Eversource's Resilience & Climate Adaptation Plan

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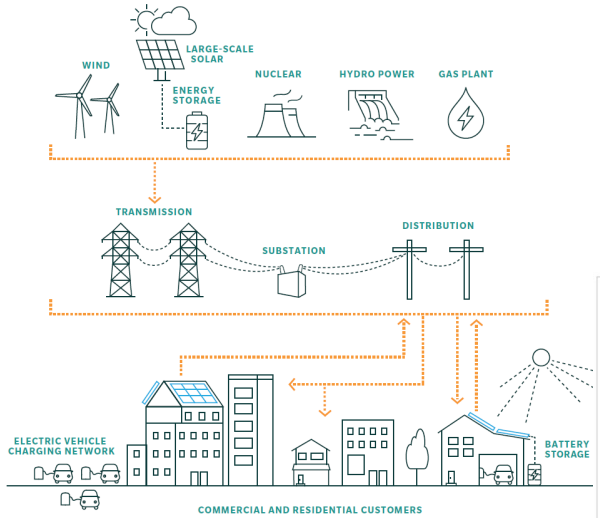
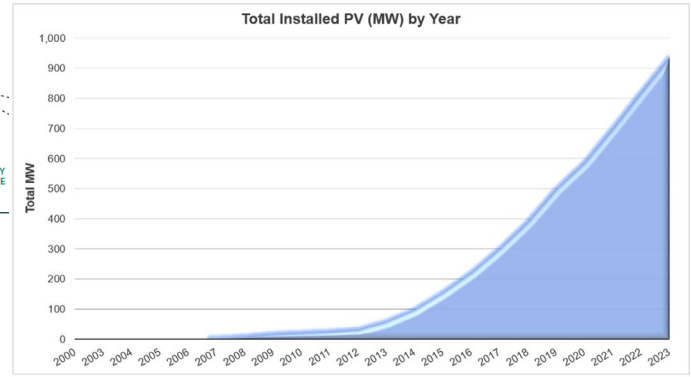
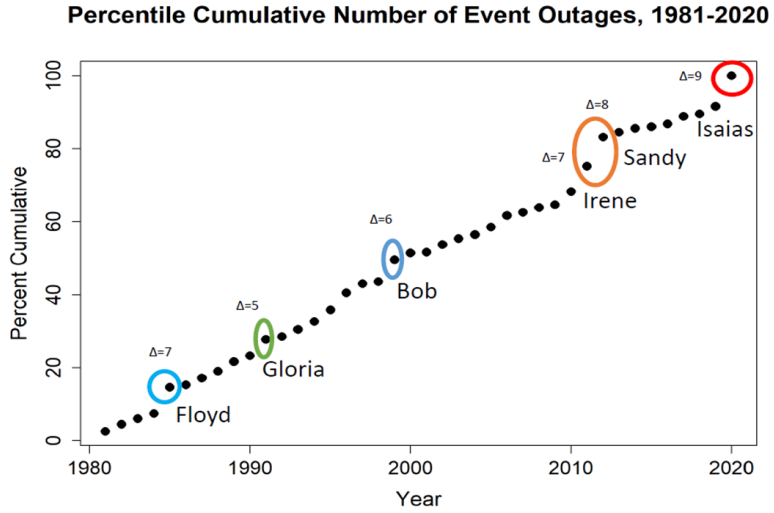
A Few Words About Eversource

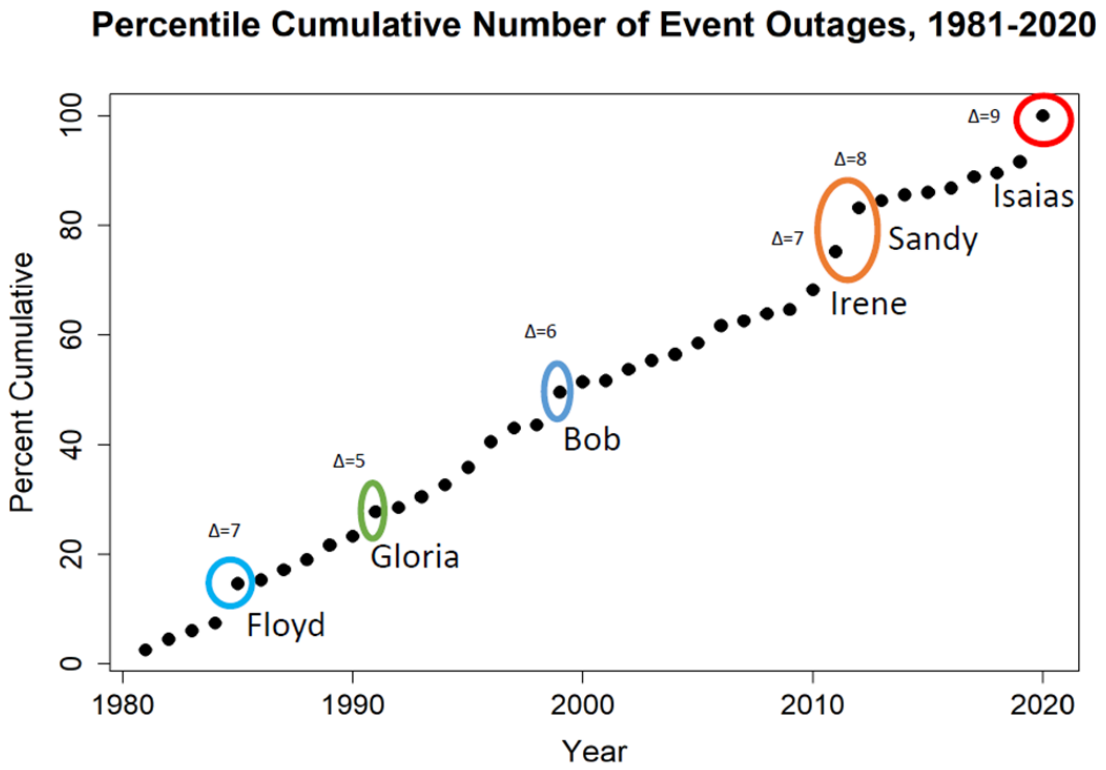
- Eversource is the largest electric utility in New England.
- Eversource serves 4.4M customers across Connecticut, Massachusetts and New Hampshire with safe, reliable and sustainable electric, gas and water service.
- New England is experiencing a variety of challenges related to the electric grid, including increased DER penetration, increasing electrification needs, aging infrastructure and climate-change related extreme events.







