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Approach to scenario analysis/forecasting methods – 05/13/22

ADVANCED DISTRIBUTION SYSTEM PLANNING

Agenda

- Background and Challenges
- Distribution Planning Approach
- MA Planning Areas
- Combined Profiles (Forecasting Methods)
- Consideration for Mitigation

EVERSOURCE ENERGY

We serve approximately:

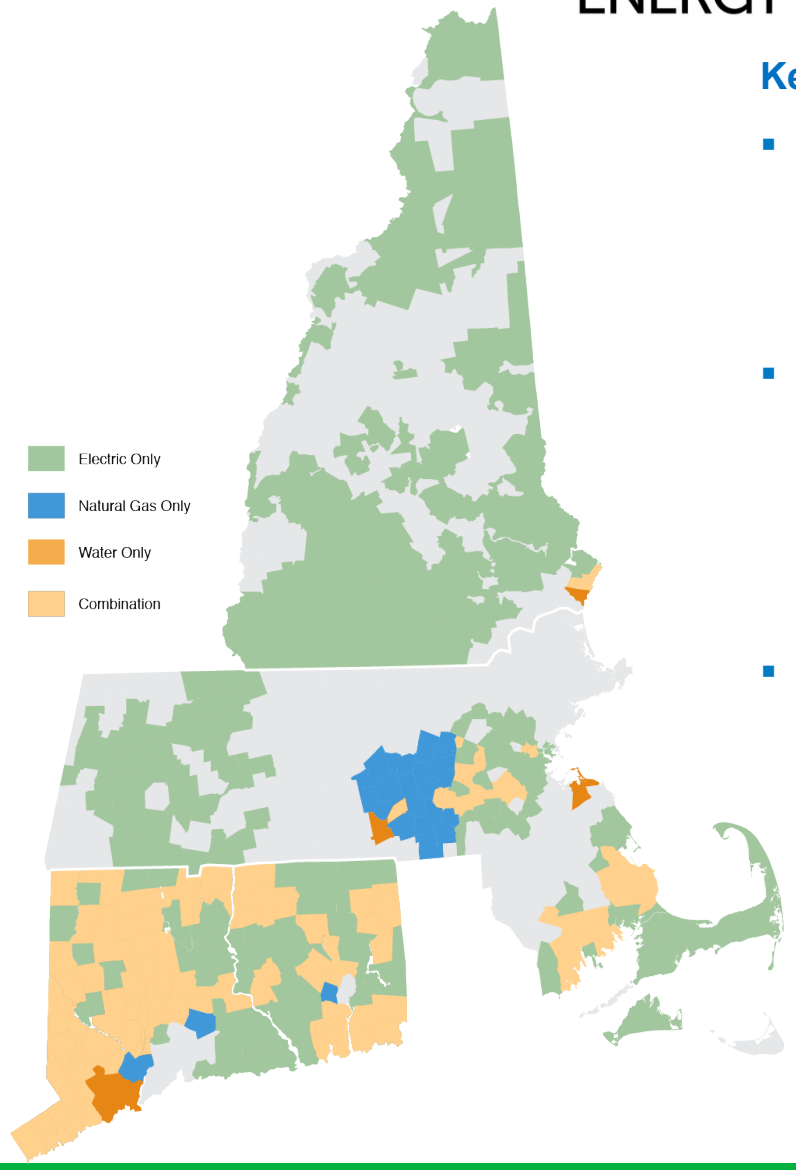
- **227,000** water customers in 59 New England Communities
- **525,000** gas customers in 123 New England Communities
- **3.2 M** Electricity customers in 499 New England Communities

We operate more than:

- **4,250** circuit miles of transmission lines
- **72,000** pole miles of distribution lines
- **575** substations
- **6,450** miles of natural gas pipelines
- **3,600** miles of water mains

Clean energy:

- Solar (70 MW) and growing
- Offshore wind (Oersted partnership)



Key Electric Distribution Planning Priorities

- New Hampshire
  - Least Cost Integrated Planning – challenge to harmonize planning criteria with economic and operational drivers
- Connecticut
  - Reliability and Resiliency Planning – new framework released May 20th, 2022
  - Integration of NWA Solutions into Distribution Planning
- Massachusetts
  - DER growth and long-term system assessment (20-75)
  - Support for projected electrification demand
  - System expansion in urban/suburban areas

Challenges in the Next 20 Years - Require granular, high-fidelity analytics and tools

- Retirement of traditional generation and expansion of inverter-based technology including significant growth in offshore wind and DER
  - Transient analysis required at the substation level
  - 8760 analysis required to understand full impact of DER over the load cycle
- Integrated long-term planning for capacity and reliability
  - Load growth driven by new sectors: Electrification, Gas Conversion, Electric Vehicles and Industry Shift
  - Advanced forecasting tools needed to predict new load growth patterns
- Climate adaptation and mitigation strategies
  - Resiliency plans to harden OH and coastal areas and reduce outage duration
  - New design and construction standards to address impacts of climate change

Approach to Bottoms-Up Integrated T&D Planning

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Identify new or expand existing D Stations
Establish incremental DER and Firm Capacity Enabled

Identify Distribution Constraints

Distribution Net Load Forecasting

Transmission Net Load Forecasting + New Generators - Retirements

Identify Transmission Constraints

Identify new Transmission Solutions

Eversource Distribution System Planning Overview

Goal of Distribution Planning

Provide orderly, economic expansion of equipment and facilities to meet future demand with acceptable system performance

