

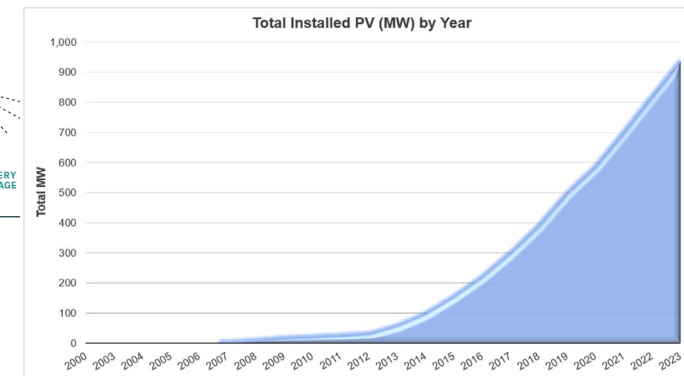
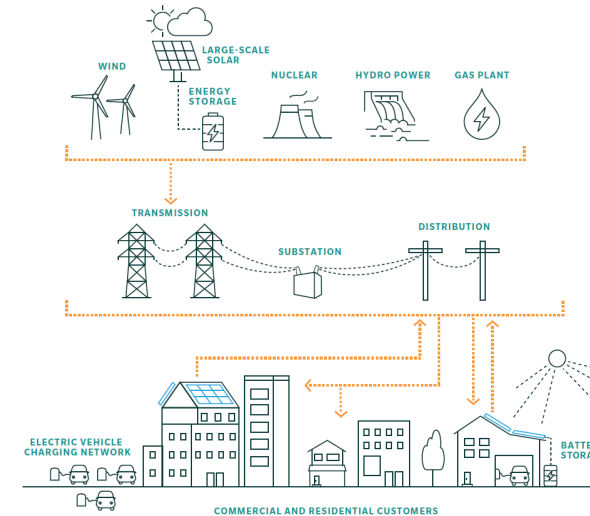
Eversource's Resilience & Climate Adaptation Plan

Elli Ntakou

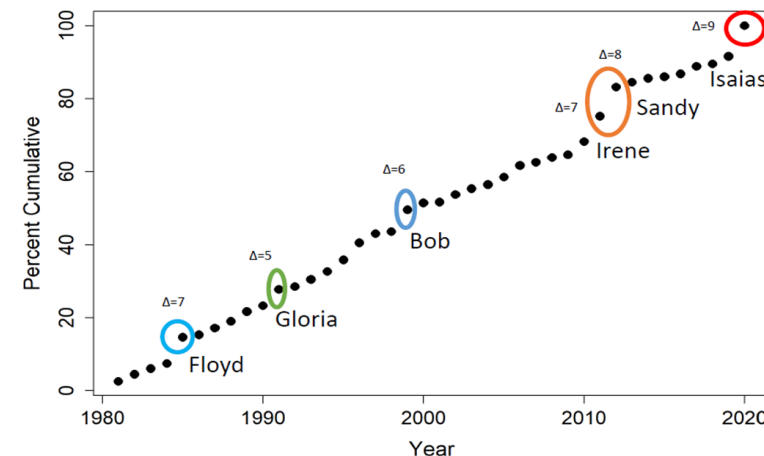
October 2024

A Few Words About Eversource

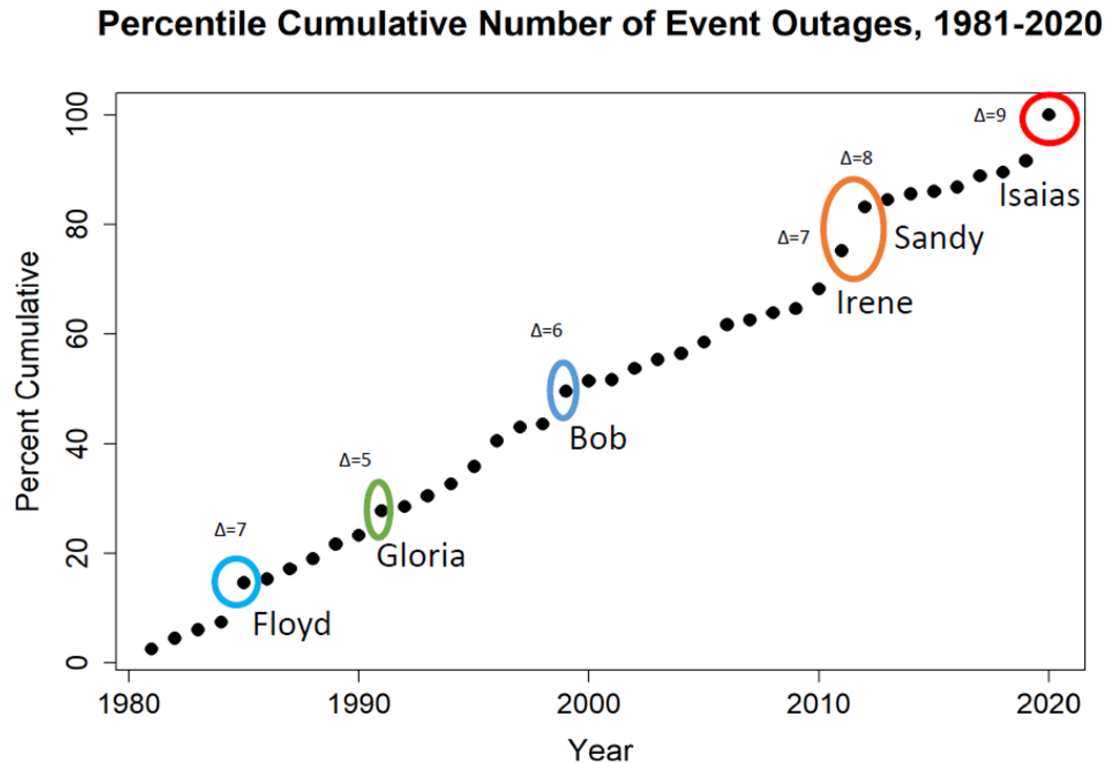
- Eversource is the largest electric utility in New England.
- Eversource serves 4.4M customers across Connecticut, Massachusetts and New Hampshire with safe, reliable and sustainable electric, gas and water service.
- New England is experiencing a variety of challenges related to the electric grid,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



