Versant Power

# Integrated Grid Planning (IGP)

## Milestone 2.0 Stakeholder Meeting

July 10th, 2025

# Agenda

- Introductions & Safety Message
- Overview of Versant Power
- Integrated Grid Planning Background
- Milestone 2.0 – Identifying Grid Needs
  - Process
  - Key Findings
- Next Steps

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# Introductions

Tyler Stanley, Program Manager, T&D System Planning

Judy Long, Senior Manager, Communications

Steve Bye, Senior Engineering Manager, EPE

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# Sun Safety

## Sunscreen:

- Use a broad-spectrum sunscreen with SPF 15 or higher.
- Reapply sunscreen every two hours, or more frequently if swimming or sweating.
- Ensure your sunscreen protects against both UVA and UVB rays.

## Seeking Shade:

- Avoid prolonged exposure to the sun between 10 a.m. and 4 p.m. when the sun's rays are strongest.
- Seek shade whenever possible, especially during peak sun hours.
- Use umbrellas, shade structures, or trees to create your own shade.

## Other Tips:

- Drink plenty of water to stay hydrated, as sun exposure can lead to dehydration.
- Wear long sleeves, pants, a hat, and other clothing that provides adequate coverage.
- Protect your eyes and the surrounding skin with sunglasses that offer UV protection.

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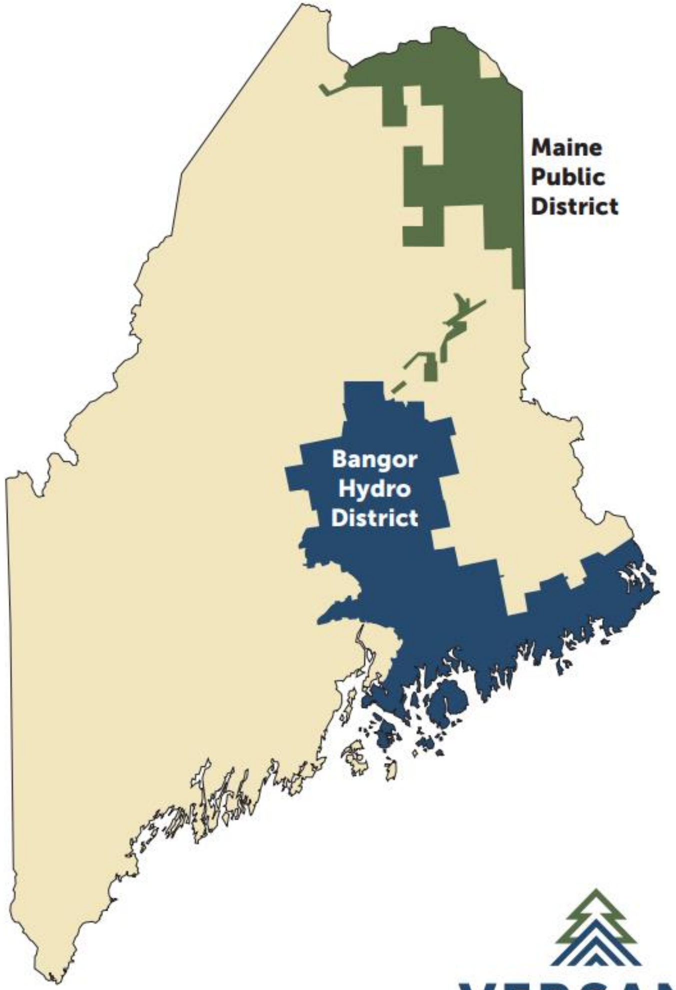
# Overview of Versant Power

- Service territory covers 10,400 square miles in northern and eastern Maine
- Service territory is geographically diverse and mostly rural
- Maine is the most forested state in the nation (90%)
- 165,000 customers
- 56% are in small Disadvantaged Communities
- 375 transmission and distribution circuits
- 1,400 transmission and distribution protection and switching devices

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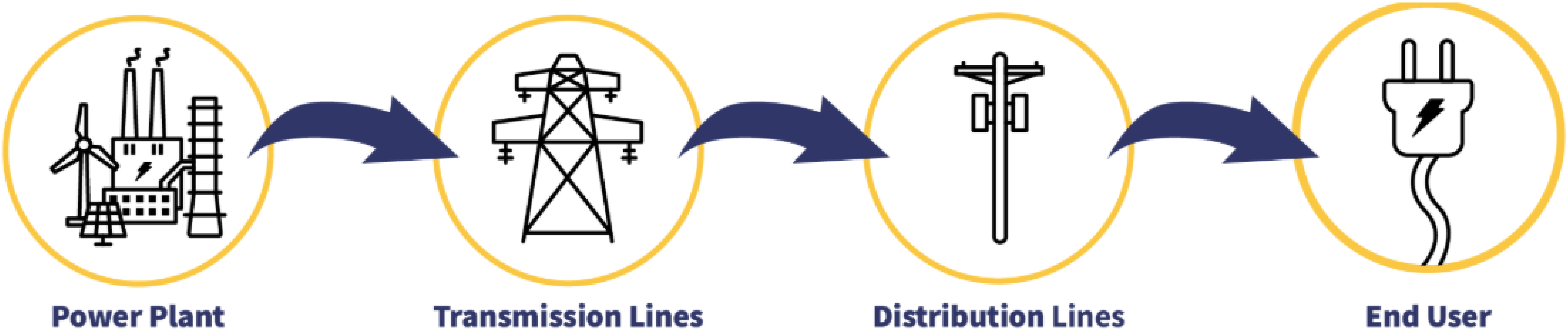
# Versant Power: Transmission & Distribution Utility

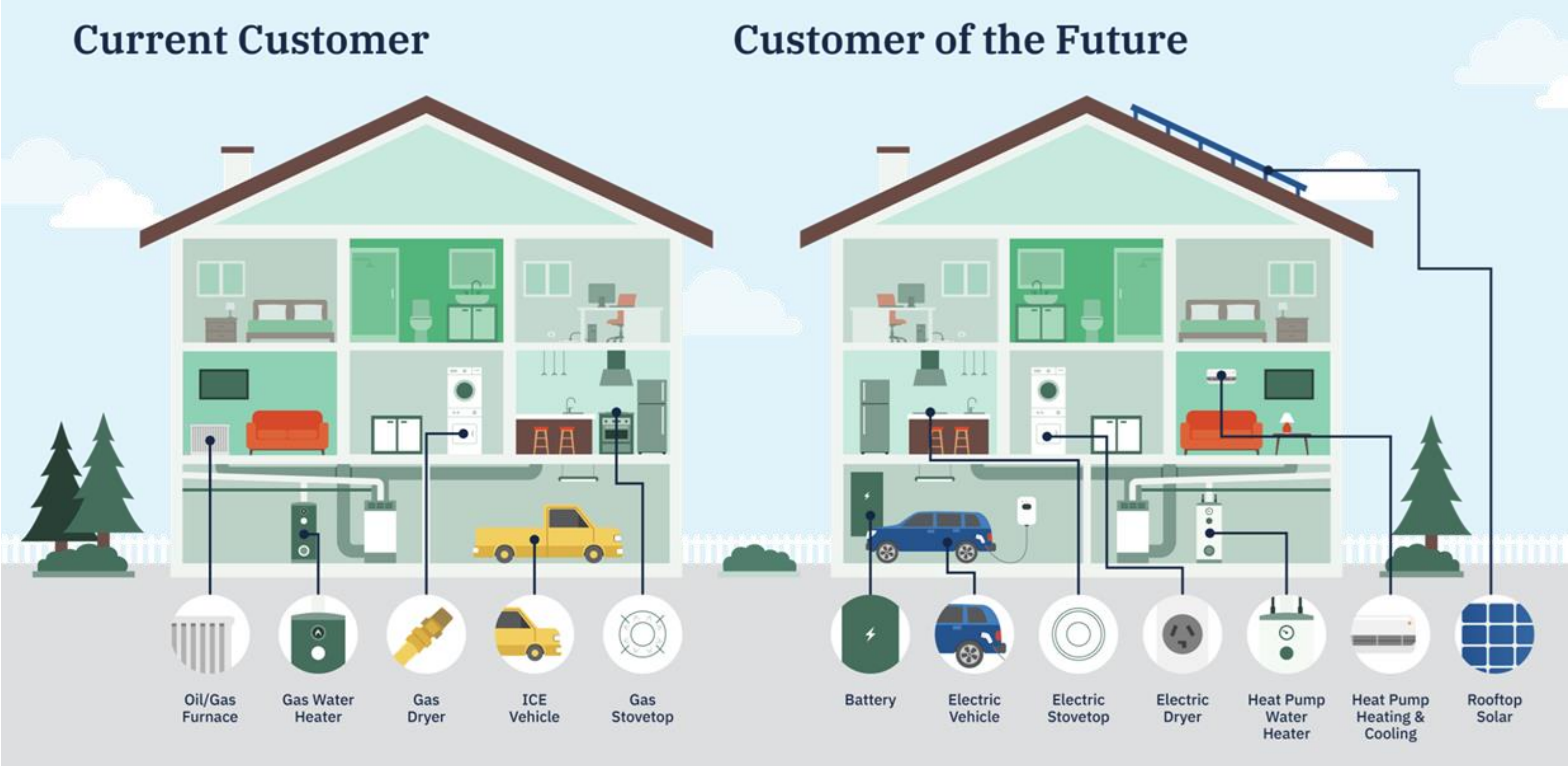
Transmission System Planning: ISO-NE (CELT) and Utilities




Distribution System Planning: Versant IGP

# What causes grid needs?

- **Load growth** from new homes, electrification (EVs, heat pumps, etc.), and economic development
- **Adoption of distributed energy resources (DER)** from customer-owned generation (rooftop PV, community solar, etc.)



