



CITY OF HEALDSBURG CITY COUNCIL AGENDA STAFF REPORT

MEETING DATE: June 2, 2025

SUBJECT: Healdsburg Electrification Energy and Demand Forecasting 2025-2045

PREPARED BY: Terra Sampson, Utility Conservation Analyst

STRATEGIC INITIATIVE(S):

Pursue Initiatives that Promote Environmental Stewardship
Maintain and Improve Infrastructure and Facilities

RECOMMENDED ACTION(S):

1. Receive an informational report on the long-range energy and demand forecast to estimate future electricity consumption demands resulting from adoption rates of building and transportation electrification, and to inform the amount of new energy sources and system capacity improvements required.
 2. Adopt a resolution accepting the "Most Likely" scenario forecast, with a planning margin, from the community-wide energy and demand forecasting and directing the Utility Director to bring forward additional renewable and zero-carbon resources for City Council consideration to meet State requirements.
-

COMMUNITY ENGAGEMENT/OUTREACH:

The development of a long-range electric energy and demand forecast was included in the Climate Mobilization Strategy (CMS), which involved a significant amount of outreach. In development of a long-range electric energy and demand forecast, staff held a public workshop in January 2025, to discuss initial results and was also invited to a Climate Action Healdsburg meeting in March 2025, to present initial results. Additionally, staff implemented an online survey in March 2025, to gather more public feedback on electrification adoption for incorporation into the final energy forecast.

BACKGROUND:

In October 2023, the City Council adopted the CMS. The adopted CMS includes measure BE-1.1 to develop a long-range electric energy and demand forecast. This forecast is needed to guide the City in purchasing new renewable energy resources and the reconstruction of the City's electric system ahead of the higher electric demands created by building and transportation electrification.

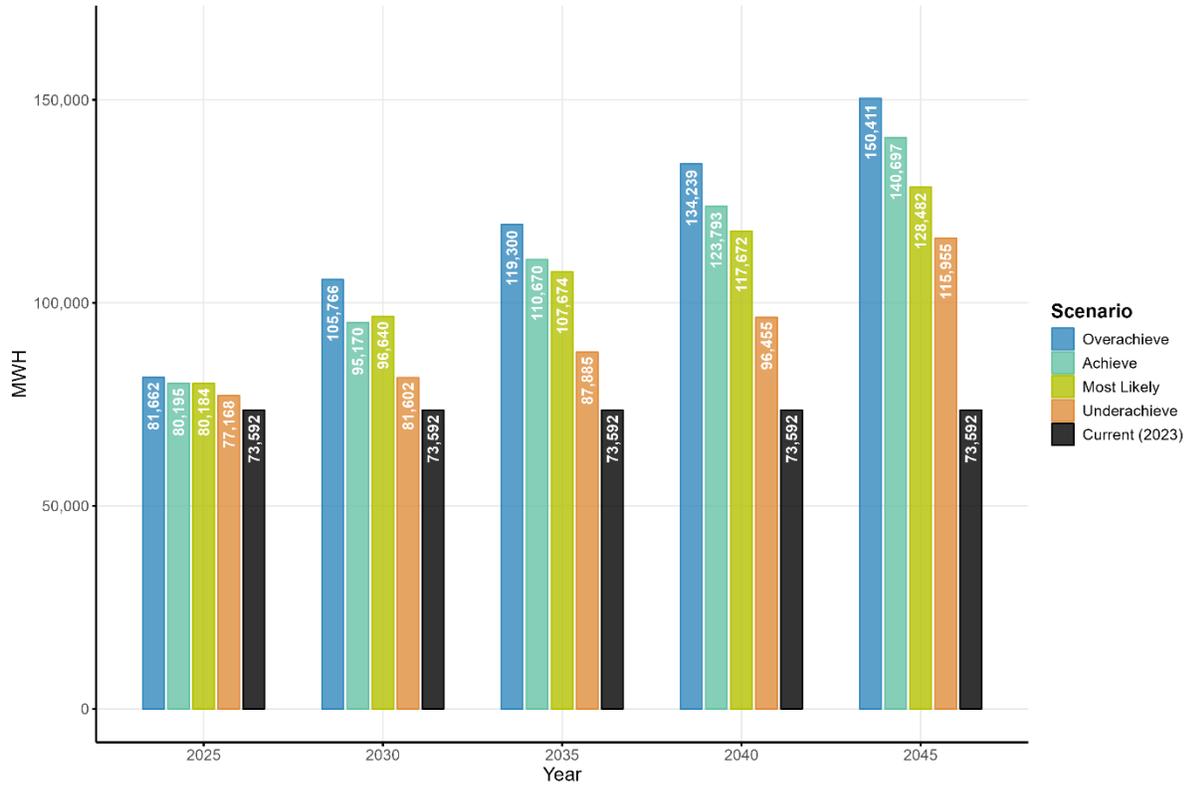
In February 2024, the City Council approved a Professional Service Agreement (PSA) with Rincon Consultants, Inc. (Rincon) to assist in the development of long-term energy and demand forecasts. Rincon and staff completed initial scenario forecasts and presented those results during a public workshop held in January 2025. In March 2025, the City Council approved an expanded scope with Rincon to further develop the scenario forecasts. In the development of the initial scenario forecasts, staff identified key areas influencing forecasted electricity consumption and peak demands needing further analysis and refinement. These areas included assumptions about what time of day and how quickly electric vehicles (EVs) will charge, impact of customer-owned solar, refinement of daily electricity consumption curves, and other improvements to the model's assumptions. These adjustments were critical to creating accurate scenario forecasts to inform significant near-term and long-term financial decisions. Rincon and staff worked together on these updates and are now presenting the final energy and demand forecasting report and results.

The scenario forecasts are heavily dependent upon EV and building electrification adoption rates. Therefore, variations in adoption rates can cause a wide range in forecasted electricity consumption and peak demands. The "Most Likely" scenario takes into consideration community survey responses, current adoption trends and rebate program participation, CMS targets, and expected State regulations. The "Most Likely" forecast indicates that Healdsburg's annual net electricity consumption could increase by 75% (nearly double) by 2045.

DISCUSSION/ANALYSIS:

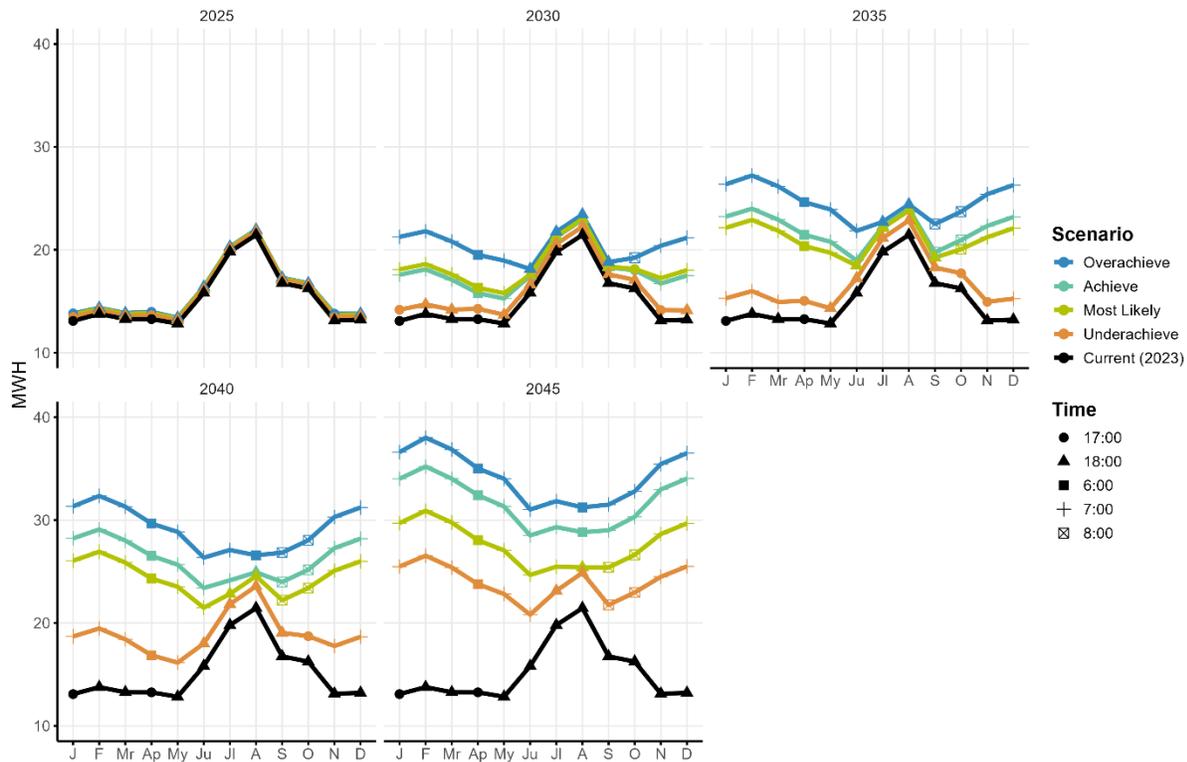
The Healdsburg Electric Department worked with Rincon to develop a 2023 baseline model of hourly electricity consumption. Scenarios with varying levels of electrification out to 2045 were then developed and applied to the baseline model, including scenarios for "Underachieve" the CMS, "Achieve" the CMS, "Overachieve" the CMS, and "Most Likely".

The chart below shows the range of future annual net electricity consumption under the different scenarios, with a 75% increase in annual net electricity consumption in 2045 in the Most Likely scenario.



Annual Net Electricity Consumption (MWh) For Each Year of Each Modeled Scenario. *The above figure depicts the expected net electricity consumption of building and EVs in megawatt hours (MWh) for each year of each scenario with the inclusion of solar. Scenarios are ordered in highest achieving to lowest and the grouped bars for each year are in the same order as described in the legend. The exact value of each individual bar is described in the graph as white text.*

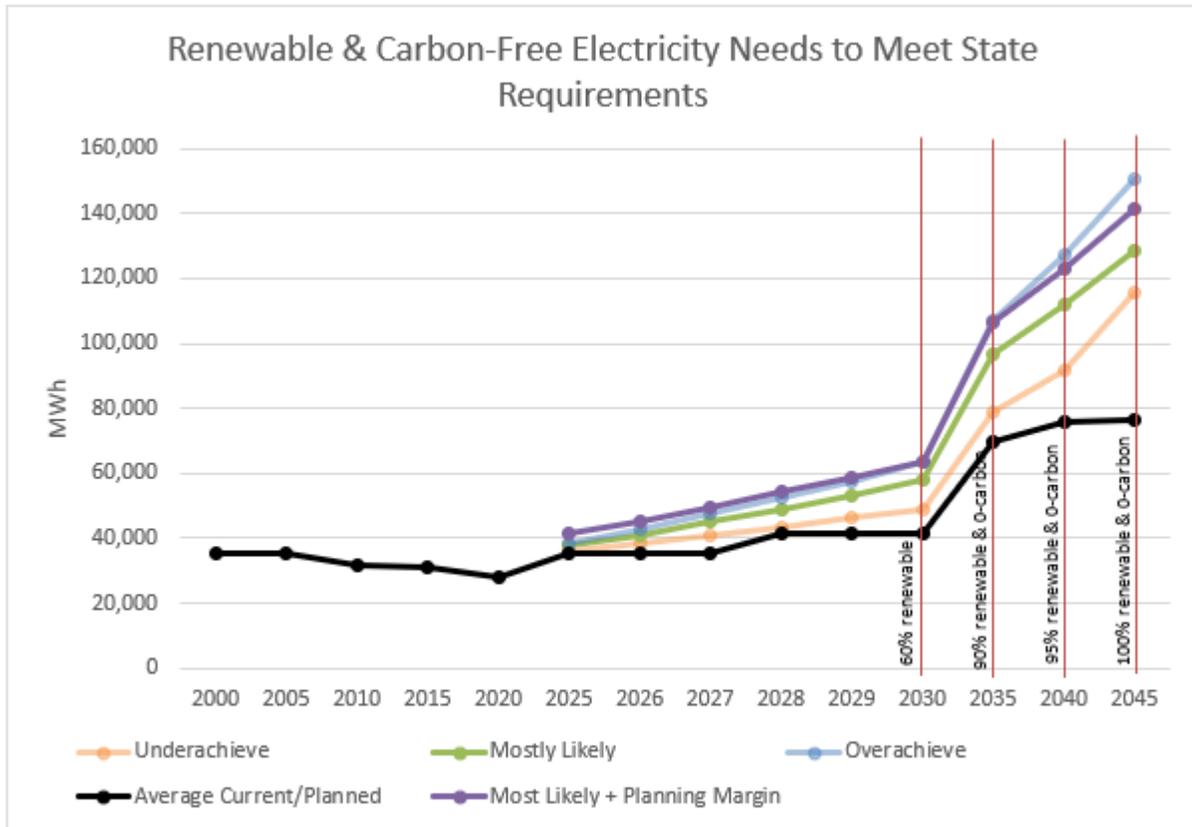
The model also analyzed the hours with the highest consumption to understand potential changes and increases in peak demands. The chart below shows how peak demands might change in the future, depending on heat pump adoption and EV charging behaviors. The chart is based on EV charging using a “delayed – finish by departure” (i.e., have the charging completed by a specific time, typically the early morning) charging behavior to avoid evening peak demands. Charging behavior can be influenced by time of use rates, the new Home Energy Load Management Program, and outreach and education. A key insight from the model development is that EV charging will drive future peak demands.



Monthly Net Peak Demand (MWh) For Each Year of Each Modeled Scenario. *The above figure depicts the expected monthly net peak demand in megawatt hours (MWh) for the maximum hour net electricity consumption for buildings and EVs across each year for each scenario with solar inclusion. The legend indicates the symbol to represent the time of day peak demand occurred in a given month.*

The State’s Renewable Portfolio Standard (RPS) Program and the Clean Energy, Jobs, and Affordability Act of 2022 set increasing renewable and zero-carbon requirements for electricity provided by electric utilities, such as Healdsburg Electric Department. The RPS requirement for 2030 is 60% renewable and the clean energy requirement for 2045 is 100% renewable and zero-carbon. As both the percentage requirement and electricity consumption increase, Healdsburg Electric must procure new renewable and zero-carbon resources.

The chart below illustrates the potential gap in renewable and zero-carbon resources to meet State requirements. For context, to meet the 2035 requirement of 90% clean energy (60% renewable plus 30% zero-carbon) in the Most Likely scenario, Healdsburg Electric would need an additional 23,000 MWh of solar generation (compared to current contracts), or about 52 acres of solar panels, and an approximately 4,000 MWh increase in average large hydroelectric generation, in addition to an assumed conversion of 11,000 MWh of the Lodi Energy Center fuel-generated power to green hydrogen already included in the Average Current/Planned line.



Comparison of Modeled Scenarios and Renewable and Zero-Carbon Procurement Needs.

The above figure depicts the annual electricity needed to meet the State requirements under the modeled scenarios in megawatt hours (MWh) and the currently planned procurement of renewable and carbon-free electricity. The gap demonstrates the renewable and zero-carbon resources that will need to be procured to meet the State requirements under the anticipated future conditions. Note that the chart only shows eligible renewables to 2030, and beginning in 2035 zero-carbon resources are also included.

This Energy and Demand Scenario Forecasting project is intended to assist Healdsburg Electric Department in planning for the future. Healdsburg Electric intends to use the findings to procure sufficient new energy resources, invest in infrastructure upgrades to accommodate the increasing electricity demands, and implement programs to help reduce grid impacts from electrification, such as the new Home Energy Load Management Program.

More detailed information about the scenario forecast development, methodology, results, and findings are included in the Energy and Demand Forecasting Report and Appendices, attached. Staff will rely on these scenario forecasts to determine when and how much renewable energy to purchase and how much capital to invest in the City’s electric distribution system. Therefore, acceptance of these scenario forecasts becomes critical due to the significant financial commitment required to prepare for this higher electricity consumption.

Staff recommend accepting the “Most Likely” scenario plus a planning margin of 10% for annual electricity consumption to account for system losses and other aspects that were not included in the model or may be under-forecasted and a planning margin of 20% for peak

demands to account for instantaneous peak demands and State-required margins. City staff will work with Northern California Power Association (NCPA) to identify potential new renewable energy contracts to fill the gaps identified in the “Most Likely” scenario and bring new renewable and zero-carbon energy contracts to Council for consideration. Results from the “Most Likely” scenario will also be used to plan for necessary infrastructure upgrades, strategic program offerings (such as EV charging behaviors and leveraging battery storage), and incorporation into the next electric rates study for 2027.

ENVIRONMENTAL STEWARDSHIP:

Measure BE-1 in the CMS sets the goal to procure 85% of electricity from renewable and zero-carbon sources by 2030 (60% renewable consistent with the RPS requirement plus 15% zero carbon to achieve the CMS target) and 100% renewable and carbon-free no later than 2045. If achieved Measure BE-1 is expected to reduce GHG emissions by 2,171 metric tons of carbon dioxide equivalent (MT CO₂e) in 2030 assuming modest adoption rates of building and transportation electrification. The long-range energy and demand forecasting helps inform the City as to how much renewable and zero-carbon energy is necessary to achieve this CMS measure.

ALTERNATIVES:

As an alternative, the City Council could choose to accept a different scenario presented in the Forecasting Report or direct staff to make modifications to the electrification adoption rates in the “Most Likely” scenario. Staff have been provided with the modeling tool and can make minor adjustments to the scenario inputs (such as the number of heat pumps installed or EVs added), if desired. However, adjustments that are more significant than changing the input numbers outlined in Appendix A, may require additional scope with the consultant.

FISCAL IMPACT:

The not-to-exceed amount of \$114,713 for this forecasting project was covered by the Electric Operations fund (Fund 540). Acceptance of the Forecasting Report and directing staff to begin planning for the “Most Likely” scenario with a planning margin does not have a fiscal impact at this time. Staff will bring forward new energy contracts for City Council consideration and present the potential contract costs at that time. Any new program offerings or substantial updates to existing programs that impact the authorized program budget will be presented to City Council along with an explanation of the funding source for the program. New infrastructure projects and improvements will be considered during the next electric rate study for 2027. While costs to meet electric system needs with increased electrification will be substantial, the additional revenue from increased electricity sales will help support these future projects.

ENVIRONMENTAL ANALYSIS:

An Energy and Demand Scenario Forecast is not subject to the provisions of the California Environmental Quality Act (CEQA) because an Energy and Demand Scenario Forecast is not a project, since it will not have a direct or reasonably foreseeable indirect impact on the environment.

ATTACHMENT(S):

Resolution

Healdsburg Energy and Demand Forecasting Report
Appendix A Model Inputs by Scenario
Appendix B Supporting Data for Scenario Development
Appendix C Community Electrification Survey

City of Healdsburg Climate Mobilization Strategy

Energy and Demand Scenarios Model

June 2, 2025



Recommended Actions

- Receive an informational report on the long-range energy and demand forecast to estimate future electricity consumption and peak demands
- Accept the “Most Likely” scenario forecast, with a planning margin, from the community-wide energy and demand forecasting
- Direct the Utility Director to bring forward additional renewable and zero-carbon resources for City Council consideration to meet increasing State requirements

Electrification Drivers: Healdsburg

Procure 85%
renewable and
carbon-free electricity
by 2030

Achieve 30% - 40%
zero-emission vehicle
adoption by 2030

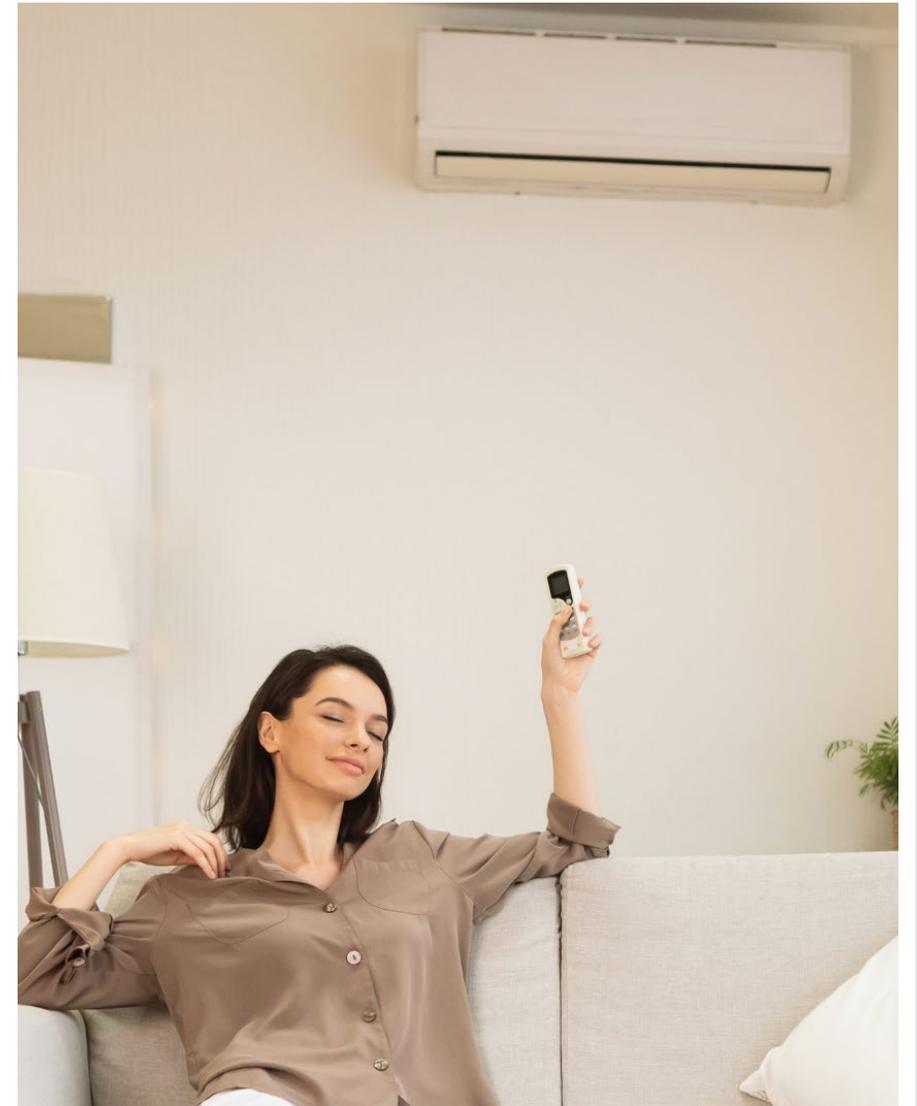
CMS Targets

Decarbonize 5% - 8%
of buildings by 2030

Achieve 100%
renewable and
carbon-free electricity
by 2045

Electrification Drivers: Market Trends

- Heat pump HVACs outpace gas furnace sales starting in 2021
- Electric water heaters have increased from 6% to 15% of market share since 2009
- Electric vehicle sales in California have tripled since 2020



How does Healdsburg Electric plan for Increased Electricity Demand?

Identify future
potential
consumption and
peak demand

- Develop energy and demand model

Identify impacts to
demand curves due
to electrification

- Model various electrification scenarios

Procure new energy
resources to meet
expected demands

- Use model results to guide energy procurement

Plan for and deploy
resources to
account for
consumption and
peak demand
trends

- Identify policies/ programs to limit negative impacts on grid

Energy and Demand Model

Intent & Approach

Intent

Develop a dynamic long-range energy and demand model that Healdsburg Electric can use to estimate electricity consumption and peak demand through 2045 under various electrification scenarios

Approach

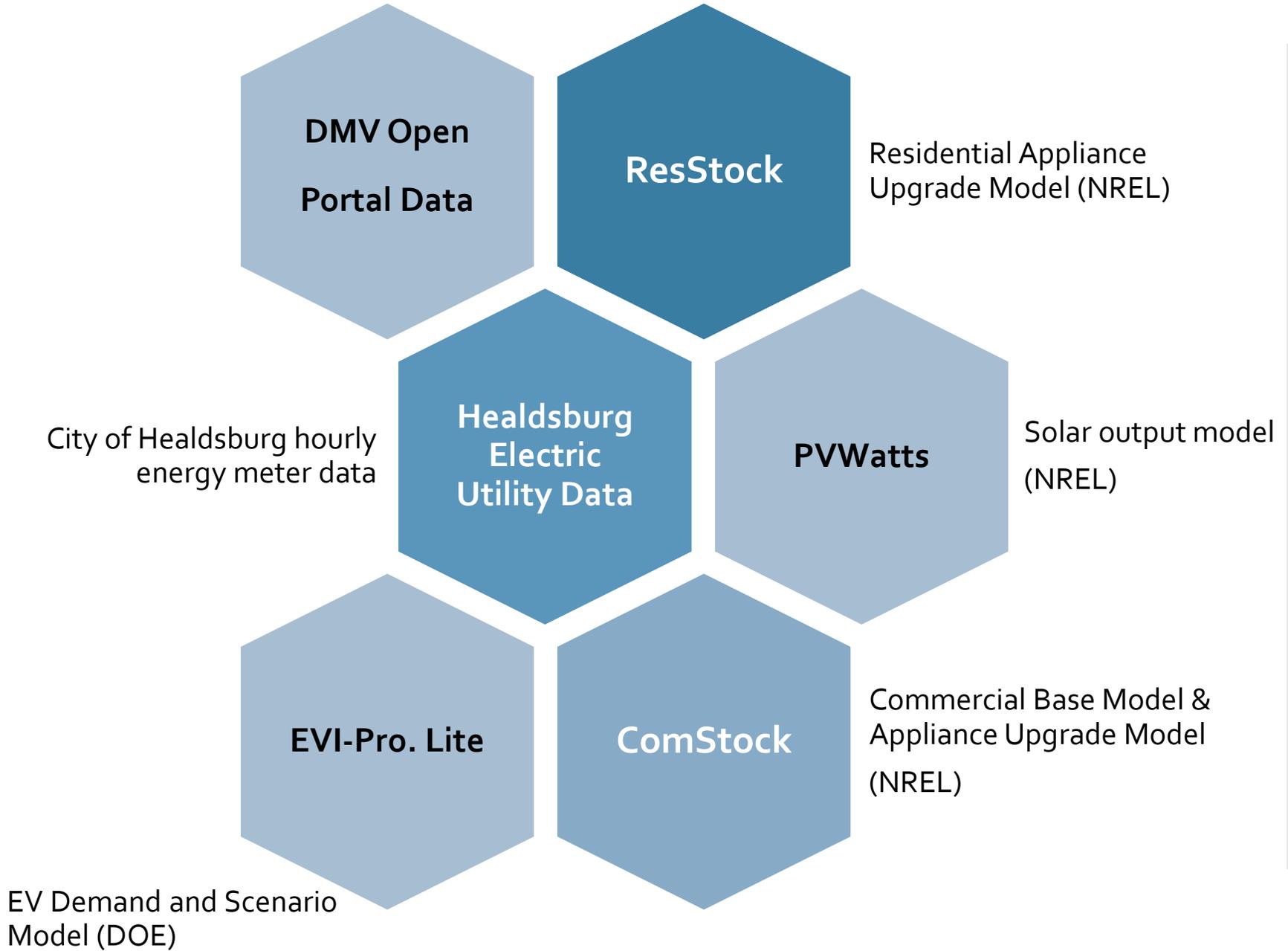
Model uses various data sources to model city-wide baseline electricity consumption and forecast future consumption and peak demand

Process

1. Establish baseline hourly city-wide electricity consumption curve
2. Built in variable input parameters that adjust the baseline electricity curve
3. Develop scenarios to forecast consumption and peak demand over time
4. Determine hourly, monthly and annual consumption and peak demands

Energy and Demand Model

Development: Data Sources



Energy and Demand Model

Development: Scenarios

- Scenarios developed to demonstrate future electricity consumption and peak demands under different conditions
- Reflect the anticipated energy and demand under different levels of CMS implementation
- Scenarios modeled:

Current	2023 baseline
Underachieve CMS	Partial progress toward CMS targets
Achieve CMS	Full achievement of CMS electrification targets
Overachieve CMS	Complete building and vehicle electrification by 2045
Most Likely	A realistic scenario based on current and expected adoption trends

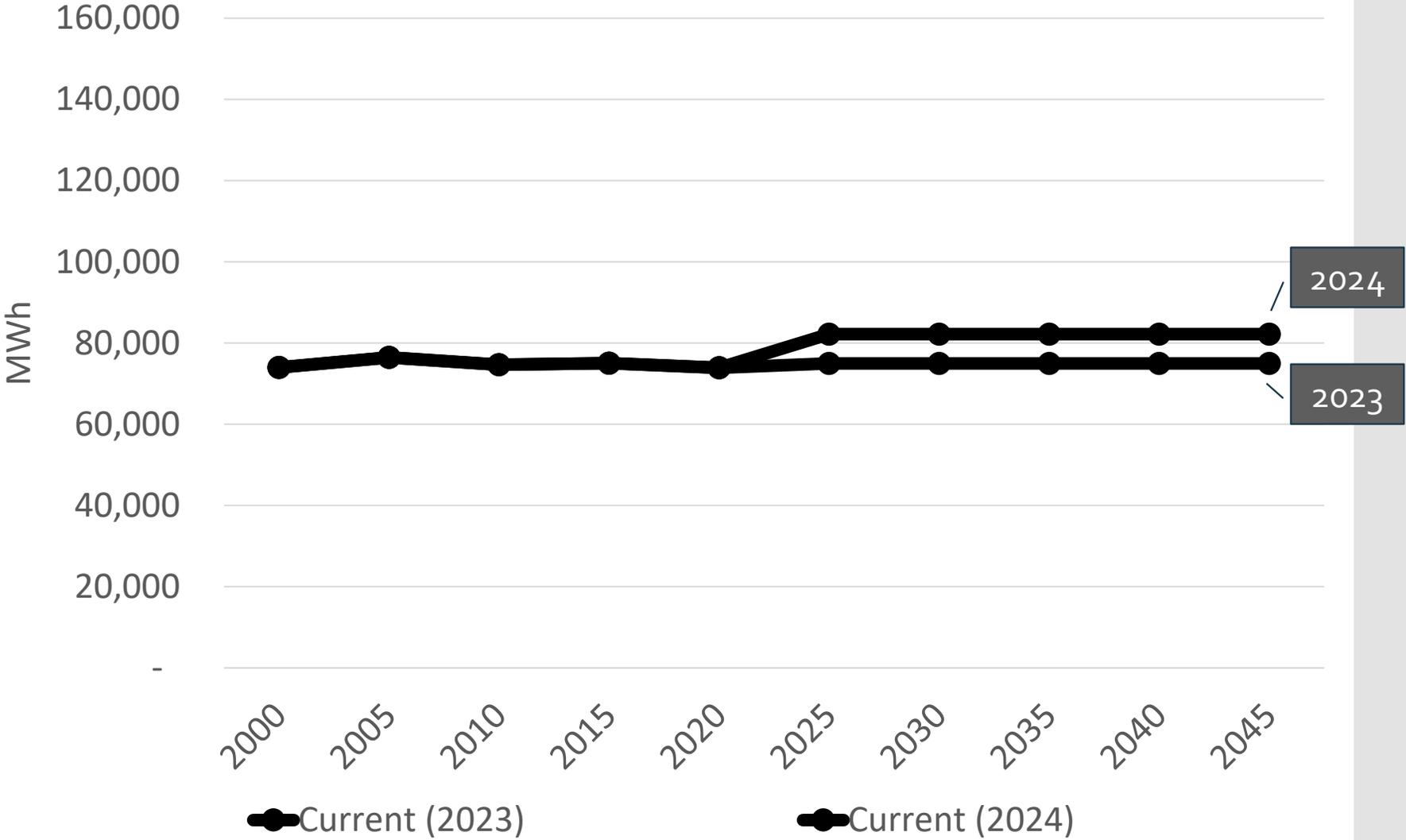
The Grid: Consumption vs. Peak Demand

Electricity usage impacts the grid in two ways:

- Electricity consumption (bulk generation)
- Peak demand (transmission and distribution) = maximum electricity demand at any given moment

