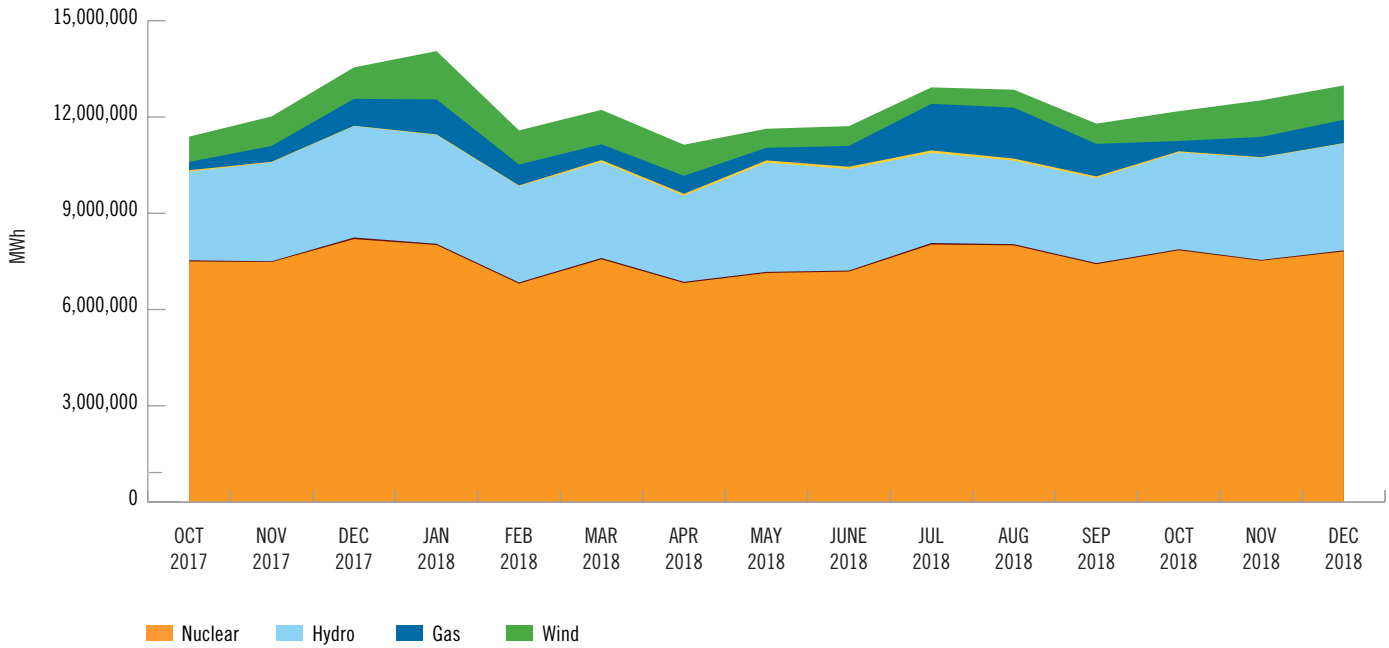


Electricity Supply

Monthly Energy Grid Output by Fuel Type

Ontario’s bulk electricity grid has a diverse supply mix, featuring baseload generators that provide energy around the clock, intermittent generators that generate when they are able (primarily wind and solar), and flexible generators that can change their output quickly (primarily natural gas).



Note: Total MW value may not add up to sum of column totals due to rounding.

