Winter Fuel Security

Public Service Department
House Energy & Technology Committee
January 7, 2022

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Regional context

- Limited gas pipeline capacity and residential heating demand limit availability of natural gas generators
- ISO-NE managed extended cold snaps in ‘14 and ‘17-’18
- Temporary ISO-NE measures planned, but not currently in place
- Emergency procedures ISO-NE OP-4 to prevent load shedding, OP-7 to manage it

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Vermont’s role in upstream energy assurance - preparedness

- Joint Utilities and State Agencies Emergency Preparedness Group & State Emergency Operations Center
- VELCO directs DUs based on ISO load-shedding guidance
- Some utilities may not be able to rotate outages
- Ongoing discussion with other NE states through NESCOE and NECPUC and with ISO-NE

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ISO-NE Operating Procedure 4

Action 1: Implement Power Caution, begin to allow depletion of 30-minute reserves	**Action 7:** Request resources without a CSO to provide energy
Action 2: Declare Energy Emergency Alert (EEA) Level 1	**Action 8:** Implement additional voltage reduction
Action 3: Request voluntary load curtailment of Market Participants' facilities	**Action 9:** Request transmission customer generation and voluntary C&I load curtailment
Action 4: Implement Power Watch	**Action 10:** Implement Power Warning and issue urgent public appeal for voluntary conservation
Action 5: Schedule Emergency Energy Transactions	**Action 11:** Request state governors' support for ISO appeals for conservation
Action 6: Declare Energy Emergency Alert (EEA) Level 2, implement voltage reduction	

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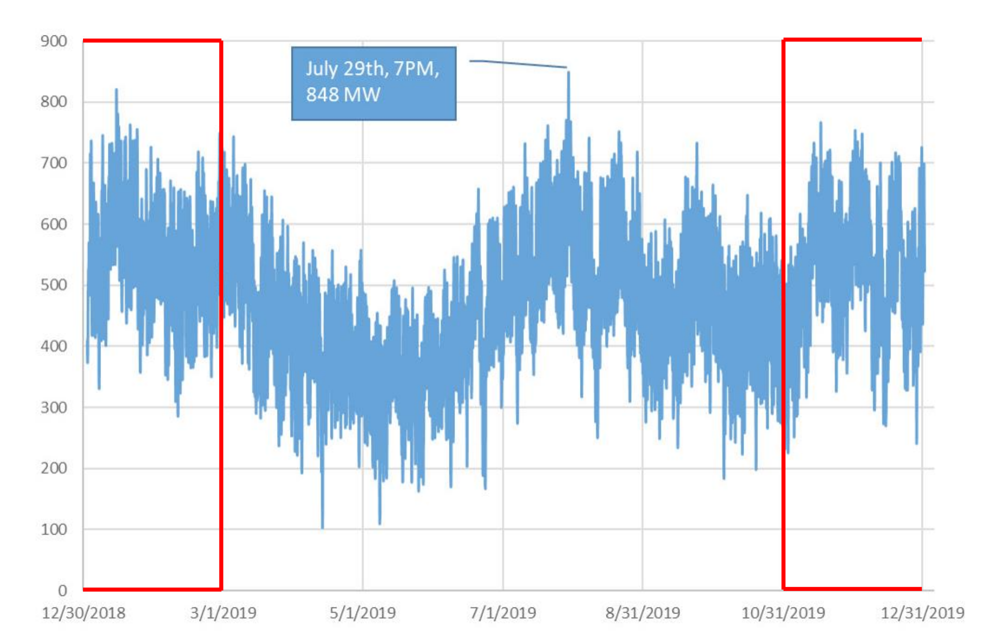
“Upstream” energy assurance

- Vermont is able to depend on imported electricity
- Some types of generators more helpful in winter than others
- Short cold snap impact versus long cold snap impact



2019 Vermont hourly power imports

Source: VELCO 2021 Long-Range Transmission Plan
https://www.velco.com/assets/documents/2021%20VLRTP%20to%20PUC_FINAL.pdf

