

IESO 2016 Annual Report

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Section 1 | IESO Corporate Profile

Corporate Profile

Vision: Powering a reliable and sustainable energy future for Ontario

Reliability -- it is at the heart of everything the Independent Electricity System Operator does -- from managing the flow of electricity across Ontario in real time, to planning and procuring for the province's emerging and future energy needs, and leading a culture of conservation. The IESO has a broad mandate and uses its unique position in the power system to ensure reliability for the next five minutes as well as for the next 20 years.

With this broadened mandate, the IESO has a unique opportunity to engage with a broad cross-section of Ontarians, from market participants to residential consumers. As it works to shape a more sustainable and reliable electricity system, the IESO strives to be a trusted source of transparent, accessible and timely electricity sector data and information. The IESO values the diversity of its stakeholders and the communities with which it engages as they assist the organization in making informed decisions and continues to find avenues for broader collaboration. It applies engagement principles to its broad range of initiatives to ensure stakeholders and communities have the opportunity to provide input on matters that significantly impact them.

IESO Strategic Plan, 2016-2020

In 2016, the IESO released a five-year corporate strategy centred on its vision, mission and corporate values. The *IESO Strategic Plan 2016-2020* describes some of the opportunities and challenges the organization expects to face in the coming years. It considers a range of environmental factors that are expected to affect the organization, including climate change, emerging technologies, operability challenges, consumer engagement and cybersecurity, among others. The strategic plan provides a roadmap for the IESO's activities over the next five years. It will help set the priorities for the organization and inform the development of the IESO's annual business plans.

This annual report, *title*, includes a look at some of the core initiatives that the IESO undertook in 2016, as well as a look forward to the coming year and beyond – all structured around three overarching strategic goals:

- Deliver superior reliability performance in a changing environment
- Drive to a more efficient and sustainable marketplace
- Be recognized as a trusted advisor, informed by engagement

2016: Ontario's Electricity Sector At a Glance

36,070 MW Installed capacity	23,213 MW Highest recorded peak on September 7, 2016
4.9 million Customers served	137 TWh Total 2016 Ontario demand
21,858 GWh 2016 total exports	7,995 GWh 2016 total imports
\$14 billion Annual financial transactions in IESO wholesale market	392,000 MWh Net energy savings from conservation programs delivered by LDCs and the IESO
\$1.66/kWh Weighted wholesale price of electricity (Hourly Ontario Energy Price)	\$9.66/kWh Global adjustment Class B rate as of December 31, 2016

Section 2 | Letter from the President & CEO and Chair

During 2016, we continued to see accelerated change and transformation across all reaches of the electricity sector. From micro-grids to the continued adoption of new energy technologies, our system is evolving in a way that is enabling more customers and stakeholders to play a more active role in the production, management, delivery and use of electricity. For the IESO, 2016 further underscored the organization's ability to adapt to a changing energy landscape and the important role it will play in the ongoing evolution of the sector.

The IESO's 2016 Annual Report outlines the strategic objectives and achievements of the IESO together with its industry partners. It also describes how we will continue to provide superior reliability in a changing environment, create a culture of conservation in Ontario and renew our electricity markets, all while working with our stakeholders and communities.

Establishing the IESO's 2016-2020 Strategic Plan was an important milestone in the evolution of the IESO, one that both defines the organization's goals and strategic objectives and establishes a framework for how the IESO will evolve to meet the growing energy needs of Ontarians. For the IESO, providing public value is a core priority in our rapidly evolving sector.

The IESO is the steward of a system that supports all Ontarians. In this year's report, we outline active initiatives and engagements, but equally important, we identify how you can get engaged. The next chapter of Ontario's electricity sector is already being written, and it's one in which many customers and stakeholders are playing an increasingly key role.

To navigate this transition over the coming years, our decision-making relies on the guidance and collective views of customers, large and small, commercial and residential, communities and stakeholders, as well as our industry partners.

Strengthening the future framework of Ontario's energy system will also be enabled through robust planning and implementation. In September 2016, the IESO published an Ontario Planning Outlook, a 20-year outlook for Ontario's electricity sector. Looking forward, the IESO will be developing an implementation plan to support the upcoming Long-Term Energy Plan, and completing a mid-term review of the Conservation First Framework. This work is aimed at better preparing the IESO and the sector generally for the future challenges and opportunities coming our way.

Through the market renewal initiative, the IESO is proposing to redesign Ontario's wholesale electricity markets to provide greater transparency, promote competition and deliver more efficient outcomes. This project will engage a wide range of stakeholders, external resources and business units across the IESO.

Supporting transformation also means ensuring that we are investing in our people and processes to meet the needs of the sector. Succession planning and continued capability building will assist us in becoming a more agile and resilient organization.

The coming year also brings additional change to the structure of the organization with the transition to a new President and Chief Executive Officer, who will lead the IESO's efforts to achieve its mandate and strategic objectives for the balance of this year and beyond. We welcome XXX to the IESO/role (include if available)

We would like to thank and acknowledge the hard work of our employees. In 2016 we launched a large number of program initiatives, supported policy development, undertook province-wide engagement efforts and worked closely with communities and consumers. We extend our congratulations and our thanks to IESO employees for their efforts over a very busy year. We would also like to recognize the significant contributions of Kim Warren, our former Vice-President, Market and System Operations, and Chief Operating Officer, who retired in December.

We look forward to helping Ontario effectively address the opportunities and challenges facing our electricity system going forward.