Source: IESO

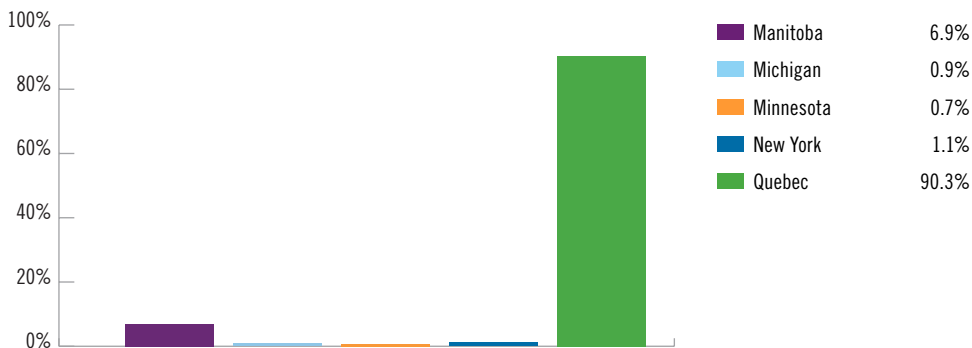
The data shown above is sourced from a report developed by the IESO, available at reports.ieso.ca/public/GenOutputbyFuelMonthly/PUB_GenOutputbyFuelMonthly.xml. The report uses settlement data to provide information for all self-schedulers, intermittent and dispatchable Ontario generators registered as a Market Participant. The report – which includes all grid-connected generators, plus those embedded generators that are also registered as market participants – is published monthly as per the Physical Settlement calendar.

Imports and Exports

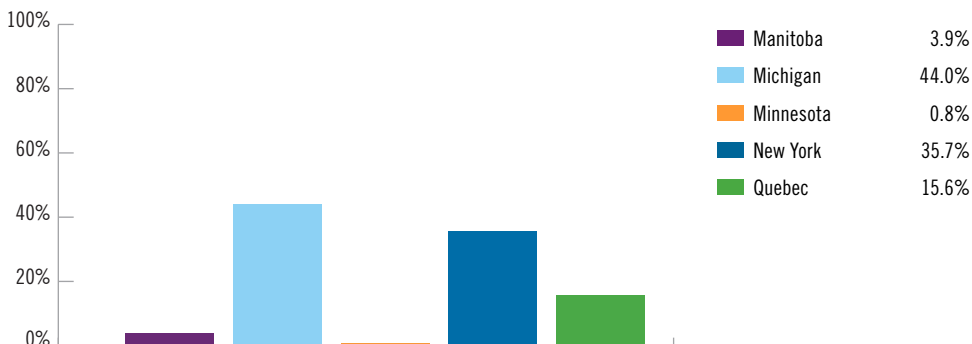
Ontario is connected to a large, stable network of transmission systems across North America, which supports system reliability and economic efficiency. Imports compete against domestic generation to provide energy at the best possible price and to support the province's needs during periods of high demand. Ontario also exports energy when it is economic, which helps to bring in revenue to offset other system and infrastructure costs and maintain system reliability during times of surplus generation.

Ontario imports and exports power across 26 interties with two provinces and three states. While Ontario is electrically interconnected with Manitoba, Michigan, Minnesota, New York and Quebec, the interties allow for electricity trade in transactions that can reach across eastern North America, contributing to a more diversified and competitive pool of supply.

Q4 Imports



Q4 Exports



Q4 (GWh)	Manitoba	Michigan	Minnesota	New York	Quebec	Total
Imports	78.2	9.7	8.4	12.5	1,018.90	1,127.80
Exports	186	2,078	40	1,686	735	4,723.8

Note: Numbers may not add up to totals due to rounding.

Source: IESO

Installed Capacity Connected to Transmission Grid

Changes to installed transmission grid capacity in this quarter highlight the continuing process of renewal in Ontario's electricity sector. While nuclear, hydroelectric and natural gas production accounted for the vast majority of bulk supply, new wind, biofuel and solar generators continued to connect to the transmission grid.

The [IESO Active Generation Contract List](#) provides the status of individual contracted electricity supply projects within different IESO procurement programs. The list is limited to generation facilities under contract to the IESO.