# Versant Power: Recent Trends & Technologies

Solar
- Significant increase in distribution solar since 2019 through net energy billing expansion
- State goal of 80% renewable energy by 2030 and 100% by 2040

Heating Electrification
- Heat pumps and heat pump water heaters
- State goal of 100,000 by 2025 was surpassed, goal of additional 175,000 by 2027

**Electric Vehicles**
- Increased adoption through federal and state incentives
- State goal of 150,000 electric vehicles on the road by 2030

**Battery Storage**
- Residential and commercial Battery Energy Storage Systems
- State goal of 300MW by 2025 and 400MW by 2030

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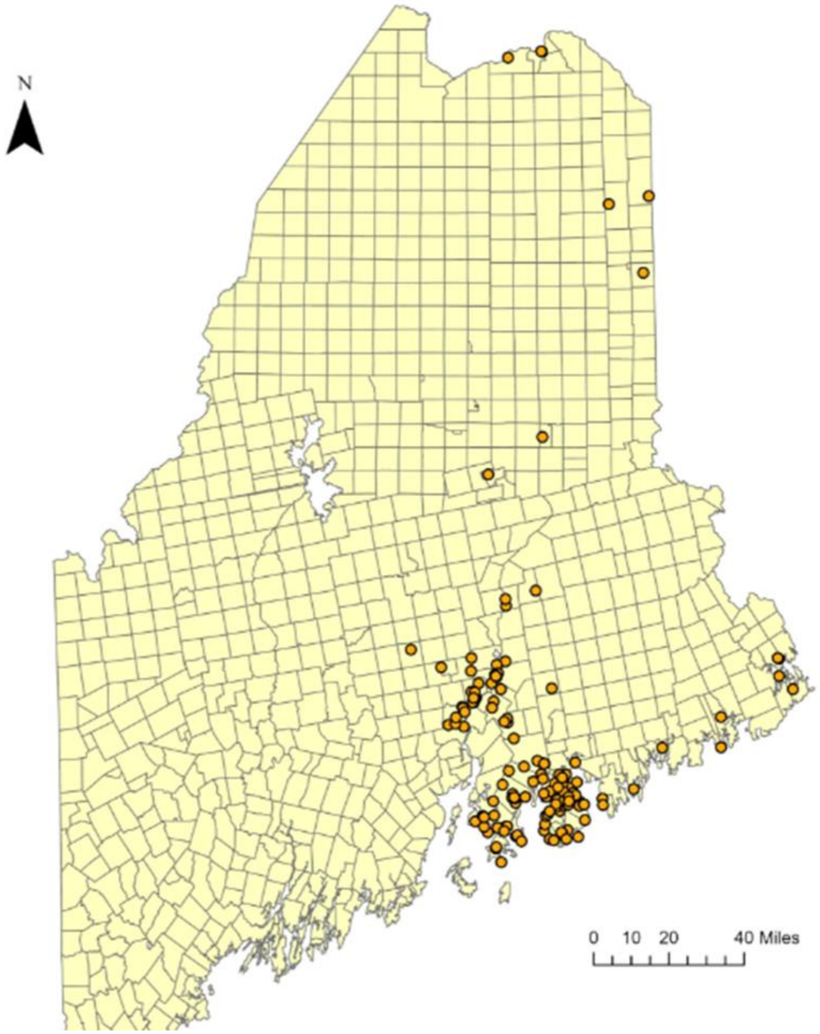
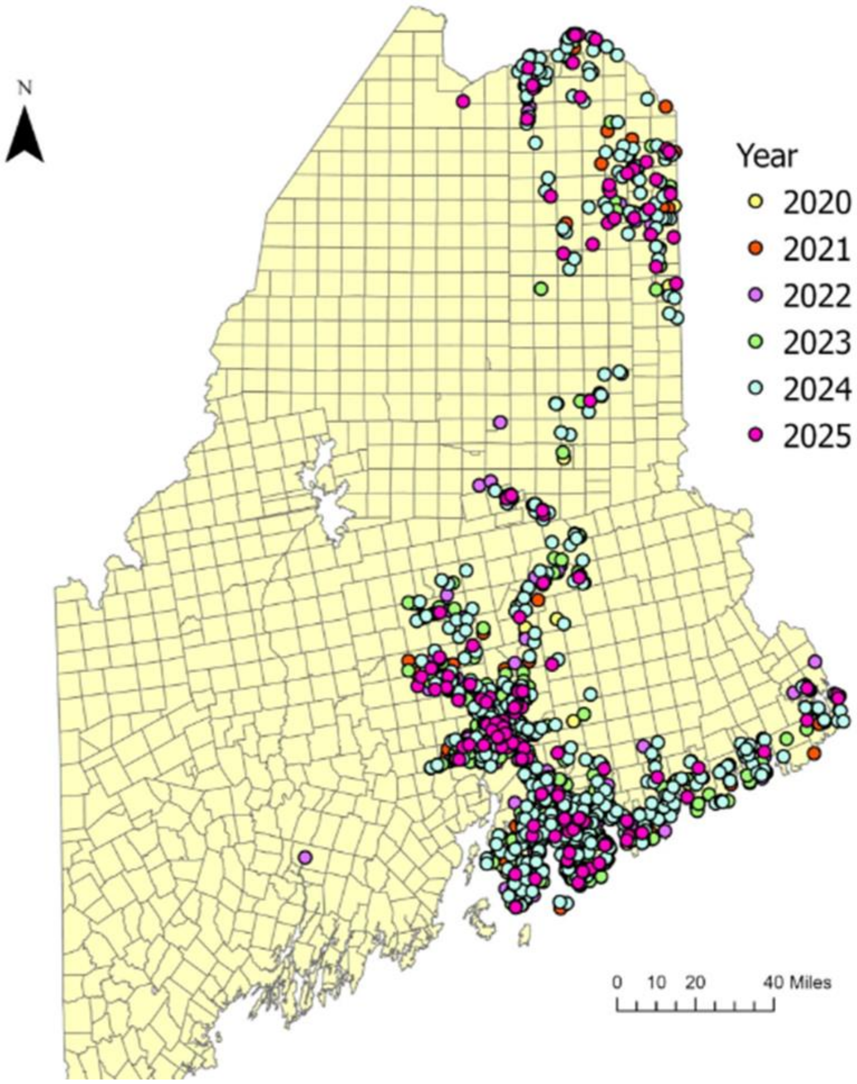
# Growth of distributed energy resources: 2020 to 2025




Total Nameplate Capacity: 14 MW




Total Nameplate Capacity: 365MW

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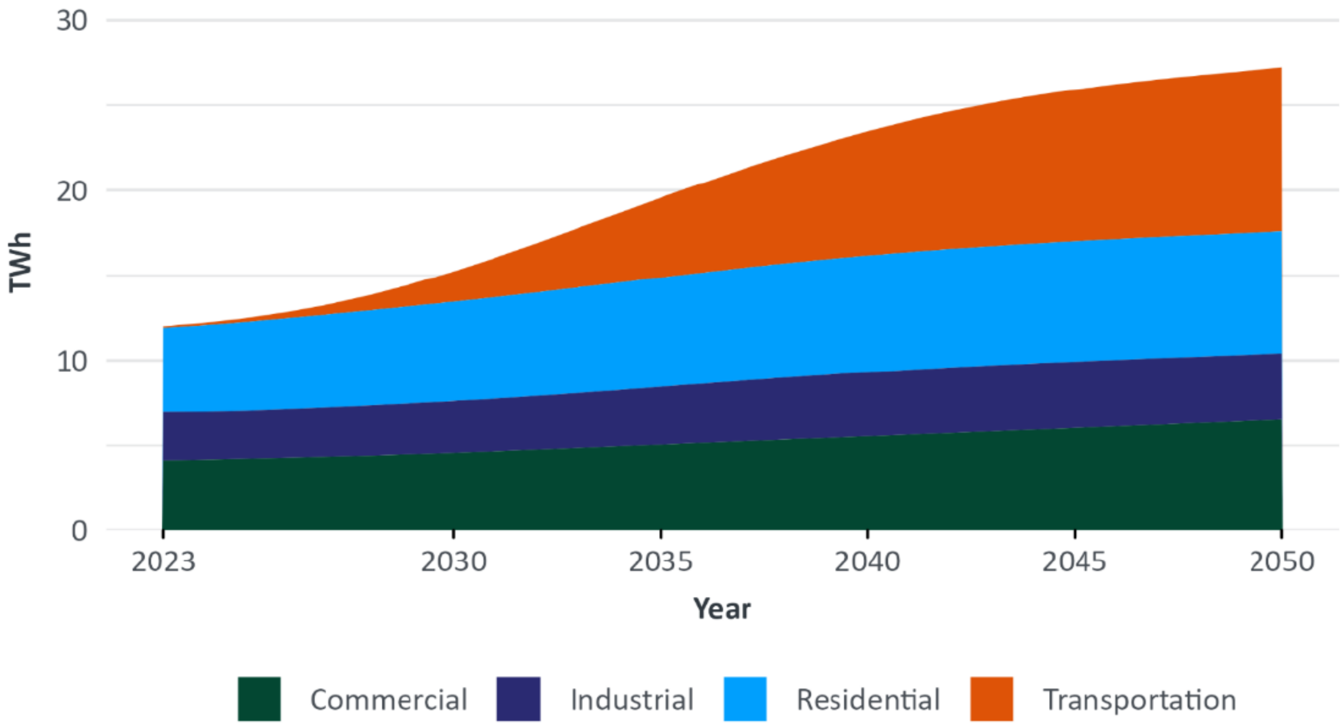
# Growth of Transportation Electrification

- By 2050, about 60% of Maine's electricity demand growth is expected to come from transportation electrification, as the state shifts from fossil fuel-powered vehicles to EVs.

FIGURE ES-1: ELECTRICITY CONSUMPTION IN MAINE BY SECTOR, CORE PATHWAY




Source: Maine Governor's Energy Office (2024). Maine Pathways to 2040: Analysis and Insights

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# What is the IGP?

- Integrated Grid Planning (IGP) is a comprehensive approach to ensure the electric grid can meet the needs of a rapidly changing energy landscape.
- IGP is an effort to analyze the electric grid, to account for a rapid transition to beneficial electrification technologies such as EV, heat pumps, and Distributed Energy Resources (DER). The main parts of the study will focus on defining the load forecasts, developing the models based on those forecasts, determining the resultant grid needs identified, and an evaluation of the potential solutions to address those grid needs.
- To meet the changing expectations of customers and stakeholders, Versant must ensure the grid is ready to handle a significant increase in load and distributed energy resources. It must be clean, affordable, resilient and safe.

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# Versant Power's Vision

Versant envisions a future electric grid that operates safely and reliably, enables a fully decarbonized energy supply, facilitates the deployment of significant distributed energy resources and beneficial electrification technologies, leverages cost-effective solutions, and does all this while maintaining affordability for our customers.

