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Storage Supply Chain Workshop, April 9, 2015, Toronto**
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Developing Stronger Links

*Summary Report of the Canadian Energy
Storage Supply Chain Workshop,
April 9, 2015, Toronto*

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Executive summary

Regardless of the technology chosen, energy storage essentially harnesses energy for later use. Energy storage is increasingly suited to delivering stable, reliable and secure power that has the potential to be more resilient to extreme weather, cyberattacks, fluctuating levels of energy generation and other pressures facing the energy sector.

Where and when these customer needs can be fulfilled by cost-effective, energy storage solutions, the market demand is expected to surge. According to Navigant Research, the 2015 global market for revenues from energy storage enabling technologies will be \$606 million, a figure projected to reach \$21.5 billion by 2024.¹

While energy storage is a field of intense international growth and competition, Canada is acknowledged to have significant strengths in this area, and therefore, stakeholders of all types are eager to protect and grow the market share of Canadian companies. At the same time, in order to reduce the costs of system operation and renewal, stakeholders are looking to ensure that Canadian markets provide a level playing field for the adoption of energy storage technologies relative to other technologies and approaches. To date, much focus of discussion has been placed on the needs of end users, however, on April 9th 2015, thought leaders from across Canada's energy storage supply chain met in Toronto to identify specific ways that Canada can play to its strengths in this field. During the "Developing Stronger Links in the Chain" workshop, convened by the National Research Council Canada (NRC) and MaRS, more than 150 participants sought ways that Canada can strengthen its ability to yield economic gains from and contribute to the 35-times revenue growth that Navigant predicts for global energy storage enabling technologies.

Together, the workshop participants determined that an ideal future involves a supply chain that collaborates to add value and provide solutions, not piecemeal parts. For the supply chain to function as an integrated value chain, participants recommended these areas of focus:

Develop a common vision – Participants wish to set a common, long-term strategy for energy storage in Canada to get all parts of the supply chain working together. They feel it is important to support that vision with a common understanding of the energy storage markets, services, and products to clearly outline how storage systems interact with the grid, and the values that they provide. As a vital component of the long-term vision, participants want a technology-agnostic roadmap for energy storage that spans the entire Canadian market, and includes a

¹ Navigant Research, [Energy Storage Enabling Technologies](#), January 2015

comprehensive analysis for Ontario and its early lead in the sector. This roadmap could be supported by describing valuable lessons learned from both early Canadian and international demonstration projects.

Collaborate across the supply chain – While recognizing that the lowest-cost solution is not always the one offering the highest value, participants felt there were benefits to standardizing key aspects of storage components and systems related to interoperability, safety and operations. It was acknowledged that this standardization could enable lower costs and result in a stronger supply chain, similar to those of other emerging technologies such as wind and solar. It was clear that members of the supply chain are eager for components and systems to work well together, but consideration needs to be given to allow the market to offer unique solutions, based on technology, application or geographic location. Several technical developments were identified that could support these solutions, such as updating planning tools and sharing data from demonstration projects.

Look beyond Canada's borders – It was recognized that both the Ontario and Canadian markets provide early test beds for storage technologies, which can support local supply chains when competitive. However bolstering the Canadian supply chain's export capability will become increasingly vital to success over the coming years. This is particularly evident since Navigant's research and analysis of energy storage markets point to those of Asia Pacific and Western Europe outpacing North American markets in the years ahead. Therefore, value chain participants need to continue to focus on their products' or services' competitive advantages, and leverage the support of government or not-for-profit entities that have the ability to accept capital risks for emerging technologies.

The need for coordinated action plans and collaboration has never been more evident; participants expressed a renewed commitment to stay connected to encourage collaboration across the energy storage supply chain. Independent of specific storage technology or application, participants acknowledged that early successes in local markets, if refocused for the international stage, will ensure Canada continues to build a robust and competitive energy storage supply chain.

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1. Introduction

Committed individuals are eager to determine how Canada's energy storage supply chain can remain competitive, now and into the future. After an early lead in this space, they are motivated for Canada to protect and grow its share of the global market for energy storage enabling technologies as a whole, which is projected to reach \$21.5 billion by 2024, up from \$606 million in 2015.²

North America currently holds a commanding lead when it comes to deploying energy storage, even compared to sizeable markets like China, Korea and Japan. According to Anissa Dehamna, Principal Research Analyst at Navigant Research, North America experienced a “breakout year” in 2014 as projects moved into commercial stages and out of the R&D, demonstration and pilot phases.

But, Navigant's extensive research and analysis of both the supply and end-user sides of energy storage and clean technologies point to growing Asian Pacific and Western European markets in the years ahead. The most obvious shift to non-North American installations happens after 2020, specifically for distributed energy storage systems (DESS), one of the highest-growth segments within the broader category of energy storage enabling technologies. Utility-scale systems are excluded from DESS, which covers storage for energy generated by decentralized, small-scale systems such as rooftop solar panels for commercial, residential and community use.

