

Understanding the Electricity System and Pricing in Ontario

Presentation to the PROBUS Club of Clarington

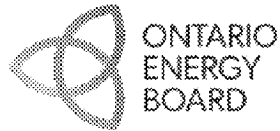
Jordan Penic, Senior Manager of Communications and Government Affairs

August 2, 2017

Ontario's Electricity Sector



ENERGY



ONTARIOPOWER
GENERATION



Local
Distribution
Companies



Determines the province's energy policy, including the Long-Term Energy Plan

Regulates the province's electricity sector

One of many generators of electricity for Ontario from nuclear, hydroelectric, gas, wind, solar and bioenergy plants

Delivers power across the province to local distribution companies and industrial consumers

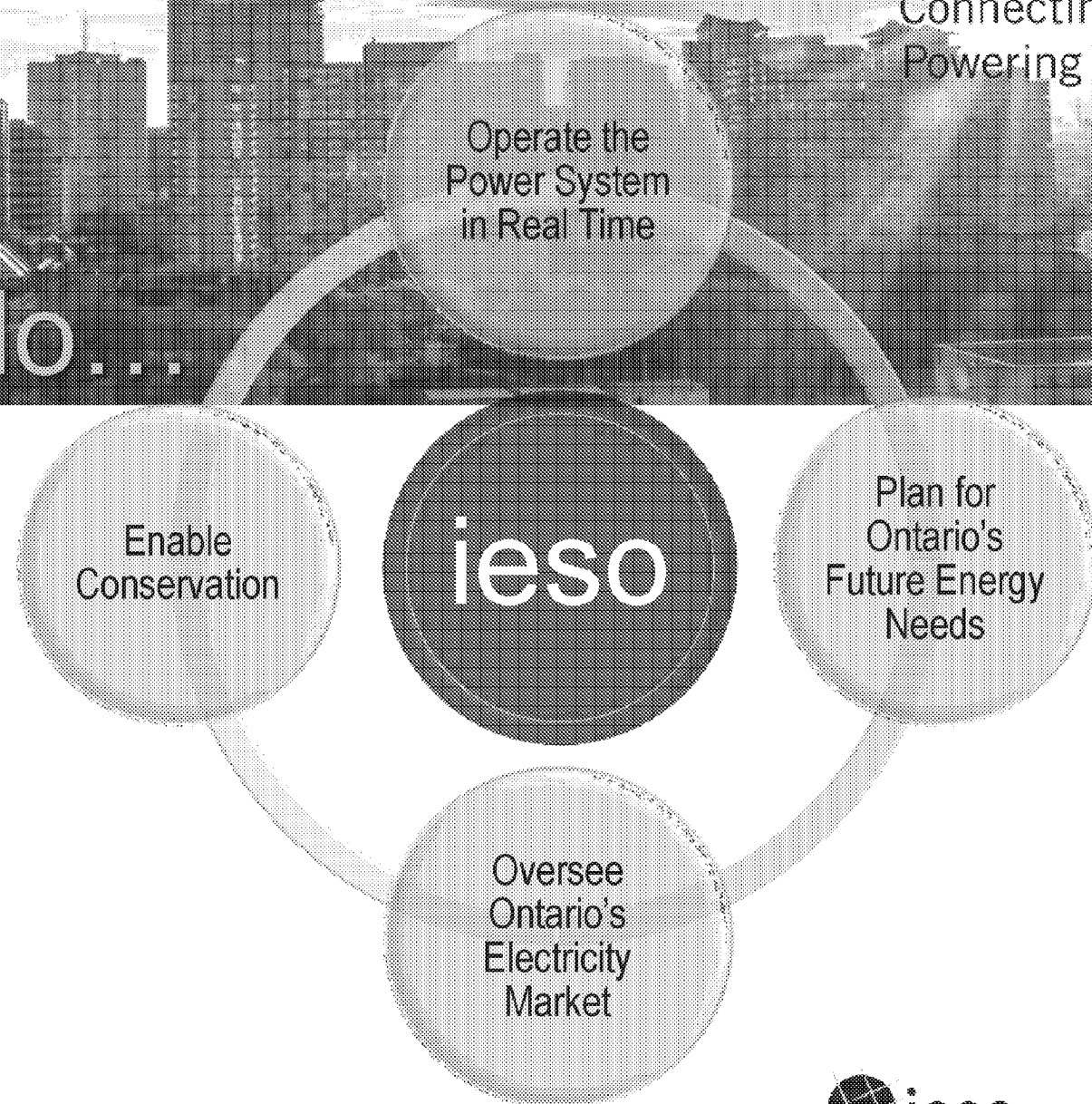
Distributes power from transmitters to homes and businesses. There are over 70 local distribution companies in Ontario (like Veridian)

Plans and operates the Ontario electricity system and market, develops a conservation culture in the province



What we do...

The IESO works at the heart of Ontario's power system ensuring there is enough power to keep the lights on, today and into the future...



Ontario at a Glance

36,070 MW

Installed Capacity (December 2016)

27,005 MW

Record Summer Peak (August 1, 2006)

24,979 MW

Record Winter Peak (December 20, 2004)

Total Annual Energy Consumed 137 TWh (2016)

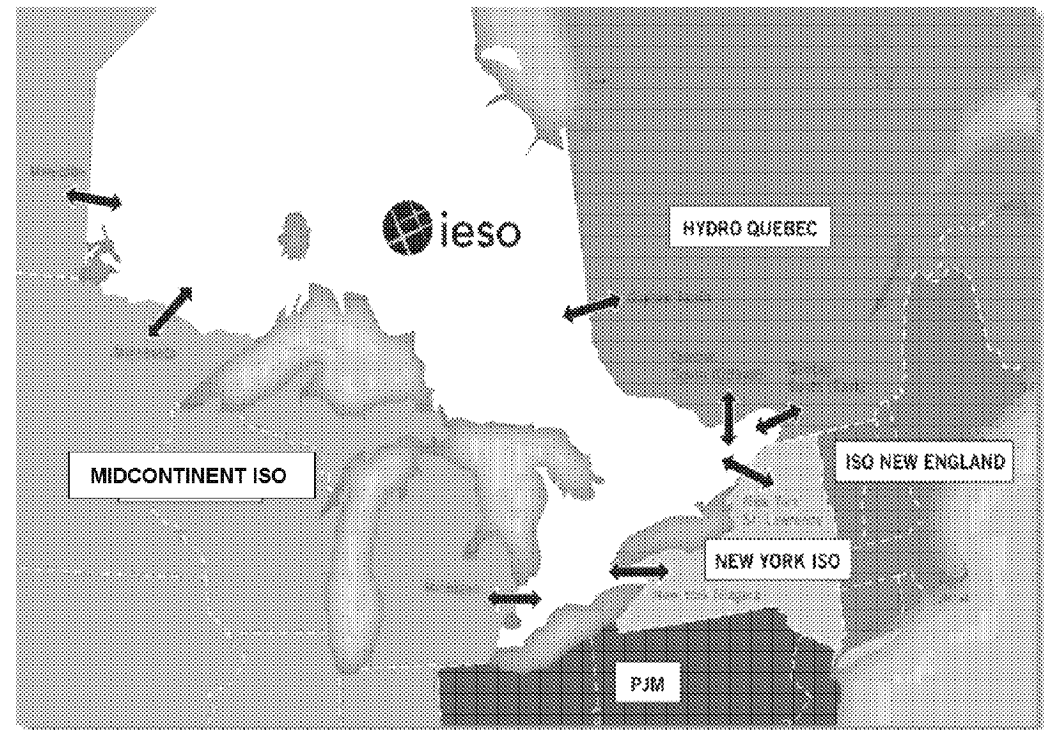
Energy Savings Through Conservation (2015) 1.3 terawatt-hours (TWh)

Customers 4.9 million

Ontario Import Capability 4,800 MW

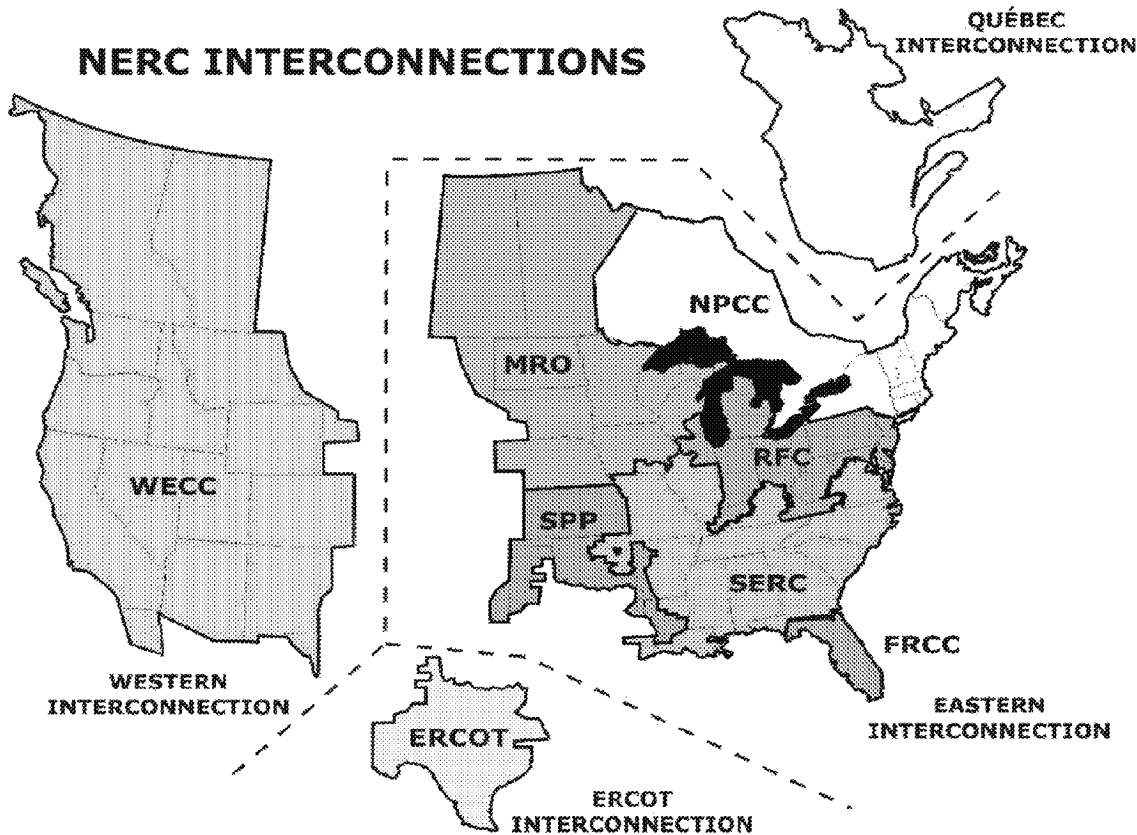
Transmission Lines 30,000 km

Interconnections New York, Quebec, Manitoba, Michigan, Minnesota



The IESO is the reliability coordinator for Ontario and works closely with other jurisdictions to ensure energy adequacy across North America.