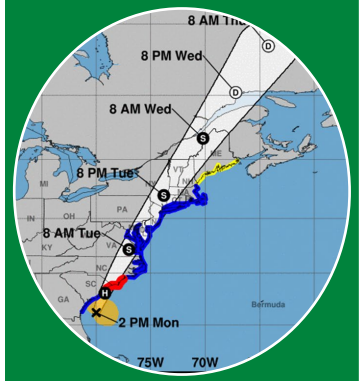
Progressing Climate Change Calls For System Hardening



- Three 1-in-30 years or worse events in our territory in the past 10 years!
- Isaias was a 1-in-50 years event.

Eversource's Approach To Resilience

Engineering Standards & Grid Modernization



Climate Adaptation & Risk Mitigation

Historical Outage Analytics

Stakeholder Engagement

COST EFFICIENCY

- What are the pillars of our plan to address climate change?
  - Resilient Standards like higher class poles and lower customer counts per zone
  - Targeted hardening based on zonal analysis of historical vulnerabilities during major storms
  - Work with other stakeholders to address climate hazards, like flooding, comprehensively and cost effectively
  - Operational changes needed to address system stress; e.g., transformer capacity and health due to higher temperatures and associated higher demand/ loading.

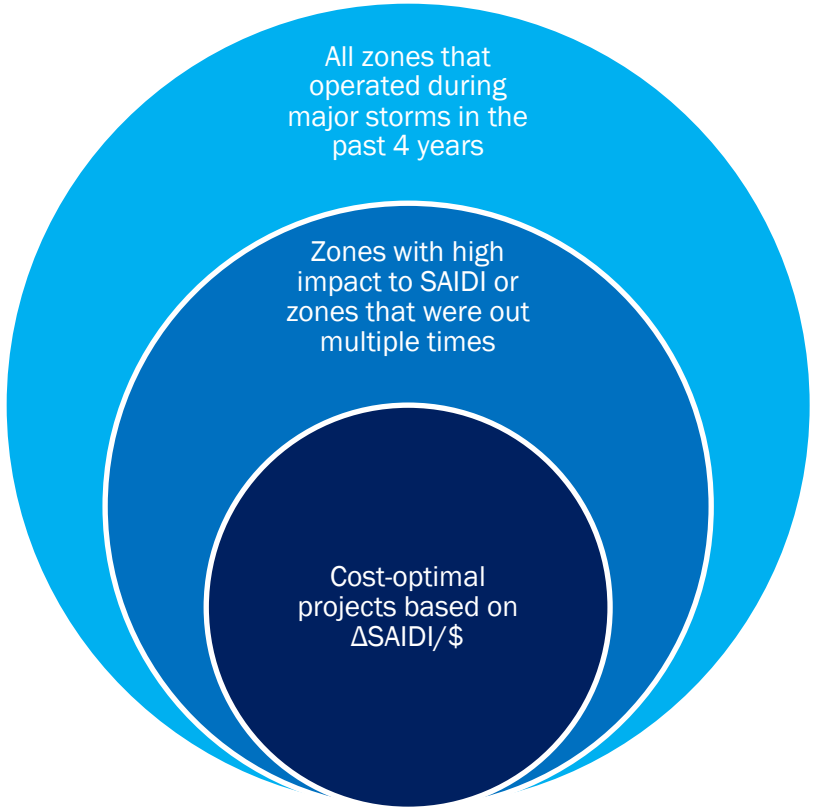
Targeted cost-optimal hardening plan

1. **Define a metric to quantify resilience**
   - Extend SAIDI to 24/7
   - All-In SAIDI is the average interruption duration inclusive of major events.
2. **Scan the system to find vulnerable zones**
   - Zones that went out multiple times in the past 4 years during major events
   - Zones that contributed significantly to all-in SAIDI
3. **Budget cost-efficient projects only**
   - Pair zones with mitigations hierarchically; higher impact to all-in SAIDI=> more effective mitigation
   - Proceed with projects with competitive ΔSAIDI/$

Targeted cost-optimal hardening plan (cont.)

