

# Sheffield-Highgate Export Interface

## SHEI

vermont electric power company



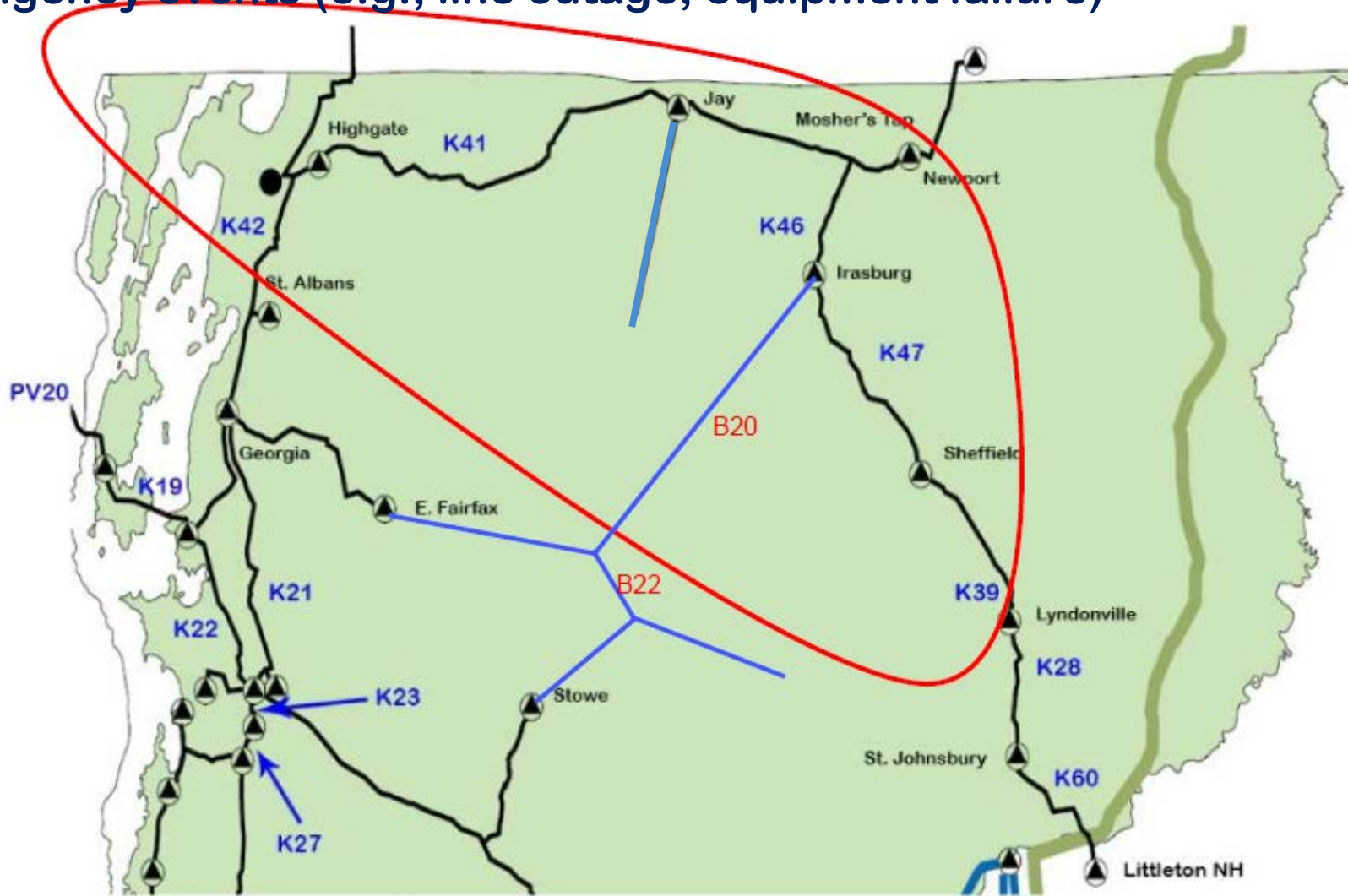
PUC Public Forum  
January 11, 2018

# How did we get here?

- Generation has grown over the last few years
- Sheffield-Highgate Export Interface was created in 2013 by ISO New England to ensure system capacity is not exceeded in anticipation of the worst/limiting transmission line outage
- Two types of interface limits: **voltage** and **thermal**
  - SHEI limit is currently based on a **voltage** constraint, i.e., a voltage limit
  - **Thermal limit** is presently slightly less restrictive than voltage limit in summer; much less restrictive in winter
- Limits are predetermined by ISO-NE off-line analyses
- Limits vary automatically in real time based on actual system conditions, such as load, generation, equipment status
- ISO-NE maintains interface flows below the limits by managing generation outputs through Do-Not-Exceed (DNE) signals to individual generators that participate in ISO-NE markets