Percentile Cumulative Number of Event Outages, 1981-2020

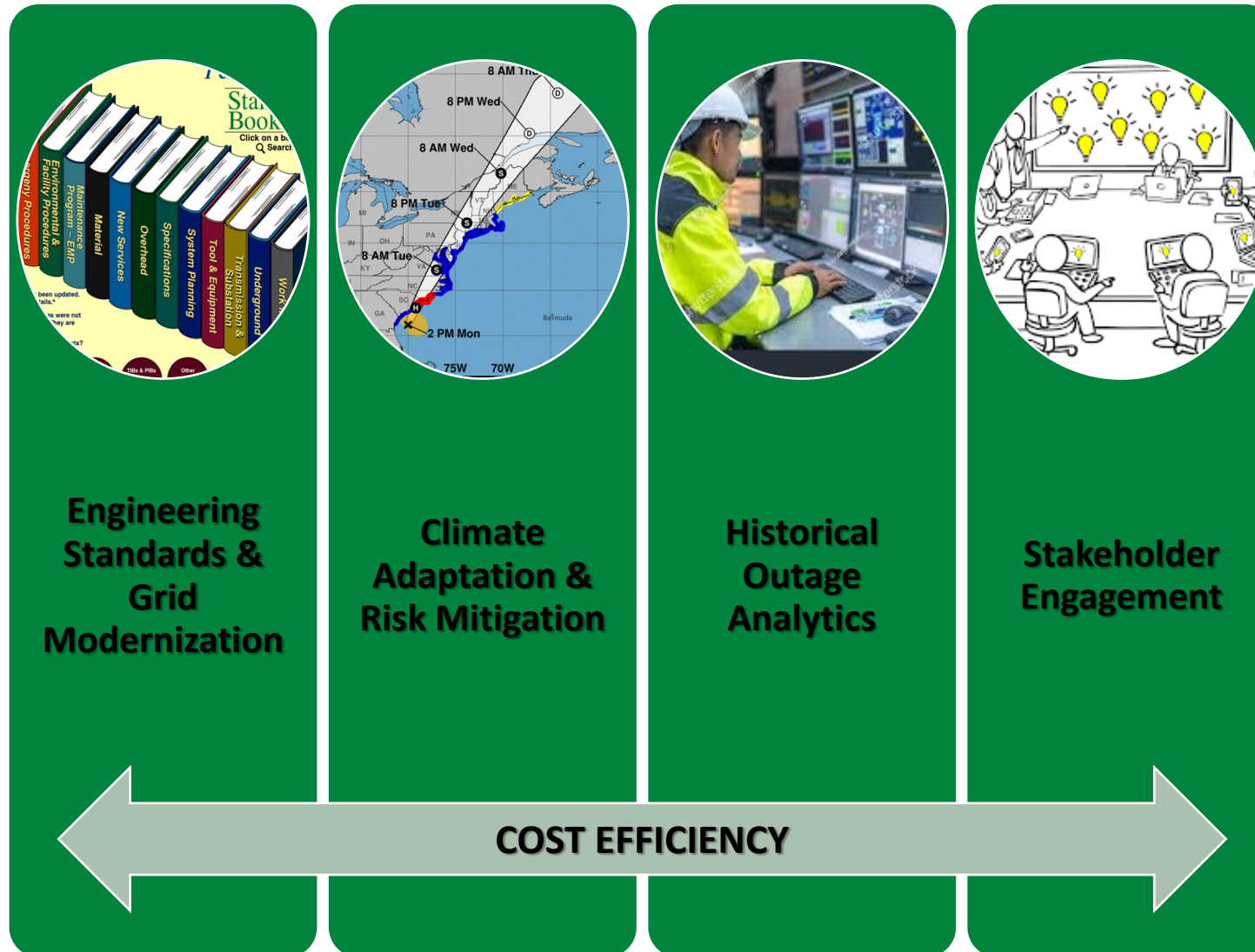


Progressing Climate Change Calls For System Hardening



- 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



- 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

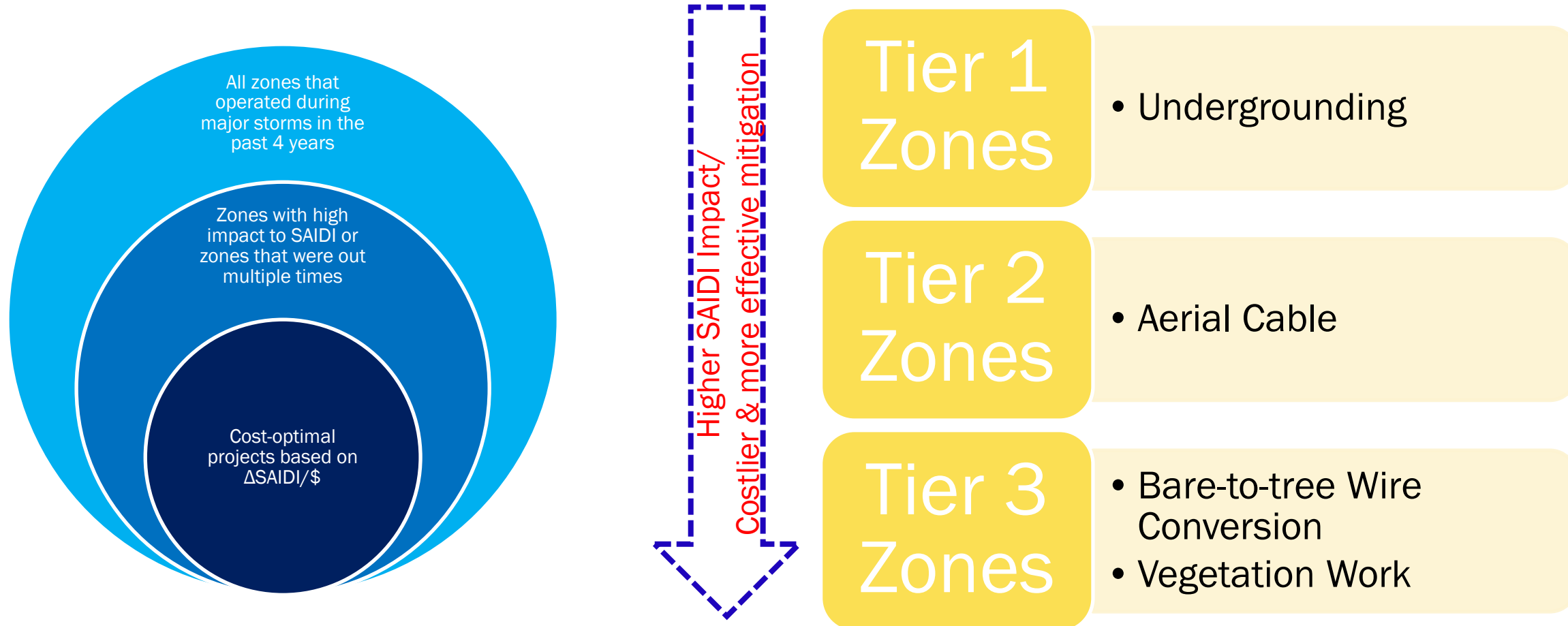
- Pair zones with mitigations hierarchically; higher impact to all-in SAIDI=> more effective mitigation
- Proceed with projects with competitive $\Delta\text{SAIDI}/\$$

