AEG
APPLIED ENERGY GROUP

DER Potential Study

Prepared for: Avista Distribution Planning Advisory Group (DPAG) Q1 Meeting

Date: March 27, 2024

In Partnership with:

cadeo

VERDANT

Agenda

- Context
- Executive Summary
- Forecasting Overview
- Results
  - Electric Vehicles
  - New Generation and Storage
- Next Steps

Presentation Structure

- The AEG team will present high-level methods and results from the DER Potential Study
  - Please hold questions until the end of each section
  - We also plan to reserve time at the end of the presentation for any additional questions

- These slides present:
  - an end-to-end analysis using the methodology and sources identified in the AEG team's 2023 *DER Forecasting Methodology* document
  - a high-level summary of detailed results (how much potential and where)
  - an opportunity for stakeholders to ask questions and share insights before we finalize the results and report

- These slides DO NOT represent a plan for Avista's future program or investment strategy

DER Potential Study Project Objectives

- Satisfy **Condition 14 from WUTC approval** of Avista's Clean Energy Implementation Plan.
- Develop reasonable estimates for new customer generation, storage, and controllable load impacts on a localized basis within Avista's Washington electric service territory.
- Investigate impacts in Highly Impacted or Vulnerable Population Areas.
- Utilize a robust forecasting model that can be updated and enhanced over time.
- Document methods, data sources, and inputs and provide results in a format that Avista can incorporate into other planning efforts (i.e., DER forecasting).
- Engage internal and external stakeholders to get buy-in on study results.

Condition 14 from WUTC approval:

- Avista will include a Distributed Energy Resources (DERs) potential assessment for each distribution feeder no later than its 2025 electric IRP… including input from the IRP TAC, EEAG, and DPAG.
- The assessment will include a low-income DER potential assessment.
- Understand DER forecasting methodologies currently employed by other utilities.

Project Overview

Utility Survey Task 1	DER Forecasting Methodology Task 2	EV & New Generation and Storage Potential Tasks 3-4	Stakeholder Presentation & Reporting Tasks 5-6
Identify priority utilities and research questions	Input development	Modeling approach	Stakeholder presentation
Develop research plan	DER adoption and load impact forecast	Stock characterization	Incorporate feedback
Utility research reporting	Scenario analysis	Adoption curves	Draft and final report
		Load impacts	

ACTIVITIES

Executive Summary

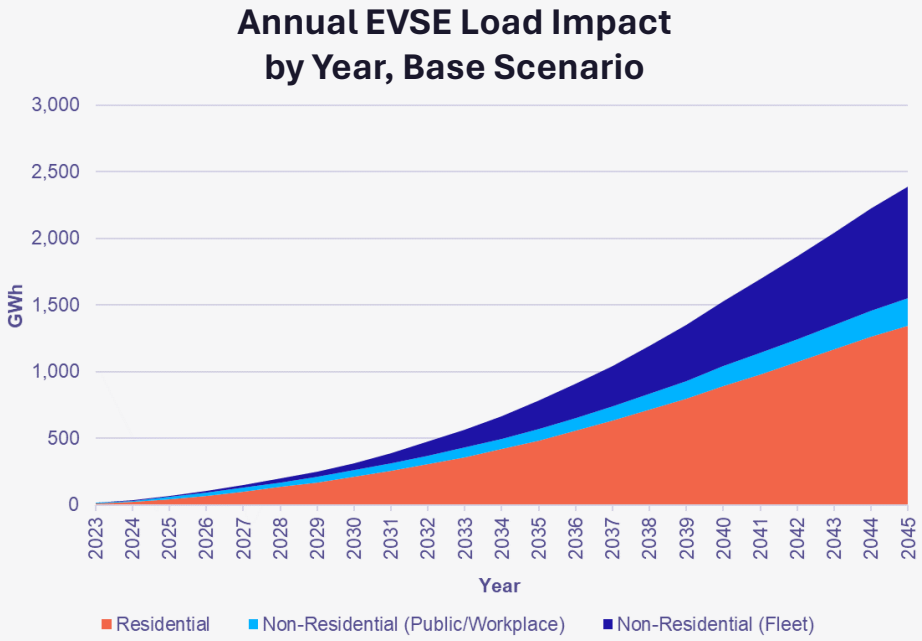
Summary of Results

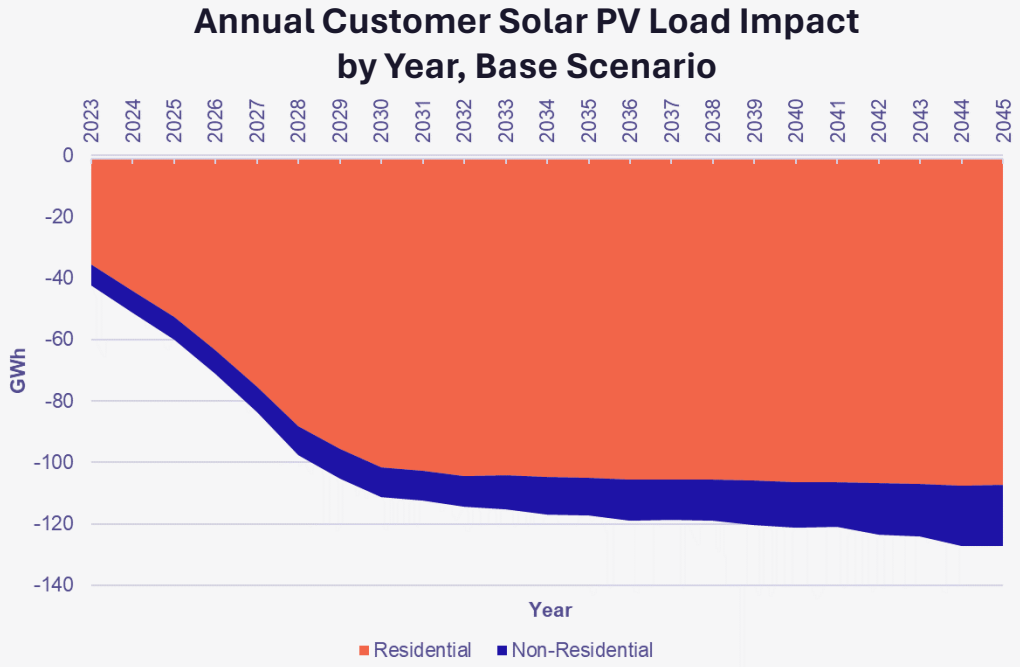
Year 2045 Result Summary, Base Scenario

Resource	Nameplate Size (MW)	% of Nameplate MW in Named Community	Annual Load Impact (GWh)	July Peak Load Impact (MW)*	December Peak Load Impact (MW)*
Customer Solar PV	105	46%	-127	-33	0
Customer Storage	97	58%	2	-3	-9
Customer Wind	1	36%	~0	~0	~0
Residential EVSE	2,110	36%	1,345	98	98
Fleet EVSE	692	67%	841	101	105
Public and Workplace EVSE	171	60%	206	33	33

* Assumes system peak occurs on weekdays, hour-ending 18:00 local time in July and December.

Summary of Results, Cont.



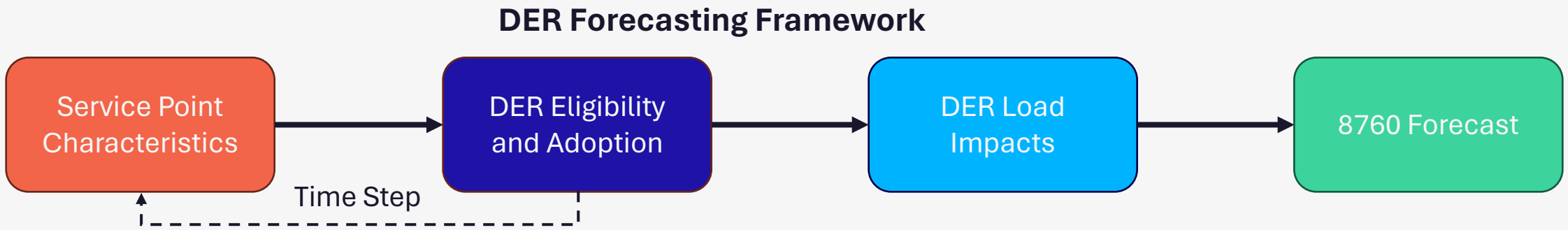


Widespread electrification of vehicle stock in Avista WA service territory to drive substantial electric **load growth** (over 2,000 GWh in 2045).

Customer solar accounts for over 120 GWh of electric **load reduction** in 2045.

