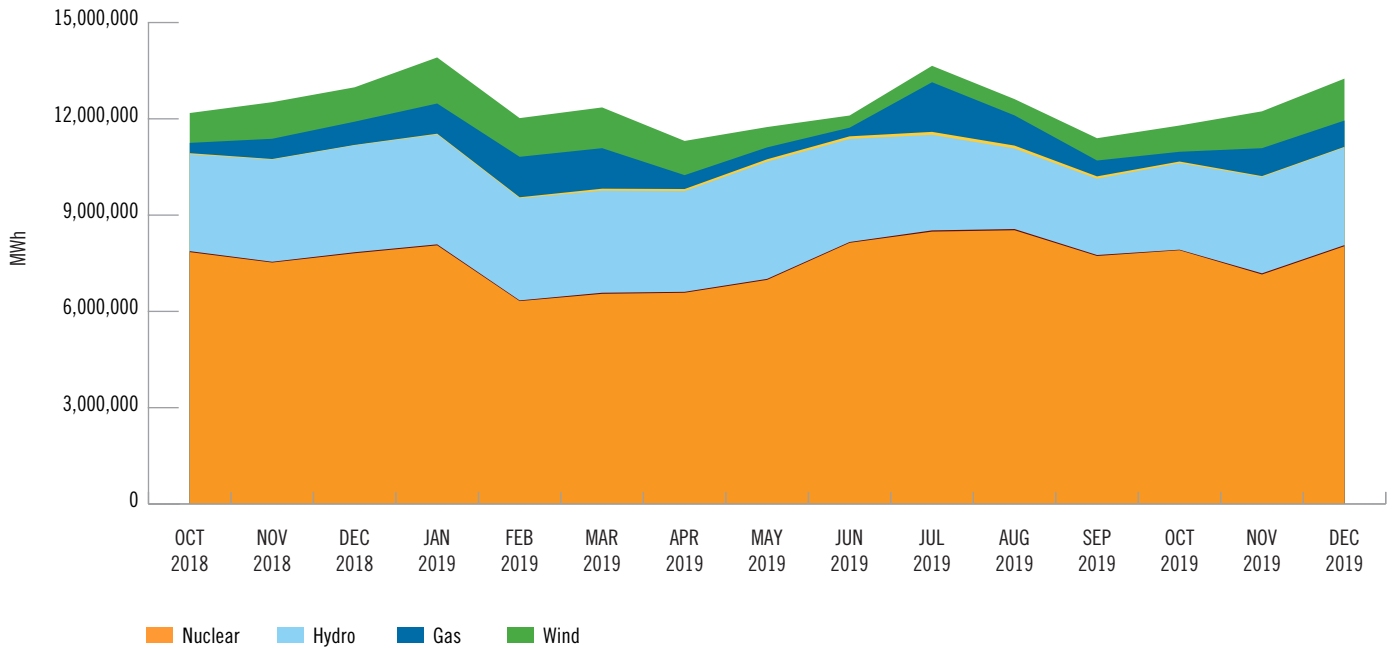


Electricity Supply

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).



Source: IESO

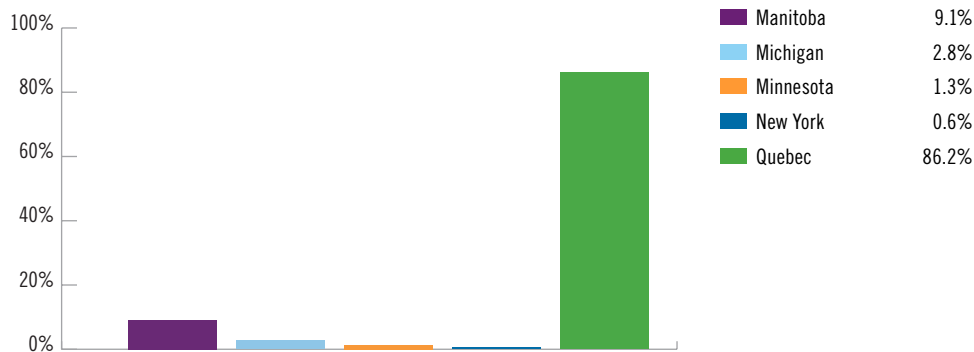
The data shown above is sourced from a report developed by the IESO, available at reports.ieso.ca/public/GenOutputbyFuelMonthly/PUB_GenOutputbyFuelMonthly.xml. The report uses settlement data to provide information for all self-schedulers, intermittent and dispatchable Ontario generators registered as 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

