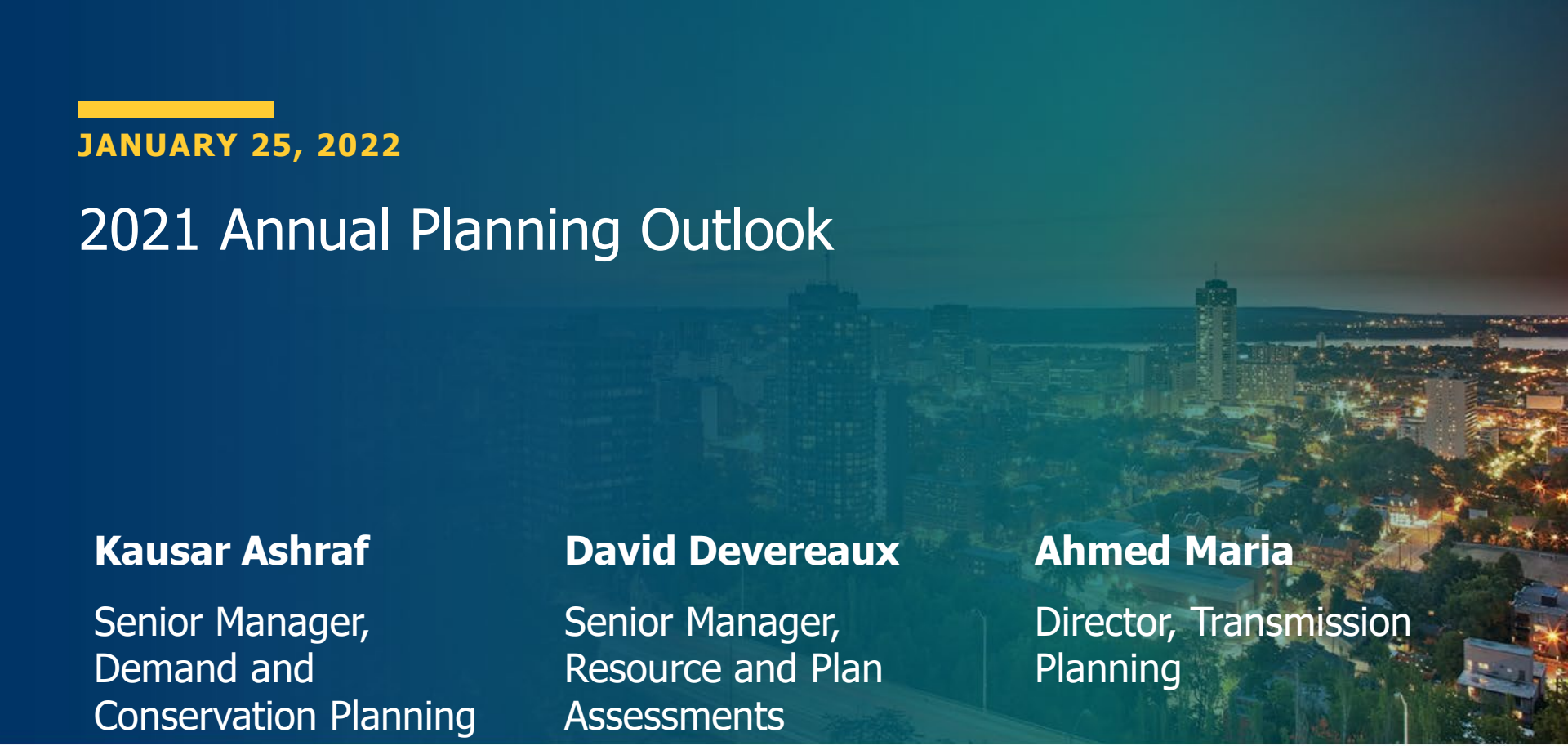
JANUARY 25, 2022

2021 Annual Planning Outlook



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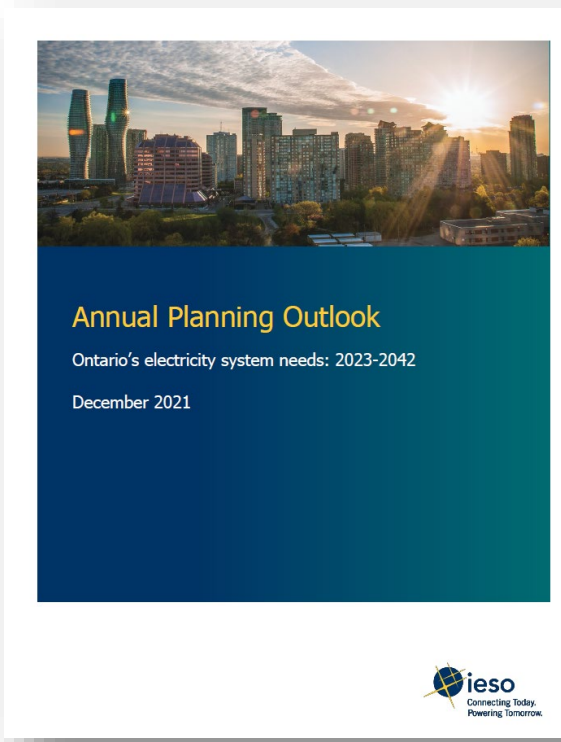
Agenda

1. APO Key Findings
2. Demand Forecast
3. Supply Outlook
4. Capacity Outlook
5. Locational Considerations
6. Energy Outlook

Annual Planning Outlook (APO)

- 20 year forecast, published annually
- Key components include:
  - Demand forecast
  - Supply outlook
  - Transmission outlook
  - Resource adequacy (capacity, energy)
  - Locational constraints and transmission reinforcements
  - Other (imports/exports, emissions, marginal costs, system costs)
- APO also informs planned actions in **Annual Acquisition Report**



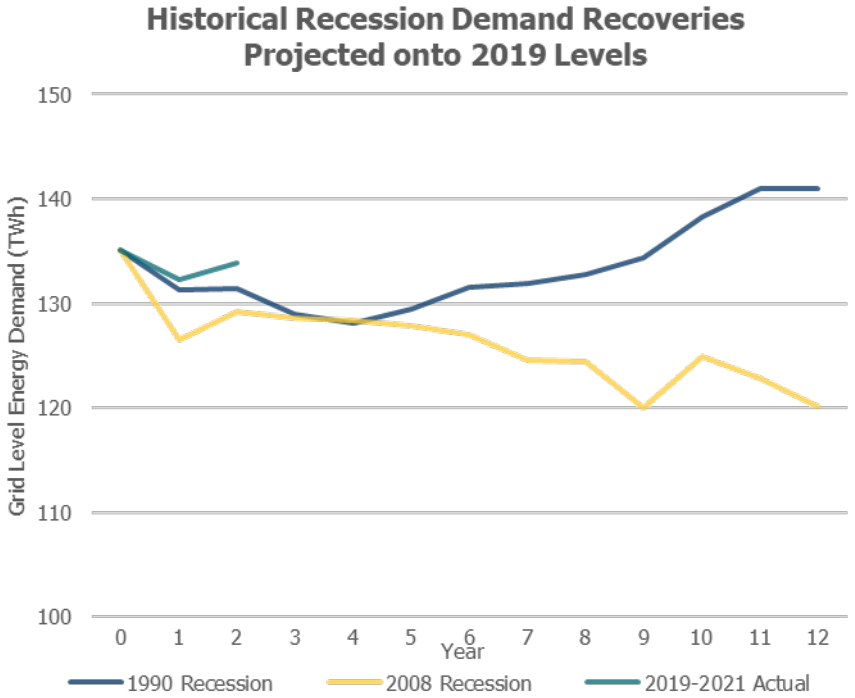
Key Messages

- The IESO forecasts both **energy** and **peak demand** to grow steadily over the outlook period.
- **Capacity needs** emerge in 2025 and grow over the forecast horizon.
- **Energy needs** also emerge in the mid-2020s, and grow sharply beginning in 2029
  - Most of these needs could be met by existing resources, as long as they continue to participate in Ontario's energy markets

