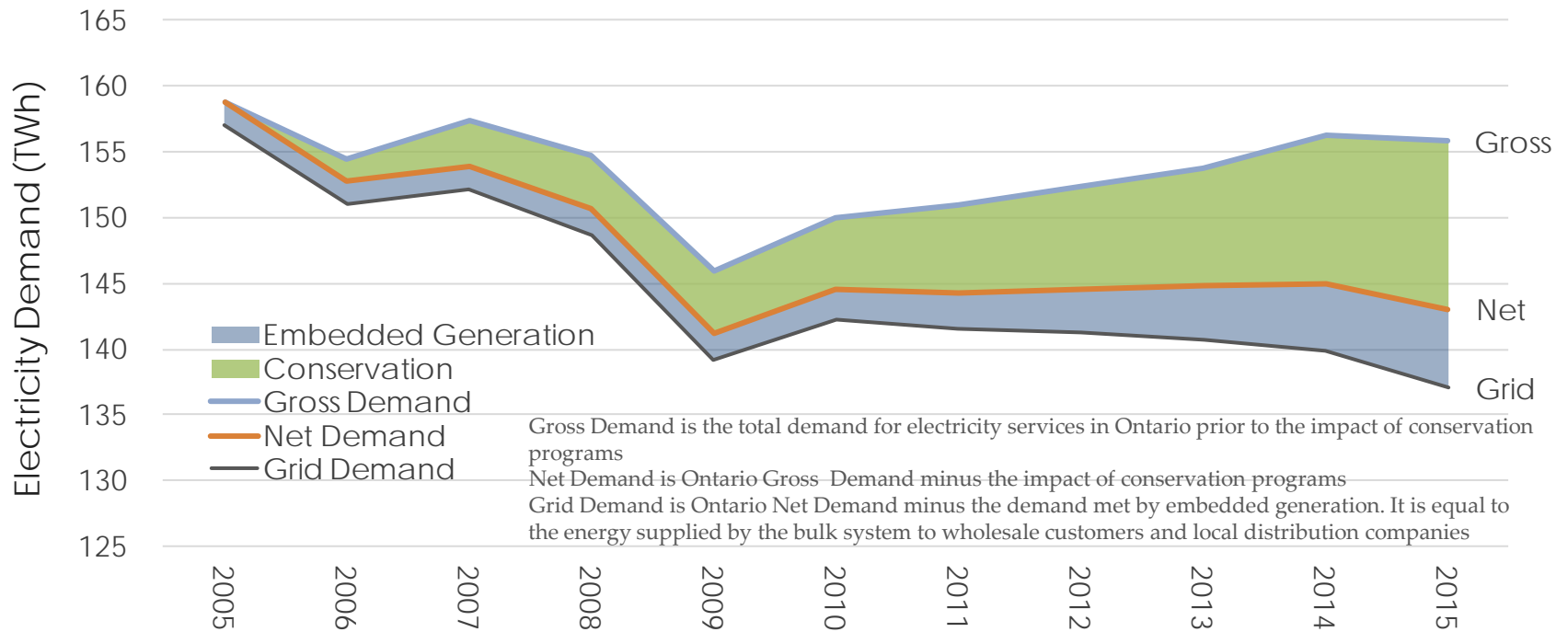


# MODULE 1: State of the Electricity System: 10-Year Review

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August 2016

# Electricity demand 2005-2015



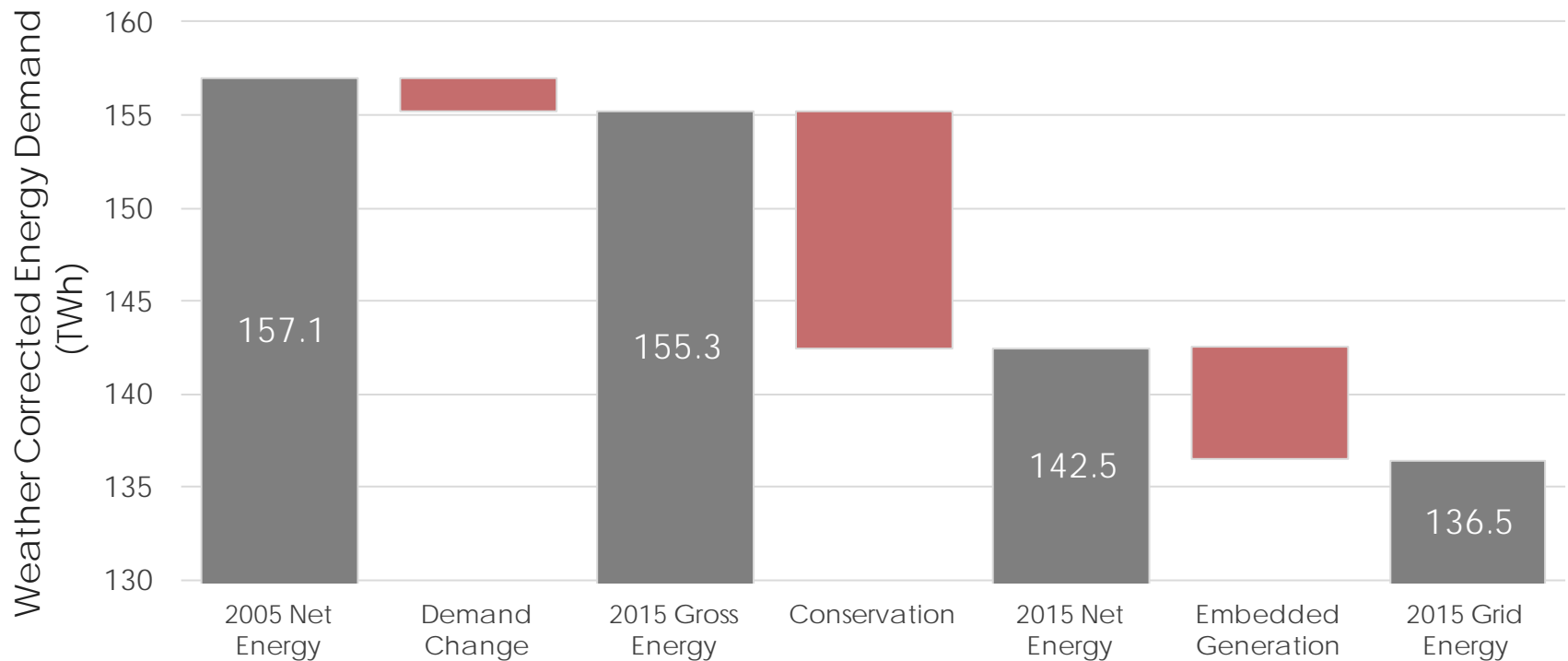
- Decline in grid demand is due to four main factors
  - Decreasing demand due to changes in the economy
  - Participation in energy efficiency programs and improvements in building codes and equipment standards
  - Changes in consumer behavior as a result of electricity prices including due to Time of Use Pricing (TOU) enabled by smart meters
  - Growing presence of embedded generation

# Ontario gross, net and grid energy demand, 2005-2015 (TWh)

<b>TWh</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
Gross Demand	158.8	154.4	157.3	154.7	146.0	149.9	151.0	152.3	153.8	156.2	155.8
Conservation	0.0	1.6	3.5	4.0	4.9	5.4	6.7	7.9	8.9	11.3	12.8
Net Demand	158.8	152.8	153.8	150.6	141.1	144.5	144.3	144.5	144.8	144.9	143.0
Embedded Generation	1.8	1.7	1.6	2.0	2.0	2.3	2.8	3.2	4.1	5.1	6.0
Grid Demand	157.0	151.1	152.2	148.7	139.2	142.2	141.5	141.3	140.7	139.8	137.0

# Net energy demand represents the total amount of electricity consumed in Ontario during the year

- Embedded generation has grown significantly in recent years through procurement programs such as RESOP, FIT and MicroFIT. These new resources caused demand on the IESO grid to decrease.
- Time of Use pricing structures have the greatest impact on peak demand. There is little direct impact on energy because load is shifted to other times

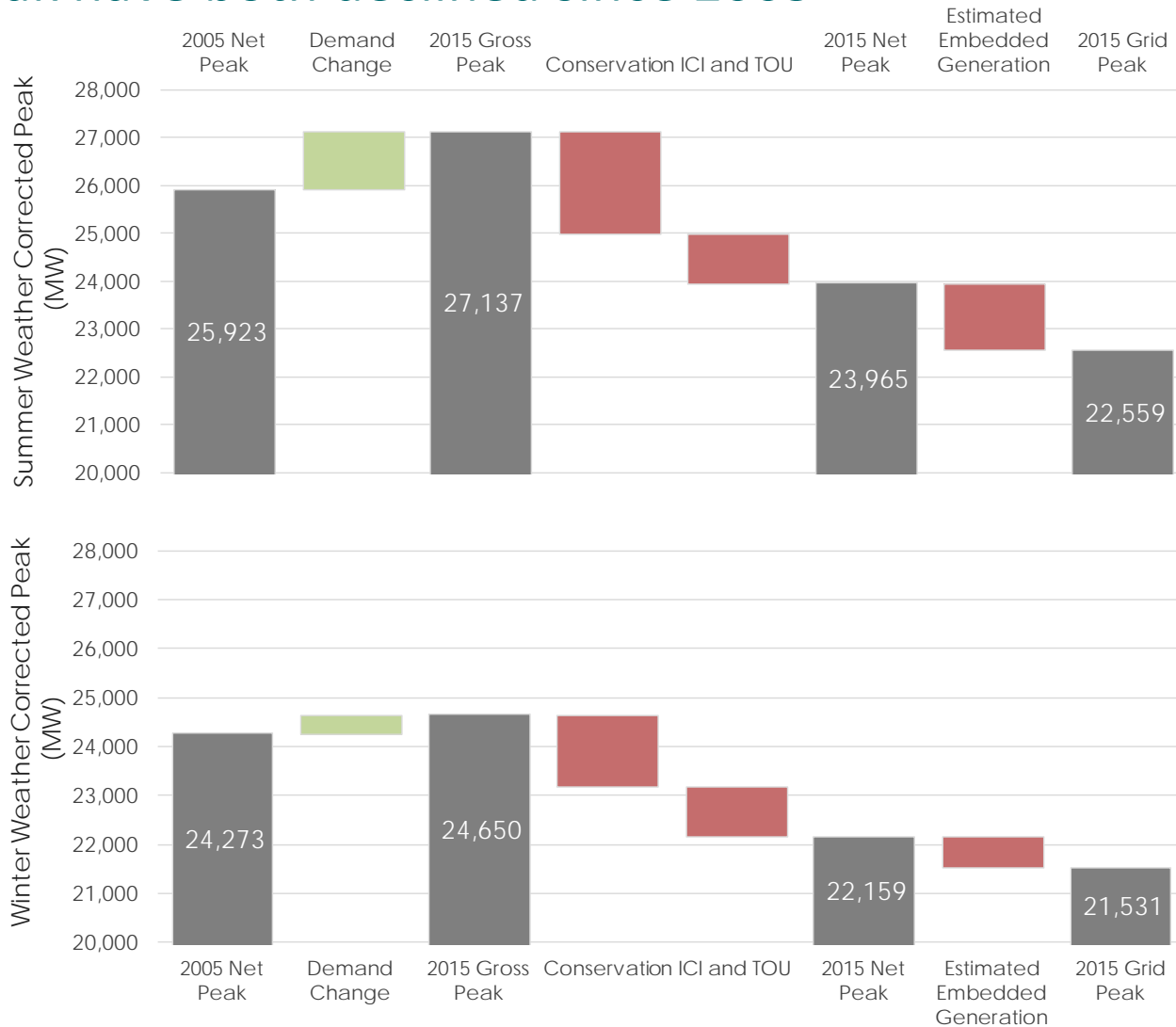


# Factors affecting energy demand

## Annual Energy (TWh, weather corrected)

2005 Net Energy	157.1
Demand Change	1.8
2015 Gross Energy	155.3
Conservation	12.8
2015 Net Energy	142.5
Embedded Generation	6.0
2015 Grid Energy	136.5

# The drivers underlying peak demand have grown, but net and grid peak have both declined since 2005



- Summer peak demand is driven by air conditioners and other space cooling technology while winter peak is related to space heating
- In 2015, Time-of-Use pricing (TOU) and the Industrial Conservation Initiative (ICI) both reduced summer and winter peaks
- “Estimated Embedded Generation” is the peak reduction attributed to embedded resources

Note: ICI varies year-on-year based on weather conditions. In 2015, a cold winter prompted a higher-than-usual contribution from ICI