Forecasting Overview

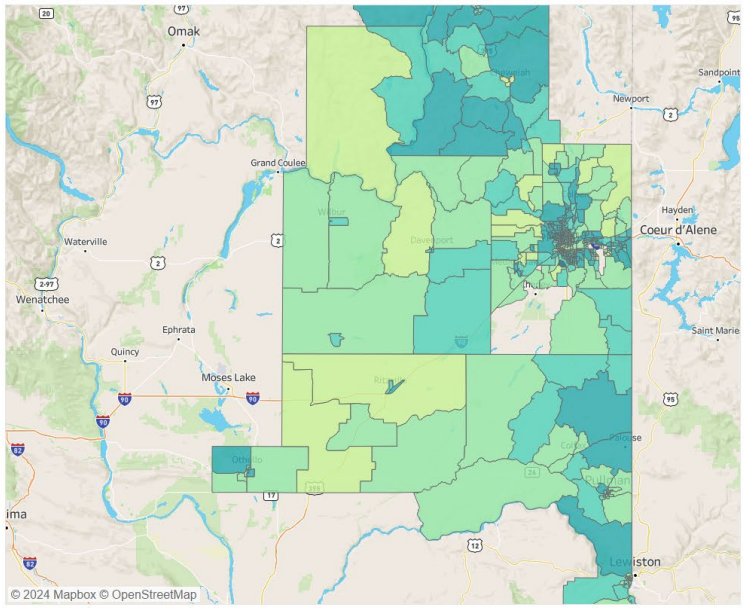
Consistent Framework to Forecast the Adoption and Load Impacts for Each DER



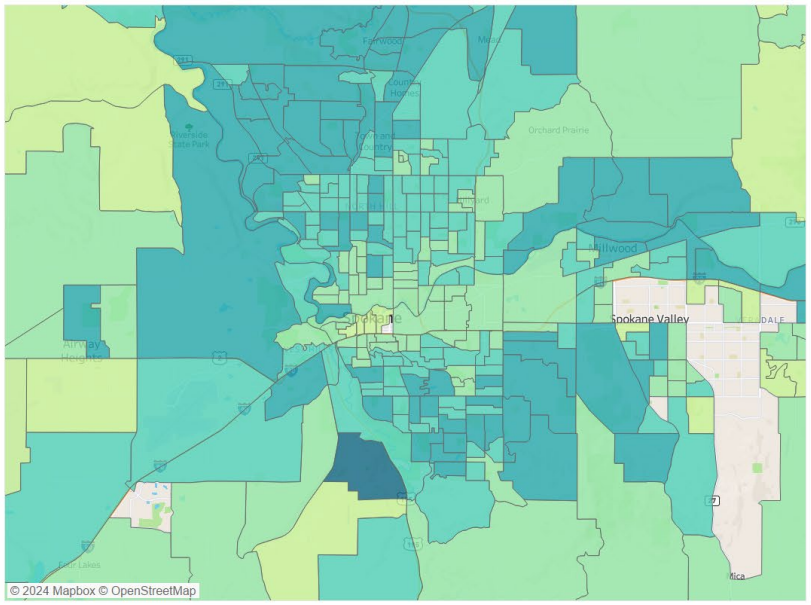
- **Service Point Characteristics** are known data for each Avista service point: number, weight class, fuel type of vehicles, building type, location, in a named community.
- **DER Eligibility and Adoption** is a time-varying, probabilistic DER adoption simulation.
- **DER Load Impacts**
  - 8760 hourly, per-unit load impacts in kW, scaled by results from DER Eligibility and Adoption step.
  - Example: multiply the 8760-hourly generation output of 1 kW of Solar PV by the adopted, nameplate kW.
- **8760 Forecast** is our model output: 8760 hourly forecast through year 2045 for each DER by census block group.

Model Produces a Forecast of 8760 Hourly Load Impacts Across Avista's Distribution System

Total MWH Impact for Residential EVSE
Year 2045, Base Scenario, Service Territory



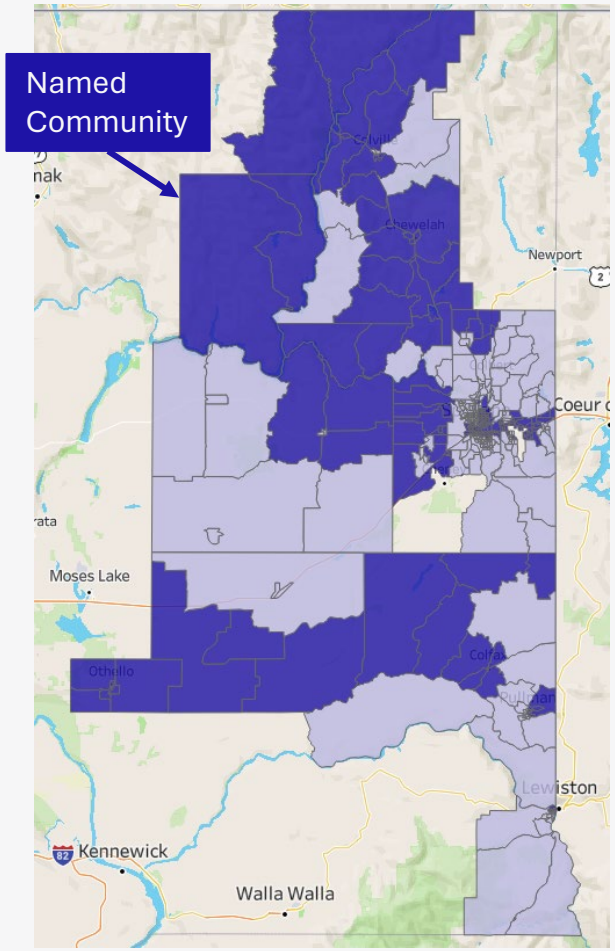
Total MWH Impact for Residential EVSE
Year 2045, Base Scenario, Spokane



Daily MWH
0-1 1-5 5-10 10-50 50-100

Named Community Definition

Named Community Map
Avista Utilities WA Electric Service Territory



Any Avista **service point for which one or more** of the following is true:

- **Highly Impacted:** in a census tract with a WA Department of Health "EHD v2.0 Overall Rank" score of 9 or 10.
- **Vulnerable:** in a census tract with a composite score of 9 or 10 in the sensitive population or socioeconomic subcategories, as identified by the WA Department of Health's Environmental Health Disparities Map.
- **Tribal Land:** in a tribal land identified by an Avista-provided GIS shape file

Terms and Acronyms

- **Peak Hour:** We assume a “planning peak” at the hour ending 18:00 on July and December weekdays. This may differ from actual system peak periods.

- **LDV:** Light duty vehicle (Class 1 and 2, 0–10,000 lbs)
- **MDV:** Medium duty vehicle (Class 3 through 6, 10,001-26,000 lbs)
- **HDV:** Heavy duty vehicle (Class 7 and 8, 26,001 lbs or more)

- **ICE:** Internal combustion engine vehicle
- **BEV:** Battery electric vehicle
- **PHEV:** Plug-in hybrid electric vehicle

- **EVSE:** Electric vehicle supply equipment; vehicle chargers
- **L1:** Level 1 EVSE (typically 1 to 3 kW)
- **L2:** Level 2 EVSE (typically 7 to 22 kW)
- **DCFC:** Direct current, fast charge EVSE (50 kW or more)

Scenario Definitions

- **Base Scenario:** Most likely future, based on current trends and policy landscape
  - Residential LDV EV market share follows California's Advanced Clean Cars II regulation, with the named community market share adjusted downward.
  - Non-residential EV market shares consistent with regional literature review (WA EV Council, SCL Electrification Study, ATLAS Public Policy study)
  - Solar PV storage adoption follows current market trends; the rate in named communities is lower than in non-named communities.

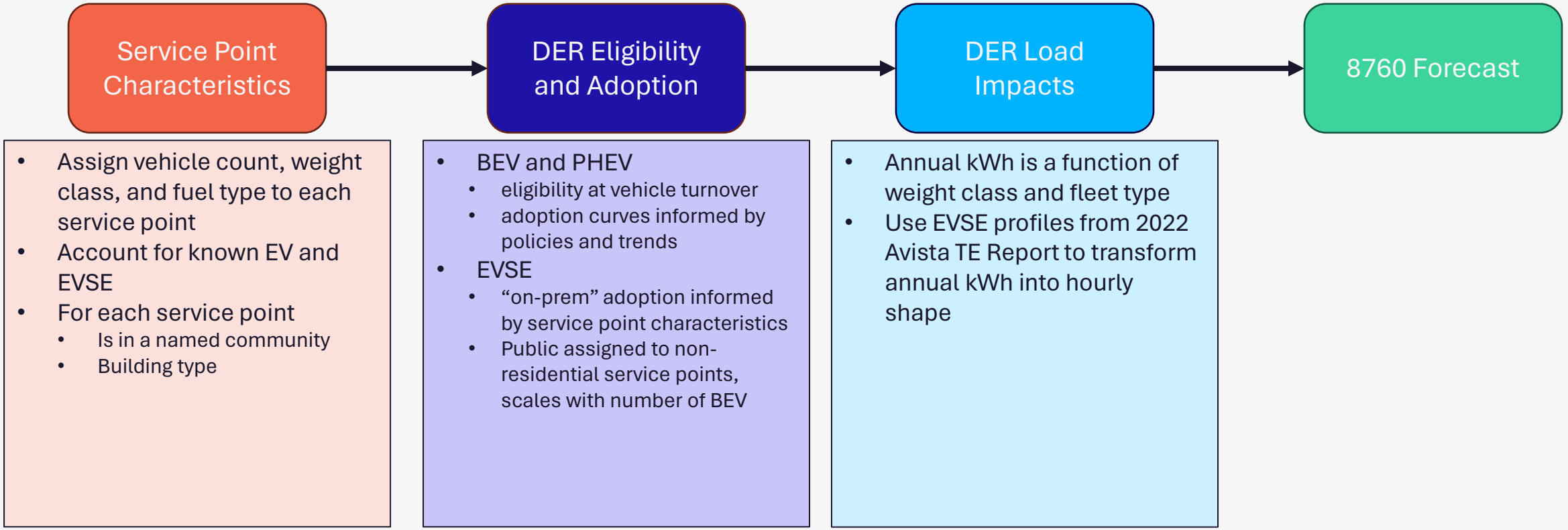
- **High Incentive Scenario:** Alternative future where policies "incentivize" DER adoption in named communities
  - Residential EV market share in named communities is the same as in non-named communities
  - Residential Solar PV and storage adoption rates in named communities is the same as in non-named communities

