
LTEP Deck: Innovation (Smart Customer, Smarter Grid)

Minister's Briefing
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CONFIDENTIAL DRAFT

Summary of Proposed LTEP Initiatives

Part 1 – Distribution System Innovation

1. Distribution Grid Modernization
2. Expansion of the Smart Grid Fund Program
3. Opportunities for Energy Storage
4. Low-Emission Vehicles

Part 2 – Sector-Wide Innovation

5. Exporting Expertise
6. Nuclear Innovations

Part 1 – Distribution System Innovation

1. LTEP Actions
2. LTEP Commitments
3. LTEP Storyline
4. Distribution System Innovation Appendix

LTEP Actions

1. Grid Modernization

- a. Ontario could create the environment to optimize investments in the smart grid and further modernize the distribution sector. The OEB could also be directed to require modernization plans from LDCs during rate filings and encourage information sharing between utilities and within the industry to make best use of learnings to date.

2. Smart Grid Fund

- a. The SGF could be renewed to continue supporting modernization and make Ontario a global innovation leader. Investments will be targeted to provide the greatest value. The program will be expanded to cover the energy sector broadly, but will focus on building on the momentum already created by SGF investments to date.

3. Storage

- a. The Ministry is making regulatory changes to update rules that create unfair barriers to storage technology.
- b. The OEB and IESO could also be directed to address other regulatory and market barriers, as well as rules that prevent utilities from capturing the full value of storage.

4. Electric Mobility

- a. Just like smart meters create the foundation for grid modernization, “smart charging” creates the foundation for minimizing potentially impacts at the edge of the grid. The Ministry / OEB will remove the barriers for utilities to provide smart charging as a service to better manage these impacts and avoid costly system upgrades.
- b. EV information is critical to better decision making and avoiding impacts. The Ministry will work with partners to share data where possible and coordinate activities to minimize these impacts and potentially enable utilities to provide more services to customers with EVs.

1. Distribution Grid Modernization – Policy Tools

LTEP Language and OEB Directive

- The Ministry would articulate in the LTEP a vision for Grid Modernization. This would include graphics to enhance general literacy of the topic, a set of principles and expected outcomes to guide a policy framework, and some reference to how Ontario differs compared to other leading jurisdictions like New York and California.
- To enact this policy framework, the Ministry would provide direction to the OEB to investigate and/or remove market and regulatory barriers to innovation, to encourage optimal investment, and to promote culture of innovation in the distribution sector. Direction options would include:
 - Providing clarity to LDCs on the treatment of smart grid and grid modernization investments, and address the diffusion of benefits problem that inhibits non-wires alternatives. Actions include, but are not limited to:
 - Establishing a formal framework for evaluating the costs and benefits of grid modernization activities, which accounts for the positive externalities generated by grid modernizing activities that accrue to other actors in the sector, and;
 - Establishing a means for LDCs to be compensated for the positive externalities that grid modernizing assets provide.
 - Requiring that LDCs include long-term system / business modernization plans in future cost-of-service filings.
 - Exploring means to encourage and fund research and development activities for LDCs, considering the possibility for:
 - A pooled fund focused on deployable smart grid technologies, which would include regulatory oversight and mandatory information sharing; and/or
 - LDC specific research and development activities focused on customer-centric innovations.
 - An information sharing mechanism on grid modernization activities among LDCs.

LTEP Commitments (con'd)

2. Smart Grid Fund

- Several Ontario-based innovators credit the SGF for their growing international success. Our learnings from SGF to date have revealed where are the barriers to innovation and what's needed to take modernization to the next level.*
- The SGF could be renewed with an expanded scope and more targeted investments that will move the yardstick on modernization. While continuing to support technology demonstrations, SGF would expand to support deployments (potentially via equity funding) as well as more targeted capacity funding.
- Through the renewed SGF, the Ministry would like to pursue several key projects / initiatives:
 - i. **EV data gathering deployment** – project that will generate critical data for EV policy.
 - ii. **Non-electricity demonstration / deployment** – this would broaden the SGF scope. Initiatives could include power-to-gas and district energy solutions
 - iii. **Turn-key grid solutions** – encourage innovators to collaborate and develop complete smart grid solutions that align with utility needs and demonstrate a clear business case that would pass the OEB sniff test.
 - iv. **LDC collaboration on modernization plans** – this would help change the 'innovation aversion' culture.
 - v. **Transactive energy deployment** – innovative jurisdictions are deploying models that enable highly advanced customer choice options.
 - vi. **International demonstrations** – showcasing successful Ontario technologies internationally. (see sections on Exporting Expertise for further details)

*There will be several vignettes to showcase successful SGF graduates. Many will be located in this chapter, but they will also be featured in the Conservation section and the Customer Choice section.

LTEP Commitments (con'd)

3. Storage

- Storage technology is very unique from anything else on the system – it both generates and consumes power. Because of this characteristic, it doesn't fit neatly into existing regulatory and market rules.
- Ontario is taking steps to update these rules so energy storage can be introduced onto the grid where it makes technological and economic sense. These measures include:
 - Regulations are being amended to address the “double counting” issue with global adjustment (GA), which is levied on storage providers when the system is charged up, but also on the end customers after the storage system puts the power back into the grid.
 - The OEB could be directed to investigate a very similar issue that arises with network charges to energy storage facilities.
 - The IESO could review charges in the application of wholesale market charges for storage.
- The recently released independent study on the value of storage showed us that there are significant opportunities for storage behind-the-meter. However, to capture the full value of the storage, we need to overcome barriers to new and innovative relationships between utilities and customers to share and benefit.

