Electric Sector Modernization Plan

October 13th, 2023

Barry Ahern and Elton Prifti

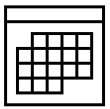
nationalgrid

The ESMP filing requirements originate from the MA Clean Energy and Offshore Wind Act (2022)

Requires each Investor-owned Electric Utility to develop an electric-sector modernization plan (ESMP) to proactively upgrade the distribution network to meet the State's clean energy goals

The plans has three planning horizons; 1) a 5-year forecast, 2) 10-year forecast and 3) a demand assessment through 2050 to account for future trends

Establishes a Grid Modernization Advisory Council (GMAC), made up of a broad range of stakeholders who will review the plans and provide recommendations to the utilities ahead of the submission to the DPU.



Plan was submitted to the Grid Modernization Advisory Council on September 1, 2023.

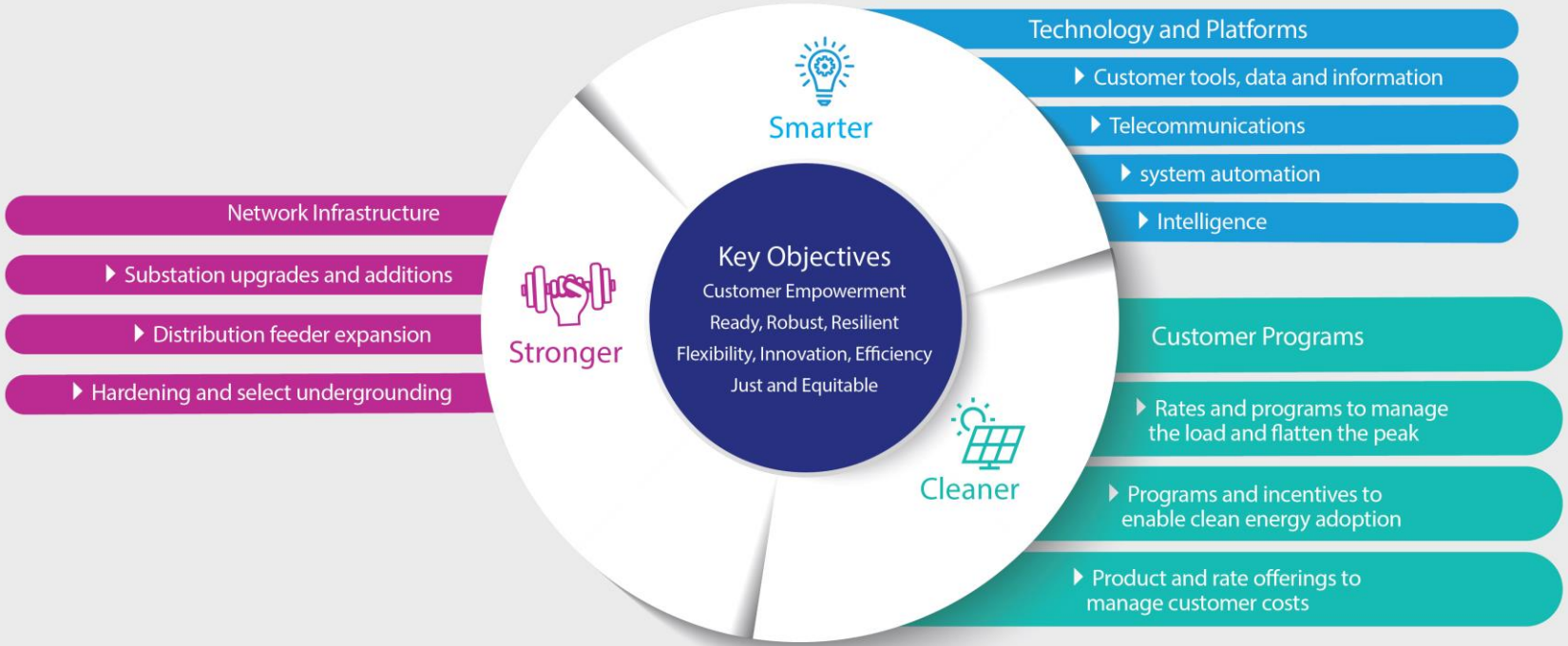
Under the legislation the company then files the plan with the DPU on January 29, 2024, and the department shall approve, approve with modifications or reject the plan within 7 months of submittal. However, there is a view that the DPU may seek longer to make its decisions.