Our goal for grid planning is to identify opportunities for "no regrets" investments that empower customer choice of modern, low-carbon technologies and are aligned with Maine's state policy goals. We are committed to collaborating with the communities we serve and other stakeholders to ensure Maine's electric grid is resilient, reliable and capable of meeting the challenges of a fully electrified future.

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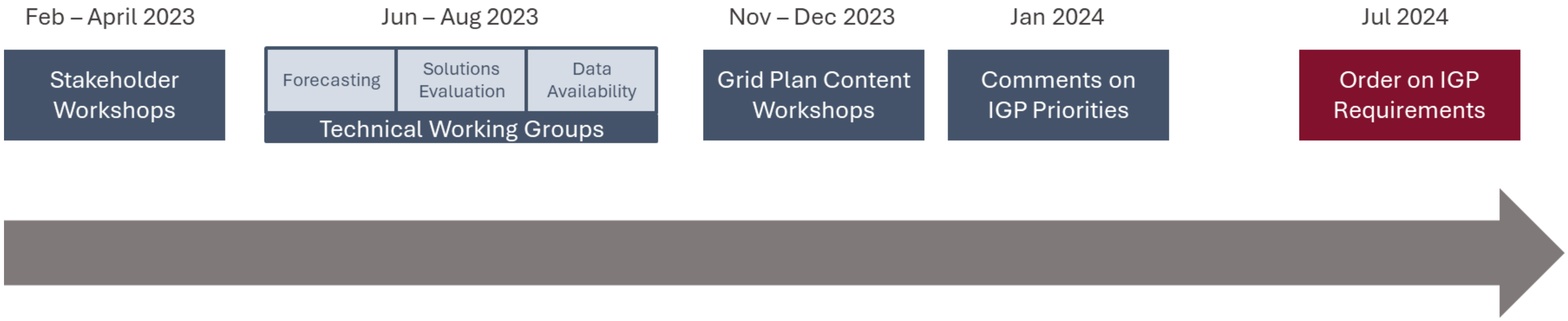
# Maine Integrated Grid Plan Timeline

In 2023, the Maine Public Utilities Commission facilitated a series of workshops and technical conferences to identify priorities, assumptions, goals methods and tools that will be used to develop utility grid plans. An order initiating utilities' 18-month planning process was released in late July 2024.




- Versant will develop a 10-year integrated grid plan designed to improve system reliability and resiliency and enable the cost-effective achievement of the greenhouse gas reduction obligations and climate policies pursuant to Title 38, section 576-A and section 577, subsection 1.

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# Integrated grid plan: What will it include?

## Identified priorities

- Utilities must create detailed plans that address reliability and resilience improvements, improve data quality for distribution system planning, and promote flexible management of customer resources including renewable energy integration, electric vehicle charging, and heating electrification, all while maintaining affordability for customers.

## Climate alignment

- These plans must support Maine's ambitious climate goals, including substantial reductions in greenhouse gas emissions.

## **Grid modernization**

- The plans should outline necessary upgrades and investments to ensure a resilient and efficient grid capable of meeting future energy demands.

# Integrated Grid Planning: Public Engagement

## Public engagement

- Utilities are required to actively engage with stakeholders, fostering open dialogue and transparency throughout the planning process.


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# IGP Progress

| Milestone 1.0<br>Meeting: 2/28/2025 | Milestone 2.0<br>Meeting: 7/10/2025 | Milestone 3.0<br>Meeting: Target Q3 | 1/12/2026 |
|---|---|---|---|
| Determine Model Inputs | System Modeling and Grid Needs Identification | Identify System Solutions | IGP Filing |

Remaining IGP Timeline

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# Forecasting Summary

Versant developed the following forecasts:

- Top/down Baseline Forecast:
  - As required by the MPUC, we used the 2024 CELT 50/50.
- Top/down High Adoption Forecast:
  - As required by the MPUC, we used the 2024 CELT 90/10.
- Bottom/up forecast:
  - Developed distribution level substation and circuit forecasts using localized data, ISO-NE forecasts, and state policy targets accounting for base load, heating electrification, transportation electrification, DER adoption, and energy efficiency.
- Scenarios:
  - As required by the MPUC, we will develop the 6 required snapshots for each of the top/down forecasts.
  - Additionally, we developed scenarios that vary the level of adoption for each of the bottom/up forecasts and include those within the same 6 snapshots.
- This comprehensive approach enabled us to create the most granular and insightful forecasting scenarios and identify the boundary cases for modeling analysis.

Six Seasonal Load Snapshots

- Summer Daytime Peak Load; Summer Evening Peak Load; Winter Evening Peak Load; Daytime Minimum Load; Evening Minimum Load; Spring Minimum Load

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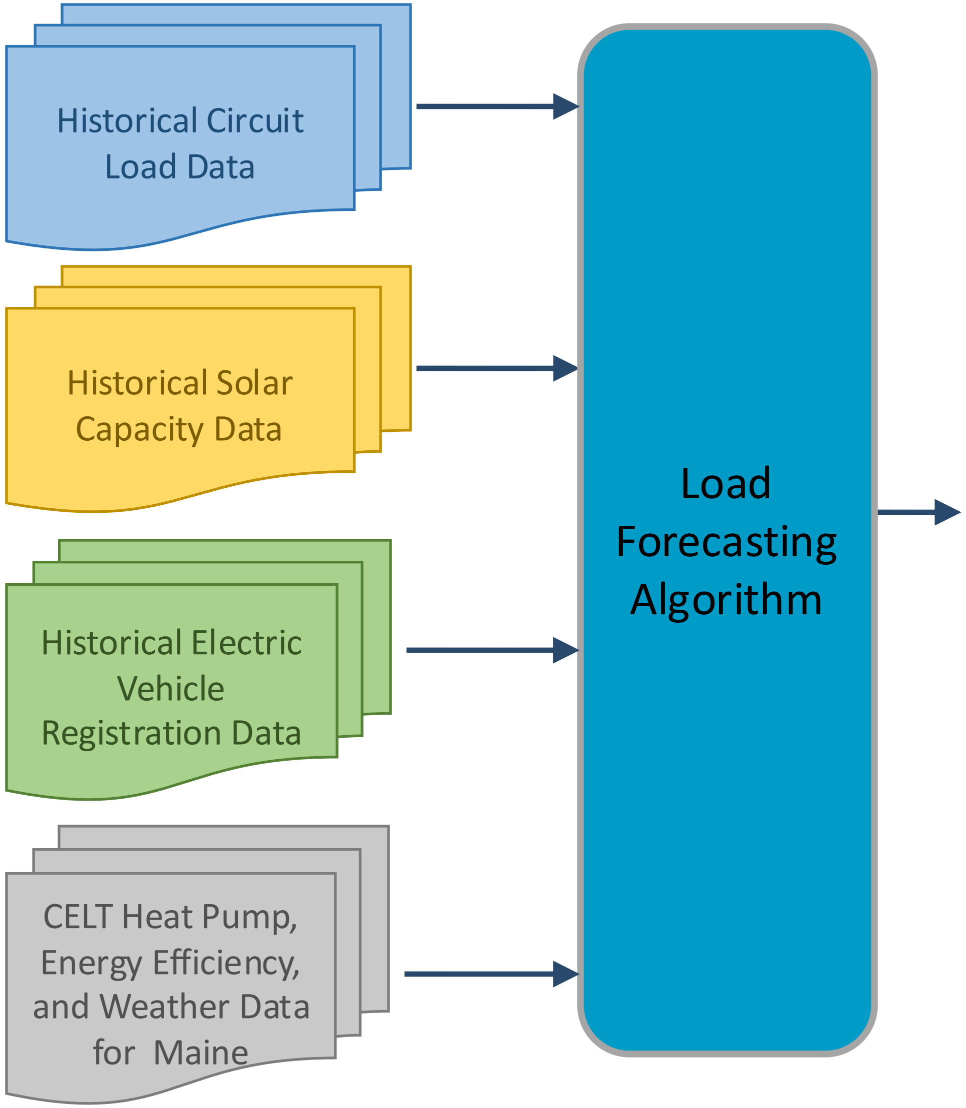
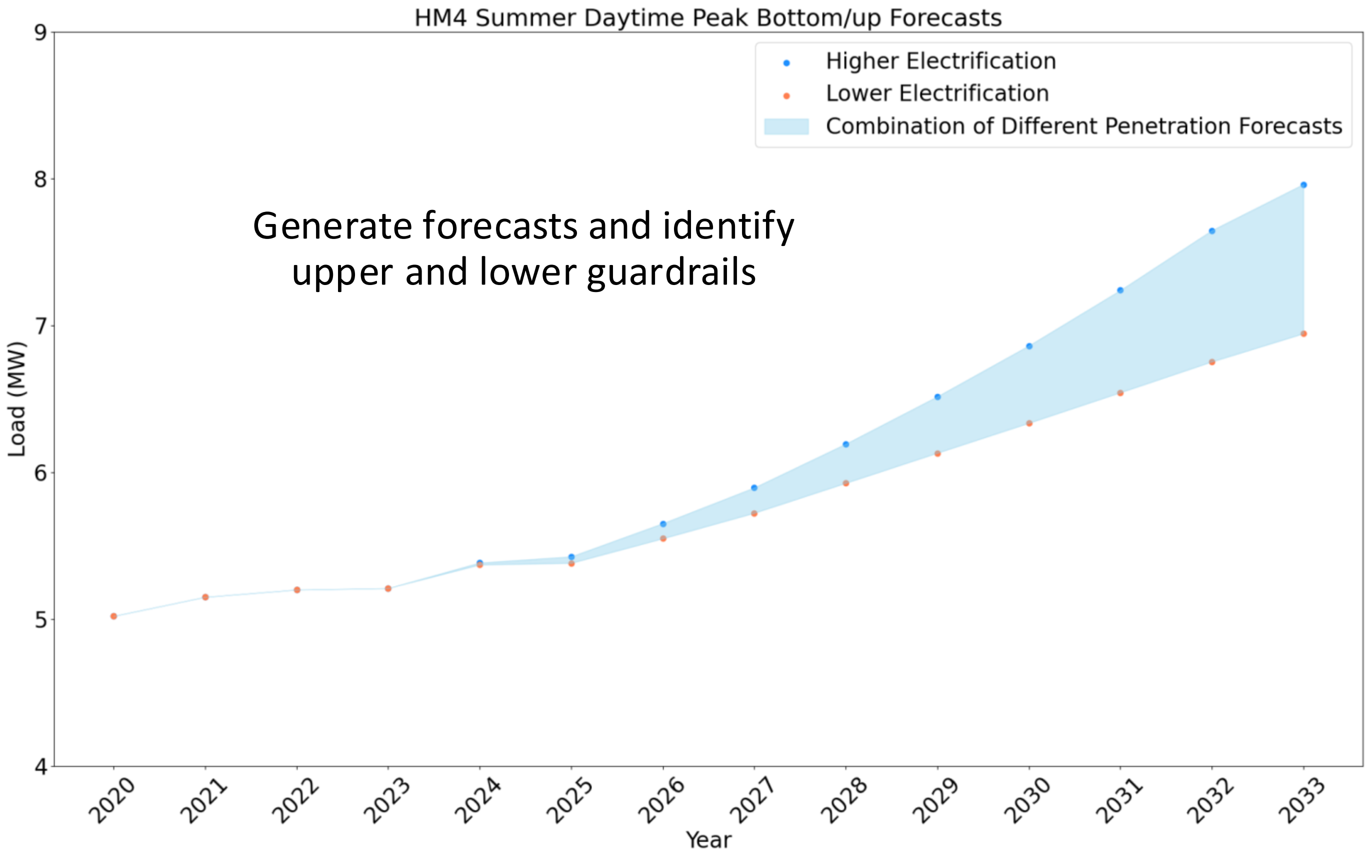
# Bottom-Up Load Forecast Methodology