Results: Electric Vehicles

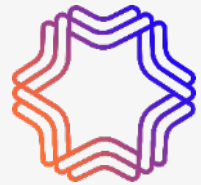
Scope of EV and EVSE Analysis

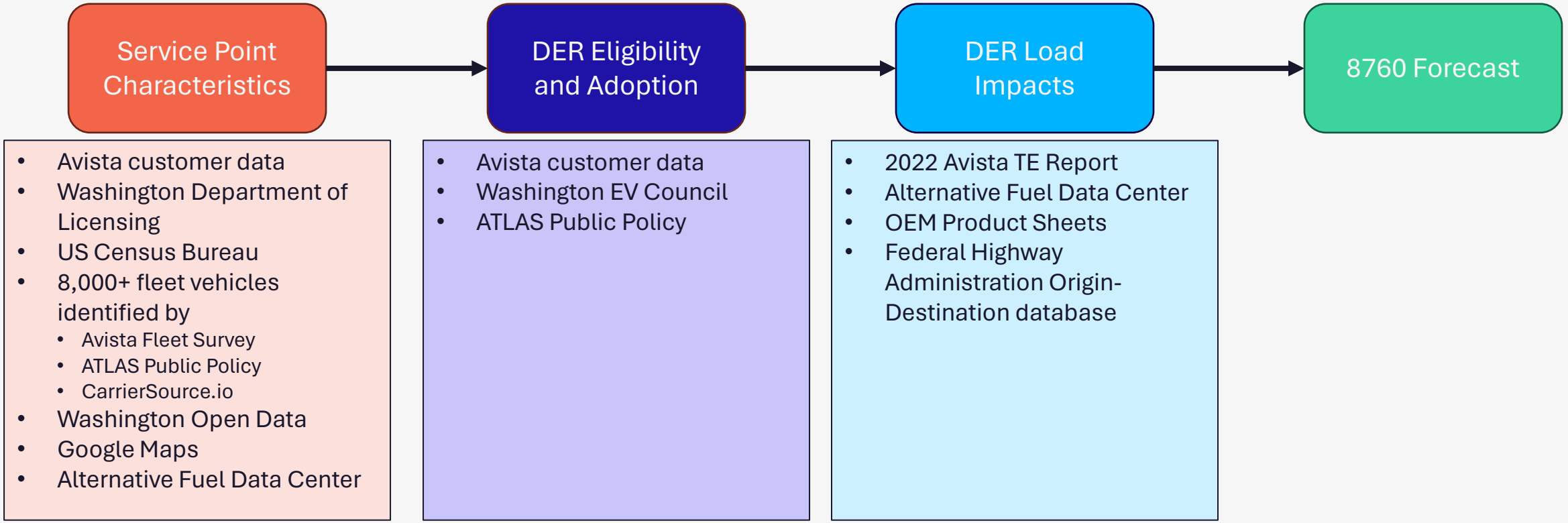
Resource	Residential	Non-Residential
LDV BEV	✓	✓
LDV PHEV	✓	✓
MDV BEV	✓	✓
HDV BEV		✓
L1 EVSE	✓	✓
L2 EVSE	✓	✓
DCFC EVSE		✓

