

# Standards for our energy future



**Electricity  
Canada**  
Our energy future

## Executive summary

Standards have already demonstrated clear value in advancing safety, innovation, and cost efficiency in the electricity sector. They strengthen infrastructure against extreme weather, improve grid security, and continue to promote affordability and reliability.

Across the sector, standards accelerate technology adoption by reducing duplication, ensuring equipment compatibility and creating investment certainty. They also ease regulatory burden, by allowing policymakers to focus on areas where active oversight is most needed. When prioritized, standards deliver measurable benefits for both the electricity system and consumers.

Despite the many successes, gaps in standards are widening. Standards for issues like artificial intelligence (AI) applications, energy storage safety, distributed energy resource (DER) integration, and digital communication protocols are either incomplete or outdated. Power quality and electromagnetic compatibility concerns are also increasing as new technologies are entering the market. Many utilities face knowledge and succession planning challenges, limiting their ability to fully engage in standards development. Without coordinated provincial and federal support, these weaknesses will slow modernization efforts, increase long-term system costs, and expose the grid to greater physical and cyber risks.

**Problem statement:** Canada's electricity sector is transforming rapidly, but gaps in emerging standards, inconsistent provincial alignment, and insufficient government funding and support threaten the long-term success of our energy future.

## Key takeaways

### **Standards are critical to enable a reliable and safe electricity grid**

Standards are essential to grid reliability, safety, and modernization. They ensure compatibility across technologies, support interprovincial and cross-border power flows, and reduce regulatory burden. As electricity systems become more complex, standards provide the foundation for coordinated, resilient infrastructure, making them a necessary and prudent investment.

### **Standards support consumer value by promoting innovation and affordability**

Standards accelerate the adoption of clean technologies, reduce duplication, and expand market access, thereby lowering costs and increasing consumer value. They promote economic growth by enabling innovation and providing investment certainty. Continued investment and regulatory guidance is required to optimize the benefit of standards for Canadians.

### **Utilities need regulatory and government support to close urgent standards gaps**

Emerging challenges, such as AI, cybersecurity, and climate adaptation require new or updated standards. Canada also faces a skills and capacity gap with respect to standards development. Provincial and federal support are essential to close these gaps, protect consumers, and ensure utilities can continue to deliver a safe, affordable, and future-ready electricity system.

## Recommendations

### **For provincial regulators**

1. Recognize standards development as a core utility investment for rate and infrastructure approvals to improve long-term affordability and system performance.
2. Reduce regulatory friction by aligning standards across jurisdictions to streamline technology deployment.

### **For federal policymakers**

1. Provide sustained funding for Canadian participation and leadership in national and international standards bodies.
2. Support transmission and interoperability standards that enable interprovincial trade and a more connected national grid.
3. Integrate standards into federal climate, innovation, and security policies to ensure resilience, affordability, and technology adoption.

## Overview

Electricity Canada and our members have long been proponents of electricity industry standards. The use of standards promotes economic growth and industry reliability through operational consistency. As we move towards greater grid expansion to tackle changing energy needs, standards are increasingly relevant in a more diversified electricity sector, with new standards emerging as a key area of focus.

In 2015, Electricity Canada released a report titled ***The Importance and Benefits of Standards in the Electric Utility Industry***, which outlined recommendations to help strengthen and advance the development of Canadian electric utility standards. The report demonstrated that prioritizing standards ensures a reliable and adaptive electricity sector. The energy landscape has changed significantly over the past decade, making it necessary to reassess emerging opportunities for standardization.

The sector faces new challenges in our changing environmental and economic landscape. Proactive policy objectives have permeated every aspect of the energy industry and dramatically shaped the way we think of investment and innovation. New security risks are changing the way we understand resource planning while sector resiliency is under pressure from climate impacts. Electricity demand in Canada, and around the world, will grow substantially over the next 25 years, leading to a new frontier for technological innovation, grid expansion, and end-use diversification.

Standards in the electricity sector will play a greater role in supporting electrification and the development of a positive energy future. It is necessary that Electricity Canada members have adequate support for standards development and participation in national and international committees and forums, such as Canadian Standards Association (CSA), the Institute of Electrical and Electronics Engineers (IEEE), and International Electrotechnical Commission (IEC). This includes strong federal funding and support from Innovation, Science and Economic Development Canada (ISED) and Natural Resources Canada (NRCan).

Effective standardization reduces regulatory burden, facilitates the adoption of new technologies, promotes equipment and power system compatibility, protects consumers, and ensures long-term system reliability. Standards have historically played a major role in ensuring the safety, reliability, and security of the grid and will continue to do so as the sector expands to meet our changing energy needs.

