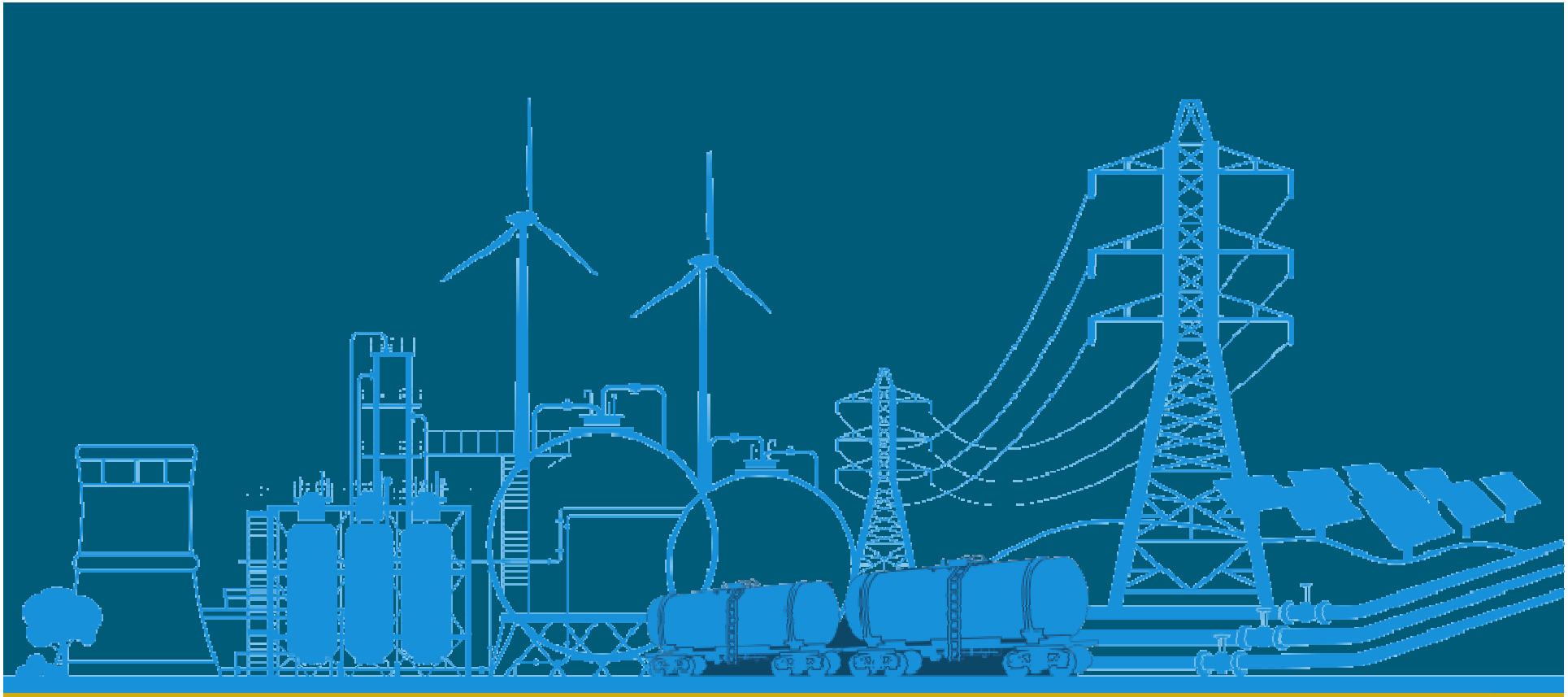
Remarks to the Council of Industrial Boiler Owners – Annual Meeting

David Rosner
Office of Energy Policy and Systems Analysis
U.S. Department of Energy

October 22, 2015

Outline

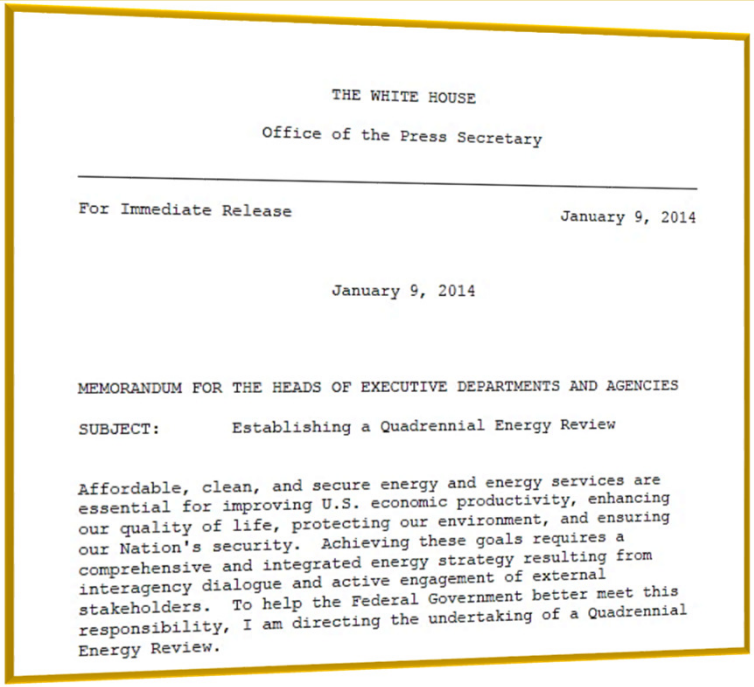
1. Introduction to DOE's Office of Energy Policy and Systems Analysis (EPSA)
2. Overview of Quadrennial Energy Review (QER) key findings and recommendations
3. The next installment of the QER
4. DOE's role in helping states and the Clean Power Plan
5. DOE support for Carbon Capture and Storage (CCS) and Combined Heat and Power (CHP)



2. QUADRENNIAL ENERGY REVIEW

ENERGY TRANSMISSION, STORAGE, AND DISTRIBUTION INFRASTRUCTURE

Presidential Memorandum



THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release January 9, 2014

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.

"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.

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President Barack Obama
January 9, 2014

- **Integrated view** of short-, intermediate-, long-term objectives for Federal energy policy;
- **Outline of legislative** proposals to Congress;
- **Executive actions** (programmatic, regulatory, fiscal, etc.) across multiple agencies;
- **Resource requirements** for RD&D and incentive programs; and
- **Strong analytical base** for decision-making.
- **First year focus** on TS&D infrastructure including: electricity transmission and distribution systems, liquid and gas pipelines, export infrastructure; interdependencies; climate and environment.

Changing US Energy Landscape

Increasing Energy Production

- Natural gas production growth
- Oil production growth
- Intermittent renewables
- Distributed generation/energy resources
- Increased generation/production/demand efficiency

Policy Developments

- CAFÉ
- Clean Air Act -111 (d), other
- Clean Water Act/other
- RFS
- RPS (state)
- RGGI (regional)

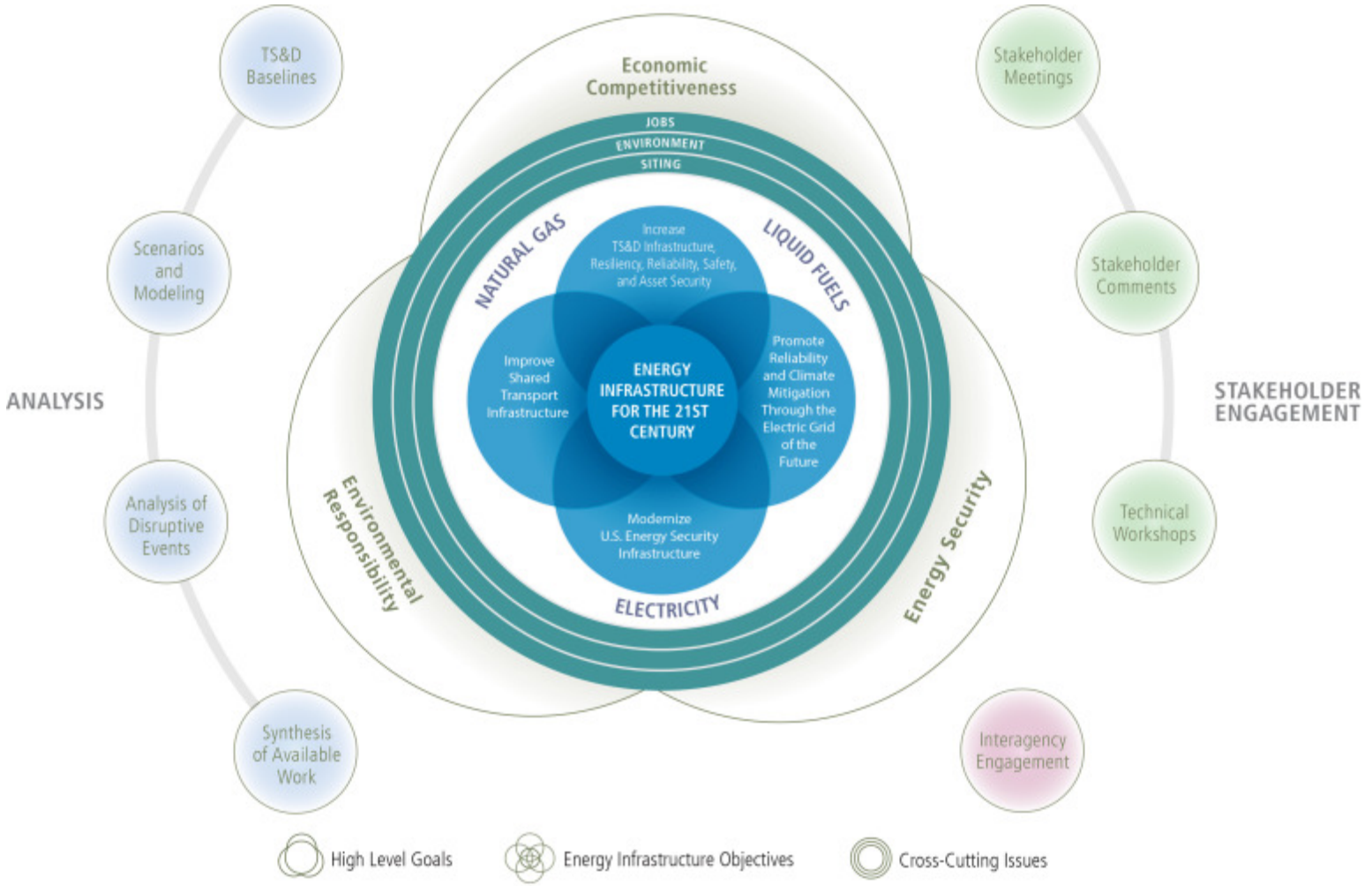
Technology Advances

- Solar (central and rooftop)
- Wind
- Demand-side
- Hydraulic fracturing

Energy Security Changes

- Decreased N. American energy imports
- Climate change impacts
- Vulnerabilities more evident, including aging infrastructures, physical and cyber threats
- Increased interdependencies
- Increased energy support required by allies