- Reliability Model
  - *How do we account for intermitted availability (renewables & DR programs)*
- Dispatch Model
  - *Considering all grid constraints*
- Cost Model
  - *Standardize cost calculations*
- Revenue Model
  - *What type of revenue options to account for, including ISO market participation*
- Benefits Model
  - *What are the direct impacts on rates to customers, including value of deferred infrastructure upgrades*

Targeted cost-optimal hardening plan (cont.)



Higher SAIDI Impact/
Costlier & more effective mitigation

Tier 1 Zones

- Undergrounding

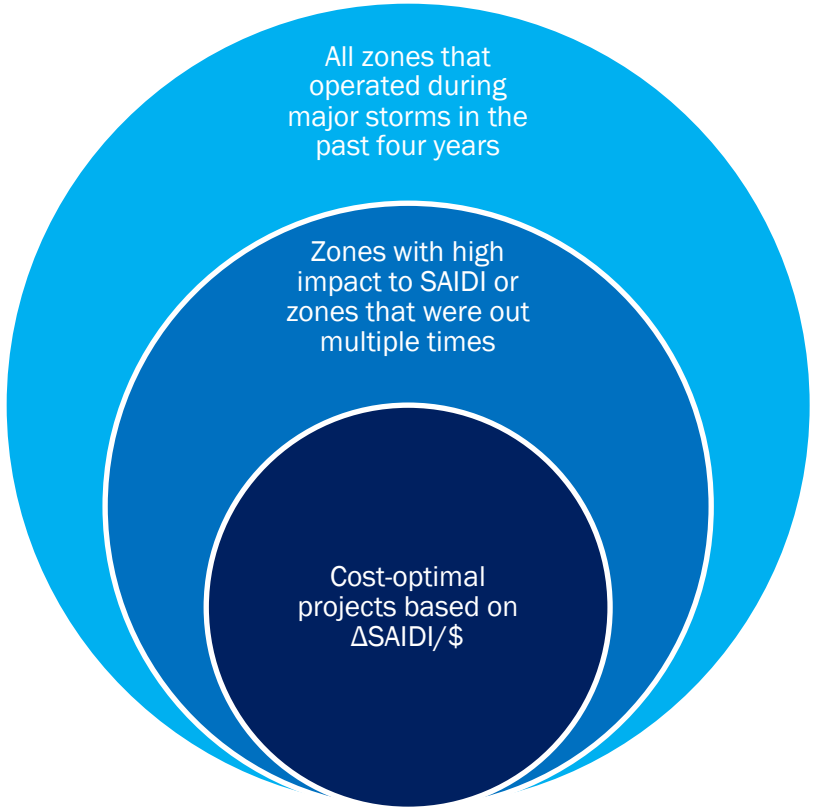
Tier 2 Zones

- Aerial Cable

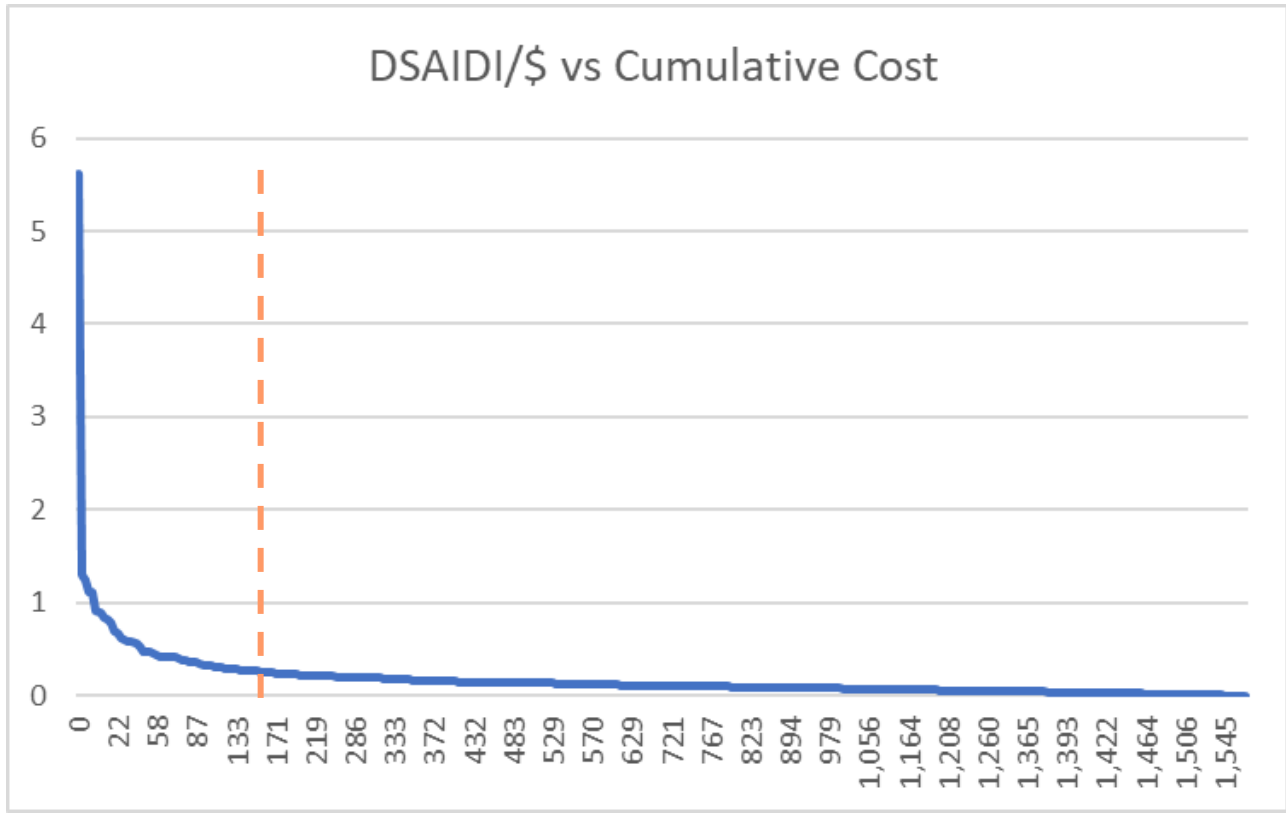
Tier 3 Zones

- Bare-to-tree Wire Conversion
- Vegetation Work

Targeted cost-optimal hardening plan (cont.)

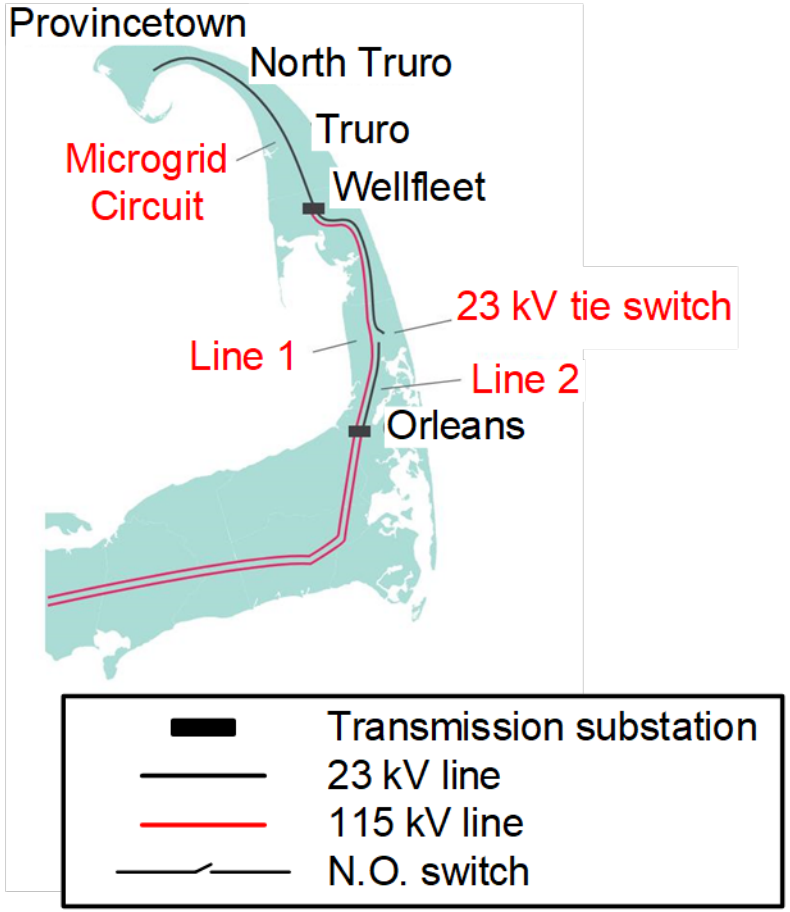


Optimal spending level is when benefits flatline; ~2X the efficiency of the entire resilience plan.



Provincetown Battery Storage Project

- The Provincetown BESS project deferred building a new 13-mile line through the Cape Cod National Seashore.
- Avoids outages for 5,685 customers by restoring them in less than a minute.



Provincetown Battery Storage Project (cont.)

- Building Size : ~ **10,000 square feet**
- Battery Size : **25 MW / 38 MWh**
- Battery Type : **Lithium Ion**
- Charge Time : **~ 8 hours [10 hours max]**
- Disch. Time : **1.5 – 3 hours (peak)**
  : 10 hours (off-peak)
- Battery Life : **12 years**

- Inverters : **16**
- Battery Racks /Inverter : **27**
- Battery Modules / Rack : **14**
- Battery Modules Total : **6048**
- GSU Transformers : **16**
- Grounding Transformers : **2**

Provincetown Battery Storage Project (cont.)

91% reduction in SAIDI in 2023, higher than projected benefits of 80%.

