POWER ADVISORY

Electricity Resource Options for the City of Windsor

City of Windsor

September 12, 2022

Contents

Power Advisory

- Consulting firm specializing in electricity markets – offices in Toronto, Calgary, Boston
- Team of energy economists, financial analysts, power system engineers, policy experts – experience with government agencies, regulators, decision makers
- Clients including distributors, transmitters, generators, regulators, system operators, investors, government
- Deep understanding of electricity markets pertaining to distributors, etc.

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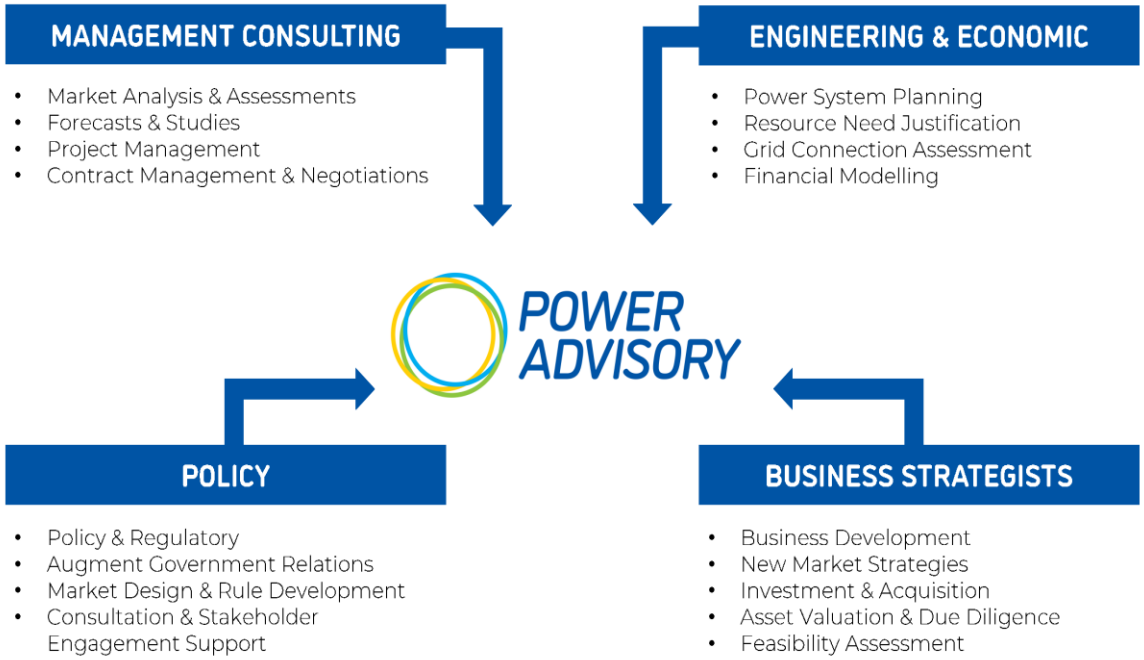


Purpose of this Report

- Power Advisory was retained by the City of Windsor to deliver a report with recommended actions to alleviate electricity supply and transmission constraints impacting investments and economic development in the City of Windsor and surrounding areas
    - The goal is to show how decisions made at the provincial level impact economic growth opportunities for the City and the region, and outline steps that the City can undertake to facilitate energy capability in the region
- This report includes:
    - An overview of Ontario's electricity sector, including province-wide supply and demand outlook
    - A review of the regional electricity planning area impacting transmission capacity to the City of Windsor (and Windsor-Essex Region more broadly)
    - A discussion of the Independent Electricity System Operator's (IESO's) procurement processes for province-wide electricity supply, including implications for the City of Windsor
    - A summary of non-transmission solutions that could be implemented to alleviate near-term transmission constraints
    - Recommendations for the City of Windsor
- While the City of Windsor took the lead to commission this report, the information, commentary and recommendations are also applicable to other municipalities in the Windsor-Essex Region
    - The report further recognizes that electricity planning and resource development outside the City of Windsor's boundary has impacts on customers located within the City's boundaries

Key Take-Aways From This Report (1/2)

- Ontario's electricity needs are growing due to economic growth and electrification of the economy, including significant growth in the agricultural sector (e.g., greenhouses)
- Ontario has a need for new electricity supply resources due to retirement and refurbishment of nuclear generation, expiring generation contracts, and the transition to a net-zero electricity grid based on Canadian government policy
- Due to the magnitude of forecasted electricity demand in the Windsor-Essex Region, five new transmission projects are proposed (i.e., various stages of development and approval) to ensure the reliability of electricity supply
    - To avoid periods that are challenging to connect new, large-scale customers, local resources or programs are needed to provide flexibly between planned transmission projects
    - Flexibility can be achieved through the deployment of non-wires solutions, such as energy storage, demand response, local generation, etc.
- There is capacity to connect new loads in Windsor-Essex
    - Large loads will require special consideration, not unlike any other areas of the province
    - Where a significant load emerges in the short-term (i.e., prior to the planned transmission reinforcement investments), Hydro One, ENWIN and other Local Distribution Companies should be empowered to develop localized solutions in conjunction with the IESO to expedite/facilitate connection

Key Take-Aways From This Report (2/2)

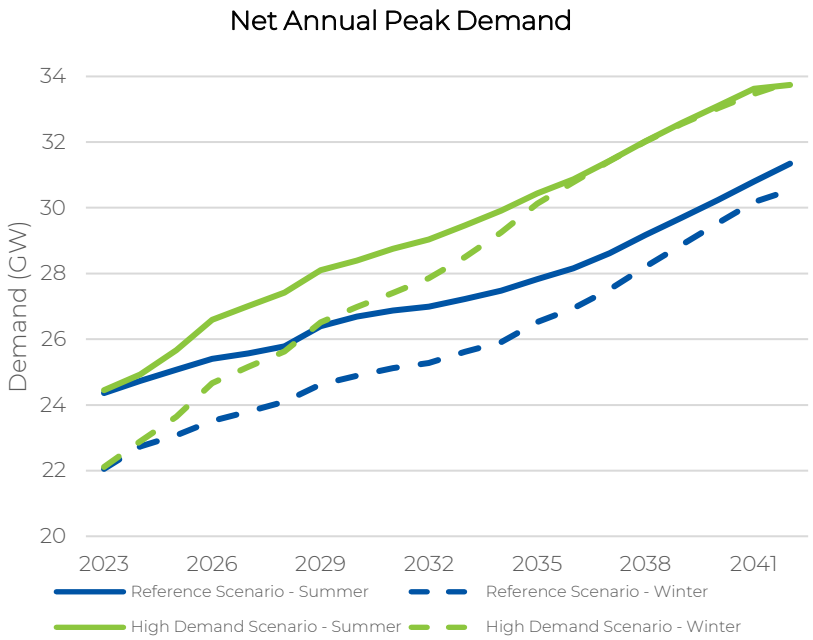
- Municipalities will play a critical role in the development of local resources (e.g., IESO procurement processes, permitting, etc.)
    - The City of Windsor should be prepared to respond to multiple requests from generators and storage providers (e.g., general development inquires, requests for council support resolutions, permitting applications, etc.)
- The Windsor-Essex region requires a coordinated approach which aligns economic development and electricity resources development to support the growth in electricity demand
    - While multiple transmission projects are planned, transmission development takes time, and therefore the IESO, Hydro One, ENWIN, and others must be engaged to develop intermediate solutions which can be deployed in the near-term
- The City of Windsor should plan to engage actively in IESO regional planning consultations, and particularly provide insight to economic development and growth opportunities that would impact electricity needs in the region

1. Ontario Electricity Outlook

Section Overview

- This section provides the outlook for Ontario as a whole with respect to electricity demand and supply
- As described in the Appendix, the IESO is responsible for Ontario-wide power system planning (i.e., bulk system), and ensuring Ontario has sufficient resources (e.g., generation, transmission, etc.) to meet Ontario's electricity demand
- The content in this section is primarily drawn from the IESO's Annual Planning Outlook (APO) and the IESO's Annual Acquisition Report (AAR)
    - APO provides a 20-year outlook of electricity resources and forecasted electricity demand
    - AAR provides the IESO's near to medium term plans to acquire electricity resources to ensure there is sufficient electricity supply to meet electricity demand
- Power Advisory provides commentary on the magnitude and urgency to acquire new resources to meet province-wide electricity needs

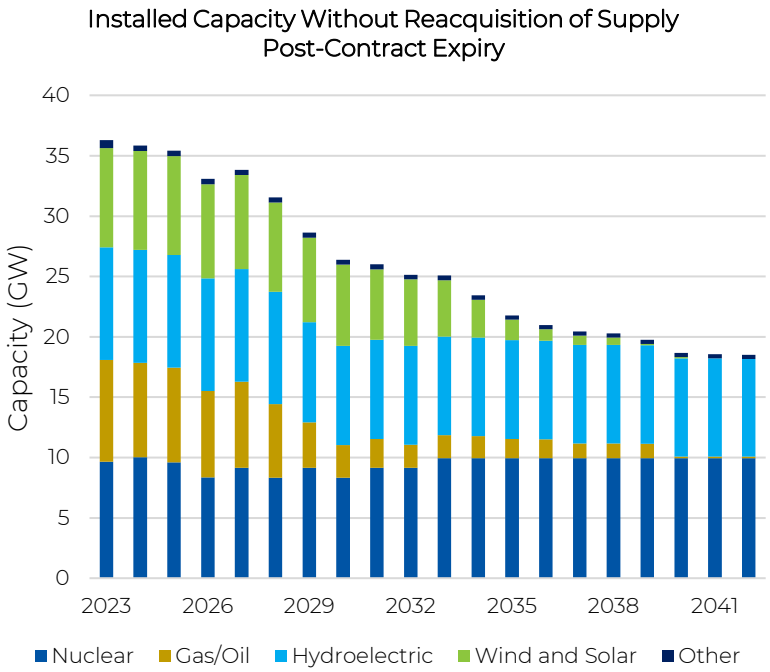
Ontario-Wide Electricity Demand is Growing