2016 Highlights

- *January*
 - IESO/Bruce Power amended refurbishment agreement takes effect
- *February*
 - IESO hosts an executive conference to address cybersecurity

- *March*
 - 16 contracts for 450 MW of renewable energy projects contracts announced under LRP I
 - Launch of province-wide Spring Coupon Event
- *April*
 - Launch of interactive residential energy-efficiency tool, Kilowatt Way
 - Stakeholder engagement for Market Renewal begins
- *May*
 - IESO and Ryerson Centre for Urban Energy release discussion papers on the future of energy consumption, sustainability, and integrated utility delivery models
- *June*
 - IESO issues 936 long-term contracts for 241 MW under FIT 4
 - Launch of Save on Energy awareness campaign, *Power What's Next*
 - IESO receives Energy Star Canada award for encouraging energy conservation through consumer incentive programs and promotional campaigns
- *July*
 - IESO/LDC Working Group issue 2016 conservation Achievable Potential Study
- *August*
 - IESO and New York Independent System Operator (NYISO) reach an agreement that enables Ontario generators to offer capacity into future NYISO installed capacity auctions
- *September*
 - Release of IESO's electricity sector technical report, the Ontario Planning Outlook
 - Reliable management of grid through extreme weather and highest peak days (Sept 7 - 23,213 MW)
- *October*
 - Launch of province-wide Fall Coupon Event
- *November*
 - IESO's workplace campaign raises over \$100,000 for United Way
 - IESO hosts second executive conference on cybersecurity
- *December*
 - Results of second annual demand response auction prices 12 to 17 percent lower than 2015
 - New agreement with Quebec takes effect

Section 4.1 | Delivering superior reliability performance in a changing environment

While operating the power system has always been a balancing act, maintaining that balance in an era of accelerated change across the sector presents new challenges in a number of areas.

Ontario relies on a diverse range of energy resources, both in terms of the generation portfolio itself, but also through the strategic use of conservation and energy efficiency, clean energy imports and emerging technologies such as storage.

With increases in variable renewable generation and distributed energy resources, as well as nuclear decommissioning and refurbishments over the planning horizon and changing customer demand patterns, Ontario's system is becoming increasingly complex to operate on a day-to-day basis.

So what does all of this mean? In part, it means the way the IESO plans, manages and operates the electricity system requires a greater level of agility than ever before. It also means that there is an increased focus on collaboration. This includes collaboration with local distribution companies (LDCs) and other electricity sector partners to establish new pathways to reliability, as well as engaging in dialogues with the IESO's system operator counterparts in other jurisdictions to share best practises and leverage the tools and techniques at its disposal to plan for and adapt to future sector evolutions.

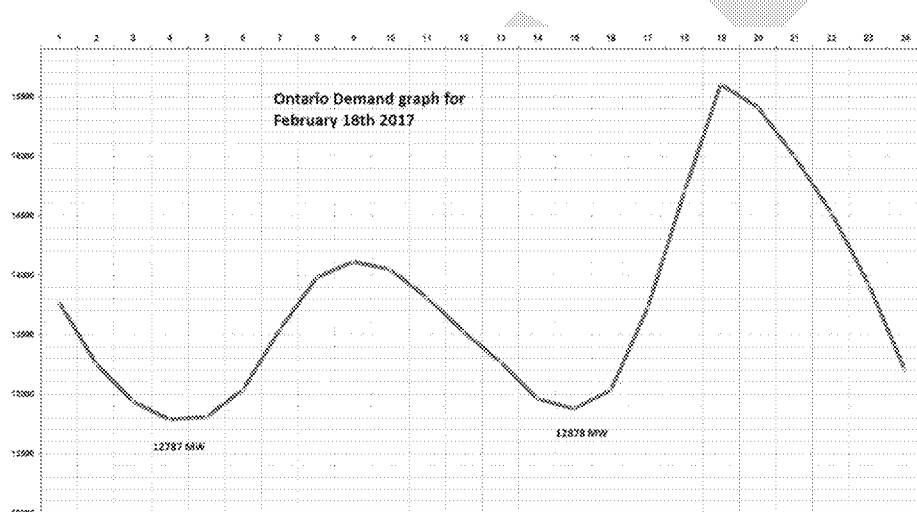
Addressing Long-Term Energy Needs

In June 2016, the *Energy Statute Amendment Act* received Royal Assent in the provincial legislature. Among its amendments, the Act replaced the Integrated Power System Plan framework and put in place a requirement for the IESO to develop an electricity sector technical report. In its role as long-term planner for Ontario's electricity system, the IESO produced a report on September 1, 2016, called the *Ontario Planning Outlook* (OPO). The report provides a 10-year review (2005-2015) and a 20-year outlook (2016-2035) for Ontario's electricity system. With four different demand outlooks, the OPO considers a range for electricity demand over the next 20 years from as high as 197 terawatt-hours (TWh) to as low as 133 TWh. This technical report also helped to guide the consultations for the province's next Long-Term Energy Plan (LTEP) – which is expected to be published in 2017.

Under the *Energy Statute Amendment Act*, the IESO is also now responsible for an implementation plan following the release of the province's LTEP, which will be a priority for the IESO in 2017. The organization will also continue to provide, on an ongoing basis, information on evolving needs and trends in the electricity sector to government, stakeholders and communities.

<Sidebar Title>

Below is an example that further illustrates how Ontario's changing system conditions can have an impact on grid conditions and present new operating challenges to system operators. On Saturday, February 18, 2017, which fell on the Family Day weekend, the confluence of unseasonably warm temperatures and bright sunshine resulted in what's called a "duck curve" load pattern, a distinctive shape (resembling the profile of duck). It depicts power production over the course of a day and illustrates the difference, and often the imbalance, between peak demand and energy production. On February 18, this pattern occurred as result of low daytime grid demands being further reduced, to nearly overnight lows, due to solar resources embedded in the distribution system generating at full or, close to, full capacity. Conversely, as the evening approached, solar generation output declined, temperatures reduced, lights came on, and grid demand climbed sharply and required other resources to ramp-up to meet the increased system demand. While not yet a common occurrence, the duck curve scenario demonstrates both the challenges associated with forecasting demand for power from the grid due to embedded variable resources and the need to have sufficient flexible resources on line to meet these significant ramping events.