Note – the DPU remains the body that determines the remuneration approach and approves the funding for the investments.

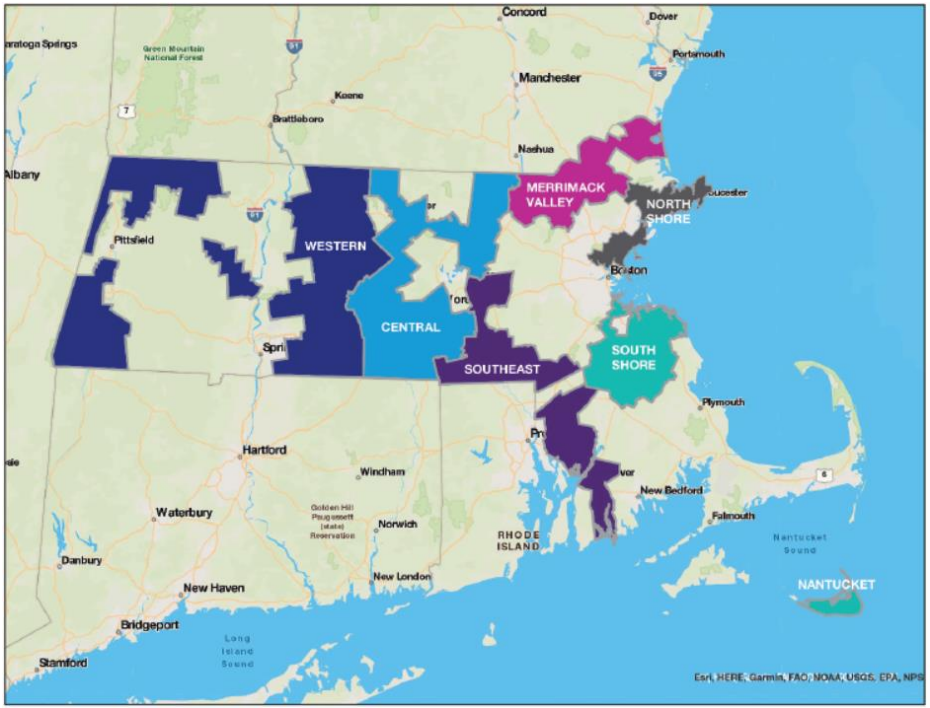
Our Plan included, amongst other things:

- Distribution Network investments required to
  - meet the load growth associated with electrification
  - prepare for future climate-driven impacts on the distribution system
- IT / Data and digital investments required to create the electric network of the future
- Investments required to build the workforce of the future
- Policy requirements to enable the timely buildout of the network

A Smarter, Cleaner, Stronger Grid



What our network looks like 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

NE Distributed Energy Resources Benchmarking

DER Activity

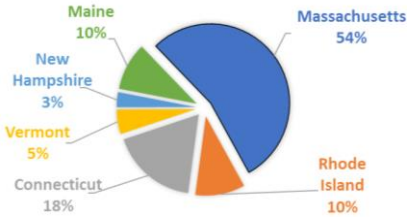
- National Grid connected 2GW of DG in MA service territory to date over 82,000 applications
- Currently there is 1.9GW of applications pending in queue

Energy Storage System (ESS) Applications

- Received >2.3GW of applications and ~1.5GW active in queue, majority in 2022
- Currently 711MW of applications in study

Source: State data from US Energy Information Administration and US CensusBureau

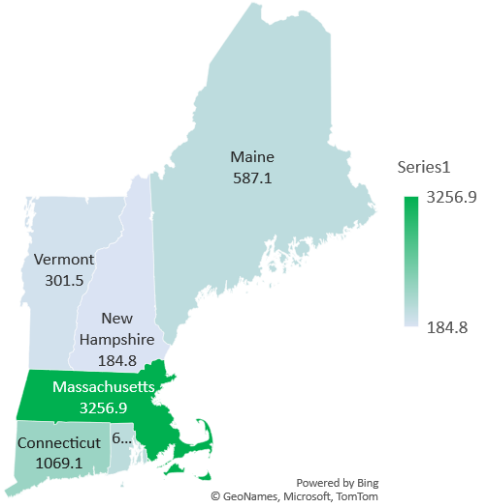
New England: State Shares of Solar Installed