- Ensure sufficient 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 exist

… and do it all for the lowest possible cost

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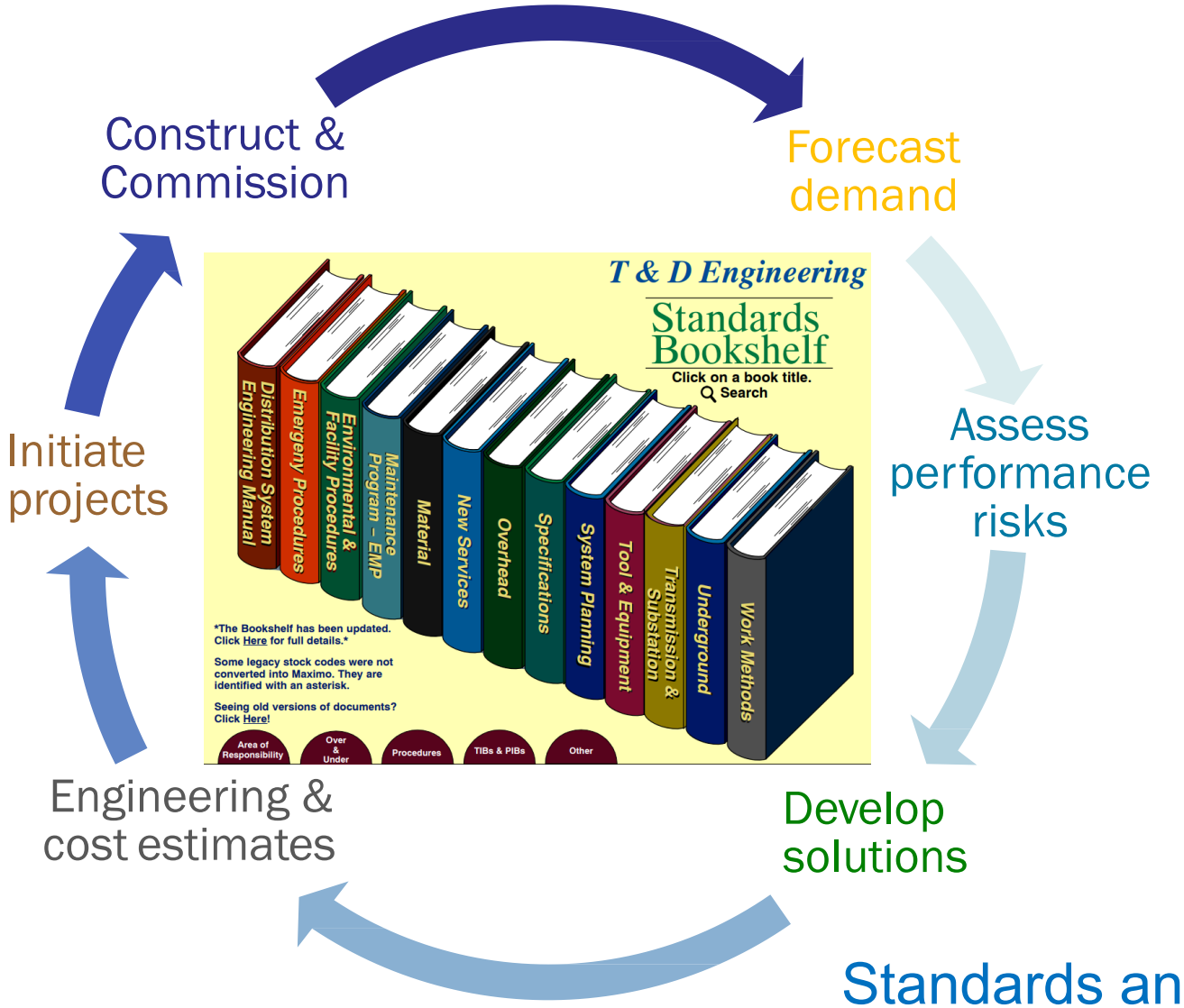
“Annual” Distribution Planning Process



- Proactively identify existing and anticipated capacity deficiencies/constraints that could lead to violations
  - During normal (N-0) operating conditions
  - During emergency (N-1) conditions
- Identify corrective actions
  - Traditional distribution expansion
  - Non-wires alternatives (NWA)
- Estimate costs and determine best engineering option based on:
  - Design criteria and operational requirements
  - Benefit-cost analysis

