QUADRENNIAL ENERGY REVIEW:

ENERGY TRANSMISSION, STORAGE, AND DISTRIBUTION INFRASTRUCTURE

IMPLEMENTATION REPORT CARD

November 2016

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U.S. DEPARTMENT OF ENERGY

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Contributors

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Preface

President Barack Obama issued a Presidential Memorandum on January 9, 2014 to establish a Quadrennial Energy Review (QER).[1] The QER is envisioned to be a focused, actionable document designed to provide policymakers, industry, investors, and other stakeholders with unbiased data and analysis on energy challenges, needs, requirements, and barriers. By translating policy goals into a set of analytically based, integrated actions, the QER enables the Federal Government to create a multi-year roadmap for U.S. energy policy.

Vice President Joseph R. Biden released the first installment of the QER on April 21, 2015. The report, which examines transmission, storage, and distribution infrastructure (TS&D), was developed by a QER Task Force comprising 22 Federal agencies and co-chaired by the White House's Domestic Policy Council and Office of Science and Technology Policy. The Department of Energy (DOE) provided analytical support and helped manage the interagency process through a Secretariat located within the Department.

Due to DOE's extensive role in the development of the QER, Secretary of Energy Ernest Moniz directed the Department's Office of Energy Policy and Systems Analysis (EPSA) to create a QER Implementation Report Card. This document also fulfills a later requirement in the *Consolidated Appropriations Act, 2016* (P.L. 114-113) to provide an update regarding the recommendations contained in the QER:

> *"The [Senate Committee on Appropriations, Subcommittee on Energy and Water Development] directs the Secretary, within 180 days after the enactment of this Act, to provide the Committee with a status of implementing the recommendations in the QER, including what has been achieved through the shared interest of involved parties, Federal Government actions cited in the report, and an analysis of recommendations that have not been adopted."*

To meet Secretary Moniz's requirements along with those of the *Consolidated Appropriations Act, 2016*, this report card assesses the cumulative achievements of Congress, DOE, and its interagency partners to implement the QER's recommendations. It does so by examining the status of each recommendation and determining if additional actions are required from the Administration and Congress in order for full implementation to occur.

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Summary

In the weeks following the QER's release, lawmakers, regulators, industry, and other stakeholders responded positively. News articles discussing or mentioning the QER appeared in more than 60 national, local, and trade publications, and 16 state and national energy organizations issued public statements of support. As domestic attention to—and support for—the QER continued to grow, it led to international interest in the report's analysis and recommendations. To date, DOE has provided briefings to representatives from more than 30 countries, the European Union, and the European Commission about the QER's development and findings.

After the initial publication, the Administration began, and continues to be, actively engaged in the implementation of the QER's 63 recommendations. Under coordination from the White House, DOE and its interagency partners are undertaking numerous initiatives to adopt the QER's proposals. Of the report's many recommendations, 29 are fully implemented and 21 are underway at differing levels of completion. Examples of the completed work include reforming energy employment data, investing in research and development of emissions monitoring equipment, and collaborating with Mexico and Canada to advance North American energy dialogue.

The bipartisan support that many recommendations have received on Capitol Hill underscores the shared interest of Congress and the Administration to improve the Nation's energy infrastructure. Congressional action that supports or authorizes implementation is ongoing, and 21 of the QER's proposals are fully or partially reflected in Federal law. By successfully working together to address issues such as energy supply disruptions and modernization of the Strategic Petroleum Reserve (SPR), Congress and the Administration continue to increase the resilience, reliability, and safety of the Nation's transmission, storage, and distribution infrastructure.

While the accomplishments achieved in the past 18 months are encouraging, more work is needed to implement all of the QER's recommendations. DOE and its interagency partners will proceed with their successful initiatives, address areas where improvement is needed, and continue to partner with Congress to secure the necessary authorizations for full implementation to occur.

Analyzing Implementation

Assessment Methodology

The QER's recommendations encompass a wide variety of topics with implementation time frames varying from less than 1 year to more than 1 decade. While DOE and its interagency partners are able to take immediate action to implement some recommendations, others first require action from Congress before an executive agency may begin substantive work. In order to capture the efforts of Federal agencies and lawmakers, this report assesses each recommendation based on two types of actions: *executive* and *legislative*.

Executive actions encompass the work completed by DOE and other Federal agencies under guidance from the White House. The extent of work that can be completed, however, is limited for certain proposals until Congress appropriates funding or changes current law to enable Federal agencies to act. In instances where Congress provides only partial or no authorization, implementation of QER recommendations is assessed on the amount of work completed using current statutory or appropriation authorities.

Legislative actions include legislation that is moving in committee, has received a floor vote in one or both chambers, or has passed both chambers of Congress. For the purposes of this report card, relevant legislation either directs an executive agency to complete a task under its current authority (e.g., issue an analytical report) or authorizes an executive agency to pursue implementation. Recommendations that require new authorizations are divided into two subcategories:

- **Appropriation**: New Congressional funding is required before Federal agencies may begin full implementation.
- **Statute**: Congressional action is required to create or modify relevant statute(s) before Federal agencies may begin full implementation.

Breakdown of Recommendations

Of the QER's 63 recommendations, Federal agencies are implementing approximately two-thirds through existing statutory or appropriation authorities. The remaining third, however, require Congressional action before full implementation can occur. Table 1 provides a breakdown of the number of recommendations in each category.

A list of all recommendations is available in the *Implementation Overview* section of this report. Additional information regarding the two legislative subcategories is provided in the *Appendix*.

Table 1: Number of Recommendations by Action Category

Action	Category Description	Total
Executive	Federal agencies can conduct implementation under existing authorities.	42
Legislative (Appropriation)	New Congressional funding is required before full implementation can occur.	11
Legislative (Statute)	Congressional action is required to create or modify relevant statute(s) before full implementation can occur.	10

Assessing Progress

This report card uses a traditional "traffic light" color code to visually represent the status of each recommendation. While the color scale remains consistent throughout the document, the criteria used to assess progress are different for executive and legislative actions.

Executive Actions

Work completed by DOE and its interagency partners is assessed using five levels of progress. The first tier, *More Information Required*, denotes recommendations for which data are unavailable to make an accurate assessment. The second tier, *Improvement Needed*, categorizes recommendations that have limited work completed and require additional action. The third tier, *New Authority Needed*, addresses the legal and financial parameters in which agencies operate to highlight the extent to which implementation can occur. This category denotes recommendations for which new actions cannot be completed until Congress provides the requisite statutory authorization or appropriation of funding. The fourth tier, *Work Underway*, denotes recommendations that are proceeding without issue. The fifth tier, *Implemented*, highlights completed work that meets the QER's recommendations, although efforts to maintain and update these actions will be ongoing.

A list of assessments for executive actions—and associated colors—is provided in Table 2.

Table 2: Assessing Executive Actions

Color	Tier	Category Description
	More Information Required	Currently unable to gauge the status of implementation.
	Improvement Needed	Additional work is required to implement the recommendation.
	New Authority Needed	No additional work can occur without Congressional action.
	Work Underway	Work is underway and implementation is occurring.
	Implemented	Implementation occurred and supportive work continues.

Legislative Actions

Congressional activity is also assessed using five levels of progress. The first tier, *Not Applicable*, identifies recommendations that can be implemented under the Executive Branch's current authorities and do not require any new actions from Congress. The second tier, *Limited or No Action*, denotes recommendations for which authorizing legislation is stalled or has not been introduced for consideration. The third tier, *Under Consideration*, highlights proposals that are not yet law but are moving through committee or have passed either the House or Senate. The fourth tier, *Partial Reflection in Law*, captures recommendations that either (1) receive a portion of the statutory authorization or appropriation of funding needed for implementation to occur, or (2) Congress has signaled support or interest by codifying a recommendation that can be implemented by an executive agency using its existing authorities (e.g., complete an analytical study). The fifth tier, *Full Reflection in Law*, includes recommendations for which Congress provided the requested appropriation of funding or statutory authorization.

A description of each legislative category is provided in Table 3.

Table 3: Assessing Legislative Actions

Color	Tier	Category Description
	Not Applicable	Legislative action is not required for implementation to occur.
	Limited or No Action	Legislation is stalled or has not been introduced.
	Under Consideration	Legislation is advancing in committee or has passed one chamber.
	Partial Reflection in Law	Congress authorized partial appropriation or statutory request.
	Full Reflection in Law	Congress authorized full appropriation or statutory request.

Twenty-one QER recommendations have appeared in three recent pieces of legislation that are now law: the B*ipartisan Budget Act of 2015* (P.L. 114-74); the *Consolidated Appropriations Act, 2016* (P.L. 114-113); and the *Fixing America's Surface Transportation (FAST) Act* (P.L. 114-94). While the *Bipartisan Budget Act* and *Consolidated Appropriations Act, 2016* provided statutory changes and appropriations requested in the QER, the *FAST Act* codified many recommendations that can be implemented without Congressional action. A list of recommendations and related legislation is provided in Table 4.

Table 4: Recommendations (Rec.) Enacted into Law

Rec.	Summary	Action
Bipartisan Budget Act of 2015 (P.L. 114-74)		
4.2	SPR emergency response capability (Life Extension Project)	Authorized Statutory Change
4.21	SPR emergency response capability (SPR Marine Terminal)	Authorized Statutory Change
Consolidated Appropriations Act, 2016 (P.L. 114-113)		
3.1	Grid modernization research	Authorized Appropriation
5.4	Address data gaps in rail transport of energy commodities	Authorized Appropriation
7.1	Quantification of natural gas infrastructure emissions	Authorized Appropriation
7.2	Detect and reduce methane losses from natural gas TS&D systems	Authorized Appropriation
7.21	Broader air quality benefits through reduced methane losses	Authorized Appropriation
7.4	Support funding to reduce diesel emissions	Authorized Appropriation
Fixing America's Surface Transportation (FAST) Act (P.L. 114-94)		
2.3	State energy assurance plans	Aligns with QER Proposal
2.5	Mitigate risks of losing transformers	Authorized Statutory Change
4.3	More contemporary view on energy security	Aligns with QER Proposal
5.1	Transport of crude oil and ethanol by rail	Aligns with QER Proposal
5.2	Analyze rail congestion impact on other energy commodities	Aligns with QER Proposal

Table 4: Recommendations (Rec.) Enacted into Law (continued)

Rec.	Summary	Action
5.3	Impacts of delayed or incomplete coal deliveries	Aligns with QER Proposal
5.8	Coordinate data collection, modeling, and analysis	Aligns with QER Proposal
5.9	Impacts of multi-modal energy transport	Aligns with QER Proposal
9.2	Increase public engagement in siting and permitting	Aligns with QER Proposal
9.3	Establish partnerships for siting and permitting	Aligns with QER Proposal
9.4	Expand mitigation and conservation planning for siting and permitting	Aligns with QER Proposal
9.5	Improve coordination across agencies for siting and permitting	Authorized Statutory Change
9.6	Authorize recovery of costs for review of project applications	Authorized Statutory Change

At the time of this report's preparation, Congress was discussing the possibility of conferencing *H.R. 8: The North American Energy Security and Infrastructure Act* with *S. 2012: The Energy Policy Modernization Act of 2016*. Due to the potential risk of including provisions that might later be removed during the conferencing process, this report does not address provisions contained in either bill.

Implementation Overview

An overview of the QER's 63 recommendations sorted by action category and chapter is provided below. Table 5 denotes the breakdown of the recommendations by three types of action categories: Legislative – Appropriation, Legislative – Statute, and Executive. Note the cumulative 11 recommendations listed as *Limited or No Action* and *Under Consideration* in the Appropriation and Statute categories are reflected in the Executive category as *New Authority Needed*.

Table 5: Implementation Status by Action Category

Appropriation		Statute		Executive	
Limited or No Action	5	Limited or No Action	4	Improvement Needed	2
Under Consideration	1	Under Consideration	1	New Authority Needed	11
Partial Reflection	0	Partial Reflection	0	Work Underway	21
Full Reflection	5	Full Reflection	5	Implemented	29
Total	**11**	**Total**	**10**	**Total**	**63**

Table 6 provides a breakdown of recommendations by chapter. Note the *Type* column lists the initial action required for each recommendation: Executive (Exec.), Legislative – Appropriation (Appr.), or Legislative – Statute (Stat.).