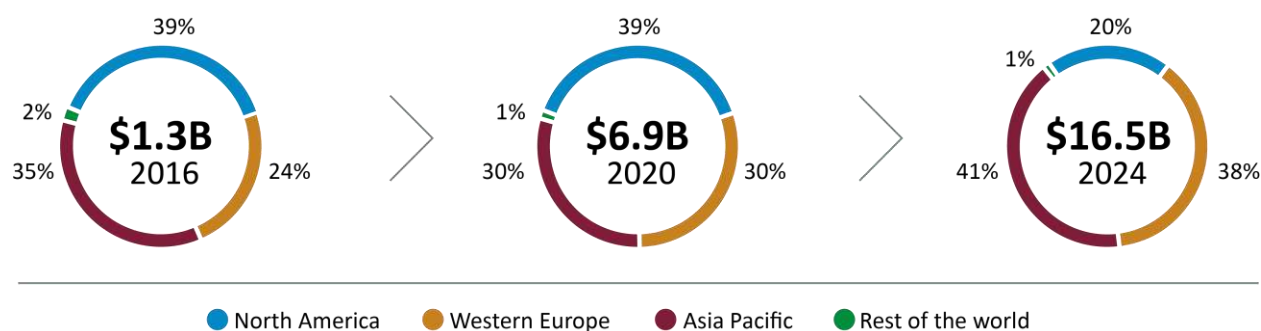


Figure 1. Navigant Research's global revenue forecasts for installed, distributed energy storage systems in 2016, 2020 and 2024, divided by geographic market.³ Original values have been rounded.

In anticipation of such change and to identify what Canada can do to bolster its supply chain, more than 150 participants attended the “Developing Stronger Links in the Chain” workshop. The National Research Council Canada (NRC) and MaRS convened the workshop on April 9, 2015, in Toronto, bringing together thought leaders from across Canada's entire energy storage and clean technology supply chains.

Representatives from component and module manufacturers, all levels of government, investment companies, system operators and utilities, integrators, academia, not-for-profit

² Navigant Research, [Energy Storage Enabling Technologies](#), January 2015

³ Navigant Research, [Community, Residential and Commercial Energy Storage](#), January 2015

foundations, industry associations, and research and technology organizations were keen to explore how Canada and Canadian industry can benefit from and contribute to worldwide growth in energy storage.

Admittedly, translating that growth into wins for Canada will take work. The workshop provided participants with a forum to work together to assess national and international factors that affect Canada's energy storage supply chain, and devise strategies that minimize risk and maximize global opportunities. What follows is a summary report of the discussions on factors required to advance those opportunities, realize economic gains, and have a positive impact on the energy changes facing Canada and countries around the world.

2. Strengthening Canada's energy storage supply chain

2.1 Ontario's early lead

In his keynote presentation, the Honourable Brad Duguid described opportunities for energy storage, based on his current role as Ontario's Minister of Economic Development, Education and Infrastructure, as well as his tenure as former Minister of Energy. When faced with an "old, outdated, dilapidated" energy system that was at risk of becoming unreliable, Ontario chose to lead rather than follow other jurisdictions. The province shut down all of its coal plants—30 percent of its energy mix.

From an emissions perspective that amount was the equivalent of removing seven million cars from the roads.⁴ The energy shift away from coal led Ontario to enhance its commitments to alternative, renewable power sources: wind, solar, biomass, biofuel and hydro. To modernize its energy system, Ontario also seized an opportunity to develop a smart grid and energy storage technologies.

"Owning energy storage technology and innovation is an opportunity that we simply must pursue. Because we can do this. We can own this."

The Honourable Brad Duguid

Minister of Economic
Development,
Employment and
Infrastructure

Government of Ontario



Throughout this change to the provincial energy system, Ontario has created tens of thousands of jobs in clean technology, setting an example for other provinces. During his keynote address, Minister Duguid spoke of the changes outlined in Ontario's Long-Term Energy Plan, a 20-year plan for cleaner energy.⁵ More importantly, he also emphasized the potential for energy storage to contribute to the economic competitiveness of the province through the robust ecosystem of entrepreneurs who are currently innovating in the sector.

⁴ Ontario Ministry of Energy, [Clean Energy news release](#), November 2010

⁵ Ontario Ministry of Energy, [Long-Term Energy Plan](#), released in 2010, updated December 2013

2.2 Think global

As he delivered the luncheon keynote, Clive Witter spoke about taking local opportunities global, which was to become a theme for the day. Apart from his role as Vice President, Insurance at Export Development Canada (EDC), Mr. Witter is also his organization's executive sponsor of clean technology.

