Identify and Avoid New Distribution Threats With the New **Grid Impact Model**

An Executive Overview

www.maisy.com/gim.htm

New Trends Threaten Grid Stability

EV Ownership

Clustered EV ownership can overload local feeders and transformers.

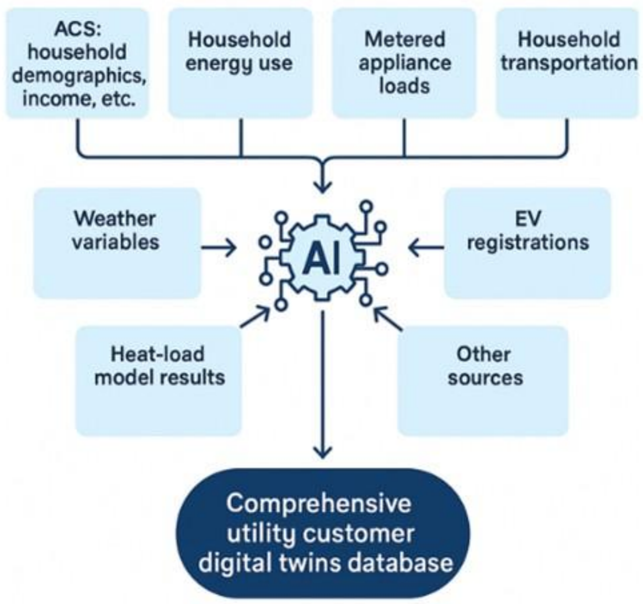
Customer Growth/Electrification

New construction & renovations are increasingly all-electric.

Weather Extremes

Increasing weather volatility adds new distribution stress.

The Grid Impact Model (GIM) Addresses these Concerns and More



Digital Twin Model – uses information from your actual customers – already curated by us with an extensive AI process

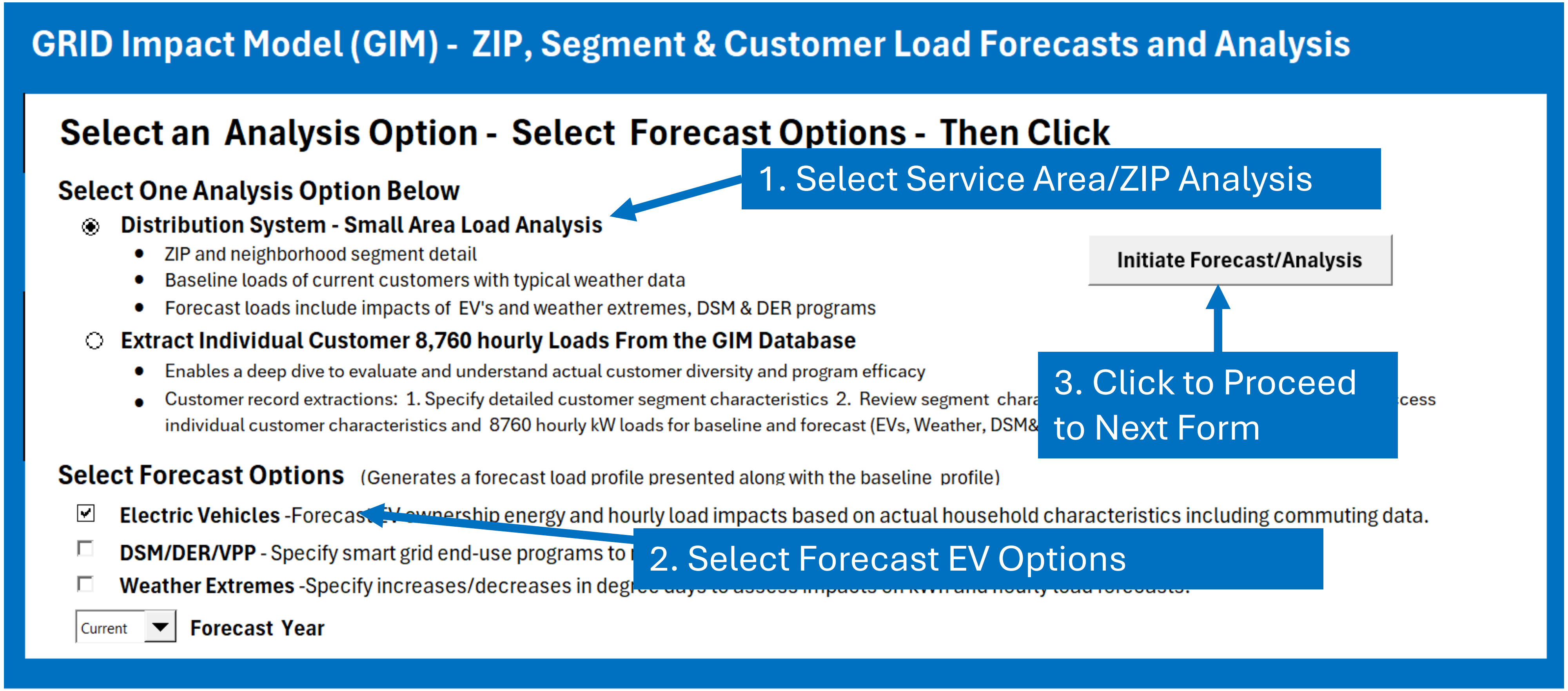
Excel Interface - intuitive/familiar user experience

