SEPTEMBER 28, 2021

Peterborough to Kingston 2021 Integrated Regional Resource Plan (IRRP)

Public Webinar #3

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Agenda

1. IRRP Status Update
2. Demand Forecast and Transmission System Needs
3. Recommendation
    - Belleville
    - Kingston Area (Gardiner and Frontenac TS)
    - Bulk Needs
4. Engagement & Next Steps

Seeking Input

As you listen today, please consider the following questions to help guide your feedback after today's webinar:

- What information needs to be considered in these recommendations?
- Please provide your feedback to the proposed recommendations?
- How can the IRRP Working Group (including the IESO, Utilities Kingston, Lakefront Utilities and Hydro One) continue to engage with the community as these recommendations are implemented, or to help prepare for the next planning cycle

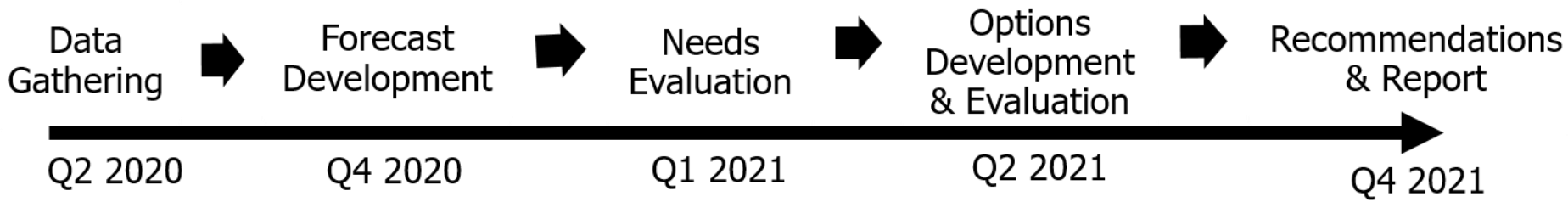
Please submit your written comments by October 19

using the feedback form by email to engagement@ieso.ca

IRRP Status Update

IRRP Status Update - Timeline

- IRRP began in Q2 2020, and is on track for completion by Q4 2021
  - Electricity demand forecast and needs have been determined, feasible options have been identified, and draft recommendations have been reviewed
  - The next steps are to finalize the recommendations and publish the report



Timeline - IRRP Status Update

- Engagement launched on Scoping Assessment – March 27, 2020
- Draft Scoping Assessment posted for public comment - April 2, 2020
- Public webinar on this regional plan and draft Scoping Assessment – April 26, 2020
- Final Scoping Assessment posted – May 4, 2020
- Local outreach to help inform engagement process – Q4 2020
- Technical Working Group Meetings to develop demand forecast, assess needs, and determine options – Q2 2020 to Q2 2021
- Public Webinar #1 on this region's forecast, needs, and engagement – March 25, 2021
- Public Webinar #2 on options for meeting this region's needs – July 28, 2021