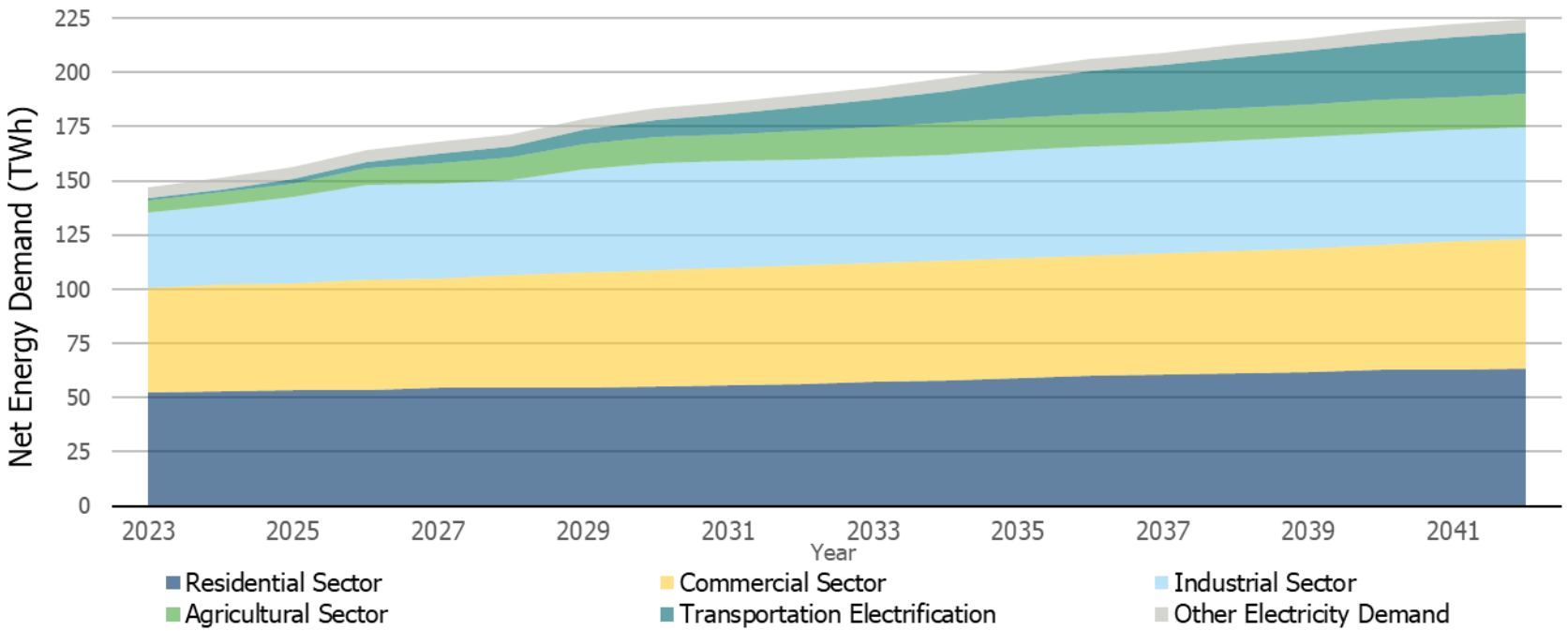
1. Demand Forecast

Past Recessions, Recoveries & Restructurings

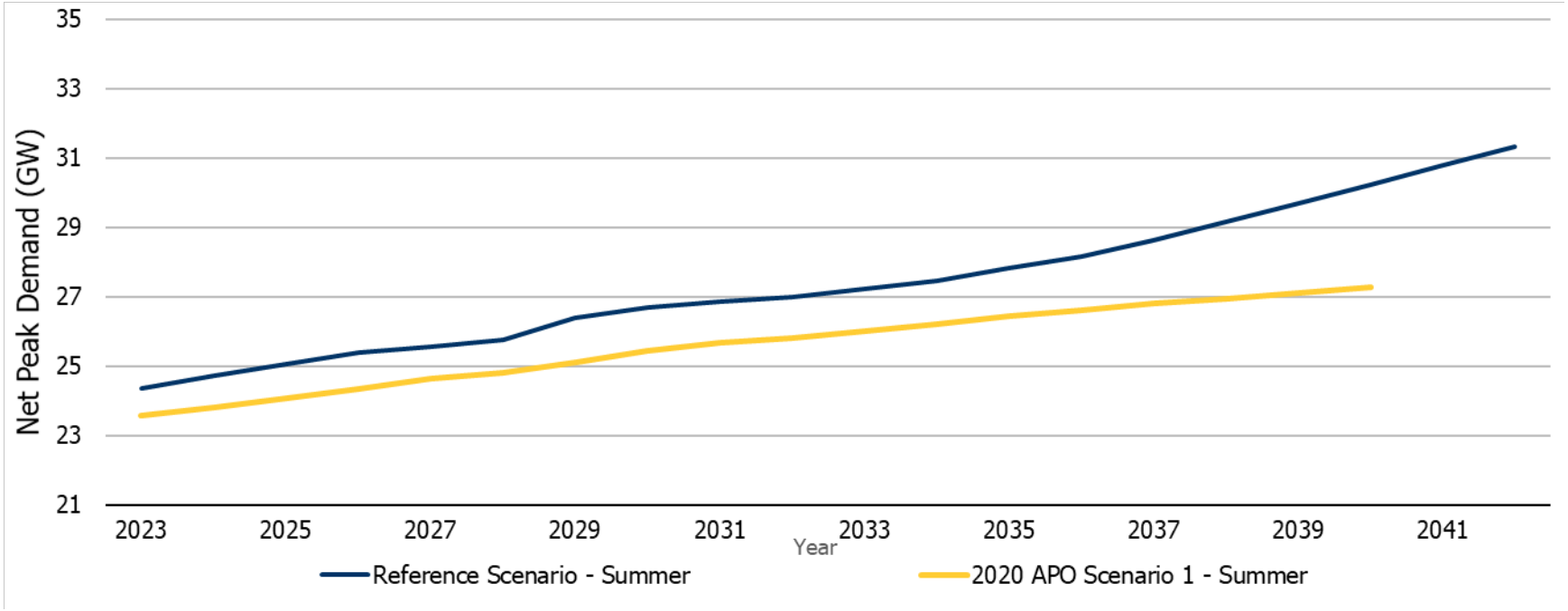
- **Recessions in 1989 and 2008:**
  - Initiated by economic conditions (trade/tax/debt/inflation) and had broad sector exposure
  - Decreases in annual electricity demand of about 6% over 1-3 years;
  - **Economic recovery**:
    - Required years for employment to recover and each instance economy incrementally restructured from an industrial based economy to a more service sector based economy
  - **Electricity demand recovery:**
    - Electricity demand levels recovered from 1989 recession by 1999
    - Electricity demand has not surpassed pre-2008 recession peak (also impacted by CDM & EG)



Demand Forecast - Energy



Demand Forecast – Peak Demand



Note: given demand uncertainties, a **high demand forecast** has been prepared, and will be discussed later.

Demand: Agriculture

- All significant load growth seen in the West of London area, including Essex, Kent, and Lambton counties
- Growth is in greenhouses and associated artificial lighting, due to the move to year-round fruit, vegetable, flower, and cannabis production
- Energy demand is expected to more than double in this region by 2030

Demand: Mining and Metals

- Bulk of growth seen in Northeast and Northwest IESO zones
- Individual projects can lead to significant increases in demand
  - Algoma Steel electric arc furnace
- Economic growth and electrification/decarbonization are driving demand growth in these sectors

Demand: Transportation Electrification

Electric Vehicles

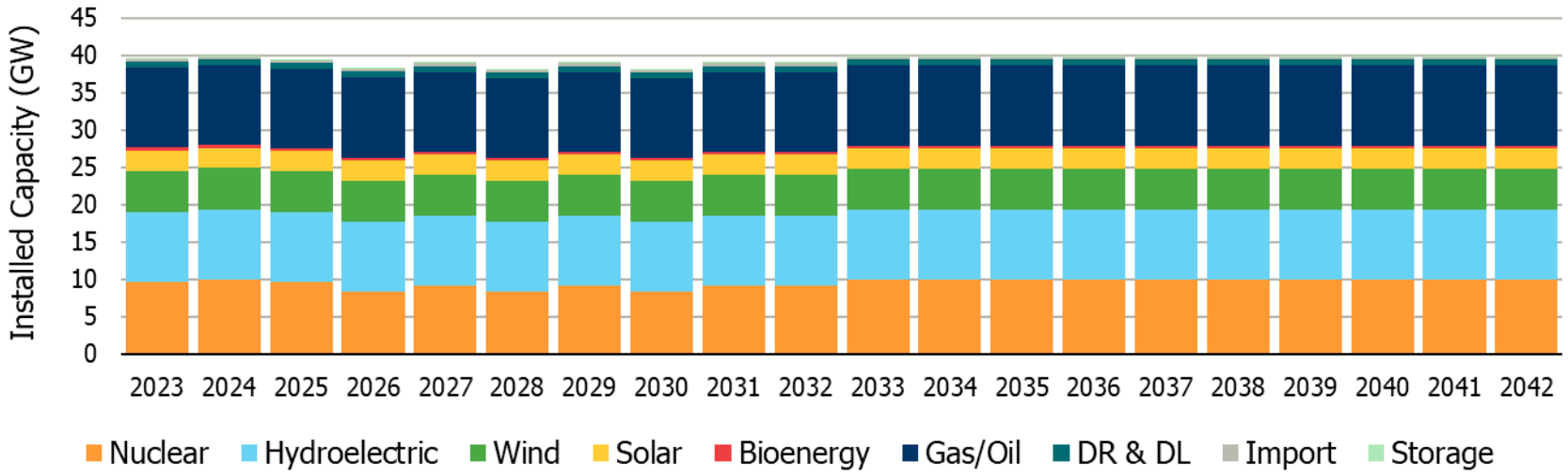
- Forecast includes assumption of 100% of light duty vehicles sold are non-emitting by 2035 (current federal policy)

Transit Electrification

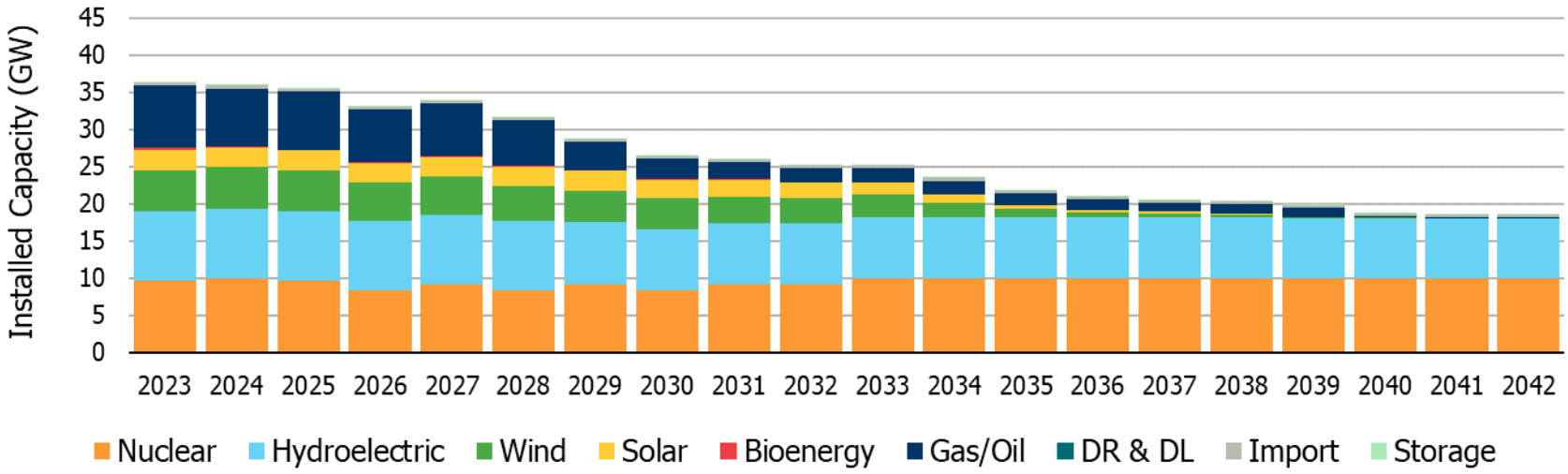
- GTA subway extensions
- New LRTs
- GO rail system electrification