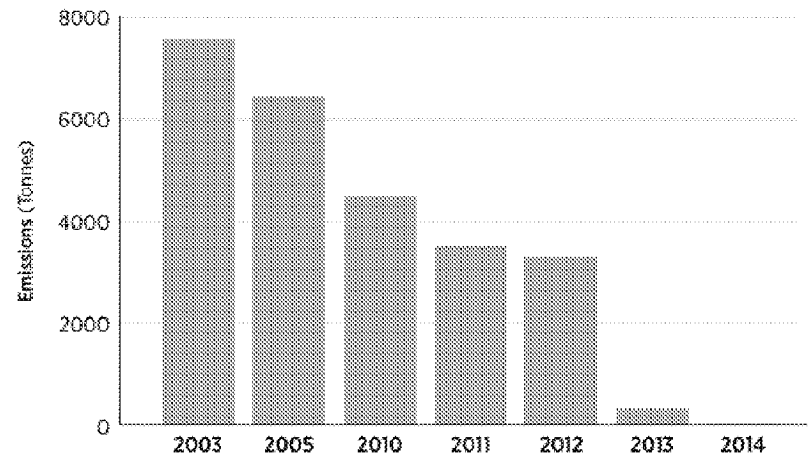
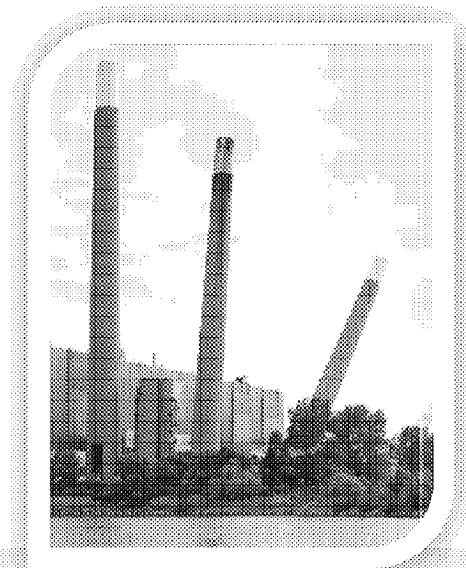
Ontario's Reliability Co-ordinator



- IESO is responsible for monitoring and enforcing reliability standards in Ontario
- IESO represents Ontario's interests as member of North American Electric Reliability Corporation (NERC) and Northeast Power Coordinating Council (NPCC)
- IESO is active in the interconnected community in emergency preparedness related activities

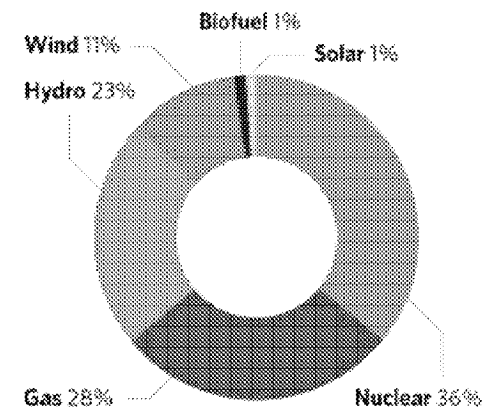
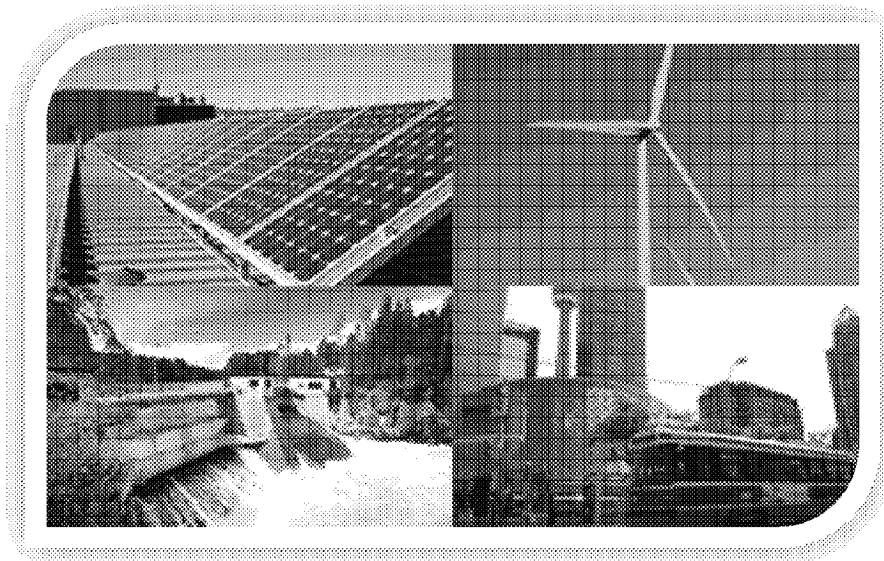
Over the last 15 years...

Coal retired from Ontario's supply mix

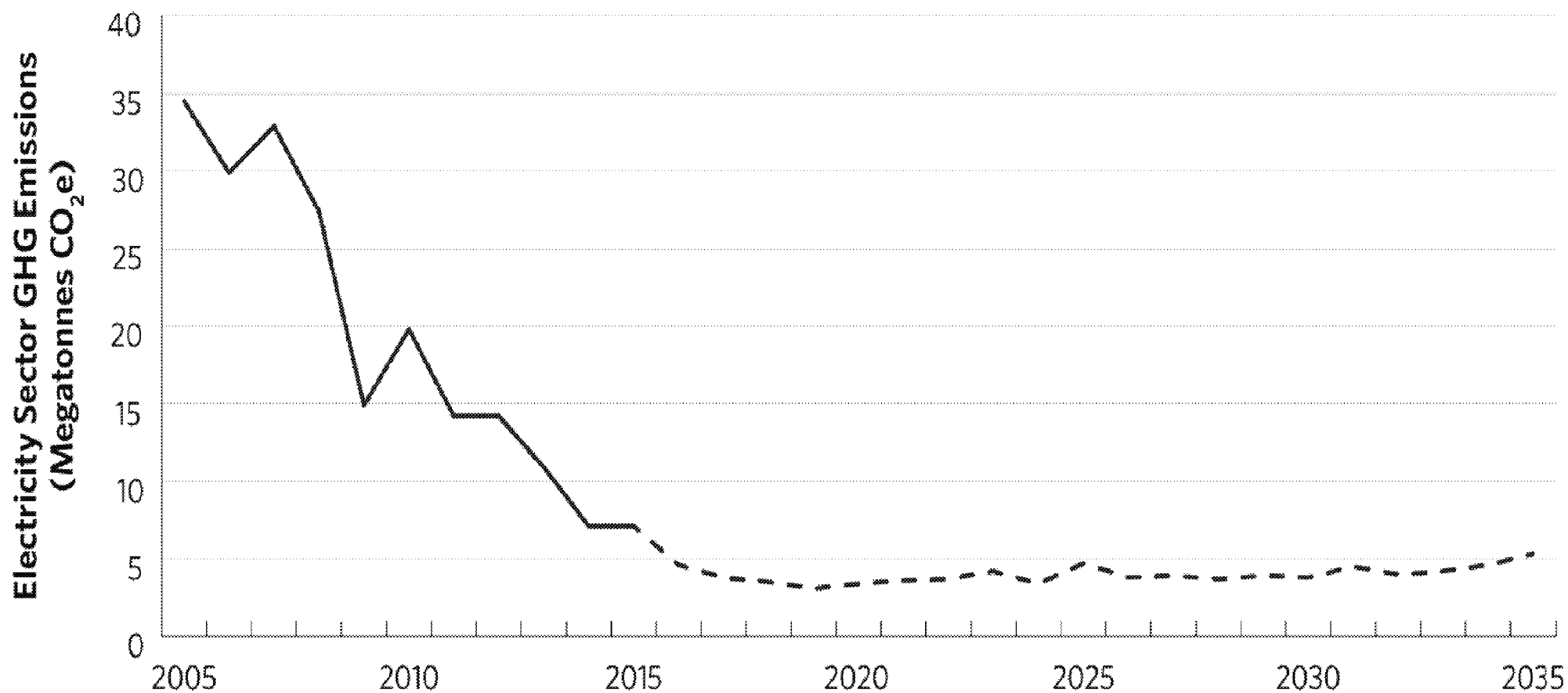


2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013

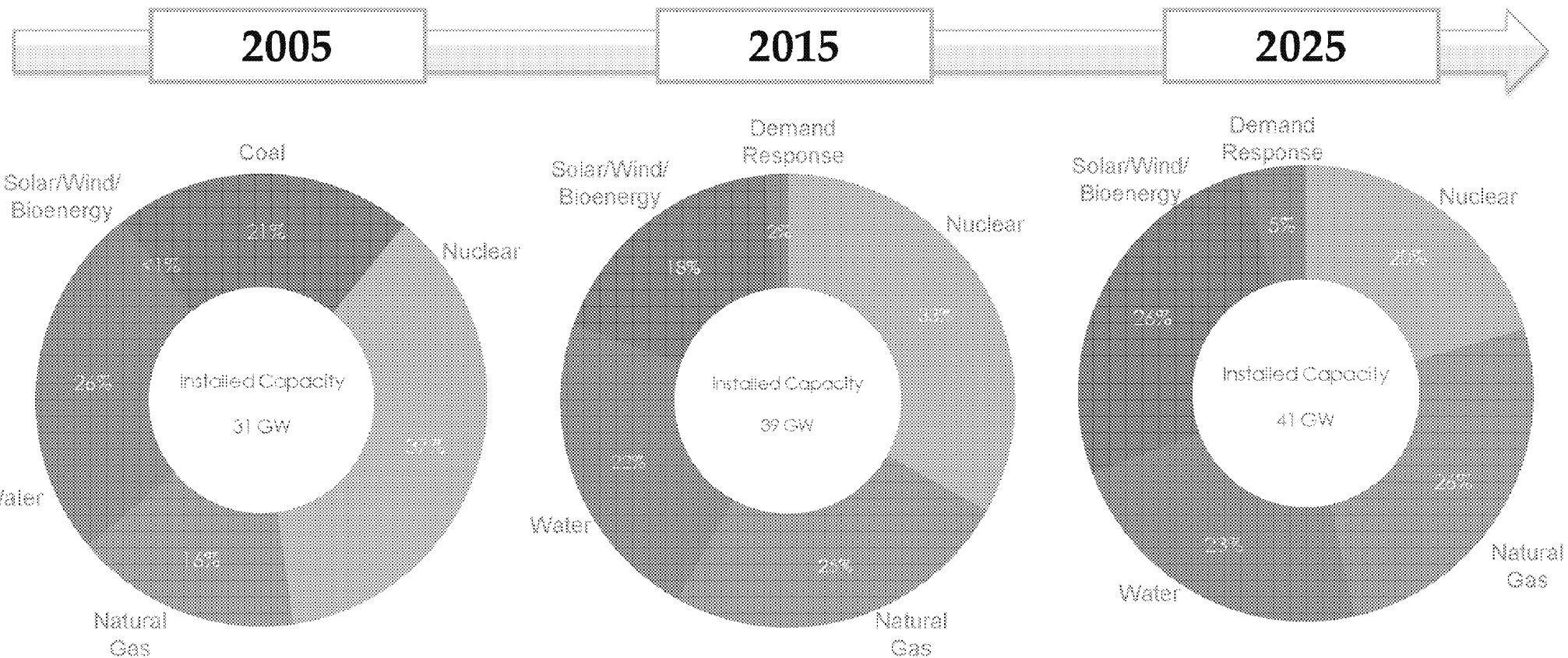
Coal replaced by 14 GW of renewable, natural gas-fired, nuclear and demand response resources



Electricity Sector GHG Emissions in Ontario



Ontario's Electricity Supply - Capacity

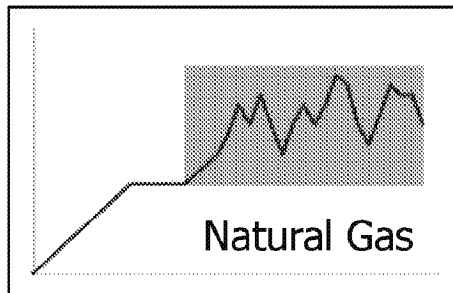
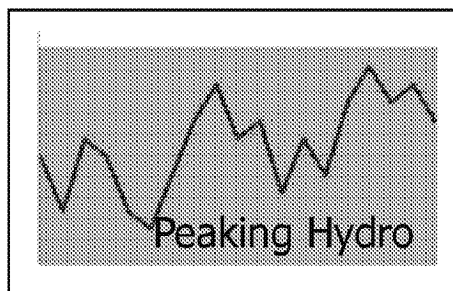


Reflects transmission grid connected and embedded generation, at year end.