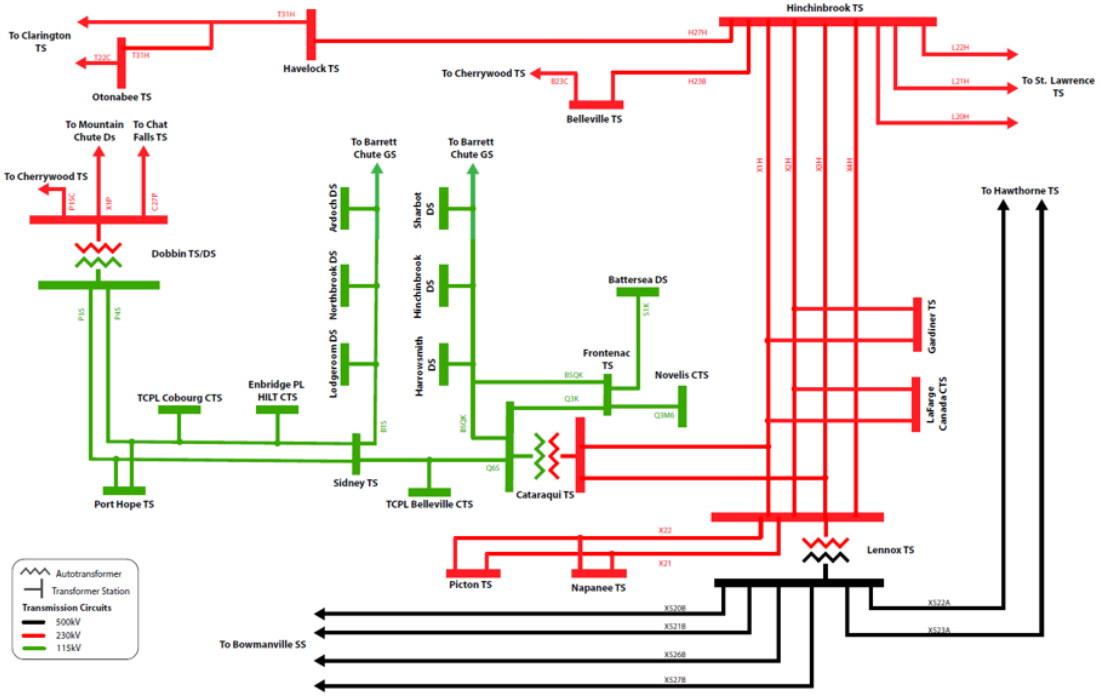
IRRP Status Update – Timeline con't

- Assessment of needs, options analysis for the region is complete
- Engagement on draft recommendations and preparation of final report is underway

Demand Forecast and Transmission System Needs

Demand Forecast - Major stations and circuits

- Transformer Stations (TS) of note: Belleville, Cataraqui, Dobbin, Gardiner, Frontenac, & Sidney
- Supply circuits of note: P15C, X2H, X4H, B5QK, P3S, P4S, Q3K, and Q6S



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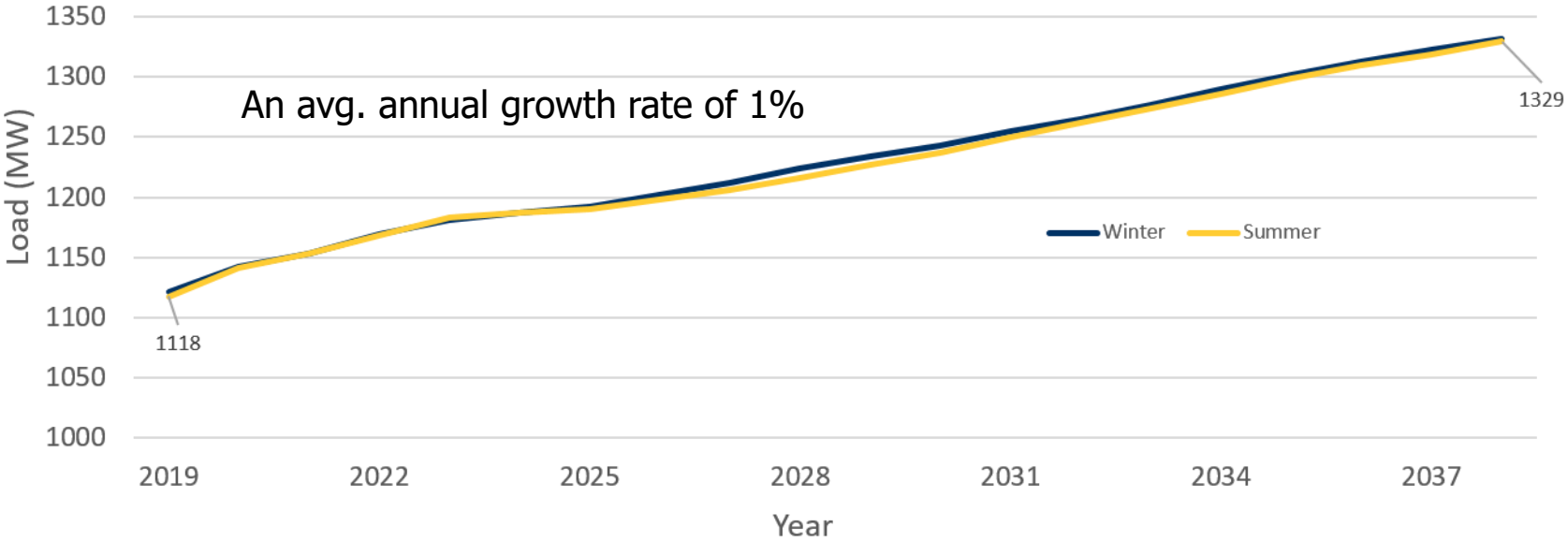
Demand Forecast - Reference Scenario

- As presented in the previous webinar, the **summer and winter** regional load forecast is:



- This is a coincident forecast, adjusted for extreme weather

Demand Forecast - Scenario Development

- Feedback received from previous webinars indicated a need to examine a high demand scenario that better reflects potential mid- to long-term electrification uptake for the region
- The Technical Working Group, in consultation with key customers, developed a high demand scenario
  - While the scenario is most impacted by the incorporation of potential impacts of electrification in the Kingston area (identified through stakeholder feedback), the rest of the region was also reviewed by the applicable LDCs to capture any relevant long-term growth plans or any currently foreseeable electrification impacts for their areas

Demand Forecast - Scenario Development cont'

Reference Forecast

- Load forecast which encompasses load growth due to proposed municipal growth and economic development along with firm/committed customer connections

High Growth Scenarios

- Various stakeholders have voiced concerns over forecast uncertainties associated with trends of electrification; there is uncertainty over proposed projects due to ongoing changes with regards to government policy, private company commitment and funding for future electrification efforts
- Given the load forecast uncertainties and the capacity constraints within the Kingston area, high growth forecasts have been developed to ensure that an adequate long-term plan for the City can be developed

Transmission System Needs - Summary

- The impact of high growth scenarios on station capacity needs is shown below
  - Frontenac TS need advances to year 2025 and 2022, high growth scenario 1 and 2 respectively
  - Gardiner TS need remains the same – today

Demand Forecast	Belleville TS Need Date	Frontenac TS Need Date	Gardiner TS DESN 1 Need Date
Reference	Today	2029	Today
High Growth 1	-	2025	Today
High Growth 2	-	2022	Today

Transmission System Needs – Summary cont'

- Three types of needs have been identified for the region: station capacity needs, local system supply needs, and bulk system supply needs
- Bulk system supply needs are focused on the 230 kV system and the options/ recommendations will be done through a Bulk System Planning study

	Needs	Location	Timeframe
1	Station Capacity	Belleville TS	Today
2	Station Capacity	Frontenac TS	Near/Mid term
3	Station Capacity	Gardiner TS DESN 1	Today
4	Local System Supply	115 kV area and B5QK circuit	Long term
5	Bulk System Supply	Dobbin to Sidney & Cataraqui Autos	Near term

 Note: Near term 1-5 years, mid term 6-10, long term > 10 years

Recommendation - Belleville TS

Recommendation – Belleville TS

- At Belleville TS, there is an existing transformer station capacity need
- The two wires options considered were:
  1. The addition of a third transformer & station bus at Belleville TS, or
  2. A new station at Belleville TS
- Distribution load transfers are not an option; lack of adjacent stations
- Non-wires options were screened out due to size and timing of the need (i.e. the need exists today)

Recommendation - Belleville TS cont’

Recommendation is Option 2: Build a new station at Belleville TS

- Since the cost estimates of the two options are very similar, building a transformer station is preferable due to higher future station capacity and better outage performance
- Installing a second transformer station at Belleville TS will resolve the need till the end of the planning horizon (20 years)
- Two 30MX capacitor banks will also be required to support the voltage of new load
- The station cost is estimated to be $35-40M, including two capacitor banks

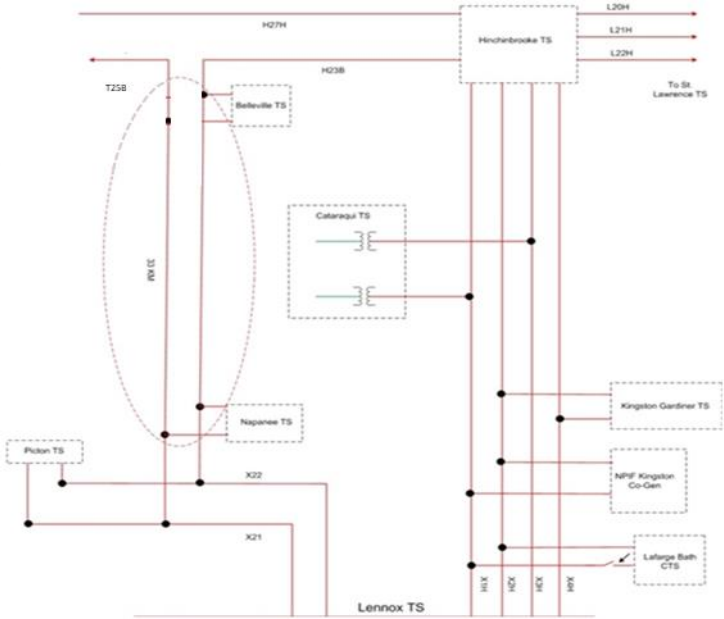
Recommendation - Belleville TS long-term growth

