

Update on the First Annual Technical Planning Conference

Prepared for IESO Stakeholder Advisory Committee

Resource Planning
Planning, Acquisition and Operations
October 17, 2018

Purpose

- This presentation provides an update on the IESO's first Technical Planning Conference held in September 2018

Questions for SAC Feedback

- What additional information should the IESO provide to the market for future updates?
- What key factors, uncertainties, scenarios, indicators, etc. should be considered in resource planning assessments?
- How should the IESO recognize and integrate risks related to resource planning assessments?

Background

- The IESO introduced this engagement initiative at the previous SAC meeting.
- The purpose of the technical planning conference, expected to become an annual event, is to support greater transparency and to invite feedback into the IESO's planning processes.
- Stakeholder feedback and the Market Renewal Project have identified that clear, transparent, and timely information about system needs is critical to successfully attracting investment.
- The full conference presentation is available at:
- <http://www.ieso.ca/en/sector-participants/planning-and-forecasting/technical-planning-conference>

What was presented at the conference

- Participants had the opportunity to learn about:
 - Electricity planning outlook including forecast of demand, resource adequacy, costs and emissions
 - Work to evolve planning processes and products
 - Key considerations for development of transmission facilities
 - Competitive transmission procurement process that the IESO is currently developing
 - Experiences from other jurisdictions in developing and participating in competitive transmission procurement processes (panel discussion)
- Participants had the opportunity to provide feedback during the conference and were encouraged to submit written feedback to the IESO.
- The following slides provide a summary of the key takeaways of the electricity planning outlook.

Electricity planning outlook - Executive summary

- **IESO intends to publish annual outlooks to:**
 - Support transparency of planning.
 - Strengthen relationship with sector stakeholders.
 - Prepare for the information requirements of the Incremental Capacity Auction and other market based acquisitions.
- **Key Findings:**
 - Demand is expected to continue to be flat.
 - A significant number of resources reach the end of their contract over the next 10 years, the outlook assumes they will all be available to be re-acquired.
 - Capacity needs may arise in 2023, likely before the Incremental Capacity Auction (ICA) will be ready; short term procurement options will be developed. There is significant uncertainty in the size and timing of the capacity gap.
 - Energy needs will be met, primarily by the increased utilization of the gas fleet.
- **Risks:**
 - Significant uncertainties affect the timing and size of the capacity need.

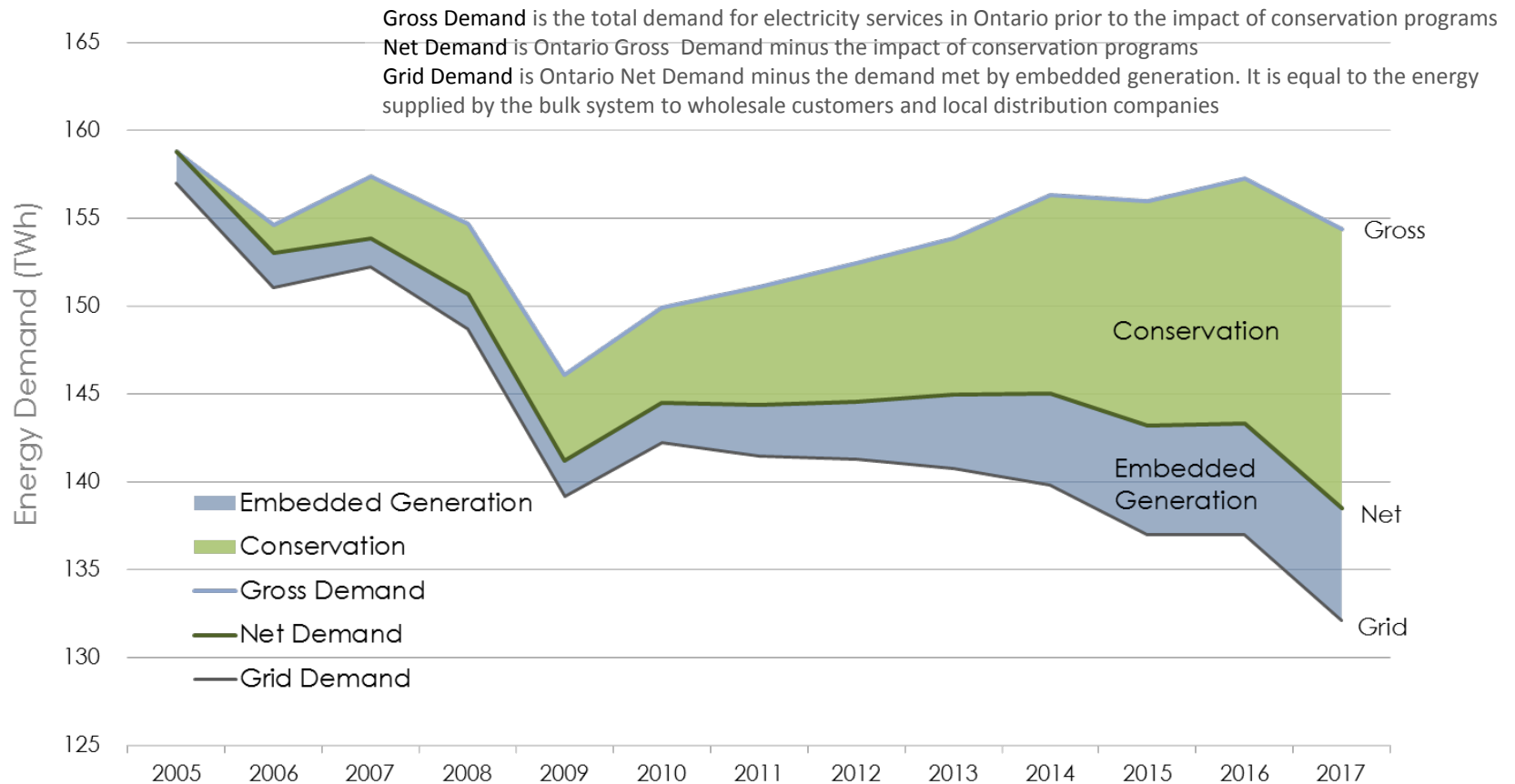
Demand forecasting

- Electricity demand forecasting anticipates future requirements for the services that electricity provides. Electricity requirements are affected by many factors, including choice of energy form, technology, equipment purchasing decisions, behaviour, demographics, population, the economy, energy prices, transportation policy and conservation.
 - IESO monitors and interprets these and other factors on an ongoing basis to develop outlooks against which integrated planning can take place
- Updates to the load forecast provide context for updated integrated plans, conservation program planning and supply procurement decisions. Analysis focuses on understanding what is causing the changes in demand by focusing on the end uses and sector trends.
- IESO conducts short, medium and long-term integrated power system planning for the province. The demand for electricity established the context for integrated planning as it determines the amount of electricity that must be served.