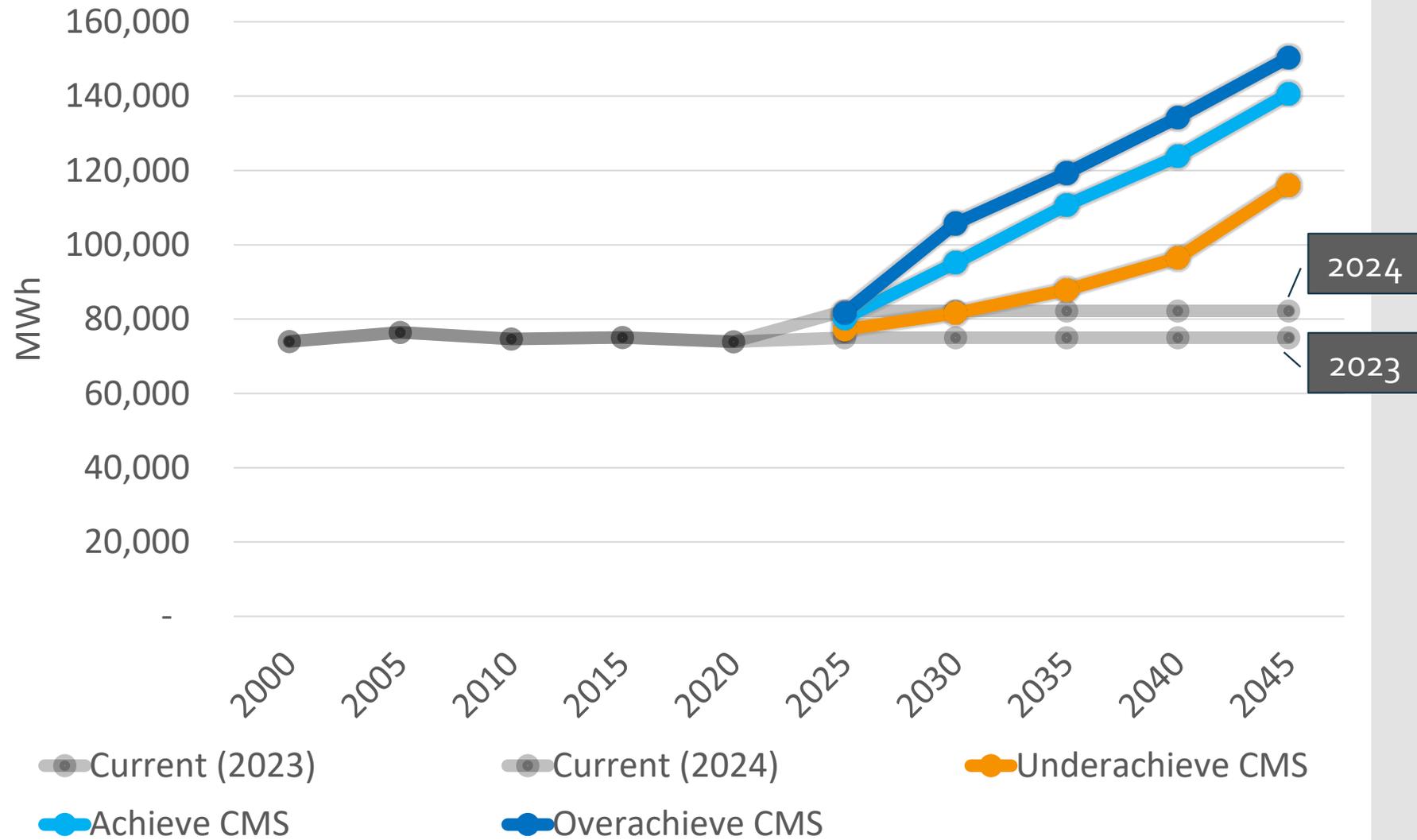
Energy and Demand Model

*Results:
Annual Electricity Consumption*



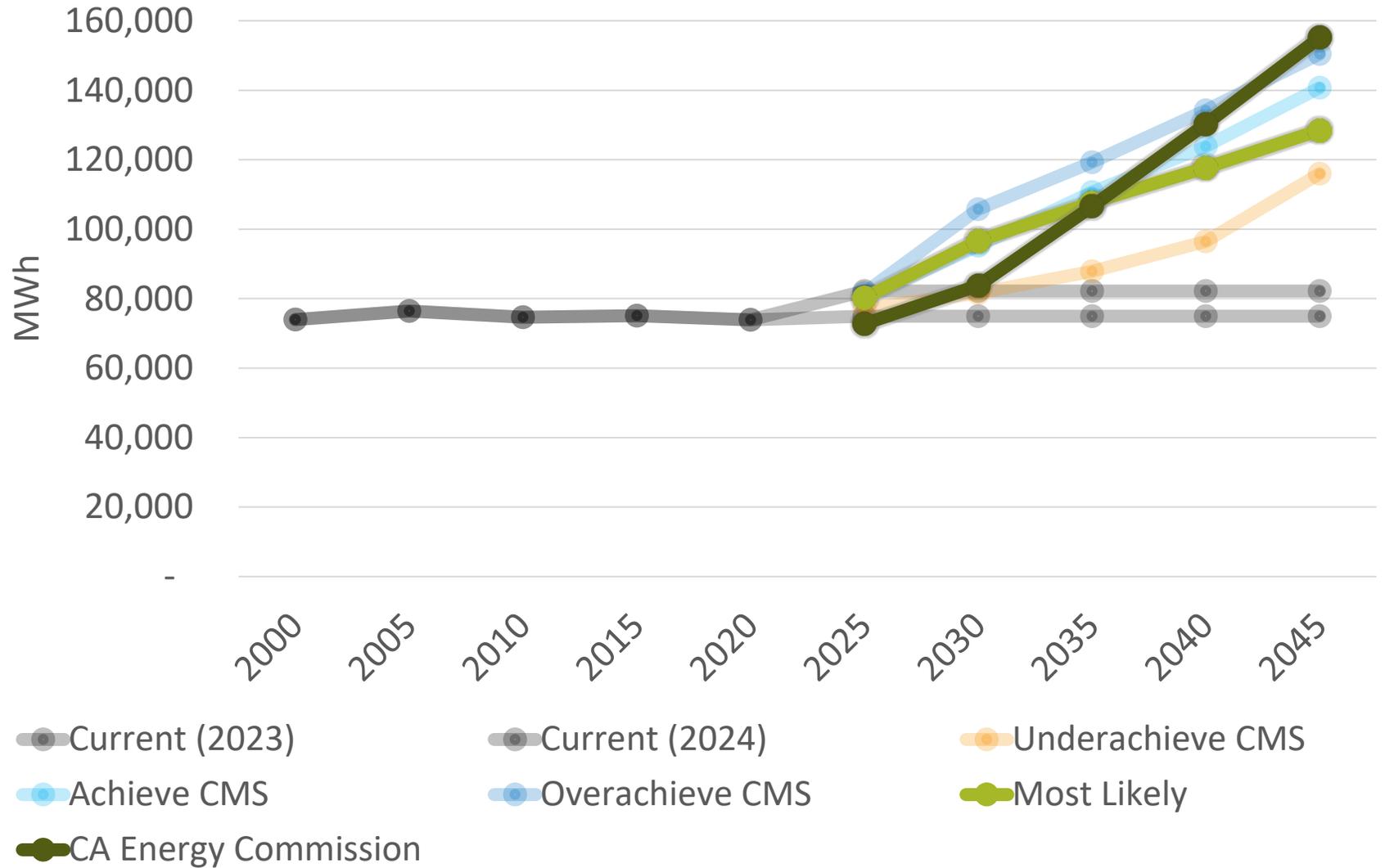
Energy and Demand Model

*Results:
Annual Electricity Consumption*



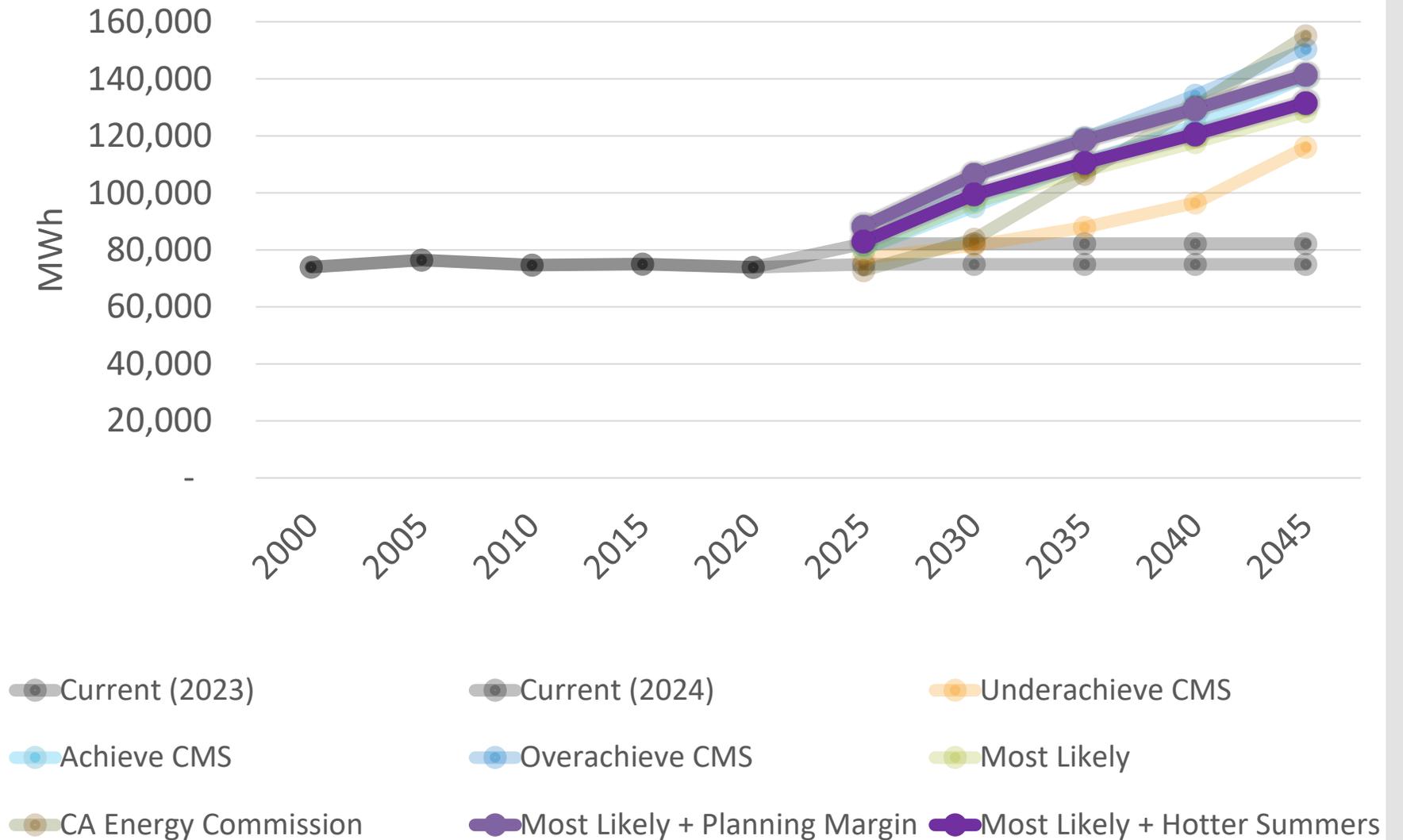
Energy and Demand Model

*Results:
Annual Electricity Consumption*



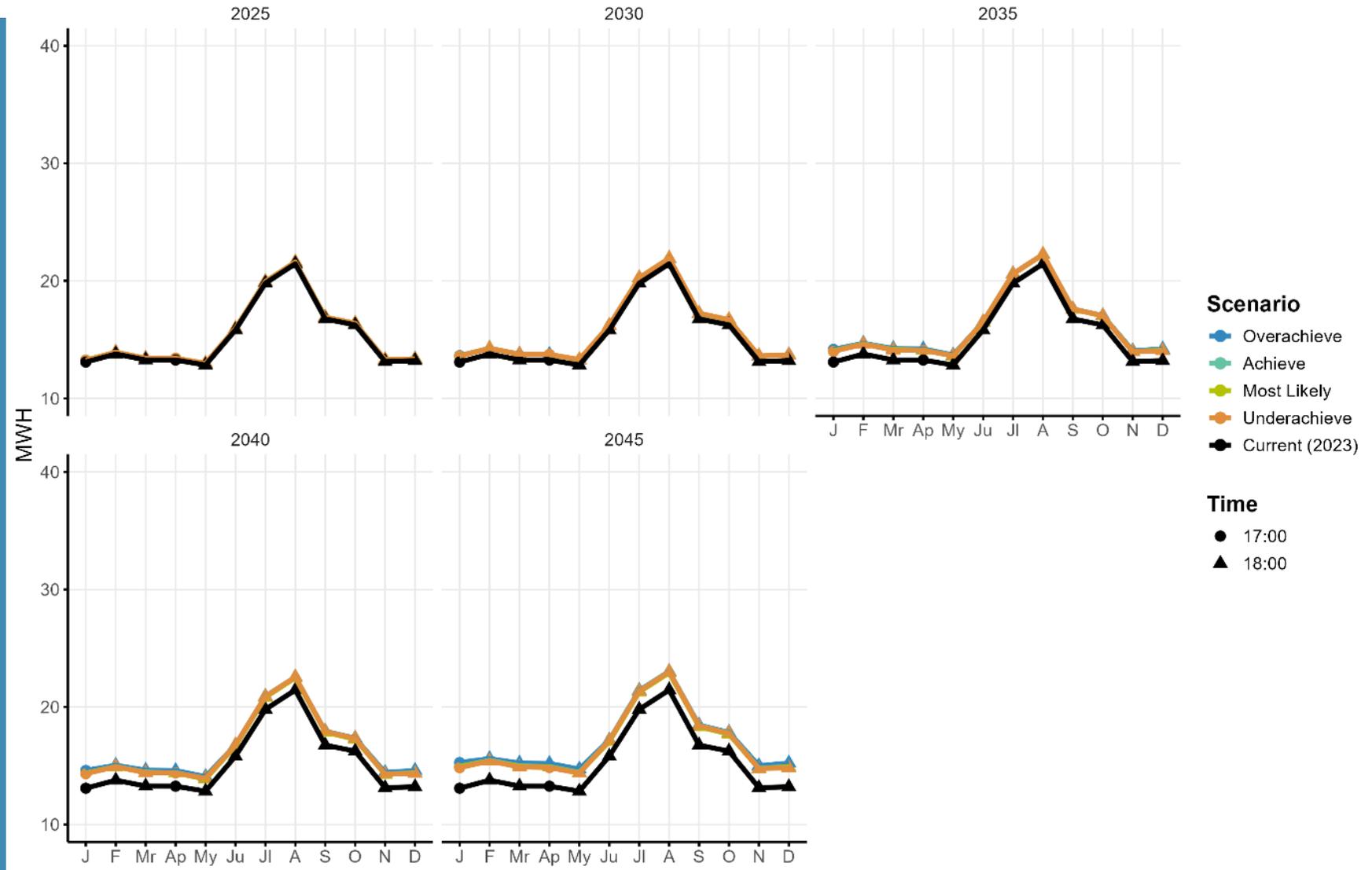
Energy and Demand Model

Results: Annual Electricity Consumption



Energy and Demand Model

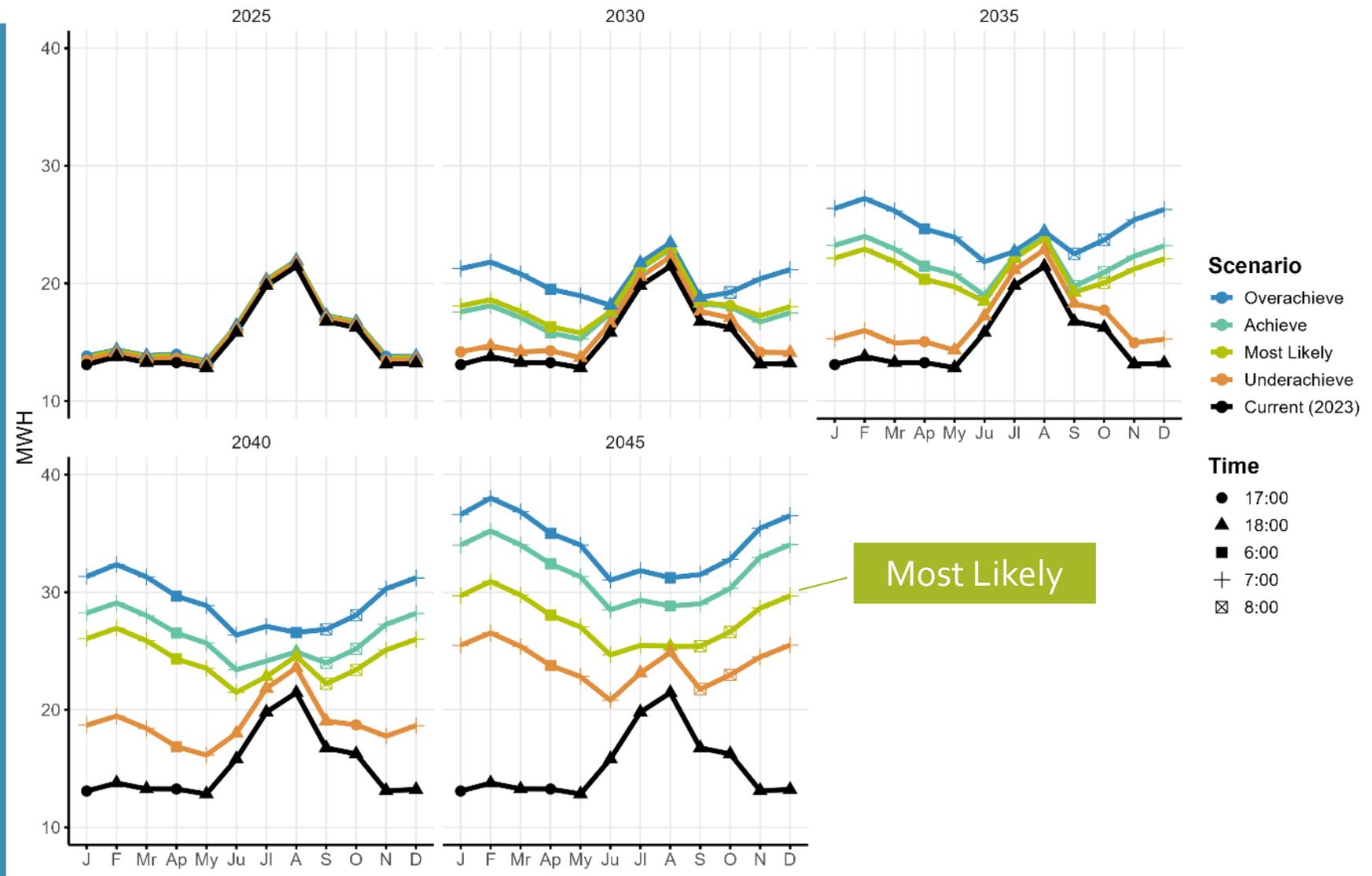
Results: Peak Demand



Monthly Building Peak Demand (MWh) For Each Year of Each Modeled Scenario

Energy and Demand Model

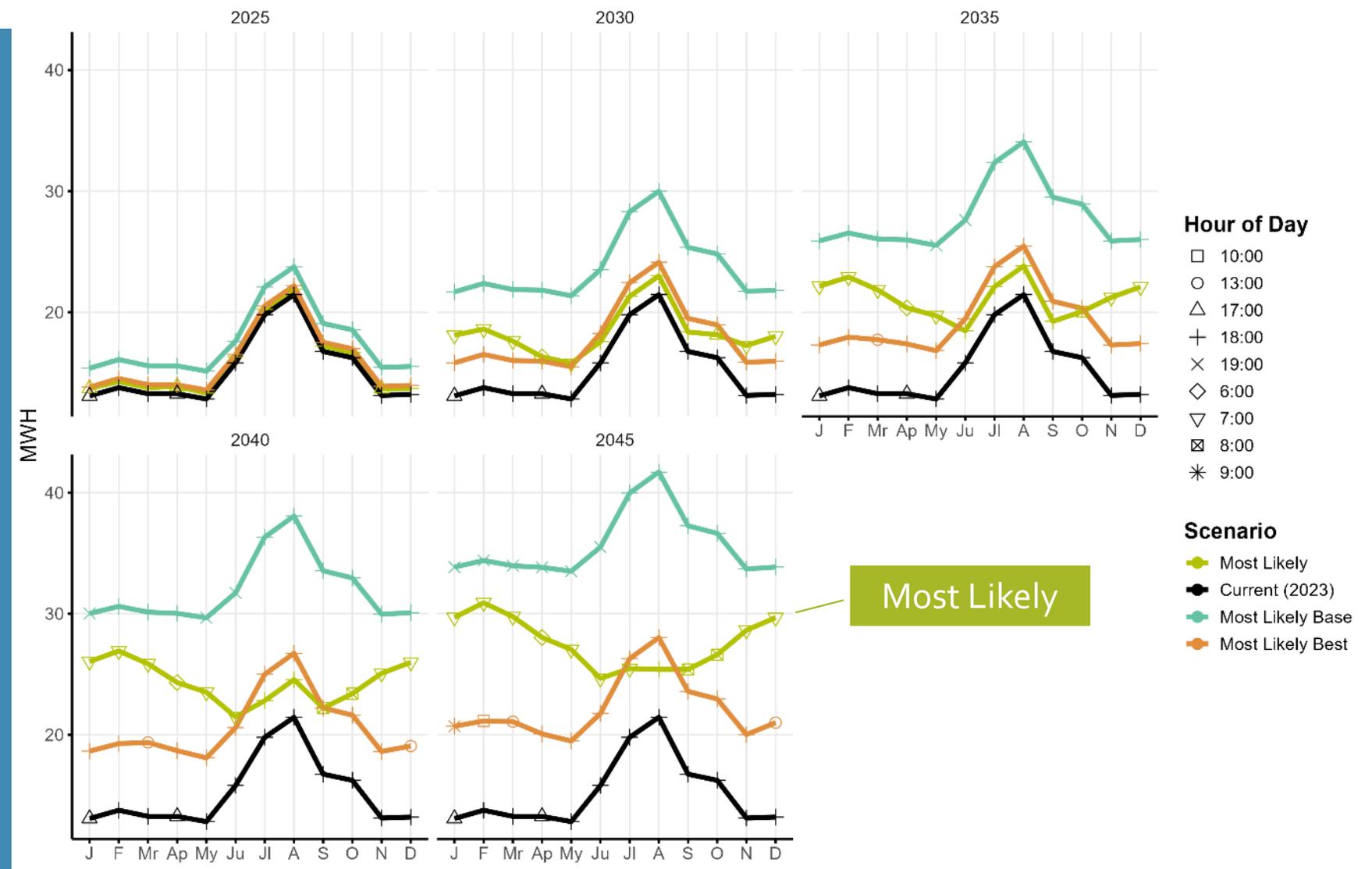
Results:
Peak Demand



Monthly Net Peak Demand (MWh) For Each Year of Each Modeled Scenario

Energy and Demand Model

*Results:
Peak Demand
with EV Charging
Regimes*



Monthly Net Peak Demand (MWh) for Each Year for the Most Likely Scenario Under Varying EV Charging Regimes

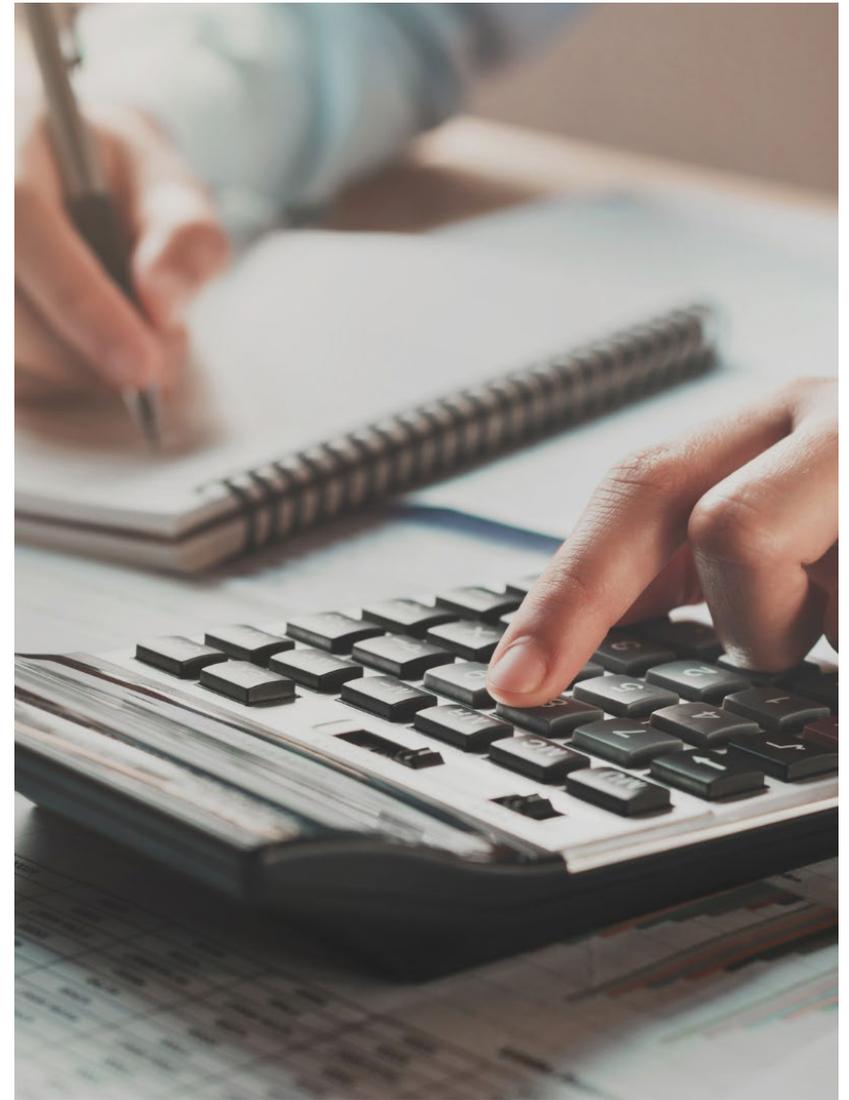
Energy and Demand Model *Results*

- **Forecasted Electricity Consumption and Peak Demand**
 - Significant increases driven by EV charging needs
 - By 2045, building electrification could increase electricity consumption by 17-21%
 - By 2045, EVs could contribute an ***additional*** 55-98% increase in annual electricity consumption
 - By 2045, the Most Likely scenario expects a 75% increase in annual net electricity consumption and a 44% increase in net peak demand
- **Key Insights**
 - Building electrification impact is smaller than EVs due to efficiency gains and on-site solar offset
 - Best practices for EV charging behavior are critical

Energy and Demand Model

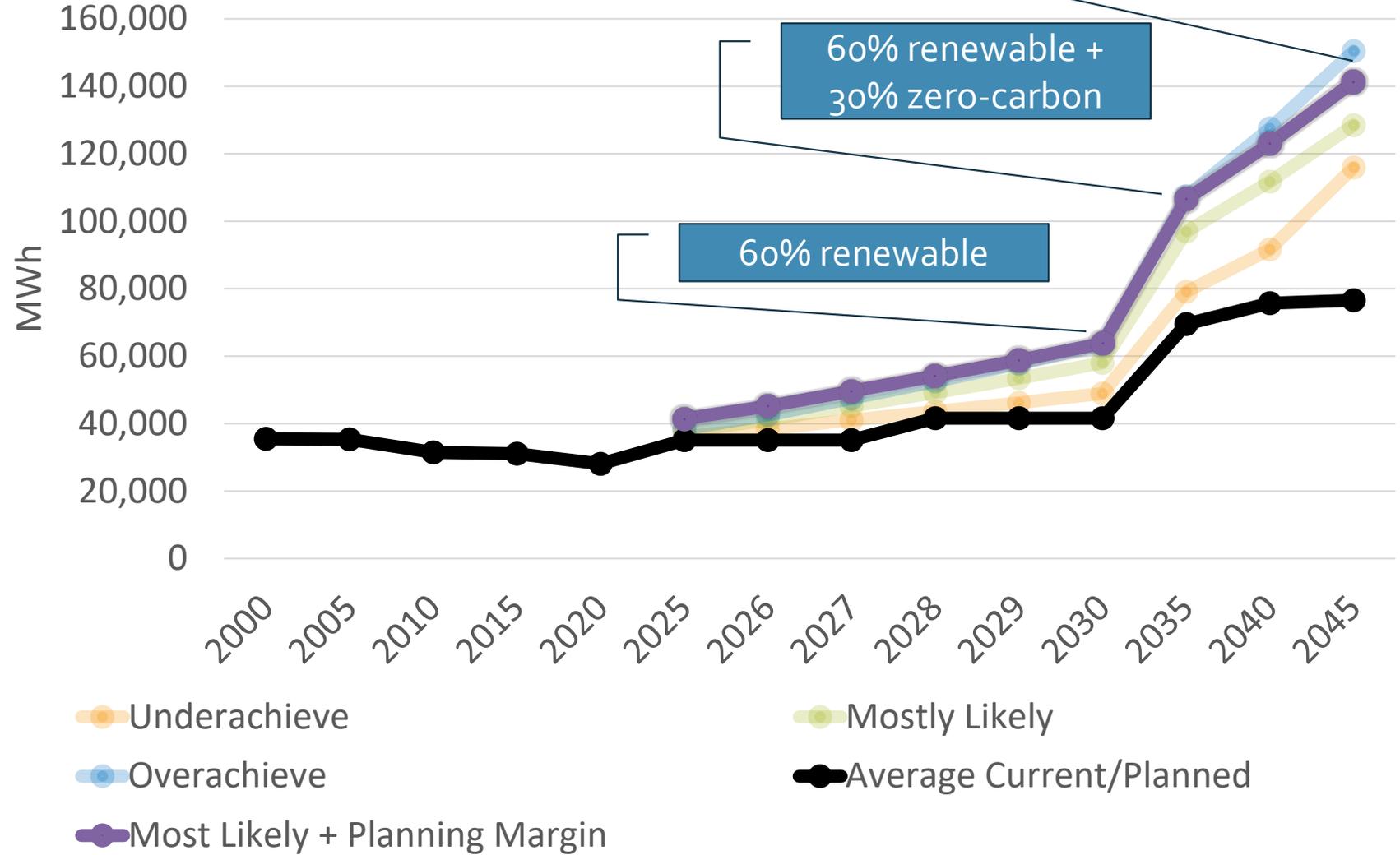
Adjustments

- Staff recommends a 10% planning margin be added to the Most Likely scenario
 - System losses
 - Hotter summers
 - Other uncertainties
- Margin will be re-evaluated in the next model update



Renewable & Carbon-Free Electricity Needs to Meet State Requirements

Results



With increased electrification, more renewable generation is needed to meet the State-required percentages for renewable and carbon-free electricity.

(Chart shows only eligible renewables until 2030, then includes other carbon-free sources - such as large hydroelectric and green hydrogen - out to 2045.)

Renewable & Carbon-Free Electricity Needs

Most Likely Scenario Results

- 2027: 52% Renewable
 - Need 10,000-15,000 MWh additional renewables = 23+ acres of solar
 - Likely use historic RECs to meet State compliance
- 2030: 60% Renewable
 - Need 16,000-22,000 MWh additional renewables = 37+ acres of solar
 - New solar project in Southern California to be completed 2028
- 2035: 60% Renewable + 30% Carbon-Free
 - Need 23,000-29,000 MWh of additional renewables = 52+ acres of solar
 - Need Lodi Energy Center at least 60% converted to green hydrogen
 - Need a wet year with 4,000 MWh (~30%) more than average hydroelectric

Potential Cost Implications

Generation

- ~\$650,000-\$750,000 per acre of solar installation
- Battery storage is critical paired with new solar installations
- There is increased cost associated with new renewable and carbon-free energy



Potential Cost Implications

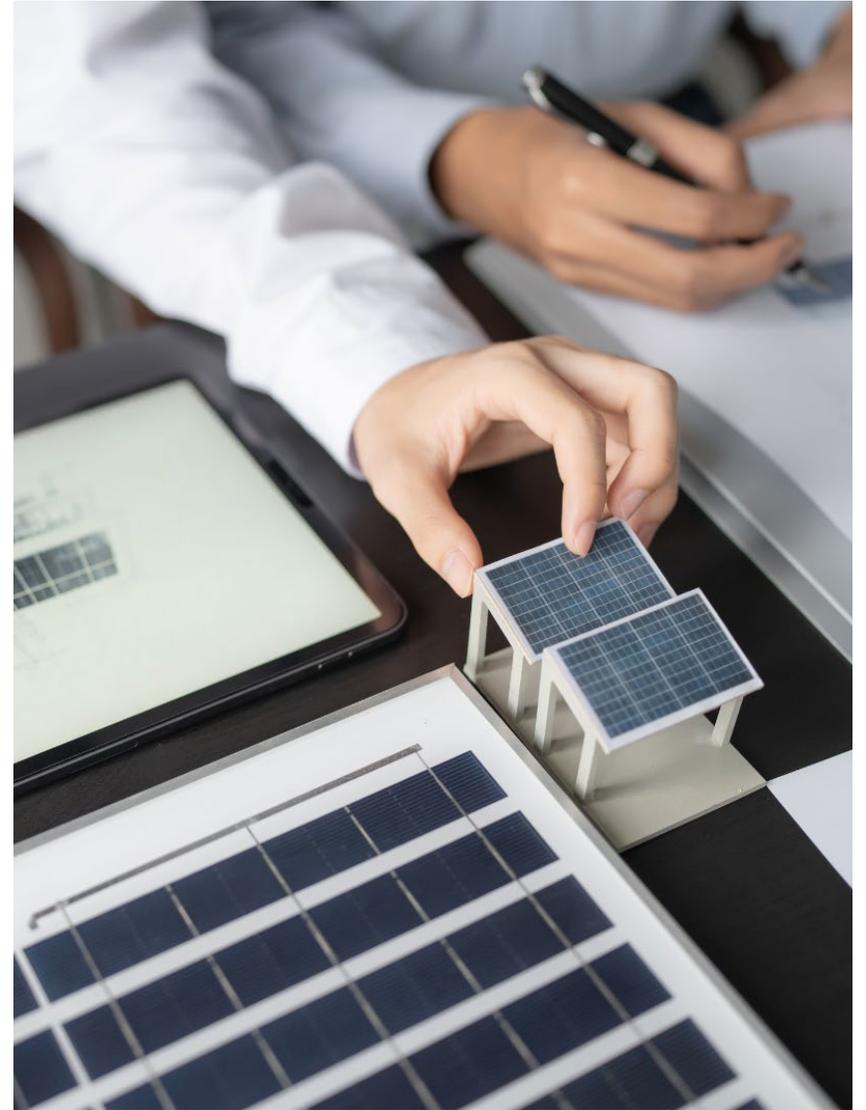
Infrastructure

- Replace / expand transformers at Badger Substation
 - ~\$10-20 million
- Increase wire and cable sizes
 - ~\$1-10 million
- Increase local transformers (green boxes)
 - ~\$10-15 million



Potential Cost Implications

- Increased electricity consumption will generate additional revenue to help offset some of these increased operating costs
- To lessen rate impacts, costs will need to be phased in over time, predicted by long-range energy and peak demand forecasts, and considered in the next electric rate study



Next Steps

- Healdsburg work with NCPA to identify desirable renewable energy contracts to fill State requirements gap and bring to Council for consideration
- Healdsburg Electric identify infrastructure needs and bring to Council for future consideration and incorporation into future rate studies
- Healdsburg Electric continue working on CMS actions to promote electrification while reducing grid impacts
 - Load management for EV charging and air conditioning
 - Variety of EV charging options, especially during the daytime
 - Leverage battery storage
 - Time of use rates and shifting loads to off-peak / daytime
 - Promote efficient electric options

Recommended Actions

- Receive an informational report on the long-range energy and demand forecast to estimate future electricity consumption and peak demands
- Accept the “Most Likely” scenario forecast, with a planning margin, from the community-wide energy and demand forecasting
- Direct the Utility Director to bring forward additional renewable and zero-carbon resources for City Council consideration to meet increasing State requirements

Questions?

Thank you



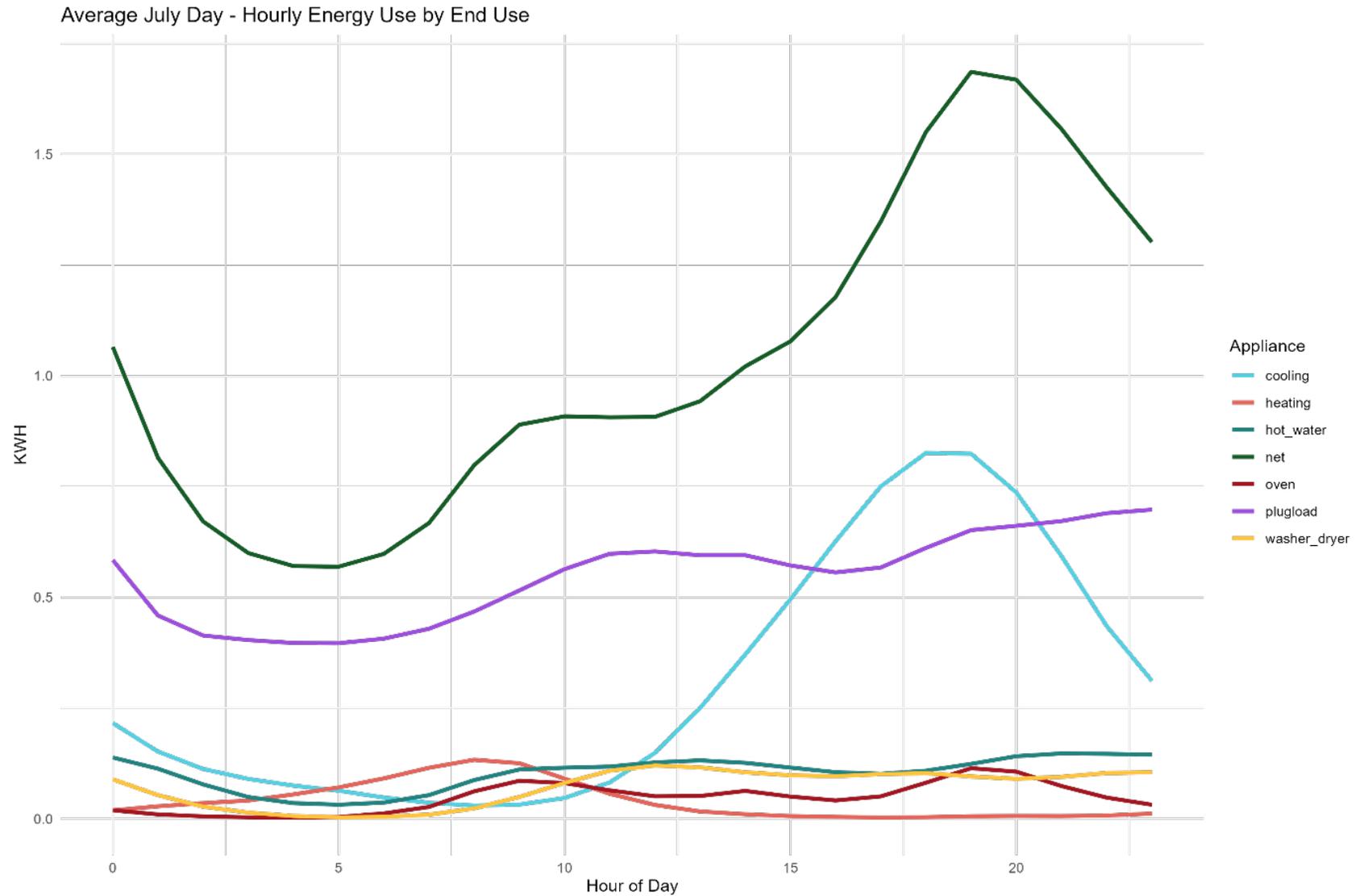
Extra Slides / Background

Scenario Conditions in 2030 and 2045

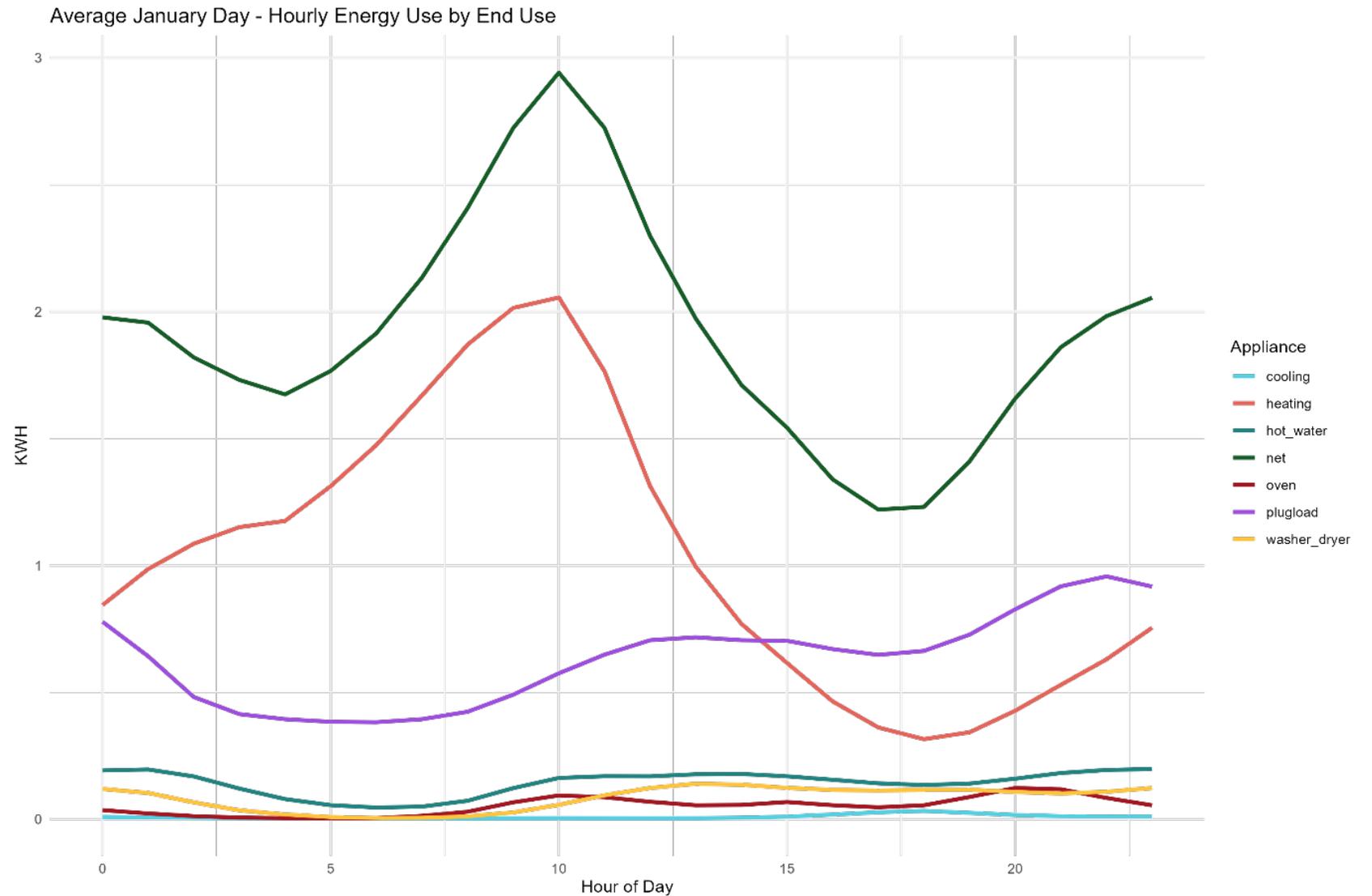
Scenario/Target Year Condition ¹	New Building Electrification	Existing Residential Building Equipment Electrification	Existing Non-residential Building Equipment Electrification	Passenger EV Penetration	Commercial EV Penetration
Underachieve					
2030 Conditions	80%	5%	2%	10%	10%
2045 Conditions ¹	80%	15%	11%	57%	50%
Achieve					
2030 Conditions	95%	8%	5%	30%	40%
2045 Conditions ¹	95%	25%	21%	90%	90%
Overachieve					
2030 Conditions	100%	20%	15%	45%	50%
2045 Conditions ¹	100%	100%	100%	100%	100%
Most Likely					
2030 Conditions	90%	10%	5%	35%	10%
2045 Conditions ¹	90%	60%	45%	75%	60%

¹ The CMS established 2030 goals, but did not include 2045 goals. As such, the conditions post 2030 presented herein are used for scenario forecasting purposes and do not represent CMS goals.