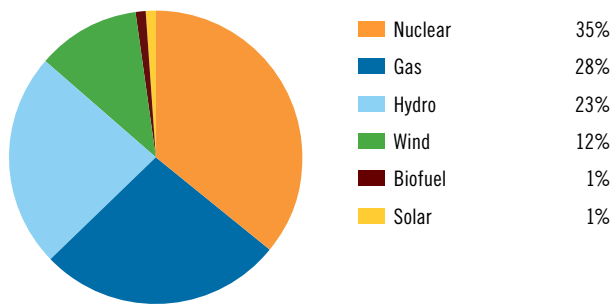
New Facilities Registered in Q4

The following projects have completed commissioning and the market entry process and are included in the total installed IESO Market Participant generator capacity:

- Amherst Island CGS - 74.1

**Note: One facility was approved for deregistration and another changed its rating. Therefore, the values presented in the Grid-Connected Capacity are lower.*

Grid-Connected Generation Capacity



Note: Data includes all transmission-connected generation facilities and distribution-connected facilities that are Market Participants. Numbers may not add up to totals due to rounding.

Source: IESO

The table below shows the increased use of renewable resources for generating electricity in the province.

Grid-Connected Generation Capacity

Year (MW)	Nuclear	Hydro	Coal	Gas*	Wind	Biofuel	Solar	Total
Q4 2018	13,009	8,482	0	10,277	4,486	295	380	36,929
2017	13,009	8,490	0	10,277	4,213	495	380	36,863
2016	12,978	8,451	0	9,943	3,923	495	280	36,070
2015	12,978	8,432	0	9,942	3,504	495	240	35,591
2014	12,947	8,462	0	9,920	2,543	455	40	34,367
2013	12,947	7,939	2,291	9,920	1,725	124	0	34,946
2012	12,998	7,947	3,293	9,987	1,511	122	0	35,858

* Units that use natural gas, oil or are dual fuel, such as Lennox, NP Kirkland and NP Cochrane, are included in the Gas category.

Source: IESO

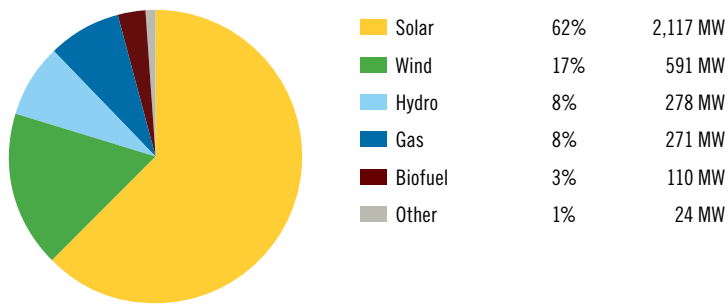
Note: Numbers may not add up to totals due to rounding.

Embedded Generation (IESO-contracted)

Embedded generators supply electricity to local distribution systems, helping to reduce demand on the transmission grid and supporting some of the needs of local communities. While wind and solar make up the majority of contracted embedded generation, the IESO has contracted for increasing amounts of hydroelectric, combined heat and power, natural gas and biofuel systems that will also connect to local distribution networks.

By the end of Q4 2018, there was 3,391 MW of contracted generation in commercial operation within local distribution systems.

Contracted Embedded Generation Capacity in Commercial Operation (Q4)

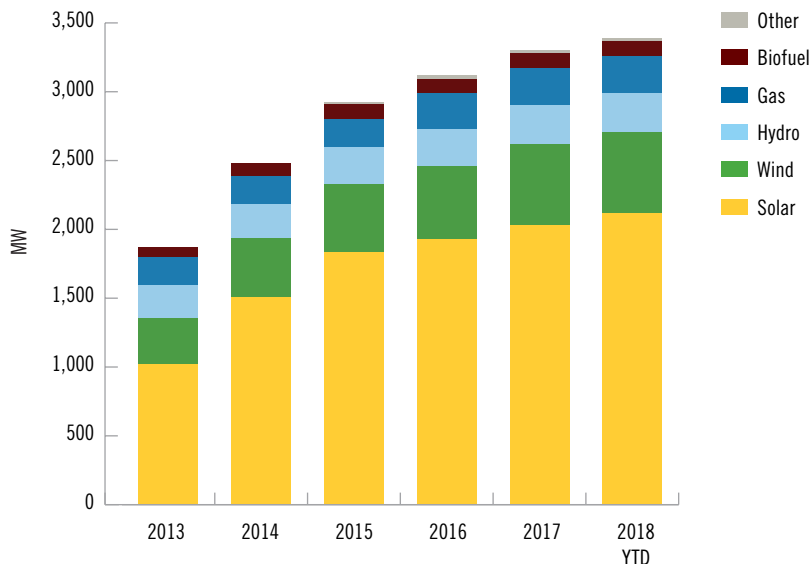


Note: Numbers may not add up to totals due to rounding.