Responding to changing grid conditions**Addressing emerging and near-term reliability needs**

All across North America, system operators are facing new challenges as their supply mixes evolve. Some of these challenges include integrating renewables and variable forms of generation, as well as gaining situational awareness and more visibility into electricity systems at the bulk and distribution levels.

In 2016, the IESO completed an operability assessment, which looked at the continuum of complex and inter-related factors at play in Ontario's power system. It focused on changes that are expected on the system in the next few years and addressed the potential operating challenges they represent.

Among the findings, the report identified that the continued growth and integration of variable generation will have a considerable effect on operability of the system in the next three to five years. This is mainly due to the variability of certain fuel sources, for example, wind or sunlight, which make them less predictable than conventional forms of generation. This results in greater forecast uncertainty from a system operation perspective.

The report identified three actions to address the operating impacts, which include the need for:

- additional frequency regulation capability, or the ability to balance the power system on a second-by-second basis
- more “dynamic” and “static” reactive control devices to better manage voltages as a result of the growth of resources connected to the distribution system
- increased flexibility from Ontario resources for intra-hour needs.

The findings of the *2016 IESO Operability Assessment* led to the formation of a stakeholder engagement focused on enabling system flexibility. In 2017, the IESO will continue its work to maintain and improve the operability of the power system through transparent mechanisms in three key areas:

Item	Need Addressed	Activities Underway to Support
Frequency regulation	Regulation service to match total system generation to total system loads (including transmission losses) and help correct variations in power system frequency. • This service corrects for short-term changes in electricity use that might affect the stability of the power system.	□ The IESO is seeking to expand the depth of the regulation service market in Ontario. □ A Request for Information (RFI) was issued in June 2016, and a draft Request for Proposals (RFP) was issued for stakeholder review and comment in December 2016. The final RFP is expected to be released in the second quarter this of 2017, with resources selected before year end 2017. (check for update)
Voltage control	A need for more reactive control devices, which control high voltages on the bulk system.	□ Studies and recommendations on the need and location of voltage control devices to address issues in the Greater Toronto Area and eastern Ontario are underway and are expected to be completed in 2017. □ The IESO will also collaborate on an implementation plan with transmitters and seek input from the IESO's Stakeholder Advisory Committee (SAC).
Flexibility	The IESO requires flexible resources to be available in real time that could provide power in 20 to 30 minutes, if called upon, specifically: • About 1,000 MW of additional flexible resources, with 300 MW expected to be obtained by the end of 2017 and the remaining 700 MW by the end of 2018.	□ In June 2016, the IESO launched a stakeholder initiative to determine potential solutions that can enable and achieve flexibility to meet the evolving needs of the system. □ Solutions considered will need to be cost-effective and competitive, transparent and technology-neutral, allowing for the use of new technology and/or existing assets. □ In 2017, the IESO will work with industry stakeholders to propose and recommend mechanisms to acquire flexibility, as well as develop work plans to implement.

These efforts to improve operability will build on previous efforts such as the Renewable Integration Initiative, which brought in centralized forecasting of wind and solar generation and the capability to dispatch transmission-connected variable generators. There is also a growing array of emerging technologies that can be leveraged for these operability issues, discussed below.

Grid-LDC Coordination initiative

The IESO and LDCs are taking collaborative steps to enhance reliability and efficiency to get a more integrated picture of how emerging technologies and distributed generation might impact the operation of the province-wide power system. The Grid-LDC Coordination initiative is working to refine a framework for data sharing between the IESO and all LDCs, to assist in real time with managing the system more effectively.

This initiative has explored the feasibility of residential solar storage-type “virtual power plant” technologies using PowerStream’s POWER.HOUSE project in Vaughan and soon in Northern Ontario through a partnership with Thunder Bay Hydro. Next it will look at how to enhance reliability and efficiency through coordination of IESO- and LDC-controlled resources. These projects will help gain insights into how upcoming changes at both the grid and distribution levels can impact system operations and identify practical ways to leverage these opportunities

In addition, in late 2016, Veridian announced the deployment of a residential microgrid involving homebuilders – managed and operated by Veridian’s 24/7 System Control Centre and controlled by Opus One’s GridOS® Microgrid Energy Management System – which may also provide another opportunity to better understand and inform data sharing and real-time system coordination between LDCs and the IESO.

Harnessing the Potential of Storage

Energy storage is another tool the IESO is exploring to assist with providing additional resource flexibility to help mitigate variable output from renewable generation. Energy storage facilities have the potential to provide a range of services to support reliability, including regulation, voltage control, operating reserve and flexibility – provided that they are the right type of facility and in the right location. The variety of benefits associated with storage can include:

<insert graphic about benefits> – includes these bullets:

- Smoothing out fluctuations of solar and wind resources, bringing added stability to the electricity system
- Easing points of congestion in transmission and distribution networks
- Helping absorb surplus baseload generation when the output is higher than minimum demands
- Providing reliability services that support voltage and frequency on the system.

The IESO is already using storage technologies as a source of frequency regulation, with two projects in operation – NRStor Inc., in partnership with Temporal Power, is providing two megawatts of regulation using flywheel technologies, and Renewable Energy Systems Canada Inc. delivers Ontario's first battery regulation service with four megawatts of capability.

