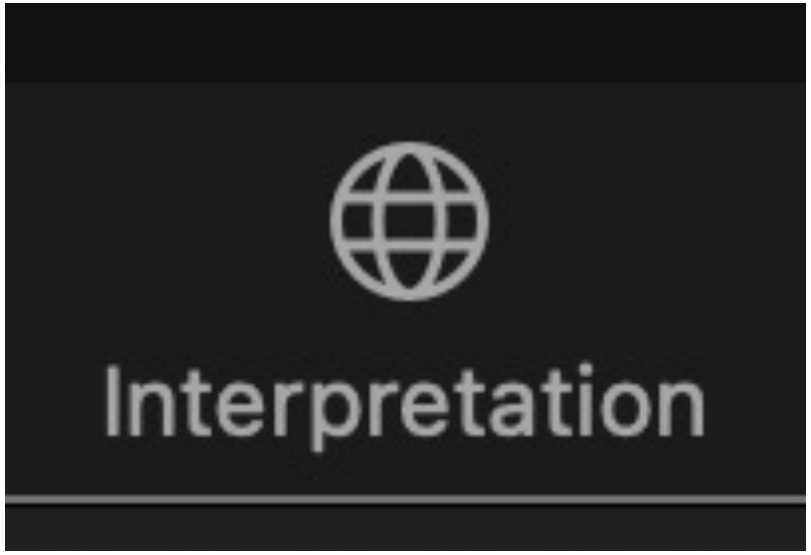
Utilities ESMP Stakeholder Workshops & Technical Sessions

Workshop #1
November 15, 2023
9 am – 1 pm

Online Interpretation

1. **We will turn on Interpretation in just a moment.**
2. Once you see the Globe logo, click it to select a language.
3. Even if you don’t need interpretation, click the logo and select ENGLISH
4. The choices today are
    1. English
    2. Spanish
    3. European Portuguese
    4. Brazilian Portuguse
    5. Chinese



Welcome & Goals of Two Workshops

- Level set everyone's understanding of draft ESMPs (including demand forecasts; grid infrastructure needs; stakeholder/community engagement plans, etc.)
- Provide initial feedback to utilities
- Better equipped to participate in ESMP finalization and implementation processes

ESMP Topics

- Today's Workshop (November 15, 9 am – 1 pm)
  - What's an Electric Sector Modernization Plan
  - Demand Forecasts
  - Grid Infrastructure Needs

- 2nd Workshop (November 28, 1-5 pm)
  - Ensuring an Equitable and Just Transition to a Clean Energy Future
  - Stakeholder & Community Engagement
  - Demand Forecasts and Grid Infrastructure : Additional feedback

Agenda

Time	Topic & Description	Lead/ Presenter
9:00	**Welcome, Overview, and Introductions** • Agenda; Approach & Ground Rules	Facilitators
9:15	**ESMP Overview**	Unitil
9:30	**Demand Forecasts** • Overview Presentation (12 minutes) • Individual Utility Presentations (18 minutes) • Break-Out Groups to Develop Questions (20 min) • Utility Responses to Questions (20 min) • Initial Feedback on Demand Forecasts (20 min)	• Facilitators • Eversource • National Grid, Unitil, Eversource • Stakeholder Groups • National Grid, Unitil, Eversource • Individual Participants
11:00	**Break**	
11:15	**Implications for Grid Infrastructure Needs** • Overview Presentation (12 minutes) • Individual Utility Presentations (18 minutes) • Break-Out Groups to Develop Questions (20 min) • Utility Responses to Questions (20 min) • Initial Feedback on Demand Forecasts (25 min)	• Facilitators • National Grid • Unitil, Eversource, National Grid • Stakeholder Groups • National Grid, Unitil, Eversource • Individual Participants
12:50	**Next Steps** • Recap of the day/Feedback • Plans for 2nd Workshop	Facilitators
1:00	**Adjourn**	

ESMP Invited Participants - updated

Organization	Representative(s)	Organization	Representative(s)
A Better City	Yve Torrie	**MA Municipal Association**	Julia Ahlberg
ACE	Sofia Owen	**Making Opportunity Count (MOC)**	Melissa Gonzalez / Shakira Collazo
Advanced Energy United	Kat Burnham	**Mass Development**	Dan Rivera
Boston Properties	Neetu Siddarth (Nov 15) Ben Myers (Nov 28)	**Mass DOT**	Christopher Aiello (Nov 15) Hayes Morrison
Browning the Green Space	Kerry Bowie	**Mass General Hospital**	Dennis Villanueva / Jason Dantona
C Power	Nancy Chafetz	**Mass Housing**	Elizabeth Torres
Calstart	Jordan Stutt	**Mass Life Sciences**	Ken Turner
EJ Table	Cindy Luppi	**Mass Solar**	Mark Sandeen
EDF	Jolette Westbrook	**NAIOP**	Anastasia Daou
Fitchburg Housing Authority	Doug Bushman	**NCLC**	John Howat
Fitchburg State	JD Head	**NECEC**	Tim Snyder
Franklin Cummings Tech	Dr. Marvin Loiseau	**Nexamp**	Brandon Bowles
Gillette Stadium	Dena Ciampa (Nov 15) Jason Stone (Nov 28)	**North Central MA Chamber of Commerce**	Roy Nascimento
IBEW	Mike Monahan	**Tesla**	Bill Ehrlich
Lowell General Hospital	Kevin Foley	**UMass Lowell**	Rauiri O'Mahony
MA Business Roundtable	Tonja Mettlach (Nov 15) JD Chesloff (Nov 28)	**United Way of North Central Mass**	Kory Eng
MA Economic Development	Helena Fruscio Altsman	**WMA Economic Develop Council**	Rick Sullivan
MA Mayor's Association	Adrienne Núñez	**Mass Bio**	Ben Bradford

ESMP Workshops Team

Utilities (leads/presenters)		Facilitators		IT Support & Translators
Erin Engstrom - lead	Eversource	Janet Gail Besser	Independent	Jeff Carpenter
Gerhard Walker – presenter	Eversource	Dr. Jonathan Raab	Raab Associates	
Lavelle Freeman - presenter	Eversource			
Matt Motley - lead	National Grid			
Shira Horowitz – presenter	National Grid			
Elton Prifti - presenter	National Grid			
Kevin Sprague – lead & presenter	Unitil			

Workshop/Zoom Protocols

- Participants
  - Should have their videos on, and their audio muted unless speaking.
  - When want to ask a question or make a comment, use the raise hand function to get in queue.
  - All questions and comments should be made verbally--the Q&A function is being disabled; and Chat should only be used to contact the host in regard to technical proble.ms
- Utilities .
  - Lead utility representatives have their videos on, and their audio muted unless speaking.
  - Utility presenters (who aren't leads) should only unmute their video audio when presenting or answering questions.
- Observers (in the audience)
  - Should be able to see and hear the workshop but will have you audio/video muted and will not be able to chat or use the Q&A function.
- The Workshops will be recorded.

Submitting Questions and Feedback

- Submission of our draft plans to the Grid Modernization Advisory Council (GMAC) is an important first step in increasing the transparency and inclusiveness of our infrastructure investment planning process.

- We consider our customers, communities, and stakeholders integral partners in developing and implementing our clean energy transition plans. We continue to build relationships and trust by listening, learning, and incorporating your feedback into our planning process.

- You are invited to submit any feedback, questions, or comments based on what you heard today or around our plans **by December 10** at:

  Eversource: MAGridMod@eversource.com
  National Grid: Future.Grid@nationalgrid.com
  Unitil: ESMP-Feedback@unitil.com

- We will do our best to reply to questions as soon as possible.

Workshop Conduct

Come prepared to discuss agenda items (by reviewing all background documents disseminated prior to the meeting and conferring with your organization and other colleagues as needed.)

Be forthright and communicative about your interests and preferences

Be clear, so that everyone understands your interests and proposals

Be concise, so that everyone who wants to provide input has an opportunity to do so (e.g., less than a minute)

What is an Electric Sector Modernization Plan?

November 13, 2023

What is an Electric Sector Modernization Plan?

is an ESMP important to the EDCs, customers and the Commonwealth?

What is an Electric Sector Modernization Plan (ESMP)?

- An ESMP is a comprehensive plan designed to ensure the electric system is capable of supporting the state's climate goals
- Massachusetts General Law Ch. 164 Section 92B
- GMAC Website: https://www.mass.gov/info-details/grid-modernization-advisory-council-gmac

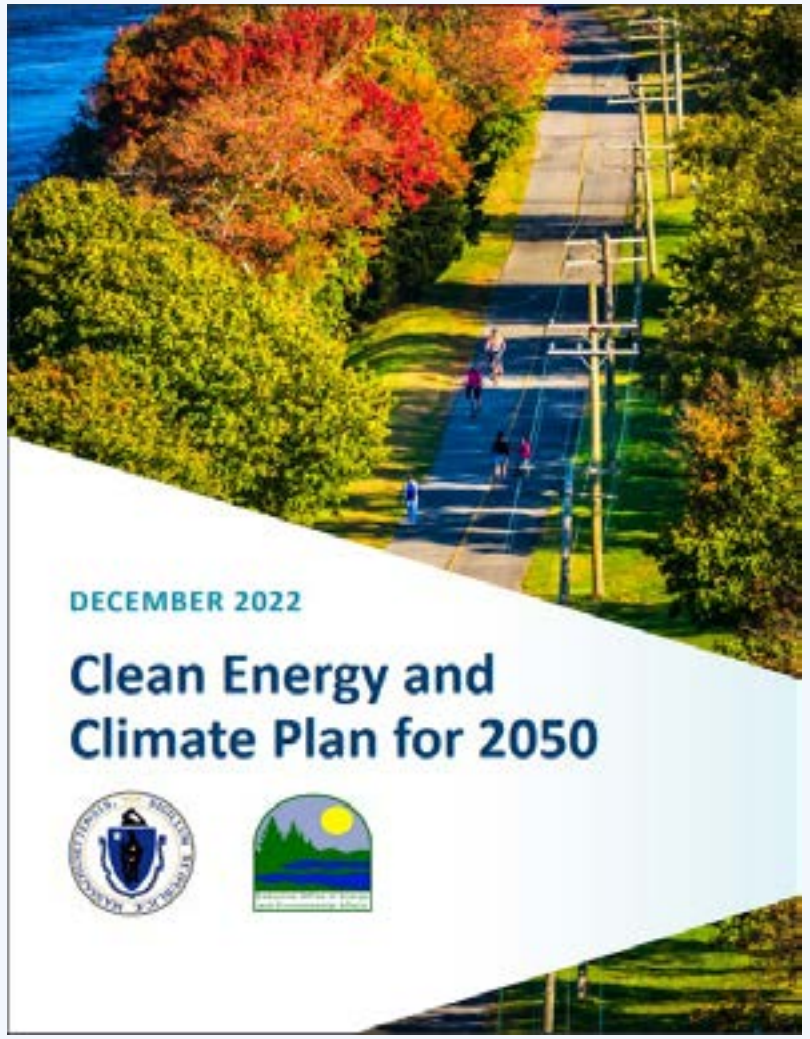
Objectives

- improve grid reliability, communications and resiliency;
- enable increased, timely adoption of renewable energy and distributed energy resources;
- promote energy storage and electrification technologies necessary to decarbonize the environment and economy;
- prepare for future climate-driven impacts on the transmission and distribution systems;
- accommodate increased transportation electrification, increased building electrification and other potential future demands on distribution and, where applicable, transmission systems; and
- minimize or mitigate impacts on the ratepayers of the commonwealth

Support the Transition to a Cleaner Energy Future

Plans are designed to support the Commonwealth's climate goals

- Today's electric system not prepared for the level of electrification and interconnection of DERs identified in the CECP
- Support the Commonwealth's pathway to decarbonization with the following investments:
  - Core Investments
  - Hosting capacity (CIP)
  - AMI
  - Utility solar
  - Grid Modernization
  - EV programs
  - Customer investments
  - Platform investments
  - Network investments
  - Resiliency
- Goal - Ensure ESMPs distribute benefits in an equitable manner, with
  - attention to mitigate the impacts on historically disadvantaged communities to support a just transition.



https://www.mass.gov/doc/2050-clean-energy-and-climate-plan/download

ESMP Plan Contents

Consistent format between EDCs to make ESMPs easier to follow

Chapter	Title/Subject	Description
1	Executive Summary	Provides a summary of the report and approach to ensuring/enabling a just transition to a clean energy future
2	Compliance with the EDC Requirements Outlined in 2022 Climate Act	Provides a link between the components with the plan with the requirements as defined in G.L. c. 164, § 92B(a)
3	**Stakeholder Engagement**	Described the stakeholder engagement process used to ensure active engagement of all stakeholders.
4	Current State of Distribution System	Provides a detailed description of the current state of the distribution system.
5	**5- and 10-Year Electric Demand Forecast**	Describes approach and assumptions used in developing the demand forecast
6	**5- and10-Year Planning Solutions**	Describes existing/approved and proposed capital spending
7	**5-Year Electric Sector Modernization Plan**	Provides the investment plan for 2025-2029 and 2030-2034
8	**2035-2050 Electric Demand Assessment**	Describes approach and assumptions used in developing the demand assessment
9	**2035-2050 Solution Set**	Describes 2035-2050 projects designed to address system constraints
10	**Reliable and Resilient Distribution System**	Describes existing reliability performance and proposed investments
11	Integrated Gas-Electric Planning	Describes the proposed process for further integration of gas and electric planning
12	**Workforce, Economic and Health Benefits**	Describes the benefits associated with the proposed projects
13	Conclusion	Describes the next steps and process to update ESMPs

Topics to be addressed 11/15/2023

Topics to be addressed 11/28/2023

ESMP Development and Review Process

Steps to ensure stakeholder engagement and feedback on the ESMP

Grid Modernization Advisory Council (GMAC)

- The GMAC is charged with reviewing and providing recommendations to EDCs including those from its Equity Working Group
- Actively engaged in providing feedback and recommendations to the EDCs
- Public listening session feedback: 10/30/23 and 11/1/2023
- Formal recommendations to be submitted to EDCs on 11/20/2023

EDC Requirements

- Required to hold 2 workshops to receive input on draft plans - (11/15/2023 and 11/28/2023)
- EDCs will respond to comments received
- Final report submitted to DPU on 1/29/2029
  - Final reports will include recommended cost recovery mechanisms and bill impacts

MA DPU Requirements

- Shall approve, approve with modifications, or reject the plan within 7 months of submittal (8/29/2023)
- In order to be approved, a plan shall provide net benefits for customers

Massachusetts General Law Ch. 164 Sections 92B and 92C

Grid Modernization Advisory Council

Who are the members of the Grid Modernization Advisory Council as appointed by the Governor?

GMAC members include representatives from a wide array of organizations and interests	
Commissioner Elizabeth Mahony (Chair) MA Department of Energy Resources	**Kathryn Cox-Arslan** - New Leaf Energy representing renewable distributed generation industry
Kelly Caiazzo - MA Attorney General	**Sarah Bresolin Silver** - ENGIE North America representing energy storage industry
Sarah Cullinan - MA Clean Energy Center	**Amy McGuire** - Highland Electric Fleets representing electric vehicle industry
Larry Chretien - Green Energy Consumers Alliance representing low and moderate income residential customers	**JS Rancourt** - Direct Expansion Solutions representing electrification industries
Marybeth Campbell - Worcester Community Action Council representing low-income weatherization program	**Andy Sun** - MIT representing engineering expertise to integrate clean energy
Kyle Murray - Acadia Center representing environmental advocacy community	**Julie Curti** - Metropolitan Area Planning Council representing municipal interests
Kathryn Wright - Barr Foundation representing the environmental justice community	**Jonathan Stout** - Dana Farber Cancer Institute representing large commercial and industrial customers
Alex Worsley - Enel North America representing transmission scale renewable energy	**Carol Sedewitz** - National Grid **Digaunto Chatterjee** - Eversource **Kevin Sprague** - Unitil

Forecasting Overview

GMAC Technical Session #1

Dr. Gerhard Walker, Manager Advanced Forecasting and Modeling

EVERSOURCE

Forecasting Overview

Why do we Forecast?

To understand future demand and service needs so that we can identify and provide orderly, economic investment, including expansion of equipment and facilities

- Ensure sufficient system capacity to meet future demand and service needs
- Satisfy voltage and power quality requirements within applicable limits
- Provide adequate reliability and resiliency to disruptive events
- Serve all customers safely wherever they are

… and do it all for the lowest reasonable cost

Utilities must forecast because infrastructure takes years to plan, site, and build

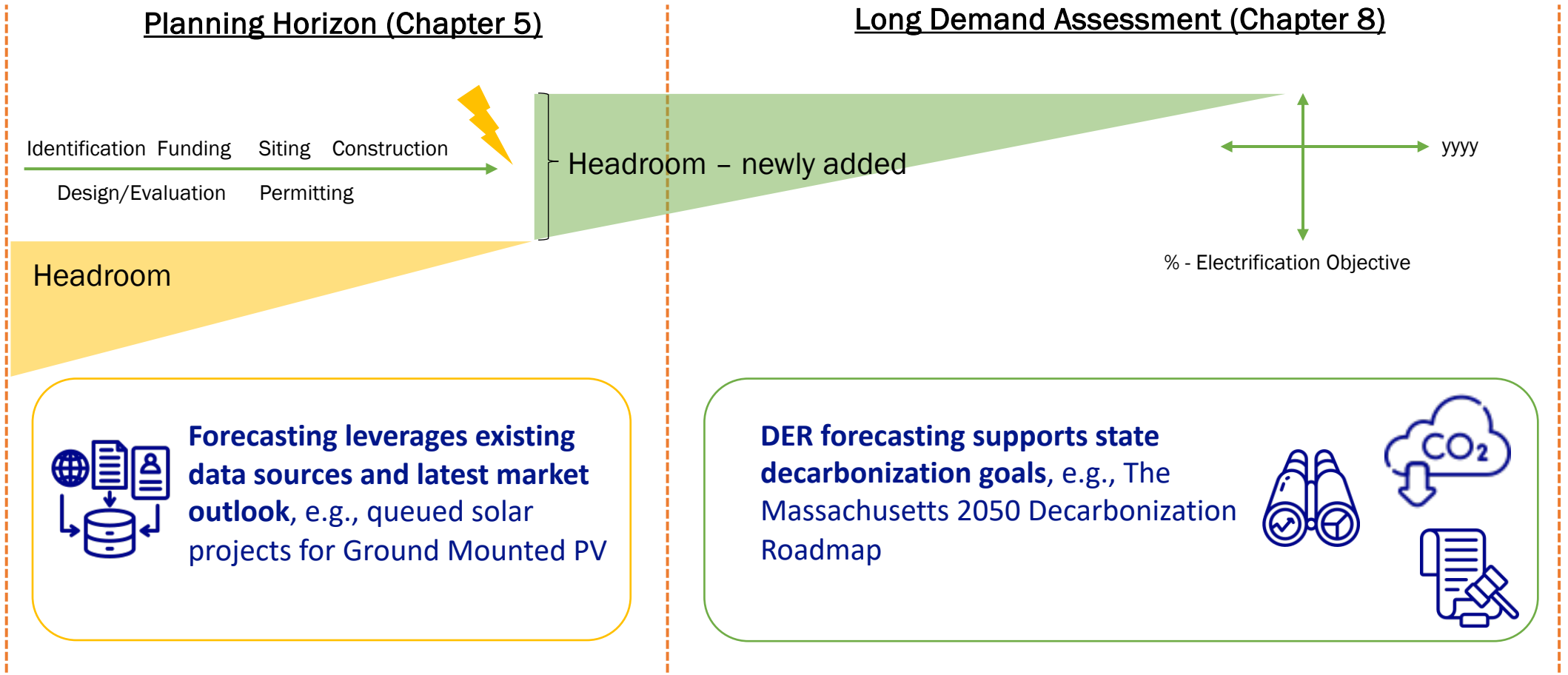
- Transmission → 10+ years
- Substations → 5-10 years
- Distribution → weeks for service upgrades, 2-3 years for circuit re-designs

The bigger the project, the longer it takes, the longer range the forecast

- Bigger Projects also have larger areas they service
- Forecasts over larger areas are significantly more accurate
- Geographically granular forecasts have significant uncertainties

Forecasting Overview – How do we Forecast

General Framework



Forecasting Overview – How Do We Forecast

Final reported peak

90/10 weather adjustment

Small Solar Generation at time of peak

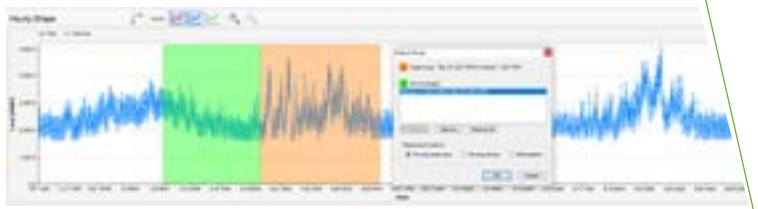
Large Solar Generation at time of peak

Transfer Correction

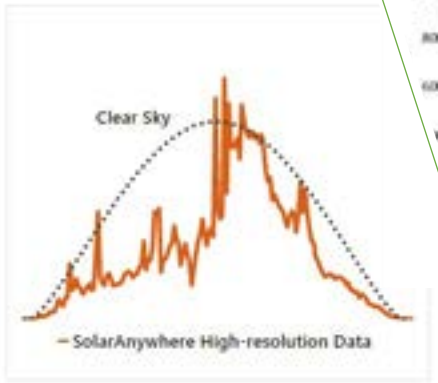
Any other generation

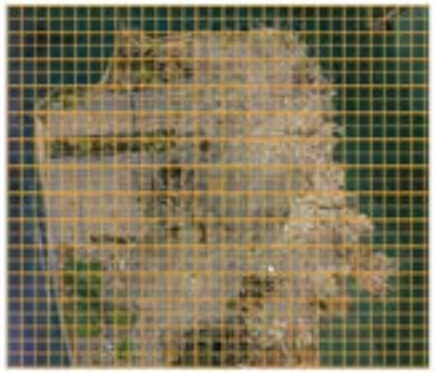
Reported Net Station Peak

Historic SCADA readings on all large generation installations



Historic, satellite-based weather data to calculate non-metered solar output





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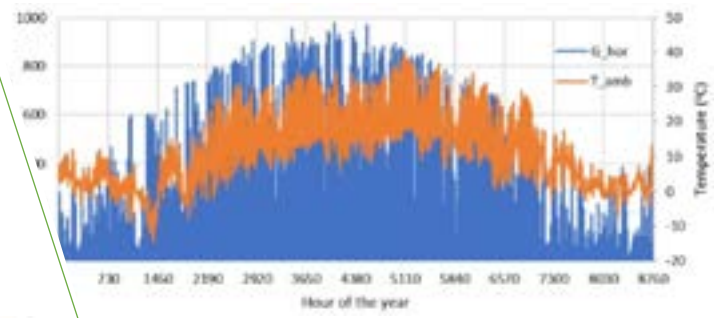


Reported Weather Normalized 90/10 Net Station Peak

Forecasting Overview – How Do We Forecast

Econometric Trend Load Model

Forecasted Weather Normalized 90/10 Gross Station Peak

Energy Efficiency Demand Res.