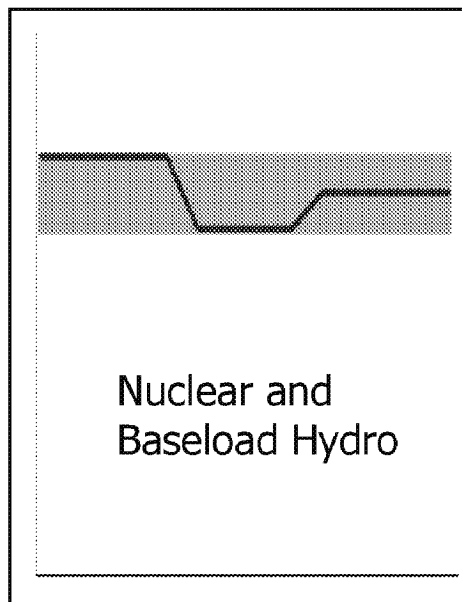
Ontario's Generation Fleet: Operating Characteristics

Each generation type has its own unique operating characteristics. The IESO has developed tools and processes to manage them reliably.

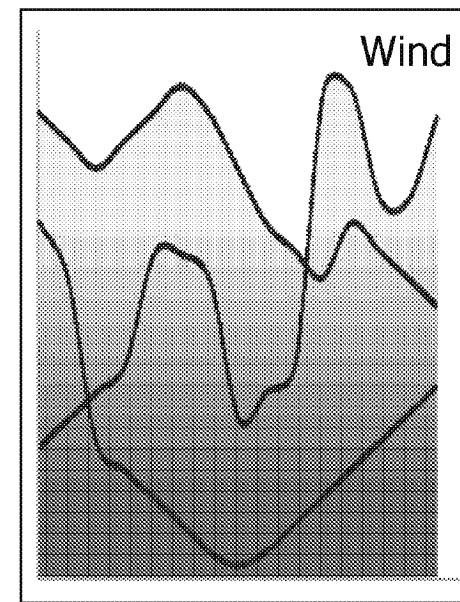
Dispatchable



Baseload



Variable

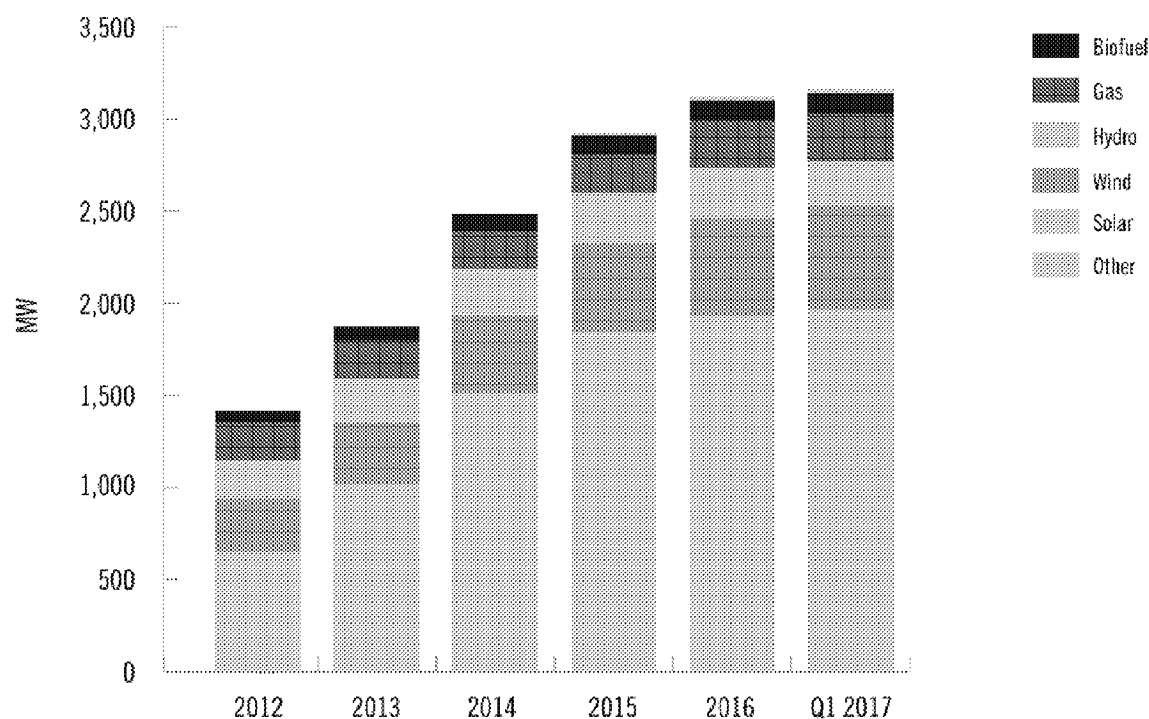


Flexibility is needed to:

- Provide load following
- Provide ramping
- Manage surplus baseload generation (SBG)

Growth of Embedded Generation and DER

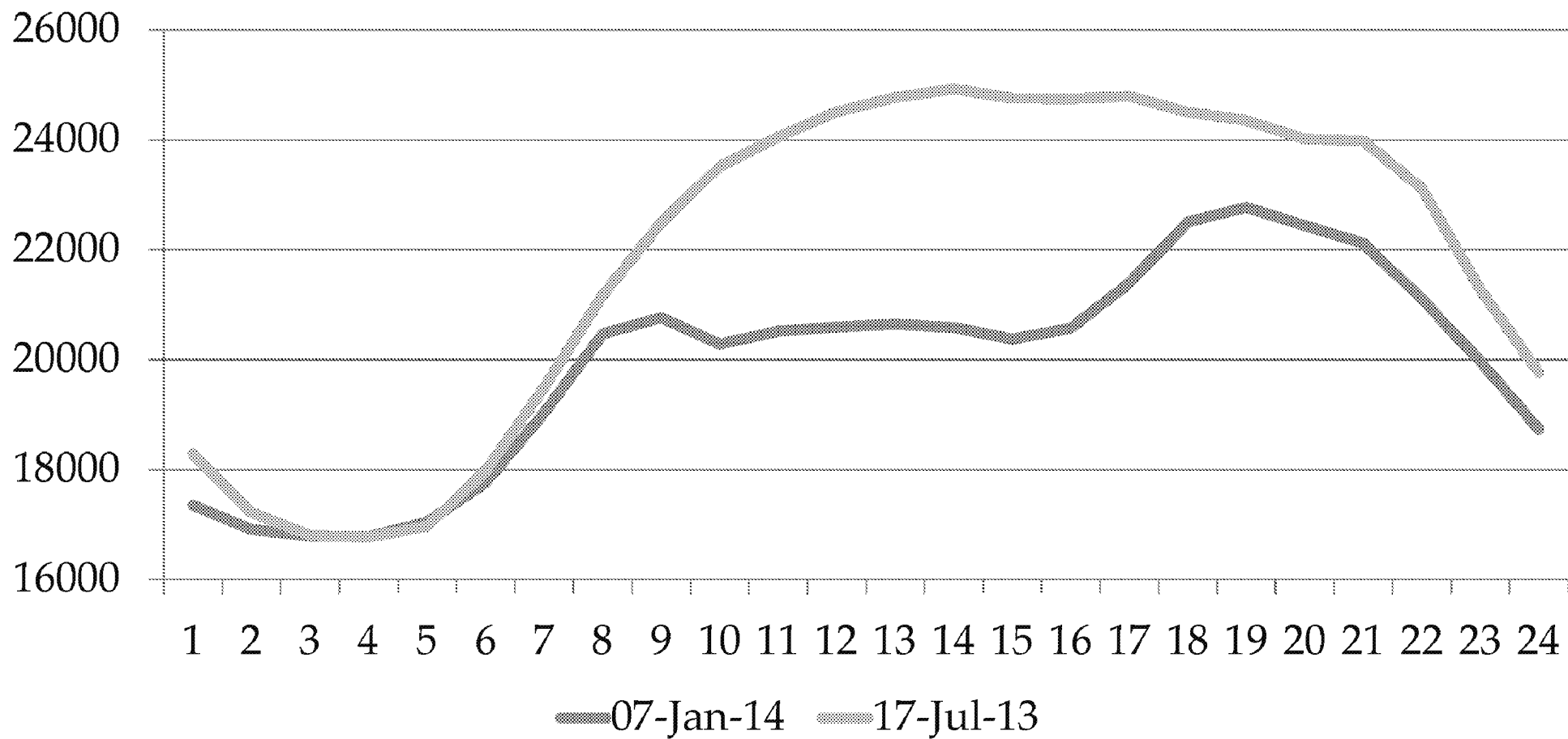
- More than **2,000 MW** of solar has been added over a 6 year period
- Expecting **3,000 MW** of embedded wind and solar by the early 2020's with more than **1,000 MW** being solar installations less than 5MW
- Output from embedded generators directly offsets the need for the same quantity of grid supplied electricity