To further support and understand the integration of storage into the electricity system, in 2015 the IESO completed a two-phase energy storage procurement, securing approximately 50 MW in total. Soon, energy storage assets procured under Phase 1 will begin providing ancillary services to Ontario's electricity system in various locations across the province. Although it's still relatively early days for these projects, as the first of these facilities is expected to come into operation in 2017, together they will build up the organization's direct experience with the various technologies, and the IESO looks forward to working with all of the project proponents to confirm and capture the full value of storage.

Growing Role of Interconnections to Strengthen Reliability

Participating in an interconnected power system enables the IESO to respond and assist in maintaining the secure and reliable operation of the grid. Ontario currently has interconnections with five of its neighbours: Quebec, Manitoba, Minnesota, Michigan and New York. These interconnections facilitate the import and export of electricity and provide operational and planning flexibility that enhance the reliability and the cost-effectiveness of the Ontario electricity system.

The IESO is working on enhancing the use of its interties to better meet system needs.

The provincial government recently concluded two electricity trade agreements with Quebec. The most recent agreement provides for Ontario to import 2.3 TWh of energy from Quebec in addition to regular wholesale energy trading. These imports will displace dispatchable Ontario-based gas-fired generation with lower-cost and lower greenhouse gas-emitting energy from the Quebec grid. The agreement provides value by displacing Ontario's higher-cost and higher-emission gas generation and makes use of existing intertie and transmission system capability.

In 2016, the IESO enabled capacity exports with one Ontario facility participating and clearing the New York Independent System Operator (NYISO's) auction. In August 2016, a Memorandum of Understanding was signed between the IESO and NYISO, designed to support specific projects on a transitional basis to gain experience and learn lessons for a long-term solution, including the foundation for an incremental capacity auction in Ontario. Joint processes with the NYISO are being established to assure deliverability. Development of the information technology functions to support control room operations were also initiated in 2016.

In addition to capacity exports, the IESO is also considering moving to 15-minute intertie scheduling as part of the market renewal initiative (see page XX). This has now become a

regulatory standard in the United States. In 2013, the IESO released a study paper concluding that more frequent intertie scheduling would provide system benefits and increase market efficiency by lowering the overall system costs of meeting demand. This will also enable Ontario to schedule resources and meet its adequacy requirements in a more cost-effective manner in the future.

Cybersecurity

Maintaining system reliability involves keeping Ontario's critical electricity infrastructure secure. As has been widely reported, the Ukraine experienced the first confirmed instance of a cyber-attack causing a blackout in 2016. Governments and industry in Canada are working together to develop coordinated cybersecurity strategies and to form organizations specifically focused on cyber defense.

Cybersecurity is a material part of the IESO's business when one considers the breadth of data the IESO collects on a given day -- more than 20,000 data points every three seconds -- to support the reliable flow of electricity across the province and its borders. The IESO has put into place robust cybersecurity and cyber incident response programs to mitigate threats to critical business operations.

The IESO is also responsible for the application and enforcement of North American Electricity Reliability Corporation (NERC) cybersecurity standards for critical electricity infrastructure connected to the bulk electricity system in Ontario.

Beyond its regulated requirements, the IESO has also been working closely with market participants and stakeholders to deepen the sector's understanding of cyber risks. These efforts include increasing information sharing between the sector and government partners, exchanging information on respective approaches to mitigating cyberattacks, creating a stronger incident response capability and enhancing the awareness of cybersecurity at the executive and board levels of organizations. The IESO held two Cybersecurity Forum conferences and hosted two executive/board level cybersecurity briefings in 2016. These forums were attended by electricity industry leaders and cybersecurity experts from across the world and included productive, forward-looking dialogue on matters related to best practices, policy framework, government support and other key areas of cybersecurity. Further meetings are being planned by the IESO for 2017, including an executive briefing scheduled for late 2017. The IESO will continue to invest in advance technologies and more robust cyber security technologies as part of its ongoing cyber threat mitigation efforts.

Section 4.2 (a) | Driving to a more efficient and sustainable marketplace – Market Renewal

Nearly 15 years ago, on May 1, 2002, Ontario's electricity market opened for the first time. It marked a major milestone for Ontario's electricity system – the process to match supply and demand would now be based on competition, where electricity is bought and sold on a spot market at competitive prices. The IESO maintains the wholesale electricity market and directs the operation of Ontario's bulk power system. The market was designed to efficiently dispatch Ontario's supply mix resources, which, at market opening, consisted of mainly coal, nuclear and hydroelectric.

Since then, Ontario's system has seen a significant resource transformation. In a relatively short period, the province experienced a substantial net growth in electricity supply and a material transition to a cleaner energy system. Over six gigawatts (GW) of installed coal-fired capacity was shut down and replaced with more than 14 GW of renewable, natural gas-fired, nuclear and demand response resources. Combined, this new supply mix changed the dynamics of Ontario's electricity system.

Over the last decade, inefficiencies with the current market were identified through the work of the Electricity Market Forum, the Market Surveillance Panel, IESO studies and stakeholder input. The IESO made a series of enhancements to adapt its market design to the changes in the supply mix.

While the IESO has maintained reliability throughout these changes and adopted new approaches to increase flexibility and resiliency into the provincial power grid, it has also become evident that the current market design needs more foundational changes.

Where are we now?

The IESO has identified the need to evolve Ontario's electricity market to address known inefficiencies and lay the foundation for a more dynamic marketplace in the future. As noted in last year's Ontario Planning Outlook, the province is in a stable supply situation that is expected to continue until the beginning of the next decade, providing an opportune time to consider and implement needed market design changes.