LTEP Commitments (con'd)

4. Electric Mobility

- Transportation is one of the largest contributors to GHG emissions. To curb climate change, Ontario is moving forward on a range of initiatives that move us to a low-emission transportation economy.
- Electrification of transportation means grid impacts. These will be felt most at the edge of the grid – most personal EV charging happens at home, and more EVs means more grid upgrades.
- There is a lack of information and data related to how EVs will impact the grid. LDCs do not have the information to know how best to utilize EVs as part of their systems or how EVs will directly impact their systems.
- Working with its ministry and agency partners, the Ministry of Energy would:
 - Help to remove regulatory barriers for utilities in investing in residential smart charging. The Ministry will need to work with OEB and other entities (Plug n' Drive) to identify the barriers and cost effective solutions. Regulatory solutions could include LDCs ratabasing some of the infrastructure related to EVs.
 - LDCs are already testing unique commercial arrangements with customers to provide this service, reducing costs for customers and avoiding the need for transformer upgrades.
 - Further, jurisdictions with high EV penetration are already seeing the effects of “clustering” on the grid, and some are making the investments to avoid these problems.
 - Develop a strategy for integrating vehicles to the grid. Smart charging provides a critical foundation to achieving this goal, which ensures that the full benefits of EVs are realized.
 - Share EV information across government and with utilities so they can provide better services and ensure that costly grid problems are avoided before they happen.

LTEP Storyline

- *Changing technology has enabled much more customer choice.*
- *Smart meters have been critical to creating this range of choice. Smart meters are also the critical foundation for a modern distribution grid.*
- *Ontario is an international leader on advanced metering infrastructure deployment (AMI*). We are still one of the few jurisdictions with universal deployment.*
 - *When most other jurisdictions talk about modernization, they are still talking about AMI.*
 - *When Ontario talks about modernization, it is about optimizing the traditional and new technologies – making the best use of them to improve efficiency and provide better services to customers, residential and commercial / industrial alike.*
- *There are barriers to modernization and innovative technology. These barriers are predominantly:*
 - *Regulatory – codes, rules, and procedures prevent innovation from happening.*
 - *Cultural – tradition and risk aversion prevent innovative thinking.*
 - *Market Rules – new technologies do not fit neatly into existing rules.*

*AMI includes smart meters and other infrastructure needed to collect and relay data to a central collection point. In Ontario, the data is collected by LDCs, which then send to the Smart Metering Entity for TOU processing.

LTEP Storyline (con'd)

- *Some American states have taken aggressive approaches to reforming and modernizing their systems (e.g. New York, California). While demonstrating some international leadership, these reforms are expensive and prescriptive.*
- *Ontario will take a different approach to modernization. It will remove barriers and create the right incentives for utilities to choose the technologies that will:*
 - *Provide better service to customers and enable more choice,*
 - *Improve system efficiency and incentivize decisions that save money, and*
 - *Optimize existing and new distribution grid assets (e.g. powerlines / transformers, distributed energy resources).*
- *The time for modernization is here. The technologies exist. Customers want more choice. Grid resiliency is being challenged by climate change. Prices will continue to grow if LDCs focus on traditional investments that optimize returns instead of optimizing service.*
- *Ontario will enable this change by working with the OEB, LDCs, and other agencies and stakeholders to remove barriers, create the right incentives, and change from a culture of status quo to a culture of innovation.*
- *The LTEP will include graphics to introduce what Grid Modernization really means – the core technologies, the key objectives, and what it means for customers.*

LTEP Storyline (con'd)

What is a modern distribution grid? How does it differ from a traditional grid? What is the benefit of modernizing?

- *Grid modernization is, at its core, about making the grid digital. Being digital means more data is collected, analyzed, and turned into useful information for people that operate the grid.*
- *For utilities, this means making sensible investments in new hardware and software to improve their systems and provide better services. For customers, this means a range of things:*
 - *There is much more choice enabled by a modern grid. Customers can generate power, net meter, see their power consumption in near real time, and soon will be able to choose the rate plan that suits their needs.*
 - *The system is more reliable and resilient. Utilities have much greater visibility of their system to identify, predict, and fix problems. These fixes can be automated, and new software can make it much easier for utilities to manage the grid.*

Traditional Grid:

- Wires, poles, transformers – power flows in one direction to customers
- Very limited visibility – field staff must periodically check assets to determine health of system
- Analog meters – must be checked manually; customers can't see consumption data

Modern Grid:

- Storage / EVs / DG / CDM / DR – more tools for customers to participate and utilities to optimize their assets
- Much greater visibility – health of system is monitored remotely
- Smart meters – give customers more tools to track and manage energy use and potentially enable more services

Part 2 – Sector-Wide Innovation

Exporting Expertise
Nuclear Innovations

Exporting Expertise

5. Exporting Expertise - Overview

- LTEP 2017 is an opportunity to commit to develop initiatives to support Ontario companies to export their products and services.
- Exporting can help companies build on their successes at home and also expose them to global competition and best practices, which in turn incents further innovation to remain competitive.
- In the LTEP, the section on exporting expertise could include two streams.
 1. **Profiling Trade Supports** that highlight the Ministry's support for energy companies to reach new markets.
 - This showcases existing work undertaken by the Ministry including producing market intelligence, participating in energy missions led by the Ministry of International Trade (MIT), and promoting Ontario's technical expertise at international forums.
 2. **Commit to develop an International Demonstration Fund** that would support the demonstration of Ontario technologies abroad.
 - Grant programs run by the Ontario or Federal Governments do not typically consider international projects to be in scope.
 - With this fund, ENERGY would help to fill the current program gap by considering the potential benefits of supporting the demonstration of Ontario technologies abroad in collaboration with the Federal Government.