Standards and criteria are the foundation of our planning and engineering

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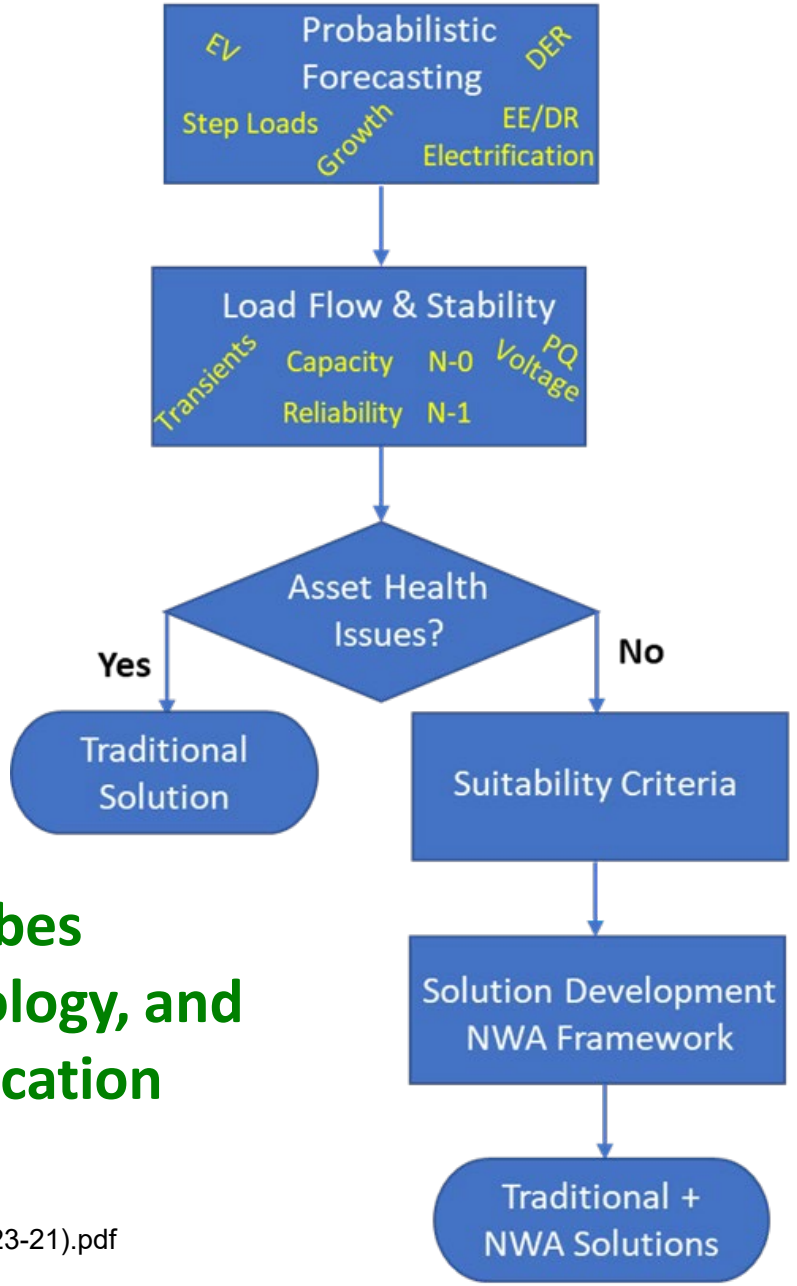
Distribution Solution Development Process

- **Advanced Forecasting** – incorporates likelihood of adoption of certain technologies by customer types at future times and locations
- **Data Analytics** – leverage traditional and non-traditional input: GIS, solar irradiance, socio-economics, travel patterns, parcel data, etc., to develop advanced models and profiles
- **Tools and Processes** – apply cutting edge tools: LoadSEER, Synergi, PSCAD, NWS Screening Tool, etc., to build representative models, assess performance and develop integrated solutions for load and DER



The Company's Distribution System Planning Guide[1] describes forecasting approach, model development, study methodology, and solution development including Non-Wires Solutions application

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[1]Filed 04/23/21 under DPU 20-75, EversourceSystemPlanningProposal(4-23-21).pdf

NWA Framework

Enables Eversource to:

- Identify high profile candidates
- Minimize engineering time on unlikely candidates
- Standardize screening criteria
- Select only solutions with proven and tested technology
- Ensure soundness of financial model

Not intended to:

- Conduct an engineering study
- Develop detailed scope and cost estimates

NWA Screening Tool

Software tool implementing the NWA Framework for fast and repeatable process

In-house development in 2020

Deployed to all three states – all planning engineers trained

NWA Framework

Framework with all assumptions, technical, regulatory, and financial, for the screening process to provide transparency, traceability, and repeatability of process