DER Forecast

Existing

Forecasted

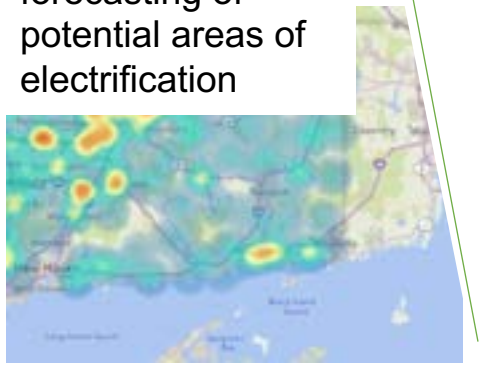
Adoption propensity modeling using service territory wide parcel data base and geospatial forecasting

Permanent Load Transfers

Strategic system reconfiguration for load shifting

Step Loads

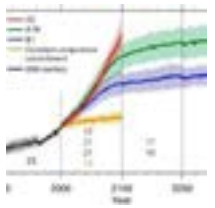
Tracking of every national and strategic account, bulk electrification efforts, and forecasting of potential areas of electrification



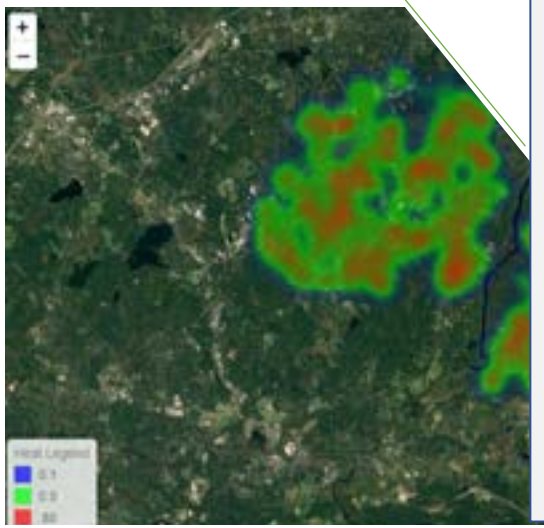
EV Growth

Adoption propensity model based on customer cluster classifications and GPS mobility tracking data

Climate



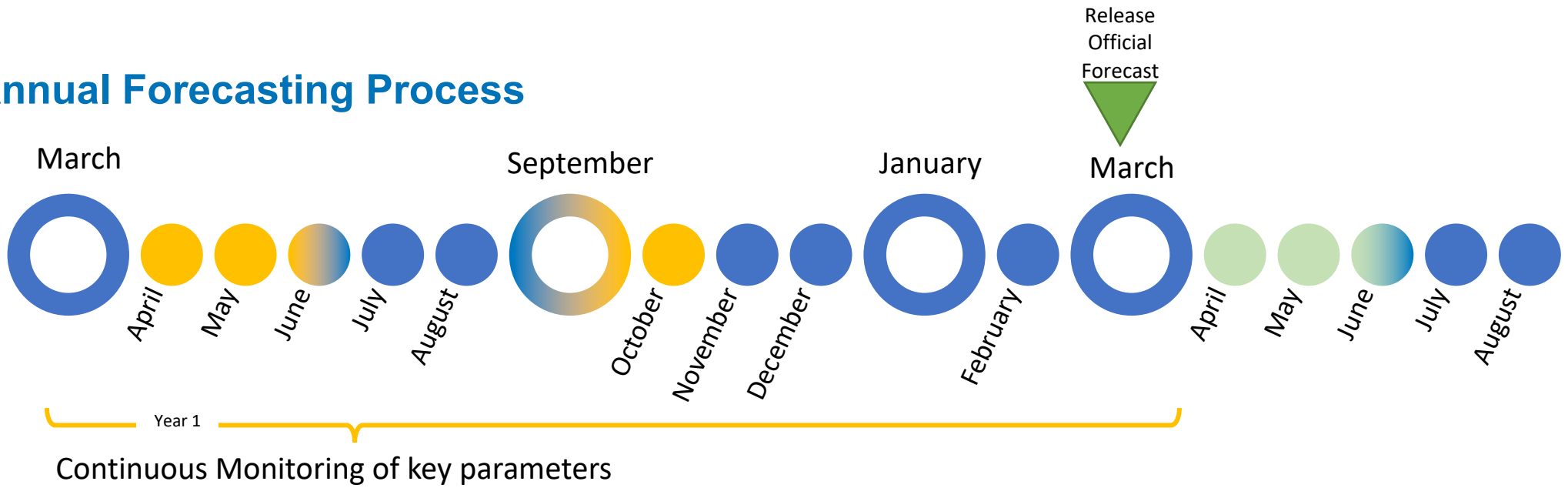
Climate impact with probability of future heatwaves



Forecasted Net Station Load with 90/10 Weather

Forecasting Overview

Annual Forecasting Process

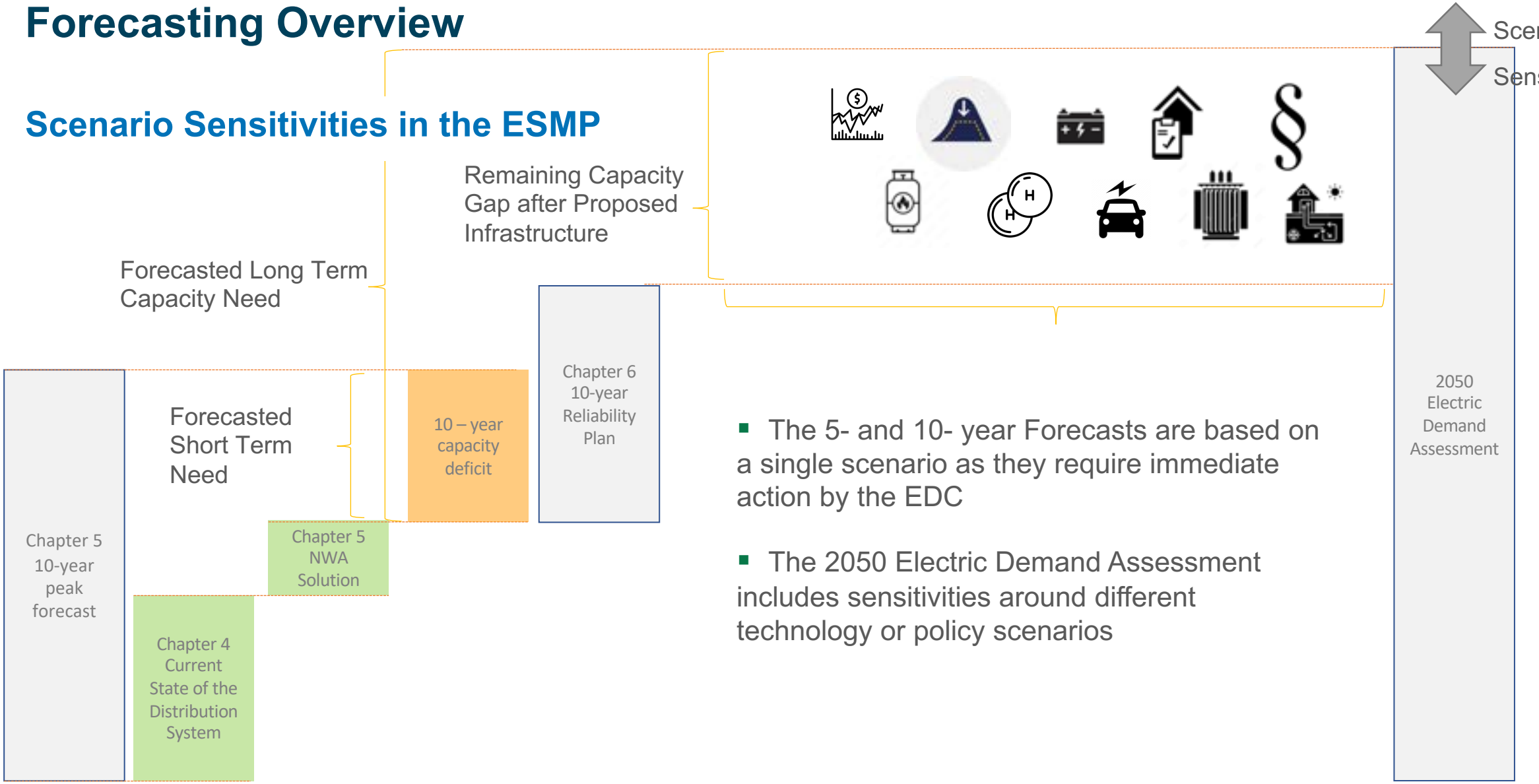


- Annual Forecast Reports Created Annually
- Finalization and data consolidation starts after summer peak period
- Continuous Adjustments, as needed throughout the year for major changes

* Different EDC's have different Release Dates for Forecasts

Forecasting Overview

Scenario Sensitivities in the ESMP



- The 5- and 10- year Forecasts are based on a single scenario as they require immediate action by the EDC
- The 2050 Electric Demand Assessment includes sensitivities around different technology or policy scenarios

Achieving Our Commonwealth's Climate Goals

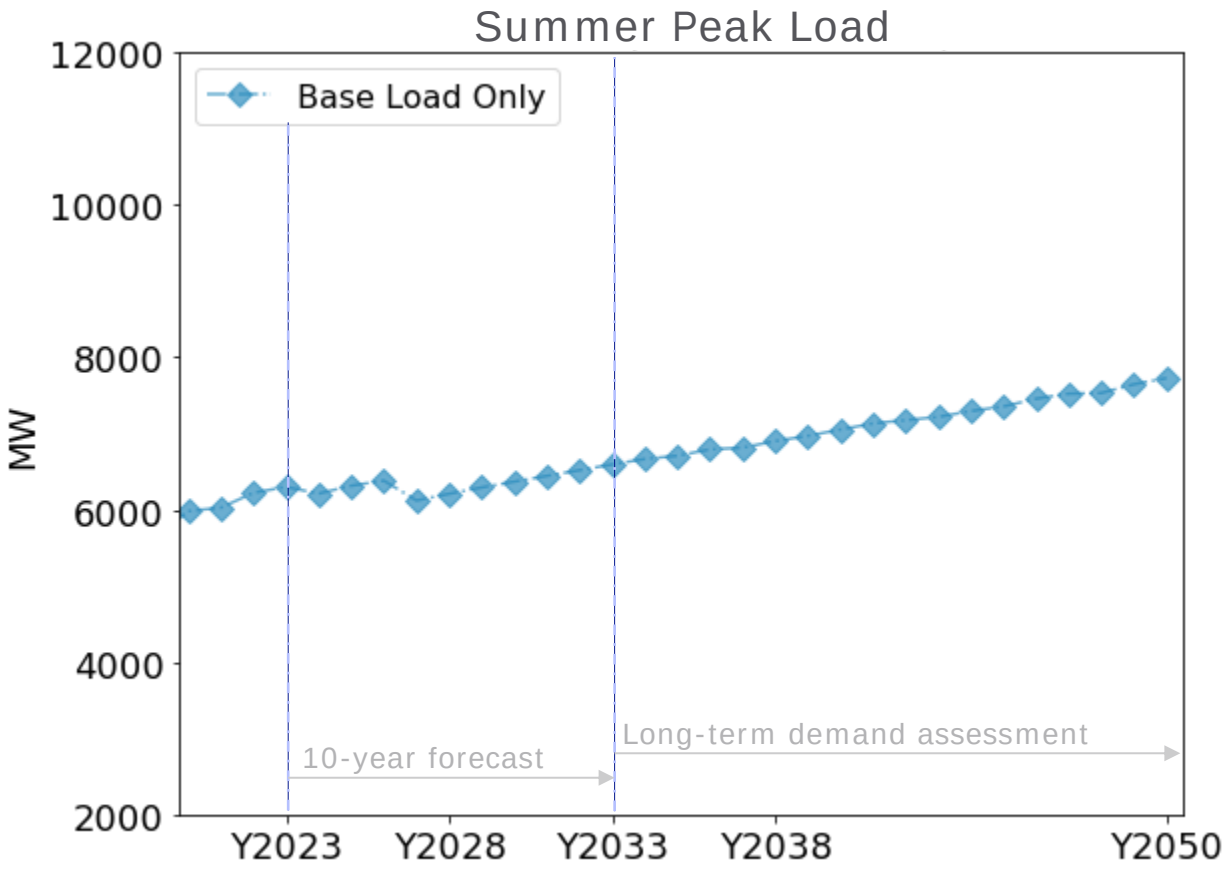
National Grid Electric Load Forecast

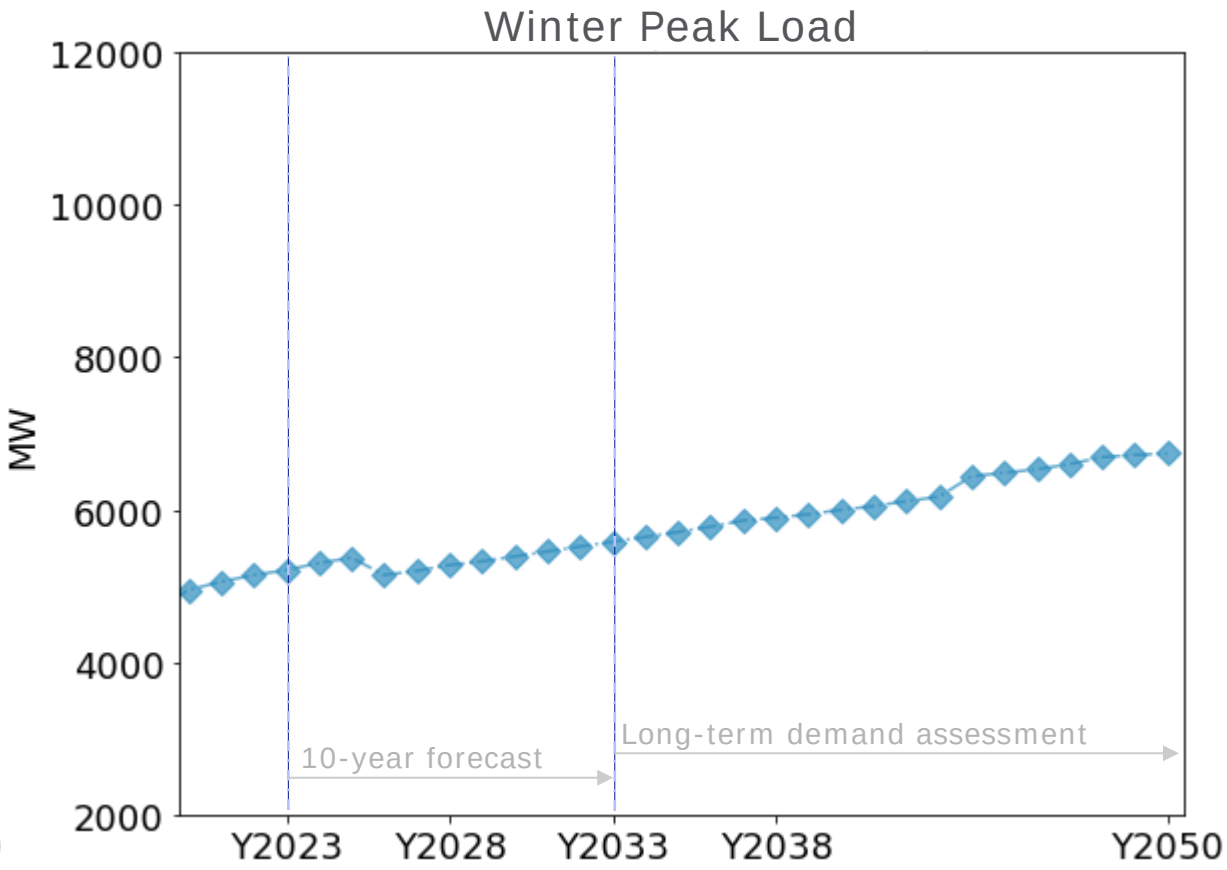
ESMP Technical Conference
November 15, 2023

nationalgrid

Econometric base load forecast and demand assessment

Base load removes impact of solar, storage, energy efficiency, demand response, heat pumps, electric vehicles