Daily Electricity Demand Curve by Building End-use (kWh) on an Average Summer Day

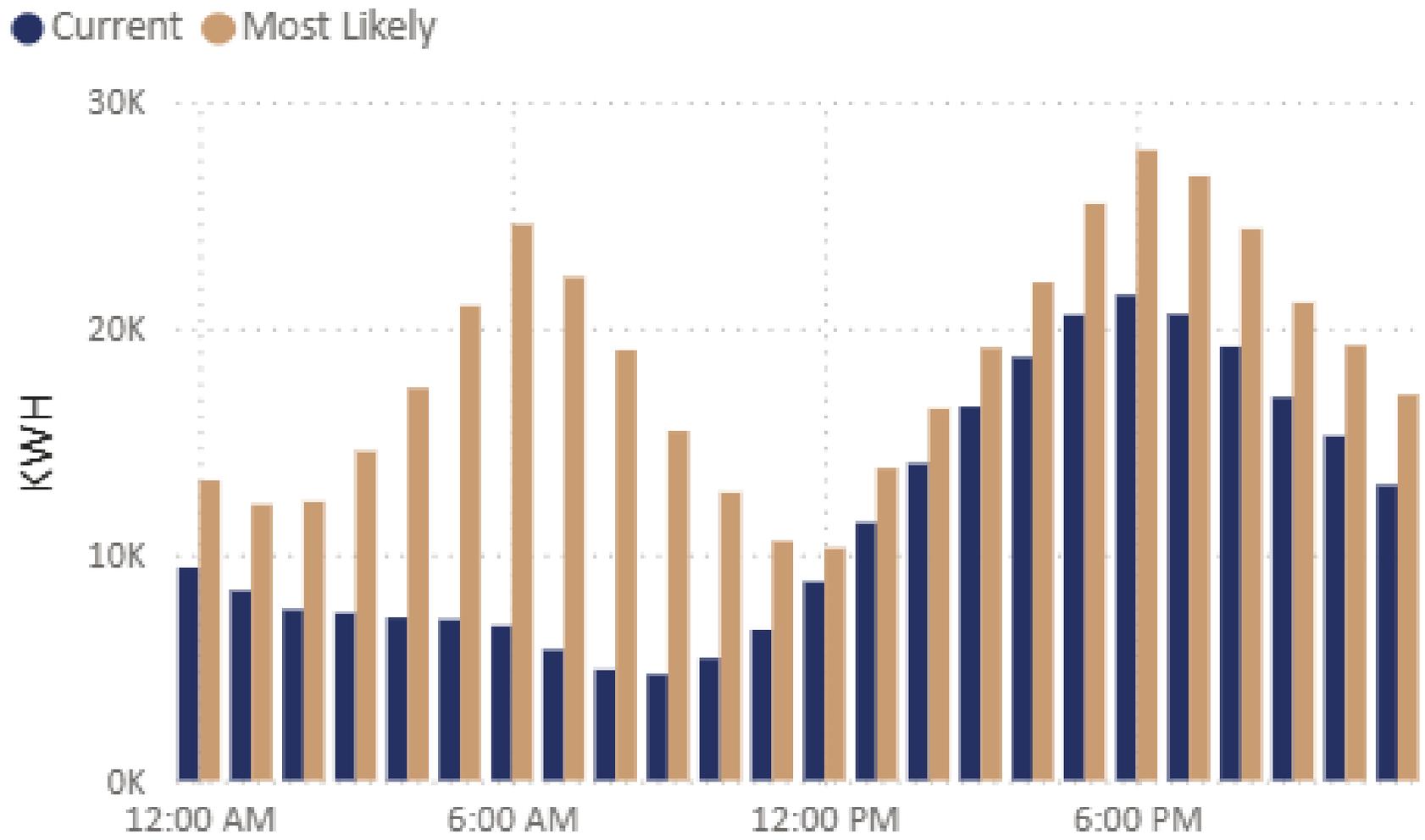


Example of Daily Electricity Demand Curve by Building End-use (kWh) on an Average Winter Day



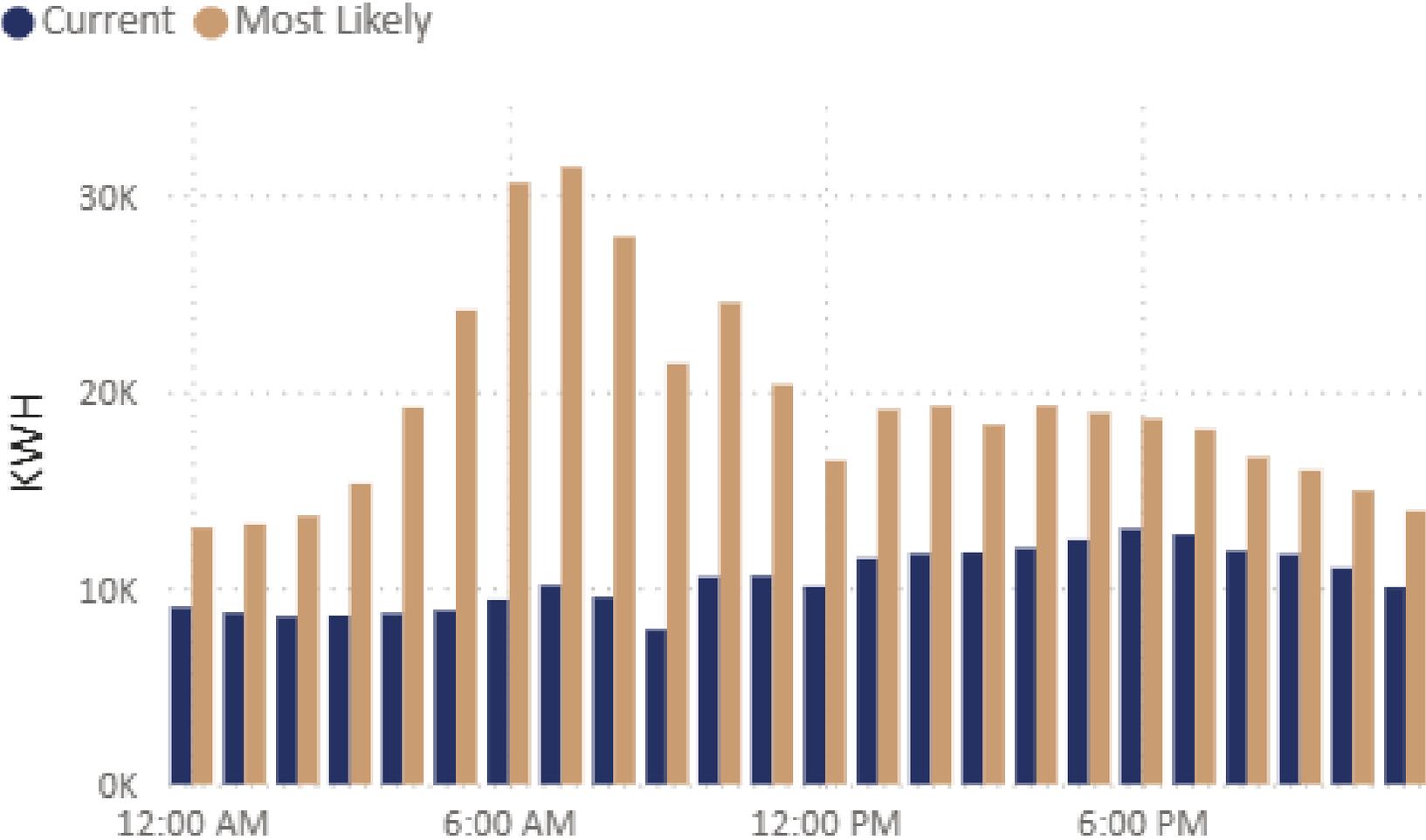
Example of Daily Electricity Demand Curve (kWh) on a Summer Peak Day

Most Likely 2045

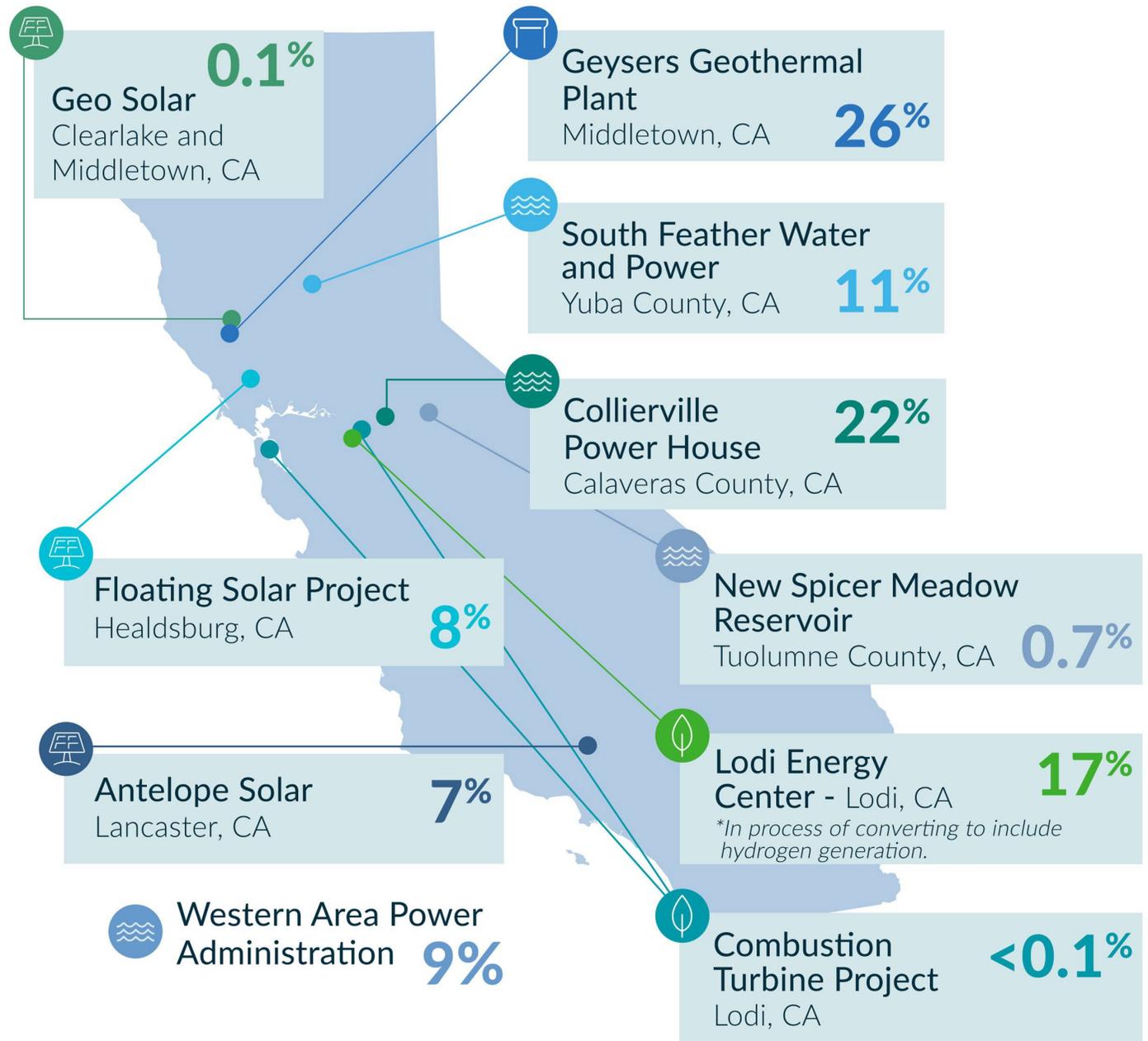


Example of Daily Electricity Demand Curve (kWh) on a Winter Peak Day

Most Likely 2045



Where Does Our Electricity Come From? (2023)



CITY OF HEALDSBURG

RESOLUTION NO.

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF HEALDSBURG ACCEPTING THE “MOST LIKELY” SCENARIO FORECAST FROM THE COMMUNITY-WIDE ELECTRIC ENERGY AND DEMAND FORECASTING AND DIRECT THE UTILITY DIRECTOR TO BRING FORWARD ADDITIONAL RENEWABLE AND ZERO-CARBON RESOURCES FOR CITY COUNCIL CONSIDERATION TO MEET INCREASING STATE REQUIREMENTS

WHEREAS, the City of Healdsburg adopted a Climate Mobilization Strategy (CMS) in support of State and Regional greenhouse gas (GHG) reduction goals; and

WHEREAS, the CMS Implementation Plan includes an action to conduct electrification infrastructure and capacity feasibility studies; and

WHEREAS, the CMS includes a measure to develop long-range energy forecasts based upon adoption rates for building and transportation electrification; and

WHEREAS, an electric energy and demand scenario forecast is important to understand future electricity consumption and peak demands under various levels of building and transportation electrification; and

WHEREAS, California’s Renewable Portfolio Standard (RPS) program and the Clean Energy, Jobs, and Affordability Act of 2022 require electric utilities to provide increasing percentages of renewable and zero-carbon electricity to their customers, including 60% renewable by 2030, 90% renewable and zero-carbon by 2035, 95% by 2040, and 100% renewable and zero-carbon by 2045; and

WHEREAS, the City Council approved a professional service agreement with Rincon Inc. for the development of long-range energy and demand scenario forecasts; and

WHEREAS, Rincon has developed an energy and demand scenario forecast model and report that indicates a 75% increase (i.e., nearly doubling) in Healdsburg annual net electricity consumption by 2045 in the “Most-Likely” scenario, as well as a 44% increase in the maximum hourly consumption; and

WHEREAS, procurement needs may be at least 10% higher than the scenario results to account for transmission losses, distribution loss, planning margins, loss of generation resources, intermittent nature of some renewable energy sources, and items not included in the forecasting model; and

WHEREAS, peak demand infrastructure needs may need to be built to accommodate at

least 5% higher peak demands than the forecasting results to account for the difference between instantaneous peak demands and modeled maximum hourly consumption, and the State requires a Resource Adequacy margin of at least 15%; and

WHEREAS, the magnitude of forecasted electricity consumption, future infrastructure investments and renewable energy resources procurement will require significant financial commitments to meet Healdsburg's forecasted energy needs due to electrification; and

WHEREAS, increased electricity consumption will generate additional revenue to help offset increased operating costs related to new renewable and zero-carbon resources as well as re-investment in the City electric distribution system; and

WHEREAS, based upon the "Most Likely" forecast, Healdsburg will have significant gaps in renewable and zero-carbon electricity generation and fall short of State RPS and clean energy requirements as both the percentage requirements and City electricity consumption increase over time; and

WHEREAS, utilizing the energy and demand scenario forecasting and making periodic forecast model updates will provide costs savings and avoid the risk of over- or under-procurement of renewable energy resources; and

WHEREAS, the "Most Likely" scenario forecast can be used to inform procurement of additional renewable and zero-carbon resources to meet State requirements, as well as propose necessary capacity improvement projects during biennial budgeting processes and rate cost-of-service studies; and

WHEREAS, energy storage systems paired with additional renewable and zero-carbon resources are essential to capture excess generation and provide reliable electricity 24/7/365 for Resource Adequacy as the City's percentage of renewable and zero-carbon resources increases; and

WHEREAS, Healdsburg Electric programs for energy efficiency, efficient electrification, and load management – especially EV charging behaviors – can also be critical to meeting State requirements and reducing peak demands; and

WHEREAS, an Energy and Demand Scenario Forecast is not subject to the provisions of the California Environmental Quality Act (CEQA) because an Energy and Demand Scenario Forecast is not a project, since it will not have a direct or reasonably foreseeable indirect impact on the environment.

NOW, THEREFORE, BE IT RESOLVED that the City Council of the City of Healdsburg does hereby:

1. Accept the “Most Likely” scenario from the Electric Energy and Demand Forecasting model and report.
2. Direct Healdsburg Electric Department staff to begin seeking additional renewable energy and zero-carbon energy resources, including energy storage resources, for further consideration by the City Council to meet State renewable and zero-carbon requirements based upon the “Most Likely” scenario forecast including a minimum 10% planning margin.
3. Find that an Energy and Demand Scenario Forecast is not subject to the provisions of the California Environmental Quality Act (CEQA) because an Energy and Demand Scenario Forecast is not a project, since it will not have a direct or reasonably foreseeable indirect impact on the environment.

PASSED, APPROVED, AND ADOPTED by the City Council of the City of Healdsburg this 2nd day of June 2025 by the following vote:

AYES: Councilmembers:

NOES: Councilmembers:

ABSENT: Councilmembers:

ABSTAINING: Councilmembers:

SO ORDERED:

ATTEST:

Evelyn L. Mitchell, Mayor

Raina Allan, City Clerk



Healdsburg Energy and Demand Forecasting

Long-Range Community Electricity Scenarios

prepared by

City of Healdsburg
Electric Department
401 Grove Street
Healdsburg, California 95448
Contact: Utilities Director

prepared with the assistance of

Rincon Consultants, Inc.
449 15th Street, Suite 303
Oakland, California 94612

May 2025



RINCON CONSULTANTS, INC.

Environmental Scientists | Planners | Engineers

rinconconsultants.com

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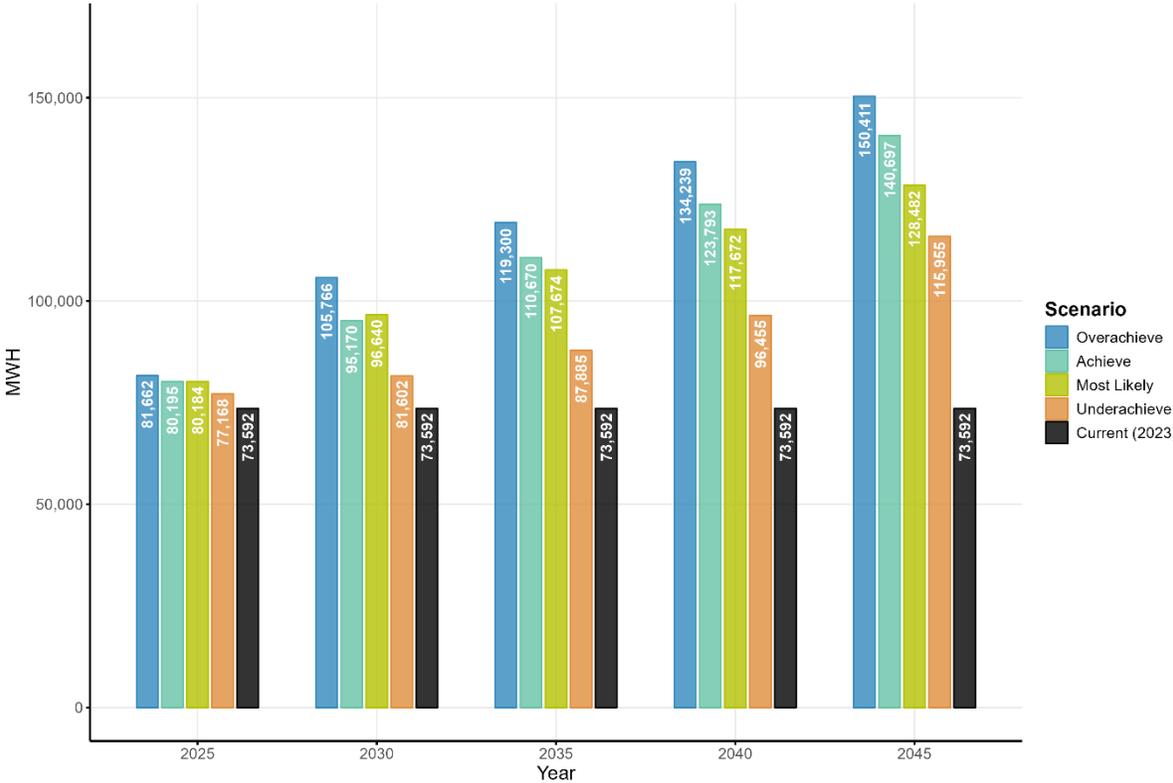
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1 Executive Summary

To achieve the goals of Healdsburg’s Climate Mobilization Strategy (CMS), and to meet increasing market trends, it is critical for Healdsburg Electric Department to forecast potential future community electricity scenarios for increasing electricity consumption and peak demands from building and transportation electrification.

The Healdsburg Electric Department worked with Rincon Consultants, Inc. to develop a 2023 baseline model of hourly electricity consumption. Scenarios with varying levels of electrification out to 2045 were then developed and applied to the baseline model, including scenarios for “Underachieve” the CMS, “Achieve” the CMS, “Overachieve” the CMS, and “Most Likely”.

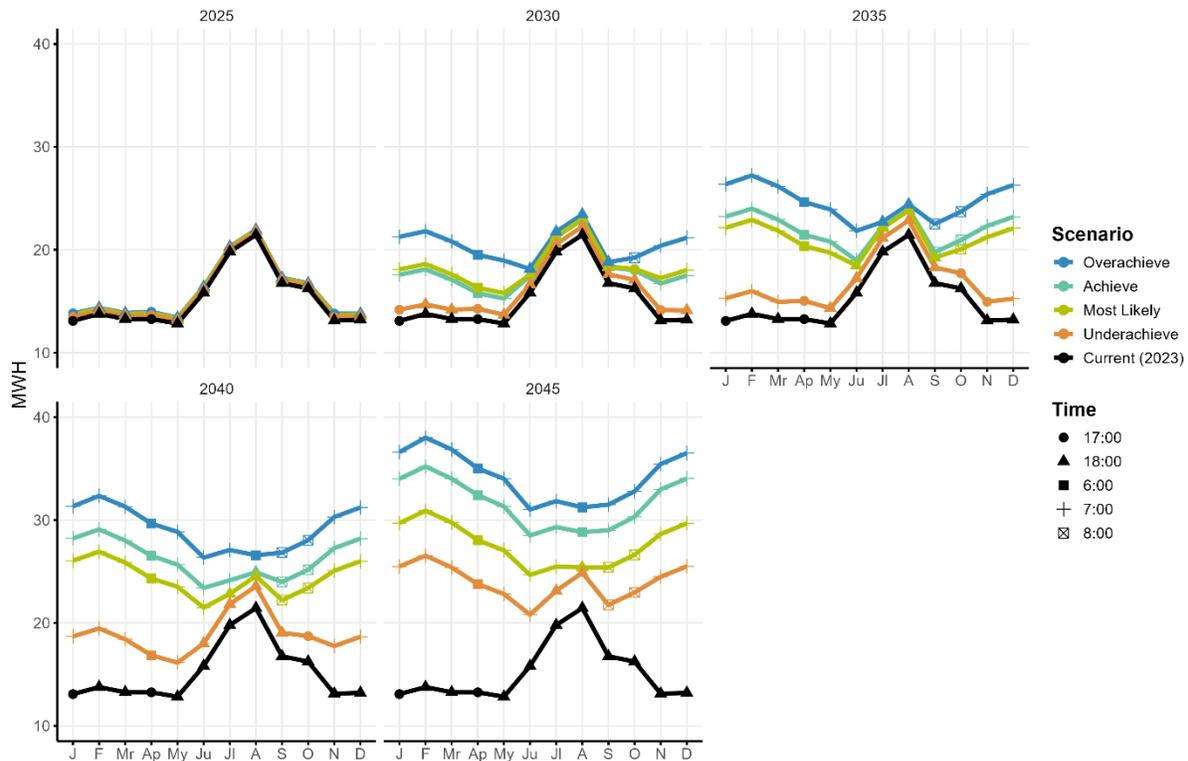
The chart below shows the range of future annual net electricity consumption under the different scenarios, with a 75% increase in annual net electricity consumption in 2045 in the Most Likely scenario.



Annual Net Electricity Consumption (MWh) For Each Year of Each Modeled Scenario. The above figure depicts the expected net electricity consumption of building and EVs in megawatt hours (MWh) for each year of each scenario with the inclusion of solar. Scenarios are ordered in highest achieving to lowest and the grouped bars for each year are in the same order as described in the legend. The exact value of each individual bar is described in the graph as white text.

The model also analyzed the hours with the highest consumption to understand potential changes and increases in peak demands. The chart below shows how peak demands might change in the future, depending on heat pump adoption and electric vehicle (EV) charging behaviors. The chart is based on EV charging using a “delayed – finish by departure” (i.e., have the charging completed by a

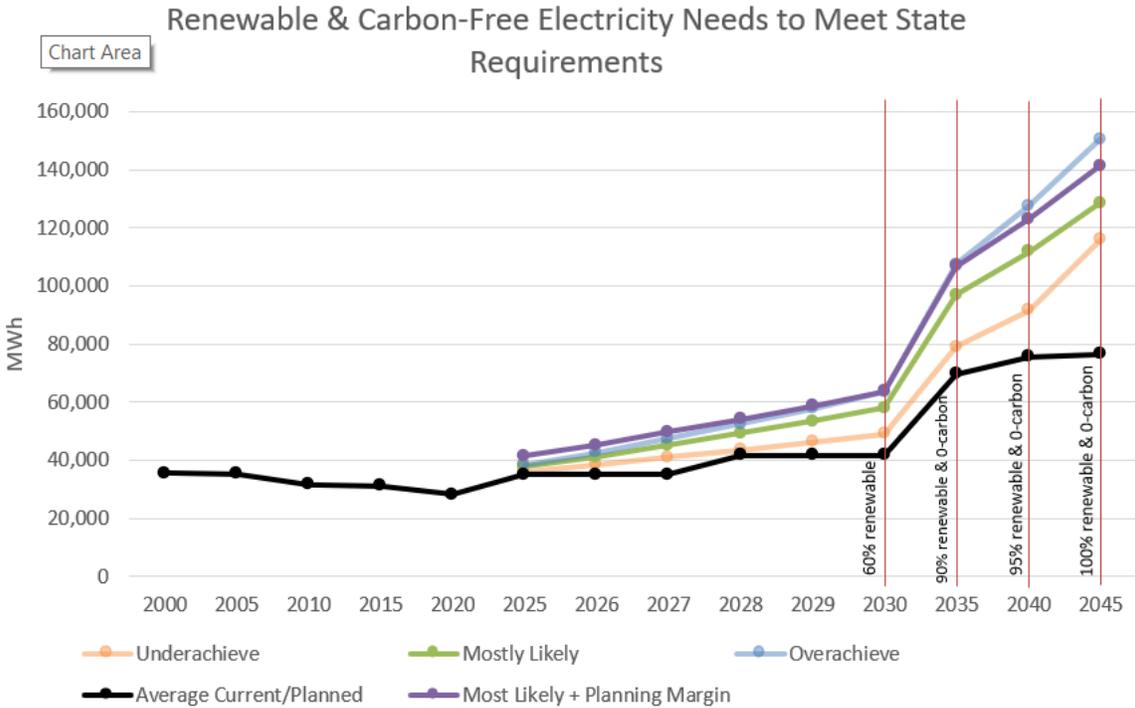
specific time, typically the early morning) charging behavior to avoid evening peak demands. Charging behavior can be influenced by time of use rates, the new Home Energy Load Management Program, and outreach and education. A key insight from the model development is that EV charging will drive future peak demands.



Monthly Net Peak Demand (MWh) For Each Year of Each Modeled Scenario. The above figure depicts the expected monthly net peak demand in megawatt hours (MWh) for the maximum hour net electricity consumption for buildings and EVs across each year for each scenario with solar inclusion. The legend indicates the symbol to represent the time of day peak demand occurred in a given month.

The State’s Renewable Portfolio Standard (RPS) Program and the Clean Energy, Jobs, and Affordability Act of 2022 set increasing renewable and zero-carbon requirements for electricity provided by electric utilities, such as Healdsburg Electric Department. The RPS requirement for 2030 is 60% renewable and the clean energy requirement for 2045 is 100% renewable and zero-carbon. As both the percentage requirement and electricity consumption increase, Healdsburg Electric must procure new renewable and zero-carbon resources.

The chart below illustrates the potential gap in renewable and zero-carbon resources to meet State requirements. For context, to meet the 2035 requirement of 90% clean energy (60% renewable plus 30% zero-carbon) in the Most Likely scenario, Healdsburg Electric would need an additional 23,000 MWh of solar generation (compared to current contracts), or about 52 acres of solar panels, and an approximately 4,000 MWh increase in average large hydroelectric generation, in addition to an assumed conversion of 11,000 MWh of the Lodi Energy Center fuel-generated power to green hydrogen already included in the Average Current/Planned line.



Comparison of Modeled Scenarios and Renewable and Zero-Carbon Procurement

Needs. The above figure depicts the annual electricity needed to meet the State requirements under the modeled scenarios in megawatt hours (MWh) and the currently planned procurement of renewable and carbon-free electricity. The gap demonstrates the renewable and zero-carbon resources that will need to be procured to meet the State requirements under the anticipated future conditions. Note that the chart only shows eligible renewables to 2030, and beginning in 2035 zero-carbon resources are also included.

This Energy and Demand Scenario Forecasting project is intended to assist Healdsburg Electric Department in planning for the future. It is recommended for Healdsburg Electric to use the findings to procure sufficient new energy resources, invest in infrastructure upgrades to accommodate the increasing electricity demands, and implement programs to help reduce grid impacts from electrification, such as the new Home Energy Load Management Program.

2 Introduction

The City of Healdsburg recently adopted the Climate Mobilization Strategy (CMS) that identified several measures, actions, and projects to implement to reduce the community's greenhouse gas emissions (GHG) in alignment with state targets. A significant focus of the CMS is to electrify the building stock and transportation sector and further decarbonize these sectors through the increased procurement of renewable and carbon free electricity sources.

The increased demand for electricity and the focus on carbon free electricity will create new challenges for energy generation, transmission, and distribution within the city. Healdsburg Electric is responsible for procuring and delivering these energy sources for the community. To obtain and distribute adequate amounts of electricity that will meet electricity consumption and peak demand in an increasingly electrified city, a series of studies must be completed to understand electricity consumption and peak demand in the future under different electrification scenarios. Specifically, the intent of the study presented herein is to develop long-range community-wide electric energy and demand scenarios to estimate electricity consumption and peak demands under various adoption rates of building and transportation electrification.

This report details the methodology utilized to develop an energy and demand scenario forecasting model for Healdsburg Electric, and the findings of the model under several predetermined scenarios. The model was designed to help Healdsburg Electric to identify and prioritize electric capital improvement projects necessary for infrastructure changes and to develop a plan on how to obtain adequate resources to meet the demand and state renewable and carbon free energy targets.

2.1 Background on Electrification

Regulatory Drivers

Electrification efforts in Healdsburg are influenced by a range of regulatory frameworks at the federal, state, and local levels. These regulations establish the foundation for reducing GHG emissions, increasing renewable energy adoption, and improving energy efficiency to meet sustainability goals. The following sections outline key regulations driving electrification policies and initiatives.

Federal Regulations

At the federal level, the U.S. has established a range of policies to support electrification and emissions reductions:

- **Energy Policy Act of 2005:** Encourages energy efficiency and the development of renewable energy technologies. It also includes provisions for tax incentives and grants for clean energy projects.
- **Inflation Reduction Act of 2022:** Provides tax credits and rebates for electrification projects, including building retrofits, electric vehicle (EV) adoption, and clean energy investments. This act aims to accelerate electrification and decarbonization across multiple sectors.
- **Clean Air Act:** Regulates air pollutants and sets emission standards, indirectly promoting electrification as a cleaner energy alternative. Amendments under this act enable the

Environmental Protection Agency (EPA) to establish emission limits for power plants and vehicles.

- Infrastructure Investment and Jobs Act (2021): Allocates funding for EV charging infrastructure, grid modernization, and clean energy technologies, making it a cornerstone for supporting electrification.

California Regulations

California has led the nation in ambitious climate policies and electrification targets:

- AB 32 - Global Warming Solutions Act (2006): Establishes California's commitment to reduce GHG emissions to 1990 levels by 2020 and sets the groundwork for further reductions beyond 2020. It requires comprehensive strategies, including cap-and-trade programs, low-carbon fuel standards, and electrification measures, to achieve emissions reductions.
- SB 100 (2018) & SB 1020 (2022): Mandates 100% zero-carbon and renewable electricity by 2045, with incremental renewable energy procurement targets along the way. It requires utilities to gradually increase the share of renewables and zero-carbon sources in their energy portfolios (e.g., 60% renewable by 2030, 90% renewable and zero-carbon by 2035, 95% by 2040).
- Advanced Clean Cars Program: Requires automakers to produce increasing numbers of zero-emission vehicles (ZEVs). The program phases out gasoline-powered cars by 2035, aligning with California's electrification goals.
- Title 24 Building Standards: Establishes energy efficiency standards for new and existing buildings, including requirements for solar photovoltaic (PV) systems, electric-ready infrastructure, and high-performance insulation to reduce energy demand and promote electrification.
- CALGreen Building Code: Introduces measures for energy efficiency, EV charging readiness, and low-emission building materials. It includes mandates for pre-wiring EV charging stations and renewable-ready features in new construction.
- Executive Order B-55-18: Sets a goal of statewide carbon neutrality by 2045, emphasizing electrification and renewable energy adoption to achieve significant GHG reductions.
- Zero-Emission Space and Water Heater Standards (under development for proposal): In a phased approach, new space or water heaters sold in California would be required to be zero-emission units. This regulation is part of California's strategy to achieve carbon neutrality by 2045.¹

California Environmental Quality Act

The California Environmental Quality Act (CEQA) requires projects to analyze and mitigate environmental impacts, including GHG emissions. Electrification is often included as a mitigation strategy to comply with CEQA requirements and reduce carbon footprints in new developments. Projects may incorporate electrification technologies such as heat pumps and EV charging infrastructure to meet environmental standards and streamline approvals.

¹ [Zero-Emission Space and Water Heater Standards | California Air Resources Board](#)

Local Regulations

The Bay Area Air Quality Management District (BAAQMD) regulates stationary sources of air pollution in the nine counties that surround San Francisco Bay². The Board oversees policies and adopts regulations for the control of air pollution, such as nitrogen oxides (NOx) within the district. While Healdsburg is located in the North Sonoma County Air Pollution Control District, the regulations overseen by BAAQMD can impact surrounding air districts and areas and thereby influence Healdsburg. On March 15, 2023 the BAAQMD Board adopted amendments to Rule 9-4: Nitrogen Oxides from Fan Type Residential Central Furnaces and Rule 9-6: Nitrogen Oxides Emissions from Natural Gas-Fired Boilers and Water Heaters.³ These rules govern point of sale emission standards for small, typically residential and commercial, water and space heating systems. Emissions of nitrogen oxides impact local and regional air quality and contribute to the formation of ozone and secondary particulate matter.

Rules 9-6 and 9-4 are expected to change market demand for water and space heating appliances in the Bay Area and surrounding areas. NOx-emitting gas appliances are currently the default appliance option for heating and cooling space and water across California. As the updated Rules take effect in a phased approach, for NOx-emitting gas water heaters and furnaces that start to fail or “burnout,” the Rules mandate that they may only be replaced with zero-NOx appliances in BAAQMD areas. Electric appliances are currently the only zero-NOx technologies available on the market. Heat pump water heaters (HPWH) and heat pump heating, ventilation, and air conditioning systems (HP HVAC) are currently the most cost-effective appliance options of these electric options. Accordingly, HPWH and HP HVAC installations are expected to increase significantly across the Bay Area beginning in 2027 and 2029.

Additionally, Sonoma County has adopted various climate and electrification policies aimed at reducing GHG emissions and transitioning to cleaner energy:

- Sonoma Climate Mobilization Strategy: Sonoma County’s Regional Climate Protection Authority has adopted goals to achieve carbon neutrality by 2030.⁴ The County's goals include increasing building energy efficiency, expanding renewable energy use, transitioning equipment from fossil fuels to electricity, reducing travel demand through focused growth, and increasing carbon sequestration.
- Climate Action and Resiliency Division: Sonoma County provides financing options and free consultations for energy projects.

Healdsburg has implemented several local regulations to promote electrification and reduce GHG emissions:

- Electrification Reach Code: In 2019 and 2022, Healdsburg adopted an Electrification Reach Code requiring all new residential and commercial buildings to utilize electric space and water heating systems.⁵ This ordinance aimed to reduce natural gas consumption in new construction, aligning with the city's sustainability goals. Enforcement has been paused, following a federal

² The Bay Area refers to all BAAQMD governed geographic regions across the Bay Area’s nine counties: San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa, Solano, Napa, Sonoma, and Marin County. Healdsburg is part of NSCAPCD, just north of BAAQMD area.

³ Bay Area Air Quality Management District (BAAQMD). Regulation 9 Rule 6: Nitrogen Oxides Emissions from Natural Gas-Fired Water Heaters - 2023 Amendment (Current). Available at: https://www.baaqmd.gov/rules-and-compliance/rules/reg-9-rule-6-nitrogen-oxides-emissions-from-natural-gas-fired-water-heaters?rule_version=2021%20Amendment

⁴ Sonoma. Climate Mobilization Strategy (Adopted 2021). Available at: <https://rcpa.ca.gov/wp-content/uploads/2020/12/Sonoma-Climate-Mobilization-Strategy-Adopted-2021-03-08.pdf>

⁵ City of Healdsburg. 2022 Electrification Reach Code (2022). Available at: <https://ci.healdsburg.ca.us/DocumentCenter/View/15534/Healdsburg-2022-Electrification-Reach-Code>

court ruling indicating that local ordinances preventing the use of gas appliances are overridden by federal law.

- Climate Mobilization Strategy (CMS): Adopted in October 2023, the CMS outlines measures to reduce carbon emissions by 2030.⁶ Key initiatives include procuring electricity from renewable and zero-carbon sources, electrifying new buildings, and retrofitting existing structures to reduce GHG emissions.
- Implementation Plan: As part of the CMS, Healdsburg developed an Implementation Plan detailing key actions.⁷

Market Trends

The shift toward electrification in residential and commercial building systems, as well as the adoption of EVs, is significantly reshaping the energy landscape in California and beyond. Key trends highlight the growing role of heat pump technologies, such as HPWH and HP HVAC, in the transition to a decarbonized economy.

Electric Water Heaters and Space Heating

In California, the adoption of electric water heaters and electric space heating systems has been rapidly increasing with growing heat pump technology. Between 2009 and 2019, the number of electric water heaters installed almost doubled, rising from 6 percent to 11 percent of the market share. Similarly, the penetration of electric space heating systems, which include air source heat pumps (ASHP), grew from 5 percent to 20 percent of homes during the same period.⁸ This increase is a response to both climate goals and market incentives. Notably, air source heat pumps are becoming more widespread, offering energy efficiency gains, and reducing reliance on fossil fuels for heating and hot water production.

Heat Pump Market Dynamics

The global supply chain for heat pump technologies is complex, with key manufacturing hubs spanning across the U.S. and other parts of the world. U.S.-based manufacturers have become significant players in the production of heat pumps, contributing to the country's role as a net exporter of heat pump technologies, especially to Europe.⁹ The market for HPWH and HP HVAC systems has been bolstered by both federal and state incentives, which support consumer adoption and reward the transition from gas-fired appliances to electric heat pump alternatives.¹⁰

HP HVAC systems, which offer both heating and cooling, currently exhibit higher market penetration (20 percent) than HPWHs (11 percent).¹¹ This is largely due to increasing demand for air conditioning in the context of a warming climate and the relative maturity of the technology. In

⁶ City of Healdsburg. Climate Mobilization Strategy (2023). Available at: <https://healdsburg.gov/DocumentCenter/View/17326/Adopted-Healdsburg-CMS-Compiled>

⁷ City of Healdsburg. Implementation Plan (2023). Available at: <https://healdsburg.gov/DocumentCenter/View/17328/Appendix-D-Implementation-Plan-Adopted>

⁸ California Heat Pump Residential Market Characterization and Baseline Study - <https://pda.energydataweb.com/#!/documents/2625/view>

⁹ https://www.energy.gov/sites/prod/files/2016/04/f30/30005_Mann_040716-1105.pdf

¹⁰ New Buildings Institute (HWP Market Transformation Scenarios): <https://newbuildings.org/heat-pump-water-heater-sales-in-2022-signal-a-decisive-shift-in-water-heating-trends/>; <https://www.calmac.org/publications/OD-CPUC-Heat-Pump-Market-Study-Report-5-17-2022.pdf>

¹¹ <https://www.technologyreview.com/2024/02/12/1087970/heat-pumps-hot/>; Building Decarb Coalition. https://buildingdecarb.org/wp-content/uploads/Heat-Pump-Shipment-Report-Spring-2023_V4.pdf

contrast, HPWHs, while commercially available for only about a decade, have experienced significant growth in the last three years despite still having a modest market share of approximately 1 percent. Sales of gas water heaters have been on the decline, with electric water heaters, including heat pump water heaters, overtaking gas models in December 2023 for the first time.¹²

Decarbonization and Electricity Resources

As California and other jurisdictions implement ambitious decarbonization goals, such as those set forth in the California Climate Scoping Plan, demand for heat pumps is expected to increase exponentially.¹³ This will require careful electric utility planning to meet increased electricity consumption and changing peak demands.