Source: IESO

The table below shows the increased use of embedded generation to supply electricity to local distribution systems in the province.

Contracted Embedded Generation Capacity in Commercial Operation



Note: Total IESO-contracted embedded generation in commercial operation at end of each period. Numbers may not add up to totals due to rounding.

Source: IESO

The data shown above are sourced from the IESO Progress Report on Contracted Supply. The report provides a quarterly update on the status of supply and procurement initiatives that are under development or in commercial operation, by fuel type, and aggregates total capacities as stated in each contract, which differs from values on installed capacity used for operation purposes. The report is available at ieso.ca/power-data/supply-overview/transmission-connected-generation.

Total Grid-Connected and Contracted Embedded Generation Capacity

This table shows all grid-connected capacity and IESO-contracted embedded capacity in the province.

Year	Nuclear	Hydro	Coal	Gas	Wind	Biofuel	Solar	Other	Total
2018 Q4 (MW)	13,009	8,760	0	10,548	5,077	405	2,497	24	40,320
2018 Q4 (%)	32%	22%	0%	26%	13%	1%	6%	<1%	

Note: Numbers may not add up to totals due to rounding.

Available Capacity at Peak

23,435 MW (Q4)

Peak Demand	20,152 MW (Q4)	Operating Reserve Requirement	1,418 MW (Q4)
Minimum Demand	10,847 MW (Q4)		

Source: IESO

Available capacity is all installed grid-connected capacity, less allowances made for seasonal derates, planned outages and the capacity of energy-limited resources. Reserves are required to ensure that the forecast Ontario Demand can be supplied with a sufficiently high level of reliability. Operating Reserve is the amount of supply resources required to handle the loss of the largest contingency on the grid, plus the loss of half the amount of the second largest contingency. More information on the criteria, tools and methodology the IESO uses to perform resource adequacy assessments can be found at ieso.ca/power-data/market-summaries-archive.

Conservation

As of Q4 2018, CFF Programs have achieved 5,772 gigawatt-hours (GWh) in electricity savings and the IAP Program has achieved 405 GWh in electricity savings. For more details on quarterly results please see the quarterly IESO Conservation Progress Report via the IESO Conservation Reports website: ieso.ca/power-data/conservation-overview/conservation-reports.

Conservation Portfolio Progress – Results (as of 2018 Q4)³

Incremental Progress		2018 Q4 Incremental	2015-2018 Q4 Incremental
LDC & IESO Delivered CFF	Peak Demand Savings (MW)	20	759
	Energy Savings (GWh)	101	5,772
IESO Delivered IAP	Peak Demand Savings (MW)	2	116
	Energy Savings (GWh)	11	405
Total Portfolio	Total Peak Demand Savings (MW)	22	875
	Total Energy Savings (GWh)	112	6,178

Note: Totals may not align due to rounding.

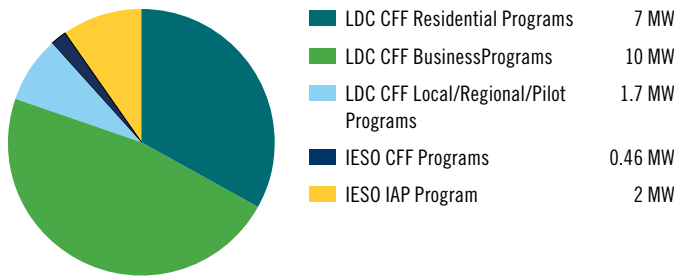
Source: IESO

2. All conservation metrics above are presented as 'net' savings which take into consideration the actual influence of the program on participants (e.g., estimating free-ridership and spill over savings). Furthermore, all savings presented above persist until the year 2020 at the end-user level (e.g., accounting for transmission and distribution system line losses). To align savings with generation level metrics, values should be increased by factor of 6.7% for distribution system level savings or a factor of 2.5% for transmission system level savings.