Inputs to the QER



ANALYSIS AND STAKEHOLDER PROCESS

STAKEHOLDER ENGAGEMENT

Public Meetings	Location	Date	Chair
Vulnerabilities (Cyber, Physical, Climate, Interdependencies)	Washington, DC	4/11	Moniz
Infrastructure Constraints—New England	Hartford, CT Providence, RI	4/21	Moniz
Petroleum Product TS&D	New Orleans, LA	5/27	Moniz
Water-Energy Nexus	San Francisco, CA	6/19	Holdren
Electricity TS&D—West	Portland, OR	7/11	Poneman
Natural Gas TS&D	Pittsburgh, PA	7/21	Moniz
Gas-Electricity Interdependence	Denver, CO	7/28	Utech
Infrastructure Constraints—Bakken	Bismarck, ND	8/8	Moniz, Foxx, Holdren, Schneider
Rail, Barge, Truck Transportation	Chicago, IL	8/8	Moniz, Foxx, Holdren, Darcy
State, Local and Tribal Issues	Santa Fe, NM	8/11	Moniz, Jewell
Infrastructure Siting	Cheyenne, WY	8/21	Moniz, Schneider
Electricity TS&D - East	Newark, NJ	9/8	Moniz
Finance and Market Incentives	New York, NY	10/6	Moniz

www.energy.gov/qer

- Briefing memo
- Agenda and speakers
- Statements
- Meeting summary
- Meeting transcript

- Technical Workshops
- Briefings
- Comments

Industry Insights

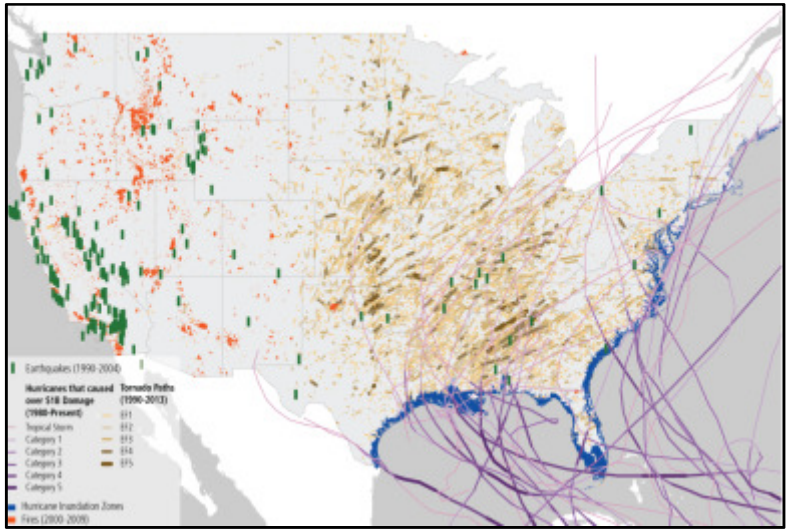
Recommendations

1. How to operate the system safely, fairly, efficiently
2. Who should be responsible for reliability, security, safety (enforcement, new investment, standards, etc)
3. How to allocate costs of resilience measures

INCREASING THE RESILIENCE, RELIABILITY, SAFETY, AND ASSET SECURITY OF TS&D INFRASTRUCTURE

Vulnerabilities and Disruptions

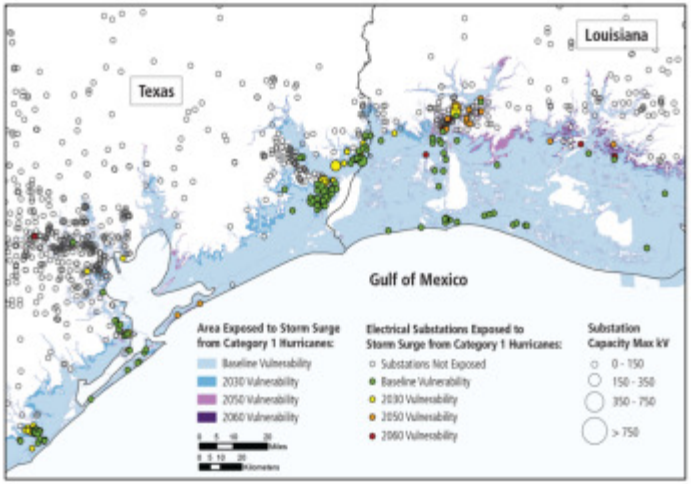
Illustrations of Tornado and Hurricane Tracks, Wildfires, Earthquakes, and Coastal Inundation



- Disruptions of TS&D infrastructures have serious consequences for the Nation and many regions of the country. Extreme weather and climate change is a leading environmental risk to this infrastructure.

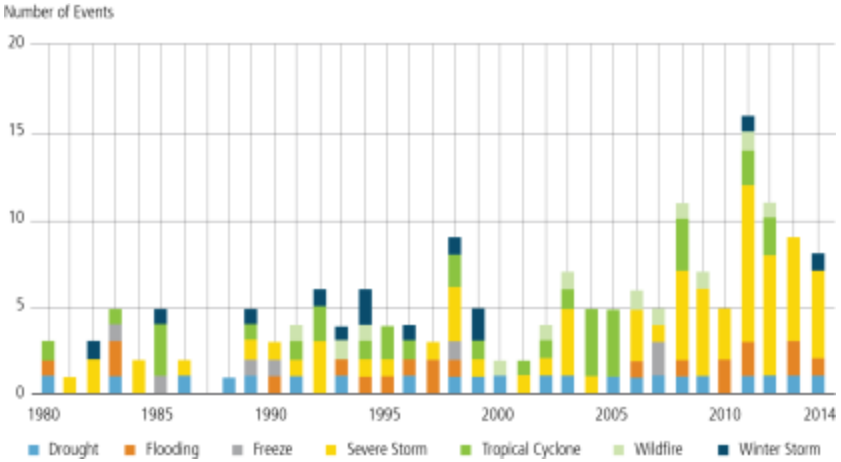
- For example, sea-level rise increases the vulnerability of electricity substations to inundation caused by hurricane storm surge

Gulf Coast Electricity Substation Facilities' Exposure to Storm Surge under Different Sea-Level Rise Scenarios

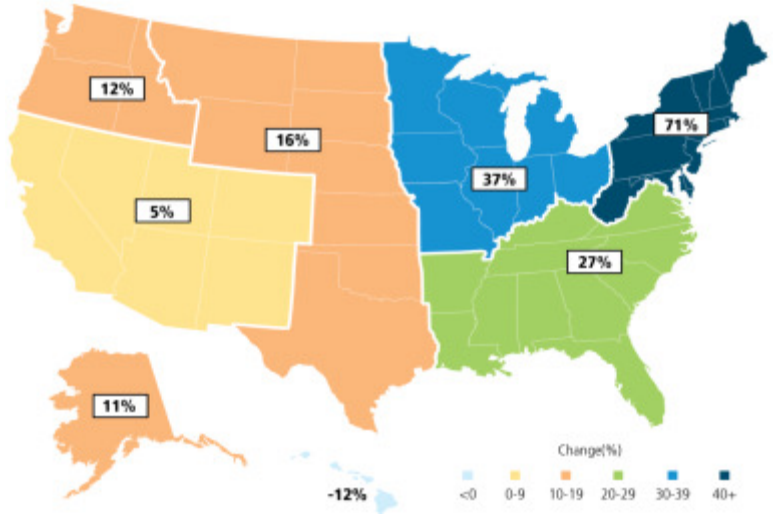


Trends of Increased Disruptions

Billion-Dollar Disaster Event Types by Year (1980-2014)