Benefits to Electrification

Building and transportation electrification provide several benefits such as those summarized below:

- **Health:** Commonly used appliances that burn gas, including stoves, heating systems, and water heaters, emit hazardous air pollutants inside a home when improperly ventilated, or when leaks occur. These can include nitrogen oxides, sulfur oxides, carbon monoxide, formaldehyde, particulate matter and other harmful pollutants that increase the risk of respiratory disease.^{14,15,16,17} Given that Californians spend 70 percent of a given day indoors,¹⁸ indoor air quality is an important health consideration for many. Gas usage in buildings causes outdoor air pollution as well and has generated six times more nitrogen oxides emissions than all in-state power plants combined.¹⁹ Outdoor air pollution from buildings has been linked to pre-mature deaths in California.²⁰
- **Safety:** Gas infrastructure carries an inherent safety risk due to the volatile nature of gas, including risk of methane leakage, damage during earthquakes, accidental explosions, or fires.

¹² <https://newbuildings.org/heat-pump-water-heater-sales-in-2022-signal-a-decisive-shift-in-water-heating-trends/>;
<https://www.ahrinet.org/system/files/2024-02/December%202023%20Statistical%20Release.pdf>

¹³ <https://efiling.energy.ca.gov/GetDocument.aspx?tn=242595>

¹⁴ Krasner, A., Jones, T. S., & La Rocque, R. (2021). Cooking with Gas, Household Air Pollution, and Asthma: Little Recognized Risk for Children. *Journal of Environmental Health*, 83(8), 14-18. <https://www.proquest.com/scholarly-journals/cooking-with-gas-household-air-pollution-asthma/docview/2505418593/se-2?accountid=201395>

¹⁵ Seals, B., & Krasner, A. (2020). Health Effects from Gas Stove Pollution. Rocky Mountain Institute, Physicians for Social Responsibility, Mothers Out Front, and Sierra Club. <https://rmi.org/insight/gasstoves-pollution-health>

¹⁶ 4 Zhao, H., Chan, W. R., Cohn, S., Delp, W. W., Walker, I. S., & Singer, B. C. (2020) Indoor air quality in new and renovated low-income apartments with mechanical ventilation and natural gas cooking in California. *International Journal of Indoor Environment and Health*, 31(3), 717-729. <https://doi.org/10.1111/ina.12764>

¹⁷ Logue, J. M., Klepeis, N. E., Lobscheid, A. B., & Singer, B. C. (2014) Pollutant exposures from natural gas cooking burners: A simulation-based assessment for Southern California. *Environmental Health Perspectives*, 122(1), 43-50. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3888569/>

¹⁸ Klepeis, N. E., Nelson, W. C., Ott, W. R., Robinson, J. P., Tsang, A. M., Switzer, P., ... & Engelmann, W. H. (2001). The National Human Activity Pattern Survey (NHAPS): a resource for assessing exposure to environmental pollutants. *Journal of Exposure Science & Environmental Epidemiology*, 11(3), 231-252.

¹⁹ California Air Resources Board. 2016 SIP Emission Projection Data: 2012 Estimated Annual Average Emissions. <https://www.arb.ca.gov/ei/emissiondata.htm>

²⁰ Dedoussi, I. C., Eastham, S. D., Monier, E., & Barrett, S. R. (2020). Premature mortality related to United States cross-state air pollution. *Nature*, 578(7794), 261-265.

Nationwide, gas ignites over 4,000 home structure fires annually, causing on average 40 deaths and \$54 million in property damage each year.²¹

- **Energy Affordability:** Gas infrastructure costs are expected to increase over the next several decades as more substantial infrastructure upgrades are required. The California Public Utility Commission generally allows each gas utility to increase gas rates based on the necessary expenditure to keep gas systems operational. Increased utility expenditures on the gas system are therefore expected to lead to escalating consumer costs that will likely impact low-income households significantly.²² Without any building electrification or renewable gas use, the cost of natural gas is expected to double from approximately \$1.5 per therm to \$3 per therm by 2050.²³ These projected increases are already being seen in Northern California, with 2023 winter gas prices 32 percent higher than 2022.²⁴ Upgrading buildings to all-electric is also an opportunity to complete other building upgrades such as air sealing and insulation, which can reduce energy costs and improve affordability.
- **Resilience:** When coupled with solar and battery energy storage, all-electric buildings can mitigate impacts of power outages. While a common misconception is that gas appliances provide a redundant system during power outages, gas appliances like water heaters, stoves, and space heaters typically cannot function without electricity to power the fans and controls needed for operation. Clean back-up power is therefore an important asset when the utility grid is down. Local solar paired with battery storage is also good for grid resilience in the region. Electrification provides an opportunity for increased investment in the electrical grid and improved local resiliency in a safe and healthy way. For example, pairing HP HVAC units with good air filtration and home weatherization can protect residents from wildfire smoke during fires.
- **High-road Local Jobs:** New electrification policies and requirements support opportunities for new local jobs and existing local businesses in construction, building trades, and the “clean and green” economy, key components of Healdsburg’s economic development strategy.²⁵
- **Greenhouse Gas Emissions Reduction:** Gas usage in buildings accounted for 20 percent of Healdsburg’s GHG emissions in 2018.²⁶ The proportion of emissions coming from gas is projected to increase as the emissions from electricity continue to reduce to meet state renewable and zero-carbon electricity targets.²⁷ This means that any appliance converted from gas to electric will have reduced GHG operation in 2030. Reducing GHG emissions in Healdsburg

²¹ Ahrens, M. & Evarts, B. (2018). Natural Gas and Propane Fires, Explosions and Leaks Estimates and Incident Descriptions. National Fire Protection Association. <https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Hazardousmaterials/osNaturalGasPropaneFires>

²² Energy and Environmental Economics, Inc. (2020). The Challenge of Retail Gas in California’s Low-Carbon Future. California Energy Commission. Available at: <https://www.energy.ca.gov/sites/default/files/2021-06/CEC-500-2019-055-F.pdf>

²³ Gridworks. (2019). California’s Gas System in Transition: Equitable, Affordable, Decarbonized and Smaller. Available at: https://gridworks.org/wp-content/uploads/2019/09/CA_Gas_System_in_Transition.pdf

²⁴ Manna, Orka. (2023). NorCal PG&E customers are paying more for gas. Here’s why and what’s being done. Available at: <https://www.kcra.com/article/california-pge-higher-gas-prices-heres-why/42715426>

²⁵ City of Healdsburg. (2019). 2020-2025 Strategic Plan. Available at: <https://ci.healdsburg.ca.us/DocumentCenter/View/11367/2020-2025-Strategic-Plan-Initiatives-and-Goals#:~:text=Strengthen%20Healdsburg%E2%80%99s%20economy%20and%20tax%20base%20through%20economic,enhancing%20customer%20service%20and%20maintaining%20a%20business-friendly%20reputation.>

²⁶ City of Healdsburg. Climate Mobilization Study (2023). Available at: <https://www.ci.healdsburg.ca.us/DocumentCenter/View/17326/Adopted-Healdsburg-CMS-Compiled>

²⁷ City of Healdsburg. Climate Mobilization Study (2023).

will contribute to Healdsburg’s CMS goals to reduce per capita emissions by at least 40 percent below 1990 levels by 2030.²⁸

Climate Mobilization Strategy Goals

In October of 2023, the Healdsburg CMS was adopted. This details the Measures and Actions Healdsburg will take in the coming years to reduce community-wide emissions by at least 40 percent in alignment with the states 2030 goal and to work towards carbon neutrality by 2045. According to the results of the 2018 GHG inventory, the largest source of GHG emissions in Healdsburg was from on-road transportation, which accounted for 55 percent of total emissions. The second largest source of GHG emissions was from natural gas usage in residential and non-residential buildings, combined to account for 20 percent of total emissions. Natural gas is used to heat water, homes, and businesses and to power gas-powered appliances. Electricity usage accounted for the third largest source of emissions, with residential and non-residential usage combining for a total of 14 percent of total emissions in Healdsburg. As such, the Measures focus heavily on decarbonizing the transportation and building sector through electrifying the building stock and vehicles in conjunction with increasing procurement of renewable and carbon-free electricity sources for the community. For Healdsburg Electric to acquire the necessary amount of renewable and carbon-free electricity and plan for the increased electricity consumption through natural community growth and increasing electrification, it must first understand the anticipated future electricity consumption and peak electrical demand in the community under various electrification scenarios. The following specific CMS Measures were considered while developing the energy and demand scenario forecasting model discussed in this report:

- Measure BE-2: Continue to adopt an Electrification Reach Code for all new residential and commercial buildings with each triannual code cycle. Consider updating electrification ordinance to eliminate natural gas consumption in new construction for the 2025 California Building Standards Code and moving forward.²⁹
- Measure BE-3: Decarbonize residential building stock by 8% by 2030.
- Measure BE-4: Decarbonize non-residential building stock by 5% by 2030.
- Measure T-4: Increase passenger zero-emission vehicle use and adoption to 30% by 2030.
- Measure T-5: Increase commercial zero-emission vehicle use and adoption to 40% by 2030.

The following section details how varying levels of CMS implementation were modeled to determine electricity consumption and peak demand in 2025, 2030, 2035, 2040, and 2045.

²⁸ City of Healdsburg. Climate Mobilization Study (2023).

²⁹ This measure is currently paused and will be reviewed during the 2025 California Building Code adoption cycle. Additionally, the 2025 Building Code includes an “electric preferred” structure that will promote use of heat pumps over gas appliances and further supports building electrification in the city.

3 Model Development

3.1 Intent

The intent of this project was to develop a dynamic long-range energy and demand model (Model) for the Healdsburg community that Healdsburg Electric can use to estimate electricity consumption and peak demand through 2045 under various electrification scenarios. These insights will help support decision-making on electricity procurement and infrastructure investments to meet future electricity consumption and peak demands.

3.2 Approach

The energy and demand model developed for Healdsburg Electric uses various data sources to model city-wide baseline electricity consumption and forecast future electricity consumption and peak demand on an hourly basis across a calendar year. The following sections detail the data sources utilized and provide an overview of the methodology employed. The following summarizes the process:

1. **Baseline Energy Consumption Model:** Established an average hourly city-wide electricity curve for Healdsburg, disaggregated by sector (residential, commercial), building type, and select end-use appliances.
2. **Model Features:** Includes toggles for inputting new commercial and residential buildings by building type, adding solar PV arrays, EV charging needs, EV charging behavior, and natural gas appliances converted to electric appliances for each building type.
3. **Scenario Development:** Different future energy and demand scenarios were created by inputting specific parameter changes (i.e., number of new homes, installed solar arrays, appliance conversions), which result in changes to hourly electricity consumption compared to the base model scenario.
4. **Results:** Generated on an hourly, monthly and annual basis, showing electricity consumption and peak demand.

This approach allows for dynamic modeling of future electricity needs. As the City gains new information (such as EV or heat pump adoption rates) the model can be easily used to analyze the impacts of electrification of buildings and vehicles on electricity consumption and peak demand over time.

This report provides results for the following energy and demand impacts:

- Electricity consumption: electricity consumed for buildings and transportation over a period of time (e.g., annually, monthly, or hourly), before on-site solar generation impacts
- Net electricity consumption: electricity consumption including on-site solar generation impacts

- Peak demand³⁰: maximum electricity demand for the time period being analyzed
- Net peak demand: peak demand including on-site solar generation impacts

Data Sources

The following section provides details on the data sources utilized to develop the Model. Table 1 summarize the data source, developing agency, and publication information.

Table 1 Data Sources Used

Use	Data Name and Developing Agencies	Publication Frequency	Latest Publication Year
Residential Appliance Upgrade Model	U.S. Residential Building Stock (ResStock) ¹ is developed by U.S. Department of Energy (DOE) and the National Renewable Energy Laboratory (NREL)	1-2 years	2024
Commercial Base Model & Appliance Upgrade Model	U.S. Commercial Building Stock (ComStock) ² is developed by the DOE and NREL	1-2 years	2024
Residential Base Model	City of Healdsburg hourly energy meter data	N/A ³	2023
Solar Panel Energy Capture	The PVWatts® Calculator uses solar data from the National Solar Radiation Database (NSRDB), which is maintained by the NREL	N/A ⁴	2020
Forecasted Electric Vehicle Energy Use	Department of Motor Vehicles Open Data Portal (DMV Open Data Portal)	Annually ⁵	2024
Electric Vehicle Energy Use	The Electric Vehicle Infrastructure Projection Tool Lite (EVI-Pro Lite) ⁶ was developed by the NREL in collaboration with the California Energy Commission (CEC), with support from the DOE’s Vehicle Technologies Office.	N/A ⁷	N/A ⁷

¹ U.S. Residential Building Stock Website: [ResStock - NREL](#)

² U.S. Commercial Building Stock Website: [ComStock - NREL](#)

³ Private dataset provided by the City of Healdsburg

⁴ PVWatts Calculator Tool: [PVWatts Calculator](#)

⁵ California Department of Motor Vehicles Open Data Portal: [Vehicle Fuel Type Count by Zip Code - Dataset - California Open Data](#)

⁶ EV-Pro Lite Tool: [Alternative Fuels Data Center: Electric Vehicle Infrastructure Toolbox \(EVI-X Toolbox\)](#)

⁷ A published tool with multiple data sources and no projected plan for updates

ResStock

U.S. Residential Building Stock End-Use Load Profiles form the basis of the electrification building models and were downloaded from the ResStock website from Release 1 and Scenario 2022 AMY2018. ResStock utilizes a variety of real-world data sources to model the U.S. residential building stock with high granularity. Key datasets include the Residential Energy Consumption Survey (RECS), which provides 15-minute interval data on energy usage and housing characteristics, and regional and local datasets on building types, climate zones, and energy systems. The tool

³⁰ The model is based on hourly electricity consumption. However, peak demand is typically measured for 5- or 15-minute intervals. Although the term peak demand is used throughout this report, it is referring to the maximum hour electricity consumption as shown in the model. Actual peak demand is estimated to be approximately 5% higher than the maximum hour electricity consumption.

integrates numerous unique combinations of housing characteristics, including data on building size, construction year, insulation levels, heating and cooling systems, and appliance usage. These datasets are combined to simulate energy performance under various scenarios, enabling a highly detailed representation of the residential building stock. ResStock was developed by the NREL and uses advanced statistical sampling and modeling techniques to ensure accuracy and comprehensiveness.

ComStock

U.S. Commercial Building Stock End-Use Load Profiles form the basis of the existing building model and were downloaded from the ComStock website from Release 1 and Scenario 2022 AMY2018. ComStock utilizes an extensive range of data sources to create a model of the U.S. commercial building stock. Core datasets include the Commercial Buildings Energy Consumption Survey (CBECS), which offers 15-minute interval data on energy consumption patterns and building characteristics, alongside regional and localized datasets that account for climate zones, building types, and energy systems. The tool synthesizes data on factors such as building size, construction year, occupancy type, equipment efficiency, and operational schedules to generate millions of unique combinations representing the commercial sector. These inputs are used to simulate energy performance across various scenarios, providing a comprehensive and scalable view of commercial building energy use. Developed by the NREL, ComStock applies sophisticated statistical sampling and modeling methods to support accurate and actionable energy analysis.

City of Healdsburg Meter Data

Rincon was provided with electricity meter data by Healdsburg Electric for 2023, cataloging the actual residential electricity use for the city for an entire year. The data was provided at an hourly interval for a sampling of meters within the entire city. Monthly total electricity sales by category were also provided.

PVWatts Solar Energy Calculator

The PVWatts® Calculator relies on data from the National Solar Radiation Database (NSRDB) to estimate the electricity generated by solar photovoltaic (PV) systems. The NSRDB includes detailed information about solar radiation, such as how much sunlight is available at specific locations, as well as weather data like temperature and wind speed. PVWatts combines this information with user inputs, such as system size, tilt angle, and location, to calculate how much electricity a solar system can produce in a year. The downloaded dataset models the energy captured by a 1 kilowatt (KW) solar array for this study.

DMV Open Data Portal

The California Department of Motor Vehicles (DMV) reports on an annual basis the registered vehicle counts broken down by zip code, model year, fuel type, make, and duty (light/heavy).

EVI-Pro Lite Load Profile Tool

The EVI-Pro Lite Tool uses real-world travel data to estimate the charging infrastructure needed to support EVs in the United States. Key data sources include the National Household Travel Survey (NHTS), which provides detailed information about how people travel, including trip lengths and times, and data on EV charging behavior and vehicle characteristics. The tool integrates these datasets with user-defined inputs, such as the number of EVs and charging preferences, to project

the number and type of charging stations required. Developed by the NREL in collaboration with the California Energy Commission (CEC), EVI-Pro Lite helps planners, utilities, and policymakers assess EV infrastructure needs under various scenarios.

3.3 Methodology

Scenario Development

While any scenario can be modeled with the developed model, Healdsburg initially developed five specific scenarios to demonstrate the potential peak demand and annual electricity consumption in 2025, 2030, 2035, 2040, and 2045. These different scenarios reflect the anticipated electricity consumption and peak demand under various levels of CMS implementation. The scenarios are defined as follows:

- **Business-as-Usual (BAU)**³¹: The number of appliance replacements by building type by year is based on current market trends continuing through 2045. New homes are assumed to be mixed fuel based on the current average building through 2045.
- **Underachieve CMS**: The goals of the CMS for building and vehicle electrification are under achieved. 80% of new homes are assumed to be all electric by 2045.
- **Achieve CMS**: The goals of the CMS for building and vehicle electrification are achieved. 95% of new homes are assumed to be all electric by 2045.
- **Overachieve CMS**: The 2030 goals of the CMS for building and vehicle electrification are exceeded, where 100% electrification of the building and transportation sector is achieved by 2045.
- **Most Likely**: Based on input from Healdsburg residents obtained through a community survey³² on expected electrification adoption, as well as current trends within the city, this scenario was developed to represent the most likely scenario to occur. Under this scenario it is anticipated that residential building electrification goals of the CMS will be exceeded, non-residential building electrification goals will be achieved for 2030 and exceeded by 2045, and electrification of the transportation sector will be slightly underachieved. 90% of new homes are assumed to be all electric by 2045.

Table 2 summarizes the building and transportation electrification conditions assumed for each scenario (Underachieve, Achieve, Overachieve, and Most Likely) for both the 2030 and 2045 target years. New building electrification estimates are based on both the percentage of new buildings which are all electric (Table 2) as well as the number of new buildings expected to be constructed. Table 3 shows the total number of buildings expected to be in operation for each milestone year through 2045. New construction was calculated by subtracting the baseline building stock (2023) from the forecasted building stock. Input values for existing residential building electrification are based on current equipment numbers in Healdsburg determined using ResStock data sets (Table 4) and the percent electrification assumed in each scenario for 2030 and 2045. Values between the baseline (2023) and 2030 and between 2030 and 2045 were interpolated.

³¹ It was determined that the BAU scenario was not representative of conditions in Healdsburg, as electrification and EV trends in Healdsburg have already outpaced the market trends observed in the 2023 baseline year. Therefore, for the purpose of this report the BAU model results are not presented or further discussed.

³² View Appendix C for detailed results from the Community Electrification Survey.

Input values for existing non-residential building electrification are based on current equipment numbers in Healdsburg determined using Comstock data sets (Table 5) and the percent electrification assumed in each scenario for 2030. In all scenarios except for the Overachieve and Most Likely scenario, equipment replacement in non-residential buildings post 2030 is assumed to continue to follow the annual replacement trend determined for the preceding 2030 years. The compound annual growth rate for equipment replacement in non-residential buildings between the baseline (2023) and 2030 was utilized to determine equipment replacement post-2030 through 2045 in all scenarios except for the Overachieve and Most Likely scenario where 100% and 45% electrification was assumed, respectively.

Input values for light-duty and heavy-duty EV penetration were determined based on the forecasted vehicle population for Healdsburg developed as part of the Healdsburg CMS and based on Department of Motor Vehicle registration data for the city. Data was further disaggregated by light-duty and heavy-duty vehicle types and the percent EV penetration for each vehicle type assigned for each scenario in 2030 and 2045. Values between the baseline (2023) and 2030 and between 2030 and 2045 were interpolated.

As mentioned above, for the Overachieve scenario, it is assumed the new buildings, existing buildings and vehicles are fully electrified by 2045. This provides an upper limit for possible electricity consumption and peak demands. See Appendix A for the complete set of model inputs by variable for each modeled year (e.g., 2025, 2030, 2035, 2040, 2045).

Table 2 Scenario Conditions in 2030 and 2045

Scenario/Target Year Condition ¹	New Building Electrification	Existing Residential Building Equipment Electrification	Existing Non-residential Building Equipment Electrification	Passenger EV Penetration	Commercial EV Penetration
Underachieve					
2030 Conditions	80%	5%	2%	10%	10%
2045 Conditions ¹	80%	15%	11%	57%	50%
Achieve					
2030 Conditions	95%	8%	5%	30%	40%
2045 Conditions ¹	95%	25%	21%	90%	90%
Overachieve					
2030 Conditions	100%	20%	15%	45%	50%
2045 Conditions ¹	100%	100%	100%	100%	100%
Most Likely					
2030 Conditions	90%	10%	5%	35%	10%
2045 Conditions ¹	90%	60%	45%	75%	60%

¹ The CMS established 2030 goals, but did not include 2045 goals. As such, the conditions post 2030 presented herein are used for scenario forecasting purposes and do not represent CMS goals.

Model Parameters

A base model was developed for each building type to get a baseline projection of what the current electricity consumption would be without any appliance upgrade, solar, or EV implementation.

ComStock™ and Healdsburg Electric meter data were utilized to determine the electricity consumption by building type in the Healdsburg climate zone.

Building Types

Sonoma County Assessor data for Healdsburg and Healdsburg Electric account data was utilized to determine the number of existing buildings in Healdsburg in the Residential and Commercial sector in 2023. Analysis of assessor data in conjunction with ResStock and ComStock subsector definitions was utilized to establish a comprehensive list of building types that make up Healdsburg’s building stock in the baseline energy demand curve. These include:

- Residential
 - Single-family
 - Multi-family
- Commercial
 - Office
 - Retail
 - Warehouse
 - Restaurant
 - Small Hotel
 - Other

New building construction projections were developed for each building type through 2045. Standard residential building growth was determined by applying an annual compound growth rate of 0.17%, obtained from the Sonoma County Regional Climate Protection Authority (RCPA) Climate Action Plan to the existing residential building stock. This projection is also used in Healdsburg’s CMS GHG forecasting. In addition to the standard growth rate in the residential sector, Healdsburg is on track to meet Regional Housing Needs Allocation (RHNA) requirements for the 2023-2031 cycle. To account for the additional residential building stock growth due to building development in response to RHNA, the number of additional RHNA homes to be built through 2045 were calculated by applying the compound annual growth rate of RHNA homes from the 2023-2031 cycle to future years. The number of anticipated additional RHNA households were added to the standard projected households to determine the total number of new households anticipated to be added through 2045.

Based on information from Healdsburg, the scenarios assume that all RHNA households added to the city’s building stock from the 2023-2031 cycle will be multi-family homes. Analysis of the last 10 years of County assessor data indicated that on average 11.7 single-family homes are built per year. Therefore, for the purposes of this project, post the current RHNA cycle, ending in 2031, it was assumed that total single-family homes added to the city’s building stock would be 11.7 per year. All RHNA households and excess new growth beyond the estimated single-family homes were attributed to multi-family units.

County assessor data was utilized to determine the annual compound growth rate of commercial buildings by subcategory that occurred over the last decade. For the purposes of this project, it was assumed that commercial building growth would continue as it has in the past and the same annual compound growth rate was applied to the existing commercial building stock to project future commercial building stock numbers through 2045. Table 3 provides a summary of existing building

stock and projections through 2045 that were utilized as base data for the Model and for modeling new buildings.

Table 3 Building Type and Stock for Current and Projected Scenarios

Building Stock	Current (2023)	2025	2030	2035	2040	2045
Residential						
Single-Family	4,033	4,050	4,092	4,173	4,232	4,290
Multi-Family	885	1,021	1,361	1,984	2,154	3,173
Commercial						
Office	125	126	127	129	130	132
Retail	58	59	60	62	63	65
Warehouse	61	62	65	67	70	73
Restaurant	18	18	19	19	20	20
Hotel	25	26	28	30	32	35
Other	165	168	175	181	188	195

Residential Electricity Consumption and Peak Demand

City of Healdsburg Meter Data (meter data) was provided by Healdsburg Electric from the year 2023 to develop a baseline example of city-wide single and multi-family residential electricity consumption and peak demand. The data provided was consolidated into hourly intervals spanning an entire year. This data was consolidated to represent a single home, then multiplied by the number of houses described in Table 3; EV inputs were excluded from this dataset. Existing solar generation for residential customers acquired from Healdsburg Electric are accounted for in the base model and all future scenarios for the residential sector though it is not disaggregated by building type.

Commercial Electricity Consumption and Peak Demand

ComStock data was used to develop the base model for city-wide commercial buildings including small hotels, small office buildings, full-service restaurants, stand-alone retail buildings, warehouses, and other buildings. All the buildings in this list were captured within the downloaded ComStock data with the exception of other buildings, which were calculated using the average of the buildings excluding restaurants. Each of these building base models from ComStock were aggregated to the hour over an entire year and do not include solar or EV charging. The kilowatt-hour (KWH) for each building was divided by the modeled square feet provided by ComStock, to determine the electricity consumption per square foot, and then multiplied by the estimated square feet of all buildings within this category currently existing within the city (Table 3).

$$Commercial\ KWH = \frac{Comstock\ (KWH)}{Modeled\ Area\ (sqft)} \cdot Commercial\ Area\ (sqft)$$

Existing solar generation for commercial customers acquired from Healdsburg Electric were added to the ComStock base models and therefore included in all future modeled scenarios as well. Provided data was not able to be disaggregated by building type, therefore existing solar for commercial buildings is incorporated at the sector level.

ComStock and ResStock Building End Use and Savings Models

ComStock and ResStock provide multiple data outputs that can be used to better understand a particular region's building stock and the impacts of energy efficiency and electrification strategies on overall energy and demand. Two major datasets were leveraged for Healdsburg's electrification demand analysis. The first is the building stock analysis which utilizes each model's annual metadata which includes information on what energy consuming equipment is found in each individual building model. This information includes both the equipment type and energy use (i.e., electricity, natural gas, etc.) for space heating and cooling, water heating, clothes washing and drying, and cooking appliances as well as pool heaters, spas, lighting and other end uses that were identified through the NREL survey process. End uses for Sonoma County are summarized in the Building End Use section below. This data provided the percentage of appliances which could be electrified within Healdsburg.

The modeled savings curves for climate zone 3C were also utilized for scenario forecasting models. These curves show the average energy use and savings compared to the baseline for an array of efficiency and electrification projects. The results are calculated by summing up the energy use from across thousands of modeled buildings within the 3C climate zone. For residential buildings, the total savings was divided by the number of residential buildings modeled to get an average single building saving curve for new residential buildings and energy use or savings curves for each appliance type. For commercial buildings, the total savings was divided by the number of square feet modeled for each commercial building type to get an average savings curve per square foot by building type and appliance. This means that within this average building there are fractions of many uses that not all buildings have (including spas, pool heating, and cooling). Therefore, the electricity/energy use of one average building is not reflective of having a particular technology, but when all buildings are summed, the outcome does reflect the estimated rate of adoption of these end uses within the city.

Building End-Use

An appliance fuel sources analysis was completed for Healdsburg residential and commercial building stock using data obtained from ResStock and ComStock. Because the sample size for just Healdsburg in ResStock and Comstock was small, the data sets for the entirety of Sonoma County were utilized to be representative of Healdsburg. ResStock and Comstock data sets were utilized to determine the prevalence of different appliance technology by fuel type (e.g., electric, natural gas, other fuel) and to estimate total electricity consumption by electric end-use appliances for each previously defined building type. The prevalence of different appliance technologies was used to determine the primary end-uses in Healdsburg to be included in the Model as well as for forecasting the number of non-electric appliances that could be transitioned from gas to electric power. Electricity use consumption by appliance type was utilized in the Model when forecasting additional electricity load that would be expected by transitioning from a natural gas to an electric appliance. Table 4 summarizes the number of gas-fueled appliances available for transition to electric in the baseline year and the anticipated added electricity load per appliance in residential buildings based off the ResStock dataset. Total electricity consumption is the sum of all hourly values over an entire year for a single appliance, and the maximum is for a single hour within the year.³³

³³ The single-hour maximum for an appliance is based on the highest consumption for one hour for the appliance over the course of the year. Depending on the appliance, this may occur at any point throughout the year. As this is the maximum demand over an aggregated hour, the peak (kW) for a given moment may be higher.

Table 4 Appliances Available for Electric Transition and Potential Added Electricity Consumption by Converted Appliances in Residential Buildings

Appliance	Water Heater ¹		HVAC ^{2,3}		Stove ⁴	Dryer ⁵
		Standard	High-Efficiency			
Single Family						
# of Gas Appliances	3,407		3,070		2,441	1,873
Total Annual Electricity Consumption (kwh)	799	2,741	875		285	216
Max Hourly Electricity Consumption (kwh)	0.17	2.35	1.02		0.10	0.06
Multi-Family						
# of Gas Appliances	589		455		330	92
Total Annual Electricity Consumption (kwh)	498	1,139	396		246	96
Max Hourly Electricity Consumption (kwh)	0.10	0.95	0.63		0.09	0.05

¹ Electricity consumption based on conversion of non-electric water heating to a heat pump water heater.

² Electricity consumption for standard HVAC is based on conversion of non-electric heating to a minimum-efficiency heat pump (SEER 15, 9 HSPF) and for a high efficiency HVAC is based on conversion of all non-electric or less-efficiency electrical heating to a high-efficiency heat pump (SEER 24, 13 HSPF).

³ Electricity consumption based on conversion to a heat pump HVAC accounts for the change in electricity demand associated with heating and cooling. Based on ResStock end-use analysis, approximately 25% of single-family homes and 35% of multi-family homes have no central AC or room AC so are assumed to currently not use electricity for cooling. For homes without cooling appliances, the conversion to a heat pump HVAC would result in increased heating and cooling electricity demand. See Appendix B for details on end-use of appliances modeled by ResStock for Healdsburg region.

⁴ Electricity consumption based on conversion of non-electric ranges to electric ranges.

⁵ Electricity consumption based on conversion of non-electric dryers to electric resistance dryers.

Table 5 summarizes the number of appliances available for conversion to electric or more electrically efficient appliances in the baseline year and the anticipated added electricity load per appliance in non-residential buildings based on the ComStock dataset. ComStock savings curves utilized to determine the electricity usage and demand for conversion of commercial roof top units (RTUs) to heat pump RTUs assumes replacement of natural gas and electric resistance RTUs, meaning that there is both an electricity increase for replacement of natural gas RTUs and an electricity savings for replacement of electric resistance RTUs with more efficient heat pump RTUs. ComStock assumes there are approximately 192 gas RTUs and 52 electric resistance RTUs in Healdsburg. The electricity usage and demand included herein for boiler replacement assumes the replacement of natural gas boilers with an air-source heat pump for space heating. The replacement of natural gas commercial cooking equipment with electric equipment is assumed for buildings with kitchen spaces. ComStock did not have electricity savings curves for replacement of commercial hot water heaters, therefore, no electricity demand curves for commercial hot water heater conversions

are included in the Model. For new commercial buildings added to Healdsburg's building stock it was assumed that HVAC systems would be 100% electric while commercial kitchens would follow existing trends, e.g., of being mixed fuel appliances and therefore it was assumed only 50% of kitchens would be all-electric. This aligns with the upcoming Title 24 2025 code which has expanded heat pump HVAC requirements to additional building types such as offices.³⁴ Total electricity consumption is the sum of all hourly values over an entire year for a single appliance, and the maximum electricity consumption is for a single hour within the year.³⁵ Negative values represent electricity loads that save electricity and a reduction in electrical use.

Table 5 Appliances Available for Conversion and Electricity Consumption by Appliance in Non-Residential Buildings

Appliance	RTUs¹	Boiler²	Kitchen Equipment
Small Office			
# of Appliances	61	8	N/A
Total Annual Electricity Consumption (kwh)	-11,492	652	N/A
Max Hourly Electricity Consumption (kwh)	-0.41	0.49	N/A
Retail			
# of Appliances	19	27	N/A
Total Annual Electricity Consumption (kwh)	-14,727	21,874	N/A
Max Hourly Electricity Consumption (kwh)	4.32	11.79	N/A
Warehouse			
# of Appliances	35	6	N/A
Total Annual Electricity Consumption (kwh)	-40,734	448	N/A
Max Hourly Electricity Consumption (kwh)	-1.03	0.87	N/A
Restaurant			
# of Appliances	15	1	11
Total Annual Electricity Consumption (kwh)	-9,820	113	71,874
Max Hourly Electricity Consumption (kwh)	0.11	0.07	14.70
Small Hotel			
# of Appliances	-	8	N/A
Total Annual Electricity Consumption (kwh)	N/A	1,932	N/A

³⁴ https://energycodeace.com/download/256482/file_path/fieldList/ECA+NR+Whats+Changed+Fact+Sheet+WEB.pdf

³⁵ The single-hour maximum for an appliance is based on the highest consumption for one hour for the appliance over the course of the year. Depending on the appliance, this may occur at any point throughout the year. As this is the maximum demand over an aggregated hour, the peak (kW) for a given moment may be higher.

Max Hourly Electricity Consumption (kwh)	N/A	2.06	N/A
Other			
# of Appliances	101	29	N/A
Total Annual Electricity Consumption (kwh)	-15,177	4,449	N/A
Max Hourly Electricity Consumption (kwh)	-0.10	2.62	N/A

Notes: N/A = not applicable appliance for building type; - = indicates no units for conversion

¹Electricity consumption based on conversion of both natural gas RTUs and electric resistance RTUs to heat pump RTUs. ComStock data had no data for hotels conversions of RTUs because HVAC systems in hotels tended to be other equipment types than RTUs.

²Electricity consumption is based on conversion of natural gas boilers to an air-source heat pump for space heating.

³Electricity consumption is based on conversion of natural gas kitchen equipment to electric kitchen equipment (e.g., broilers, fryers, griddles, ovens, ranges, and steamers) in applicable buildings. Of the modeled building types presented herein only restaurants are considered to have kitchen type spaces.

Electrification Savings Curves by Appliance

END USE SAVINGS SHAPES

Several appliance types were identified as likely upgrades from natural gas to electric for Healdsburg in coming years and were chosen as closest predictors for electrical demand by building type. End Use Savings Shapes (EUSS) were used to model each appliance electrical demand, by building type. The EUSS data sets present the overall energy savings associated with various upgrades as well as disaggregates the energy demand by fuel source including natural gas, electricity, and other fuels. In most cases the conversion of appliances from natural gas to electricity results in net energy savings but an increase in electricity consumption.

ComStock and ResStock provide EUSS for a variety of energy efficiency and electrification actions including replacing gas water heaters with HPWH and replacing gas furnaces with HP HVAC units. Each of these datasets (22 in total) were aggregated to the hour mark and represent a single appliance so they could be easily scaled up when modeling future scenarios. ResStock 2022.1 series savings curves from Upgrade 7 were used to model the electricity impact associated with switching from a natural gas appliance to an electric alternative. Because the ResStock Upgrade 7 is for whole home electrification, each appliance modeled was disaggregated from the data set to model electricity impact associated with dryer, kitchen range, hot water heater and HVAC conversion from natural gas to electric. ComStock 2024.1 series savings curves from Upgrades 8 and 22 were utilized to model the electricity impact associated with boiler and kitchen equipment conversion from natural gas to electric. ComStock does not have a model for electricity impact associated with just fuel conversion measures of RTU and HVAC equipment to heat pumps. Therefore, ComStock 2024.1 series savings curves from Upgrade 1 was used to model the electricity impact associated with replacement of both gas-fired and electric resistance RTUs with a high-efficiency heat pump RTU. ComStock does not have a model for the electricity impact associated with fuel conversion of hot water heaters and therefore, the Model does not include electricity usage and demand impacts for hot water heater conversion in commercial buildings. The datasets by Upgrade are defined as follows:

Residential

- Upgrade 7 – Whole home electrification std. efficiency (used to pull individual appliance curves)

- Upgrade 11 – Whole home electrification and envelope upgrade (used for new whole home electrification curves)

Commercial

- Upgrade 1 – Heat Pump Rooftop Package Unit (HVAC)
- Upgrade 8 – Heat Pump Boiler (for space heating)
- Upgrade 22 – Electric Kitchen

NEW BUILDING ESTIMATES

New residential buildings were also modeled using EUSS from ResStock using the whole home electrification and envelope upgrade scenario (Upgrade 11 from the 2024.2 series)³⁶ and represent one new single-family or multi-family dwelling. Solar PV adoption (required by CA building code) was incorporated into the new single-family homes by adding a 3.5 kW array for each single-family home added. A 3.5 KW array equates to an annual energy offset of roughly 6,000 kWh. ComStock does not have a whole building electrification scenario for new commercial buildings due to the variation in the appliances and conditions that are relevant for each commercial building type. Further, current building codes do not target commercial buildings for whole building electrification. Therefore, new commercial buildings were modeled assuming the same energy profile as existing commercial buildings. This is conservative as new commercial buildings experience increased efficiency and some electrification compared with existing buildings. To account for the likely level of electrification that new commercial buildings would undergo and increasing heat pump or electric-ready requirements in CA building code, it was assumed that 100% of new commercial buildings would install an electric heat pump RTU and 50% would install electric kitchen equipment. This was accounted for in modeled scenarios by adding 100% of the new building RTUs and 50% of the new building kitchen equipment to the number of existing building equipment numbers input into the Model for conversion.

Solar Arrays

The number of residential and commercial solar arrays to be added to the grid were forecasted based on historic Healdsburg data. Healdsburg Electric provided solar array data including number of arrays and array capacity added to the grid since 2002. Based on this data, on average, approximately 24 residential solar arrays³⁷ with an average nameplate capacity of 6 kW and approximately 2 commercial solar arrays with an average nameplate capacity of 84 kW have been added to the grid each year in the past decade. Solar arrays added to multi-family buildings are included in the commercial solar array values. It was assumed that this trend would continue in Healdsburg through 2045. While storage batteries also exist in the city, battery storage impacts were excluded from modeling at this time due to the understanding that most batteries are currently used as backup resources and are not actively managed for reducing peak loads. Table 6 summarizes the total number of solar arrays and additional capacity that is assumed to exist in the modeled year. All scenarios were run assuming the same trend of solar array addition over time.

³⁶ <https://www.nrel.gov/docs/fy24osti/89600.pdf>

³⁷ Residential averages exclude new construction, as the model already accounts for included solar in new single-family construction.

Table 6 Additional Solar Included Each Model Year

Category	2025	2030	2035	2040	2045
Residential					
Number of Cumulative Arrays	24	145	266	387	508
Total Capacity (kW)	151	906	1,661	2,416	3,171
Commercial					
Number of Cumulative Arrays	2	12	22	32	42
Total Capacity (kW)	167	1,004	1,841	2,677	3,514

Electric Vehicle Charging

The current vehicle counts by fuel type registered to the 95448 zip code for Healdsburg was obtained from the DMV Open Data Portal. In 2024 there were 20,357 registered vehicles in Healdsburg of which 18,510 were light-duty vehicles and 1,847 were heavy-duty vehicles. Of the registered vehicles, 924 of the light-duty vehicles were designated as plug-in EVs while 4 heavy-duty vehicles were designated as plug-in EVs. This data was utilized as the baseline to forecast both the future vehicle numbers in Healdsburg in alignment with anticipated growth as well as forecast the number of plug-in EVs based on the defined scenario goals. Table 7 summarizes the number of EVs anticipated to be added to Healdsburg by year by scenario.