May 2023 Event

- ✓ Open conductor fault near source substation.
- ✓ BESS carried all load until fault is isolated and repairs are completed
- ✓ Benefits to 9,917 customers that would have been on outage for 42 minutes

December 2023 Event

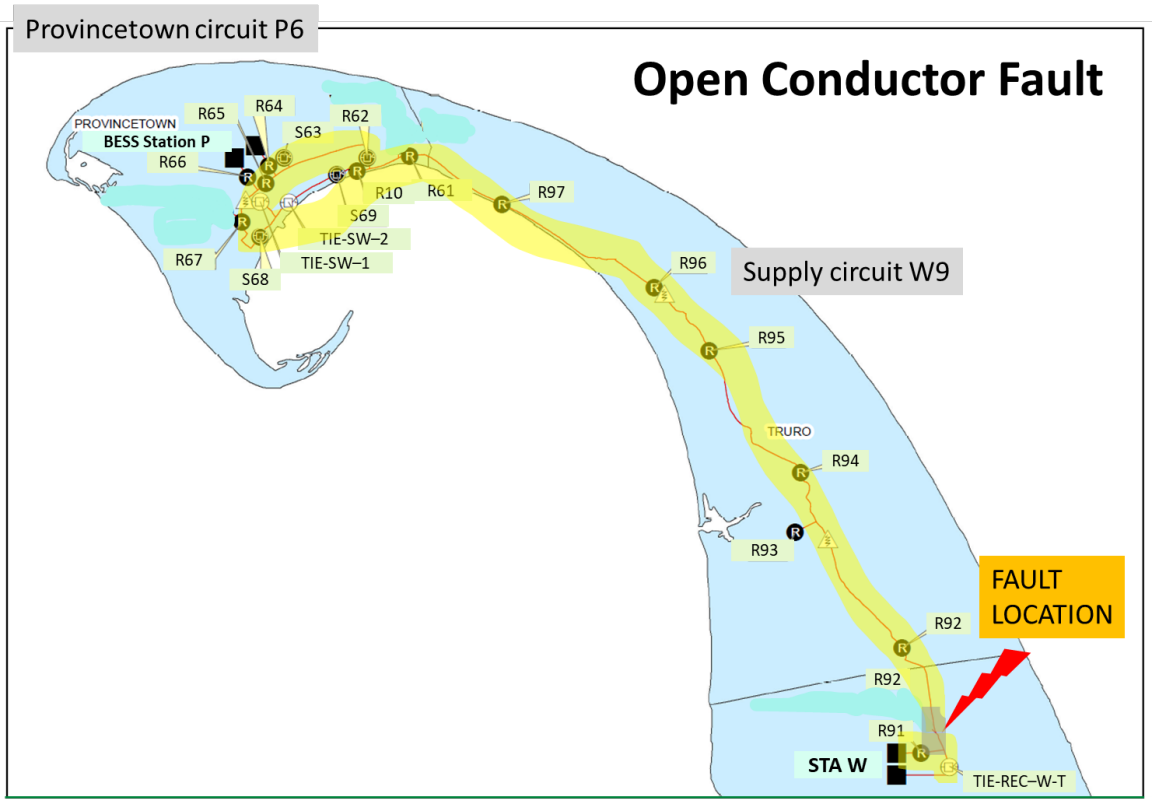
- ✓ Major storm impacts region.
- ✓ BESS avoided 3 faults in the area
- ✓ BESS operation benefitted 11,966 customers.

Provincetown Battery Storage Project (cont.)

91% reduction in SAIDI in 2023, higher than projected benefits of 80%.

May 2023 Event

- ✓ Connector and single-phase tap burnt open close to feeder station
- ✓ BESS engaged automatically to restore 9,917 customers
- ✓ Only 133 customers on outage for 42 minutes
- ✓ BESS discharged to 81%.