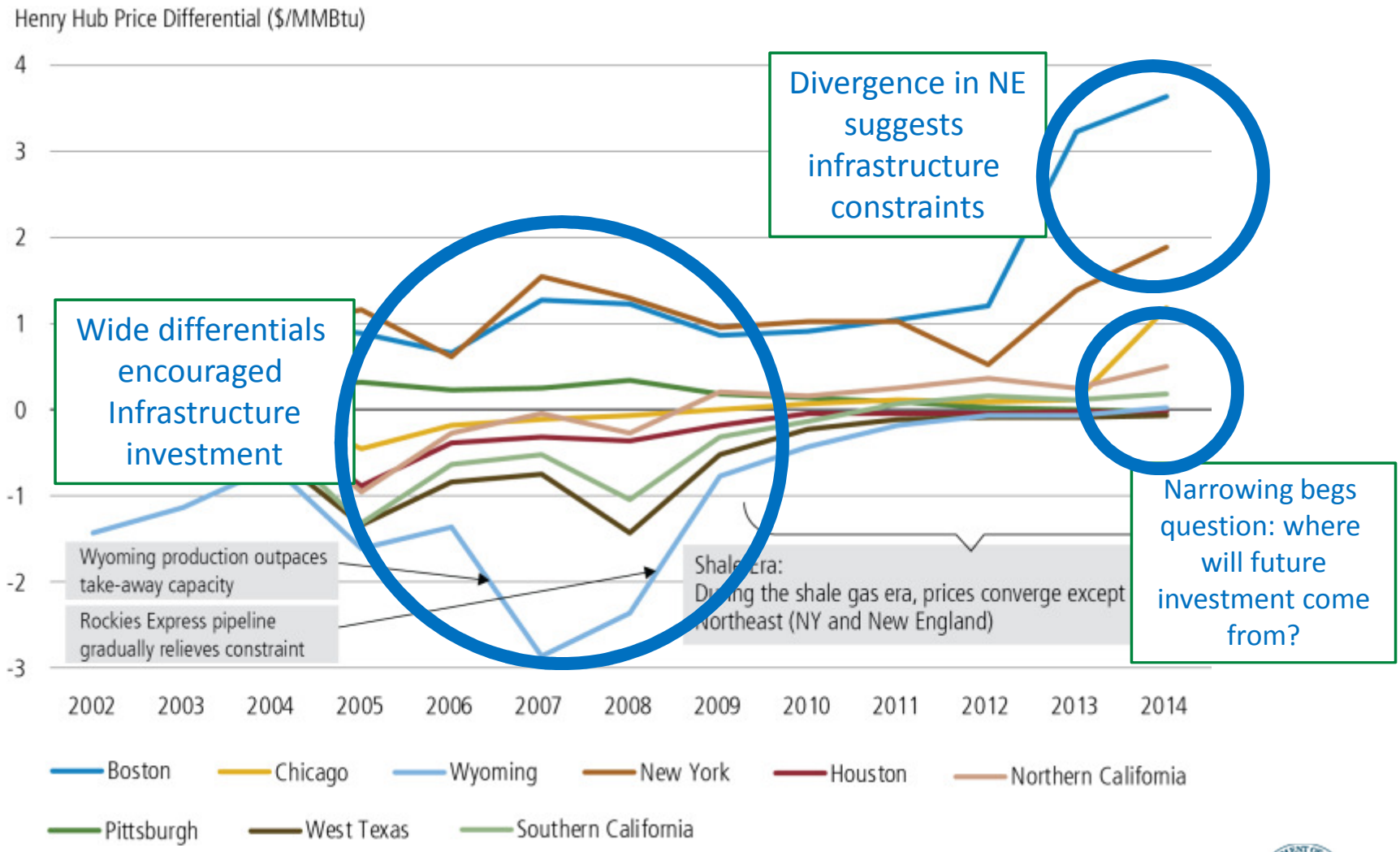
Increased Intense Precipitation Events (Heaviest 1% of All Daily Events, 1958-2012)



Selected Findings

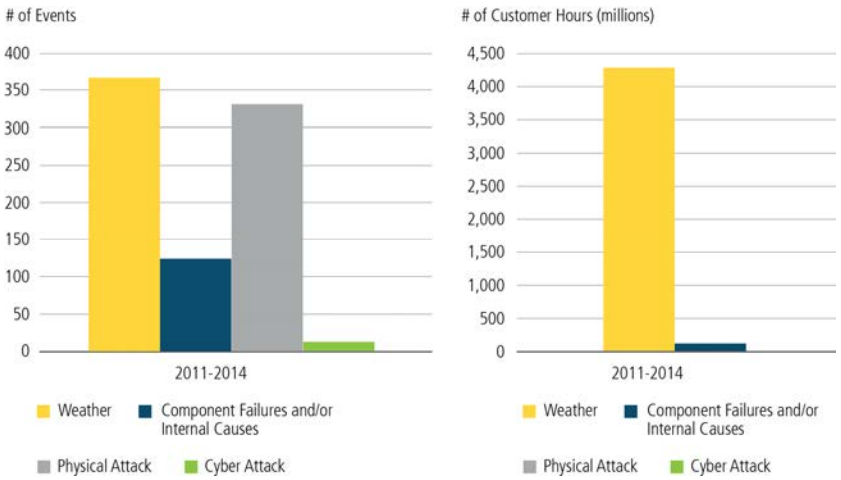
- Mitigating energy disruptions is fundamental to infrastructure resilience
- TS&D infrastructure is vulnerable to many natural phenomena, and some extreme weather events have become more frequent; threats and vulnerabilities vary substantially by region
- Cyber incidents and physical attacks are growing concerns
- High-voltage transformers are critical to the grid
- Aging, leak-prone natural gas distribution pipelines and associated infrastructures prompt safety and environmental concerns

Importance of Gas Transmission Infrastructure



Recommendations

Electricity Outages by Type of Event and Lost Customer Hours

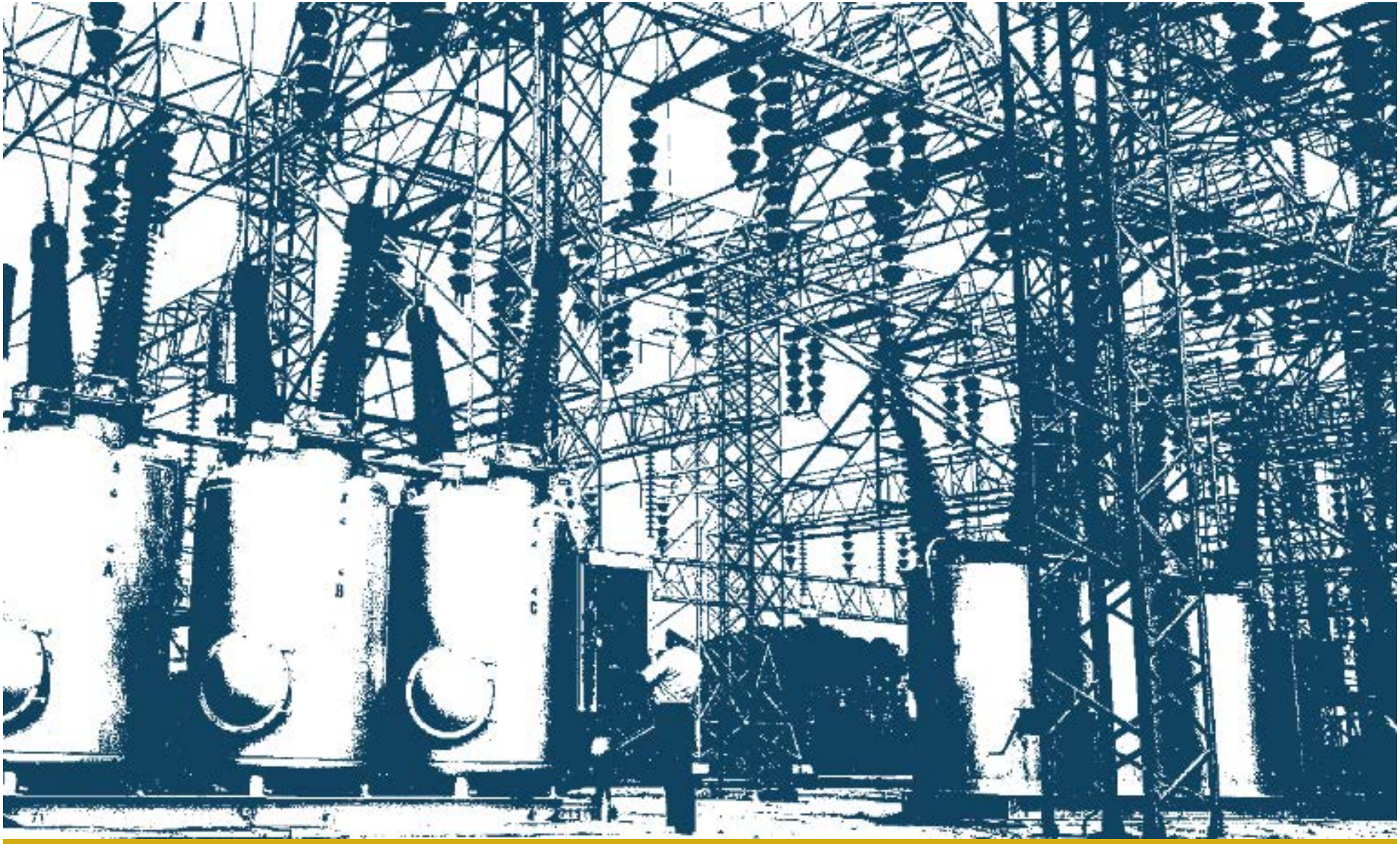


The Quadrennial Energy Review, April 2015

"Building a resilient, reliable, safe, and secure energy infrastructure is a national priority and vital to American competitiveness, jobs, energy security, and a clean energy future."

Selected Recommendations

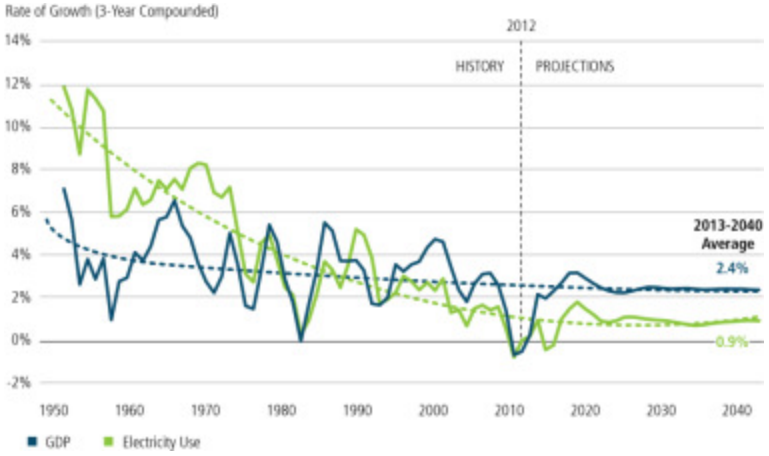
- Establish a $2.5 - $3.5 B competitive financial assistance program to accelerate pipeline replacement and enhance maintenance programs for natural gas distribution systems
- Provide $350 - $500 M in support for the updating and expansion of state energy assurance plans
- Establish a $3-3.5 B competitive grant program to promote innovative solutions to enhance energy infrastructure resilience, reliability, and security
- Analyze the policies, technical specifications, and logistical and program structures needed to mitigate the risks associated with loss of transformers
- Analyze the need for additional or expanded regional product reserves
- Integrate the authorities of the President to release products from regional petroleum product reserves (RPPRs) into a single, unified authority