Table 7 Number of EVs in Need of Charging by Scenario and Year

Scenario	2025	2030	2035	2040	2045
Underachieve					
Light-duty EVs	1,164	2,117	3,814	6,873	12,356
Heavy-duty EVs	38	216	502	793	1,088
Total EVs	1,202	2,333	4,316	7,666	13,445
Achieve					
Light-duty EVs	1,830	6,353	10,704	15,145	19,635
Heavy-duty EVs	137	850	1,214	1,585	1,959
Total EVs	1,968	7,204	11,917	16,729	21,594
Overachieve					
Light-duty EVs	2,330	9,531	13,558	17,669	21,817
Heavy-duty EVs	171	1,061	1,427	1,801	2,177
Total EVs	2,500	10,592	14,986	19,470	23,994
Most Likely					
Light-duty EVs	1,997	7,413	10,347	13,342	16,362
Heavy-duty EVs	38	216	573	937	1,306
Total EVs	2,034	7,629	10,920	14,279	17,669

Electric vehicle charging data was obtained using Electric Vehicle Infrastructure Projection Tool Lite (EVI-Pro Lite). The EVI-Pro Lite tool includes default Worst Case, Best Case, and Base Case scenarios to evaluate how different charging behavior impacts electricity demand. For informational purposes the default Worst Case, Best Case, and Base Case scenarios are defined below. These cases were evaluated but it was determined that different selections within the EVI-Pro Lite tool would be more representative of Healdsburg, such as vehicle miles traveled, home charging, and other inputs. Therefore, a Healdsburg-specific EV charging case that best represented expected Healdsburg EV conditions was developed and incorporated into the Model. Because temperature effects EV charging battery range, winter and summer scenarios were modeled and compiled in the Model to better represent EV charging demand throughout the year. The Healdsburg-specific EV charging case is defined as follows, with details on the input parameters provided in the Table 8:

- **Healdsburg-specific Case:** Representative of expected Healdsburg charging behavior.
- **Default Base Case:** Representative of typical charging behavior for the region.
- **Default Best Case:** Representative of the best charging behavior where the demand curve is smoother through strategic charging times.
- **Default Worst Case:** Representative of the worst charging behavior where the peaks of the demand curve are exacerbated by charging occurring all at once.

Table 8 EV Parameter Inputs

Parameter	Healdsburg-specific	Best Scenario	Base Scenario	Worst Scenario
Average daily miles traveled per vehicle	25 miles ¹	25 miles	35 miles	45 miles
Average ambient temperature	50°F (Winter) 68°F (Summer)	68°F	50°F	104°F
Plug-in vehicles that are all-electric	50%	25%	50%	75%
Plug-in vehicles that are sedans	50%	80%	80%	20%
Mix of workplace charging	20% Level 1 and 80% Level 2	80% Level 1 and 20% Level 2	20% Level 1 and 80% Level 2	80% Level 1 and 20% Level 2
Access to home charging	75% with 20% Level 1 and 80% Level 2	50% with 80% Level 1 and 20% Level 2	100% with 50% Level 1 and 50% Level 2	100% with 20% Level 1 and 80% Level 2
Preference for home charging	80%	60%	100%	100%
Home charging strategy	Delayed – finish by departure ²	Immediate – as slow as possible (even spread)	Immediate – as fast as possible	Delayed – start at midnight
Workplace charging strategy	Immediate – as fast as possible	Immediate – as slow as possible (even spread)	Immediate – as fast as possible	Delayed – start at midnight

¹ Based on Healdsburg VMT data utilized for the CMS, vehicles on average travel 18 miles a day. The lowest daily travel option available in EVI-Pro Lite was for 25 miles.

² While this behavior is not what is currently practiced by most Healdsburg residents, Healdsburg chose to model this scenario as the city will aim to implement a large education campaign, time of use strategy, and other programs to encourage EV charging behaviors that reduce peak demands.

This dataset models demand (kW) for 15-minute intervals within a single day (weekday and weekend day) depending on the input parameters. Rincon averaged the 15-minute kW demand over an hour to convert to kWh. Then each day was replicated for weekday/weekend day over an entire year before being applied to the base model to calculate future modeled scenarios. EV charging electricity consumption is based on the size of the fleet added to the model. Vehicle numbers determined from the DMV Open Data Portal were used to model the EV fleet size. The number of EV vehicles added to the model can be done in increments of 500.

A check of the EVI-Lite tool was completed using vehicle miles traveled (VMT) data from Healdsburg CMS obtained from a travel demand model. Annual forecasted VMT was translated to electricity needs for charging based on vehicle energy efficiency (e.g., kWh per mile) values obtained from EMFAC2021 to backcheck electricity needs determined by EVI-Pro Lite modeled values. This backcheck was within 2% of EVI-Pro Lite cumulative results for the Healdsburg-specific case. The percent error between EVI-Pro Lite modeled values and the backcheck electricity needs was least when the CMS VMT values were nearest a multiple of 500 as the EVI vehicles were modeled in the tool in increments of 500. Additionally, the backcheck values were lower than EVI-Pro Lite modeled results. This is due to EVI-Pro Lite background data using a daily mileage that is greater than that anticipated in Healdsburg. Based on the VMT data available for Healdsburg, light-duty vehicles travel on average 19 miles per day while heavy-duty vehicles travel on average 7 miles per day.

Because the lowest daily mileage that can be modeled with EVI-Pro Lite is 25 miles per day, EVI-Pro Lite produced an overestimate of electricity needs for Healdsburg registered vehicles. However, because EV charging in Healdsburg is cheaper than surrounding areas, Healdsburg experiences an influx of drivers coming to the city to charge their vehicles. Therefore, while a higher mileage for EV charging is included in the Model, this is considered representative of the annual EV charging that Healdsburg is likely to experience, and may even be a low estimation if EV drivers are intentionally ‘filling up’ in Healdsburg.

4 Results

4.1 Current Energy and Demand

Annual Electricity Consumption

Figure 1 presents the current annual electricity consumption by month disaggregated by residential and commercial building stock. The baseline model estimated the current net electricity consumption in Healdsburg to be 73,592 MWh for 2023, with the greatest demand occurring in the summer months of July and August. This was compared to actual data in 2023 which totaled 74,985 MWh, a discrepancy of about 2%. The annual modeled net electricity consumption serves as both a baseline and a backcheck on the overall Model accuracy. Approximately 62% of net electricity consumption is from commercial buildings in Healdsburg while the remaining 38% is made up from residential net electricity consumption.

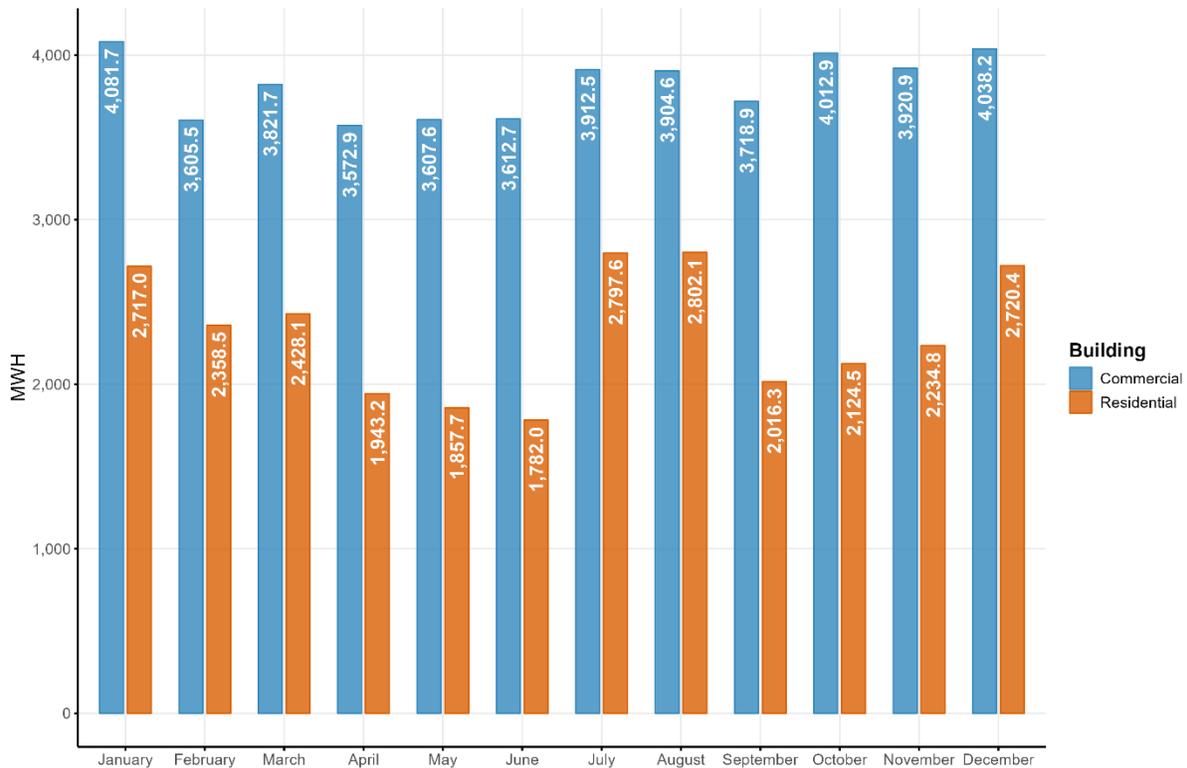


Figure 1 Annual Net Electricity Consumption (MWh) for the Current Base Model Scenario.

The above figure depicts the total expected net electricity consumption in megawatt hours (MWh) for each month under current conditions which encompasses all of the building base models. This graph does not take into consideration additional solar, new appliances, new construction, or additional electric vehicles. The exact value of each individual bar is described in the graph as white text.

Peak Demand

Figure 2 presents the current net peak demand by month. Net peak demand within this Model is measured in MWh on an hourly basis. The model net peak demand for electricity in Healdsburg in 2023 was 21.4472 MWh on August 6th at 6:00 PM. This is due in part to August 6th being one of the three hottest days in 2023. August is typically one of the hottest months in Healdsburg and the net peak demand is partly driven by the need for cooling and the time coinciding with when most residents are arriving home from work and solar has reduced production. Table 9 presents the month, day, time, and temperature of Healdsburg net peak demands over the last 6 years for reference.

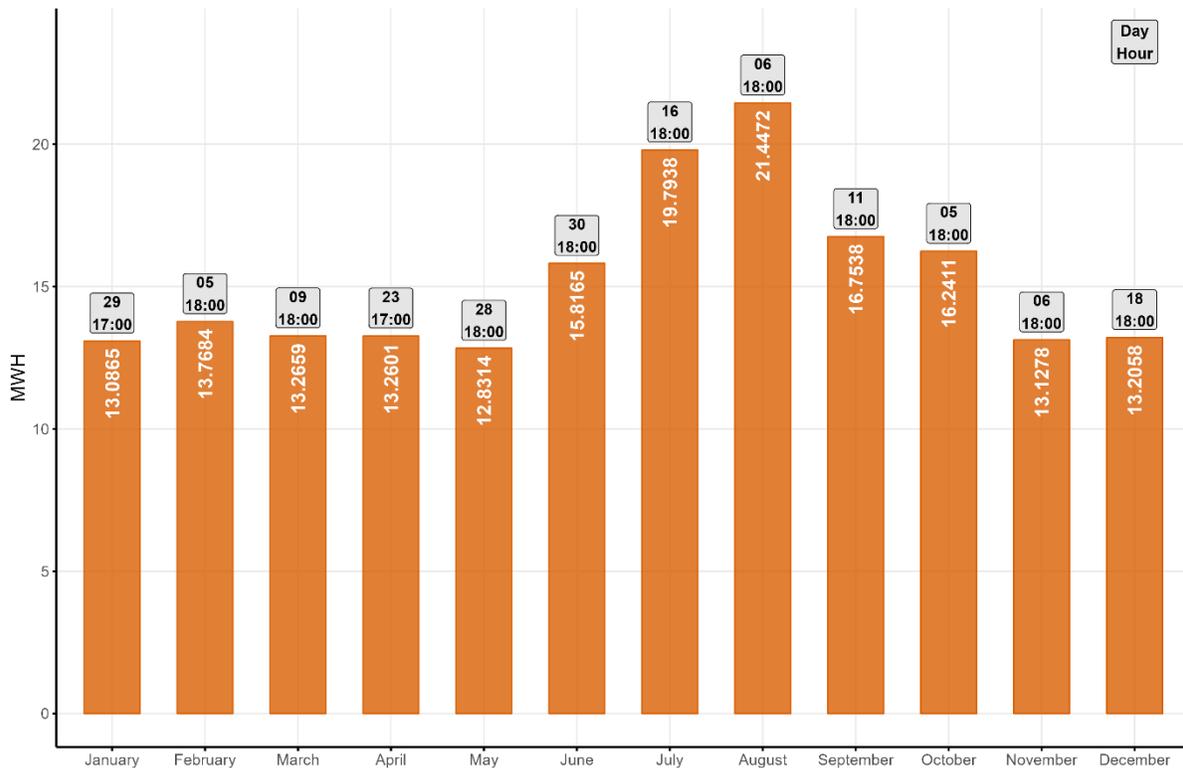


Figure 2 Net Peak Demand (MWh) for the Current Base Model Scenario. The above figure depicts the hour each month with the modeled net peak demand in megawatt hours (MWh) for the maximum hour net electricity consumption under current conditions. This graph does not take into consideration any forecasted changes to solar, buildings, appliances or EVs which will be covered in the forecasted scenarios. The exact value of each individual bar is described in the graph as white text, and the day of the month and hour of each maximum use is displayed in the gray boxes above each bar.

Table 9 Healdsburg Historic Net Peak Demand

Date	Time	Peak Demand (MW)	Temperature (F)
September 25, 2019	17:00	23.00	103
September 7, 2020	17:00	23.19	111
June 17, 2021	18:00	20.48	102
September 6, 2022	15:00	24.63	114
August 6, 2023	19:00	19.24	100
July 2, 2024	19:00	23.63	105

4.2 Energy and Demand Scenarios

The following sections provide the results for all forecasted scenarios in terms of electricity consumption (i.e., no solar included) and net electricity consumption (i.e., with solar included) on an annual, monthly, and peak demand basis.³⁸ Electricity consumption shows the total electricity needed to power homes, businesses, and vehicles in Healdsburg. As electricity consumption increases, the utility will need to deploy additional resources to meet this demand.

Annual Electricity Consumption

Figure 3 demonstrates the change in electricity consumption for buildings only (i.e., no EVs or solar) compared with the current building electricity consumption across all scenarios and milestone years. As shown, building electrification under all scenarios increases annual electricity consumption by 2030 by approximately 4,000 MWh. By 2045 building electrification increases annual electricity consumption beyond current consumption by approximately 12,500 to 15,500 MWh depending on the scenario. Figure 4 presents the modeled annual electricity consumption for both buildings and EV charging across all scenarios and milestone years. As shown, modeled EV charging increases annual electricity consumption compared to current consumption by approximately 11,000 to 35,000 MWh by 2030 and approximately 53,000 to 87,000 MWh by 2045 depending on the scenario. Compared with Figure 3, this demonstrates that increased EV adoption and associated charging needs could increase annual electricity consumption an additional 7,500 to 31,500 MWh by 2030 and 40,000 to 72,000 MWh by 2045 compared with the impacts of building electrification alone. As such, between 68% to 89% of increased annual electricity consumption in 2030 and between 76% to 83% of increased annual electricity consumption in 2045 is attributable to EV charging needs versus building electrification. Table 10 shows that electricity consumption could increase to between 85,000 MWh to 109,000 MWh by 2030 and to between 126,000 to 161,000 MWh by 2045. This is 1.1 to 1.5 times the current consumption by 2030 and 1.7 to 2.2 times the current consumption by 2045.

Figure 5 presents the modeled annual net electricity consumption across all scenarios and milestone years, accounting for increased electricity consumption from building electrification and EV charging as well as the offsetting impacts of increased on-site solar generation. Compared with Figure 4, this demonstrates that the modeled increased solar generation can offset electricity consumption from building electrification and EV charging by approximately 3,000 MWh and 10,500 MWh annually by

³⁸ Each of the forecasted scenarios were modeled under Healdsburg-specific EV charging conditions and assuming electrification of HVACs with standard heat pump HVAC systems. Modeling standard HVAC systems provides a more conservative estimate for forecasting electricity demand compared to modeling higher efficiency heat pumps.

2030 and 2045, respectively. All scenarios were modeled with consistent solar generation assumptions over time. Consequently, in scenarios with higher rates of building electrification and EV penetration, the additional solar generation has a reduced effect in offsetting the increased electricity consumption. Table 10 further details the annual net electricity consumption by scenario and by milestone year disaggregated by building electricity usage, EV charging usage, and impact of on-site solar generation. Based on the modeled scenarios, net electricity consumption is projected to increase by approximately 8,000 to 32,000 MWh by 2030 and 42,000 to 77,000 MWh by 2045 compared to current net electricity consumption, depending on the scenario. As shown in Table 10, for the Most Likely scenario, net electricity consumption is anticipated to increase by about 31% by 2030 and nearly 75% by 2045 compared with current annual net electricity consumption.

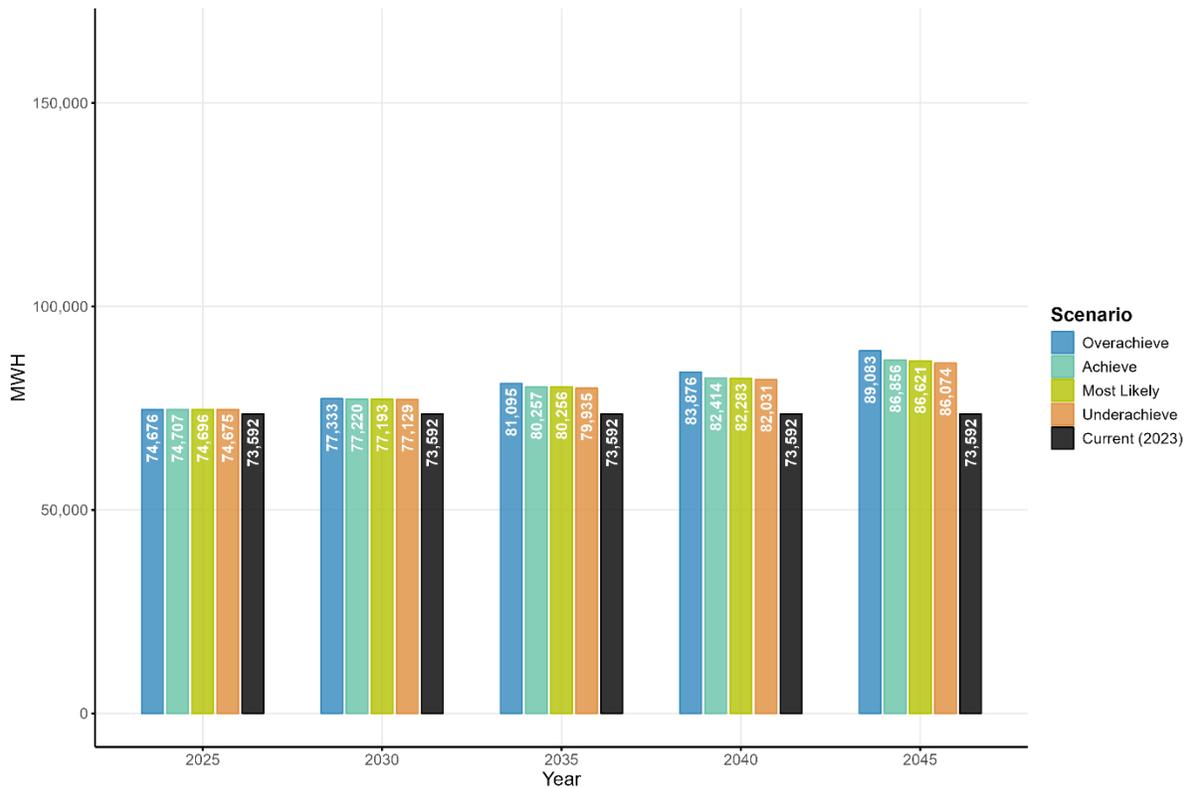


Figure 3 Annual Building Electricity Consumption (MWh) For Each Year of Each Modeled Scenario. The above figure depicts the expected electricity consumption by buildings in megawatt hours (MWh) for each milestone year and across each scenario. Scenarios are ordered from highest achieving to lowest and the grouped bars for each year are in the same order as described in the legend. The exact value of each individual bar is described in the graph as white text.

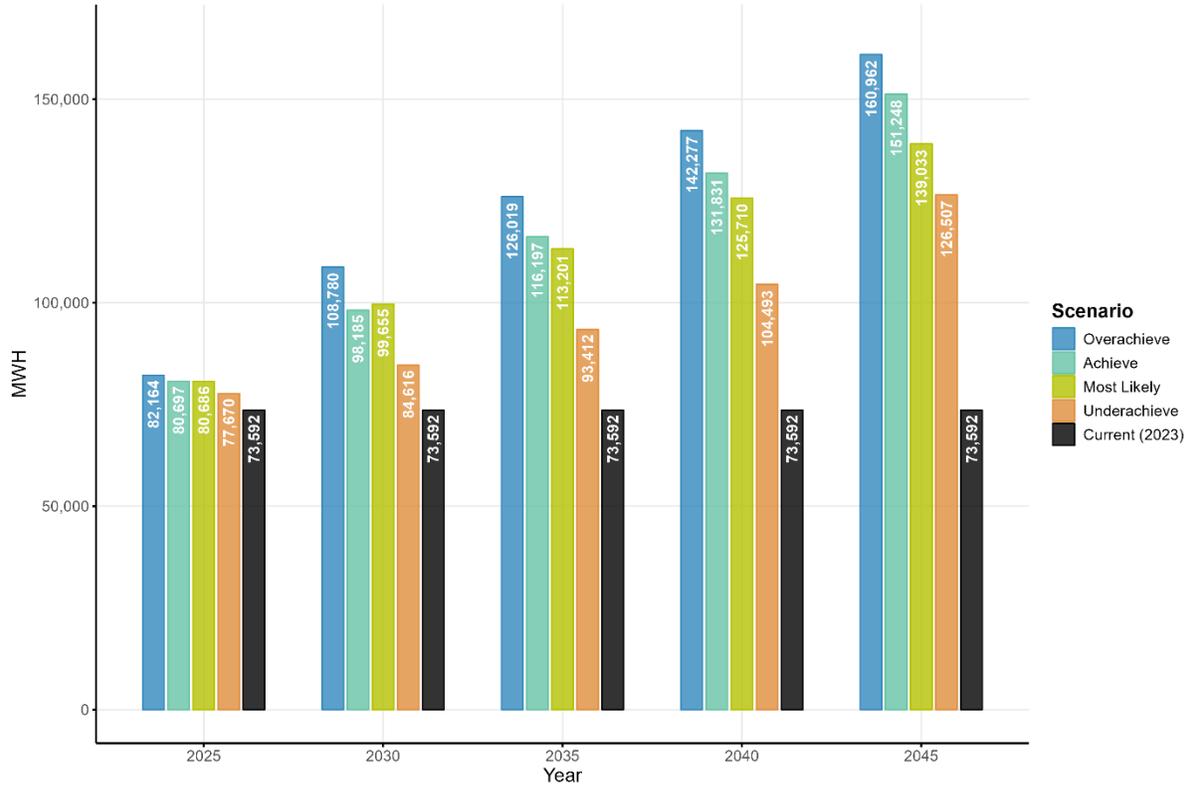


Figure 4 Annual Building and Electric Vehicle Electricity Consumption (MWh) For Each Year of Each Modeled Scenario. The above figure depicts the expected electricity consumption by buildings and EVs in megawatt hours (MWh) for each year of each scenario. Scenarios are ordered in highest achieving to lowest and the grouped bars for each year are in the same order as described in the legend. The exact value of each individual bar is described in the graph as white text.

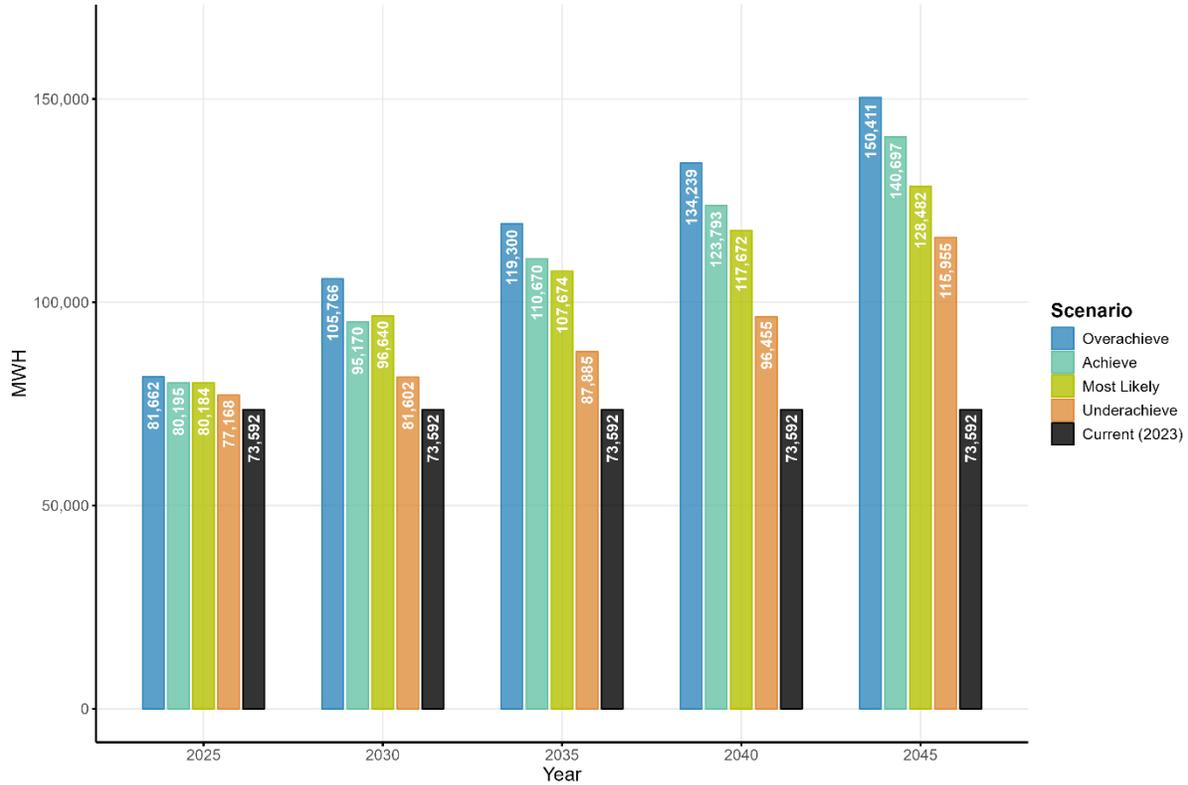


Figure 5 Annual Net Electricity Consumption (MWh) For Each Year of Each Modeled Scenario. The above figure depicts the expected net electricity consumption of building and EVs in megawatt hours (MWh) for each year of each scenario with the inclusion of solar. The continued growth of solar on new and existing buildings helps drive a decrease in annual net electricity consumption in most scenarios compared to the electricity consumption without solar included (Figure 4). Scenarios are ordered in highest achieving to lowest and the grouped bars for each year are in the same order as described in the legend. The exact value of each individual bar is described in the graph as white text.

Table 10 Annual Electricity Consumption (MWh) by Scenario and Year

Scenario	2025	2030	2035	2040	2045
Underachieve					
Building Annual Electricity Consumption (MWh) ¹	74,675	77,129	79,935	82,031	86,074
EV Annual Electricity Consumption (MWh) ²	2,995	7,487	13,477	22,462	40,433
Annual Electricity Consumption (MWh)	77,670	84,616	93,412	104,493	126,507
Solar Offset (MWh)	-502	-3,014	-5,527	-8,038	-10,552
Net Annual Electricity Consumption (MWh)	77,168	81,602	87,885	96,455	115,955
% Increase from Current Usage	5%	11%	19%	31%	58%
Most Likely					
Building Annual Electricity Consumption (MWh) ¹	74,696	77,193	80,256	82,283	86,621
EV Annual Electricity Consumption (MWh) ²	5,990	22,462	32,945	43,427	52,412
Annual Electricity Consumption (MWh)	80,686	99,655	113,201	125,710	139,033
Solar Offset (MWh)	-502	-3,015	-5,527	-8,038	-10,551
Net Annual Electricity Consumption (MWh)	80,184	96,640	107,674	117,672	128,482
% Increase from Current Usage	9%	31%	46%	60%	75%
Achieve					
Building Annual Electricity Consumption (MWh) ¹	74,707	77,220	80,257	82,414	86,856
EV Annual Electricity Consumption (MWh) ²	5,990	20,965	35,940	49,417	64,392
Annual Electricity Consumption (MWh)	80,697	98,185	116,197	131,831	151,248
Solar Offset (MWh)	-502	-3,015	-5,527	-8,038	-10,551
Net Annual Electricity Consumption (MWh)	80,195	95,170	110,670	123,793	140,697
% Increase from Current Usage	9%	29%	50%	68%	91%
Overachieve					
Building Annual Electricity Consumption (MWh) ¹	74,676	77,333	81,095	83,876	89,083
EV Annual Electricity Consumption (MWh) ²	7,488	31,447	44,924	58,401	71,879
Annual Electricity Consumption (MWh)	82,164	108,780	126,019	142,277	160,962
Solar Offset (MWh)	-502	-3,014	-6,719	-8,038	-10,551
Net Annual Electricity consumption (MWh)	81,662	105,766	119,300	134,239	150,411

% Increase from Current Usage	11%	44%	62%	82%	104%
1. Building electricity consumption presented here includes electricity used for EV charging as of 2023 due to the inclusion of EV charging electricity usage included in the base data from Healdsburg Electric.					
2. EV electricity consumption encompasses all new EV charging consumption post-2023.					

Monthly Electricity Consumption

To better understand electricity consumption throughout the year monthly electricity consumption for each scenario was also analyzed. Figure 6 demonstrates the modeled monthly electricity consumption by buildings under each scenario while Figure 7 demonstrates the modeled monthly electricity consumption by buildings and EVs under each scenario. As shown in Figure 6, electricity consumption for buildings will continue to be largest in winter months (e.g., December and January) and summer months (e.g. July and August), coinciding with the coldest and hottest times periods where electricity consumption for heating and cooling is at highest demand. While current trends show similar consumption in the winter and summer months, modeled scenarios show that at higher electrification rates such as those reached by 2045, the electricity consumption in the winter may surpass the usage in the summer. This is due to the conversion of natural gas furnaces to electric heat pumps for heating.

The added consumption for EV charging, shown in Figure 7, increases the overall monthly electricity consumption based on the number of EVs included in the modeled scenario. However, the general trends for the months with highest consumption remain similar to those trends observed in Figure 6 just at a greater magnitude due the assumption that driving behaviors are the same throughout the year. As shown in Figure 8, the addition of solar on new and existing buildings is able to offset some of the increased electricity consumption from building and vehicle electrification.

A comparison between Figure 7 and Figure 8 show that increased solar generation has the greatest impact on the monthly net electricity consumption occurring in the summer when solar generation is at its highest. For example, in the Overachieve scenario in 2045, the monthly electricity consumption in January is nearly 15,000 MWh and approximately 13,750 MWh in July and August, a 1,250 MWh difference between the winter and summer monthly usage (Figure 7). On the other hand, with the addition of solar, in the Overachieve scenario in 2045, the monthly net electricity consumption in January is only slightly lowered to approximately 14,800 MWh while in July and August the monthly net electricity consumption drops to approximately 12,500 MWh, a 2,300 MWh difference between the winter and summer monthly net electricity consumption (Figure 8).

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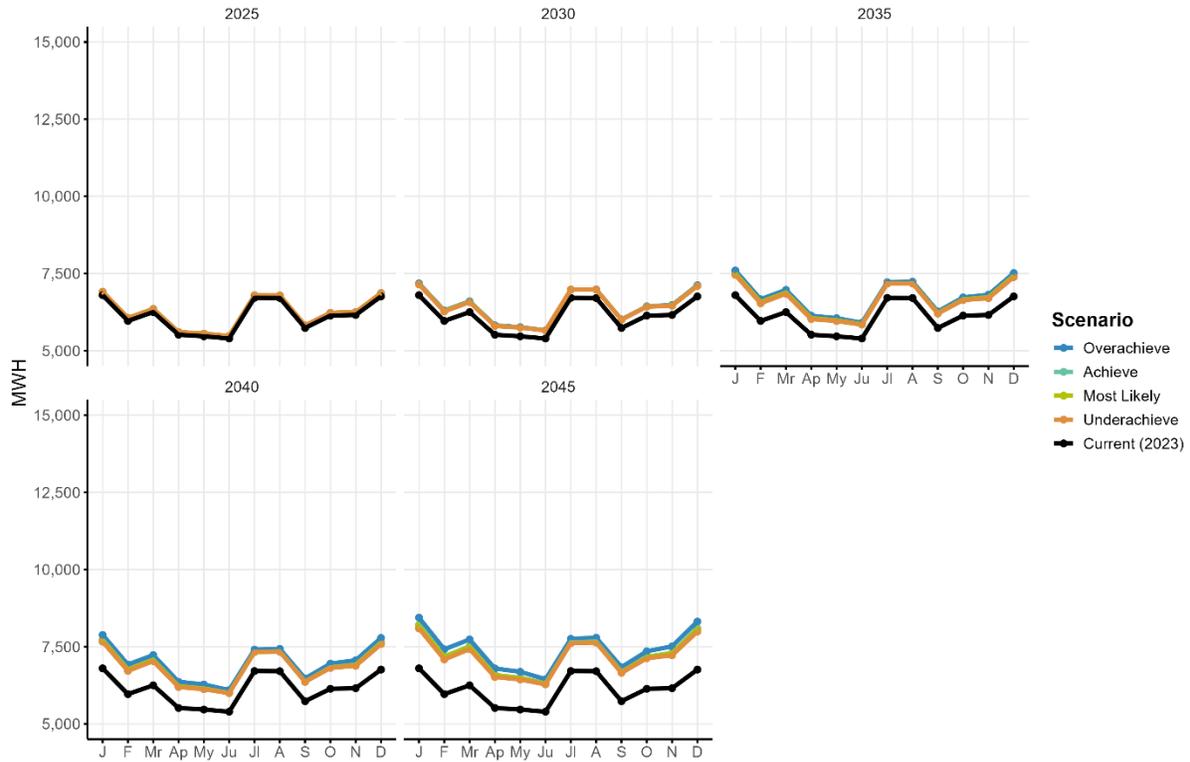


Figure 6 Monthly Building Electricity Consumption (MWh) For Each Year of Each Modeled Scenario. The above figure depicts the expected monthly electricity consumption by buildings in megawatt hours (MWh) for each milestone year and across each scenario. Scenarios are color coded as described in the legend.

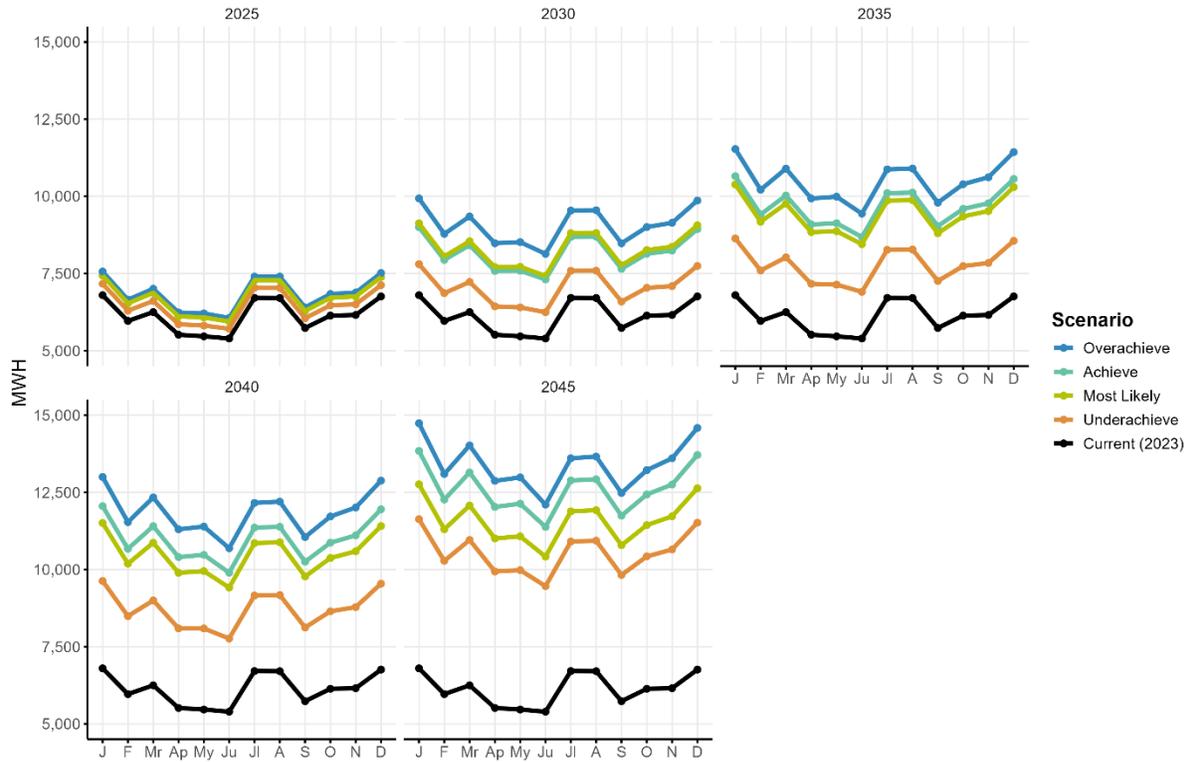


Figure 7 Monthly Building and Electric Vehicle Electricity Consumption (MWh) For Each Year of Each Modeled Scenario. The above figure depicts the expected monthly electricity consumption by buildings and EVs in megawatt hours (MWh) for each year of each scenario. Scenarios are color coded as described in the legend.