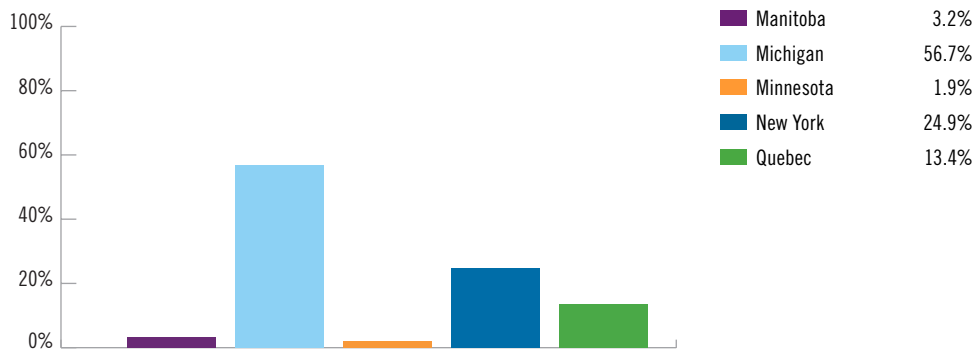
Ontario is connected to a large, stable network of transmission systems across North America, which supports system reliability and economic efficiency. Imports compete against domestic generation to provide energy at the best possible price and to support the province’s needs during periods of high 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	111.97	34.35	16.29	7.94	1,066.01	1,236.56
Exports	154.86	2,775.31	90.59	1,219.18	653.68	4,893.62

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

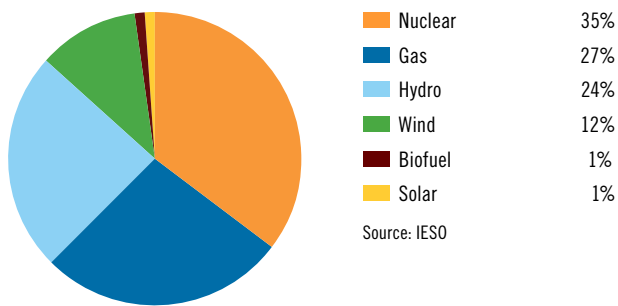
Source: IESO

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.

Grid-Connected Generation Capacity (Q4)



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.

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
2019	13,009	9,065	0	10,277	4,486	295	424	37,555
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

* 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

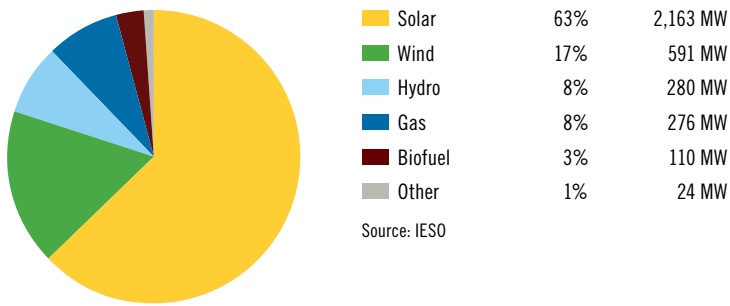
Note: Numbers may not add up to totals due to rounding.

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 2019, there was 3,445 MW of contracted generation in commercial operation within local distribution systems.

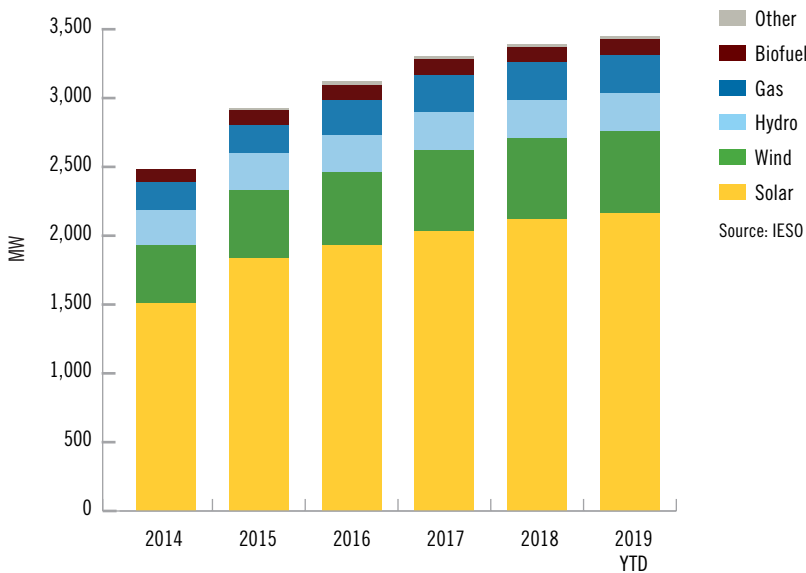
Contracted Embedded Generation Capacity in Commercial Operation (Q4)



Note: Each of the above numbers appear in the IESO Q4 Progress Report on Contracted Supply.

