AVANGRID

2022

Distribution Planning: Innovation & Development Overview

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Agenda

- Who is AVANGRID?
- Traditional Distribution Planning Activities
- New Distribution Planning Responsibilities
- Forecasting
- CYME and Power Flow Analysis
- Distributed Generation (DG) Interest in Maine

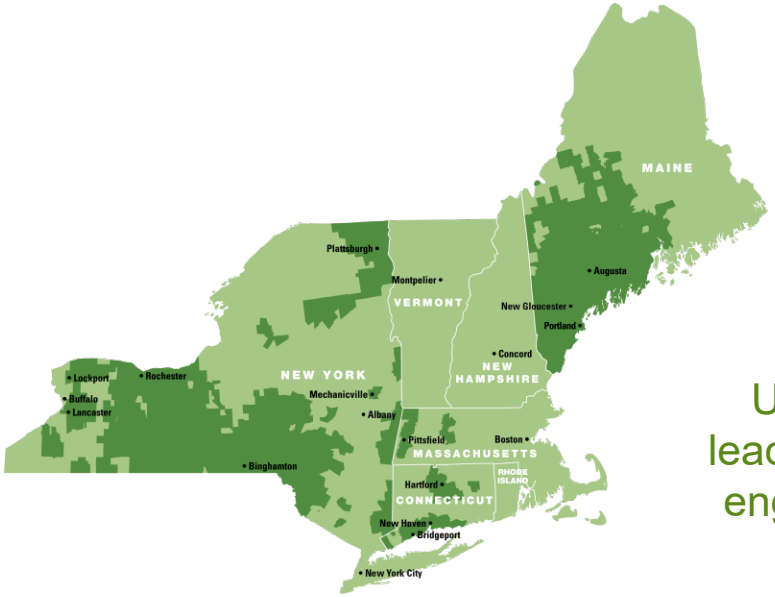
AVANGRID

Avangrid Networks

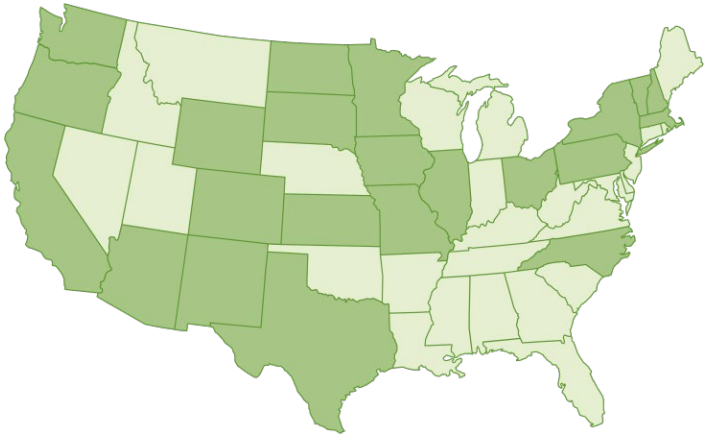
- 8 regulated electric and gas utilities in the Northeast
- 3.3 million customers
- ≈ 1 million smart meters with 1.8 million pending

Avangrid Renewables

- 3rd largest wind energy generator in U.S.
- 53 operating wind farms
- 22 states in U.S.

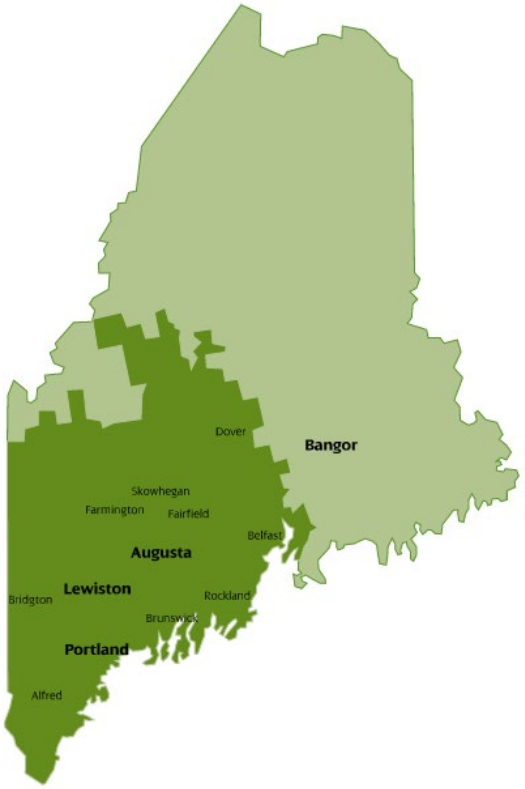


Utility industry leader in customer engagement and satisfaction



Overview of CMP System

- ~631,000 customers
- ~11,000 square miles (17.703 sq. KM)
- 1,809 MW all-time peak (2021)
- 11 Divisions (Work Centers: Alfred, Augusta, Belfast, Bridgton, Brunswick, Dover, Fairfield, Farmington, Lewiston, Portland, Rockland, Skowhegan)
- 204 distribution substations
- 254 transformer banks
- 474 total circuits