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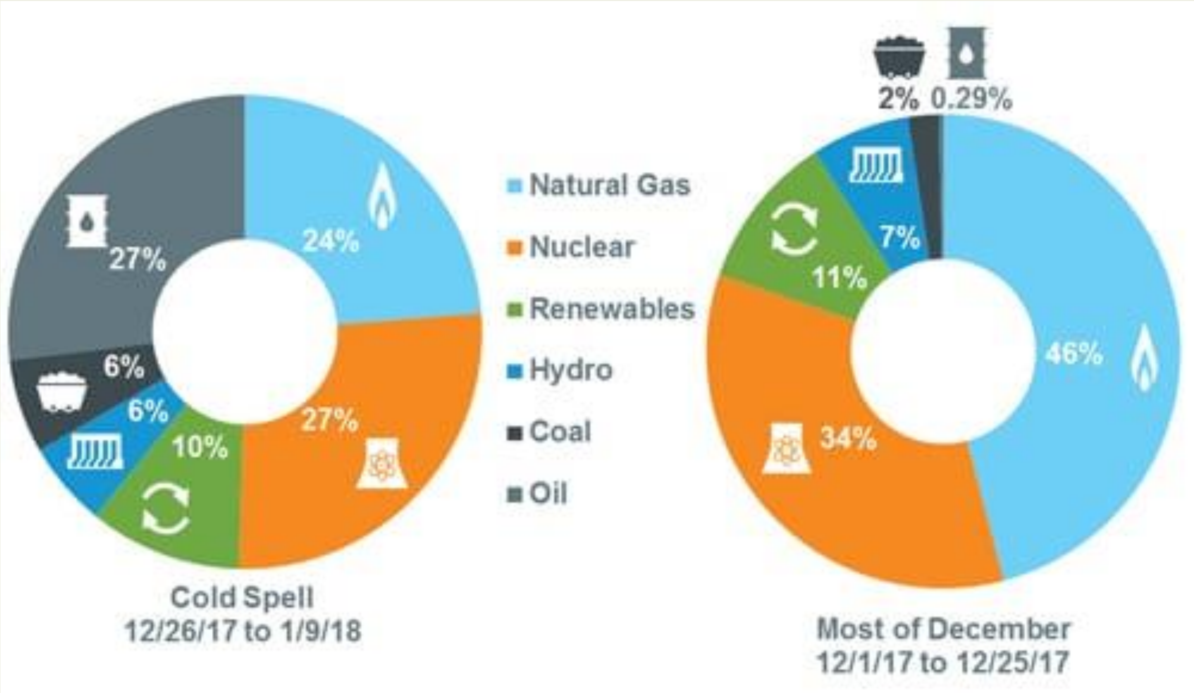
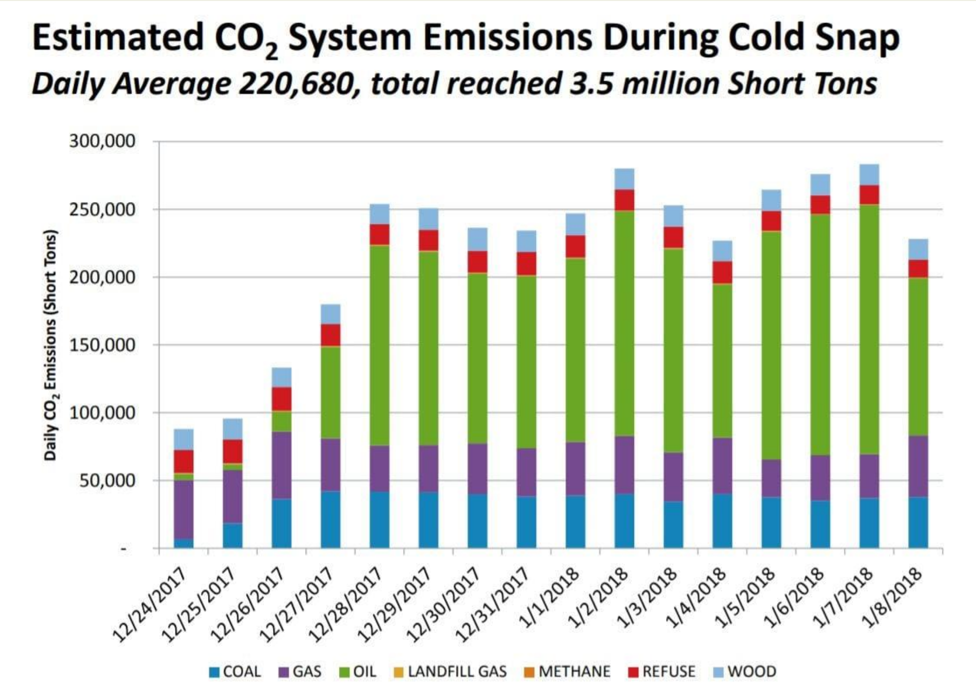
Regional fuel mix in cold snaps





Source: ISO New England, April 25, 2018:
https://isonewswire.com/2018/04/25/winter-2017-2018-recap-historic-cold-snap-reinforces-findings-in-operational-fuel-security-analysis/