Open for input and public stakeholder engagement

Filed publicly with regulators in all three jurisdictions

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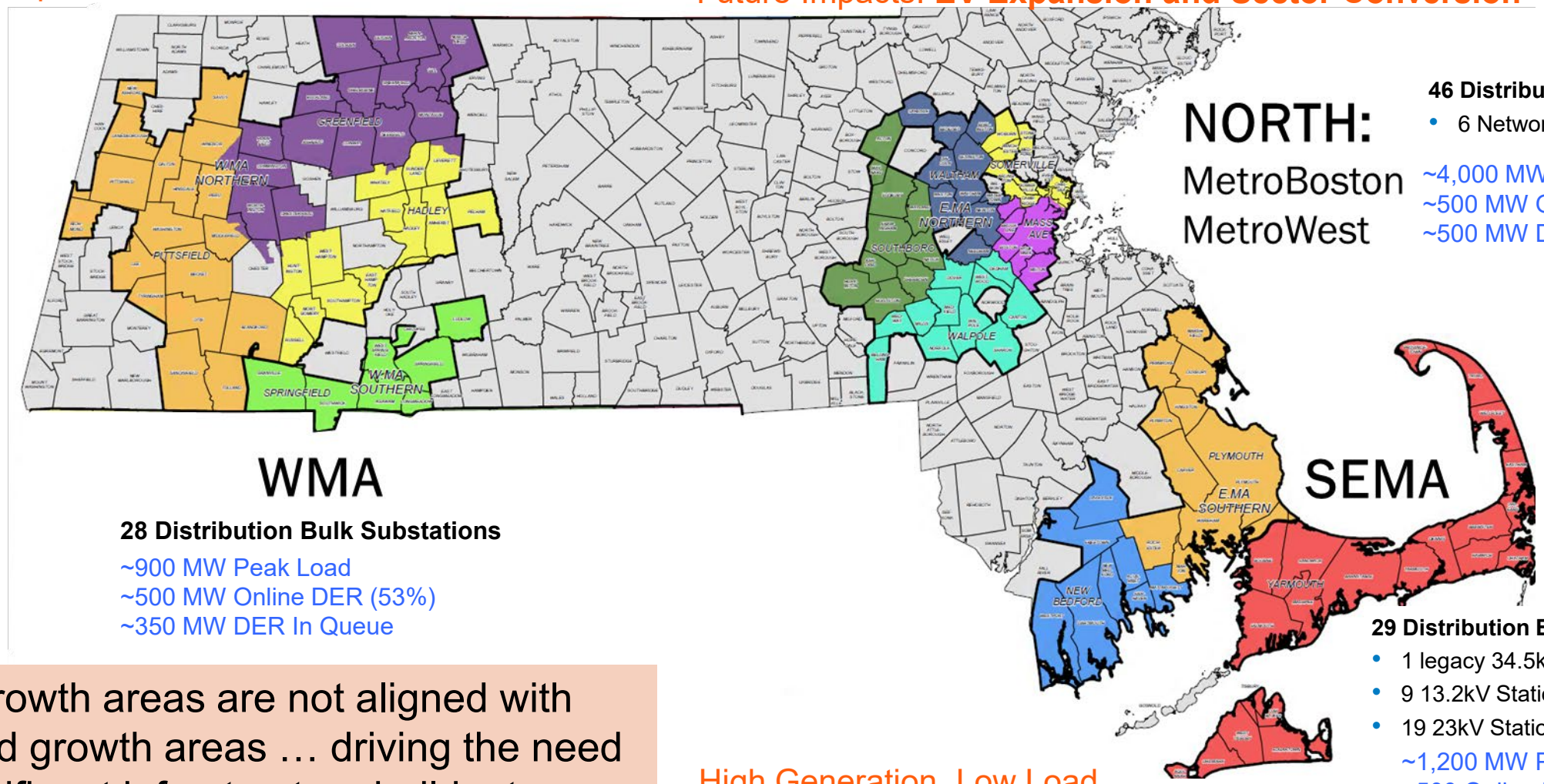
MA Distribution System Planning Process

Massachusetts Planning Challenges

Low Load, Growing Generation
Future Impacts: **DER Growth**

High Load, Low Generation
Future Impacts: **EV Expansion and Sector Conversion**

*All DER MW are as of 2021



NORTH:

MetroBoston
MetroWest

46 Distribution Bulk Stations

- 6 Network Stations

~4,000 MW Peak Load
~500 MW Online DER (13%)
~500 MW DER In Queue

WMA

28 Distribution Bulk Substations

~900 MW Peak Load
~500 MW Online DER (53%)
~350 MW DER In Queue

SEMA

29 Distribution Bulk Stations

- 1 legacy 34.5kV Substations
- 9 13.2kV Station
- 19 23kV Stations

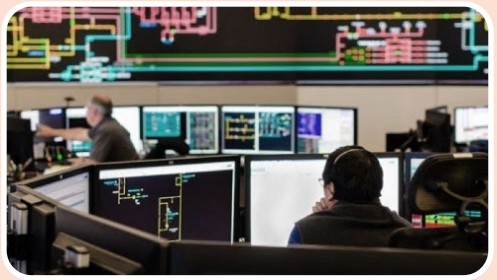
~1,200 MW Peak Load
~500 Online DER (40%)
~1,300 MW DER In Queue

DER growth areas are not aligned with demand growth areas … driving the need for significant infrastructure buildout

High Generation, Low Load
Future Impacts: **Offshore Wind and DER**

Investment in Modern Grid-Enabled Choices

Visibility → **Optimization** → **Enable**



Infrastructure Investments

- Increased transmission and distribution network strength
- Improved regional connectivity
- Modernize aging infrastructure
- Harden against storms, floods, and other threats