Top States for Solar per Sq-Mi

Rank	State
1	Rhode Island
2	New Jersey
3	Massachusetts
4	Connecticut
5	California

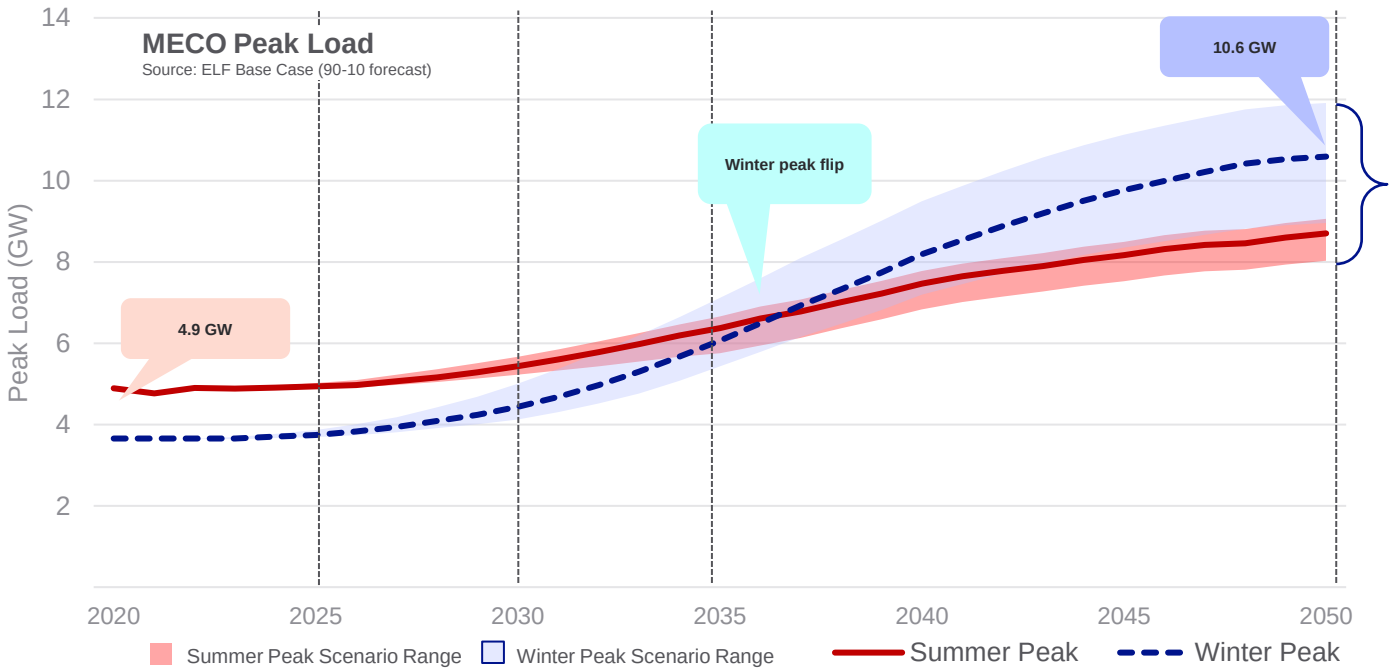
Installed MW per state as of Dec 2022



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



Scenario Forecast Range*

Represents uncertainty in adoption & policy changes for critical assumptions around:

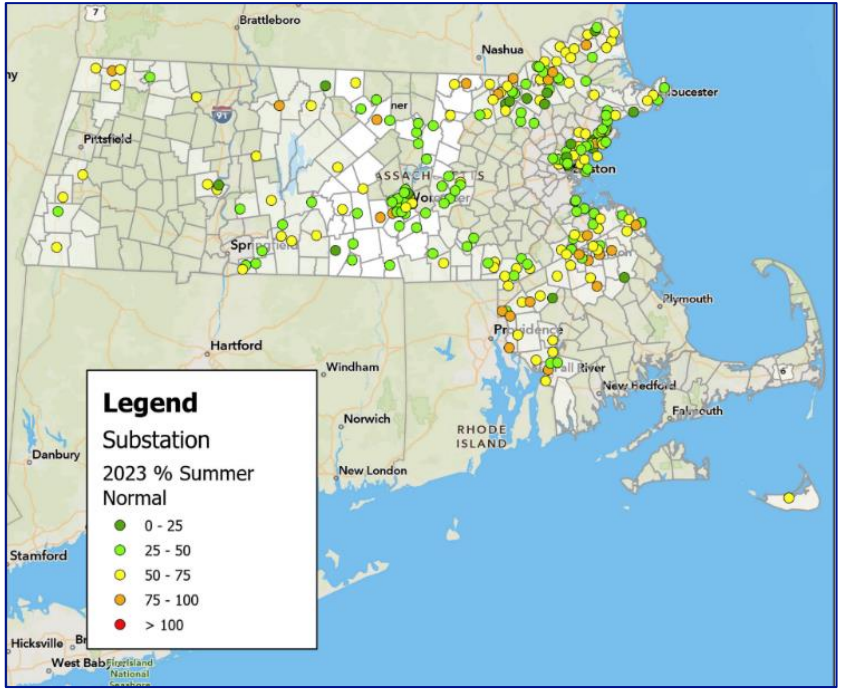
- **Heat pumps & electric resistance support**
- **EV adoption & charging behavior**
- **EE programs & home weatherization**
- **Impact of other demand reduction levers**

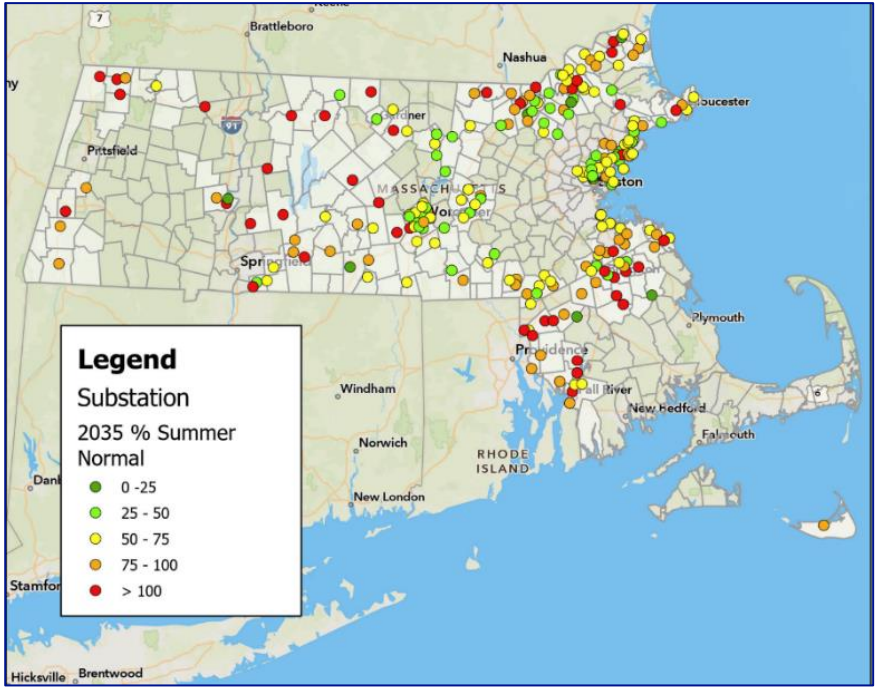
Note: (1) The shaded peak load scenario ranges reflect the full range of over 2000 scenarios modeled by the ELF team based on various DER sensitivities and weather scenarios.
(2) The lines in the center of the shaded regions represent the Company's "base case" – i.e., our estimated most likely future scenario.