MODERNIZING THE ELECTRIC GRID

Key Trends in Electricity

Historic and Projected Rate of Growth of Electricity Use and GDP (1950-2040)

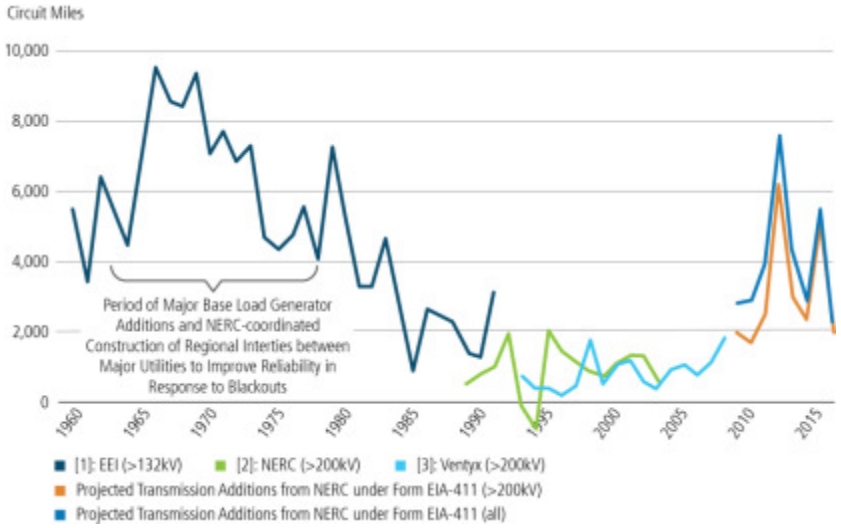


Selected Findings

- Growth in U.S. electricity demand is at its lowest level in decades
- Investments in transmission and distribution upgrades and expansions will grow
- There is increased use of distributed energy resources
- Extreme weather events and risks of widespread power outages have been increasing
- Lack of adequate information/tools impedes resilience
- State RPS and efficiency standards could influence infrastructure needs

Findings

Historic and Projected Expansion of Net Transmission Circuit Miles (1960-2015)



The Quadrennial Energy Review, April 2015

"Innovative technologies and services are being introduced to the system at an unprecedented rate, often increasing efficiency, reliability, and the roles of customers, but also injecting uncertainty into grid operations, traditional regulatory structures, and utility business models."

Selected Findings

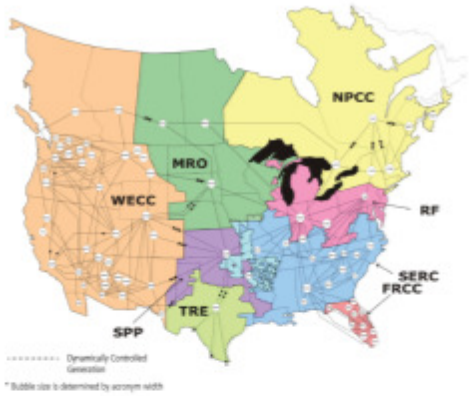
- Flexible grid system operations and demand response can enable renewables and reduce the need for new bulk-power-level infrastructure
- Investments in resilience have multiple benefits
- Innovative technologies have significant value for the electricity system
- Appropriate valuation of new services and technologies and energy efficiency can provide options for the utility business model
- Different business models and utility structures rule out "one-size-fits-all" solutions to challenges
- States are the test beds for the evolution of the grid of the future

Recommendations and Jurisdictional Landscape

Selected Recommendations

- Provide $3.5 B in grid modernization research and development, analysis, and institutional support
- Conduct a national review of transmission plans and assess barriers to their implementation
- Provide $300-$350 M in state financial assistance to promote and integrate transmission, storage, and distribution infrastructure investment plans for electricity reliability, affordability, efficiency, lower carbon generation, and environmental protection
- Value new services and technologies
- Improve grid communication through standards and interoperability

NERC Regional Entities and Balancing Authorities



Federally Regulated Power Lines

Regional Transmission Organizations (RTO)/ Independent System Operators (ISO)

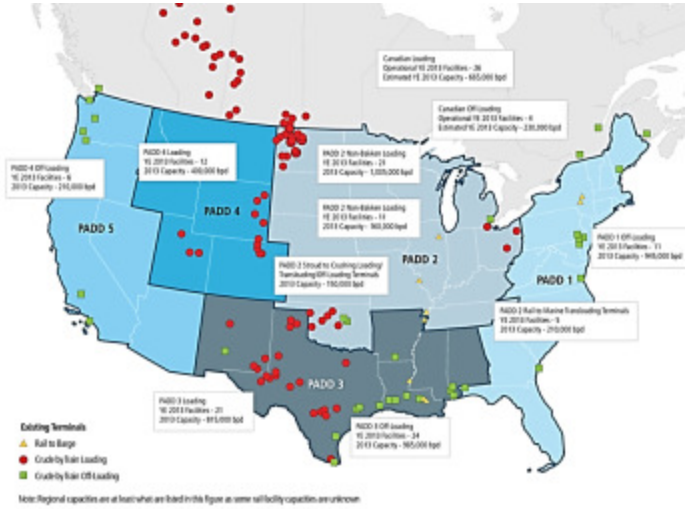
MODERNIZING U.S. ENERGY SECURITY INFRASTRUCTURES IN A CHANGING GLOBAL MARKETPLACE

Rapidly Changing Supply/Infrastructure Geography

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

- In 2010, the United States and Canada had six rail loading facilities for crude oil and four offloading facilities

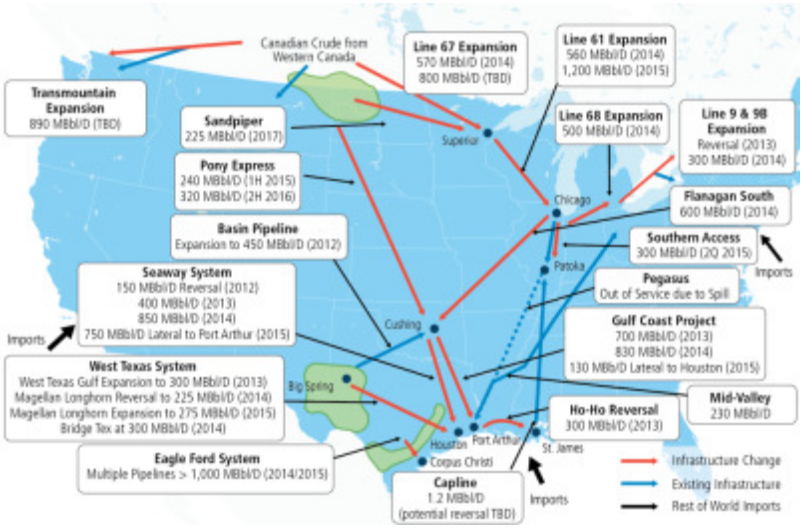
Crude Oil by Train Loading (red) and Offloading (green) Facilities 2013



- By year-end 2013, crude oil by rail capacity had grown to include 65 loading facilities in Petroleum Administration Defense Districts (PADD) 2, 3, and 4. Rail-to-barge facilities also increased.

Findings

Highlighted Pipeline Reversals and Expansions Accommodating Increased Domestic and Canadian Supply



The Quadrennial Energy Review, April 2015

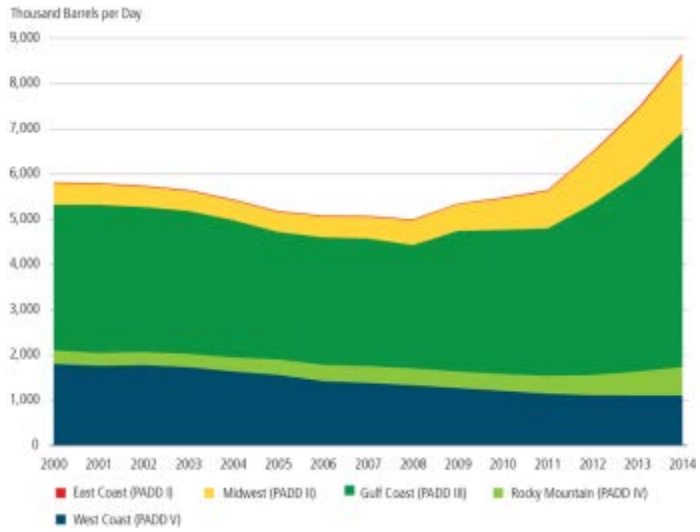
"The United States is now the world's largest producer of petroleum and natural gas. Combined with new clean energy technologies, and improved fuel efficiency, and growth in oil and natural gas production, U.S. energy security is stronger than it has been for over half a century."

Selected Findings

- The United States has achieved unprecedented oil and gas production growth
- The network of oil distribution ("the midstream") has changed significantly
- The Strategic Petroleum Reserve's ability to offset future energy supply disruptions has been adversely affected by domestic and global oil market developments coupled with the need for upgrades
- Biofuel production in the United States has increased rapidly over the last decade, enhancing energy security and reducing greenhouse gases from transportation

Recommendations

U.S. Crude Oil Production by PADD



The Quadrennial Energy Review, April 2015

"Challenges remain in maximizing the security benefits of our resources in ways that enhance our competitiveness and minimize the environmental impacts of their use."