Integration Tools

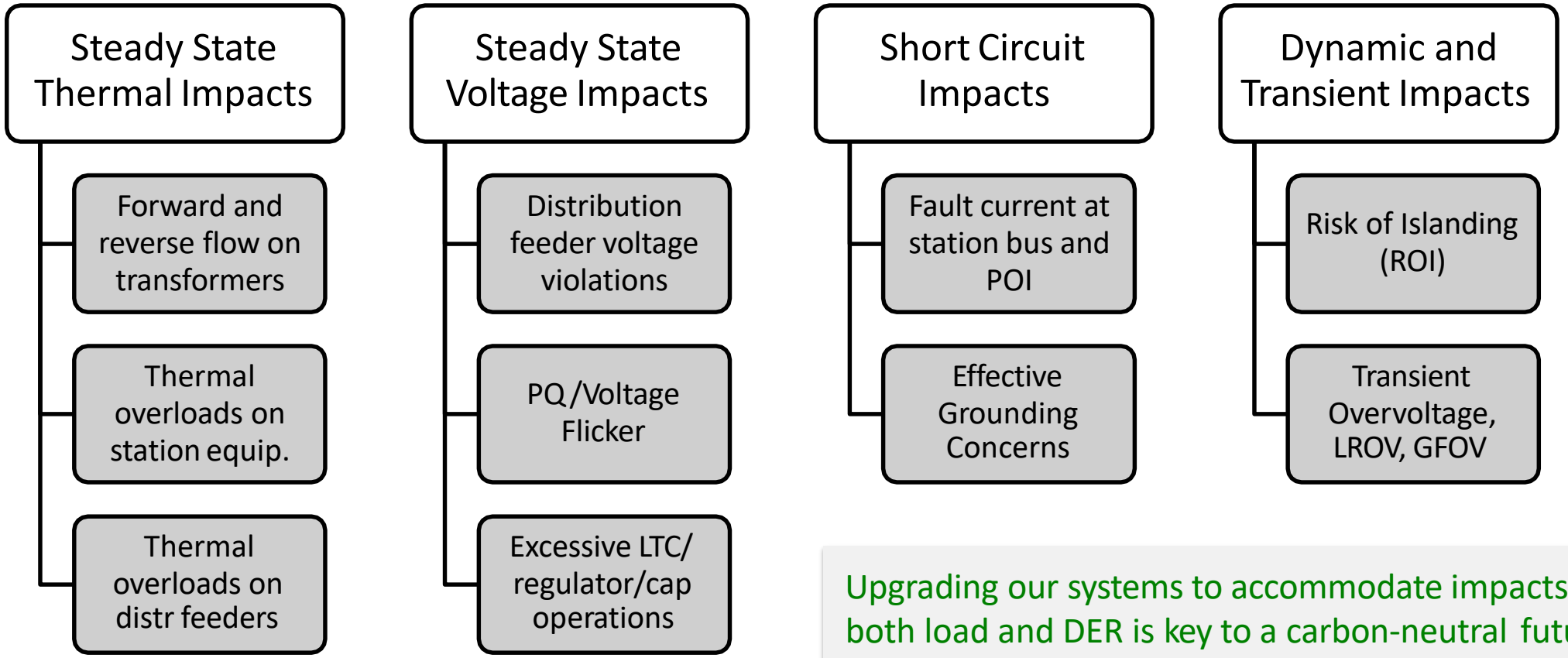
- Improved communications and data
- Tools to manage large volumes of data
- Improved visibility
- Identify locational benefits of resources
- Outage management system

New Technologies

- Energy storage
- Customer-centric platforms
- Microgrids
- Self-Healing Grid
- PQ Solutions (e.g. DVAr, STATCOM)

Integrated Distribution Planning

- **Advanced tools and processes used to assess impact and proactively plan the system to safely, reliably provide service for both load and DER**



Upgrading our systems to accommodate impacts of both load and DER is key to a carbon-neutral future

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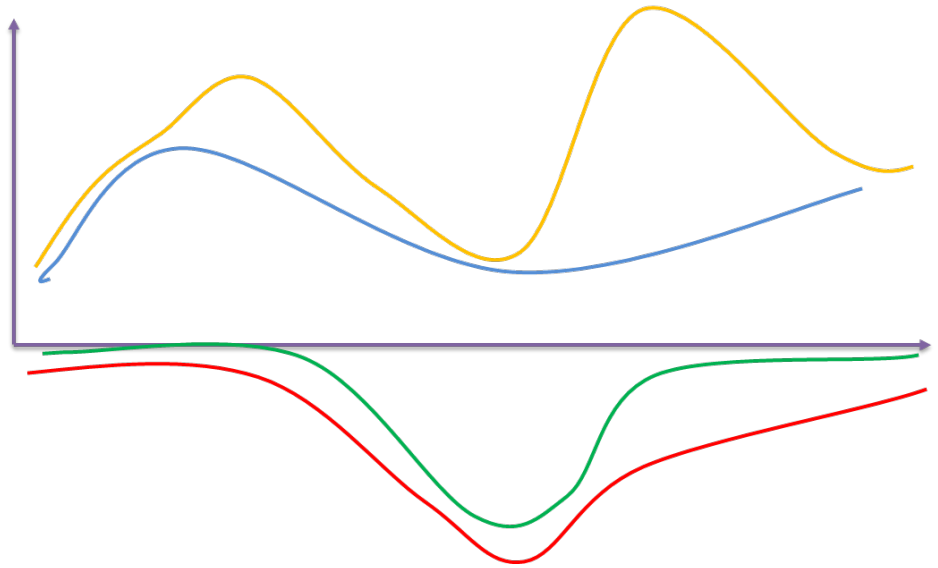
INTEGRATED PLANNING
FORECASTING-ANALYSIS-PLANNING

Advanced Forecasting Process

- **Scenario modeling based on high level "forecast"**
  - High-level forecast provided by an external entity, such as state decarbonization pathways
  - Forecast scenario is broken down to regional impacts on the distribution system
  - Bottoms-up metrics and adoption propensities are used to allocate impacts locally
- **Use component modeling approach to build forecasting scenarios**
  - Each component represented as an 8760 profile
  - Component profiles are created for various forecast scenarios
  - System Planning selects component profiles and merges them to create forecast
- **Company forecast components**
  - Trend Load Data
  - Step Load Growth
  - Energy Efficiency
  - DG Adoption
  - EV Adoption
  - Energy Storage
  - Sector Conversion
  - Capacity Reserves