He alluded to Canadian businesses having short-term opportunities resulting from economic recovery in the United States. Lower oil and gas prices help Canadian exporters, as do the weakened Canadian dollar, but competition is fierce in the U.S.

Despite competitive forces, he noted that pursuing business in the global economy is worthwhile. Export trade drives a significant portion of Canada's gross domestic product, yet right now only 4 percent of Canadian companies are exporting, leaving much room for growth. And, according to a Deloitte study of Canadian productivity, exporters outperform non-exporting companies by more than 30 percent.⁶

Medium-term opportunities will come from emerging countries and established countries where mass urbanization is stressing existing infrastructure. Mr. Witter encouraged companies to consult EDC because the organization has local people, on the ground in international markets, who work with teams back in Canada that have sector-specific knowledge. Last year, 90 percent of those introductions on behalf of Canadian companies were for SMEs.

He admitted that financing is difficult, sometimes even with proven technologies. However, EDC aims to make Canadian companies more bankable. After one of EDC's key technical partners attests that a company has proven technology, then EDC may finance works in progress, bonding requirements or working capital needs. Technical partners may include Écotech in Quebec, MaRS in Ontario, and NRC and SDTC nationally.

“Market acceptance when you go overseas can take time, but it will be rewarding, and can be done, particularly with the right partners, in the right way.”

Clive Witter
Vice President, Insurance
EDC



Three clean technology and energy storage case studies that he shared included: Hydrogenics for bonding support, Ostara for export guaranteeing for contracts overseas, and Nexterra for letters of credit to support a major UK contract.

As a key takeaway based on EDC's global experience, Mr. Witter warned that Canada's SMEs are “unlikely to succeed with large businesses unless they can work with integrators to provide a one-stop solution for customers.”

⁶ Deloitte LLP, [The Future of Productivity: Smart Exporting for Canadian Companies](#), 2014

3. Identifying Canada's supply chain strengths and risks

Despite having varied roles across the energy storage supply chain, panelists and participants saw similar factors as essential to set Canada and the energy storage sector up for success. The points they raised can be grouped under the prominent themes outlined in Figure 2 below.

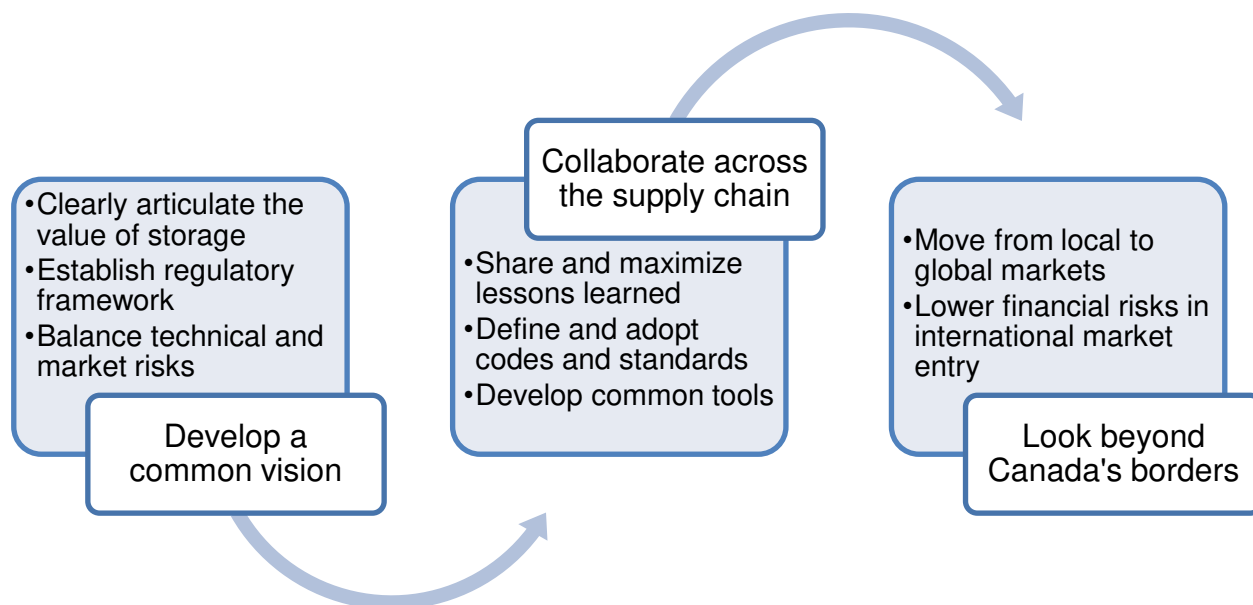


Figure 2. Recurring themes from the 2015 Canadian Energy Storage Supply Chain Workshop

Although the themes emerged throughout the workshop, they were particularly evident during the panel sessions, “Searching for the missing links in the chain” and “Creating new links by building on previous success,” delivered by executives from Celestica, CSA Group, eCamion, Hatch, Hydrogenics, Hydrostor, NRStor, Schneider Electric, and Ontario’s Independent Electricity System Operator.