Targeted cost-optimal hardening plan (cont.)

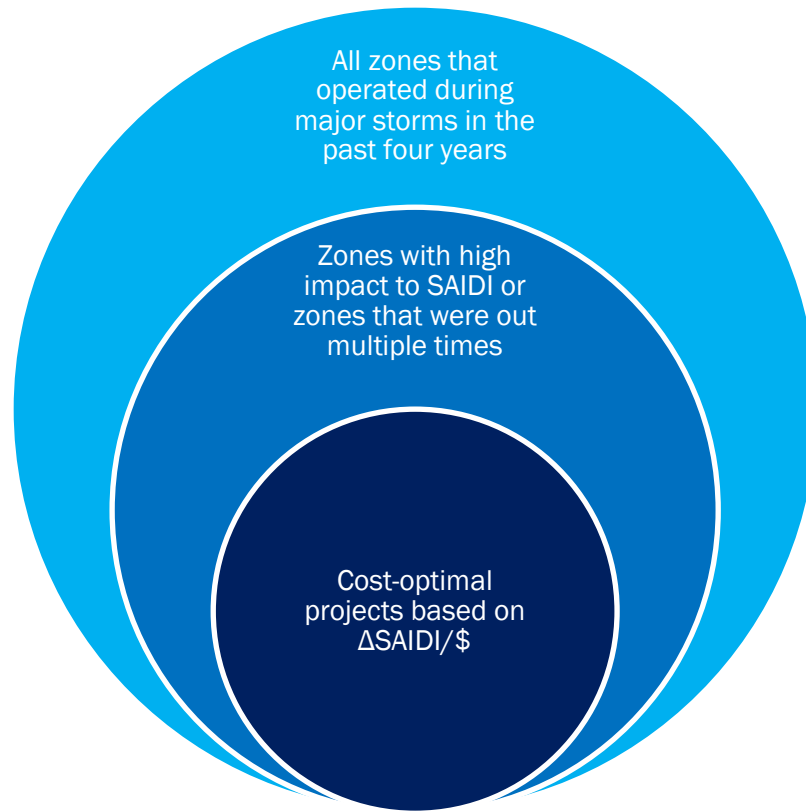
- Reliability Model
 - How do we account for intermitted availability (renewables & DR programs)
- Dispatch Model
 - Considering all grid constraints
- Cost Model
 - Standardize cost calculations
- Revenue Model
 - What type of revenue options to account for, including ISO market participation
- Benefits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