Source: IESO

- Significant growth in electricity demand, at least 2% per year (IESO Reference Scenario)
  - Represents a departure from historic demand patterns which have been relatively flat over the past 5 years
  - Demand growth primarily attributed to agricultural greenhouses, mining expansion, steel producer electrification, electrifying transportation, and continued residential sector growth
- High Demand Scenario represents impact of uncertainties, such as increased electrification driven by government policy, and increased economic activity
- Power Advisory's analysis suggests the IESO's High Demand Scenario may be more probable given policy and industry drivers to achieve net-zero carbon emission goals and electrification

Contracts Expiring and Nuclear Generators are Retiring and Undergoing Refurbishment



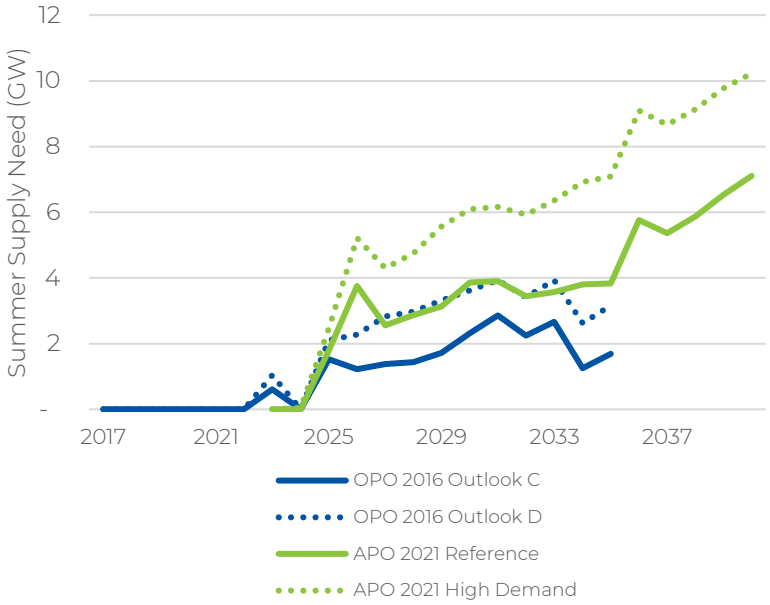
Source: IESO

- Pickering nuclear generation station (NGS) retiring in 2024/2025, Bruce NGS and Darlington NGS undergoing refurbishment in accordance with provincial plans
- Contracts with generators held with the IESO will expire during the outlook period
  - Some existing generation may retire, even those in high-demand areas due to insufficient electricity market prices
  - If generators do not remain in-service after their contracts expire, the effective summer capacity of the supply mix drops from 25 GW in 2023 to 16 GW by 2042
- The IESO has re-contracted Ontario Power Generation's (OPG's) Lennox generation facility and is presently negotiating with Atura Power (solely owned by OPG) to re-contract the Brighton Beach generation facility (located in Windsor)
- Additional details on the IESO's efforts to re-contract existing supply are provided in Section 3

Maintaining Resource Adequacy Requires Significant Investment

- After years of surplus generation, amount of new supply needed in Ontario is unprecedented
- Immediate need to build, invest in new electricity supply and associated infrastructure (e.g., electricity distribution and transmission)
- Short on time considering development, permitting/approvals, community engagement, supply chain constraints, inflation, etc.
- No single resource-type will provide all reliability attributes and environmental attributes required (i.e., decarbonization goals vs. re-contracting existing gas generation)
- Windsor-Essex regional supply needs are substantial, given demand growth and transmission constraints, as described in Section 2
- Windsor-Essex can expect significant amounts of new resources, including distributed energy resources, to meet supply needs

Ontario Supply Need with Continued Operation of Existing Resources, Comparing 2016 & 2021 Projections



Source: IESO

Resource Acquisition Challenges Ahead

- IESO is under significant pressure to meet supply needs, therefore has launched multiple procurement initiatives (e.g., medium-term, and long-term Request for Proposals (RFPs)), as described in Section 3
- IESO's procurements must overcome several challenges to attract required investment, including
  - Independent Power Producers (IPPs) wary of Ontario market risk (e.g., historical government intervention and contract cancelations, large provincially-owned generator (OPG) with dominant supply position, etc.)
  - Other jurisdictions attracting significant investment by IPPs in competition to Ontario (e.g., decarbonization goals of U.S. markets, etc.)
- IESO's plans show need for additional resource acquisition mechanisms to meet province-wide needs emerging in mid-2020s
  - These needs increase if existing generation retires post expiry of contracts

Source: IESO

Summary of Resource Adequacy Risks

Magnitude of Supply Needs

- Ontario's electricity needs are significant in magnitude and arising in the near term

Limited Resource Options

- Options to meet supply needs are limited, and there are increasing expectations that electricity supply will continue to be low carbon and less or zero emitting

Procurement Risks

- IESO must overcome a number of challenges in upcoming centralized procurements to attract investment, including development risk, supply chain risk, etc.

Decarbonization goals

- Types of resources that are attractive in a net-zero economy include storage, renewable generation, hybrid renewable generation co-located with energy storage, programs such as energy efficiency, etc.

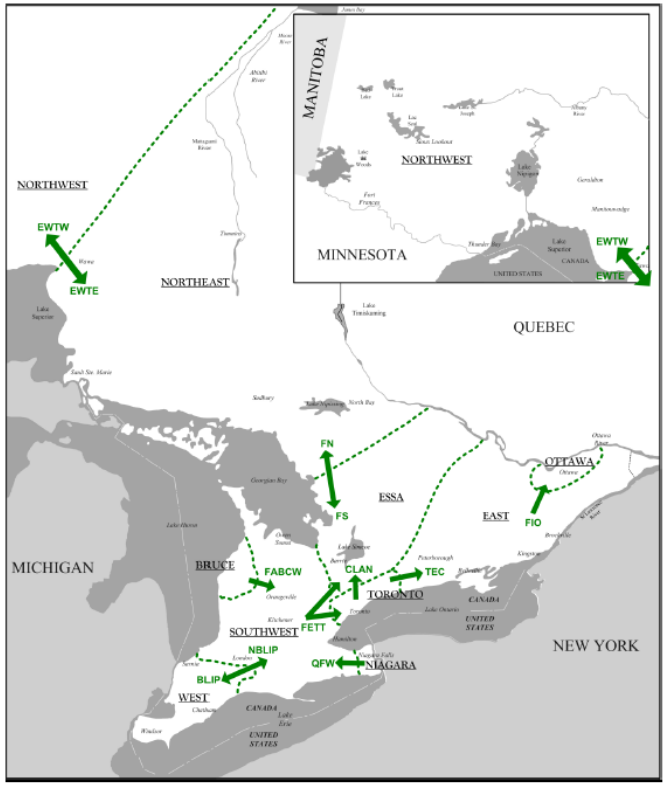
2. Regional Electricity Needs Impacting the City of Windsor

Section Overview

- This section provides an overview of the electricity needs of the Windsor-Essex Region that are impacting the City of Windsor
- The IESO is responsible for preparing Integrated Regional Resource Plans (IRRPs) for each planning region across Ontario
    - The IESO receives input on regional plans from Hydro One, LDCs (e.g., ENWIN, Essex Powerlines, etc.), and other customer representatives and stakeholders
- Much of the content within this section references the most recent Windsor-Essex IRRP, completed in 2019, as well as bulk system plans prepared by the IESO in 2021 (i.e., Need for Bulk Transmission Reinforcement in Windsor-Essex Region) and other planning documents (e.g., APO)
- Power Advisory provides commentary on the magnitude of resources needs in the Windsor-Essex region