2. Supply Outlook

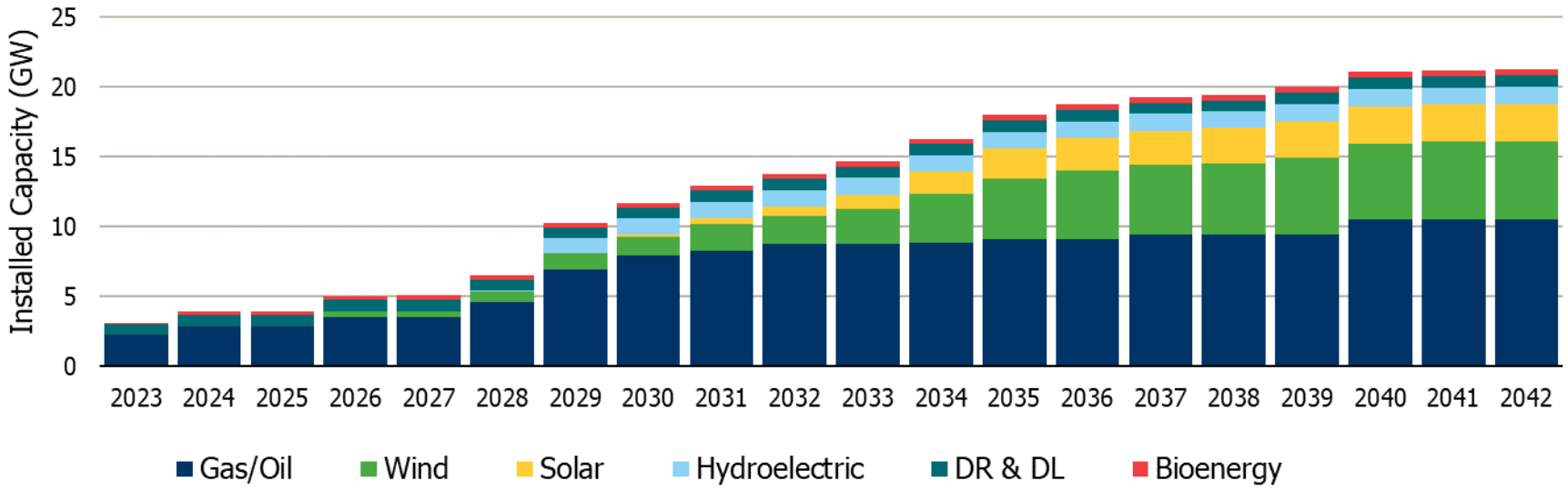
Supply Outlook – Installed Capacity



Supply Outlook – without Reacquisition



Supply Outlook – Resources Post Contract Expiry



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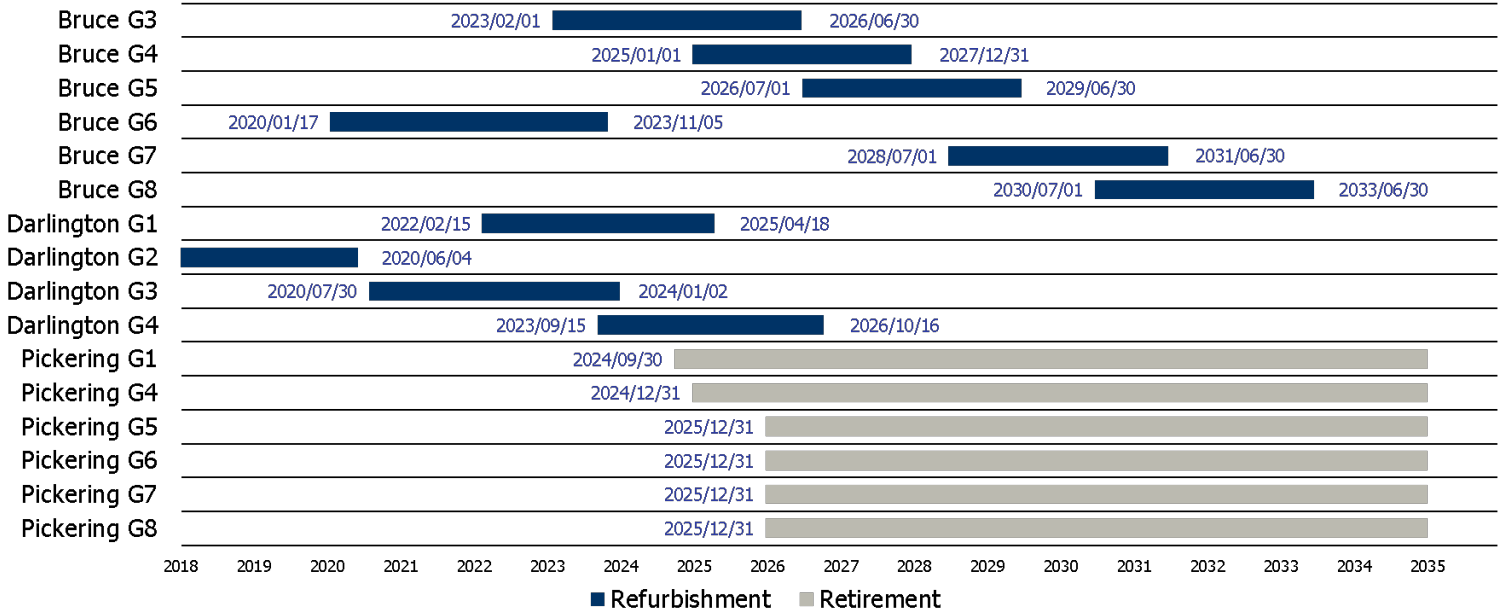
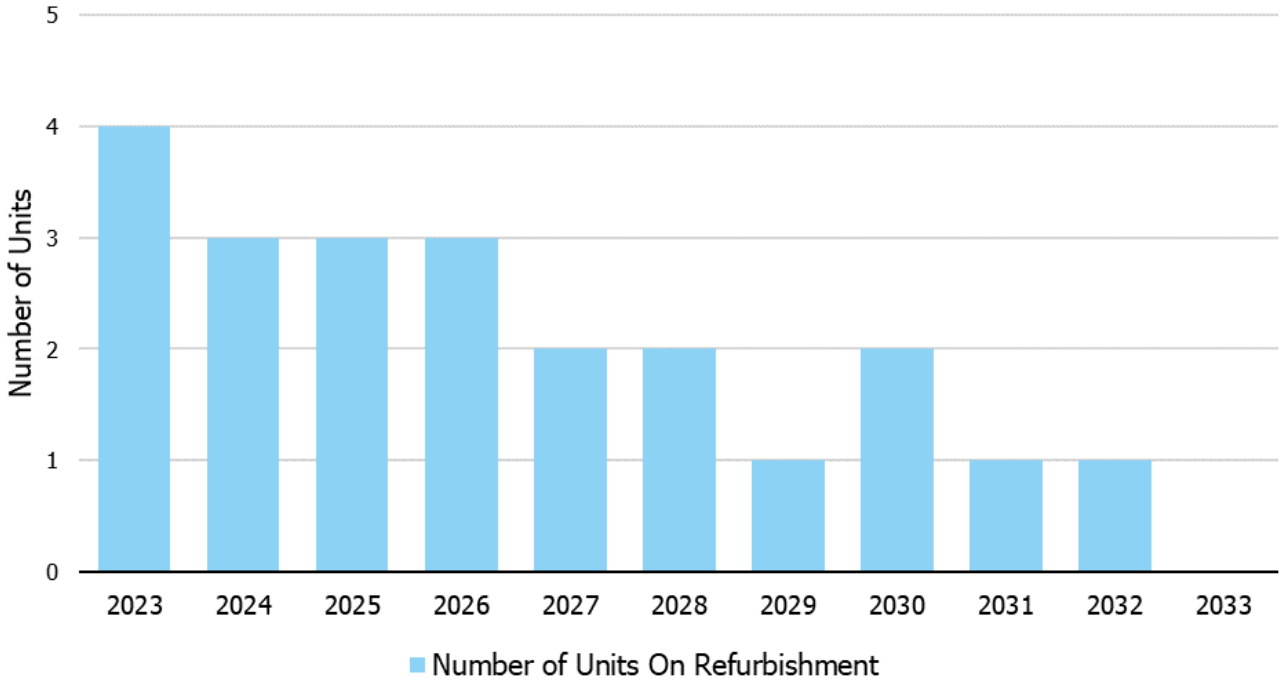
Nuclear Refurbishment - Schedule



Nuclear Refurbishment – Units on Outage



3. Transmission Outlook

Ontario's Transmission System

The capabilities of the transmission system is a critical input to reliability assessments because limitations on moving power from one part of the province to another can contribute to demand-supply imbalances at a zonal level

The transmission transfer capabilities assess the existing transmission system capability, plus transmission system reinforcements that are planned or underway that will provide benefits within the planning horizon

Transmission System Projects – Planned or Underway

- East-West Tie Reinforcement
- Various reinforcements in the West of London and West of Chatham Areas
- Flow East Toward Toronto ("FETT") Capacity Upgrade
- Hawthorne-Merivale in Ottawa
- Lennox Reactors in Eastern Ontario