- Bottom/up method includes multiple forecasts per circuit and per scenario
- Forecasts cover a range of various adoption combinations, such as low/medium/high adoption of electric vehicles, low/medium/high adoption of solar, etc.
- These resulting forecasts are the inputs to the models.

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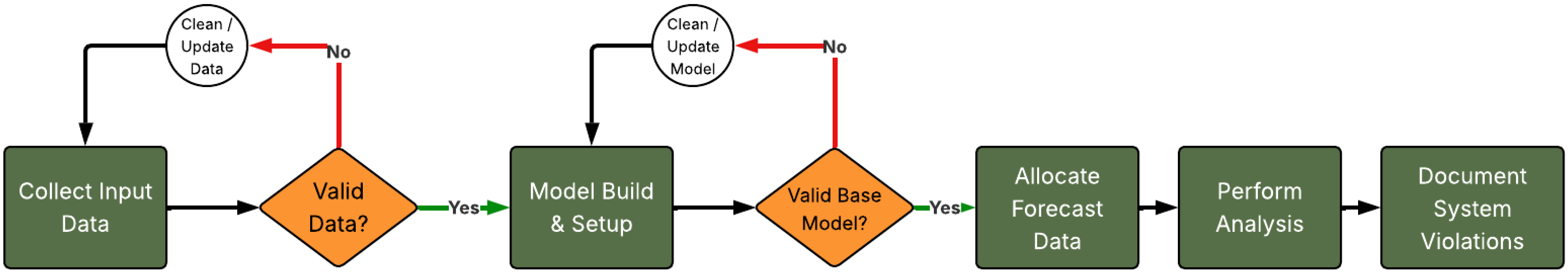
# Needs Identification Process

The needs identification process involves multiple steps to ensure reasonable accuracy for the model, yielding definitive results from the analyses.

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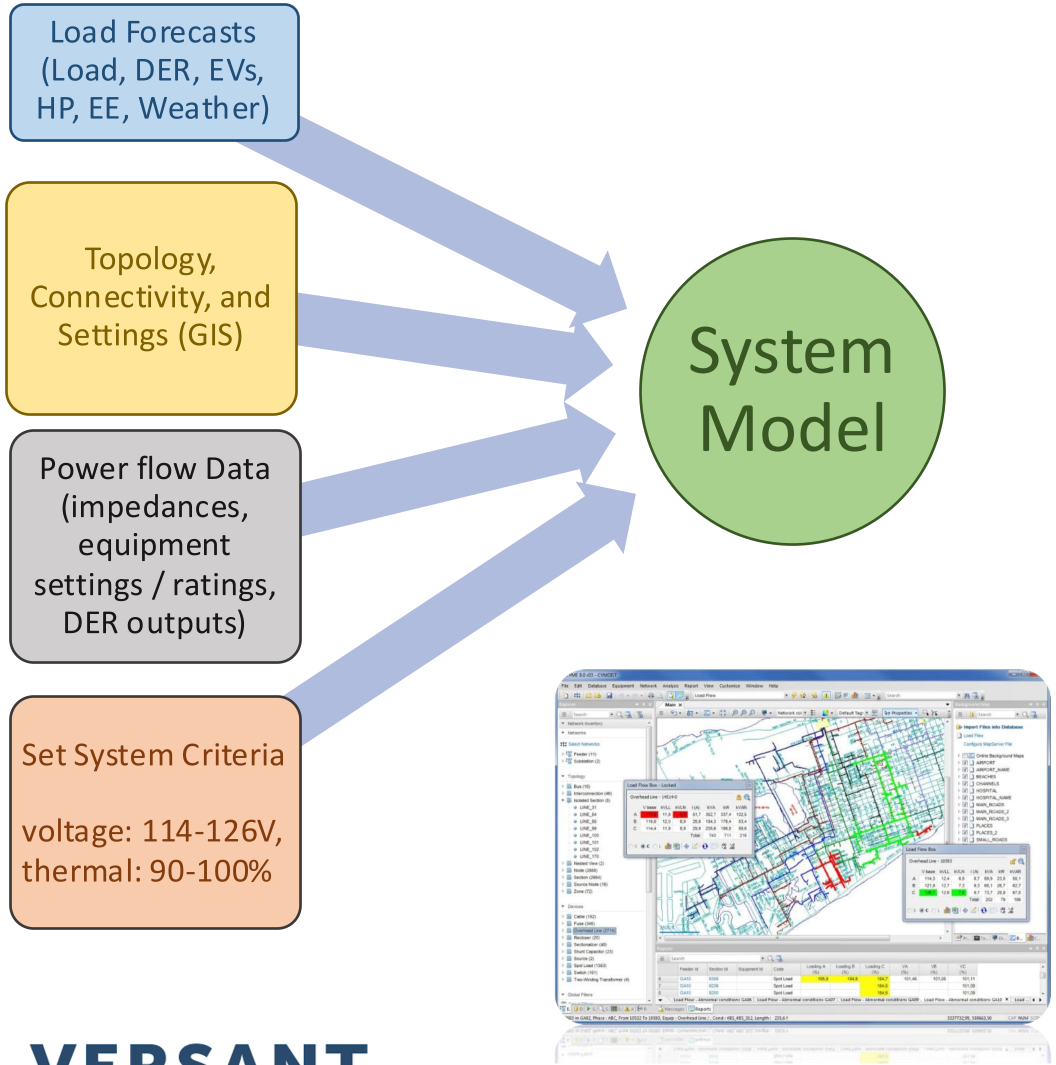
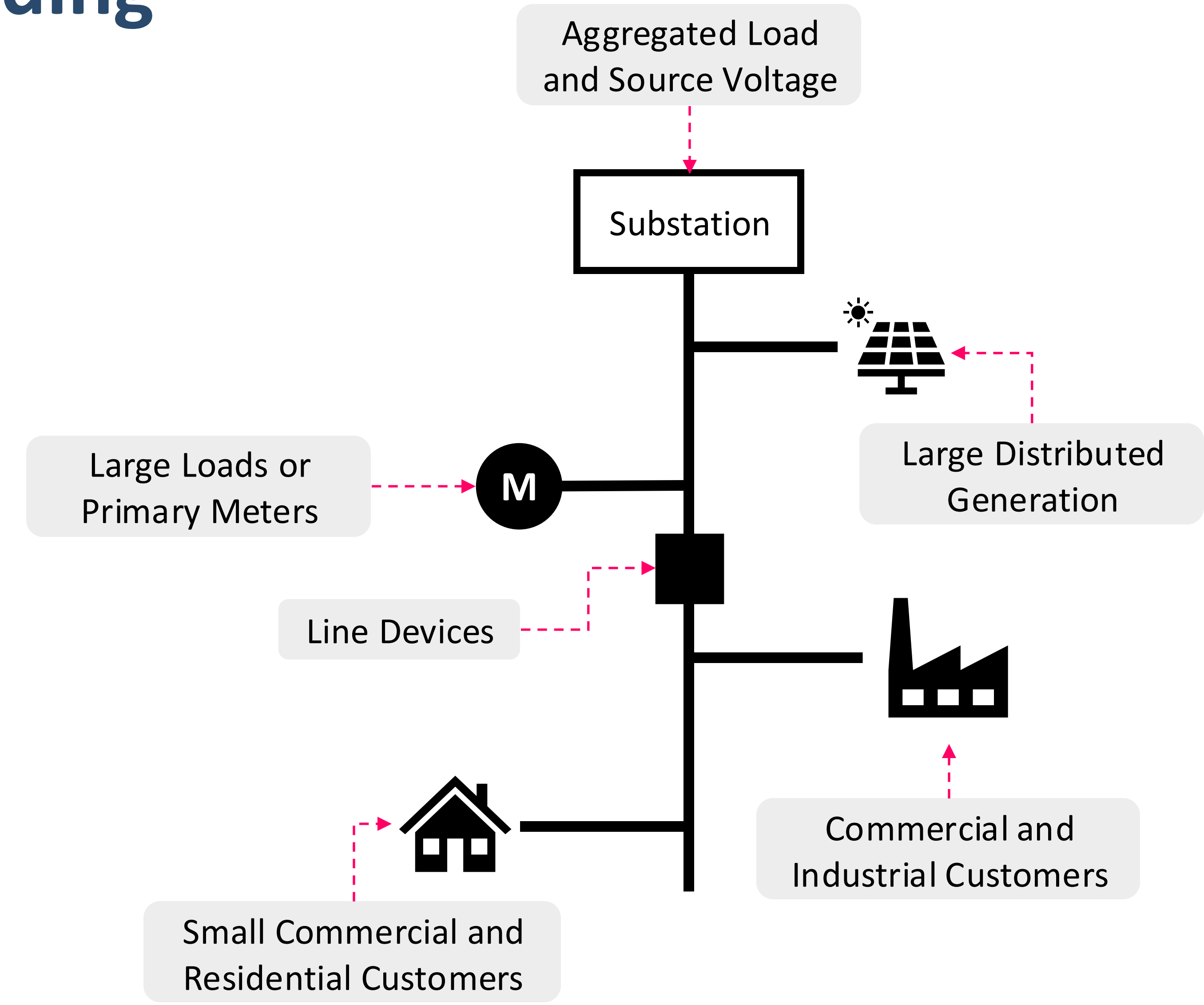
# Data inputs and model building