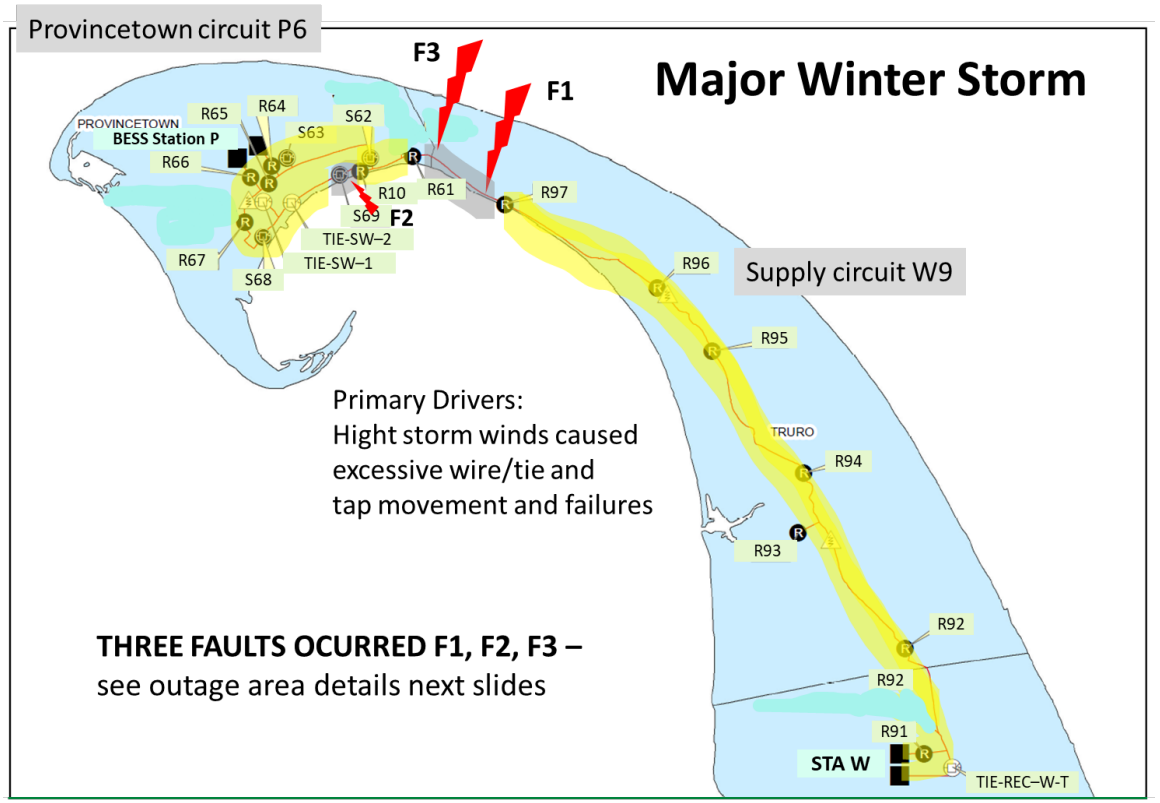


Provincetown Battery Storage Project (cont.)

91% reduction in SAIDI in 2023, higher than projected benefits of 80%.

December 2023 Event

- ✓ High winds caused pole and wire movement and failures.
- ✓ F1 resulted in 611 customers out for 2 hours and 20 minutes.
- ✓ With the BESS microgrid, 5,662 customers downstream of R61 were automatically restored.

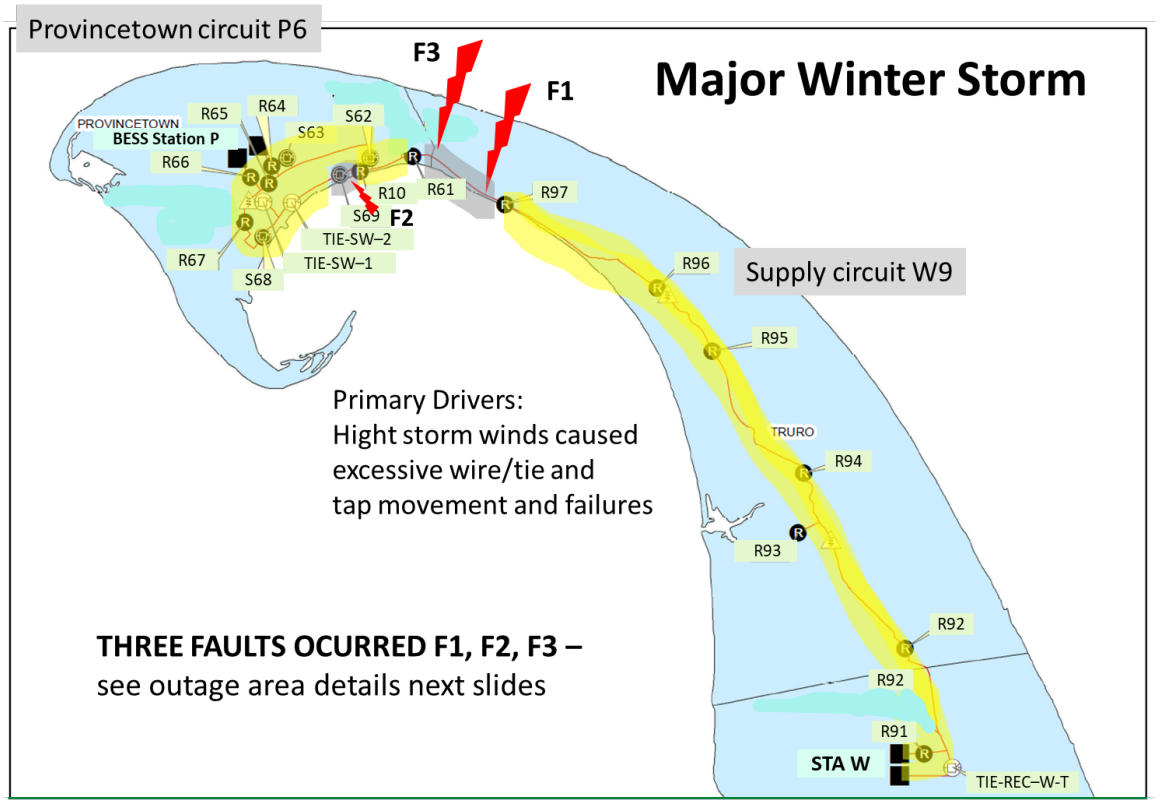


Provincetown Battery Storage Project (cont.)