3.1 Developing a common vision

Participants agreed that to propel the sector forward, energy storage requires a shared vision involving all levels of government and business. A cohesive focus would facilitate the supply chain’s ability to partner at the project, provincial and national levels. This was especially apparent in three areas: understanding and articulating the value of ES to end customers; ensuring the regulatory regime was set up to support the introduction of this new technology; and, ensuring that market participants balanced their market and technical risks.

3.1.1 Clearly articulating the value of storage

Panelists reminded technology companies and manufacturers to communicate their value, and that of energy storage systems overall, to the end customers in a clear and uniform manner,

especially since value and costs are not necessarily equal to one another. Many organizations are focused on reducing technology or manufacturing costs, and this will be important over the long run, but to increase market size, emphasis needs to be placed on the value of energy storage. That is, that energy storage provides increased benefits and serves customers pressing needs.

Jill Tipping, Vice President and Chief Financial Officer, Solar Business Canada, Schneider Electric, spoke of her desire to see organizations step up to address areas of value, even if the path to monetization is less obvious.

To underscore the importance of value, several panelists noted that customers are less concerned with what technology is used, but that the entire system does what they need it to accomplish. While organizations may excel at developing energy storage technology with new attributes, those extras are only valuable to the market if the customers value them. But, regardless of the value, pressure to reduce costs will not subside, and it was suggested that this may require a mind shift for engineers, who may associate low cost as a negative attribute.

Participants were urged to continue to invest in R&D innovation, specifically with a focus on ways to help reduce costs, contribute to smarter deployments or address areas with customer pull. Another way to add value was to delegate tasks such as project management, financing and construction, so that organizations can spend more time focusing their core expertise on adding value where customers need it most.

An important step in securing those customers at the outset is to communicate to them the ways that energy storage can help reduce their costs and increase production by delivering stable, reliable and secure power. By drawing examples from high-value projects and technologies that have been proven in Ontario and elsewhere in Canada, as well as by working closely with the regulatory agencies that ensure a fair and open market, members of the energy storage supply chain can ensure the potential benefits of storage are clear to customers. However, this is not a short-term endeavour, and significant focus must be given to this task in order to ensure it is accepted by all members of the supply chain.

“The areas of greatest potential for value creation—for citizens, for governments and for global economies—are not the ones that are most easy to monetize. I would like to see industry and government tackle that gap.”

Jill Tipping
VP and CFO
Solar Business
Canada,
Schneider Electric



3.1.2 Establishing a clear regulatory framework

The successful deployment and adoption of any new technology requires a balance between technical risk and reward. And, when dealing with highly regulated sectors like the electric utility industry, all market participants must recognize that system operators and utility

companies are in the business of minimizing risk.

Workshop participants described the challenges of demonstrating energy storage solutions in the environment, where their energy storage technologies that can sometimes be complex, had to (or should) function as assets that are easy for system operators to both use and control.

Concerns were also expressed that mechanisms do not exist to streamline regulatory and policy frameworks in Canada, everything from inter-provincial requirements and management of resources to building codes, zoning and fire prevention codes. Panelists also spoke of Canada having a sub-optimal governance structure with the nation's relatively small market being divided by province or jurisdiction, and further sub-divided by type of utility.

This fragmentation across regulatory frameworks and business models rapidly leads to inefficiencies across the supply chain. Some attendees also noted that current procurement and payment practices are not set up to accommodate energy storage, which does not readily fit within traditional categories for the energy sector, such as generation, transmission and distribution.

Participants felt that collaborating on a revised regulatory framework for energy storage in key jurisdictions would set a baseline with which regulatory organizations and policy makers could align their efforts to reduce risk.

Specific initiatives that could assist in removing regulatory barriers and bridging gaps were seen as ways to accelerate opportunities for Canada. In general, workshop participants were encouraged that Energy Storage Ontario and other enabling organizations were identifying regulatory barriers that negatively affect business cases in that province, and encouraged all stakeholders across the country to continue to move forward on regulatory change as quickly as possible.

3.1.3 Balancing technical and market risks

Another compromise described was the balance between leading-edge technologies and customer requirements. While R&D is vital for product development, industry must understand the actual customer needs and their risk tolerance for unproven technologies.

Since the technology, market rules, and competitive environment continue to evolve, strong partnerships between suppliers and customers will help strengthen the industry and drive equitable regulations. In some cases, new financing strategies and business models may need to be developed to support this emerging industry. Government incentive programs were

“Our largest threat to ourselves is disharmony along regulatory regimes, and what investments we’re willing to make and risks we’ll take.”