Table 6: Implementation Status by Chapter

Rec.	Summary	Type	Legislative Status	Executive Status
Chapter 2: Increasing the Resilience, Reliability, Safety, and Asset Security of TS&D Infrastructure				
2.1	Data and metrics to enhance energy infrastructure	Exec.	Not Applicable	Work Underway
2.2	Natural gas pipeline replacement and maintenance programs	Stat.	Limited or No Action	New Authority Needed
2.3	State energy assurance plans	Appr.	Under Consideration	New Authority Needed
2.4	Grant program to promote innovation	Appr.	Limited or No Action	New Authority Needed
2.5	Mitigate risks of losing transformers	Stat.	Full Reflection	Work Underway
2.6	Regional product reserve analysis (PADD 1 and PADD 3)	Exec.	Not Applicable	Work Underway
2.61	Regional product reserve analysis (PADD 5)	Exec.	Not Applicable	Work Underway
2.7	Presidential authority to release products from RPPRs	Stat.	Limited or No Action	New Authority Needed

Table 6: Implementation Status by Chapter (continued)

Rec.	Summary	Type	Legislative Status		Executive Status	
Chapter 3: Modernizing the Electric Grid						
3.1	Grid modernization research	Appr.		Full Reflection		Implemented
3.2	Strategy for storage and flexibility	Exec.		Not Applicable		Work Underway
3.3	Review of transmission plans and assessment of barriers	Appr.		Limited or No Action		New Authority Needed
3.4	State financial assistance for TS&D infrastructure investment	Appr.		Limited or No Action		New Authority Needed
3.5	Coordinate goals across jurisdictions	Exec.		Not Applicable		Implemented
3.6	Value new services and technologies	Exec.		Not Applicable		Work Underway
3.7	Improve grid communication	Exec.		Not Applicable		Work Underway
3.8	Uniform methods for measuring energy efficiency	Exec.		Not Applicable		Implemented
Chapter 4: Modernizing U.S. Energy Security Infrastructures in a Changing Global Marketplace						
4.1	Update SPR release authorities	Stat.		Limited or No Action		New Authority Needed
4.2	SPR emergency response capability (Life Extension Project)	Stat.		Full Reflection		Implemented
4.21	SPR emergency response capability (Marine Terminal)	Stat.		Full Reflection		Implemented
4.3	More contemporary view on energy security	Exec.		Partial Reflection		Implemented
4.4	Drop-in jet fuel and diesel research and demonstration	Exec.		Not Applicable		Implemented
4.41	Technical support to states for higher ethanol blends	Exec.		Not Applicable		Implemented
4.5	Domestic shipping and energy security	Exec.		Not Applicable		Improvement Needed
4.6	Monitoring propane storage, use, and exports	Exec.		Not Applicable		Implemented
Chapter 5: Improving Shared Transport Infrastructures						
5.1	Transport of crude oil and ethanol by rail	Exec.		Full Reflection		Work Underway
5.2	Analyze rail congestion impact on other energy commodities	Exec.		Partial Reflection		Work Underway

Table 6: Implementation Status by Chapter (continued)

Rec.	Summary	Type	Legislative Status	Executive Status
5.3	Impacts of delayed or incomplete coal deliveries	Exec.	Partial Reflection	Work Underway
5.4	Address data gaps in rail transport of energy commodities	Exec.	Not Applicable	Implemented
5.5	Funding for waterborne freight infrastructure	Stat.	Under Consideration	New Authority Needed
5.6	Grants for shared energy transport systems	Appr.	Limited or No Action	New Authority Needed
5.7	Partnerships for waterborne transport infrastructure	Exec.	Not Applicable	Implemented
5.8	Coordinate data collection, modeling, and analysis	Exec.	Partial Reflection	Implemented
5.9	Impacts of multi-modal energy transport	Exec.	Partial Reflection	Work Underway
5.10	Assess energy component transportation	Exec.	Not Applicable	Work Underway
Chapter 6: Integrating North American Energy Markets				
6.1	Continue North American energy dialogue advances	Exec.	Not Applicable	Implemented
6.2	Increase North American energy data integration	Exec.	Not Applicable	Implemented
6.3	Joint energy system modeling, planning, and forecasting	Exec.	Not Applicable	Implemented
6.4	North American regulatory harmonization programs	Exec.	Not Applicable	Implemented
6.5	Coordinate training and professional interactions	Exec.	Not Applicable	Implemented
6.6	Arctic safety, reliability, and environmental partnerships	Exec.	Not Applicable	Implemented
6.7	Arctic remote energy delivery partnerships	Exec.	Not Applicable	Implemented
6.8	Caribbean energy infrastructure	Exec.	Not Applicable	Implemented
Chapter 7: Addressing Environmental Aspects of TS&D Infrastructure				
7.1	Quantification of natural gas infrastructure emissions	Appr.	Full Reflection	Work Underway
7.2	Detect and reduce methane losses from natural gas TS&D systems	Appr.	Full Reflection	Work Underway
7.21	Broader air quality benefits through reduced methane losses	Appr.	Full Reflection	Implemented

Table 6: Implementation Status by Chapter (continued)

Rec.	Summary	Type	Legislative Status		Executive Status	
7.3	Lower the cost of continuous emissions monitoring equipment	Exec.		Not Applicable		Implemented
7.4	Support funding to reduce diesel emissions	Appr.		Full Reflection		Implemented
7.5	Beneficial use and/or disposal of dredging material	Exec.		Not Applicable		Implemented
7.6	Improve environmental data collection and analysis	Exec.		Not Applicable		Improvement Needed
7.7	Promote best practices for carbon dioxide pipelines in states	Exec.		Not Applicable		Work Underway
7.8	Financial incentives for carbon dioxide pipelines	Stat.		Limited or No Action		New Authority Needed
Chapter 8: Enhancing Employment and Workforce Training						
8.1	Energy-job training system	Exec.		Not Applicable		Implemented
8.2	Open-source learning community for courses in energy-related fields	Exec.		Not Applicable		Implemented
8.3	Accelerate development of energy and manufacturing curricula	Exec.		Not Applicable		Implemented
8.4	Facilitate national credentials for energy occupations	Exec.		Not Applicable		Work Underway
8.5	Facilitate the transition of military veterans into the energy sector	Exec.		Not Applicable		Implemented
8.6	Reform existing energy jobs data collection systems	Exec.		Not Applicable		Implemented
Chapter 9: Siting and Permitting of TS&D Infrastructure						
9.1	Resources to Federal agencies for siting and permitting projects	Appr.		Limited or No Action		New Authority Needed
9.2	Increase public engagement in siting and permitting	Exec.		Full Reflection		Work Underway
9.3	Establish partnerships for siting and permitting	Exec.		Full Reflection		Work Underway
9.4	Expand mitigation and conservation planning for siting and permitting	Exec.		Full Reflection		Work Underway
9.5	Improve coordination across agen-cies for siting and permitting	Stat.		Full Reflection		Work Underway
9.6	Authorize recovery of costs for review of project applications	Stat.		Full Reflection		Work Underway

Chapter II

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

Implementation Overview for Chapter 2

Table 7: Summary of Chapter 2 Recommendations

Rec.	Summary	Type*	Legislative Status	Executive Status
2.1	Data and metrics to enhance energy infrastructure	Exec.	Not Applicable	Work Underway
2.2	Natural gas pipeline replacement and maintenance programs	Stat.	Limited or No Action	New Authority Needed
2.3	State energy assurance plans	Appr.	Under Consideration	New Authority Needed
2.4	Grant program to promote innovation	Appr.	Limited or No Action	New Authority Needed
2.5	Mitigate risks of losing transformers	Stat.	Full Reflection	Work Underway
2.6	Regional product reserve analysis (PADD 1 and PADD 3)	Exec.	Not Applicable	Work Underway
2.61	Regional product reserve analysis (PADD 5)	Exec.	Not Applicable	Work Underway
2.7	Presidential authority to release products from RPPRs	Stat.	Limited or No Action	New Authority Needed

**Lists the type of initial action: Executive (Exec.), Appropriation (Appr.), or Statute (Stat.).*

Highlights

Following the release of the QER, the Administration undertook new efforts to enhance the resilience, reliability, and security of the Nation's TS&D infrastructure. As a lead agency for energy infrastructure, DOE has launched numerous initiatives to support and facilitate the resilience, reliability, and modernization of the energy sector. These efforts include the Grid Modernization Initiative (GMI) and the related Grid Modernization Laboratory Consortium (GMLC) to support critical research and development in advanced storage systems, clean energy integration, standards and test procedures, and a number of other key grid modernization areas. Another example is DOE's Partnership for Energy Sector Climate Resilience, which was created in April 2015 to enhance U.S. energy security by improving the resilience of energy infrastructure to extreme weather and climate change impacts. Under the Partnership, DOE collaborates with 18 owners and operators of energy assets to develop and pursue strategies to reduce climate- and weather-related vulnerabilities.[2] These and other efforts will help enhance electric reliability and resilience to a broad range of threats and challenges, including aging infrastructure, physical attacks, and geomagnetic storms.

The Administration is also moving forward with efforts to secure critical infrastructure, including the electric power and the oil and natural gas subsectors, from cybersecurity threats. DOE's Cybersecurity for Energy Delivery Systems (CEDS) program in the Office of Electricity Delivery and Energy Reliability (OE) seeks to enhance the reliability and resilience of the Nation's energy infrastructure by reducing the risk of energy disruptions due to cyberattacks. CEDS supports the research and development of cutting-edge cybersecurity solutions, accelerates information sharing with industry and other partners, and develops solutions for reconstitution after a large-scale cyber event.

Implementation Status

Rec.	Summary	Type	Legislative Status	Executive Status
2.1	Data and metrics to enhance energy infrastructure	Exec.	Not Applicable	Work Underway

Recommendation 2.1: Develop comprehensive data, metrics, and an analytical framework for energy infrastructure resilience, reliability, and asset security. To assess the resilience, reliability, and security of energy infrastructures, the QER indicated that DOE should work in collaboration with the Department of Homeland Security and interested infrastructure stakeholders to develop common analytical frameworks, tools, and metrics. DOE will implement this recommendation through the GMLC, which plans to utilize $3 million to initiate a project that uses data analytics for threat detection and response. The initiative will develop technologies and methodologies to protect the grid from advanced cyber and all-hazard threats through the collection of disparate data and the employment of advanced analytics.[3] DOE completed additional work to implement this recommendation through the October 2015 publication of a report that examines regional vulnerabilities and resilience solutions to climate change. The report provides regional profiles that include overviews of energy infrastructure and key vulnerabilities, detailed descriptions of critical energy subsectors, and descriptions of climate change trends and projections.[4]

Rec.	Summary	Type	Legislative Status	Executive Status
2.2	Natural gas pipeline replacement and maintenance programs	Stat.	Limited or No Action	New Authority Needed

Recommendation 2.2: Establish a competitive program to accelerate pipeline replacement and enhance maintenance programs for natural gas distribution systems. The program proposed in the QER would provide Federal competitive financial assistance to states to incentivize cost-effective improvements in the safety and environmental performance of natural gas distribution systems. In the absence of Congressional authorization to implement this recommendation, DOE is taking other steps toward achieving these important outcomes. In March 2016, DOE announced a partnership with the National Association of Regulatory Utility Commissioners (NARUC) to launch a 3-year technical partnership focused on natural gas distribution pipeline modernization. The partnership, which is part of DOE's broader Natural Gas Modernization Initiative, enables NARUC commissioners from across the country to participate in technical workshops and other forums already underway at DOE.[5]

Rec.	Summary	Type	Legislative Status	Executive Status
2.3	State energy assurance plans	Appr.	Under Consideration	New Authority Needed

Recommendation 2.3: Support the updating and expansion of state energy assurance plans. Enabling states and localities to identify potential energy disruptions, quantify their impacts, and develop comprehensive plans that respond to those disruptions is a key finding from the QER. To implement this recommendation, DOE's Fiscal Year (FY) 2017 Budget Request proposes a new State Energy Assurance Program in OE. The program would provide funds via competitive regional cooperative assistance awards to support continual energy assurance plan improvement; exercise regional and state capabilities to characterize energy sector supply disruptions; communicate among local, state, tribal, regional, Federal, and industry partners; and identify gaps in energy planning and emergency response training programs. The new program will complement OE's current efforts to address energy assurance issues, which include forums; web-based training; and table top exercises for Federal, state, tribal, and local energy officials to exchange and share information.

The *FAST Act* partially addresses state energy assurance by discussing disruption-response planning. Sec. 61001 of the law directs the Secretary of Energy to develop and adopt procedures that improve communication and coordination between Federal partners and industry, improve supply chain assessments, establish company liaisons within DOE, streamline regulatory relief processes, increase engagement when developing state and local energy assurance plans, establish education programs, and involve states and the oil and natural gas industry in emergency drills. While this work is applicable toward implementing this recommendation, additional action is required by Congress to approve DOE's proposed State Energy Assurance Program.

Rec.	Summary	Type	Legislative Status	Executive Status
2.4	Grant program to promote innovation	Appr.	Limited or No Action	New Authority Needed

Recommendation 2.4: Establish a competitive grant program to promote innovative solutions to enhance energy infrastructure resilience, reliability, and security. The QER recommended that DOE should establish a program to provide competitively awarded grants to states to demonstrate innovative approaches to TS&D infrastructure hardening and enhancing resilience and reliability. In the absence of Congressional authorization, DOE is partially implementing this recommendation through its work with privately owned utilities in the aforementioned Partnership for Energy Sector Climate Resilience. The Partnership is structured to promote innovative solutions for resilience by identifying and using metrics for measuring success in enhancing climate resilience, assessing cost and benefits of climate resilience actions, and identifying key gaps and opportunities related to the development and deployment of climate-resilient energy technologies, practices, and policies.[6]

Rec.	Summary	Type	Legislative Status	Executive Status
2.5	Mitigate risks of losing transformers	Stat.	Full Reflection	Work Underway

Recommendation 2.5: Analyze the policies, technical specifications, and logistical and program structures needed to mitigate the risks associated with loss of transformers. The initiative proposed in the QER to mitigate the loss of transformers calls on DOE to partner with other Federal agencies to conduct an assessment of transformers' technical specifications, storage locations and amounts, security, and methods of transportation. DOE's EPSA and OE are completing a study regarding the potential establishment of a Strategic Transformer Reserve, which will be submitted to Congress by December 2016 in compliance with Sec. 61004 of the *FAST Act*. DOE also awarded $1.3 million through the GMLC to investigate the technical specifications of a potential Federal strategic reserve that would provide spare transformers in times of extreme events. The project will determine the number and assortment of spare transformers required to recover from extreme events in a timely manner, the optimal number and location of storage facilities, transportation logistics, and recommendations for withdrawal practices.[7]

Rec.	Summary	Type	Legislative Status	Executive Status
2.6	Regional product reserve analysis (PADD 1 and PADD 3)	Exec.	Not Applicable	Work Underway

Recommendation 2.6: Analyze the cost-benefit of additional or expanded regional product reserves (PADD 1 and PADD 3). In May 2014, DOE announced the creation of the Northeast Gasoline Supply Reserve (NGSR) to help mitigate the effects of significant disruptions on gasoline supplies in the Northeast.[8] Following this action, the QER proposed a study to examine the need for regional petroleum product reserves (RPPRs) in the Petroleum Administration for Defense District 1 (PADD 1), which includes the East Coast, and District 3 (PADD 3), which includes the Gulf Coast. In February 2016, DOE's Energy Information Administration (EIA) released a study examining the supply, consumption, and distribution of transportation fuels in PADDs 1 and 3.[9] DOE's Office of Fossil Energy (FE) is continuing this work, with support from EPSA, to complete a cost-benefit analysis of RPPRs in PADDs 1 and 3.