Growth beyond 20 years: The addition of new supply lines maybe required to support load growth beyond 20 years and to fully utilize the transformer station

In the next regional planning cycle:

1. Assess whether a supply line re-enforcement to Belleville is required, which may cost ~$140M to $145M and require a review to see if/how the upstream bulk system is impacted

2. Evaluate how energy efficiency or other non-wires alternatives could delay the need for a new line and therefore delay any additional costs



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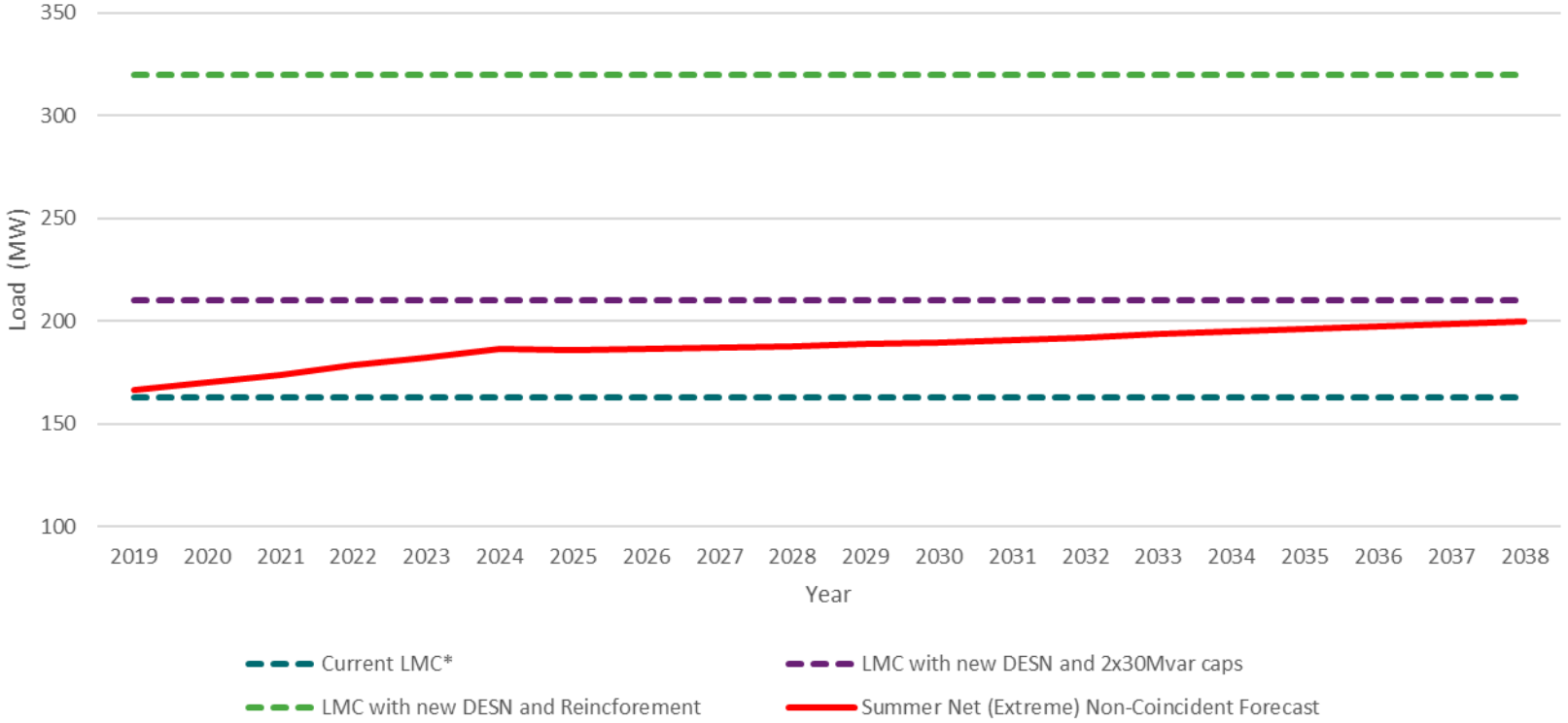
Recommendation - Belleville TS



*Current Load Meeting Capability is limited by transformer ratings, to fully achieve this level some additional reactive support is needed

Recommendation – Kingston Area (Gardiner and Frontenac TS)