5. Exporting Expertise – LTEP content

- In developing its current suite of trade supports, ENERGY has already built relationships with federal and provincial trade leads, including Global Affairs Canada and Ontario's Ministries of International Trade and Economic Development and Growth.
 - These partnerships have supported the Ministry in identifying potential opportunities for the Ministry to promote Ontario's energy expertise abroad (e.g. market intelligence, joining missions, B2B facilitation), existing trade supports for Ontario energy companies, and alignment with the Province's Going Global and Cleantech strategies.
 - ENERGY is continuing to develop market research, facilitate inbound and outbound missions, and identify international forums where Ontario can showcase its expertise.
- ENERGY would deepen its engagement with the federal government, including NRCan, in particular on an International Demonstration Fund to support proposed program design and potential funding or program delivery.
 - NRCan has indicated openness to this collaboration following the release of the 2017 Federal Budget, which included several funding announcements, e.g. the \$1.26B Strategic Innovation Fund, which includes technology demonstration for Cleantech.
 - ENERGY continues to consider the most appropriate mechanism to administer and deliver proposed international demonstration funding.
- ENERGY has continued to keep its finger on the pulse of companies' needs as well, through regular engagement with industry associations and local trade organizations such as the Toronto Region Board of Trade.

5. Exporting Expertise – LTEP Storyline

- *LTEP 2017 is an opportunity to commit to develop initiatives to support Ontario companies to export their products and services.*
- *Ontario's energy innovators – those with expertise in smart grid, renewables, nuclear and other technologies – are using the solid base they established in Ontario to export to other parts of the world.*
- *Ontario continues to be committed to the dynamic and innovative business climate that made this possible.*
- *Ontario's government provides vital programs and services that support companies looking to export, as do other organizations; however, during LTEP consultations, we heard from the Ontario energy sector that there is a larger role for Ontario to play in facilitating energy exports.*
- *Ontario will expand its role in supporting Ontario energy companies by working with our sector and trade partners to develop trade initiatives that strengthen international relationships and create new business opportunities for Ontario's energy companies, and promote Ontario's technical expertise abroad.*
- *Ontario will also develop a program that supports the demonstration of made-in-Ontario energy technologies abroad, collaborating with our trade partners to do so.*

Nuclear Innovations

Continuing to assess the feasibility and potential of Nuclear Innovations

Recommendation:

- **Exploratory:** The 2017 LTEP could highlight Ontario's continued interest in nuclear innovation which includes monitoring and researching the evolving energy landscape as it relates to new technologies and opportunities to support Ontario's nuclear industry.

Decision:

- The Ministry will continue to collaborate with the federal government in the promotion of research and development to support both energy and non-energy applications of nuclear innovations. These could include small modular reactors (SMRs), nuclear fuel research, nuclear fusion, hydrogen and nuclear technology spin-offs.
- The Ministry will continue to build relationships with key industry stakeholders to:
 - Foster innovation across the nuclear sector and maintain Canada's world-class science and technology capabilities; and
 - Promote Ontario's nuclear expertise domestically and globally.
- The Ministry will continue to assess the policy and regulatory considerations for nuclear innovations in Ontario, as well as exploring various forms of support for potential demonstration projects.

Continuing to assess the feasibility and potential of Nuclear Innovations

Considerations – Nuclear Innovations:

- **SMRs** – SMRs are a new generation of compact, factory-built and expandable nuclear power reactors with advanced safety features. SMRs can potentially provide benefits compared to current reactor designs such as a smaller footprint, more passive safety features, potential for economies of scale through mass production and reduced project/overbuild risk. SMRs can serve off-grid load to replace diesel power (e.g., 2 to 30 MW range) or provide grid-scale electricity generation (e.g., 30 to 300 MW range) on an incremental basis to adapt to changing energy demand.
- **Nuclear Fuel Research** – There may be opportunities in the future to pursue alternative nuclear fuels with the aim of reducing the volume and radioactivity of waste products. This could include technological innovations in recycling and reprocessing of used fuel or alternatives to uranium fuel for nuclear reactors (e.g., thorium).
- **Nuclear Fusion** – Fusion energy research has the potential to produce massive amounts of clean energy with minimal radioactive waste. Today, there are small-scale fusion energy research organizations in Canada: University of Alberta, University of Saskatchewan, General Fusion, Sylvia Fedoruk Canadian Centre for Nuclear Innovation, Alberta/Canada Fusion Technology Alliance.
- **Hydrogen** – Hydrogen is a low-carbon energy source that in the future could replace gasoline for transportation or natural gas for heating. Research is ongoing into applications for Ontario's nuclear technology in the large scale production of hydrogen (e.g., work is underway at the Hydrogen Laboratory at Canadian Nuclear Laboratories).
- **Technology Spin-offs** – Nuclear technology has other scientific applications such as the production of isotopes for medical diagnosis and treatment of life-threatening diseases (e.g., Cobalt-60), as well as for use in space exploration (e.g., heat and power for Mars rovers). Research is ongoing into opportunities for Ontario to expand its role in production and novel uses for isotopes.

Continuing to assess the feasibility and potential of Nuclear Innovations

Considerations – Federal Government and Industry Interest:

- The federal government recently signalled its continued interest in innovative nuclear technologies and their potential role in meeting Canada's climate change goals.
 - Canada's Mid-Century Long-term Low-Greenhouse Gas Development Strategy – The strategy, submitted as part of Canada's commitment to COP21, provides a basic framework for addressing challenges and opportunities for achieving deep emissions reductions in the mid to long-term with a focus on meeting climate-change objectives and enabling growth.
 - Among the proposed tools to help meet demand and GHG reduction targets, the strategy highlights a number of emerging nuclear technologies as discussed on the previous slide.
- The Canadian Nuclear Association (CNA) is also interested in exploring emerging nuclear technologies through the creation of a Nuclear Innovation Council.
 - Nuclear Innovation Council – To further explore the role emerging nuclear technologies in reducing GHG emissions, the CNA has proposed the creation of a Nuclear Innovation Council which would be a forum through which industry can talk with government practitioners and policy-makers in the area of industrial innovation and technology.
 - The aim of the Council would be to inform government policies relating to nuclear technology and to develop and support a Canadian Nuclear Innovation Agenda.