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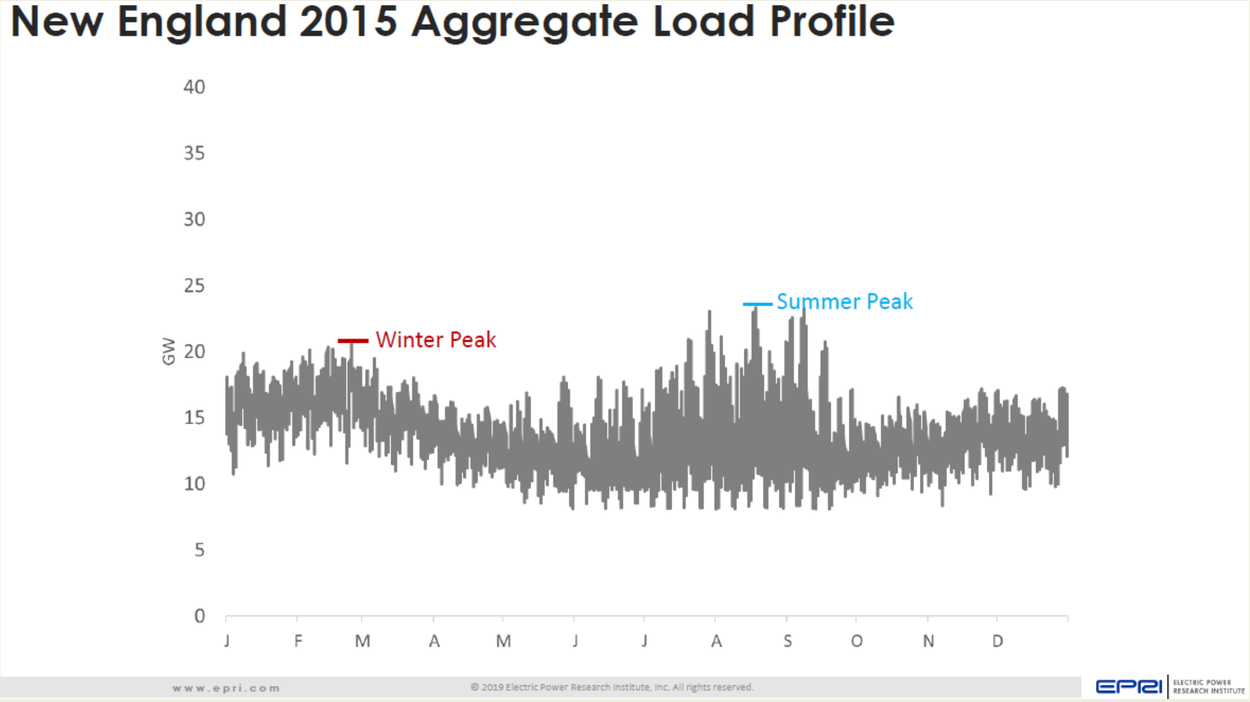