Electric Vehicle- and EVSE-Specific Forecasting Framework

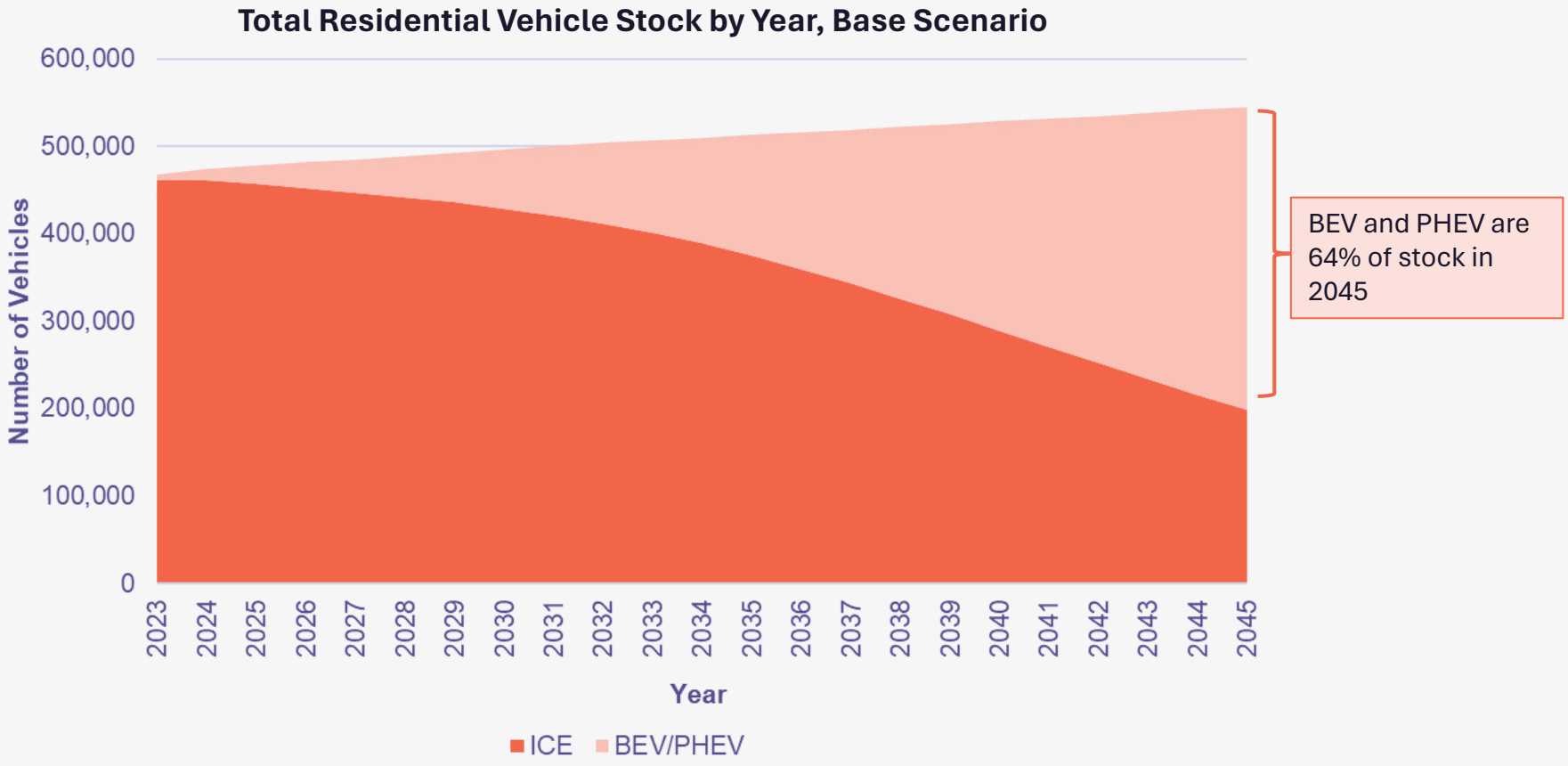


Data Sources for Electric Vehicle and EVSE Analysis

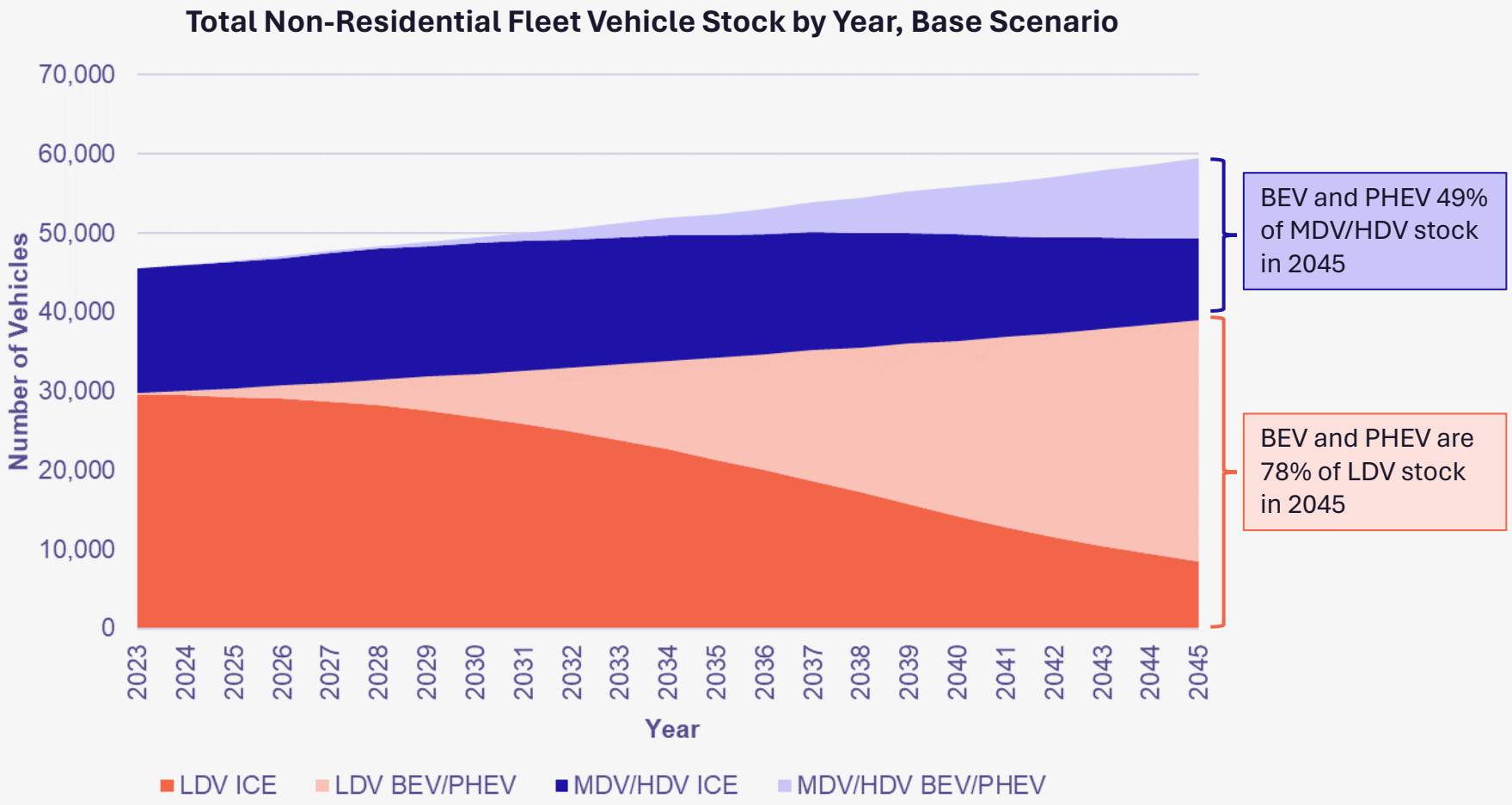




BEV Approaches 64% of Residential Vehicle Stock in 2045

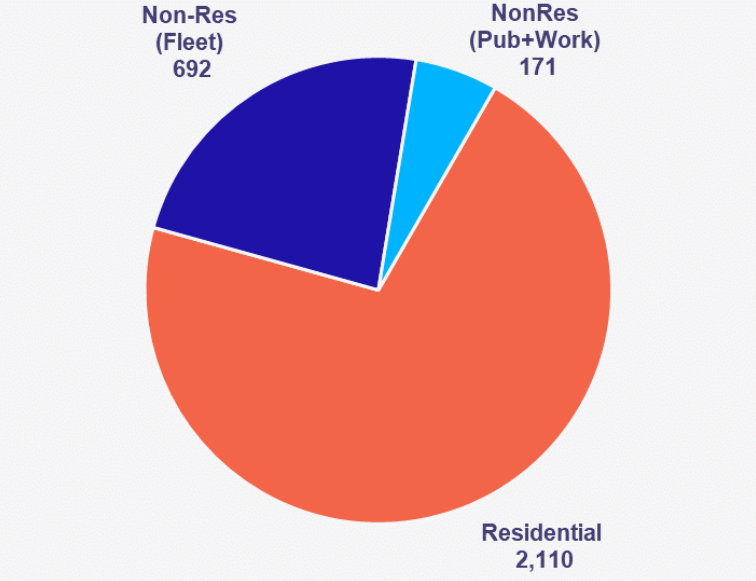


BEV is 78% of Fleet LDV Stock and 49% of Fleet MHDV Stock in 2045



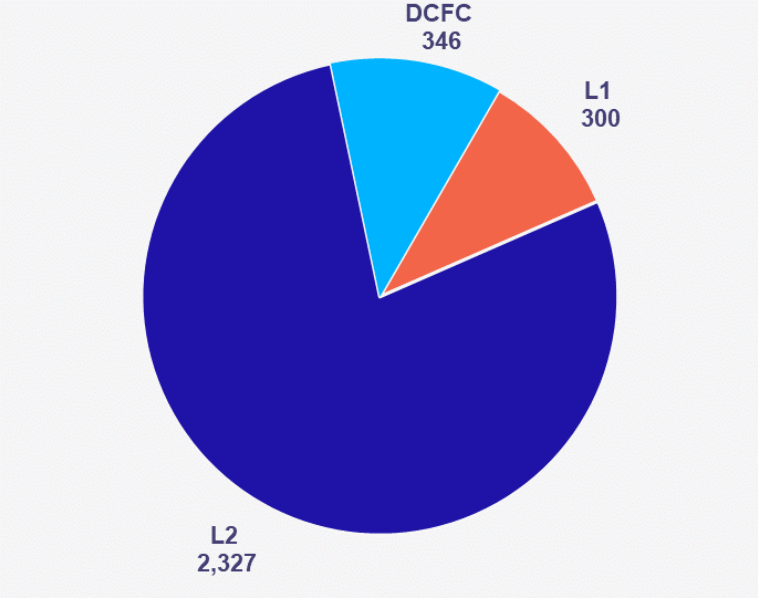
EVSE Adoption Summaries

EVSE Adoption by Sector
Base Scenario, Nameplate MW in 2045
Total: 2,973 MW



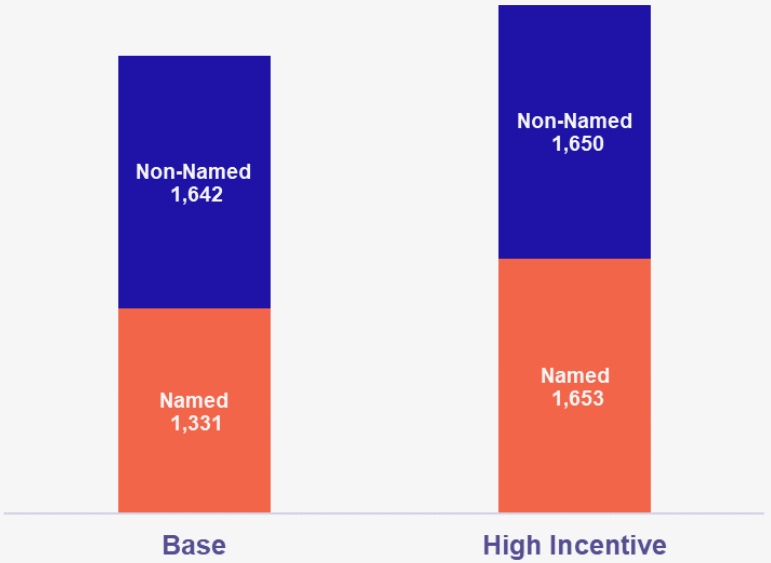
Most charging is residential

EVSE Adoption by Charger Type
Base Scenario, Nameplate MW in 2045
Total: 2,973 MW



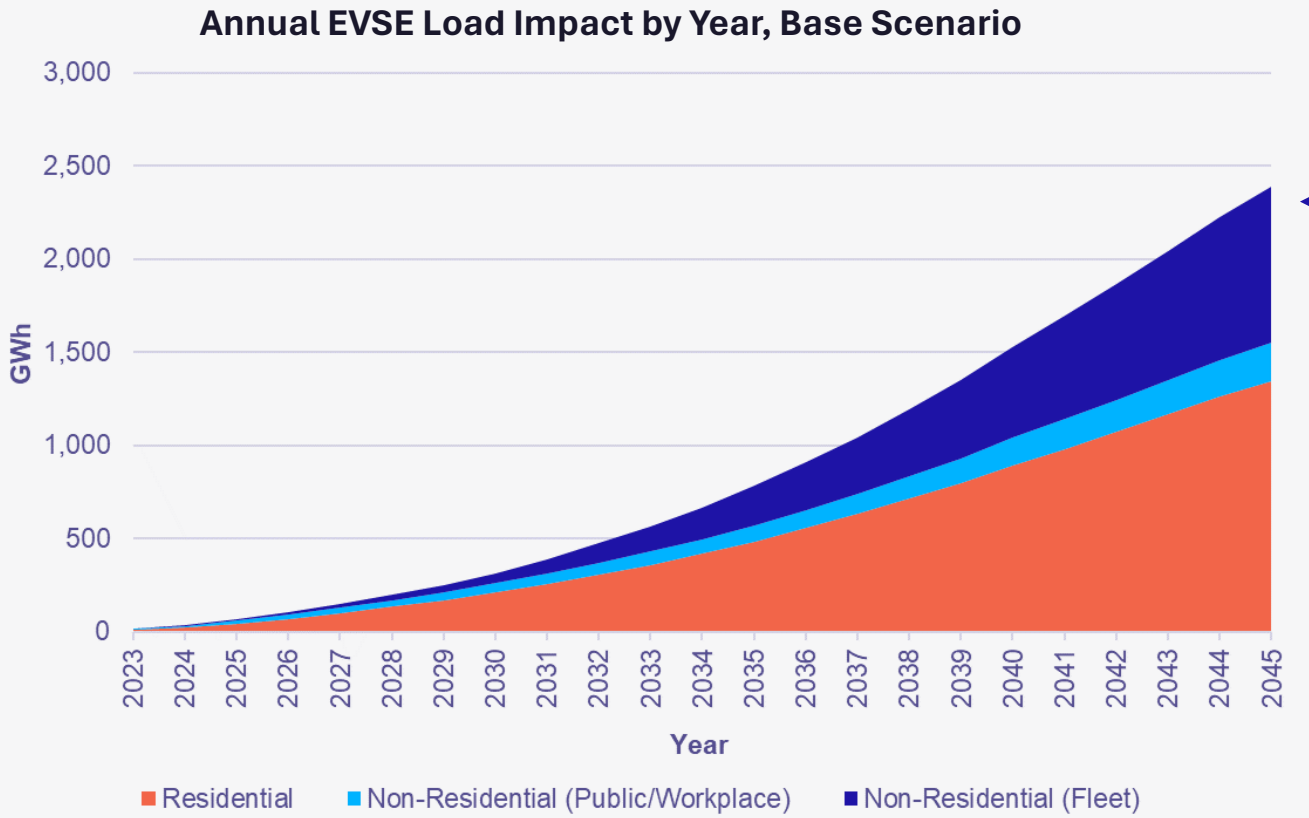
L2 is the predominant charging type

Total EVSE Adoption by Named Community and Scenario
Nameplate MW in 2045
Totals: 2,973 MW; 3,303 MW



More BEV in High Incentive scenario but mix of charging types shifts.