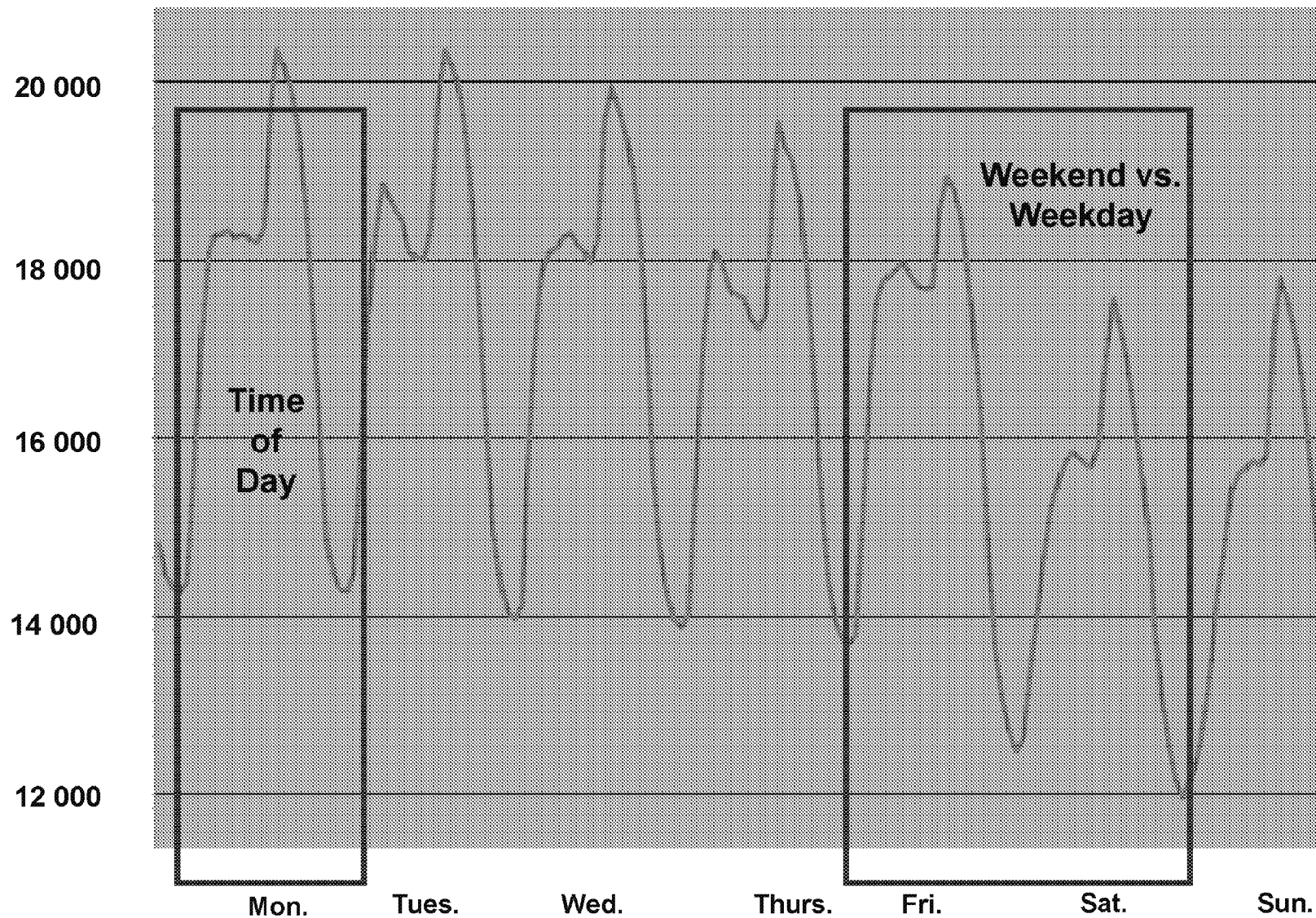
By the end of **Q1 2017**, there was **3,161.9 MW** of contracted generation in commercial operation within local distribution systems.

Demand for Electricity and the Growing Role of the Consumer

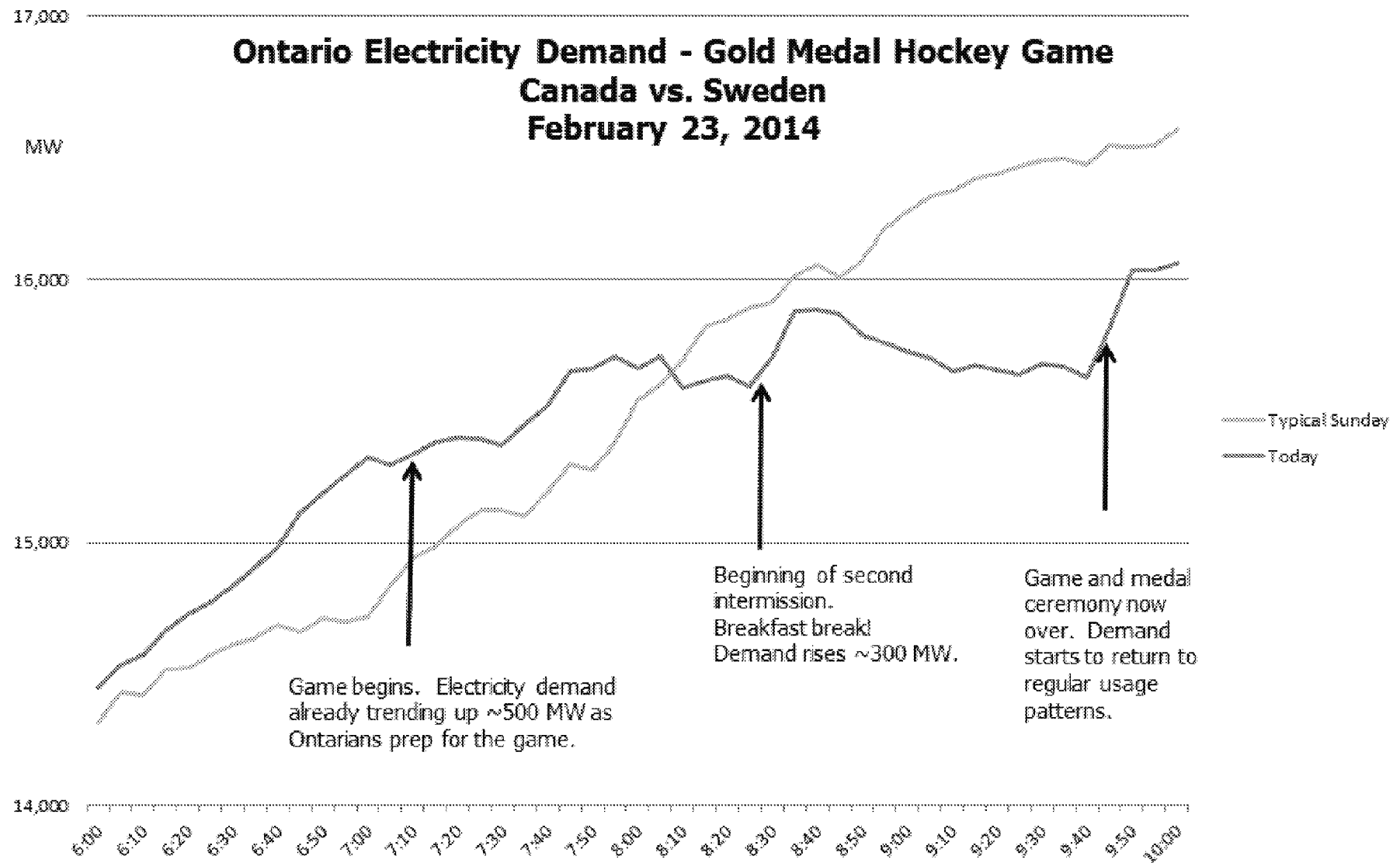
Summer vs. Winter Demand



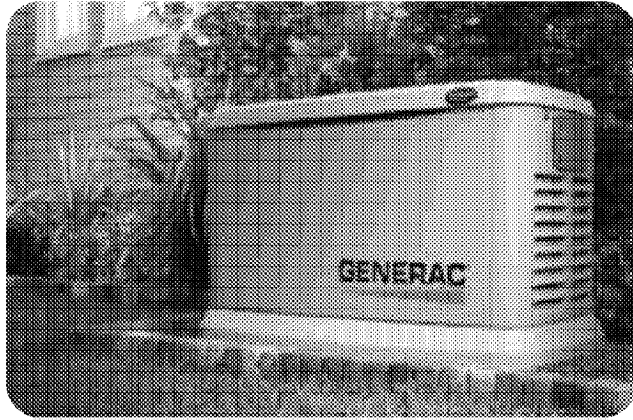
Day-to-Day Demand Varies Considerably



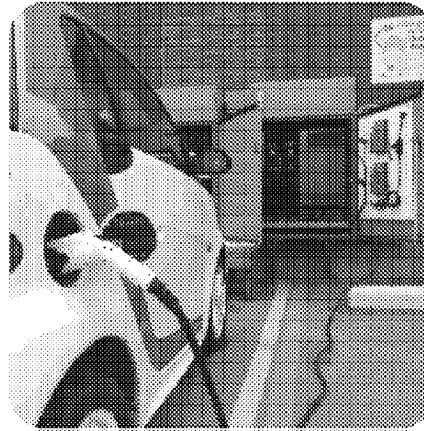
Demand for Electricity: The Impact of Consumer Behaviour



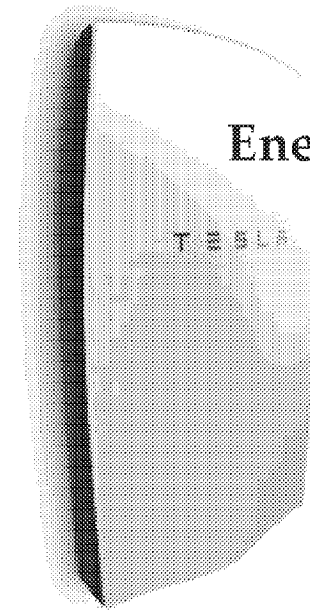
Growing Role of the Consumer



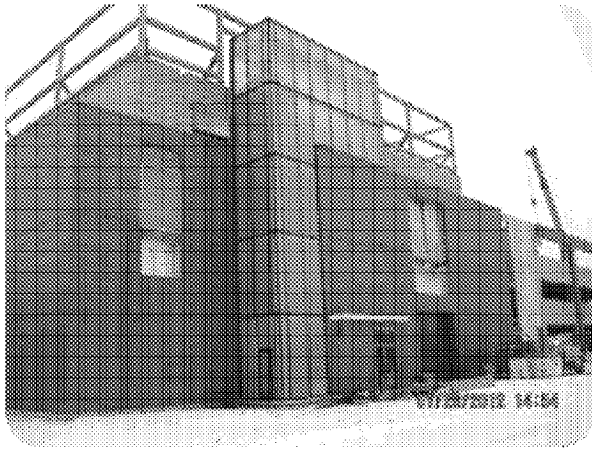
Gas-fired Generators



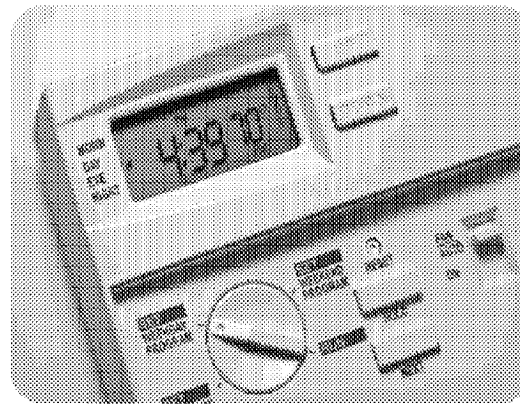
Microgrids



Energy Storage



Combined Heat & Power



Residential Demand Response



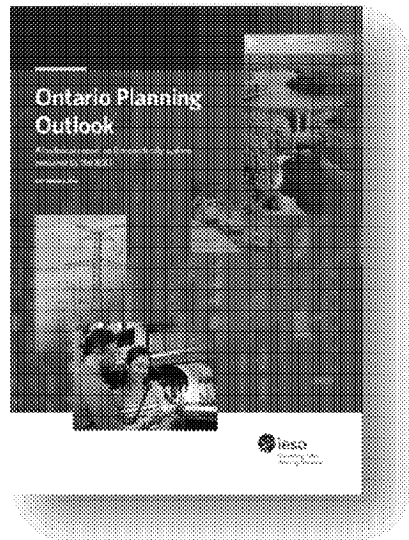
Renewable Generation

Planning for Ontario's Future Electricity Needs

Preparing for change in an evolving sector

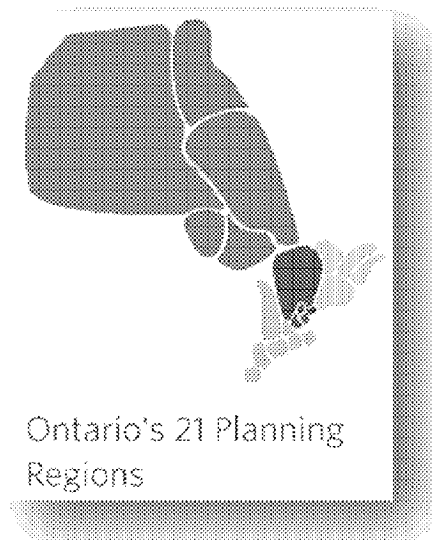
The **IESO** has a **unique vantage point** on the power system – ensuring reliability for the next five minutes all the way to the next 20 years