Dashboards Results – service area, ZIP, neighborhood and individual customers

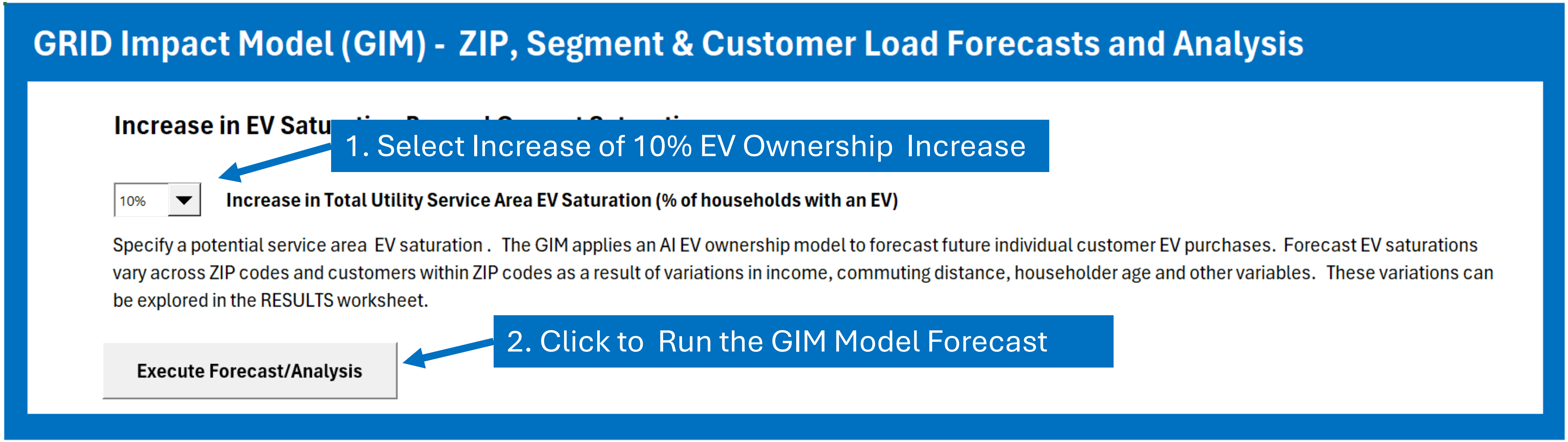
Critical Distribution Grid Issues – EVs, electrification, weather extremes, rate structures, DSM, DER and VPP programs