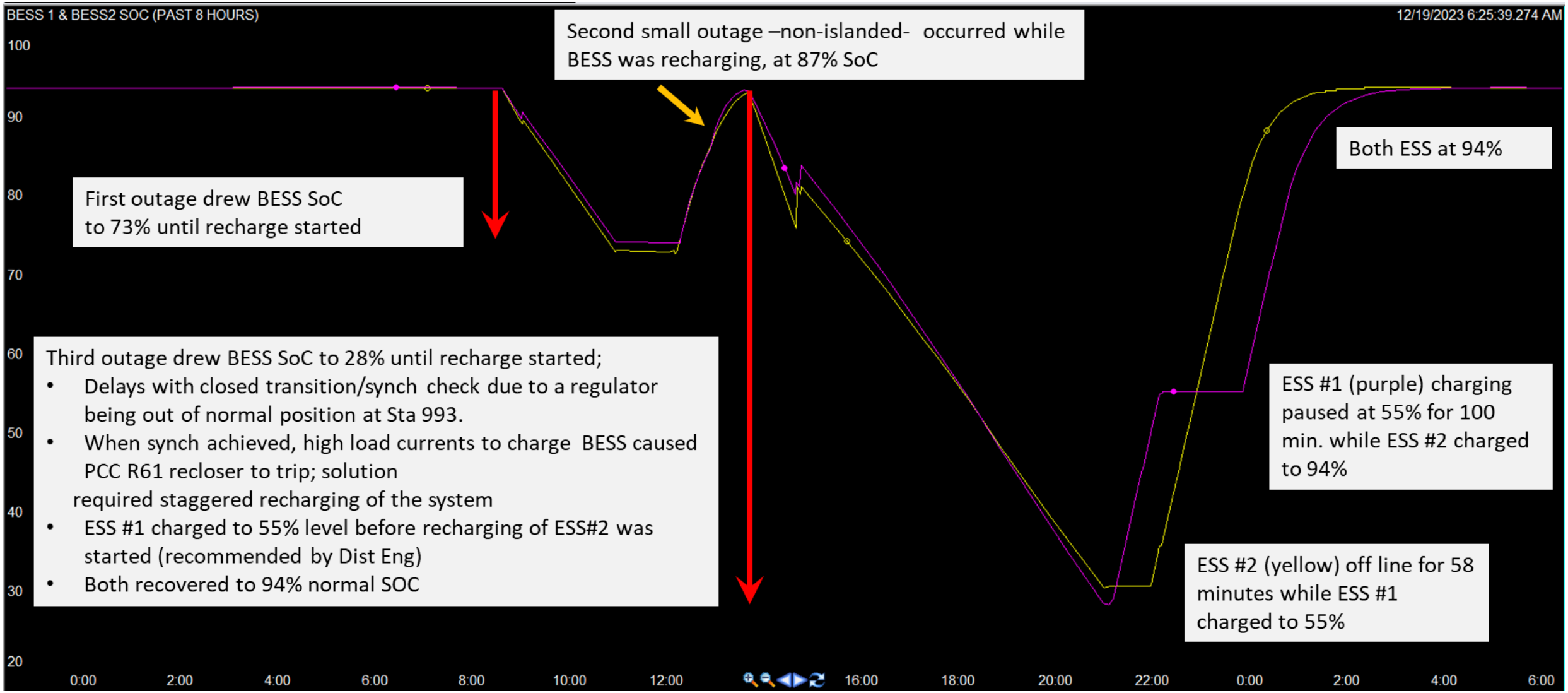
91% reduction in SAIDI in 2023, higher than projected benefits of 80%.

December 2023 Event

- ✓ F3 resulted in 611 customers out for 6 hours and 50 minutes.
- ✓ F3 created extensive damage, hence the ~7-hour restoration time.
- ✓ With the BESS microgrid, 5,662 customers downstream of R61 were automatically restored.