Provincial Bulk Planning



Identifies the provincial mix of electricity resources and determines what's needed to deliver electricity to customers throughout the province.

Regional Planning Process



A process for identifying and meeting regional electricity needs, with the goal of maintaining reliable electricity supply to the region

Province's Long-Term Energy Plan

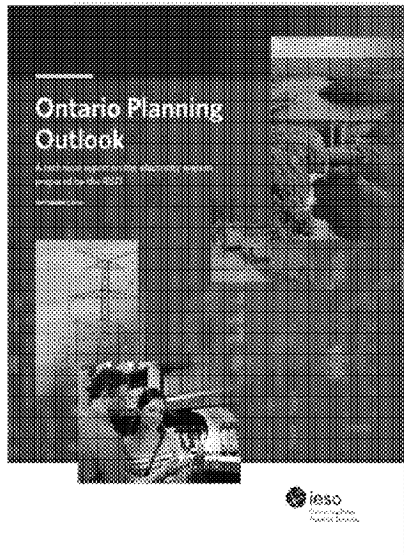


Identifies a policy planning framework that considers cost-effectiveness, reliability, clean energy, community engagement and conservation before building new generation and transmission

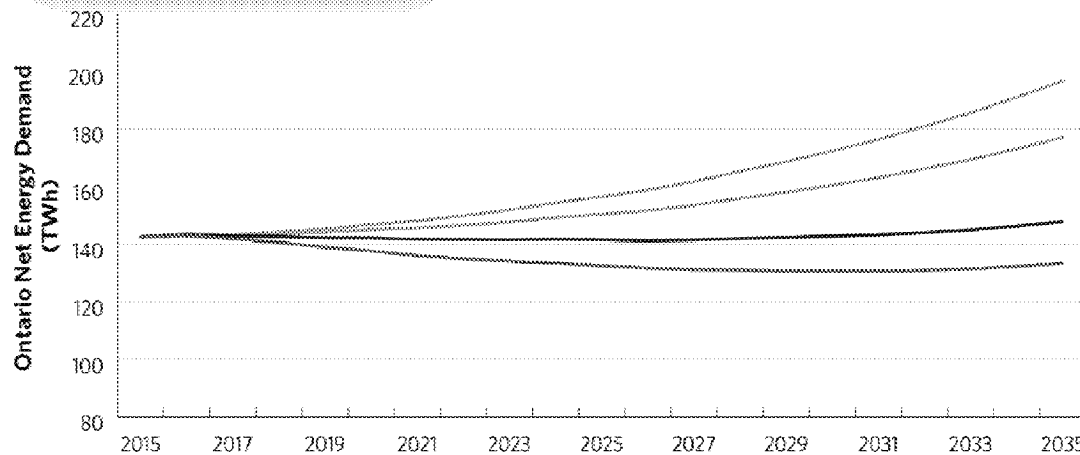
Preparing for change in an evolving sector – system planning

Ontario Planning Outlook

Report presents the IESO's planning outlook for the 2016 through 2035 period and includes a range of demand outlooks



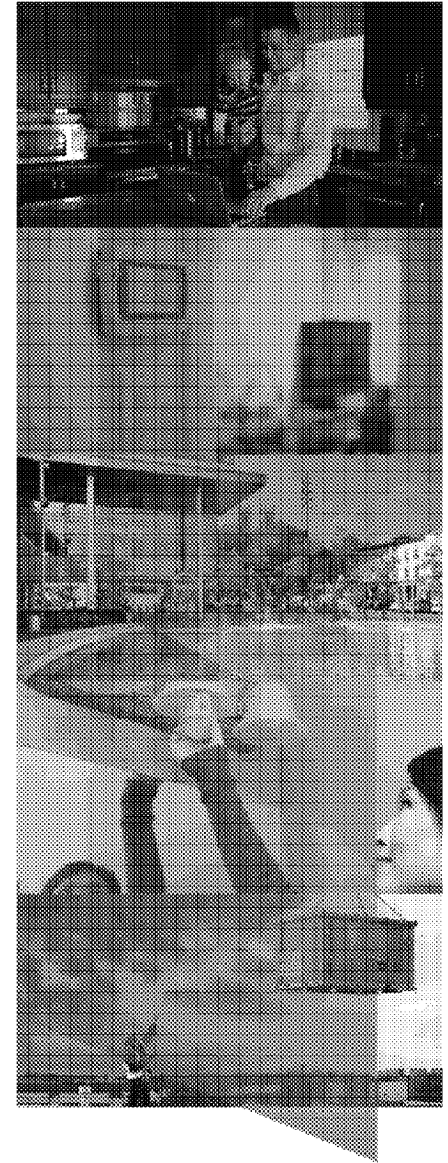
Looks at the needs of the electricity system associated with capacity, reliability, market and system operations, transmission and distribution



- Ontario well-positioned to meet provincial needs until the mid-2020s
- Implementation of the province's climate change policies will have an impact on the demand for electricity
- In higher demand outlooks, additional investments in new resources would be required to meet the increase in demand
- Opportunities for increased conservation will also vary with increases and decreases in demand

Putting Conservation First

- Conservation provides a **clean and cost-effective alternative** to building new generation
- Conservation lowers peak demand, deferring and avoiding the need to build new infrastructure
- Conservation is **expected to offset almost all demand growth until 2032**
- The goal of the *Conservation First Framework* is to reduce electricity consumption by 8.7 TWh – **the equivalent of powering Mississauga and Sudbury for a year** – by December 31, 2020
- **Save on Energy** initiatives offer incentives and programs for residential and business customers





Save on Energy has programs, rebates and resources to help you:

- ✓ SAVE MONEY
- ✓ SAVE ENERGY
- ✓ STAY COMFORTABLE



For Homes

HEATING & COOLING INCENTIVE +

Peaksaver Plus®

COUPONS +

Buying a New Home +

Home Assistance Program +

For Business

Small Business Lighting

Retrofit Program +

Peaksaver Plus®

AUDIT FUNDING +

EXISTING BUILDING COMMISSIONING +

Energy Managers +

HIGH PERFORMANCE NEW CONSTRUCTION +

PROCESS AND SYSTEMS +

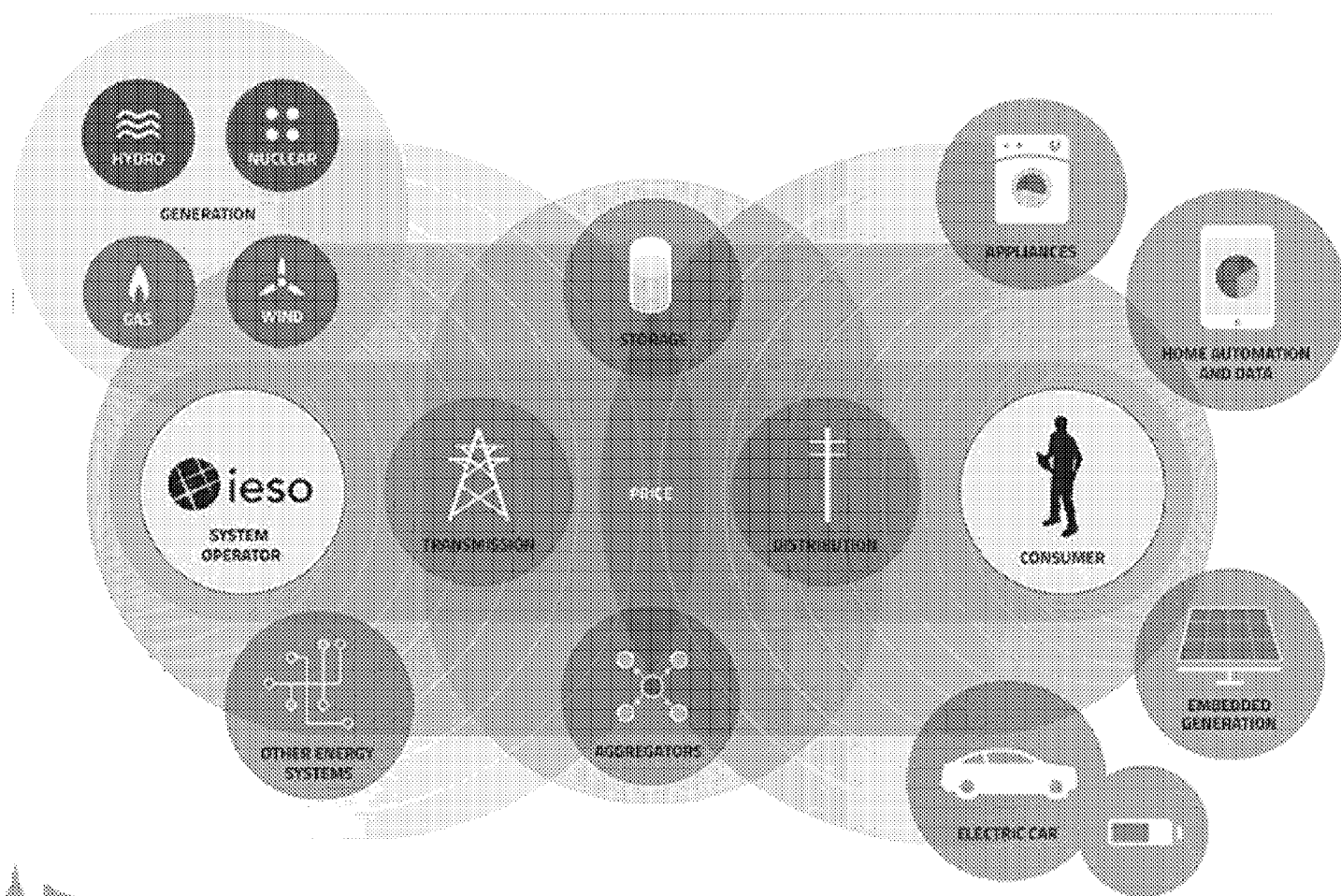
DEMAND RESPONSE

TRAINING & SUPPORT +

NEW HOME CONSTRUCTION +

Social and Assisted Housing

What's happening in the electricity sector...