### What is a standard?

Standards are an approved set of rules intended for repeated use that aim to ensure operational consistency. Industry standards are approved by recognized standardization bodies to ensure consensus by subject matter experts.

### Key standards bodies

- **Standards Council of Canada (SCC)** is a Canadian crown corporation and standards accreditation body with the mandate to promote voluntary standardization in Canada
- **Canadian Standards Association (CSA)** is a standards development organization accredited by the SCC, composed of representatives from industry, government, and consumer groups
- **Underwriters Laboratory (UL)** is a standard development body accredited by the SCC
- **International Electrotechnical Commission (IEC)** is an organization that publishes international standards for electrical technologies
- **International Organization for Standardization (ISO)** is a global independent organization that develops and publishes international standards
- **North American Electric Reliability Corporation (NERC)** develops and enforces reliability standards for the North American bulk power system

## Standards promote technology adoption and economic growth

Standards promote the adoption of new technologies and approaches by reducing the degree of firm-specific work required for effective deployment. Upstream and downstream firms engaged in the sector can be assured that investments made in supporting grid development will be broadly applicable across all service providers. This reduces the risk of capital investment and broadens the market penetration of new products and practices. Creating standards that promote tested best practices in jurisdictions that are not first-stage adopters prevents the inefficient duplication of work and increases the speed of adoption.

Standardization accelerates the adoption of new technologies and practices promoting economic growth and can lead to increased efficiency in the deployment of labour and capital.

Standards have also been shown to have a positive effect on innovation. However, timing is a crucial consideration, as poorly implemented standards introduced too early can lock in sub-optimal technology, while those introduced too late can lead to high adoption costs to meet the standard's requirements. Policymakers and standards development organizations must be conscious of utilities' perspectives on this issue to ensure an optimal standards strategy is implemented. Utilities aim to support their subject matter experts with the resources to participate in standards development activities, while also continuing to facilitate knowledge transfer within their organizations. To ensure the industry has the required competencies for the standards of the future, utilities must continue to receive regulatory and governmental support.

## Success Stories

- **Standards for climate change adaptation:** CSA plays a significant role in helping Canada adapt to climate change through the development and revision of standards that enhance the resilience of infrastructure. In 2025, CSA updated several standards, including CSA C22.3 No. 1 (Overhead Systems) and CSA C22.3 No. 7 (Underground Systems), to improve the resilience of electrical and communication infrastructure against extreme weather events.
- **NERC Bulk Electric System (BES) definition and exception process:** The BES definition ensures that all critical elements affecting the bulk electric system are appropriately identified through specific inclusions and exclusions. Entities responsible for BES elements are required to comply with NERC standards. Electricity Canada collaborated with members to advocate for technically appropriate exclusions, avoiding significant and undue costs for utilities, ultimately making electricity more affordable for customers.
- **Mandatory NERC reliability standards:** NERC standards were developed to ensure the reliability and security of the bulk electric system in North America. Major blackouts, such as the 2003 blackout, exposed vulnerabilities in the power grid. These events highlighted the need for mandatory and enforceable reliability standards to prevent widespread outages. NERC standards provide the requirements necessary for planning, operating, and maintaining the bulk electric system. The standards create a uniform set of expectations for all entities involved in the bulk electric system, regardless of region or jurisdiction. With increasing threats to critical infrastructure, NERC standards also address cybersecurity (CIP standards) and physical security to protect the grid from attacks.

## Key standards issue in the electricity sector

**Grid modernization:** The electricity system needs to be modernized to keep up with growing demand, climate challenges, and new technologies; standards are essential to that process. Grid modernization includes a wide range of upgrades and standards that ensure these technologies can work together safely and efficiently by setting common rules for how they're built, connected, and operated.

**Evolving customer experience:** As more electric vehicles, heat pumps, and other devices come online, standards help manage how they interact with the grid. They guide everything from how power flows through the system to how planners forecast demand and invest in new infrastructure. On the operational side, standards ensure all the equipment and systems are compatible, improving reliability and system coordination.

**Transmission standards:** As Canada aims to boost interprovincial and cross-border grid connections, technical standards ensure that systems are compatible. This helps with everything from market access to emergency support. Transmission standards also make large-scale renewable integration and resource sharing possible across regions.

**Cybersecurity:** Cybersecurity is now a frontline issue. Smart grids, AI tools, and digital meters make the system more efficient, but also more exposed to cyber threats. While there are some protections in place, gaps remain in AI integration and data sharing across provinces.

**Climate adaptation:** Climate adaptation is an urgent and ongoing need. Infrastructure design standards that factor in extreme weather, wildfires, and flooding will improve the resiliency of power systems for future conditions.