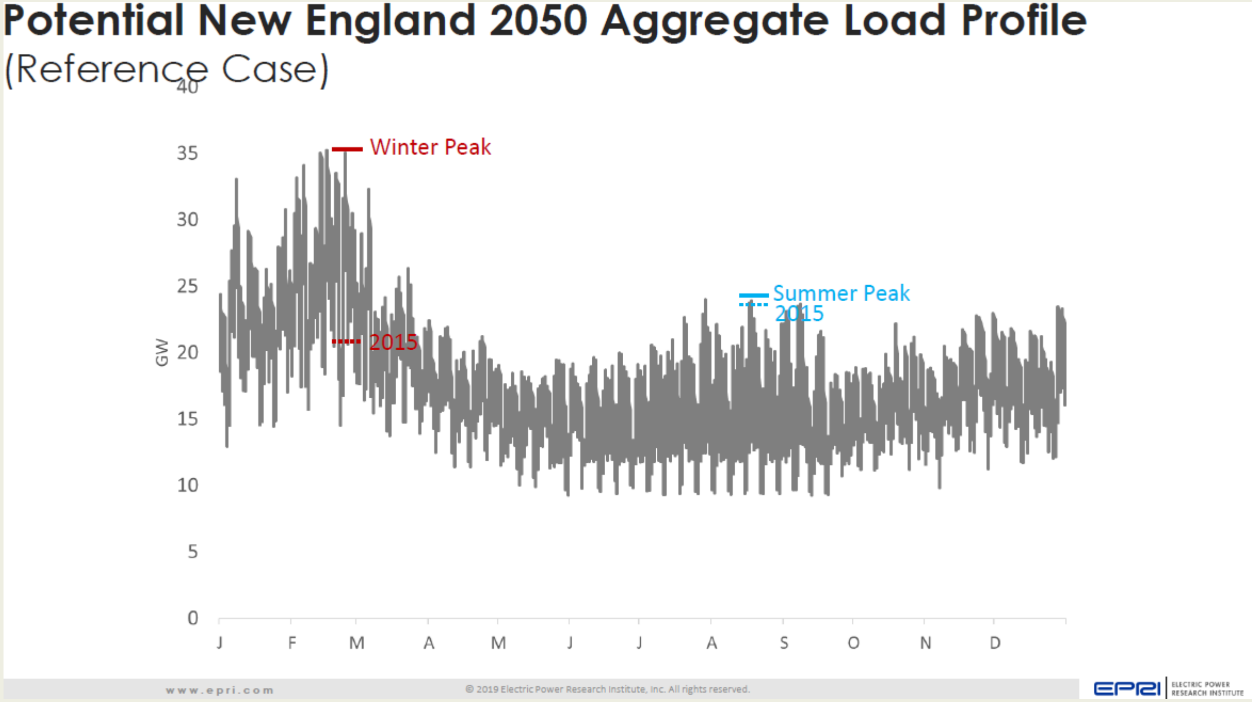
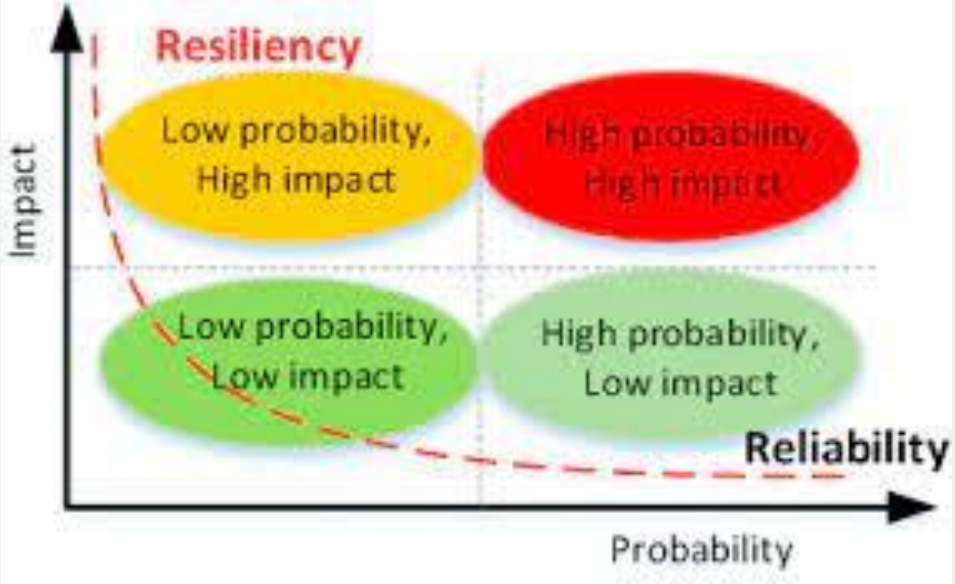
Seasonal loads with electrification