# Factors affecting summer and winter peak demand

## Summer Peak (MW, weather corrected)

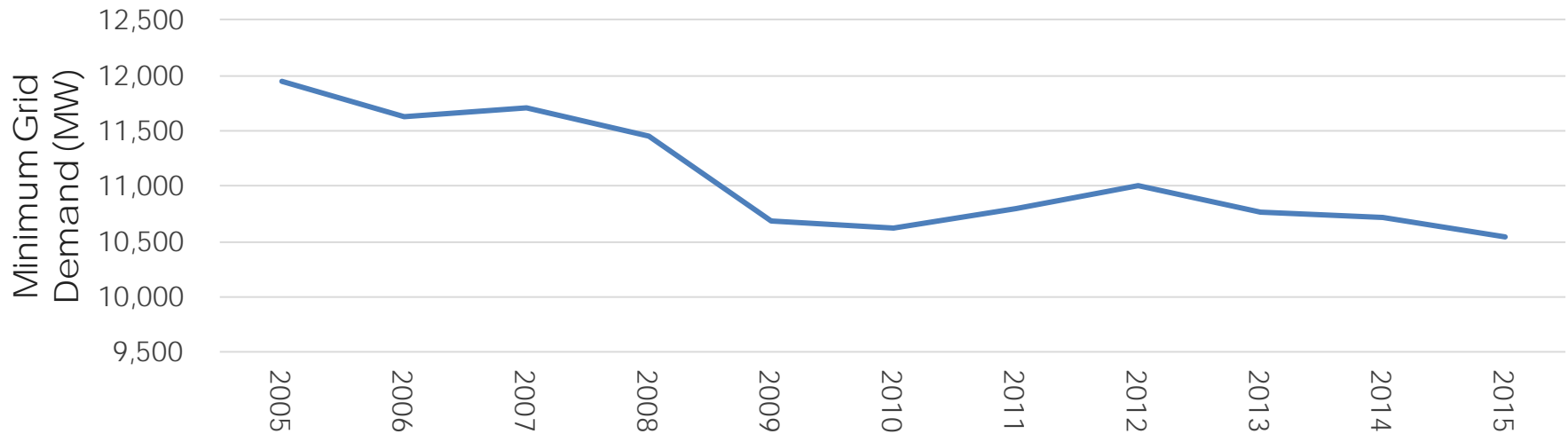
2005 Peak	25,923
Demand Change	1,214
2015 Gross Peak	27,137
Conservation	-2,133
ICI and TOU	-1,039
2015 Net Peak	23,965
Estimated Embedded Generation	-1,406
2015 Grid Peak	22,559

## Winter Peak (MW, weather corrected)

2005 Peak	24,273
Demand Change	377
2015 Gross Peak	24,650
Conservation	-1,461
ICI and TOU	-1,030
2015 Net Peak	22,159
Estimated Embedded Generation	-628
2015 Grid Peak	21,531

# Minimum grid demand has declined by about 1,500 MW

- Annual minimums typically occur during overnight hours on holidays or weekends
- Decrease in minimum demand has been driven by changes in the economy and participation in energy efficiency programs
- Embedded generation has had modest impact on minimum grid demand to date as the overwhelming majority of Ontario's distribution-connection generation is solar PV. Solar PV produces electricity during the day but is unable to meet demand overnight.

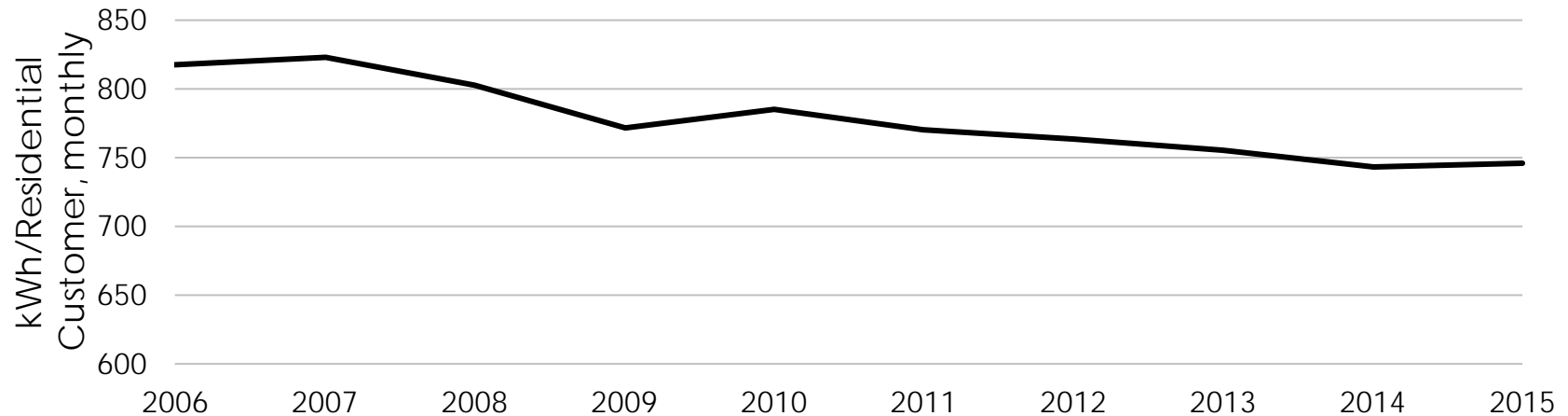


MW	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Minimum Grid Demand	11,950	11,621	11,699	11,450	10,678	10,618	10,799	10,998	10,765	10,719	10,539



# Energy efficiency has slowed demand growth in the residential and commercial sectors

- One of the main drivers of demand growth since 2005 has been expanding commercial floor space for offices, retail, and institutions. At the same time, buildings have adopted new technologies to reduce electricity demand for lighting and other end uses
- Businesses are also making more efficient use of existing space; in most sectors there are more employees per square foot today than in 2005
- Efficient technology and expanded use of natural gas heating has reduced energy intensity (measured in kWh per household) in the residential sector
- This trend is evident in the OEB's Residential Customer rate class



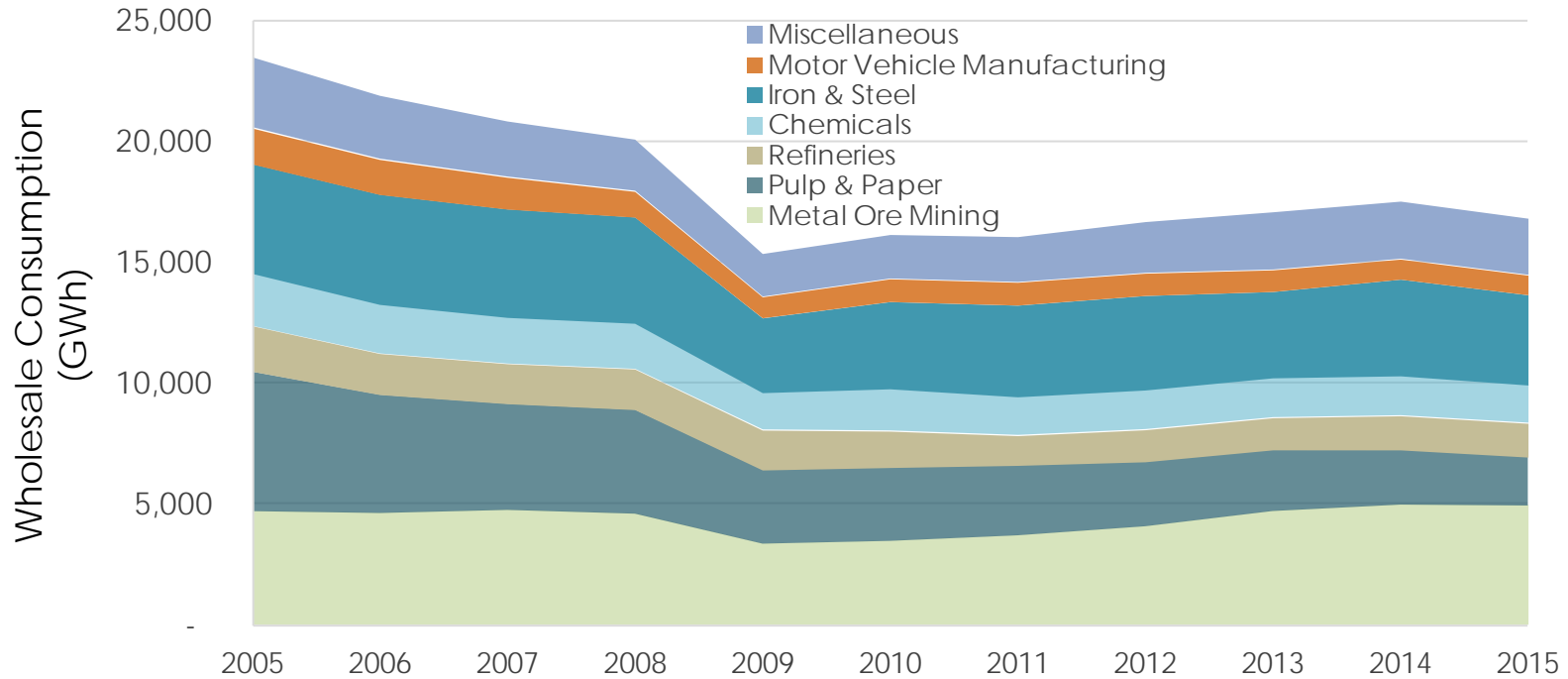
Average of OEB Residential Rate Class

kWh/Household	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Energy Intensity	817	824	802	771	785	770	764	755	743	746

OEB Yearbook of Electricity Distributors: <http://www.ontarioenergyboard.ca/OEB/Industry/Rules+and+Requirements/Reporting+and+Record+Keeping+Requirements/Yearbook+of+Distributors>

The Residential Customer class does not include some large apartment buildings and condos.

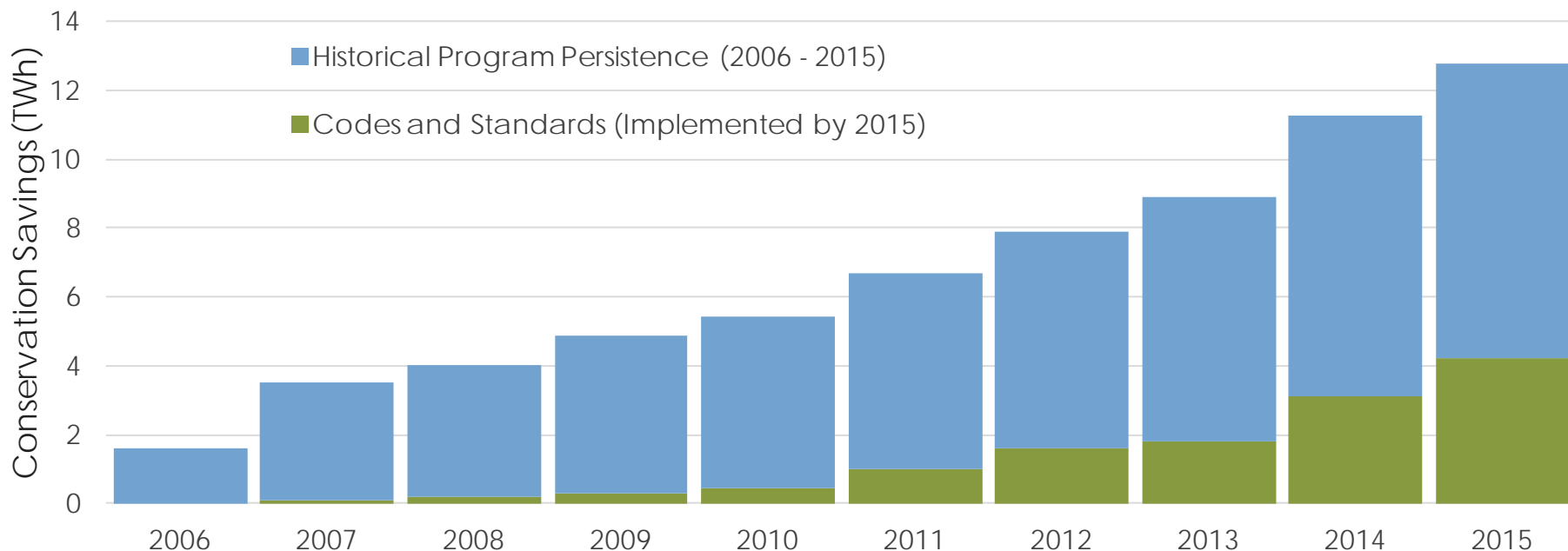
# Electricity demand from large industrial consumers



<b>GWh</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
Metal Ore Mining	4,691	4,614	4,743	4,587	3,348	3,463	3,693	4,067	4,697	4,962	4,923
Pulp & Paper	5,768	4,893	4,391	4,304	3,072	3,058	2,916	2,689	2,547	2,280	2,024
Refineries	1,868	1,680	1,636	1,661	1,632	1,488	1,217	1,311	1,315	1,397	1,383
Chemicals	2,189	2,043	1,923	1,897	1,524	1,726	1,578	1,620	1,632	1,633	1,562
Iron & Steel	4,546	4,563	4,494	4,405	3,094	3,610	3,795	3,911	3,573	4,002	3,735
Motor Vehicle Manufacturing	1,496	1,456	1,323	1,069	871	943	946	926	897	833	813
Miscellaneous	2,887	2,601	2,278	2,113	1,760	1,800	1,855	2,100	2,368	2,363	2,321

Conservation represents savings from energy efficiency programs, changes in customer behavior, building codes, and equipment standards.