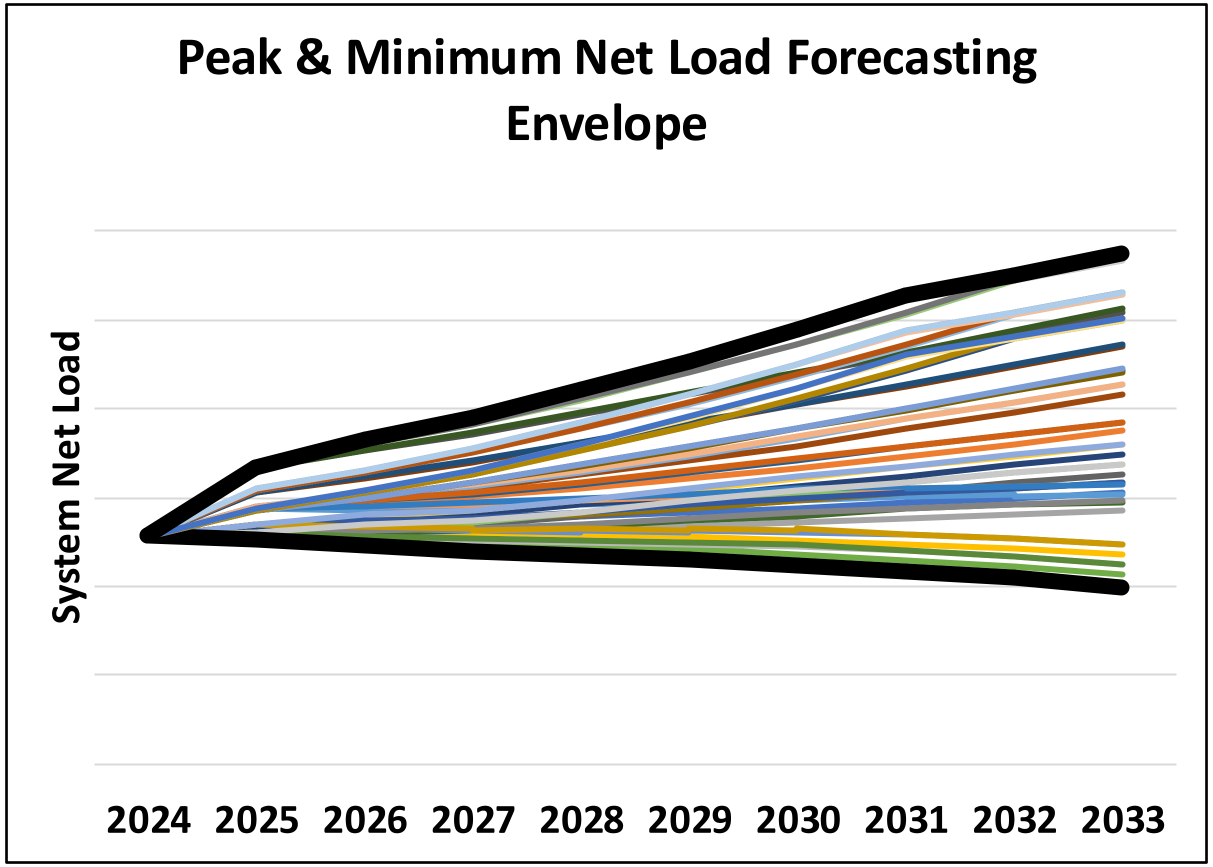
# Allocate forecast data within the model

Versant developed sets of forecast data based on permutations of Baseline/High Adoption forecasts from the CELT, our bottom-up forecast, and six seasonal load snapshots required by the MPUC.

The goal of the grid needs analysis is to stress-test the system and identify locations where electrification load and growth of distributed energy resources may cause problems. The forecasts that most stress the system are the Peak Load and Minimum Load scenarios.

Versant applied the Peak Load and Minimum Load data sets to the system models for subsequent powerflow analysis. This "worst-case scenario" methodology is an industry-accepted best practice and aligns with the MPUC IGP Order by:

- ✓ Managing long-term risks
- ✓ Stress-testing system reliability
- ✓ Aligning with State Policy




**Peak Net Load Forecast:** Highest electrification load, lowest DER output.
**Minimum Net Load Forecast:** Lightest electrification load, highest DER output.

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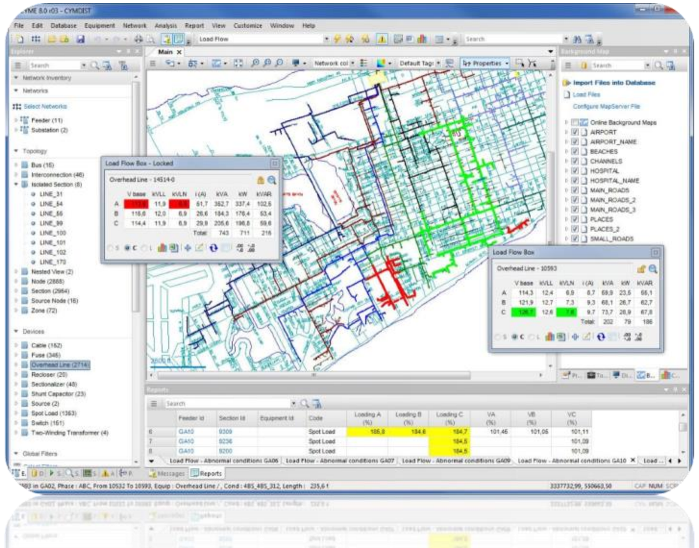
# Identifying System Needs

Once the load forecasts have been allocated in the system models, a powerflow analysis is run to identify violations of system planning criteria:

**Thermal/Overload Violations** occur when electrical equipment (like lines or transformers) carries more current than its rated capacity, risking overheating or failure.

**Voltage Violations** happen when voltage at a point on the grid is outside acceptable limits (MPUC Ch. 320 service quality rules – ANSI C84.1 criteria), which can damage equipment or degrade service quality.



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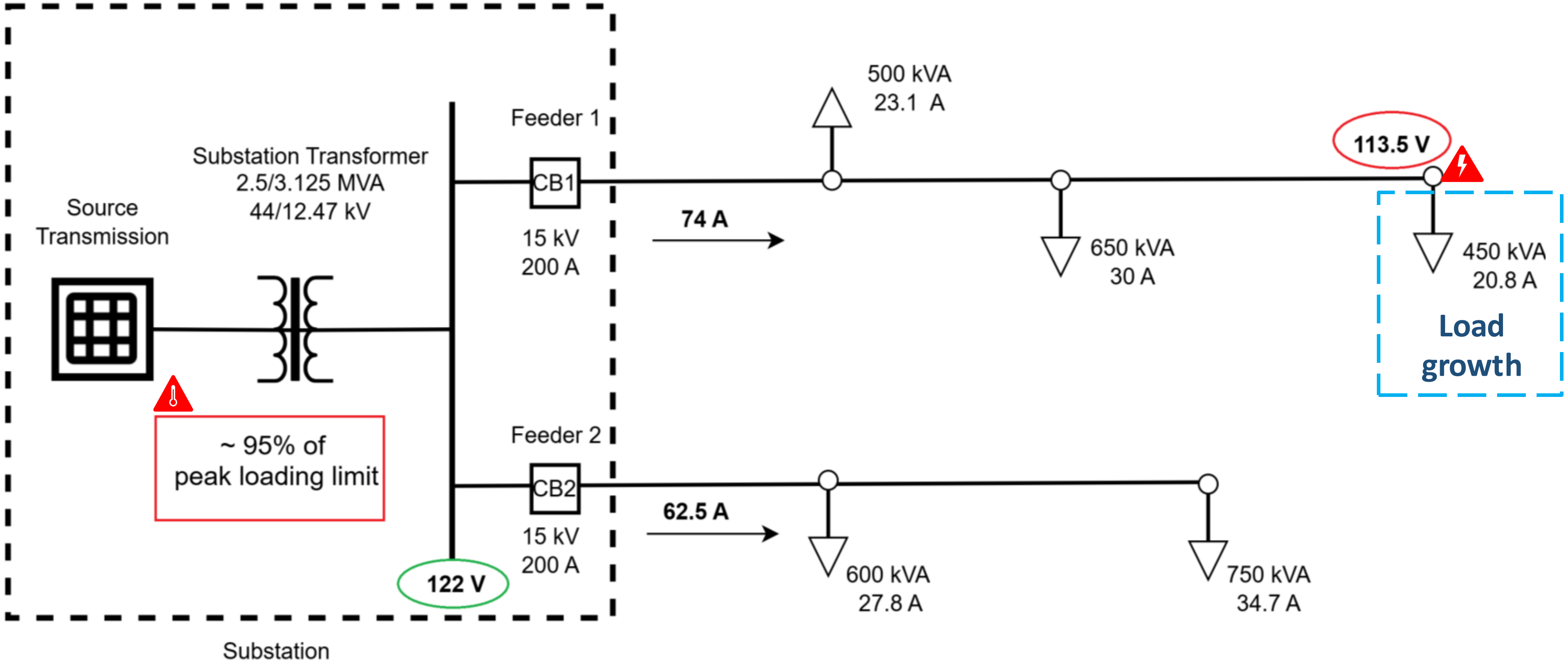
# System violations from Electrification Load growth

Load growth causes more current flow through the system which can lead to thermal overloads and potentially voltage drops on the system:

**Thermal Overload:** When load increases, more current flows through the system causing rising temperatures within equipment, possibly exceeding their thermal ratings – leading to overheating and potential failures

**Voltage Drop:** As more load is added, more current is sourced from the substation leading to a greater voltage drop across system equipment (transformers, power lines, etc.) and lower voltages – which may cause customer equipment to malfunction or become damaged.

