



# JOINT UNITED STATES-CANADA ELECTRIC GRID SECURITY AND RESILIENCE STRATEGY

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# Executive Summary

This *Joint United States-Canada Electric Grid Security and Resilience Strategy* (Strategy) is a collaborative effort between the Federal Governments of the United States and Canada and is intended to strengthen the security and resilience of the U.S. and Canadian electric grid from all adversarial, technological, and natural hazards and threats. The Strategy addresses the vulnerabilities of the two countries' respective and shared electric grid infrastructure, not only as an energy security concern, but for reasons of national security. This joint Strategy relies on the existing strong bilateral collaboration between the United States and Canada, and reflects a joint commitment to enhance a shared approach to risk management for the electric grid. It also articulates a common vision of the future electric grid that depends on effective and expanded collaboration among those who own, operate, protect, and rely on the electric grid. Because the electric grid is complex, vital to the functioning of modern society, and dependent on other infrastructure for its function, the United States and Canada developed the Strategy under the shared principle that security and resilience require increasingly collaborative efforts and shared approaches to risk management.

The Strategy envisions a secure and resilient electric grid that is able to withstand hazards and recover efficiently from disruptions. In pursuit of this goal, the Strategy organizes joint approaches to protect today's electric grid, manage contingencies by enhancing response and recovery capabilities, and cultivate a more secure and resilient future electric grid. As an expression of shared intent and approach, the Strategy organizes joint efforts to manage current and future security challenges.

Three strategic goals underpin the effort to strengthen the security and resilience of the electric grid:

- **Protect Today's Electric Grid and Enhance Preparedness:** A secure and resilient electric grid that protects system assets and critical functions and is able to withstand and recover rapidly from disruptions is a priority for the governments of both the United States and Canada.
- **Manage Contingencies and Enhance Response and Recovery Efforts:** The Strategy sets out a shared approach for enhancing continuity and response capabilities, supporting mutual aid arrangements such as cyber mutual assistance across a diverse set of stakeholders, understanding interdependencies, and expanding available tools for recovery and rebuilding.
- **Build a More Secure and Resilient Future Electric Grid:** The United States and Canada are working to build a more secure and resilient electric grid that is responsive to a variety of threats, hazards, and vulnerabilities. To achieve this, the electric grid will need to be more flexible and agile, with an architecture into which new technologies may be readily incorporated.

The Strategy will be implemented in accordance with forthcoming U.S. and Canadian Action Plans, which will each detail specific steps and milestones for achieving the Strategy's goals within their respective countries. These documents are intended to guide future activity within areas of Federal jurisdiction, with full respect for the different jurisdictional authorities in both countries. The Strategy is not intended to, nor does it, create any binding obligations under international law.

Implementation will occur in consultation with state and provincial governments, regulators, and utilities, where applicable, and will require the sustained, coordinated, and complementary efforts of individuals and groups from both countries, including many who contributed to the development of the Strategy, such as private sector partners, policy makers, and the public. The two countries' common effort to strengthen the security and resilience of the electric grid is imperative for both governments and all who depend on this critical asset.



# Introduction

This *Joint United States-Canada Electric Grid Security and Resilience Strategy* (Strategy) is a collaborative effort between the Federal Governments of the United States and Canada and is intended to strengthen the security and resilience of the U.S. and Canadian electric grid from all adversarial, technological, and natural hazards and threats. The Strategy addresses the vulnerabilities of the two countries' respective and shared electric grid infrastructure, not only as an energy security concern, but for reasons of national security. This joint Strategy relies on the existing strong bilateral collaboration between the United States and Canada and reflects a joint commitment to enhance a shared approach to risk management for the electric grid. It also articulates a common vision of the future electric grid that depends on effective and expanded collaboration among those who own, operate, protect, and rely on the electric grid. Because the electric grid is complex, vital to the functioning of modern society, and dependent on other infrastructure for its function, the United States and Canada developed the Strategy under the shared principle that security and resilience requires increasingly collaborative efforts and shared approaches to risk management.

The Strategy envisions a secure and resilient electric grid that is able to withstand hazards and recover efficiently from disruptions. In pursuit of this goal, the Strategy organizes joint approaches to protect today's grid, manage contingencies by enhancing response and recovery capabilities, and cultivate a more secure and resilient future grid. As an expression of shared intent and approach, the Strategy organizes joint efforts to manage current and future security challenges.