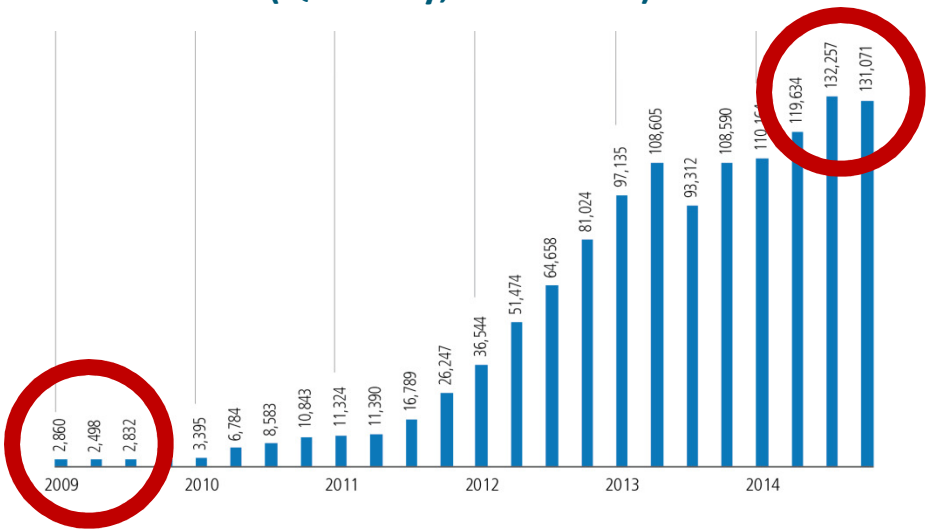
Selected Recommendations

- Update Strategic Petroleum Reserve (SPR) release authorities to reflect modern oil markets
- Invest $1.5 - $2 B to optimize the SPR's emergency response capability
- Support fuels diversity through research, demonstration, and analysis
- Undertake a study of the relationship between domestic shipping and energy security

IMPROVING SHARED ENERGY TRANSPORT INFRASTRUCTURES

Intermodal Trends

Class I Railcars of U.S. Crude Oil (Quarterly, 2009–2014)

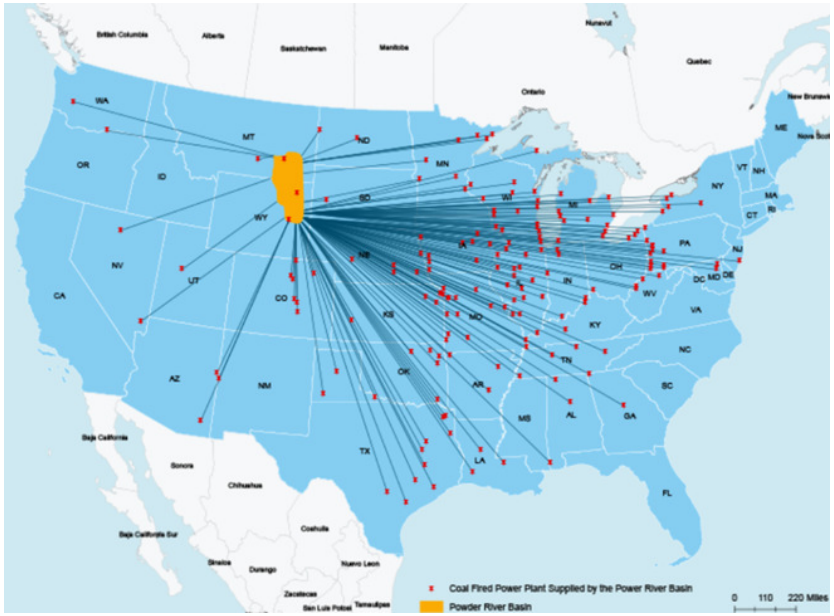


Rail, Barge, Truck Issues

- Between 2009 and 2014, rail shipments of crude oil increased roughly 4,400 percent
- In one year (2011-12), truck shipments of crude oil increased 53%, rail 423%, and barge 38%
- For every new shale well, the Nation's railroads move approximately 40 rail cars of drilling material
- Ethanol, now displacing 10% of U.S. gasoline demand, moves on rail, barge and truck. 70% of ethanol shipments from production plants to distribution terminals is moved by rail.

Rail Trends

Coal-Fired Power Plants Supplied by the Powder River Basin



A study by USDA's Agricultural Marketing Service concluded that, for the period from August 2013 through August 2014,

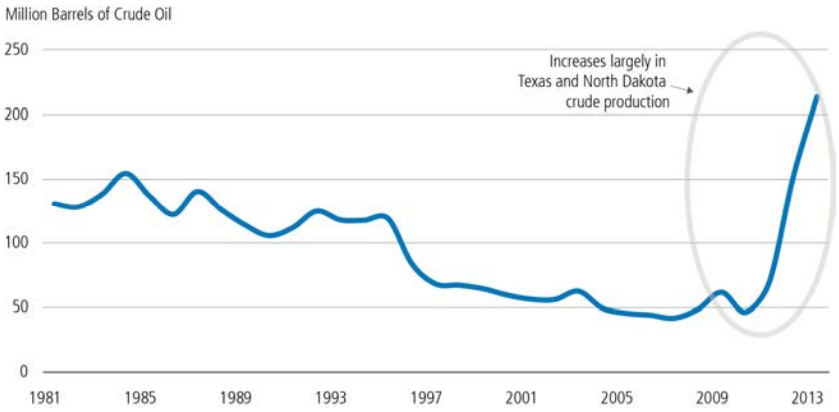
"the magnitude and duration of recent unexpected shifts in supply and demand for … rail service… have exceeded previous events in terms of both magnitude and duration, including Hurricane Katrina, which caused major disruptions throughout the entire agricultural transportation network."

Key Rail Findings

- Oil is an attractive commodity for railroad as it is not seasonal
- On average, roughly 1 million barrels of oil were moved by rail per day in 2014—nearly 12 percent of U.S. domestic crude oil production
- 34 states get coal for power generation from the Powder River Basin in Wyoming, almost all by rail. Eight states obtain more than 90 percent of their domestic coal from Wyoming. It is largely transported through regions of rail congestion where much of our oil and agriculture also originate.

Recommendations

US crude oil production (1981-2013)



The Quadrennial Energy Review, April 2015

"Changes in the U.S. energy marketplace are stressing the Nation's infrastructures… particularly in the case of oil where the rapid increase in U.S. tight oil production is transforming conventional patterns and modes."

Selected Recommendations

- Support a $2 - $2.5 B program of competitively awarded grants for shared energy transport systems
- Enhance the understanding of important safety-related challenges of transport of crude oil and ethanol by rail and accelerate responses
- Address critical energy data gaps in the rail transport of energy commodities and supplies
- Support alternative funding mechanisms for waterborne freight infrastructure
- Support public-private partnerships for waterborne transport infrastructure

INTEGRATING NORTH AMERICAN ENERGY MARKETS

Findings and Recommendations

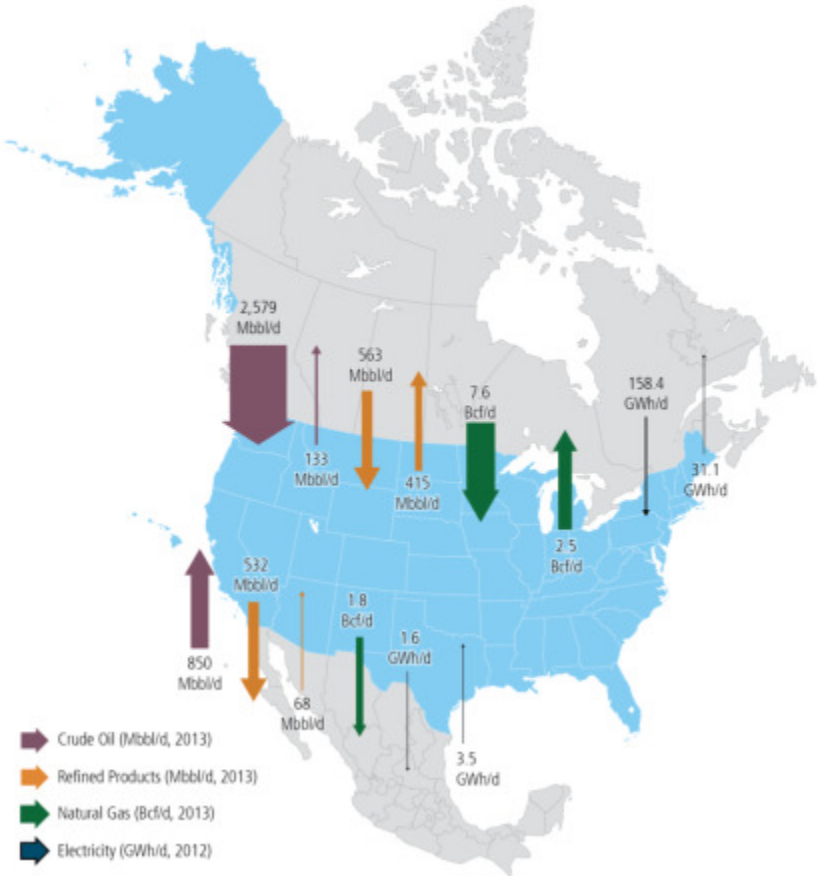
Selected Findings

- The United States has robust energy trade with Canada and Mexico, and increasingly in the Caribbean region. This presents abundant opportunities for increased integration of markets and policies.
- There is an opportunity to lower Caribbean electricity costs and emissions

Selected Recommendations

- Continue advances that have been made in the North American energy dialogue
- Increase the integration of energy data among the United States, Canada, and Mexico
- Undertake comparative and joint energy system modeling, planning, and forecasting
- Establish programs for academic institutions and not-for-profits to develop legal, regulatory, and policy roadmaps for harmonizing regulations across borders
- Coordinate training and encourage professional interactions
- Partner with Canada and the Arctic Council on Arctic energy safety, reliability, and environmental protection
- Partner with Canada and the Arctic Council on energy delivery to remote areas
- Promote Caribbean energy TS&D infrastructure

North American Energy Flows



ADDRESSING ENVIRONMENTAL ASPECTS OF TS&D INFRASTRUCTURE

Selected Findings

- TS&D infrastructure can serve as an enabler for – or barrier to – better environmental outcomes for the overall energy system
- Energy transport, refining, and processing infrastructure contribute to emissions of criteria air pollutants that pose risks to public health and the environment

Selected Recommendations

- Improve quantifications of emissions and expand R&D for natural gas TS&D infrastructure
- Support funding to reduce diesel emissions
- Enact financial incentives for the construction of CO2 pipeline networks