Rec.	Summary	Type	Legislative Status	Executive Status
2.61	Regional product reserve analysis (PADD 5)	Exec.	Not Applicable	Work Underway

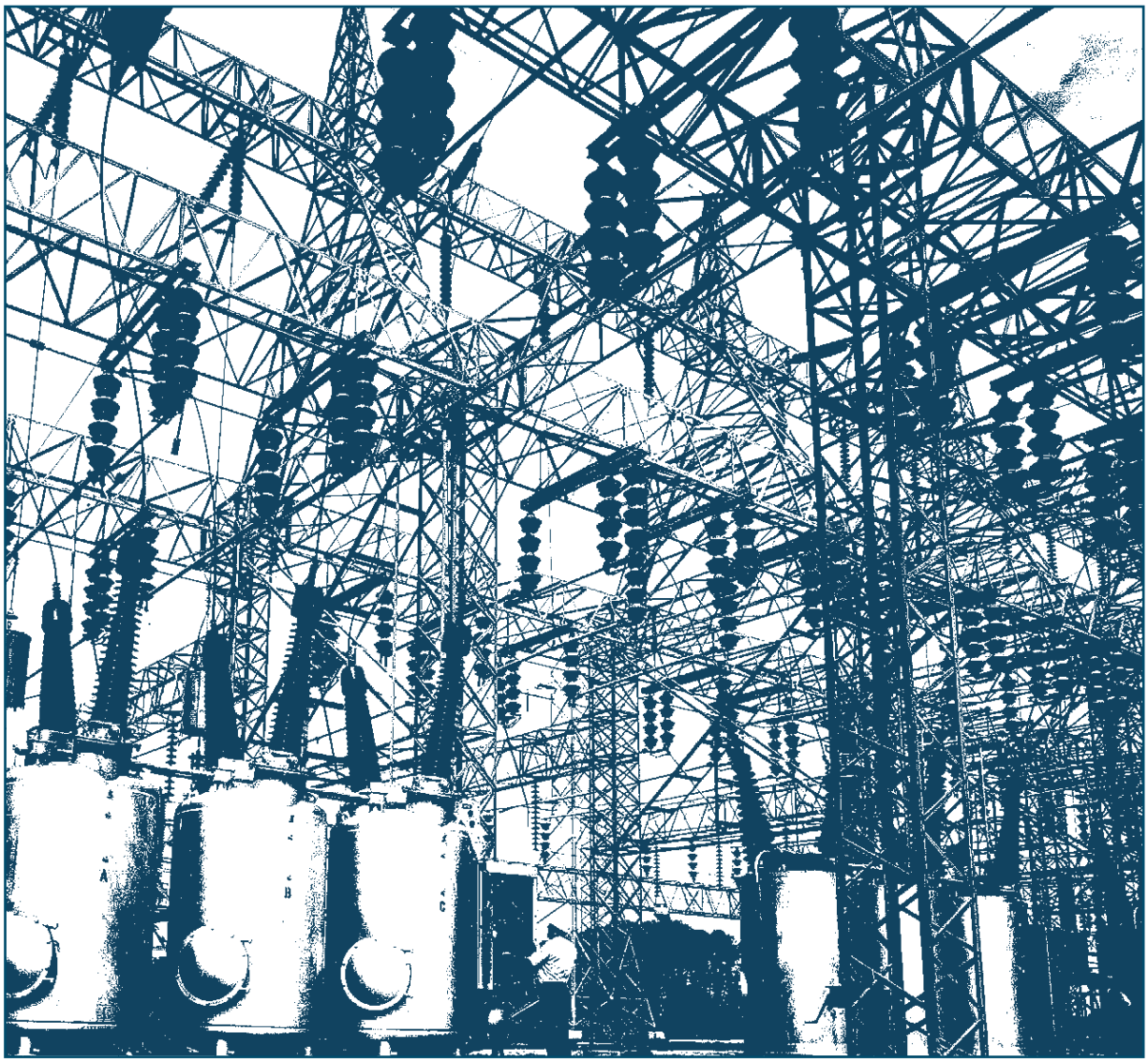
Recommendation 2.61: Analyze the need for additional or expanded regional product reserves (PADD 5). In conjunction with Recommendation 2.6, EIA released a study in September 2015 examining the supply, consumption, and distribution of transportation fuels in PADD 5, which includes the West Coast.[10] FE and EPSA are also currently completing a cost-benefit analysis of an RPPR in PADD 5.

Rec.	Summary	Type	Legislative Status	Executive Status
2.7	Presidential authority to release products from RPPRs	Stat.	Limited or No Action	New Authority Needed

Recommendation 2.7: Integrate the authorities of the President to release products from RPPRs into a single, unified authority. The NGSR and the Northeast Home Heating Oil Reserve do not operate under the same release authorities. The QER called on Congress to align the release triggers for both reserves, and DOE staff has provided technical assistance on draft legislative language to Congressional Committees.

Chapter III

MODERNIZING THE ELECTRIC GRID



Implementation Overview for Chapter 3

Table 8: Summary of Chapter 3 Recommendations

Rec.	Summary	Type*	Legislative Status	Executive Status
3.1	Grid modernization research	Appr.	Full Reflection	Implemented
3.2	Strategy for storage and flexibility	Exec.	Not Applicable	Work Underway
3.3	Review of transmission plans and assessment of barriers	Appr.	Limited or No Action	New Authority Needed
3.4	State financial assistance for TS&D infrastructure investment	Appr.	Limited or No Action	New Authority Needed
3.5	Coordinate goals across jurisdictions	Exec.	Not Applicable	Implemented
3.6	Value new services and technologies	Exec.	Not Applicable	Work Underway
3.7	Improve grid communication	Exec.	Not Applicable	Work Underway
3.8	Uniform methods for measuring energy efficiency	Exec.	Not Applicable	Implemented

**Lists the type of initial action: Executive (Exec.), Appropriation (Appr.), or Statute (Stat.).*

Highlights

The Administration is conducting a number of activities to modernize the Nation's electric grid. DOE's GMI is focused on the development of new architectural concepts, tools, and technologies that measure, analyze, predict, protect, and control the grid of the future. The Grid Modernization Multi-Year Program Plan (MYPP), which DOE released in November 2015, defines a vision for the modern grid that utilizes the Department's work from the QER, the Quadrennial Technology Review, and other activities to describe the research, development, and demonstration initiatives that DOE will focus on over the next 5 years.[11]

DOE is also continuing its work through the GMLC, which was launched in November 2014 as a strategic partnership between DOE headquarters and the National Laboratories to collaborate on the goal of modernizing the Nation's grid.[12] In January 2016, DOE proposed $220 million in funding to the National Laboratories over 3 years to support 87 critical research and development projects.[a, 13] These initiatives cover topics including advanced storage systems, clean energy integration, and standards and test procedures.

The QER Task Force is also conducting additional analyses of the electricity system due to the critical linkages that exist between electric infrastructure and the Nation's economic, environmental, and national security objectives. In recognition of this continued importance, the Administration is currently developing the second installment of the QER to undertake a deeper, dedicated analysis of electricity from generation to end use. The report is scheduled to be published before January 2017.

[a] The funding amounts listed for proposed GMLC projects may be subject to appropriations and final negotiations with award recipients.

Implementation Status

Rec.	Summary	Type	Legislative Status	Executive Status
3.1	Grid modernization research	Appr.	Full Reflection	Implemented

Recommendation 3.1: Provide grid modernization research and development, analysis, and institutional support. Early and strategic investments by DOE in foundational technology development, enhanced security capabilities, institutional support, and stakeholder engagement provide decision makers with a common set of tools that balance the interests of the electric industry with those of consumers. DOE implemented this recommendation through the GMI, which addresses three broad areas: (1) the development and demonstration of technologies for better measurement, integration, management, and control of grid operations; (2) the development and dissemination of new and improved models for analysis, management, and optimization of grid performance; and (3) development of analytical methodologies and frameworks for improving business models that can deliver to consumers the value and benefits of grid modernization. This work includes measurement research to improve control of microgrids being conducted in coordination with the National Institute of Standards and Technology (NIST). In FY 2016, Congress enacted $295.4 million for GMI activities through the *Consolidated Appropriations Act, 2016*. In its FY 2017 Budget Request, DOE seeks $378.5 million to continue and to expand the GMI. Additionally, work completed by DOE and the National Laboratories through the MYPP and GMLC will also address grid modernization challenges.

Rec.	Summary	Type	Legislative Status	Executive Status
3.2	Strategy for storage and flexibility	Exec.	Not Applicable	Work Underway

Recommendation 3.2: Establish a framework and strategy for storage and flexibility. To address the little information that exists on the benefits and costs of storage and flexible resources deployment below the bulk system level, the QER determined that DOE should conduct regional and state analyses of storage deployment to produce a strategy for flexibility and storage. In March 2016, the Demand Response and Energy Storage Integration Study Collaboration among DOE and the National Laboratories produced a report examining demand response and energy storage integration.[14] In FY 2017, DOE's Energy Storage Program within OE proposes utilizing $2.6 million as part of the GMI to collaborate with utility regulators to develop analytic tools and uniform model standards for energy storage that can accommodate regional diversity. Analytical models will include risk attributes of energy storage along with primary, secondary, and tertiary value-stream recognition. The program will also work with standards bodies to facilitate the adoption of energy storage codes and standards related to safety and performance.

Rec.	Summary	Type	Legislative Status	Executive Status
3.3	Review of transmission plans and assessment of barriers	Appr.	Limited or No Action	New Authority Needed

Recommendation 3.3: Conduct a national review of transmission plans and assess barriers to their implementation. The study proposed in the QER regarding a more detailed and comprehensive national review of transmission plans includes assessments on the types of transmission projects proposed and implemented, current and future costs, and consideration of interregional coordination. To implement this recommendation, DOE's FY 2017 Budget Request includes a provision that a "national review of transmission plans and assessment of barriers to their implementation" will be completed by the National Electricity Delivery Division in OE pending appropriations from Congress.

Rec.	Summary	Type	Legislative Status	Executive Status
3.4	State financial assistance for TS&D infrastructure investment	Appr.	Limited or No Action	New Authority Needed

Recommendation 3.4: Provide state financial assistance to promote and integrate TS&D infrastructure investment plans for electricity reliability, affordability, efficiency, lower carbon generation, and environmental protection with a focus on regional coordination. Recognizing that states can provide innovative ways to address new trends that meet environmental, resilience, and efficiency goals, the QER recommended competitive funding for states to promote and integrate TS&D infrastructure investment plans that preserve or enhance reliability and affordability. DOE's FY 2017 Budget Request proposes $15 million for the creation of a State Distribution-Level Reform Program to competitively award 5–10 cooperative agreements to states to utilize the grid architecture approach to address their system challenges. However, the proposal has not received support in either the House of Representatives or the Senate.

Rec.	Summary	Type	Legislative Status	Executive Status
3.5	Coordinate goals across jurisdictions	Exec.	Not Applicable	Implemented

Recommendation 3.5: Coordinate goals across jurisdictions. The QER stated that DOE should play a convening role to bring together public utility commissioners, legislators, and other stakeholders at the Federal, state, and tribal levels to explore integration approaches. To implement this recommendation, the Grid Modernization MYPP highlights the technical assistance that DOE provides to states and tribal governments on existing and emerging policy, technology, regulatory, and market issues in the electricity sector. In the MYPP, DOE also supports regional planning and reliability organizations to facilitate long-term regional planning at the inter-connection level and to assist in developing institutional frameworks, standards, and protocols for integrating emerging technologies, as well as for the physical and cybersecurity of the grid.[15] This initiative is echoed in a $3.5 million GMLC project to develop and test interconnection and interoperability standards that harmonize requirements across jurisdictions and eliminate conflicting requirements across technology domains.[16]

Rec.	Summary	Type	Legislative Status	Executive Status
3.6	Value new services and technologies	Exec.	Not Applicable	Work Underway

Recommendation 3.6: Value new services and technologies. Efficient characterization and valuation of services provided to the grid by existing and new technologies are important for maintaining reliability and affordability, and for providing clear price signals to consumers. Defining the characteristics of a reliable, affordable, and environmentally sustainable electricity system, as well as creating approaches for developing pricing mechanisms for those characteristics, was a need identified by the QER. To further this goal, DOE is coordinating with NIST's Transactive Energy Challenge to create a modeling platform for community use in comparing net benefits across varying transactive energy schemes. DOE also plans to implement this recommendation through a $3 million GMLC project to develop a widely accepted, well-tested valuation methodological framework for evaluating the collection of net benefits that can be provided by different grid-related technologies and services.[17]

Rec.	Summary	Type	Legislative Status	Executive Status
3.7	Improve grid communication	Exec.	Not Applicable	Work Underway

Recommendation 3.7: Improve grid communication through standards and interoperability. In its assessment of consumer-level and grid-level devices, the QER determined the ability for these devices to coordinate and communicate their operations in a common language with the grid, and among themselves, is missing. To address the issue, the Grid Modernization MYPP includes four technical targets that seek to (1) incorporate communications models into grid simulation and management tools; (2) develop methods to manage the heterogeneity of the network; (3) develop a framework for testing devices in a realistic, reconfigurable "utility equivalent" environment; and (4) improve dynamic management of data flows. In 2016, the Department is using the GMI to develop low-cost power, vehicle, and building sensors that rely on open-source interoperability standards to provide visibility and understanding to grid operators. The DOE research plan is supported by strategic collaborations, such as the "Grid 3.0" multi-organization collaboration that convenes stakeholders to identify technical issues critical to future grid interoperability, and the coordinated effort with NIST to develop interoperability standards through consensus channels such as the Smart Grid Interoperability Panel. Further support for interoperability is occurring through the GMLC foundational project, which advances interoperability from an institutional perspective with anticipated funding of $1 million for 3 years starting in FY 2016.