**Energy efficiency:** Canada has strong energy efficiency standards that, alongside federal and provincial programs, help reduce energy demand, improve affordability, and support climate goals. Much of the technical and implementation work is led by utilities, and achieving national goals depends on strong, ongoing support from regulators to ensure effective coordination, reduce delays, and deliver consistent outcomes across the country.

**Standards education:** There is a knowledge and succession planning gap in standards. Many planners, engineers, and decision-makers don't fully understand how standards shape the system. The industry needs to foster the technical expertise required to contribute effectively to standards development. Without better education and training, the sector risks delays and missteps.

**Power quality and electromagnetic compatibility (EMC):** Power quality and EMC are growing concerns as the grid becomes more complex and reliant on fast-evolving digital technologies. Poor power quality can damage equipment and lead to costly outages. Updated standards around voltage performance and equipment emissions, and equipment immunity are needed to keep pace with changing grid conditions.

**Emerging gaps:** Finally, there are several areas where new or updated standards are urgently needed: AI applications, data centre integration, DER integration, energy storage safety, load forecasting, and digital communication protocols. If Canada wants a grid that's resilient, secure, and ready for the future, closing these gaps needs to be a top priority.

### **Issue highlight: Harmonic emissions, a standards priority**

Over the past decade, harmonic emissions have significantly increased in the transmission and distribution systems. This happens when devices that use power electronic converters are emitting unwanted electrical noise into the power grid, which increases voltage distortion and losses on the network.

The International Electrotechnical Commission (IEC) has developed consumer equipment standards for vendors, such as IEC 61000-3-2 and IEC 61000-3-12, to control harmonic emissions injected into the grid. These standards are mandatory for vendors in many parts of the world but have not yet been adopted in Canada. With increased pressure from regulators and electricity consumers for better power quality, the adoption of these standards has become a priority. Electricity Canada is working with members to advocate for the adoption of IEC Electromagnetic Compatibility (EMC) standards as national standards for Canada.

## **How regulators and policymakers can support standards**

Government policies and regulations are evolving to encourage economic growth and support the rapid expansion of Canada's electricity sector. The way standards are implemented can vary widely depending on the needs of different regions, industries, and utilities. In some cases, companies and utilities voluntarily adopt standards to improve performance or efficiency. In others, the industry develops its own standards through self-regulation or governments and regulatory bodies mandate standards to ensure safety, reliability, and consistency across the sector.

### **Standards support regulatory harmonization**

Standards are used across every stage of the electricity system, generation, transmission, and distribution, forming the backbone of the reliable service. However, Canada's electricity sector operates under a patchwork of different market structures and regulatory frameworks, which have historically made large-scale interprovincial electricity sharing difficult. As the country pursues electrification and clean energy goals, strengthening national connectivity through new transmission infrastructure is becoming increasingly important to support the most critical parts of our economy.

### **Standards reduce regulatory burden**

Standards help reduce the burden of government regulation. When clear, effective standards are in place, regulators can focus their attention on areas where additional oversight is genuinely needed. For example, while some standards appear in regulation, many IEC standards are widely adopted by industry without being mandated. This voluntary adoption demonstrates how standardization can drive best practices and compliance without formal regulation. The result is a lighter administrative load on both government and industry, making the sector more flexible and better able to respond to Canada's fast-changing energy needs. Nevertheless, voluntary standards are not always effective, and the industry needs a clear path to recommend legislation when needed.

### **Standards are for the customer**

Standards directly support efficiency, safety, and affordability. Utilities across the sector are actively investing in standards development, working collaboratively with vendors, governments, and customer representatives. These efforts drive consistency, lower system costs, and support smarter, long-term infrastructure decisions. Standards deliver clear benefits to consumers, with measurable impacts on reliability and rates. While these initiatives require upfront utility investment, the long-term consumer gains in cost control and service quality are substantial. Policymakers and regulators need to understand the importance of these standards investments as they ultimately serve the customer and provide the necessary support required for ongoing standards development.

## Recommendations for provincial economic regulators

### **1. Prioritize standards in rate and infrastructure approvals**

Recognize standards development as a critical utility investment that improves long-term affordability, system performance, and consumer value.

### **2. Reduce regulatory friction through standards alignment**

Improve consistency across jurisdictions and streamline approvals for emerging technologies like DERs, EV infrastructure, and grid modernization tools.

## Recommendations for federal policymakers

### **1. Provide sustained funding for standards leadership**

Enable Canadian leadership in national and international standards forums (e.g., CSA, IEEE, IEC) through consistent federal funding.

### **2. Enable a nationally connected grid through standardization**

Support transmission and interoperability standards that facilitate interprovincial electricity trade and grid resilience.

### **3. Incorporate standards into climate, innovation, and security policy**

Ensure that standards are embedded in federal strategies related to climate resilience, clean tech adoption, and grid security.

## Key takeaways

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