2,391 GWh of EVSE Load Impact by 2045

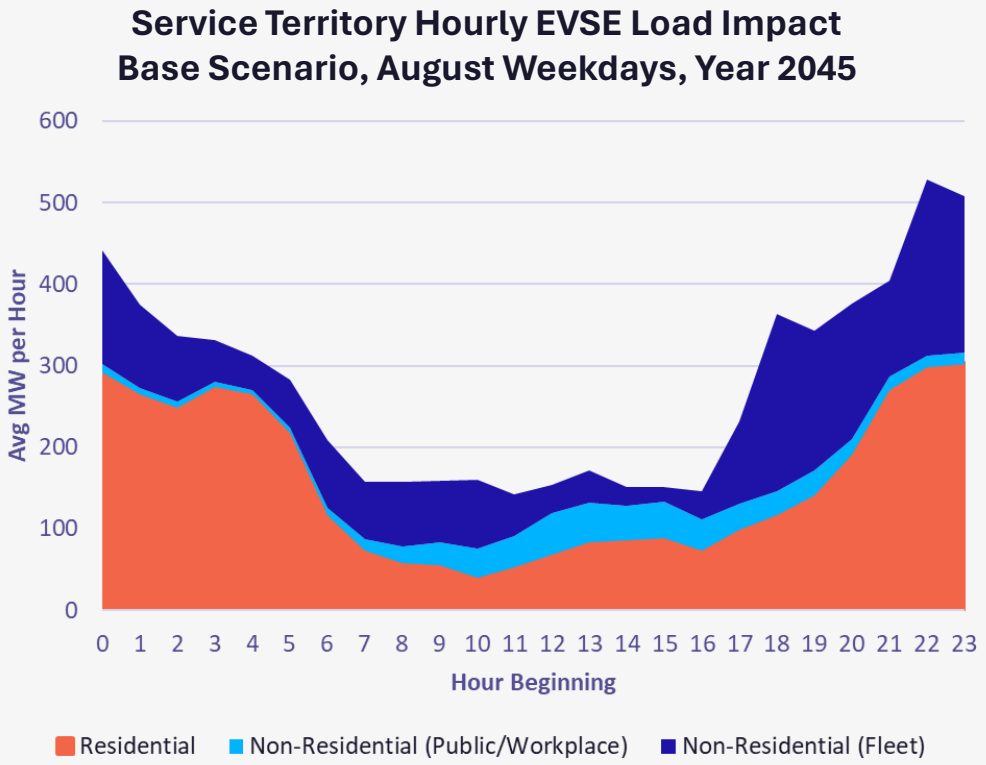


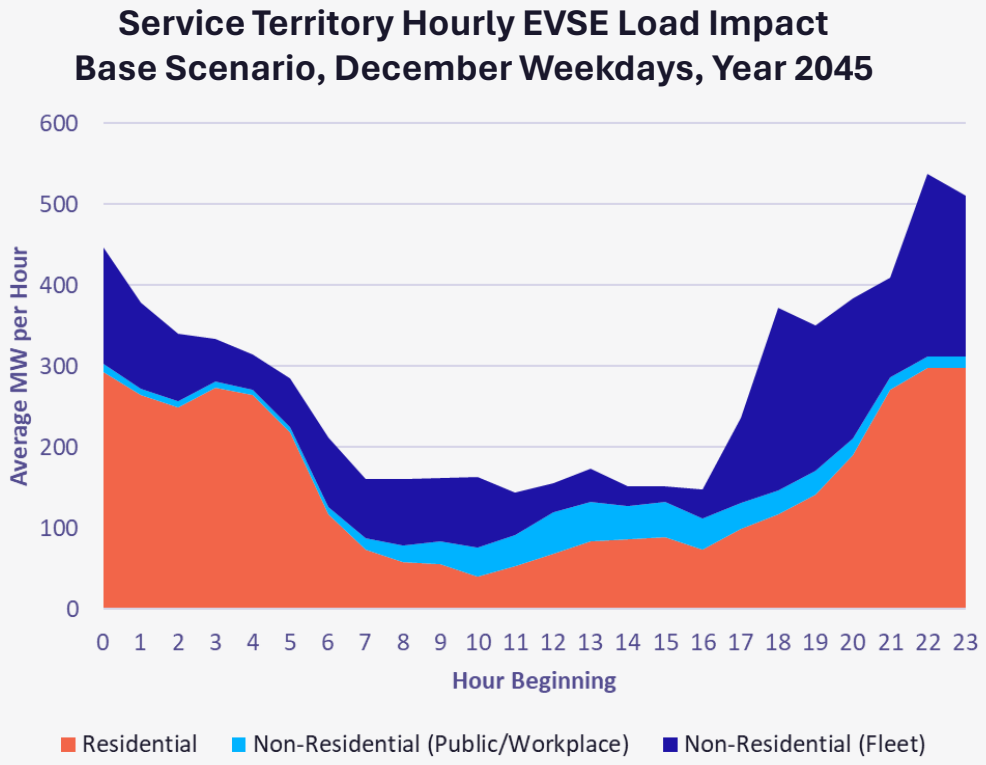
Base scenario: 2,391 GWh in 2045

- **40% increase** in Avista WA's electric load by year 2045.
- **2,373 GWh new load** relative to current-state

High incentive scenario: 2,617 GWh

Hourly EVSE Load Impact During Peak Periods

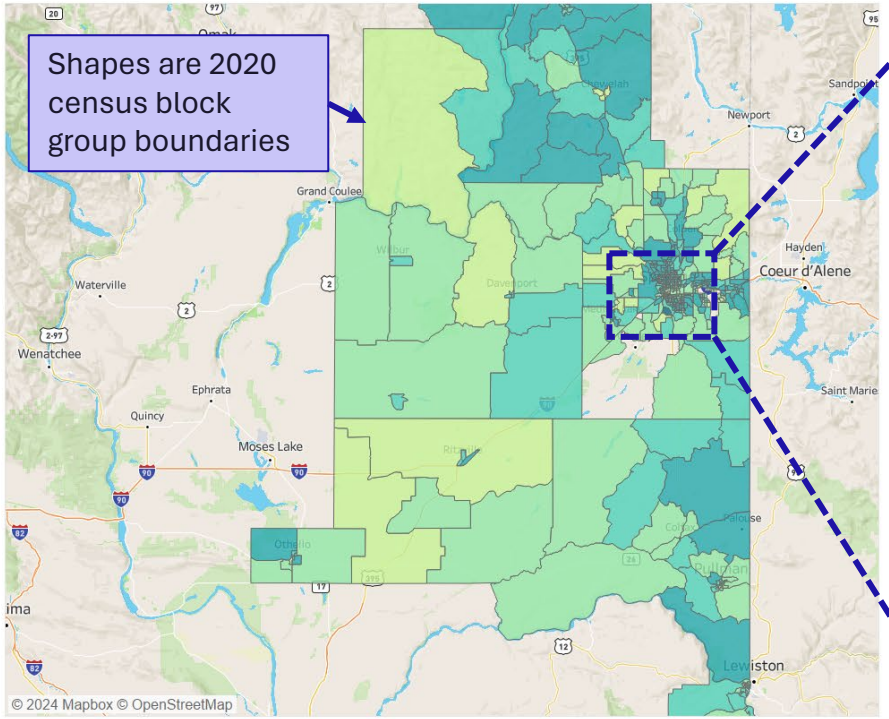




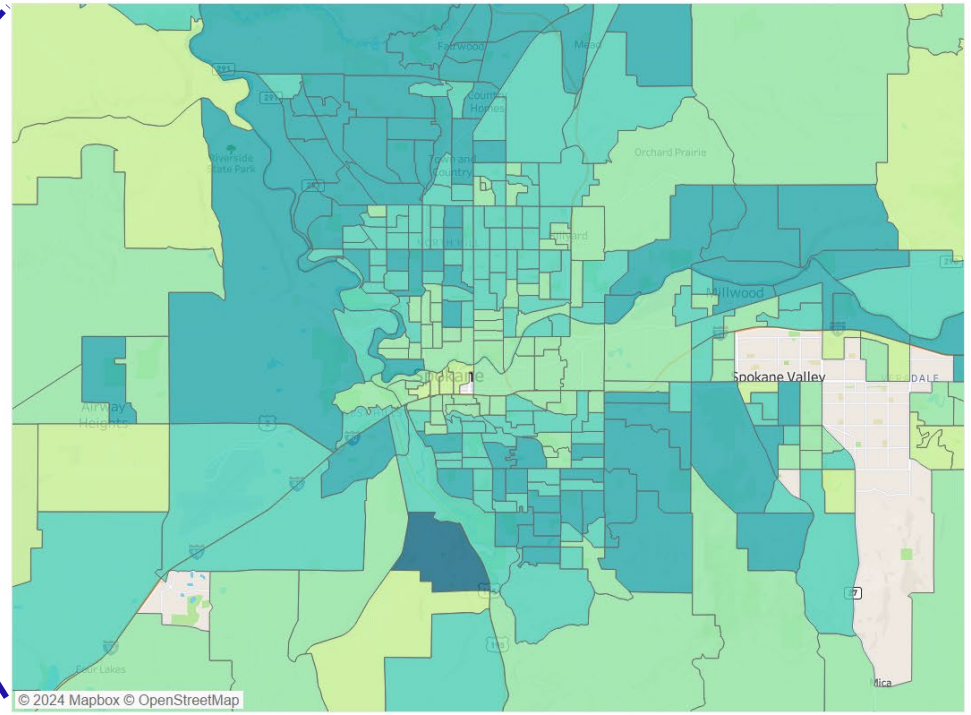
Hourly load impact is driven by input shape, which assumes most residential and fleet charging happens overnight.