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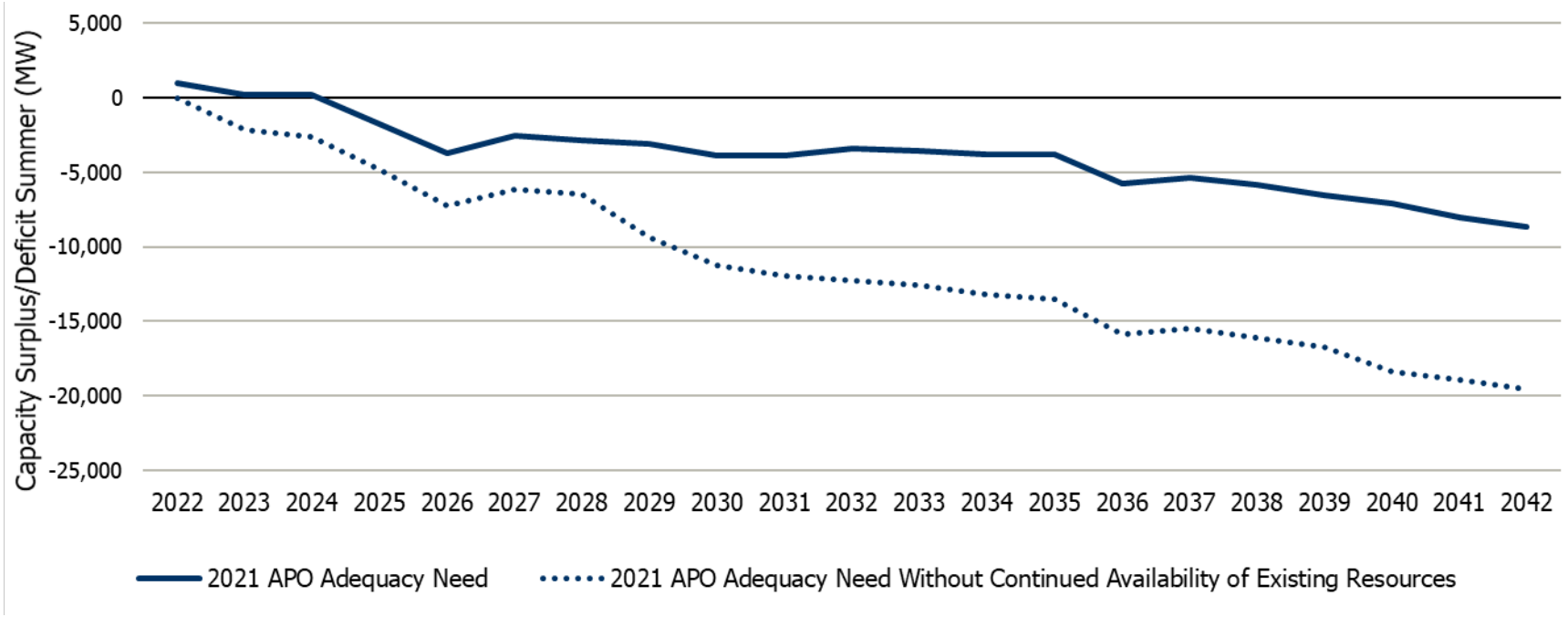
Transmission System Projects

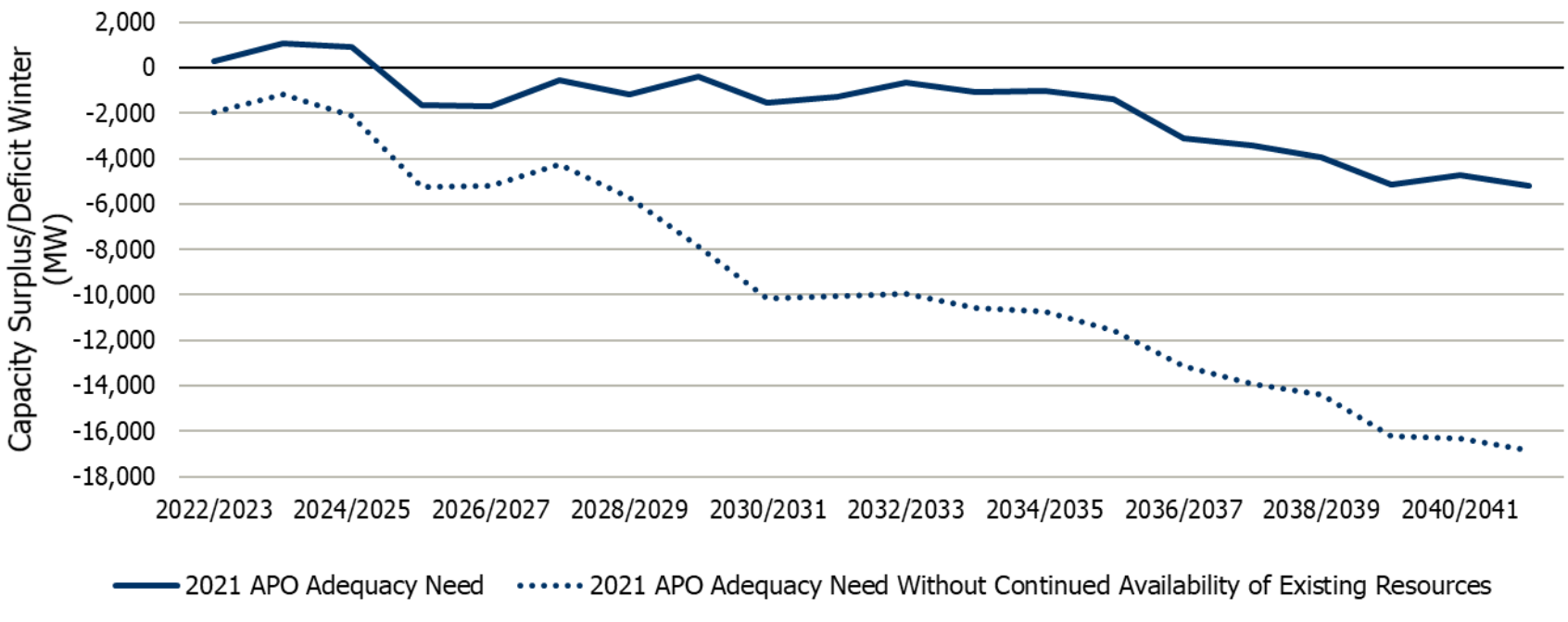
Projects	Description
East-West Tie Reinforcement	Will provide long-term, reliable electricity supply to Northwest Ontario to enable forecasted demand growth and changes to the supply mix in the region
West of London and West of Chatham Reinforcements	Responding to the need for additional capacity in the Windsor-Essex region, driven primarily by strong and sustained growth in the agricultural sector
FETT Capacity Upgrade	Required to supply demand east of the FETT interface, given the loss of supply capacity driven by the retirement of Pickering NGS and refurbishments at Darlington NGS
Hawthorne-Merivale Reinforcement	This transmission path supplies load in western Ottawa and delivers eastern Ontario resources and imports from Quebec to southern Ontario load centres
Lennox Reactors	To address acute operational challenges resulting from high system voltages in eastern Ontario and the GTA during low-demand periods