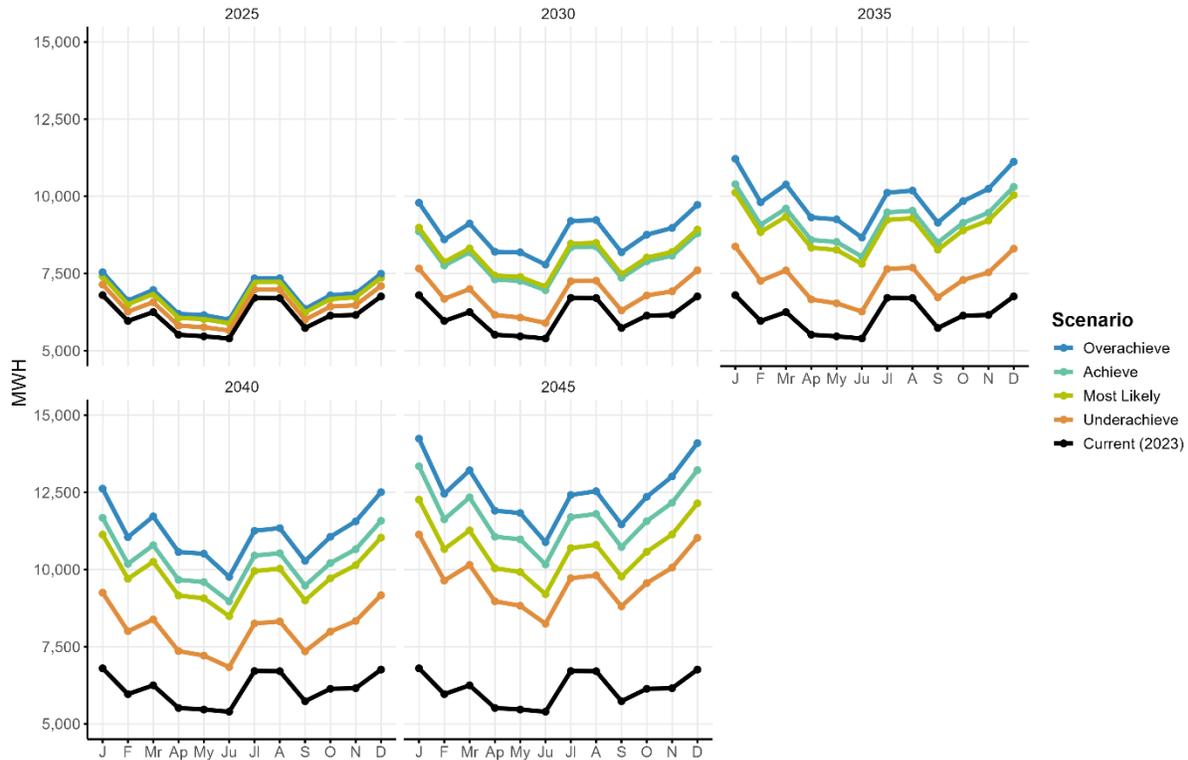


Figure 8 Monthly Net Electricity Consumption (MWh) For Each Year of Each Modeled Scenario. The above figure depicts the expected monthly net electricity consumption of building and EVs in megawatt hours (MWh) for each year of each scenario with the inclusion of solar. Scenarios are color coded as described in the legend.

Peak Demand

The electricity grid is built to meet/exceed peak demand. As peak demand increases, the grid will need to be improved to handle these new peak loads. The following section discusses the peak demand³⁹ for each of the scenarios determined on an annual basis as well as on a monthly basis. Figure 9 summarizes the peak demand from buildings only on an annual basis while Figure 10 shows the peak demand from buildings only by month for all scenarios for each milestone year modeled. As shown in Figure 9 and Figure 10, when evaluating just building peak demand, in all the scenarios the peak demand is modeled to occur on August 6th at 6 pm. This is due in part to August 6th being one of the three hottest days in 2023, the year in which the baseline electricity consumption is based on. Further as shown in Figure 10, the monthly peak demand occurs between 5 and 6pm coinciding with people returning home from work and increased use of appliances (especially AC units) at the home. As shown, building electrification under all scenarios has a relatively minor impact on peak demand through 2030, adding up to 0.44 MWh or a 2% increase to current peak demand compared with the highest electrification scenario modeled (Overachieve). By 2045, peak demand from building electrification could increase peak demand by an additional 1.57 MWh or a

³⁹ The hourly model produced results for the maximum hour electricity consumption during different time frames, which is referred to in this section as the peak demand. Instantaneous peak demand is estimated to be approximately 5% higher than the maximum hour electricity consumption.

7% increase beyond current peak demand under a 100% electrification scenario as shown in the Overachieve scenario.

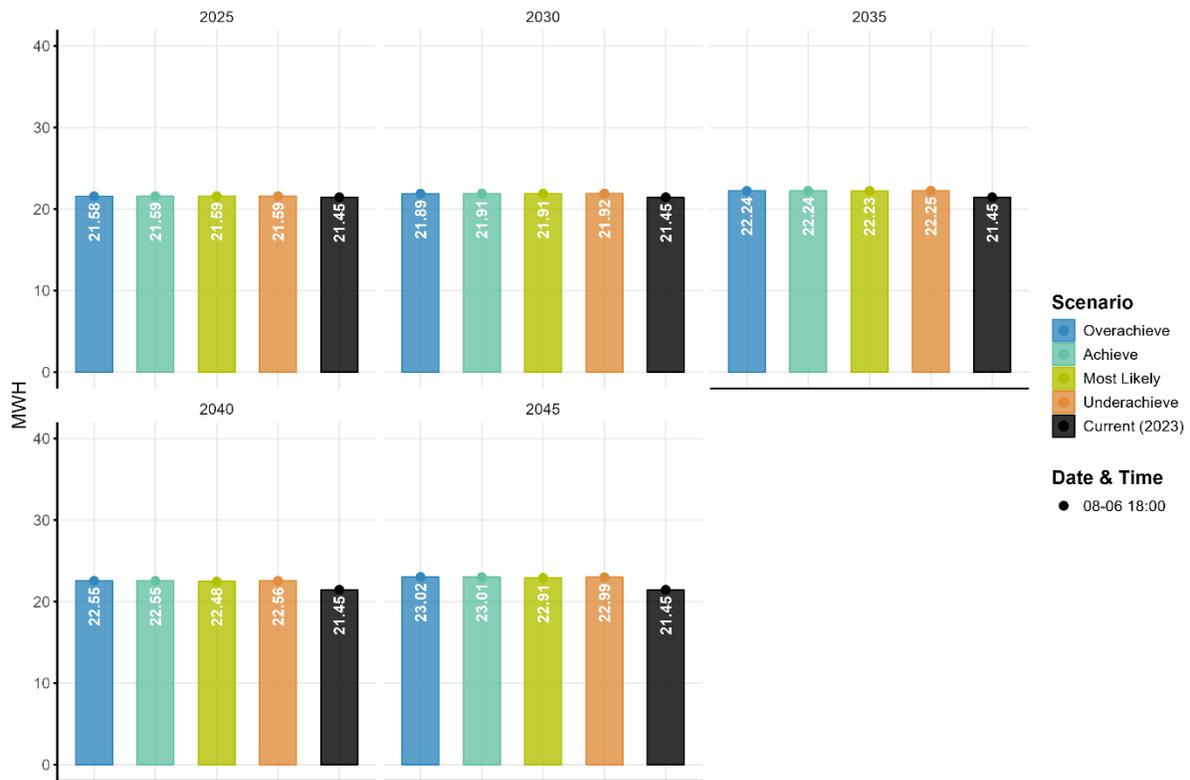


Figure 9 Annual Building Peak Demand (MWh) For Each Year of Each Modeled Scenario. The above figure depicts the expected annual peak demand in megawatt hours (MWh) for the maximum hour electricity consumption for buildings across each year for each scenario. Scenarios are ordered from highest achieving to lowest and the grouped bars for each year are in the same order as described in the legend. The exact value of each individual bar is described in the graph as white text. The legend indicates the symbol to represent the day and time peak demand occurred.

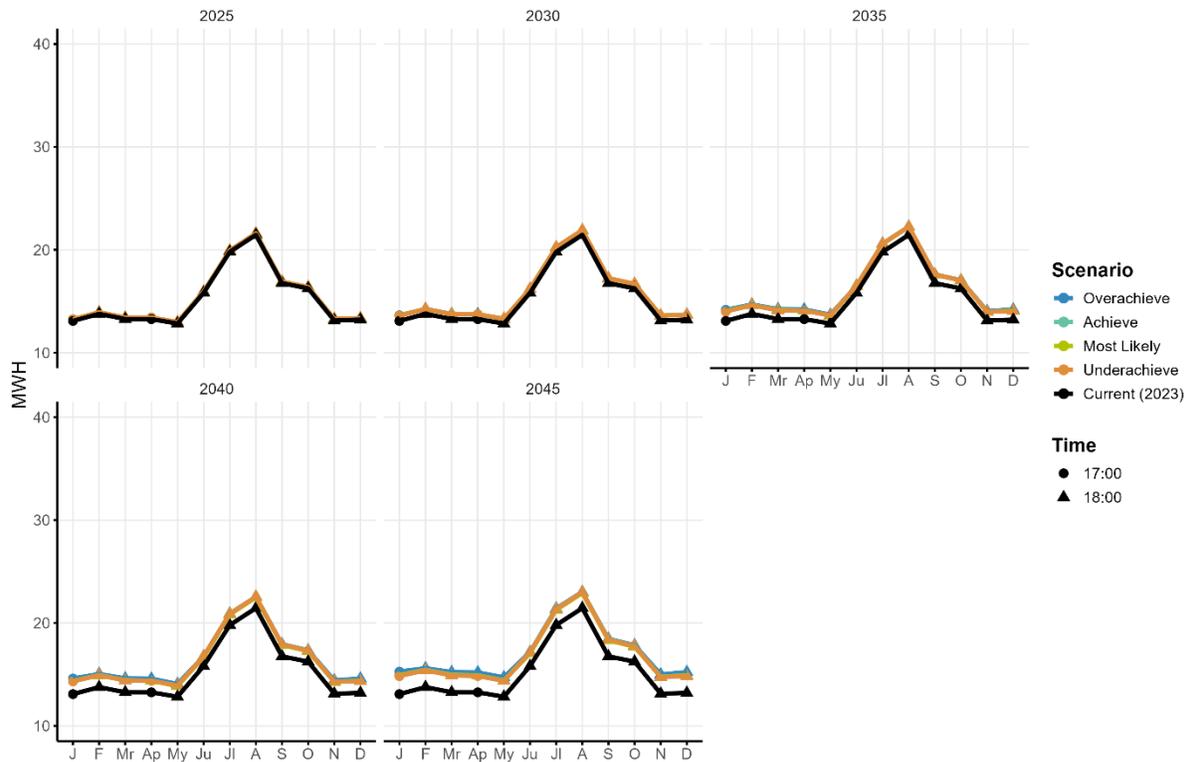


Figure 10 Monthly Building Peak Demand (MWh) For Each Year of Each Modeled Scenario. The above figure depicts the expected monthly peak demand in megawatt hours (MWh) for the maximum hour electricity consumption for buildings across each year for each scenario. The legend indicates the symbol to represent the time of day peak demand occurred in a given month.

Figure 11 summarizes the peak demand from buildings and EVs on an annual basis, while Figure 12 shows the peak demand from buildings and EVs on a monthly basis for all scenarios for each milestone year modeled. As shown in Figure 11, peak demand could increase beyond current peak demand by 4% to 9% in 2030 and between 24% and 77% in 2045 depending on the modeled scenario. Based on the Most Likely scenario, peak demand is anticipated to increase by about 1.59 MWh or 7% in 2030 and 9.50 MWh or 44% in 2045 compared with current peak demand.

Figure 12 further demonstrates that the timing of peak demand is anticipated to change with increasing penetration of EVs. For all scenarios, through 2030 the peak demand is modeled to occur August 6th at 6pm. As previously described, the date coincides with one of the hottest days of the baseline year and at a time when people are coming home from work. However, by 2045, for all scenarios the peak demand is modeled to occur on February 23rd at 7 am coinciding with one of the coldest days of the baseline year and at a time when people are getting ready to leave for work and their cars are finishing up their charging.

This is likely due to two interacting factors. First, as described in *Monthly Electricity Consumption*, the electricity consumption in the winter months for heating is anticipated to increase as building electrification results in the replacement of natural gas furnaces with electric heat pumps. This is illustrated in Figure 10 where peak demand in buildings increases with increasing electrification occurring through 2045 and the peak demand in winter months increases at a greater magnitude than the peak demand in summer months (though the summer peak still remains much higher than

the winter peak in buildings). The second factor contributing to the trends observed in Figure 11 and Figure 12, is the EV charging regime modeled and the increasing penetration of EVs modeled over time. As detailed in *Electric Vehicle Charging*, by 2045 every scenario assumes more than half of all vehicles will be EVs. Further, the Healdsburg-specific charging regime modeled for all scenarios assumes that home charging will be delayed and programmed to finish by departure (i.e., in time for the morning commute). As more EVs are charging with a home charging regime to finish by departure, the electricity demand just before people leave for work will continue to increase. As shown in Figure 12, these compounding factors start to shift the peak demand from the evening of the hottest days of the year to the mornings of the coldest days of the year. Faster EV adoption results in an earlier shift from summer to winter peaks. For example, in the Overachieve scenario, the peak demand transitions from August 6th at 6pm to February 23rd at 7am between 2030 and 2035, while for the Underachieve scenario, with a lowest number of EVs modeled, the peak demand does not transition to the February 23rd date until the 2045 year (Figure 11). Comparison of Figure 10 and Figure 12 demonstrate that the shift in timing of peak demand is largely driven by the increasing number of EVs rather than changes in peak demand from buildings. Further, this shift is largely dependent on the EV charging regime modeled – changes or greater diversity in the charging strategy deployed by EV users can have significant impacts on when the peak demand may occur. See *Timing and Type of EV Charging* for additional discussion regarding impacts of EV charging strategy and behavior.

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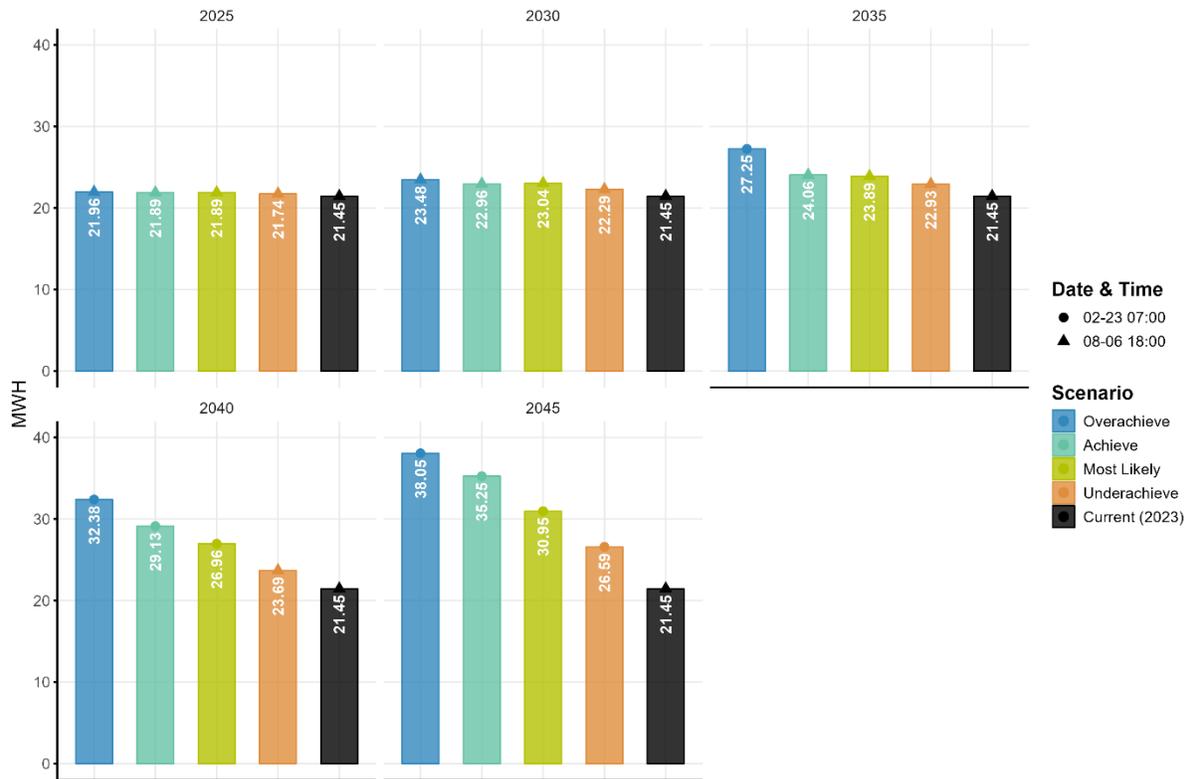


Figure 11 Annual Building and EV Peak Demand (MWh) For Each Year of Each Modeled Scenario. The above figure depicts the expected annual peak demand in megawatt hours (MWh) for the maximum hour electricity consumption for buildings and EVs across each year for each scenario. Scenarios are ordered from highest achieving to lowest and the grouped bars for each year are in the same order as described in the legend. The exact value of each individual bar is described in the graph as white text. The legend indicates the symbol to represent the day and time peak demand occurred.

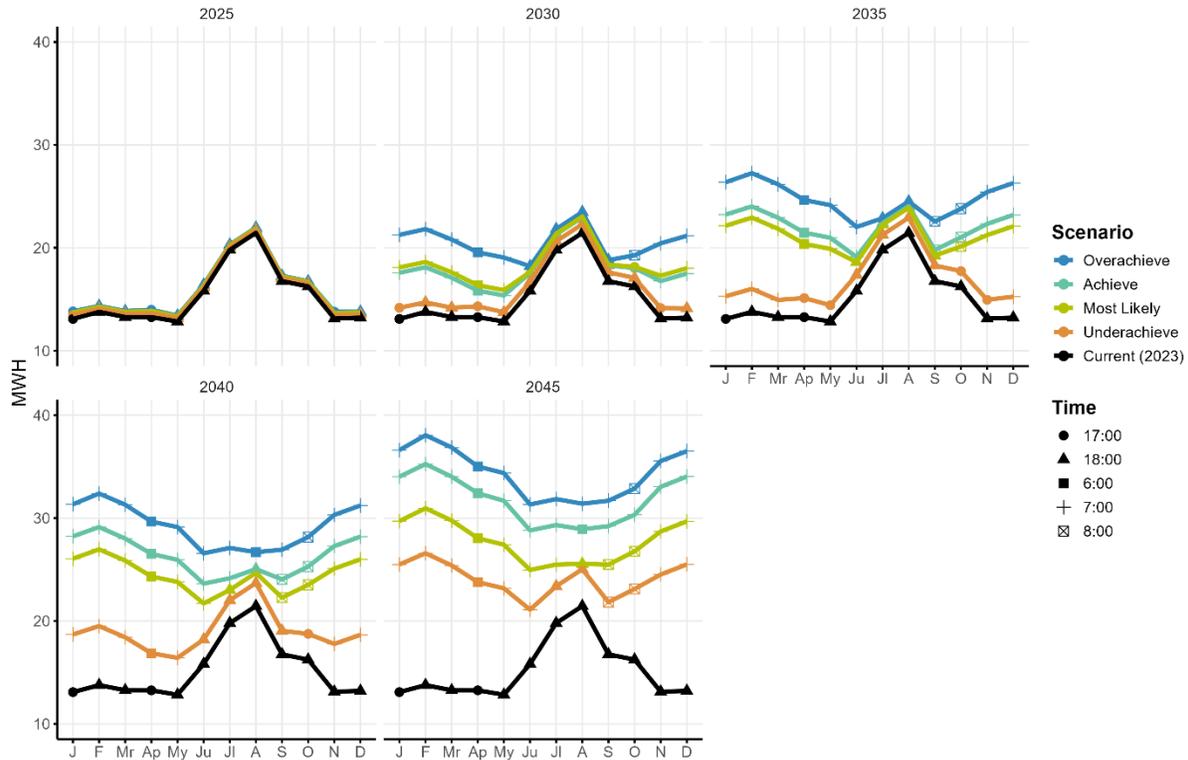


Figure 12 Monthly Building and EV Peak Demand (MWh) For Each Year of Each Modeled Scenario. The above figure depicts the expected monthly peak demand in megawatt hours (MWh) for the maximum hour electricity consumption for buildings and EVs across each year for each scenario. The legend indicates the symbol to represent the time of day peak demand occurred in a given month.

Figure 13 summarizes the annual net peak demand from buildings and EVs for all scenarios for each milestone year modeled with the inclusion of solar, while Figure 14 shows the net peak demand from buildings and EVs on a monthly basis with solar included. Comparison between Figure 11 and Figure 13 demonstrate solar has the ability to offset peak demand by up to 0.05 MWh both in 2030 and 2045. While solar generation is anticipated to grow significantly between 2030 and 2045, solar offsetting potential is highest in summer months when longer daylight hours result in higher solar generation. So as the peak demand shifts from summer months to winter months the impact of solar on the peak demand begins to change. For example, in 2040 when the peak demand for the Underachieve scenario is occurring in August the addition of solar is modeled to offset peak demand by 0.12 MWh whereas in 2045 when the peak demand is modeled to occur in February when solar generation is lower, solar is modeled to offset only 0.05 MWh from the peak demand. Further, as solar generation increases this can influence when the peak demand occurs. For example, it is observed in Figure 11 that the peak demand in the Achieve scenario in 2035 occurs on the August 6th date in the evening, whereas with the addition of solar, the net peak demand is now observed on February 23rd in the morning as shown in Figure 13.

Figure 14 demonstrates the modeled monthly net peak demand for each scenario of each milestone year with the inclusion of solar. While the trends in Figure 14 with solar inclusion and Figure 12 with no solar inclusion are similar, Figure 14 shows that solar does offset the peak demand to varying degrees with the greatest impact on peak demand occurring in the summer months when solar

generation is at its highest. See *Impact of Timing on Peak Demand* for additional information on the interaction of solar generation and peak demands in winter and summer.

Table 11 further details the net peak demand by scenario and by milestone year disaggregated by building demand, EV charging demand, and impact of solar generation. Based on the modeled scenarios, net peak demand is projected to increase by approximately 0.8 to 1.98 MWh by 2030 and 5.09 to 16.55 MWh by 2045 compared to current net peak demand, depending on the scenario. As shown in Table 11, for the Most Likely scenario, net peak demand is anticipated to increase by about 7% by 2030 and nearly 44% by 2045 compared with current net peak demand.

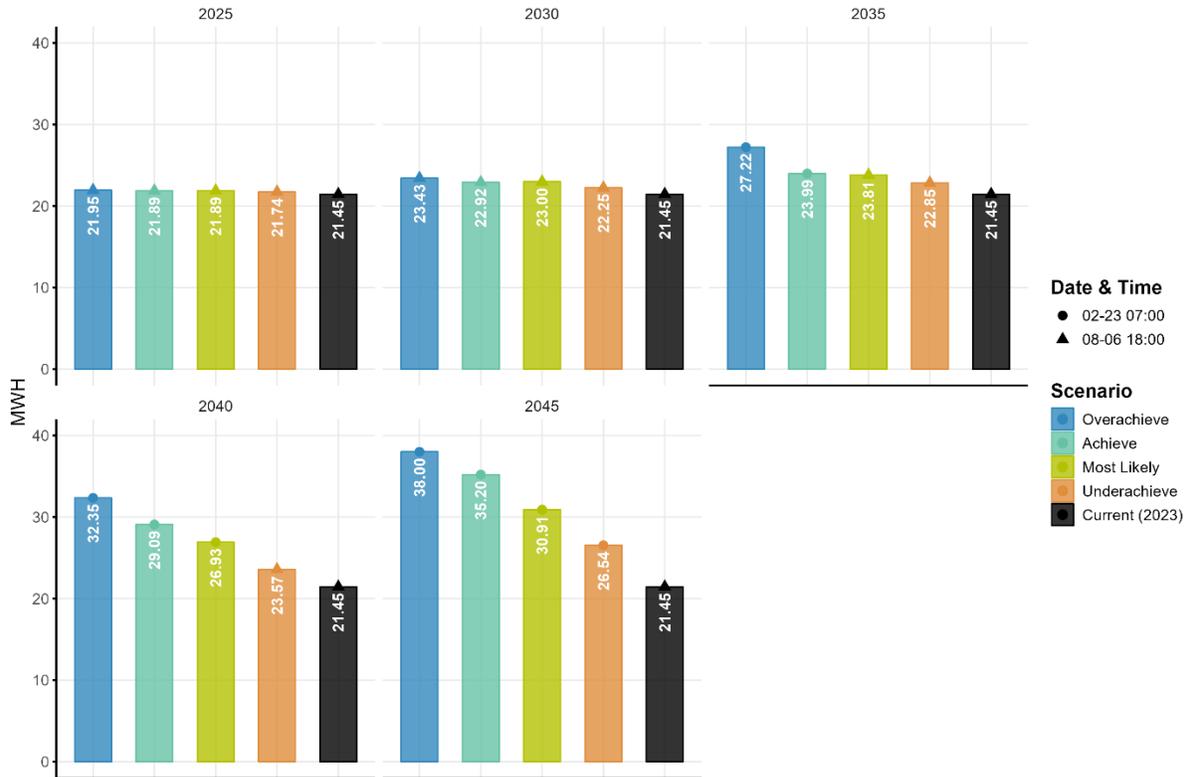


Figure 13 Annual Net Peak Demand (MWh) For Each Year of Each Modeled Scenario. The above figure depicts the expected annual net peak demand in megawatt hours (MWh) for the maximum hour net electricity consumption for buildings and EVs across each year for each scenario with inclusion of solar. Scenarios are ordered from highest achieving to lowest and the grouped bars for each year are in the same order as described in the legend. The exact value of each individual bar is described in the graph as white text. The legend indicates the symbol to represent the day and time peak demand occurred.

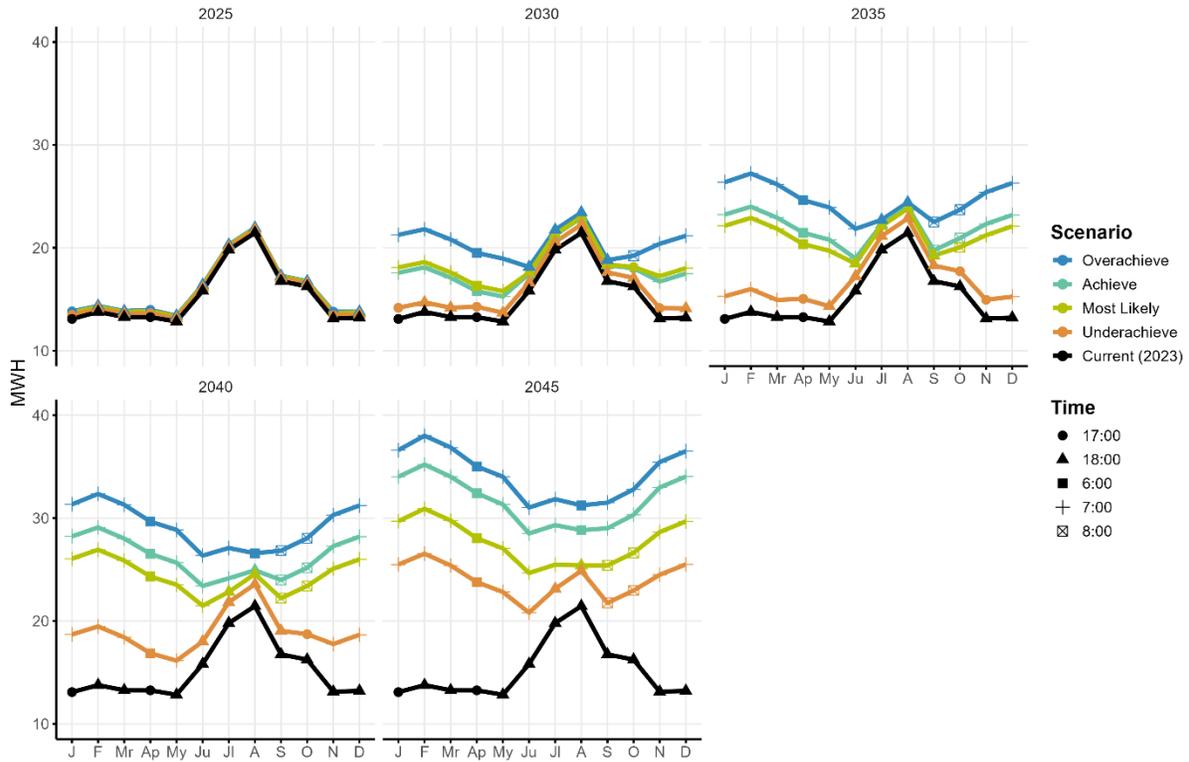


Figure 14 Monthly Net Peak Demand (MWh) For Each Year of Each Modeled Scenario. The above figure depicts the expected monthly net peak demand in megawatt hours (MWh) for the maximum hour electricity consumption for buildings and EVs across each year for each scenario with solar inclusion. The legend indicates the symbol to represent the time of day peak demand occurred in a given month.

Table 11 Peak Demand⁴⁰ (MWh) by Scenario and Year

Scenario	2025	2030	2035	2040	2045
Underachieve					
Building Peak Demand (MWh)	21.59	21.92	22.25	22.56	22.99
EV Peak Demand (MWh)	0.15	0.37	0.68	1.13	3.60
Peak Demand (MWh)	21.74	22.29	22.93	23.69	26.59
Solar Peak Demand Offset (MWh)	0.00	-0.04	-0.08	-0.12	-0.05
Net Peak Demand (MWh)	21.74	22.25	22.85	23.57	26.54
% Increase from Current Peak Demand	1%	4%	7%	10%	24%
Most Likely					
Building Peak Demand (MWh)	21.59	21.91	22.23	22.48	22.91
EV Peak Demand (MWh)	0.30	1.13	1.66	4.48	8.04
Peak Demand (MWh)	21.89	23.04	23.89	26.96	30.95
Solar Peak Demand Offset (MWh)	0.00	-0.04	-0.08	-0.03	-0.04
Net Peak Demand (MWh)	21.89	23.00	23.81	26.93	30.91
% Increase from Current Peak Demand	2%	7%	11%	26%	44%
Achieve					
Building Peak Demand (MWh)	21.59	21.91	22.24	22.55	23.01
EV Peak Demand (MWh)	0.30	1.05	1.82	6.58	12.24
Peak Demand (MWh)	21.89	22.96	24.06	29.13	35.25
Solar Peak Demand Offset (MWh)	0.00	-0.04	-0.07	-0.04	-0.05
Net Peak Demand (MWh)	21.89	22.92	23.99	29.09	35.20
% Increase from Current Peak Demand	2%	7%	12%	36%	64%
Overachieve					
Building Peak Demand (MWh)	21.58	21.89	22.24	22.55	23.02
EV Peak Demand (MWh)	0.38	1.59	5.01	9.83	15.03
Peak Demand (MWh)	21.96	23.48	27.25	32.38	38.05
Solar Peak Demand Offset (MWh)	-0.01	-0.05	-0.03	-0.03	-0.05
Net Peak Demand (MWh)	21.95	23.43	27.22	32.35	38.00
% Increase from Current Peak Demand	2%	9%	27%	51%	77%

⁴⁰ The hourly model produced results for the maximum hour electricity consumption during different time frames, which is referred to in this section as the peak demand. Instantaneous peak demand is estimated to be approximately 5% higher than the maximum hour electricity consumption.

Timing and Type of EV Charging

Based on the analysis, EV charging will be the major driver of peak demand as buildings and vehicles are electrified. However, while building electricity consumption and peak demand is largely driven by factors such as weather and temperature, EV charging electricity consumption and peak demand is largely driven by behavior. The Most Likely scenario was used to further analyze monthly peak demand for each forecast year under different EV charging regimes. EV charging regimes used for this analysis included the Healdsburg-specific case, as used in all modeled scenarios discussed thus far, as well as the EVI-Pro default Base and Best Case scenarios as defined in Table 8. The variables most influential of peak demand in relation to EV usage include the following:

- Charger speed (e.g., Level 1 vs Level 2)
- Charger location (e.g., workplace vs home)
- Timing of charging
- Charging strategy (e.g., fast as possible, slow as possible)
- Fleet make-up efficiency of the EV (e.g., the percentage of EV fleet anticipated to be passenger EVs vs SUVs, trucks or commercial EVs)
- Miles driven per day

Total miles driven, energy efficiency of the vehicles, and the fleet make up (e.g., light-duty vs heavy-duty) are the primary drivers in the electricity consumption associated with EV charging. For peak demand, charging behavior such as whether the vehicle is charged as fast as possible, or as slow as possible and timing of charging significantly impacts peak demand. Refer to Table 8 for details on input parameters for Healdsburg-specific, Base, and Best Cases.

As shown in Figure 15, under the Most Likely scenario, the Base Case results in net peak demand approximately 40% greater than current net peak demand in 2030 and 100% greater than current net peak demand in 2045 with the net peak demand always occurring in summer months (e.g. August) in the evening around 6pm. Similarly, under the Best Case, the net peak demand also occurs in the summer months and evening hour through 2045 though the net peak demand is only about 10% higher in 2030 and 30% higher in 2045. The Base Case employs an “immediate -fast as possible” charging strategy while the Best Case employs an “immediate – slow as possible” charging strategy to even the spread of charging. Because both home charging strategies involve beginning to charge immediately, this overlaps with building peak demand. The result is net peak demand occurring during summer evenings. However, the Best Case “slow as possible” strategy shows a significantly reduced impact to the net peak demand compared with the Base Case by smoothing the spread of charging throughout the night when overall building demand is low. In contrast, the Healdsburg-specific Case employs a “delayed – finish by departure” strategy that shifts charging time to occur early in the morning prior to departure. This results in the summer peak being offset to a greater extent than in the Base and Best-Case scenario with only about a 5% increase by 2030 and 16% increase by 2045 compared with current summer net peak demand. However, while this charging strategy reduces the impact on the summer net peak demand it does increase the prevalence of a winter net peak demand in the morning that coincides with the building electricity winter peak demand. This results in a winter net peak demand that is about 50% greater in 2030 and 150% greater in 2045 than the currently observed winter net peak demand. Overall, this results in an annual net peak demand that is about 45% higher than current net peak demand by 2045 and with a shift in net peak demand from summer evenings to winter mornings.

As previously described, building peak demand differs in the summer and winter months where in the summer building peak demand occurs in the evenings when people are arriving home from work, cooling demand is high and solar generation is reducing. In the winter, building net peak demand occurs early in the morning when people are starting their day, heating demand is high, and solar generation for the day has not started yet. While building net peak demand currently occurs in the summer, the magnitude of electricity needed for EV charging can shift the overall net peak demand to whenever the bulk of EV charging is taking place. When the EV charging peak demand aligns with the building peak demand, higher impacts to the grid are observed. This occurrence can be seen in Figure 15, where for the Most Likely scenario under the Healdsburg-specific Case a winter net peak demand in February grows over time as charging demand for EVs increases with increasing EV penetration. By 2040, the winter net peak demand in the Most Likely scenario is larger than the summer net peak demand previously observed. This is due to EV electricity demand dominating the net peak demand over building electricity demand by 2040 and the timing of EV electricity demand under a “delayed- finish by departure” charging strategy causing an early morning peak demand for EV charging.

Based on the analysis of current annual net electricity consumption and net peak demand and anticipated levels of electrification, EV charging is expected to be the primary driver of future electricity consumption and peak demand. This is due to increased electricity consumption in the building stock being partially offset by the energy efficiency of new electric appliances, the anticipated increase in solar arrays due to building code requirements, and the comparatively large amount of electricity needed to move a large vehicle at high speeds. The results of this analysis also provide insight into the importance of EV charging behavior. If EV charging can be incentivized to occur during off-peak hours and spread across the day with both at home and workplace charging, the overall impact to the grid can be greatly reduced. Alternatively, if charging occurs at the same time across the city and at a time that coincides with the summer afternoon or winter morning building peak demand, then the grid impacts will be exacerbated.

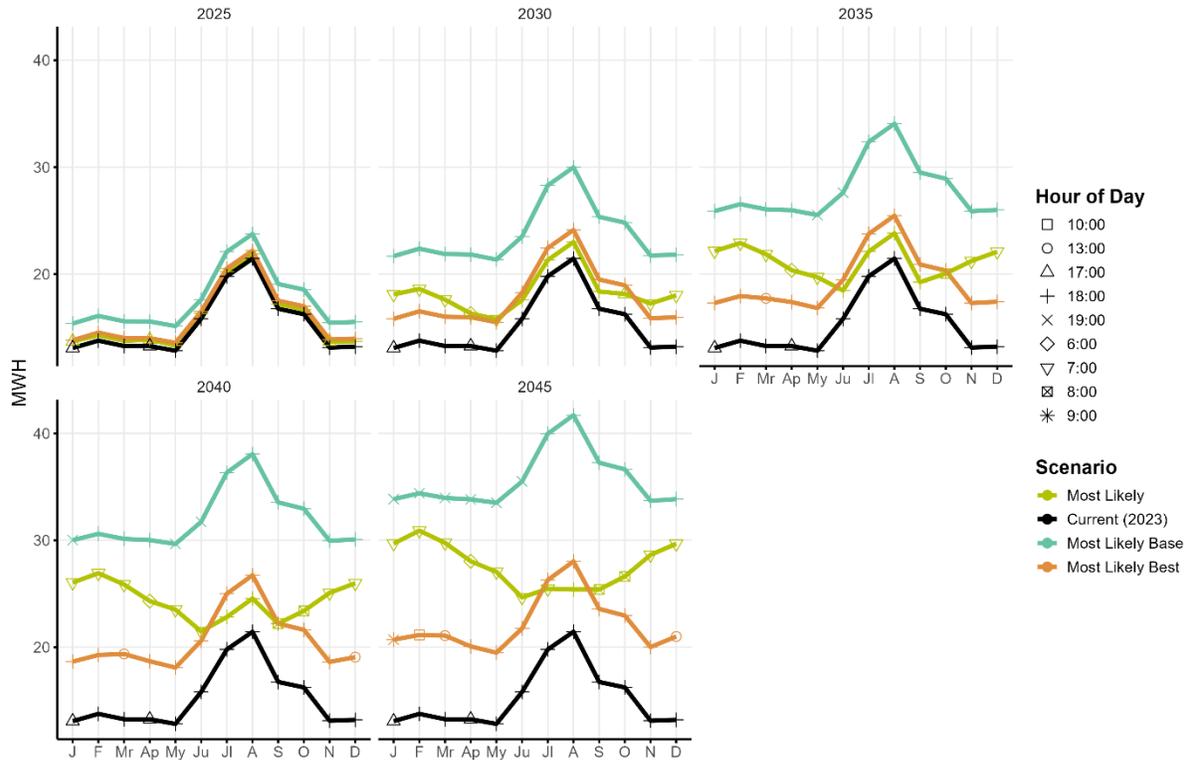


Figure 15 Monthly Net Peak Demand (MWh) for Each Year for the Most Likely Scenario Under Varying EV Charging Regimes. The above figure depicts the expected monthly net peak demand in megawatt (MWh) for the maximum hour net electricity consumption for the Most Likely scenario under different EV charging regimes including: Healdsburg-specific Case denoted as “Most Likely”, Base Case denoted as “Most Likely Base”, and Best Case denoted as “Most Likely Best” in the legend. These curves include building and EV electricity demand with the inclusion of solar. The legend shows the time of day for each month’s peak demand as well as the corresponding symbol. Note that though evaluated, “Most Likely Worst” is not presented in the above graph as it results in net peak demand that far exceeds the presented scenarios, greatly altering the Y-axis and therefore limiting the ability to clearly see the trends presented. Further, the “Most Likely Worst” scenario is deemed to be highly unlikely and not representative of a trend that would be observed in actuality.