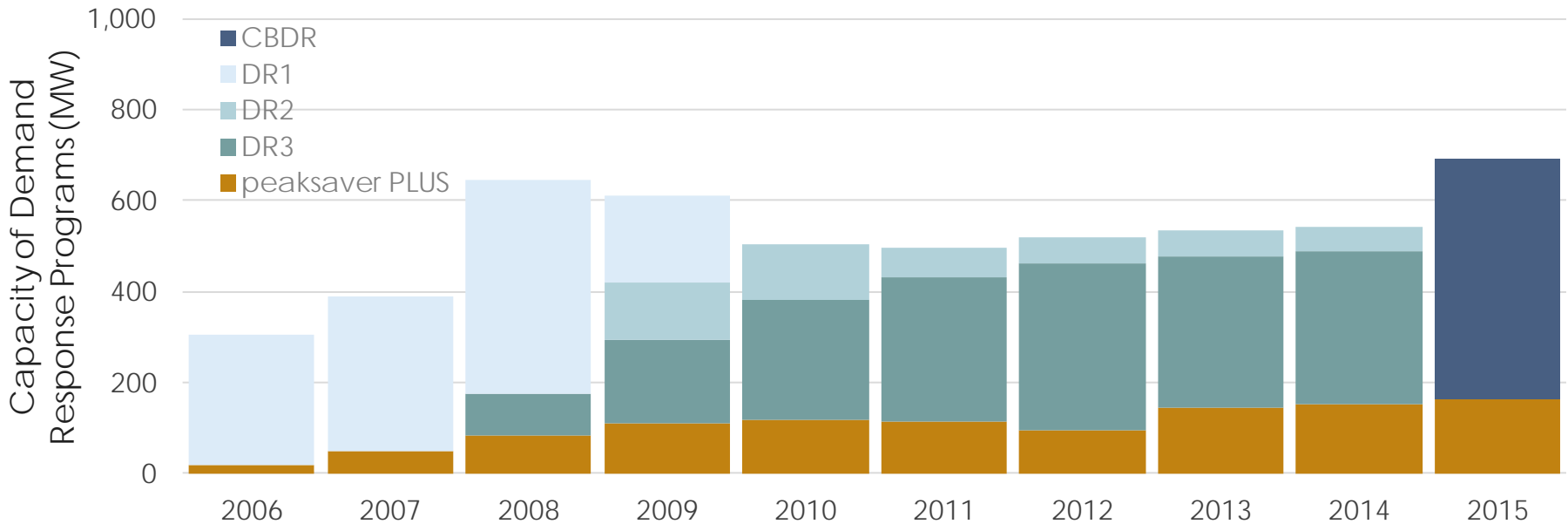
- Ontario saved a cumulative 67 TWh of electricity between 2005 and 2015 through conservation
- Nearly 13 TWh electricity was saved in 2015, about one third of savings from codes/standards, about two-thirds from conservation programs



Conservation program savings between 2006 and 2014 have been evaluated, program savings for 2015 and codes and standards savings are estimated.

# Demand response includes those demand-side actions by consumers to reduce consumption upon request by the IESO

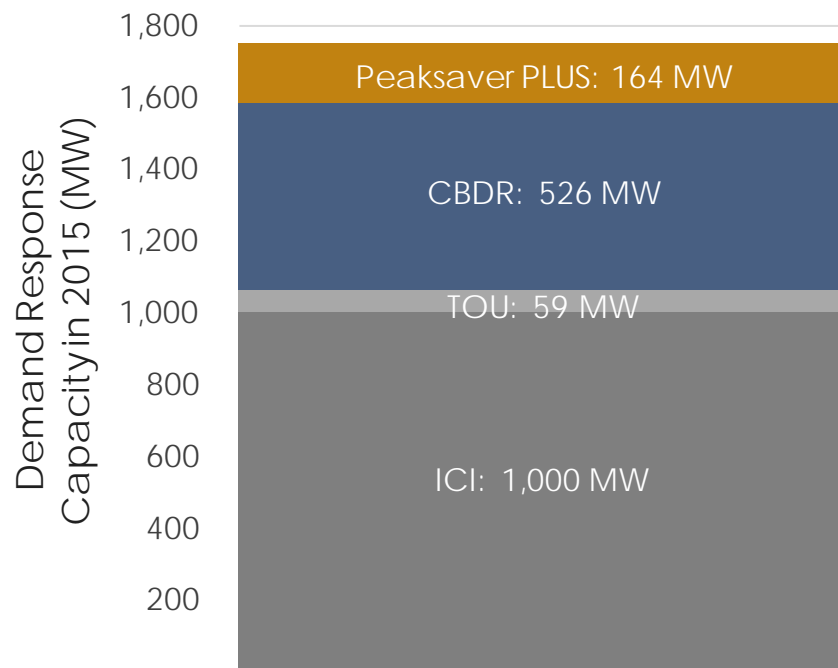
- Demand response programs prior to 2015 included DR1, DR2, and DR3 for business customers and peaksaver PLUS for residential customers
- Beginning in 2015, business DR3 programs were transitioned to the market as capacity-based demand response (CBDR)
- The first capacity-based demand response auction conducted in December 2015 is contributing 391.5 MW for the 2016 summer season and 403.7MW for the 2016-2017 winter season.



Demand Response Auction: <http://www.ieso.ca/Pages/Participate/Stakeholder-Engagement/Demand-Response-Auction.aspx>

# Demand response is also achieved through targeted rate structures for residential and small commercial customers and pricing incentives for large customers

- Time of Use (TOU) has existed in Ontario since approximately 2005 for low volume electricity consumers with smart meters
  - It provides an incentive for consumers to shift electricity use away from higher demand periods to lower demand periods
- Another pricing incentive program designed to reduce demand at peak times is the Industrial Conservation Initiative (ICI)
  - Certain large customers with demand greater than 3 MW (Class A customers) are eligible to participate
  - Global Adjustment amounts for participating Class A customers are adjusted to reflect their contribution to overall system demand during the top five peak hours of a year



ICI Program:  
<http://www.ieso.ca/Pages/Participate/Settlements/Global-Adjustment-for-Class-A.aspx>

- Demand response resources together amounted to approximately 1.8 GW in 2015

# Conservation program savings vs. codes & standards savings, 2006 – 2015 (TWh), demand response programs, 2006 – 2015 (MW), and demand response capacity in 2015 (MW)

## Conservation Savings

TWh	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Historical Programs Persistence (2006-2015)	1.6	3.4	3.9	4.6	5.0	5.7	6.3	7.1	8.1	8.5
Codes and Standards (implemented by 2015)	0.0	0.1	0.2	0.3	0.5	1.0	1.6	1.8	3.1	4.2

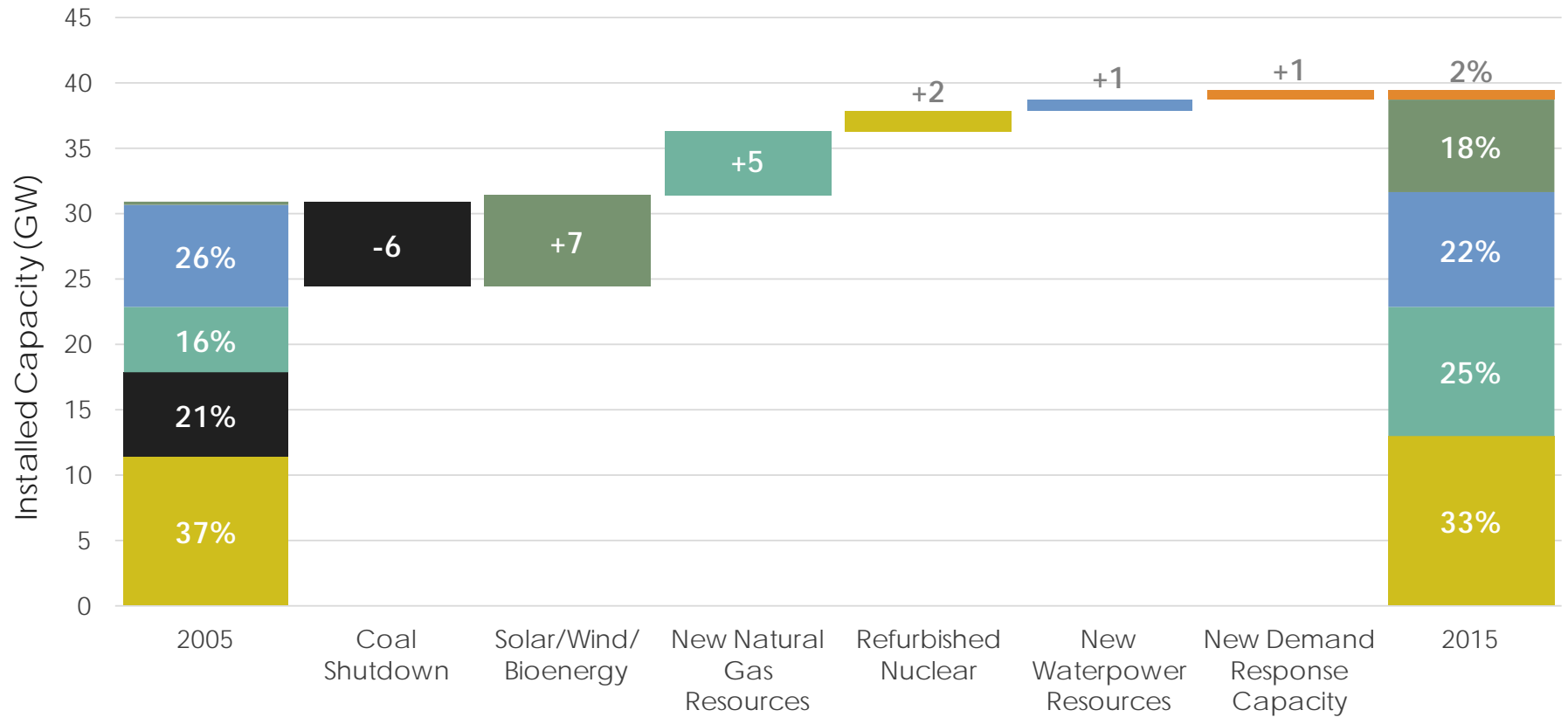
Conservation program savings between 2006 and 2014 have been evaluated, program savings for 2015 and codes and standards savings are estimated.

2015 verified program results will be available by the end of 2016

## Demand Response Capacity

MW	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
peaksaver PLUS	20	48	84	112	117	115	96	143	152	164
DR3	0	0	91	182	264	315	367	335	335	0
DR2	0	0	0	128	122	69	56	55	55	0
DR1	285	340	471	188	0	0	0	0	0	0
CBDR	0	0	0	0	0	0	0	0	0	526
TOU										59
ICI										1,000

# Change in installed supply resources 2005-2015



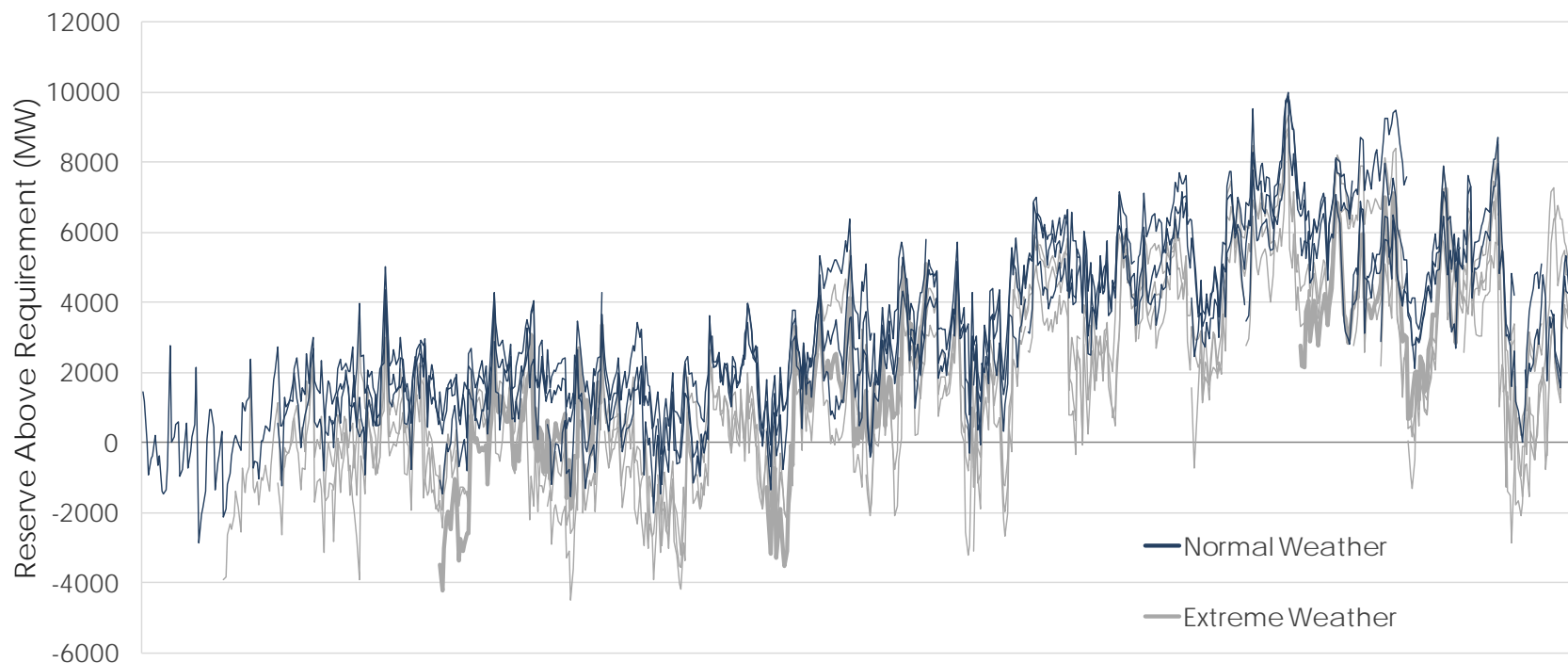
## Net changes to installed generation capacity, 2005 – 2015

<b>Installed Capacity (MW)</b>	<b>2005</b>	<b>2015</b>
Nuclear	11,397	13,014
Coal	6,434	0
Natural Gas	4,976	9,852
Waterpower	7,910	8,768
Solar PV/Wind/Bioenergy	134	7,068
Demand Response	0	690



# Capacity margins

- Capacity margins, sometimes referred to as “resources above requirement” are an indicator of resource adequacy and describe the extent to which resources exceed or fall below targeted levels
- Ontario’s capacity margins over the past ten years are approximated below. Weekly projections are shown from all of the IESO’s 18-month outlooks published between late 2002 and 2015