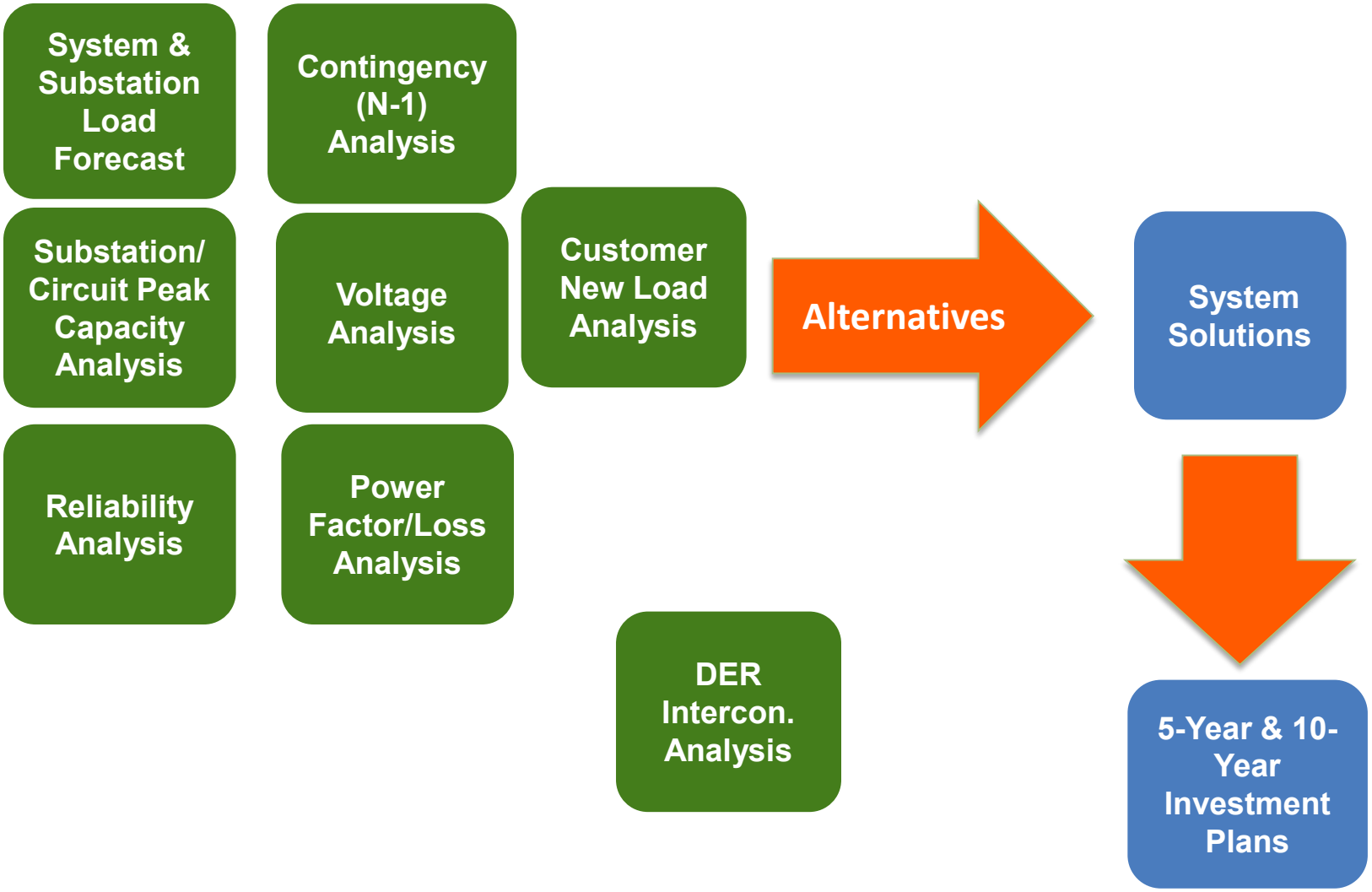
- Approximately 25,000 miles (40,234 KM) of distribution lines
- Downtown Portland supplied by underground network system

Overview of UI System

- ~330,000 customers across 17 Towns
- ~335 square miles (539 sq. KM)
- 1,456 MW all-time peak (2006)
- 28 bulk 13.8 kV substations
- 2 low-voltage 4 kV substations distribution)
- 359 total circuits (14 are 4 kV)

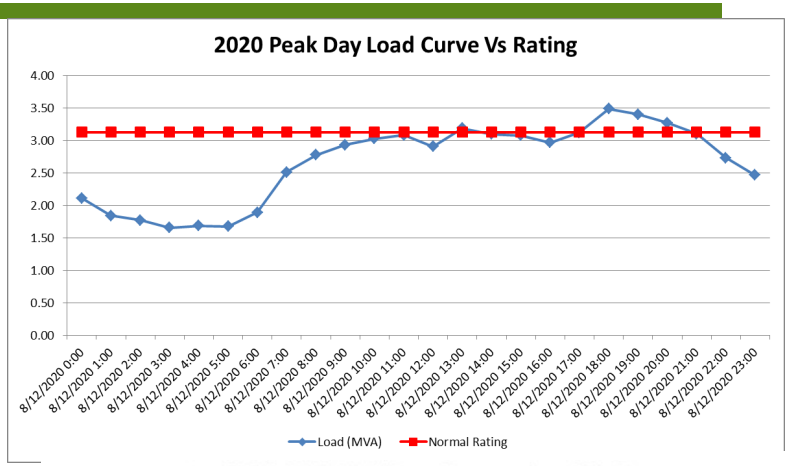
- 3,282 pole-line miles (5,282 KM) of overhead distribution lines and 691 miles (1,112 KM) of underground primary cables
- Downtown New Haven and Bridgeport supplied by underground network systems

