexus** *San Francisco, CA (June 19)*
- **Finance and Market Incentives** *New York, NY*
- **Natural Gas TS&D** *Pittsburgh, PA (July 21)*
- **State, Local and Tribal Issues** *Santa Fe, NM (August 11)*
- **Gas-Electricity Interdependence** *Denver, CO (July 28)*
- **Infrastructure Siting** *Cheyenne, WY (August 21)*
- **Rural Electricity, Biomass Processing and Transportation** *Iowa*
- **Business/Economic Development** *Atlanta, GA*
- **Final Meeting** *Washington, DC*

WHY STAKEHOLDER ENGAGEMENT?

Build on Existing Work

Identify Key Issues

Involve Public

GUIDING PRINCIPLES

Transparency: Everyone has access to the process

Accountability: Stakeholders' input will be considered

Analytical Approach

QER Analysis Process

- **Develop Vision Statement (done)**
- **QER baseline, systems and scenario analyses**
  a. Baseline / Business As Usual (BAU)
     1. Prepare baseline reports on the state of systems (Literature & Analytic Review)
     2. Establish reference case (proposed: EIA- Annual Energy Outlook 2014 (AEO), with EPSA fine tuning)
  b. Assess the Reference Case against the metrics and vision
  c. Perform sensitivity analyses on the reference case: compare infrastructure needs
  d. Perform scenario analysis, including:
     1. Storyline scenarios
     2. Event-driven analyses
- **Craft policy alternatives**
- **Policy analysis**
- **Make policy recommendations, including executive actions, legislative proposals, recommended further research**

Select Questions on Natural Gas

- What new natural gas processing, transmission, storage, distribution, and LNG-related infrastructure is necessary before 2030?
- What are the key safety, security and environmental issues for these systems, current and future?
- What are key electric coordination issues that should be resolved to support the potential for increased gas use for power generation while maintaining adequate reliability?
- What are the key potential cyber and/or physical threats to the natural gas system?
- What are workforce effects of building new and upgrading existing infrastructure?
- What are the notable regional issues for natural gas? Are there any significant bottlenecks in building new infrastructure to meet changing needs?
- How safe and reliable is natural gas infrastructure? What are the trends?

Select Questions on Electric Power

- What are the systems' vulnerabilities (e.g., cyber and physical attacks, extreme weather events)? What methods/metrics can be used for planning and paying for resilience?
- How well can the current TS&D system support Greenhouse Gas emission reductions?
- What are the limiting factors in integrating and maintaining zero and low carbon generation in the operation of the power grid? How can new transmission, storage and demand response facilitate the incorporation of zero and low carbon generation? What steps can be taken to facilitate the introduction of advanced technologies to the TS&D grid?
- What improvements can be made in the use of real-time data, analysis and communication of transmission system conditions? How can improved smart grid interoperability standards better integrate customer response into the operation of the transmission system?
- What are the business challenges and opportunities facing the electric industry? How does the current market structure affect the ability to finance infrastructure
- What steps can be taken to improve the siting and maintenance of transmission facilities under federal discretion?

Select Questions on Liquid Fuels

- Are Strategic Petroleum Reserve (SPR) offloading infrastructure and policies appropriate in light of increased domestic production and pipeline reversals?
- What infrastructure modifications are needed to accommodate rapid shifts in development of North American oil supply and increasing domestic light crude production? What is the appropriate role of government in facilitating adjustments to the liquids fuel system?
- What are the projections for end-of-life retirements across infrastructure and how much of that infrastructure is operating beyond its intended lifespan? Are private infrastructure owners incentivized to conduct maintenance, repairs and replacements to address reliability and resiliency? Is government funding appropriate to maintain important government-owned infrastructure (locks, dredging)?
- How sustainable is increased liquid fuels by rail? What effect will increasing use of rail for transport of oil have on other energy rail uses (coal, ethanol, propane) and non-energy cargos and passenger travel?
- How will crude oil and natural gas price spreads influence the need for expanding NGL infrastructure?

THANK YOU