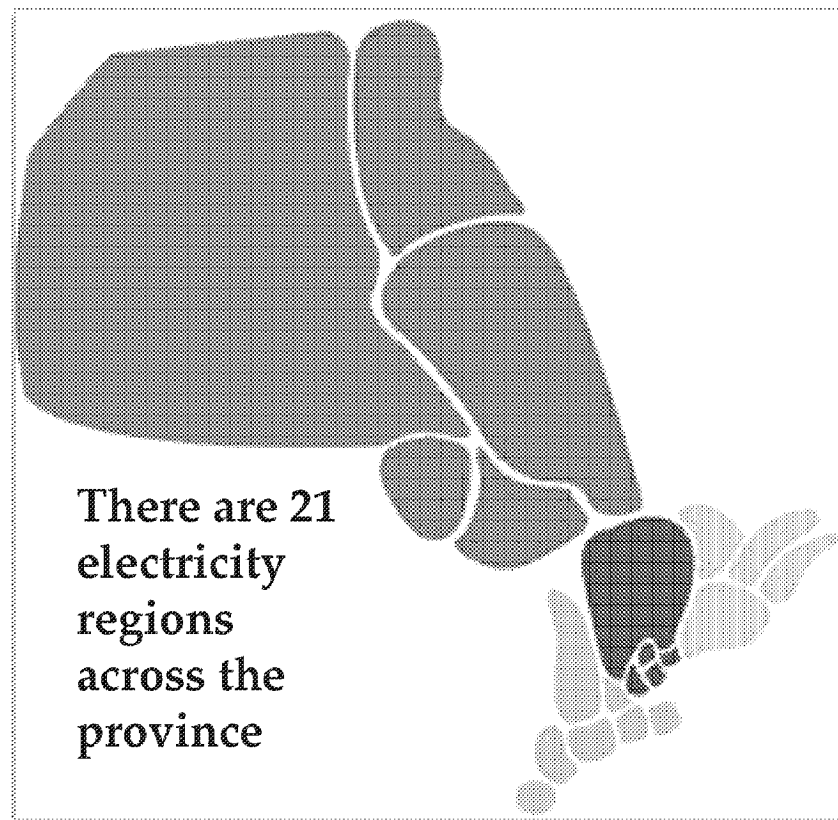


The pace of change in the energy sector is high:

- ☐ fuel switching
- ☐ electric vehicles
- ☐ emerging potential of the Smart Grid
- ☐ behind-the-meter generation
- ☐ renewable fuels
- ☐ international efforts to fight climate change
- ☐ proliferation of big data
- ☐ home automation
- ☐ energy storage

Preparing for change in an evolving sector – regional planning

- The electricity needs of all 21 of Ontario's planning regions have now been evaluated for regional planning; needs re-evaluated on a five-year cycle
- The 20-year regional plans ensure a reliable electricity supply to communities and look at a variety of options including:
 - Conservation
 - Generation
 - Transmission and distribution
 - Other innovative solutions



Benefits of Regional Planning

- ☐ Minimize unwarranted or risky investments
- ☐ Better positioned to integrate and optimize
- ☐ Provides a more formalized planning process

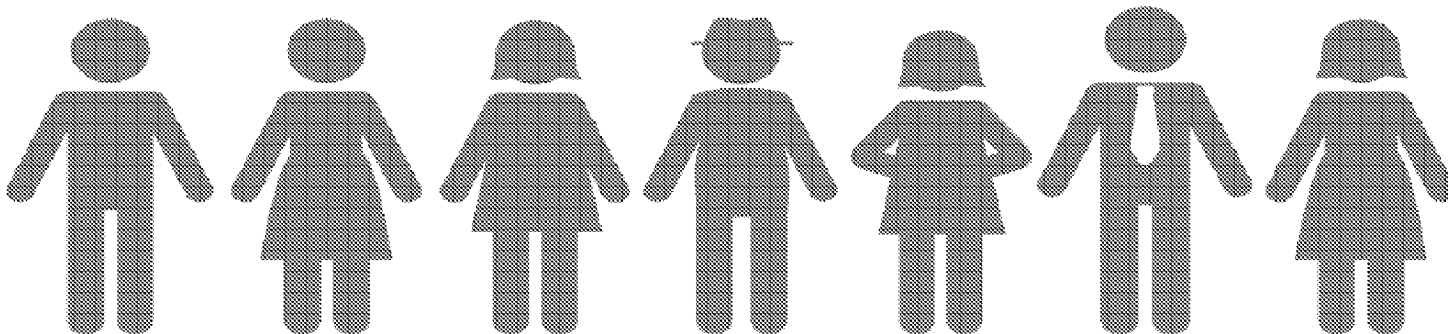
Preparing for change in an evolving sector – regional planning engagement

Local Advisory Committees (LAC)

- Have up to **18** members, representing municipalities, Indigenous communities, consumers and citizens, the business community, and environmental and conservation groups
- LACs represent community interests within the study area, and provide insight into their values and perspectives, including information on local priorities and ideas on the design of community engagement strategies

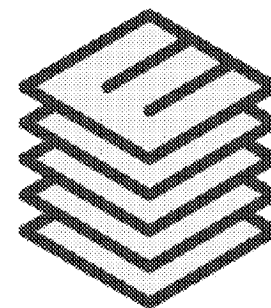
Current LACs

- Greenstone-Marathon
- GTA East
- Parry Sound/Muskoka
- Barrie/ Innisfil
- Thunder Bay
- Toronto
- West of Thunder Bay
- York Region
- Ottawa



Community Energy Plans

- The IESO is actively working with sector partners to help municipalities understand the link between community energy planning and the regional electricity planning process
- Community Energy Plans help establish local priorities for how energy should be generated, delivered and used in the community now and into the future



Ontario
**ENERGY
COMMUNITY
OF PRACTICE**

ECOP is being led by **QUEST** and the **Clean Air Partnership** and is being supported by the **IESO**

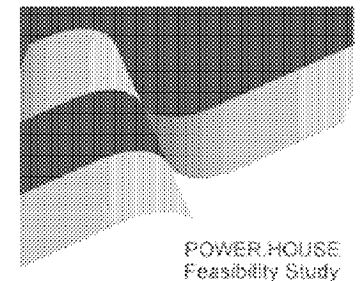
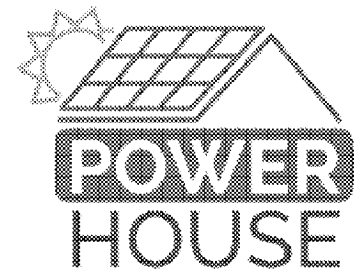
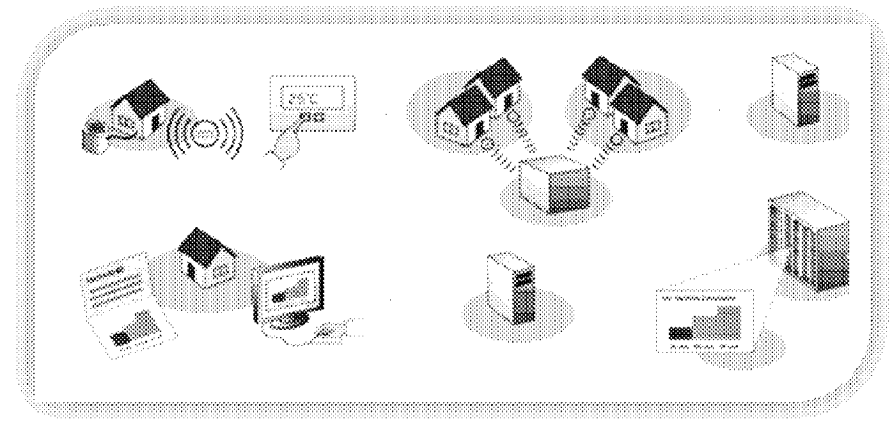
The **Ontario Energy Community of Practice (ECOP)**

- Provides education and capacity building for Ontario municipalities, utilities and other local stakeholders to develop and implement community energy plans
- Training tools, sharing of best practices and facilitation of peer-to-peer collaboration
- Helps align local, regional and provincial energy planning activities
- New outreach initiatives will be launched in Fall 2017

Enhancing reliability: IESO collaborating with LDCs and municipalities

The IESO is looking at ways to enhance reliability and efficiency through the coordination of IESO and LDC-controlled resources

- ❑ IESO's Grid-LDC Interoperability Standing Committee
- ❑ Smart Grid Forum
- ❑ Local demand management pilots
- ❑ Conservation and demand management local achievable potential studies:
Toronto, Barrie-Innisfil, and Parry Sound-Muskoka



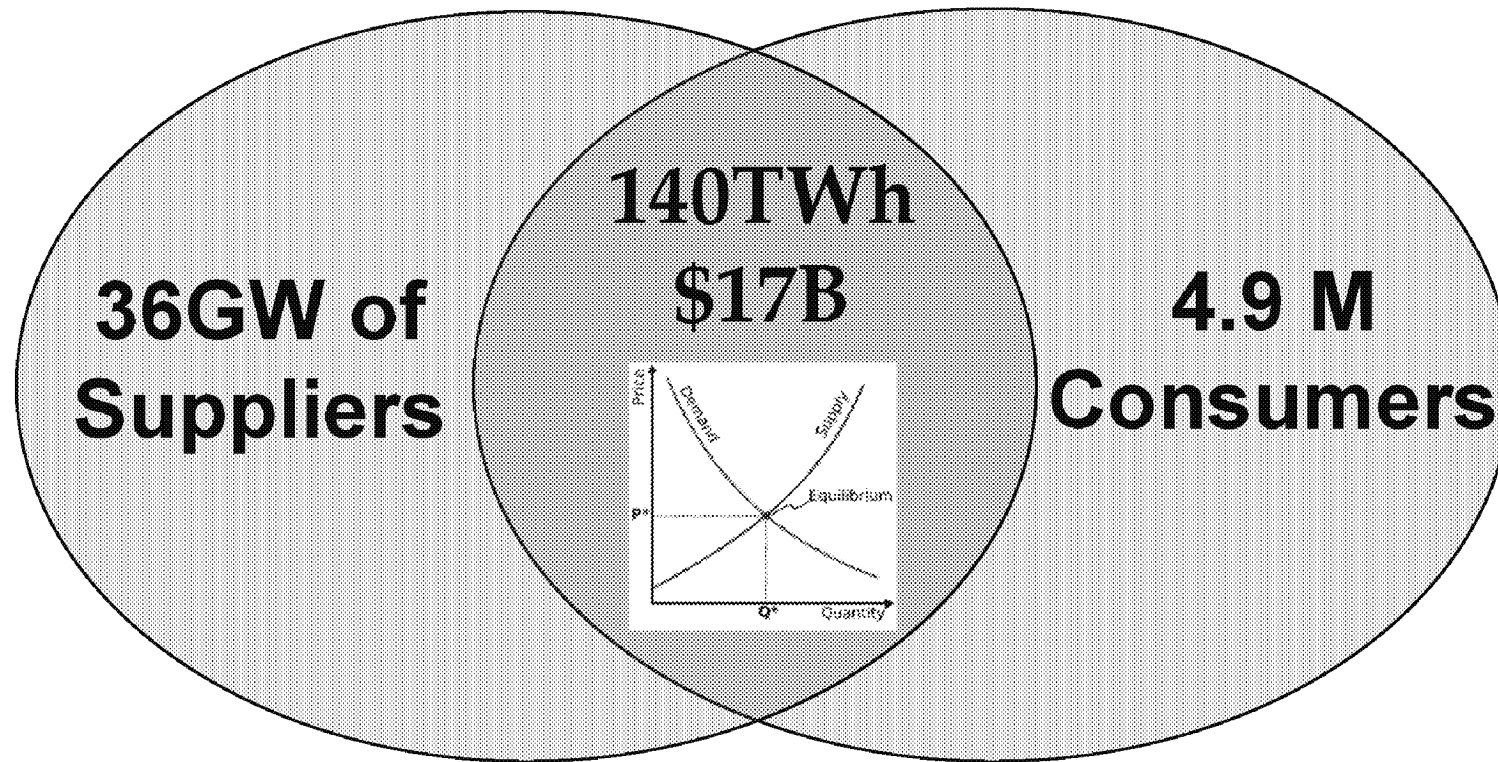
The IESO and Alectra: **Feasibility study** to analyze costs, benefits, technical capabilities, and key considerations associated with aggregating a large-scale fleet of solar storage assets to deliver both customer and grid value