Forecast	Why	When
Short Term	1-10 Day Ahead: The published numbers in the 1 Day Ahead forecast are used to commit generation Day Ahead as part of the Day Ahead Commitment process. This improves reliability and helps ensure we will have sufficient generation in real-time to meet demand.	Daily
Medium Term	18 Month – 5 Year Outlook: IESO's assessment of the reliability of the Ontario electricity system over the medium term.	Quarterly
Long Term	20 Year Outlook: The IESO forecast of energy and demand for a 20 year timeframe which is utilized to identify sustainable electricity solutions for Ontario's future.	Annual

Historical demand: 2005 – 2017

- Energy demand has been on a declining trend over the past decade, driven by changes to the economy, conservation savings, and embedded generation.

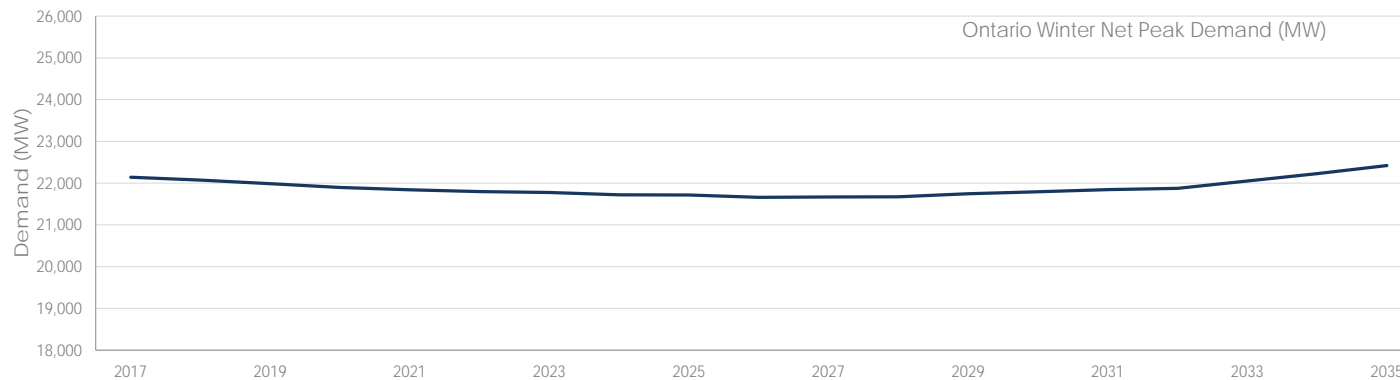
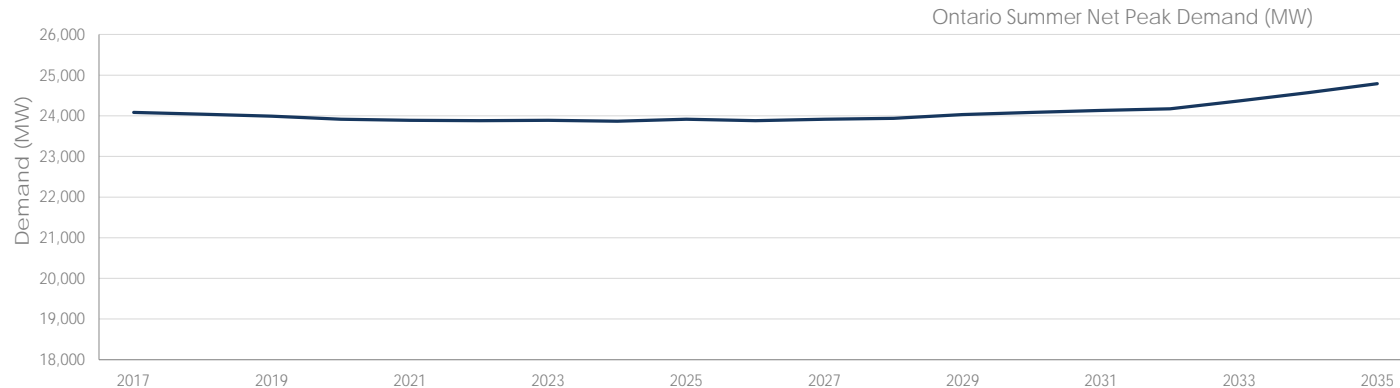


Key drivers considered for electricity demand

- **Major economic drivers:**
 - Residential households
 - Commercial floor space
 - Gross Domestic Product (Real GDP, manufacture GDP, service sector GDP)
 - Industrial output/activities
- **Electricity price and natural gas price forecast:**
 - High electricity price results in greater natural efficiency uptake
 - Rate design impacts – annualized price effect of the Industrial Conservation Initiative is included in the sector price forecast
- **Conservation forecast**
 - Energy efficiency programs
 - Codes and standards

Reference net demand outlook

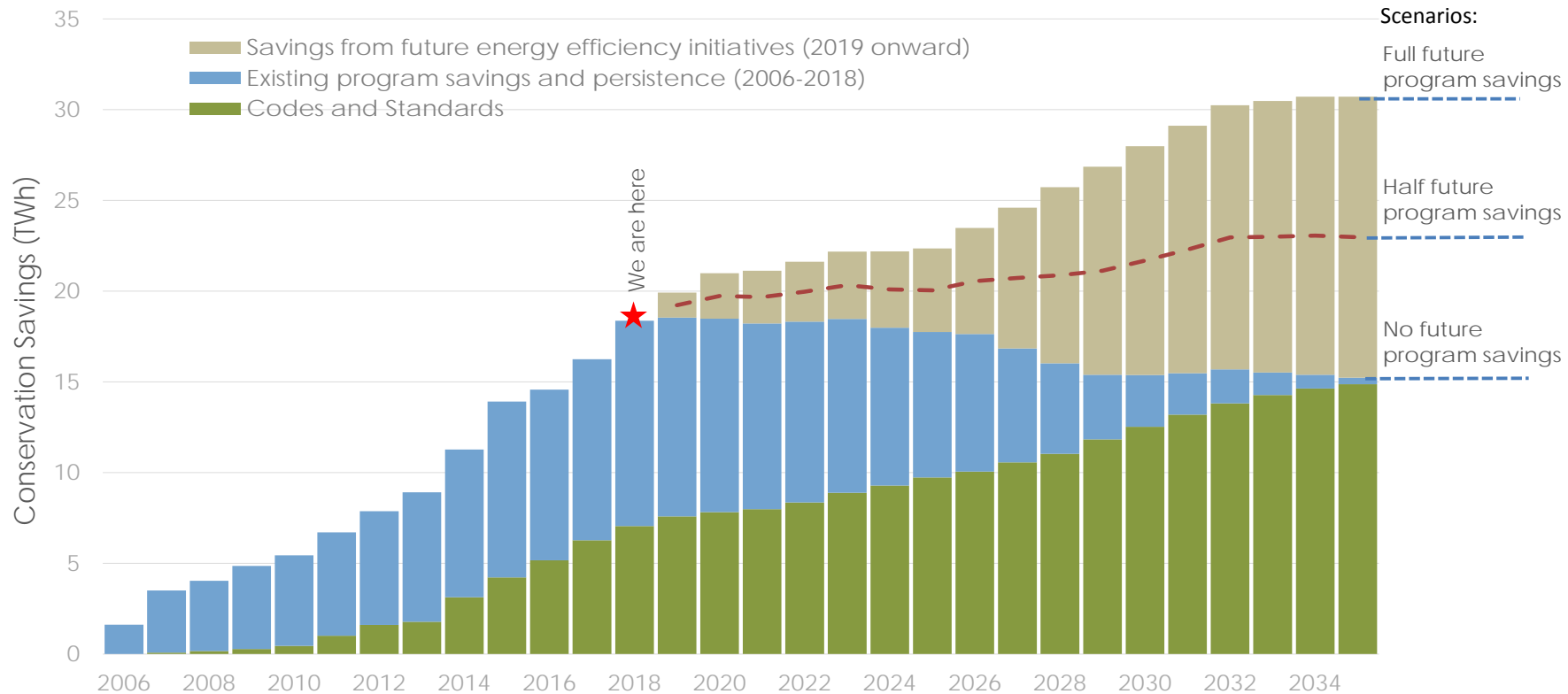
- Electricity demand, after the impact of conservation savings, is the starting point for addressing future system needs. The 2016 OPO Demand Outlook B is used for the Reference Case.