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.

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
2019 Q4 (MW)	13,009	9,346	0	10,553	5,076	405	2,587	24	41,000
2019 Q4 (%)	32%	23%	0%	26%	12%	1%	6%	<1%	

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

Available Capacity at Peak

24,597 MW (Q4)

Peak Demand	20,974 MW (Q4)	Operating Reserve Requirement	1,418 MW (Q4)
Minimum Demand	10,739 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

Together the Conservation First Framework (CFF), Industrial Accelerator Program (IAP) and the Interim Framework (IF) are expected to achieve 8.7 TWh in savings. As of Q4 2019, Conservation and Demand Management (CDM) Programs have achieved 7,478 gigawatt-hours (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.

As is common at the start of all conservation frameworks, participation levels in the Interim Framework took time to increase as new programs were implemented, program-delivery vendors were on-boarded, and customers became more familiar with new program offerings. Energy and demand savings from programs under the Interim Framework are forecasted to increase over time as more projects are completed and participation levels continue to increase. Actual savings are expected to continue to accrue through 2021-2022 as committed projects enter into service.

Prior to the COVID-19 health emergency, the IESO was forecasting to cost effectively achieve 100% of the energy savings and demand targets. The IESO is updating its 2020 forecast to account for the COVID-19 health emergency and its impact to overall energy savings and demand targets.

Conservation Portfolio Progress – Results (as of 2019 Q4)²

Incremental Progress		2019 Q4 Incremental	2015-2019 Q4 Incremental	2020 Target Progress (%)
LDC & IESO Delivered CFF	Peak Demand Savings (MW)	56	871	-
	Energy Savings (GWh)	391	6,987	116
IESO Delivered IAP	Peak Demand Savings (MW)	1	123	-
	Energy Savings (GWh)	-1	451	35
IESO Delivered IF	Peak Demand Savings (MW)	5	6.6	3.5
	Energy Savings (GWh)	27	40	2.8
Total Portfolio	Total Peak Demand Savings (MW)	61	1,001	-
	Total Energy Savings (GWh)	418	7,478	-

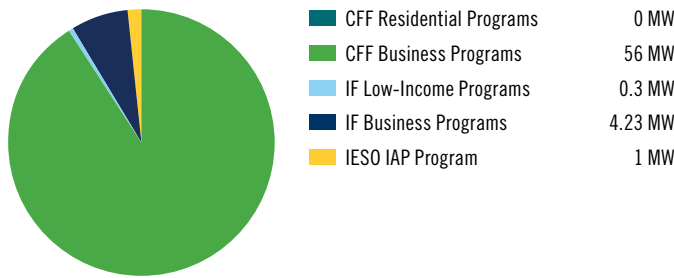
Note: Totals may not align due to rounding.

Source: IESO

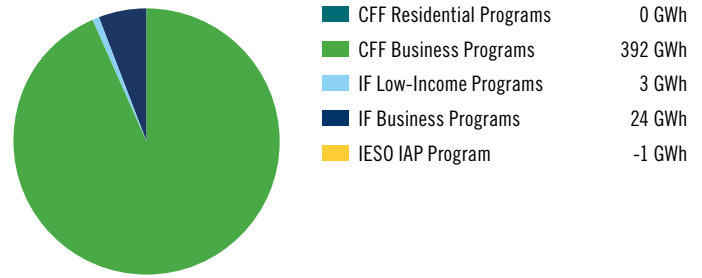
² Results presented are 'reported' (i.e. 'unverified') based on project installation dates corresponding to the indicated period and are based on projects reported and invoiced to the IESO as of 2019 Q2.

Incremental Savings (2019 Q4)

2020 Annual Peak Demand Savings



2020 Annual Energy Savings



Note: Numbers may not add up to totals due to rounding. Energy savings for the IAP in Q4 2019 were nil (0) but are presented as -1 GWh due to an adjustment to Q3 2019 reported results.

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, 2018, and ended on April 30, 2019.