4. Resource Adequacy

Capacity Outlook - Summer



Capacity Outlook - Winter

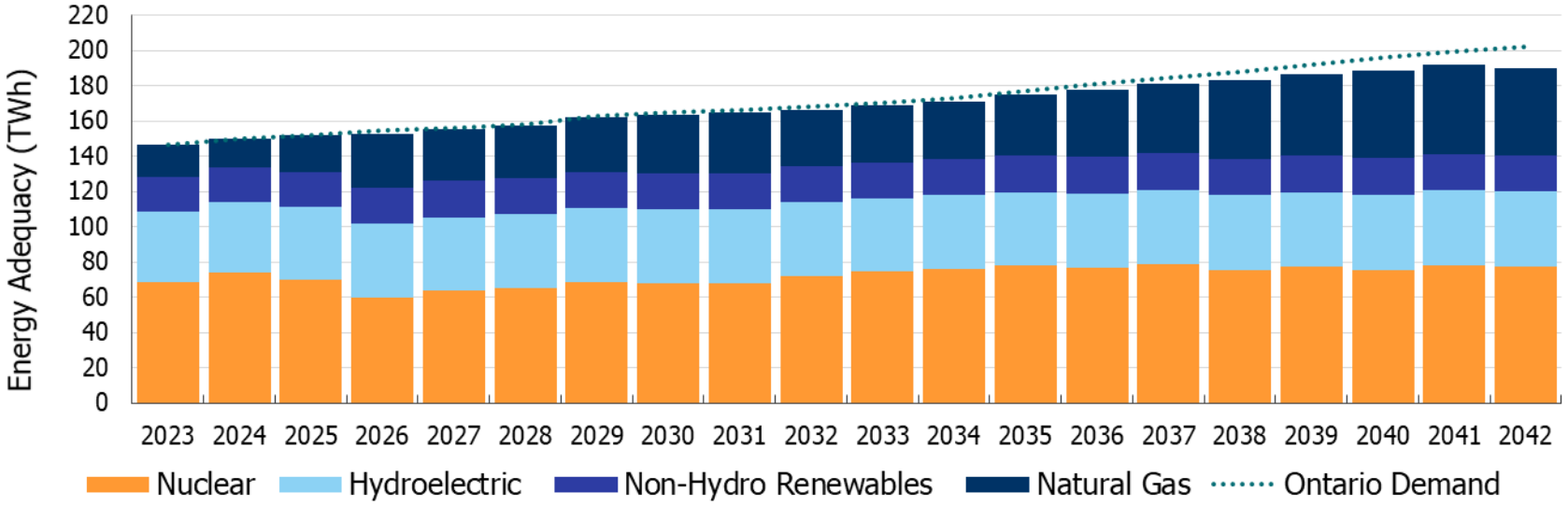


Supply Uncertainties

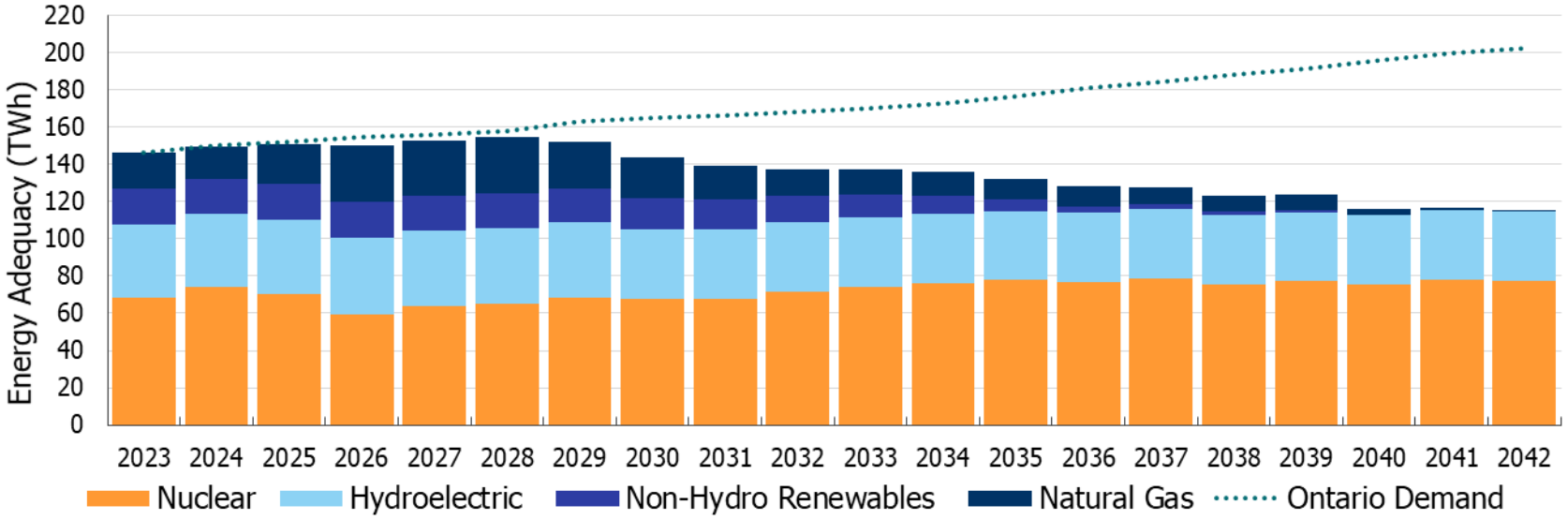
Potential sources of capacity and energy not included in this outlook:

- Oneida Battery
- Lake Erie Connector
- Biomass Facilities
- Small Modular Reactors
- Small Hydroelectric Facilities
- Pumped Storage Project Proposals

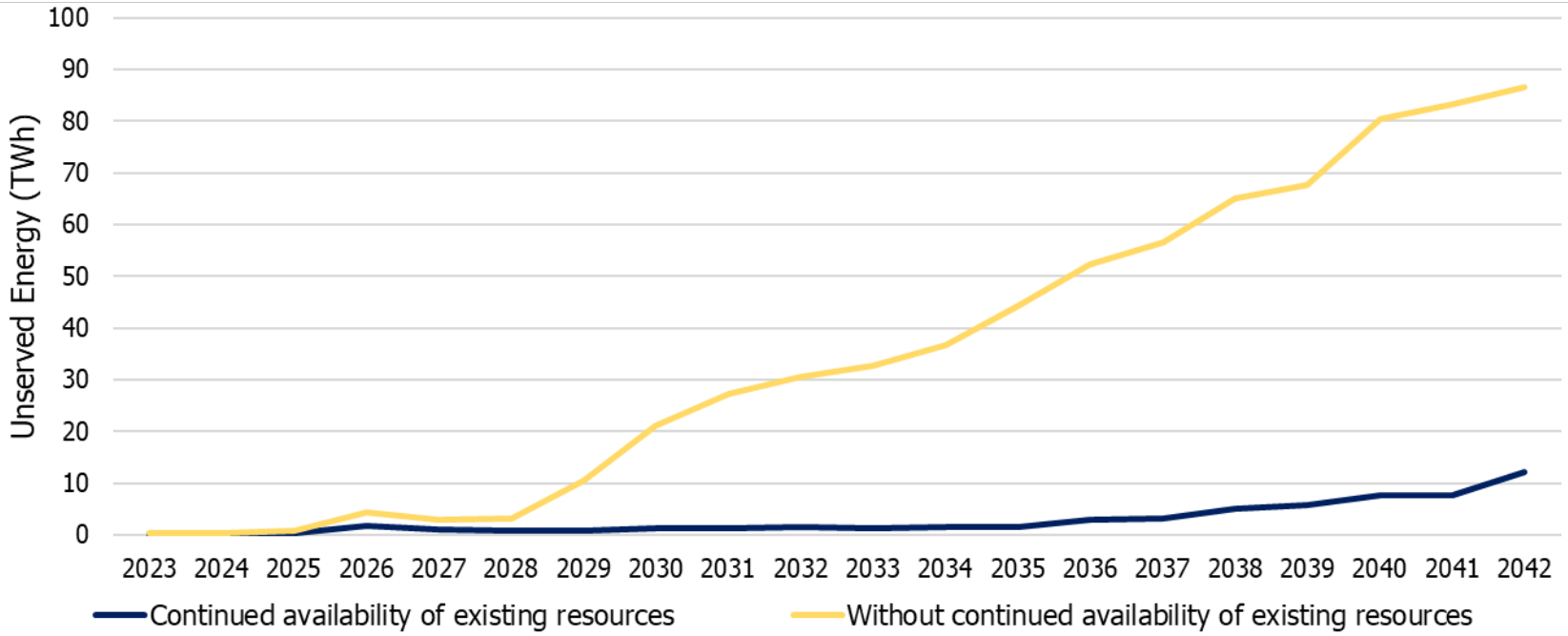
Energy Adequacy Outlook – with reacquisition



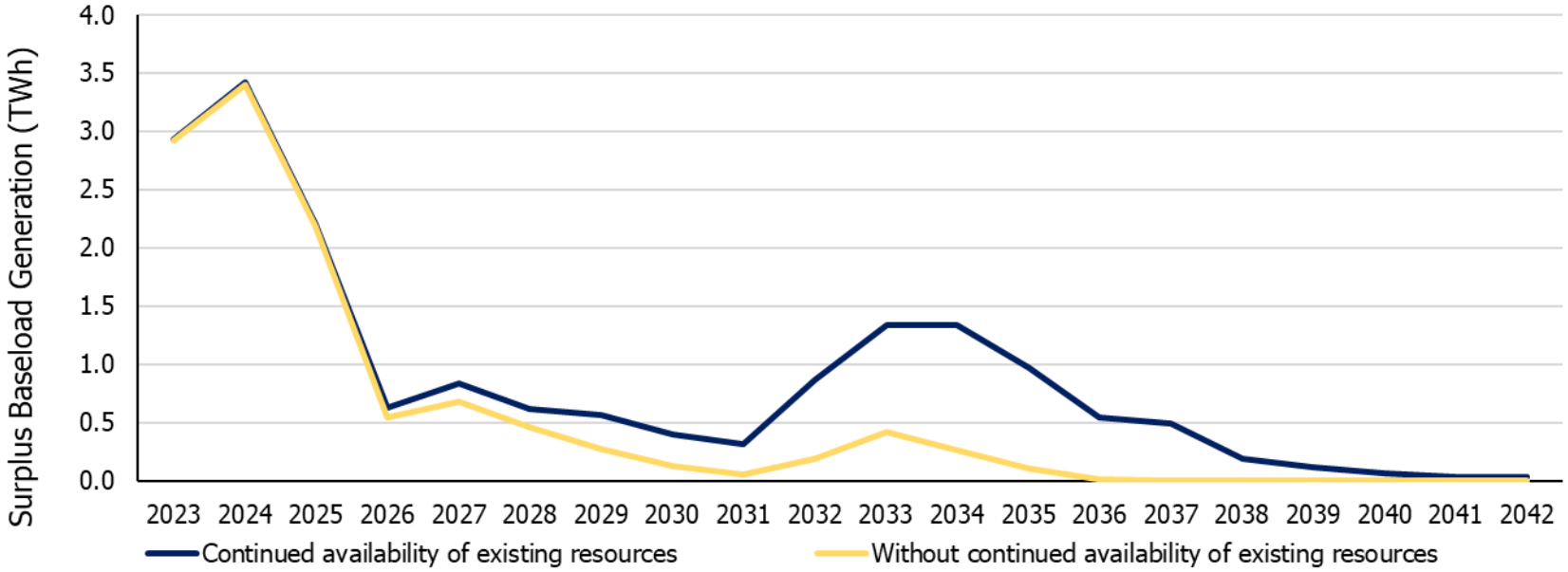
Energy Adequacy Outlook – without reacquisition