- In the Reference demand outlook, it is assumed: households grow 24% from 2015 to 2035, total commercial floor space is 4,093 million square feet by 2035, industrial electric consumption in the absence of economic restructuring, 1 million EVs by 2035, planned transit projects 2025-2035, 31 TWh conservation savings by 2035.
- The above demand outlook reflects 1,000 MW of ICI in the summer at the time these outlooks were developed. The current impact of ICI is estimated to be 1,400 MW.

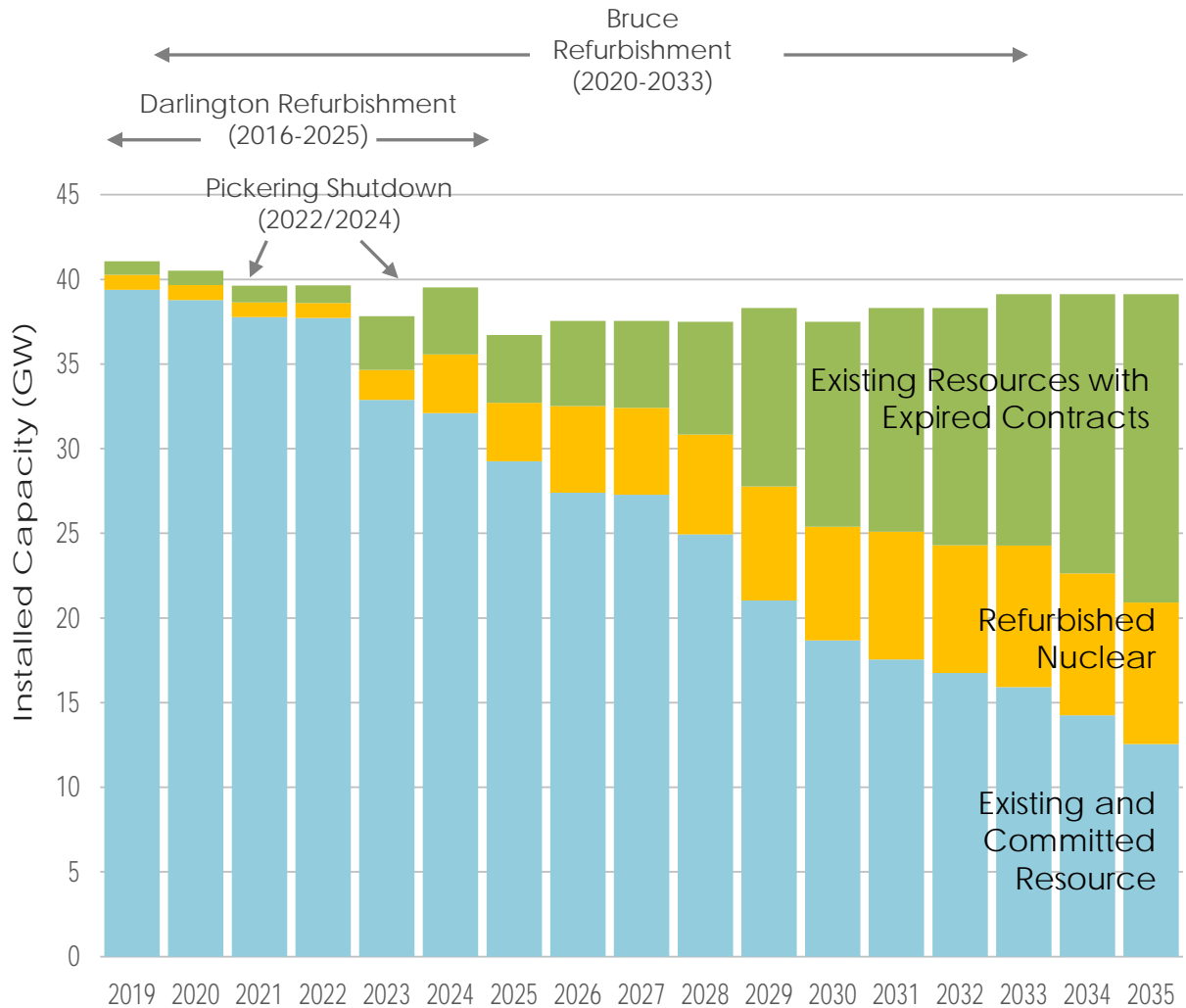
Long-term conservation forecast is 31 TWh by 2035

- The reference demand outlook reflects achievement of the full conservation forecast achieved by 2035
 - Approximately 50% of forecast savings are from Codes and Standards and 50% from conservation programs. Ontario is on track to achieve about 18 TWh by 2018.
 - Codes and standards savings will continue to grow while historical program savings decay.
- There is uncertainty with respect to the continuation of new conservation programs moving forward. Three scenarios for programs have been considered.