By 2035, without ESMP, forecasted demand exceeds system capacity

Substation load as a percentage of capacity across our system, assuming no capacity expansion

2023 vs. **2035**





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*:

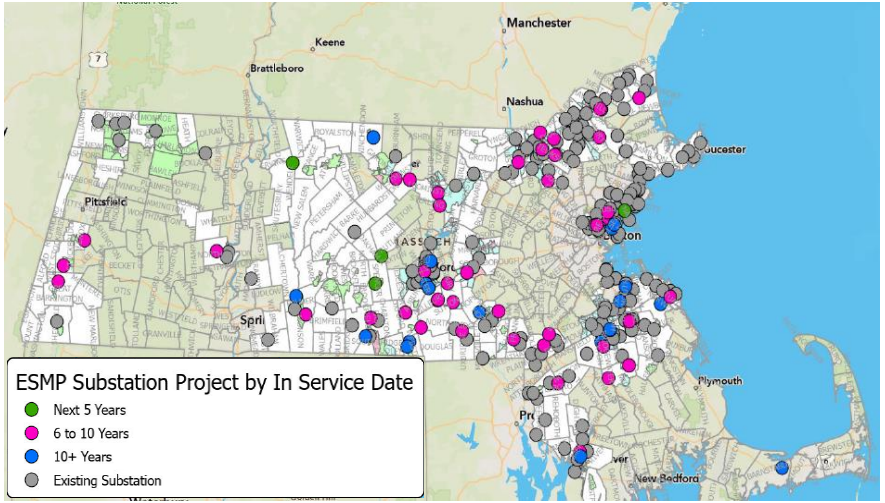
In the next 10 years…

- 21% Load Growth (from 2022)
- Upgrade 17 existing substations
- Build 28 new substations
- Add 17 feeders

2035 – 2050

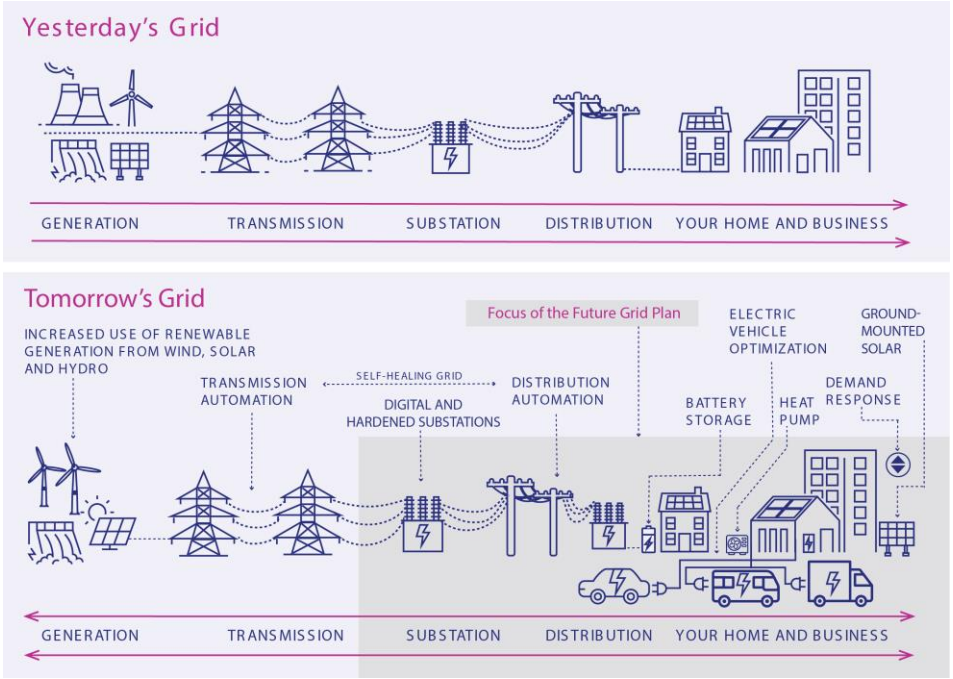
- 2x Load Growth (from 2022)
- Complete 86 total projects
- Upgrade 44+ existing substations
- Build 26+ new substations