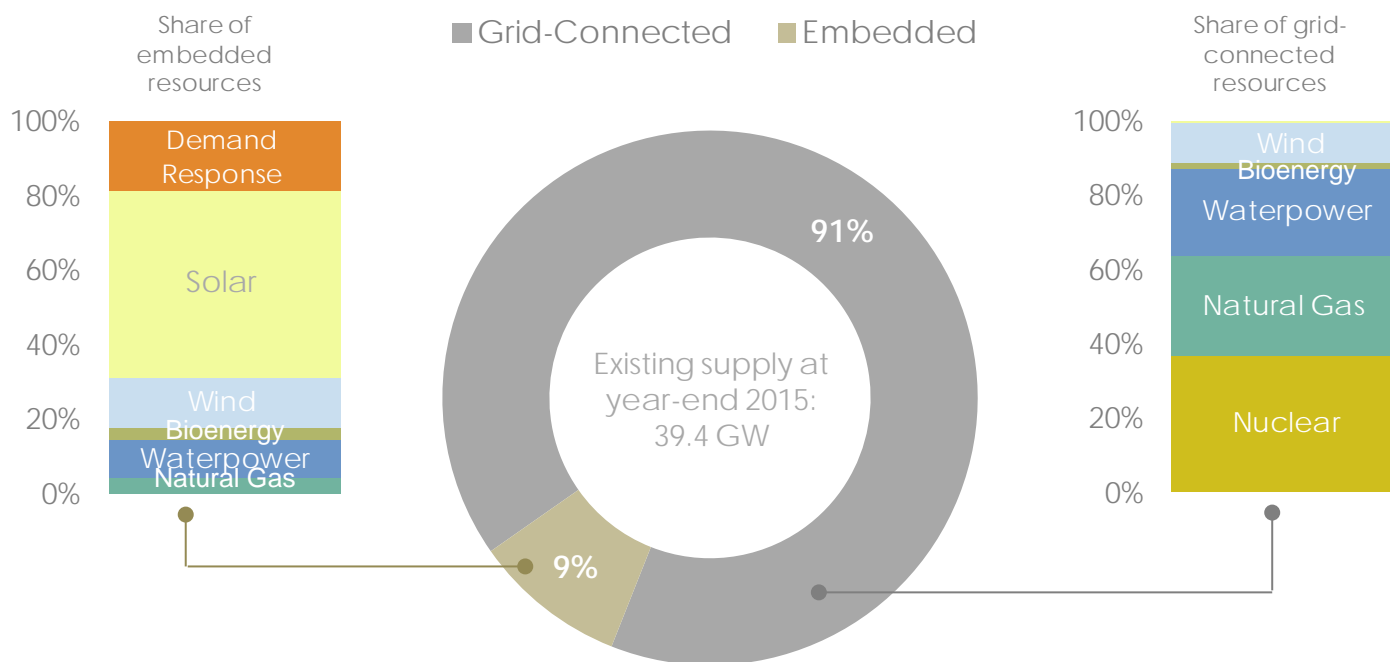


Additional information and data available on IESO Website:

<http://www.ieso.ca/Pages/Participate/Reliability-Requirements/Forecasts-&-18-Month-Outlooks.aspx>

# Grid connected versus embedded resources

- Embedded resources are small-scale supply resources located within the distribution system and are not part of the IESO controlled grid
- In 2015, approximately 91% of Ontario supply was connected to the IESO grid while 9% is connected to the distribution system
- Most of Ontario's currently distribution-connected capacity is renewable, including resources contracted under the FIT and microFIT programs

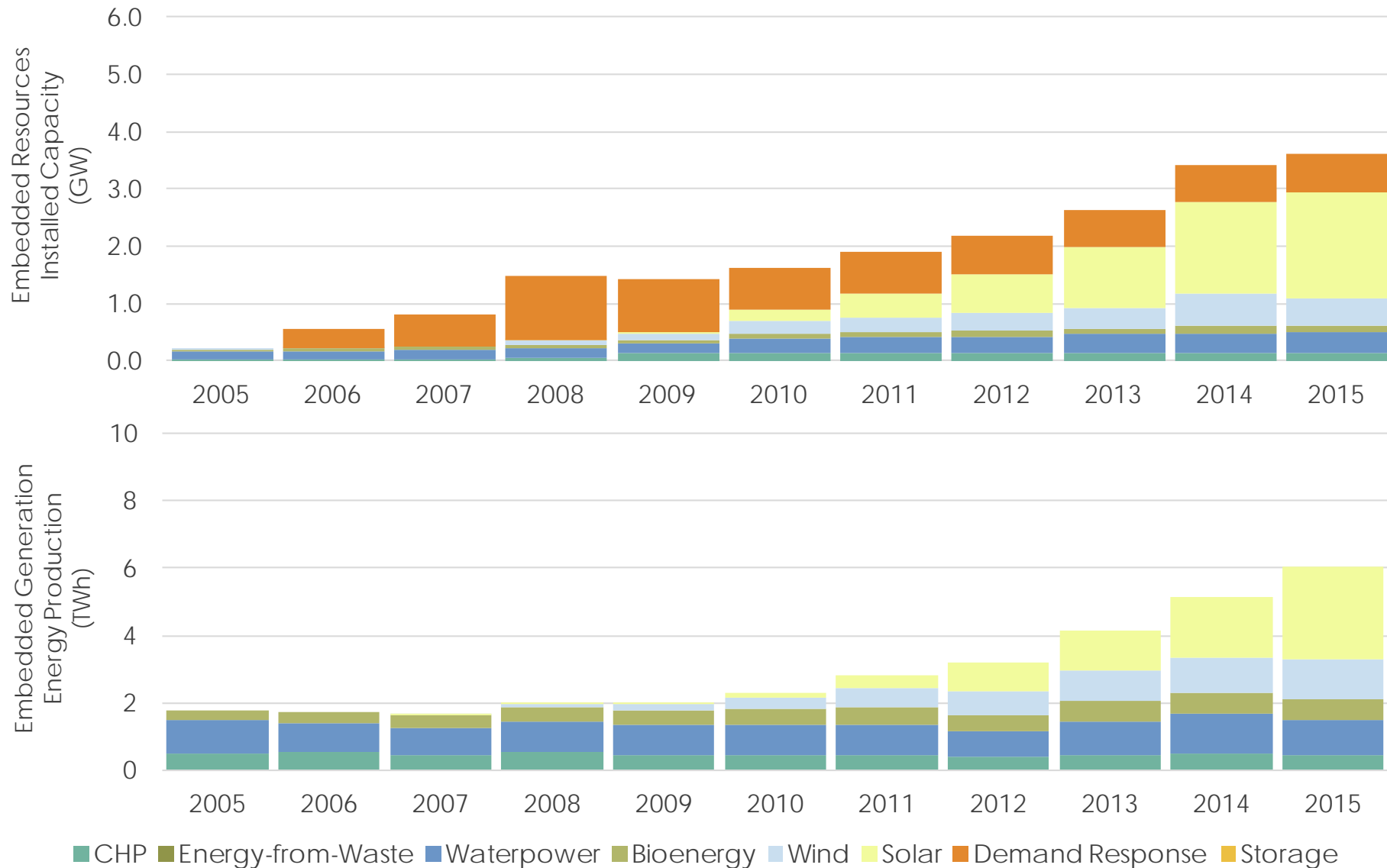


# Installed capacity of embedded resources at year-end 2015

<b>Installed Capacity (MW)</b>	<b>Grid-Connected</b>	<b>Embedded</b>
Nuclear	13,014	0
Natural Gas	9,697	155
Waterpower	8,401	367
Bioenergy	461	114
Wind	3,883	491
Solar PV	280	1,839
Demand Response*	0	690

\* Capacity-based demand response is transitioning to a market-based resource. As of 2016 it will be 'grid-connected' and not embedded.

# Embedded generation, installed capacity, and energy production 2005-2015



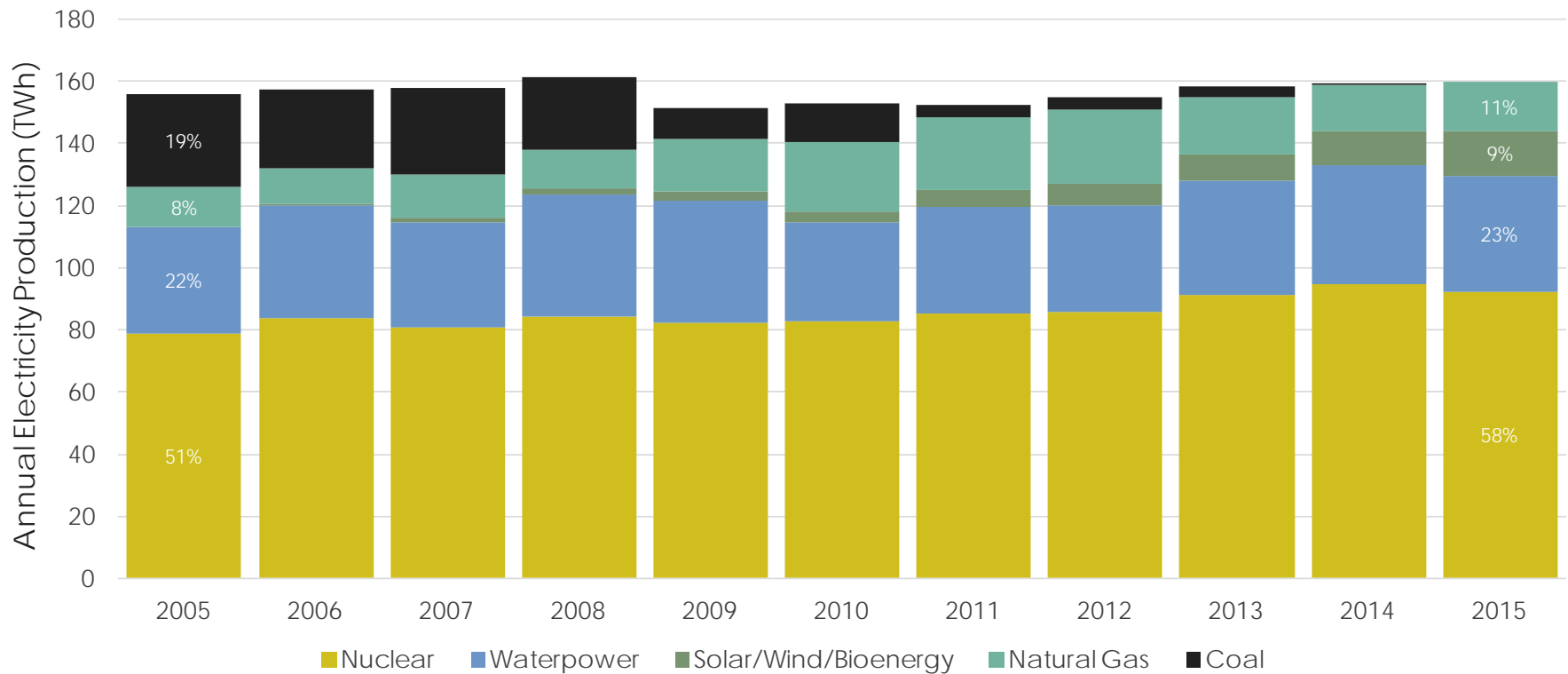
## Embedded generation, installed capacity, and energy production 2005-2015

<b>Installed capacity, embedded resources (MW)</b>											
	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
CHP	17	35	35	66	129	129	136	137	134	139	140
Waterpower	146	146	153	158	178	270	276	295	333	336	363
Bioenergy	42	42	62	65	66	85	90	91	104	146	104
Wind	2	2	11	78	105	205	245	329	365	425	491
Solar	0	0	0	10	40	195	432	662	1,039	1,585	1,839
Demand Response	0	332	552	1,097	923	735	724	677	655	655	690
Storage	0	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>207</b>	<b>557</b>	<b>813</b>	<b>1,473</b>	<b>1,440</b>	<b>1,619</b>	<b>1,903</b>	<b>2,192</b>	<b>2,631</b>	<b>3,286</b>	<b>3,627</b>

<b>Energy Production, embedded resources (TWh)</b>											
	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
CHP	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.5	0.5	0.5
Waterpower	1.0	0.9	0.8	0.9	0.9	0.9	0.9	0.8	1.0	1.1	1.0
Bioenergy	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.7	0.6
Wind	0.0	0.0	0.0	0.1	0.2	0.3	0.6	0.7	0.9	1.0	1.2
Solar	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.8	1.2	1.8	2.8
Demand Response	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Storage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Total</b>	<b>1.8</b>	<b>1.7</b>	<b>1.6</b>	<b>2.0</b>	<b>2.0</b>	<b>2.3</b>	<b>2.8</b>	<b>3.2</b>	<b>4.1</b>	<b>5.1</b>	<b>6.0</b>

# Electricity production by fuel type 2005-2015

- Nearly 90% of Ontario's annual electricity production is now derived from non-fossil sources
- Included within this figure is the production from embedded generation which grew since 2005 and now accounts for 6 TWh, or 4% of all electricity produced