The strategic environment facing the system assets and critical functions of the U.S. and Canadian electric grid is complex and dynamic. The electric grid in the United States and Canada is made up of interconnected Federal, territorial, municipal, co-operative, and investor-owned and operated utilities. The Strategy reflects that different types of utilities have variable levels of resources and require different approaches to, and support for, risk-based decision-making. At a systems level, generation, transmission, and distribution are the critical functions of the electric grid, and owners and operators share the primary responsibilities for the continued operation and security of these functions. Owners and operators are also responsible for implementing mitigation and protection measures to improve security and for leading response and restoration efforts. At the same time the electric grid has evolved to incorporate new forms of generation and energy sources.

Policy and regulatory authorities in both the United States and Canada play a crucial role in establishing reliability and security standards and working with public and private partners to ensure electric grid security and resilience. New threats, hazards, and vulnerabilities continue to emerge even as we improve our abilities to respond to and recover from incidents and work to prevent, protect against, and mitigate potential consequences of future incidents. The United States and Canada share priorities to reduce the systemic risk to the electric grid through combined and aligned organizational, technical, and policy efforts across the public and private sector.

The electric grid serves as both a vital function of society and an essential aspect of national security. Extended electric outages can have severe consequences for national defense, communications, water and waste water, health care, emergency management, and transportation, among other critical services.

Past incidents have demonstrated the cascading impacts posed by interdependencies, by highlighting ways that the electric grid depends on other sectors, including the communications infrastructure and information systems. Natural events are just one of many hazards to the electric grid and the critical services it supports. Superstorm Sandy in 2012 crippled much of the State of New Jersey's energy infrastructure; flooded operation centers for the New York City transit system; and damaged backup power systems, emergency power generation capabilities, and computer-based train operations for a major transit system, which halted movements of people and goods. The 2003 North Eastern Blackout, which began initially with power lines in contact with tree branches, was magnified by a series of cascading computer failures that affected airline operations, the financial and banking sector, blood and potable water supplies, and other critical services. Compounding effects, such as increasing trends for extreme weather as climate continues to change, may have far-reaching implications for the security and reliability of electric grid operations.

Although the lessons learned from these events have led to improvements in system reliability and advancements in modeling, microgrids, and energy storage solutions, governments and electric grid owners and operators face a new and evolving set of threats, hazards, and vulnerabilities, some of which are cyber-enabled. At the same time, the electric grid's resilience increasingly depends on the security of the information technology systems that support it. Technological advances within the electric grid improve reliability and capacity by removing or mitigating vulnerabilities such as the potential for human error, but they can also introduce new vulnerabilities when redundancy is reduced or additional means of cyber and physical access are added. This changing system architecture allows for more efficient management of the electric grid, but may also make the electric grid more vulnerable to technical disruptions and cyber threats, and requires a new focus on technological implementation in the context of risk management.

Policy makers in the United States and Canada understand and value the benefits derived from their shared environmental and security goals and the infrastructure that underpins both countries' economies. Further, the United States and Canada have a long history of cross-border collaboration to optimize the use of electricity-generation assets on both sides and improve the reliability and efficiency of the electric grid. This Strategy represents continued emphasis on international, cross-sector, and public-private collaboration to ensure a secure and resilient U.S. and Canadian electric grid.





# Strategic Goals

The three high-level goals of this Strategy are as follows:

- Protect Today's Electric Grid and Enhance Preparedness;
- Manage Contingencies and Enhance Response and Recovery Efforts; and
- Build a More Secure and Resilient Future Electric Grid.





# Development of the Strategy

In March 2016, U.S. President Barack Obama and Canadian Prime Minister Justin Trudeau issued the “U.S.-Canada Joint Statement on Climate, Energy, and Arctic Leadership.” In the statement, they pledged to enhance efforts to “[d]evelop a joint U.S.-Canadian strategy for strengthening the security and resilience of the North American electricity grid [and to] work together to strengthen the security and resilience of the electric grid, including against the growing threat from cyber-attacks and climate change impacts.” The Canadian Government and U.S. Government established an interagency, bilateral Policy Committee to review past and current efforts to complete this objective.