‼ *This example shows how load growth is causing* ***thermal overloading*** *on the substation transformer, and localized* ***low voltage*** *on the feeder.*

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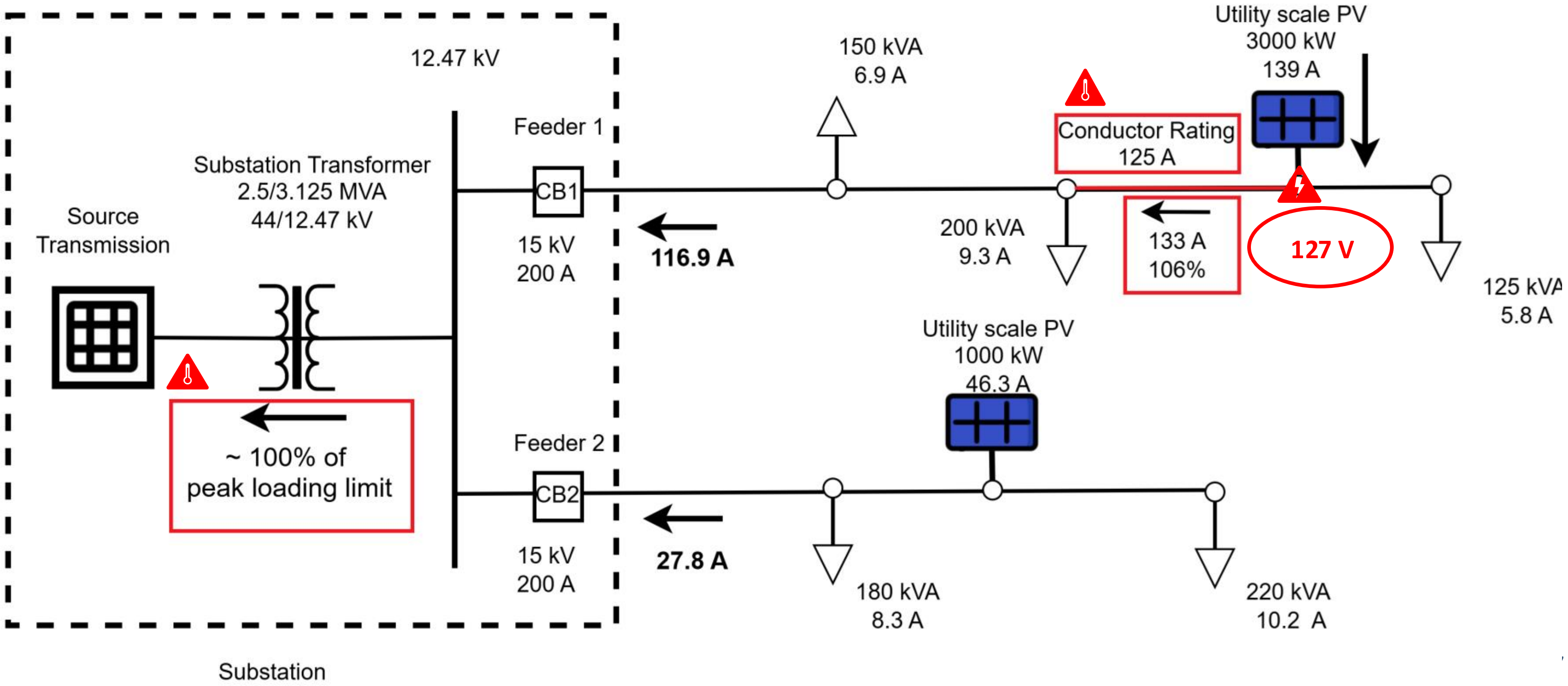
# System violations from adoption of distributed resources

DER interconnections cause reverse powerflow when the local generation exceeds local demand. This can lead to reverse powerflow and potentially voltage rise on the system:

- **Reverse Powerflow Overload:** If the net current flow from both load and DER generation exceeds the ratings of system equipment, the equipment can overheat, leading to damages & safety concerns
- **Voltage Rise:** When DERs inject power into the system, they introduce a new voltage/current source and reduce feeder losses, causing voltage to rise – which can damage equipment and disrupt customer loads.

‼ *This example shows how two large solar PV are causing **thermal overloading** on the substation transformer.*

‼ *Furthermore, the solar PV on Feeder 1 is also causing localized **high voltage** and **overloading** of the feeder conductor.*

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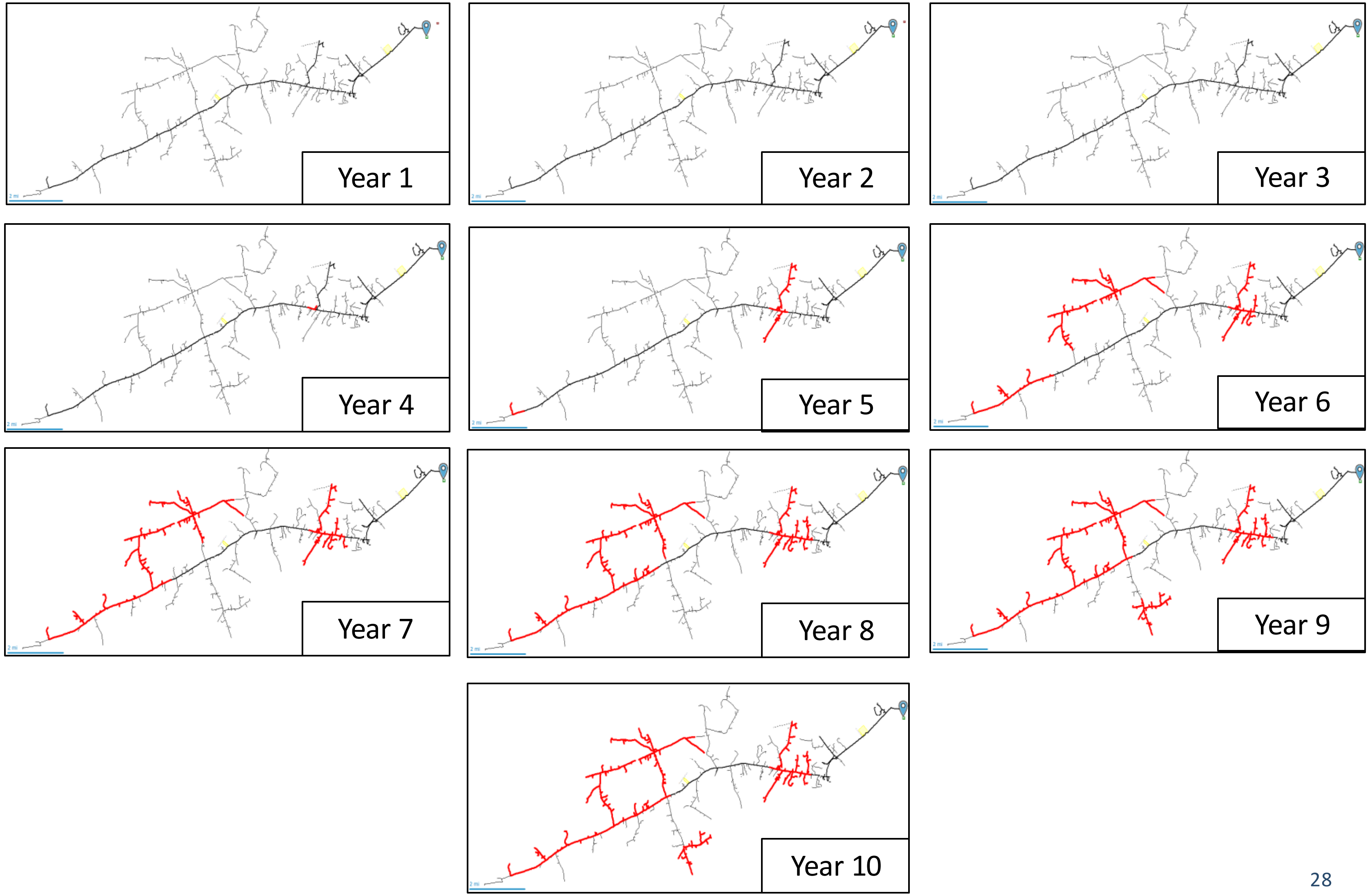
# Multi-year load flow analysis

- Powerflow analysis, including the electrification load and DER forecast, performed for each year (1 through 10)
- Violations identified in each year, anticipating that violations will become more frequent and severe as load and DERs increase.
- Identified the time, location, and severity of when electrification load and DER growth triggered violations.



# Key trends from system needs assessment

The system would experience impacts from increased electrification and DER adoption.