# Where is the SHEI?

ISO-NE determines SHEI limits at or below which the system can withstand potential system contingency events (e.g., line outage, equipment failure)



# Flow over SHEI equals total generation minus total load

With due regard to equipment status and the negative effects of some generators

- Total load is between 20 MW and 60 MW
  - Average load is 35 MW
- Total generation is 430 MW (all at maximum potential output)
  - Including Highgate 225 MW HVdc converter – largest resource within SHEI
    - Highgate typically runs at maximum capacity almost 24 hours a day

Generation dispatchable by ISO-NE		Generation not dispatchable by ISO-NE	
Utility-scale wind	105 MW	Landfill methane	8 MW
Utility-scale hydro	35 MW	Total solar PV (small & large)	11 MW
Utility-scale thermal (rarely runs)	45 MW	Other standard offer (hydro, farm methane)	3 MW

- Higher SHEI generation from October to May
  - Spring season is more challenging due to higher hydro and lower loads
    - Growing energy efficiency and behind-the-meter/non-dispatchable generation aggravating constraints

# Generation curtailment process

- ISO-NE real time monitoring observes that export level is about to exceed predetermined interface limit
- Dispatchable generators\* receive a Do-Not-Exceed (DNE) limit (maximum allowed output)
  - No impact if DNE limit is above a generator's real time capability
- Curtailment priority is based on
  - Energy Offer Price
  - Distribution factor
  - Dispatch range (Ecomin/Ecomax)

*\*generators that participate in NE regional market*



# DNE highlights

- Software-based algorithms
- Electronic communications
- DNE instruction (dispatch limit) sent to each dispatchable generator at least every 5 minutes
- Wind and hydro can set Locational Marginal Price (LMP) following institution of DNE on 5/25/2016
- Generators can offer as low as -\$150 per MWh (pay to generate)
- Behind-the-meter resources (e.g., net metering, standard offer) and resources with a PPA are essentially outside the markets, but effect interface flow and market prices

# SHEI is not a load-serving reliability problem eligible for regional pool transmission funding support

- System concerns can be prevented by backing down generation based on economics and other market rules
- Solutions not eligible for traditional regional cost sharing
- Modest transmission upgrades or non-transmission options could mitigate most current SHEI congestion in the short term (current generation sources loads)
  - Reactive devices; operational ambient-based ratings; B-20 line upgrade; energy storage
- Robust, long-term solutions that specifically address SHEI constraints likely to be complex and possibly costly
  - New transmission lines; new tools (e.g., storage, demand management, strategic electrification); hybrid solutions
- Collective problem that will require multiple stakeholders' engagement

# SHEI information posted on VSPC website—public

- July 12, 2017 — SHEI study kickoff and information sharing  
<https://www.vermontspc.com/grid-planning/shei-info>  
[https://www.vermontspc.com/library/document/download/5810/20170712\\_SHEI\\_Preso\\_MtgVersion.pdf](https://www.vermontspc.com/library/document/download/5810/20170712_SHEI_Preso_MtgVersion.pdf)
- September 1, 2017 — study update  
<https://www.vermontspc.com/library/document/download/5894/SHEI%20Study%20SeptemberUpdate.pdf>
- September 11, 2017 — study update makeup session  
<https://www.vermontspc.com/library/document/download/5894/SHEI%20Study%20SeptemberUpdate.pdf>
- October 18, 2017 — final study update  
<https://www.vermontspc.com/library/document/download/5894/SHEI%20Study%20SeptemberUpdate.pdf>
- Other information also available at  
<https://www.vermontspc.com/grid-planning/shei-info>



# Sheffield-Highgate Export Interface study summary

- Hired EIG to study 17 options and 45 combinations, including...
  - Reactive support, subtransmission and transmission upgrades, and energy storage
- Used VSPC framework to facilitate an open discussion of concerns and solutions
- Key results
  - Logical to address voltage concerns first (B20/B22, SC, AVR)
  - K42 line could be key for relieving thermal concerns
    - Implement ambient-based ratings (static or dynamic)
    - Reconductor as part of asset condition project
- Tensions
  - Short-term and quick solution versus long-term solution with implementation challenges
  - No pre-established mechanism for stakeholder engagement nor cost allocation of economic upgrades
  - Concern over follow on projects benefitting from the solutions
- Stakeholders will select preferred option(s)
- VELCO will provide support as needed

# What's next?

- Additional analysis underway by affected distribution utilities
- Estimators will be convening to ensure comparable costing
- Considering ongoing “working group”
- Continuing public information through VSPC and VSPC website