The Healdsburg-specific EV charging case requires Healdsburg to be successful in managed EV charging programs and promoting diversified charging behaviors amongst EV drivers. The Healdsburg-specific EV charging case uses the selection of charging for “delayed - finish by departure”. This is one of the primary objectives of Healdsburg’s new Home Energy Load Management Program – to avoid evening peak hours and strategically charge enrolled vehicles to meet their ready-by preferences while reducing grid impacts of many vehicles all charging at once overnight or in the early morning. Healdsburg has also implemented pricing structure changes at its public EV chargers to discourage charging during evening peak hours and provides commercial EV charger rebates to promote workplace charging. Programs such as these will be critical to avoid adding onto the existing summer cooling peak demand, compounding early morning winter peak demands due to building electrification combined with overnight EV charging, or creating a new peak if enough EVs are all scheduled to start charging at the same time, such as midnight. Ideally, EV drivers will charge as much as possible from the mid-morning through early-afternoon to take advantage of abundant solar resources on the grid, as well as avoid seasonal peak

hours (winter and summer) and diversify their overnight charging. Survey results for when EV drivers plan to charge were varied, but the highest preference was for overnight at home starting right when they get home during current evening peak demands. To avoid the high peaks shown in the model when using the Base Case, Best Case or even the Healdsburg-specific Case, Healdsburg will need more participation in its EV programs to manage loads and substantial outreach on desired charging behaviors, as well as evaluation of time-of-use (TOU) rate improvements.

Impact of Timing on Peak Demand

As demonstrated in the previous sections, the interaction between building electricity demand, EV charging demand, and solar generation play an influential role in when peak demand occurs. To further demonstrate this interaction as it relates to seasonal changes in peak demand, a daily electricity demand curve for an average summer day (in July) and an average winter day (in January) was prepared. This demonstration scenario was modeled based on the electricity demand for 250 new single-family buildings, 500 EVs following the Healdsburg-specific EV charging case, and 250 3.5 kW solar arrays to correspond with a single 3.5 kW array added per new single-family building. As shown in Figure 16, on a typical July day, a new single-family building shows a steady increase in electricity consumption throughout the day starting around 6am and peaking around 6 to 7pm, while EV charging peaks between 6 and 8am. However, the large peak in solar generation in the middle of the day is able to completely offset the electricity demand occurring in the middle of the day. This results in an overall daily curve that peaks in the morning between 6 and 7am. At this time of day solar energy is just getting started and can only marginally decrease the EV charging electricity demand. The buildings' overall demand drops sharply off as solar generation increases resulting in more electricity being sent to the grid than being consumed during the middle of the day such that the daily curve actually shows a negative demand⁴¹. The curve also shows another slightly small evening peak occurs between 6 and 7pm as solar generation for the day decreases and people are arriving home from work and building electricity demand increases.

Figure 17 also demonstrates the daily electricity demand curves for buildings, EV charging, and solar generation but over the course of an average winter day (in January). As shown, EV charging follows a similar trend as in the summer day where EV charging demand peaks in the morning between 6 and 7am. This is due to the use of the “delayed – finish by departure” charging strategy where charging is primarily occurring just before people leave the house in the morning. In contrast to the building electricity curve for the summer day, in the winter, the new single-family home electricity consumption has a peak that occurs around 10 am and another that occurs around 9pm and extends through midnight. Although solar generation does occur in the winter, it is to a lesser degree than in the summer and is not enough to completely offset the electricity consumption occurring in the middle of the day. This results in an overall daily peak occurring between 6 and 7am that is larger than the EV charging peak due to the coinciding building electricity and EV charging demands and limited solar generation available to offset the peak. The daily curve does drop in the middle of the day offsetting some fraction of the EV and building electricity demands. A small evening peak also occurs between 4 to 5pm as solar generation is decreasing, and people are arriving home from work where there is again coinciding EV charging and building electricity demand.

⁴¹ Note that the Model can also be used to identify negative and minimum hourly demands, which are also important to ensure that Healdsburg is not pushing excess solar generation back into the transmission system. Strategic EV and battery storage charging could also help to maintain minimum demands and avoid ‘back feeding’ into the transmission system as solar installations increase.

Note that this demonstration scenario assumes two EVs for every new and efficient single-family home, as such EV charging drives the timing of the peak demand in this demonstration. As previously discussed, peak demand analysis of the entire Healdsburg building stock and forecasted EV penetration rates under the modeled scenarios show the peak demand occurring in the evenings in the summer months until EV charging begins to dominate demand causing the peak to shift to the morning.

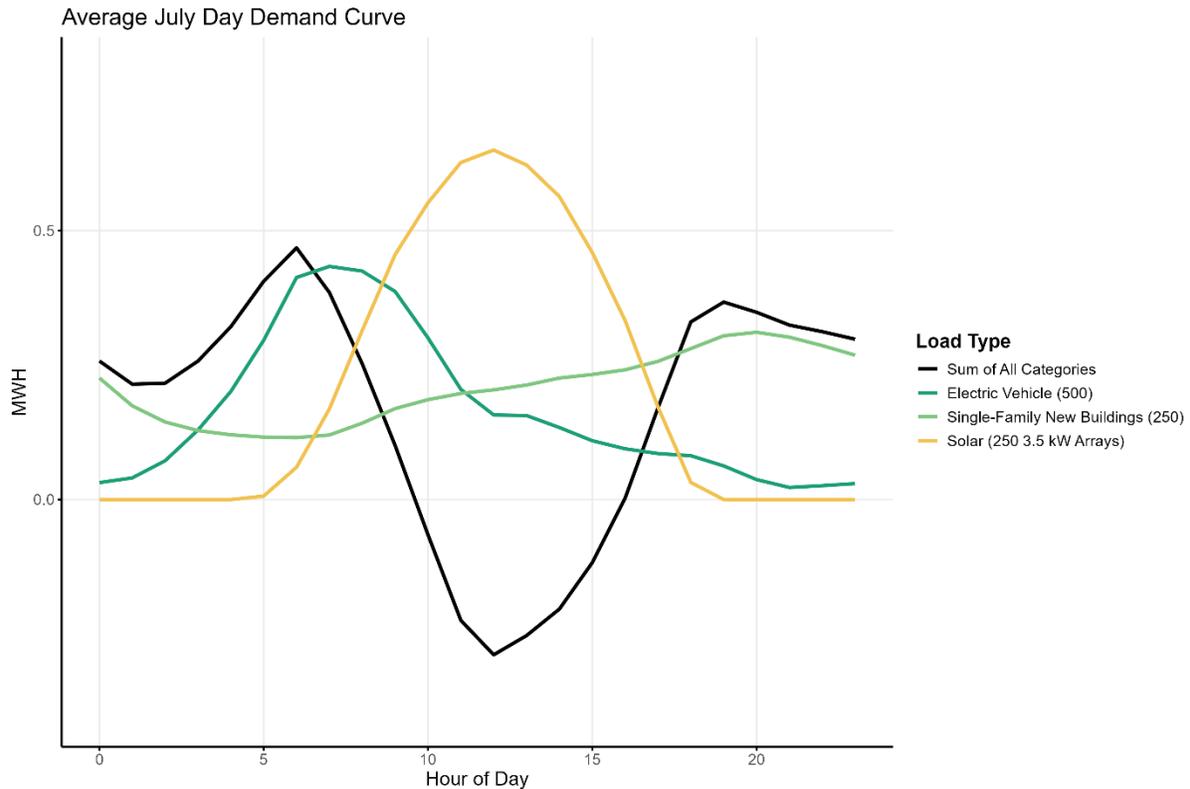


Figure 16 Example of Daily Electricity Demand Curve (MWh) on an Average Summer Day. The above figure depicts the electricity consumption curve in megawatt hours (MWh) for a single day for 250 new single-family buildings, 500 EVs, and 250 3.5 kW solar arrays as well as the cumulative curve for all of the indicated electricity uses. This graph was developed to provide an example of how the electricity consumption curves from buildings, EV charging, and solar generation interact on an average summer day.

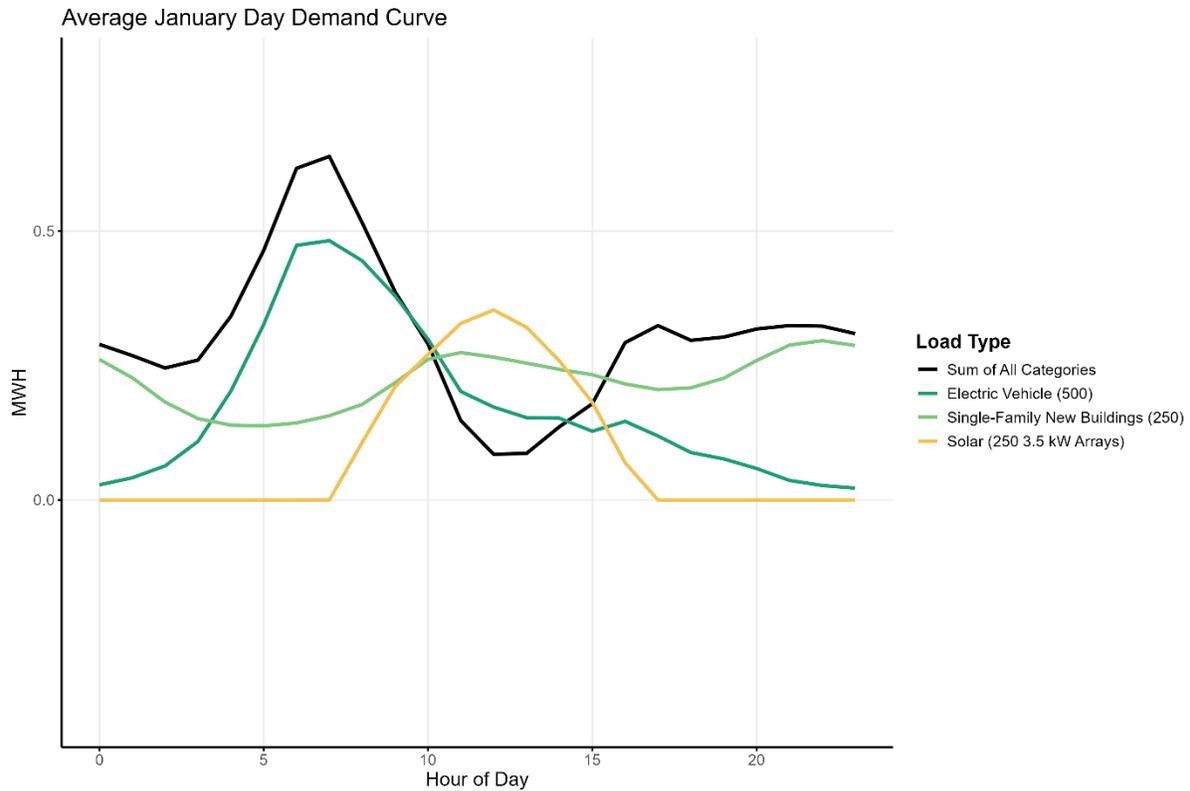


Figure 17 Example of Daily Electricity Demand Curve (MWh) on a Average Winter Day.

The above figure depicts the electricity consumption curve in megawatt hours (MWh) for a single day for 250 new single-family buildings, 500 EVs, and 250 3.5 kW solar arrays as well as the cumulative curve for all of the indicated electricity uses. This graph was developed to provide an example of how the electricity consumption curves from buildings, EV charging, and solar generation interact on an average winter day.

The timing for the community-wide net peak demand will also change over time with more electrification. Figure 18 and Figure 19 demonstrate current city-wide hourly electricity consumption compared to hourly electricity consumption in the Most Likely scenario in 2045. Figure 18 shows the winter peak day and Figure 19 shows the summer peak day.

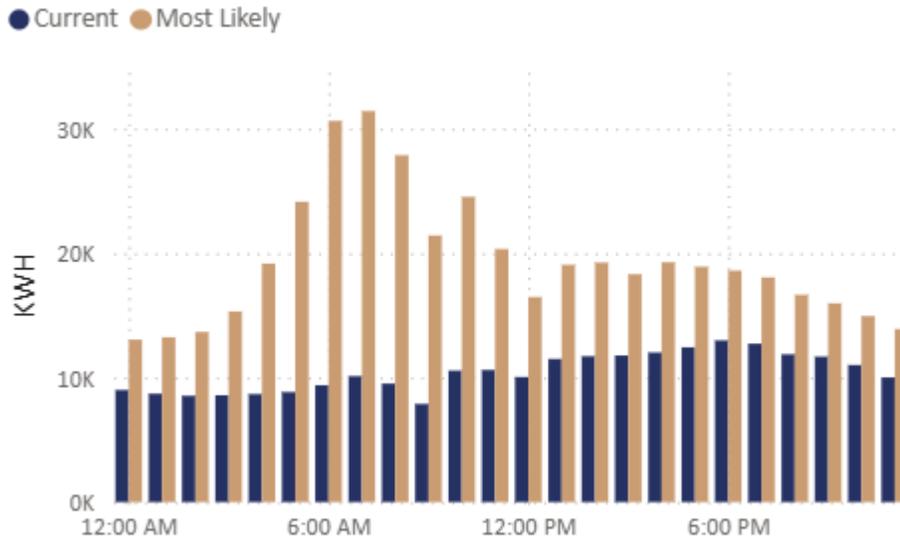


Figure 18 Example of Daily Electricity Demand Curve (kWh) on a Winter Peak Day. The above figure compares the city-wide hourly electricity consumption in kilowatt hours (kWh) for the winter peak day (February 23) from the current 2023 baseline and the Most Likely scenario in 2045.

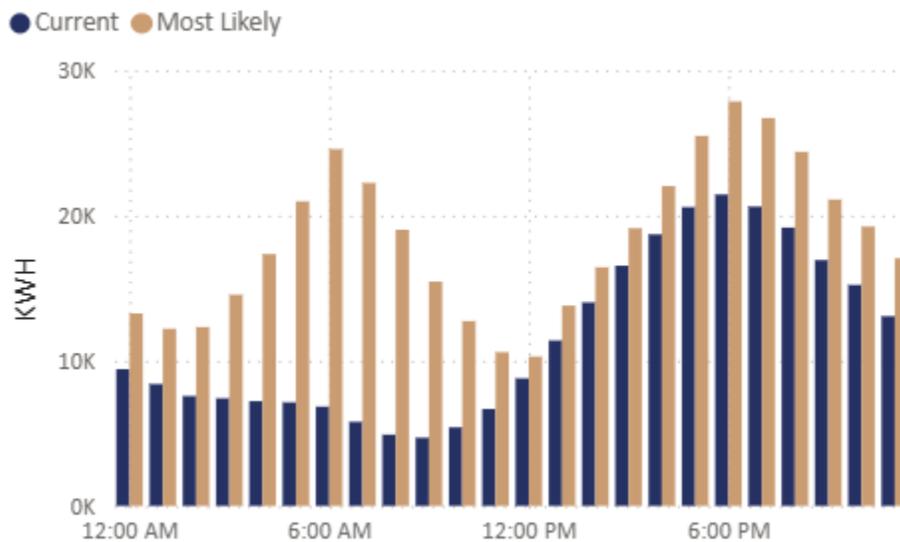


Figure 19 Example of Daily Electricity Demand Curve (kWh) on a Summer Peak Day. The above figure compares the city-wide hourly electricity consumption in kilowatt hours (kWh) for the summer peak day (August 6) from the current 2023 baseline and the Most Likely scenario in 2045.

Appliance Electricity Demand

To further investigate the cause of the building electricity peaks occurring on an average summer and average winter day shown in Figure 16 and Figure 17, respectively, the individual daily demand curves for each end-use in a single-family home was modeled. As shown in Figure 20, the net peak demand for a single-family home on an average July day is largely driven by electricity demand for cooling. Electricity demand for general plug load is also shown to steadily increase throughout the day with the highest use occurring between 8pm to midnight. This results in an overall single-family building electricity daily demand curve peaking between 6 and 7pm on an average summer day as also shown in shown in Figure 16. Figure 21 shows that the 10 am single-family home building peak observed in Figure 17 occurring at 10am on an average winter day is largely driven by heating demand that peaks at 10am.

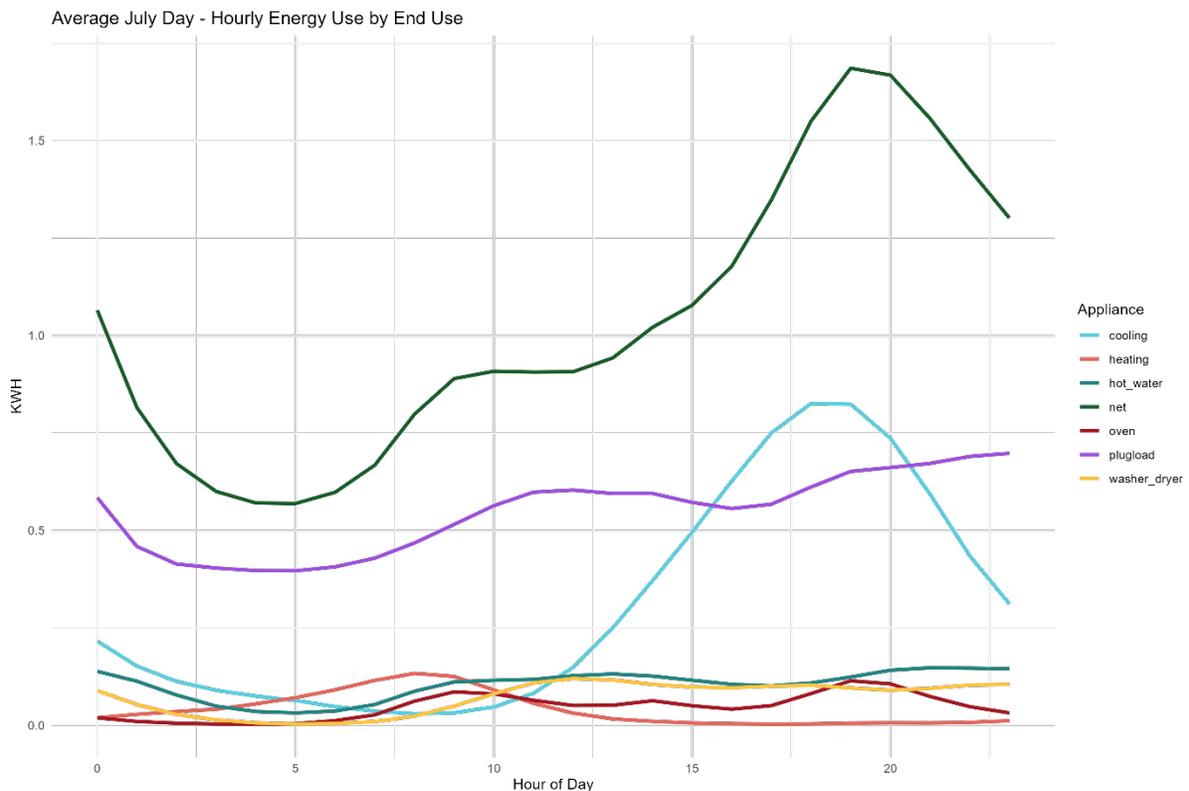


Figure 20 Example of Daily Electricity Demand Curve by Building End-use (kWh) on an Average Summer Day. The above figure depicts the electricity consumption curve in kilowatt hours (kWh) for each electrical end-use (e.g., cooling, heating, hot water heating, plug load) modeled in a new single-family home on a average day in July. This graph was developed to provide an example of how the electricity consumption curves from individual end-uses contribute to the overall building electricity demand curve.

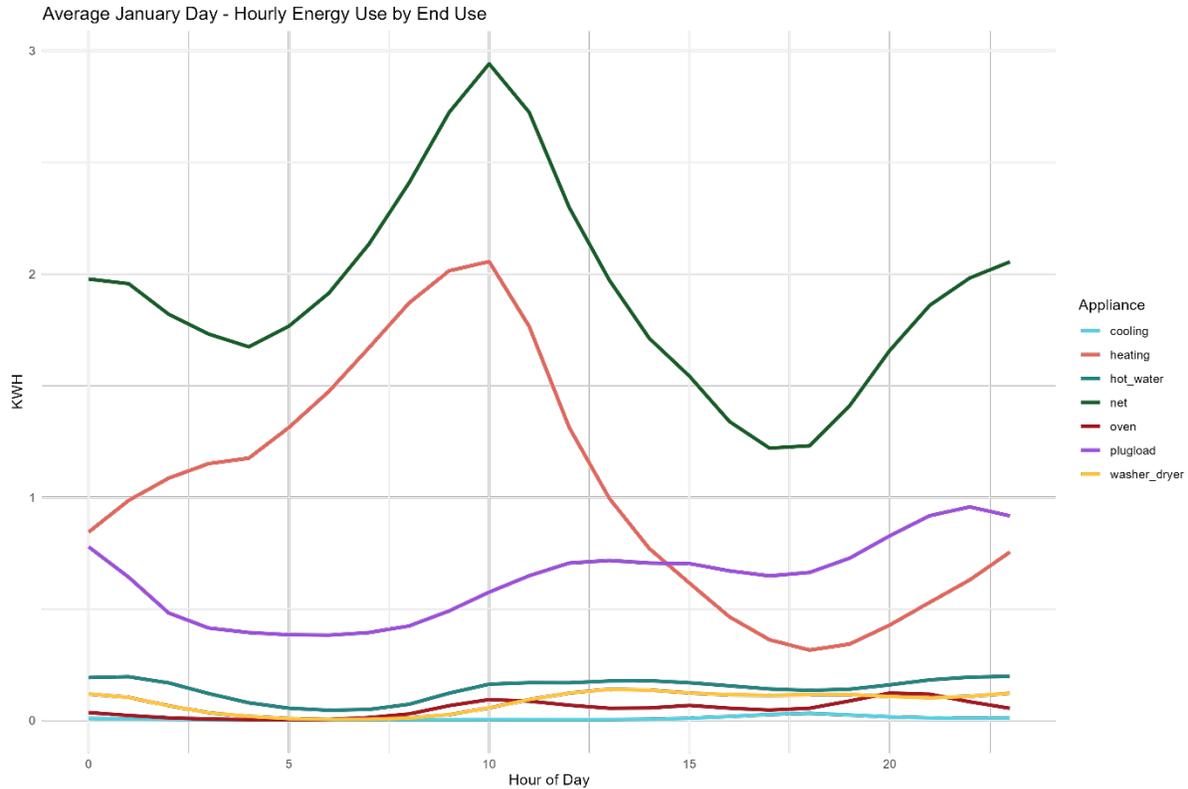


Figure 21 Example of Daily Electricity Demand Curve by Building End-use (kWh) on an Average Winter Day. The above figure depicts the electricity consumption curve in kilowatt hours (kWh) for each electrical end-use (e.g., cooling, heating, hot water heating, plug load) modeled in a new single-family home on a average day in January. This graph was developed to provide an example of how the electricity consumption curves from individual end-uses contribute to the overall building electricity demand curve.

5 Findings

This section presents the key results of the study, highlighting significant trends and patterns observed in the data. The analysis reveals critical insights into building and vehicle electrification, demonstrating drivers of electricity consumption and peak demand. These findings provide a deeper understanding for Healdsburg Electric as they plan for the continued electrification of Healdsburg.

5.1 Summary of Results

Key Results

Results for all forecasted scenarios are presented in terms of electricity consumption (i.e., no solar included) and net electricity consumption (i.e., with solar included) on an annual, monthly, and peak demand maximum hour electricity consumption basis. Electricity consumption shows the total electricity needed to power homes, businesses, and vehicles in Healdsburg. As electricity consumption increases, the utility will need to procure and deploy additional resources to meet this demand. Net electricity consumption shows the total electricity expected with the inclusion of solar generation that can offset some electricity consumption. The Overachieve scenario provides an upper limit for possible electricity consumption under full electrification while the Most Likely scenario results demonstrate the annual, monthly, and peak demand that are likely to be most representative of future conditions. This section summarizes the key results based on the Most Likely scenario.

- Annual electricity consumption (i.e., building electricity and EV charging consumption without solar) is modeled to increase by 26,063 MWh (35%) by 2030 and 65,441 MWh (89%) by 2045 compared with current net annual electricity consumption of 73,592 MWh.
- Annual net electricity consumption (i.e., building electricity and EV charging consumption with solar) is modeled to increase by 23,048 MWh by 2030 (31%) and 54,890 MWh (75%) by 2045 compared with current net annual electricity consumption of 73,592 MWh.
- Annual peak demand (i.e., building electricity and EV charging peak demand without solar) is modeled to increase by 1.59 MWh (7%) by 2030 and 9.50 MW (44%) by 2045 compared with current net peak demand of 21.45 MWh.
- Annual net peak demand (i.e., building electricity and EV charging peak demand with solar) is modeled to increase by 1.55 MWh (7%) by 2030 and 9.46 MW (44%) by 2045 compared with current net annual peak demand of 21.45 MWh.
- Through 2030 while EV penetration is anticipated to be less than 50% of the total registered vehicles, peak demand will continue to occur during summer months when building electricity use for cooling demand dominates peak demand. As EV penetration begins to exceed 50% of total registered vehicles post-2030, EV charging will begin to be the dominant driver of peak demand. Depending on the charging strategy utilized and other EV managed charging strategies, this can shift the timing of peak demand from summer evenings to winter mornings.

Assumption Limitations

Like any model this Model was developed based on a series of assumptions that can impact the resulting annual usage and peak demand, increasing or decreasing anticipated values. The following highlights key assumptions and the potential impacts that should be considered when planning:

- **Building Equipment:** This analysis uses the building equipment assumptions provided by the ResStock and ComStock models. While these models use real building data collected from thousands of surveys, they only estimate the exact buildings within Healdsburg. For example, if significantly more cooling or less cooling is present or there is significantly higher or lower presence of RTU's in commercial buildings, then the results will be skewed. However, these models represent the best available data for assessing an entire city's building stock.
- **Building Time of Use:** The ResStock and Comstock model savings curves provide 15-minute energy use data across the entire year. However, this data is averaged across the 3C climate zone which includes a wider area beyond just Healdsburg. Therefore, the actual time of use data in Healdsburg may be different.
- **Stacked impacts:** The ResStock savings curve used to estimate electricity increases/savings were taken from a package of electrification measures that interact with each other. The following description is provided by ResStock "For a systems level description, ResStock models the heat transfer of individual representative dwelling units. Any device, person, or animal in the home giving off heat will impact the heat transfer between the interior of the home and the exterior environment. As such, nearly all of the ResStock upgrades interact on a heat transfer level and this will impact both the necessary equipment size for heating and cooling the home as well as the operation time and necessary energy." Therefore, at low levels of electrification, the results may be skewed as these interactions are not accurately modeled. However, these impacts are expected to be minimal for this use case.⁴²
- **EV charging regime:** The presented results modeled a Healdsburg-specific EV charging regime that utilizes a "delayed -finish by departure" charging strategy. This charging strategy has a significant impact on both the timing of the peak demand and the peak capacity needed. As demonstrated in *Timing and Type of EV Charging*, use of other EV charging strategies such as "immediate – as fast as possible" or "immediate – as slow as possible" can shift the timing of peak demand and the anticipated change in peak demand. As demonstrated in
- Figure 15, EV charging strategy can result in a 10% to 40% increase in 2030 and 30% to 100% increase in 2045 beyond the current peak demand for the Most Likely Scenario.
- **EV Size:** EV's have a wide range of efficiencies from 1 mile per kWh to over 4 miles per kWh, over a 400% difference. The assumptions within the Healdsburg-specific EV charging regime assume an efficiency of 2 miles per kWh on average.⁴³

Potential Adjustments to Model Results

During Model development various items were identified that could impact model results but were not within the scope of the project to model and are expected to have a relatively small impact.

⁴²https://nrel.github.io/ResStock.github.io/docs/resources/explanations/Individual_Measures_Not_Combined.html

⁴³<https://www.energy.gov/eere/vehicles/articles/fofw-1374-december-23-2024-model-year-2024-electric-vehicles-offer-consumers>

It was not within the scope of this project to model all possible residential and commercial appliances that could be switched to electric appliances. For example, gas fireplaces, pool heaters, spas, cooktops in commercial buildings, and water heaters in commercial buildings are not included. Most of these are expected to have a relatively small impact; however, heat pump water heaters in commercial buildings have the potential to add large electricity usage increases. If commercial heat pump water heater installations occur at the same rate as heat pump boilers in the Most Likely scenario, this could increase annual electric consumption and demand as shown in Table 12 below. Since commercial buildings are mostly operating during the daytime, it is unlikely that substantial demand from commercial heat pump water heaters will overlap with the peak demands identified in the model.

Table 12 Potential Electricity Increase with Addition of Commercial Heat Pump Water Heaters

	2025	2030	2035	2040	2045
Annual Electricity Consumption Increase (MWh)	55.38	198.42	431.13	670.47	923.08
Demand Increase (MW)	0.002	0.005	0.012	0.019	0.026

Healdsburg Electric Department also recently completed a forecast for energy efficiency program achievable savings, such as electricity savings from insulation, lighting, clothes washers and more. If the efficiency program targets are achieved, they could reduce annual electric consumption and demand as shown in Table 13 below. Again, since the majority of savings come from the commercial sector operations, it is unlikely that substantial demand reductions from energy efficiency projects will overlap with the peak demands identified in the model.

Table 13 Potential Electricity Savings with Implementation of Energy Efficiency Program

Electricity	2025	2030	2035	2040	2045
Annual Electricity Consumption Increase (MWh)	-117.28	-625.37	-1,329.49	-1,949.52	-2,244.56
Demand Increase (MW)	-0.032	-0.151	-0.300	-0.395	-0.429

When modeling for new residential homes, the total energy consumption of the home was modeled. Although most of these buildings would be all electric or near 100% electric there are some end-uses that would still include small amounts of natural gas consumption such as outdoor grills or fireplaces that are accounted for in that total energy consumption. Due to this, the Model overestimates electricity consumption by new residential buildings by about 1-2%. Since electricity from new residential buildings make up approximately 2% and 7% of total Modeled electricity consumption in 2030 and 2045, respectively, the impact to modeled consumption is considered negligible. Additionally, as described in *New Building Estimates*, all modeled new residential buildings were based on the EUSS from ResStock using the whole home electrification and envelope upgrade scenario (Upgrade 11). The number of new residential buildings modeled was based on customer projections and the percent of new builds assumed to be 100% electric based on the modeled scenario (Table 3). As such, the new residential buildings that were not all electric were not

accounted for in the modeled results. In the Underachieve, Achieve, Most Likely, and Overachieve scenario this equated to 20%, 5%, 10%, and 0% of new residential buildings not being accounted for, respectively. Based on per building electricity consumption for residential buildings, the unaccounted for non all-electric new buildings would add between 0.1% and 0.5% additional electricity to the total electricity consumption modeled in 2030 depending on the scenario. In 2045, depending on the scenario, the unaccounted for non all-electric new buildings would add between 0.4% and 1.7% additional electricity to the total electricity consumption.

When procuring electricity resources, there is also a need to procure for 4% system losses in the transmission and distribution, as well as maintaining planning reserve margins. The model may have also underestimated some opportunities for electricity consumption increases, such as EV drivers intentionally ‘filling up’ in Healdsburg or other items that were not considered as part of this Model. Additionally, the model forecasts future peak demands based on maximum hour electricity consumption; however, the Electric Department must be ready and able to service instantaneous demands on the system. In reviewing Electric Department data for shorter peak demand windows (e.g., 5 minute and 15 minute), the actual peak demand is generally 4-5% higher than the maximum hour consumption. Additionally, there is a ‘Resource Adequacy’ margin requirement of at least 15%. Table 14 and Table 15 below shows the results of the Most Likely scenario with a 10% increase in annual consumption and a 20% increase in peak demand as a planning margin, to better serve for procurement and planning purposes to ensure sufficient resources and infrastructure are available to meet electricity needs. Table 14 does not include on-site solar generation assumptions while Table 15 does include assumptions of on-site solar generation offsets.

Table 14 Most Likely Scenario Electricity Consumption and Peak Demand with Planning Margin without Additional On-Site Solar

Electricity	2025	2030	2035	2040	2045
Annual Electricity Consumption – Procurement Target (MWh) ¹	88,755	109,621	124,521	138,281	152,936
Peak Demand – for Infrastructure Planning (MW) ²	26.268	27.648	28.668	32.352	37.14
1. A planning margin of an additional 10% was applied to the annual electricity consumption (i.e., solar not accounted for) 2. A planning margin of an additional 20% was applied to the peak demand (i.e., solar not accounted for)					

Table 15 Most Likely Scenario Net Electricity Consumption and Peak Demand with Planning Margin with Additional On-Site Solar

Electricity	2025	2030	2035	2040	2045
Annual Net Electricity Consumption – Procurement Target (MWh) ¹	88,202	106,304	118,441	129,439	141,330
Net Peak Demand – for Infrastructure Planning (MW) ²	26.27	27.60	28.57	32.32	37.09

1. A planning margin of an additional 10% was applied to the annual net electricity consumption (i.e., additional on-site solar accounted for)
2. A planning margin of an additional 20% was applied to the net peak demand (i.e., additional on-site solar accounted for)

Comparisons of Other Forecasts

The California Energy Commission (CEC) also published a Local Reliability Scenario net electricity consumption forecast for each utility in California in 2023. As shown in the Figure 24 below, the CEC forecast generally falls within the model scenarios, though starts out closer to the Underachieve scenario in 2030 and ends up closer to the Overachieve and Most Likely with Planning Margin scenarios in 2040. Based on the CEC’s Local Reliability Scenario, the Healdsburg average annual growth for 2023-2040 is 3.55%. This is based on a larger planning area model, which may limit the amount of Healdsburg-specific data used for the forecast. In the same CEC study, the PG&E Greater Bay Area Service Area is forecasted to have an annual average net electricity consumption growth of 2.85% and the NCPA Greater Bay Area is expected to have 2.77%. The Healdsburg Most Likley scenario has an annual average growth of 2.39%.

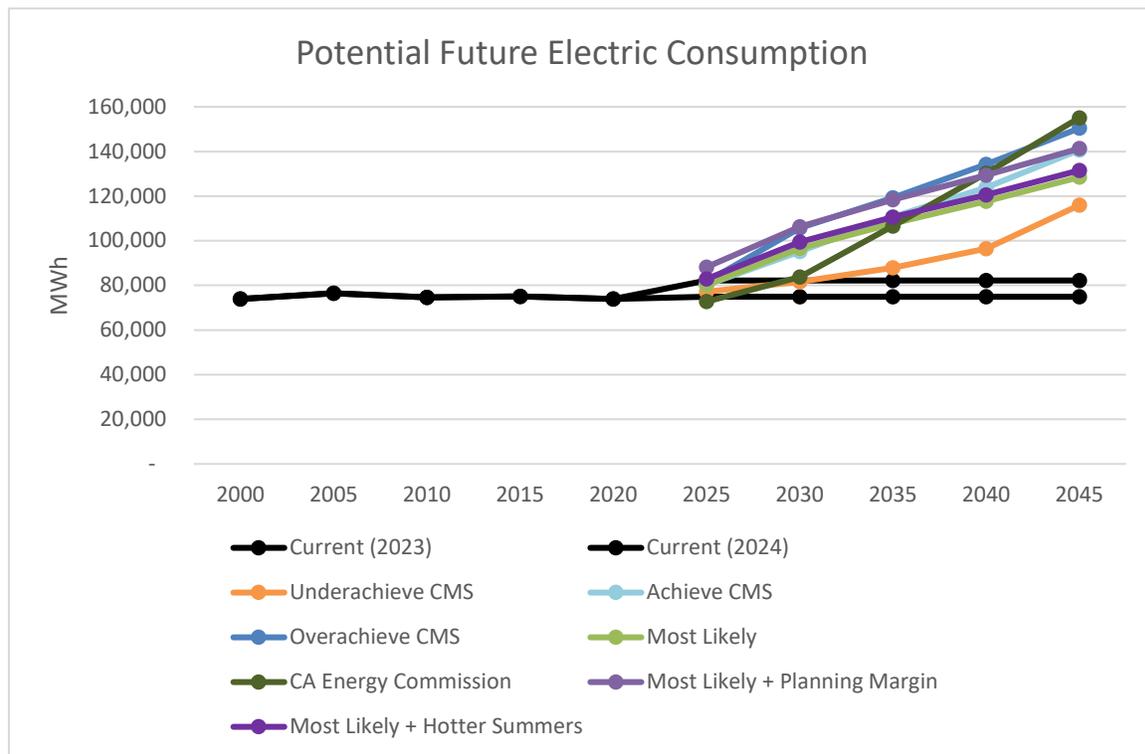


Figure 22 Comparison of Modeled Scenarios and CEC Local Reliability Scenario Forecasted Potential Future Electricity Consumption. The above figure depicts the potential future net electricity consumption in megawatt hours (MWh) based on the modeled scenarios presented in this report compared with CEC Local Reliability Scenario forecasted net electricity consumption. Note that the CEC forecast only goes through 2040 and was extended to 2045 for this chart using an annual percentage increase of 3.55%.

Based on the CEC’s analysis in the Integrated Energy Policy Report, peak demand in 2030 is anticipated to be approximately 10% higher than current peak demand and approximately 38%

higher than current peak demand in 2040 as shown in Figure 23. As discussed above, modeled peak demand for Healdsburg could increase beyond current peak demand by 4% to 9% in 2030 and between 10% and 51% in 2045 based on the Underachieve and Overachieve scenario, respectively. Based on the Most Likely scenario, peak demand is anticipated to increase by about 7% in 2030 and 26% in 2040, following a similar trajectory and trend line as the CEC peak demand analysis.