Rec.	Summary	Type*	Legislative Status	Executive Status
3.8	Uniform methods for measuring energy efficiency	Exec.	Not Applicable	Implemented

Recommendation 3.8: Establish uniform methods for measuring and verifying energy efficiency. Regulators need ways to understand, validate, and value savings from energy efficiency practices, including understanding the value of infrastructure avoidance as a result of efficiency investments. Through its Uniform Methods Project, the QER found DOE should accelerate the development of uniform methods for measuring energy savings and promote adoption of these methods in public and private efficiency programs. During the last year, the Uniform Methods Project has finalized protocols for Data Center IT Efficiency Measures and Residential Behavior.[18] Protocols for Combined Heat and Power and Strategic Energy Measurement are currently under review. Additional work includes the November 2015 report by the Federal Energy Management Program in DOE's Office of Energy Efficiency and Renewable Energy (EERE). The report contains procedures and guidelines for quantifying the savings resulting from energy efficient equipment, water conservation, improved operation and maintenance, renewable energy, and cogeneration projects installed by third-party contractors at customer facilities.[19]

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Chapter IV

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

Implementation Overview for Chapter 4

Table 9: Summary of Chapter 4 Recommendations

Rec.	Summary	Type*	Legislative Status	Executive Status
4.1	Update SPR release authorities	Stat.	Limited or No Action	New Authority Needed
4.2	SPR emergency response capability (Life Extension Project)	Stat.	Full Reflection	Implemented
4.21	SPR emergency response capability (Marine Terminal)	Stat.	Full Reflection	Implemented
4.3	More contemporary view on energy security	Exec.	Partial Reflection	Implemented
4.4	Drop-in jet fuel and diesel research and demonstration	Exec.	Not Applicable	Implemented
4.41	Technical support to states for higher ethanol blends	Exec.	Not Applicable	Implemented
4.5	Domestic shipping and energy security	Exec.	Not Applicable	Improvement Needed
4.6	Monitoring propane storage, use, and exports	Exec.	Not Applicable	Implemented

**Lists the type of initial action: Executive (Exec.), Appropriation (Appr.), or Statute (Stat.).*

Highlights

DOE undertakes substantive efforts regarding U.S. energy security through the collaborative work of its divisions. EPSA serves as the focal point for policy analysis, analytic support, and advice relating to energy markets and energy supply and demand. It assists in developing long-term strategies to ensure energy security and to prepare for and respond to energy supply disruptions. The Department's Office of International Affairs serves a vital interagency function by coordinating with the National Security Council, the Department of State (DOS), and others to determine how U.S. energy security, energy relations, and energy developments with other countries could impact or be affected by national security decisions. Lastly, EERE implements a range of strategies aimed at enhancing energy security by reducing U.S. reliance on oil, increasing energy affordability, and offering Americans a broader range of energy choices. The work of these offices—and many others—underscores DOE's efforts to implement the recommendations from Chapter 4 of the QER.

Implementation Status

Rec.	Summary	Type	Legislative Status	Executive Status
4.1	Update SPR release authorities	Stat.	Limited or No Action	New Authority Needed

Recommendation 4.1: Update SPR release authorities to reflect modern oil markets. The QER determined that Congress should update the SPR release authorities in the *Energy Policy and Conservation Act of 1975* (P.L. 94-163) so that (1) the definition of a "severe energy supply interruption" includes an interruption of the supply of oil that is likely to cause a severe increase in the price of domestic petroleum products; and (2) the requirement that a "severe increase in the price of petroleum products has resulted from such emergency situation" is changed to a "requirement that a severe price increase will likely result from such emergency situation." While Sec. 401 of the *Bipartisan Budget Act of 2015* modified the term "severe energy supply interruption" to include an act of terrorism, the authorizing provision did not include the QER's recommended changes. However, Sec. 402 of the Act authorizes the Secretary of Energy to submit an action plan to Congress that includes a description of whether existing legal authorities are adequate.

Rec.	Summary	Type	Legislative Status	Executive Status
4.2	SPR emergency response capability (Life Extension Project)	Stat.	Full Reflection	Implemented

Recommendation 4.2: Invest to optimize the SPR's emergency response capability (Life Extension Project). Following the QER's recommendation to undertake a life extension program for key SPR components, which include surface infrastructure and additional brine-drive caverns, Congress enacted the authorization. Sec. 404 of the *Bipartisan Budget Act of 2015* authorizes the Secretary of Energy to sell up to $2 billion worth of crude oil from the SPR between FY 2017 and FY 2020 to provide for the construction, maintenance, repair, and replacement of SPR facilities. Sec. 402 of the Act also requires the Department to submit a Strategic Review to Congress, which will be used to inform DOE's SPR infrastructure modernization plans. The Administration submitted an FY 2017 budget amendment related to SPR modernization in April 2016 requesting authorization for the Secretary of Energy to draw down and sell oil from the SPR for revenues of at least $375.4 million in FY 2017.

Rec.	Summary	Type*	Legislative Status	Executive Status
4.21	SPR emergency response capability (Marine Terminal)	Stat.	Full Reflection	Implemented

Recommendation 4.21: Invest to optimize the SPR's emergency response capability (Marine Terminal). The QER also recommended increasing the incremental distribution capacity of the SPR by enhancing marine-based capacity at the Gulf Coast terminus of the SPR distribution system. As described in Recommendation 4.2, Sec. 404 of the *Bipartisan Budget Act of 2015* authorizes the drawdown and sale of crude oil from the SPR to provide for the construction, maintenance, repair, and replacement of SPR facilities.

Rec.	Summary	Type	Legislative Status	Executive Status
4.3	More contemporary view on energy security	Exec.	Partial Reflection	Implemented

Recommendation 4.3: Support other U.S. actions related to energy security infrastructures that reflect a broader and collective view of energy security. Pursuant to the QER's recommendation, the United States continues to consult with allies and key energy trading partners on energy security issues, as well as supporting actions related to energy infrastructures that are consistent with U.S. interests and Group of Seven principles on energy security. DOE, Natural Resources Canada, Canada's National Energy Board, and the Mexican Secretariat of Energy are advancing North American energy security by sharing technical information, research plans, and best practices in numerous areas. DOE is enhancing this work by collaborating with DOS to write a report that increases our collective understanding of the issues and considerations facing U.S. energy security. Following direction from Congress in Sec. 61005 of the *FAST Act*, the review will (1) assess U.S. energy security in domestic and global energy markets, (2) identify metrics for evaluating energy-related actions with respect to their effects on energy security, and (3) include an implementation strategy for ensuring that metrics are applied consistently throughout the government.

Rec.	Summary	Type	Legislative Status	Executive Status
4.4	Drop-in jet fuel and diesel research and demonstration	Exec.	Not Applicable	Implemented

Recommendation 4.4: Continue research, development, and deployment of drop-in biofuels and support work related to higher-level ethanol blends. Biofuels for aviation and large vehicle applications face considerable challenges in penetrating markets, and the QER recommended continued funding of research and demonstration activities on drop-in jet fuel and diesel. DOE's Bioenergy Technologies Office (BETO) is investing in cutting-edge technologies designed to produce drop-in biofuels, including renewable gasoline, diesel, and jet fuels, from non-food sources of biomass. As stated in DOE's FY 2017 Budget Request, BETO plans to emphasize the development of innovative processes to convert cellulosic and algal-based feedstocks into bio-based gasoline, diesel, and jet fuel at a target cost of $3.00 per gallon of gasoline equivalent.

Rec.	Summary	Type	Legislative Status	Executive Status
4.41	Technical support to states for higher ethanol blends	Exec.	Not Applicable	Implemented

Recommendation 4.41: Provide technical assistance for drop-in biofuels and higher-level ethanol blends. As part of its continuing support for biofuels, the QER stated that DOE should provide technical support to states, communities, and private entities wishing to invest in infrastructure to dispense higher-level ethanol blends. BETO coordinates with Federal agency stakeholders and state, industry, and academic experts to develop safe, reliable, and cost-effective infrastructure for renewable fuels. One example of BETO's work is the Demonstration and Market Transformation (DMT) subprogram, which supports the commercial production of advanced biofuels and bioproducts. DMT reduces technology and investor risks through design and process validation at the pilot, demonstration, and pioneer scales. Validating these technologies at smaller scales is essential for building and sustaining private sector investments in the bioenergy industry.

Rec.	Summary	Type	Legislative Status	Executive Status
4.5	Domestic shipping and energy security	Exec.	Not Applicable	Improvement Needed

Recommendation 4.5: Undertake a study of the relationship between domestic shipping and energy security. To investigate the security linkage between energy and maritime commerce, the QER recommended that relevant Federal agencies should conduct a study of the economic, engineering, logistics, workforce, construction, and regulatory factors affecting the domestic shipping industry's ability to support U.S. energy security. While the Maritime Administration (MARAD) within the Department of Transportation (DOT) published a report in November 2015 that examined the U.S. shipbuilding and repairing industry, it focused on the economic importance of the sector and did not address factors related to energy security. Additional work is needed to fully implement this recommendation.

Rec.	Summary	Type	Legislative Status	Executive Status
4.6	Monitoring propane storage, use, and exports	Exec.	Not Applicable	Implemented

Recommendation 4.6: Continue to monitor propane storage, use, and exports. Given the changes occurring in propane transmission, storage, and distribution infrastructure, the QER stated that DOE should ensure adequate support for EIA's data collection and analysis relative to domestic propane storage, use, and exports. To implement this recommendation, EIA maintains significant data and publishes four reports related to propane: (1) *Petroleum and Other Liquids/Supply Disposition Report*, (2) *This Week in Petroleum (propane section)*, (3) *Heating Oil and Propane Update*, and (4) *Short-Term Energy Outlook*.

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Chapter V

IMPROVING SHARED TRANSPORT INFRASTRUCTURES

Implementation Overview for Chapter 5

Table 10: Summary of Chapter 5 Recommendations

Rec.	Summary	Type*	Legislative Status	Executive Status
5.1	Transport of crude oil and ethanol by rail	Exec.	Full Reflection	Work Underway
5.2	Analyze rail congestion impact on other energy commodities	Exec.	Partial Reflection	Work Underway
5.3	Impacts of delayed or incomplete coal deliveries	Exec.	Partial Reflection	Work Underway
5.4	Address data gaps in rail transport of energy commodities	Exec.	Not Applicable	Implemented
5.5	Funding for waterborne freight infrastructure	Stat.	Under Consideration	New Authority Needed
5.6	Grants for shared energy transport systems	Appr.	Limited or No Action	New Authority Needed
5.7	Partnerships for waterborne transport infrastructure	Exec.	Not Applicable	Implemented
5.8	Coordinate data collection, modeling, and analysis	Exec.	Partial Reflection	Implemented
5.9	Impacts of multi-modal energy transport	Exec.	Partial Reflection	Work Underway
5.10	Assess energy component transportation	Exec.	Not Applicable	Work Underway

**Lists the type of initial action: Executive (Exec.), Appropriation (Appr.), or Statute (Stat.).*

Highlights

The Administration continues to pursue opportunities to increase and improve the Nation's transportation infrastructures. As described in the *Budget of the United States Government, Fiscal Year 2017*, the Transportation Investment Generating Economic Recovery (TIGER) multi-modal competitive grant program has provided nearly $4.6 billion to 381 projects in all 50 States, the District of Columbia, and Puerto Rico since 2009. These Federal funds leverage money from private sector partners, states, local governments, metropolitan planning organizations, ports, and transit agencies to make capital investments in surface transportation infrastructure. In FY 2017, the Administration proposes nearly doubling the amount of grant funding available through the TIGER program to support innovative, multi-modal investments in the Nation's infrastructure.

The Administration also worked collaboratively with Congress to pass the *FAST Act*. While the law does not contain explicit references to the QER, numerous provisions reflect the intention of the QER's recommendations and have the potential to improve the movement of energy-related commodities and products. Most notably, Sec. 70103 of the law directs the DOT to establish a National Multimodal Freight Network (NMFN) by December 2016 to (1) assist states with the strategic direction of resources to move freight, (2) inform freight transportation planning, and (3) assist in the prioritization of Federal investments.