Traditional Distribution Planning Activities



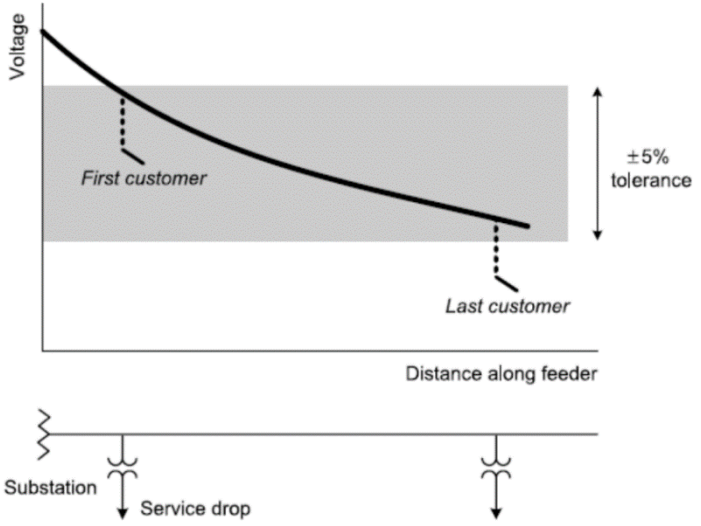
Distribution Planning Traditional Responsibilities

- **Load Serving Capacity Analysis**
  - Analyses performed to ensure equipment, circuits and substations operate within their limits and ensure new customer load can be supplied safely and reliably
- **Reliability Analysis**
  - Availability and quality of power supply at each customer service entrance
  - Indices include SAIDI, CAIDI, SAIFI, MAIFI, FAIFI
- **Voltage/VAR Analysis**
  - Voltage analysis includes circuit and customer service voltage compliance with State and utilities voltage regulations
  - VAR analysis refers to power factor correction



ANSI C84.1 Voltage Ranges for 120 V

	Service Voltage		Utilization Voltage	
	Minimum	Maximum	Minimum	Maximum
Range A	114 (–5%)	126 (+5%)	110 (–8.3%)	125 (+4.2%)
Range B	110 (–8.3%)	127 (+5.8%)	106 (–11.7%)	127 (+5.8%)



Distribution Planning Traditional Responsibilities

Responsible for Planning Infrastructure

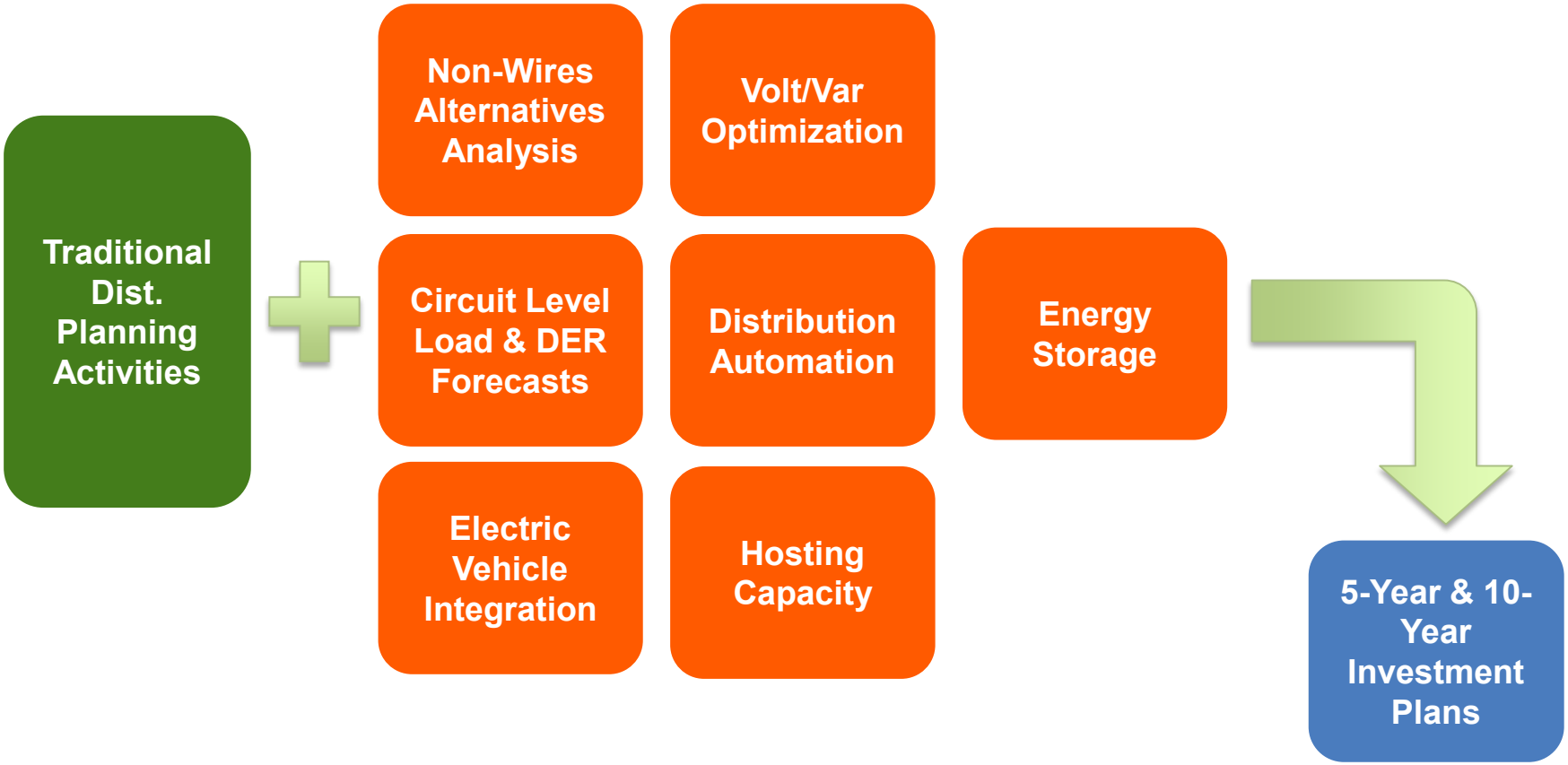
- **Substation**
  - Ensure Adequate Substation Thermal Capacity, and Operation Within Required Voltage Level
  - Projects - New Substations, Substation Expansion, Load Transfers (N-1 Contingency Analysis)
- **Distribution**
  - Ensure Circuits Have Adequate Thermal Capacity, and Operation Within Required Voltage Levels
  - Projects – Circuit reconfiguration &/or upgrades
- **Reliability**
  - Plan Infrastructure To Maintain Reliability Levels
  - Projects – Strategic (Reclosers), SCADA Switches, Line Reconfiguration &/or upgrades
- **Customer / Distributed Generation**
  - Interconnection of Generators to Distribution System