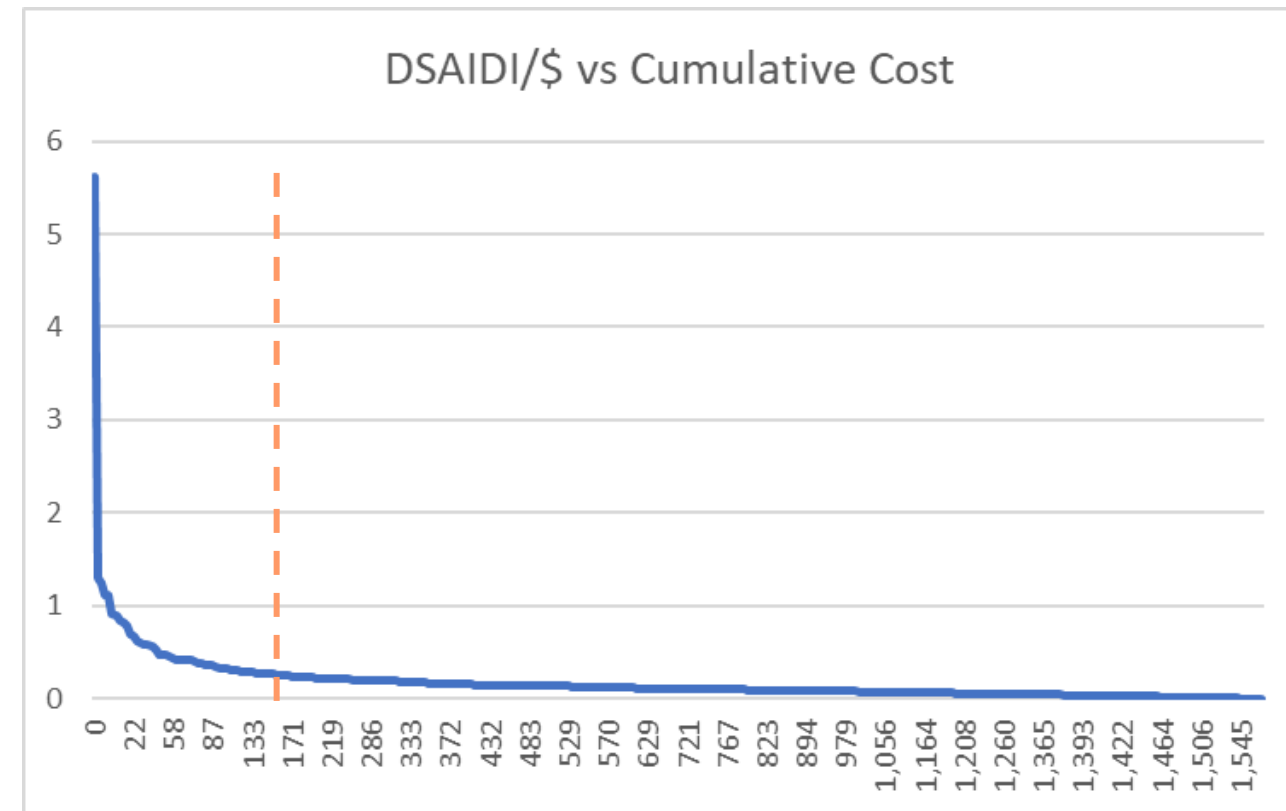
Targeted cost-optimal hardening plan (cont.)



Targeted cost-optimal hardening plan (cont.)