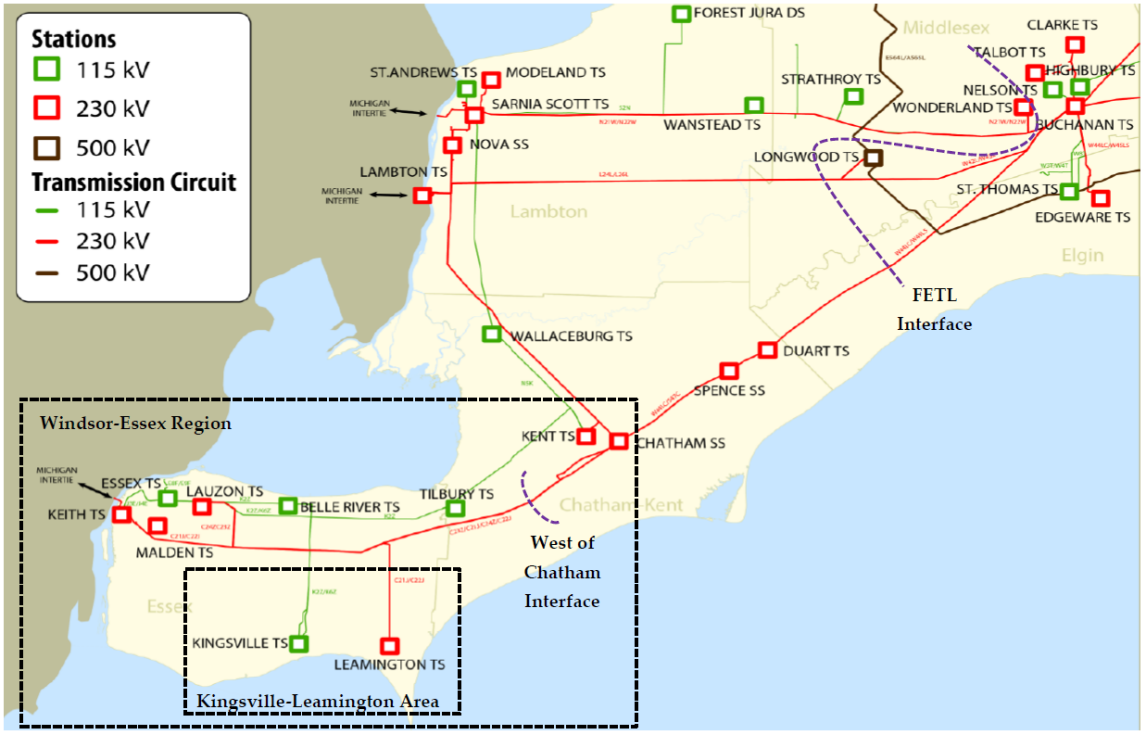
IESO Electrical Zones

- The IESO-controlled grid (i.e., Ontario's bulk power system) is divided into 10 electrical zones, connections between zones are internal transmission interfaces
    - The map to the right shows the IESO zones and transmission interfaces
    - Some interfaces have unidirectional transfer limits (i.e., they are unconstrained in one direction)
    - Interface limits are used to ensure power system stability, maintain acceptable pre-contingency and post-contingency voltage levels, and acceptable thermal loading limits



Source: IESO

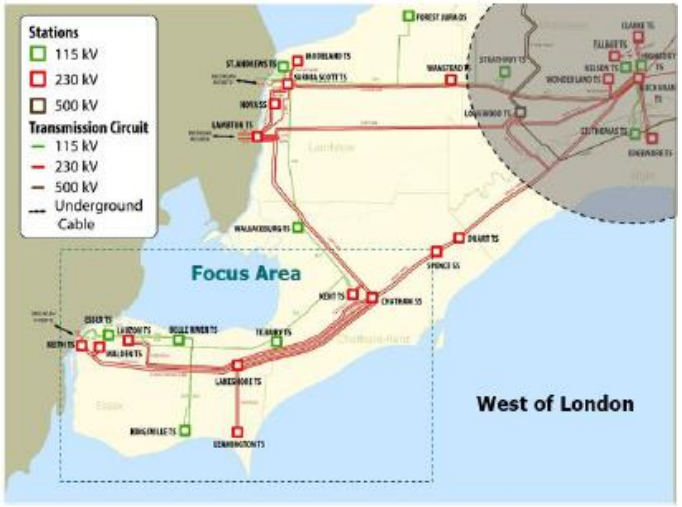
West Of London Area and Windsor-Essex Region

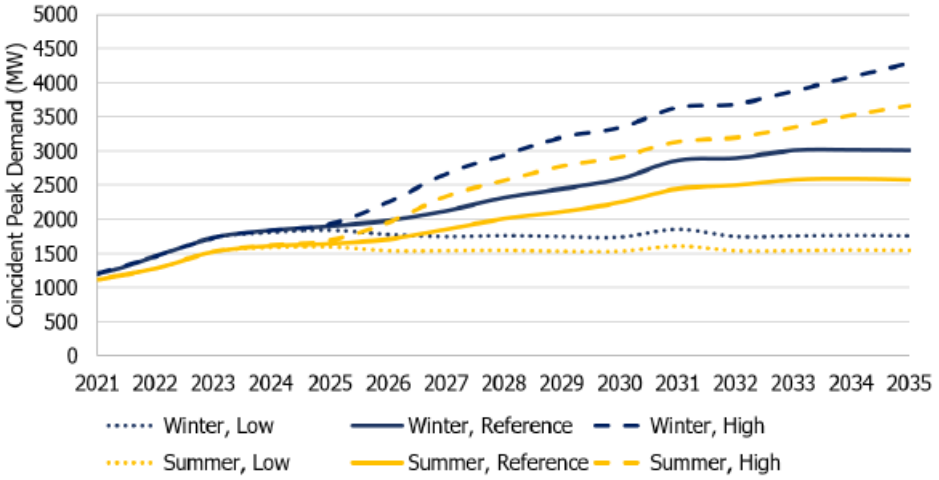


- The West of London area is located in the southwest corner of Ontario and is composed of two regions:
  - Windsor-Essex
  - Chatham-Kent-Sarnia
- Due to significant demand growth, the West of Chatham (WOC) interface is expected to at times be overloaded and must be addressed
- Demand growth expectations for different system planners (i.e., IESO, Hydro One) vary, but all expect large increase of demand in the Windsor-Essex area over the next decade

Source: IESO

Windsor-Essex Focus Area Demand Outlook



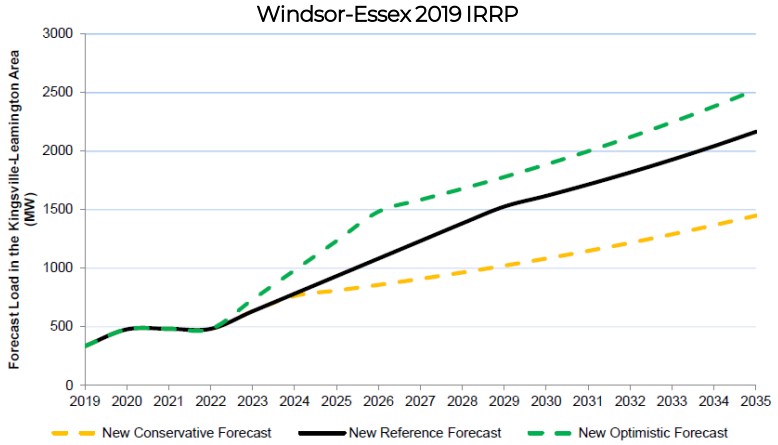


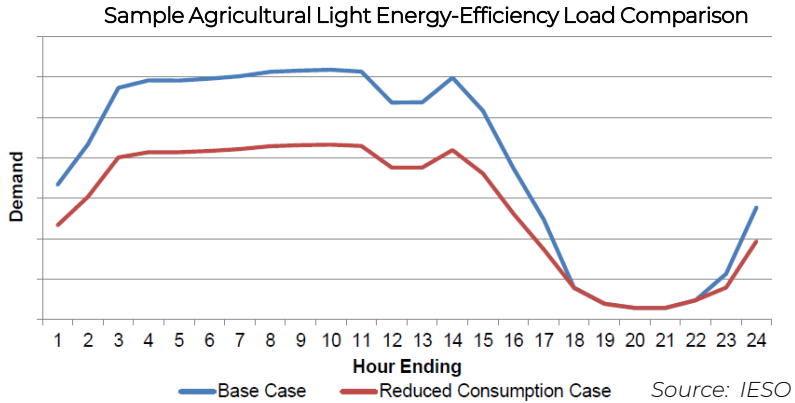
IESO: Focus Area Demand Outlook

- Significant load growth in the Windsor-Essex focus area from new and forecasted greenhouse customer connections are driving winter peak demand from less than 2 GW in 2025 to over 3 GW by 2035
- Ontario is forecasted to shift from summer peaking to winter peaking, this will impact supply contributions of some resources (e.g., solar generation) which may need to be augmented with other resources (e.g., energy storage)

Kingsville-Leamington Area Demand Growth

- Within the focus area, the Kingsville-Leamington Area is the major growth driver, with between 500 MW and 1,500 MW of demand growth expected by 2030
    - Per the IRRP, load growth is primarily driven by agricultural greenhouse investments (IESO expects over two-thirds of Kingsville-Leamington load to come from agricultural customers), with lighting being the key component
- Agricultural investments also require heating with many potential customers exploring cogeneration opportunities depending on electricity prices and economics
    - Uncertainty from cogeneration investment is one of the reasons why load growth forecasts have such a wide range for the Windsor-Essex region – if many new customers adopt cogeneration, grid demand in the region will be lower reducing strain on the transmission system





Source: IESO

Kingsville-Leamington Load Profile Expectations

MW Range	% Probability of Demand Reduction Needed at the given MW Range or Greater											
14-15	0%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
12-14	2%	3%	1%	0%	0%	0%	0%	0%	0%	0%	0%	1%
11-12	5%	6%	2%	0%	0%	0%	0%	0%	0%	0%	0%	2%
9-11	7%	12%	2%	0%	0%	0%	0%	0%	0%	0%	0%	2%
8-9	9%	14%	2%	0%	0%	0%	0%	0%	0%	0%	0%	4%
6-8	15%	22%	3%	0%	0%	0%	0%	0%	0%	0%	0%	5%
5-6	21%	26%	4%	0%	0%	0%	0%	0%	0%	0%	0%	8%
3-5	23%	32%	4%	0%	0%	0%	0%	0%	0%	0%	0%	9%
2-3	28%	36%	6%	0%	0%	0%	0%	0%	0%	0%	0%	14%
0-2	35%	40%	8%	0%	0%	0%	0%	0%	0%	0%	0%	17%
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Key Statistics	
Forecast Year	2021
Peak Reduction Targeted	15MW
Total Hours Requiring Demand Reduction per Year	95