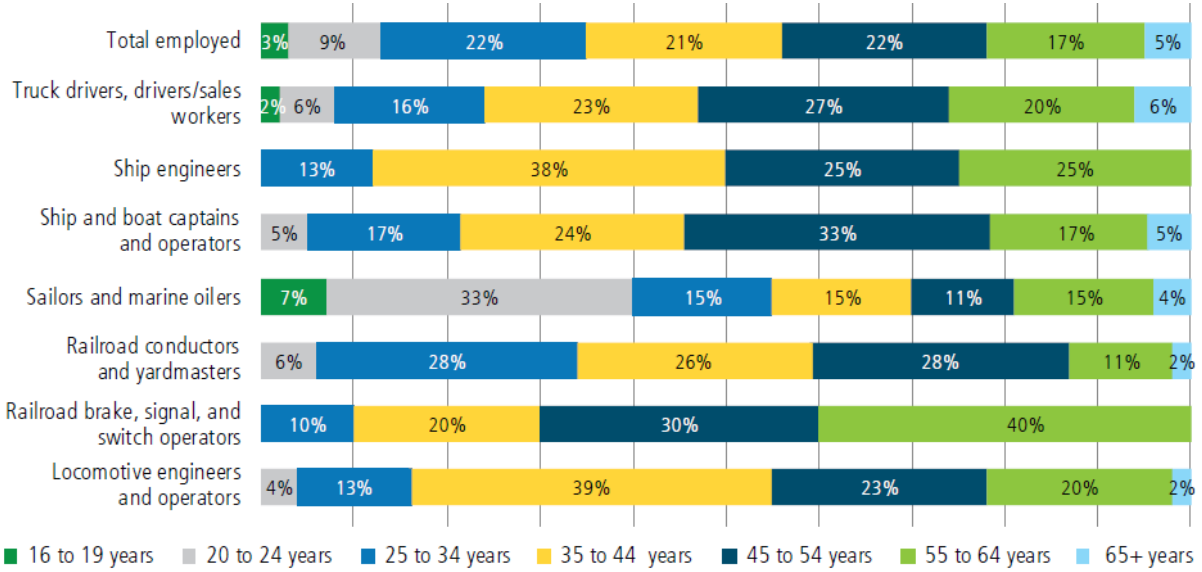
Current CO_2 - Enhanced Oil Recovery (EOR) Operations and Infrastructure

U.S. regions with large-scale CO_2 pipeline systems currently in operation	Miles of Pipeline
Permian Basin (W. TX, NM, and S. CO)	2,320
Rocky Mountains (N. CO, WY and MT)	810
Gulf Coast (MS, LA and E. TX)	740
Mid-Continent (OK and KS)	480
Other (ND, MI, Canada)	215

ENHANCING EMPLOYMENT AND WORKFORCE TRAINING

Findings and Recommendations

Age Distribution of Select Transportation Workers (2014



Selected Findings

- By 2030, projections indicate that the energy sector overall, including the TS&D segment, will employ an additional 1.5 million workers, mainly in the construction, installation and maintenance, and transportation areas. 200,000 more workers with computer and mathematics skills will be required.
- Defining priorities in the area of jobs and workforce training and establishing effective programs requires good data

Selected Recommendations

- Facilitate national credentials for energy occupations. DOE should support and facilitate an industry-led process of defining needed skills in a number of emerging occupations.
- Establish an interagency working group to reform existing energy jobs data collection systems

SITING AND PERMITTING OF TS&D INFRASTRUCTURE

Findings and Recommendations

Selected Findings

- Close collaboration with tribal, state, and local governments is critical to siting, permitting, and review of infrastructure projects
- Robust public engagement is essential for the credibility of the siting, permitting, and review process

Selected Recommendations

- Enact statutory authorities to improve coordination across agencies
- Adopt Administration proposals to authorize recovery of costs for review of project applications

3. The Next QER

4. DOE Role: The Clean Power Plan

Power sector reductions: the Clean Power Plan

Step 1: Establish stringency

US government [EPA] sets national technology-specific standards and provides additional options for state-level standards for power sector - both emissions per kwh **(rate-based)** & total emissions **(mass-based)**

Standards based on "best system of emissions reduction adequately demonstrated" which considers analysis of multiple factors, including costs

Step 2: Compliance

Each state formulates its **own plan** to meet its prescribed goal

States can choose to comply on a **rate** basis or on a **mass** basis

States can choose to go it **alone, use emissions/credit trading** or **cooperate**

If State does not act, US EPA imposes "Federal plan"

Clean Power Plan: Compliance Options

States Choose How to Meet the Goals (illustrative strategies)

- Efficiency improvements at higher emitting plants*
- Expanding use of existing natural gas combined cycle (NGCC) units*
- New renewable energy, including wind, solar (utility and distributed), geothermal, wave and tidal, hydropower*
- New nuclear power (including under construction)
- Nuclear uprates
- **Carbon capture and storage** (CCS) for existing EGUs
- Demand-side energy efficiency programs
- **Combined heat and power** (CHP)
- **Waste heat to power** (WHP)
- Transmission and distribution efficiency improvements
- Water system efficiency
- Use of certain biomass
- **Co-firing or switching to natural gas**
- Dispatch changes
- Working with utilities to consider retiring units that are high emitting
- **Energy conservation programs**
- Market-based trading programs

STATE, LOCAL AND TRIBAL TECHNICAL ASSISTANCE GATEWAY

Frequently Asked Questions

Featured Topic: Greenhouse Gas Reduction Strategies in the Electric Power Sector

CONTACT US

For more information about technical assistance at the Department of Energy, contact us via e-mail.

The State, Local and Tribal Technical Assistance Gateway provides an access point to DOE's technical assistance and cooperative activities with state, local and tribal officials. Through its **program and staff offices**, DOE has engaged extensively with various levels of state, local and tribal governments, providing technical assistance on a range of energy issues. Our existing technical assistance and other activities, as well as relevant information offered by other federal agencies, are provided below by program or topic.

If you're a state, local or tribal official, or a representative from an organization of such officials, with a specific question or need for assistance, **email us** and we'll work collaboratively across the DOE to address your inquiry. Responses could include access to DOE and national laboratory experts; ongoing cooperative activities with national state, local, regional and tribal associations and external subject matter experts; and existing and new materials including guidebooks, toolkits, webinars and data. Any technical assistance provided will depend on the inquiry and the availability of DOE resources.

Examples of DOE Technical Assistance to State, Local, and Tribal Governments (energy.gov/TA)

Existing Technical Assistance and Cooperative Activities by Program and Topic

Assistance with Greenhouse Gas Reduction Strategies in the Electric Power Sector

Energy Efficiency and Renewable Energy State and Local Solutions Center

Tribal Energy Technical Assistance

Electricity Policy Technical Assistance Program

Nuclear Energy Technical Assistance

Fossil Energy Technical Assistance

Better Buildings Challenge

Building Energy Codes Program State Technical Assistance

Solar Outreach Partnership

Clean Cities Technical Assistance

Combined Heat and Power Technical Assistance Partnerships

International Users: Clean Energy Solutions Center

SunShot Solar Technical Assistance Team

Data, Tools, and Best Practices

State Energy Program Solution Center

State Energy Profiles

State and Local Energy Data

Database of State Incentives for Renewables & Efficiency

Bioenergy Knowledge Discovery Framework

Alternative Fuel Data Center

Combined Heat & Power Resource Center

Solar Energy Resource Center

WINDExchange

Six Wind Energy Regional Resource Centers

Geothermal Regulatory Roadmap

Building Energy Codes Resource Center

Building America Solution Center

Better Buildings Residential Program Solution Center

Better Buildings Residential Network

Home Energy Score

Home Performance with ENERGY STAR (HPwES)