To advance these efforts, the IESO and stakeholders are examining the benefits and costs of evolving and improving the market. Market renewal, as the project is called, will be a major undertaking both for the IESO and for Ontario's electricity sector, and it represents the most significant enhancement of Ontario's market since it first opened in 2002.

In 2016, when the IESO launched a stakeholder engagement for market renewal, it appointed members for a working group that represents a broad cross-section of market participants and stakeholders to help guide the market renewal work. Comprised of experienced individuals representing generators, traders and consumers, the working group is a key stakeholder forum

for this project.

The IESO also engaged an economic consulting firm, the Brattle Group, to develop a benefits case for the market renewal project, supported through input by the working group and stakeholders. The analysis draws on past Ontario studies and the experience of other jurisdictions that have gone through similar market redesign processes. The final benefits case is expected to be posted on the IESO website at the end of March (check).

Early findings show potential for cost savings, with a baseline estimate of \$3.5 billion (net present value) over a 10-year period from 2021-2030. These savings represent a net efficiency benefit, meaning the total commodity cost of electricity (i.e., energy, global adjustment and uplifts) is reduced by that amount. The majority of savings are expected to flow to consumers, while the rest would flow to other market participants. Costs for the project are estimated to fall in the range of up to \$200 million. While these are only initial findings, the numbers demonstrate that the range of reasonably expected benefits far outweighs the likely costs of the project. (check language against final benefits case)

Benefits of transitioning to more efficient market-based platforms

Market renewal is expected to provide value for Ontario's ratepayers by putting downward pressure on costs while fostering an open and competitive marketplace with broad participation. Effective markets provide clear signals for the value of needed services, and they enable all resources – whether new or existing – to compete to meet those needs. Effective markets, where prices accurately reflect underlying system conditions, also enable individual resources and consumers to make informed decisions, capturing innovation and better managing costs and risks.

Proposed changes to the market include:

- moving from scheduling and dispatching primarily in real time to a financially binding day-ahead market that will provide the IESO and market participants more certainty
 - A day-ahead market will require replacing the current two-schedule system (where prices are determined under one schedule and energy is dispatched under another) with a more efficient single-schedule market
- introducing a capacity auction where all resources will compete on a level playing field, resulting in lower costs and potentially avoiding or deferring the need to build new resources
- delivering greater flexibility from existing assets and from our interties
- other operability enhancements as identified by the IESO and its stakeholders.

The energy and operability initiatives under market renewal are designed to address inefficiencies with our current market design and improvements to the way the IESO schedules energy. Market renewal also proposes to introduce an incremental capacity auction that would

allow non-traditional resources (such as demand response, distributed energy resources, upgrades to existing assets, and imports) to compete with existing assets. A capacity auction would function similarly to Ontario's existing DR auction (see breakout box) but would include broader participation. This mechanism has been used in a number of North American markets, as well as globally, to cost-effectively meet the capacity needs of modern electricity systems.

The IESO benefits from almost 15 years of experience with Ontario's electricity market and can also draw upon decades of best practice in other jurisdictions. The IESO has an ideal vantage point from which to undertake this work with stakeholders. The IESO will work with stakeholders to reset Ontario's market in a way that both addresses existing challenges and unlocks future possibilities.

A work plan for market renewal will be developed in 2017 through engagement with stakeholders. It will identify specific market design changes for implementation over the coming years and will identify target timelines for completing design and implementation work.

Demand Response Auction

For a number of years, the IESO has been exploring what types of flexible, responsive mechanisms could be introduced to complement the existing market structure. The IESO's annual demand response (DR) auction is part of those ongoing efforts and has helped to expand Ontario's DR capabilities and transition to a more cost-effective, market-based platform for this resource. DR has been introduced into the market where it can be called upon like other resources to meet provincial needs and can reduce the need to build costly generating facilities by reducing electricity usage during the hours of highest demand, typically on a hot summer day. The first capacity-based DR auction, conducted in December 2015, contributed 391.5 MW during the 2016 summer season and 403.7 MW for the 2016-17 winter season.

The results of the second annual DR auction were announced in December 2016 and resulted in both increased participation and prices for demand response capacity that were 12 to 17 percent lower than those achieved in 2015. The amount of DR procured through the auction increased by 16 percent in the summer to 455.2 MW and 18 percent in the winter to 477.5 MW from the previous year. The next DR auction will be held in December 2017, for delivery of DR capacity between May 2018 and April 2019. The successful DR providers will be integrated into the electricity market along with generators and will help provide capacity to ensure the province's energy needs are met during peak hours. Lessons learned from the DR auction will be applied to the design of a capacity auction.

Engagement Plans for 2017

The market renewal project has a broad reach and will address the way the IESO schedules energy, procures capacity and meets operability needs in the province. The IESO recognizes that these proposed changes will impact market participants and contract counterparties. The IESO will work collaboratively to understand and address the impacts, as required. At the same time, the market renewal project is not a traditional stakeholder engagement as it encompasses various work streams and will require engagement on various levels, including:

- education for the broader sector
- strategic discussions to focus on policy and key issues
- design discussions to determine, together with stakeholders, the optimal approach for Ontario
- technical dialogues with subject matter experts
- development of market rules and manuals.

The project will also require an enduring stakeholder commitment over a number of years.

To undertake this work, the IESO will use existing and newly created stakeholder engagement forums to seek input from both the traditional, sector-focused stakeholders and the broader stakeholder community. For example, the IESO will:

- Use existing stakeholder forums including the IESO Stakeholder Advisory Committee (SAC) and the Technical Panel.
- Institute a CEO's Executive Roundtable to ensure awareness and discussion on high-level issues related to the project.
- As the project progresses, engage the broader stakeholder community to ensure they are informed and able to provide input into the decision-making process.