Electricity Pricing and the Market

The Wholesale Electricity Market

- Primary role of the spot market - the **efficient dispatch** of resources to meet system demand
- The market helps to maintain the reliability of the electricity system by enabling the efficient allocation of resources.
- Produces a **transparent, efficient price signal** that reflects the incremental cost of energy
- **Competition** amongst resources encourages resources to offer reflecting their marginal cost of production, lowering costs for consumers
- Wholesale market includes the economically efficient **scheduling of energy** between Ontario and neighbours (imports and exports)

The Wholesale Electricity Market: A Dynamic Marketplace



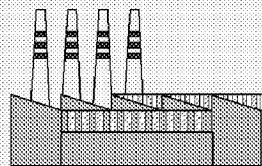
- The wholesale market connects Consumers and Suppliers in real time and allows for competition amongst resources
- Advances in technology are enabling even greater competition through resources such as **energy storage** and **demand response**

Market Participants

Boundary of IESO-controlled grid

90

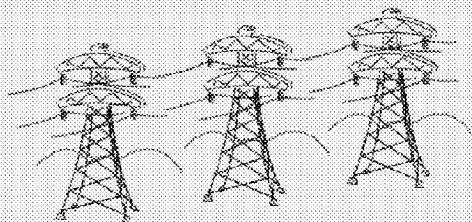
Direct Connect
Customers



Large facilities
(over 5,000 kW)

5

Transmitters



74

Generator
Market Participants



60+ Local Distribution Companies Serving

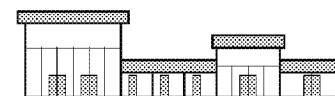
~4,400,000

Residential Customers



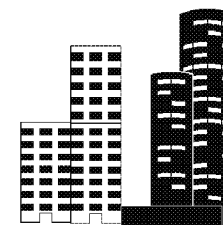
~430,000

General Service
Customers (< 50 kW)



~57,000

Large General
Service Customers
(> 50 kW to 4,999 kW)



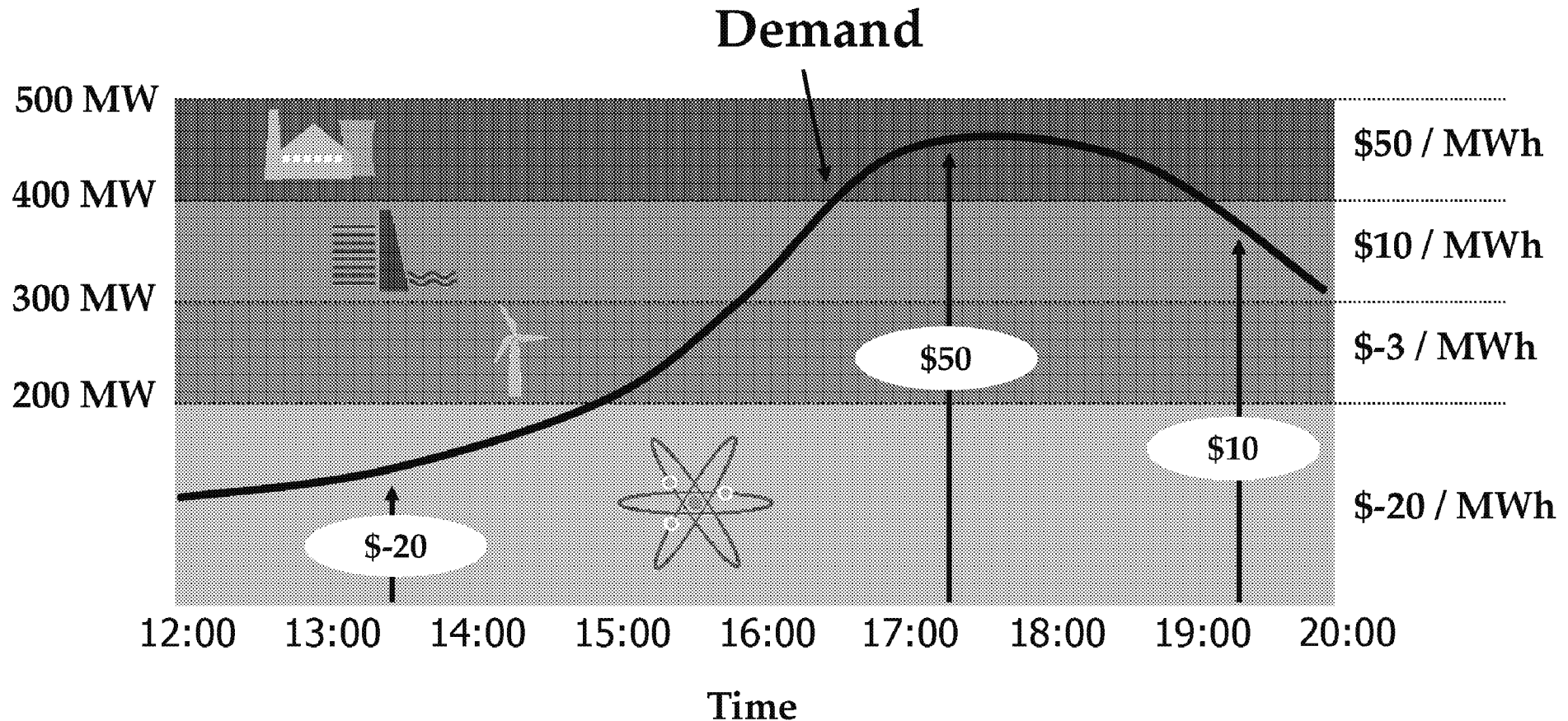
60

Energy traders
(import/export market)



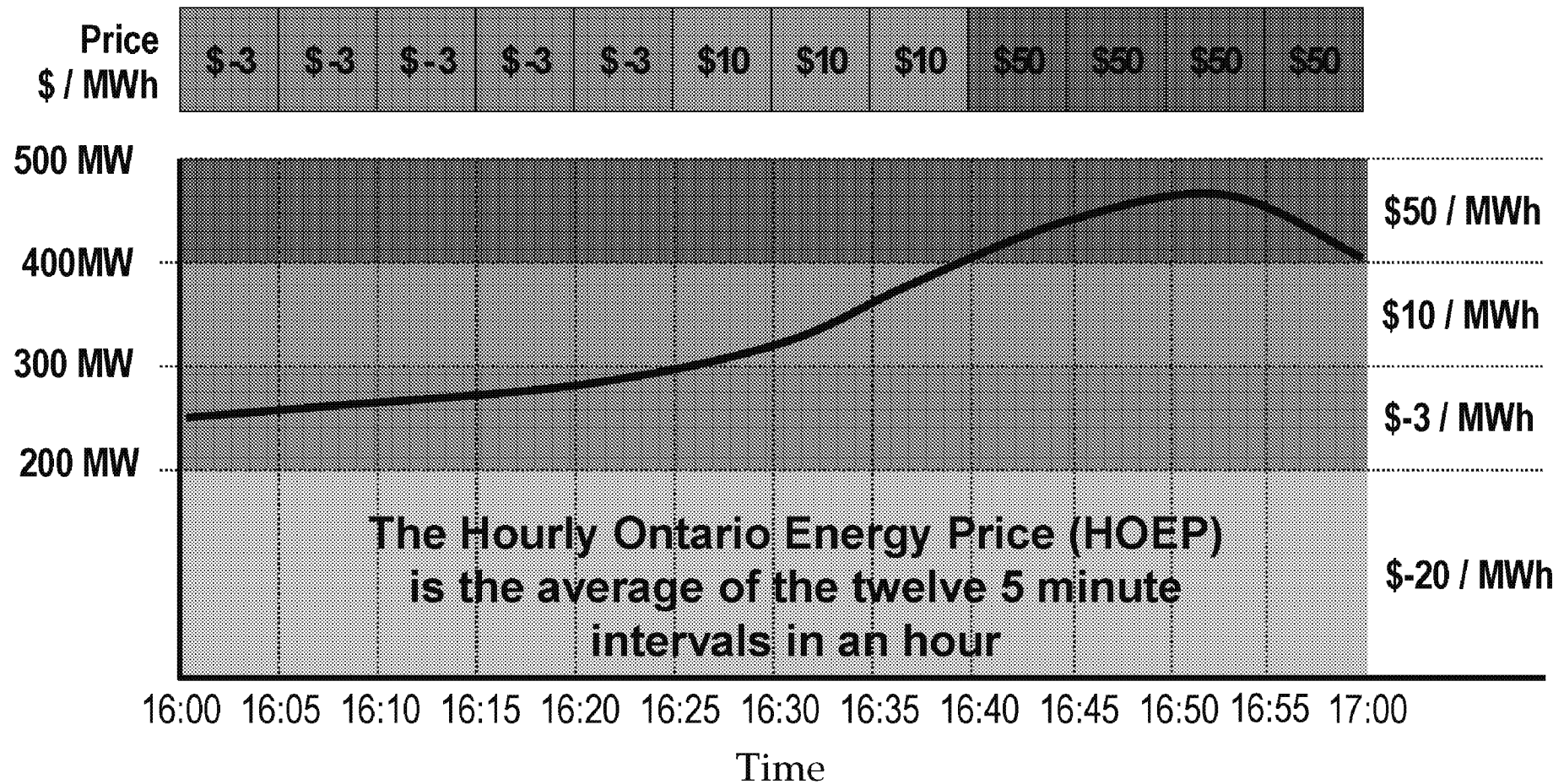
Note: diagram does not include participants in all IESO programs or initiatives

Demand and Price



Price is set by stacking offers from lowest to highest cost. The lowest cost resources are chosen first until the demand for electricity is satisfied.