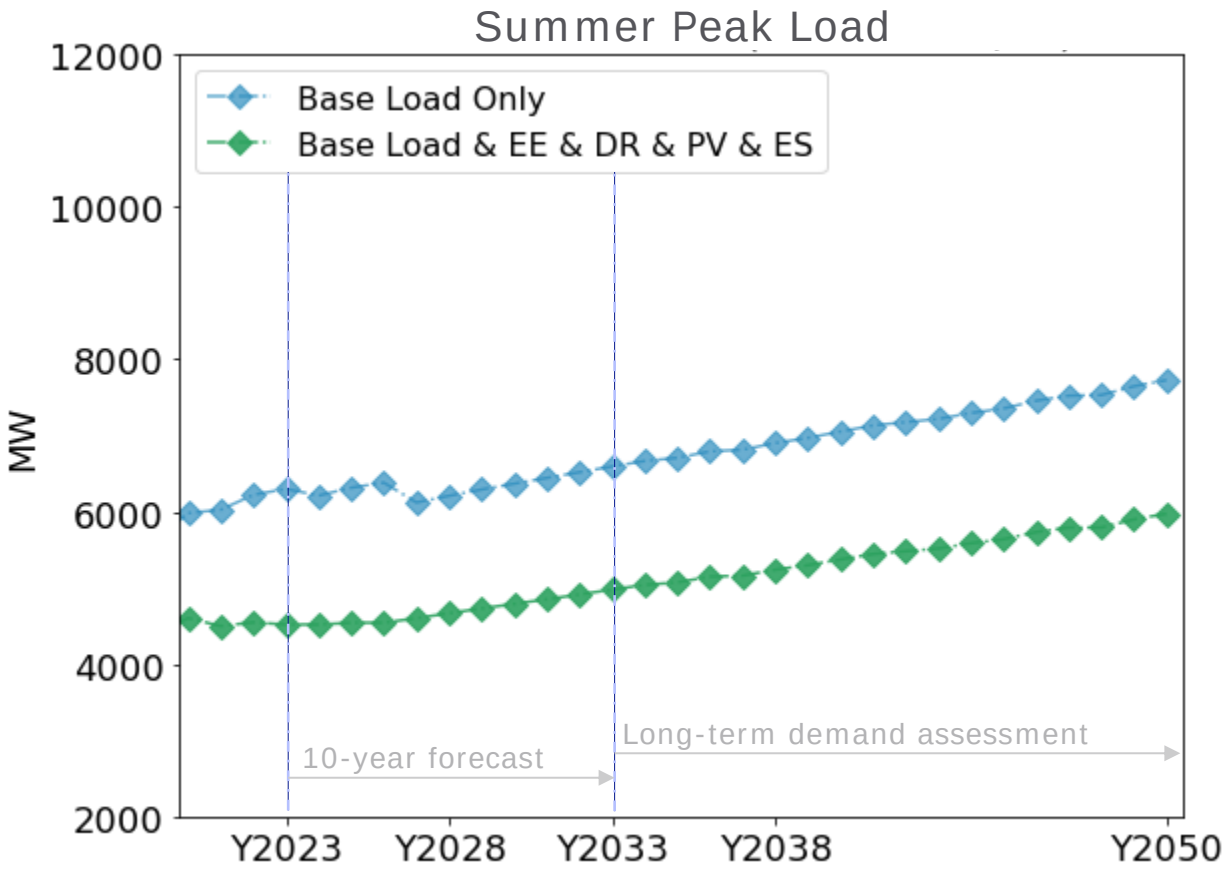


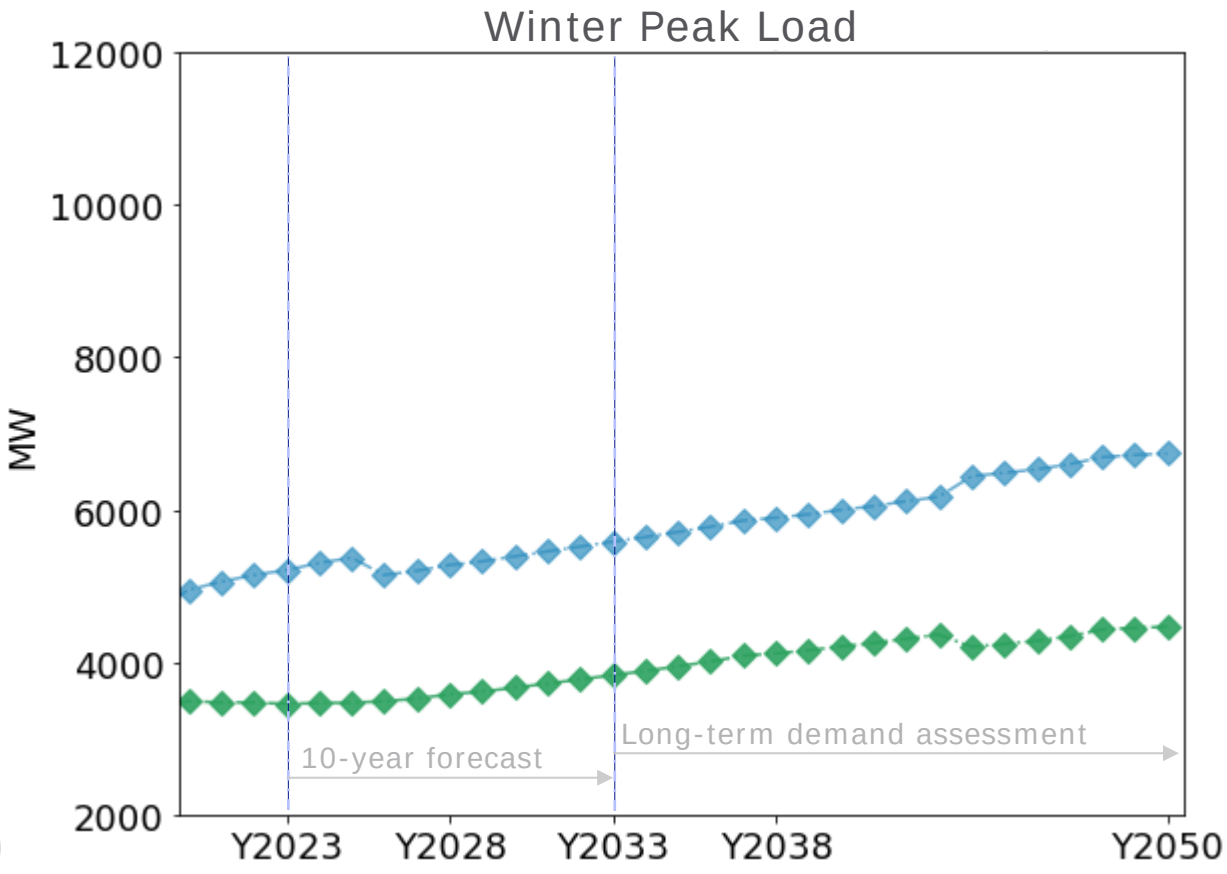


Note: Seasonal peak hours will change due to adoptions of different DERs

Add impact of PV, EE, DR, storage, consistent with state goals

Net load with DERs

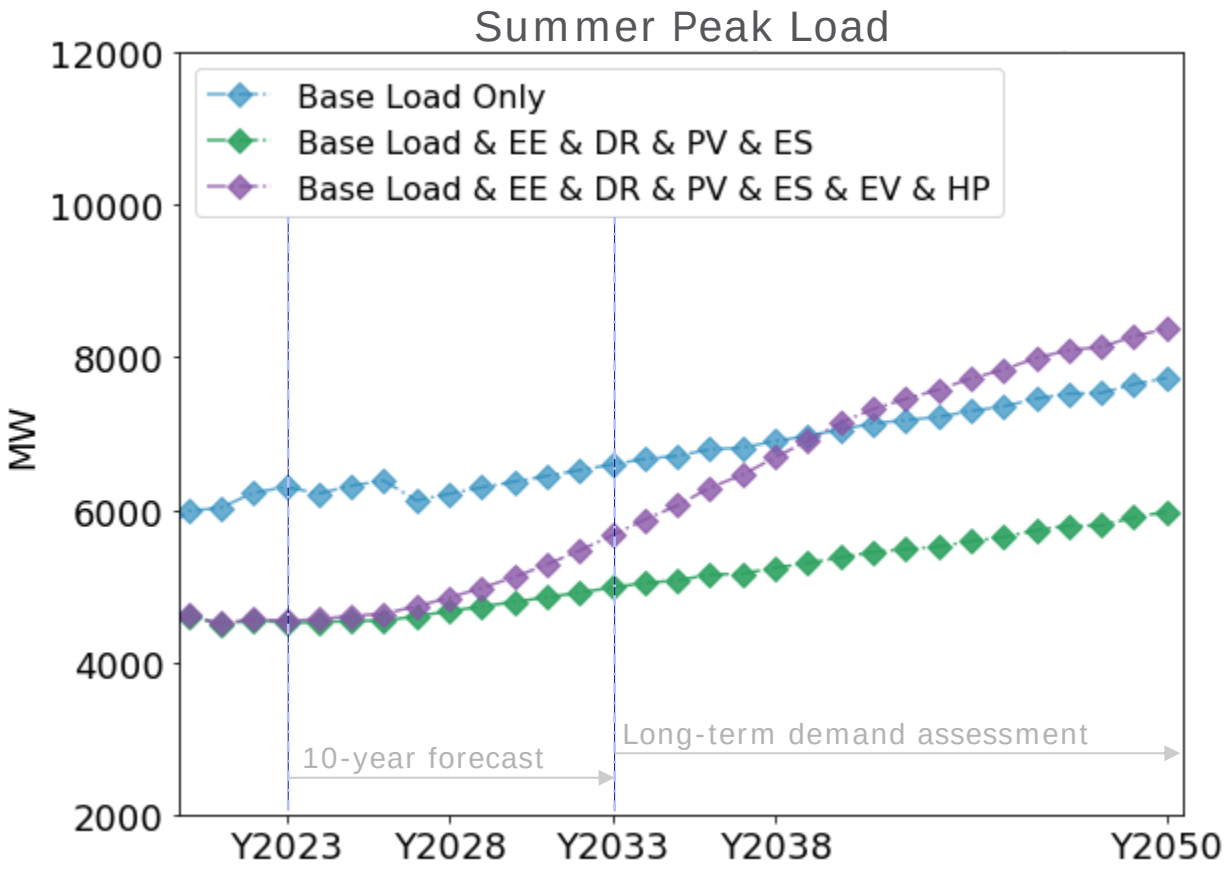


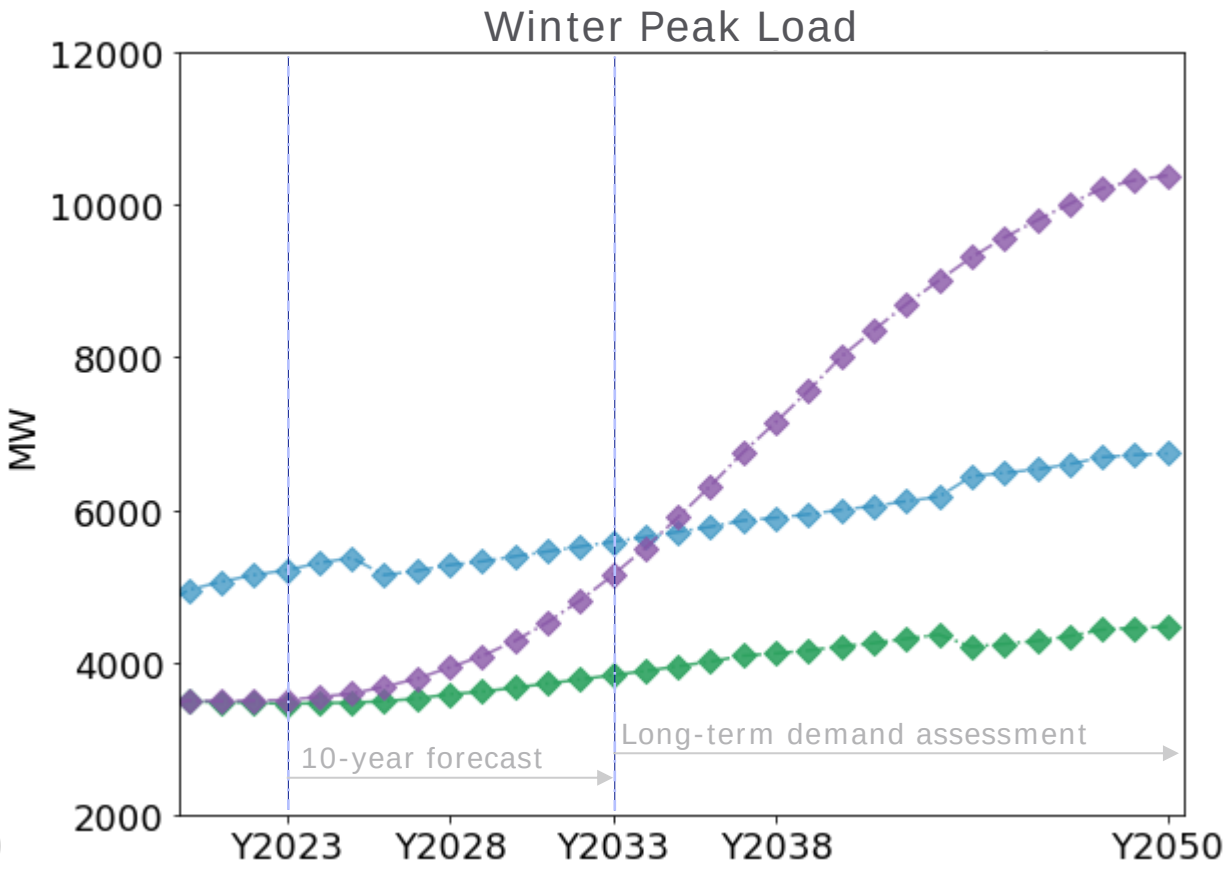


Note: Seasonal peak hours will change due to adoptions of different DERs

Add impact of beneficial electrification consistent with state goals

Net load with DERs and beneficial electrification





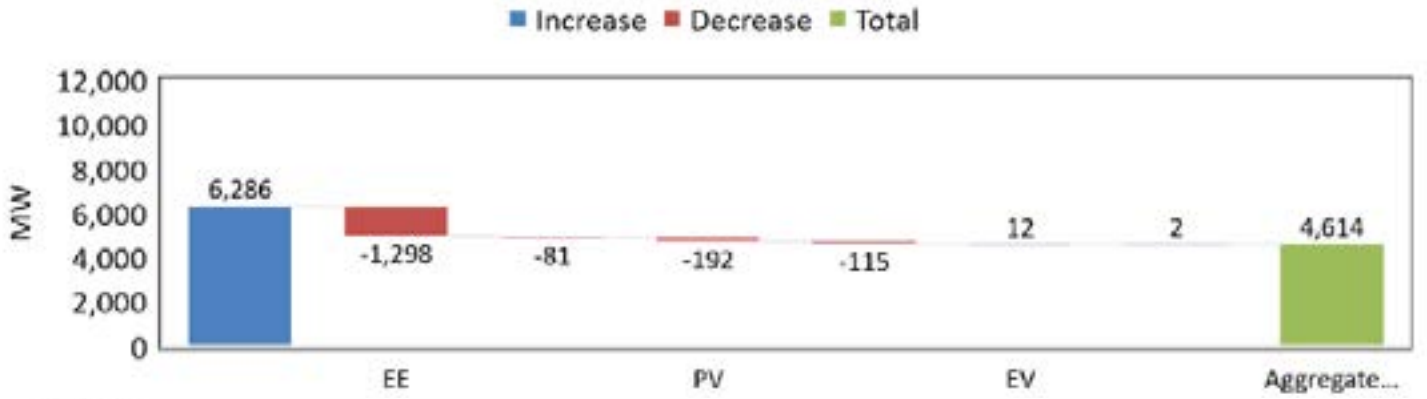
Note: Seasonal peak hours will change due to adoptions of different DERs

Summary of Forecasted Growth

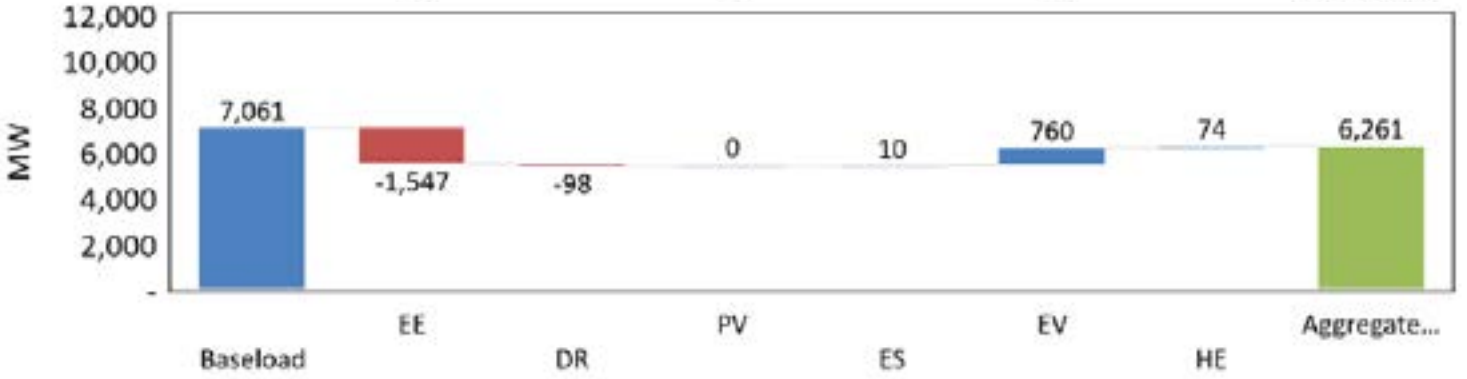
Net load projected to grow by 35% through 2034 and 131% by 2050. Driven by growth in beneficial electrification.

PV installed capacity projected to double by 2034 and more than triple by 2050, however does not directly contribute to peak hour because of shift to winter/darker hours.

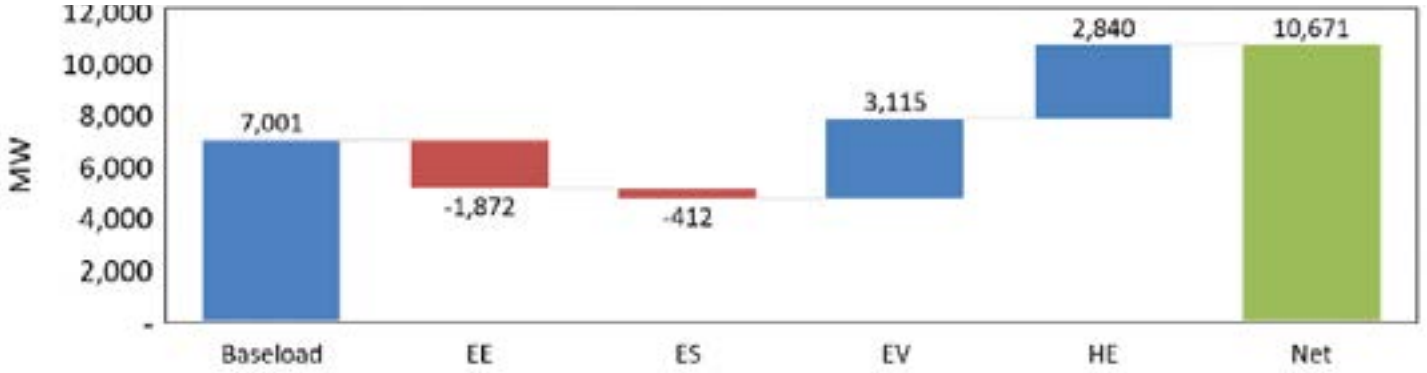
2022



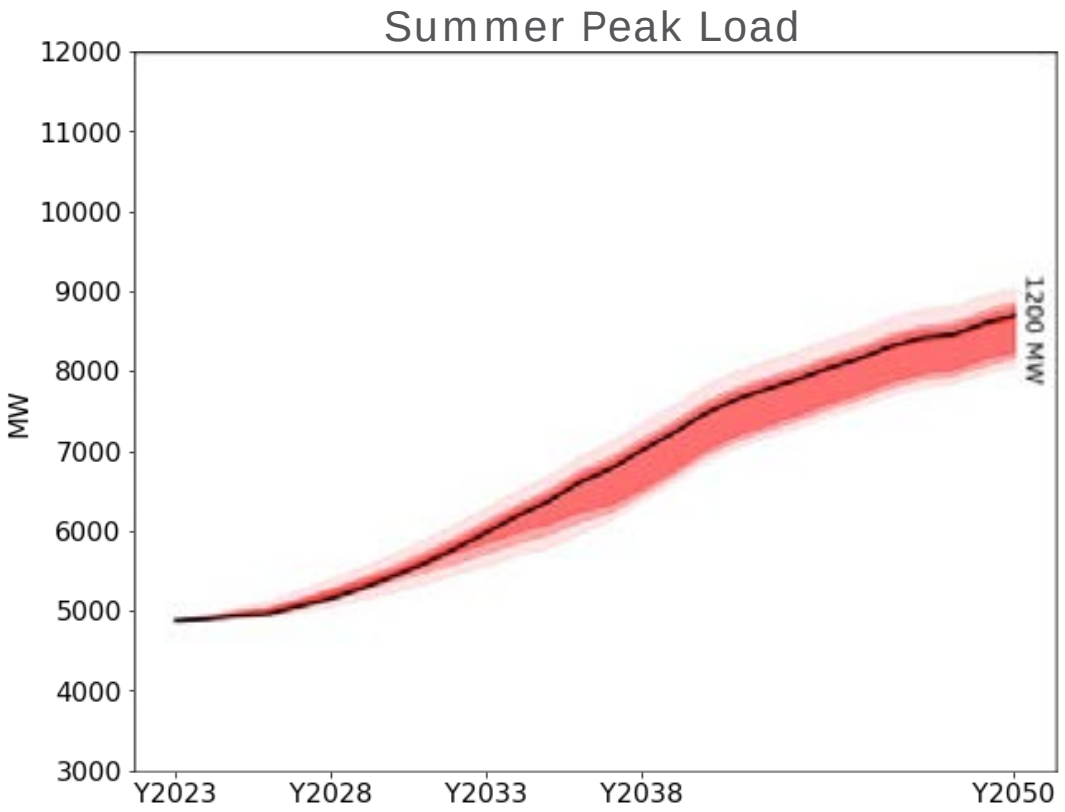
2034

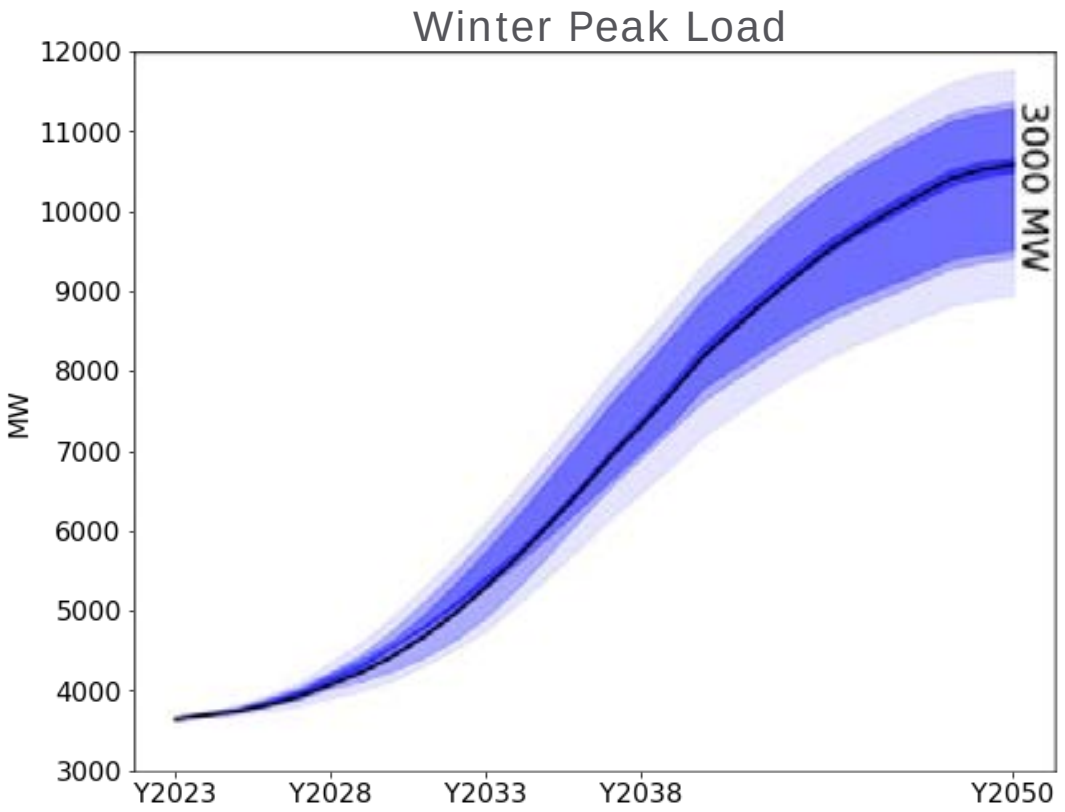


2050



Generate 2000+ scenarios to show uncertainty





nationalgrid

Load Forecasting and Demand Assessment

5- and 10-Year Demand Forecast

Chapter 5 – 5 and 10 Year Forecast

Assumptions in Forecast

- Base load weather normalized using weighted temperature humidity index
- Large known spot/step loads added
- Energy Efficiency (EE) – assumes past history of EE continues
- Distributed Energy Resources (DER) – separate forecast based upon 3 and 5 year historical slope of DER capacity – normalized to peak hour
- Electric Vehicles (EV) – separate EV forecast using ISO-NE EV Adoption Forecasts scaled to registered vehicles within our territories, assumptions for charging diversity and utilization
- Electrification – appliance load and space heating/air conditioning, assumes transition to electric (80% electric by 2050)
- Volt-VAR Optimization (VVO) – when fully deployed 1.75% savings.