Example: Impacts of 10% New EV Ownership

GIM Results for **actual utility customers in 2 Orlando ZIP codes**

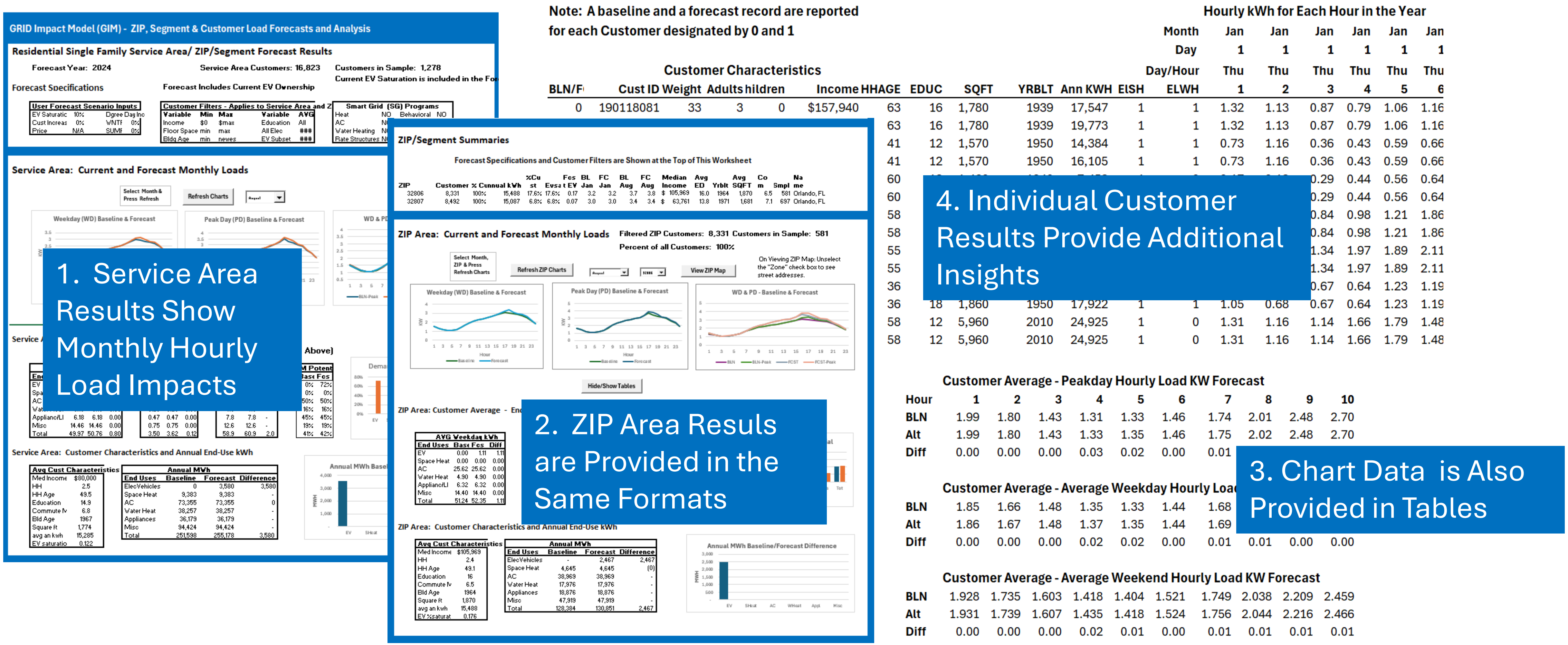


Specify New Service Area EV Ownership



The model determines EV ownership probability for each of the digital twin utility customers, assigning new owners as required to reach the service area assumption of 10%. New ownership varies across ZIPs reflecting variations in customer characteristics.

Forecast Detail is Provided in Dashboards and Individual Customer Records

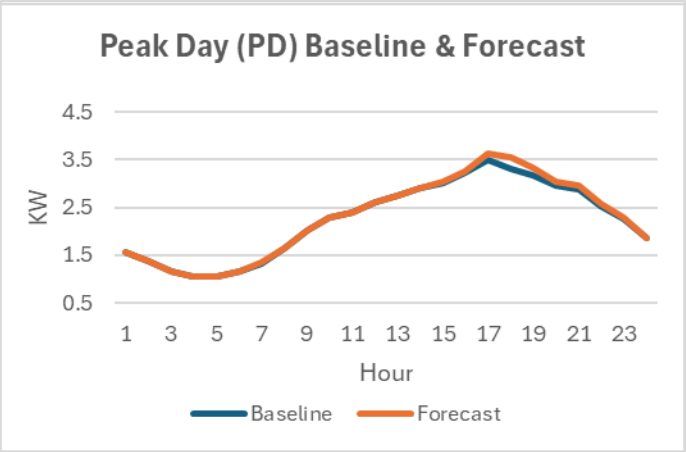


Summary Results

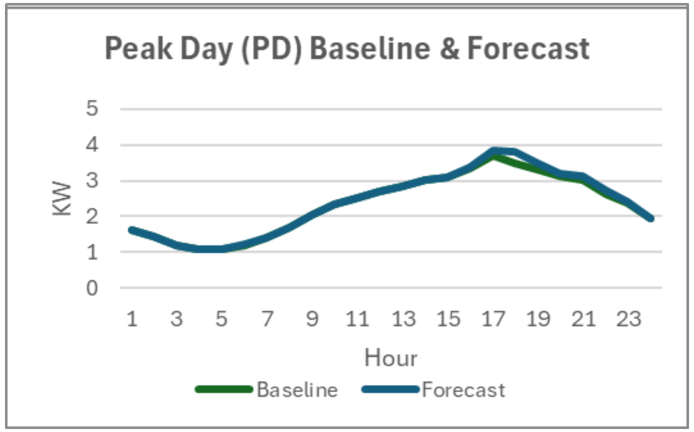
1. Minimal aggregate impact at service area and ZIP level.
2. ZIP results are a reasonable proxy for substation impacts (~ # customers served for typical substation).
2. Customer charging diversity reduces individual customer kW impact at the ZIP level.
3. Forecast ZIP ownership is much greater in ZIP 32806 reflecting income and other differences.

August Peak Dean Hourly KW Loads

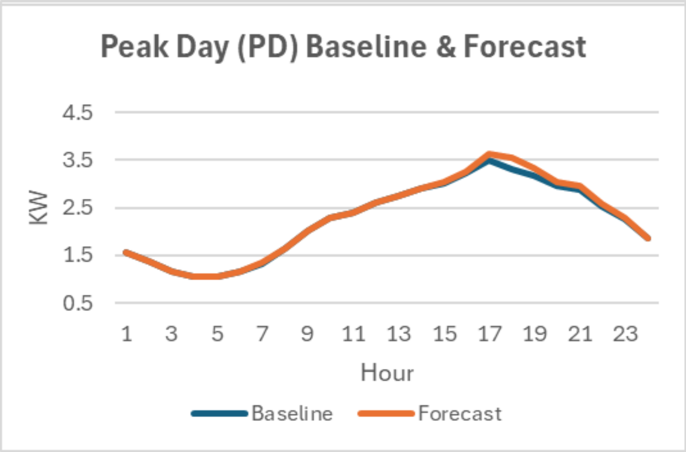
Service Area (both ZIPs)