Distribution Planning Practices

Resiliency (reliability index - must include storms)

- Resiliency plans developed by the Company to:
  - Reduce number of outages during extreme weather
  - Provide efficient and effective response when outages do occur.
- Key elements of resiliency plan:
  - Topology improvements to the distribution system (adding ties)
  - Hardening of the infrastructure
  - Automation of the system

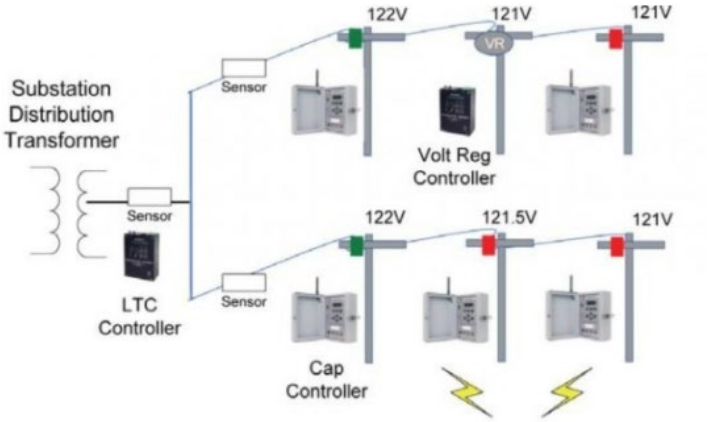
New Distribution Planning Responsibilities



New Distribution Planning Responsibilities

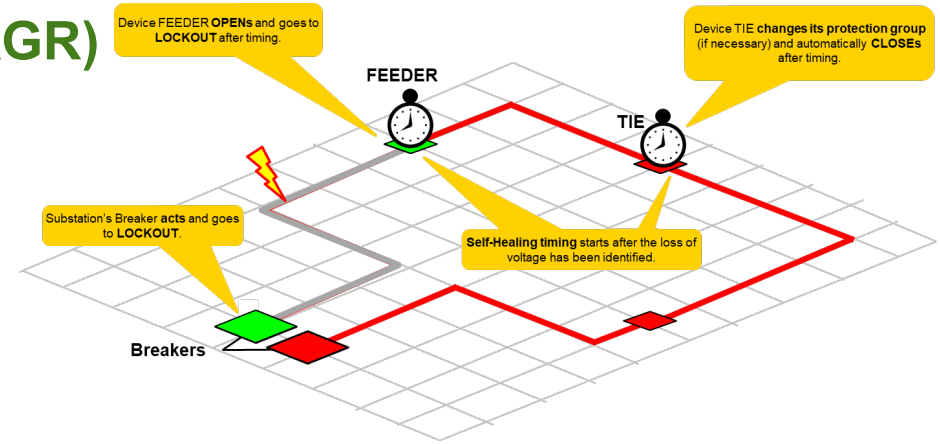
- **Non-Wires Alternative Analysis**
  - LD 1181 - An Act To Reduce Electricity Costs through Non-wires Alternatives (Maine)
  - Non-Wires Alternative Coordinator – State of Maine
- **Energy Storage**
  - Researching pilot opportunities
  - Reduce thermal overloading concerns
  - Microgrid opportunities
- **Volt/VAR Optimization**
  - Distribution Management System
  - More efficient grid operation, by reducing system losses, peak demand and/or energy consumption