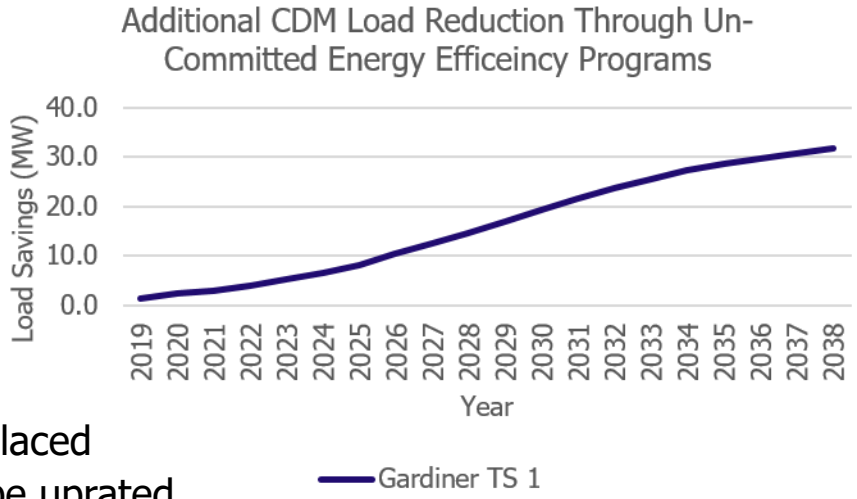
Options - Frontenac & Gardiner TS

- In order to address this need, the following options being considered are:
  1. Distribution load transfers - Permanent load transfers to an available station
  2. Increase capacity of the existing station(s) – through asset refurbishment/uprates
  3. A new station (new or existing site)
  4. Non-wires solutions (energy efficiency or local resources)
- A combination of options will be required in order to meet needs and provide sufficient flexibility to meet potential long-term growth

Recommendation – Gardiner TS 1 – Non Wires Alternatives

Implementing Non-Wires Alternatives in the area to reduce demand

- Additional Conservation Demand Management (CDM) through Energy Efficiency is presented on the right; the cost of it is $89M
- Gardiner TS need is today and it cannot be resolved through CDM due to time involved in implementing it
- Furthermore, the existing transformers need to be replaced regardless due to its end of life, at which point it will be uprated. Therefore, no savings can be achieved through pursuing other options. Consequently, CDM is not recommended
- Other non-wires options were screened out due to large size and timing of the need being today



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Recommendation – Gardiner TS 1

- Permanent load transfers from Gardiner TS 1 to Gardiner TS 2: ~$2M
- Upgrade the Gardiner TS 1, which is at its End of Life (EOL): ~$0M
  - Negligible advancement cost (~0M) as the equipment needs to be replaced and is already in Hydro One's work plan
- Total cost: ~$2M

Action	2038 Reference (MW)	2038 High growth (MW)	LTR (MW)	Load Over LTR Reference (MW)	Load Over LTR High growth (MW)
Current State	170	178	125	45	53
11MW Load Transfer	159	167	125	34	42
Uprate of Transformers	159	167	160	-1	7
11MW Load Transfer/New Breaker Position at Gardner 2	148	156	160	-12	-4

Note: LTR – Long-term Emergency Rating
(capability of transformers under an outage event)

Options – Frontenac TS

- The reference scenario indicates a capacity need for the central and eastern Kingston area in the mid term while higher growth scenarios show a need in the near term
- Due to this risk and uncertainty, several wires alternatives were assessed:
    - 10 MW load transfer from Frontenac TS to Gardiner TS 2
    - New transformer station connected to 115 kV system
    - New transformer station connected to 230 kV system
- Non-wires alternatives were also assessed

Options – Frontenac TS

A 10 MW load transfer from Frontenac TS to Gardiner 2 TS was explored and ultimately found to be unfavorable as it:

- Does not meet high growth forecasts
- Reduces distribution system flexibility as large scale, temporary load transfers may no longer be possible
- Net Present Value calculations indicate load transfer is only economical for the reference forecast

Options – Frontenac TS cont'