Part 1 – Appendix

1. Distribution Grid Modernization
2. Expansion of SGF Program
3. Opportunities for Energy Storage
4. Low Emission Vehicles
5. Exporting Expertise

1. Distribution Grid Modernization – Recommendations

Recommendation:

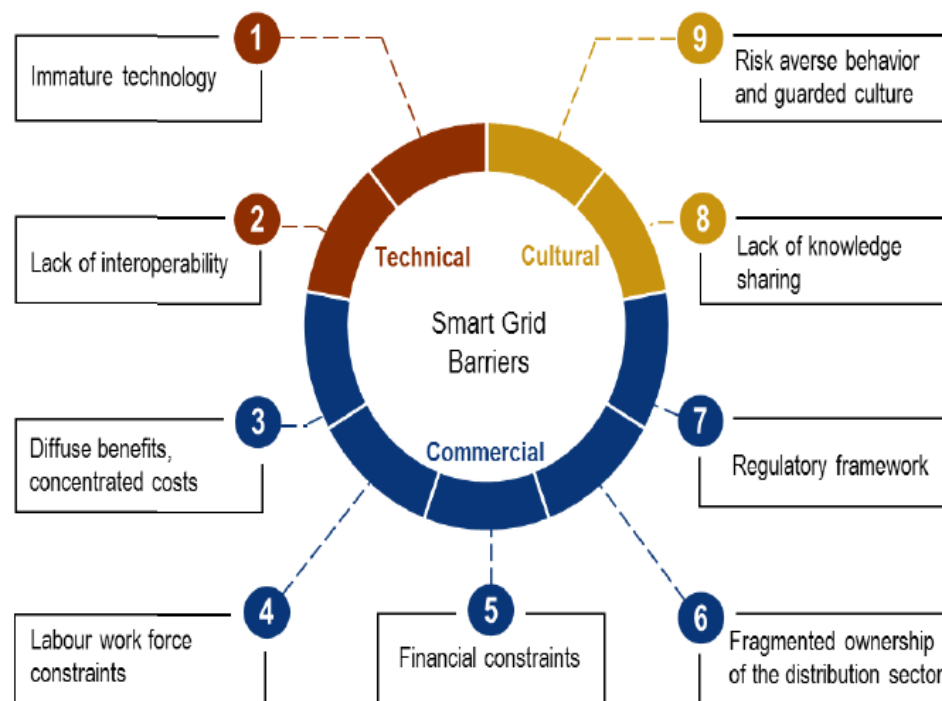
- **Decision:** The Ministry would articulate a vision for distribution grid modernization in LTDP, emphasizing the value created by using information technology to create a platform for an integrated, intelligent electricity distribution system.
- **Decision:** The Ministry would work to create the basic environment that enables utilities to choose the investments that make the most sense for creating efficiency, managing their systems, and serving customers better. This requires moving beyond traditional capital planning models that rewards more investment in “poles and wires” and deters investment in innovative technologies and solutions.
- **Direction:** The Ministry would articulate its intent to remove market and regulatory barriers to innovation in the distribution system. This could include, but is not limited to:
 - Addressing the diffuse benefits problem arising from smart grid investments to capture the full value of distribution sector innovation, including establishing a formal framework for evaluating the costs and benefits of grid modernization activities;
 - Requiring that distributors clearly communicate their expenditures on smart grid technologies and articulate a substantial, long-term grid modernization plan in cost-of-service rate filings;
 - Creating incentives for operational expenditures by distributors that defer upgrades or optimize the use of existing capital, which may include a regulated rate-of-return;
 - Exploring incentives for utilities to introduce new technologies that promote an integrated and intelligent grid ; and,
 - Moving to address the aversion to innovation and smart grid investment. -
- **Decision:** The Ministry could establish a mechanism to incent and encourage the sharing of grid modernization activities and regulatory experiences among Ontario’s distribution companies.
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1. Distribution Grid Modernization – Considerations

Considerations:

- Through the *Green Energy Act*, 2009, and the 2010 Ministerial Directive to the OEB, the government articulated its direction for the OEB to establish, implement, and promote a smart grid for Ontario.
 - Ministry research finds that the vision of an integrated, intelligent grid for Ontario has not yet been realized.
 - Since the introduction of the OEB's Renewed Regulatory Framework for Electricity Distributors, distributor asset planning shows little evidence of extensive exploration of smart grid technologies as opposed to traditional 'poles and wires' investments.
- The 2015 Navigant *Ontario Smart Grid Assessment and Roadmap* identified that continued investment in smart grid through 2035 has the potential to deliver a net benefit of \$6.3 billion to Ontarians.

Figure 5. Barriers to the Development of a Smart Grid



Source: Navigant

- Navigant also identified a number of technical, commercial, and cultural barriers that would inhibit Ontario's ability to realize the full value of continued smart grid investment, including Ontario's regulatory framework, a culture of risk aversion in the distribution industry, and a lack of information sharing among distributors on smart grid investments.
- A number of these barriers – including diffusion of benefits, the regulatory framework, and lack of knowledge sharing – are addressed by Ministry's grid modernization recommendations.

1. Distribution Grid Modernization – Considerations (con'd)

Considerations:

- Ministry research indicates that advanced communications and information technology infrastructure is required to realize the full value emerging technologies:
 - New distribution technologies are increasingly digital, using automation and grid information to optimize their operation.
 - Modern home and business energy management systems rely on intelligible information to make decisions on energy use.
 - Any exchange between customer technologies and the grid (like vehicle-to-grid or demand response) requires a communications infrastructure.
 - Sensors can also provide grid visibilities to areas that Ontario's distributors are typically blind to – low-voltage systems close to our homes and businesses. As DER is adopted, the visibility enabled by these sensors will be needed to maintain reliability and fully utilize these assets.
- There are a number of business models that may emerge in the distribution sector in the future – from “transactive energy” to “distribution system operators.”
 - What model will emerge for Ontario is unknown – it will be a function of local conditions, customer behaviour, regulatory decisions, and policy direction.
 - By implementing an information and communication technology platform – the one commonality between all of these models – the Ministry can enable the natural evolution of the electricity market, but not dictate it.
- Accordingly, grid modernization is about moving beyond isolated smart grid investments to an integrated, distributed, intelligent system that embraces a holistic view of innovation – from technology to business models. It is a comprehensive policy that touches on the role of the LDC, approaches to innovation, and customer choice.