R&D

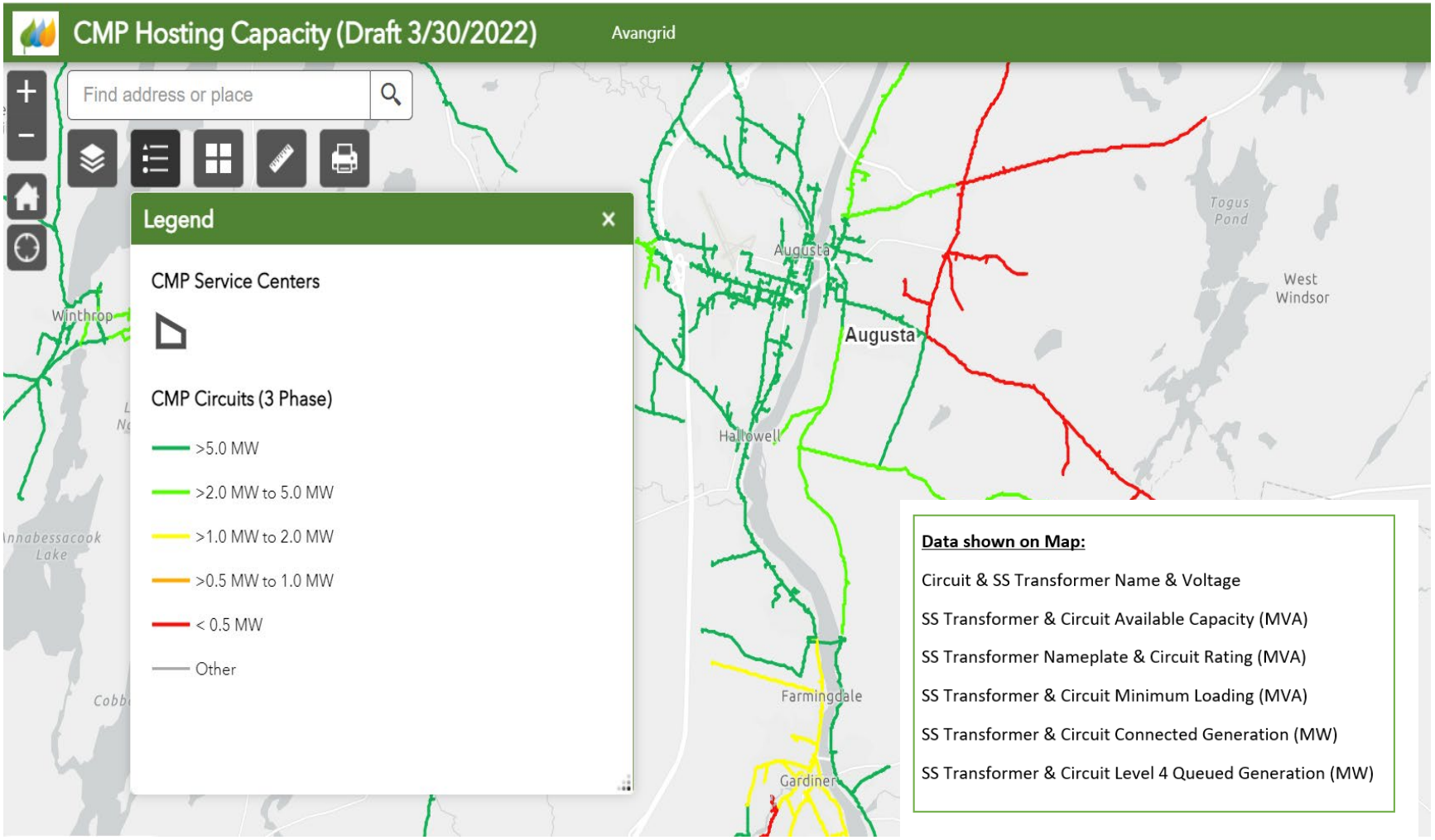


Distribution Automation

- **Worst Performing Service Territory, then Circuit completed first**
- **Customers "zones" within remote control devices**
  - 500 customers and/or "10 miles" (analysis is case by case)
- **Reclosers**
  - Focus on isolating branches
  - Reclosers must coordinate back to substation
- **SCADA Switch**
  - Installed at tie points to let the Network operate remotely
- **Automatic Grid Restoration (AGR)**



CMP Hosting Capacity Maps

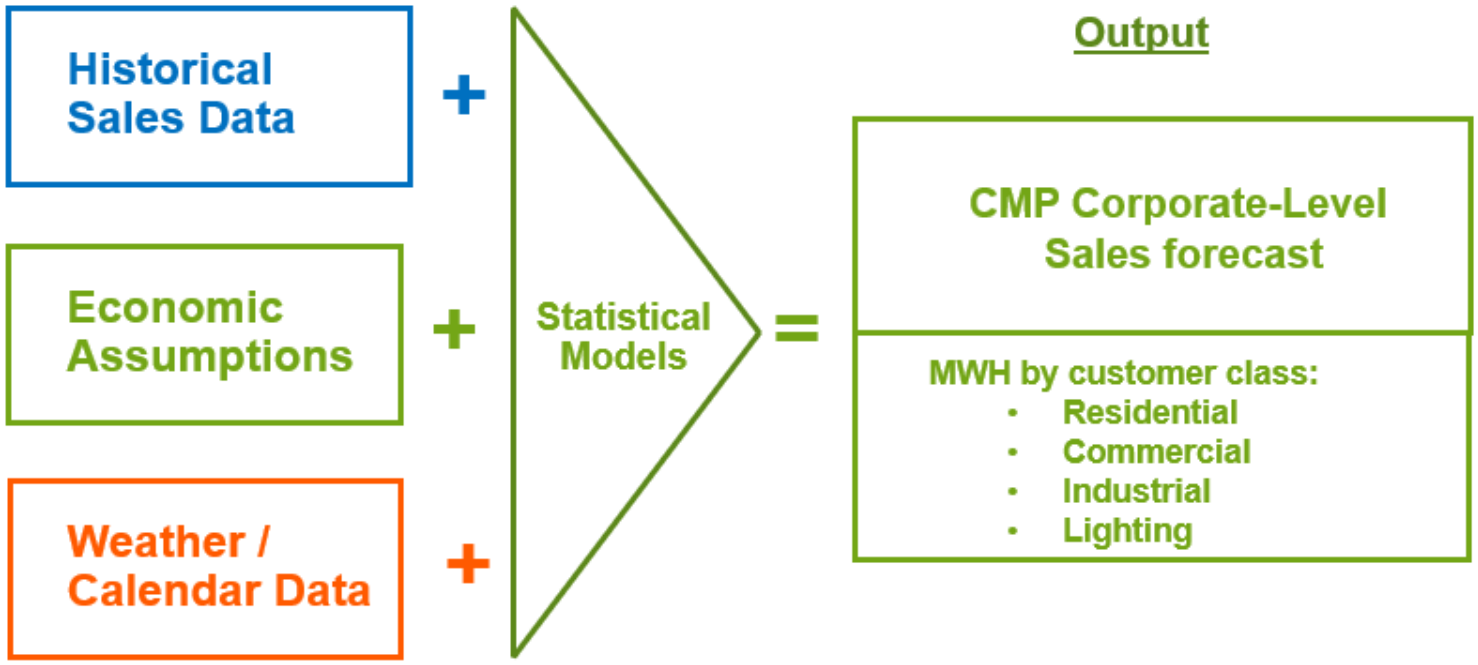


Corporate Level Sales Forecasts

CMP Forecast Process

CMP Corporate-Level Sales Forecasts are developed for each customer class using econometric models