Source: Aidan Tuohy, EPRI: ISO-NE Grid Transformation Day, May 23, 2019: https://www.iso-ne.com/static-assets/documents/2019/05/a2_grid_transformation_solving_technical_challenges_tuohy_epri.pdf

Resilience planning



Metrics for Resilience in Theory and Practice (Joe Eto, LBNL, 2018)

- What resilience **threat(s)** is the focus?
- What **aspect(s)** of the threat(s) is of concern?
  - *Can we measure the extent to which these concerns are or will be addressed? How will we know if we have made things better or if they are getting worse (in the absence of an actual threat)*
- What is our **design standard** for addressing these concerns?
- What are the pros and cons of available **alternatives** for meeting these standards?
  - *What is the lowest cost option?*
  - *What, if any, additional benefits might they provide? What are these worth?*
  - *Are there options for recourse?*

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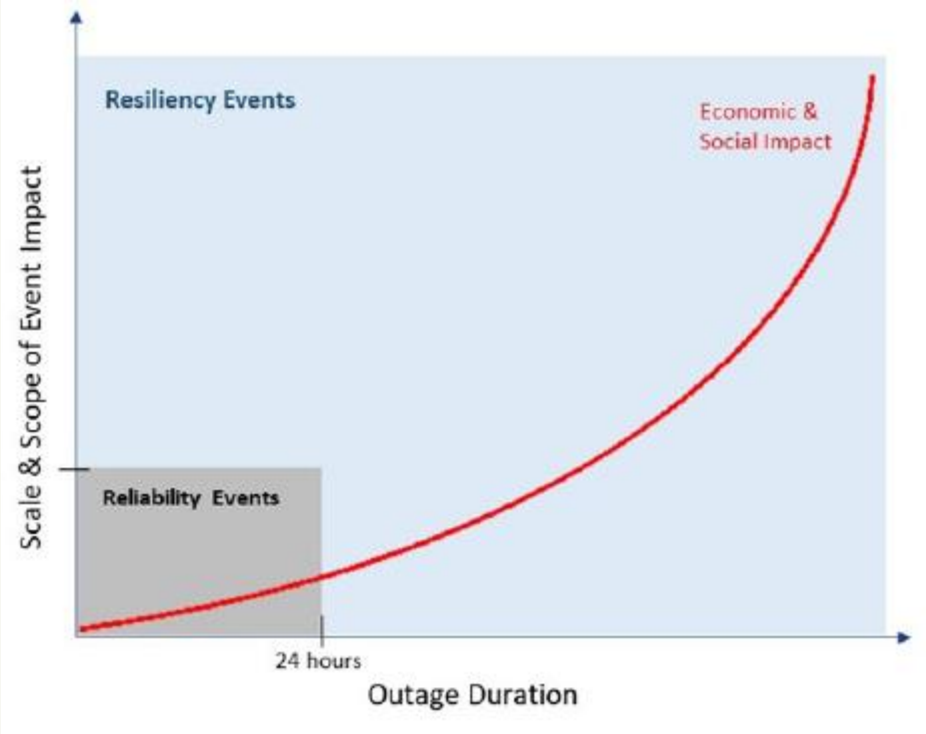
Reliability & resilience domains



https://gridarchitecture.pnnl.gov/media/Modern-Distribution-Grid_Volume_IV_v1_0_draft.pdf, p. 30

https://gridarchitecture.pnnl.gov/media/Modern-Distribution-Grid_Volume_IV_v1_0_draft.pdf, p. 38

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“Downstream” energy infrastructure resilience

Potential climate resilience **threats:**

- Acute shocks
  - Flooding
  - Ice storms
  - Heavy wet snow
  - Extreme wind, Gradient Wind
- Chronic stressors
  - Prolonged cold snaps
  - Prolonged heat waves

Potential climate resilience **solutions:**

- Vegetation management (maintenance vs widening, widening being resilience)
- Strategic location of utility infrastructure (e.g., line relocation, undergrounding, elevating resources)
- Storm-hardening construction: larger class poles, covered wire, spacer cable, self-supporting cable
- Self-healing systems
- Storage
- Microgrids

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Public Service Department advocacy

- Efficiency, flexible load management, storage
- System & DER visibility, communications, control
- Policy & program design – particularly seeking and valuing time-based attributes (daily, seasonal)
- Strategic system investments

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CEP & CAP energy infrastructure resilience strategies

A. Create a policy, planning and organizational foundation to support effective investments in infrastructure resilience.

B. Public, private, and nonprofit entities should be prepared to respond and recover quickly to disruptions caused by severe weather and other climate change threats.

C. Increase the resilience of critical infrastructure to severe weather and other climate change threats by reducing vulnerabilities of specific facilities.

D. Increase the resilience of critical infrastructure to severe weather and other climate change threats by improving system efficiency, reliability, and redundancies.

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Climate Plan recommendations

c. Seek federal stimulus (ARPA), infrastructure bill, and other non-ratepayer funding to defray costs of utility resilience upgrades that exceed benefits to ratepayers, such as:

- Ubiquitous communications networks that enable full utilization and participation of distributed energy resources in an interactive grid.
- Resilience Zones: batteries installed at or near critical facilities, potentially paired with solar (and/or small wind) and with a microgrid/islanding where possible, to allow them to continue to operate in the event of extended disruptions to electric service.
- Strategic upgrades to substations, distribution, and transmission capacity across the Vermont grid needed to enable the state's renewable and electrification goals, after first exploring feasibility of any lower-cost options, e.g. flexible load management, curtailment, and storage.
- Emerging non-wires technologies that address major challenges system resilience (e.g. long-duration outages).

Questions?

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Projected Vermont Winter Peak Load and Component Forecasts