The Market Renewal Working Group has been established to provide expertise and advice to support the development and implementation of market renewal initiatives.

Transparency will be a key component in the stakeholder engagement process. All materials that have been presented and provided to the IESO market renewal working group are available on the market renewal section of the IESO's website. The IESO encourages all interested parties, or their representatives, with an interest in these matters to participate in this engagement.

Section 4.2 (b) | Driving to a more efficient and sustainable marketplace – Conservation

Driving to a more efficient and sustainable marketplace – Conservation and Energy Efficiency

Energy conservation in Ontario has gone through a considerable evolution, and it's one that continues to grow as Ontario's system becomes more dynamic and interconnected. Today, energy efficiency and conservation are playing increasingly important roles in the energy landscape, both at the system level to meet electricity needs and also as an effective tool for consumers of all sizes to help reduce their own energy costs. From optimizing energy-efficient products to supporting certified energy manager training, conservation programs are helping Ontario businesses and residential customers better understand what energy-efficient options are available for them. In turn, these programs are contributing to better quality and more efficient homes, improving day-to-day operations in businesses and contributing to a more reliable and sustainable system for future generations.

In 2016, the IESO continued its role in the advancement of a conservation culture in Ontario, working with local distribution companies (LDCs) and others to connect end-use customers to energy-efficient solutions. The past year saw continued progress against the province's six-year (2015-2020) Conservation First Framework (CFF), designed to provide LDCs with greater flexibility to design and deliver conservation programs that meet local community needs, strengthen regional collaboration and benefit both customers and the provincial grid.

Approved conservation and demand management (CDM) plans are now in place for all LDCs in the province, which in total accounts for the achievement of the seven terawatt-hour (TWh) CFF target. An additional 1.7 TWh of energy savings is to be achieved through the Industrial Accelerator Program, which has been designed to help transmission-connected customers achieve energy savings. At the same time, efforts continued to ensure programs are delivered in a cost-effective manner by applying rigorous third-party evaluation, measurement and verification of program results, which are made publicly available on the IESO's website.

With the introduction of the province's *Climate Change Action Plan*, the IESO and the province are exploring the potential to build on the existing suite of energy-efficiency and conservation programs to support and coordinate with the implementation and delivery of low-carbon objectives of the plan to reduce greenhouse gases.

Conservation First Framework: by the numbers

Consumers of all sizes throughout the province continued to take advantage of the range of energy conservation tools, resources and incentives tailored to Ontario homes and businesses through the **Save on Energy** programs delivered with LDCs. These include incentives for lighting upgrades, purchasing energy-efficient products and replacing inefficient equipment.

Businesses of all sizes continue to access program funding that is helping to improve production efficiency, upgrade equipment and train their staff in energy management, which in turn is resulting in improved productivity, better work environments and lower operating costs.

Residential

451 GWh of energy savings achieved	9.5 million coupons redeemed across the province	17.8 million energy-efficiency products purchased	224,000 installations through the Heating and Cooling Program
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Business

1,463 GWh of energy savings achieved	20,600 projects completed through the Small Business Lighting Program	450 projects completed through the Energy Managers Program	19,700 projects taken on through the Retrofit Program
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(note – energy savings achieved are persisting to 2020)

Preliminary unverified results indicate that LDCs had collectively achieved 27 percent of the provincial CFF target, or 1.92 TWh of the seven TWh target in 2015-2016. That represents enough to electricity to power a city the size of Guelph for a year. In addition, the Industrial Accelerator Program has achieved 0.20 TWh of the 1.7 TWh target in 2015-2016, or 12 percent of the 2020 target. This number is expected to increase as more projects are verified and implemented over the coming period.

These results represent real savings for residents and businesses. For example, Valiant TMS, a Windsor-based company that designs and manufactures welding, assembly and material handling systems for the automotive and aerospace industry, upgraded its lighting, compressors, and heating and cooling systems, resulting in savings of four million kilowatt-hours annually, which represents 25 percent of its annual energy consumption. The Thunder Bay Regional Health Sciences Centre, a 375-bed acute care hospital, emergency centre and research facility, lowered its electricity consumption by 22 percent thanks to Save on Energy incentives. This resulted in \$660,000 in annual cost savings, which could be reinvested into patient and family care services. More information on these projects, along with other testimonials and case studies, is available at www.saveonenergy.ca.

Getting to 2020, and beyond

Conservation First Framework Mid-Term Review

In late 2016, the IESO launched a public engagement process to seek feedback from stakeholders to inform the development of the mid-term review of both the 2015 to 2020 CFF and the Industrial Accelerator Program. The mid-term review will focus on a range of key issues, including the allocation of budgets and targets among LDCs, lessons learned regarding LDC funding models, customer needs and satisfaction, conservation integration with regional planning and alignment with Ontario's *Climate Change Action Plan*.

This review will inform potential approaches to achieving conservation objectives to 2020 and beyond, as well as consider the deployment of innovative new programs that did not exist prior to the framework and that were developed through pilot programs funded by the IESO.

Input from stakeholders and communities through public engagement meetings will be a key component leading up to and throughout the review. Comprehensive, open engagement in alignment with the IESO's *Stakeholder Engagement Principles* will help ensure that all LDCs, customers, channel partners and other interested parties have meaningful opportunities to provide feedback on the framework's success and challenges.

A Mid-Term Review Advisory Group, comprised of a variety of stakeholder representatives, has been assembled to tackle more detailed discussions.

Conservation and energy efficiency require a sustained commitment to achieve persistent savings over the long term, and the mid-term review will be an important marker in setting the next phase of conservation in our province. In early 2018, a final report will be submitted to the Minister of Energy and published on the IESO's website. For more information on this stakeholder initiative, please visit the IESO's Conservation Framework Mid-Term Review webpage or email engagement@ieso.ca.