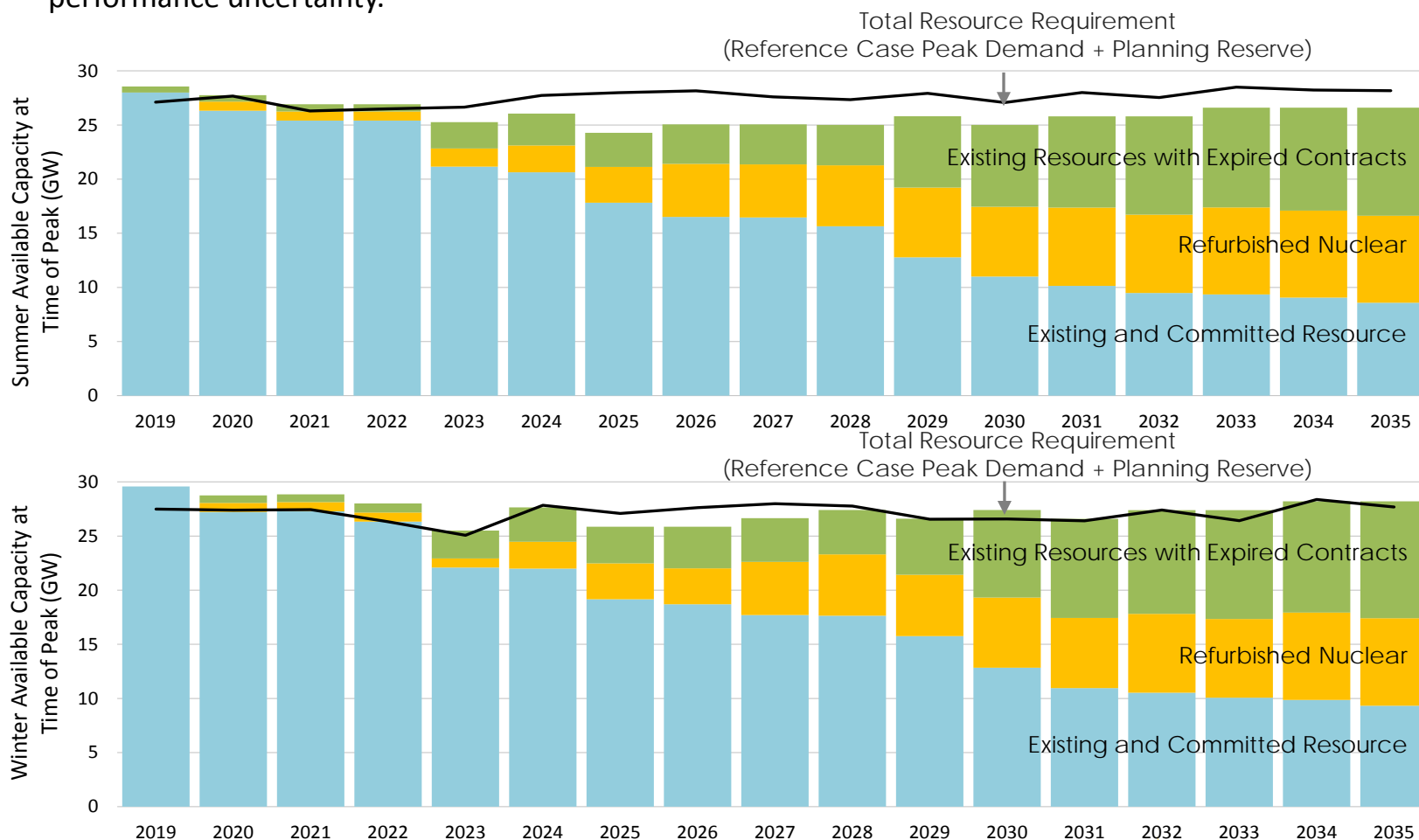
Installed supply outlook

- Significant resource turnover on the horizon with nuclear retirements and refurbishments and contracted facilities reaching end of commercial agreements.
- Installed supply ranges between 37 - 41 GW (26 - 30 GW at time of peak) between 2019-2035.
- Supply mix relatively unchanged over the planning outlook: nuclear, waterpower, renewables, and gas-fired resources each represent about a quarter of supply, with DR at ~2%.
- Small reductions in installed supply capacity due to cancellation of renewable contracts and Thunder Bay retirement.
- Pickering operates to 2022/2024. CNSC has renewed licence.
- First Darlington refurbishment halfway through and on schedule.
- Period between 2021-2025 sees most activity as 3 to 4 nuclear units are on refurbishment outage and Pickering reaches end of life.
- 2,000 contracts representing 18 GW of installed resources reach end of contract term by 2035; most would be expected to participate in the ICA.



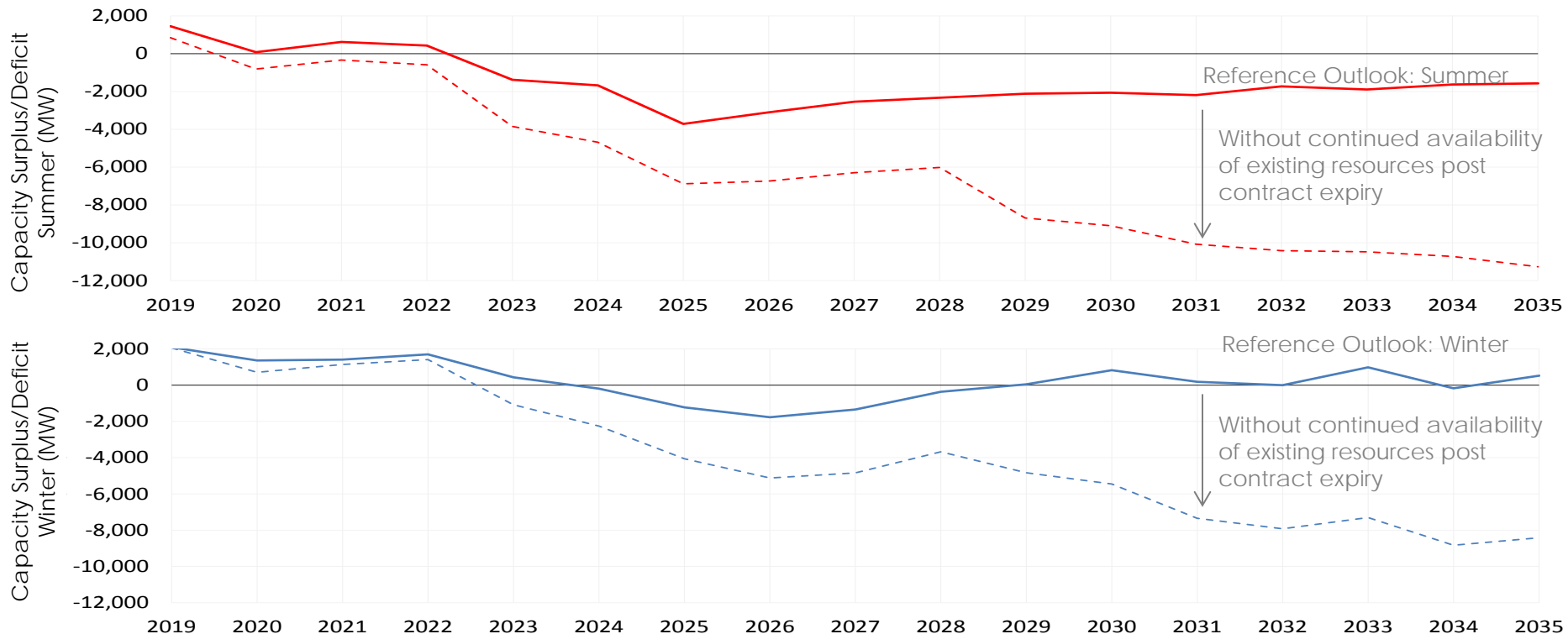
Available supply compared to total resource requirement

- In the reference demand outlook, capacity needs emerge in 2023 if all resources continue to be available.
- System is planned to meet a reliability standard of loss of load expectation no greater than 0.1 days/year.
- The planning reserve reflects load forecast uncertainty, generator forced outages, wind variability, and nuclear performance uncertainty.