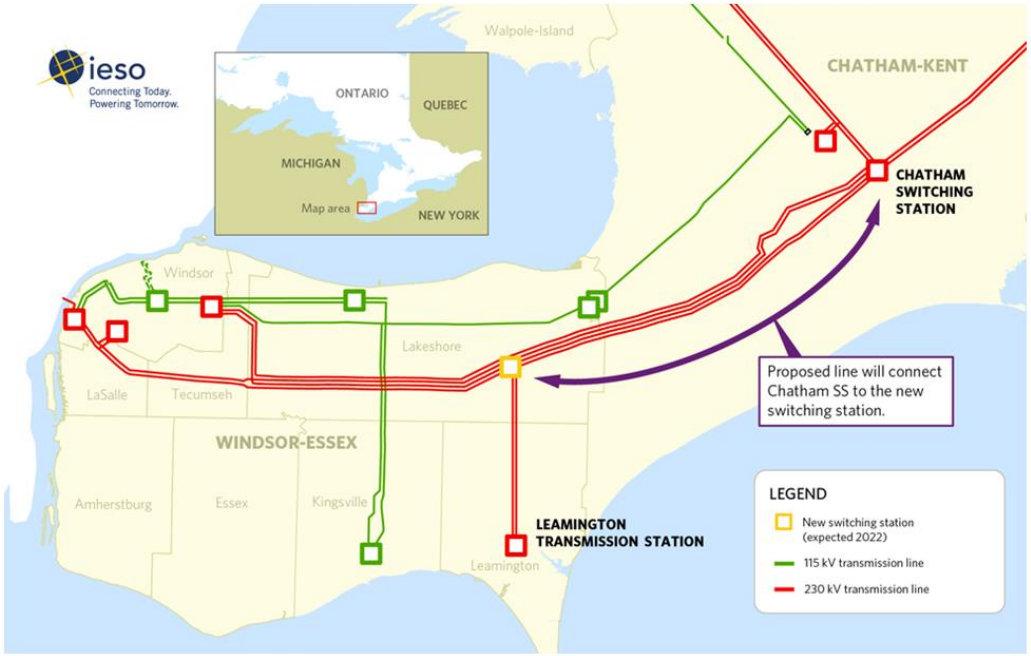
IESO: Windsor-Essex 2019 IRRP

MW Range	% Probability of Demand Reduction Needed at the given MW Range or Greater																							
14-15	0%	0%	0%	0%	0%	0%	0%	1%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
12-14	0%	0%	0%	0%	0%	0%	0%	2%	3%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
11-12	0%	0%	0%	0%	0%	0%	0%	5%	6%	2%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
9-11	0%	0%	0%	0%	0%	0%	0%	8%	7%	4%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
8-9	0%	0%	0%	0%	0%	0%	0%	9%	12%	4%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6-8	0%	0%	0%	0%	0%	0%	0%	14%	19%	7%	4%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5-6	0%	0%	0%	0%	0%	0%	0%	16%	23%	12%	8%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
3-5	0%	0%	0%	0%	0%	0%	0%	19%	25%	14%	8%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
2-3	0%	0%	0%	0%	0%	0%	1%	21%	33%	17%	11%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
0-2	0%	0%	0%	0%	0%	0%	2%	26%	35%	19%	13%	2%	2%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Hour Ending	1AM	2AM	3AM	4AM	5AM	6AM	7AM	8AM	9AM	10AM	11AM	12PM	1PM	2PM	3PM	4PM	5PM	6PM	7PM	8PM	9PM	10PM	11PM	12AM

- Resources required to address regional system needs will need to be able to target specific hours to increase probability of reducing transmission system constraints
- The graphic above shows that resources for the Kingsville-Leamington Area will need to reduce consumption of electricity in the morning for the winter months to have an impact on power system needs

Planned Transmission Development Activities: Chatham SS to Lakeshore SS

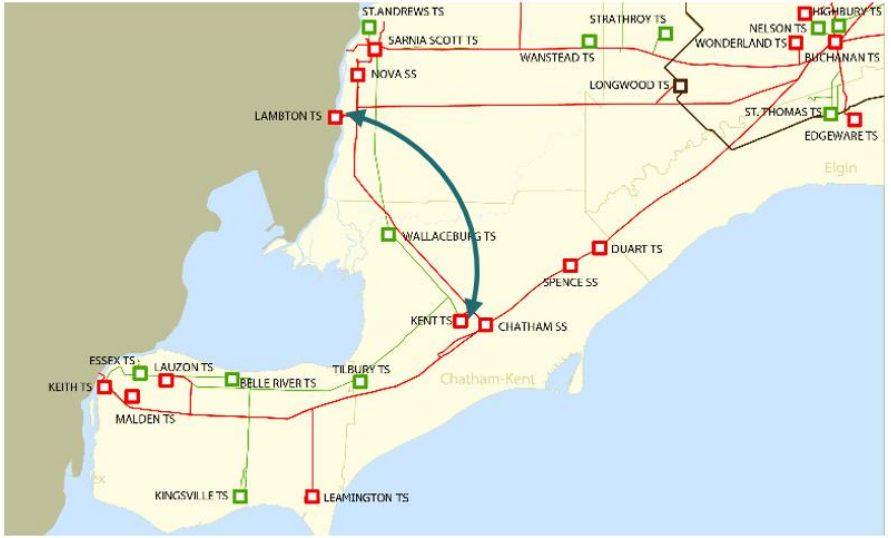
- To address the WOC interface constraint, the IESO issued a letter in January 2019 requesting Hydro One to begin developing a new double 230kV transmission line from Chatham switching station (SS) to a new Lakeshore SS
  - Target in-service date is winter 2025/2026
  - In December 2020, the Minister of Energy instructed the Ontario Energy Board (OEB) to amend Hydro One's transmission license to include the requirement to develop and seek approvals for the transmission line
- The new transmission line will expand the WOC interface capability by ~400 MW – an added benefit of the new Lakeshore SS is that it will help address voltage issues in the region
  - The additional interface capability will support grid connections in the area



Source: IESO

Planned Transmission Development Activities: Lambton TS to Chatham SS

- In March 2021, the IESO requested Hydro One to construct a new double 230 kV transmission line from Lambton transformer station (TS) to Chatham SS to ensure sufficient bulk transfer capability is available to supply forecasted load growth
    - Target in-service date is 2028, therefore there is more time for further planning compared to the Chatham SS to Lakeshore SS line
- The Lambton TS to Chatham SS line will also improve supply deliverability from resources in the Lambton-Sarnia area to meet provincial needs as well as provide additional supply to the Windsor-Essex area



Source: IESO

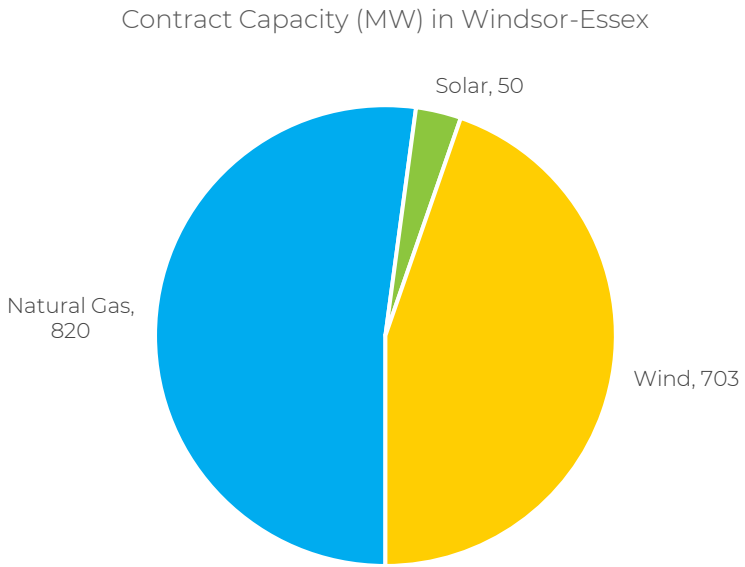
Bulk System 500 kV Expansion

- As part of the southwest bulk transmission study, the IESO identified the long-term need for bulk transmission system expansion and requested Hydro One to explore extending the 500 kV system from Longwood TS (London) to Lakeshore TS (north of Leamington)
- In March 2022, the Ontario government announced a $5 billion electric vehicle (EV) battery manufacturing plant in Windsor by LG Energy Solutions and Stellantis – this will increase load and further require additional electricity supply

Source: IESO

Resource Development in Windsor-Essex

- Even with planned bulk transmission expansion, the IESO has forecasted a supply need for local resources in the focus area to support regional power system needs and demand growth
- A key conundrum for the IESO is the treatment of operating generators following expiry of their contracts
    - The majority of contracted generators in Windsor-Essex are gas-fired generation – there are questions regarding continued operation post expiry of contracts considering the Canadian governments net-zero carbon emissions policy objective (i.e., net-zero electricity grid by 2035)
    - Specifically, the federal Clean Electricity Regulation will likely impact future operation of gas-fired generators
- Replacement or continued operation of operating generators is required under the current IESO planning outlook – additional supply resources in Windsor-Essex can delay the need date for future transmission development timelines