Achievable Potential Study

In June 2016, the IESO completed an Achievable Potential Study to assess electricity conservation potential in Ontario. Supported by input from a working group comprised of 12 LDCs and expert industry observers, the study considered the potential for energy-efficiency programs and behind-the-meter generation projects. It concluded that within the current assumptions, approximately 7.4 TWh of conservation can be achieved by LDCs by 2020. It also found that in the longer term, about 19 TWh can be achieved from distribution- and transmission-connected customers by 2035. The Achievable Potential Study will be used to inform the Conservation Framework Mid-Term Review (see xxx) and will be a useful tool in informing program development as well as regional and long-term energy planning.

Driving innovation in conservation, energy efficiency and demand management

In addition to the energy-efficiency programs delivered through the LDCs, the IESO is committed to encouraging new, innovative solutions and technologies that will help Ontario meet its conservation targets.

The IESO's Conservation Fund helps transform the market by supporting innovative energy-saving pilots and bringing ground-breaking new processes, technologies and policies to the market. In 2016, the Conservation Fund committed \$9.5 million to five initiatives. Project examples include:

- LDC achievable potential studies for their service territories
- enhancing CanmetENERGY's RETScreen energy-efficiency software, which provides project feasibility and energy performance analysis
- supporting an energy conservation study on commercial freezer temperature modification
- implementing a smart electric vehicle charging pilot for workplaces.

The LDC Innovation Fund is helping utilities explore new technologies that can contribute to a modern and efficient grid. The fund supports program design and testing of new initiatives, providing LDCs the opportunity to market test the delivery mechanisms and savings potential of new innovative program offerings before including them in their CDM plan and budget. These pilots are also assessed for their potential to be developed into local, regional or province-wide programs. Results of pilot programs are shared with other LDCs and the public so that the LDC community can collaborate and take away key learnings for their own projects.

Section 4.3 | Engaging stakeholders, communities and consumers

Responding to change in a rapidly evolving sector has become a constant part of the IESO's work. As Ontario's electricity system becomes more interconnected and regionally focussed, the IESO's traditional forms of engagement will continue to expand as new generators, customers, Indigenous peoples and communities continue to become more actively involved in the sector. With this evolving landscape, the IESO's ability to achieve its goals will be dependent on the valuable input it receives.

The IESO's *Engagement Principles* provide an effective framework for ensuring stakeholders and communities have the opportunity to provide input on matters that impact them. Input was considered in the development of the principles, and both the IESO and the public have come to rely on these to guide open, transparent and meaningful opportunities for input. The IESO's engagement principles also provide a foundation for the IESO's engagement with Indigenous communities.

The IESO will continue to provide broad engagement vehicles and processes to ensure that its initiatives are guided by collective engagement. This was re-affirmed in the IESO's 2016-2020 Strategic Plan: Seeking out and responding to input from communities, customers and stakeholders to inform IESO's decision-making, and has been adopted as one of the organization's strategic objectives.

At the same time, to be effective and meaningful, engagement must also go through a process of continuous improvement and measurement. The IESO will continue to undertake stakeholder and community interviews and/or surveys, which will continue to indicate the level of satisfaction with the engagement process and whether the IESO has demonstrated appropriate consideration of input in decisions.

The Stakeholder Advisory Committee (SAC) has an important role to provide the IESO with input and feedback on proposed decisions or changes that affect all communities and stakeholders. Through input from the SAC, stakeholder priorities have been considered in the development of the organization's core corporate planning documents, including the IESO's latest business plan. The IESO has established corporate performance measures (CPMs) for its key initiatives across the organization, designed to assess progress toward the achievement of its core mandate and strategic objectives. These targets have been developed to be specific, measurable, achievable, relevant and time-bound. They also reflect input received from the SAC to make the CPMs both outcome-oriented and externally focused.

Going forward, the IESO will continue to evolve its engagement processes and procedures, as well as their application, to meet the needs of its expanding stakeholder and community base.

Engaging communities and consumers

Technology developments are continuing to change the landscape of the traditional bulk power system, creating a larger role for the consumer within the broader system and offering a wider range of possibility for meeting their energy needs. Customers are becoming increasingly engaged and involved in managing their energy consumption through things such as:

- smart home technologies and innovative software applications
- community microgrids
- distributed energy resources
- electric vehicles
- storage technologies
- heat pumps
- residential demand management resources
- audits and retrofits.

At the same time, communities are becoming more focused on how to meet their communities' energy needs through the development of community energy plans. As part of this, municipalities and Indigenous communities are working with their local utilities, community members and key stakeholders to establish an energy vision and develop plans to achieve this vision.

The result is that consumers and communities are taking an increasingly active role in how their energy needs are being met, and they are exploring local resources that can also meet regional reliability needs. This could take the form of non-wires supply options such as conservation and distributed energy resources as well as other innovative solutions. In its role to support this progress and ensure that plans, processes and systems under its control keep pace, the IESO will continue to expand its outreach efforts to include a broader vision of community engagement.

All of these activities contribute to the development of regional electricity plans across the province, plans that are designed to ensure a reliable supply of electricity over the next 20 years. These regional electricity plans ensure that community based solutions, which are technically viable, economic and consistent with the values of the local community are accounted for in the plans needed to meet capacity and reliability needs in a local area. Meetings with municipalities and communities, as well as feedback received from the 11 Local Advisory Committees (LACs) across the province contribute a local voice and help identify local priorities in the development of regional plans. LACs are comprised of municipal, First Nation, Métis, environmental, business, sustainability and community representatives, and they continue to be an effective model for the IESO to engage communities in the regional planning process. All LAC meetings are open to the public.