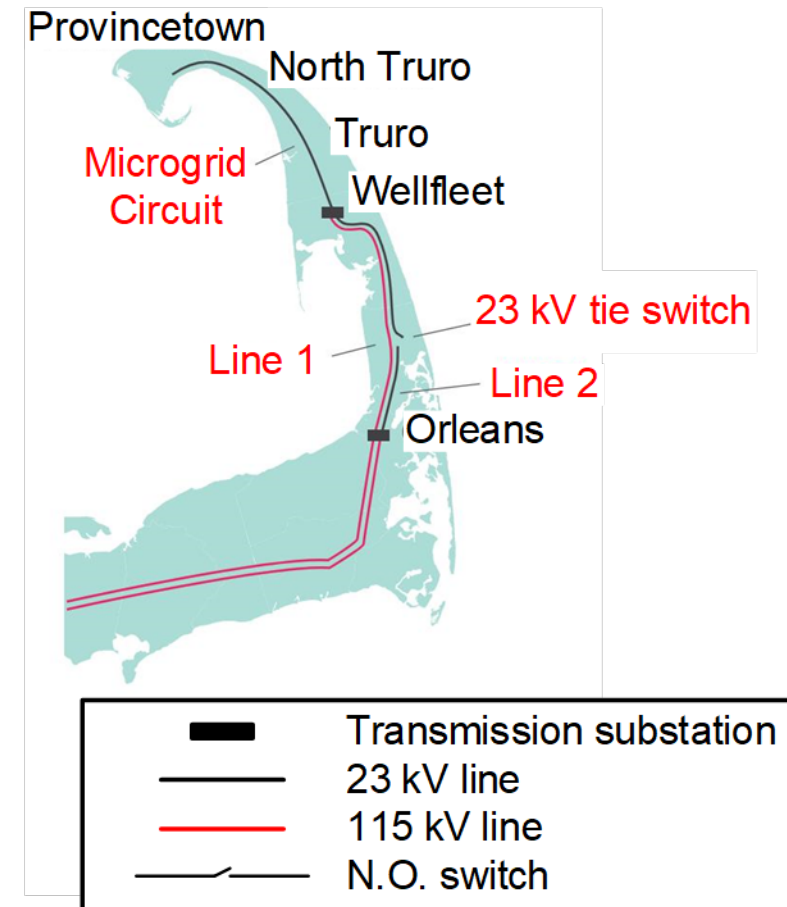


Optimal spending level is when benefits flatline; ~2X the efficiency of the entire resilience plan.



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

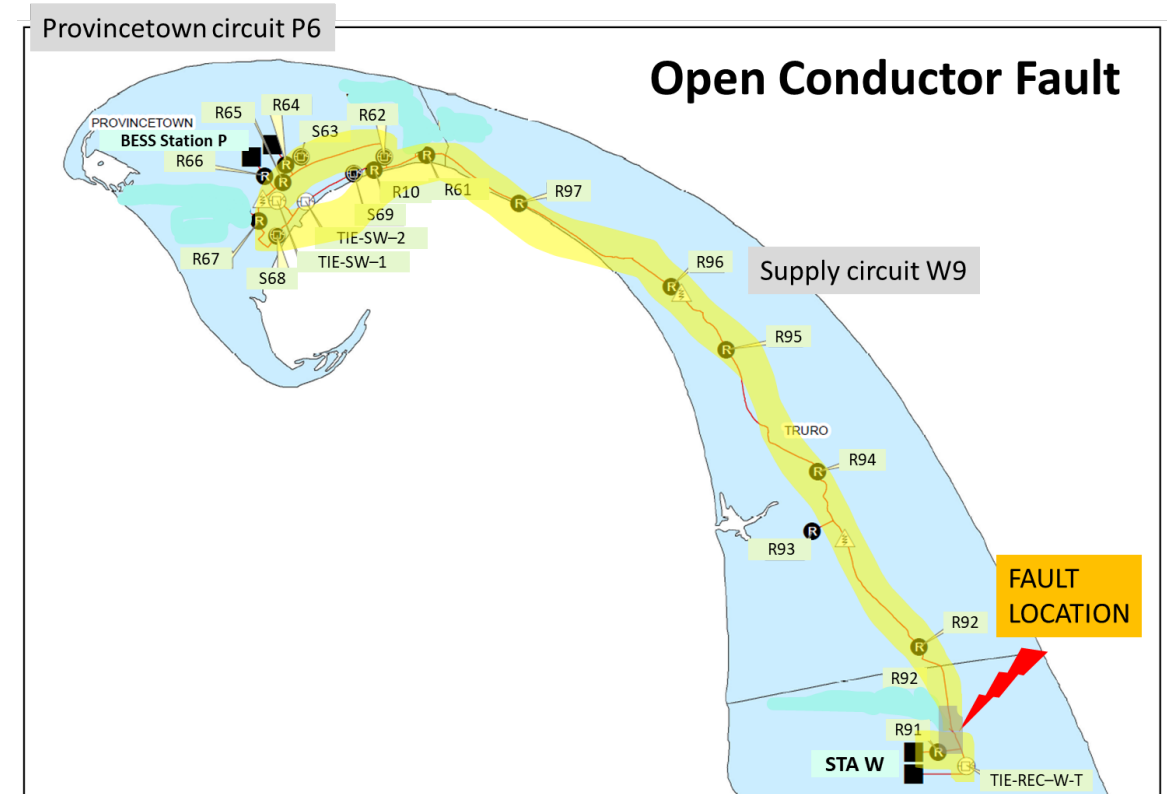
- ✓ Major storm impacts region.
- ✓ BESS avoided 3 faults in the area
- ✓ BESS operation benefitted 11,966 customers.

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%.