Stephen Brown
Director, Technologies
CSA Group



recognized as being generally effective strategies to promote value creation, especially for remote communities or where existing infrastructure is limited.

Participants were urged to continue to invest in R&D innovation, specifically with a focus on ways to help reduce costs, contribute to smarter deployments or address areas with customer pull. It was noted, however, that fragmentation risks will surface within the supply chain when there is undue competition between companies and technologies vying for dominance.

Therefore, participants recommended striking the right balance of project size and scope, as well as how much focus to place on the competitiveness of their technology versus the needs in the marketplace. Panelists pointed out that many small and medium-sized enterprises (SMEs) are unlikely to succeed if attempting to manage too many small customers. Yet, by partnering with other companies that are either more vertically integrated, or have complementary skill sets, Canada's technology companies would be able to focus on their core business, and lower the overall risk in their path to market.

“A good project may or may not have the best technology, and it may or may not have the lowest price per unit of the storage piece. But, for the success of the technology and the sector as a whole, we need to see good projects come forward...they need to get built. And, they need to get built on time and be on the system and be operating.”

Shawn Cronkwright
Director
Renewables Procurement
IESO



3.2 Collaborating across the supply chain

The need for collaboration is nothing new, but participants were encouraged to seize any opportunity to come together to leverage advantages from across the supply chain, in an effort to make sure Canada's energy storage market is as large as possible.

Currently, Canada's energy storage supply chain operates in a fairly linear manner as shown in figure 3. However, given the identified market risks, it was clear that along with innovating, it was important for members of the supply chain to add value through partnerships. By partnering in key areas such as project management, financing and construction, each organization could spend more time focusing its respective core expertise. This could assist the industry in moving away from piecemeal offerings. Instead of developing and selling individual parts or technologies, members of the supply chain could increase the overall value of each project by introducing a fully packaged solution for each customer.



Figure 3. Understanding the value of Canada’s energy storage supply chain

3.2.1 Maximizing lessons learned

From best practices to emulate, to mistakes to avoid, panelists noted that there was much for supply chain participants to learn—from one another, from other industries, and from other countries—to be able to do projects smarter, cheaper and faster.

When collaborating on projects, partners can benefit from one another’s experience working on other projects of that size, with those technologies, with similar customers, or with particular countries or jurisdictions. Additionally, collaborators can share tips about the enablers that contribute to their success.

It was in this context that NRC noted it has launched a project to assist organizations in maximizing the lessons learned from demonstration projects across the country. As a first step in that project, NRC is recruiting owners of demonstration projects to participate in collecting data that will help owners analyze their project’s operation, and learn from other projects in Canada and around the world. After gaining local validation, projects are better positioned for local or domestic deployment.

Going forward, panelists advised that energy storage should look to gain lessons from Canada’s mature, successful industry sectors, which tend to have robust supply chains and steadier procurement channels. Ontario’s automotive and Canada’s aerospace sectors were put forward as examples. Panelists also suggested looking to industries like banking or information and communication technologies (ICT) to apply lessons learned about security innovation. It is on the basis of such cross-industry lessons that workshop participants anticipate more interactions between all the links in the chain and greater involvement by the enablers.

Lessons can also be applied from within the renewable energy sector, where lack of societal acceptance has been a stumbling block. Societal acceptance can hinder even the most reliable or advanced technologies. So, to avoid repeating similar mistakes with energy storage, panelists counselled that participants listen to consumer concerns and never assume that individuals want a technology solution in their backyard. In response, participants called for concerted

efforts for public communications to clearly explain the benefits of energy storage to consumers and communities.

Nearly every panelist urged Canadian businesses to take what they learn from projects on known proving grounds, then scale up to pursue competitive, international markets. Before entering those global markets, however, international successes and failings can inform decisions for organizations in Canada's energy storage supply chain. Workshop panelists believe that Canada has much to gain by looking at countries like Germany, France and Australia, where there has been active government involvement with industry.

3.2.2 Codes, standards and regulations (CSRs)

To standardize the safe implementation of building systems, infrastructure, and large-scale utility services (e.g., electricity, water, natural gas), a range of CSRs are defined by stakeholder groups and adopted by authorities having jurisdiction. Technical standards foster robustness and scalability in the supply chain, for example, by establishing uniform interface criteria or communication methodologies. Standards are adopted because they can reduce the number of design parameters, can harmonize system specifications, and are therefore useful for driving down technology costs.

However, to realize the maximum benefit from CSRs, industry must apply them throughout the supply chain, from component to application levels, and they should be universally recognized in the global marketplace. While a selection of local codes may be specific to a given installation site, it will be important to identify opportunities to agree upon the most applicable CSRs for the energy storage sector. Doing so, would allow for simpler project-approval processes as well as more consistency across jurisdictions, including nationally and abroad. As users become more familiar with packaged energy storage systems that meet a common set of CSRs, then trust and support for the technologies is expected to strengthen. Most importantly, safety and reliability concerns should diminish to levels expected from traditional utility services.