Representatives from the following departments and others responsible for energy, security, safety, and defense coordinated their efforts to develop this Strategy:

- U.S. Department of Energy
- U.S. Department of Homeland Security
- Natural Resources Canada
- Public Safety Canada

Throughout the Strategy’s development, these representatives benefited from the support of and input from many additional departments, agencies, and stakeholders, including the Electricity Subsector Coordinating Council and the Energy and Utilities Sector Network.

The executive-level commitment of both Governments builds on other complementary efforts that have resulted in the *Canada-United States Action Plan for Critical Infrastructure* (2010) and the United States’ Quadrennial Energy Review (QER), which stems from the U.S. Climate Action Plan (June 2013). The second installment of the QER will address the electric system, from power generation to end-use, for the electric grid of the 21st century.

The interagency, bilateral Policy Committee sought and incorporated public feedback on several versions of this Strategy through the U.S. Federal Register as well as through two interagency workshops. The Policy Committee made practical, analytically based recommendations for the Federal Governments of Canada and the United States to work with partners to achieve the goals of this Strategy.





# Implementation

The Strategy will be implemented in accordance with forthcoming U.S. and Canadian Action Plans, which will each detail specific steps and milestones for achieving the Strategy's goals within their respective countries. These documents are intended to guide future activity within areas of Federal jurisdiction, with full respect for the different jurisdictional authorities in both countries. The Strategy is not intended to, nor does it, create any binding obligations under international law.

Implementation will occur in consultation with state and provincial governments, regulators, and utilities, where applicable, and will require the sustained, coordinated, and complementary efforts of individuals and groups from both countries, including many who contributed to the development of the Strategy, such as private sector partners, policy makers, and the public. The two countries' common effort to strengthen the security and resilience of the electric grid is imperative for both governments and all who depend on this critical asset.

Iterations and future development will be guided by each country's Action Plan. The Strategy sets the groundwork upon which to build future activity, just as the following multiple prior efforts informed this strategy:

- Canada's National Strategy for Critical Infrastructure (2009) and Action Plan for Critical Infrastructure (2014–2017);
- U.S. Presidential Policy Directive (PPD) 8, "National Preparedness" (2011); PPD 21, "Critical Infrastructure Security and Resilience" (2013); and PPD 41, "United States Cyber Incident Coordination" (2016);
- U.S. Executive Order 13636, "Improving Critical Infrastructure Cybersecurity," and Executive Order 13653, "Preparing the United States for the Impacts of Climate Change" (2013);
- U.S. *National Space Weather Strategy and National Space Weather Action Plan* (2015); and
- Canada's *Fundamentals of Cyber Security for Canada's Critical Infrastructure Community* (2016).

## 1. Protect Today's Electric Grid and Enhance Preparedness

A secure and resilient electric grid that protects system assets and critical functions and is able to withstand and recover rapidly from disruptions is a priority for the governments of both the United States and Canada. To achieve the goal of protecting today's grid, private sector entities as well as Federal, state, provincial, tribal/indigenous, territorial, and local governments must coordinate their activities through timely and effective information sharing. Information sharing is crucial for ensuring electric grid security and must involve Federal Government departments and agencies, industry owners, operators, third-party participants from the private and public sector, and other key stakeholders who would benefit from actionable threat, hazard, and vulnerability information. Further, information sharing across and within these groups must be timely and effective to facilitate prudent, efficient, evidence-based investments in the electric grid's security.

Protecting against and mitigating cyber and physical risks to the electric grid in a prioritized manner requires that public and private sector partners continue to work together to: improve their joint understanding of threats, hazards, vulnerabilities, and consequences; prioritize protection and mitigation efforts; build and validate response capabilities and investigate threats; and enhance the current performance of the electric grid and dependent systems.

Isolated or complex events with cascading effects that take place in either country can have major consequences for both the United States' and Canada's electric grids and adversely affect national security, economic stability, and public health and safety. Securing and encouraging investments in risk reduction in the existing electric grid and against such consequences is central to the joint and respective national security goals of the United States and Canada. The United States and Canada will strengthen interactions between regulatory structures and operational requirements and augment current incentives to encourage investment in protective measures for both persistent risks and outlier events.