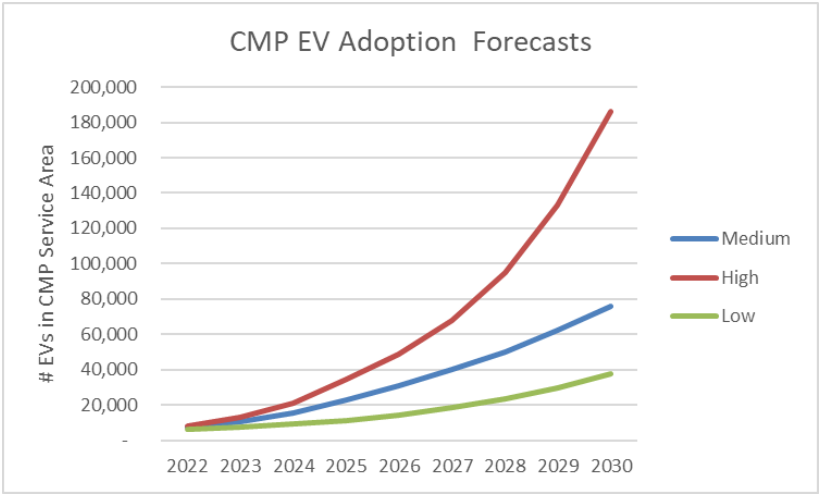
Model Inputs



Forecasting EV Adoption & Load

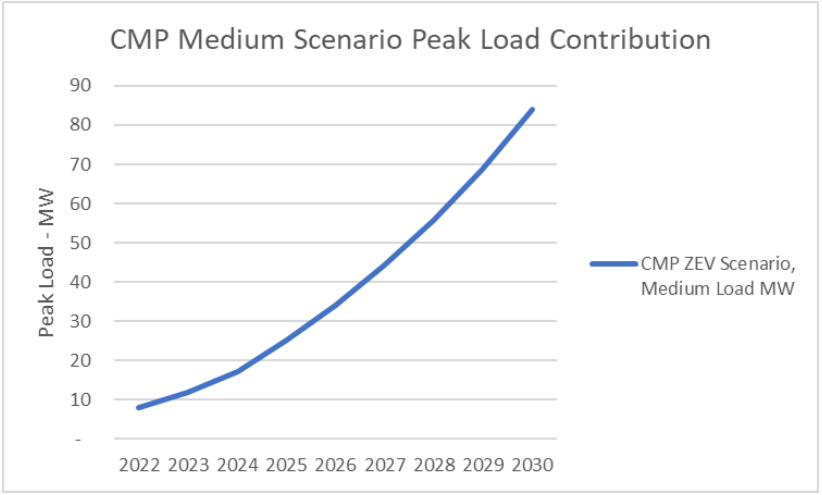
Vehicle Adoption Scenarios

- Medium = Assumes 15% of light-duty vehicle sales by 2025 and 30% by 2030
- High = Aligned with State goals
- Low = 50% of medium scenario



EV Load Forecast

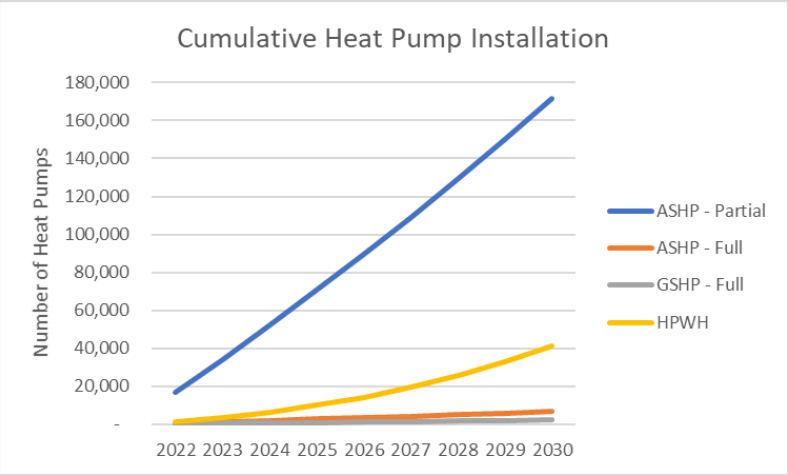
- Forecast uses the medium EV adoption scenario
- Daily load profile based on NREL's EVI Pro Lite tool
- Load is allocated to circuits based on current EV adoption trends



Forecasting Heat Pump Adoption & Load

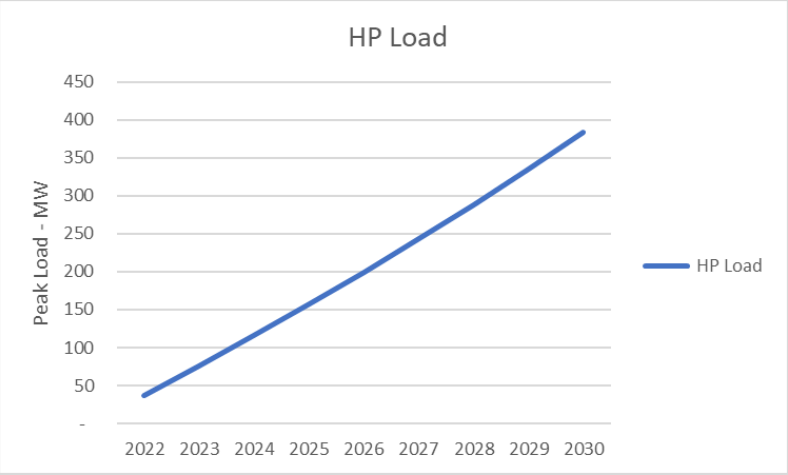
Heat Pump Adoption

- Adoption forecast based primarily on the ISO-NE forecast, which is based on input from Maine