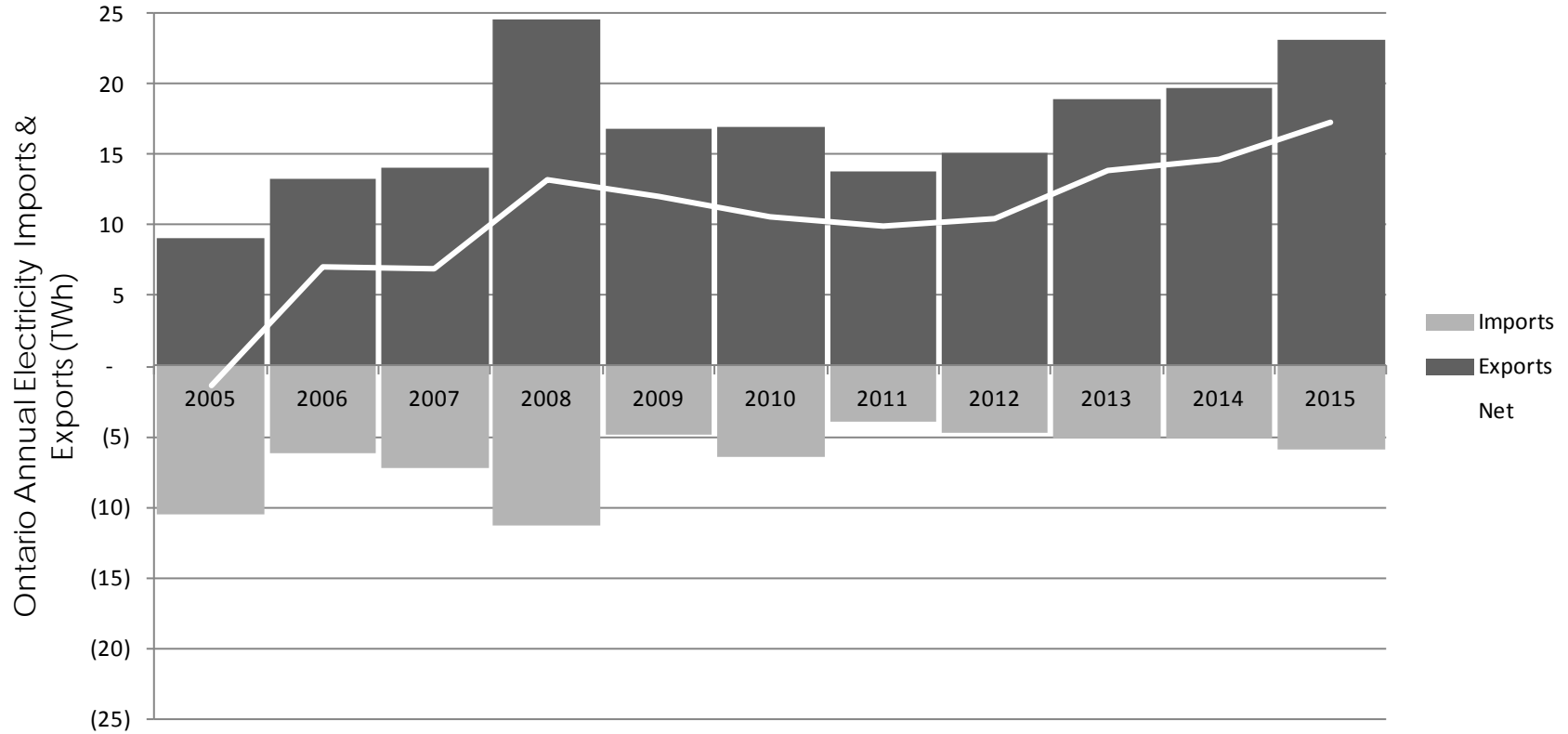
# Electricity production by fuel type 2005-2015

## Ontario electricity production

TWh	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Solar/Wind/Bioenergy	0.3	0.7	1.4	1.9	2.9	3.7	5.4	6.6	8.1	10.6	14.2
Natural Gas	12.9	11.5	13.8	12.5	17.1	22.2	23.6	23.9	18.7	15.3	15.9
Nuclear	79.0	84.0	81.0	84.4	82.5	82.9	85.3	85.6	91.1	94.9	92.3
Coal	30.0	25.0	28.0	23.2	9.8	12.6	4.1	4.3	3.2	0.1	0.0
Waterpower	34.0	35.9	33.8	39.2	39.0	31.6	34.2	34.6	37.1	38.2	37.3

# Electricity imports and exports 2005-2015

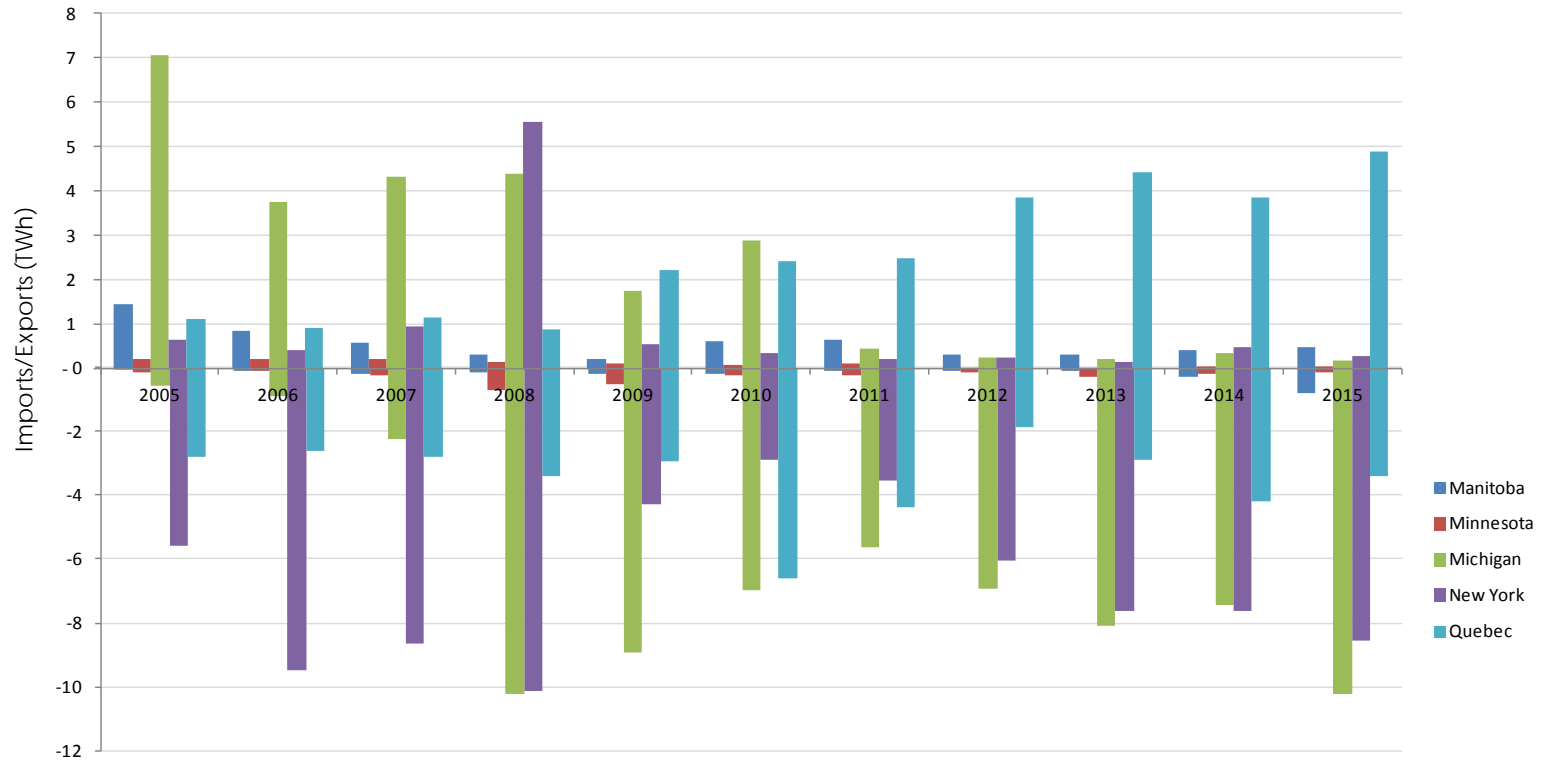
- Since 2005, Ontario has become a net exporter of electricity





# Electricity imports and exports 2005-2015 by jurisdiction

- The majority of Ontario's exports are delivered to the United States, mostly to New York (NYISO) and further south to the PJM market (which serves over 13 states, including Pennsylvania, New Jersey and Maryland)
- Ontario's exports to the U.S. Midwest have grown in recent years
- Electricity imports today are mostly sourced from Québec and Manitoba



# Electricity imports and exports 2005-2015 by jurisdiction

## Trade with neighbouring jurisdictions

TWh	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Imports	10.50	6.18	7.20	11.30	4.86	6.38	3.92	4.71	5.12	5.13	5.90
Exports	9.11	13.22	14.13	24.56	16.85	16.98	13.85	15.10	18.98	19.77	23.15
Net Exports	-1.39	7.04	6.93	13.26	11.99	10.6	9.93	10.39	13.86	14.64	17.25

Imports (TWh)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Manitoba	1.45	0.86	0.58	0.32	0.22	0.62	0.66	0.33	0.32	0.41	0.48
Minnesota	0.22	0.21	0.21	0.14	0.11	0.10	0.12	0.02	0.02	0.04	0.04
Michigan	7.07	3.75	4.31	4.40	1.76	2.88	0.45	0.26	0.21	0.34	0.20
New York	0.65	0.43	0.94	5.55	0.54	0.34	0.21	0.27	0.14	0.48	0.28
Quebec	1.11	0.93	1.16	0.89	2.23	2.43	2.48	3.84	4.42	3.85	4.90
Total	10.50	6.18	7.20	11.30	4.86	6.38	3.92	4.71	5.12	5.13	5.90

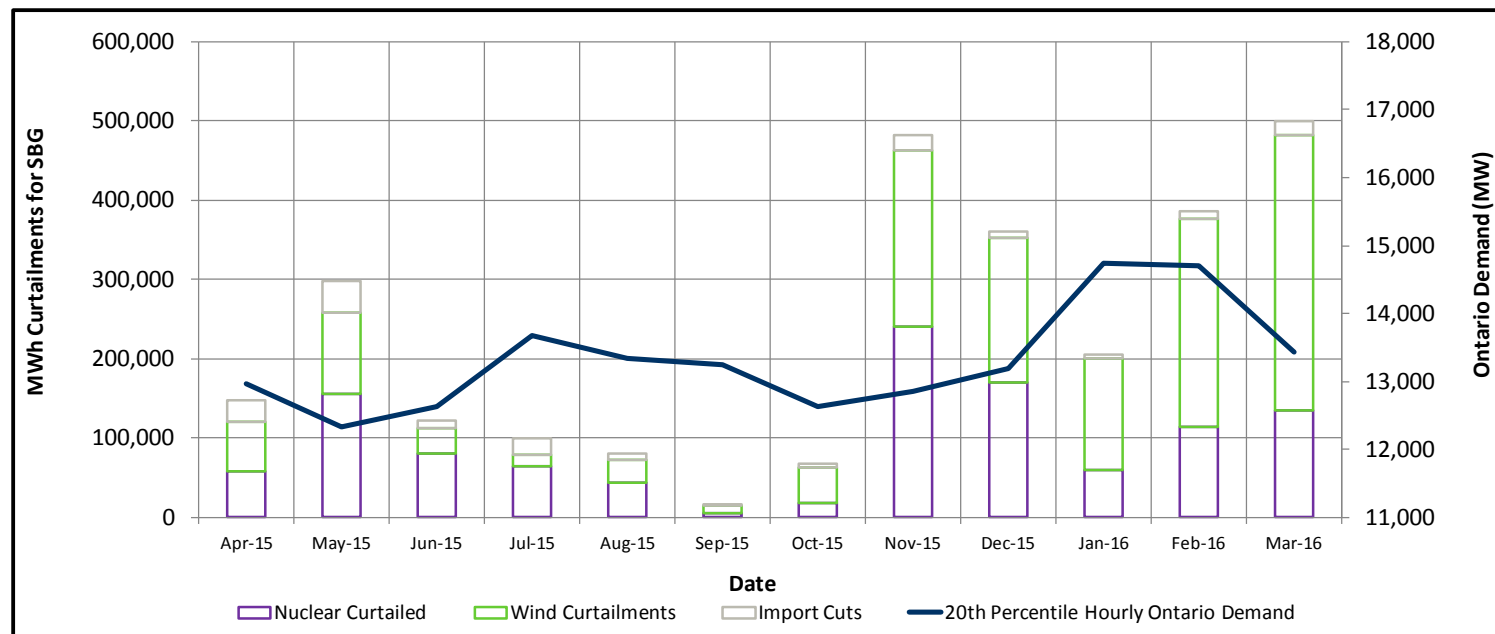
Exports (TWh)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Manitoba	0.04	0.10	0.18	0.13	0.19	0.21	0.09	0.09	0.12	0.30	0.79
Minnesota	0.13	0.12	0.25	0.69	0.54	0.26	0.25	0.17	0.27	0.20	0.16
Michigan	0.56	0.88	2.24	10.21	8.91	6.99	5.63	6.91	8.07	7.44	10.25
New York	5.59	9.48	8.65	10.16	4.28	2.89	3.52	6.05	7.62	7.62	8.57
Quebec	2.78	2.63	2.80	3.38	2.93	6.62	4.36	1.89	2.90	4.21	3.38
Total	9.11	13.22	14.13	24.56	16.85	16.98	13.85	15.10	18.98	19.77	23.15

## Operability: Overview

- Operability relates to aspects of a power system that allow the main components of load, supply and transmission to function
- Operability is an indicator of whether resources can be reasonably and reliably coordinated to deliver power to the loads in real-time dispatch to match varying loads and extreme system conditions
- The power system must be capable of delivering power and be able to sustain significant system events, while maintaining reliability across a spectrum of system operating conditions and requirements
- In a balanced system there is enough redundancy and technological diversity to meet electricity needs without over-reliance on any one particular resource

# Surplus baseload generation (SBG)

- SBG occurs when the baseload generation is higher than the Ontario Demand plus net exports. SBG typically occurs during periods of low demand in Ontario and/or connected neighbouring systems. The expected baseload generation includes nuclear generation, baseload waterpower generation, and intermittent generation such as wind and solar.
- The IESO has enhanced its processes to maintain supply-demand balance. The system is balanced using market mechanisms which include export scheduling, dispatch of renewables, and manoeuvring/shutdown of nuclear units. Out-of-market mechanisms such as import cuts could also be utilized to alleviate SBG conditions



Source: IESO 18-month outlook, June 21, 2016.