Local Advisory Committees have been formed in the following areas as part of the IESO's regional planning process:

1. Greenstone-Marathon (sub-region of Northwest Ontario) (community)
2. Greenstone-Marathon (sub-region of Northwest Ontario) (First Nation)
3. GTA East
4. Ottawa
5. Parry Sound/Muskoka (sub-region of South Georgian Bay/Muskoka)
6. Thunder Bay (sub-region of Northwest Ontario)
7. Toronto
8. West of Thunder Bay (sub-region of Northwest Ontario) (community)
9. West of Thunder Bay (sub-region of Northwest Ontario) (First Nation)
10. York Region (sub-region of GTA North)
11. Barrie/Innisfil (sub-region of South Georgian Bay/Muskoka)

All 21 planning regions in the province have completed the first five-year cycle of the regional planning process; this means that their needs have been examined and where required, Integrated Regional Resource Plans have been developed. In the first round of regional planning, 16 plans have been completed and are posted on the IESO website. Moving forward, the IESO will continue to work collaboratively with all communities to help best address their energy priorities and system needs ensure that the implementation of recommendations from completed plans is supported.

Indigenous Engagement

From First Nation-led transmission companies that are working to connect remote communities, to providing substantive input at Local Advisory Committees, to equity partners in over 1,000 MW of renewable projects, Indigenous communities are important partners in supporting Ontario's sustainable energy future.

To assist with capacity building, the IESO works to ensure all Indigenous communities are aware of funding programs, upcoming procurements and electricity planning and have the opportunity to provide input and feedback, and that all feedback is considered in the development of programs and procurements.

In 2016, the IESO continued to receive advice and guidance on the development of programs and initiatives through the Aboriginal Energy Working Group, comprised of First Nation and Métis community members who reside across the province and who are active in Ontario's electricity industry. Representatives from the IESO also spoke at 13 Indigenous conferences or community meetings, attended 13 additional conferences and assemblies and met with communities on more than 70 occasions.

Also in 2016, the IESO supported the Ministry of Energy in engaging Indigenous communities from across Ontario to provide input to the next Long-Term Energy Plan (LTEP). This included a customized series of regional Indigenous sessions, structured around an LTEP Indigenous engagement workbook. These sessions were part of the ongoing dialogues with Indigenous communities on everything from energy policy development to program delivery.

In 2016, the two-year capacity agreements with the Chiefs of Ontario (COO) and the Métis Nation of Ontario (MNO) for the funding of an Energy Analyst position came to end. Both of these agreements have been renewed for two additional years based on feedback from the organizations on the benefits of this position and the continued need to have a dedicated resource able to focus on energy issues.

Throughout 2016, the IESO continued efforts to reduce the dependence on diesel in all remote communities. This work included continuing to support the implementation of the Remote Communities Connection Plan. This plan informed an Order-in-Council from the provincial government in 2016, confirming the need to connect these 21 remote communities. The IESO has continued to support the current project to connect 16 of the communities through various regulatory processes and assessments. Work has also continued to build capacity in the communities as they prepare for connection, and the IESO has supported discussions with the federal government on project funding.

The IESO has also established an energy working group with the Matawa communities, which include the remaining five remote communities that are economic to connect to the bulk electricity system. Additionally, in 2016 the IESO launched the Energy Partnerships Program, which will support both the connection of remote communities as well as the effort to reduce reliance on diesel in the four remote communities that are not currently economic to connect.

In 2017 and beyond, the IESO will continue to engage First Nations and Métis communities through one-on-one, face-to-face meetings, customized engagement plans, working groups, capacity building initiatives, social media and participating at various Indigenous events. Customized engagement will ensure that communities have the opportunity to participate in relevant electricity matters, including regional planning, new marketplace mechanisms, procurements, funds and conservation initiatives. In addition, the IESO will work to ensure that programs are established with considered input from communities and that any identified barriers are removed.

Expanding the Tools of Engagement

In 2017, the IESO is launching initiatives to engage Ontarians in some new and different ways.

IESO's New Corporate Website

The IESO's new corporate website was designed to better reflect all parts of the IESO's expanding mandate. With more than one million interactions per year, the site will continue to provide timely, trusted and vital sector data to market participants, stakeholders, communities and members of the public.

It has also been designed to be more accessible, engaging and with a more intuitive navigation. By taking a more customer-centric approach to design and content development, the IESO's website will further enable customers to make well-informed energy decisions, explore new content areas and gain further insights into the workings of Ontario's electricity sector. The redesign of the IESO's website has been a collaborative project and has included input from external users as well as representatives from across all of the IESO's service groups to ensure it meets a wide range of needs.

Energy Show at the Ontario Science Centre

The IESO and the Ontario Science Centre have embarked on a five-year partnership to help bring energy knowledge and understanding to all Ontarians. Under this agreement, the IESO is the lead supporter of the Energy Show, as well as a supporter of the Centre's two energy-related school programs. Building upon the Science Centre's iconic electricity demonstration, the Energy Show is a family-friendly 30-minute presentation that delves deeper into the principles and concepts of energy. Through interactive and animated investigation, experimentation and collaboration, guests of all ages learn about the different sources of renewable and non-renewable energy and are encouraged to think about the way they use energy in their daily lives.

Province-wide Summit and Regional Forums

The IESO will host a Stakeholder Summit in Toronto and four Regional Forums in 2017 to be held across the province. These events will explore the future direction of the electricity sector, while also engaging communities in local issues that matter most to them. More information about these events, when it is available, can be found on the IESO website in the Stakeholder Engagement section.