Peak Load Forecast vs Demand Assessment

Peak load forecast is used to determine when a project is required, while the demand assessment will be used to adequately size the solution for the future.

Load Adders

What assumptions add to the Base Load Forecast?

Load Adders

Large Spot Loads

Assumptions:

- Known (or relatively certain) new spot loads are added to the forecast
  - These loads are not grown into the future
  - i.e. future 3MW load on circuit 30W30
- Existing large spot loads are held constant throughout the forecast
  - i.e. 8MW load on circuit 50W53

Electric Vehicles

Assumptions:

- Separate 10 year EV forecast are added into the Base Load forecast
- ISO-NE EV Adoption Forecasts by state were used as the basis
  - High Rate – 100% of the ISO-NE Forecasts
  - Baseline – 67% of the ISO-NE Forecasts
- Every owner will have charging
  - 33% - Level 1, 67% - Level 2 chargers
- DC fast charge facilities
  - High Rate – 2 DCFC facilities per year
  - Baseline – 1 DCFC facility every two years
- Anticipate slower EV adoption over next few years due to charging infrastructure
- Includes time of day assumptions

Electrification

Assumptions:

- Adoption assumption:
  - 2025 – 2029 – 1%
  - 2030 – 2034 – 2%
- Residential assumption
  - Appliance and heating/AC loads
  - Heat Pump SEER rating of 18 (13.68 btu/W)
- Commercial/Industrial assumption based upon CECP
  - peak gas loads for all commercial/industrial gas customers as the basis for is commercial/industrial electrification load forecasts
  - 87% small C&I customers to electrify
  - 52% large C&I customers to electrify
- Includes hourly usage assumptions

Load Reducers

What assumptions reduce to the Base Load Forecast?

Load Reducer

Energy Efficiency

Assumptions:

- Mass Save Energy Efficiency Plan
- Past energy efficiency savings included as part of base load measurement. Not able to separate the load reduction
- 2022-2024 Three-Year Energy Efficiency Plan - $22 million
- Passive and active energy savings is approximately 0.5 MW.

Distributed Energy Resources

Assumptions:

- Separate 10 year DER forecast are completed and then added into the Base Load forecast
- Solar PV
  - Based on the 5- and 3-year historical slope of DER capacity growth
  - Projected incremental DER is used to develop hourly DER projections
  - Hourly peak output is calculated using the average hourly DER output of the large DG
- Energy Storage Systems("ESS")
  - Sufficient ESS installed to level the load curve
  - Hourly dispatch (charge/discharge) based on the forecasted peak day hourly interval data
  - Assumed a portion of ESS could be charging during peak load or discharging during minimum load

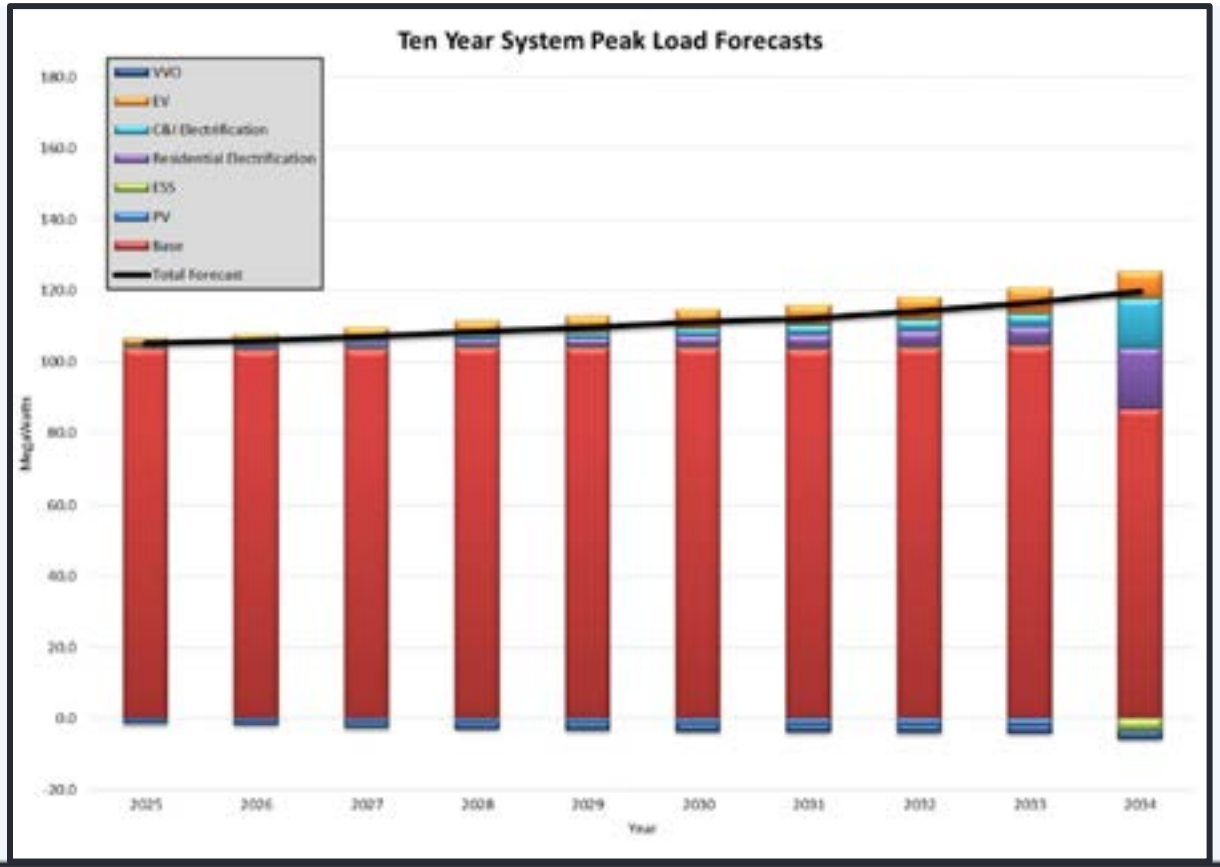
Volt-Var Optimization (VVO)

Assumptions:

- Anticipated reduction in current loads when VVO is implemented
  - Base Load Forecasts – 2% reduction
  - Residential Electrification – 1% reduction
  - Commercial/Industrial Electrification – 0.75%
  - EV – 2%
- Overall load reduction when VVO is fully deployed of approximately 1.75%

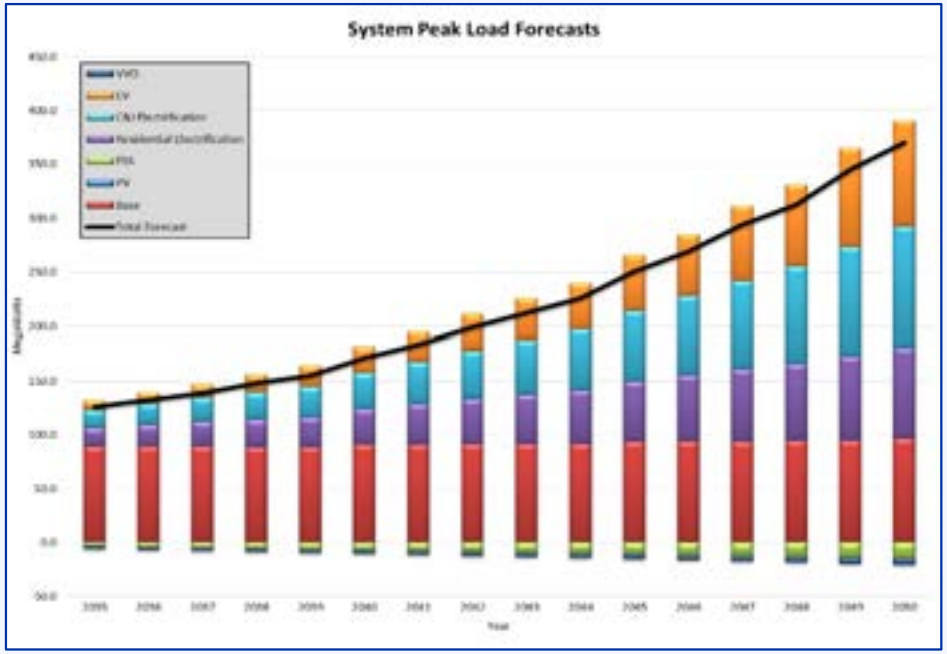
5- and 10-Year Demand Forecast

Chapter 5 – 5 and 10 Year Forecast



Demand Assessment

Demand Assessment designed to support State's decarbonization goals.



Assumptions:

- Demand assessment supports our share of the State's goals
- Common assumptions
  - Load Forecast and Demand Assessment
- Assessment does not consider changes in building codes
- Demand response of heat pumps not included
  - assumed low participation
- Technology innovation plays large role in accuracy of forecast
- Time of day usage assumptions to develop forecast
- 80% of residential customers convert to electric heat by 2050
- 87% of small and 52% of large C&I customers convert by 2050
- High rate or 100% of ISO-NE EV forecast from 2036-2050
- EV managed charging program not assumed in forecast
- DERs 70% of peak load and 300% of light load
- Same approach to VVO reductions

Demand Assessment

Demand Assessment designed to support State's decarbonization goals.

Sector	Description	State Benchmark	Units	Scaled Benchmark	Units	Company Forecast	Units
Transportation Sector (Note 2)							
	Light-Duty EV	5,000,000		46,976	vehicles	52,841	vehicles
	Medium/Heavy Duty EV	353,000		3,316	vehicles		
Building Sector (Note 2)							
	Residential air source heat pumps	2,000,000		18,790	heat pumps	21,201	heat pumps
	Residential Ground source heat pumps	195,000		1,832	heat pumps		
	Residential EE Retrofits	1,300,000		12,214	homes	0	
	Commercial air source heat pumps	1,500,000,000		14,092,698	sq. ft.	Note 3	
	Commercial ground source heat pumps	140,000,000		1,315,319	sq. ft.	Note 3	
Power Sector (Note 2)							
	Offshore Wind	23.0	GW	216	MW		
	Onshore Wind	1.0	GW	9	MW		
	Solar	27.0	GW	254	MW	254	MW
	Storage	5.8	GW	54	MW	60	MW

Note 1 Massachusetts Census Data 2020
https://malegislature.gov/Redistricting/MassachusettsCensusData/CityTown
Note 2 2050 Clean Energy and Climate Plan, Table 3-3
https://www.mass.gov/doc/2050-clean-energy-and-climate-plan/download
Note 3 Company forecasts are based on peak gas usage of gas C&I customers

Forecasting Results – Eversource

GMAC Technical Session #1

Dr. Gerhard Walker, Manager Advanced Forecasting and Modeling

EVERSOURCE

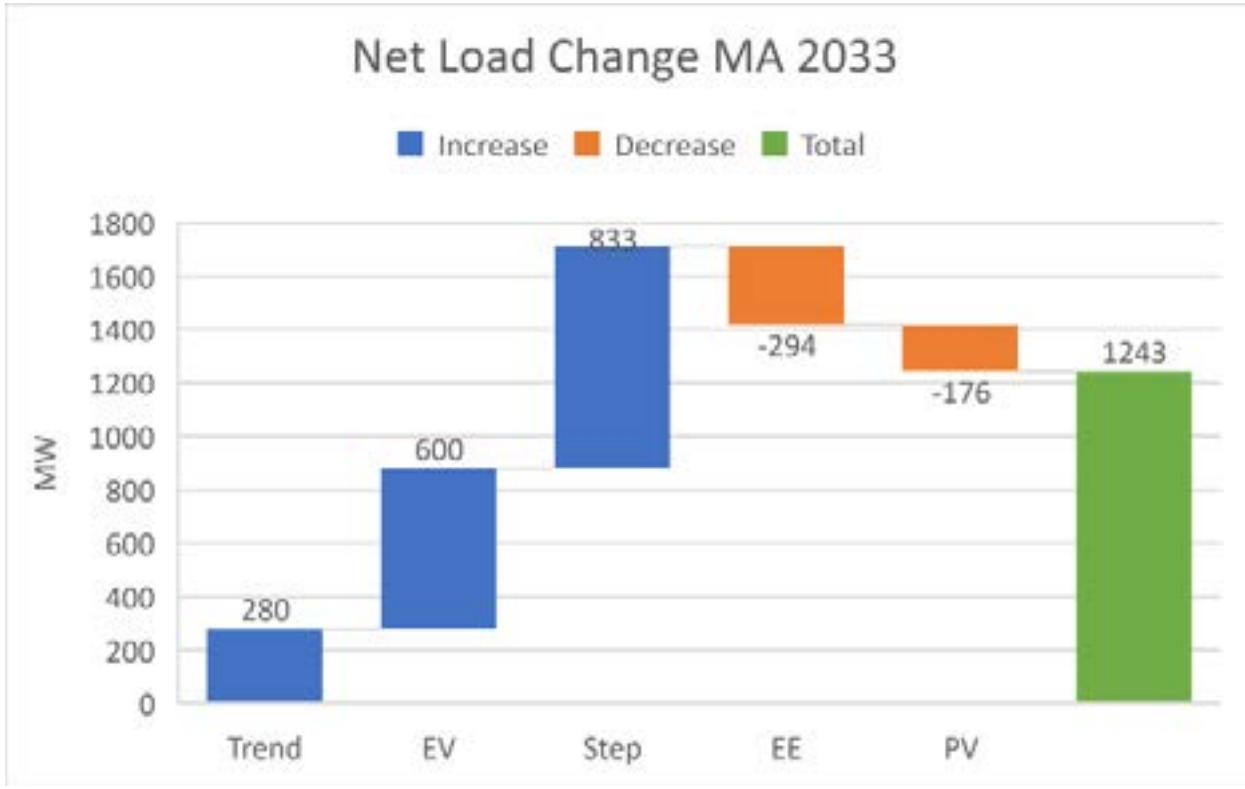
Chapter 5: 5- and 10-Year Forecast

Chapter 5 describes the load forecasting process and the forecast for the next 5 and 10 years. Over the next 10 years, the system will see significant load growth due to step loads and electrification.

7.4 GW Peak Load

+20% System Wide

2.8 GW Peak Solar



Chapter 5 – 5- and 10-Year Forecast

Step loads comprise the largest demand increase across the territory over the next 10 years.

Step Loads represent large new customer additions such as high rises, labs, or fast charging stations

- 833 MW of Step Loads
  - 796 MW in the next 5 years across the state
  - 794 MW of Step Loads in the Metro Regions
    - 605 MW Metro Boston
    - 189 MW Metro West