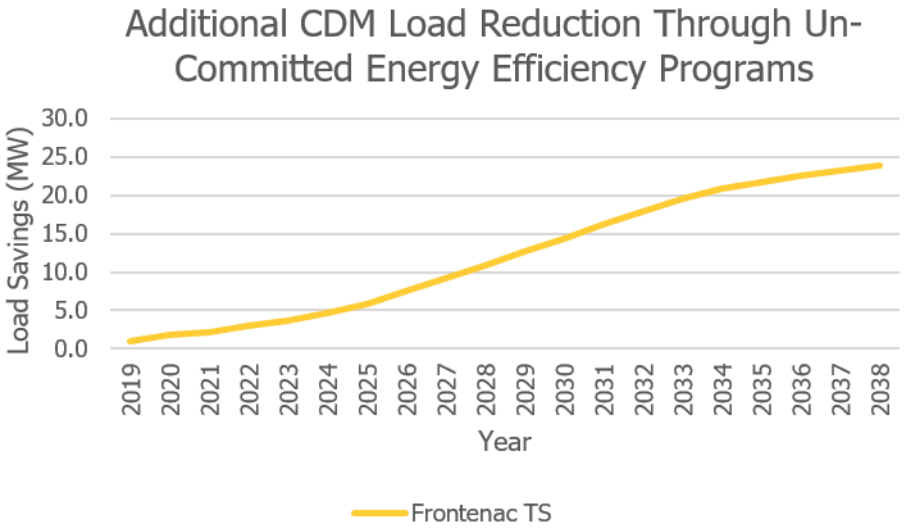
	115 kV Station	230 kV Station
Capacity	Lines B5QK and Q3K limiting the capacity on 115 kV system Capacity limitation at Cataraqui Auto transformers	Proposal to carry out in two phases reduces cost but also reliability Fully utilizes new transformer station capacity*
Connection & Proximity	Connected to B5QK, Q3K Near existing station, and closer to load growth	Connected to X2H, X4H – West of UK service area Not optimal but compromise for both utilities
Cost	Line upgrade B5QK, Q3K ($77M), New Station ($30M), Total: $107M Cataraqui Auto transformers upgrade ($?)*	Does not require line extension, New Station ($36.5M) Total: $36.5M

*pending a further bulk study

Options – Frontenac TS – Non Wires Alternatives

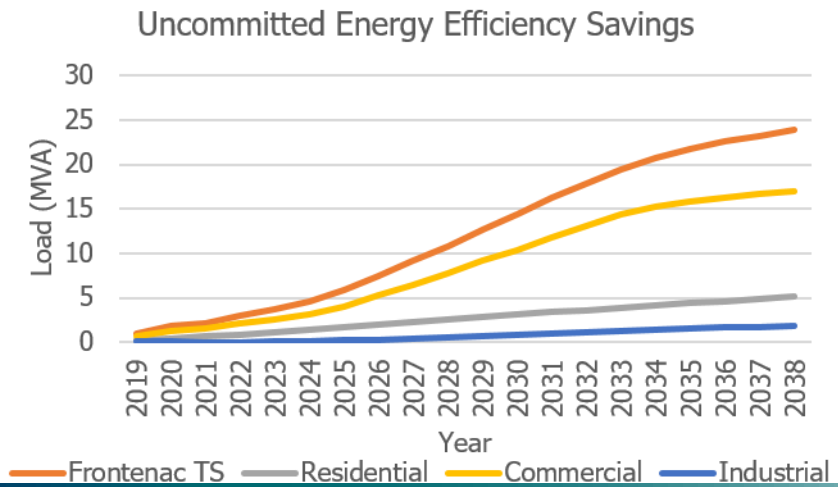
Implementing Non Wires Alternatives in the area to reduce demand

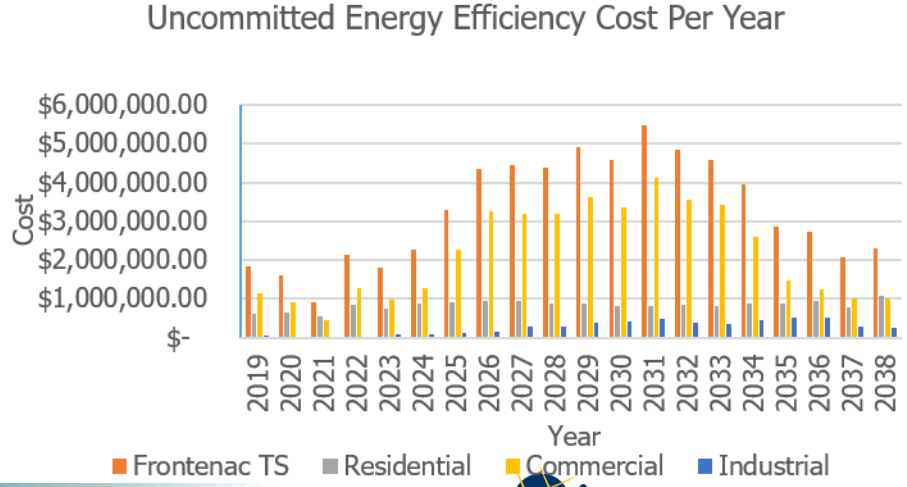
- Additional Conservation Demand Management (CDM) through Energy Efficiency is presented on the right.
- The CDM identified is cost-effective on a system basis at an overall cost of $65M
- Targeting CDM can defer needs based on available forecasts; clarity is needed on implementation mechanism and allocation of costs