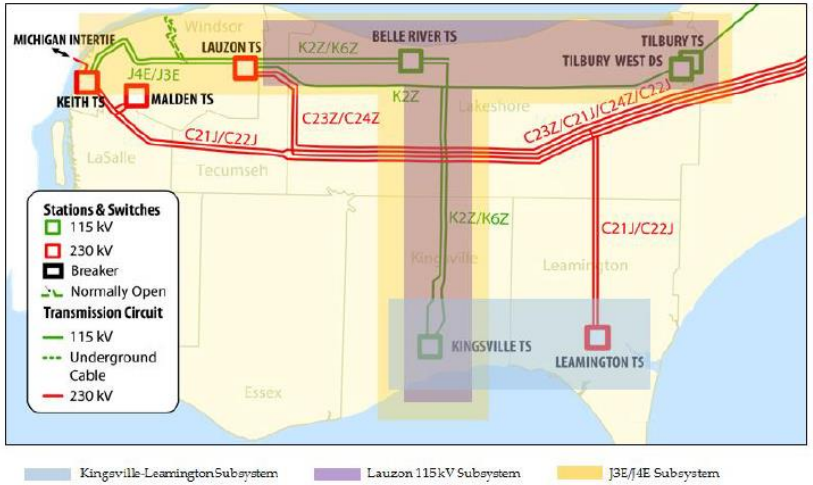
Source: IESO

Order in Council – Minister's Directive to OEB

- The Stellantis battery manufacturing plant, in addition to the rapid load growth in the focus area, accelerated the IESO's need date for power system investments, compared to earlier studies resulting in the Minister of Energy issuing an Order in Council (OIC) to the OEB to amend the licence agreement for Hydro One to support development activities for the following projects
    - New 230 kV transmission line from Lambton TS to Chatham SS, as described in the IESO's March 2021 letter to Hydro One
    - New 500 kV transmission line from Longwood TS to Lakeshore SS, contemplated in the IESO's bulk transmission study
    - A second 500 kV transmission line from Longwood TS to Lakeshore SS
    - New 230 kV transmission line from Lakeshore TS to Windsor area, final connection location not identified
- The scope and timing for all of the transmission projects listed shall be in accordance with IESO recommendations and therefore can adjust based on updated planning activities, demand outlooks, local resource development and existing resource retention
- As a condition of their licence amendment, Hydro One has an obligation to undertake development activities for the above listed projects – providing greater regulatory certainty for cost recovery
- Further, the OIC identified the above listed projects as priorities with streamlined regulatory processes where possible, including the OEB's Leave to Construct application
    - For clarity, Hydro One will still be required to seek Leave to Construct from the OEB for all of the above listed projects

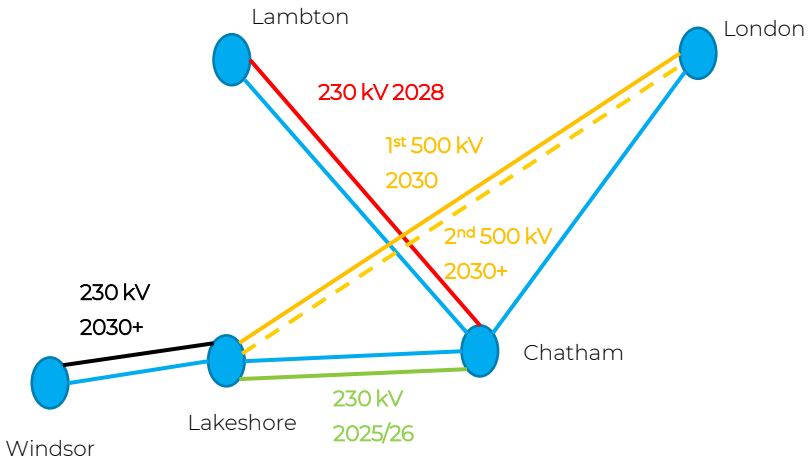
Ability to Connect New Load In Windsor-Essex Impacted by System Limits

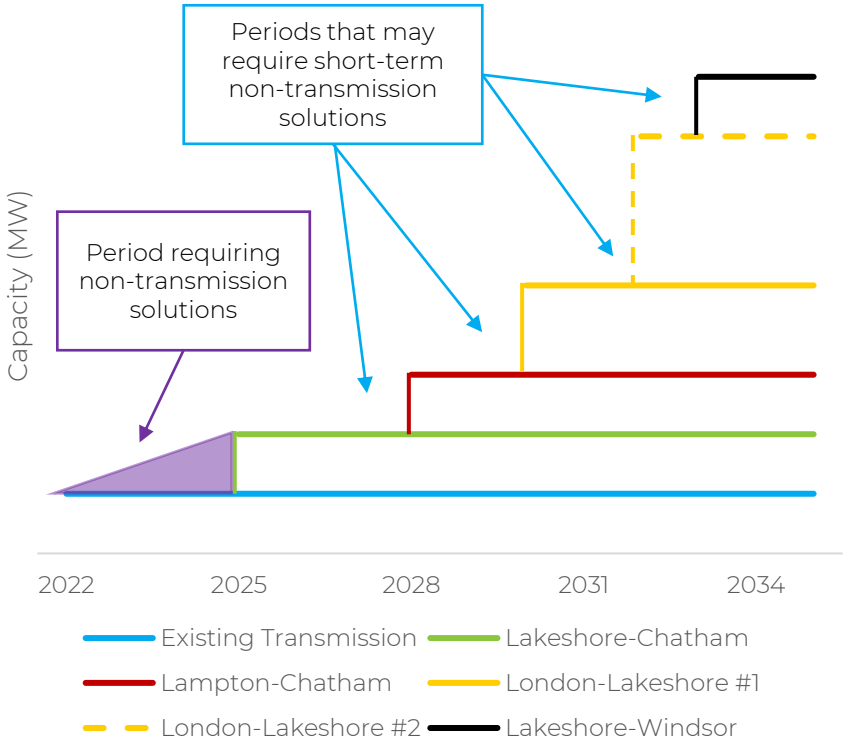
- In the 2019 Windsor-Essex IRRP, the IESO identified a potential transmission constraint in the J3E/J4E sub-system (i.e., the 115 kV network supplying Windsor, Lakeshore, and Kingsville)
  - The IRRP stated that supply to all stations in the J3E/J4E sub-system is thermally limited by flow on the J4E circuit
  - The IRRP did not anticipate any significant load growth in the sub-system at the time and therefore did not initiate any action
- The larger than anticipated number of connection requests from new loads are increasing the risk of thermal overages that is slowing connection processes
  - Thermal connection overloads occur primarily during peak loading hours or during reliability events (e.g., following an outage)
  - Remedial action schemes (i.e., automatic system re-arrangements) and managed connections can provide some flexibility until longer term solutions are implemented (e.g., new 230 kV lines from Chatham SS to Lakeshore SS)
  - Further, distribution-connected projects may face connection constraints due to short-circuit limitations, where projects greater than 10 MW are required to complete a System Impact Assessment (SIA) with the IESO



Source: IESO

High-Level Summary of New Transmission Planned for West of London





Note: These graphs are for illustrative purposes only, and the depiction is not to scale. In-service dates for mid- and long-term projects will be reviewed depending on updated load growth forecasts.

Need to Address Periods of Uncertainty as Transmission System Expands

- Transmission development takes time, and it involves significant investment and coordination for permitting and construction
  - Connection capacity expansion from the completion of transmission projects are “lumpy”, as capacity is brought on-line all at once (e.g., 1,000 MW blocks with asset life of approximately 60 years)
  - Meanwhile, energy demand continues to increase with some uncertainty with respect to the rate of growth
- Additional flexibility is required, and can be achieved through the deployment of non-wires solutions, such as energy storage, demand response (DR), local generation, etc.
- While these non-wires solutions would address regional system constraints, which might be shorter-term in nature given planned build-out of transmission, new resources developed will likely also have value in the long-term given province-wide electricity supply needs

To avoid periods that are challenging to connect new, large-scale customers, local resources or programs are needed to provide flexibly between planned transmission projects

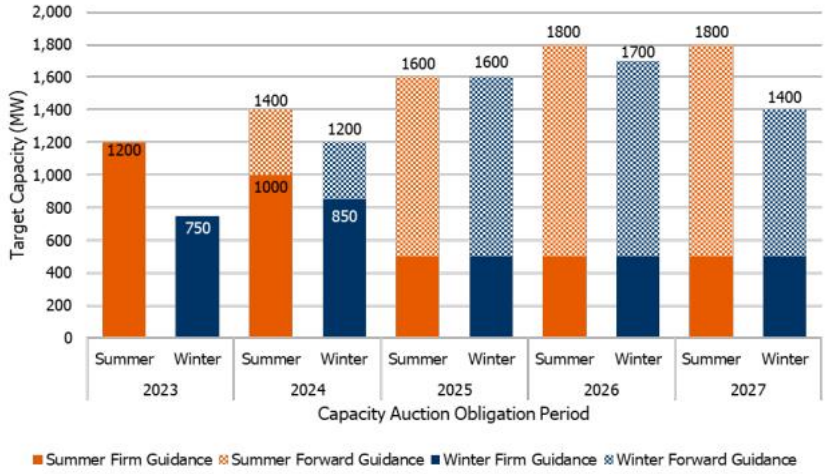
3. Electricity Resource Acquisition

Section Overview

- As described in Section 1, Ontario has urgent needs to procure electricity supply resources resulting from the decommissioning and refurbishment of nuclear generation, expiring contracts for other generators, and growing electricity demand
- This section provides a review of the main procurement mechanisms that the IESO has planned to utilize in the near-term to ensure there are sufficient supply resources available to meet supply needs
- In addition to meeting province-wide electricity demand, the IESO proposes to use these procurement mechanisms to alleviate local electricity supply and transmission-constraints
- Power Advisory's commentary with respect to the main challenges of these procurements is provided