Implementation Status

Rec.	Summary	Type	Legislative Status	Executive Status
5.1	Transport of crude oil and ethanol by rail	Exec.	Full Reflection	Work Underway

Recommendation 5.1: Enhance the understanding of important safety-related challenges of transport of crude oil and ethanol by rail and accelerate responses. Noting the cooperative work of DOE and the Pipeline and Hazardous Materials Safety Administration (PHMSA) to strengthen safety regulations for the transport of crude oil and ethanol by rail, the QER supported continued interagency efforts in light of the crucial role rail continues to play in energy commodity transport. In June 2015, DOE and PHMSA requested Sandia National Laboratories to prepare a study to, among other tasks, identify properties in crude oil that may contribute to the increased likelihood and/or severity of combustion events during handling and transport.[21] Once the study is complete, Sec. 7309 of the *FAST Act* directs the Secretaries of Energy and Transportation to jointly submit a report to Congress within 180 days that contains the results of the Sandia study in addition to recommendations to improve the safe transport of crude oil in the form of legislation and regulations by DOT and DOE. Additionally, Subtitle C of Sec. 7001 of the *FAST Act* addresses the safe transportation of flammable liquids by rail through community safety grants, real-time emergency response information, and other provisions that strengthen and advance the safe and efficient movement of hazardous materials.

DOT's FY 2017 Budget Request also addresses the safe transportation of energy products by requesting $1.9 million for the Federal Railroad Administration to advance the work begun by DOE and PHMSA. The new funding will be used to conduct rail tank car tests and better understand the safety risks associated with the frequent rail transport of large volumes of crude oil.[22]

Rec.	Summary	Type	Legislative Status	Executive Status
5.2	Analyze rail congestion impact on other energy commodities	Exec.	Partial Reflection	Work Underway

Recommendation 5.2: Further analyze the effects of rail congestion on the flow of other energy commodities, such as ethanol and coal. With a lack of data of how rail congestion may affect the delivery of energy commodities, the QER encouraged DOE, the Surface Transportation Board, and the Federal Energy Regulatory Commission (FERC) to continue collaborating to develop their collective understanding. DOE is currently working with DOT to update the National Transportation Atlas Database (NTAD) to incorporate intermodal and energy facilities. Once this work is complete, the agencies will use the Alternative Fuel Transportation Optimization Tool (AFTOT), which analyzes the transportation needs and constraints associated with fuel and raw material collection, processing, and distribution in the continental United States,[23] to run modeling scenarios and generate flow estimates.

This recommendation is also partially reflected in Sec. 70101 of the *FAST Act*, which outlines the goals of the NMFN including reducing congestion, eliminating bottlenecks, and improving the travel of freight to and from the Nation's ports, airports, and gateways. While this provision is not explicitly linked to the QER, it provides an opportunity to further address the effects of rail congestion on energy commodities.

Rec.	Summary	Type	Legislative Status	Executive Status
5.3	Impacts of delayed or incomplete coal deliveries	Exec.	Partial Reflection	Work Underway

Recommendation 5.3: Analyze the grid impacts of delayed or incomplete coal deliveries. The study proposed in the QER recommended examining the role of freight rail in utility operations, the growing complications created by freight infrastructure constraints on multiple energy products and other bulk commodities, and whether a minimum coal stockpile for electricity reliability should be established for each coal-fired unit. In February 2016, EIA released a synopsis of the dominant role rail plays in coal shipments to the power sector.[24] An additional analysis in March 2016 reviewed rising coal stockpiles at power plants and a corresponding decrease in shipments of coal by rail due to a warmer-than-average winter and competition with natural gas and renewables.[25] Sec. 70101 of the *FAST Act* partially addresses this recommendation through the abovementioned NMFN goal to identify freight bottlenecks.

Rec.	Summary	Type	Legislative Status	Executive Status
5.4	Address data gaps in rail transport of energy commodities	Exec.	Not Applicable	Implemented

Recommendation 5.4: Address critical energy data gaps in the rail transport of energy commodities and supplies. The QER identified the need for survey and other data on the monthly movements of crude oil by rail. EIA began publishing crude-by-rail data in March 2015, followed by ethanol- and biodiesel-by-rail data in April 2016. All rail data are reported on a monthly basis with historical data back to 2010. The data provide key insights and allow public, government, and industry audiences to track crude oil, ethanol, and biodiesel movements between and within regions of the country, as well as shipments to and from Canada.[26]

Rec.	Summary	Type	Legislative Status	Executive Status
5.5	Funding for waterborne freight infrastructure	Stat.	Under Consideration	New Authority Needed

Recommendation 5.5: Support alternative funding mechanisms for waterborne freight infrastructure. The QER envisioned a Federal interagency working group to examine alternative financing arrangements for waterborne transportation infrastructure and to develop public-private partnerships to finance port and waterway infrastructure. Efforts should consider new user-fee arrangements that better allocate costs to beneficiaries and encourage non-Federal involvement in ports and inland waterways. The Army Corps of Engineers' (USACE) FY 2017 Budget Request proposes reforming the laws governing the Inland Waterway Trust Fund (IWTF) to make the costs of using waterways more comparable to other means of transportation. The proposal calls for collecting $1.3 billion over 10 years through an annual per vessel fee to sufficiently increase the amount paid by commercial navigation users to meet their share of the costs of activities financed by the IWTF.[27]

Rec.	Summary	Type	Legislative Status	Executive Status
5.6	Grants for shared energy transport systems	Appr.	Limited or No Action	New Authority Needed

Recommendation 5.6: Support a new program of competitively awarded grants for shared energy transport systems. The QER proposed a new Actions to Support Shared Energy Transport Systems (ASSETS) program to provide grants to reduce congestion from additional movement of energy commodities to and from coastal ports and inland waterways. Modeled after the TIGER program, ASSETS would enhance public safety in and around ports and waterways in addition to helping meet competiveness, environmental, and security goals. In the absence of Congressional funding, DOE's EPSA is collaborating with DOT's staff to identify compelling examples of projects that could qualify for funding under the ASSETS program.

Rec.	Summary	Type	Legislative Status	Executive Status
5.7	Partnerships for waterborne transport infrastructure	Exec.	Not Applicable	Implemented

Recommendation 5.7: Support public-private partnerships for waterborne transport infrastructure. The QER's proposal to develop a set of shared investment priorities for the U.S. freight transport system recognized the value of ensuring that both public and private needs are met. The USACE Alternative Financing Team continues to investigate best practices and options for instituting public-private partnerships for marine transportation system-related projects and is working with USACE's Institute for Water Resources (IWR) to assist in the economic analysis of upgrading the Nation's waterborne infrastructure to support energy shipments of tomorrow. Under the Committee on the Marine Transportation System (CMTS), USACE is partnering with DOT and the Department of Treasury to lead an Integrated Action Team for Infrastructure Investment that continues to develop tools and foundational research in support of using public-private partnerships to address the ongoing need for infrastructure recapitalization in the Nation's ports and waterways.

Rec.	Summary	Type	Legislative Status	Executive Status
5.8	Coordinate data collection, modeling, and analysis	Exec.	Partial Reflection	Implemented

Recommendation 5.8: Coordinate data collection, modeling, and analysis. The interagency effort proposed in the QER encourages DOE to work with DOT, USACE, the Department of Agriculture, and other relevant agencies to improve and coordinate their respective data collection, analytical, and modeling capabilities for energy transport on shared infrastructures. The primary data collector for waterborne transport is USACE's Waterborne Commerce Statistics Center. In addition, the USACE Engineering Research and Development Center and the IWR continue to support interagency efforts to better coordinate and collaborate on data collection, sharing, and analysis. Both offices have models that can help inform decision making for more efficient use of existing shared infrastructure, as well as highlighting the needs for future investments using sound research and science. CMTS also has a Marine Transportation System Data Integrated Action Team, which is co-led by USACE and MARAD. The team is working to improve interagency data collection, sharing, and analysis as it relates to the waterborne movement of commerce, including energy products.

The *FAST Act* directs DOT in Sec. 70101 to identify interagency data-sharing opportunities that promote freight planning and coordination. While this provision is not explicitly linked to the QER, it provides an opportunity to further enhance the collection, modeling, and analysis of data related to marine, rail, and other energy transport modes.

Rec.	Summary	Type	Legislative Status	Executive Status
5.9	Impacts of multi-modal energy transport	Exec.	Partial Reflection	Work Underway

Recommendation 5.9: Assess the impacts of multi-modal energy transport. The QER encouraged DOE, DOT, and USACE to conduct a one-time comprehensive assessment of investment needs and opportunities to upgrade the Nation's energy-related shared water transport infrastructure. DOE is currently working with DOT to update the NTAD to incorporate intermodal and energy facilities. Once this work is complete, the agencies will use the AFTOT to run modeling scenarios and generate flow estimates at the county level. Additionally, IWR is developing initial analysis on capacity across the Nation's river systems by season in anticipation that there will likely be a movement of energy commodities to waterborne systems as rail reaches maximum capacity.

This recommendation is partially reflected in the *FAST Act*, which directs DOT in Sec. 70102 to develop a national freight strategic plan by December 2017 that includes an identification of corridors providing access to energy exploration, development, installation, or production areas. While this provision is not explicitly linked to the QER, it provides another opportunity to assess the Nation's energy-related shared water-transport infrastructure.

Rec.	Summary	Type	Legislative Status	Executive Status
5.10	Assess energy component transportation	Exec.	Not Applicable	Work Underway

Recommendation 5.10: Assess energy component transportation. The study proposed in the QER examines the logistical challenges in the transportation of oversized or high-consequence energy materials, equipment, and components. It also calls for an examination of the opportunities for coordination of Federal, state, and local permitting and other regulatory processes along affected transportation routes, as well as the role of private sector infrastructure owners and users in enhancing the safety and reliability of transporting certain energy-related materials components. DOE is compiling and assessing geospatial data and will develop a permitting/regulatory analysis that examines current regulatory requirements for transporting large components at the Federal, state, and local levels.

Chapter VI

INTEGRATING NORTH AMERICAN ENERGY MARKETS

Implementation Overview for Chapter 6

Table 11: Summary of Chapter 6 Recommendations

Rec.	Summary	Type*	Legislative Status	Executive Status
6.1	Continue North American energy dialogue advances	Exec.	Not Applicable	Implemented
6.2	Increase North American energy data integration	Exec.	Not Applicable	Implemented
6.3	Joint energy system modeling, planning, and forecasting	Exec.	Not Applicable	Implemented
6.4	North American regulatory harmonization programs	Exec.	Not Applicable	Implemented
6.5	Coordinate training and professional interactions	Exec.	Not Applicable	Implemented
6.6	Arctic safety, reliability, and environmental partnerships	Exec.	Not Applicable	Implemented
6.7	Arctic remote energy delivery partnerships	Exec.	Not Applicable	Implemented
6.8	Caribbean energy infrastructure	Exec.	Not Applicable	Implemented

**Lists the type of initial action: Executive (Exec.), Appropriation (Appr.), or Statute (Stat.).*

Highlights

The Administration continues to address the integration of North American energy markets through numerous mechanisms. The Foreign Ministers from the United States, Canada, and Mexico met in January 2016 to continue their ongoing dialogue on energy security and climate issues, and they committed to work together to promote regional energy security, particularly with respect to the Caribbean and Central America. In February 2016, the North American Energy Ministers met to sign a new Memorandum of Understanding Concerning Climate Change and Energy Collaboration, which expanded areas of cooperation among the three countries. In May 2016, heads of government from the Caribbean and Central America, as well as senior Mexican and Canadian officials, participated in an Energy Summit hosted by Vice President Biden. The Summit pursued energy diversification, clean energy development, and energy integration, with the end goal of improving energy security and economic competitiveness.

Bilateral discussions between the United States and Mexico are encouraging the development and implementation of initiatives to foster cooperation in the energy sector between the two countries. At the bilateral High-Level Economic Dialogue in February 2016, Mexico and the United States launched the U.S.-Mexico Energy Business Council, agreed to continue U.S. assistance to support Mexico's transition to a competitive power market, and shared best practices on offshore oil and gas project regulations. These efforts capitalize on work completed under the auspices of the 2015 U.S.-Mexico High-Level Economic Dialogue that enhanced cross-border electricity coordination through increased information sharing on a range of topics, including wholesale energy markets, renewable energy, and smart grid development.[28]

Bilateral interactions between the United States and Canada also continue, and the two countries recently reiterated their shared commitment to address energy-related issues. In March 2016, President Obama and Prime Minister Trudeau issued a joint statement that, among other topics, addressed the intention of both countries to implement the historic climate agreement made in December 2015 at the 21st Conference of Parties in Paris, France; coordinate domestic climate actions to reduce air emissions; cooperate on clean energy; and form a partnership to address the changing Arctic.[29]

Implementation Status

Rec.	Summary	Type	Legislative Status	Executive Status
6.1	Continue North American energy dialogue advances	Exec.	Not Applicable	Implemented

Recommendation 6.1: Continue advances that have been made in the North American energy dialogue. The QER found that the United States, Canada, and Mexico should encourage further business exchanges and regular minister-level engagement. Since the QER's release, DOE, the Department of Natural Resources Canada, and the Mexican Secretariat of Energy have undertaken bilateral and trilateral initiatives including those noted above, and all three countries support multilateral initiatives such as Mission Innovation and the Clean Energy Ministerial. The countries are working cooperatively through the existing framework provided by the North American Energy Ministers Meeting and sharing technical information, research plans, and best practices in areas such as an energy data-sharing initiative; reliable, resilient, and low-carbon electricity grids; clean energy technologies; carbon capture, use, and storage; industrial energy efficiency; reducing emissions from the oil and gas sector, including methane and black carbon; and meeting national, regional, and global climate goals.