As a result of minimal standards, manufacturers, engineers, and construction and installation teams are also unclear where their responsibilities begin and end for particular products or parts of energy systems. This uncertainty reduces trust in energy storage technology, can affect the safety of users, and makes it difficult for any of the parties to provide comprehensive warranties.

Therefore, workshop participants want Canada to work with standard-setting organizations internationally and domestically to ensure that the energy storage sector does not get left behind. In response, and to support the energy storage industry in navigating and evaluating this work, NRC noted that it is working with other organizations like the Electric Power Research Institute (EPRI) to help map the current suite of CSRs applicable to energy storage, right across the value chain. Wherever appropriate, this project will also involve collaboration from the International Electrotechnical Commission (IEC) and similar organizations such as the

Canadian Standards Association (CSA), the Institute of Electrical and Electronics Engineers (IEEE), etc. This process is expected to identify any gaps and opportunities for harmonization that can help facilitate the safe and cost-effective commercialization of energy storage technologies.

3.2.3 A need for common tools

Participants felt that improved tools are needed to facilitate smarter ways to design, plan, procure and implement diverse, integrated energy systems. Existing tools are limited in their abilities to factor in energy storage and new technologies for modeling or estimating purposes. Enhancements to software and other tools could guide more-informed decisions and investments. Improved tools may also free up SMEs to focus on their core capabilities.

With a variety of grid-scale and smaller projects underway across Canada, workshop participants also recognized the need for tools to make it easier to share data and learn from best practices. NRC attendees welcomed industry to participate in its supply chain database project, which exists to catalogue the qualified suppliers and end-use adopters in Canada's energy storage sector. The goal is to help them readily identify business partners that are well positioned to provide high-value, cost-effective systems.

3.3 Looking beyond Canada's borders

The balance between domestic markets, where demonstration projects are highly valuable in building credibility, and the potential to tap into larger export opportunities, is another area that requires careful attention by members of the supply chain. Participants described the timing, global competition, and partners focused on foreign distribution or implementation as aspects to consider when addressing international markets.

3.3.1 Moving from local to global markets

Many participants recognized that the size of the Canadian market, while significant, paled in comparison to the potential provided by export markets. It was recognized from other sectors that local success often provides a stepping stone for Canadian companies internationally. In fact, one panel session facilitator credited Canada's SmartGrid with achieving 11 percent year-over-year growth in employment, driven primarily by exports, including 40 percent of exports going to non-US markets.⁷

However, panelists also spoke of large Canadian projects involving 127 different suppliers and service providers. By contrast, many national and international customers prefer a turnkey solution that is managed by a project integrator serving as a single, client-facing point for the dozens or hundreds of individual suppliers involved in substantial projects. Therefore, apart from amplifying the national market, a collaborative approach also provides SMEs with a

⁷ Céline Bak, Introduction to panel two during the Canadian Energy Storage Supply Chain Workshop, 9 April 2015

stronger foothold and broader capacities when pursuing opportunities in foreign markets.

Additionally, in order to enter export markets, Canadian businesses will need to understand and stay informed of local trends and factors affecting those markets. Specifically, the panelists with overseas projects spoke of companies needing to be plugged into the supply chains in those countries, because many materials may have to be sourced

“We find the biggest source of cost reduction is in design for manufacturability.”

Jill Tipping
VP and CFO, Solar Business Canada
Schneider Electric

locally as cost-conscious customers seek favourable price points. In other circumstances, complex components, or robust supply chains may favour the export market. Understanding the value that Canadian suppliers can provide will take time, but with perseverance and partnership, Canada’s supply chain can prepare to reap the rewards of export opportunities.

It was also noted that through its offices around the world, EDC can advise business owners and help connect them with those on the ground in particular countries. Foreign Affairs and Trade Development Canada also has trade commissioners who are mandated to help countries do business with Canada through its 160 international trade offices.

3.3.2 Financing and reducing risks

Without financing and capital, organizations of any size will struggle to meet their customer needs. However, identifying and securing financing can be especially difficult for initial projects or for product and technology development.