Options – Frontenac TS – Non Wires Alternatives

- Preliminary analysis indicates a substantial amount of uncommitted energy efficiency potential
- Significant efforts have already been made through past CDM programs to target cost effective savings in this area
- IESO should continue to work with Technical Working Group members to refine analysis and explore opportunities to target additional savings opportunities





Options – Frontenac TS – Non Wires Alternatives cont'

- Single Cycle Gas Turbine and battery storage alternatives were assessed for all needs
- For the reference forecast, battery storage could potentially defer the need, thereby postponing building a new transformer station
- However, for a higher growth forecast, battery storage is not an economic or a feasible solution when compared to building a transformer station; nevertheless it could potentially delay the need to build a transformer station

Recommendation – Frontenac TS

Benefits of connecting new Transformer Station to 230 kV system:

- Addresses the long term reference forecast and high growth scenarios
- Does not require upstream transmission system upgrades
- Connecting to 230 kV system is preferred as it provides additional capacity and preserves capacity on 115 kV system for future growth

Recommendation:

- Load growth should be closely monitored by the transmitter and applicable LDCs
- A new station on the 230 kV system is recommended to meet the area's needs
- The timing and siting of the station to be coordinated between the transmitter and LDCs
- Explore implementation/cost allocation for cost-effective CDM/storage to delay the need, while in tandem develop plans for a new transformer station