Guidelines for Home Energy Professionals

Hydrogen and Fuel Cell Database

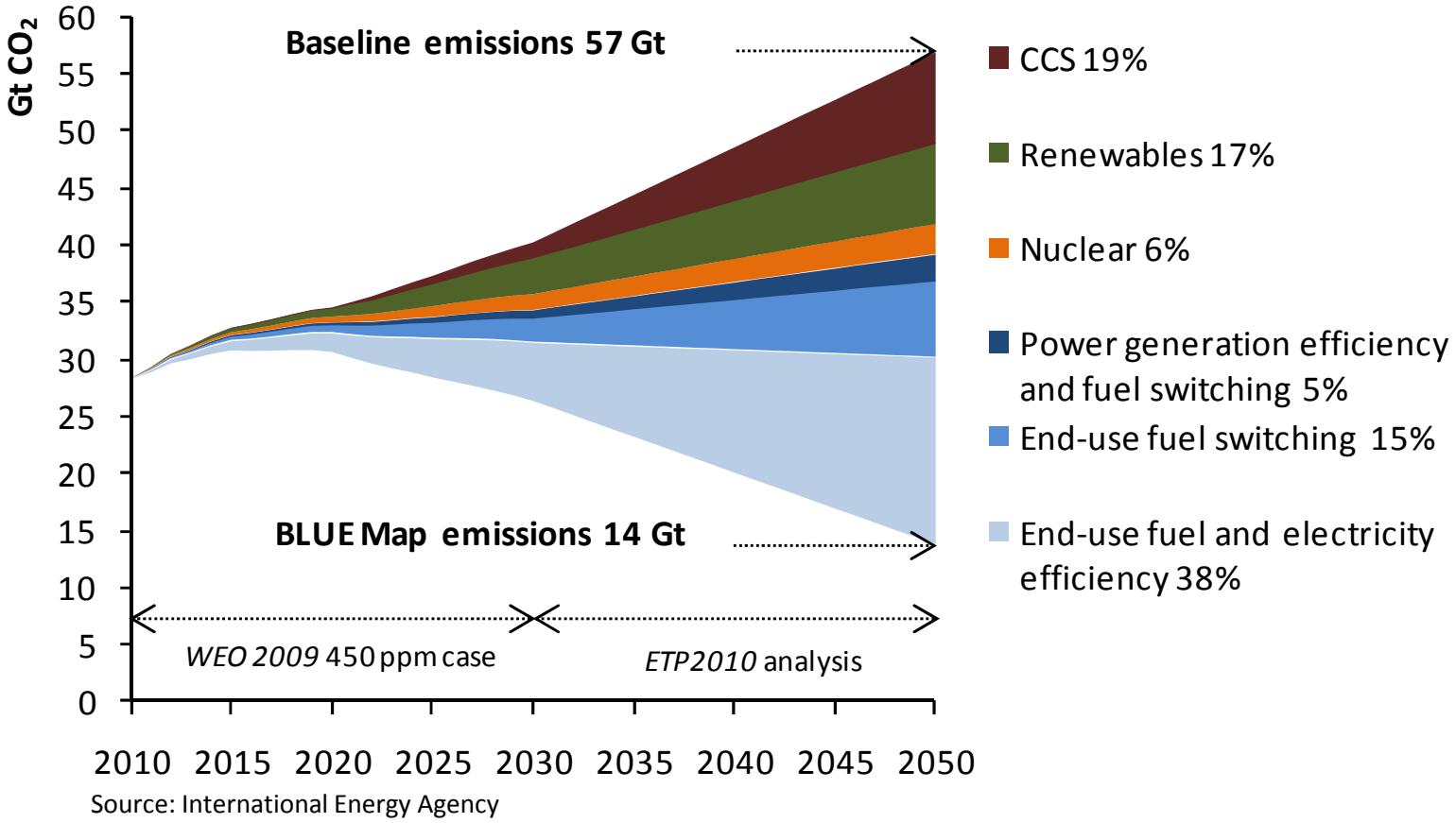
Hydropower Permitting Resources

Community Energy Strategic Planning Guide

5. DOE Support for CHP and CCS

CCS Will Be Required To Meet Our Global Carbon Emission Reduction Goals

Office of Fossil Energy



Source: International Energy Agency

We must strengthen our commitment to deployment of clean coal with CCUS

Industrial Sector CCS

- The industrial sector accounts for slightly more than one-quarter of total U.S. CO_2 emissions, according to data from DOE's Energy Information Administration.
- DOE has allocated funds to more than 25 projects that capture and sequester CO_2 emissions from industrial sources - such as cement plants, chemical plants, refineries, paper mills, and manufacturing facilities - into underground formations.
- Two projects are aimed at testing large-scale industrial carbon capture and storage:
  - The two projects are expected to capture and store a total of 2 million tons of CO_2 per year, and increase domestic production of oil.
  - Projects include Air Products & Chemicals, Inc. (TX, 1 million TPY, operating); Archer Daniels Midland Company (IL, 1 million TPY; under construction).

Industrial Sector CCS (continued)

- Seven projects targeting innovative concepts for beneficial CO_2 use.
  - DOE funding for seven projects that aim to find ways of converting captured CO_2 emissions from industrial sources into useful products such as fuel, plastics, cement, and fertilizers.
  - These projects are funded with $106 million from the Recovery Act — matched with $156 million in private cost-share.
- On September 7, 2010, DOE selected an additional 22 projects with $575 million in funding that will accelerate carbon capture and storage research and development for industrial sources.
- Many other activities underway--$1.4 billion total investment in ICCS.

Clean Coal deployment: urgent and important

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Fossil Energy

Not just about cost

- Costs are higher than plants without CCS
- Costs are lower than many clean energy alternatives

Not just about technology

- Many technologies are well demonstrated
- Improvement potential is very large

Policy Issue: could finance many ways

- Rate recovery; feed-in tariffs; direct grants
- Clean energy portfolios; tax-free debt financing; others

CCS Activities in the U.S. – Focused on Technology Development and Market Mechanisms

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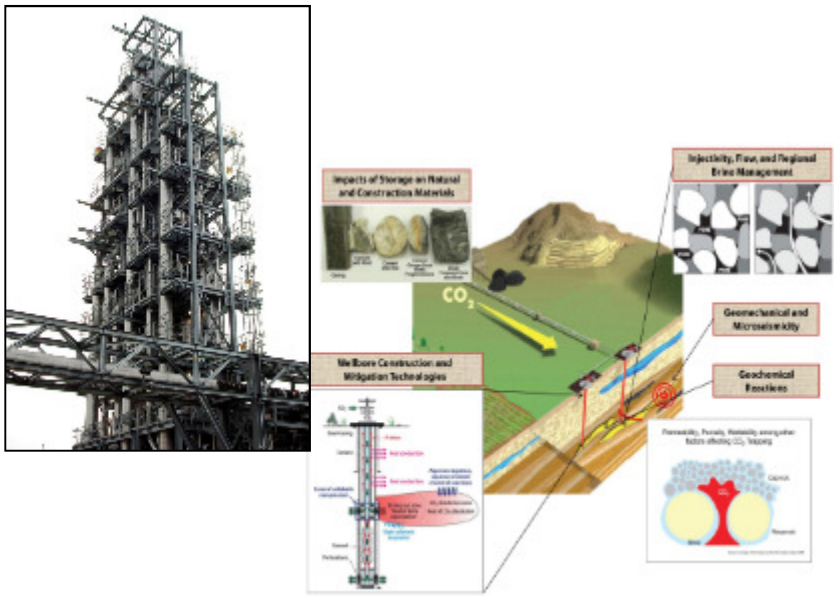
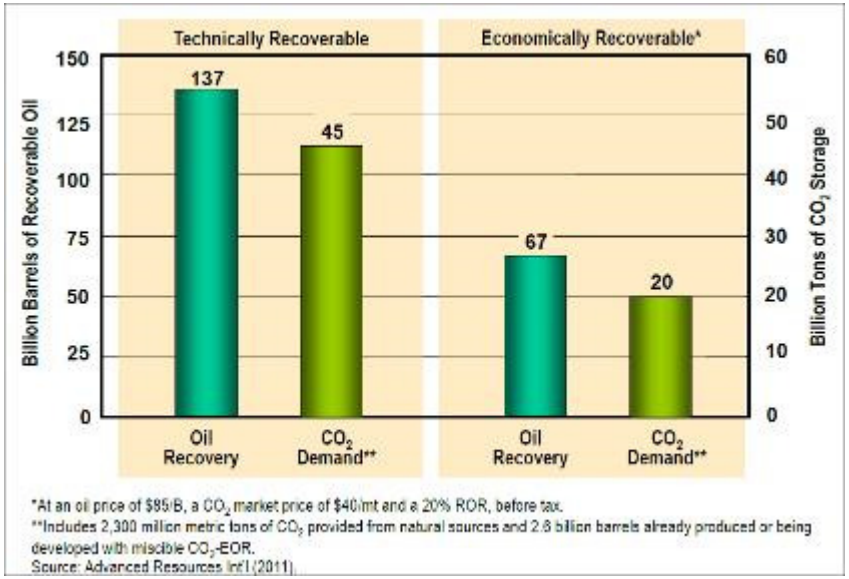
Technology Push



- R&D focused on: cost (capture) and confidence (storage)
- Demos (integration and learning)

Market Pull

Domestic Oil Supplies and CO_2 Demand (Storage) Volumes from "Next Generation" CO_2-EOR Technology**



*At an oil price of $85/B, a CO_2 market price of $40/mt and a 20% ROR, before tax.
**Includes 2,300 million metric tons of CO_2 provided from natural sources and 2.8 billion barrels already produced or being developed with miscible CO_2-EOR.
Source: Advanced Resources Int'l (2011)

- Existing Market Mechanisms: Enhanced Oil Recovery (EOR)
  - 65 million tons per year of CO_2 to produce nearly 300,000 barrels of oil per day.
- Regulatory Framework (Evolving)
- Financing (Tax Credits and Loan Guarantees)

Major CCS 1st Gen Demonstration Projects
Project Locations & Cost Share

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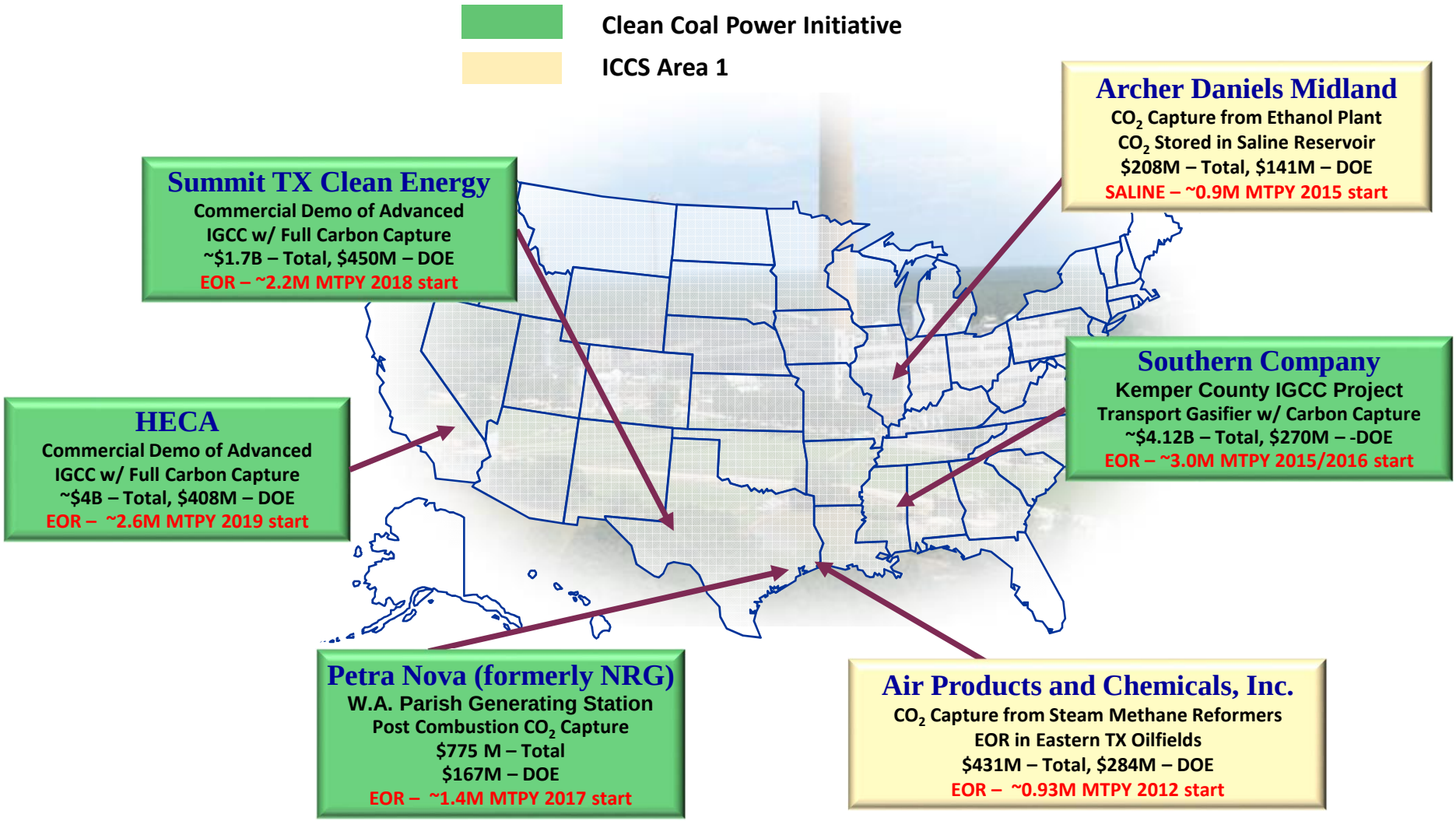