Capacity Auctions

- Annual Capacity Auctions are competitive procurement mechanisms used by the IESO for short-term (i.e., seasonal) balancing of supply needs
- Each year participants submit bids to secure commitment from the IESO
- Resources that "clear" the auction receive short-term (i.e., seasonal) commitments from the IESO for capacity payments and must be available during the obligation period (i.e., winter and/or summer season)
- Eligible resources include:
  - DR
  - Capacity imports
  - Dispatchable energy storage
  - Dispatchable generators (e.g., gas-fired generation)
- The IESO is also consulting on the potential to develop a new "forward capacity auction", details still being developed



Source: IESO

Re-Contracting Existing Capacity

- Given that the existing contracts for multiple electricity supply resources (mainly generators) are nearing their end of their contract terms, the IESO has developed a procurement process focusing on re-contracting these resources
- The IESO launched the first Medium Term RFP (MT 1 RFP) (submission deadline was April 28, 2022)
  - Original target capacity was 750 MW, however, following registration, IESO reduced the target capacity to 475 MW
  - Eligibility was restricted to existing and/or operating generation and storage with contracts that must expire or be terminated on or before April 30, 2026 (i.e., no new-build resources, no DR)
  - Contract term effective 2024, 2025 or 2026, with a 5-year term length (i.e., MT Contract serves as a contract renewal)
  - The procurement targeted province-wide electricity needs, however there was a strong preference for resources in the West and East zones
- The IESO announced results of the MT 1 RFP on August 23, 2023, which secured 310 MW of summer capacity and 382 MW of winter capacity, well short of original targets
  - Future MT RFPs will be scheduled by the IESO
- In addition, the IESO has entered into/completed sole-source negotiations for two large-scale electricity resources (Lennox Generating Station (GS) and Brighton Beach GS) that were deemed by the IESO to be essential for local needs

Acquiring New Capacity

- The IESO is currently developing new competitive procurements to acquire supply capacity from new electricity resources
  - Expedited RFP
  - Long-Term RFPs (LT 1 and LT 2 RFP)
  - Same Technology Upgrades Solicitation
- Participants that are successful through these procurements will be awarded “long-term” contracts for the supply of capacity with the IESO
- Given the magnitude of electricity supply required and the need to ensure contracted projects are ultimately developed and constructed on-time, the IESO implemented a Request for Qualifications (RFQ) phase for the Expedited and LT RFPs
- Currently, the IESO RFPs are not limiting fuel source eligibility (i.e., open to storage, renewable genertion, gas-fired generation, etc.), however, future procurements will need to consider policy direction from the Ontario government
  - The IESO is due to report back to the Ministry of Energy on October 7, 2022 with respect to the Pathways to Decarbonization, including a potential moratorium on procurement of new gas-fired generation
- Small-scale resources (e.g., 1 MW and less) are not eligible to participate in the above listed forthcoming IESO procurements

Summary of Forthcoming RFPs

	LT 1 / LT 2 RFP	Expedited Procurement	Same Technology Upgrades
Target capacity	2,500 MW for LT 1 RFP; and 1,500 MW for LT 2 RFP	~1000 MW of effective capacity	~500 to ~1000 MW of effective capacity
Term Start	No later than 2027 (LT 1 RFP), and 2030 (LT 2 RFP)	2025	2025
Term length	20 year term with potential additional term available for resources able to come online early	20-22 year base term	New contract or extension of existing contracts. Length of contract/extension to be determined
Locational considerations	Global need with strong preference for resources in the **West and East** zones	Targeted at meeting global need	Targeted at meeting global need
Eligible Resources	Technology neutral; new-build resources at greenfield sites or co-located at existing sites able to achieve commercial operation no later than 2027.	Technology neutral; new- build resources at greenfield sites or co-located at existing sites; must achieve commercial operation by 2025/2026.	Expansions or uprates to existing resources that are under contract and operating in IESO- administered markets. Expansion or uprate must be the same technology as the existing resource and able to achieve commercial operation in 2025.
Qualification	Participation in LT1 RFQ Required	Participation in LT1 RFQ Required	Existing counterparty in good standing with existing contract

Progress on Procurements to Date

- The IESO received RFQ submissions for the Expedited and LT1 RFP on June 30, 2022
  - Submissions from 70 applicants were received, and due to high-volume, the IESO delayed the procurement schedule
  - On August 23, 3022, the IESO announced that 55 applicants passed the RFQ phase, and are eligible to proceed with proposals in response to the applicable RFPs
  - The majority of the applicants indicated an interest in developing stand-alone battery energy storage
  - The IESO is currently consulting with stakeholders on the terms and conditions of the draft RFP and contract

Milestone	Expedited RFP	LT1 RFP
RFQ Applicants Announced	August 23, 2022	August 23, 2022
Final RFP Posted	October 1, 2022	January 30, 2023
Submission Deadline	December 20, 2022	July 2023
Contract Award	February 28, 2023	October 2023

The above reflects the most up-to-date schedule provided by the IESO

- Additional IESO procurements are expected to be announced consistent with future AARs
- The City of Windsor can expect multiple IESO procurement processes each year for the foreseeable future

Role of Municipalities

- Municipalities play a critical role in the procurement and development of new generation
- Municipal Council Support Resolutions
    - As part of the IESO's RFP processes, new generation and storage resources will be prioritized if they receive a council support resolution in support of the project prior to the proposal submission deadline
    - Obtaining these resolutions will increase the project's proposal rated criteria score, and provide it with a competitive advantage relative to other projects
- Planning Act Approvals
    - Prior to the construction of a new generator or storage resource, the project must receive planning approval as part of the environmental permitting process
    - Following the repeal of the Green Energy Act, municipalities now have much more authority with respect to the permitting and approvals process of renewable generation
- IESO continues to consult with municipalities as they develop RFPs for new electricity supply resources

Supporting Local Electricity Supply

- Given the emerging supply needs and recognition of the important role of the existing/operating generation fleet, municipalities play a pivotal role in attracting and retaining investment in electricity resources
- For example, Halton Hills issued a council resolution that stated
  - Their continued support for gas-fired generation until a clean energy source can replace them without dramatically increasing the price of electricity for consumers
  - Their desire for the Ontario government to support the development of clean energy alternatives and energy efficiency
  - Their understanding of the IESO's study, Gas Phase-Out Impact Assessment, as reasoning for its support of operating gas-fired generators
    - The study showed that greenhouse gas (GHG) emissions from the entire electricity generation system in Ontario currently contributes to 3% of GHG in Ontario
    - The Ontario electricity grid supports electrification of systems that contribute larger amounts of GHG emissions such as trains, cars and trucks, and home heating
    - Gas-fired generation provides "on-demand" electricity and can prevent brown-outs and black-outs when demand is high

Challenges with Resource Acquisition Plans

- The main challenges with the IESO's resource acquisition plans, include
  - **Timelines** – There is limited time to complete environmental permitting, equipment acquisition, grid connection, close financing, project construction, etc.
  - **Municipal and community engagement** – With restricted timelines, the ability to engage with municipalities and local communities is limited, and risking community "backlash" if projects feel rushed or inconsiderate of community needs
  - **Resource uncertainty** – The Canadian government will be implementing the new Clean Electricity Regulation that will restrict the use of gas-fired generation, creating present investment uncertainty – therefore, the IESO's contracts should address these challenges to ensure investor confidence and reduce costs, and the IESO's procurement plans will ultimately need to be compliant with federal regulations when they come into force
  - **Local requirements** – While the IESO's process is prioritizing resources in regions of the grid that require capacity (such as Windsor-Essex), it does not guarantee that the required resources will be cleared in the procurement process – in other words, projects located in other parts of the province could be acquired ahead of resources in Windsor, as the IESO's procurements are prioritizing for multiple factors, including duration, location, Indigenous community participation, community support, price, etc.

Other IESO Processes

- Outside of the IESO procurements described, the IESO is also considering other initiatives that would reduce capacity needs
- These initiatives include
  - Conservation and Demand Management (CDM) programs (e.g., energy efficiency programs)
  - Grid Innovation Fund projects and other pilot programs
- Power Advisory notes that the IESO is completing a Mid-Term Review on the existing CDM programs, and it is expected that the IESO will announce increased CDM targets and opportunities for energy efficiency and other CDM resources
  - In April 2022, the Minister of Energy asked the IESO to provide options and analysis for cost-effective additional or expanded CDM programming, which would contribute to meeting power system needs, including the growing agricultural greenhouse sector in Southwest Ontario
  - The IESO has also launched a "local initiatives" program to competitively procure CDM, including targeted programs in the Belle River area in Essex County
  - Under previous CDM frameworks, Ontario's LDCs, such as ENWIN, Essex Powerlines, etc., played a very active role in administering programs

4. Electricity Resource Options

Section Overview

- In addition to the planned expansion of transmission solutions, regionally-deployed electricity resources can be used to alleviate capacity constraints
- This section provides a review of various non-transmission options, including their advantages and disadvantages
- As mentioned in Section 2, there is a need to develop new electricity resources in the near-term to alleviate supply constraints in the Windsor-Essex region prior to the completion of new transmission projects
- In the longer-term, resources can be deployed to provide additional flexibility and security in between the planned build-out of additional transmission