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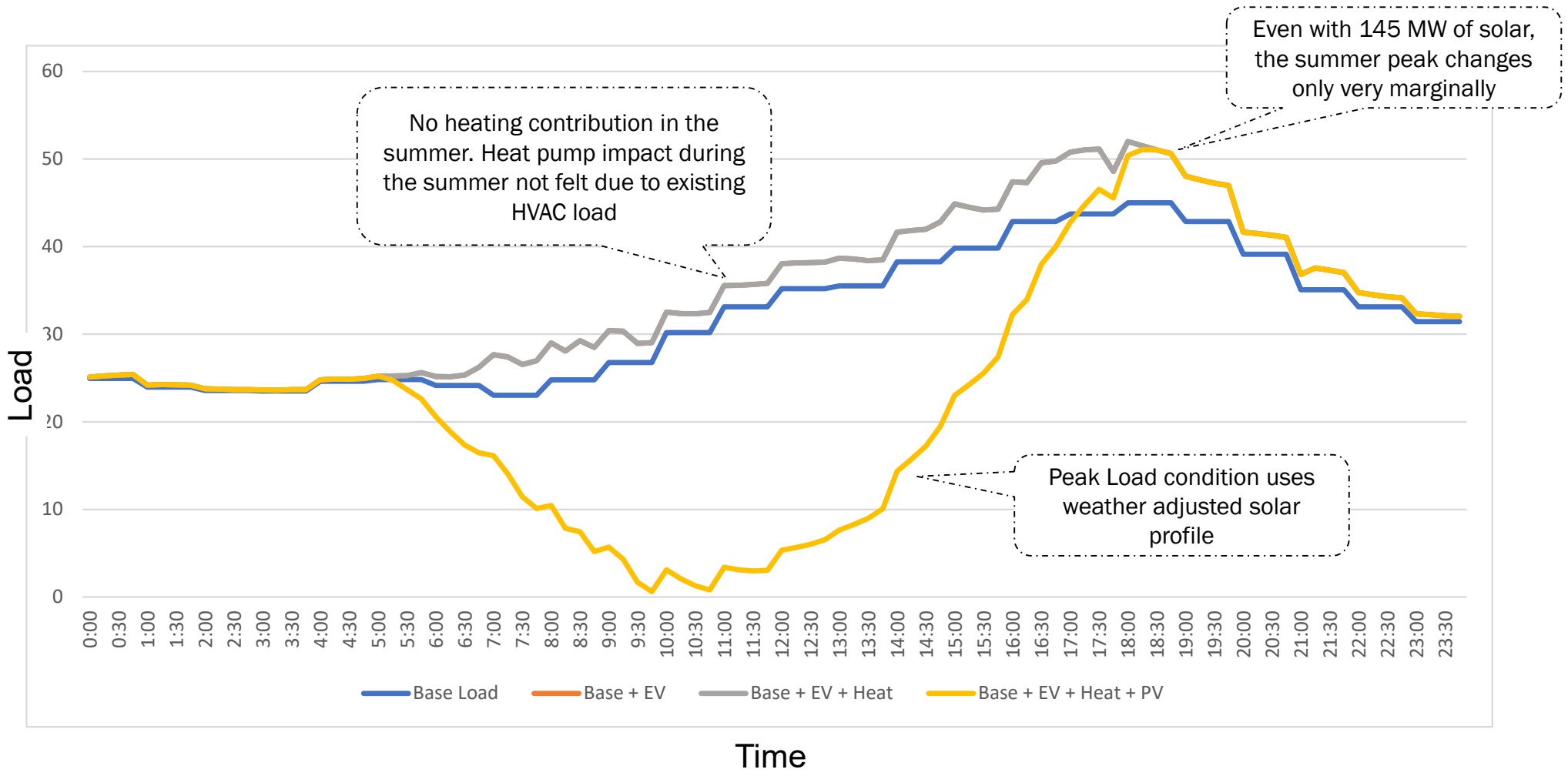