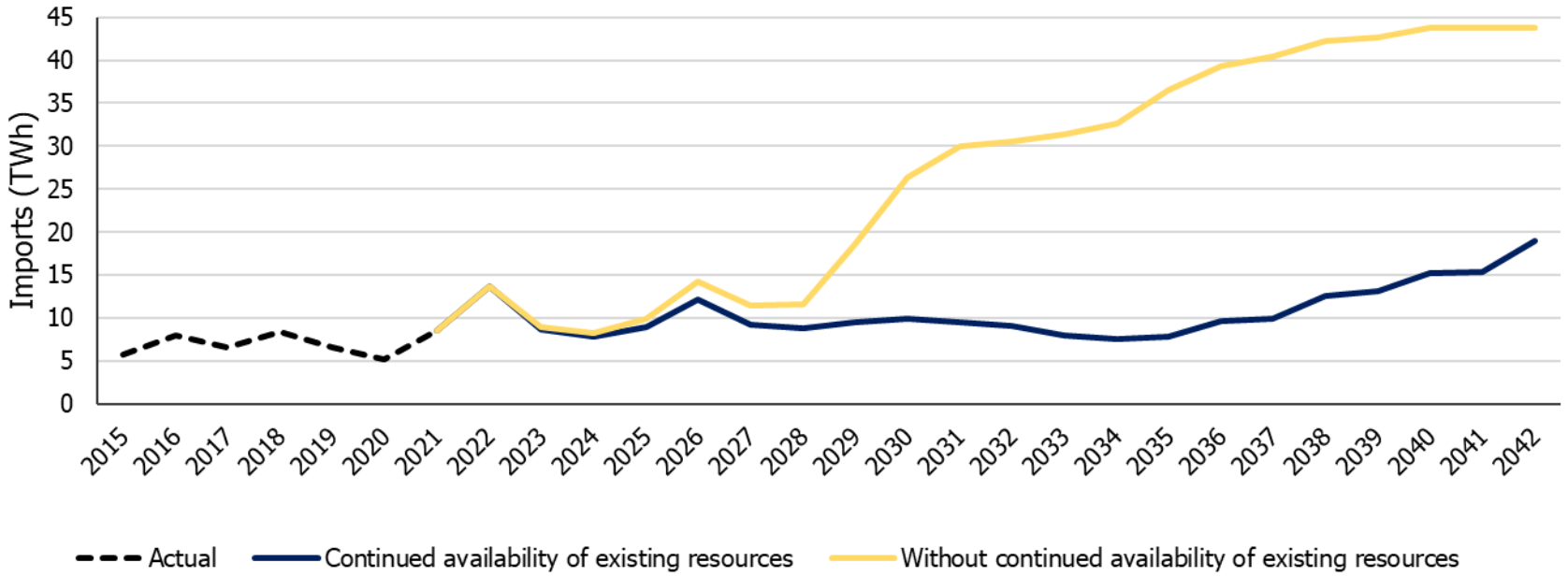
Potentially Unserved energy



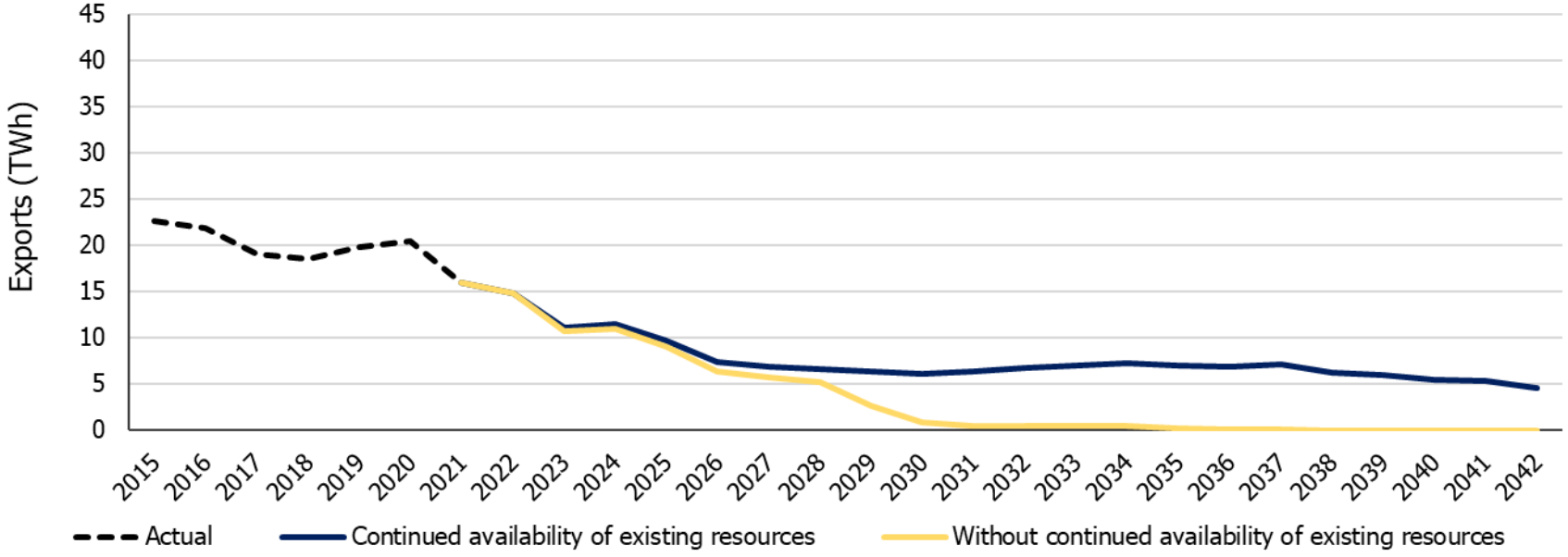
Surplus Baseload Generation



Imports

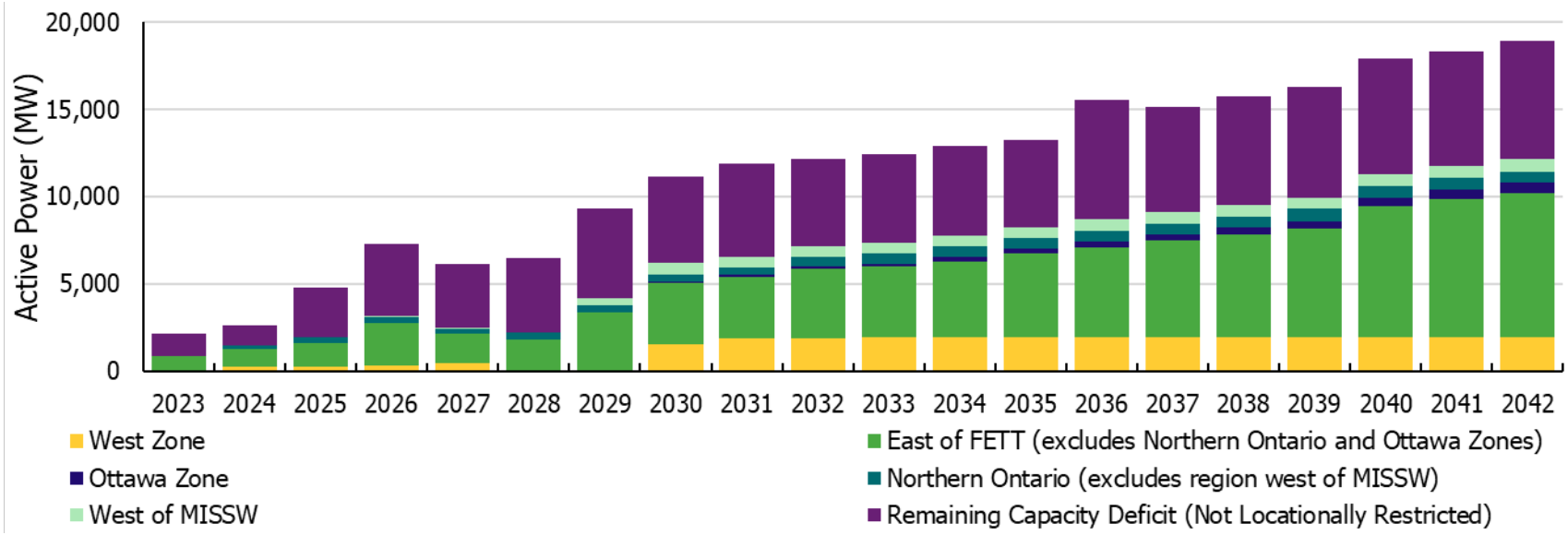


Exports

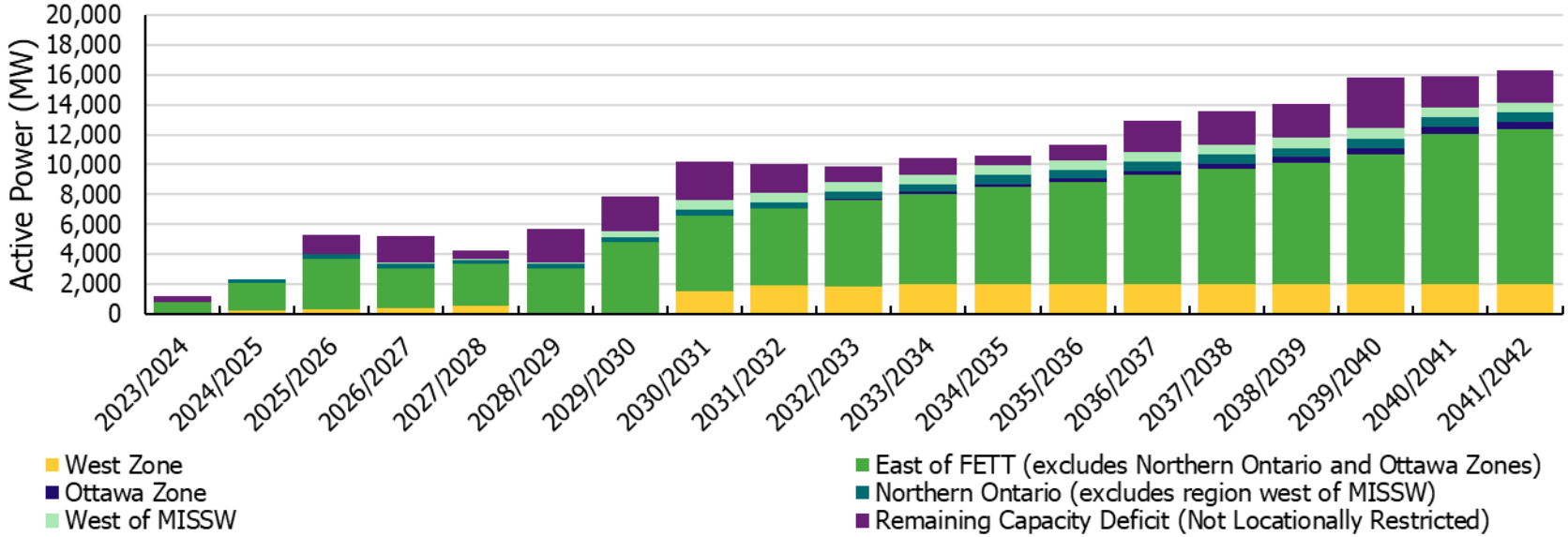


5. Locational Considerations

Locational Capacity Needs (Summer)



Locational Capacity Needs (Winter)