Rec.	Summary	Type	Legislative Status	Executive Status
6.2	Increase North American energy data integration	Exec.	Not Applicable	Implemented

Recommendation 6.2: Increase the integration of energy data among the United States, Canada, and Mexico. Efforts to systematically compare export and import data, validate data, and improve data quality between the EIA and its counterparts in Canada and Mexico were identified by the QER as areas to improve. To implement this recommendation, in February 2016, Secretary Ernest Moniz, Mexican Secretary of Energy Pedro Joaquin Coldwell, and Canadian Minister of Natural Resources James Carr officially launched the North American Cooperation on Energy Information website (https://www.nacei.org/). Information available through this online portal and on all three countries' websites includes an initial suite of static and interactive North American energy infrastructure maps, an exchange of views and projections on cross-border energy flows, data tables and methodological guides to inform the comparison of energy trade data among the three countries, and a cross reference of terms and definitions in each country's official language(s).

Rec.	Summary	Type	Legislative Status	Executive Status
6.3	Joint energy system modeling, planning, and forecasting	Exec.	Not Applicable	Implemented

Recommendation 6.3: Undertake comparative and joint energy system modeling, planning, and forecasting. The QER determined that the United States, Canada, and Mexico should enhance comparative and joint modeling, planning, and forecasting among their energy ministries and related governmental agencies. DOE implemented this recommendation through the framework provided by the North American Energy Ministers Meeting and the North American Cooperation on Energy Information website, which included publication of the first-ever joint energy system modeling report, the *2015 Trilateral Energy Outlook Project*. The Department also sponsored workshops at the University of Idaho in Boise and at the University of New Mexico in Albuquerque with participants from Canada and Mexico, respectively, and the not-for-profit organization Resources for the Future (RFF). At the workshops, participants discussed methods to harmonize the regulatory and planning efforts among the three countries. DOE anticipates additional work will include the incorporation of input from Canada and Mexico into the second installment of the QER, which will focus on electricity.

Rec.	Summary	Type	Legislative Status	Executive Status
6.4	North American regulatory harmonization programs	Exec.	Not Applicable	Implemented

Recommendation 6.4: Establish collaborative programs in each country for academic institutions and not-for-profits to develop legal, regulatory, and policy roadmaps for harmonizing regulations across borders. To identify gaps, best practices, and inconsistencies with regulations in the United States, Canada, and Mexico, the QER recommended creating partnerships among universities, qualified not-for-profits, and relevant energy regulatory authorities. Implementation occurred when DOE sponsored two workshops with RFF—one at the University of Idaho in Boise and one at the University of New Mexico in Albuquerque. Following the conclusion of the workshops, RFF published a synopsis paper containing several recommendations for DOE, government agencies, academic institutions, and stakeholders to increase the harmonization of cross-border regulations for electricity.[30] To continue implementing this recommendation, DOE anticipates sponsoring a third workshop in 2016 to address the harmonization of cross-border regulations in the oil and gas sector.

Rec.	Summary	Type	Legislative Status	Executive Status
6.5	Coordinate training and professional interactions	Exec.	Not Applicable	Implemented

Recommendation 6.5: Coordinate training and encourage technical dialogue. The QER recommended that there should be coordinated training and enhanced dialogue for the technical staff in the three countries' government agencies who share similar responsibilities of evaluating and implementing cross-border energy projects. The Administration is implementing this recommendation by expanding existing energy cooperation initiatives, which includes exchanging information between Mexico's Energy Regulatory Commission and FERC.[31] The Department of the Interior (DOI) is also working with Mexico's Secretariat of Energy and Secretariat of the Environment and Natural Resources to (1) increase the countries' understanding of offshore safety and

environmental enforcement; and (2) enhance environmental safety regulations related to natural resource exploration through a partnership between DOI's Bureau of Safety and Environmental Enforcement with Mexico's Agency for Safety, Energy, and Environment.

DOE also continues to implement this recommendation through the work of OE. OE published a U.S.-Canada cross-border regulatory side-by-side comparison of electricity-permitting requirements in July 2015 that is intended to function as a reference document for government officials, potential developers, and other stakeholders.[32] OE has proposed working on a similar effort with Mexico to compare respective federal regulations and regulations in U.S. southern border states with those in Mexico.

Rec.	Summary	Type	Legislative Status	Executive Status
6.6	Arctic safety, reliability, and environmental partnerships	Exec.	Not Applicable	Implemented

Recommendation 6.6: Partner with Canada and the Arctic Council on Arctic energy safety, reliability, and environmental protection. Partnering with Canada and other members of the Arctic Council enables Federal agencies to address the QER's recommendation that emphasizes researching the effects of oil spills, improving methods to mitigate pollution incidents, and developing guidelines for preparedness and response. After assuming the chairmanship of the Arctic Council in April 2015, the United States began implementing this recommendation by establishing and executing a program that addresses three thematic areas: (1) improving economic and living conditions in Arctic communities; (2) Arctic Ocean safety, security, and stewardship; and (3) addressing the impacts of climate change.[33] The United States took further action when it joined Canada to issue a joint statement in March 2016 aimed at conserving Arctic biodiversity through science-based decision making, utilizing a science-based approach to reducing the environmental impact of oil and gas infrastructure and operations, and establishing policies for low-impact shipping corridors.[34]

Rec.	Summary	Type	Legislative Status	Executive Status
6.7	Arctic remote energy delivery partnerships	Exec.	Not Applicable	Implemented

Recommendation 6.7: Partner with Canada and the Arctic Council on energy delivery to remote areas. By working with the Arctic Council and through Federal agencies, the QER found that the United States should promote the Remote Community Renewable Energy (RCRE) partnership. The United States, as chair of the Arctic Council, included the RCRE as part of the Council agenda to improve clean energy access for Arctic communities.[35] The Department of State's Bureau of Energy Resources is designing and implementing projects within the Arctic Council and with Canada to improve clean energy access to remote and rural Arctic communities that are largely dependent on dirty and expensive diesel fuel for electricity and home heating. The Arctic Remote Energy Networks Academy, which is a partnership between the United States, Canada, Iceland, and Finland, will train the next generation of energy champions and promote development of clean, affordable, and reliable energy systems. Additional work includes a joint research project between DOI and DOE's National Renewable Energy Laboratory that seeks to ease the integration of high levels of wind power into diesel microgrids. DOE is also implementing a new $4 million initiative to significantly accelerate efforts by remote Alaskan communities to adopt sustainable energy strategies. The Remote Alaskan Communities Energy Efficiency Competition is

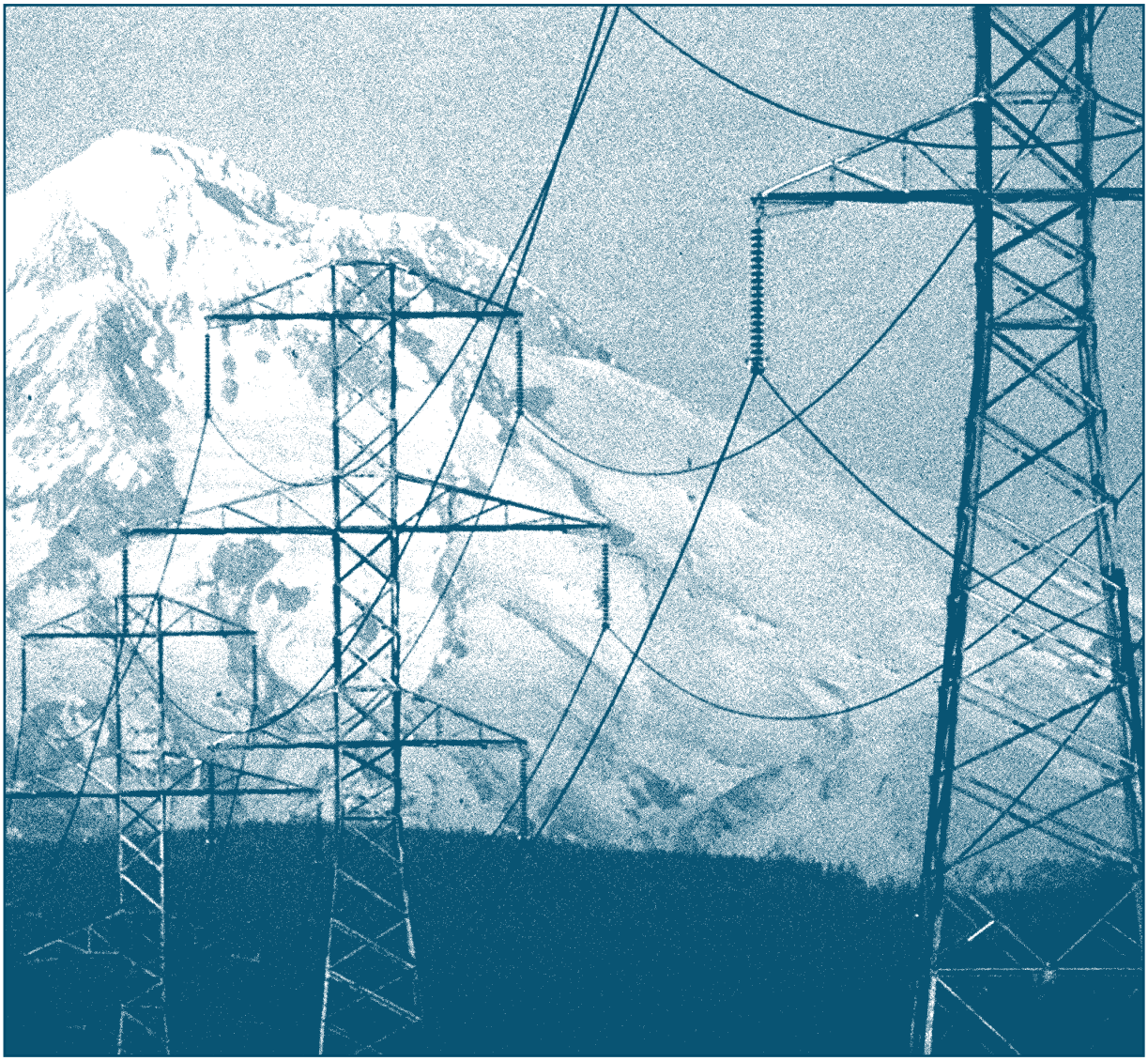
intended to empower remote Alaskan communities to develop and implement solutions that can effectively advance the use of reliable and affordable clean energy, as well as energy efficient solutions that are applicable throughout rural Alaska and potentially in other Arctic regions.[36]

Rec.	Summary	Type	Legislative Status	Executive Status
6.8	Caribbean energy infrastructure	Exec.	Not Applicable	Implemented

Recommendation 6.8: Promote Caribbean energy transmission, storage, and distribution infrastructure. As part of a larger strategy, the QER determined that the United States should support the diversification of energy supplies in the Caribbean. In April 2015, the Administration's Caribbean Energy Security Initiative and U.S.-Caribbean and Central American Energy Security Task Force launched the U.S.-Caribbean-Central American Energy Security Task Force. In May 2016, the Task Force presented a plan recommending actions to advance regional cooperation in addition to clean energy security, integration, and investment throughout the Caribbean and Central America.[37]

Chapter VII

ADDRESSING ENVIRONMENTAL ASPECTS OF TS&D INFRASTRUCTURE



Implementation Overview for Chapter 7

Table 12: Summary of Chapter 7 Recommendations

Rec.	Summary	Type*	Legislative Status	Executive Status
7.1	Quantification of natural gas infrastructure emissions	Appr.	Full Reflection	Work Underway
7.2	Detect and reduce methane losses from natural gas TS&D systems	Appr.	Full Reflection	Work Underway
7.21	Broader air quality benefits through reduced methane losses	Appr.	Full Reflection	Implemented
7.3	Lower the cost of continuous emissions monitoring equipment	Exec.	Not Applicable	Implemented
7.4	Support funding to reduce diesel emissions	Appr.	Full Reflection	Implemented
7.5	Beneficial use and/or disposal of dredging material	Exec.	Not Applicable	Implemented
7.6	Improve environmental data collection and analysis	Exec.	Not Applicable	Improvement Needed
7.7	Promote best practices for carbon dioxide pipelines in states	Exec.	Not Applicable	Work Underway
7.8	Financial incentives for carbon dioxide pipelines	Stat.	Limited or No Action	New Authority Needed

**Lists the type of initial action: Executive (Exec.), Appropriation (Appr.), or Statute (Stat.).*

Highlights

By coordinating efforts among DOE, FERC, the Environmental Protection Agency (EPA), and other interagency partners, the Administration is moving forward with efforts to address the environmental impacts from energy TS&D infrastructure. In May 2016, EPA took steps to cut methane emissions from the large and complex oil and natural gas industry and keep on track to achieve the Administration's January 2015 goal to cut methane emissions from the oil and gas sector by 40–45 percent from 2012 levels by 2025.[38] EPA's actions include three final rules that together will curb emissions of methane, smog-forming volatile organic compounds, and toxic air pollutants such as benzene, from new, reconstructed, and modified oil and gas sources. EPA also took a critical step needed to carry out the Administration's commitment to regulate methane emissions from existing oil and gas sources. In May 2016, the agency issued for public comment an Information Collection Request that will require companies to provide extensive information that will be instrumental for developing comprehensive regulations to reduce methane emissions from existing oil and gas sources.[39]