Electricity Resources

- Firm imports
- Gas-fired generation
- Battery energy storage
- Renewable genertion co-located with battery energy storage
- Demand response and energy efficiency

Transmission-Connected vs. Distribution-Connected

Transmission-Connected	Distribution-Connected
Hydro One Networks	By service territory of LDC (e.g., ENWIN, Essex Power Lines, Hydro One Networks)
High voltage transmission system that connects the province-wide electricity grid	Lower-voltage distributions system that connects majority of electricity consumers
Larger-scale generation and storage facilities can be connected, typically greater than 20 MW	Smaller-scale generation and storage facilities can be connected, typically less that 20 MW
Requires IESO and Hydro One connection studies	Connection studies completed by LDC, and consider “up stream” capability of transmission system (possible to SIA if region is constrained)
Transmission-connected generation can provide benefits to bulk system or regional grid	In addition to providing benefits to the bulk or regional grid, distribution connected resources may also provide benefits to the distribution system, depending on local distribution system needs
Must be IESO Market Participants	Optional to become IESO Market Participant if greater than 1 MW

Firm Imports

- Windsor-Essex Region is interconnected with Michigan at Keith TS by the J5D 230 kV transmission line ("Windsor to Detroit")
    - This is one of four lines that interconnect Ontario to Michigan, with the other three points located in Lambton and Sarnia
- While the entire Ontario-Michigan transmission interface has a combined capability of 1,600 MW during the summer and winter, the Windsor to Detroit line is limited to 400 MW
    - For many technical reasons, the capabilities of the Ontario-Michigan interface have been limited for a number of years
- Interconnection between Ontario and Michigan supports imports and export trade via the Ontario and Michigan wholesale electricity markets
    - New Capacity Auction rules enable 'firm imports' from Michigan (e.g., obligation to make capacity available) from specific generators
    - However, the Midcontinent Independent System Operator (MISO) is also experiencing a capacity shortfall, which will limit availability of imports from the Michigan interface
    - MISO rules may also constrain resource participation in the IESO's annual Capacity Auctions

Advantages	• No new construction is required within the City of Windsor's limits
Disadvantages	• Imports participating in Capacity Auctions are not guaranteed due to competition • Electricity flows cannot be scheduled individually (scheduled across 4 Michigan interfaces as a whole)
Considerations	• GHG emitting resources would be eligible to participate • IESO's next pre-auction report for the Capacity Auction will indicate eligibility and limits on imports

Gas-Fired Generation

- The City of Windsor currently hosts several operating gas-fired generators, including
  - Brighton Beach GS – Atura Power
  - East Windsor Cogeneration Centre – Capital Power
  - West Windsor Power Plant – ENGIE
  - Windsor-Essex Power Plant – TransAlta
- Other large and small-scale gas-fired generators also currently operate in the Windsor-Essex Region
- Continued operations of these generators are essential in the near-term for the reliability of electricity in the Windsor-Essex Region
- These generators may be suitable for expansions to increase their capacity and electricity output (e.g., additional turbines)
  - Capacity may also be increased through additional storage
- New gas-fired generation or expansions of operating generators may be limited due to forthcoming policy (e.g., Clean Electricity Regulation)

Advantages	• Reliable electricity production, providing energy, capacity and other grid services • Ability to leverage existing sites, or expand on adjacent industrial lands
Disadvantages	• Proposed Clean Electricity Regulation creates challenges • Subject to increasing costs over-time due to carbon tax • Many customers and investors seeking green electricity supply
Considerations	• Approaches to reduce carbon intensity of gas may include, hydrogen, renewable natural gas, carbon capture and storage, carbon offsets, however use of these options may be limited (e.g., technically, economically, legislatively, etc.)

Battery Energy Storage

- Multiple utility-scale battery energy storage projects are expected to proceed through the IESO's planned Expedited and LT1 RFP
- Can be either transmission-connected or distribution-connected
- Sites would consist of multiple battery enclosures, typically in proximity to transmission or distribution systems, or adjacent to existing generators (separately connected)
- Ontario's experience with battery energy storage is growing, however it is still considered a new-technology within the resource mix

Image Source: GE

Advantages	• Provides capacity during peak periods when energy is most needed and valuable • Low environmental impact leads to relatively streamlined permitting process
Disadvantages	• Does not produce energy • Relatively new technology in Ontario's resource mix • While costs are declining, still relatively expensive • Supply chain constraints impacting availability of batteries and critical minierals • Energy losses on conversion and storage
Considerations	• Significant uptake of new projects globally • Ontario economic development opportunities with respect to battery manufacturing

Renewable Generation Co-Located with Storage

- Energy storage can be added to operating renewable generators (e.g., wind and solar) to firm-up capacity
- Several large-scale renewable energy projects currently operate in the Windsor-Essex region, including Belle River Wind, Windsor Solar, Gosfield Wind Project
- Multiple distribution-connected renewable energy projects are currently operating within the City of Windsor (e.g., 20 MW), with additional renewables operating in the Essex region (e.g., ~ 140 MW)
    - Most of the projects within the City of Windsor represent rooftop Feed-in Tariff projects with 20-year contracts
    - Additional projects may be operating under net-metering configurations
- Existing sites could be eligible for the addition of energy storage and/or expansion
- New renewable generation co-located with storage sites could be developed within the Windsor-Essex region

Advantages	• Renewable sources of energy • Ability to provide peaking capacity during times of system need
Disadvantages	• Requires consideration of land-use and environmental permitting, especially for new projects
Considerations	• Limited experience in Ontario context, with new participation models being developed by IESO

Demand Response and Energy Efficiency

- DR is the ability of electricity customers to curtail their electricity usage in response to dispatch instructions during times of peak demand on the grid
    - DR resources are currently eligible to participate in the IESO's Capacity Auction, including smaller scale and aggregated resources
    - Some customers leverage "behind-the-meter" storage or generation to reduce electricity consumption from grid
- Energy efficiency refers to the installation or retrofit of a customer's electrical equipment such that it utilizes less energy to perform the same services
    - The IESO has successfully delivered energy efficiency programs for industrial customers, and new programs are being rolled out
- These programs also provide additional revenue-streams to customers and/or reduce customers' electricity costs
- Novel and innovative approaches may be developed in the future, including EV smart charging programs

Advantages	• No requirement for new development and can leverage on-site resources • Possible revenue stream or savings for participants • Environmentally friendly
Disadvantages	• Does not produce energy
Considerations	• Ontario has robust experience with demand response, particularly industrial demand response • In addition to IESO, Ontario LDCs and other service providers are well equipped to deliver energy efficiency programs

Alternatives Procurement Approaches

- Under the current regulatory framework, the IESO has responsibility to ensure resources are available to meet bulk system needs
- Other creative approaches for meeting resource needs may include the following
- **Utility-led programs** (e.g., CDM, local DR, local generation, etc.)
  - Hydro One and LDCs (e.g., ENWIN, Essex Powerlines) could be enabled to deploy local programs or procurements to secure required resources
  - This would leverage the utilities existing experience deploying customer-facing programs, while freeing up resources at the IESO (i.e., allowing IESO to focus on larger scale procurements)
- **Customer generation** (e.g., self supply)
  - Existing regulations enables customers to connect behind-the-meter resources to offset their own electricity consumption, resulting in reduced electricity costs
- **Customer acquisition** (e.g., corporate power purchase agreements (PPAs))
  - Removing barriers to enable options for customers to acquire their own electricity supply, similar to other jurisdictions (e.g., Alberta, etc.)

Summary of Options

- DR and energy efficiency programs can be deployed quickly and cost-effectively in the near-term to reduce or eliminate capacity constraints
    - Leveraging existing customer assets
    - Does not require construction/connection to the grid
- In the medium-term, the IESO's upcoming procurements are likely to result in new local supply, only if participants are successful in the Windsor-Essex Region
    - It is expected that a significant amount of energy storage will be contracted by the IESO through these processes
- Operating gas-fired generation will continue to play an essential role in providing reliable supply
- It is possible that new gas-fired generation could also be developed, however these projects would have a longer permitting and approval process, including significant community engagement requirements and opposition from some stakeholder groups
- Firm imports from Michigan, even if enabled via the Capacity Auction, are unlikely to be reliable in the longer-term due to capacity shortfalls in MISO

6. Recommendations for the City of Windsor

Section Overview

- This section provides Power Advisory's recommendations for the City of Windsor's consideration, including
  - Municipal Council Support Resolutions
  - Prepare for Increase in Permit Applications
  - Engage Early with the IESO, Hydro One, and LDCs (e.g., ENWIN) as Economic Development is Pursued
  - Participation in Regional Planning Processes
  - Leverage Municipal Lands and Properties
  - Strategic Government Advocacy
    - Need to Streamline the IESO's Procurement Approach
    - Enable Hydro One and LDCs to Support Resource Acquisition
    - Enable Customer Acquisition through Corporate PPAs

Municipal Council Support Resolutions

- Recognition that multiple solutions will be required to enable continued electricity resource adequacy in the long-term (from new transmission to local measures)
- Given locational needs and opportunity to increase rated criteria scores within the IESO RFPs, the City of Windsor should be prepared to respond to multiple requests from generators and storage providers
    - Establish criteria and review processes to meet with resource developers
    - Prepare city council in advance with respect to local electricity needs and link to economic development
- Rated criteria scoring will mean that the City of Windsor will have a direct role in the success of new supply resources being located within city limits
- The City of Windsor should consider establishing itself as a “willing host” for resource development, sending a signal to the electricity sector and investment community
    - Precedent established by Halton Hills
- As more projects and applicants are expected to be communicated publicly, it will be important to establish an appropriate public communication and engagement strategy to build and maintain support for projects