Regional Carbon Sequestration Partnerships

Developing the Infrastructure for Wide Scale Deployment

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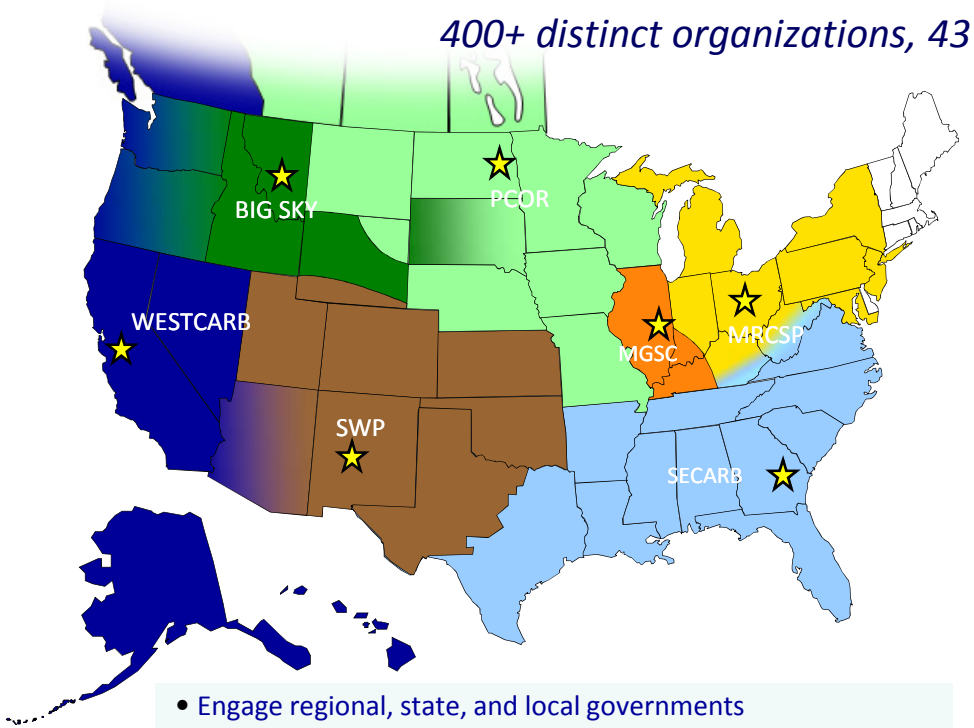
Seven Regional Partnerships

400+ distinct organizations, 43 states, 4 Canadian Provinces



- Engage regional, state, and local governments
- Determine regional sequestration benefits
- Baseline region for sources and sinks
- Establish monitoring and verification protocols
- Validate sequestration technology and infrastructure

Characterization Phase (2003-2005)

Search of potential storage locations and CO_2 sources	Found potential for 100s of years of storage

Validation Phase (2005-2011)

20 injection tests in saline formations, depleted oil, unmineable coal seams, and basalt

Development Phase (2008-2018+)

8 large scale injections (over 1 million tons each)	Commercial scale understanding and validation

RCSPs are tasked to determine the best geologic storage approaches and apply technologies to safely and permanently store CO_2 for their specific regions.

RCSP Phase III: Development Phase
Large-Scale Geologic Tests

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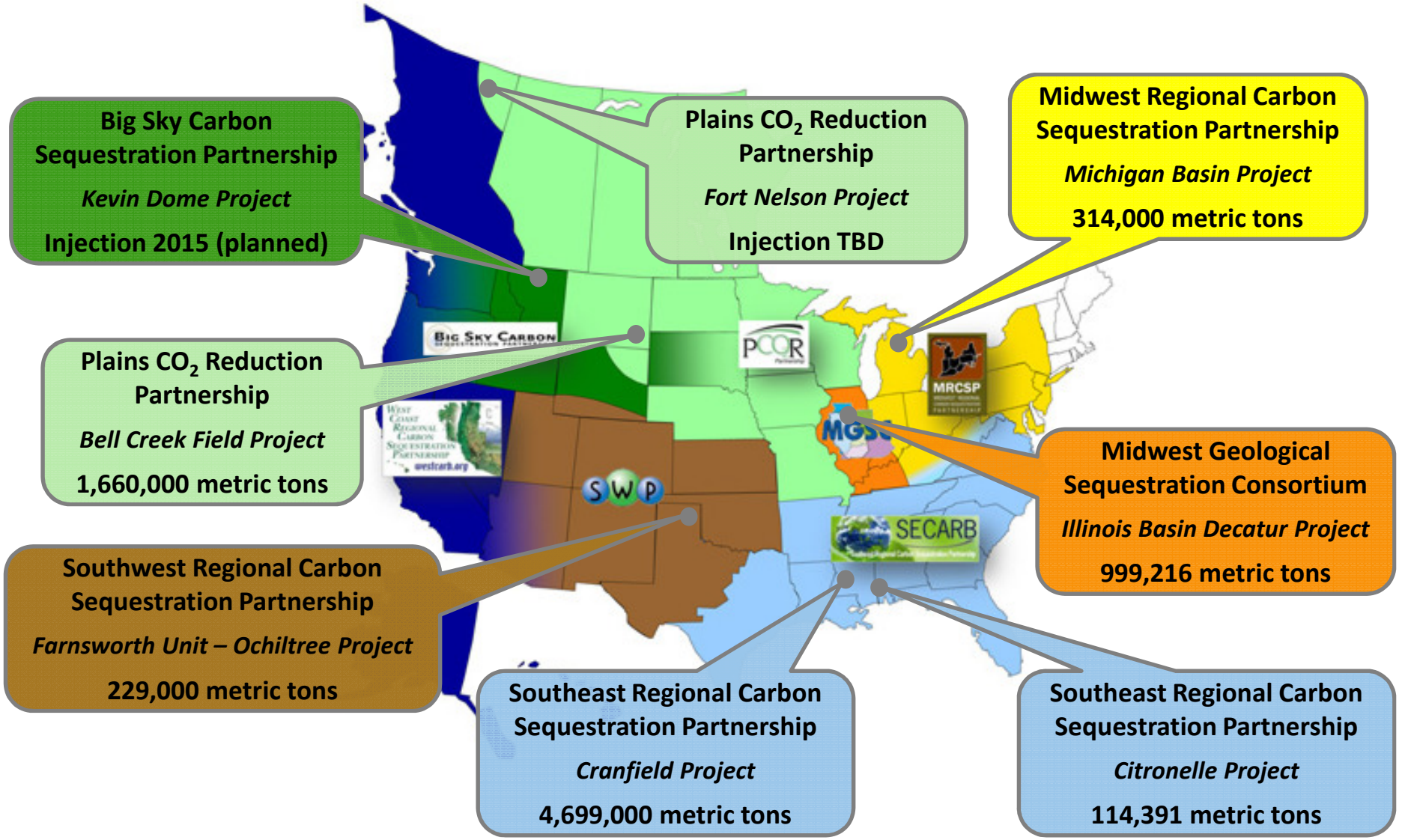


Injection volumes updated as of March 2015

DOE's Continued Interest in CHP

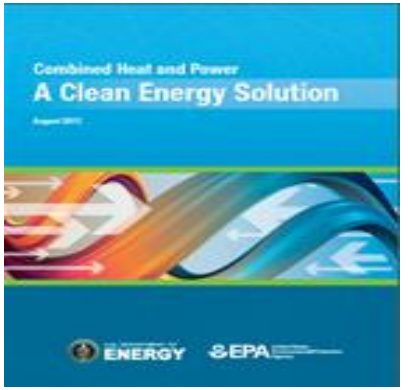
DOE's AMO CHP Deployment Program: www.energy.gov/chp

Covers industrial, commercial, and institutional

Support President's Executive Order 13624: 40GW of new CHP by 2020

Program activities include:

- **Market Analysis and Tracking**
  - CHP Market Study
  - DOE/ICF CHP Installation Database
- **Publication of fact sheets, reports, project profiles:**
  - Waste Heat to Power Market Assessment
  - CHP Project Profile Database
- **CHP Technical Assistance Partnerships (CHP TAPs).**
- **Packaged CHP Accelerator**
- **9/15/2015: $70 million in funding for the next Clean Energy Manufacturing Innovation Institute:**
  - Reduce the cost of deployment for technologies such as advanced sensors, controls, platforms, and modeling for manufacturing by as much as 50 percent.



Thank You

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