Ensuring the security and resilience of the electric grid requires analyzing system vulnerabilities, including interdependencies, to identify risk management priorities. These measures will improve the electric grid's physical security and cybersecurity and accelerate the restoration of electricity after disruptions.

The United States and Canada will pursue the following objectives to achieve the strategic goal of protecting today's electric grid and enhancing preparedness:

- 1.1 Enhance Information Sharing:** Measures to improve security and resilience rely on timely and effective information sharing across and within governments and industry. The United States and Canada will enhance information sharing across and within governments and industry with partners who own, operate, protect, and rely on the electric grid. We will build organizational capacity to manage risks jointly and establish clear roles and responsibilities for communicating risks and other information to each other and the public. Further, we will develop timely and effective responses to critical threat, hazard, and vulnerability information, including tactical and strategic intelligence data.
- 1.2 Coordinate and Improve Forensic, Law Enforcement, and Protection Capabilities:** Federal Government departments and agencies play an essential role in identifying threats to the electric grid. In a dynamic threat environment, the continued improvement of tools and methods to discern threats more effectively is critical. The United States and Canada will coordinate and improve processes for detecting, monitoring, analyzing, reporting, investigating, and mitigating threats to the electric grid. We will also improve coordination between responsible government departments and agencies and electric grid owners and operators to defend the electric grid.
- 1.3 Protect against Major Isolated and Cascading Events:** Protection of the electric grid against major events necessitates prudent investments, robust designs, and an all-hazards—adversarial, natural, and technological—risk approach to understanding system performance vulnerabilities across generation, transmission, and distribution systems. The United States and Canada will continue to work in coordination with owners, operators, and other stakeholders to protect and harden existing features of

the electric grid, to identify and mitigate system-wide criticalities, and to put in place measures that reduce system-wide risk. We will work with partners to develop guiding principles and technical means, including automated and manual approaches, to prevent cascading events, including blackouts.

**1.4 Align Standards, Incentives, and Investments with Security Goals:** Investment planning for security and resilience measures necessitates a clear assessment of the potential value of the proposed investments and operating costs, and an alignment of those costs with regulatory processes and tools for prudent cost recovery, including tools for valuing security. The United States and Canada will jointly develop tools to connect security and resilience decision-making to infrastructure investment and financing and to improve the balance of investment in risk-reduction measures and response and recovery investments.

**1.5 Understand and Mitigate Vulnerabilities from Interdependencies with Other Critical Infrastructure:** The U.S. and Canadian electric grid is a highly interdependent and complex system on which societal functions depend. Critical infrastructure sectors have grown increasingly reliant on continued grid operations. Likewise, in order to function, the electric grid increasingly depends on other infrastructure, such as the communications systems necessary for controlling electric grid systems. The United States and Canada will work with owners, operators, and other stakeholders to enhance monitoring of system-wide performance of the electric grid, improve forecasting and modeling of effects on dependent systems, and work through public-private partnerships to address vulnerabilities, including social vulnerabilities associated with dependence on the electric grid. We will enhance our understanding of how different demographic groups may be more vulnerable to disruptions. In addition, we will work with owners, operators, and other stakeholders to identify and mitigate both cyber and physical risks to and from the electric grid and other types of infrastructure, including electric grid interdependencies on water, natural gas, telecommunications, transportation, financial services, and national defense.

## 2. Manage Contingencies and Enhance Response and Recovery Efforts

The electric grid is composed of a highly diverse set of assets, systems, and functions, and is primarily owned and operated by the private sector in the United States or by provincial, territorial, investor-owned, and municipal utilities in Canada. In part because of its complexity and physical size, the electric grid is vulnerable to disruptions from many types of hazards and threats. Enhancing response and recovery efforts depends on collaboration with all stakeholders. The Strategy sets out a shared approach for enhancing continuity and response capabilities, supporting mutual aid arrangements such as physical and cyber mutual assistance across a diverse set of stakeholders, understanding interdependencies, and expanding available tools for recovery and rebuilding. In the face of evolving physical threats, technological risks, cyber incidents, and natural hazards, the electric power industry has recognized the increased need for enterprise-level security and resilience by investing in response and recovery capabilities, including business continuity plans and assessments of the vulnerabilities of critical single-

point assets, such as power plants, and networked features, such as transmission lines and cyber systems. The United States and Canada will work with public and private partners, especially electric grid owners and operators, to manage contingencies and enhance response and recovery efforts more effectively. We will pursue the following objectives to achieve the strategic goal of managing contingencies and enhancing response and recovery efforts:

- 2.1 Improve Emergency Response and Continuity:** Improving the independent and joint abilities of the United States and Canada to respond to an emergency and to enhance continuity of operations is imperative to building a resilient, reliable, safe, and secure electric grid, a national priority vital to competitiveness, jobs, energy security, national security, and the clean energy future for the United States and Canada. The United States and Canada will improve the ability of the public and private sectors to respond to electric grid-related emergencies through enhancing capabilities to identify the location of the problem and re-route power around affected areas. We will improve the ability to assess the state of the electric grid by supporting research, development, and deployment of initiatives such as “smart grid” technology and of technological advances in electric grid monitoring. As a result, utilities can quickly and efficiently respond to power outages as well as improve business continuity when there are cyber incidents. These technologies will be designed to boost the efficiency of outage response teams and reduce utilities’ operational costs by identifying where resources are needed to make repairs. The United States and Canada will also seek to encourage the expansion of public and private resources for response to and recovery from major power outages through electric grid modernization. Additional resources should include more robust equipment and systems, research and development for more resilient critical electric grid components, and hardening of assets. We will coordinate assistance programs as appropriate to encourage the public and private sectors to refine existing response and recovery plans, develop new ones, and conduct training and exercises to execute those plans.
- 2.2 Support Mutual Assistance for Recovering from Disruptions Caused by Physical and Cyber Threats:** The speed with which power systems can be restored after a disruption depends, in part, on the resources available for recovery. Utilities in the United States and Canada have a long history of providing mutual assistance in the event of disruptions through agreements, whereby requesting utilities typically reimburse responding companies on a cost-recovery basis. The United States and Canada will continue to explore organizational and regulatory options to enhance the effectiveness and efficiency of these mutual assistance groups, especially in instances of cross-border collaboration. We will encourage utilities to collaborate when there are cyber incidents by developing plans and capabilities, assigning roles, and developing procedures to respond.
- 2.3 Identify Dependencies and Supply Chain Needs During Emergencies:** Because the U.S. and Canadian electric grids are so interconnected, communities, businesses, and industries may not be fully aware of their reliance on an integrated electric



grid infrastructure that depends on interconnected operations in both countries. Likewise, the operation of the electric grid depends on other infrastructure, such as communications, fuel, and water. The United States and Canada will continue to work together to model these complex relationships, to identify vulnerabilities and points of criticality, and to address the risks they pose. We will help provinces, states, and regions better understand their electric grid risks and assist them in adopting more effective resilience strategies through modeling and identifying supply chain vulnerabilities.

- 2.4 Recover and Rebuild:** Recovery does not end immediately after power has been restored. Improvements in the electric grid that go beyond restoration of previously existing infrastructure are likely to need approval from state or provincial regulatory agencies that have the authority to determine whether rates may be raised or revenues used to cover improvements. The governments and partners of the United States and Canada will explore and study cost-effective proposals to improve resilience during reconstruction after disruptions, including the effects of climate change. We will also consider any regulatory changes that are recommended to cover the costs of these improvements.

### 3. Build a More Secure and Resilient Future Electric Grid

The United States and Canada are working to build a more secure and resilient electric grid that is responsive to a variety of threats, hazards, and vulnerabilities. To achieve this, the electric grid will need to be more flexible and agile, with an architecture into which new technologies may be readily incorporated. As the electric grid evolves, electric grid owners and operators are integrating a variety of approaches to risk management, including more diverse and distributed generation that could provide a more resilient and secure electric grid. Greater use of intermittent sources of power will elevate the role of energy storage systems and enable a more flexible system. In the future, the electric grid will likely draw on new combinations of generation, incorporate evolving energy storage and distribution systems, and accept new technologies, many of which are emerging much more rapidly than the electric grid technologies of the last century. Owners and operators will need to protect the electric grid from new and evolving risks, cyber threats in particular, that stem from such technologies. Utilities have varying levels of resources to make the investments necessary to meet their needs, so incentives that go beyond those provided for by current policy may be needed. In addition, global climate change will increasingly create new stresses to which the electric grid will need to adapt.