1. Distribution Grid Modernization – Considerations (con'd)

Considerations:

- Conceptually, grid modernization can be seen as a “*platform*,” a foundation comprised of an information technology, including smart meters, sensors, data analytics, and advanced distribution management systems.
- The *platform* is inherently technology neutral: it provides the prerequisite infrastructure for advanced distributed energy resources, utility assets, and customer energy technologies but does not dictate those to be adopted.
 - Realize the full value of distributed energy resources and other innovative technologies, including realizing their full potential and minimizing potential negative impacts on the grid;
 - Enhance grid visibility and provide advanced data and analytics, increasing reliability, enabling better maintenance regimes, encouraging innovation, and promoting advanced asset planning; and,
 - Provide the information and infrastructure required to enable and support customer choice.
- The goal of the platform is to enable – but not direct – efficient outcomes in the distribution sector by providing a framework that enables utilities to optimize their asset and operational plans, and enables customers to make sound energy decisions.
- The platform enables a number of other Ministry outcomes, including:
 - The greater adoption of renewable energy (see LTEP Themes, Minister’s Briefing February 2, 2017);
 - Customer empowerment;
 - Enhanced conservation and energy efficiency outcomes (see Enhancing Commitment to Conservation Deck)
 - Virtual net metering (see Net Metering content in LTEP Themes, Minister’s Briefing February 2, 2017); and,
 - Reduction of emissions from the energy sector.

1. Distribution Grid Modernization – Collaborators and Costs

Collaborators:

Collaborator	Role
LDCs, OEB	Engage in ongoing discussions to consult and move forward on grid modernization. The OEB directive will have several components and will require engagement and close monitoring post-LTEP. It would be valuable to have ongoing engagement directly with LDCs to support implementation and get feedback on challenges / opportunities.
Ontario Smart Grid Forum	Continued participation in Forum as an expert body on grid modernization issues and opportunities.

Costs:

2017-2018	2018-2019	2019-2020	2020-2021	TOTAL
\$0M	\$0M	\$0M	\$0M	\$0M

- There is no significant cost associated with implementing the LTEP and OEB directives.
 - The goal of the platform is to enable – but not direct – efficient outcomes in the distribution sector by providing a framework that enables utilities to optimize their asset and operational plans, and enables customers to make sound energy decisions.

1. Distribution Grid Modernization – Risks / Considerations

Risk/Consideration	Strategy
Ensuring that the directive provides enough space for interpretation and implementation, but has enough specificity to meet government policy objectives.	• The 2010 Smart Grid Directive to the OEB has been operationalized through their Renewed Regulatory Framework (RRFE). The Ministry should communicate that as government refines its grid modernization policy to achieve more domestic uptake and innovation, some changes may be needed on the regulatory side to support these outcomes. • The Ministry will work with the OEB to find the appropriate balance.
LDCs may be concerned about Ministry interference in distribution system planning, and increased reporting obligations.	• The concept of a distribution grid modernization platform was endorsed by the EDA in their Power to Connect vision paper. • While some LDCs may be concerned about additional regulatory requirements that do not align with business interests, the overall goal of grid modernization policy is to enable decisions that make the most sense for individual LDCs.

2. Expanding the SGF – Considerations (con'd)

Recommendation:

- **Decision:** To build on previous success, an expanded SGF program is a policy tool which will continue to support the Ministry's goal of addressing barriers to grid modernization within the sector. The expanded program would be diversified to achieve a broader set of government policy objectives and ensure that government learns as much as possible about how new technologies work and how they can be commercialized.
 - IESO has limited experience with the distribution sector, which is a growing policy responsibility for the Ministry of Energy. Thus, rate-basing the program is not recommended.
 - This action is supported by Navigant's *Smart Grid Roadmap*, which states that there is a strong business case for continuing to invest in smart grid technologies through 2035.

Considerations:

- Over five years, the Ministry has developed in-depth knowledge and insight into cutting edge technologies and leveraged its learnings to identify both barriers to and opportunities to support distribution grid modernization.
 - For instance, in the most recent SGF round, investments were strategically made in high-value technologies identified in the Navigant Smart Grid Roadmap, specifically focussing on the technologies providing greater grid visibility. Grid visibility, in turn, is a focus of grid modernization.

2. Expanding the SGF – Considerations (con'd)

Considerations:

- A survey of SGF recipients and subsequent research indicates that there are a number of cultural and market behaviours that are impeding the uptake of grid modernizing technologies in Ontario.
 - While technologies may be market ready, developers are not working together to present complete solutions to utilities in a way that makes good business sense. There continues to be work required to ensure companies can be in a better position to market their technologies in the sector.
- The government has several initiatives in place to support innovation and advance economic growth. The Smart Grid Fund is the only one focusing on the electricity distribution sector, which has significant room to grow as smart meters are rolled out in other jurisdictions.
 - The SGF puts the Ministry in a strategic position to continue to encourage the adoption of -- but not dictate -- innovative processes, services, business models, and technologies as well as an awareness of innovation and best practices – a critical support for grid modernization policy.
- The SGF can be broadened to do more than electricity distribution innovation, helping to meet other government policy initiatives (e.g. climate change mitigation and adaptation, fuel switching, district energy systems).

2. Expanding the SGF – Implementation Timelines and Strategy

LTEP Document

- To meet the 2013 LTEP commitment to expand SGF, announce the next round of SGF in the LTEP.