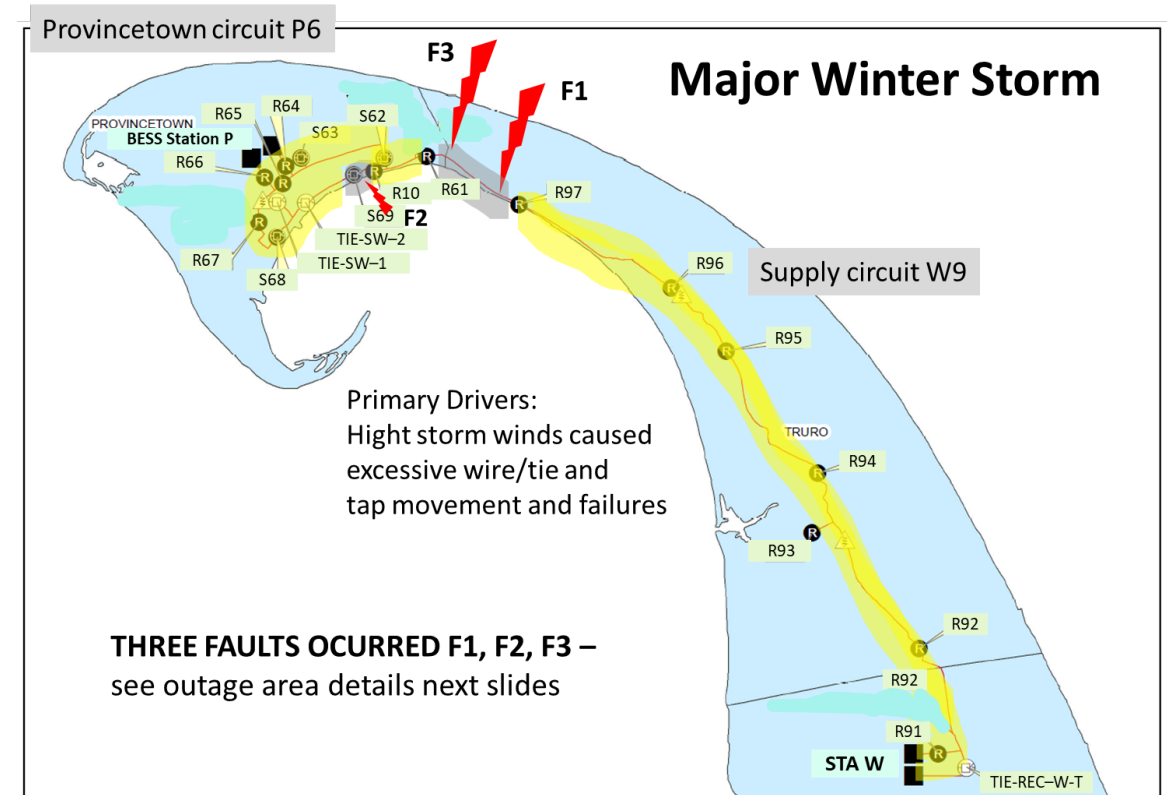


Provincetown Battery Storage Project (cont.)

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.