Capacity adequacy outlook (surplus/deficit) under reference demand outlook

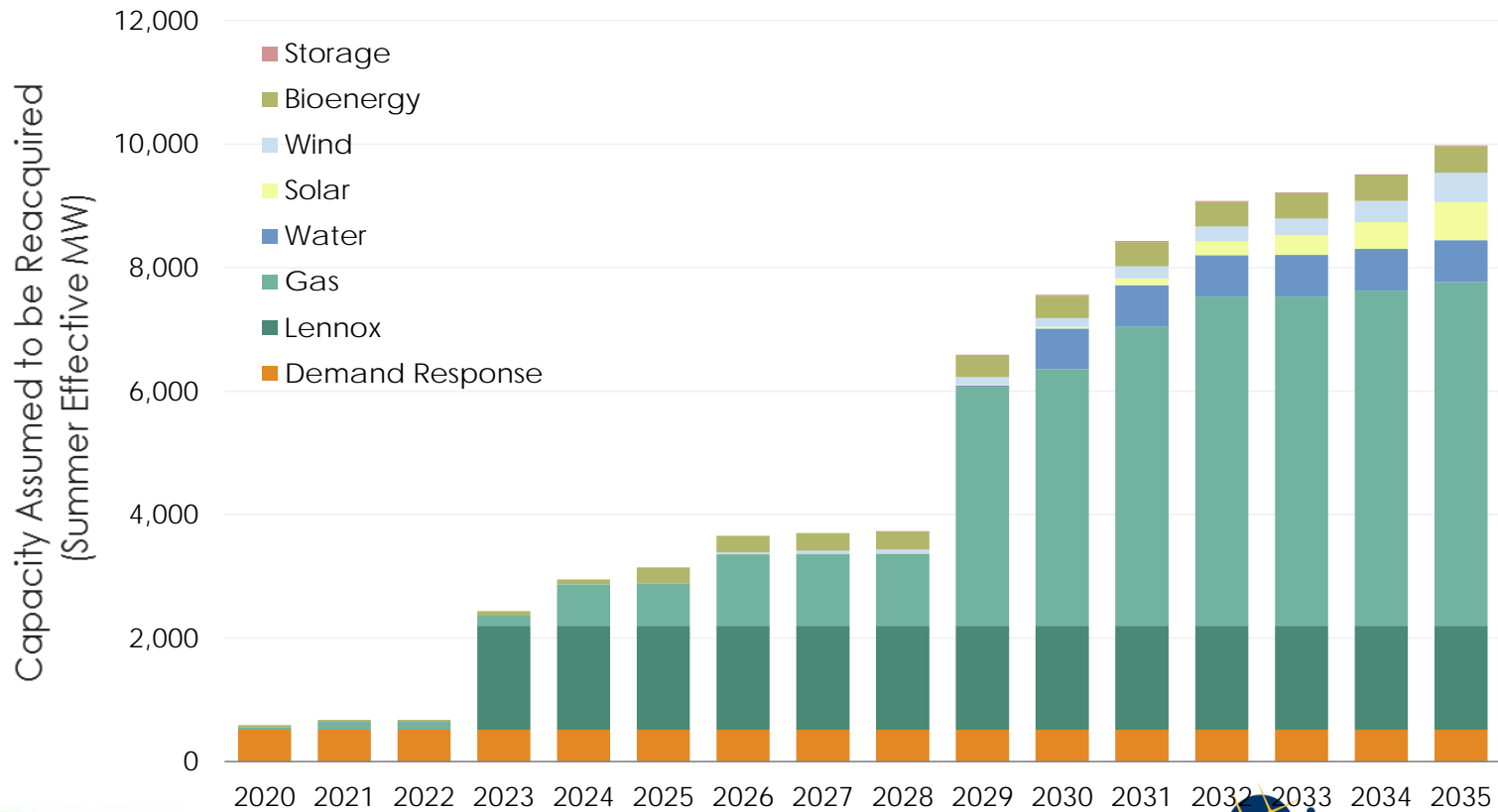
- In the reference outlook, a need for new capacity of about 1,400 MW emerges in 2023. The need increases to 3,700 MW in 2025 before plateauing to about 2,000 MW over the long-term. This assumes that capacity from existing resources continues to be available post contract which helps to defer and reduce the need for new capacity.
- Long-term capacity need primarily driven by Pickering retirement.
- Continuing to acquire capacity from demand response through the auction can meet needs to 2023.



Capacity Surplus (+)/Deficit (-) (MW)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Summer Adequacy: Reference Outlook	1,454	81	622	433	-1,377	-1,673	-3,711	-3,099	-2,536	-2,330	-2,118	-2,065	-2,192	-1,729	-1,895	-1,625	-1,566
Summer Adequacy: Reference Outlook Without Existing Res.	847	-811	-335	-583	-3,844	-4,686	-6,878	-6,736	-6,292	-6,018	-8,689	-9,096	-10,077	-10,418	-10,475	-10,724	-11,273
Winter Adequacy: Reference Outlook	2,091	1,364	1,408	1,698	435	-192	-1,229	-1,770	-1,343	-366	47	825	184	-2	983	-176	523
Winter Adequacy: Reference Outlook Without Existing Res.	2,060	710	1,143	1,410	-1,085	-2,263	-4,063	-5,124	-4,838	-3,675	-4,833	-5,451	-7,344	-7,921	-7,306	-8,834	-8,419