Recommendation/Path Forward – Supply Needs with Bulk Planning Linkages

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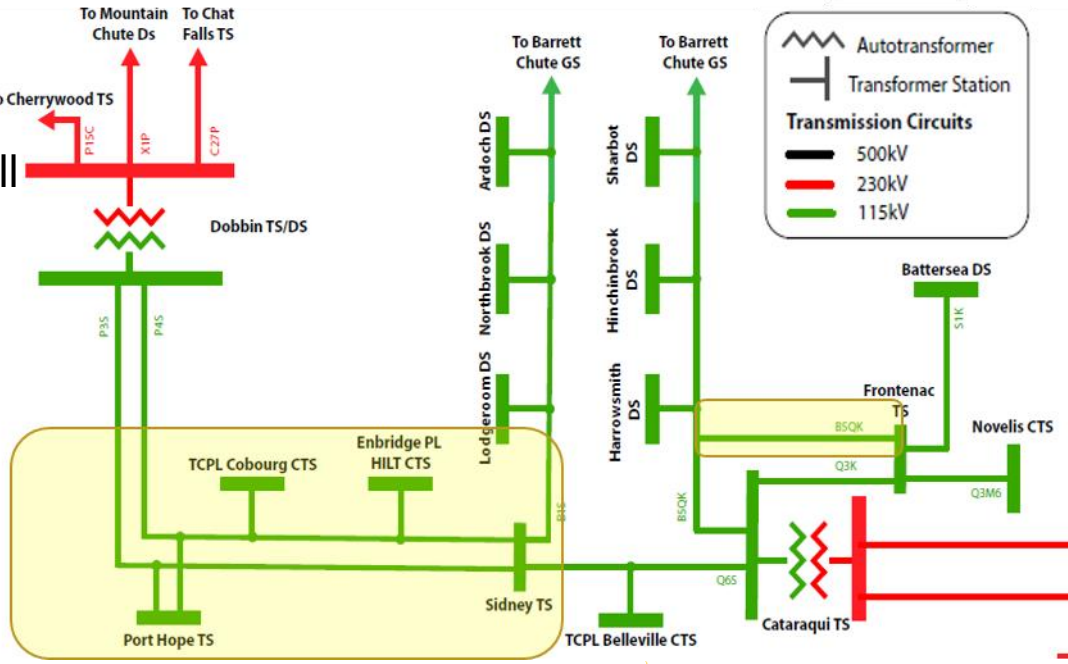
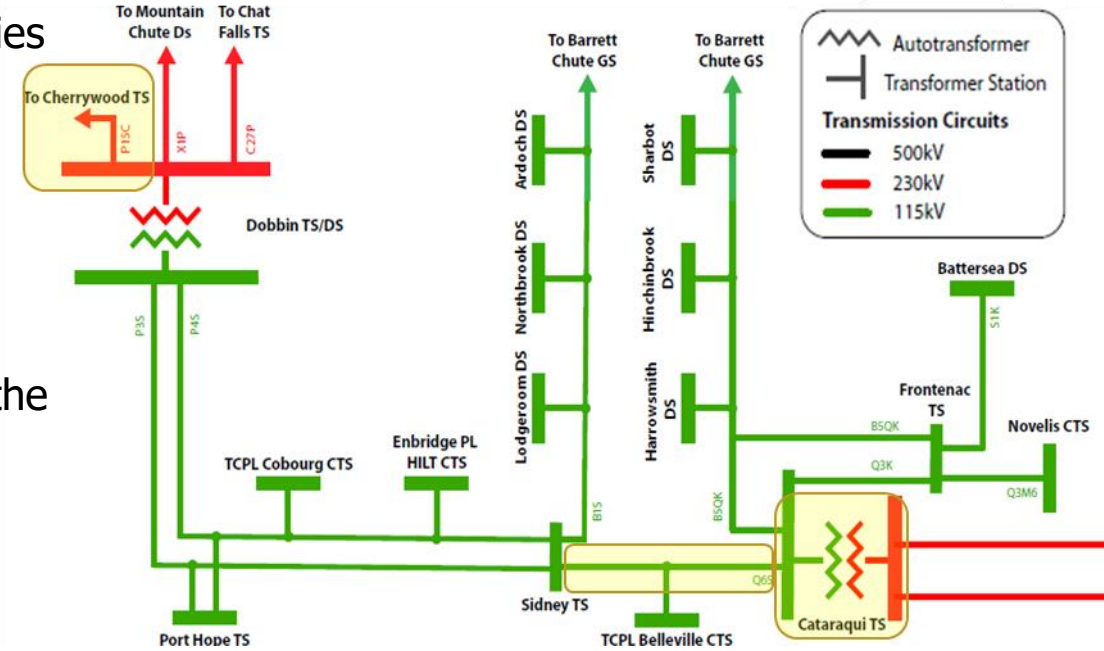
- There are also long-term needs in the 115 kV pocket and B5QK circuit
  - The highlighted 115 kV area can have voltage issues for the loss of P15C & C27P circuits, which will be reviewed through a bulk study
  - B5QK circuit (~1km) can be overloaded, therefore, the load growth will be monitored



Recommendation/Path Forward – Supply Needs with Bulk Planning Linkages

- There are near-term Bulk system needs at Dobbin to Sidney & Cataraqui Autos
  - P15C and Q6S are critical supplies circuits to the Dobbin to Sidney Load; losing one will result in a thermal overload on the other
  - Losing one of the Cataraqui autotransformers will overload the remaining autotransformer



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Recommendation/Path Forward – Supply Needs with Bulk Planning Linkages cont'

115 kV Area and B5QK Circuit

- Working group to monitor and re-assess in the next planning cycle

Cataraqui Auto-Transformers

- A cost effective way to increase the autotransformer thermal ratings is to upgrade the transformer secondary cables, increasing the LTR from 265 MVA to 300 MVA
- Outcome of Gatineau corridor end of life study could reduce or eliminate this need
- Solution scope should be confirmed by the IESO as part of a future bulk planning study for the Lennox/St Lawrence area

Dobbin to Sidney

- All options under consideration in the IESO's ongoing Gatineau corridor bulk planning study would address supply needs in the Dobbin to Sidney pocket

Engagement & Next Steps

Your Feedback is Important

As you prepare your feedback, consider the following questions to guide your feedback on the options analysis presented for the Peterborough to Kingston IRRP:

- What information needs to be considered in these recommendations?
- Please provide your feedback to the proposed recommendations?
- How can the IRRP Working Group (including the IESO, Utilities Kingston, Lakefront Utilities and Hydro One) continue to engage with the community as these recommendations are implemented, or to help prepare for the next planning cycle

Please submit your written comments by October 19
using the feedback form by email to engagement@ieso.ca

Next Steps

Item	Date	Description
IRRP ends	November 4, 2021	• Report published

Thank You

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