Provincetown Battery Storage Project

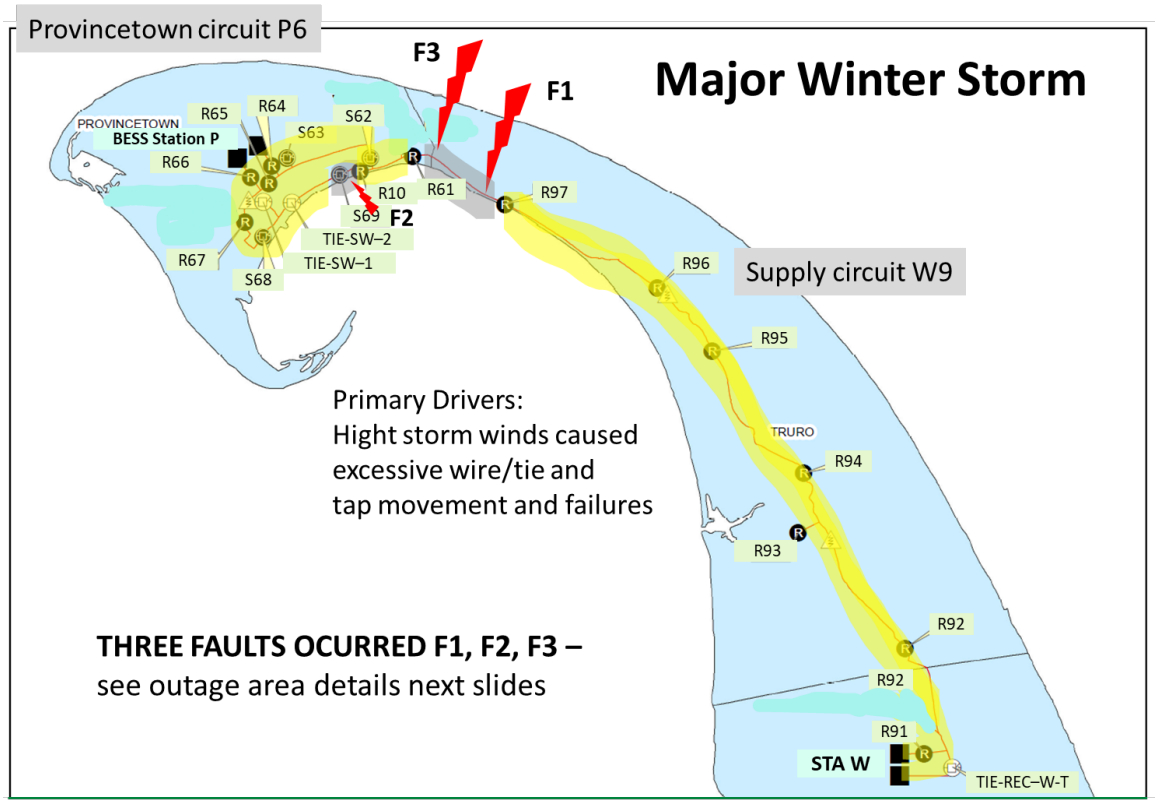


Provincetown Battery Storage Project

91% reduction in SAIDI in 2023, higher than projected benefits of 80%.

December 2023 Event

- ✓ F2 was a wires down event also due to high winds.
- ✓ 162 customers out for 27 hours!
- ✓ 642 customers were automatically restored.

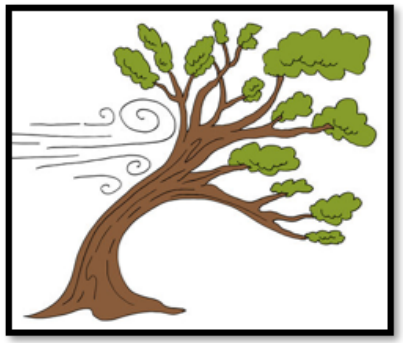


Climate Change Vulnerability Study- Climate Projections

AMBIENT TEMPERATURE

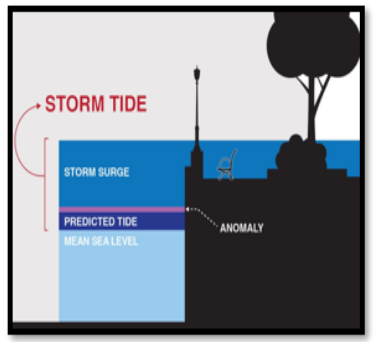
DROUGHT

HIGH WINDS



PRECIPITATION

SEA LEVEL RISE/ STORM SURGE



- Projections were made out to 2080 with intermediate steps in 2030 and 2050
- Multiple climate change scenarios were used; SSP2-4.5 50th percentile and SSP5-8.5 90th percentile for the year 2050 are highlighted here
- The impact of temperature on energy demand was also assessed.

Impacts to Coastal Substations; Sea Level Rise & Storm Surge

- 2’ of SLR by 2050
- 3’ of SLR by 2080

NOAA data for SLR

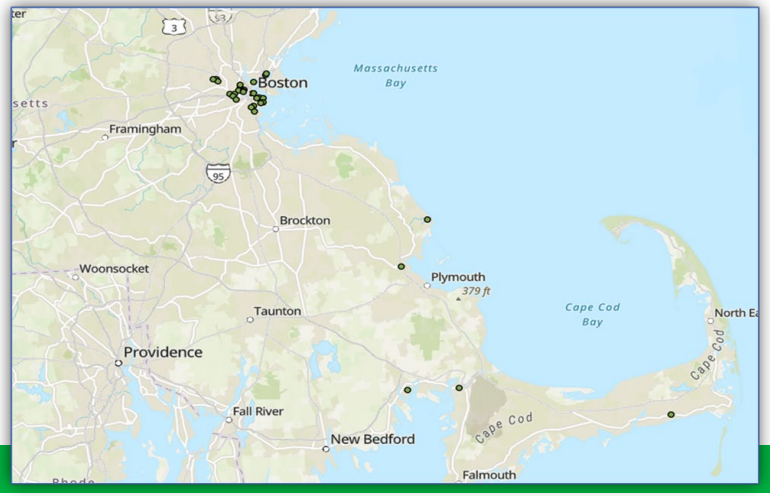
- Cat. 1- Cat. 3

NOAA data for Storm Surge

Elevation Standards

- Based on FEMA’s 1-in-100-year flood maps

- Protect at-risk stations
- Constrain new station location
- Update elevation standards



Closing Statements

- Massachusetts' Electric Sector Modernization Plan (ESMP) final decision issued in September
- Reliability and resilience for non-vertically integrated utilities
- The importance of grid modernization and automation and "eyes on the grid" (AMI, monitoring and measuring)
- DER ownership and control