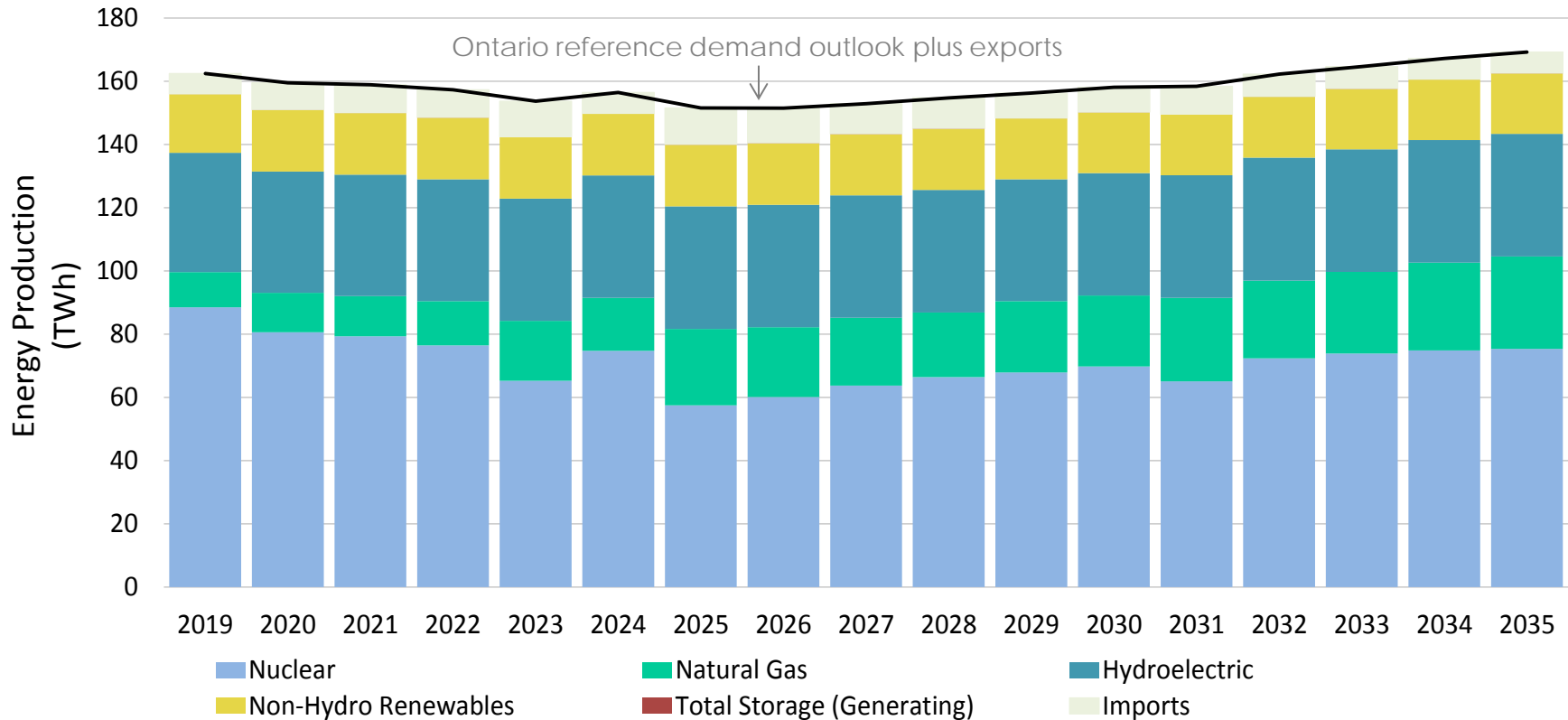
Resources with expired contracts

- Approximately 2,000 contracts representing 18,000 MW of installed capacity - which is equivalent to about 10,000 MW of available capacity at time of peak – will expire by 2035.
 - Expectation is that reliability services are continued to be provided by those existing resources.
- Although 21,000 microFIT contracts reach term, they represent a significantly smaller share of installed capacity totalling about 190 MW. There is uncertainty in the availability of microFIT resources post contract expiration.
- About 600 MW available peak capacity expires in 2020 growing to 2,400 MW in 2023 following the expiration of contracts including Lennox. This grows to 6,600 MW by 2029 as gas facilities reach contract term.



Energy adequacy outlook

- In the Reference Outlook, which assumes the continued availability of capacity from existing resources, Ontario is expected to have an adequate supply of energy to meet the energy demand forecast throughout the outlook.
- Production from natural gas-fired generation increases following Pickering retirement and during the nuclear refurbishment period.



Imports and exports reflect those that take place due to economic opportunities that exist in the real time energy market and the 2016 Ontario-Quebec Energy Sales and Energy Cycling Agreement. Reflects the continued availability of existing resources post contract expiration. Energy generated from storage is about 0.1 TWh per year between 2020 and 2035.

Ancillary services outlook

- The IESO is evolving the market to create a more dynamic and transparent market that will send price signals for the different reliability products that are needed to reliability operate the grid today and tomorrow.
- In order to ensure market participants can make effective investments to respond to those needs, the IESO will be providing transparent forecast of all existing reliability services (capacity, energy, and ancillary services)
- Different resources provide different services to the electricity grid. Frequency support, ramping and balancing, and voltage support – the essential reliability services as defined by NERC - are needed in order to make the electricity system operable.
- There is an increasing need today for some services such as flexibility/load following and regulation service.
 - Needs are being driven by the changing nature of the fleet including increasing amounts of variable generation and distributed energy resources as well as changes to the transmission and distribution system.
 - As the supply mix evolves, there may be a need to increase the types of services acquired and their quantities.
- The IESO is seeking to publish the longer-term requirements for ancillary services.

Summary of electricity needs in the reference outlook

Capacity

- A need for new capacity of about 1,400 MW emerges in 2023. The need increases to 3,700 MW in 2025 before plateauing to about 2,000 MW over the long-term.
- There is significant uncertainty in the size and timing of the need for new capacity

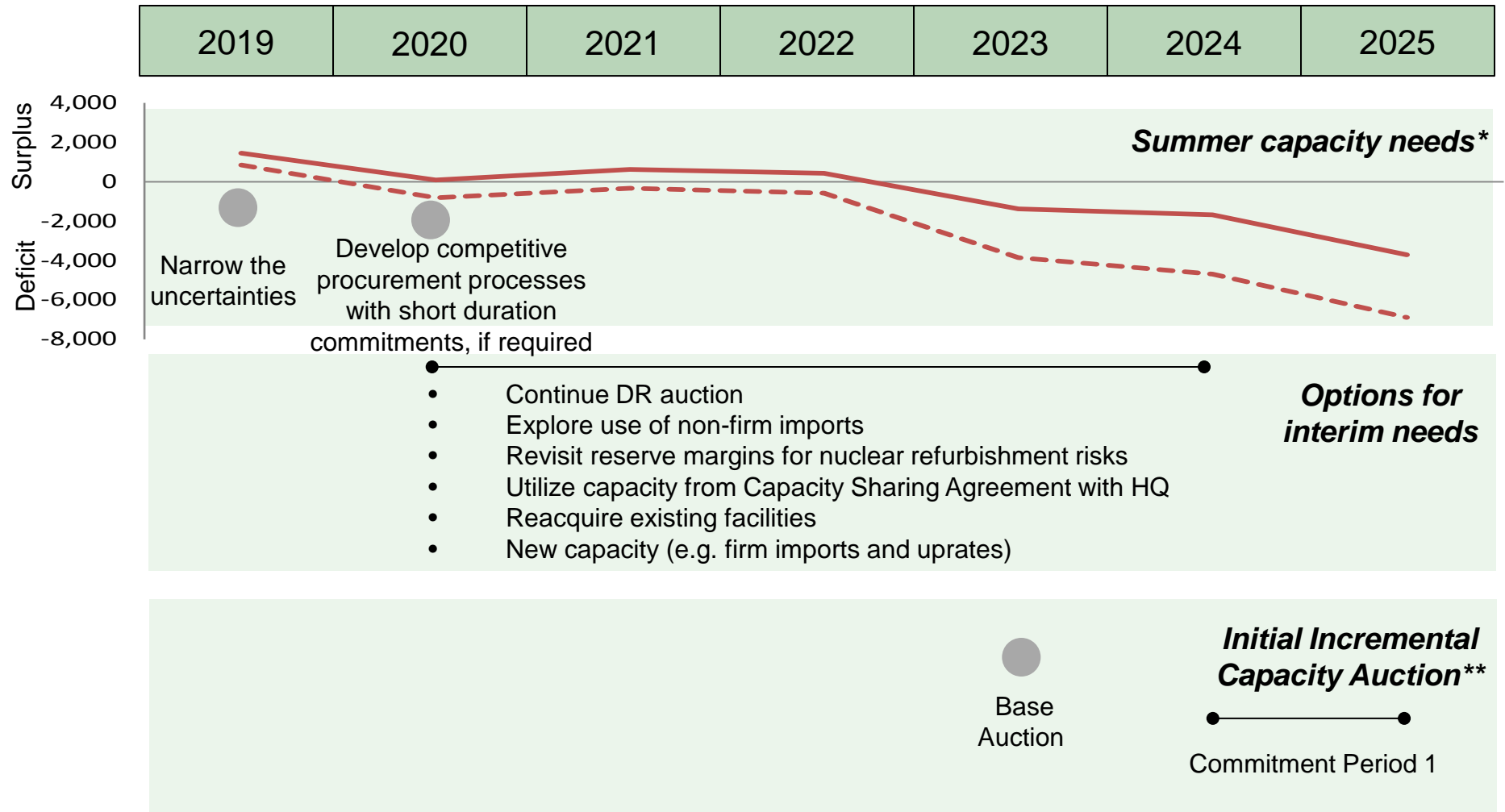
Energy

- Ontario is expected to have an adequate supply of energy to meet the energy requirements throughout the reference outlook.