The electric grid gains reliability from the development and integration of new technologies, but technology also introduces new potential security vulnerabilities. Expanding networks of sensors are improving the amount, speed, and quality of data generated about the electric grid. With advanced computation and analytics, a more accurate picture of electric grid status is becoming available in real time, providing greater decision capabilities and more reliable automated responses to events. These changes also increase the number of vulnerabilities to cyber incidents. The United States and Canada will pursue the following objectives to achieve the strategic goal of building a more secure and resilient future grid:

- 3.1 Understand and Manage New and Evolving Risks from Electric Grid Technologies and Electric Grid Design:** The electric grid is encountering new and evolving risks that arise, in part, from the rapid growth of new technologies within and connected to the electric grid. As new sources of energy generation are increasingly incorporated into the electric grid, they drive adaptations in new technologies. In addition, impacts from increasingly severe weather events due to climate change, as well as space-weather and other high-impact events, create the requirement for continuous assessment and design improvements. To the extent possible, the United States and Canada will identify, understand, and address these emerging and evolving threats, hazards, and vulnerabilities. We will seek to ensure that continued integration of electric grid and information technology infrastructures is a security benefit despite any new challenges posed by enhanced integration.
- 3.2 Develop and Deploy Security and Resilience Tools and Technologies:** In the context of increased distributed generation, the United States and Canada will pursue the technological, institutional, and architectural evolution of the electric grid when it enhances security and resilience. The United States and Canada will work with partners to research, identify, develop, assess, and facilitate the adoption of new technologies where they will improve electric grid security and resilience, and we will explore whether alternative solutions are preferable where new technologies fail to improve security and resilience. The United States and Canada will also collaborate to reduce vulnerabilities to critical, hard-to-construct components like large power transformers by incorporating more robust advanced components and power electronics into next-generation equipment. To achieve an electric grid that is able to heal itself following major disruptions, we will work to develop a system where power flow can be quickly reconfigured, frequencies can be stabilized, and voltages can be controlled. The United States and Canada will identify, develop, and facilitate the adoption, where appropriate, of advanced system design tools to mitigate cyber threats in an increasingly decentralized electric system.
- 3.3 Integrate Security and Resilience into Planning, Investment, Policy Decision-Making, and Coordination Regarding Cross-Border Electric Grid Integration between the United States and Canada:** Utilities, electric grid operators, and government authorities in the United States and Canada have a long history of collaborating on planning for investments and regulatory policies related to cross-border electric grid integration. As the electric grid becomes more agile and multi-directional, and new threats like climate change evolve, institutions in the two countries will need to enhance their capabilities for quantitative risk analysis and modeling to characterize electric grid threats, hazards, and vulnerabilities more effectively; understand the consequences of loss-of-power events; and support risk-informed decisions. The United States and Canada will explore improved mechanisms to value prudent investments for security and resilience adequately and to harmonize security and reliability regulation with the evolving strategic environment for the electric

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grid. Where current processes are poorly aligned with the goal of improving electric grid security and resilience, we will identify the causes of misalignment and provide information for appropriate adjustments, including through cost recovery.

- 3.4 Understand and Mitigate Risks Posed by Climate Change:** As global temperatures rise, wildfires, drought, and high demand for electricity put stress on the energy infrastructure. Severe weather is a leading cause of power outage and fuel supply disruption. Climate change is projected to cause an increase in the frequency, duration, and intensity of many types of extreme weather. The United States and Canada will support research and innovation through new or existing initiatives that will make our electric grid more flexible and more efficient as we work toward a cleaner, more climate-resilient energy system.
- 3.5 Develop a Highly Skilled Workforce:** As the electric grid system evolves and new threats emerge, the United States and Canada, in coordination with industry and academia, will strive to advance the training and education of next-generation workers. We will work to address the gap created by the retirement of existing highly skilled workers, and we will also ensure awareness of future employment opportunities to prepare for work in this sector.