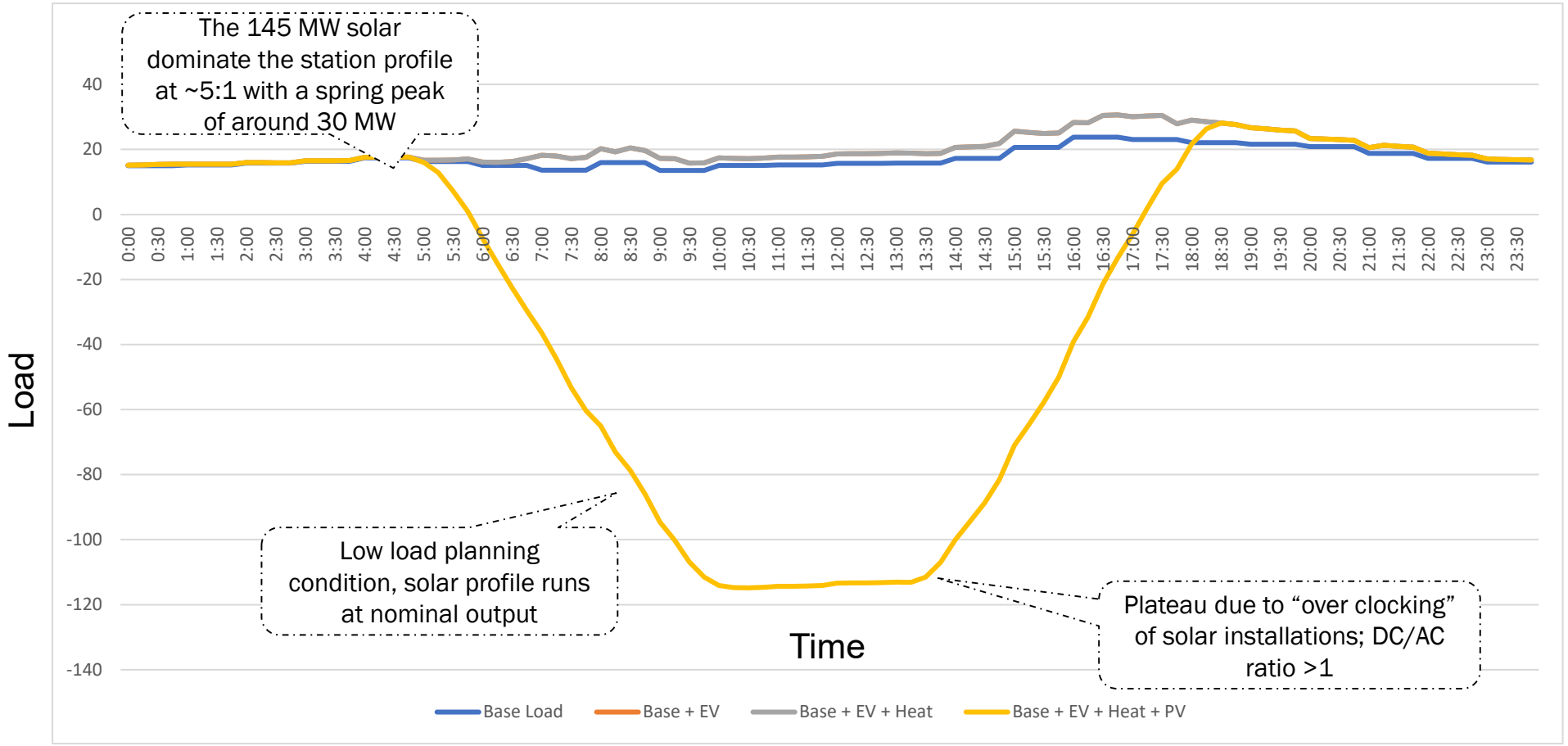
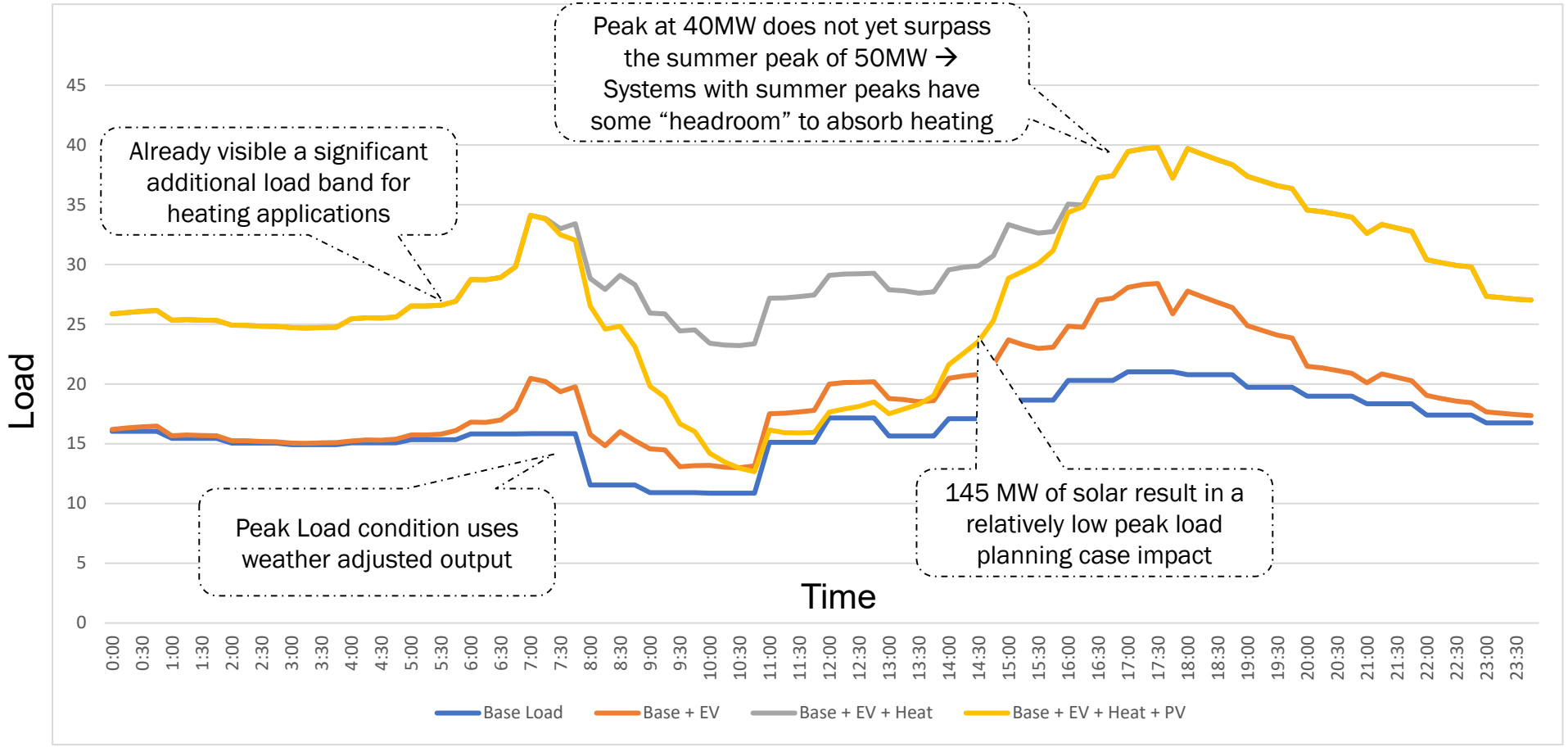
Combined Profile – Summer 2030