[http://www.ieso.ca/Documents/marketReports/18MonthOutlook\\_2016jun.pdf](http://www.ieso.ca/Documents/marketReports/18MonthOutlook_2016jun.pdf)

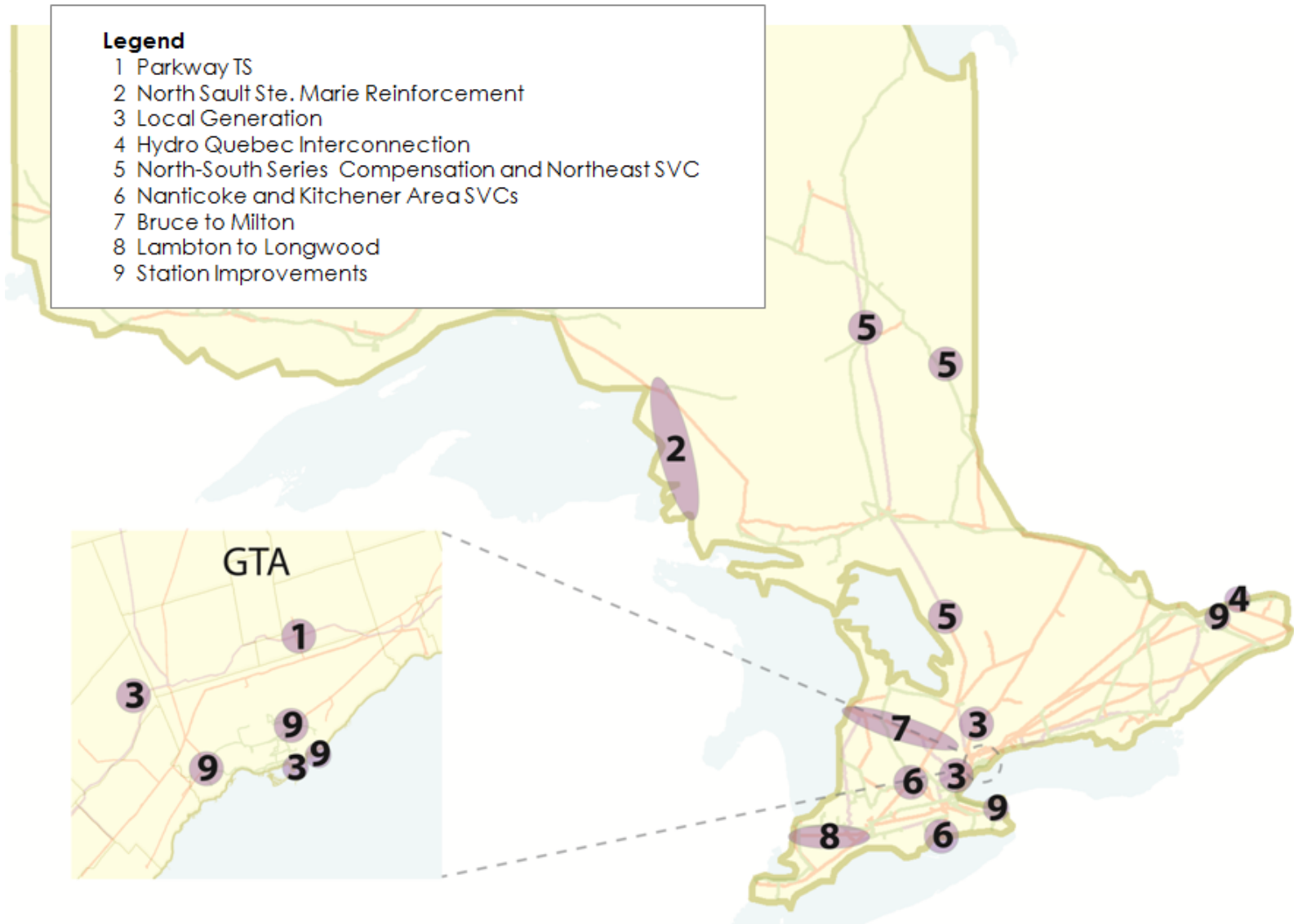
# Load-following and operational flexibility

- Load-following is the capability of the generation fleet to increase and decrease its output in response to changes in demand (commonly referred to as ramp rate). Operational flexibility is the ability to commit and schedule resources to meet load-following requirements within the available timeframe
- Operational flexibility required by the power system has been increasing, driven by increased variable generation and changing load behaviour due to weather, economic conditions, and embedded generation
- Operational flexibility has been decreasing because of the phase-out of coal-fired generation and a transition to natural gas as Ontario's intermediate resources
- Despite the significant system changes, the flexibility and capability of the Ontario fleet along with the enhanced operational actions taken have been adequate to maintain reliability

# Operating reserve and frequency regulation

- Operating Reserve
  - It is the supply or load reduction capacity which can be called upon on short notice (within 10 mins and 30 mins) to address sudden changes in supply or demand
  - Variable generation (VG) output variability has been within the conditions addressed by both 10 minute and 30 minute reserve requirements
  - The amount of operating reserve procured during this timeframe was adequate for the supply mix and system conditions experienced
- Frequency Regulation
  - It is the service required to control power system frequency and maintain the balance between load and generation on a second-by-second basis
  - The IESO's Renewables Integration Initiative (RII) introduced centralized resource forecasting to help reduce forecast errors associated with increasing amounts of variable generation. The IESO also started to explore the use of new technologies to provide regulation (Alternative Technologies for Regulation procurement in 2012)
  - The frequency of the power system was adequately maintained by available resources. However, it has been observed that in adequately regulating the frequency, the resources providing regulation have often been stretched to their limits

# Recent transmission investment & planning activities: Locations



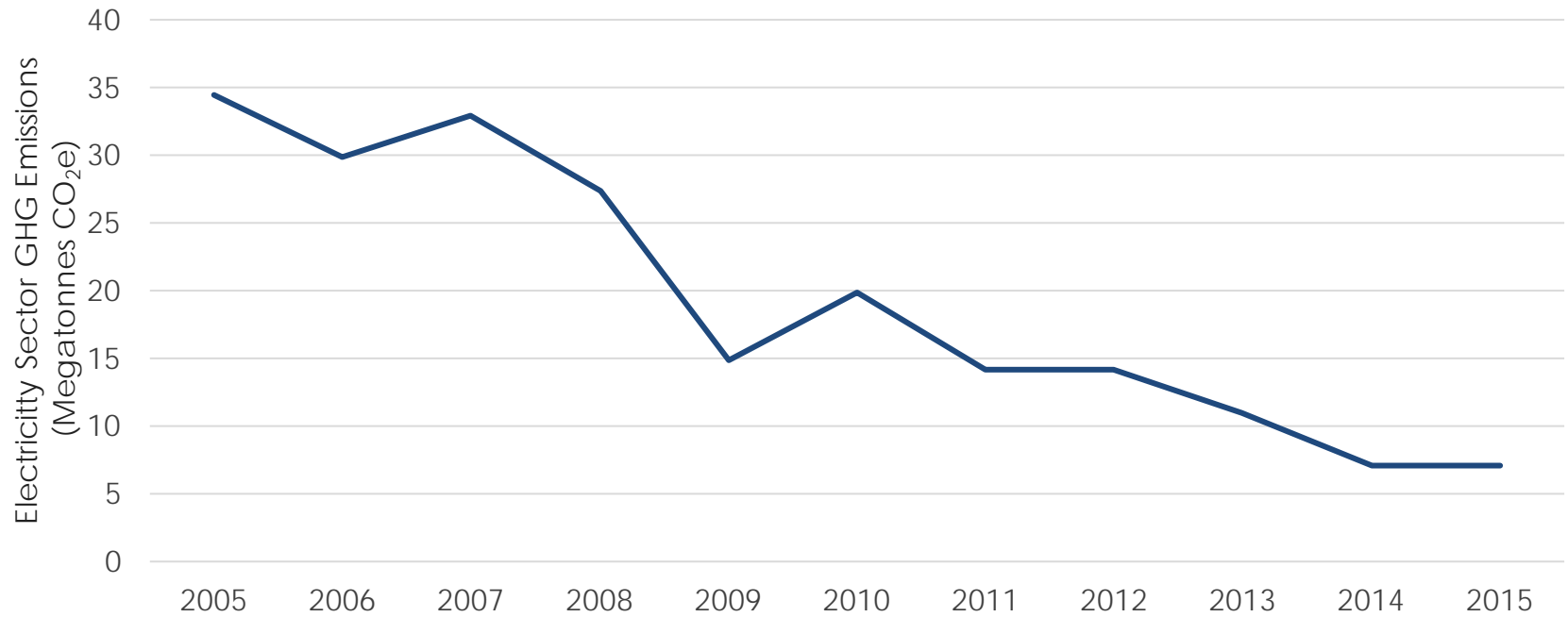
# Recent transmission investment & planning activities: Drivers

Investment/Planning Activities	In-Service	Drivers			
		Facilitating the Off-Coal Policy	Maintaining System Reliability and Security	Facilitating Interconnection with Neighboring Jurisdictions	Enabling Renewable Resources
<b>Parkway 500/230kV transformers</b>	2005	X	X		X
<b>North Sault Ste. Marie Transmission Reinforcement: Third Line to Wawa</b>	2006		X		X
<b>Local Generation: Portlands Energy Centre, Halton Hills, Goreway, York Energy Centre</b>	2008-2013	X	X		
<b>Hydro Quebec HVDC (High-Voltage Direct Current) Interconnection</b>	2009			X	
<b>Voltage Support in Northern Ontario</b>	2011	X			X
<b>Voltage Support at Nanticoke and Kitchener area</b>	2012-2013	X			X
<b>Bruce to Milton Transmission Reinforcement</b>	2012	X	X		X
<b>West-of-London Reconductoring : Lambton to Longwood Transmission Upgrade</b>	2014				X
<b>Station Improvements: Leaside, Hearn, Manby, Hawthorne, Allanburg</b>	2014-2015		X		X



# Ontario electricity sector GHG emissions, 2005 - 2015

- Due to the retirement of coal-fired generation and the reduced demand for electricity, the greenhouse gas (GHG) emissions from Ontario's electricity sector fell by 80% since 2005.
- GHG emissions from the electricity sector now make up roughly only 4% of the province's total emissions.
  - Total Ontario economy wide emissions in 2014 were 170.2 MT (Environment Canada)
  - Electricity sector emissions in 2014 were ~4% (= 7.1 MT/170.2 MT) of this