Before financial institutions and venture capitalists are willing to step in, business risks must also be well understood and mitigated against. As financial advisors will point out, managing risk and investments go hand in hand. To assist Canadian companies with financing and managing the risks associated with early-stage technologies, products, market expansion, and project financing, the following options are available:

- NRC can co-invest with industry partners for strategic R&D projects for energy storage.⁸ Companies may also access financial assistance for their innovative technologies through NRC’s Industrial Research Assistance Program (IRAP).⁹
- Workshop co-host MaRS manages an Investment Accelerator Fund offering up to \$500,000 in early-stage investments for companies with potential to provide Ontario with sustainable economic value.¹⁰ The former MaRS Cleantech Fund is now a \$30-million, private fund called ArcTern Ventures, which can invest in top clean-technology

⁸ NRC, Energy Storage for Grid Security and Modernization, [website](#)

⁹ NRC-IRAP, Financial Assistance [website](#), or via the IRAP Concierge Service [website](#)

¹⁰ MaRS Discovery District, Investment Accelerator Fund, [website](#)

prospects validated by MaRS.¹¹

- Sustainable Development Technology Canada oversees a \$915-million SD Tech Fund for technologies that are beyond the proof-of-concept phase, but still pre-commercial.¹²
- Accessing finances for international business is facilitated by programs and services through EDC that offers bonding support, export guarantees for overseas contracts, letters of credit for proven technologies, and may finance works in progress or working capital needs.¹³
- Regional development agencies such as FedDev Ontario¹⁴ and Western Economic Diversification Canada¹⁵ manage programs to fund businesses for their innovative products, technologies and partnerships that could enhance industry productivity and economic growth.
- Many multinational companies (e.g., Siemens, Samsung, 3M, BASF, Bosch, NEC, AES Energy Storage, RES, S&C) offer either investment subsidiaries or collaborative R&D programs.

As projects move on to the demonstration or implementation phase, companies can investigate funds that are available from their respective provincial and federal infrastructure programs.

4. Readying for the future: offsetting risks with Canada's strengths

As with any emerging sector, the energy storage supply chain faces numerous challenges. Recognizing those barriers to success is essential before Canada's supply chain can seek ways to mitigate risks and capitalize on its strengths.

4.1 Risks to the supply chain

Most of the risks identified were linked to the themes previously discussed. Fortunately for the supply chain, nearly all of the risks can be offset by either Canadian advantages or by sustained initiatives to support the supply chain and set Canada up for success. These risks include:

- Supply chain fragmentation
- Globalization
- Insufficient trust in "newer" technologies
- Lack of standardization

¹¹ ArcTern Ventures, [website](#)

¹² Sustainable Development Technology Canada, SD Tech Fund and Virtual Incubator, [website](#)

¹³ Export Development Canada, EDC Financing Solutions, [website](#)

¹⁴ FedDev Ontario, [website](#)

¹⁵ Western Economic Diversification Canada, [website](#)

Canada needs teamwork, based on commonalities and complementary capabilities, because it is no longer sufficient for the supply chain to focus on individual capabilities and differences. Protectionist, not-invented-here attitudes between suppliers can jeopardize Canada's opportunities to put forward an integrated solution that best meets customer needs. Panelists also pointed to collaborations between governments and industry in other countries as being a distinct competitive disadvantage for Canada, particularly with some nations taking nearly an activist approach to energy storage and clean technologies.

In the face of global competition, additional threats to the supply chain include a protectionist, not-invented-here attitude in some international jurisdictions, closing the doors to Canadian exports. This can be compounded when the host country's technology companies receive attractive incentives that can lead to hard-to-beat pricing. In some cases, a host country's incentives can reduce the risk for its companies to participate in more energy storage projects, which means Canada's competitors are gaining additional experience from those extra projects.

Participants felt the Canadian tendency to avoid risk can itself be a threat. In fact, many noted that Canada had much to gain by proceeding with projects that showed potential, even if that requires adopting less risk-adverse attitudes and business practices. Although Canadians expect warranties and guarantees before getting on board, a certain amount of trust is required for emerging sectors to flourish. Clearly, research, development, and most importantly deployment have roles to play in improving technology to heighten end users' trust in energy storage's reliability, efficiency and security. Certainly, without this level of trust, early adoption will not be sufficient to achieve economies of scale for Canadian companies to take their products, technologies and systems to the next level. Lack of trust also factors in at the consumer level, where negligible consumer or user awareness directly correlates to low levels of societal acceptance.

The current lack of standards causes increased project costs for Canadian companies because they must adjust technologies and products for every situation they encounter. For example, a company with a product that interfaces with an inverter may need to spend an inordinate amount of effort tweaking the inverter to address voltage and harmonic distortion. That effort costs the organization time and money, which could be better spent focusing on adding value to projects, meeting customer needs or searching for cost-cutting measures.

4.2 Homegrown advantages

Just as a component that fails can cause a system to grind to a halt, Canada's energy storage supply chain is only as strong as the weakest link in its chain. Although risks and areas for improvement exist, panelists were optimistic. In fact, throughout the keynote and panel sessions, the following competitive advantages surfaced as Canadian strengths to help address threats and seize market opportunities at home and internationally.