Heat Pump Load Forecast

- Assumes zero net summer load
- Incremental load is toward winter peak
- This is a preliminary forecast
  - Currently studying and developing more sophisticated heat pump load models



Distribution Planning Power Flow Analysis

CYME

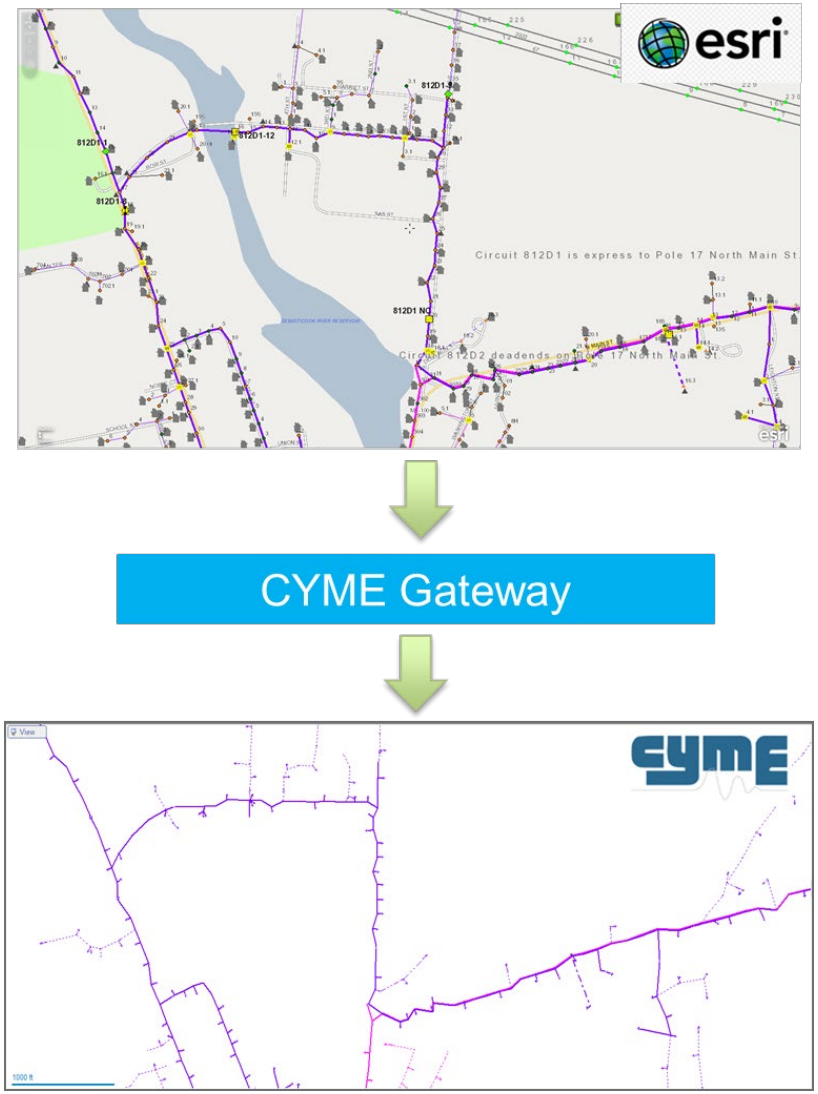
Use Eaton's CYME power flow analysis software for peak and minimum load conditions (static model)

Gateway

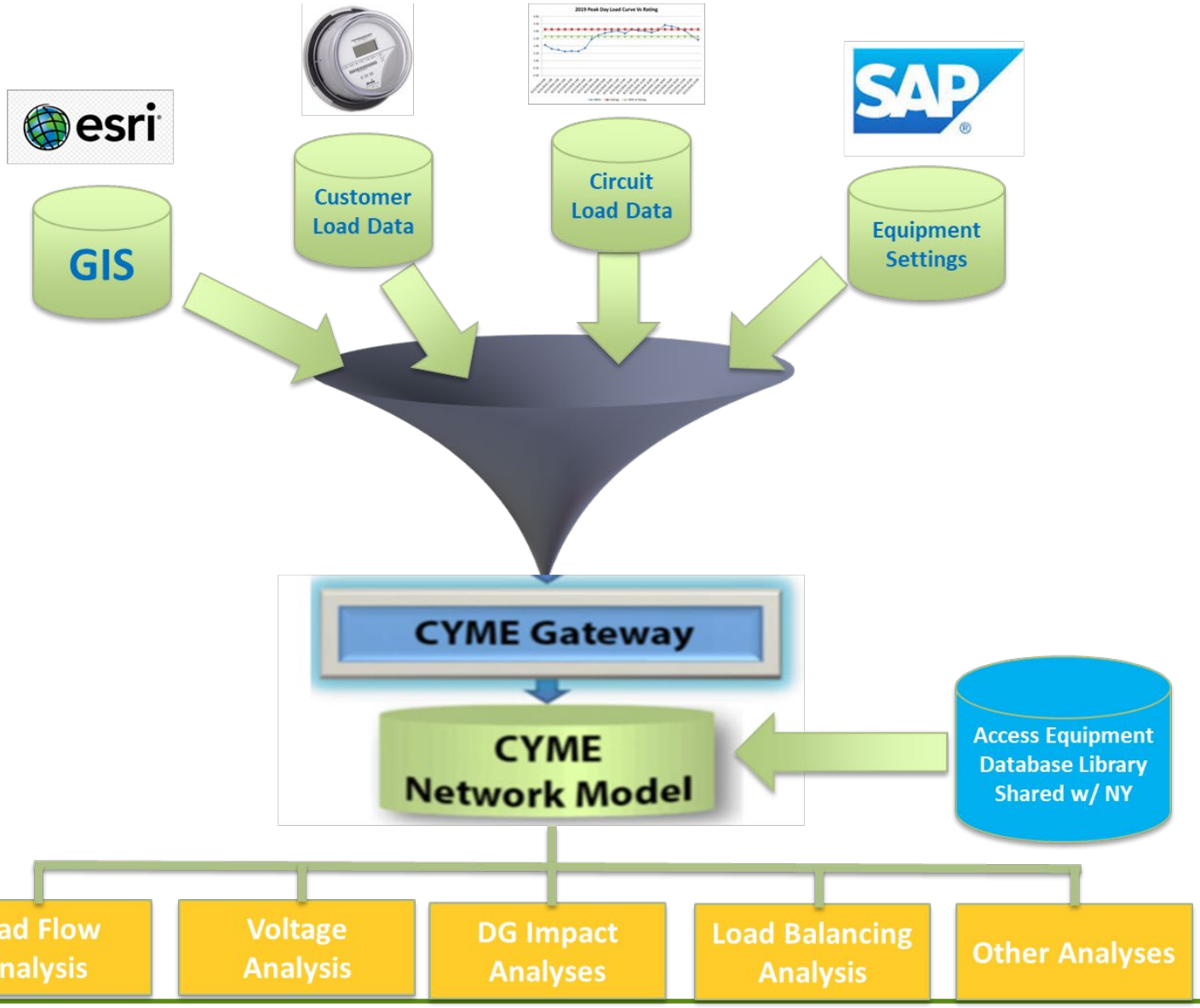
Use CYME Gateway for interface to Company's GIS for electrical connectivity