Funding

- The Ministry would seek \$60M in new funding over a five-year period beginning in 2017-18 in order to meet LTEP 2013 commitment to expand SGF.
- Concurrently, partnerships for federal funding would be pursued. Budget 2017 announced innovation funding with a focus on smart grid. Early discussions with Natural Resources Canada (NRCan) indicate strong interest to defer to Ontario's expertise in using funds in Ontario, potentially through formal partnership. Discussions are ongoing.

Program Delivery

- The Ministry would develop program framework, guidelines, and application materials consistent with new TB authorities.
- Program would be modified to:
 - Account for significant sector expertise developed through previous SGF and target specific activities that will drive more domestic grid modernization,
 - Broaden the scope to include “energy” activities that have distribution grid elements (e.g. power-to-gas, district energy),
 - Incorporate other government policy objectives, including Cleantech Strategy, economic growth, and climate change mitigation / adaptation, and
 - Continue to ensure LDC participation and involvement in demonstration and deployment projects.
- SGF expansion could be vehicle to support international trade (see section 5) and Smart Distributed Generation (see Renewables deck).

2. Expanding the SGF – Collaborators and Costs

Collaborators:

Collaborator	Role
Sector Stakeholders	Consultations on program design, particularly on structuring more targeted calls for applications.
SDTC and NRCan	- Potential funding partner of specific projects – for NRCan, potential for formal partnership agreement. - Review of SDTC projects and their results to inform gap analysis on project results from SGF projects.
LDCs	Leverage learning from completed SGF projects. Engage LDCs in ongoing discussions on supporting demonstration projects on the grid.

Costs:

Year 1 2017-2018	Year 2 2018-2019	Year 3 2019-2020	Year 4 2020-2021	Year 5 2021-22	TOTAL
\$0M	\$20M	\$18M	\$15M	\$7M	\$60M

- There are no rate-based entities with the expertise to deliver on SGF / grid modernization policy objectives, or on broader government policies. Program should remain tax-based to avoid rate impacts.
- No funding required for the first fiscal year. However, contracts will be ready for execution early in 2018-2019.
- SGF could potentially be a vehicle to deliver funding for international trade activities and Smart Distributed Generation.

2. Expanding the SGF – Risks / Considerations

Risk/Consideration	Strategy
Expansion is approved at a reduced amount.	• The program design can be adjusted to accommodate lower funding levels, however this may reduce the impact of the program on meeting grid modernization policy objectives, which have no costs identified. • Potential partnerships with NRCan and / or SDTC could be leveraged to optimize the value of a lower SGF amount.
Federal smart grid investments in Ontario are made independent of provincial guidance / input.	• The Ministry is developing strong relationships with federal counterparts. NRCan may wish to pursue a formal partnership, which typically defer to provincial / territorial decisions on project selection. An MOU can be explored with SDTC to ensure collaboration.
Tighter financial requirements may limit the ability to transfer funds between fiscal years.	• The proposed budget accounts for fiscal year issues (e.g. \$0M in 2017-2018). Given significant experience in program delivery, future rounds of funding will follow strict timelines to ensure agreements are executed on time and potential project issues are mitigated as early as possible.

3. Learning from Energy Storage – Recommendations / Considerations

Recommendations:

- **Decision:** Ensure there are no market or regulatory barriers for storage technology to participate in Ontario's market. The Ministry should continue to work with agencies and stakeholders to address regulatory barriers to commercial deployment of energy storage technologies, either onto the grid or behind the meter.
- **Direction:** Direct OEB and IESO to continue to work with storage companies to ensure no unfair barrier exists.

Considerations:

- Ministry analysis to date is that there is not a specific need for a policy framework focused on storage deployment in Ontario. At this time, technology costs and system needs do not align.
- Nonetheless, there are potential value streams from storage technology on the system, and prices continue to drop. As such, the Ministry should continue to work with agencies and stakeholders to address regulatory barriers to commercial deployment of energy storage technologies.
- Storage projects that were awarded contracts in the first phase of the IESO procurement were expected to be in service by end of 2016. None are yet in service and it is likely that some will request extensions to their contracted timelines. Storage projects that were awarded contracts in the second phase of the IESO procurement are not expected to enter service until early 2018.
- The Ministry agrees with IESO that future procurements for system services (such as regulation services) should be technology neutral, and storage providers should be encouraged to participate in tenders alongside alternative service providers.
- As energy storage costs fall and become competitive with other technologies in the provision of system services, the Ministry should continue to work with agencies and stakeholders to address regulatory issues that might create barriers to the deployment of commercial energy storage projects.

3. Opportunities for Energy Storage – Policy Tools

LTEP Content

- The LTEP should reflect on all the work done to date on energy storage, point to where there are real opportunities for the technology (e.g. behind-the-meter, market renewal), and confirm that the Ministry will work to remove market and regulatory barriers, including those identified under Grid Modernization (e.g. diffuse benefits).
- The independent storage study procured by the Ministry provides a very clear signal of behind-the-meter opportunities for this technology – meetings with storage companies have confirmed this.

OEB Directive

- Direct OEB to review the application of network charges to energy storage facilities and, if appropriate, bring forward recommendations for changes to the transmission and distribution codes to ensure equitable treatment of energy storage facilities.

IESO Direction

- Direct IESO to review the application of wholesale market charges to energy storage facilities and, if appropriate, bring forward recommendations for changes to the market rules to ensure equitable treatment of storage facilities.

Regulatory Changes

- Propose regulatory amendments (potentially to O.Reg. 429/04 under the Electricity Act) that will address duplication of Global Adjustment charges associated with certain grid-connected storage devices.

3. Opportunities for Energy Storage – Collaborators and Costs

Collaborators:

Collaborator	Role
OEB	The OEB would be responsible for adjusting network codes as appropriate to implement the directive.
IESO	The IESO would be responsible for initiating market rule change procedures to implement the direction. The IESO will also continue work on Market Renewal, which will be a vehicle for future storage procurements.
Energy Storage Canada (ESC)	ESC will continue to be engaged for perspectives on proposed changes, and to continue discussions on identifying other barriers that unfairly create competitive disadvantage for the storage industry.