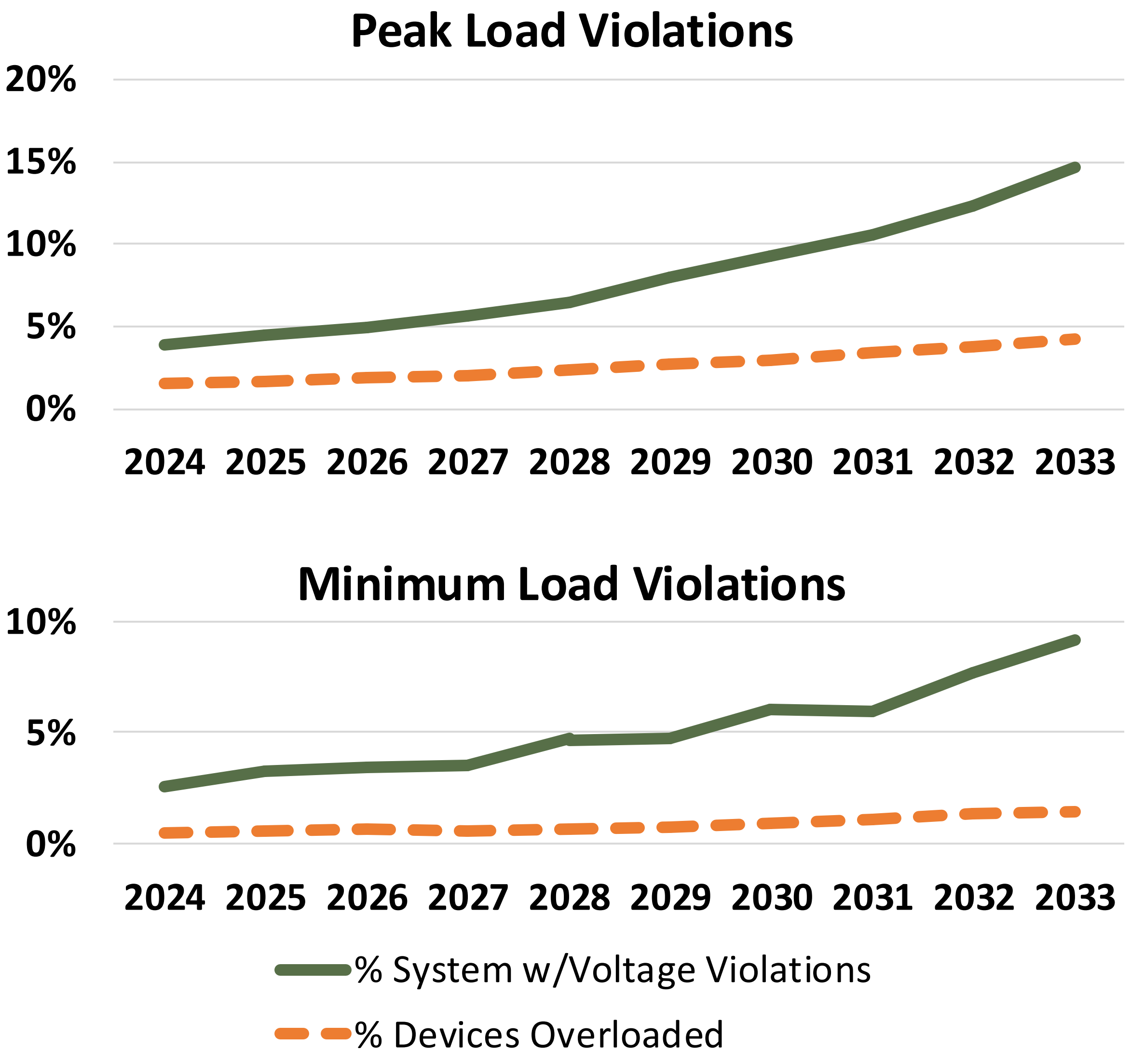
**Peak Load system needs**

- Drivers: Electrification load growth
- Trend: Steady increase with electrification load growth

**Minimum Load system needs**

- Drivers: High DER penetration
- Trend: Step increases with large DER adoption

Overall, **80-90%** of Versant's system is ready to accommodate rapid electrification and DER adoption.

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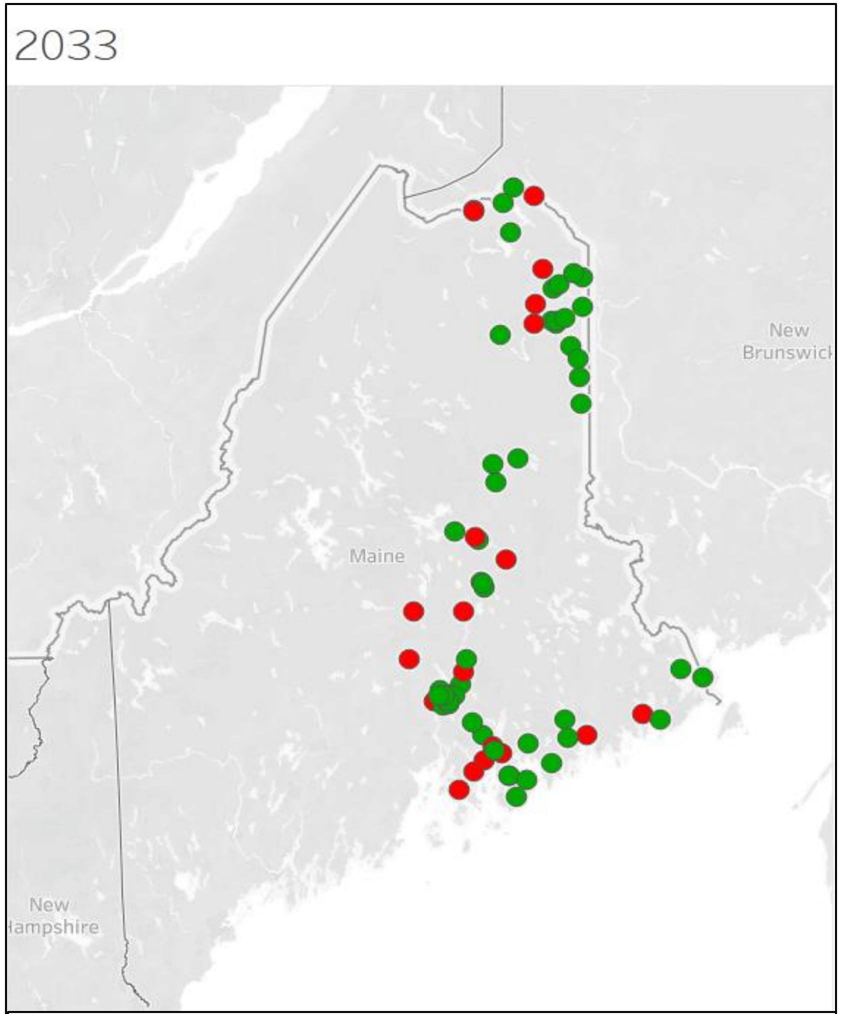
# Grid Needs Results – Peak Load in 2033

| Device Type | # Overloaded | % of total devices | Overload Severity |
|---|---|---|---|
| Breaker | 2 | ~1% | ~140-160% |
| Fuse | 668 | ~4% | ~100-2500% |
| Recloser | 19 | ~3% | ~101-195% |
| Regulator | 77 | ~40% | ~100-415% |
| Sectionalizer | 16 | ~10% | ~110-210% |
| Switch | 14 | ~2% | ~100-190% |
| Substation Transformers | 21 | ~19% | ~100-260% |

| Violation Type | # circuit miles | % of total circuit miles | Severity of violation |
|---|---|---|---|
| Voltage violations | 985 | ~15% | 100-130 V |
| Thermal violations | 23 | ~0.4% | 100-180% |



Substation Transformer Overloads – Peak Load

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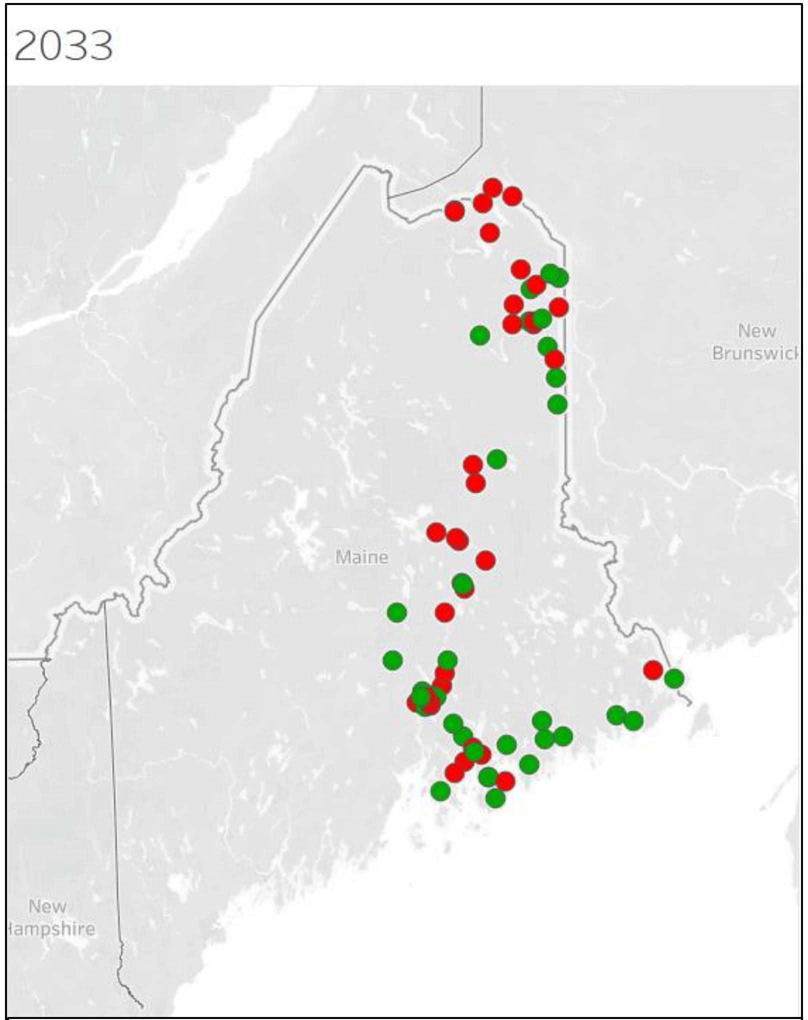
# Grid Needs Results – Minimum Load in 2033

| Device Type | # Overloaded | % of total devices | Overload Severity |
|---|---|---|---|
| Breaker | 5 | ~3% | 100-200% |
| Fuse | 69 | ~0.4% | 100-650% |
| Recloser | 16 | ~2% | 110-440% |
| Regulator | 56 | ~27% | 100-350% |
| Sectionalizer | 0 | n/a | n/a |
| Switch | 26 | ~4% | 100-185% |
| Substation Transformers | 34 | ~31% | 100-360% |

| Violation Type | # circuit miles | % of total circuit miles | Severity of violation |
|---|---|---|---|
| Voltage violations | 617 | ~9% | 126-140 V |
| Thermal violations | 30 | ~0.5% | 100-300% |