Combined Profile – Spring 2030



Combined Profile – Winter 2030
Typical High DER Substation



Multi-Year Modeling Approach for Integrated System Planning

Planning Forecast Requirements

Instead of single peak-hour, a planning forecast now requires 24-hour time-series data

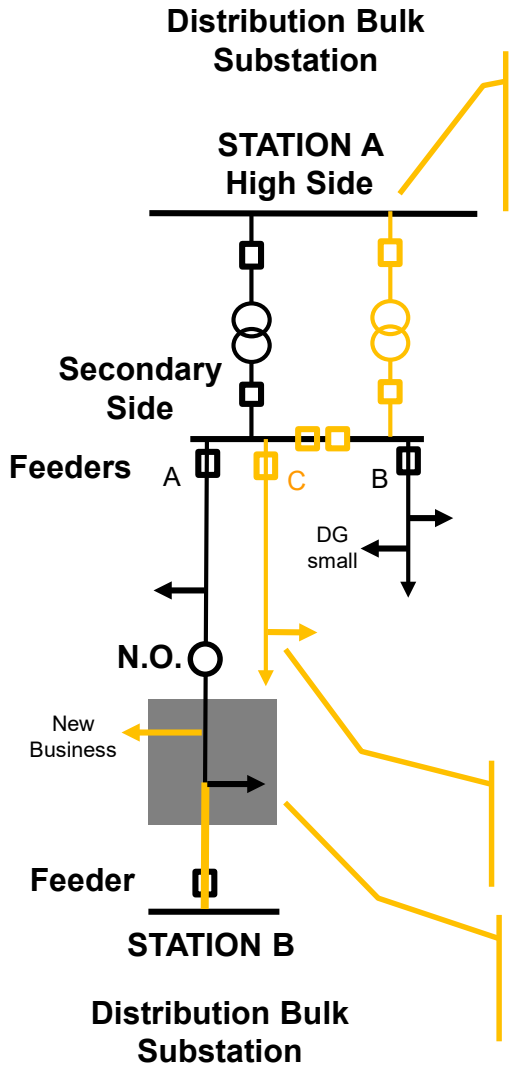
Instead default load profiles, a planning model now requires specific 8760 and 24-hr load profiles by area/substation

Instead of single year 8760 profile, a planning model requires ten-year 8760 profiles that account for Electrification, PV, EE, EV, etc.

Large Load, or Large DER Customers

- Years 1-5, actual new business installations to be modeled at specific locations based on in-service date

- Years 3-10, growth curves required for new business installations without specific locations identified

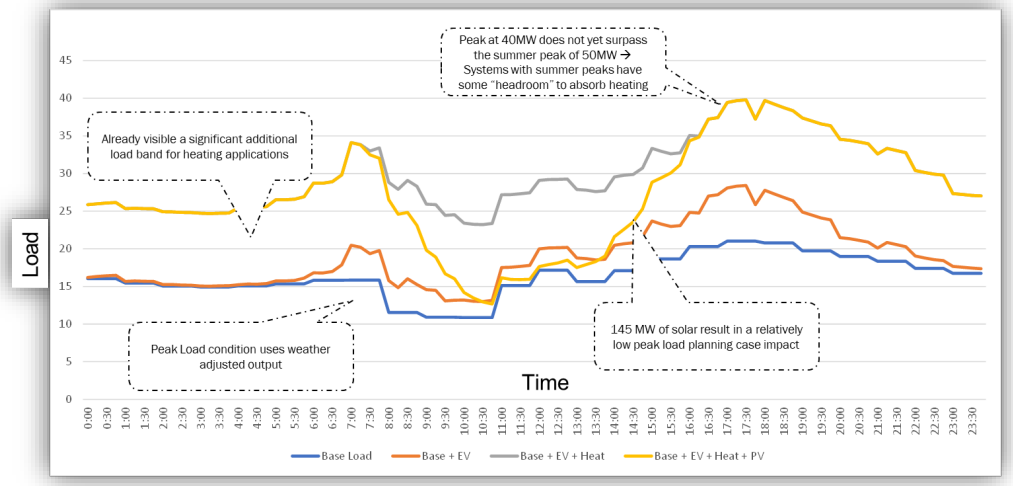


Year 2
Transformer Replacement
Asset Condition

Year 3
New Feeder required for reliability improvement

Year 4
Feeder Upgrade
New business

Combined 8760 Profile by Year used as input to Planning Model



Thank You

QUESTIONS?