Costs:

2017-2018	2018-2019	2019-2020	2020-2021	TOTAL
\$0M	\$0M	\$0M	\$0M	\$0M

- There is no significant cost associated with implementing either the directives or making regulatory changes. Any costs will be related to agency implementation of the regulatory changes, which are expected to be part of day-to-day business activities.

3. Opportunities for Energy Storage – Risks / Considerations

Risk/Consideration	Strategy
Multiple work streams may deliver inconsistent amendments to the various charges under review.	The Ministry will coordinate activities and ensure, through the directive / directions and regulatory changes, that affected parties must work together to ensure consistency and compatibility in changes to market and regulatory rules.
Industry may become impatient with time taken to review and implement any necessary changes.	- The Ministry will reiterate that work is underway as per the LTEP commitments. The LTEP will also flag where independent research has identified the most significant opportunities for storage deployment (behind-the-meter with commercial / industrial customers). - Implementing Grid Modernization will also support the industry but helping to address other regulatory barriers (e.g. accounting for the full value of storage by observing / compensating for diffuse benefits).

4. Low Emission Vehicles – Recommendations

Recommendations:

- **Decision:** The Ministry would develop a vehicle to home / grid integration roadmap that reflects the potential benefits of leveraging EV batteries to provide benefits to the home and to the grid.
- **Decision:** Work with other ministries on the implementation of EV initiatives under the CCAP to ensure that grid impacts are identified and mitigated, and any grid benefits are optimized.
- **Exploratory:** The Ministry would continue working with industry and ministry partners to identify other ways that it can support the uptake and integration of electric and low-carbon (i.e., hydrogen fuel cells, biofuels and natural gas) mobility in the province.
- **Decision re: Low Emission Fuels:**
 - Recognize that there are multiple alternatives for low-carbon transportation fuels and vehicles and that not all solutions are applicable in all parts of the province. Transportation is a system -- low emission vehicles often require infrastructure investment and fuel availability to be used and adopted.
 - Continue work on the green commercial vehicle program to support the purchase of a range of alternative fuel vehicles and low-carbon technology, and a four-year limited incentive program for LNG or CNG-fuelled trucks. (NOTE: ENERGY is not the lead.)
 - Continue work on the fuelling infrastructure program for commercial motor vehicles that will establish a network of natural gas, recovered biogas, hydrogen and electric charging stations, as needed.

4. Low Emission Vehicles – Considerations

Considerations:

- **General:** There is no government policy lead for low emission transportation. However there are positive interministry relationships to ensure information sharing and cooperation. Thus, if there is a desire for the Ministry to carve out a broader role in this sector, it has a strong basis upon which to work with other ministries.
- **Vehicle to home / grid (V2X) Roadmap:** The technology needed for these applications is being tested, but commercialization of solutions has not achieved scale. The Ministry has started a detailed investigation to create the Roadmap, but at this time, the LTEP should only provide indicative wording.
 - However, V2X is an excellent example of grid modernization technology, and could be treated as a vignette under this broader theme.
- **Low Emission Fuels:**
 - Green Commercial Vehicle Program: The CCAP allocates \$125-170 million for this program.
 - Network of Low-Emission Fuelling Stations: The CCAP allocates \$75-100 million for this program.
 - Other measures: CCAP also proposes to boost renewable content in fuels, pilot programs for use of waste methane as a transportation fuel and assist fuel distributors to offer high-blend sustainable biofuels (**Note:** MOECC is responsible for renewable fuel standards).

4. Low Emission Vehicles – Policy Tools

LTEP Document

- Smart Charging:
 - The Ministry would create the environment for utilities to work directly with EV customers using smart charging technology. This will require working with the OEB (potentially via directive) to enable utilities to provide smart charging as a service, reducing the potential impacts at the grid edge and avoiding potentially costly system upgrades.
 - Smart charging is optimized when EV data is shared between ministries and with utilities (see Electric Mobility below). It also provides the foundation for vehicle grid integration (below).
- Vehicle-Grid Integration:
 - The LTEP would introduce the concept of Vehicle-Grid Integration (VGI), which is an excellent example of how Grid Modernization provides benefits to customers and utilities by leveraging EV batteries. The LTEP would signal at a high level how the Ministry will approach the development of a VGI Roadmap, which would be developed post-LTEP. Develop a vehicle to home / grid integration roadmap that reflects the potential benefits of leveraging EV batteries to provide benefits to the home and to the grid.
 - This activity aligns very closely with Grid Modernization and directly addresses one of the EV Climate Change Action Plan commitments.

4. Low Emission Vehicles – Policy Tools

LTEP Document

- Electric Mobility:
 - The Ministry would use the LTEP to clearly define its role in electric mobility, which includes passenger vehicles, transit, and commercial / industrial applications. This approach will be based on the Ministry of Energy's legislative mandate to a) review all energy matters in relation to the energy needs of the province, and b) make recommendations on the effective coordination of all energy matters within the Government of Ontario. The LTEP could include specific activities, such as:
 - Working with other ministries on the implementation of EV initiatives under the CCAP to ensure that grid impacts are identified and mitigated, and any grid benefits are optimized.
 - Examining how to enhance, support, and encourage planning of mass transit electrification in a way that promotes early engagement and involvement of key electricity sector stakeholders.
 - Working with other ministries to gather and analyze data / information on electric vehicle use to support EV policy decisions across government.
- Low Emission Fuels:
 - The LTEP would acknowledge alternative fuels for transportation as another opportunity to reduce emissions.