Substation Transformer Overloads – Min Load

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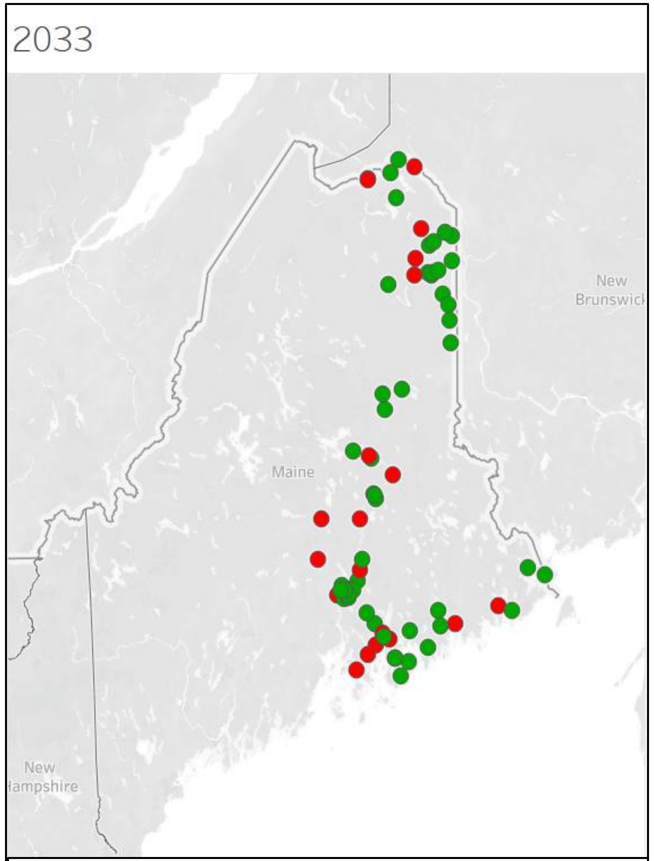
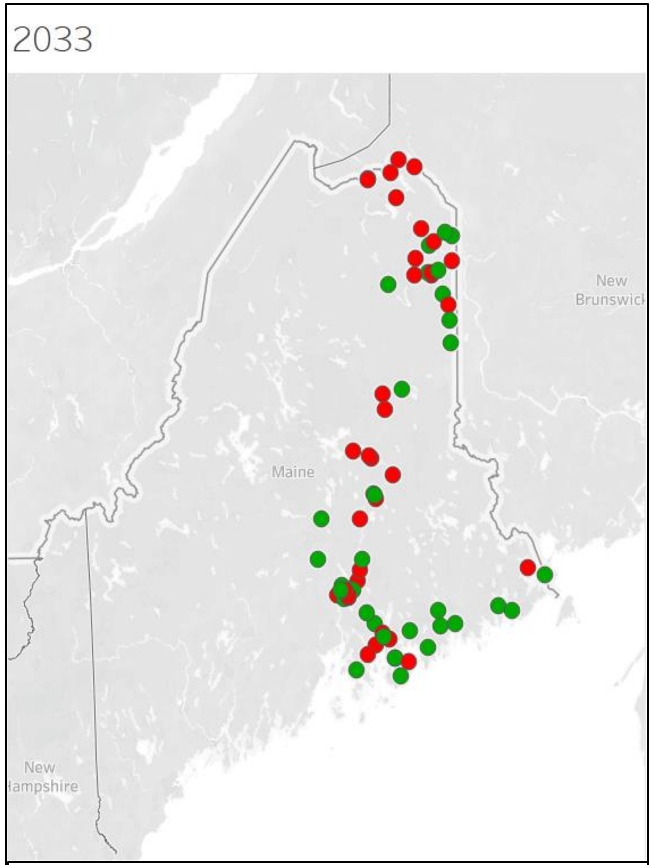
# Spatial distribution of system needs

General trends over the 10-year forecast indicate:

- Most system needs during peak load are in the Bangor Hydro District, driven by electrification load growth.
- Most system needs during minimum load are in the Maine Public District, driven by adoption of distributed energy resources.
- Some peak load and minimum load grid needs overlap.
- Addressing peak load issues may resolve some minimum load violations caused by significant penetration of distributed energy resources.




Substation Overloads – Peak Load
Driven by Electrification




Substation Overloads – Minimum Load
Driven by DER Adoption

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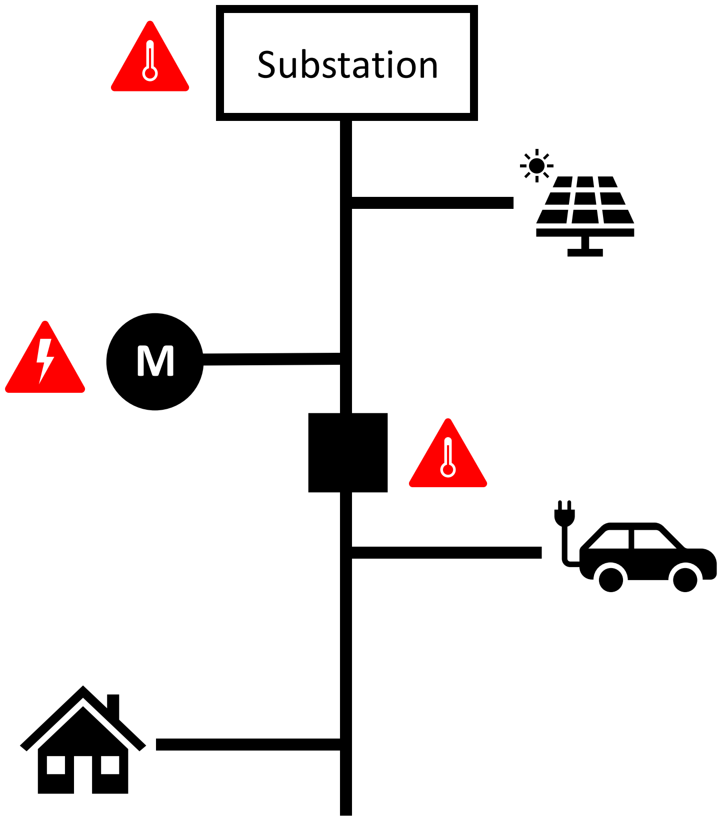
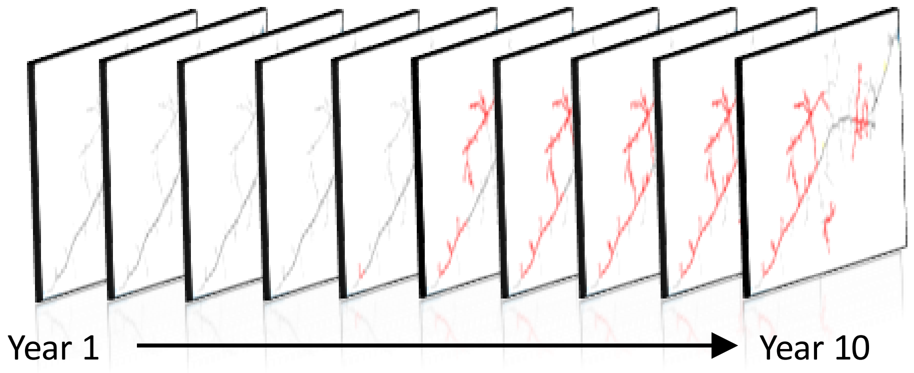
# Milestone 2.0 Summary

Most of the system is equipped to accommodate rapid growth from electrification and DER adoption over the next 10 years. However, some substantial assets – such as substation transformers, voltage regulators and conductors – would be affected.

- ✓ Electrification growth will have greater impact in the Bangor Hydro District
  - ✓ Affects the system during peak load
  - ✓ Increased low voltage violations
  - ✓ Increased loading of substation & line equipment
- ✓ Penetration of distributed energy resources will have greater impact in the Maine Public District
  - ✓ Affects the system during minimum load
  - ✓ Increased high voltage violations
  - ✓ Increased loading of substation transformers, switches & conductors

Milestone 2.0 identified the needs, and Milestone 3.0 will be about evaluating the solutions – a range of options from traditional upgrades to non-wires alternatives – using the MPUC scorecard.

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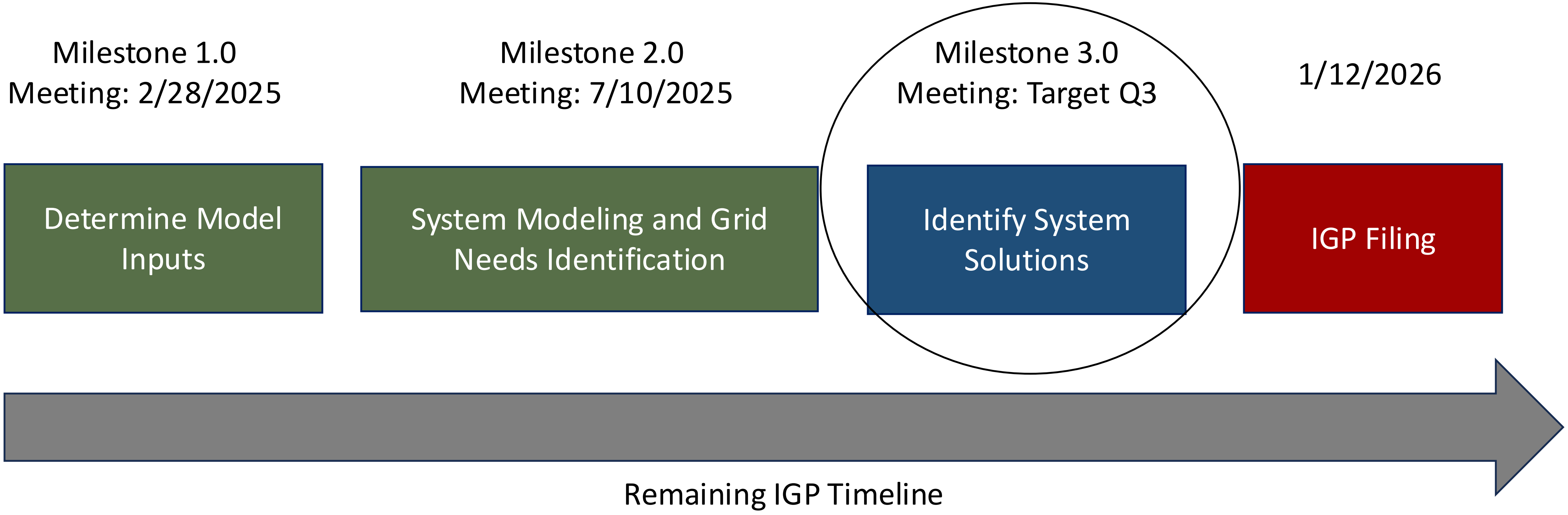


Any comments or feedback are encouraged to be submitted within 30 days in order to be incorporated in our analysis.

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# What's next?

1. Submit comments within 30 days
2. Watch for email updates
3. Check content posted on website
4. Join our discussions

gridandclimate@versantpower.com

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# Thank you!

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