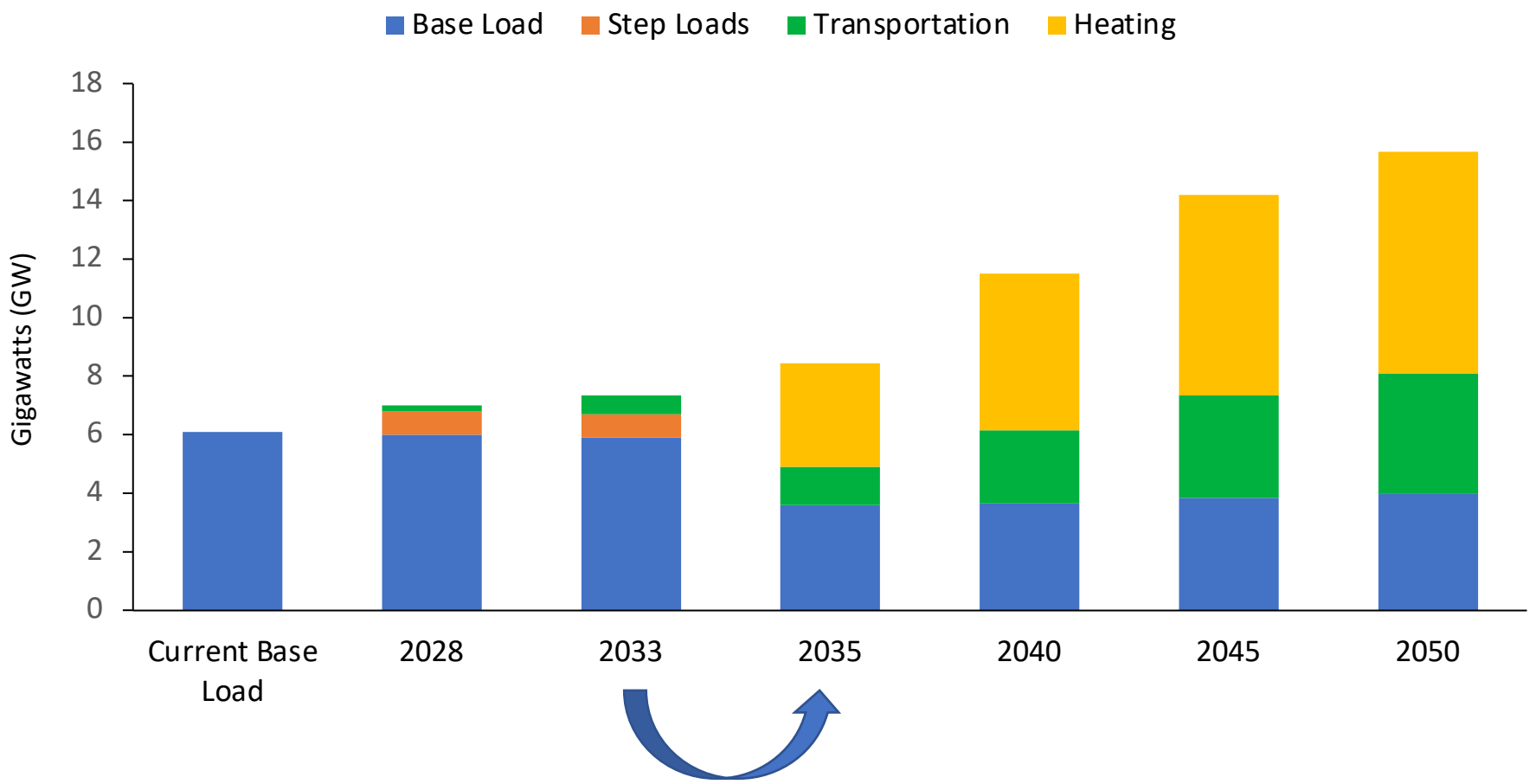
Chapter 8 Long Term Forecast

Electric Heating and Vehicles Dominate System Load

15.3 GW Peak Load

+150% System Wide

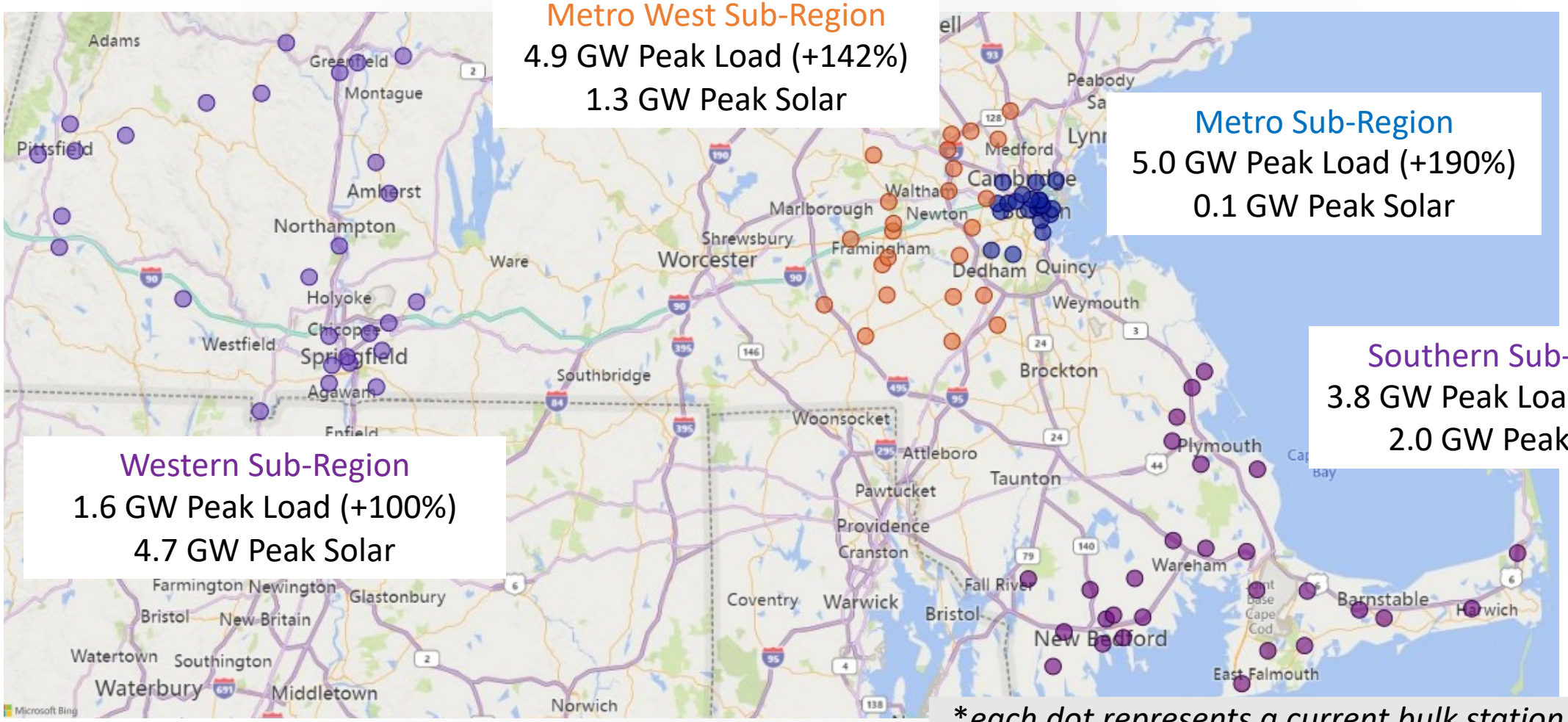
8.2 GW Peak Solar



Winter Peak Transition reduces Base Load due to loss of Cooling Load

Chapter 8 – Long Term Demand Assessment

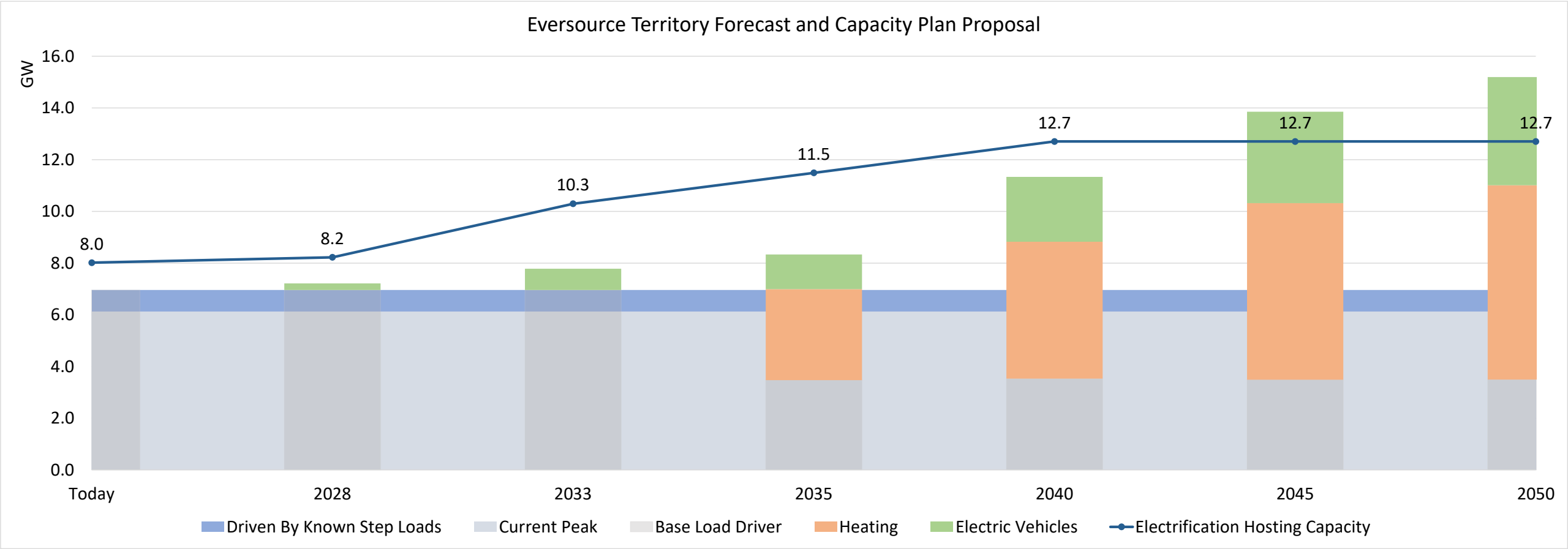
2050 Forecast by Sub-Region (with existing sub-stations)



*each dot represents a current bulk station

2050 Load Projection

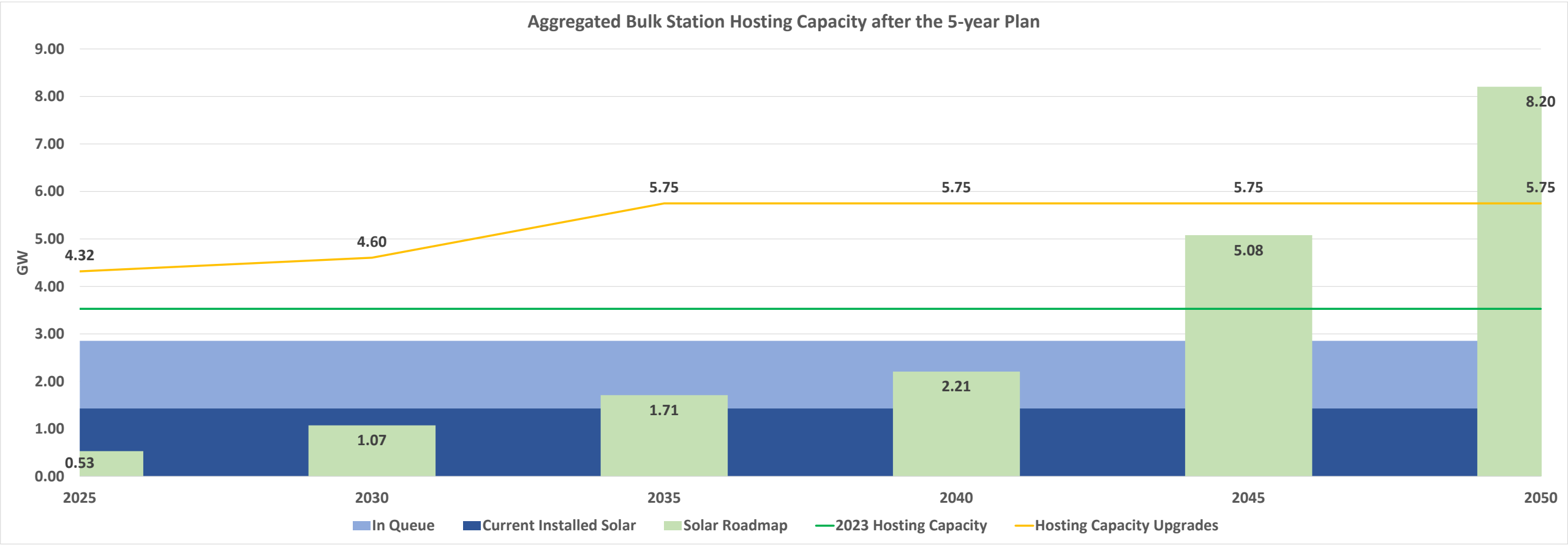
Comparison of Projected Load and Proposed Capacity Additions



**This data represents system wide aggregated values and does not show local constraints due to load pockets*

2050 DER Projections

Comparison of Projected Solar and Proposed Hosting Capacity Additions



**This data represents system wide aggregated values and does not show local constraints due to high PV development*

Breakouts to Develop Clarifying Questions on Demand Forecasts

1. **Once in break-outs**, everyone should simultaneously use the **Chat function to write down one question** you'd like to ask a utility/the utilities on their demand forecast(s). (4 min)
2. Once everyone has written down their question, move down the Chat list and **each person briefly explain what their question is and why it is important**. (5 min)
3. Have a **brief discussion** to see if any of the questions can be **combined, consolidated, or sharpened**—type any changed/combined questions in the Chat. (5 min)
4. Identify **one volunteer** to help the group **prioritize the questions**, and to **ask the prioritized questions to utility/utilities on behalf of the group**. (1 min)
5. Then have the volunteer go back down the Chat list of questions one by one and have everyone use the **hand-raising function** to prioritize the questions—by each person raising their hand for **only their top three questions** (and have the volunteer record the number of votes in the chat or off-line). Don't forget to **lower hand after each question**. (5 min)
6. The volunteer should then **use the prioritization to ask as many questions as time allows**. The questions will be in your chat when you return to main room.

Note: Utilities not participating; facilitators will float to observe (and pace if need be); observers/audience on break.

Break-Out Affinity Groups (#1 and # 2) - updated

#1 CBO/EJC		#2 DG/DER/EV Developers	
EDF	Jolette Westbrook	**Advanced Energy United**	Kat Burnham
ACE	Sofia Owen	**NECEC**	Tim Snyder
Making Opportunity Count (MOC)	Melissa Gonzalez	**Nexamp**	Brandon Bowles
United Way of North Central Mass	Kory Eng	**Mass Solar**	Mark Sandeen
EJ Table	Cindy Luppi	**C Power**	Nancy Chafetz
Browning the Green Space	Kerry Bowie	**Tesla**	Bill Ehrlich
National Consumer Law Center	John Howat	**Mass DOT**	Christoper Aiello (Nov 15) Hayes Morrison
Mass Housing	Elizabeth Torres	**Calstart**	Jordan Stutt

Break Out Affinity Groups (#3 and #4) - updated

#3 Housing/Large Users/Business		#4 Labor/Workforce/Muni /State/Quasi-State Agencies	
WMA Economic Develop Council	Rick Sullivan	**IBEW**	Mike Monahan
Fitchburg Housing Authority	Doug Bushman	**North Central MA Chamber of Commerce**	Roy Nascimento
A Better City	Yve Torrie	**Franklin Cummings Tech**	Dr. Marvin Loiseau
NAIOP	Anastasia Daou	**UMass Lowell**	Rauiri O'Mahony
Boston Properties	Neetu Siddarth (Nov 15) Ben Myers (Nov 28)	**MA Municipal Association**	Adrienne Nunez (Nov 15) Josie Ahlberg (Nov 28)
Mass General Hospital	Dennis Villanueva or Jason Dantona	**Mass Development**	Dan Rivera
MA Business Roundtable	Tonja Mettlach (Nov 15) JD Chesloff (Nov 28)	**MA Economic Development**	Helena Fruscio Altsman
Fitchburg State	JD Head	**Mass Life Sciences**	Ken Turner
Lowell General Hospital	Kevin Foley	**Mass Bio**	Ben Bradford
Gillette Stadium	Dena Ciampa (Nov 15) Jason Stone (Nov 28)		

Clarifying Questions (and Responses) on Demand Forecasts

- Round-robin Q&A with:
  - Each break-out group asks one of their top questions
  - Keep going around as time allows
  - Avoid questions that another group already essentially asked
- Direct question at:
  - The lead-off presenter
  - An individual utility
  - All the utilities
- Utility responses should be responsive (and succinct)
- Additional questions not covered, can be submitted to the utility websites (see slide on Submitting Questions) for response following the meeting

Stakeholder Discussion and Feedback on Demand Forecasts

- Initial thoughts and feedback on the utilities' ESMP-related demand forecasts
- Raise hands to get in queue
- Be clear about whether providing feedback to an individual utility or all the utilities
- Be succinct so that everyone can provide their initial feedback
- Facilitators may ask follow up questions and guide discussion as time allows
- Remember these are your initial reactions, and we are planning to provide another opportunity to share feedback at the next workshop on 11/28

BREAK (11:00 TO 11:15 AM)

Grid Infrastructure Needs

nationalgrid

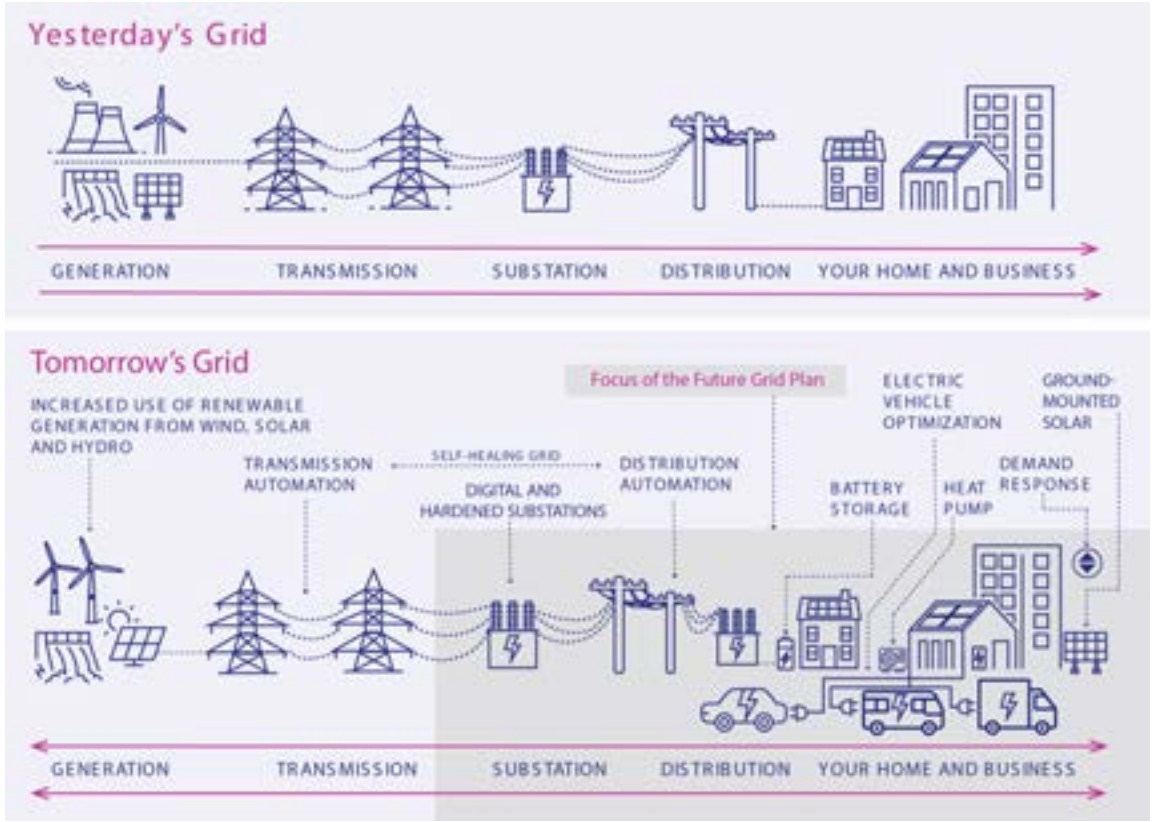
Grid Infrastructure – Current State

Transmission lines carry electricity long distances at high voltage levels (e.g., 69 kV, 115 kV, 345 kV)

Substation Transformers step voltage down to lower voltages safer for local distribution (e.g., 15 kV, 5 kV)

Distribution Lines or **Feeders** carry power overhead or underground to homes and businesses, where **Distribution Transformers** step voltage down further

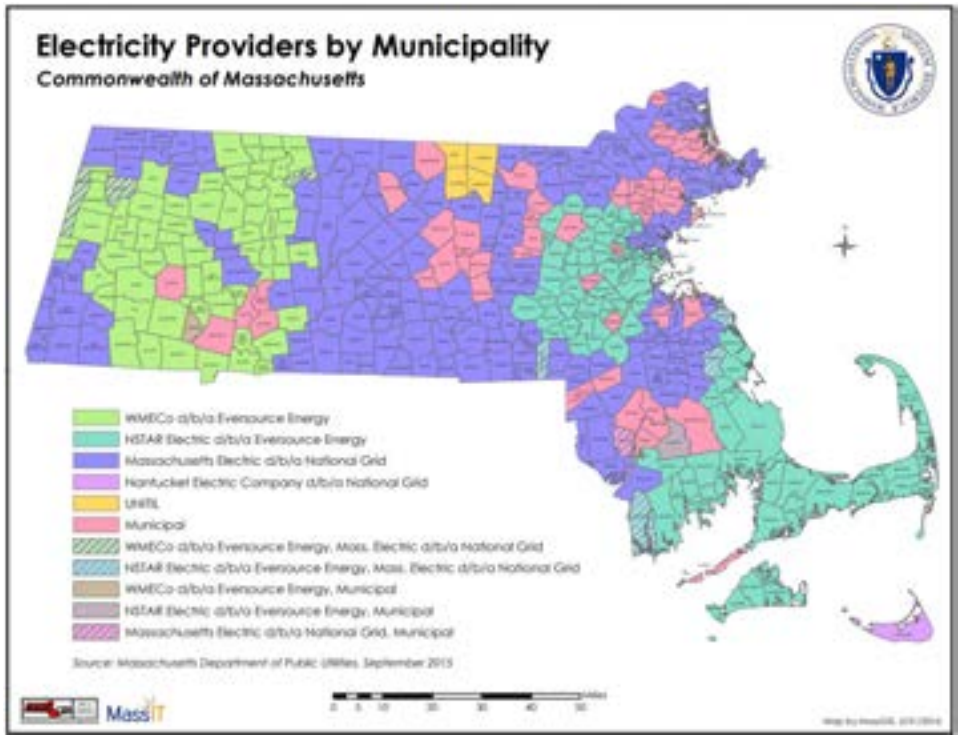
Generation occurs both at a centralized level (feeding into transmission) and distribution level (DER)



National Grid

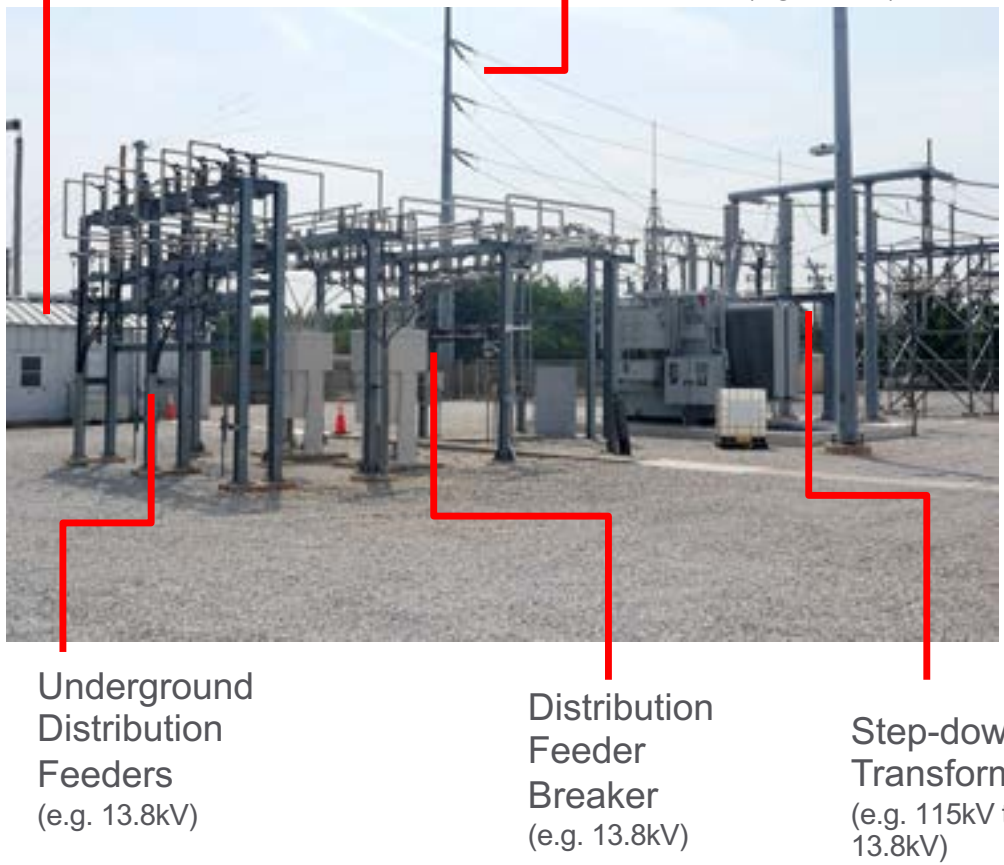
Grid Infrastructure by the Numbers

	Eversource	National Grid	Unitil	State-Wide
Planning Subregions	4	6	1	11
Substations	172	178	15	365
Miles Distribution	20,700	18,500	522	39,722
Miles Overhead	11,500	13,500	454	25,454
Miles Underground	9,200	5,000	68	14,268
Poles	500,000	720,000	19,100	1,239,100
Distribution Service Transformers	172,900	183,600	6,500	363,000
Electric Customers	1.5 million	1.3 million	30,500	2,830,500