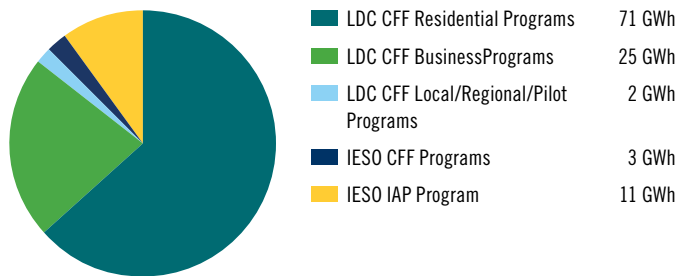
3. Results presented are 'reported' (i.e. 'unverified') based on project installation dates corresponding to the indicated period and are based on projects reported and invoiced to the IESO as of 2018 Q4.

Incremental Savings (2018 Q4)

2020 Annual Peak Demand Savings



2020 Annual Energy Savings



Note: Numbers may not add up to totals due to rounding.

Source: IESO

Demand Response (DR)

Demand response and peak savings programs benefit the electricity system and lower energy costs for consumers by contributing to overall peak savings for the province.

Beginning in December 2015, DR capacity has been procured through a competitive DR Auction process. The DR Auction provides a transparent and cost-effective way to select the most competitive providers of DR, while ensuring that all providers are held to the same performance obligations.

The December 2018 DR auction procured 818.4 MW for the summer six-month commitment period beginning on May 1, 2019, and 854.2 MW for the winter six-month commitment period beginning on November 1, 2019.

More information on the Demand Response Auction is available at: ieso.ca/en/sector-participants/market-operations/markets-and-related-programs/demand-response-auction

Peak Savings

The Industrial Conservation Initiative (ICI) encourages large consumers to shift their energy use away from system-wide peaks. Customers who are able to reduce their impact on peaks benefit the system by reducing the need to build new infrastructure. In 2017, ICI is estimated to have reduced peak demand by 1,400 MW. Participating customers are assessed an individual Global Adjustment (GA) rate, based on the percentage that their demand contributes to the top five system coincident peaks measured during a defined base period.

The table below lists the top five daily peaks for the most recent base period, which began on May 1, 2016, and ended on April 30, 2017.

Top 5 Peaks: Hours & System-Wide Consumption (Base Period: May 1, 2017 to April 30, 2018)

Date	Hour Ending	Allocated Quantity of Energy Withdrawn (MW)	Embedded Generation (MW)	Total (MW)
September 25, 2017	17	21,170.494	641.115	21,811.609
September 26, 2017	17	21,038.558	626.445	21,665.003
June 12, 2017	17	20,701.997	1,296.884	21,998.881
January 5, 2018	18	20,238.280	646.859	20,885.139
July 19, 2017	18	20,122.460	861.665	20,984.125

Note: The value in the Total (MW) column is the number used to calculate a customer's Peak Demand Factor. The above values are used for the adjustment period July 1, 2017 to June 30, 2018.

Source: IESO

Information on peak tracking can be found at ieso.ca/sector-participants/settlements/global-adjustment-for-class-a