ZIP 32806

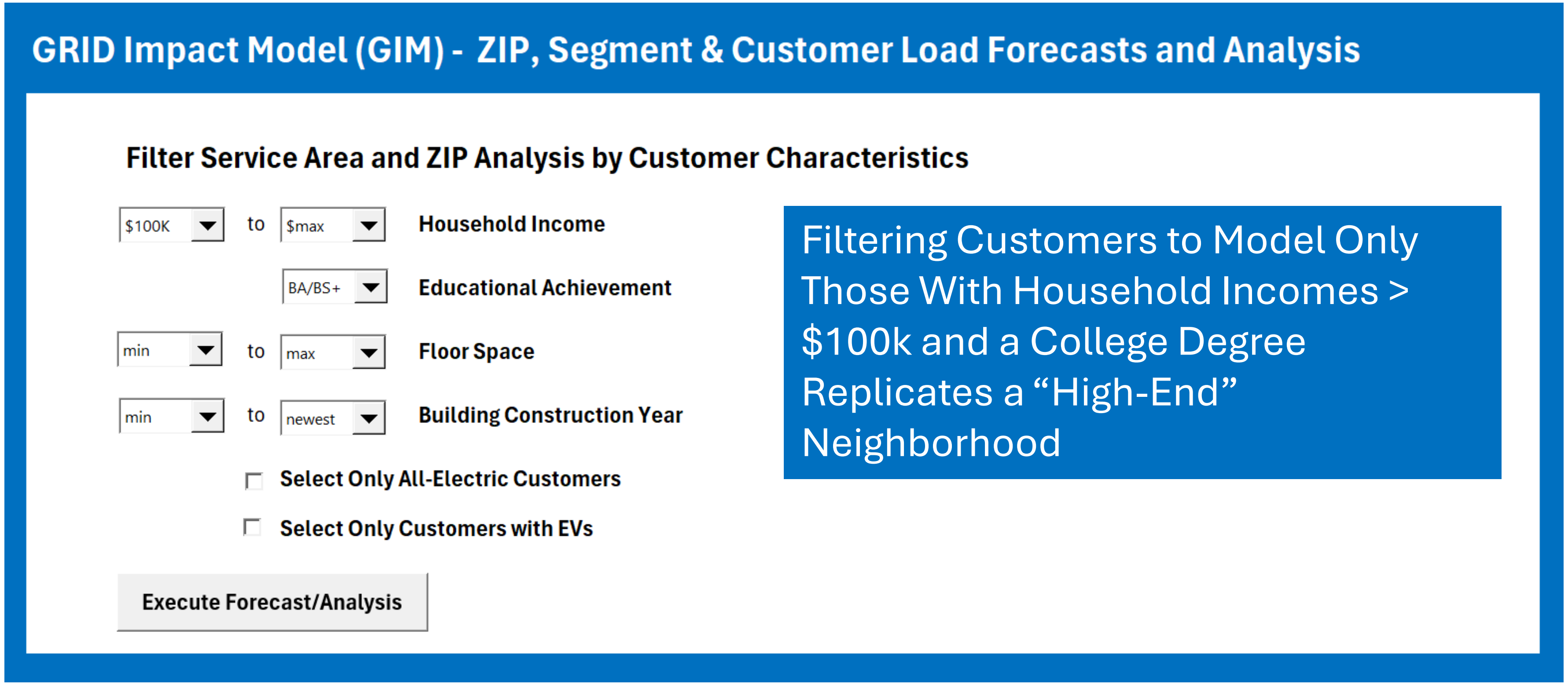


ZIP 32804



Area	Customers Total	w/Evs	%w/Evs	Aug Peak KW Impact	% Peak KW Increase	Median Income	Avg Years Education
Service Area	16,823	2,052	12.2%	0.12	3.4%	$80,000	14.9
ZIP 32806	8,331	1,466	17.6%	0.17	4.6%	$105,969	16.0
ZIP 32807	8,492	577	6.8%	0.07	2.1%	$63,761	13.8