An outlook of the system



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

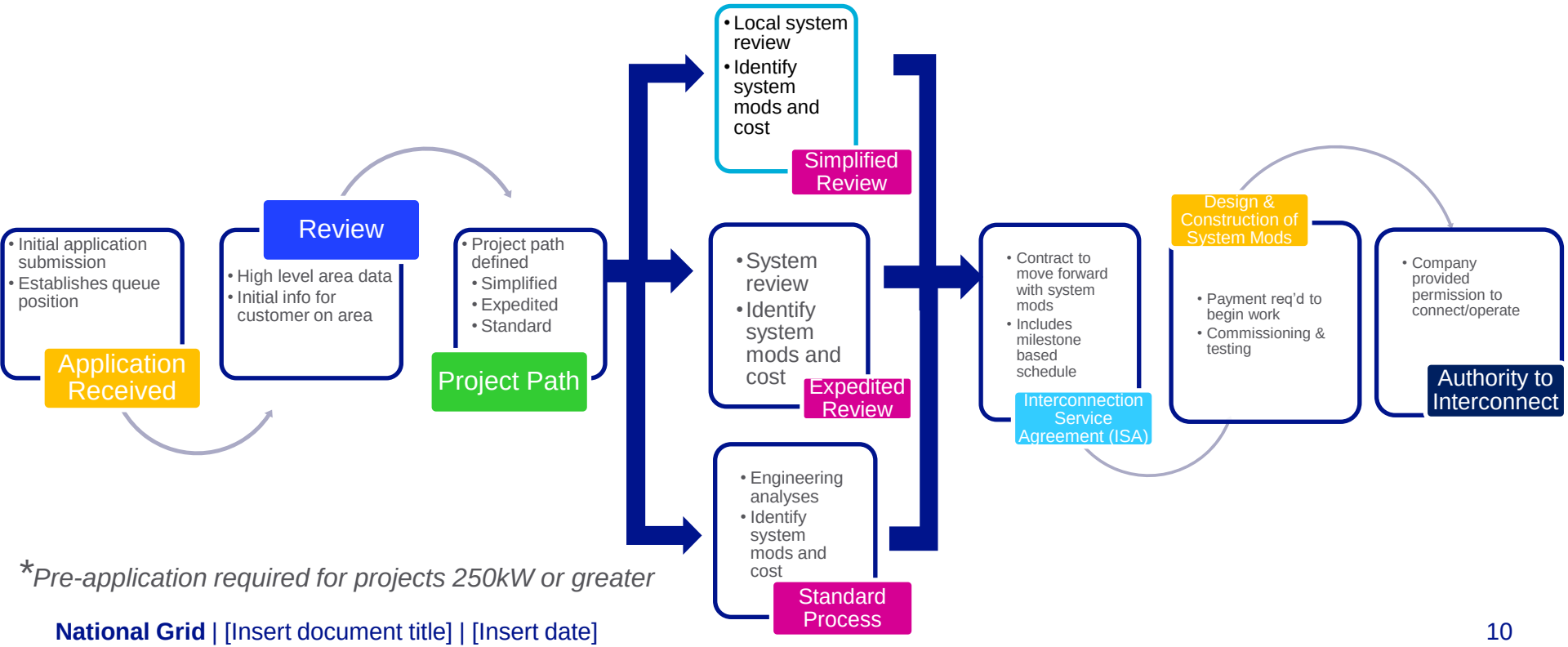
By 2035, 4 GW of new system capacity to support state-wide electrification, enabling EVs & heat pumps adoption



The plan will also provide jobs and societal economic benefits to the Commonwealth