An obvious strength is Canada's global reputation for its abundant natural resources. Canada's

physical makeup provides other distinct advantages like presenting access to a mix of remote locations for microgrids, diverse population-density models and varied geography and temperatures (intense cold to high humidity). Each of these offer Canada's energy storage supply chain a confluence of opportunities to obtain experience that competing nations may lack.

In order to optimize the value from that experience gained, Canada can rely on its healthy appetite for innovation, supported by world-class research and technology organizations and a multitude of businesses with talented engineers, designers and installers. Having the right people with the right skills is an important asset, and getting those teams to collaborate across the supply chain is imperative for developing Canadian capacity.

“We [Canada] can now add value to the global market for energy storage because we have the right designers, right engineers and right capabilities.”

Stephen Brown
Director, Technologies, CSA Group

The trust of international markets was highlighted as both an essential quality for success and a Canadian advantage. Canadians have earned reputations as trustworthy suppliers and vendors, and that is further supported by Canada's brand, which can bolster confidence when seeking export opportunities and working with members of the global supply chain. The availability of government-to-government contracting gives international clients added reassurances by letting them access Canadian SMEs through direct guarantees with the Government of Canada.

Specific examples of Canadian leadership related to energy included managing a clean electricity grid and having Ontario as one of the first jurisdictions in the world to fully implement residential smart meters. Panelists encouraged participants to continue to foster leadership by: developing, demonstrating and deploying energy storage solutions; leveraging existing Canadian advantages; and, exporting Canadian knowledge and capabilities to global markets.

Shawn Cronkwright, Director, Renewables Procurement, Ontario's Independent Electricity System Operator, cautioned workshop participants that the entire supply chain and additional jurisdictions need to be involved if Canada is to maintain leadership in energy storage. He noted that Ontario has ample supply for the foreseeable future and must respect costs paid by ratepayers, so he urged developers to look beyond Ontario for additional opportunities.

5. Next steps

5.1 Recommendations

After thinking about what an ideal supply chain would look like in the years ahead, participants were asked to identify the similarities and differences between that ideal and today's situation.

In doing so, they combined their lists of “big ideas” in what equates to a list of the participants’ recommendations.

Strategies – Participants wish to set a common, long-term vision for energy storage to get all parts of the supply chain working together. They feel it is important to support that vision with a common model to define a product, a service and a standard, and outline how the storage system interacts with the grid. As a vital component of the long-term vision, participants want a technology-agnostic energy storage roadmap. In support of that need, NRC seeks collaborators for its Canadian Roadmap for Grid-scale Energy Storage project.

“It is important to recognize that in some instances Canada can play a really large role in social value for energy storage as implemented in a smart-grid environment, for example, for first responders, hospitals, schools, which would be available 24/7, even in remote regions.”

Stephen Brown

Director, Technologies, CSA Group

Cut costs and look beyond Canada’s borders –

Competition and customer needs necessitate a sustained effort by everyone in the supply chain to seek ways to reduce costs. These efforts also serve to prepare the supply chain to export Canadian energy storage solutions to global markets.

Codes, standards and regulations – Rather than completely standardizing everything from parts to systems from the outset, participants felt there was value in starting by figuring out key applications, and then standardizing aspects relative to those applications. As part of the standardization process, safety for all (for consumers, for workers, in buildings and the grid) was considered a priority. To that end, NRC is looking for participants to be involved in the Canadian Energy Storage Codes and Standards Roadmap.

Interoperability – Members of the supply chain are eager for everything to work well together, but with flexibility for solutions to be offered by market, application and geographic location. Integrated planning tools and enhanced procurement tools that factor in energy storage could contribute to gains on this front. Interoperability also requires information sharing, so participants recognized the need to develop a platform containing demonstration data about projects, lessons learned and how energy storage technologies and products were used, with cases spanning electric, thermal, passive solar, hydrogen and natural gas.

Rewards and accountability – Based on successes in other countries and jurisdictions, participants want federal and provincial governments to establish mechanisms to reward or incentivize members of the supply chain for embarking on value-added projects. They also want to see a move toward full-cycle ownership of projects or products, from planning phases through to decommissioning.

5.2 Actions

Following the panel presentations and breakout sessions, participants noted that they wished to stay connected, and possibly meet annually to encourage connections and collaborations between members of the energy storage supply chain, regardless of their technology focus or geographic location. This included staying in touch with research and technology teams at NRC, teams at Energy Storage Ontario, MaRS and other enabling organizations.

The participants were also keen to engage on the international stage, including with standards-setting communities, to better understand future requirements and to keep Canada plugged in for potential export opportunities.

“I’m not sure there is anything with more growth potential for Ontario and renewable energy than development and commercialization of storage technology.”

The Honourable Brad Duguid
Minister of Economic Development,
Employment and Infrastructure
Government of Ontario