Prepare for Increase in Permit Applications

- Development of electricity generation and energy storage projects are subject to the Planning Act
- As such, the City of Windsor's planning staff will be engaged with the review and approval of new generation and energy storage projects within the context of the City's official plans
- There has been little recent experience with the development new generation and energy storage projects in recent years
- Planning staff can anticipate a change of pace and should expect to be engaged in several projects over the next few years as the IESO's planned procurements ramp up

Engage Early with the IESO, Hydro One, and LDCs as Economic Development is Pursued

- Regular communications with the IESO, Hydro One, and LDCs (e.g., ENWIN) should be established with respect to local development
    - Coordination with LDCs required when new customers are connecting to distribution systems
- Hydro One has indicated that it is willing to pursue creative non-wire solutions, where applicable, as interim solutions as new transmission capacity is being developed
- While connection constraints are at the transmission level and not the distribution level, ENWIN has also indicated a willingness to support the deployment of programs or other local initiatives
    - New distribution-connected generation could be limited by local distribution capacity
- Information about local economic development and growth can inform Hydro One's strategy for developing innovative projects or approaches

Participate in Regional Planning Processes

- The IESO is anticipated to begin consultation on the next Windsor-Essex IRRP to respond to changing conditions and economic development in the Fall of 2022
    - Hydro One's Needs Assessment is currently underway, and the IESO's public consultation on the Scoping Assessment and IRRP will likely begin in early 2023
- The City of Windsor should plan to engage actively in these consultations, and particularly provide insight to economic development and growth opportunities that would impact electricity needs in the region
    - ENWIN, alongside other LDCs in the region, are actively engaged in regional planning studies, and the City of Windsor should consider a coordinated approach
- The City of Windsor may also consider a coordinated approach to participating in regional planning studies with Invest Windsor-Essex

Leverage Municipal Lands and Properties

- The City of Windsor may have access to municipal lands and properties that would be suitable for electricity resource development, particularly energy storage
- On excess lands or undeveloped properties, stand alone storage or other generation projects may be developed and directly connected to the transmission system or distribution system
    - The City of Windsor has worked with Samsung in the past to provide access to municipal lands for development
- Municipal buildings could support behind-the-meter energy storage and/or solar energy, or DR and energy efficiency
    - The City of Windsor could work with an aggregator and/or other service providers for low-or no cost options for project development
    - The City of Windsor can support deployment of energy efficiency programs
- The City of Windsor has opportunity for additional municipal revenue and reduced operating expenditures (e.g., reduced electricity costs) through lease agreements and other contractual arrangements with service providers
- Additionally, the City of Windsor could promote customer-self supply and participation in energy efficiency programs, and could coordinate with ENWIN

Strategic Government Advocacy

- Engagement with the Minister of Energy and the IESO should focus on the following factors

1. Need to Streamline IESO Procurement Approach
    - The IESO's current framework involves multiple procurement types on different timescales and significant complexity for municipal engagement – consider streamlining with one or two predictable processes each year
    - The IESO's procurement approach currently does not guarantee that resources will be successful within the Windsor-Essex region
    - The IESO should consider streamlined bilateral negations with essential generators that are nearing contract expiry dates
2. Enable Hydro One and LDCs to Support Resource Acquisition
    - Hydro One and LDCs should be empowered to deploy CDM programs to reduce strain on the electricity grid as new transmission is being developed
    - Hydro One and LDCs should be enabled to deploy energy storage as non-wires solutions in the near-term, this could include a procurement process for competitive solutions

Strategic Government Advocacy

3. Enable Customer Acquisition through Corporate PPAs
    - Large-scale companies should be empowered to secure their own electricity supply through long-term contracts (e.g., PPAs) with generators and other electricity suppliers (e.g., storage, etc.)
    - This would reduce the burden on the IESO to acquire resources, reduce the Global Adjustment in the longer-term, and enable customer choice with electricity supply
    - If enabled, the City of Windsor could also participate in procurement of electricity supply for its own operations

Conclusion

- Economic development in the City of Windsor is dependent on continued availability of electricity supply
- The Windsor-Essex region requires a coordinated approach which aligns economic development and electricity resources development to support the growth in electricity demand
    - While multiple transmission projects are planned, transmission development takes time, and therefore the IESO, Hydro One, ENWIN, and others must be engaged to develop intermediate solutions which can be deployed in the near-term
- There is capacity to connect new loads in Windsor-Essex
    - Large loads will require special consideration, not unlike any other areas of the province
    - Where a significant load emerges in the short-term (i.e., prior to the planned transmission reinforcement investments), Hydro One, ENWIN and other LDCs should be empowered to develop localized solutions in conjunction with the IESO to expedite/facilitate connection
- The IESO's forthcoming RFPs for new supply should continue to be monitored by the City of Windsor, as success of those initiatives is materially important for the electricity supply in the region

Appendix A: Overview of Ontario's Electricity Sector and Key Players

Ontario Market Overview

Local Distribution Companies (LDCs)

Independent Power Producers (IPPs)

Embedded retail customers

Wholesale consumers

- Ontario's electricity market was deregulated between 1998 and 2002 – the vertically integrated Ontario Hydro was split into Hydro One (transmission and distribution), OPG, the IESO (as administrator of the wholesale market, the Ontario Electricity Financial Authority, and the Electrical Safety Authority
- However, for a variety of reasons, government intervention in the market (i.e., freezing rates, etc.) has resulted in the Ontario electricity sector to be dominated by contracted electricity supply

Roles and Responsibilities of Key Players

Ontario MINISTRY OF ENERGY	• The Ontario Government's Ministry of Energy is responsible for establishing the electricity policy, legislation and regulation • Electricity Act and Ontario Energy Board Act are primary legislation governing electricity sector; per legislative authority, Ministerial Directives can be issued to OEB and IESO
ONTARIO ENERGY BOARD	• The OEB is the independent regulatory body for the electricity sector • Licences transmitters, distributors, generators, wholesale consumers, retailers, etc. • Responsible for rate regulation of transmitters, distributors, OPG, IESO and establishing prices per Regulated Price Plan
ieso Independent Electricity System Operator	• The IESO is responsible for administering the wholesale electricity market, bulk power system planning and resource acquisition • IESO is a contract counterparty to a significant amount of electricity supply in Ontario (effectively, de facto Load Serving Entity) • The IESO has responsibility for administering province-wide CDM programs

Roles and Responsibilities of Key Players

Ontario Power Generation	• OPG is Crown Corporation (i.e., owned by the Government of Ontario) • OPG owns and operates electricity supply across Ontario, including heritage hydroelectric generation, nuclear generation, gas generation and other non-hydroelectric renewables • OPG's assets are either rate-regulated by the OEB or under contract with the IESO
hydro one	• Hydro One is the predominant transmission facility owner in Ontario; also owns and operates the distribution network for vast swaths of the province (predominately rural) • The Ontario government is the largest shareholder of Hydro One
Local Distribution Companies (LDCs)	• There are approximately 60 LDCs in Ontario of various sizes and customer make-up (i.e., rural/urban); most are municipally-owned • ENWIN is the LDC that is owned by the City of Windsor • Ontario's LDCs are predominately "wires companies", and are responsible for the distribution of electricity from the bulk system to distribution-connected consumers, connecting customers (both consumers and generators), and billing • Cost of electricity supply "passed through" to LDC customers

Roles and Responsibilities of Key Players

Independent Power Producers (IPPs)	• Ontario's wholesale electricity market enables participation by IPPs • Effectively IPP-owned generation is under contract with the IESO • Large scale and transmission-connected generators must participate in the wholesale market; small-scale and distribution-connected generators may operate as "embedded generators" and are not obligated to participate directly in the wholesale market
Wholesale consumers	• Approximately 14% total load in Ontario is from wholesale consumers; these consumers are typically large industrials and may be either transmission- or distribution-connected • Wholesale consumers can opt to participate as either dispatchable load or non-dispatchable load
Embedded retail customers	• Embedded retail customers are distribution-connected and make up approximately 86% of total load in Ontario • Small loads (i.e., residential and small commercial) are charged for electricity supply based on RPP, and large loads pay the market price for electricity; for a variety of reasons, Ontario does not have a robust competitive retail market

Appendix: List of Acronyms

AAR	IESO's Annual Acquisition Report
APO	IESO's Annual Planning Outlook
CDM	Conservation and Demand Management
DR	Demand Response
EV	Electric Vehicle
GHG	Greenhouse Gas
GS	Generating Station
GW	Gigawatt (i.e., 1,000 MW)
IESO	Independent Electricity System Operator (Ontario)
IPP	Independent Power Producers
IRRP	IESO Integrated Regional Resource Plans
kV	Kilovolt
LDC	Local Distribution Company
LT	Long-Term (e.g., IESO's LT 1 RFP)
MISO	Midcontinent Independent System Operator
MT	Medium-Term (e.g., IESO's MT 1 RFP)
MW	Megawatt
NGS	Nuclear generation station
OEB	Ontario Energy Board
OIC	Order in Council
OPG	Ontario Power Generation
PPA	Power Purchase Agreement
RFP	Request for Proposals
RFQ	Request for Qualifications
SIA	System Impact Assessment
SS	Switching Station (i.e., transmission infrastructure)
TS	Transformer Station (i.e., transmission infrastructure)
WOC	West of Chatham

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