Geospatial Results: Res EVSE Load Impact

Total MWH Impact for Residential EVSE
Year 2045, Base Scenario, Service Territory



Total MWH Impact for Residential EVSE
Year 2045, Base Scenario, Spokane



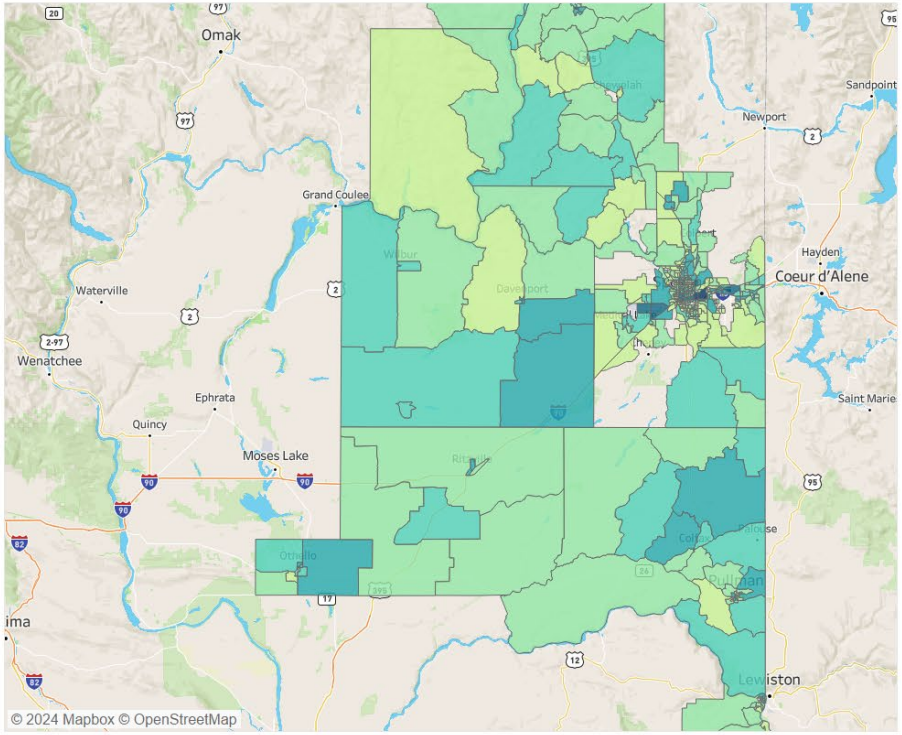
Color ramp represents block group load impact

Daily MWH
0-1 1-5 5-10 10-50 50-100

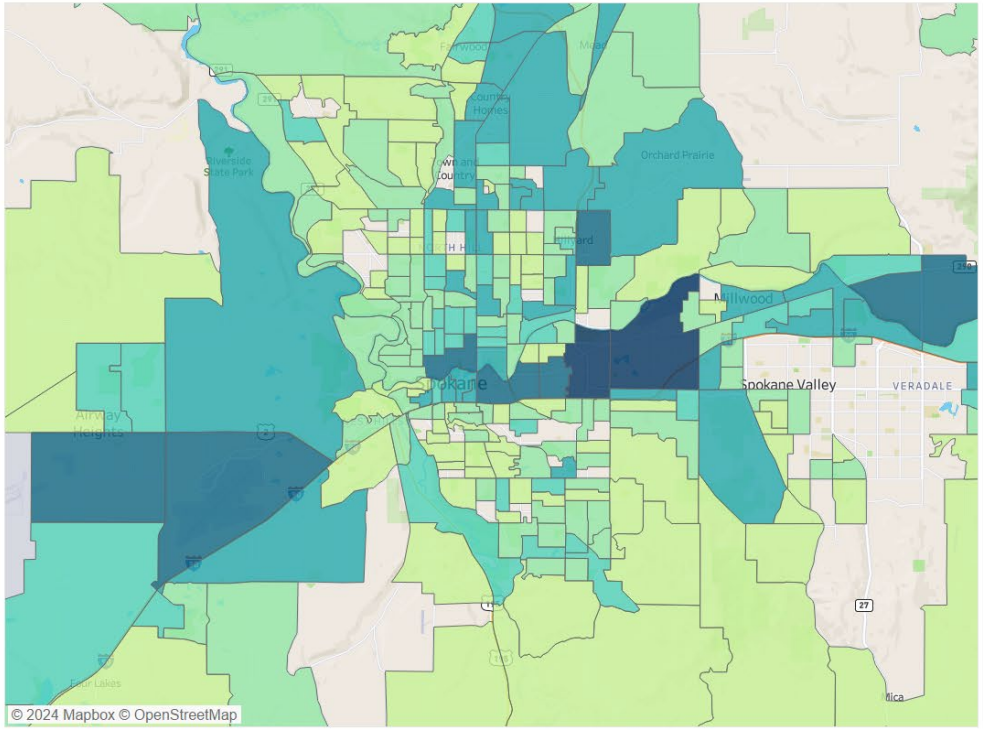
Results: New Generation and Storage

Geospatial Results: Non-Res EVSE Load Impact

Total MWH Impact for Non-Residential EVSE
Year 2045, Base Scenario, Service Territory



Total MWH Impact for Non-Residential EVSE
Year 2045, Base Scenario, Spokane



Daily MWH

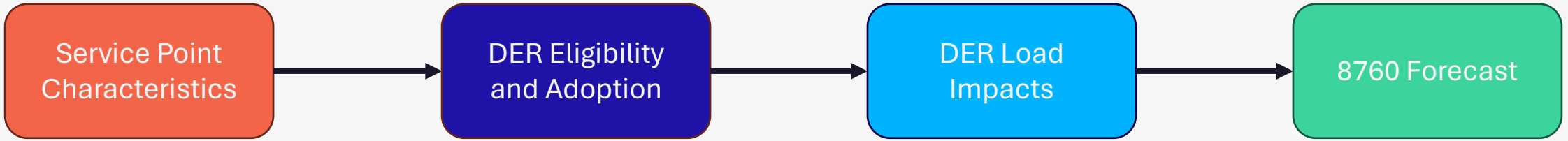
0-1 1-5 5-10 10-50 50-100 100 or more

Scope of New Generation and Storage Analysis

Resource	Residential	Non-Residential
Customer Solar PV	✓	✓
Customer Storage	✓	✓
Customer Wind	✓	✓

- AEG team's analysis goes into detail for the technologies in the table above
- AEG team also considered other generation technologies (i.e., biomass, combined heat and power) but did not include due to their unfavorable economics

New Generation and Storage Forecasting Framework

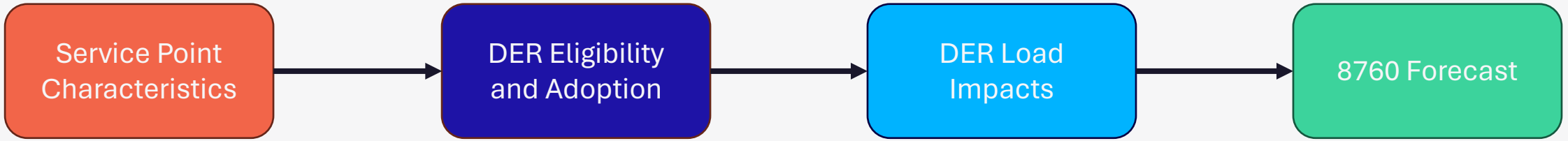


- Place known Customer Solar PV and Customer Wind at service points
- For each service point
  - Is in a named community
  - Building type

- Apply eligibility criteria
- For each year, apply adoption probability that accounts for
  - Historic Customer Solar and Customer Wind adoption trends
  - Future changes in technology price
  - TOU rate structure for Customer Storage

- Assign nameplate size to each adopter
  - Customer Solar PV: Res 2-7 kW, Non-Res 25+ kW
  - Customer Storage: Res 5 kW/13 kWh, Non-Res 50 kW/100kWh
  - Customer Wind: 5 kW
- Scale a “unitized” hourly load profile by nameplate size.
  - Customer Solar and wind profiles from 4 locations in the territory
  - Customer Storage assumes TOU rate structure