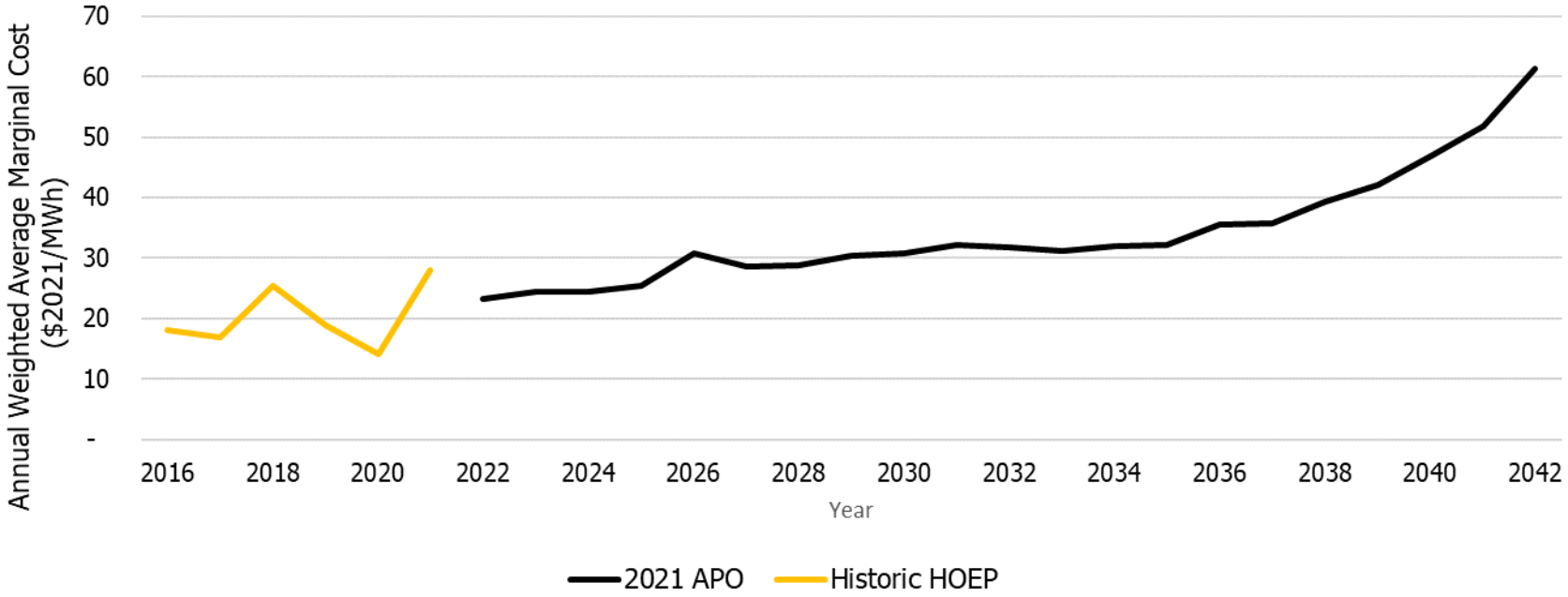
Plans to Address Locational Constraints

Several bulk system planning recommendations that, once implemented, will address the various locational constraints include:

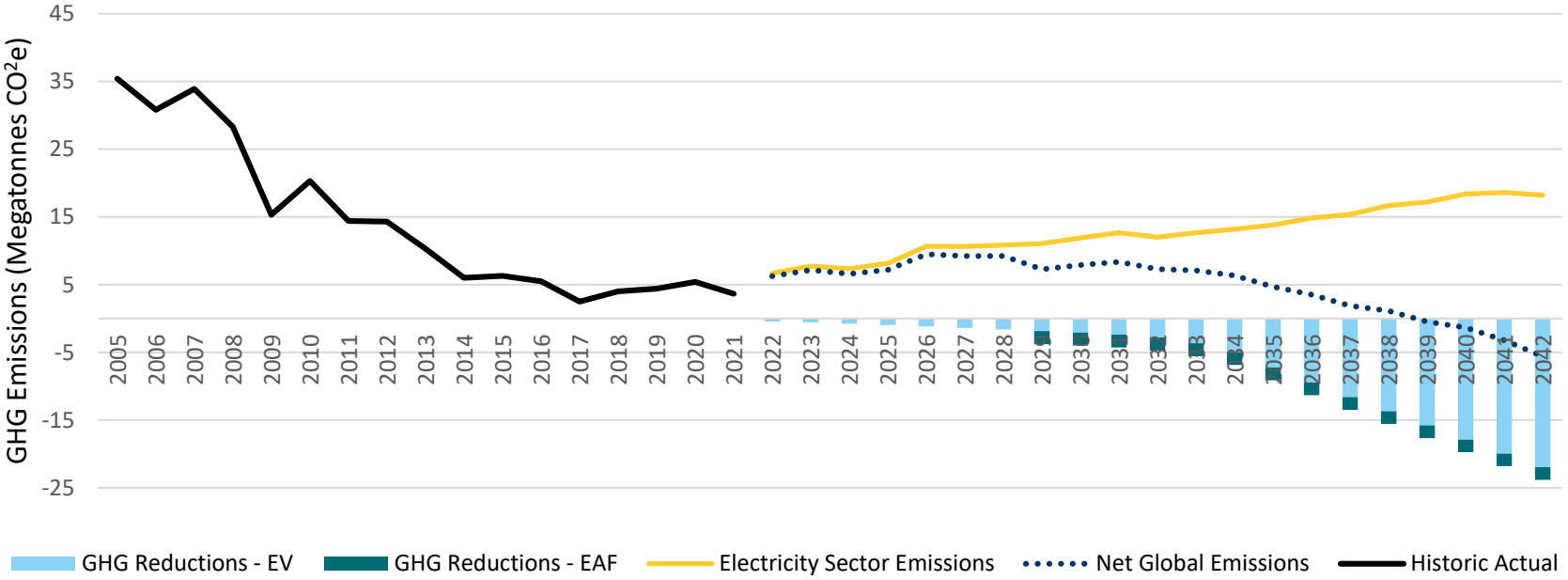
- Re-contracting with Lennox GS to address the near-term constraint east of FETT
- Re-contracting with Brighton Beach GS to address the near-term constraint in the West Zone constraint
- Acquiring capacity per the West of London bulk plan to address the longer-term constraint in the West Zone (this need could be met by re-acquiring existing capacity in the area)
- Bulk system plans are underway that seek to address the longer-term locational constraints in Ottawa and northern Ontario

6. Outcomes and Other Considerations

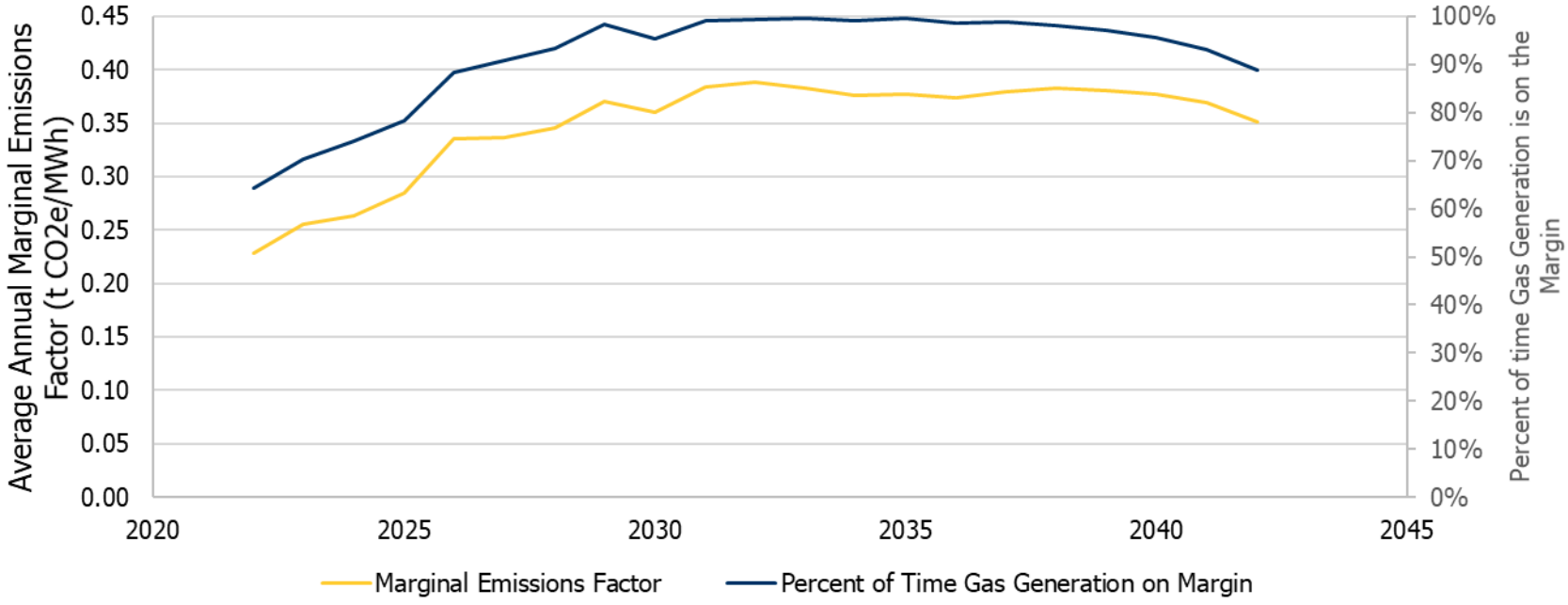
Marginal Costs



Emissions



Marginal Emissions Factors



Operability Considerations

- IESO has begun incorporating **Operability** considerations into APO
- 2021 APO included a module on **Ancillary Services** (specifically Regulation and Blackstart services)
- **Key finding:** IESO forecasts no incremental need for scheduled regulation in Ontario up to 2026

7. High Demand Forecast

Uncertainties - Demand Forecast

- Every demand forecast has uncertainty related to economic growth, customer preference and customer growth
- In addition to the normal uncertainty there are a number of potential incremental pressures on Ontario's electricity demand. These additional uncertainties can be grouped into two categories:
  1) economic development activity and
  2) evolving government policy
- As these additional uncertainties represented by projects and policies not yet confirmed, they are not included in the reference forecast, but will be included in the high demand scenario
- As markets evolve quickly and polices are pending and evolving, the predictability of the timing and size of electricity demand increases becomes more challenging