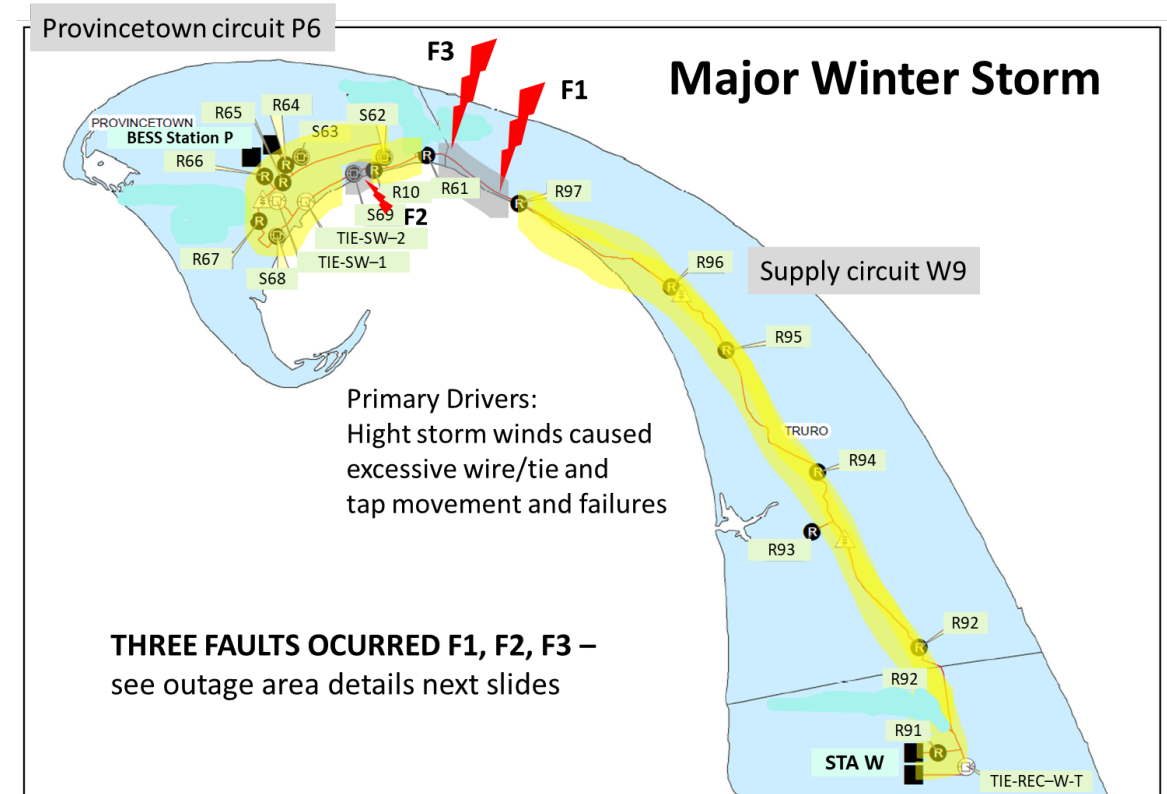


Provincetown Battery Storage Project (cont.)

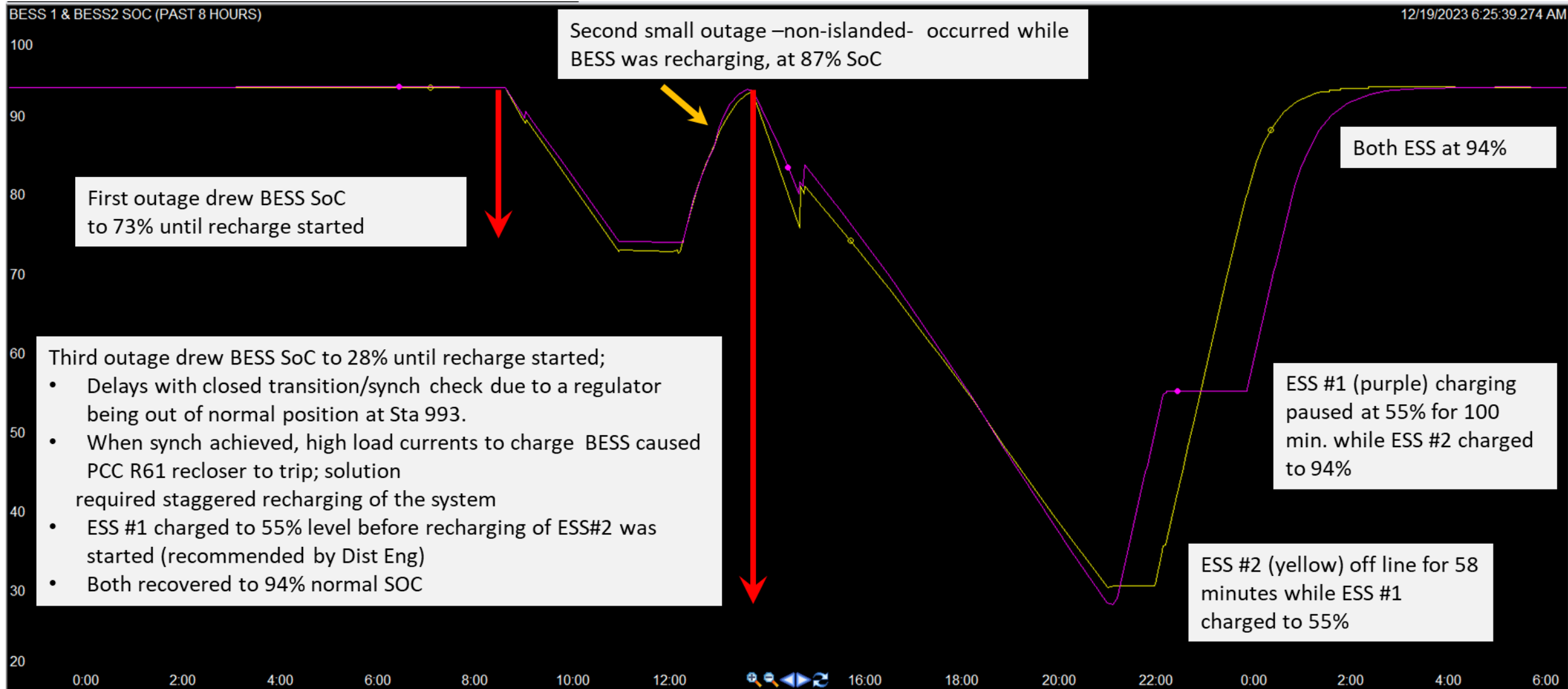
91% reduction in SAIDI in 2023, higher than projected benefits of 80%.