Next Filter Customer Analysis to Consider "High-End" Neighborhood EV Impacts

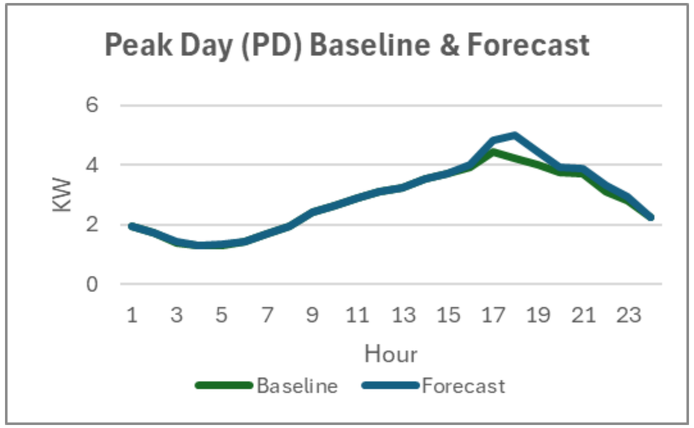


Summary Results: “High End” Neighborhoods

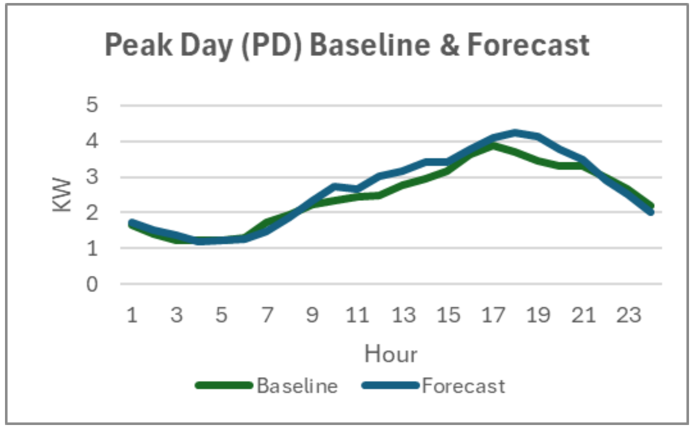
1. ZIP aggregate “high end” neighborhood analysis is a proxy for primary feeder impacts.
2. kW impacts (0.77 KW) may pose issues depending on the extent of current excess feeder capacity.
3. The % Filtered with EVs indicates that there will be an average of 4 EV owners for each 10 customers along feeder laterals and transformers in the 32806 customer segment - requires customer analysis to assess local feeder and transformer impacts.

August Peak Day Hourly KW Loads

ZIP 32806



ZIP 32807



			Customers			Aug Peak	% Peak KW	Median	Avg Years
Area	Total	Filtered	% Cust	Filtered w/Evs	% Filterd w/Evs	KW Impact	Increase	Income	Education
Service Area	16,823	4,475	26.7%	2,052	37.6%	0.68	16.7%	$174,000	19.9
ZIP 32806	8,331	3,170	38.1%	1,236	39.0%	0.77	18.2%	$180,000	20.0
ZIP 32807	8,492	1,305	15.4%	448	34.3%	0.47	12.5%	$146,725	19.8

Analyze Individual Customer Loads from “High-End” Neighborhoods

Note: A baseline and a forecast record are reported for each Customer designated by 0 and 1

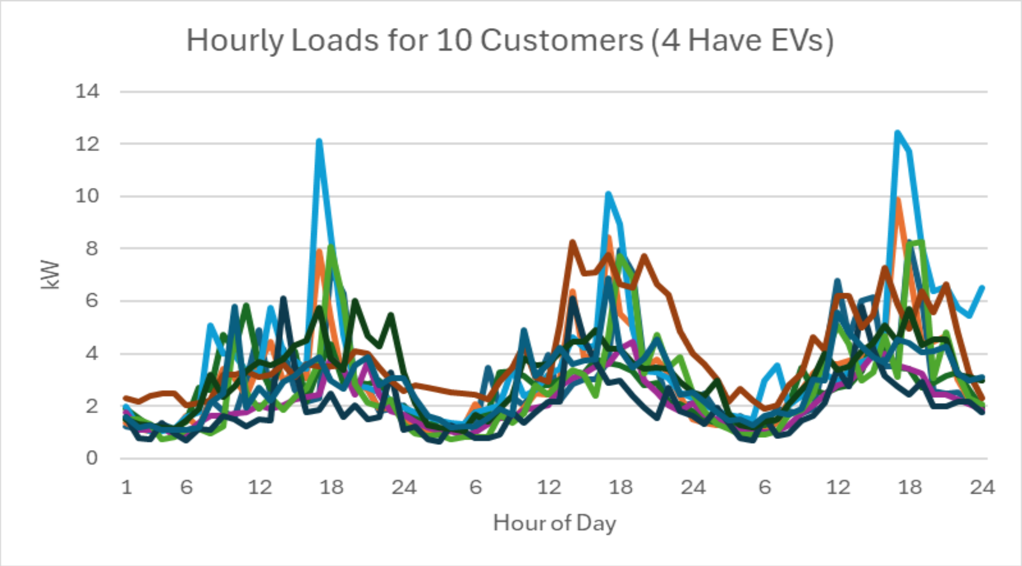
													Hourly kWh for Each Hour in the Year									
												Month	Jan	Jan	Jan	Jan	Jan	Jan	Jan	Jan	Jan	Jan
												Day	1	1	1	1	1	1	1	1	1	1
			Customer Characteristics									Day/Hour	Thu	Thu	Thu	Thu	Thu	Thu	Thu	Thu	Thu	Thu
BLN/F(	Cust ID	Weight	Adults	hildren	Income	HHAGE	EDUC	SQFT	YRBLT	Ann KWH	ElSH	ELWH	1	2	3	4	5	6	7	8	9	10
0	190118081	33	3	0	$157,940	63	16	1,780	1939	17,547	1	1	1.32	1.13	0.87	0.79	1.06	1.16	1.44	1.45	0.63	1.44
1	190118081	33	3	0	$157,940	63	16	1,780	1939	19,770	1	1	1.32	1.13	0.87	0.79	1.06	1.16	1.44	1.45	0.63	1.44
0	190383929	15	2	0	$107,300	55	16	1,950	1950	19,135	1	1	0.72	0.77	1.34	1.97	1.89	2.11	2.86	3.23	2.96	2.97
1	190383929	15	2	0	$107,300	55	16	1,950	1950	20,849	1	1	0.72									.97
0	190424625	12	2	0	$114,000	36	18	1,860	1950	17,922	1	1	1.05									.18
1	190424625	12	2	0	$114,000	36	18	1,860	1950	17,922	1	1	1.05									.18
0	190669962	49	2	0	$124,300	68	22	2,370	1950	25,620	1	1	4.12									2.6
1	190669962	49	2	0	$124,300	68	22	2,370	1950	28,443	1	1	4.12									2.6
0	191099444	7	2	0	$130,000	29	16	2,000	1950	18,070	1	0	0.77	0.7	0.5	1.65	2.58	2.69	2.77	2.71	3.25	1.43
										070	1	0	0.77	0.7	0.5	1.65	2.58	2.69	2.77	2.71	3.25	1.43
										954	1	1	1.04	1.12	1.21	0.73	0.84	0.73	1.32	1.57	0.73	1.39
										172	1	1	1.04	1.12	1.21	0.73	0.84	0.73	1.32	1.57	0.73	1.39
										871	1	0	0.91	0.86	0.5	0.49	1.51	1.07	1.54	1.47	1.35	1.39
										585	1	0	0.91	0.86	0.5	0.49	1.51	1.07	1.54	1.47	1.35	1.39
										892	1	1	1.25	0.51	0.51	0.58	0.64	1.2	0.8	1.04	1.55	2.04