Implementation Status

Rec.	Summary	Type	Legislative Status	Executive Status
7.1	Quantification of natural gas infrastructure emissions	Appr.	Full Reflection	Work Underway

Recommendation 7.1: Improve quantification of emissions from natural gas TS&D infrastructure. Additional Federal funding for new measurements to update methane emission factors and activity data is an effective strategy to significantly improve methane emission estimates in the Greenhouse Gas Inventory. For FY 2016, Congress appropriated $5 million to DOE's FE Emissions Quantification from Natural Gas Infrastructure subprogram. In the FY 2017 Budget Request, FE proposed a restructuring to enable more effective program management and execution, which will create the Emissions Mitigation and Quantification subprogram that will support emissions quantification research focused on updating and improving component-level emissions factors and better characterizing the regional variability of methane emissions across the natural gas value chain. The goal is to improve the quality and reliability of data that is being reported in the Greenhouse Gas Inventory and the new U.S. Geological Survey initiative to quantify greenhouse gas emissions from fossil fuels development on Federal lands, with an emphasis on understanding regional variation and reducing uncertainty in emissions estimates. To support this program and the related program described under Recommendation 7.2, DOE posted a funding opportunity announcement on April 14, 2016.[40]

Rec.	Summary	Type	Legislative Status	Executive Status
7.2	Detect and reduce methane losses from natural gas TS&D systems	Appr.	Full Reflection	Work Underway

Recommendation 7.2: Expand natural gas transmission and distribution research and development programs. To reduce methane leaks and enhance the operational efficiencies of pipelines, storage facilities, and compressor stations, the QER found that DOE should develop and demonstrate cost-effective technologies. For FY 2016, Congress approved $7 million for the Emissions Mitigation from Midstream Infrastructure subprogram. In the FY 2017 Budget Request, FE proposes a restructuring to enable more effective program management and execution, which will create the Emissions Mitigation and Quantification subprogram. This subprogram will continue research on natural gas infrastructure focused on reducing methane emissions from pipelines, storage facilities, and related equipment. In FY 2017, priority research areas include advanced composite materials, non-reactive coatings with embedded sensors, and pipeline inspection and repair.

Rec.	Summary	Type	Legislative Status	Executive Status
7.21	Broader air quality benefits through reduced methane losses	Appr.	Full Reflection	Implemented

Recommendation 7.21: Broader air quality benefits through reduced methane losses. Reducing methane losses and improving midstream infrastructure efficiency to reduce ozone precursors can help states meet national air quality standards. DOE is leveraging its research and development efforts to assist states through the same $7 million appropriation listed for Recommendation 7.2. Other actions that will help achieve this goal include the EPA regulations noted above and EPA's May 2016 Draft Control Techniques Guidelines for reducing volatile organic compound emissions from existing oil and gas sources.[41]

Rec.	Summary	Type	Legislative Status	Executive Status
7.3	Lower the cost of continuous emissions monitoring equipment	Exec.	Not Applicable	Implemented

Recommendation 7.3: Invest in research and development to lower the cost of continuous emissions monitoring equipment. The QER stated that DOE should enhance the Methane Observation Networks with Innovative Technology to Obtain Reductions (MONITOR) program, led by the Advanced Research Projects Agency-Energy (ARPA-E), to ensure the most successful projects are field tested and deployed. ARPA-E is investing additional funding in the MONITOR program and, after releasing a funding opportunity announcement in February 2016, it has selected for award negotiations a $3.5 million project for a testing facility. This facility would evaluate the MONITOR project team's methane-sensing technologies in an environment that simulates real-world natural gas well pad conditions.[42]

Rec.	Summary	Type	Legislative Status	Executive Status
7.4	Support funding to reduce diesel emissions	Appr.	Full Reflection	Implemented

Recommendation 7.4: Provide funding to programs that reduce diesel emissions. Protecting workers at, and communities near, ports and rail yards from diesel particulate matter emissions necessitated a recommendation in the QER for continued grant funding to the *Diesel Emissions Reduction Act* (DERA) program. EPA's DERA national grants program provides funding to regional, state, local, tribal agencies/consortia, and not-for-profit organizations with jurisdiction over transportation or air quality for diesel emissions reductions projects. Following an FY 2016 appropriation from Congress in the *Consolidated Appropriations Act, 2016*, EPA distributed a request for proposals in February 2016 and anticipates awarding $26 million to recipients in October 2016.[43] Additionally, the *FAST Act*, which continues the successful Congestion Mitigation and Air Quality Improvement Program, also requires states and local municipalities to prioritize funding for the most cost-effective projects that reduce particulate emissions, including both on- and off-road port-related equipment and vehicles.[44]

Rec.	Summary	Type	Legislative Status	Executive Status
7.5	Beneficial use and/or disposal of dredging material	Exec.	Not Applicable	Implemented

Recommendation 7.5: Conduct research needed on dredging materials. As shared infrastructures for energy commodity transport are enhanced, the QER found USACE should continue to undertake research and development on treating dredged material. As part of its assessments, the Dredging Operations and Environmental Research Program at USACE released a technical paper in July 2015 that reviews the fate and performance of nearshore-placed dredged material.[45] USACE also continues to decide whether to issue permits authorizing the ocean disposal of dredged materials and relies on EPA's ocean dumping criteria when evaluating permit requests. EPA Regional and USACE District Offices work closely together to evaluate and test dredged material proposed for ocean disposal to ensure that it will not adversely affect human health and the marine environment.[46]

Rec.	Summary	Type	Legislative Status	Executive Status
7.6	Improve environmental data collection and analysis	Exec.	Not Applicable	Improvement Needed

Recommendation 7.6: Improve environmental data collection, analysis, and coordination. Data and analysis on the environmental characteristics and impacts of TS&D infrastructure are needed to fill gaps on environment, safety, and public health issues. The QER stated that DOE should work with other Federal agencies to improve these efforts, but limited work has occurred to implement this recommendation.

Rec.	Summary	Type	Legislative Status	Executive Status
7.7	Promote best practices for carbon dioxide pipelines in states	Exec.	Not Applicable	Work Underway

Recommendation 7.7: Work with states to promote best practices for siting and regulating carbon dioxide (CO_2) pipelines. Several states have made substantial progress to improve CO_2 pipeline siting, and in order to provide models for additional state actions, the QER recommended that DOE work with other Federal agencies to promote communication, coordination, and sharing of lessons learned. In April 2016, FE and EPSA hosted a technical workshop with state officials and stakeholders to share best practices and identify priority research and analytical actions to enable further progress. Learnings from that meeting will be summarized in a forthcoming public report.

Rec.	Summary	Type	Legislative Status	Executive Status
7.8	Financial incentives for carbon dioxide pipelines	Stat.	Limited or No Action	New Authority Needed

Recommendation 7.8: Enact financial incentives for the construction of CO_2 pipeline networks. By providing tax incentives to spur activity that expands CO_2 pipeline infrastructure, the QER found greenhouse gases could be reduced through carbon capture, utilization, and storage while also promoting domestic oil production through enhanced oil recovery. Following a request made in the FY 2016 Budget, the Administration submitted another proposal in the FY 2017 Budget to create a Carbon Dioxide Investment and Sequestration Tax Credit. This initiative would provide $2 billion for a new, refundable, allocable investment tax credit for carbon capture equipment and supporting infrastructure. The proposal would also provide a 20-year refundable sequestration tax credit indexed annually by an inflation adjustment factor. The credit would be $50 per metric ton of CO_2 permanently sequestered and not beneficially reused (e.g., in enhanced oil recovery) and $10 per metric ton for CO_2 that is permanently sequestered and beneficially reused.[47]

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Chapter VIII

ENHANCING EMPLOYMENT AND WORKFORCE TRAINING

Implementation Overview for Chapter 8

Table 13: Summary of Chapter 8 Recommendations

Rec.	Summary	Type*	Legislative Status	Executive Status
8.1	Energy-job training system	Exec.	Not Applicable	Implemented
8.2	Open-source learning community for courses in energy-related fields	Exec.	Not Applicable	Implemented
8.3	Accelerate development of energy and manufacturing curricula	Exec.	Not Applicable	Implemented
8.4	Facilitate national credentials for energy occupations	Exec.	Not Applicable	Work Underway
8.5	Facilitate the transition of military veterans into the energy sector	Exec.	Not Applicable	Implemented
8.6	Reform existing energy jobs data collection systems	Exec.	Not Applicable	Implemented

**Lists the type of initial action: Executive (Exec.), Appropriation (Appr.), or Statute (Stat.).*

Highlights

The Administration continues to move forward with its efforts to address the demand for new energy workers and to enhance workforce training for jobs supported by the energy industry. DOE's FY 2017 Budget Request supports standing up the Office of Energy Jobs Development (EJD) to accelerate the growth of—and access to—jobs in all sectors of the Nation's energy economy.

EJD plans to focus on three key areas: (1) managing the collection of annual energy jobs growth data and issuing an annual energy jobs report; (2) coordinating the ongoing energy workforce development activities within DOE's program offices and National Laboratories, as well as managing external partnerships with other Federal agencies on energy workforce development; and (3) providing energy economic development technical services to states, municipalities, and tribal governments.

Instituting EJD within DOE will enhance ongoing activities related to the development of energy jobs that are currently administered by the Department's Jobs Strategy Council (JSC). Established by Secretary Moniz in 2014, the Council is composed of the heads of DOE's program offices, and its work has created a foundation upon which QER implementation has occurred. EJD will formalize and consolidate DOE's energy workforce efforts and enhance the implementation of the QER's workforce recommendations.

Implementation Status

Rec.	Summary	Type	Legislative Status	Executive Status
8.1	Energy-job training system	Exec.	Not Applicable	Implemented

Recommendation 8.1: Support an energy-job skills training system. The QER found that the Interagency Skills Working Group, which includes the Departments of Energy, Labor (DOL), and Education (ED), should support actions for a job-driven skills-training system throughout the United States. To implement this recommendation, the DOL-led Skills Working Group is pursuing initiatives in energy and advanced manufacturing in which DOE, ED, and the National Science Foundation (NSF) participate. The first is a manufacturing workforce initiative with the Aluminum Association, as well as a project with Solar City, Erie Community College, and the University of Buffalo to provide new energy and advanced manufacturing curricula. The second involves designing new and enhanced apprenticeship programs through DOL's adoption of energy as one of six core industrial sectors.

Rec.	Summary	Type	Legislative Status	Executive Status
8.2	Open-source learning community for courses in energy-related fields	Exec.	Not Applicable	Implemented

Recommendation 8.2: Expand support for an open-source learning community. To develop, facilitate, and expand the use of state-of-the art courses in energy-related fields, the QER stated that DOE should solicit proposals from organizations that would maintain and continuously improve the National Training and Education Resource (NTER). Consistent with the original development and deployment strategy, the NTER was successfully released as an open-source project in the public domain in April 2016.[48] It is now being supported by an open-source community of users, developers, and support providers that maintain and continuously improve the learning management and content management platform to deliver education and training content in energy and other fields.[49]

Rec.	Summary	Type	Legislative Status	Executive Status
8.3	Accelerate development of energy and manufacturing curricula	Exec.	Not Applicable	Implemented

Recommendation 8.3: Coordinate efforts to accelerate the development of high-quality energy education programs. By collaborating with DOL and NSF to accelerate their existing curricula and apprenticeship programs, the QER recommended that DOE should coordinate efforts to develop and deliver energy-related courses, as well as provide technical support. DOE's JSC implemented this recommendation through its coordination with DOL, the Department of Commerce, and the Department of Defense (DOD) on methods to strengthen the delivery of new curricula being developed at DOE and DOD labs, the National Network for Manufacturing Innovation, and at community colleges funded by NSF.

Rec.	Summary	Type	Legislative Status	Executive Status
8.4	Facilitate national credentials for energy occupations	Exec.	Not Applicable	Work Underway

Recommendation 8.4: Facilitate national credentials for energy occupations. In 2015, the Secretary of Energy convened the JSC at DOE to accelerate the growth of, and access to, jobs in all sectors of the U.S. energy economy. By partnering with the Careers Pathways Skills Working Group, DOE and 11 Federal agencies worked together to identify energy career pathways and support the career pathways exchange, which is an effort to streamline information exchange and communication between the Federal Government and public stakeholders. The interagency and interdepartmental efforts of the JSC also provided a mechanism to highlight and amplify work at DOE in energy skills identification, such as the DOE Solar Career Map and Wind Career Map tools.

Rec.	Summary	Type	Legislative Status	Executive Status
8.5	Facilitate the transition of military veterans into the energy sector	Exec.	Not Applicable	Implemented

Recommendation 8.5: Facilitate the transition of military veterans into the energy sector. The QER found that DOE should collaborate with DOL and DOD, as well as industry and other stakeholders, to standardize the applicability of Military Occupation Codes to civilian jobs in energy sectors. To implement the recommendation, Secretary Moniz announced the creation of the Utility Industry Workforce Initiative in June 2015, which is a partnership between DOE, DOL, DOD, the Department of Veterans Affairs, and five utility trade associations to recruit and train service members, veterans, and military spouses to qualify for high-skilled jobs in the utility industry.[50] Additionally, the Solar Ready Vets program, originally launched as a pilot program in 2014, is now a national program administered by the Solar Foundation under the Solar Training and Education for Professionals funding program begun in 2016. DOE's SunShot Solar Ready Vets program connects the Nation's skilled veterans to the solar energy industry, preparing them for careers as solar photovoltaic system installers, sales representatives, system inspectors, and other solar-related occupations. Solar Ready Vets is enabled by DOD's SkillBridge Initiative, which allows exiting military personnel to pursue civilian job training, employment skills training, apprenticeships, and internships up to 6 months prior to their separation with the military.