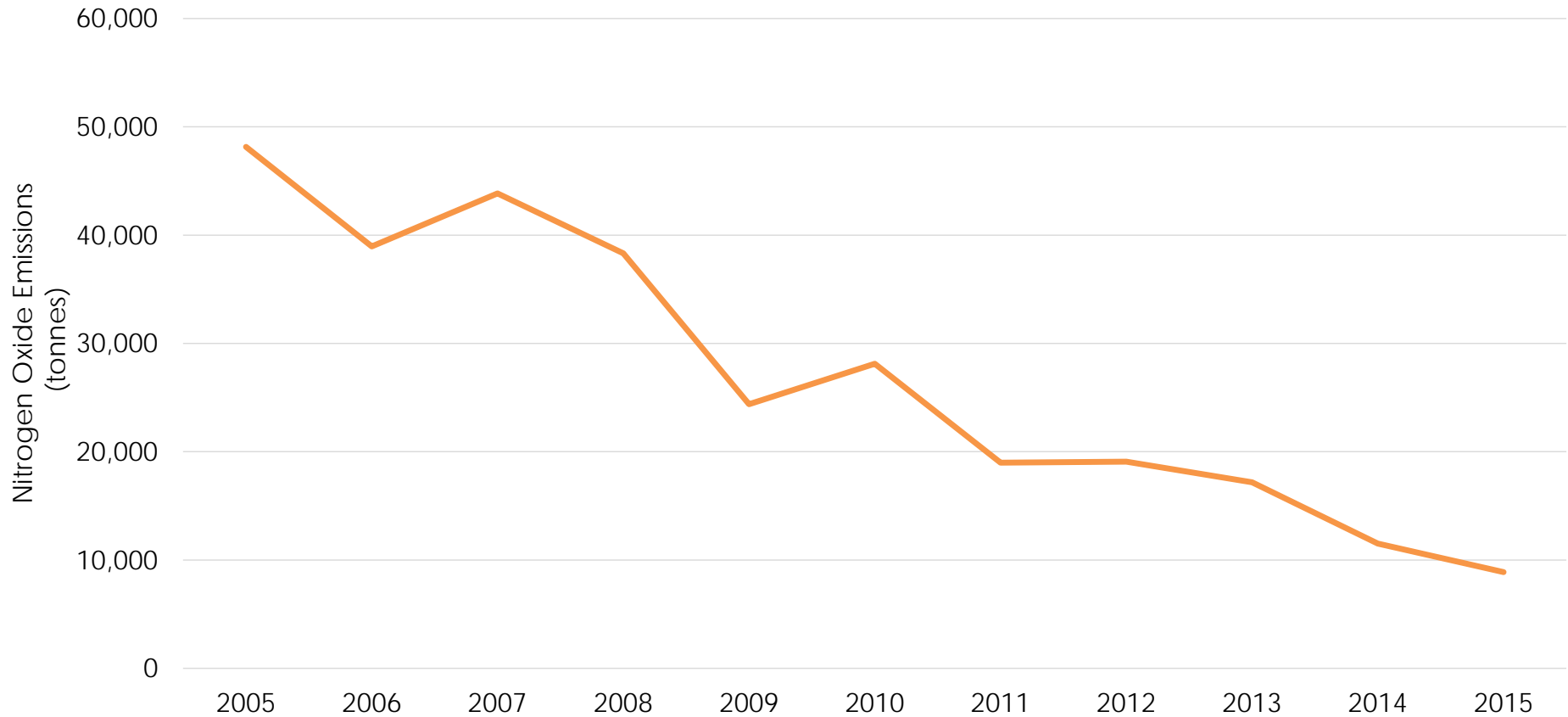


# Ontario electricity sector GHG emissions, 2005 - 2015

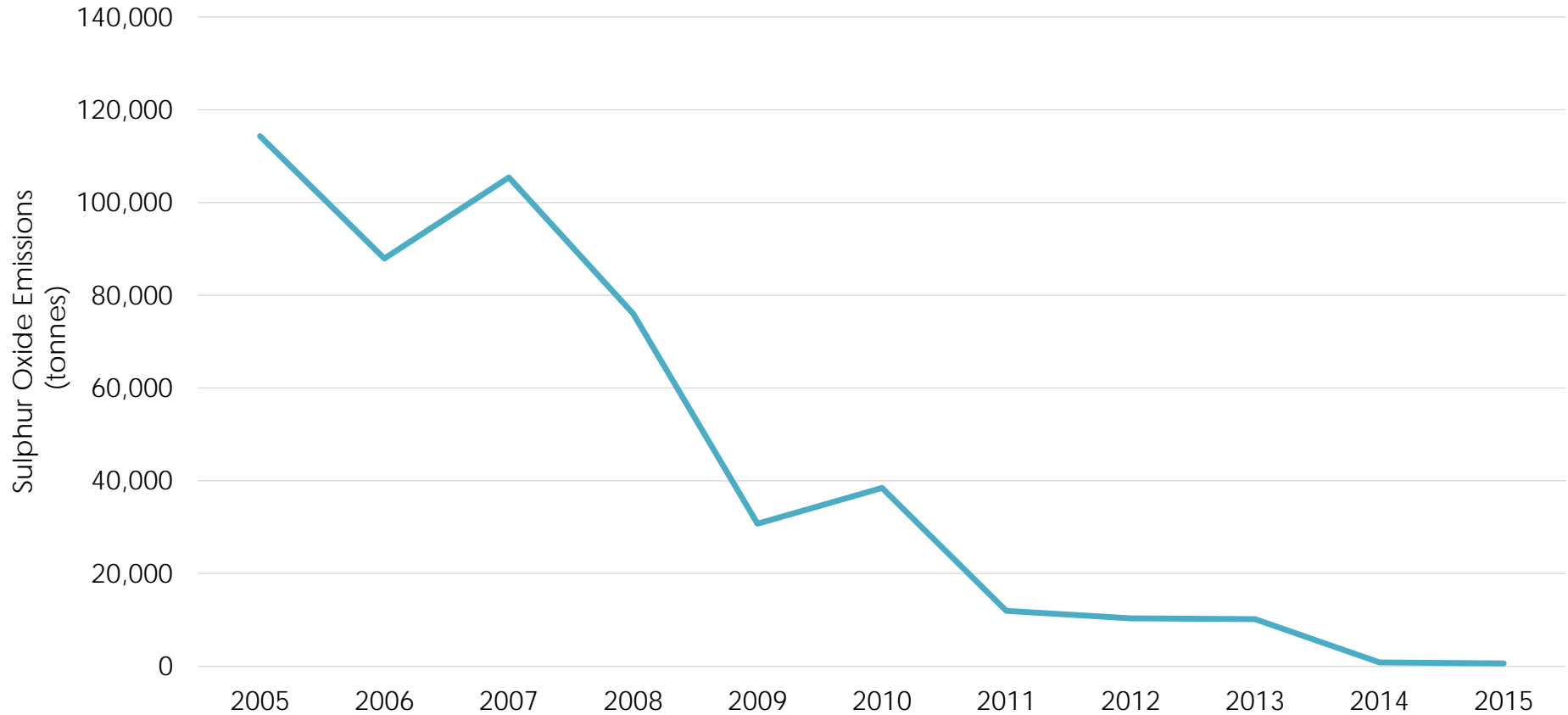
<b>MT CO<sub>2</sub>e</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
Electricity Sector GHG Emissions	34.5	29.9	32.9	27.4	14.9	19.8	14.2	14.2	10.9	7.1	7.1

Note: 2005-2013 is from Environment Canada, 2014-2015 is estimated by IESO.