High Demand Forecast - Uncertainties

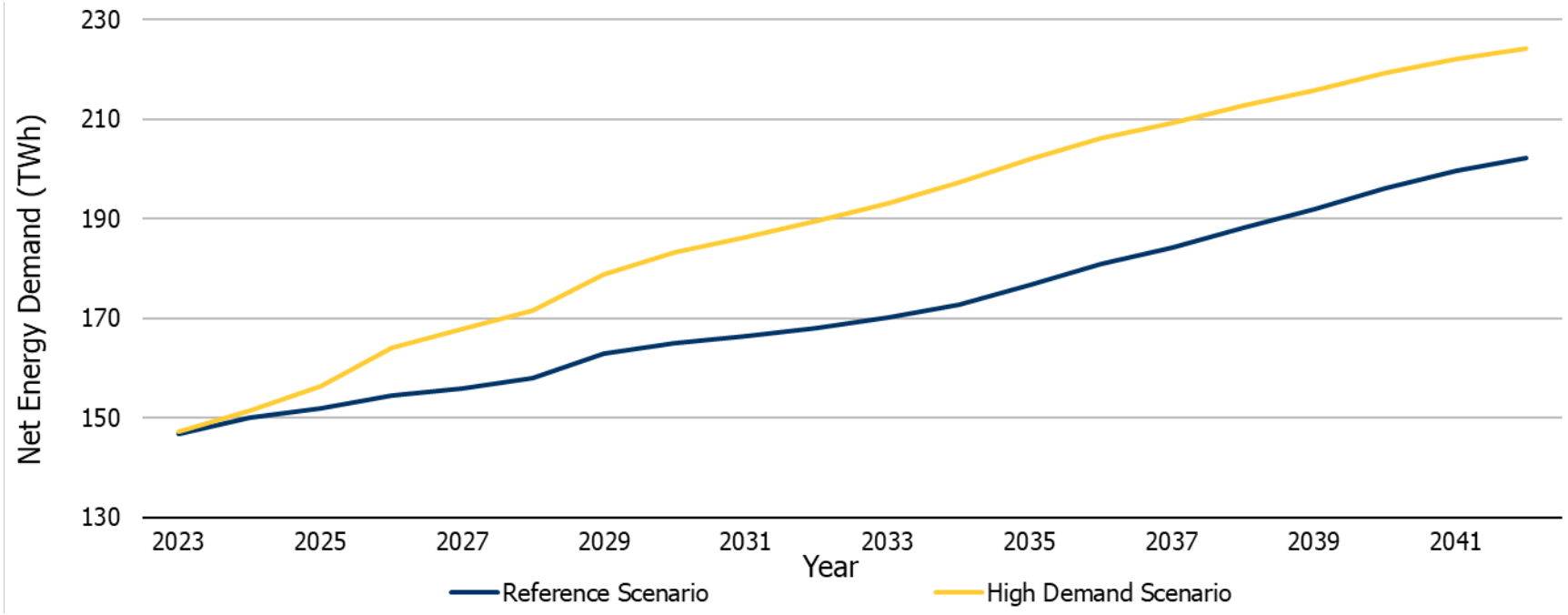
residential and **commercial** sector: space and water heating electrification, and increased work-from-home

agricultural sector - increased greenhouse demand

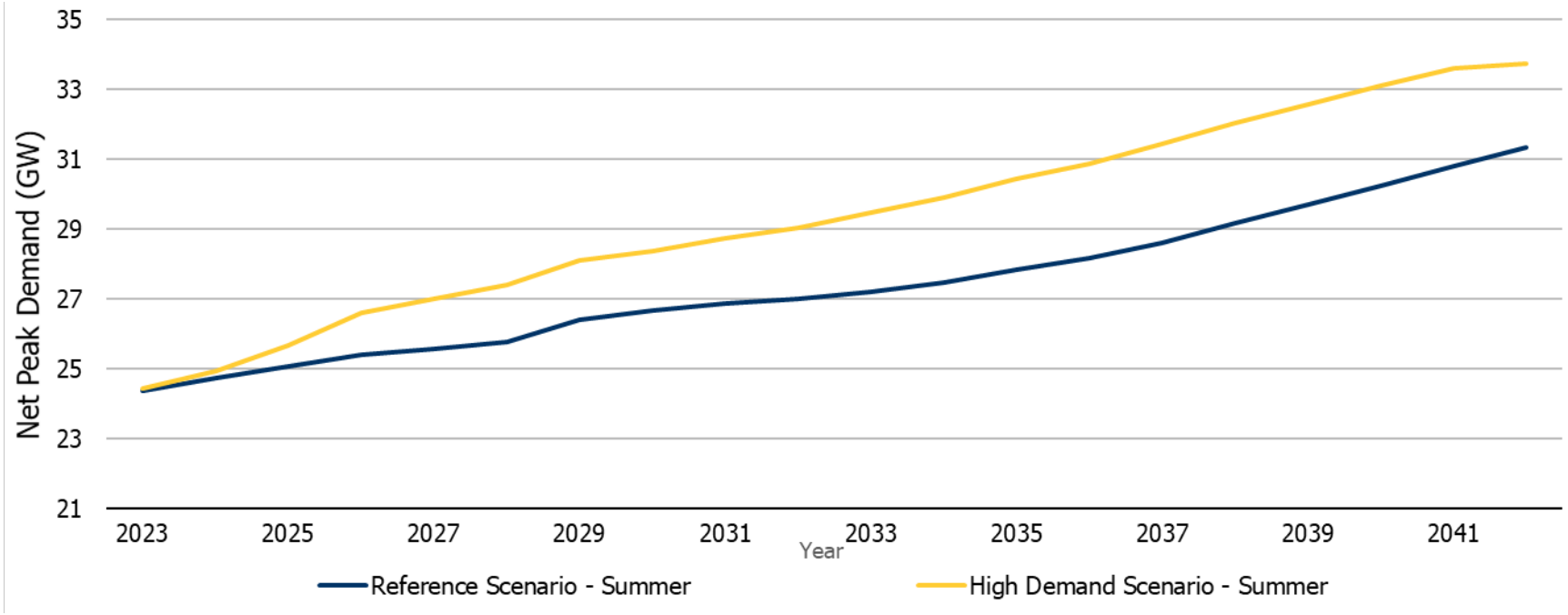
industrial sector: increased mining, primary metal and automobile (including supply chain) production demand

transportation electrification - earlier EV adoption and increased bus electricity demand

High Demand Forecast – Energy Demand

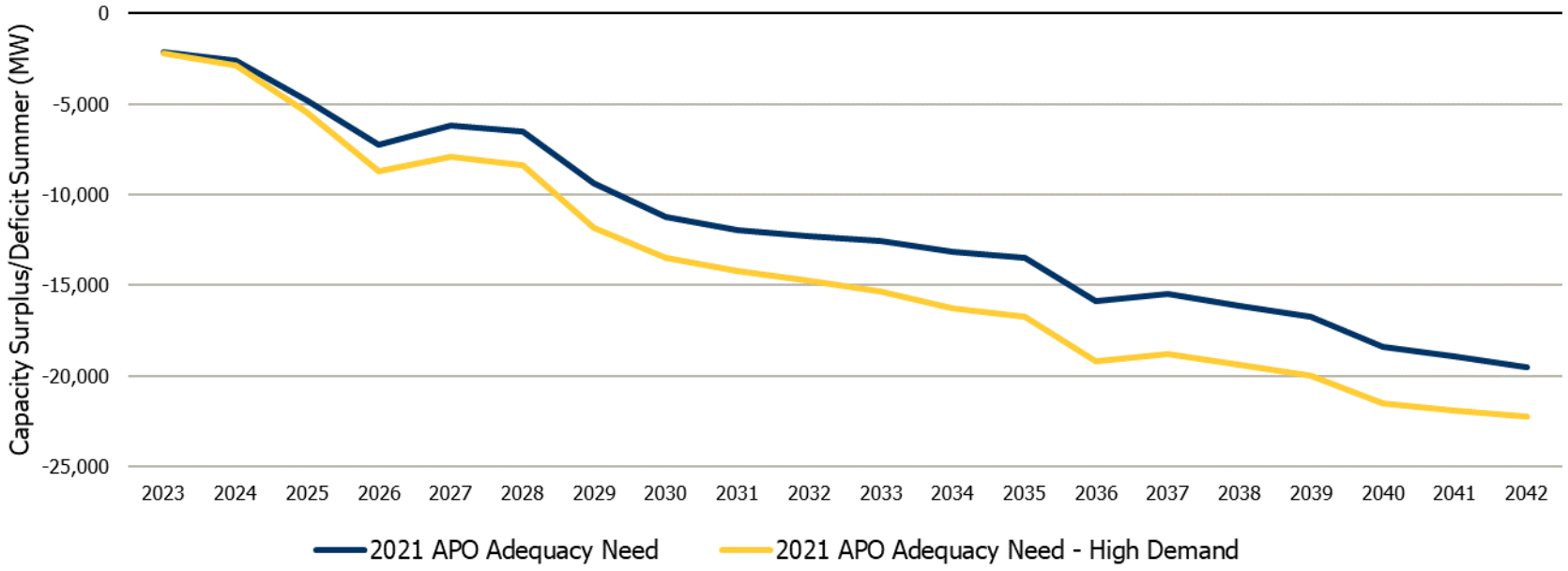


High Demand Forecast – Peak Demand



High Demand Forecast – Summer Capacity Surplus/Deficit,

without Continued Availability of Existing Resources



Conclusion

Conclusion – Key Messages

- **Capacity:** need emerges mid-decade and persists through the remainder of the outlook period. **Locational capacity needs** exist east of FETT, West of London, in Ottawa and in the Northeast. Planned actions to address capacity needs will be outlined in the 2022 Annual Acquisition Report (AAR).
- **Energy:** needs are forecast to begin mid-decade and increase sharply **without the continued availability** of existing resources post contract expiry. The need to provide continuous energy for several hours will inform actions in the 2022 AAR.

Next Steps

- Planning for **2022 APO** has begun – we welcome your feedback
  - Feedback form and instructions on IESO Stakeholder Engagement webpage
- Planned actions resulting from APO forecast will be outlined in the **2022 Annual Acquisition Report**
- In 2022 the IESO will be working on the **Zero Emissions Pathways** project, which will also build on APO data and analysis

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