2. Difference in annual kWh use reflects total kWh required for EV charging over the year.

1. Two records are reported for each customer; the first reflects baseline 8760 hourly loads and the second reflects hourly loads where an additional 10% of service area customers have purchased EVs.

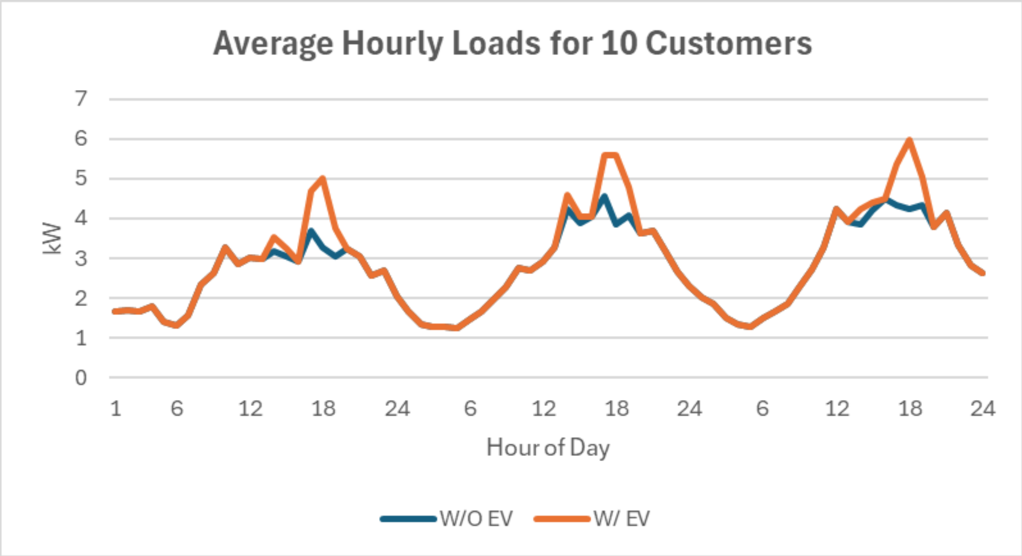
Transformer/Feeder Customer Analysis

1. Consider load impacts of 40% EV ownership on transformers & feeder branches
2. Select a sample of 10 actual utility customers (4 with EVs) from the customer database