Ancillary Services

- There is an increasing need today for some services such as flexibility/load following and regulation service. There may be a need to increase these types of services as the supply mix evolves. The IESO will be in a better position to identify ancillary services needs in the following years.

Anticipated Schedule Prior to the First Incremental Capacity Auction

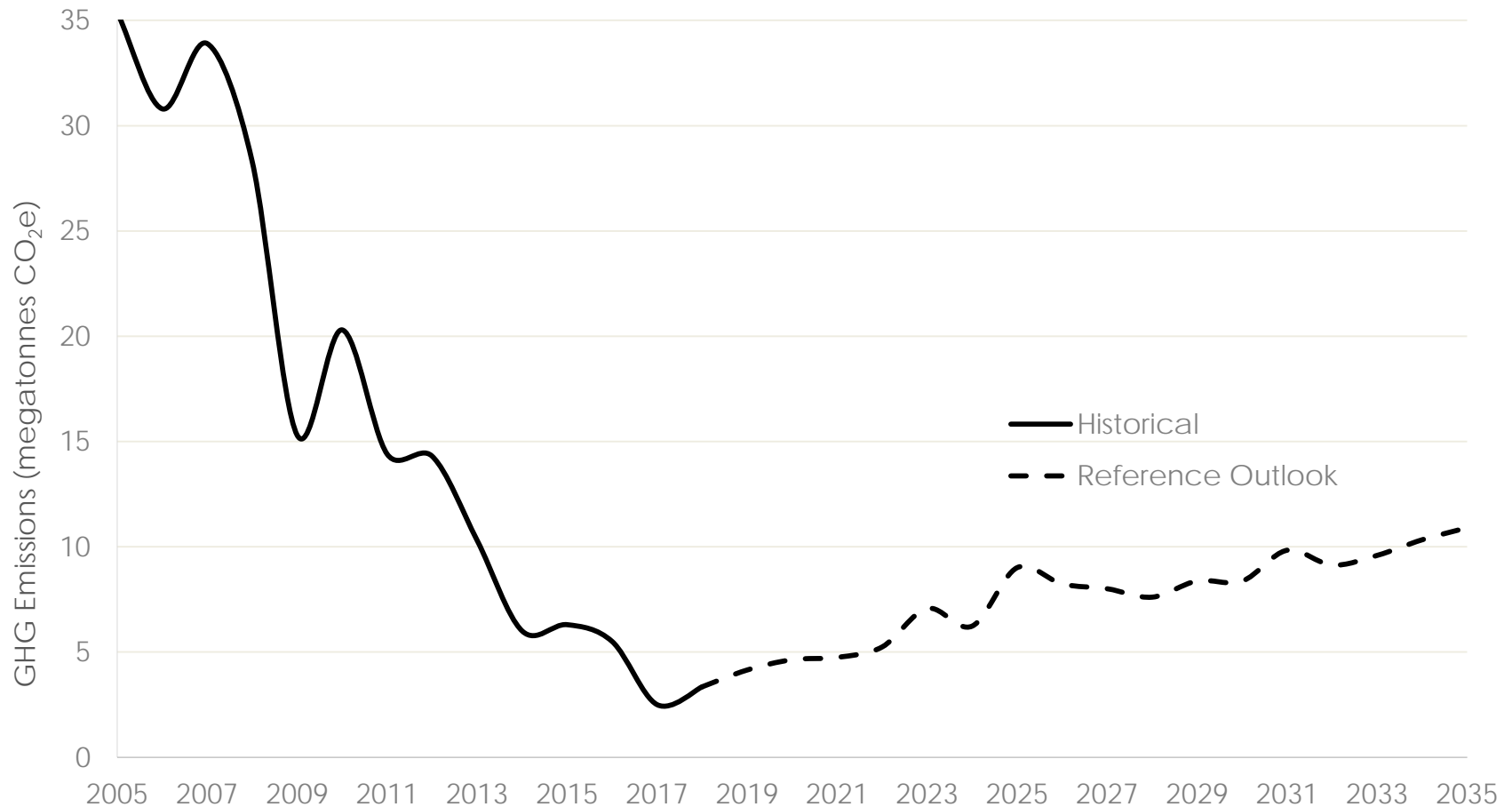


*Solid line represents the capacity surplus/deficit with continued availability of existing resources post contract expiry, and dashed line assumes without.