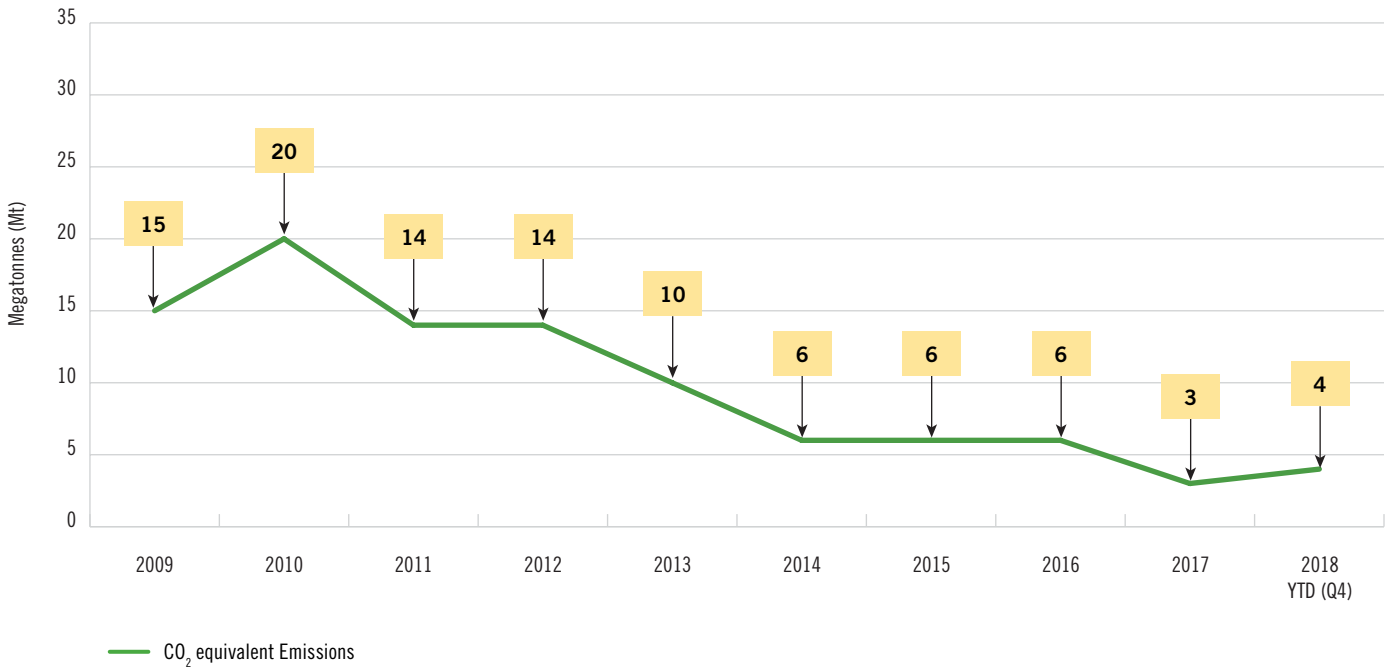
More information on the ICI is available at ieso.ca/-/media/files/ieso/document-library/global-adjustment/ici-backgrounder.pdf?la=en.

Greenhouse Gas Emissions

The marked decline in greenhouse gas emissions (measured in tonnes of CO₂ equivalent) is a result of the phase-out of coal-fired electricity generation in the province and uptake of renewable generation and conservation measures. Emissions of oxides of sulphur (SO_x) – which are predominantly a by-product of coal combustion – have also shown a marked decrease with the phase-out of coal-fired electricity.

Greenhouse Gas Emissions for the Ontario Electricity Sector

The chart below shows annual greenhouse gas emissions (measured in tonnes of CO₂ equivalent) for the years 2009-2018. Year-to-date greenhouse gas emissions in Q4 2018 totalled approximately 4 megatonnes (Mt).



Source: IESO, Environment Canada, Ontario Ministry of Environment and Climate Change

Air Contaminants

Air contaminants, including oxides of sulphur (SO_x), oxides of nitrogen (NO_x) and fine particulate matter (PM_{2.5}), are also released during combustion of fossil fuels.

Air Contaminants for the Ontario Electricity Sector (Tonnes)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018 YTD (Q4)
SO _x Emissions	30,762	38,508	11,966	10,342	10,192	846	424	579	501	467
NO _x Emissions	23,653	27,358	18,198	19,867	17,973	11,448	10,355	9,323	6,920	7,300
PM _{2.5} Emissions	991	855	518	479	445	309	258	235	187	223

Source: IESO, Environment Canada