Hourly Ontario Energy Price

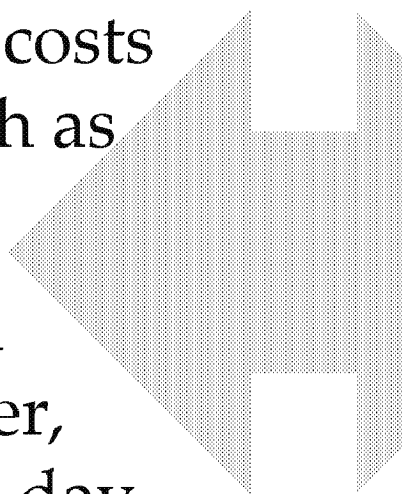


Hourly Ontario Energy Price = \$20.42

Electricity Pricing: Energy Costs & Capacity Costs

Wholesale Price

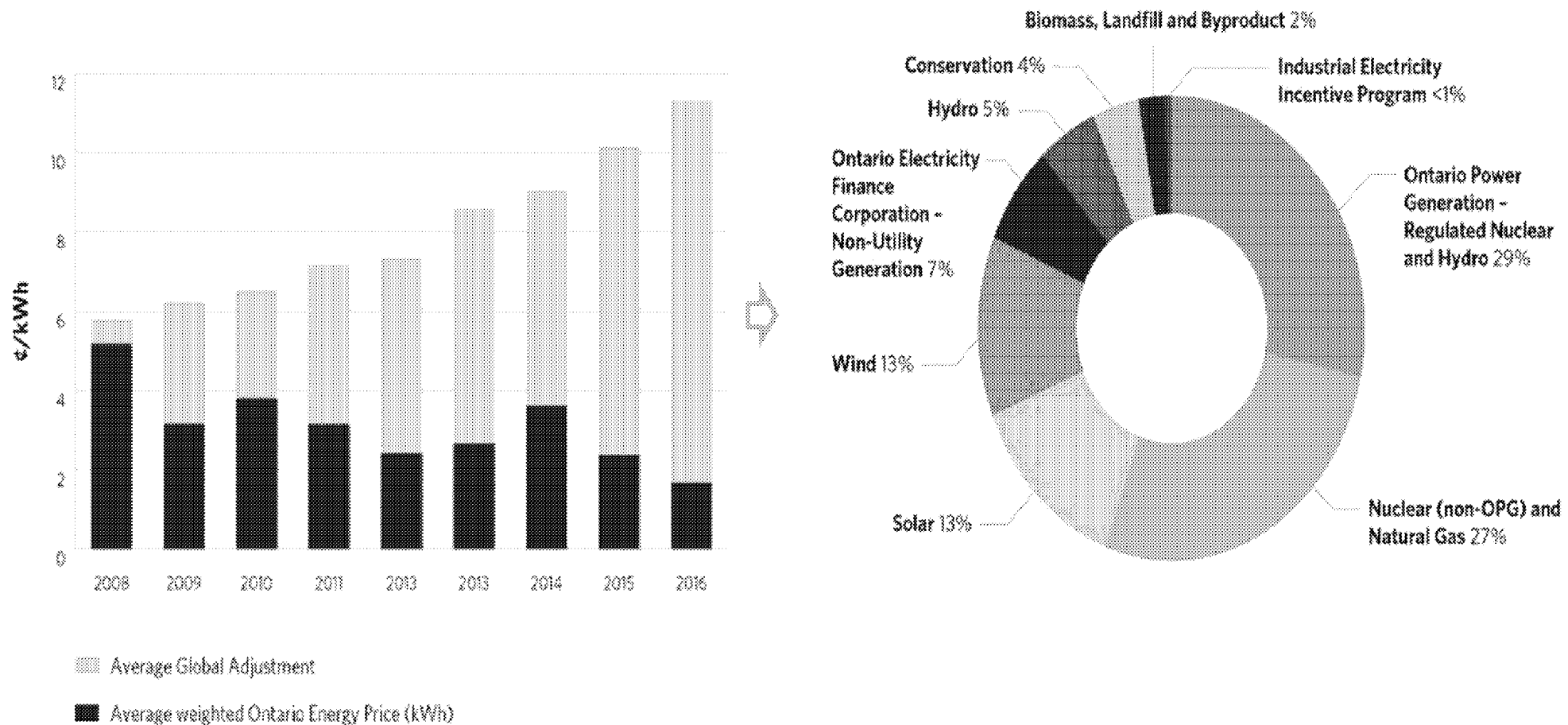
- Signals current supply and demand situation
- Covers operational costs of production – such as fuel
- Varies by hour, and impacted by weather, time of day, year or day of the week



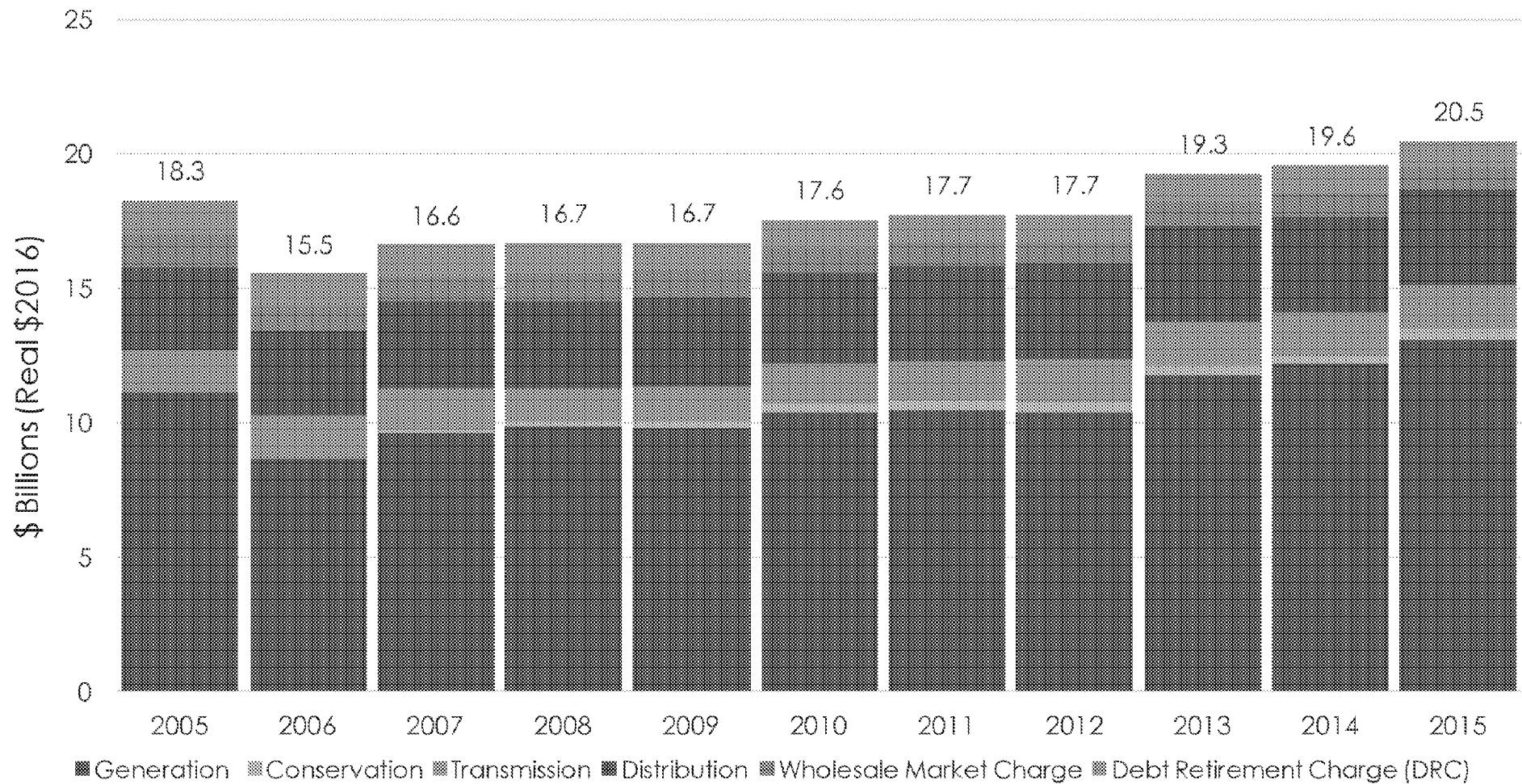
Global Adjustment

- Investment or capacity costs to build or refurbish infrastructure – that are not covered through market revenues
- Includes contracts, and regulated rates to generators and other suppliers as well as conservation
- The GA also changes when new projects come into service, contract payments take effect or as a result of changes in demand

Electricity Pricing Trends and Global Adjustment Contributors



Historical Perspective: total cost of electricity service 2005-2015



Ontario Government's Fair Hydro Plan

- As of July 1, 2017, your electricity bill will be reduced by 25% on average if you're a residential consumer.
- In addition:
 - electricity rates will not increase beyond the rate of inflation for four years
 - your bill will be even lower, as much as 40 to 50%, if you live in an eligible rural or remote community or have a low income
 - This 25% reduction includes the 8% rebate that took effect on January 1, 2017.
- The plan spreads out the cost of Ontario's electricity investments over a longer period of time.

Time-of-Use Pricing

Current Time-of-Use Rates effective July 1, 2017

6.5¢ per kWh off-peak

9.5¢ per kWh mid-peak

13.2¢ per kWh on-peak

- The Ontario Energy Board (OEB) sets time-of-use rates.
- Time-of-use rates paid by residential and small business customers include the global adjustment charge.
- These regulated rates are based on projections of consumption – how much power consumers will use – combined with the estimated cost of power over that time period.
- If the previous projection was either too high or low, that will also be accounted for in the new rates.
- For more information, see [OEB website](#).

IESO Resources – Keep in Touch

Connecting Today. Powering Tomorrow.

The Independent Electricity System Operator (IESO) works at the heart of Ontario's power system. The IESO delivers key services across the electricity sector including: managing the power system in real-time, planning for the province's future energy needs, enabling conservation and designing a more efficient electricity marketplace to support sector evolution.

Wednesday, June 07, 2017

Demand	Hourly Ontario Demand at 12:00 p.m. EST			13,901 MW	>		
	14,062 MW						
	Projected Demand at 1:00 p.m. EST						
	Today's Projected Peak at 10:00 p.m. EST			15,422 MW			
Supply	Hourly Output by Fuel Type (Transmission-Connected) at 12:00 p.m. EST				>		
	Nuclear	19,345 MW	Hydro	4,527 MW		Gas	273 MW
	Renewables	1,000 MW	Interprovincial	1,000 MW		Generator Availability at Peak at 10:00 p.m. EST	15,422 MW
	Total Supply					22,875 MW	
	Total Demand					14,062 MW	



Connecting Today.
Powering Tomorrow.

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saveonenergy.ca

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Powering Tomorrow.