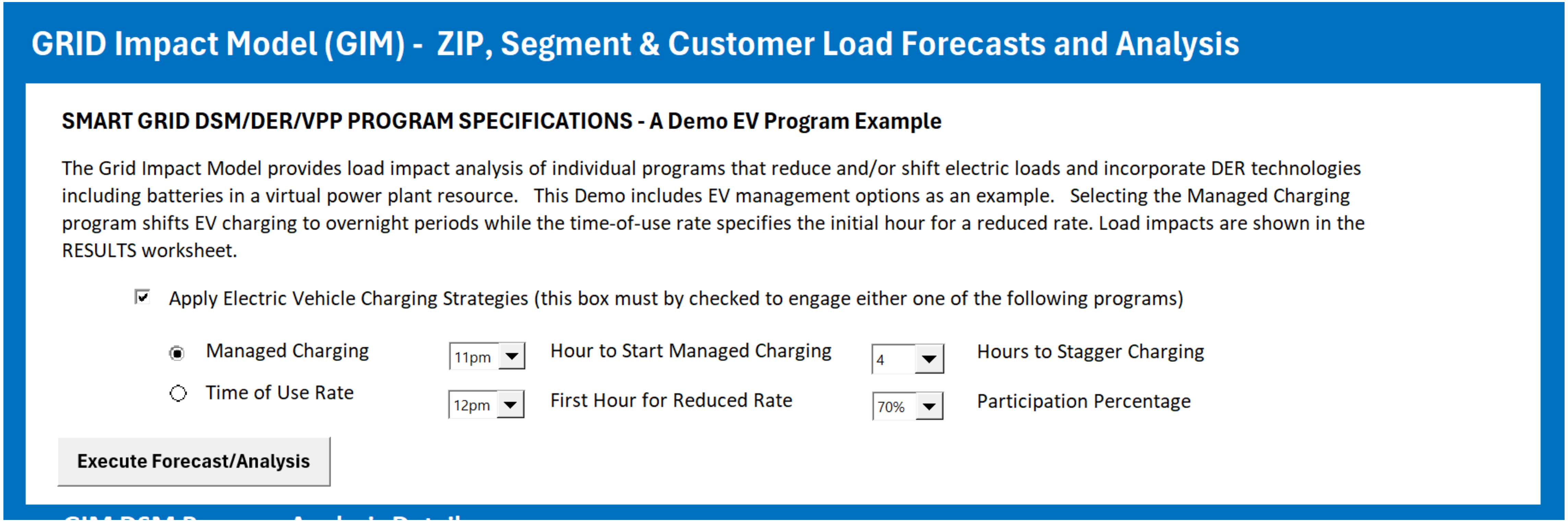


1. Significant diversity in hourly loads in this 10-customer sample.

2. Increased diversified transformer and feeder loads (1.5 – 2 kW) are likely to damage the transformer and significantly degrade power quality along the feeder branch.

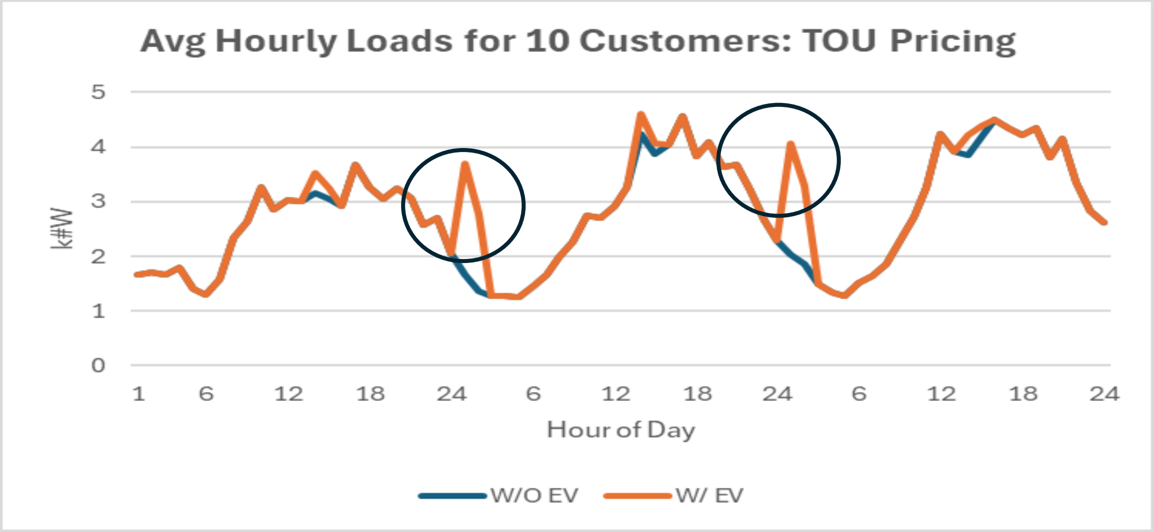


Evaluate EV TOU Rates and Managed Charging



Next Consider the Sample of 10 Customers Under the Two Charging Strategies.