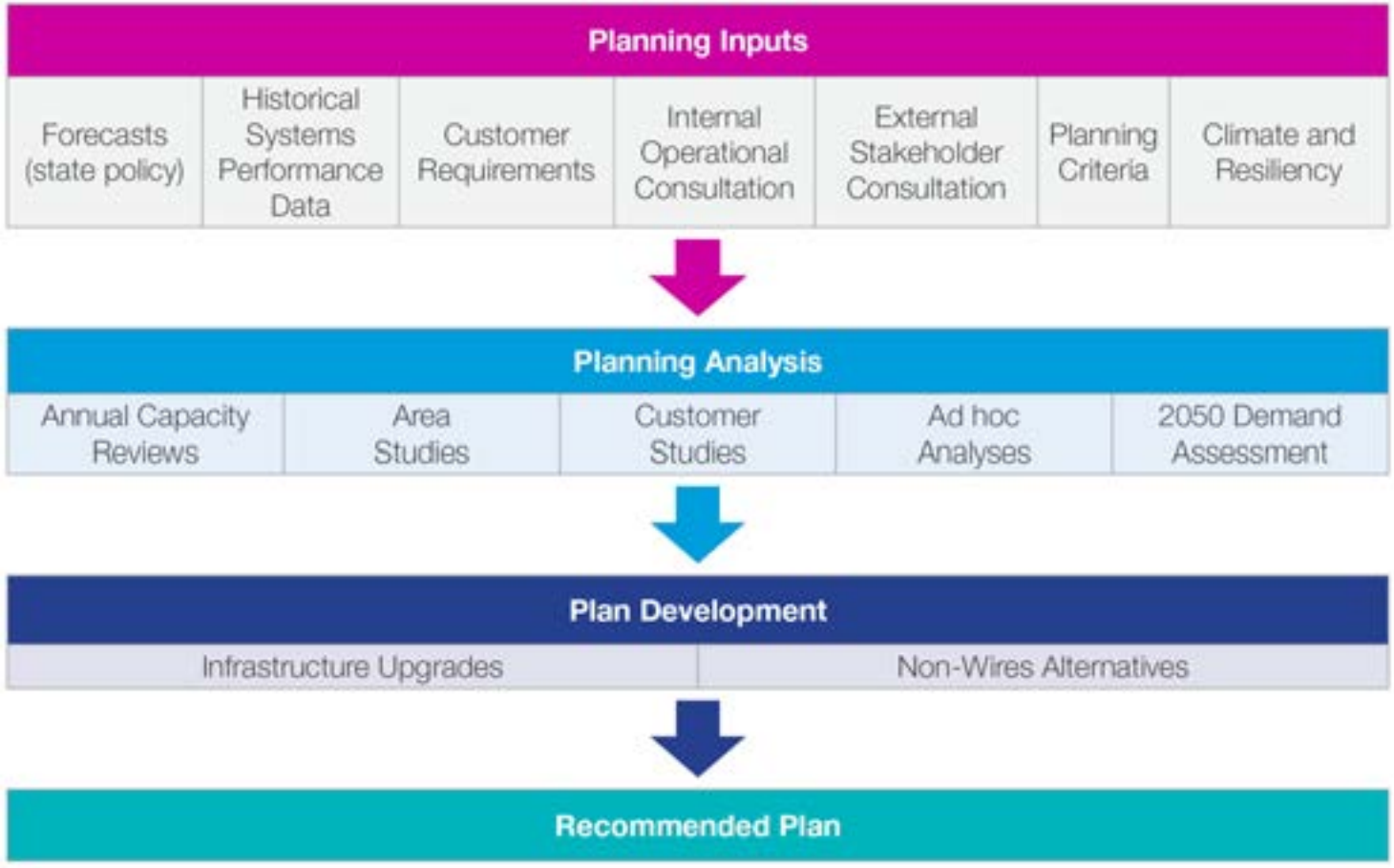
Substations - Key Component

- **Substations** link the transmission system to the distribution system, and eventually the end users – our customers
  - They convert power utilizing power transformers that do not move or rotate
- Substations are a key component of the electric power system, essential in meeting customer demands and supporting 21st century economies
  - They are critical in converting wind power, solar generation, and any form of clean energy resources from source to customers
- Projects to expand or build new substations are high cost, long duration projects that can become a bottleneck to electrification and other customer requests, if we do not build in advance



Grid Infrastructure – Planning Process

- **The EDCs have formal planning processes that are generally consistent across all three Companies**
  - Forecast identifies projected demand
  - Planning Criteria establishes thresholds for acceptable behavior (EDC-specific)
  - Recommendations (infrastructure and otherwise) are developed to address performance concerns
- **The ESMP process for each EDC was consistent with the goals identified in the legislation, and followed established planning processes; the outcomes are EDC-specific based on the unique characteristics of each Company's system.**



Grid Infrastructure

November 13, 2023

Grid Infrastructure Estimates

Estimated change in grid infrastructure from 2025-2050

	Existing	2025-2029 Estimate	2030-2039 Estimate	2040-2050 Estimate	2025-2050 Total Increase Estimate	2025-2050 % Increase Estimate
Substations	15	16	16	19	4	27%
Miles Distribution	522	530	550	570	48	9%
Miles Overhead	454	460	470	480	26	6%
Miles Underground	68	70	80	90	22	32%
Poles	19,100	19,320	19,740	20,060	960	5%
Distribution Service Transformers	6,500	6,890	7,150	7,410	910	14%
Electric Customers	30,500	31,400	32,900	34,300	3,800	12%

Note: The table provided above is an estimate based upon the current ESMP plan and is used for presentation only. The draft ESMP did not attempt to provide this level of estimation. The estimates provided are subject to change as the load forecast, demand assessment and technology changes which will drive modifications to this plan.

Capacity Expansion 2025-2030

Projects identified to address capacity constraints (ESMP Section 6)

Lunenburg Substation Expansion - 2026

Constraints

2025 - Lunenburg Regulator Loading

2026 – Lunenburg Transformer Loading

Driver:

New 3 MW Customer on 30W30

Solution:

Install 30MVA 69/13.8kV Transformer

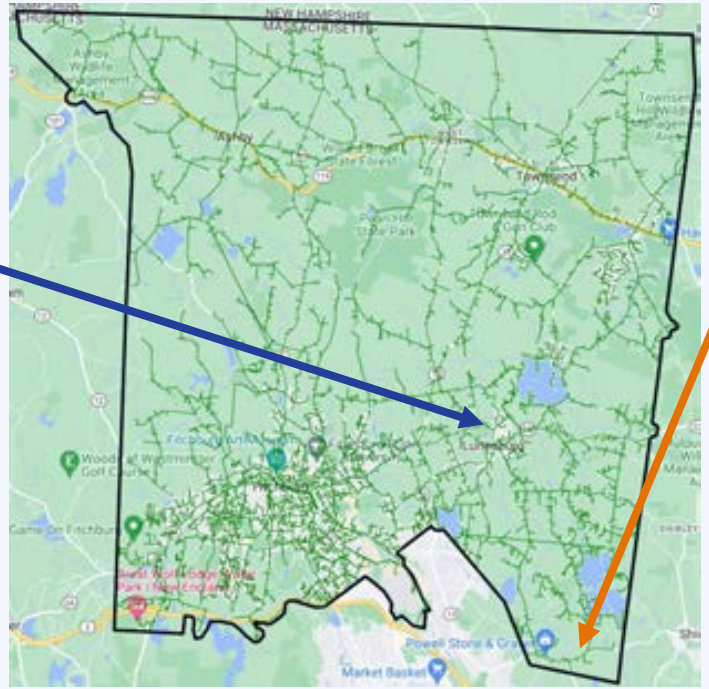
Split 30W30 into 2 circuits

Split 30W31 into 2 circuits

Costs ($9.1 million):

2025 - $4.4 million

2026 – $4.7 million



New South Lunenburg Substation - 2030

Constraints

2030 – 08/09 Loading N-1 Condition

2034 – Flagg Pond loading

Driver:

Normal load growth on north end of system

Solution:

New system supply in South Lunenburg

115kV Ring Bus

115 x 69kV to 13.8kV

Offloads Flagg Pond, 01, 02, 08, 09 lines

Costs ($20.5 million):

2025 - $3.0 million

2027 – $7.0 million

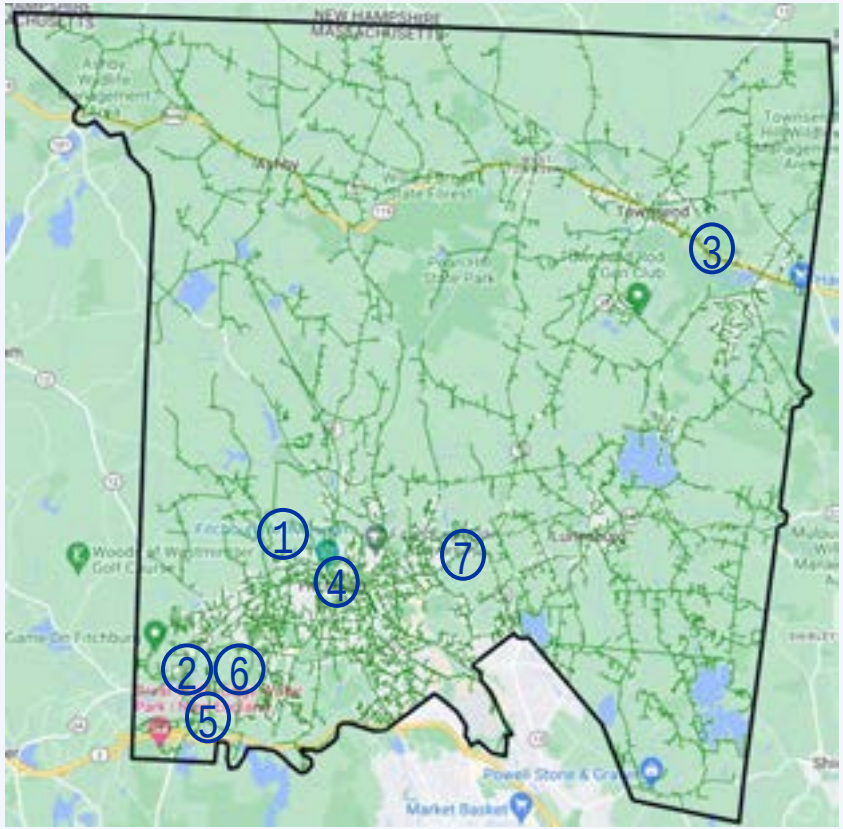
2028 - $8 million

2029 - $2.5 million

Capacity Expansion 2031-2039

Projects identified to address capacity constraints (ESMP Section 9)

1. Establish 2nd Circuit at Rindge Road – 2035
2. Replace Princeton Road 50T2 Transformer – 2035
3. Townsend Substation Capacity Additions – 2036
4. Install New Circuit and Split Circuit 22W1 – 2036
5. Flagg Pond Capacity Additions – 2037
6. Replace Princeton Road 50T3 Transformer – 2037
7. Pleasant Street Substation Capacity Additions - 2038



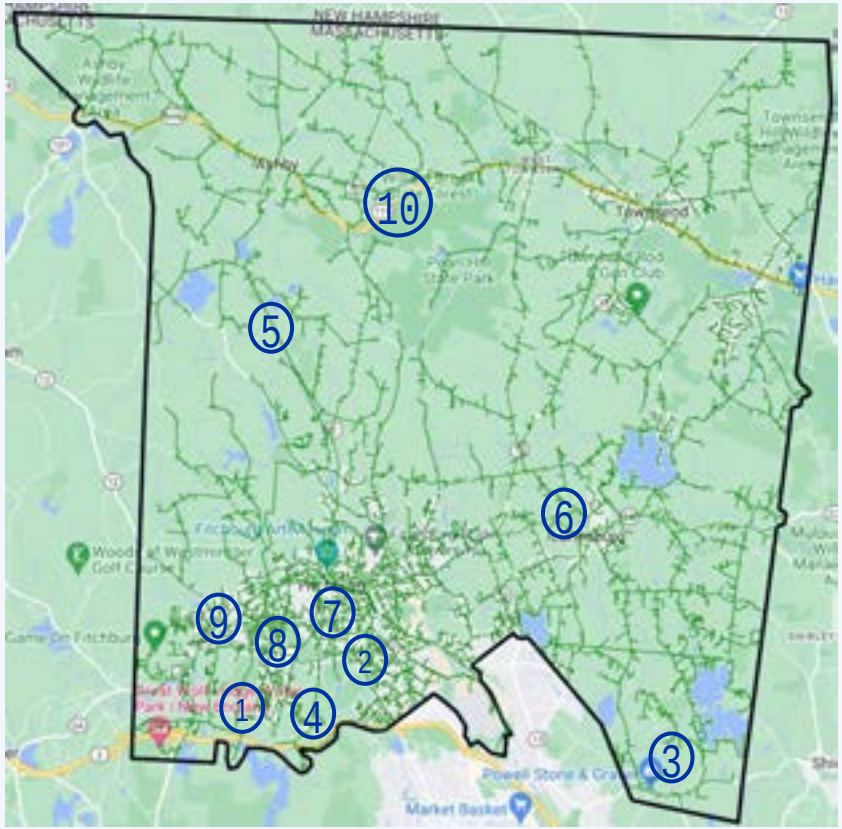
The projects shown here are based upon the most recent load forecast and demand assessment. These projects will be re-evaluated each year when the load forecast and demand assessment is updated with the most up to date load, DER and NWA information.

Capacity Expansion 2040-2050

Projects identified to address capacity constraints (ESMP Section 9)

1. 01 and 02 Line Capacity Additions – 2040
2. Summer Street Substation Capacity Additions – 2040
3. Construction New Lunenburg/Summer Street Supply – 2042
4. Beech Street Tap Substation – 2042
5. New Rindge Road and Ashby Area Substations – 2044
6. Replace Lunenburg 30T1 Transformer – 2044
7. Construction 2nd 69kV Line between Summer S/S and Sawyer Passway – 2045
8. Canton Street Substation Capacity Additions – 2047
9. Replace River Street 25T1 Transformer – 2048
10. Replace West Townsend 39T1 Transformer - 2050

The projects shown here are based upon the most recent load forecast and demand assessment. These projects will be re-evaluated each year when the load forecast and demand assessment is updated with the most up to date load, DER and NWA information.



Eversource Grid Infrastructure Investments

GMAC Technical Session #1

Lavelle Freeman, Director Distribution System Planning

11/15/2023

EVERSOURCE

Current Grid Can't Support Clean Energy Transition

ADDITIONAL INFRASTRUCTURE NEEDED

Bulk Distribution Substations as *clean energy hubs*, are critical elements of the clean energy transition, creating the necessary headroom to accommodate future system demand

Eversource's 10-Year Capital Plan:

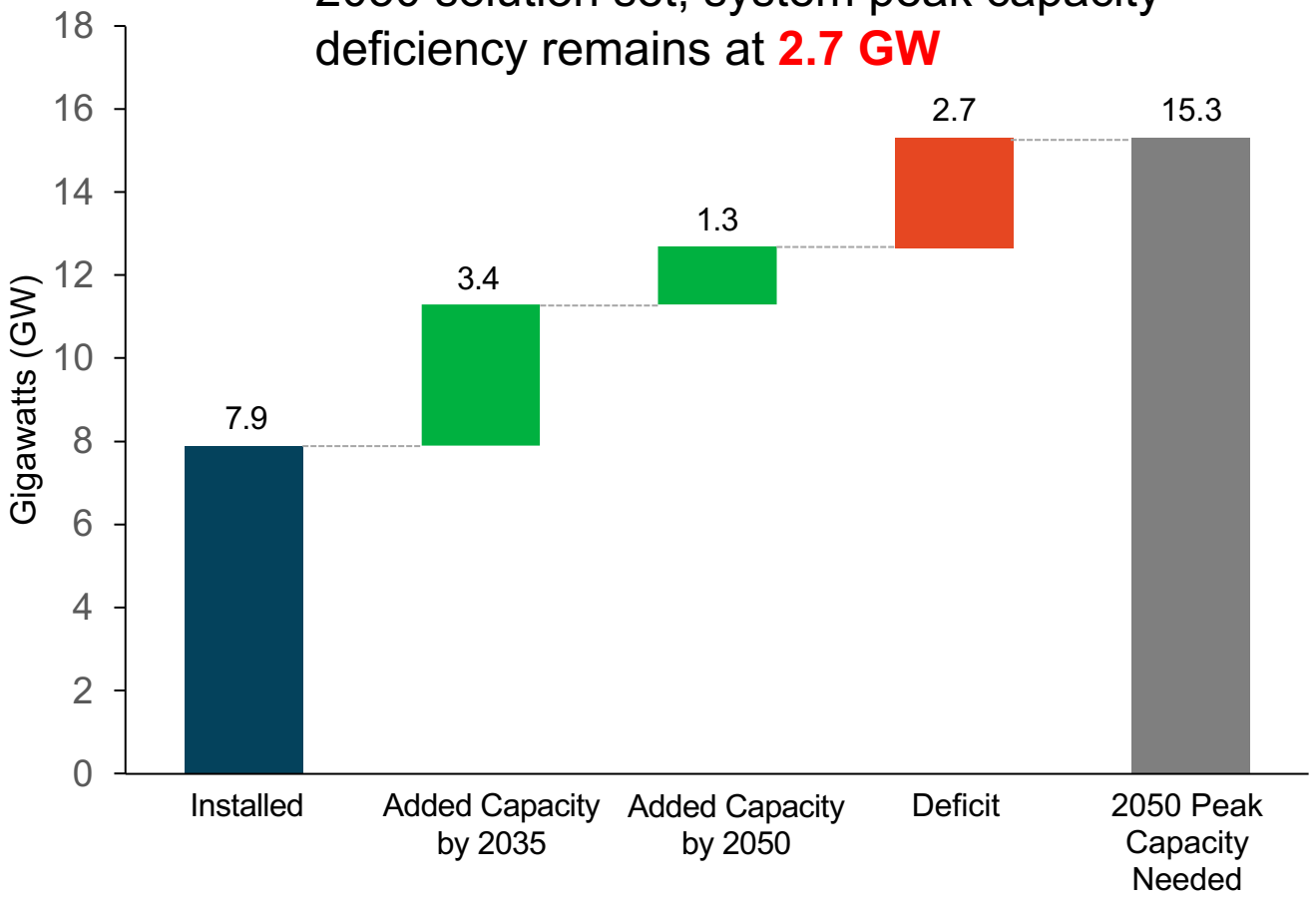
- Upgrades 12 existing substations
- Adds 14 substations

Beyond 2035:

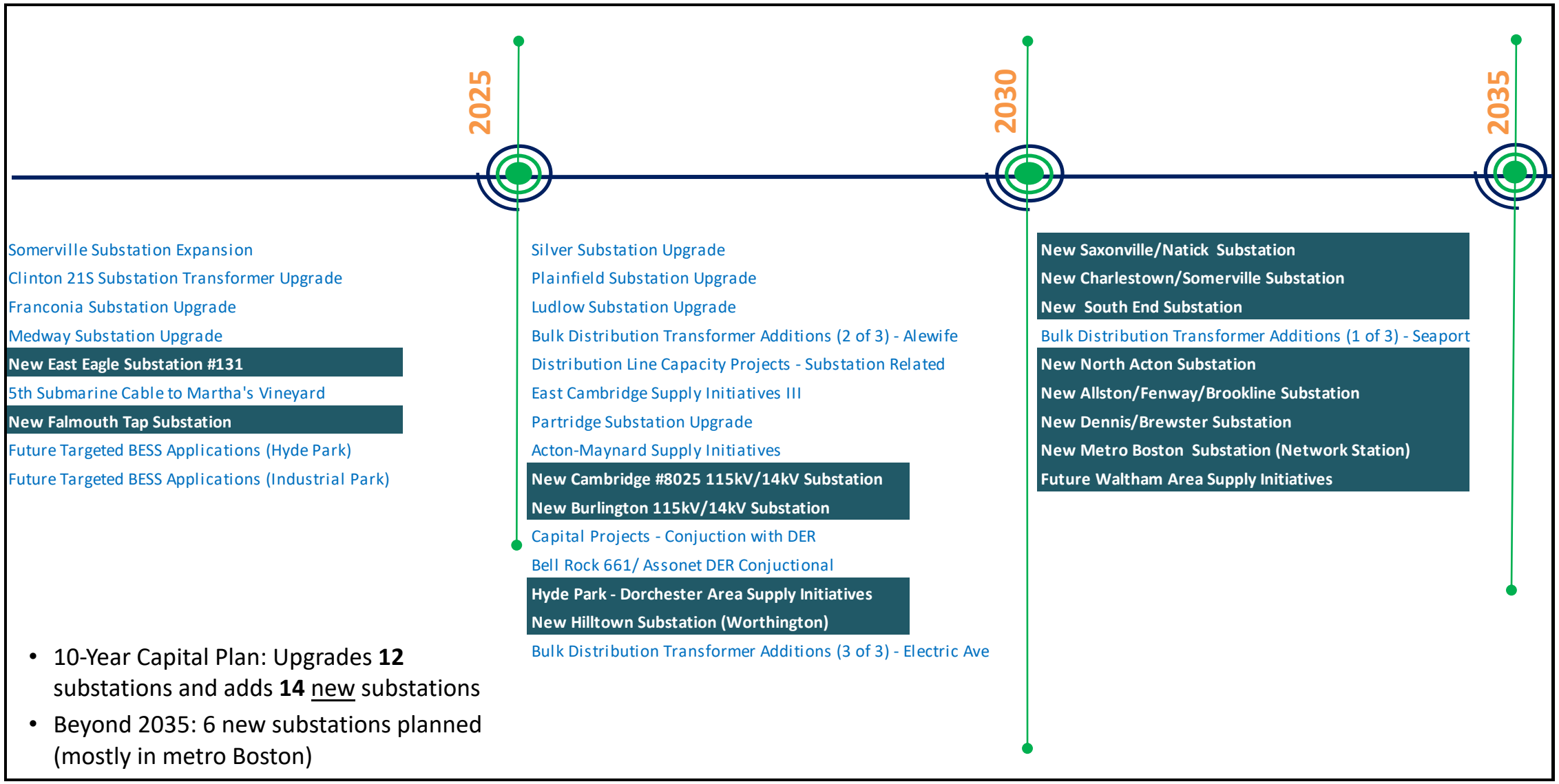
- 6 additional substations are currently planned, all in EMA

Additional infrastructure and policy changes will be needed to close 2050 gap

With existing 10-Year Capital Plan and 2050 solution set, system peak capacity deficiency remains at **2.7 GW**

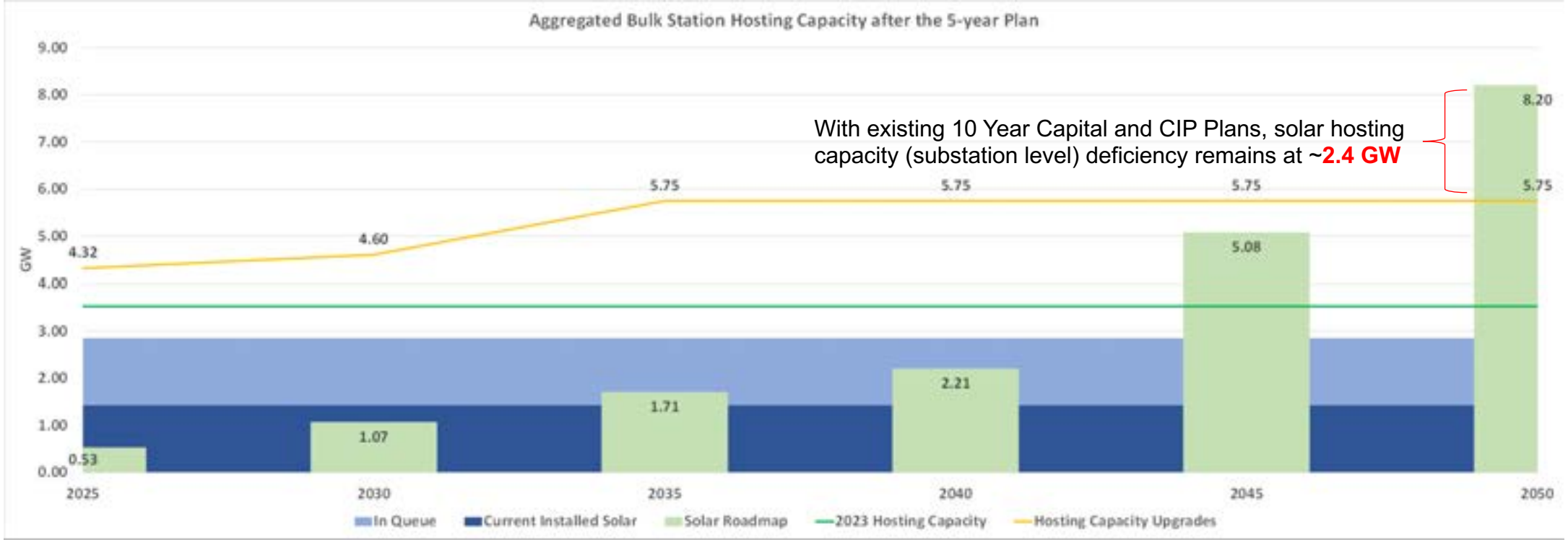


10 Year Infrastructure Plan – Major Capital Projects



- 10-Year Capital Plan: Upgrades **12** substations and adds **14** new substations
- Beyond 2035: 6 new substations planned (mostly in metro Boston)

5-10 Year and 2050 Plan: DER Hosting Capacity Needs and Solutions



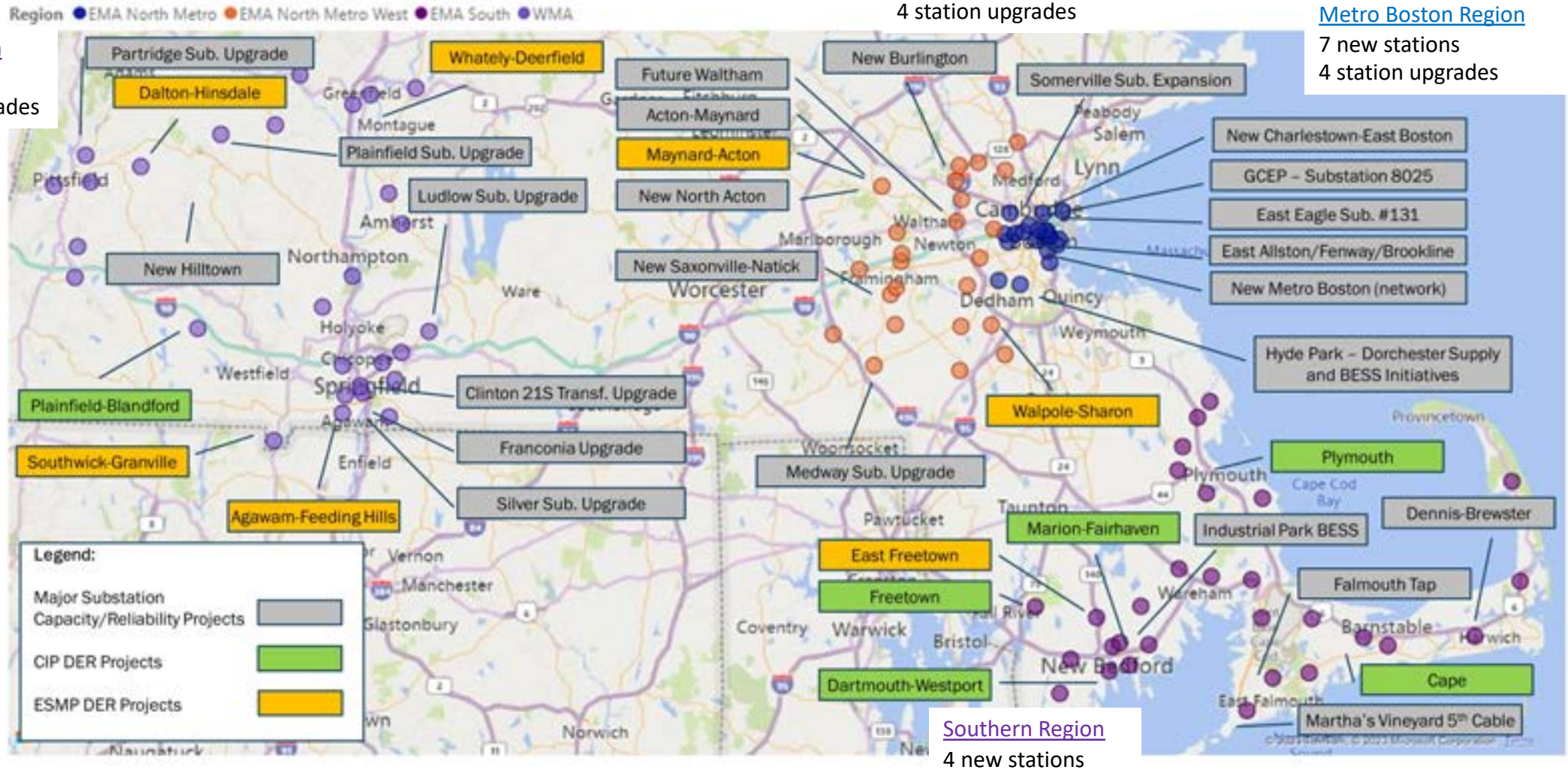
- As of 2023, total DER hosting capacity is **~3.5GW** with installed solar generation of **~1.5GW**
- Over the next 10-years, solar generation is forecasted to increase to **~2.9GW**
- 10-Year CIP solutions upgrades 14 substations and adds 3 new substations
- In addition to the 10-Year Capital Plan solutions, CIP solutions add incremental **~3 GW** of hosting capacity
- Significant number of additional CIPs and smart solutions needed to meet 2050 goals

Major Capital Projects in the 10-Year Plan

Western Region
2 new stations
10 station upgrades

Metro West Region
4 new stations
4 station upgrades

Metro Boston Region
7 new stations
4 station upgrades

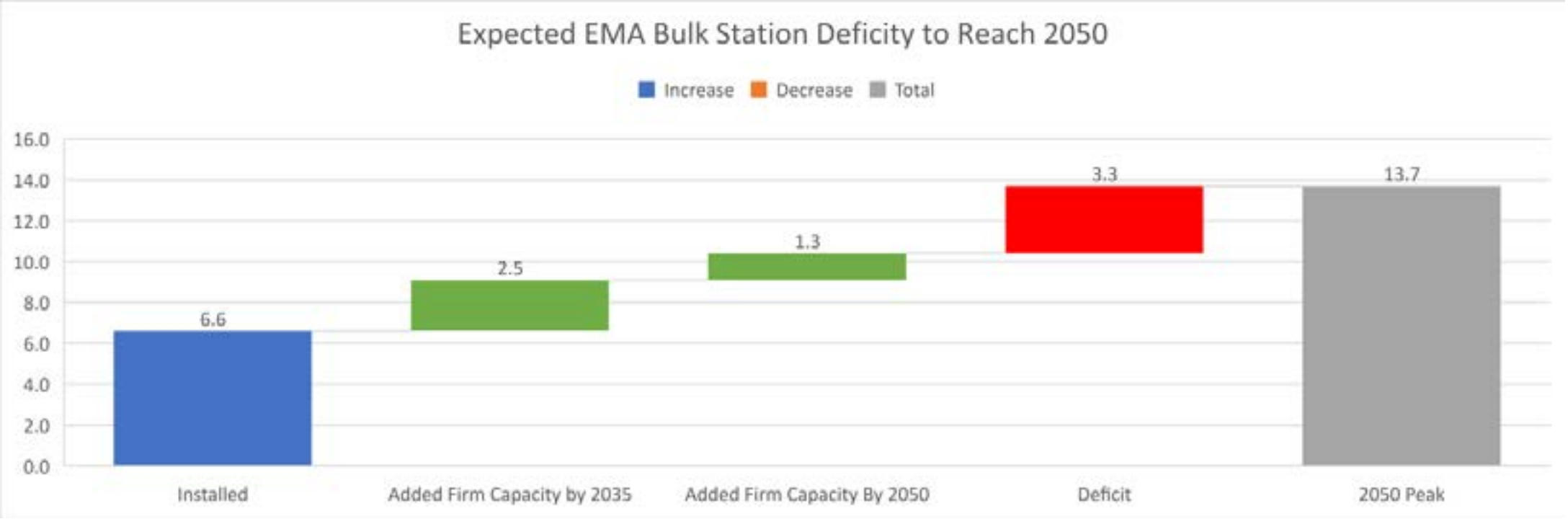


Southern Region
4 new stations
7 station upgrades

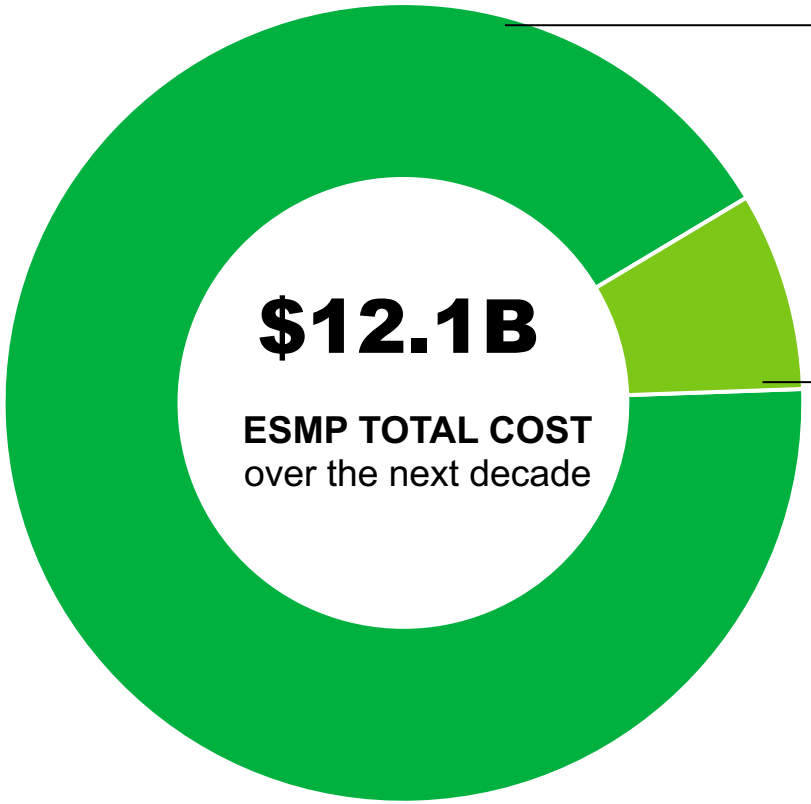
- 17 new substations (14 Load, 3 CIPs)
- 26 substation upgrades (12 Load and 14 CIPs)

Projected Bulk Substation Capacity Deficiencies in EMA to Reach 2050 Goal
(Metro Boston, Metro West, Southeast)

- With existing 10-Year Capital Plan and planned substation additions and upgrades beyond 2035, Eastern Massachusetts system peak capacity deficiency remains at **3.3 GW** (1.7 GW in Metro West and 1.6 GW in Southeast)
- To close this gap with infrastructure, 11 additional new substations in the Metro West and 10-11 additional new substations in the Southeast regions would need to be constructed
- Additional solutions beyond large bulk substation additions are needed

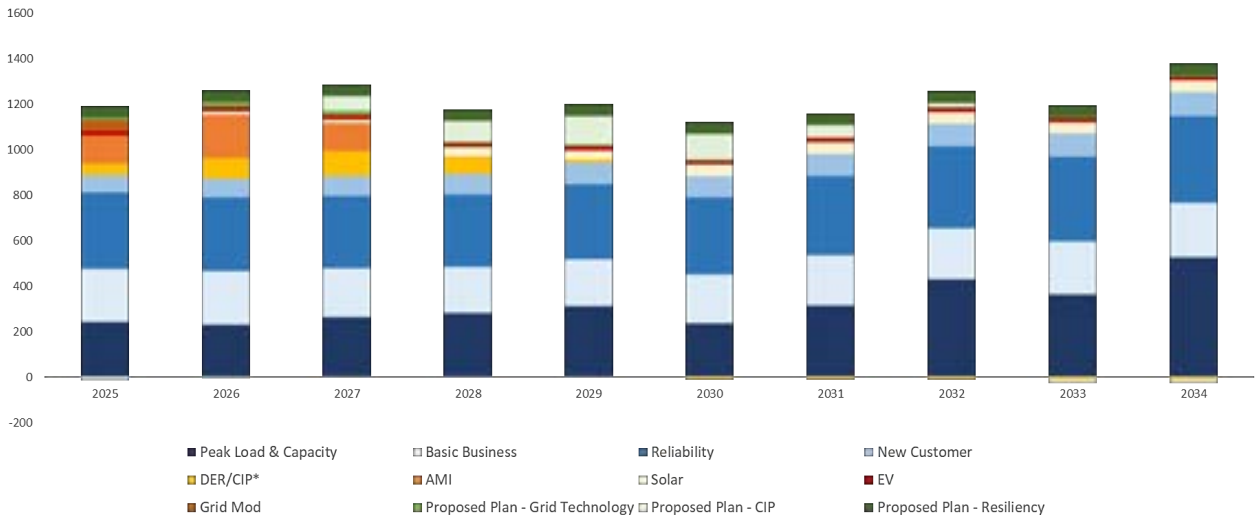


Proposed ESMP Investments Over 10 Years



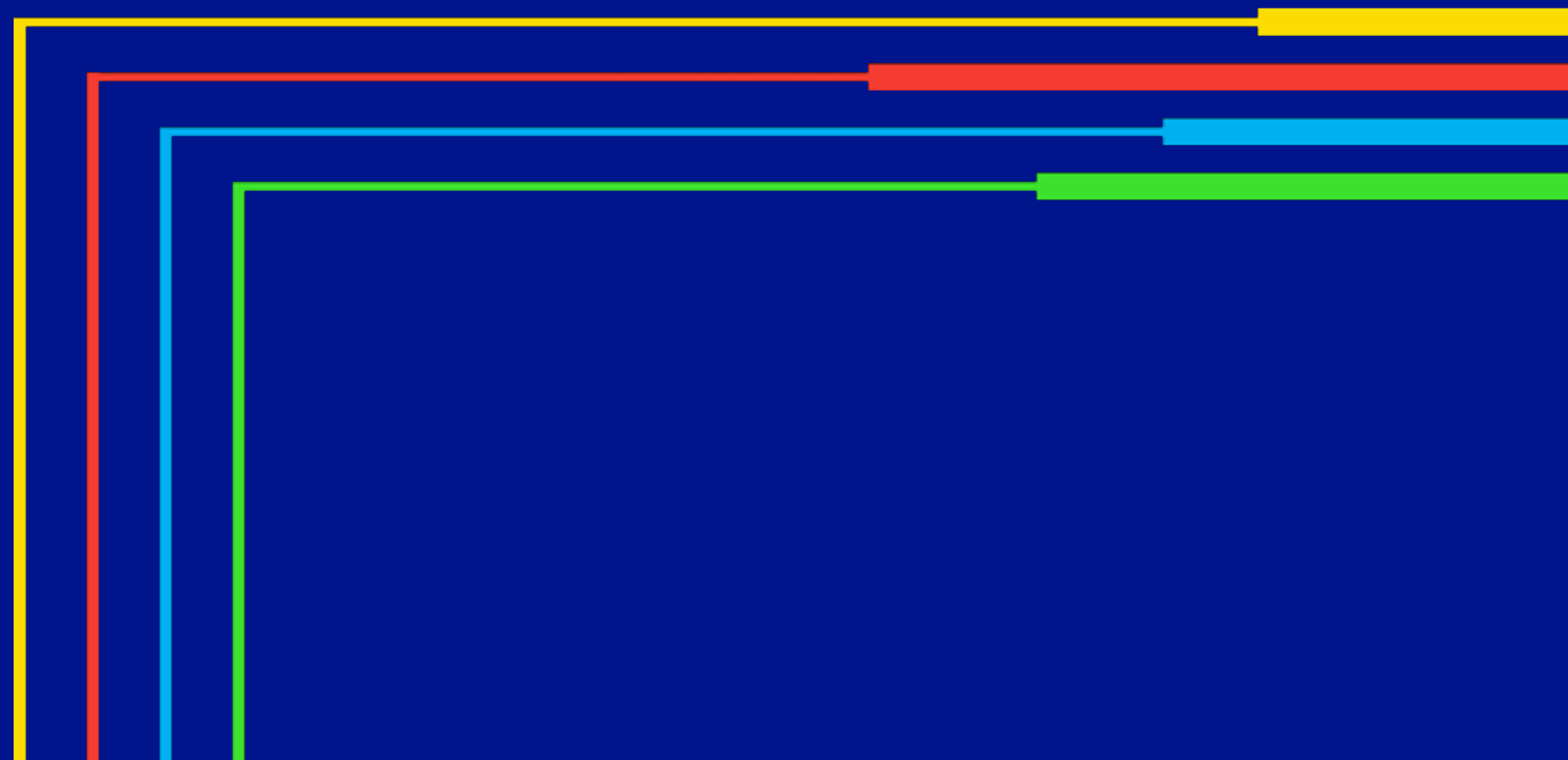
~$11B **planned distribution system investments**
to provide safe and reliable service to customers and enable clean energy advancement