Data Sources for New Generation and Storage Analysis



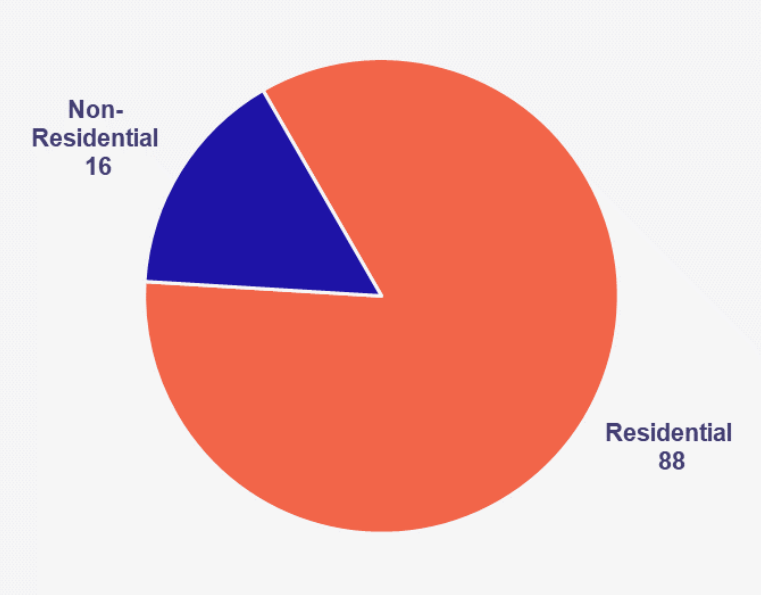
- US Census Bureau
- Avista DER interconnection data
- Avista customer data

- Avista customer data
- NREL DGEN market model
- Avista TOU pilot tariff sheet

- NREL PV Watts
- AEG team analysis
- Avista TOU pilot tariff sheet

105 MW of Customer Solar PV Forecasted in 2045

Customer Solar PV Adoption by Sector
Base Scenario, Nameplate MW in 2045
Total: 105 MW

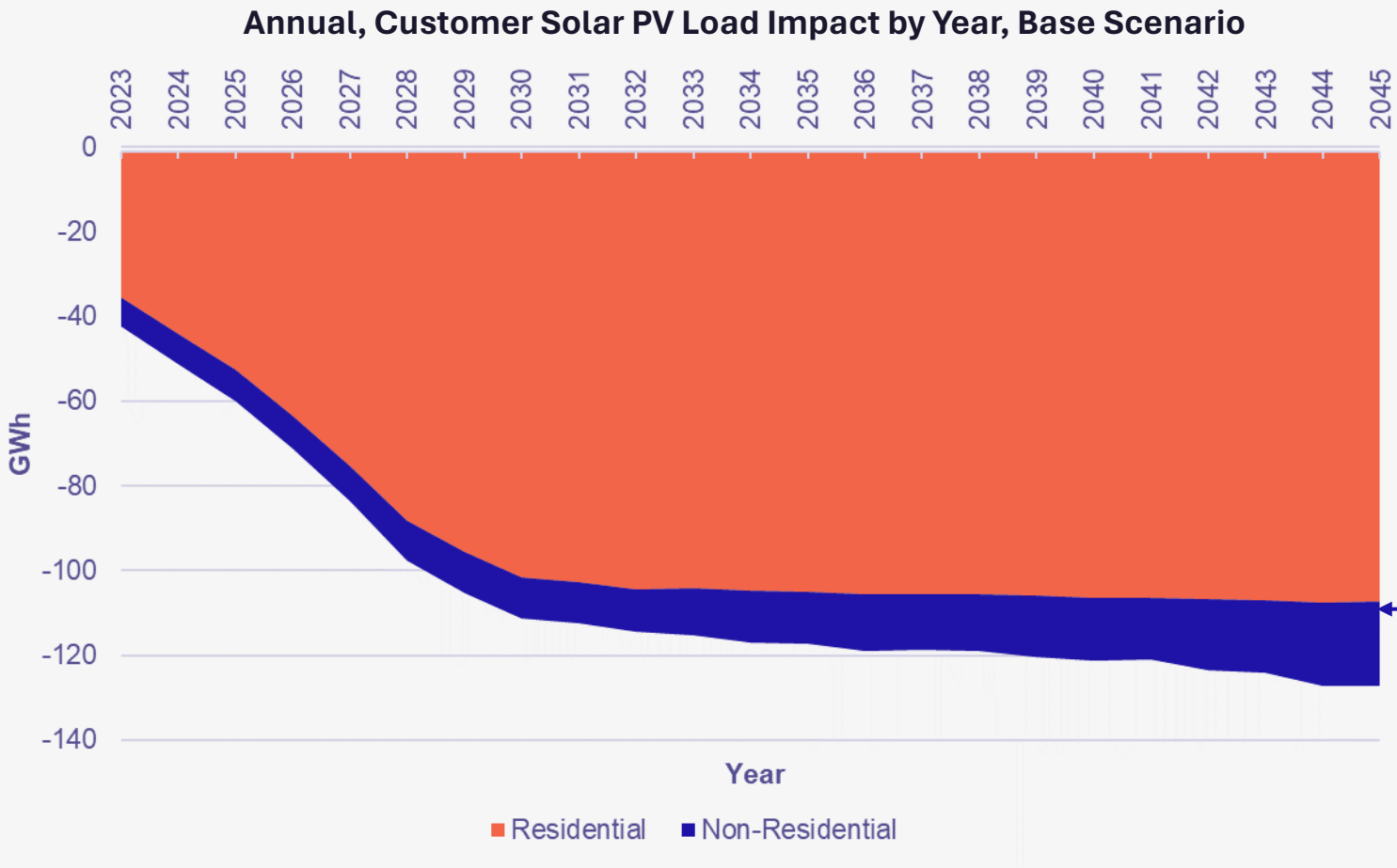


84% of customer solar PV is residential

Total Customer Solar PV Adoption by Scenario
Nameplate MW in 2045
Totals: 105 MW, 117 MW

Incremental 12 MW of solar PV in High Incentive scenario

127 GWh of Customer Solar PV Load Impact in 2045

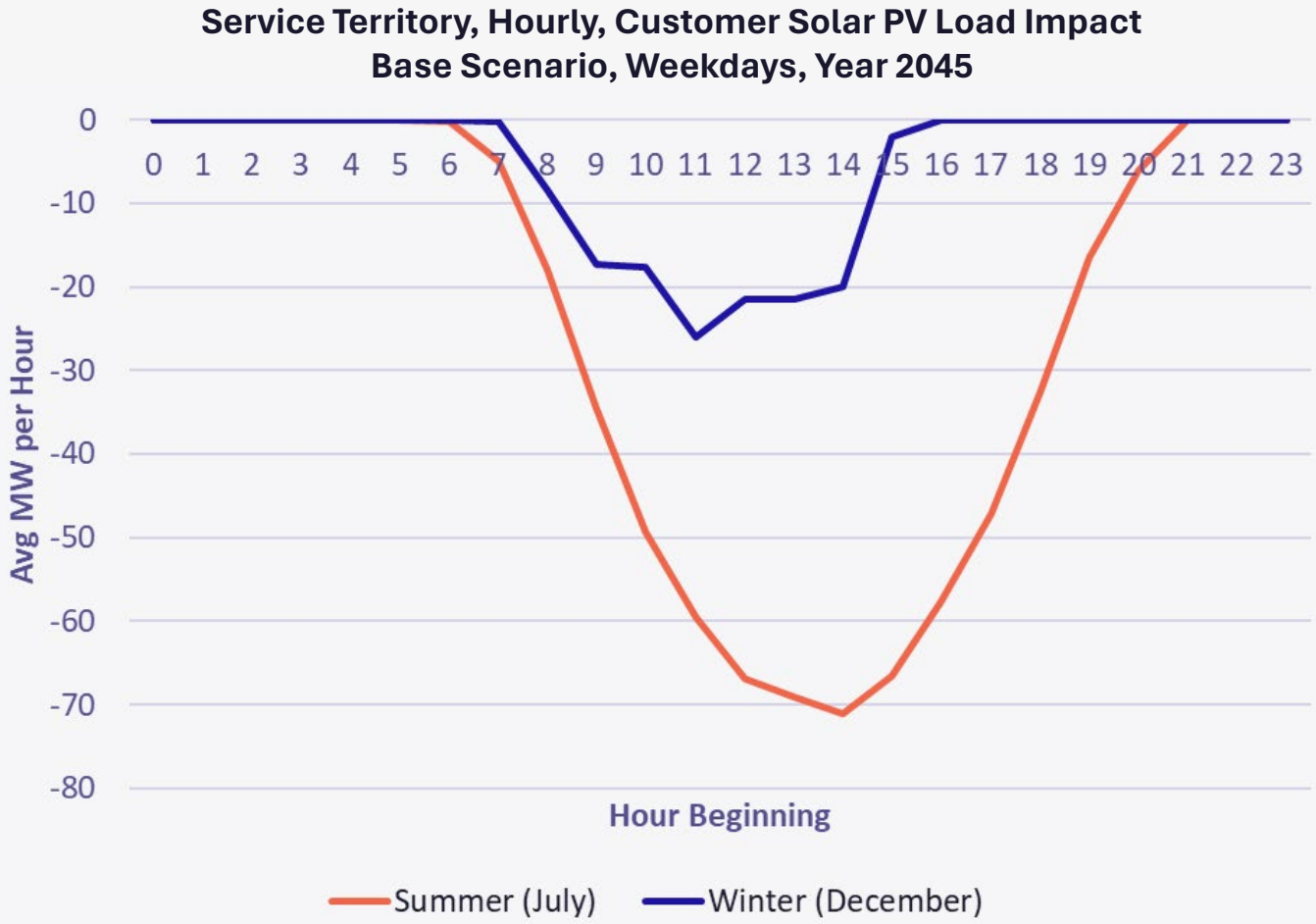


Base Scenario: 127 GWh

- **1% to 3% reduction** in Avista WA's electric load by year 2045.
- **82 GWh increase** over current state