## Conclusion

A robust, secure, and resilient electric grid is essential to serving the needs of the public in terms of health and safety, economic security, and national security. A physical incident, cyber incident, or natural event affecting the electric grid can be potentially catastrophic for the way of life in the United States and Canada. A security mechanism that works today may not be effective tomorrow—the ways and means of threats and hazards constantly change, whether by design of a cyber incident or through unpredicted climate trends. Electric grid stakeholders must prepare for disruptive events and continue to work to address the potential threats, hazards, vulnerabilities, and consequences in the systems they manage.

This joint Strategy is intended to protect against and mitigate risks by prompting development and implementation of U.S. and Canadian Action Plans. In accordance with these forthcoming Action Plans, Federal Government department and agencies will continue to work with utility owners and operators, as well as state, provincial, tribal/indigenous, territorial, and local governments, to maintain preparedness, obtain predictive information, and reduce vulnerabilities. Based on the significance of critical infrastructure, such as the electric grid, in broader national and economic security strategies, it is in the interest of both Federal Governments to ensure updates and adaptation to evolving and emerging risks. To fulfill the strategic vision for energy grid security and resilience, as the very nature of the electric grid itself continues to evolve, establishing and maintaining security measures for the U.S. and Canadian electric grids will continue to require significant dedication of resources from all participants. The electric grid transcends political and geographic boundaries, and its operations shift based on demand or availability of natural resources. Canada and the United States share responsibility for making every reasonable effort to fulfill our commitment to the electricity system of the 21st century.





# Bibliography

Department of Energy. Office of Electricity Delivery and Energy Reliability. *Insurance as a Risk Management Instrument for Energy Infrastructure Security and Resilience*. 2013.

Department of Homeland Security. "National Infrastructure Protection Plan." Last updated June 16, 2015. <https://www.dhs.gov/national-infrastructure-protection-plan>.

Executive Office of the President (EOP). "Principles for Federal Engagement in Standards Activities to Address National Priorities." EOP Memorandum M-12-08. January 17, 2012.

-----*U.S. Open Data Action Plan*. Washington, DC: EOP, May 9, 2014.

Executive Order 13636. "Improving Critical Infrastructure Cybersecurity." February 12, 2013.

Executive Order 13653. "Preparing the United States for the Impacts of Climate Change." November 1, 2013.

Executive Order 13744. "Coordinating Efforts to Prepare the Nation for Space Weather Events." October 13, 2016.

Federal Emergency Management Agency (FEMA). "Emergency Support Function 15: Standard Operating Procedures." Last updated August 21, 2014.

-----"National Planning Frameworks." Last updated March 19, 2015. [www.fema.gov/national-planning-frameworks](http://www.fema.gov/national-planning-frameworks).

-----"National Preparedness Goal." Last updated March 19, 2015. [www.fema.gov/national-preparedness-goal](http://www.fema.gov/national-preparedness-goal).

-----"Whole Community." Last updated June 10, 2016. <https://www.fema.gov/whole-community>

-----*A Whole Community Approach to Emergency Management: Principles, Themes, and Pathways for Action*. FDOC 104-008-1. December 2011.

ICF International, "Electric Grid Security and Resilience: Establishing a Baseline for Adversarial Threats." June 2016.

Office of Management and Budget (OMB). "Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities." OMB Circular A-119. Washington, DC: OMB, February 10, 1998.

National Science and Technology Council (NSTC). *National Space Weather Strategy*. Washington, DC: OSTP, October 2015.

----- . *National Space Weather Action Plan*. Washington, DC: OSTP, October 2015.

Presidential Policy Directive 8. "National Preparedness." March 30, 2011.

Presidential Policy Directive 21. "Critical Infrastructure Security and Resilience." February 12, 2013.

Presidential Policy Directive 41. "United States Cyber Incident Coordination." July 26, 2016.

Public Safety Canada. *Action Plan for Critical Infrastructure*. 2014 – 2017.

----- . *Canada-United States Action Plan for Critical Infrastructure*. 2010.

----- . *Fundamentals of Cyber Security for Canada's Critical Infrastructure Community*. 2016.

----- . *National Strategy for Critical Infrastructure*. 2009.