$960M **new capital expenses**
(proposed)

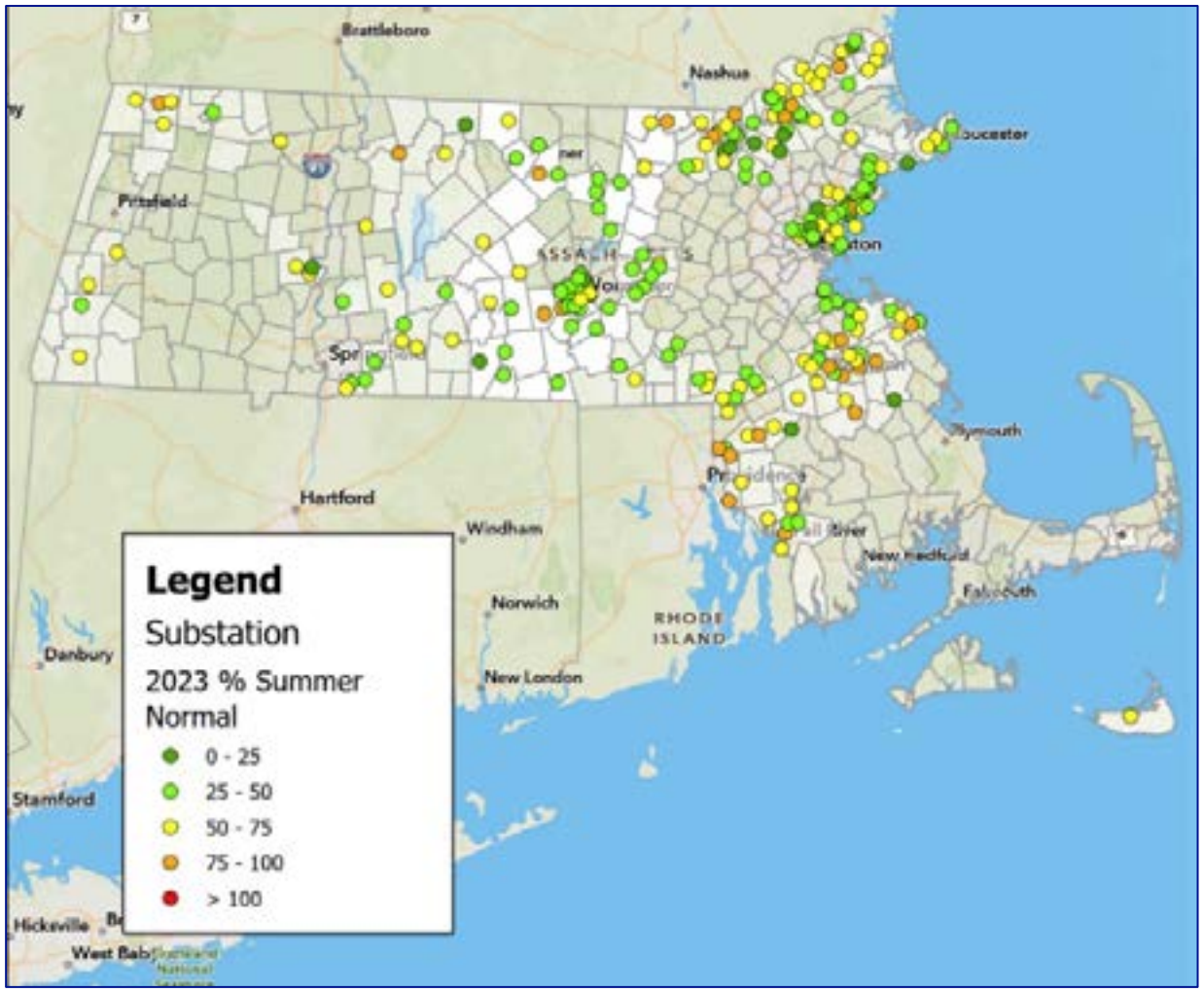


National Grid Infrastructure Investments

nationalgrid



What our network looks like and what it enables today



Serving our 1.3M electric customers via our networks...

18K
Miles of electric distribution lines

178
Distribution substations

720K
Poles

...and by making customer connections.

200 MW
Total DER connected in 2022

~1,800
EV Chargers enabled to date

18K+
Households that installed heat pumps in 2022 through the Mass Save program, with 10k+ supported by National Grid

2GW
DER connected to our network

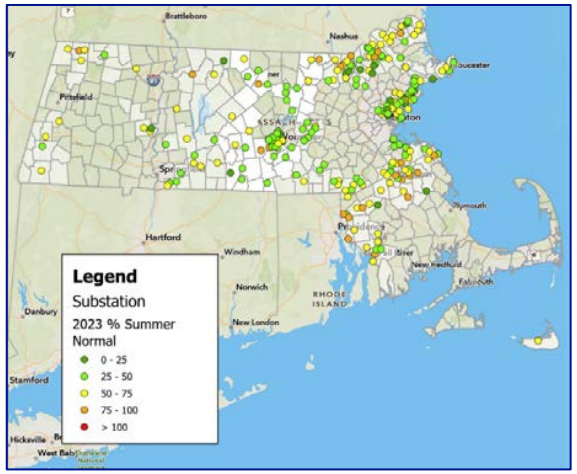
~32K
Additional EV Chargers to be enabled via Phase 3 EV programs

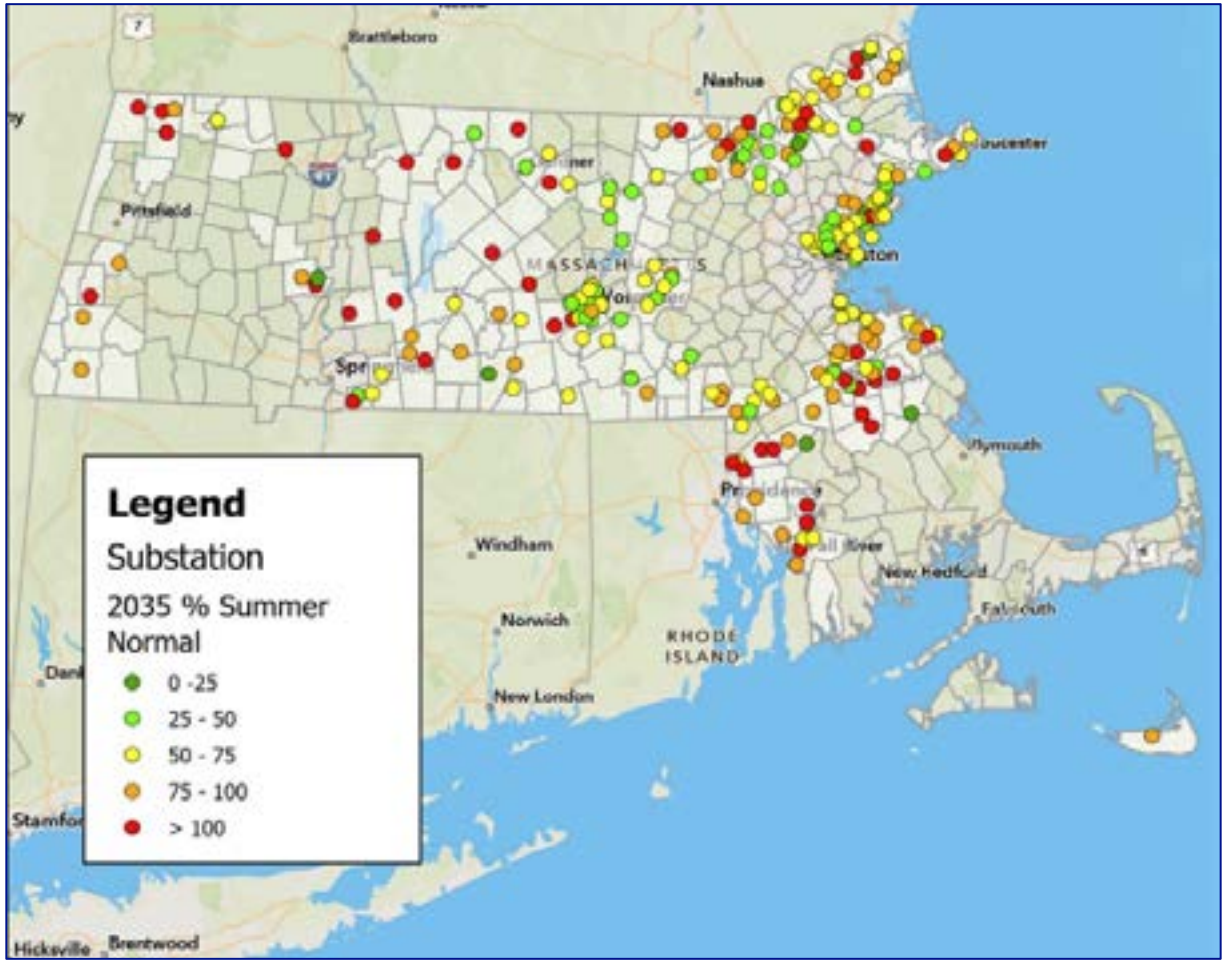
45K+
Planned additional households for heat pump installation through Mass Save by 2024, with 21k+ targeted for support by National Grid

To deliver on the Commonwealth's climate goals, we will build an electric system that can support a doubling of electric demand

Our State's Goals by 2050

- **20 GW** of solar
- **20 GW** of offshore wind
- **10 GW** of energy storage
- **5M** electric vehicles
- **3M** decarbonized buildings





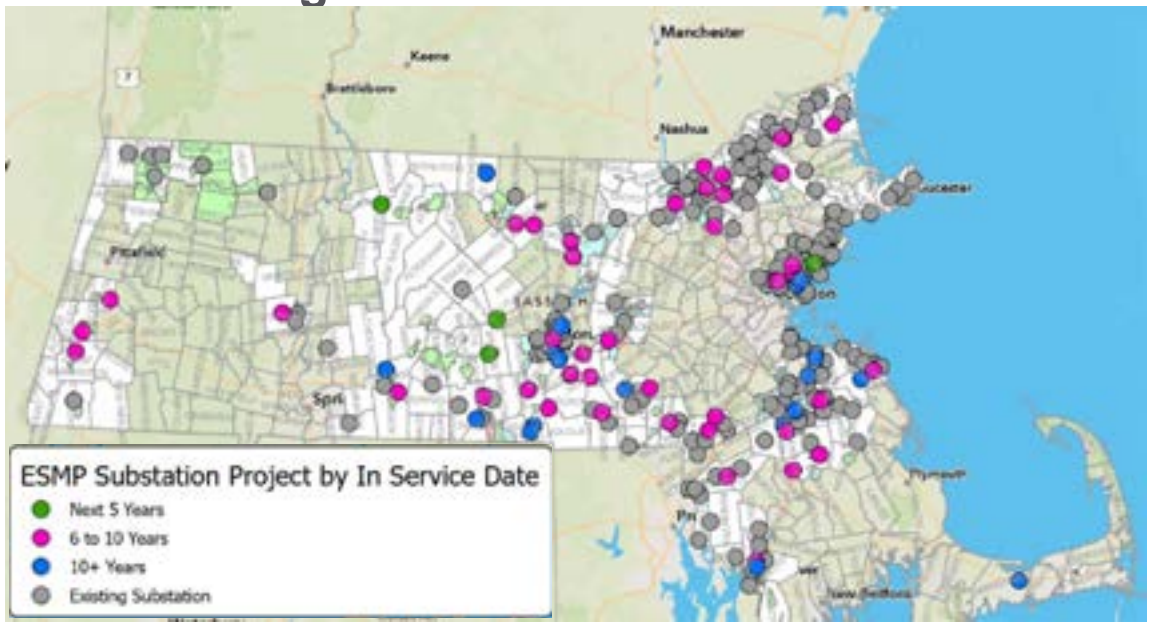
National Grid

We must build out network infrastructure significantly to support this forecasted load growth

To address projected asset overloads resulting from forecasted load growth and to increase system capacity, the following investments were proposed*:

In the next 5 years…	2030-2034	2035 – 2050
0% Average System Load Growth	21% Load Growth (from 2022)	200% Load Growth (from 2022)
Upgrade 13 existing substations	Upgrade 17 existing substations	Upgrade 44+ existing substations
Add 32 feeders	Build 15 new substations	Build 26+ new substations
	Add 105 feeders	Complete 86 total projects

Existing & Future ESMP Substations



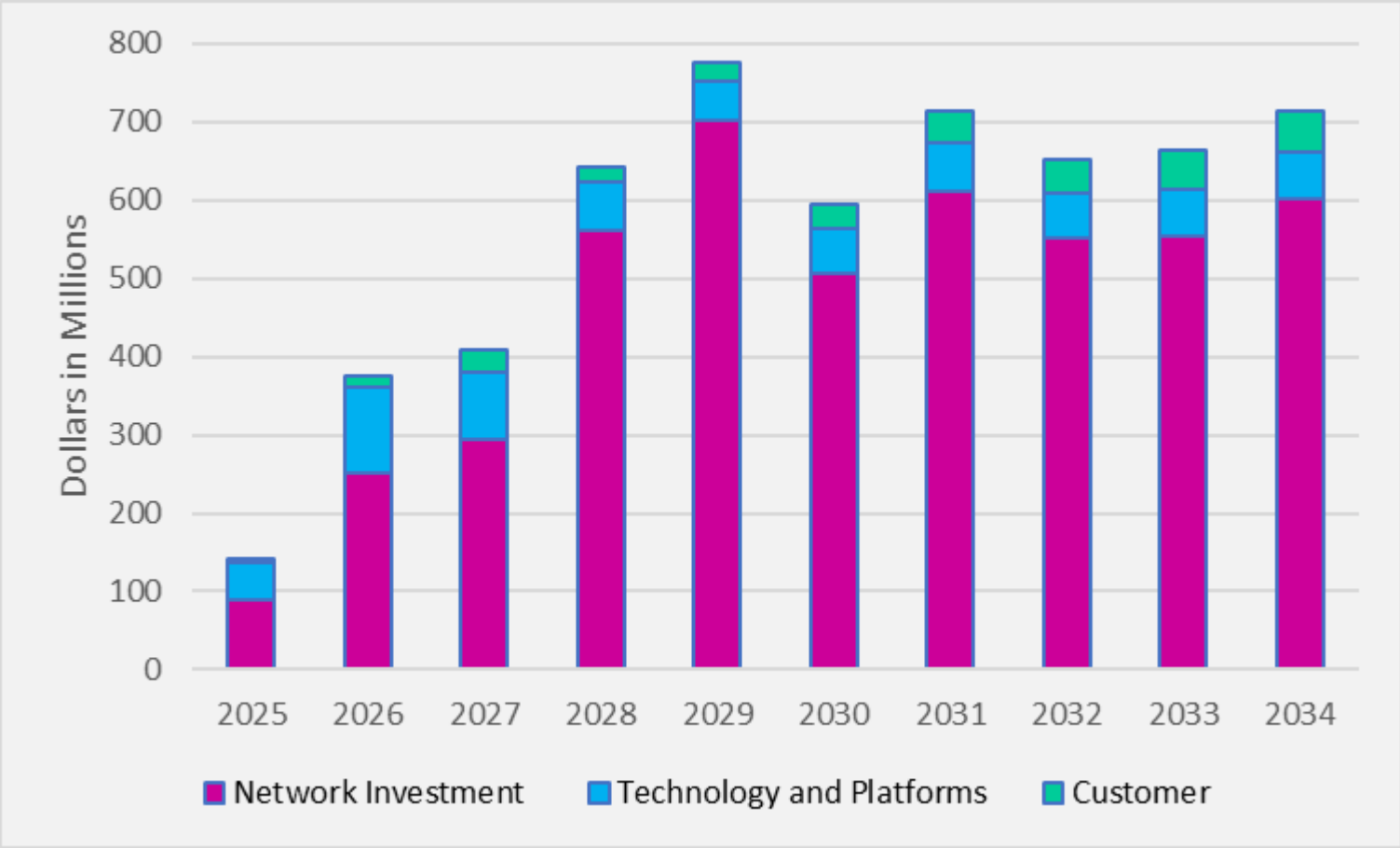
National Grid

**Non-Wires alternatives will be considered as "avoided infrastructure" and as a "bridge to wires"*

The ESMP requires investment of $2.4bn over the next five years with Network Investments leading the way

We'll build key infrastructure…

Upgrade 10 substations, **construct 3** new substations, and execute work on **100+ miles of distribution lines** by 2029



…enabling electrification

This work will **enable 1 GW** of beneficial electrification and DER hosting capacity, and lay the bricks for another **3 GW by 2034**

Breakouts to Develop Clarifying Questions on Grid Infrastructure Needs

1. **Once in break-outs**, everyone should simultaneously use the **Chat function to write down one question** you'd like to ask a utility/the utilities on their grid infrastructure needs. (4 min)
2. Once everyone has written down their question, move down the Chat list and **each person briefly explain what their question is and why it is important**. (5 min)
3. Have a **brief discussion** to see if any of the questions can be **combined, consolidated, or sharpened**—type any changed/combined questions in the Chat. (5 min)
4. Identify **one volunteer** to help the group **prioritize the questions**, and to **ask the prioritized questions to utility/utilities on behalf of the group**. (1 min)
5. Then have the volunteer go back down the Chat list of questions one by one and have everyone use the **hand-raising function** to prioritize the questions—by each person raising their hand for **only their top three questions** (and have the volunteer record the number of votes in the chat or off-line). Don't forget to **lower hand after each question**. (5 min)
6. The volunteer should then **use the prioritization to ask as many questions as time allows**. The questions will be in your chat when you return to main room.

Note: Utilities not participating; facilitators will float to observe (and pace if need be); observers/audience on break.

Break-Out Affinity Groups (#1 and # 2) - updated

#1 CBO/EJC		#2 DG/DER/EV Developers	
EDF	Jolette Westbrook	**Advanced Energy United**	Kat Burnham
ACE	Sofia Owen	**NECEC**	Tim Snyder
Making Opportunity Count (MOC)	Melissa Gonzalez	**Nexamp**	Brandon Bowles
United Way of North Central Mass	Kory Eng	**Mass Solar**	Mark Sandeen
EJ Table	Cindy Luppi	**C Power**	Nancy Chafetz
Browning the Green Space	Kerry Bowie	**Tesla**	Bill Ehrlich
National Consumer Law Center	John Howat	**Mass DOT**	Christopher Aiello (Nov 15) Hayes Morrison
Mass Housing	Elizabeth Torres	**Calstart**	Jordan Stutt

Break Out Affinity Groups (#3 and #4) - updated

#3 Housing/Large Users/Business		#4 Labor/Workforce/Muni /State/Quasi-State Agencies	
WMA Economic Develop Council	Rick Sullivan	**IBEW**	Mike Monahan
Fitchburg Housing Authority	Doug Bushman	**North Central MA Chamber of Commerce**	Roy Nascimento
A Better City	Yve Torrie	**Franklin Cummings Tech**	Dr. Marvin Loiseau
NAIOP	Anastasia Daou	**UMass Lowell**	Rauiri O'Mahony
Boston Properties	Neetu Siddarth (Nov 15) Ben Myers (Nov 28)	**MA Municipal Association**	Adrienne Nunez (Nov 15) Josie Ahlberg (Nov 28)
Mass General Hospital	Dennis Villanueva or Jason Dantona	**Mass Development**	Dan Rivera
MA Business Roundtable	Tonja Mettlach (Nov 15) JD Chesloff (Nov 28)	**MA Economic Development**	Helena Fruscio Altsman
Fitchburg State	JD Head	**Mass Life Sciences**	Ken Turner
Lowell General Hospital	Kevin Foley	**Mass Bio**	Ben Bradford
Gillette Stadium	Dena Ciampa (Nov 15) Jason Stone (Nov 28)		

Clarifying Questions (and Responses) on Grid Infrastructure Needs

- Round-robin Q&A with:
  - Each break-out group asks one of their top questions
  - Keep going around as time allows
  - Avoid questions that another group already essentially asked
- Direct question at:
  - The lead-off presenter
  - An individual utility
  - All the utilities
- Utility responses should be responsive (and succinct)
- Additional questions not covered, can be submitted to the utility websites (see slide on Submitting Questions) for response following the meeting

Stakeholder Discussion and Feedback on Grid Infrastructure Needs

- Initial thoughts and feedback on the utilities ESMP-related grid infrastructure needs
- Raise hands to get in queue
- Be clear about whether providing feedback to an individual utility or all the utilities
- Be succinct so that everyone can provide their initial feedback
- Facilitators may ask follow up questions and guide discussion as time allows
- Remember these are your initial reactions, and we are planning to provide another opportunity to share feedback at the next workshop on 11/28

Wrap Up and Next Steps

- Recap & Feedback
- Stakeholder Workshop #2 topics
  - Ensuring an Equitable and Just Transition to a Clean Energy Future
  - Stakeholder and Community Engagement
  - Demand Forecasts and Grid Infrastructure : Additional feedback
- Proposed Approach to Second Workshop
  - Panels on Ensuring Equity, followed by mixed break-outs
  - Utility presentations on Stakeholder and Community Engagement proposals, followed by Q&A and discussion
- Next Steps
- Anything else?