**Assuming first Commitment Period begins in 2024. Subject to change.

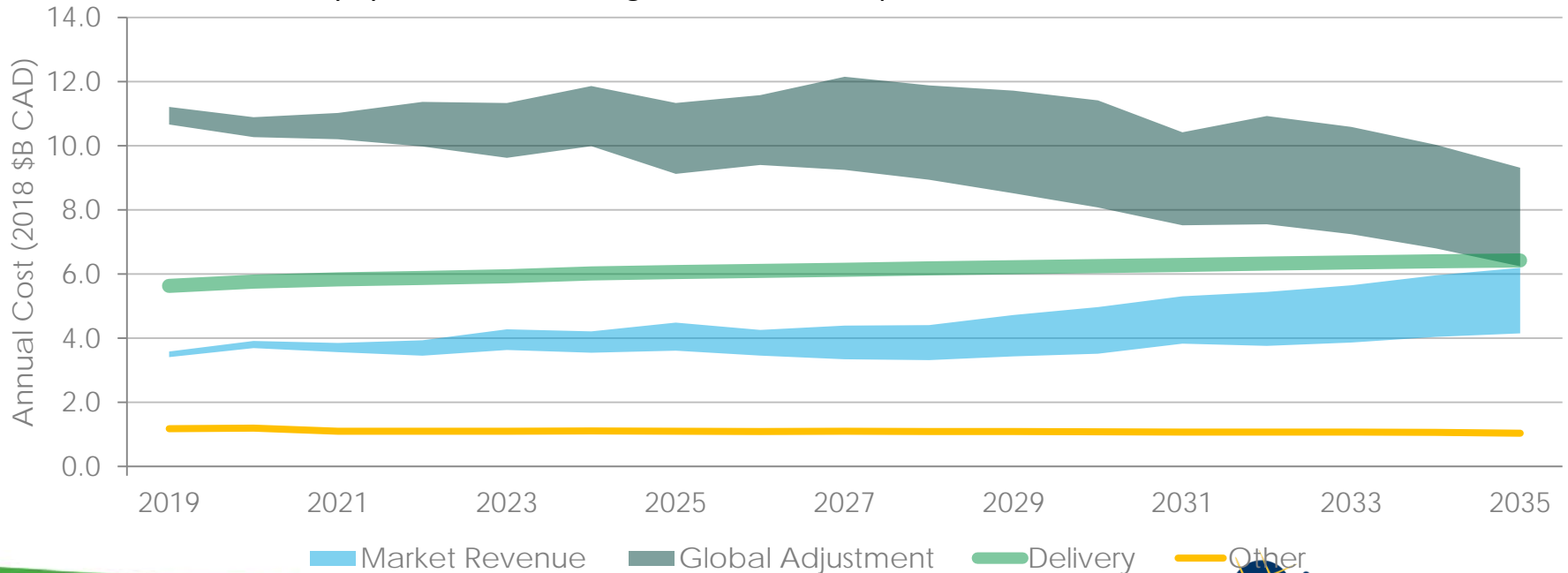
Greenhouse gas (GHG) emissions

- Greenhouse gas emissions from the Ontario electricity sector have declined by more than 90% since 2005, reducing its contribution to total province-wide emissions from 17% to less than 4%
- Declining nuclear production will result in increased gas generation and greenhouse gas emissions; however, Ontario electricity sector emissions will remain well below historic levels over the next two decades



Estimate of electricity component costs

- Cost estimates are based on planning assumptions and are used to understand impacts relative to reference scenario.
- Decreased nuclear production and increased gas-fired generation lead to a modest increase in market revenues at a real cumulative annual growth rate of 2%
 - This assumes current energy market structure. Impact of Locational Marginal Pricing is not included.
- Increase in market revenues leads to a modest decrease in Global Adjustment (GA) at a real cumulative annual growth rate of -1.8%.
 - This assumes conservation funding framework and all new and existing capacity participating in the Incremental Capacity Auction (ICA) receives a notional estimate of the ICA clearing price. ICA Costs will likely be recovered through their own charge, but are included as part of GA in the chart below.
- Total electricity system costs and large volume rates expected to stabilize in real-terms.



System uncertainties

Demand outlook: The current economic outlook indicates that downside uncertainties outweigh upside uncertainties:

- **Trade barriers:** Tariffs on various sectors could have a ripple effect that would cascade throughout the economy.
- **Economic uncertainties:** Demand forecasts are based on economic growth and population projections. Unexpected events like recessions or trade barriers could lead to lower demand.
- **Industrial Conservation Initiative (ICI):** Demand forecast will be significantly impacted by changes to the eligibility of ICI, and the broader rate structure.
- **Growth in the agricultural and industrial sector:** Projected rapid greenhouse expansion in Leamington (500+MW of winter load growth expected in 2020) and development of the Ring of Fire will increase the load up in local areas.
- **Market adoption of technology** (electric vehicles, heat pumps): The elimination of incentives will likely slow down sales and impact demand.

Supply outlook: There are uncertainties that affect availability of electricity supply and availability of capacity on the market:

- **OPG decisions:** Pickering retirement is the main driver of new-build capacity requirements.
- **Refurbishment schedule:** An additional reserve is included in the capacity outlook to manage the risk of a delayed return to service of nuclear units after refurbishment.
- **Lennox Generating Station:** Contract expires in 2022. The station plays an important role in the system.
- **Demand Response:** Future auction parameters affect the availability of DR.
- **Availability of generators with expired contracts:** There is limited information on the ongoing availability of generators with expired contracts.
- **OPG's non-nuclear regulated assets:** Potential exists for additional capacity across OPG's non-nuclear regulated assets

System cost and emissions outlook: Changes to demand and supply would impact cost and emissions.

- **Demand Outlook:** Changes to the demand forecast will have an impact on both cost and emissions.
- **Carbon prices:** The federal carbon backstop expected on January 1, 2019 in Ontario, with minimal impact on electricity sector.
- **Market Renewal:** Timing, design and implementation could influence resource acquisition cost assumptions.
- **Fluctuations in natural gas prices:** Cost forecast is sensitive to changes in forward natural gas prices.

Risk considerations

- **System Reliability Risks**

- Capacity gap may emerge prior to the first expected ICA commitment period.
- Uncertainty regarding availability of resources with contracts that expire prior to the first commitment period of the ICA.
- Limited knowledge of long term plans by generation asset owners, particularly those approaching end of contract.
- Physical condition of generation assets over time.
- Uncertainty in capacity and energy market revenues available for generators, including the combined cycle gas generation fleet.

- **Cost Risks**

- Total system cost is subject to fluctuations in:
 - demand forecast.
 - carbon pricing.
 - gas prices.
 - actual resource acquisition costs.

Options to address interim capacity needs before the first commitment period of the ICA

- The potential gap emerging in the next five years is proportionally very small and is best filled with resources that do not require long lead times and long term commitments.
- Options for short term competitive procurements in the years prior to the first ICA commitment period to address capacity needs include:
 - **Continuation and growth of the DR Auction:** Current DR auction participants are expected to remain available. Total DR potential can be higher/lower than current levels.
 - **Non-firm imports:** Continue to explore use of non-firm imports.
 - **Reserve margins for nuclear refurbishment risks:** Revisit the reserve required to manage the risk due to multiple nuclear refurbishment outages and potential impact of delays.
 - **Capacity Sharing Agreement with HQ:** 500 MW during summer months is available to be used in one year or in increments over several years with one year notice.
 - **Reacquire existing facilities:** Contracts for Lennox, Brighton Beach, and other generators will expire over the next decade. A competitive short-term contracting process could be used to reacquire these resources under short term commitments until they are able to compete in the ICA
 - **New capacity:** Could include firm imports and uprates.

Next steps

- Provide updated information to the market.
- The most cost-effective and prudent approach is to wait until we have more certainty about the size of the capacity gap. Outlook in 2019 will focus on narrowing the uncertainties. There is no immediate need to act to fill the gap now.
- A plan will be put in place by the end of 2019 to execute in 2020 to acquire any necessary resources for 2023.
- Continue to procure Demand Response through the DR Auction.
- Continue to update and engage communities and stakeholders as we review and refine our resource adequacy forecasts, and as we move to acquire resources necessary to fill the capacity gap.

General feedback from the Conference

- The event was well attended, over 100 people attended including representatives from generators, consumers, distributors/transmitters, municipalities, industry associations, Ministry of Energy and OEB.
- Feedback was very positive, with many stakeholders expressing that the information presented was one of the best sessions that the IESO has delivered in some time.
- Stakeholders made it clear that they would like to see the data, assumptions and methodologies that underpin our assessments so that they can assess risk and opportunity using their own assumptions and methods.
- In addition, stakeholders noted their observation that the IESO is working much better together, with clear signs of increased alignment amongst its various functions.
- Participants were encouraged to submit written feedback to the IESO by mid-October. Feedback will be summarized and posted on the IESO website by Q4 2018. Feedback received will help inform IESO's planning processes and further discussions at future engagement meetings.

Questions for SAC Feedback

- What additional information should the IESO provide to the market for future updates?
- What key factors, uncertainties, scenarios, indicators, etc. should be considered in resource planning assessments?
- How should the IESO recognize and integrate risks related to resource planning assessments?