Load Allocation

Algorithm used to distribute load on a circuit among "spot loads" or transformers. Methodology based on kWh, kW or transformer size.



Distribution Planning Power Flow Analysis



DG Growth in Maine

What is the size of this effort?

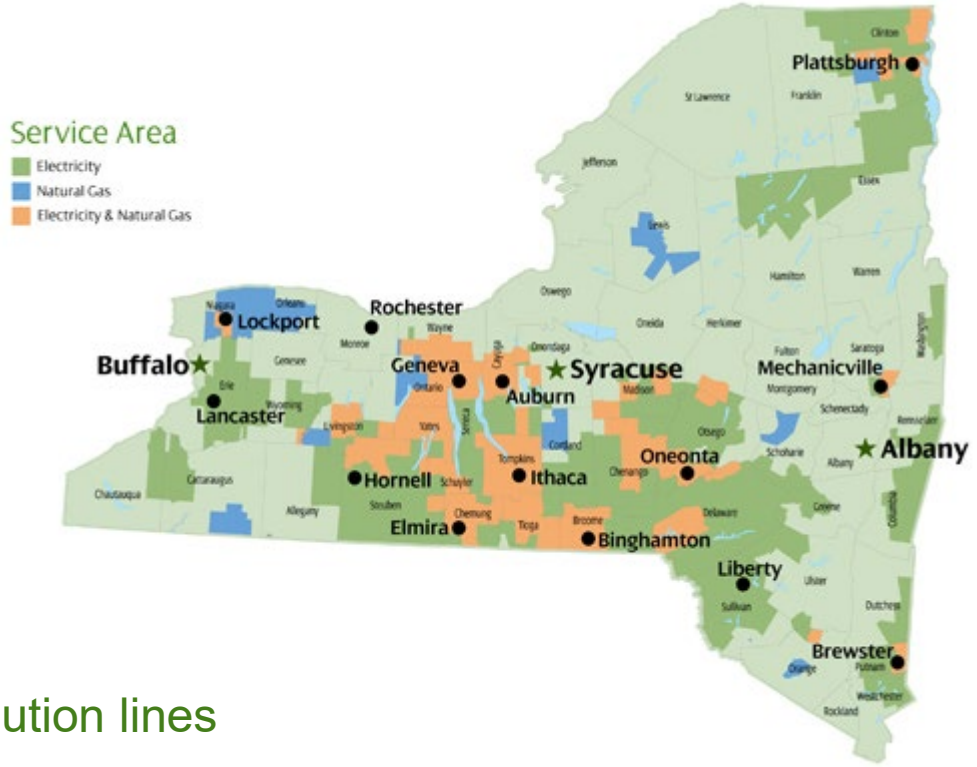
- 715 Applications
- 1,820 MW (surpasses the peak load of CMP)
- 391 Interconnection Agreements
- Over 518 Studies
  - 400 Combined Studies
  - 16 Feasibility studies
  - 96 Restudies
  - 6 Facility Studies
- Supporting the needs of 96 different developers
- Approximately 200 (non-construction) internal and contract resources in place
- Projecting a need of 200 construction crews

Questions?

Extra Slides

Overview of NYSEG System

- ~907,000 electric customers
- ~270,000 gas customers
- ~18,000 square miles
- Serves App. 40% of Upstate New York
- 429 distribution substations
- 963 transformer banks
- 1,389 total circuits



- Approximately 35,000 miles of distribution lines
- Downtown Binghamton and Auburn supplied by underground network system

Overview of RG&E System

- ~385,000 electric customers
- ~319,000 gas customers
- ~2,700 square miles
- Serves areas surrounding City of Rochester
- 156 distribution substations
- 279 transformer banks
- 621 total circuits

- Approximately 8,900 miles of distribution lines
- Downtown Rochester supplied by underground network system