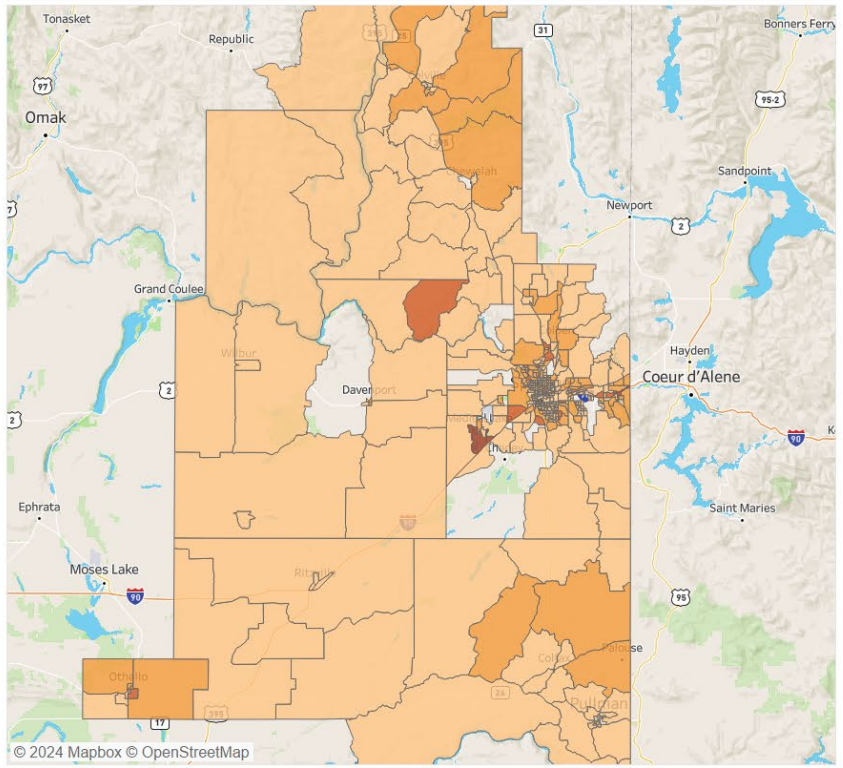
High Incentive Scenario: 132 GWh

Hourly Customer Solar PV Load Impact During Peak Periods

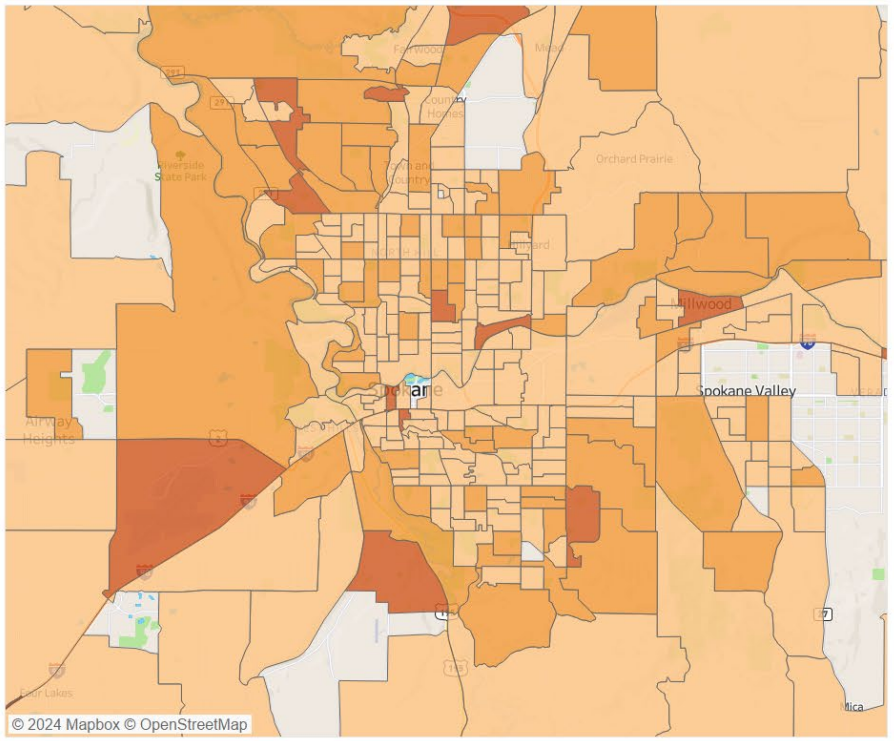


Geospatial Results: Solar PV Load Impact

Total MWH Impact for Customer Solar PV
Year 2045, Base Scenario, Service Territory



Total MWH Impact for Customer Solar PV
Year 2045, Base Scenario, Spokane

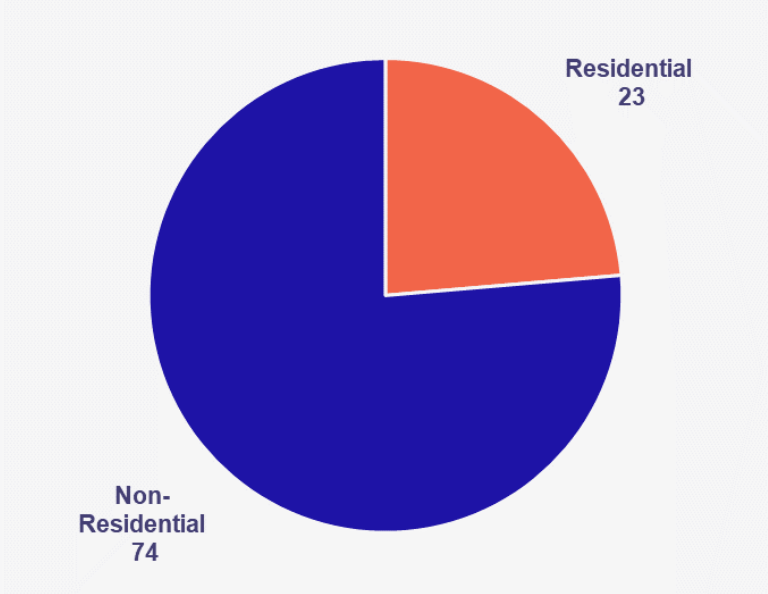


Avg Daily MWH

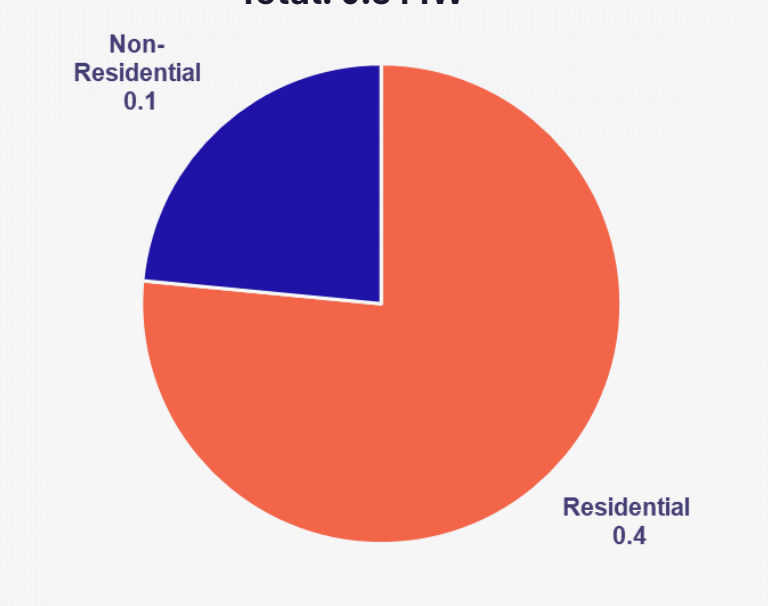
- 0-1
- 1-2
- 2-5
- 5 or more

Wind and Storage Adoption

Customer Storage Adoption by Sector
Base Scenario, Nameplate MW in 2045
Total: 97 MW



Customer Wind Adoption by Sector
Base Scenario, Nameplate MW in 2045
Total: 0.5 MW



Customer storage and customer wind load impacts are minimal.

- Storage: 2 GWh annual energy, -3 MW at summer peak, -9 MW at winter peak
- Wind: <1 GWh, ~0 MW at summer and winter peak

Questions?

Next Steps for Avista

- DER Potential Assessment
  - Engage with identified large fleet customers directly and refine transportation electrification load forecast
  - Include findings from the study in the load forecast
  - Include results in the 2025-2026 System Assessment study plan
- Distribution Planning Advisory Group
  - Collect input from stakeholders on future topics
    - Provide suggestions to DistributionPlanning@avistacorp.com
  - Next meeting scheduled on July 24

Thank You.

AEG
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