Top 5 Peaks: Hours & System-Wide Consumption (Base Period: May 1, 2018 to April 30, 2019)

Date	Hour Ending	Allocated Quantity of Energy Withdrawn (MW)	Embedded Generation (MW)	Energy Storage Injections (MWh)	Total (MW)
September 5, 2018	17	22,551.315	1,076.151	0.446	23,627.020
July 5, 2018	15	22,415.022	1,418.704	0.008	23,833.718
July 4, 2018	18	22,122.730	734.709	0.393	22,857.046
August 28, 2018	17	21,643.799	1,069.941	0.581	22,713.159
September 4, 2018	17	21,379.327	803.919	0.759	22,182.487

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 July 1, 2019 to June 30, 2020 adjustment period.

Source: IESO

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

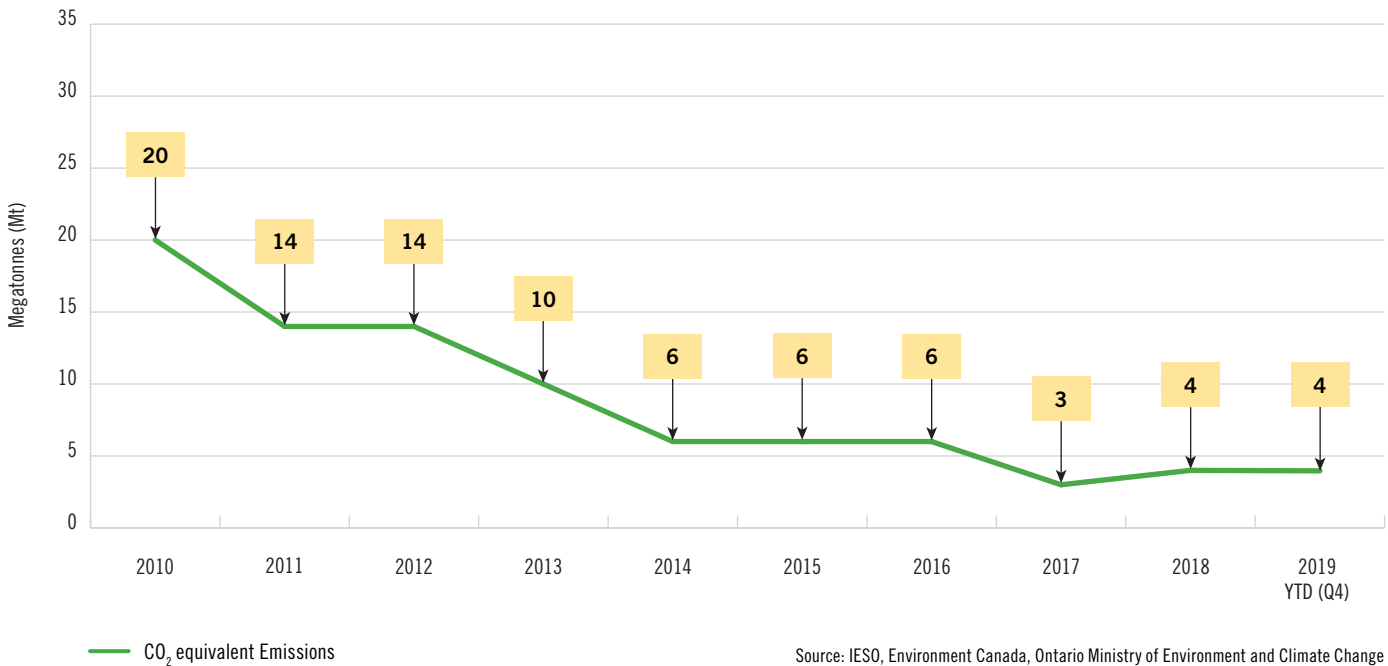
More information on the ICI is available at ieso.ca/-/media/files/ieso/document-library/global-adjustment/ici-backgrounder.pdf?la=en.

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, uptake of emissions-free 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 2010-2019. Year-to-date greenhouse gas emissions in Q4 2019 totalled approximately 4 megatonnes (Mt).



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)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SO _x Emissions	38,507	11,966	10,342	10,192	846	424	579	644	504	464
NO _x Emissions	27,358	18,198	19,867	17,973	11,448	10,355	9,323	5,695	5,924	6,010
PM _{2.5} Emissions	843	518	468	445	309	262	239	195	210	212

Source: IESO, Environment Canada