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

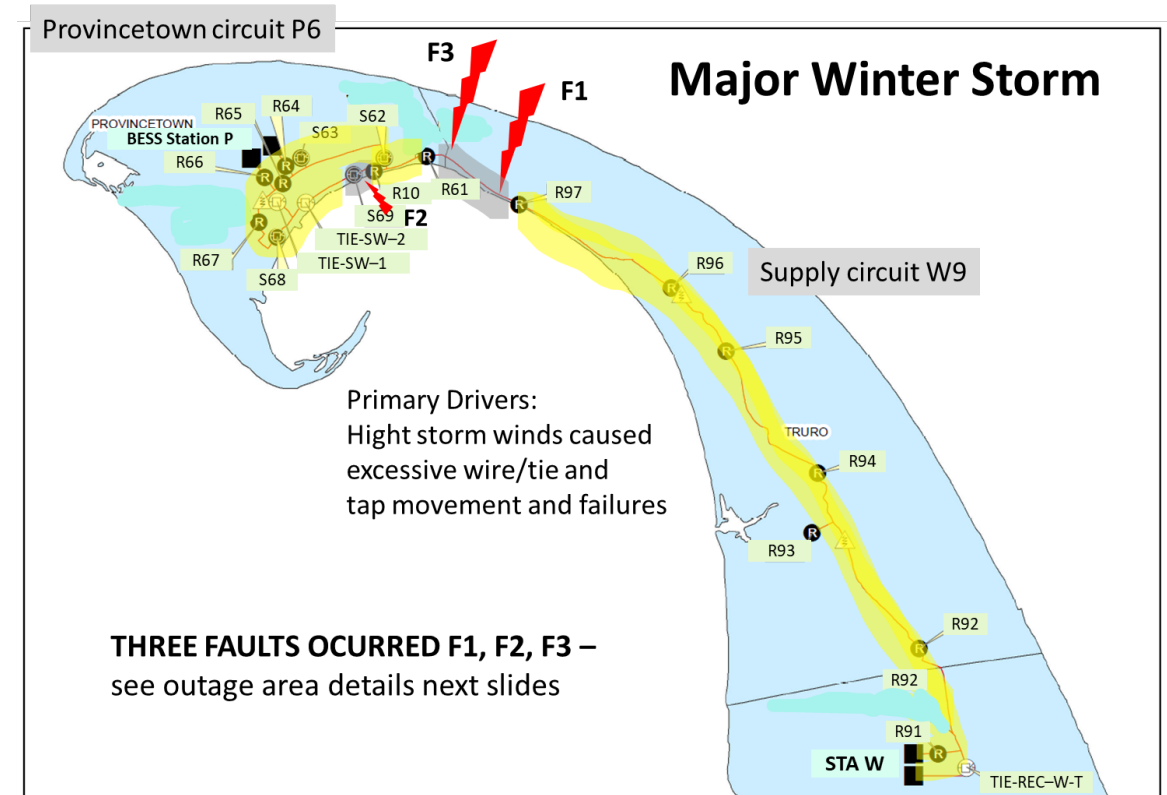


Provincetown Battery Storage Project

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.

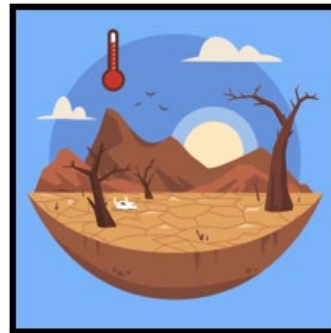


Climate Change Vulnerability Study- Climate Projections

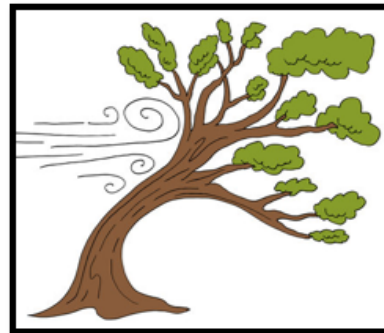
AMBIENT
TEMPERATURE



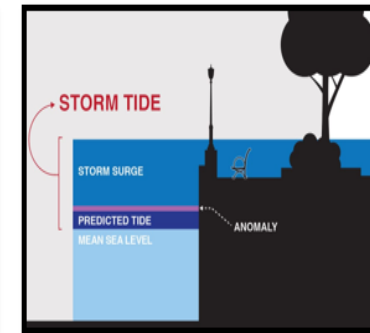
DROUGHT



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

➤ Cat. 1- Cat. 3

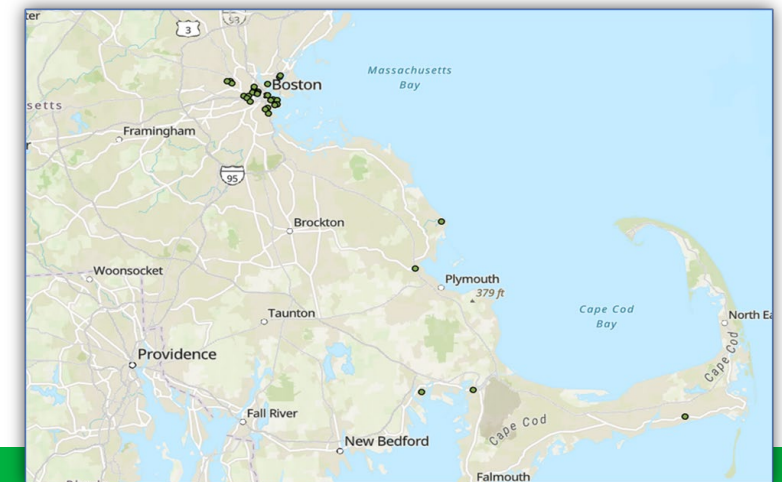
NOAA data
for Storm
Surge

NOAA data
for SLR

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