Rec.	Summary	Type	Legislative Status	Executive Status
8.6	Reform existing energy jobs data collection systems	Exec.	Not Applicable	Implemented

Recommendation 8.6: Reform energy employment data collection systems. Establishing the interagency workgroup proposed in the QER would enable the reform of existing data collection systems to provide consistent and complete definitions of energy jobs across all sectors of the economy. To complete this recommendation, DOE established an interagency working group that includes DOL, the Bureau of Labor Statistics, and EIA. The JSC also charted a 3-year course to establish an energy jobs survey to provide annual energy jobs data and solve the problem of inaccurate energy jobs counting. DOE commissioned the first *U.S. Energy and Employment Report* in March 2016,[51] will complete construction of a new Federal survey tool in August 2016, and anticipates issuing the second *U.S. Energy and Employment Report* in December 2016.

Chapter IX

SITING AND PERMITTING OF TS&D INFRASTRUCTURE

Implementation Overview for Chapter 9

Table 14: Summary of Chapter 9 Recommendations

Rec.	Summary	Type*	Legislative Status		Executive Status	
9.1	Resources to Federal agencies for siting and permitting projects	Appr.		Limited or No Action		New Authority Needed
9.2	Increase public engagement in siting and permitting	Exec.		Full Reflection		Work Underway
9.3	Establish partnerships for siting and permitting	Exec.		Full Reflection		Work Underway
9.4	Expand mitigation and conservation planning for siting and permitting	Exec.		Full Reflection		Work Underway
9.5	Improve coordination across agencies for siting and permitting	Stat.		Full Reflection		Work Underway
9.6	Authorize recovery of costs for review of project applications	Stat.		Full Reflection		Work Underway

**Lists the type of initial action: Executive (Exec.), Appropriation (Appr.), or Statute (Stat.).*

Highlights

The Administration continues to focus on improving the quality and timeliness of infrastructure permitting, review, and consultation on Federal and non-Federal lands. The Administration created the Interagency Rapid Response Team for Transmission (RRTT) in 2013 to improve Federal electric transmission infrastructure permitting, review, and consultation. Following the QER's release, the RRTT has continued its work to apply a uniform approach to consultations with tribal governments and to use Integrated Federal Planning to coordinate statutory permitting and review among Federal and state agencies. As part of the RRTT, DOE continues to maintain a dashboard that lists information including required permits, agency points of contact, milestones and due dates, and descriptions of progress for each of the seven RRTT pilot projects.

The *FAST Act* also addresses many of the recommendations related to the siting and permitting of energy infrastructure. Title XLI of the Act seeks to improve the Federal permitting process through various measures, but the most substantive is the creation of a Federal Permitting Improvement Steering Council (FPISC). Composed of representatives from 13 Federal agencies and led by an executive director appointed by the President, the Council is directed by Congress to enhance the Federal review of many types of large-scale projects, including infrastructure for renewable or conventional energy production, electricity transmission, and pipelines.

As stated in the *Budget of the United States Government, Fiscal Year 2017*, many of the *FAST Act's* permitting provisions align with ongoing Administration efforts and will be implemented in 2016.[52]

Implementation Status

Rec.	Summary	Type	Legislative Status	Executive Status
9.1	Resources to Federal agencies for siting and permitting projects	Appr.	Limited or No Action	New Authority Needed

Recommendation 9.1: Allocate resources to key Federal agencies involved in the siting, permitting, and review of infrastructure projects. Federal agencies responsible for infrastructure siting, review, and permitting have experienced dramatic appropriations cuts and reductions in staff. The QER recommends that Congress should fully fund these priorities, and the Administration will continue to work with lawmakers to find a path forward on enacting the necessary legislative language for this recommendation to be implemented.

Rec.	Summary	Type	Legislative Status	Executive Status
9.2	Increase public engagement in siting and permitting	Exec.	Full Reflection	Work Underway

Recommendation 9.2: Prioritize meaningful public engagement through consultation with Indian tribes, coordination with state and local governments, and facilitation of non-Federal partnerships. The QER found that early and meaningful public engagement with affected residential communities and other non-Federal stakeholders can reduce siting conflicts. The *FAST Act* underscores the importance of public engagement and implements this recommendation. Sec. 41002 directs the FPISC to issue annual recommendations regarding best practices to (1) enhance early stakeholder engagement by considering and incorporating recommendations provided in public comments on proposed projects; (2) increase transparency; and (3) reduce information-collection requirements and other administrative burdens on agencies, project sponsors, and other interested parties such as members of the public. Additionally, Sec. 41003 requires Federal agencies to establish a concise plan for coordinating public and agency participation in required Federal environmental reviews within certain time frames.

Rec.	Summary	Type	Legislative Status	Executive Status
9.3	Establish partnerships for siting and permitting	Exec.	Full Reflection	Work Underway

Recommendation 9.3: Establish regional and state partnerships and co-locate dedicated cross-disciplinary energy infrastructure teams. The QER highlighted the benefits of co-locating environmental review and permitting staff from multiple Federal agencies into centralized locations and engaging impacted communities. Sec. 41002 of the *FAST Act* requires the FPISC to issue annual recommendations on best practices to (1) improve coordination between Federal and non-Federal governmental entities, including through the development of common data standards and terminology across agencies; and (2) create and distribute training materials useful to Federal, state, tribal, and local permitting officials. Sec. 41003 also requires lead agencies to coordinate the Federal environmental review and authorization processes with any state, local, or tribal agency responsible for conducting any separate review or authorization of a project to ensure timely and efficient completion of environmental reviews and authorizations. Lastly, Sec. 41004 enables three or more contiguous states to enter into an interstate compact establishing regional infrastructure development agencies to facilitate authorization and review of relevant projects.

Rec.	Summary	Type	Legislative Status	Executive Status
9.4	Expand mitigation and conservation planning for siting and permitting	Exec.	Full Reflection	Work Underway

Recommendation 9.4: Expand landscape- and watershed-level mitigation and conservation planning. By focusing mitigation efforts on activities where environmental needs and contributions are the greatest, the QER determined that the Federal Government can reduce impacts on the Nation's landscapes and natural and cultural resources. Sec. 41002 of the *FAST Act* requires the FPISC to issue annual recommendations on best practices to (1) ensure timely decisions regarding environmental reviews and authorizations, including through the development of performance metrics; (2) improve coordination between Federal and non-Federal governmental entities, including through the development of common data standards and terminology across agencies; and (3) develop and make available to applicants appropriate geographic information systems and other tools. Additionally, Sec. 41005 states Federal agencies must integrate environmental reviews and authorizations in conjunction with other environmental reviews and authorizations being conducted by cooperating or participating agencies, including environmental reviews and authorizations required under the *National Environmental Policy Act of 1969 (P.L. 91-190)*.

Rec.	Summary	Type	Legislative Status	Executive Status
9.5	Improve coordination across agencies for siting and permitting	Stat.	Full Reflection	Work Underway

Recommendation 9.5: Enact statutory authorities to ensure coordination across agencies. The QER noted the Administration's efforts to improve Federal permitting and review proposals by establishing an Interagency Infrastructure Permitting Improvement Center. While the RRTT aims to utilize integrated Federal planning and resolve interagency conflicts to improve the siting and permitting process, Sec. 41005 of the *FAST Act* codifies the creation of the FPISC and requires Federal agencies to establish a concise plan for coordinating public and agency participation in, and completion of, any required Federal environmental review and authorization for the project within a certain time frame.

Rec.	Summary	Type	Legislative Status	Executive Status
9.6	Authorize recovery of costs for review of project applications	Stat.	Full Reflection	Work Underway

Recommendation 9.6: Adopt Administration proposals to authorize recovery of costs for review of project applications. While some Federal agencies have the legal authority to recover permitting costs from project applicants, the QER suggested creating greater flexibility for agencies to accept funds. Sec. 41009 of the *FAST Act* implements this recommendation by enabling Federal agencies to issue regulations establishing a fee structure to reimburse the Federal Government for reasonable costs incurred in conducting environmental reviews and authorizations for covered projects. The Act also allows the Executive Director of the FPISC, with the approval of the Director of the Office of Management and Budget, to transfer funding to agencies to facilitate timely and efficient environmental reviews and authorizations.

APPENDIX

Table 15: Recommendations Requiring Budgetary Authorization

Rec.	Summary	Type*	Legislative Status	Executive Status
2.3	State energy assurance plans	Appr.	Under Consideration	New Authority Needed
2.4	Grant program to promote innovation	Appr.	Limited or No Action	New Authority Needed
3.1	Grid modernization research	Appr.	Full Reflection	Implemented
3.3	Review transmission plans and assess barriers	Appr.	Limited or No Action	New Authority Needed
3.4	State financial assistance for TS&D infrastructure investment	Appr.	Limited or No Action	New Authority Needed
5.6	Grants for shared energy transport systems	Appr.	Limited or No Action	New Authority Needed
7.1	Quantification of natural gas infrastructure emissions	Appr.	Full Reflection	Work Underway
7.2	Detect and reduce methane losses from natural gas TS&D systems	Appr.	Full Reflection	Work Underway
7.21	Broader air quality benefits through reduced methane losses	Appr.	Full Reflection	Implemented
7.4	Support funding to reduce diesel emissions	Appr.	Full Reflection	Implemented
9.1	Resources to Federal agencies for siting and permitting projects	Appr.	Limited or No Action	New Authority Needed

*Lists the type of initial action: Executive (Exec.), Appropriation (Appr.), or Statute (Stat.).

Table 16: Recommendations Requiring Statutory Authorization

Rec.	Summary	Type*	Legislative Status	Executive Status
2.2	Natural gas pipeline replacement and maintenance programs	Stat.	Limited or No Action	New Authority Needed
2.5	Mitigate risks of losing transformers	Stat.	Full Reflection	Work Underway
2.7	Presidential authority to release products from RPPRs	Stat.	Limited or No Action	New Authority Needed
4.1	Update SPR release authorities	Stat.	Limited or No Action	New Authority Needed
4.2	SPR emergency response capability (Life Extension Project)	Stat.	Full Reflection	Implemented
4.21	SPR Emergency Response Capability (Marine Terminal)	Stat.	Full Reflection	Implemented
5.5	Funding for waterborne freight infrastructure	Stat.	Under Consideration	New Authority Needed
7.8	Financial incentives for carbon dioxide pipelines	Stat.	Limited or No Action	New Authority Needed
9.5	Improve coordination across agencies for siting and permitting	Stat.	Full Reflection	Work Underway
9.6	Authorize recovery of costs for review of project applications	Stat.	Full Reflection	Work Underway

*Lists the type of initial action: Executive (Exec.), Appropriation (Appr.), or Statute (Stat.).

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LIST OF ACRONYMS

AFTOT	Alternative Fuel Transportation Optimization Tool
ARPA-E	Advanced Research Projects Agency–Energy, Department of Energy
ASSETS	Actions to Support Shared Energy Transport Systems Program
BETO	Bioenergy Technologies Office, Department of Energy
CO_2	Carbon dioxide
CEDS	Cybersecurity for Energy Delivery Systems Program
CMTS	Committee on the Marine Transportation System
DERA	Diesel Emissions Reduction Act
DMT	Demonstration and Market Transformation Subprogram
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DOL	Department of Labor
DOS	Department of State
DOT	Department of Transportation
ED	Department of Education
EERE	Office of Energy Efficiency and Renewable Energy, Department of Energy
EIA	Energy Information Administration, Department of Energy
EJD	Office of Energy Jobs Development (Proposed), Department of Energy
EPA	Environmental Protection Agency
EPSA	Office of Energy Policy and Systems Analysis, Department of Energy
FE	Office of Fossil Energy, Department of Energy
FERC	Federal Energy Regulatory Commission
FPISC	Federal Permitting Improvement Steering Council
FY	Fiscal Year
GMI	Grid Modernization Initiative
GMLC	Grid Modernization Laboratory Consortium
IWR	Institute for Water Resources, Army Corps of Engineers
IWTF	Inland Waterway Trust Fund
JSC	Jobs Strategy Council, Department of Energy
MARAD	Maritime Administration, Department of Transportation
MONITOR	Methane Observation Networks with Innovative Technology to Obtain Reductions Program
MYPP	Multi-Year Program Plan, Grid Modernization Initiative
NARUC	National Association of Regulatory Utility Commissioners
NGSR	Northeast Gasoline Supply Reserve

NIST	National Institute of Standards and Technology, Department of Commerce
NMFN	National Multimodal Freight Network
NSF	National Science Foundation
NTAD	National Transportation Atlas Database
NTER	National Training and Education Resource
OE	Office of Electricity Delivery and Energy Reliability, Department of Energy
PADD	Petroleum Administration for Defense District
PHMSA	Pipeline and Hazardous Materials Safety Administration, Department of Transportation
QER	Quadrennial Energy Review
RCRE	Remote Community Renewable Energy Program
RFF	Resources for the Future
RPPR	Regional Petroleum Product Reserve
RRTT	Rapid Response Team for Transmission, Council on Environmental Quality
SPR	Strategic Petroleum Reserve
TIGER	Transportation Investment Generating Economic Recovery Program
TS&D	Transmission, Storage, and Distribution
USACE	Army Corps of Engineers, Department of Defense
USGS	Geological Survey, Department of the Interior

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