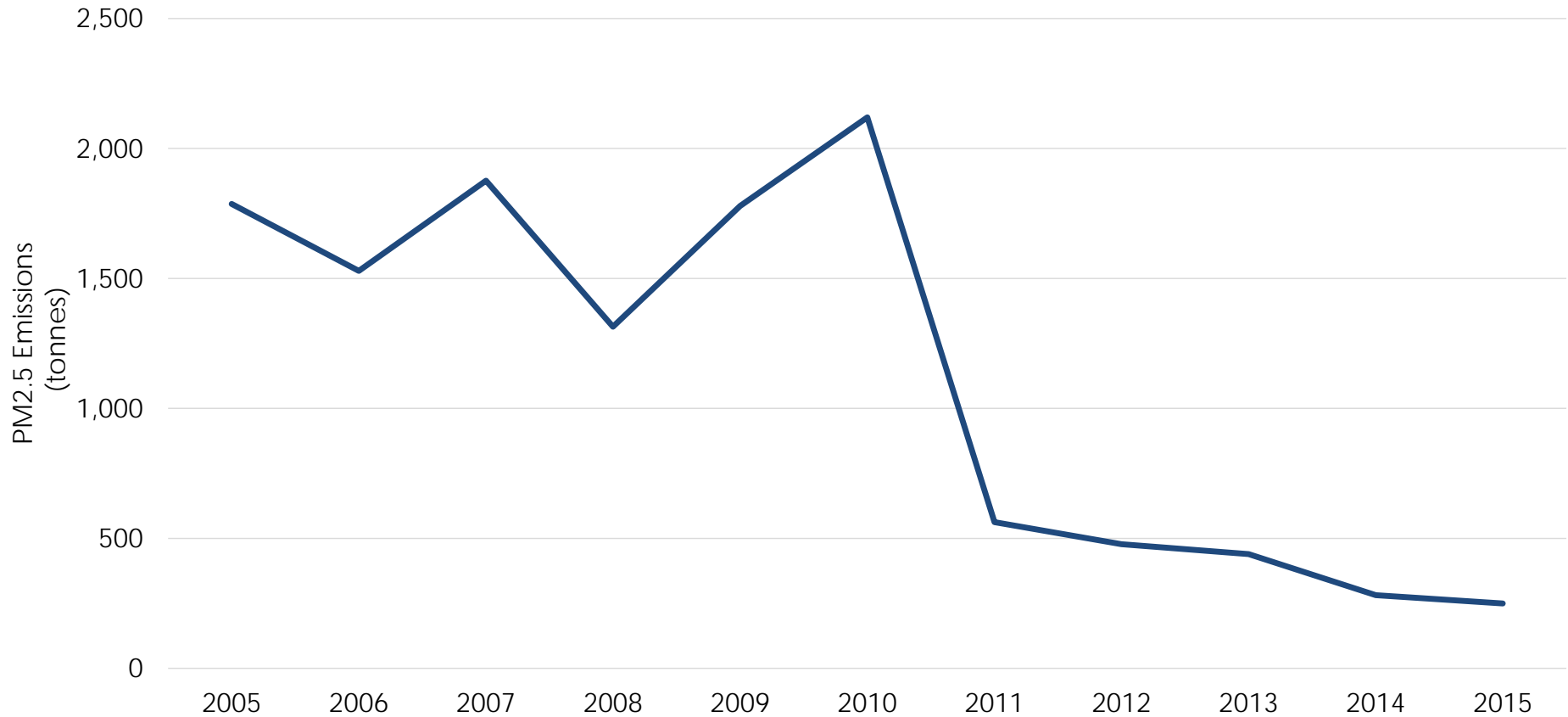
# Historical nitrogen oxide emissions



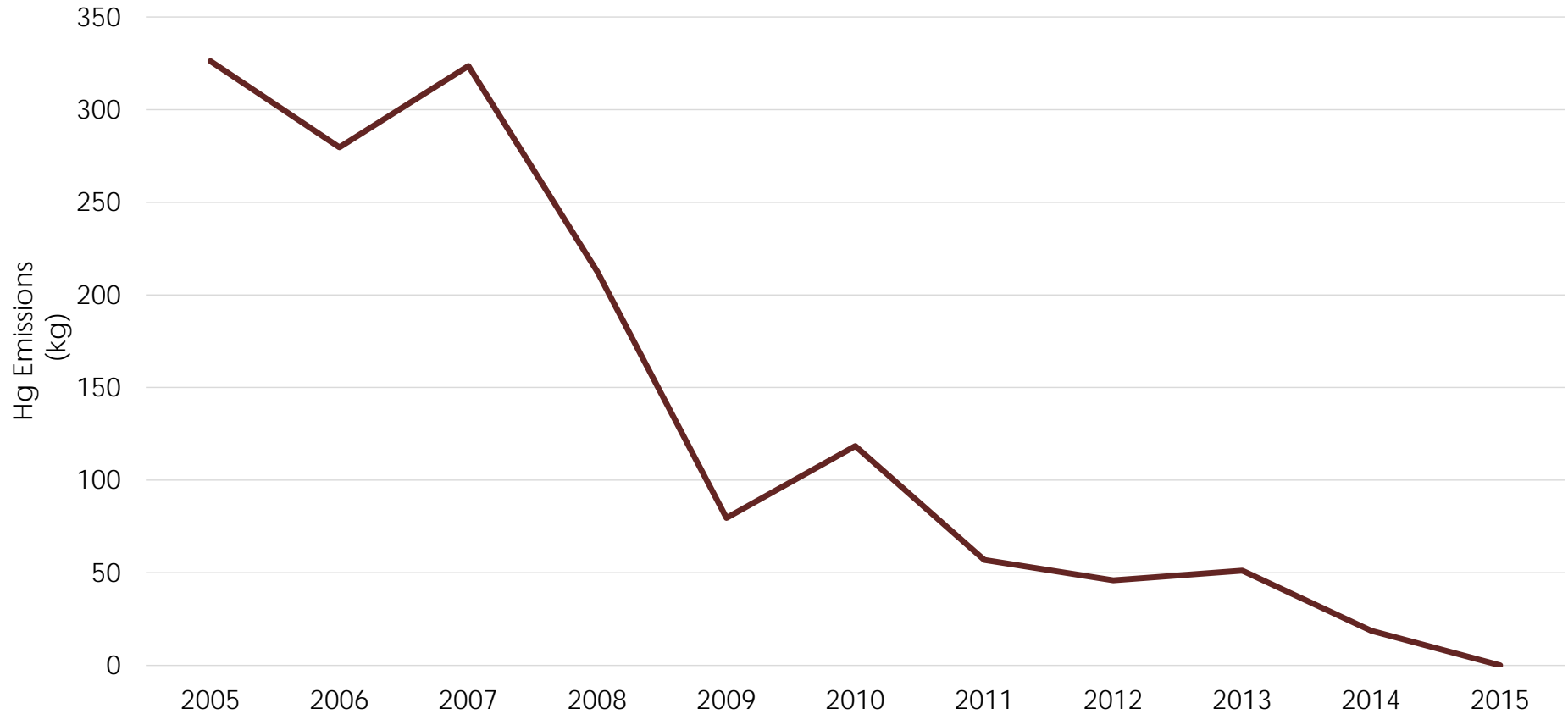
# Historical sulphur oxide emissions



# Historical fine particulate matter (<2.5µm) emissions



# Historical mercury emissions



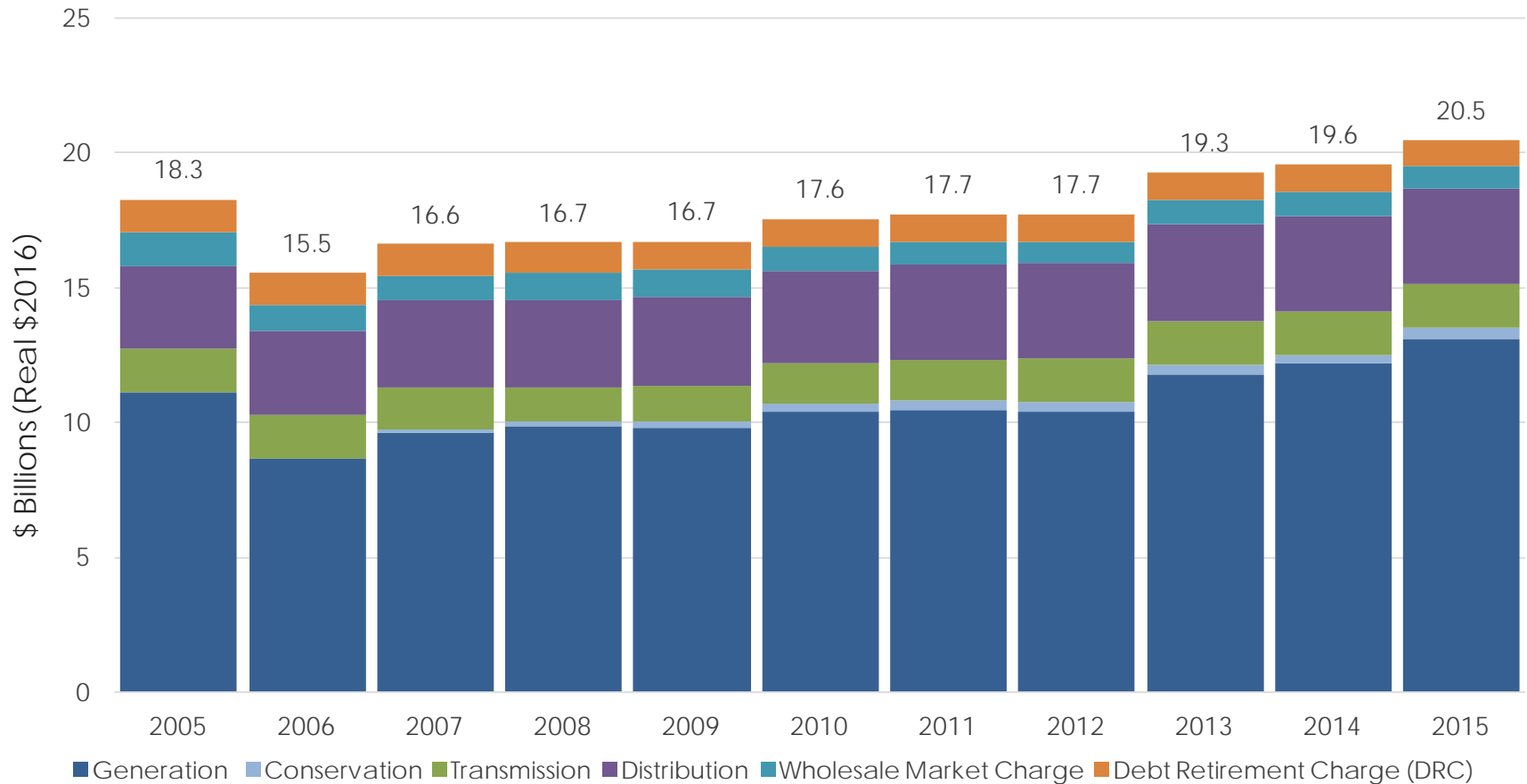
# Historical air contaminant emissions

## Historical Air Contaminant Emissions

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Nitrogen oxide emissions (tonnes)	48,143	38,955	43,846	38,314	24,389	28,130	18,988	19,077	17,183	11,520	8,877
Sulphur oxide emissions (tonnes)	114,323	87,932	105,420	76,020	30,768	38,448	11,971	10,342	10,192	847	620
Fine particulate matter (<2.5µm) emissions (tonnes)	1,787	1,529	1,876	1,314	1,779	2,120	562	478	439	281	249
Mercury emissions (kg)	326	280	324	212	80	118	57	46	51	19	0

# Total cost of electricity service 2005-2015

- 2005 was an anomalous year.<sup>1</sup> Total cost of electricity grew 3.2% per year (on average) from 2006 to 2015 in real 2016\$.

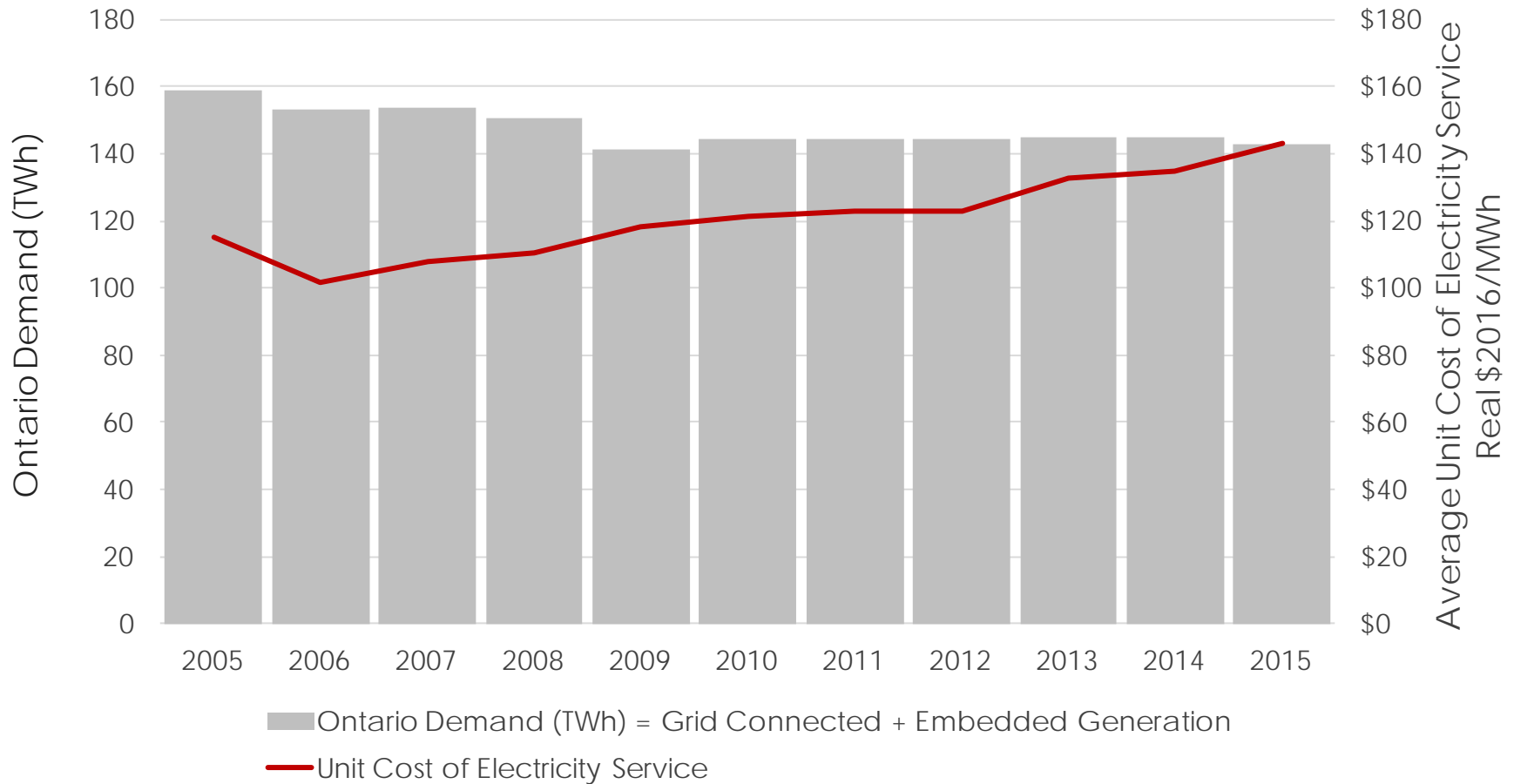


<sup>1</sup> Unusual weather and tight supply conditions led to very high demand and record market prices for power, adding about \$3B to the cost of electricity bill.



# Average unit cost of electricity service 2005-2015

- 2005 was an anomalous year.<sup>1</sup> Average unit cost of electricity grew 3.9% per year (on average) from 2006 to 2015 in real 2016\$.



<sup>1</sup> Unusual weather and tight supply conditions led to very high demand and record market prices for power, adding about \$3B to the cost of electricity bill.

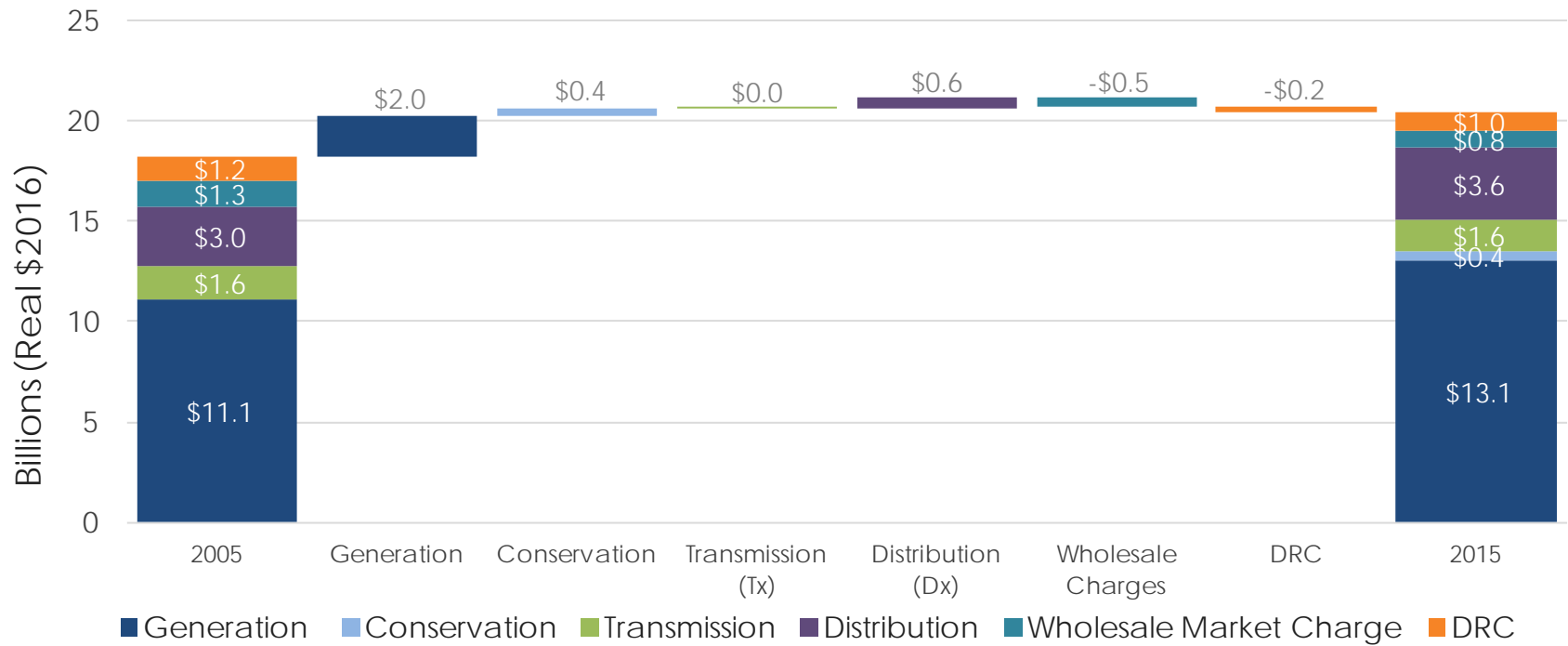
# Total cost of electricity service and average unit cost of electricity service

## Total Cost of Electricity Service

Real \$2016, Billions	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Generation	11.1	8.6	9.6	9.9	9.8	10.4	10.5	10.4	11.8	12.2	13.1
Conservation	0.0	0.0	0.1	0.2	0.2	0.3	0.4	0.4	0.4	0.3	0.4
Transmission	1.6	1.6	1.5	1.3	1.3	1.5	1.5	1.6	1.6	1.6	1.6
Distribution	3.0	3.2	3.3	3.2	3.3	3.4	3.5	3.5	3.6	3.5	3.6
Wholesale Market Charge	1.3	0.9	0.9	1.0	1.0	0.9	0.9	0.8	0.9	0.9	0.8
Debt Retirement Charge (DRC)	1.2	1.2	1.2	1.1	1.0	1.1	1.0	1.0	1.0	1.0	1.0
<b>Total</b>	<b>18.3</b>	<b>15.5</b>	<b>16.6</b>	<b>16.7</b>	<b>16.7</b>	<b>17.6</b>	<b>17.7</b>	<b>17.7</b>	<b>19.3</b>	<b>19.6</b>	<b>20.5</b>

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
<b>Ontario Demand (TWh) = Grid Connected + Embedded Generation</b>	158.8	153.0	153.8	150.6	141.1	144.5	144.3	144.5	145.0	144.9	143.0
<b>Average Unit Cost of Electricity Service (\$/MWh - Real \$2016)</b>	\$115.07	\$101.53	\$107.93	\$110.68	\$118.42	\$121.48	\$122.85	\$122.73	\$132.78	\$134.96	\$143.48

# Change in total cost of electricity service By service type



2016 \$ Billions	2005	2015	Delta 2015 - 2005
Generation	\$11.1	\$13.1	\$2.0
Conservation	\$0.0	\$0.4	\$0.4
Transmission	\$1.6	\$1.6	\$0.0
Distribution	\$3.0	\$3.6	\$0.6
Wholesale Market Charge	\$1.3	\$0.8	-\$0.5
Debt Retirement Charge (DRC)	\$1.2	\$1.0	-\$0.2
<b>Total Cost of Electricity Service</b>	<b>\$18.3</b>	<b>\$20.5</b>	<b>\$2.2</b>

Figures may not add due to rounding.

Generation costs were unusually high in 2005. In 2004, generation was \$8.4 billion and 2006 it returned to \$8.6 billion.