4. Low Emission Vehicles – Collaborators and Costs

Collaborators:

Collaborator	Role
Other ministries	- Ministries will be engaged regularly to provide support on implementation, ensure energy sector stakeholders are engaged, and gather / share data. - Includes MTO, MOECC, MOI, MOH, MGSC, MEDG
Agencies / NGOs	- Ontario Power Generation has signaled significant interest in supporting electrification of transportation. As a main supporter of Plug'n Drive, there are potential opportunities for collaboration. - The OEB's dynamic pricing program under the RPP Roadmap is underway – this could potentially be leveraged for EV policy / programs.
LDCs	Some LDCs have strong interest in developing their own EV initiatives, being more involved in government policy and program design, and potentially being involved earlier in the municipal planning process for electrification projects.

Costs:

2017-2018	2018-2019	2019-2020	2020-2021	TOTAL
\$0M	TBD	TBD	TBD	TBD

- Potential costs associated with enabling smart charging are not known. Any framework to encourage smart charging would encourage investments where they make economic sense.

4. Low Emission Vehicles – Risks / Considerations

Risk/Consideration	Strategy
Ministries may be reluctant to work collaboratively on information sharing and receiving support from ENERGY on respective LEV activities.	- The Ministry has established strong working relationships across all ministries. ENERGY will continue to leverage these relationships and use the LTEP to support an enhanced role for the Ministry in transportation electrification policy. - Data availability concerns could potentially be addressed through a targeted SGF call for applications that focuses on data gathering for electrified transportation, particularly regarding personal vehicles.
Proposed activities do not align with the Ministry's mandate and authorities.	Any LEV policy / program initiatives will be evaluated against the Ministry's legislative mandate to ensure alignment.
Too much focus on electricity, when alternative fuel transportation is also a nascent industry.	Of the 92 CCAP initiatives, 30 are focused on low-emission vehicles, and 28 of those are electric. It would be consistent with Ontario's current approach to focus on electricity as a fuel while continuing to consider ways to support alternative fuel options / initiatives, where appropriate.
Rate-base pressures from smart charging.	Enabling LDC smart charging may have rate-base impacts, but those investments are intended to avoid potentially more costly transformer / system upgrades.

Exporting Expertise – Implementation Timelines and Strategy

Direct Ministry Implementation

- **Trade Supports:** Ministry to continue its work to facilitate trade. Continue engagement with Global Affairs Canada (GAC) and MIT to identify potential opportunities for the Ministry to promote Ontario's energy expertise abroad (e.g. market intelligence, joining missions, B2B facilitation).
- **International Demonstration Fund:** Ministry could take steps to develop a new funding program administered by the ministry.
 - Ministry could also engage the federal government on program design and potential funding or program delivery collaboration following the 2017 Federal Budget announcement of the \$1.26B Strategic Innovation Fund (which includes technology demonstration for Cleantech).

Trade Supports

Milestone Date	Milestone Activity
Ongoing	ENERGY to continue to develop market research, facilitate inbound and outbound missions, and identify international forums where Ontario can showcase its expertise and partner with other ministries, agencies and industry associations as appropriate.

International Demonstration Fund

Milestone Date	Milestone Activity
Spring/Summer 2017	ENERGY to engage with the federal government and partner ministries to scope the parameters of the fund.

Exporting Expertise – Collaborators / Costs for Trade Supports

Trade Supports Collaborators:

Collaborator	Role
MIT, MEDG	Support to align ENERGY's trade supports with the Province's Going Global Strategy (MIT) and the Province's Cleantech Strategy (MEDG).
GAC, NRCan	Advise ENERGY on possible areas of collaboration for initiatives supporting energy-sector trade (e.g. GAC trade commissioner services, NRCan innovation programs), or existing resources that could be better promoted to the energy sector (BDC, EDC).
Industry Associations, Toronto Region Board of Trade (TRBOT)	Identify needs within the sector to support companies' export work (industry associations), and potential target areas for energy sector exports (TRBOT).

Trade Supports Costs:

2017-2018	2018-2019	2019-2020	2020-2021	TOTAL
~0	~0	~0	~0	0

- Costs are expected to be minimal – most costs incurred would be as needed, for trade mission support and would be managed internally to the ministry.

Exporting Expertise – Collaborators / Costs for International Demonstration Fund

International Demonstration Fund Collaborators:

Collaborator	Role
NRCan, GAC	Potential partnership to design parameters of the fund, or coordinate joint funding (NRCan); provide some implementation support for individual projects – e.g. GAC trade network could support on-the-ground due diligence or project implementation/promotion.
MIT, MEDG	Advise on fund design/eligibility criteria to minimize overlap/duplication with existing provincial programs (MIT, MEDG).
Industry Associations	In response to LTEP submissions calling for funding to support demonstration projects, may be consulted on final program design/eligibility criteria.

International Demonstration Fund Costs:

2017-2018	2018-2019	2019-2020	2020-2021	TOTAL
\$0	TBD	TBD	TBD	TBD

- The total funding envelope would be subject to internal approval, and informed by discussions with the Federal Government and other stakeholders outlined above.
- The fund could be delivered through a SGF mechanism.

Exporting Expertise – Risks / Considerations

Trade Supports

Risk/Consideration	Strategy
Potential concern about duplication of trade supports from stakeholders	Ongoing engagement with Ontario ministries and other stakeholders to identify existing supports and align existing initiatives to mitigate this risk.
Metrics to demonstrate value of trade activities not fully developed at this time.	Ministry would work with MIT and GAC to develop appropriate metrics to measure the success of various trade supports.

International Demonstration Fund

Risk/Consideration	Strategy
Stakeholders may raise concerns that the overall envelope is small and the program is slow to rollout	- Fund could be positioned as a time-limited pilot with review to inform potential rounds. Concerns could be addressed by announcing the total envelope in 2017-18. - Immediate work to follow on development of fund parameters, identifying synergies with potential partners, etc.
Limited interest from NRCan or Trade Commissioner Service in providing on-the-ground support	- Federal participation is not required to proceed with the fund. - Program could focus solely on those markets where Ontario has representatives posted during initial launch.