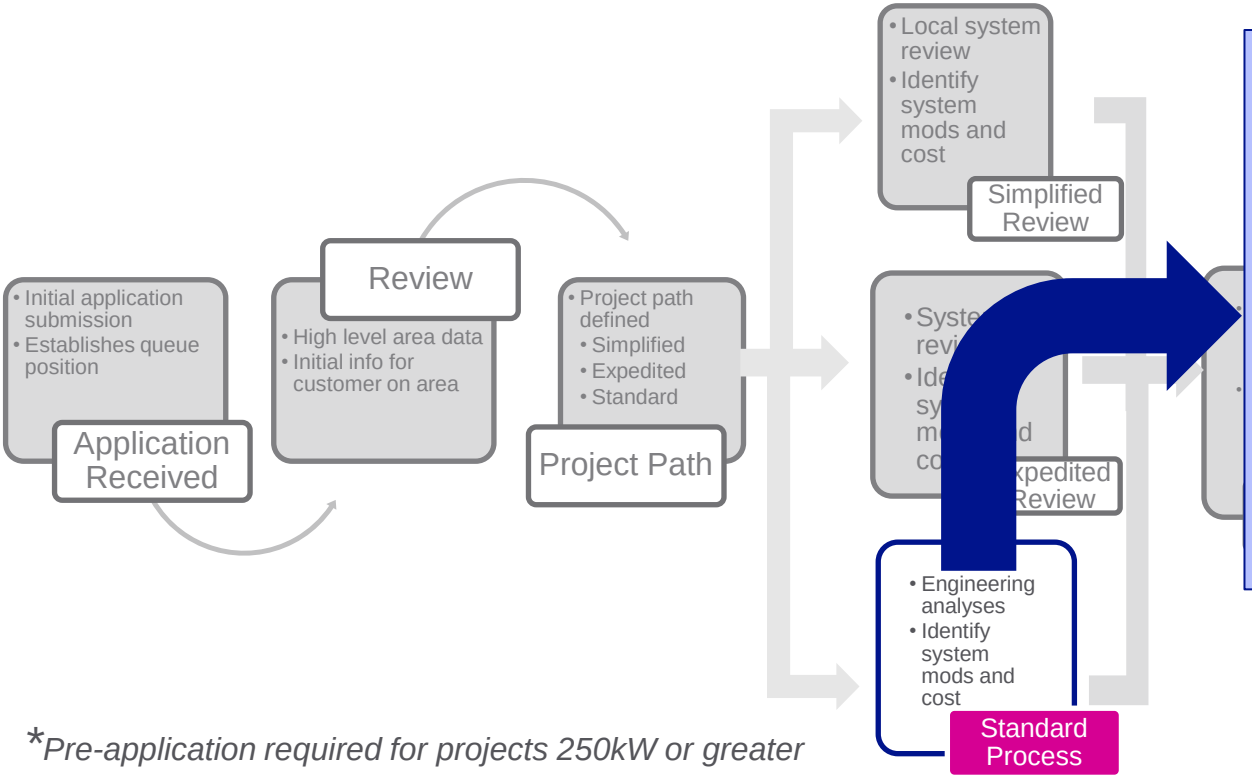
By 2030, jobs and other economic benefits, including:	**11K** Full- and part-time jobs	**1.4B** Incremental economic output
By 2035, 4 GW of new system capacity, enabling:	**1.1M** EVs	**750K** Heat pumps

Massachusetts: *DG Process Overview per MDPU 1468*



**Pre-application required for projects 250kW or greater*

Massachusetts: *DG Process Overview per MDPU 1468*



Transmission impacts from DER are governed by ISO-NE processes.

- Once a high-level distribution solution has been identified, notification is made to ISO-NE for any proposed DER 1 MW or larger.
- ISO-NE determines the need for transmission analysis.
- Any necessary studies are performed by Transmission Planning to identify transmission impacts and any necessary transmission upgrades.

Note that the Distribution Study timelines are on hold for the above ASO process (6-12 months+)

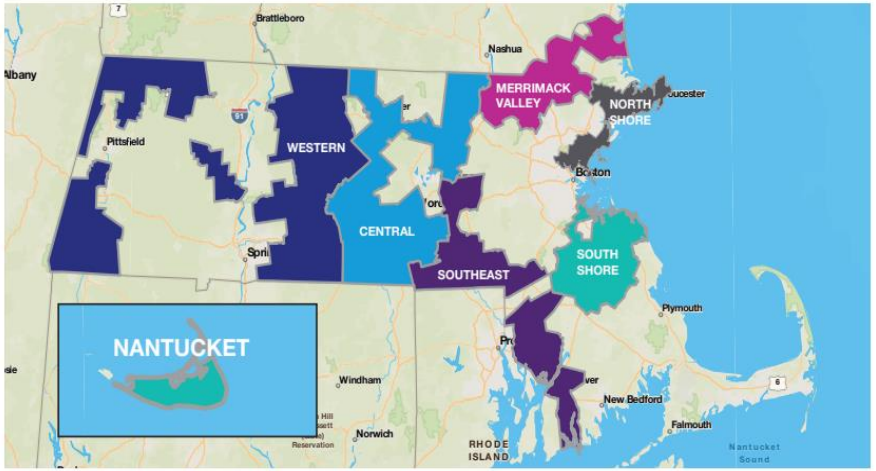
**Pre-application required for projects 250kW or greater*