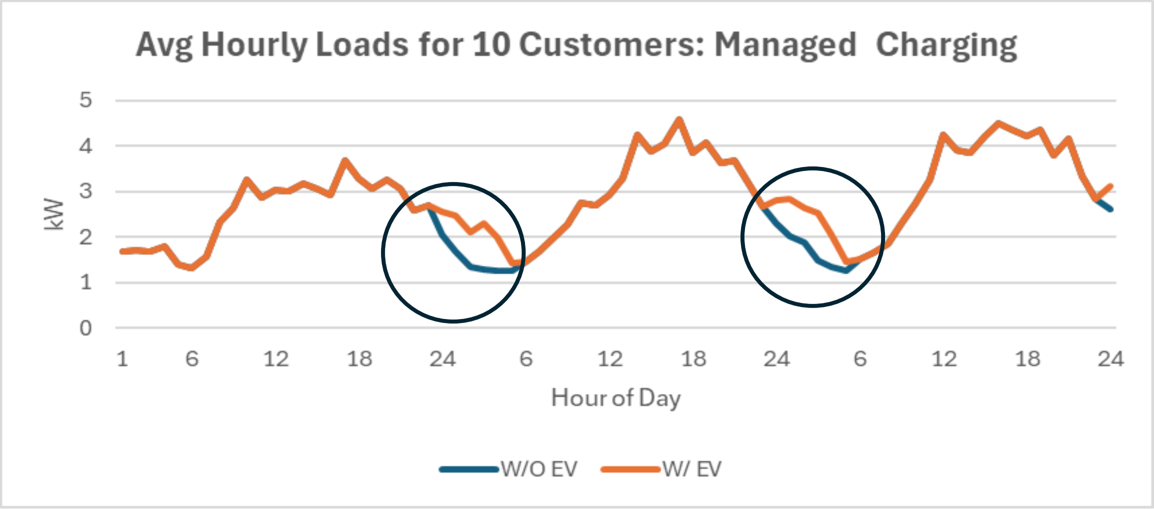
EV Load Management Options



Time-of-Use EV rate at 12pm

Typical “timer peak” reflects 70% of EV owners set charging timers for first hour of reduced EV rate .

Shifts, but barely limits peak kW



Managed charging beginning at 11 pm

Utility managed charging staggers EV charging over 4 hours beginning at 11 pm.

Shifts and smooths EV kW charges

Analysis Summary: +10% EV Ownership

Forecast EV Ownership Varies Significantly by ZIP Area

17.6% versus 6.8%

An EV Charging Strategy Will be Necessary to:

Address transformer overloading in some areas

Avoid power quality issues, especially on distribution lateral lines

EV Charging Strategy Comparison

TOU timer peaks can overwhelm shifting benefits in areas with high EV concentrations

Managed charging is a more comprehensive approach and potentially part of a virtual power plant strategy

Grid Impact Model Characteristics

Forecast Output Detail

- ❑ Service Area, ZIP, neighborhood, individual customers
- ❑ Excel interface, dashboards, charts, tables; annual, monthly, hourly; customer data

Forecast Run Options

- ❑ Current year, 2030, 2035
- ❑ Weather extremes, EV ownership, electrification , customer growth
- ❑ One or more DSM options, virtual power plant analysis

DSM Analysis Options

- ❑ Space heating , AC water heating, EV, Tariff-based, behavioral DSM programs
- ❑ EVs and home batteries: managed charging and load contributions
- ❑ Virtual power plant strategies

Utility Management and Planning Support

- ❑ General utility management, forecasting and planning functions
- ❑ Inputs to current distribution system modeling and analysis tools

Utility System Planning Support

- ❑ Identify area where EV growth will stress feeders, transformers, and regulators
- ❑ Develop timelines for upgrades before overloads occur
- ❑ Model weather-driven peak impacts and resilience needs
- ❑ Support general distribution planning with ZIP-level and sub-ZIP forecasts
- ❑ Guide siting of microgrids, storage, non-wires alternatives
- ❑ Provide data for budget planning, board reporting, and long-term load strategy

Program & Investment Evaluations Support

- ❑ Quantify benefits of managed charging and load shifting
- ❑ Support business cases for ADMS, DERMS, or time-series DMS tools
- ❑ Prioritize SCADA, AMI analytics, and voltage management upgrades
- ❑ Evaluate ROI of load control for HVAC, water heat, and EV charging
- ❑ Provide defensible inputs for grid-modernization and resilience grants
- ❑ Justify hosting-capacity tools, digital twins, and GIS model buildout
- ❑ Help secure funding for software, sensors, and automation deployments

Existing Distribution Planning Tools Support

- Import EV growth as load multipliers or time-series profiles in DSA Software
- Map ZIP and sub-ZIP forecasts to feeders, transformers, or GIS service areas
- Run unmanaged vs. managed charging scenarios to test peak and voltage impacts
- Prioritize capital upgrades using overload and hotspot forecasts
- Apply weather-based load curves in time-series simulations
- Layer water heater, HVAC, and AC load-control savings to show deferred upgrades
- Use outputs in hosting-capacity screening and interconnection studies
- Support screening even without full circuit models by linking loads to ZIP-level transformer counts

Grid Impact Model Summary

- ❑ Digital twin model and database
- ❑ Service area, ZIP, neighborhood & individual customer hourly load visibility, analysis and forecasts
- ❑ Uses data on your utility customers — data already curated by us
- ❑ Results for current year, 2030 and 2035
- ❑ Low-cost tool identifies distribution threats, DSM program potentials, supports utility planning and distribution system modeling
- ❑ **View more at www.maisy.com/gim.htm**