ESMP Impact on Transmission System

ISO-NE 2050 Study had to make a large volume of carefully formulated assumptions across the system

The ESMP enables Transmission to closely focus on needs of Distribution customers

National Grid's Six Major Service Sub-regions



ESMP introduced an enhanced level of detail, better informing:

- End State Substation Profiles
- Specific interconnection need per area
- Supply chain volume
- Land and permitting needs

ESMP has enabled:

- More comprehensive assessment of distribution system needs beyond typical studies (LSP)
- Ability to better coordinate active projects in all areas, relative to the interim needs of the system
- Another input all other projects being progressed in transmission

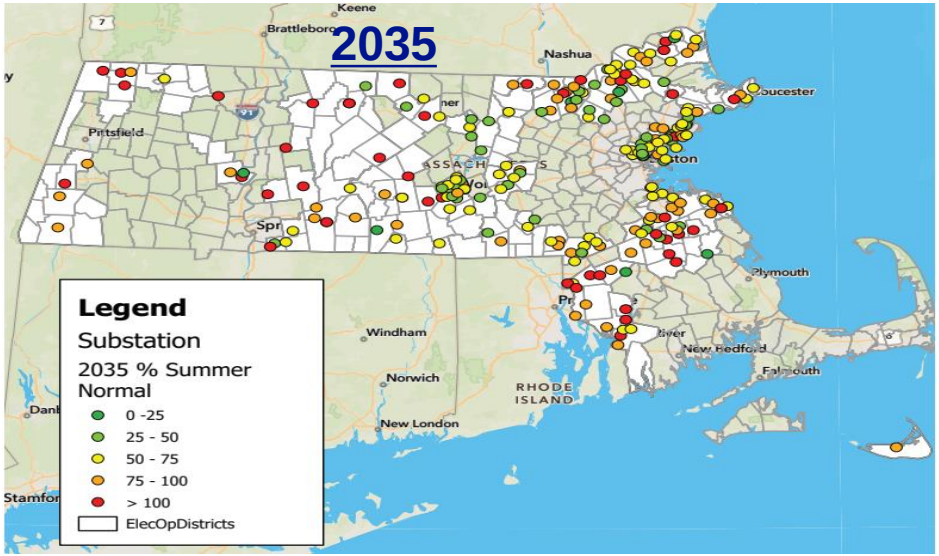
Challenges on regional transmission: Need for Capacity

Future Capacity Needs

- All projects with an asset condition driver, continue to include an alternatives assessment
- This aim of this approach is to ensure we construct now, with 2050 as a core consideration.
- Build for the future, most cost effectively, with least disruption to residents of MA

Western MA Scenario

- Asset condition driver prompting a full rebuild of four 69kV circuits
- Considering the ISO-NE 2050 study, and growing proliferation of DER, and now additional information from the ESMP, there is clearly a need for more capacity
- The proposal is to build the 69kV circuits to an operating voltage of 115kV



What can be done with ISO-NE to best manage Impacts

ISO-NE 2050: Rebuild Priority Road Map

ISO-NE states that a number of the overloads observed can be addressed with incremental upgrades.

NESCOE Engagement

There is ongoing work with NESCOE to provide more visibility to our asset condition projects and proposed scopes

- The scoping of any project needs to more deliberately take into account:
  - Future resiliency and capacity needs of the asset
  - Formally integrate 2050 needs and ESMP network capacity needs into scope

For Coastal Assets

More consideration given to future high-capacity needs based on OSW penetration when there are regulated projects being progressed in these areas

- An absence of this consideration:
  - May lead to a missed opportunity to maximize OSW imports
  - Significant redesign or rework at a later point in time

nationalgrid