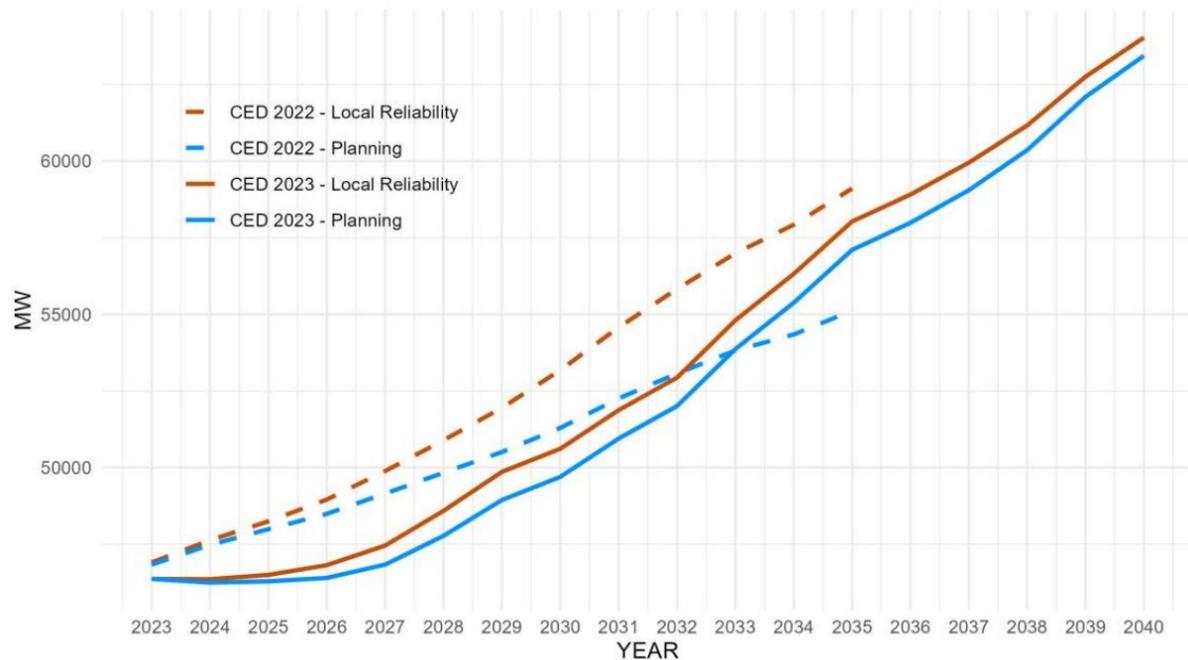


Figure 23 Managed System Peak Demand (California ISO) from the CEC's 2023 Integrated Energy Policy Report. The above figure obtained from the CEC 2023 Integrated Energy Policy Report shows that statewide peak demand in megawatts (MW) is expected to increase by approximately 10% by 2030 and 38% by 2040 compared with 2023 statewide peak demand.⁴⁴

The recently completed Healdsburg energy efficiency program forecast also included a forecast of fuel substitution programs and resulting electricity increases. The energy efficiency programs forecast only considered building energy and did not forecast any changes in annual electric consumption due to electric vehicles or on-site solar installations. Table 16 below compares the energy efficiency program forecast and the Most Likely scenario without EVs or on-site solar. As shown, the energy efficiency forecast estimates for building electricity consumption are about 2 to 3% higher than the modeled Most Likely Scenario pre-2030. Post-2030, the energy efficiency forecast scenario estimates are 9 to 13% higher than the modeled Most Likely Scenario. This is likely due to the Model developed for Healdsburg focusing on the electric conversion of primary end-uses including hot water heating, heating and cooling, dryers, and stoves. As such, other end-uses that could be converted to electric such as pool heaters or spas are not accounted for so the overall

⁴⁴ Bailey, Stephanie, Jennifer Campagna, Mathew Cooper, Quentin Gee, Heidi Javanbakht, and Ben Wender. 2023. 2023 Integrated Energy Policy Report. California Energy Commission. Publication Number: CEC-100-2023-001-CMF. Accessed at: [2023 Integrated Energy Policy Report](#)

increase in electrical consumption could be underestimated. The energy efficiency forecast also utilized a different source for kWh impacts from switching to electric appliances and different assumptions for electric appliance adoption. This difference becomes more prominent in later milestone years as electrification of end-uses increases. The information presented in Table 16 indicates the appropriateness of applying a 10% planning margin to the Most Likely Scenario results in this report for annual net electricity consumption planning.

Table 16 Comparison of Energy Efficiency Forecast and Most Likely Scenario Results for Annual Building Electricity Consumption

Annual Electricity Consumption	2025	2030	2035	2040	2045
Energy Efficiency Forecast (MWh)	76,413	79,186	87,303	93,051	97,996
Most Likely Scenario Buildings only (MWh)	74,696	77,193	80,256	82,283	86,621
Difference (%)	2%	3%	9%	13%	13%

5.2 Expected Climate Change Impacts

Although not currently modeled, climate change is expected to significantly impact both annual usage and peak electricity demand. As climate change results in more hot days during summer months, the usage and demand for cooling will increase, leading to higher overall electricity consumption. For example, Healdsburg experienced about a 25% increase in electricity usage between July 2023 and July 2024, with five more days over 90 degrees and two more days over 100 degrees in July 2024 compared to July 2023. Additionally, in 2023 the peak demand occurred on a day that was 100 F. However, the peak was 23-28% higher in 2024 and 2022, with temperatures at 105 F and 114 F, respectively. This trend is indicative of future electricity usage as hotter summer days become more common. Peak demand is also expected to shift and intensify, particularly during heatwaves, as there is a greater need to run air conditioning or cooling systems for longer periods. This can strain the power grid and necessitate infrastructure upgrades to ensure reliability and prevent outages. Conversely, milder winters may reduce the need for heating, slightly offsetting the increased summer consumption. Additionally, the extremes may get more extreme for both summer and winter seasons. However, the net effect is likely to be a substantial rise in annual electricity consumption. Overall, climate change will require significant adjustments in energy planning and infrastructure to accommodate these shifts in electricity demand, which could be considered in a future update to the scenarios.

Although it is very difficult to forecast climate change impacts, Table 17 below shows the Most Likely scenario with a 20% increase for July and August building consumption and a 20% increase in summer peak demand for buildings as an example of impacts of hotter summers.

Table 17 Potential Electricity Consumption and Peak Demand for Most Likely Scenario under Hotter Summers

Electricity	2025	2030	2035	2040	2045
Net Annual Electricity Consumption (MWh)	82,901	99,432	110,548	120,604	131,535

Difference from Current Annual Electricity Consumption (%)	13%	35%	50%	64%	79%
Net Peak Demand (MWh)	26.21	27.38	28.26	26.93 ¹	30.91 ¹
Difference from Current Peak Demand (%)	22%	28%	32%	26%	44%

1. The net peak hourly demand value remain nearly the same as the Most Likely Scenario modeled under current conditions (Table 11). This is due to the peak moving from the summer to the winter by 2040 due to EV charging needs and therefore the net peak hourly demand not being impacted by hotter summers.

5.3 Challenges

Increased electricity consumption and peak demand present several significant challenges for utilities and grid operators. One major issue is the strain on existing infrastructure, which may not be equipped to handle the higher loads, leading to potential outages and reliability concerns.⁴⁵ Additionally, the need for more generation capacity, often from renewable sources, requires substantial investment and time to develop.⁴⁶ Peak demand periods can exacerbate these issues, as they necessitate the use of peaking power plants, which are typically less efficient and more expensive to operate, as well as rely on fossil fuels.⁴⁷ Furthermore, integrating new technologies and managing the variability of renewable energy sources add complexity to grid management. Addressing these challenges requires a combination of infrastructure upgrades, smart grid technologies, and effective demand-side management strategies.

Meeting State Requirements and Providing Electricity 24/7/365

The State’s Renewable Portfolio Standard (RPS) program and Clean Energy, Jobs, and Affordability Act of 2022 set increasing requirements for renewable and zero-carbon electricity to be provided by electric utilities, as follows:

- 52% renewable by 2027
- 60% renewable by 2030
- 90% renewable and zero-carbon by 2035, minimum 60% renewable with remainder from other zero-carbon sources (such as large hydroelectric or green hydrogen)
- 95% renewable and zero-carbon by 2040, minimum 60% renewable
- 100% renewable and zero-carbon by 2045, minimum 60% renewable

As electric consumption and the State-required percentages increase over time, Healdsburg Electric will need to procure new renewable and zero-carbon resources. The Figure 24 shows historic renewable generation from 2000-2020, as well as forecasted renewable generation based on recent averages, the contracted Grace Solar project in 2028, and the inclusion of large hydroelectric and Lodi Energy Center phased conversion to green hydrogen beginning in 2035. Figure 24 also shows the amount of renewable and zero-carbon resources needed to meet the State requirements. The

⁴⁵ <https://www.icf.com/insights/energy/demand-growth-challenges-opportunities-utilities>

⁴⁶ <https://www.brattle.com/wp-content/uploads/2024/05/Electricity-Demand-Growth-and-Forecasting-in-a-Time-of-Change-1.pdf>

⁴⁷ [Tidwell-et al-2013ACCSWUS_Ch12.pdf](#)

area between the bottom line and the Scenario lines represents the gap in renewable and zero-carbon resources that will need to be procured to meet the State requirements.

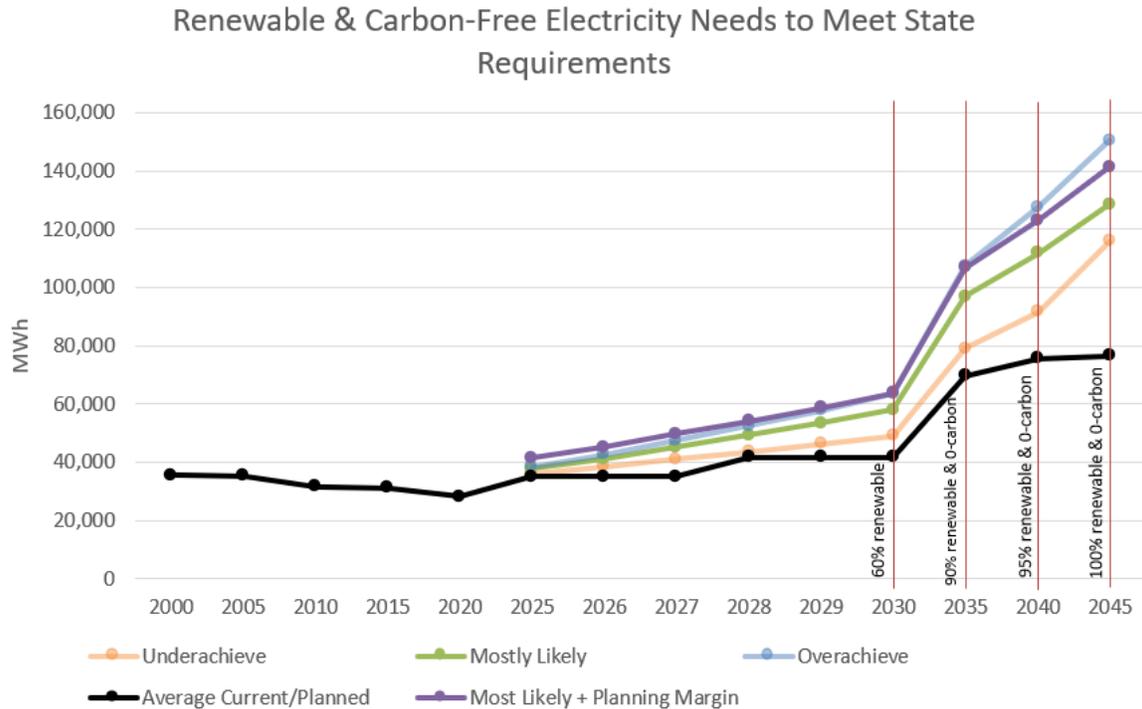


Figure 24 Comparison of Modeled Scenarios and Renewable and Zero-Carbon Procurement Needs. The above figure depicts the annual electricity to meet the RPS and State percentage requirements under the modeled scenarios in megawatt hours (MWh) and the currently planned procurement of renewable and carbon free electricity. The gap demonstrates the renewable and zero-carbon resources that will need to be procured to meet the State’s requirements under the anticipated future conditions. Note that the chart only shows eligible renewables to 2030, and beginning in 2035 zero-carbon resources are also included.

While Healdsburg Electric has some historic carryover credits that can help meet the State’s RPS requirements, Healdsburg is still expected to cumulatively fall short of the RPS compliance by 274,978 MWh credits in the Most Likely Scenario (or 405,748 MWh in the Most Likely + Planning Margin Scenario) by 2045, if no additional renewable energy resources are procured. Healdsburg could also cumulatively fall short of the remaining zero-carbon generation needed by 87,589 to 130,828 MWh by 2045, if no additional zero-carbon energy resources are procured.

For context, to meet the 2027 requirement of 52% renewable energy, Healdsburg Electric would need an additional 6 MW of solar capacity (10,000 MWh of solar generation), or about 23 acres of solar panels. To meet the 2030 requirement of 60% renewable energy, Healdsburg Electric would need an additional 9 MW of solar capacity (16,000 MWh of solar generation) (compared to current contracts), or about 37 acres of solar panels. To meet the 2035 requirement of 90% clean energy (60% renewable plus 30% zero-carbon), Healdsburg Electric would need an additional 13 MW of solar capacity (23,000 MWh solar generation) (compared to current contracts), or about 52 acres of solar panels, and an approximately 30% increase (4,000 MWh) in average large hydroelectric generation, in addition to an assumed conversion of 60% (11,000 MWh) of the Lodi Energy Center fuel-generated power to green hydrogen already included in the Average Current/Planned line.

Costs for new solar installations are approximately \$2.5-3 million per MW, which is about \$650,000-\$750,000 per acre. Ground-mounted solar installations are currently the cheapest option for new renewable generation. It is also extremely important to begin pairing new solar installations with battery energy storage systems (BESS) to capture excess daytime solar generation and provide electricity 24/7/365, as well as meet ‘Resource Adequacy’ requirements. Local BESS could also help reduce forecasted peak demands and lessen or defer the need for infrastructure replacements. Costs for BESS can vary widely; typically around \$2 per Watt⁴⁸.

Much like the rest of the State, Healdsburg will need to reinvest in its electric distribution system to meet the electricity needs identified in this project. This includes:

- Replace and/or expand transformers at Badger Substation (Order of magnitude \$10-20 million)
- Increase wire and cable sizes to deliver more power (Order of magnitude \$1-10 million)
- Increase local transformers (green boxes) to feed both EV chargers and new heat pump loads (Order of magnitude \$10-15 million)

To lessen rate impacts, costs will need to be phased in over time. The next electric rates cost-of-service study should take into account both increased revenue from increased electricity consumption, as well as the procurement and infrastructure costs needs outlined above.

5.4 Recommendations

While the “electrify everything” approach to reducing GHG emissions provides a clear pathway to carbon neutrality (electrification paired with renewable energy) it poses challenges to grid operators and electricity providers. While some grid improvements and expansion of energy resources will be required regardless, there are strategies which can be employed to reduce the magnitude of these investments.

Efficient Electricity Consumption

Using less electricity is a well-known concept to our communities. With building and vehicle electrification the need for efficiency has not changed. The following strategies can be promoted within the community to promote efficient electricity consumption:

- **Solar and Storage Systems:** Pairing solar with battery storage can help reduce both total electricity usage and peak demand (see below). One kW of solar PV can produce over 1,577 kWh of power each year in Healdsburg.
- **Efficient homes:** Homes which have insulation, efficient windows, and efficient appliances use less energy, especially during hot and cold weather. Improving buildings efficiency is a cost-effective way to reduce electricity consumption and save on energy bills. Promoting energy efficiency through utility programs could help reduce overall demand.
- **Drive smaller EVs for fewer miles:** While EVs have much lower GHG emissions than their gas consuming counterparts over time, smaller EVs have much lower electricity demand than large EVs. As discussed above, the difference between light-duty EVs and heavy-duty EVs is more than double the total electricity demand. In addition, driving less and taking public transportation, biking, or walking is the most environmentally friendly (and low electricity use) option available. Keeping total EV miles low through these strategies will help lower impacts to the grid and generation resources.

⁴⁸ https://atb.nrel.gov/electricity/2024/utility-scale_battery_storage

Peak Demand Reduction and Load Smoothing

Electricity load smoothing, also known as load equalization or peak shaving, is the process of reducing peak electrical demand to maintain a more consistent load on the power grid. This is achieved by shifting when electricity is used or by storing energy during periods of low demand and releasing it during periods of high demand.⁴⁹ By smoothing the load, utilities can prevent grid overloads, reduce the need for peaking power plants, and improve the overall efficiency and reliability of the electrical system. This practice is particularly important in systems with high variability in demand, such as those with a considerable proportion of renewable energy sources.⁵⁰ The following section provides a list of techniques for load smoothing that can reduce the peak demand on the system.

- **Energy Storage Systems:** These systems store excess energy during periods of low demand and release it during peak demand times. Examples include lithium-ion batteries and pumped hydro storage.⁵¹ As of the end of 2024, there are 75 battery storage systems in Healdsburg. However, approximately 80% of these systems are believed to be used predominantly only for back up and are not believed to be actively managed to reduce peaks. More strategic management and programming of storage systems could help reduce future peak impacts. Managed battery storage could also help prevent ‘back feeding’ excess solar generation into the transmission system as solar installations increase.
- **Demand Response Programs:** These are programs designed by the utility to help balance electricity supply and demand by encouraging customers to reduce or shift their electricity usage during peak periods. This can be achieved through time-of-use pricing, critical peak pricing, financial incentives, or direct load control.⁵² Direct load control programs, such as EV managed charging or smart thermostats, allow utilities to remotely cycle off appliances like air conditioning during peak demand in exchange for incentives.
- **Load Shifting:** Consumers of electricity can significantly impact the electricity grid by adopting load-shifting behaviors, which help smooth the load curve. The utility can adopt rate structures that incentivize consumers to shift their electricity demand away from high-cost hours to low-cost hours. Some examples of actions customers can take include:
 - **Building Energy:** Consumers can plan to run appliances during off-peak hours when electricity demand is low (i.e., middle of the day), or pre-cool or pre-heat homes before peak demand periods. There are several load sharing devices and technologies like programmable thermostats or smart panels that can be used to control and shift loads based off the appliance energy needs.
 - **EV Charging Behavior:** This can be through adopting behavior to charge vehicles at off-peak times (such as the middle of the day when solar production is high) or using smart charging systems to charge vehicles at off-peak hours to reduce the strain on the grid during high-demand periods. Utility rates can further incentivize people to charge during these hours. While there is less flexibility when commercial vehicles are charged,

⁴⁹ [What is Load Equalisation in Electrical Drive? Definition & Method - Circuit Globe](#)

⁵⁰ [EDF Residential Smoothing Final Report-2016-0415](#)

⁵¹ <https://www.m-hikari.com/ams/ams-2013/ams-77-80-2013/karimAMS77-80-2013.pdf>

⁵² <https://blogs.edf.org/energyexchange/wp-content/blogs.dir/38/files/2017/10/EDF-Residential-Smoothing-Final-Report-2016-0506.pdf>

the use of smart technology and distributed charging for fleets can reduce the strain on the electrical grid as well.

- **Charging Station Locations:** Spreading the load of EV charging across multiple locations and times optimizes grid efficiency and reliability. For example, increasing the number of workplace chargers will increase the number of EVs charged during midday when demand is lower and solar production is high. With only home charging the potential for EVs to all begin charging at 6 pm, further exacerbating peak demands, is high.
- **Smart Grid Technologies:** Smart grids use advanced communication and control technologies to optimize the distribution and consumption of electricity. This includes real-time monitoring and automated adjustments to balance supply and demand.⁵³
- **Distributed Energy Resources (DERs):** Integrating renewable energy sources like solar panels and wind turbines, along with local energy storage, can help smooth the load by providing additional power during peak times and storing excess energy when demand is low.⁵²

⁵³ <https://www.saarcenergy.org/wp-content/uploads/2018/05/Load-Forecasting-Methods-and-Techniques-by-Dr.-Chandrasekhar-Reddy-Atla-Dr.-Chandras.pdf>

Appendix A

Model Inputs by Scenario

Underachieve

Category	Variable	2025	2030	2035	2040	2045
Residential Solar	# Solar Arrays (kW capacity added)	151	906	1,661	2,416	3,171
Residential - SF	# New Builds	13	47	112	159	206
	# replaced water heater	12	71	118	165	212
	# high efficiency HVAC	-	-	-	-	-
	# standard efficiency HVAC	19	115	192	268	345
	# replaced stove	2	9	16	22	28
	# dryers replaced	1	7	12	17	22
Residential - MF	# New Builds	109	381	879	1,015	1,830
	# replaced water heater	5	28	46	65	84
	# high efficiency HVAC	-	-	-	-	-
	# standard efficiency HVAC	2	13	21	30	38
	# replaced stove	1	3	5	7	10
	# dryers replaced	0	1	1	1	2
Commercial Solar	# Solar Arrays (1kW)	167	1,004	1,841	2,677	3,514
Commercial - Office	Square Footage Added	5,672	11,344	22,689	28,361	39,705
Commercial - Retail	Square Footage Added	7,888	15,775	31,551	39,438	55,213
Commercial - Warehouse	Square Footage Added	14,441	57,765	86,647	129,971	173,295
Commercial - Restaurant	Square Footage Added	-	2,884	2,884	5,768	5,768
Commercial - Hotel	Square Footage Added	19,229	57,687	96,145	134,603	192,289
Commercial - Other	Square Footage Added	30,243	100,810	161,296	231,863	302,430
Commercial - Office	# replaced RTU	2	8	14	19	26
Commercial - Retail	# replaced RTU	1	2	5	6	8
Commercial - Warehouse	# replaced RTU	1	5	7	11	14
Commercial - Restaurant	# replaced RTU	0	1	2	3	3
Commercial - Other	# replaced RTU	3	12	20	28	37
Commercial - Office	# replaced Gas RTU	2	7	13	18	23
Commercial - Retail	# replaced Gas RTU	1	2	5	6	8
Commercial - Warehouse	# replaced Gas RTU	1	3	5	7	10
Commercial - Restaurant	# replaced Gas RTU	0	1	1	2	2
Commercial - Hotel	# replaced Gas RTU	0	1	1	2	2
Commercial - Other	# replaced Gas RTU	3	9	15	22	29
Commercial - Office	# replaced Electric RTU	0	1	1	2	2
Commercial - Retail	# replaced Electric RTU	0	0	0	0	0
Commercial - Warehouse	# replaced Electric RTU	0	1	2	3	4
Commercial - Restaurant	# replaced Electric RTU	0	0	0	1	1
Commercial - Hotel	# replaced Electric RTU	1	3	4	6	9
Commercial - Other	# replaced Electric RTU	1	3	4	6	8
Commercial - Office	# replaced boiler	1	1	2	3	4
Commercial - Retail	# replaced boiler	1	2	3	4	5
Commercial - Warehouse	# replaced boiler	1	2	3	5	6
Commercial - Restaurant	# replaced boiler	0	1	1	1	1
Commercial - Hotel	# replaced boiler	1	2	3	4	6
Commercial - Other	# replaced boiler	2	6	9	13	17
Commercial - Restaurant	# replaced kitchen equipment	0	1	1	2	2
ZEVs		1,000	2,500	4,500	7,500	13,500

Notes

1. Non-residential commercial equipment values includes number of "new" commercial building equipment assumed to be electric (100% of HVAC, 50% of boiler and 50% of kitchen)
2. Grayed out values for RTUs provide information on the assumed split of RTUs that replace gas vs electric resistance RTUs when the total # of replaced RTUs is input into the Model. This is based on the assumed ComStock end-use of RTUs by fuel type.
3. ComStock data set indicated limited electricity data and savings curves for hotel RTU replacement indicating hotel RTUs are limited. Therefore no hotel RTU replacements modeled.

Most Likely

Category	Variable	2025	2030	2035	2040	2045
Residential Solar	# Solar Arrays (kW capacity added)	151	906	1,661	2,416	3,171
Residential - SF	# New Builds	15	53	126	179	232
	# replaced water heater	24	141	376	612	847
	# high efficiency HVAC	-	-	-	-	-
	# standard efficiency HVAC	38	230	613	996	1,379
	# replaced stove	3	19	50	81	112
	# dryers replaced	2	14	38	62	86
Residential - MF	# New Builds	122	428	989	1,142	2,059
	# replaced water heater	9	56	149	242	335
	# high efficiency HVAC	-	-	-	-	-
	# standard efficiency HVAC	4	26	68	111	154
	# replaced stove	1	6	17	28	38
	# dryers replaced	0	1	3	5	7
Commercial Solar	# Solar Arrays (1kW)	167	1,004	1,841	2,677	3,514
Commercial - Office	Square Footage Added	5,672	11,344	22,689	28,361	39,705
Commercial - Retail	Square Footage Added	7,888	15,775	31,551	39,438	55,213
Commercial -Warehouse	Square Footage Added	14,441	57,765	86,647	129,971	173,295
Commercial -Restaurant	Square Footage Added	-	2,884	2,884	5,768	5,768
Commercial - Hotel	Square Footage Added	19,229	57,687	96,145	134,603	192,289
Commercial -Other	Square Footage Added	30,243	100,810	161,296	231,863	302,430
Commercial - Office	# replaced RTU	3	11	19	26	35
Commercial - Retail	# replaced RTU	1	3	8	11	16
Commercial -Warehouse	# replaced RTU	1	6	12	20	28
Commercial -Restaurant	# replaced RTU	0	2	4	7	9
Commercial -Other	# replaced RTU	4	15	34	55	75
Commercial - Office	# replaced Gas RTU	2	10	18	24	32
Commercial - Retail	# replaced Gas RTU	1	3	7	11	15
Commercial -Warehouse	# replaced Gas RTU	1	4	9	14	19
Commercial -Restaurant	# replaced Gas RTU	0	1	3	5	7
Commercial - Hotel	# replaced Gas RTU	0	1	2	2	3
Commercial -Other	# replaced Gas RTU	3	12	27	43	59
Commercial - Office	# replaced Electric RTU	0	1	2	2	3
Commercial - Retail	# replaced Electric RTU	0	0	0	0	0
Commercial -Warehouse	# replaced Electric RTU	0	2	4	6	9
Commercial -Restaurant	# replaced Electric RTU	0	0	1	1	2
Commercial - Hotel	# replaced Electric RTU	1	3	6	9	13
Commercial -Other	# replaced Electric RTU	1	3	7	12	16
Commercial - Office	# replaced boiler	1	1	3	5	7
Commercial - Retail	# replaced boiler	1	2	7	11	16
Commercial -Warehouse	# replaced boiler	1	2	4	6	9
Commercial -Restaurant	# replaced boiler	0	1	1	1	1
Commercial - Hotel	# replaced boiler	1	2	4	6	9
Commercial -Other	# replaced boiler	2	6	13	21	28
Commercial -Restaurant	# replaced kitchen equipment	0	1	3	4	6
ZEVs		2,000	7,500	11,000	14,500	17,500

Notes

1. Non-residential commercial equipment values includes number of "new" commercial building equipment assumed to be electric (100% of HVAC, 50% of boiler and 50% of kitchen)
2. Grayed out values for RTUs provide information on the assumed split of RTUs that replace gas vs electric resistance RTUs when the total # of replaced RTUs is input into the Model. This is based on the assumed ComStock end-use of RTUs by fuel type.
3. ComStock data set indicated limited electricity data and savings curves for hotel RTU replacement indicating hotel RTUs are limited. Therefore no hotel RTU replacements modeled.

Achieve

Category	Variable	2025	2030	2035	2040	2045
Residential Solar	# Solar Arrays (kW capacity added)	151	906	1,661	2,416	3,171
Residential - SF	# New Builds	16	56	133	189	245
	# replaced water heater	19	113	193	273	353
	# high efficiency HVAC	-	-	-	-	-
	# standard efficiency HVAC	31	184	314	444	575
	# replaced stove	2	15	26	36	47
	# dryers replaced	2	11	20	28	36
Residential - MF	# New Builds	129	452	1,044	1,206	2,173
	# replaced water heater	7	45	76	108	139
	# high efficiency HVAC	-	-	-	-	-
	# standard efficiency HVAC	3	21	35	50	64
	# replaced stove	1	5	9	12	16
	# dryers replaced	0	1	2	2	3
Commercial Solar	# Solar Arrays (1kW)	167	1,004	1,841	2,677	3,514
Commercial - Office	Square Footage Added	5,672	11,344	22,689	28,361	39,705
Commercial - Retail	Square Footage Added	7,888	15,775	31,551	39,438	55,213
Commercial -Warehouse	Square Footage Added	14,441	57,765	86,647	129,971	173,295
Commercial -Restaurant	Square Footage Added	-	2,884	2,884	5,768	5,768
Commercial - Hotel	Square Footage Added	19,229	57,687	96,145	134,603	192,289
Commercial -Other	Square Footage Added	30,243	100,810	161,296	231,863	302,430
Commercial - Office	# replaced RTU	3	11	19	25	33
Commercial - Retail	# replaced RTU	1	3	6	7	10
Commercial -Warehouse	# replaced RTU	1	6	9	13	18
Commercial -Restaurant	# replaced RTU	0	2	2	4	4
Commercial -Other	# replaced RTU	4	15	25	36	47
Commercial - Office	# replaced Gas RTU	2	10	17	23	30
Commercial - Retail	# replaced Gas RTU	1	3	6	7	10
Commercial -Warehouse	# replaced Gas RTU	1	4	6	9	12
Commercial -Restaurant	# replaced Gas RTU	0	1	2	3	3
Commercial - Hotel	# replaced Gas RTU	0	1	1	2	3
Commercial -Other	# replaced Gas RTU	3	12	20	28	36
Commercial - Office	# replaced Electric RTU	0	1	2	2	3
Commercial - Retail	# replaced Electric RTU	0	0	0	0	0
Commercial -Warehouse	# replaced Electric RTU	0	2	3	4	6
Commercial -Restaurant	# replaced Electric RTU	0	0	1	1	1
Commercial - Hotel	# replaced Electric RTU	1	3	5	7	10
Commercial -Other	# replaced Electric RTU	1	3	5	8	10
Commercial - Office	# replaced boiler	1	1	3	4	5
Commercial - Retail	# replaced boiler	1	2	4	6	8
Commercial -Warehouse	# replaced boiler	1	2	4	5	7
Commercial -Restaurant	# replaced boiler	0	1	1	1	1
Commercial - Hotel	# replaced boiler	1	2	3	5	6
Commercial -Other	# replaced boiler	2	6	11	15	20
Commercial -Restaurant	# replaced kitchen equipment	0	1	1	2	3
ZEVs		2,000	7,000	12,000	16,500	21,500

Notes

1. Non-residential commercial equipment values includes number of "new" commercial building equipment assumed to be electric (100% of HVAC, 50% of boiler and 50% of kitchen)
2. Grayed out values for RTUs provide information on the assumed split of RTUs that replace gas vs electric resistance RTUs when the total # of replaced RTUs is input into the Model. This is based on the assumed ComStock end-use of RTUs by fuel type.
3. ComStock data set indicated limited electricity data and savings curves for hotel RTU replacement indicating hotel RTUs are limited. Therefore no hotel RTU replacements modeled.

Overachieve

Category	Variable	2025	2030	2035	2040	2045
Residential Solar	# Solar Arrays (kW capacity added)	151	906	2,416	2,416	3,171
Residential - SF	# New Builds	17	59	140	199	257
	# replaced water heater	47	282	1,324	2,365	3,407
	# high efficiency HVAC	-	-	-	-	-
	# standard efficiency HVAC	77	460	1,330	2,200	3,070
	# replaced stove	6	37	839	1,640	2,441
	# dryers replaced	5	29	644	1,258	1,873
Residential - MF	# New Builds	136	476	1,099	1,269	2,288
	# replaced water heater	19	112	271	430	589
	# high efficiency HVAC	-	-	-	-	-
	# standard efficiency HVAC	9	51	186	320	455
	# replaced stove	2	13	118	224	330
	# dryers replaced	0	2	32	62	92
Commercial Solar	# Solar Arrays (1kW)	167	1,004	1,841	2,677	3,514
Commercial - Office	Square Footage Added	5,672	11,344	22,689	28,361	39,705
Commercial - Retail	Square Footage Added	7,888	15,775	31,551	39,438	55,213
Commercial - Warehouse	Square Footage Added	14,441	57,765	86,647	129,971	173,295
Commercial - Restaurant	Square Footage Added	-	2,884	2,884	5,768	5,768
Commercial - Hotel	Square Footage Added	19,229	57,687	96,145	134,603	192,289
Commercial - Other	Square Footage Added	30,243	100,810	161,296	231,863	302,430
Commercial - Office	# replaced RTU	3	11	31	49	68
Commercial - Retail	# replaced RTU	2	5	12	19	26
Commercial - Warehouse	# replaced RTU	2	9	21	34	47
Commercial - Restaurant	# replaced RTU	0	3	7	13	17
Commercial - Other	# replaced RTU	6	25	60	95	131
Commercial - Office	# replaced Gas RTU	2	10	28	45	63
Commercial - Retail	# replaced Gas RTU	1	5	12	18	25
Commercial - Warehouse	# replaced Gas RTU	1	6	15	24	33
Commercial - Restaurant	# replaced Gas RTU	0	3	6	10	13
Commercial - Hotel	# replaced Gas RTU	0	1	2	3	5
Commercial - Other	# replaced Gas RTU	4	20	47	75	102
Commercial - Office	# replaced Electric RTU	0	1	2	4	6
Commercial - Retail	# replaced Electric RTU	0	0	0	1	1
Commercial - Warehouse	# replaced Electric RTU	1	3	7	11	15
Commercial - Restaurant	# replaced Electric RTU	0	1	2	3	4
Commercial - Hotel	# replaced Electric RTU	1	4	9	13	18
Commercial - Other	# replaced Electric RTU	1	5	13	21	28
Commercial - Office	# replaced boiler	1	2	5	8	12
Commercial - Retail	# replaced boiler	1	5	14	22	31
Commercial - Warehouse	# replaced boiler	1	3	6	9	12
Commercial - Restaurant	# replaced boiler	1	2	2	2	2
Commercial - Hotel	# replaced boiler	1	3	6	9	13
Commercial - Other	# replaced boiler	2	9	21	32	44
Commercial - Restaurant	# replaced kitchen equipment	0	2	5	9	12
ZEVs		2,500	10,500	15,000	19,500	24,000

Notes

1. Non-residential commercial equipment values includes number of "new" commercial building equipment assumed to be electric (100% of HVAC, 50% of boiler and 50% of kitchen)
2. Grayed out values for RTUs provide information on the assumed split of RTUs that replace gas vs electric resistance RTUs when the total # of replaced RTUs is input into the Model. This is based on the assumed ComStock end-use of RTUs by fuel type.
3. ComStock data set indicated limited electricity data and savings curves for hotel RTU replacement indicating hotel RTUs are limited. Therefore no hotel RTU replacements modeled.

Appendix B

Supporting Data for Scenario Development

New Building Forecast Data

Customer Count Forecast

	Current (2023)	Average Building Sq Footage	Annual Coi	2025	2030	2035	2040	2045	Current (2023) Electric Accounts
Commerical (ALL - based on Number of Buildings)	581	9348.746811	0.5%	587	602	617	632	647	1,092
Office	125	5672.173469	0.2%	126	127	129	130	132	
Retail	58	7887.634615	0.5%	59	60	62	63	65	
Warehouse	61	14441.22222	0.9%	62	65	67	70	73	
Restaurant	18	2883.75	0.6%	18	19	19	20	20	
Hotel	25	19228.94737	1.8%	26	28	30	32	35	
Other	165	10081	0.8%	168	175	181	188	195	
Excluded	129	5246.5	0.0%	129	129	129	129	129	
Residential Customers (ALL - based on Number of Units)	4918			5071	5453	6157	6386	7463	
Single-Family	4033			4050	4092	4173	4232	4290	3,783
Multi-Family	885			1021	1361	1984	2154	3173	1,220
Manufactured	N/A								

New Home Starts (compared to 2023 baseline)

	2025	2030	2035	2040	2045
Residential Homes	153	535	1239	1468	2545
Single-Family	17	59	140	199	257
Multi-Family	136	476	1099	1269	2288
Manufactured	N/A	N/A	N/A	N/A	N/A

New Commercial Buildings (compared to 2023 baseline)

	Building Count					Square Footage					
	2025	2030	2035	2040	2045	2025	2030	2035	2040	2045	
Commerical (ALL - based on Number of Buildings)	6	21	36	51	66	56,092	196,324	336,555	476,786	617,017	
Office	1	2	4	5	7	5,672	11,344	22,689	28,361	39,705	Office
Retail	1	2	4	5	7	7,888	15,775	31,551	39,438	55,213	Retail
Warehouse	1	4	6	9	12	14,441	57,765	86,647	129,971	173,295	Warehouse
Restaurant	0	1	1	2	2	-	2,884	2,884	5,768	5,768	Restaurant
Hotel	1	3	5	7	10	19,229	57,687	96,145	134,603	192,289	Hotel
Other	3	10	16	23	30	30,243	100,810	161,296	231,863	302,430	Other
Excluded	0	0	0	0	0	-	-	-	-	-	

New Electric Equipment Counts in Commercial (compared with 2023 baseline)

RTU Count					
	2025	2030	2035	2040	2045
Office	1	2	4	5	7
Retail	1	2	4	5	7
Warehouse	1	4	6	9	12
Restaurant	0	1	1	2	2
Hotel	1	3	5	7	10
Other	3	10	16	23	30
Boiler Count					
	2025	2030	2035	2040	2045
Office	1	1	2	3	4
Retail	1	1	2	3	4
Warehouse	1	2	3	5	6
Restaurant	0	1	1	1	1
Hotel	1	2	3	4	5
Other	2	5	8	12	15
Kitchen Count					
	2025	2030	2035	2040	2045
Restaurant	0	1	1	1	1

For new buildings assume the following electrification: 100% HVAC, 50% water heaters and 50% commercial kitchens.

Residential End-Use Assessment using ResStock

Heating Fuel Type	Residential Market Rate (baseline)
Electric	21%
<i>Electric Heat Pumps</i>	5%
Natural Gas	69%
Propane	6%
Other	4%

Heating Fuel Type	Single-Family Market Rate (baseline)
Electric	16%
<i>Electric Heat Pumps</i>	5%
Natural Gas	71%
Propane	7%
Other	5%

Heating Fuel Type	Multi-Family Market Rate (baseline)
Electric	41%
<i>Electric Heat Pumps</i>	5%
Natural Gas	58%
Propane	1%
None	1%

Water Heating Fuel Type	Residential Market Rate (baseline)
Electric	18%
<i>Electric Heat Pumps</i>	0%
Natural Gas	74%
Propane	7%
Other	0.2%

Water Heating Fuel Type	Single-Family Market Rate (baseline)
Electric	14%
<i>Electric Heat Pumps</i>	0%
Natural Gas	76%
Propane	9%
Other	0.3%

Water Heating Fuel Type	Multi-Family Market Rate (baseline)
Electric	32%
<i>Electric Heat Pumps</i>	0%
Natural Gas	68%
Propane	0%
Other	0.0%

ACType	Residential Market Rate (baseline)
Central	54%
Ducted Heat Pump	4%
Mini Split	1%
None	26%
Room AC	14%

AC Type	Single-Family Market Rate (baseline)
Central	58%
Ducted Heat Pump	5%
Mini Split	1%
None	25%
Room AC	12%

AC Type	Multi-Family Market Rate (baseline)
Central	38%
Ducted Heat Pump	2%
Mini Split	3%
None	34%
Room AC	23%

Cooking Fuel Type	Residential Market Rate (baseline)
Electric	42%
Natural Gas	54%
Propane	4%

Cooking Fuel Type	Single-Family Market Rate (baseline)
Electric	37%
Natural Gas	58%
Propane	4%

Cooking Fuel Type	Multi-Family Market Rate (baseline)
Electric	61%
Natural Gas	38%
Propane	2%

Dryer Fuel Type	Residential Market Rate (baseline)
Electric	44%
Natural Gas	38%
Propane	2%

Dryer Fuel Type	Single-Family Market Rate (baseline)
Electric	47%
Natural Gas	45%
Propane	2%

Dryer Fuel Type	Multi-Family Market Rate (baseline)
Electric	30%
Natural Gas	9%
Propane	2%

Current Residential Equipment Values

Healdsburg Residential Customers (2023)

4918

HVAC

Heating Fuel Type	Residential Market Rate (baseline - 2018)	Estimated Number in		New Healdsburg			Annual Compound Growth Rate (CAGR)
		Healdsburg	TECH Projects	Healdsburg Rebates	Numbers	New % Distribution	
Electric	21%	1048			1123	23%	1.5%
Electric Heat Pumps	5%	265	10.64250963	64	340	7%	1.5%
Natural Gas/Other Fuel	79%	3864			3790	77%	-1.5%

Water Heating

Water Heating Fuel Type	Residential Market Rate (baseline - 2018)	Estimated Number in		New Healdsburg			Annual Compound Growth Rate (CAGR)
		Healdsburg	TECH Projects	Healdsburg Rebates	Numbers	New % Distribution	
Electric	18%	887			898	18%	0.2%
Heat Pump Water Heaters	0%	0	1	10	11	0%	0.2%
Natural Gas/ Other Fuel	82%	4031			4020	82%	-0.2%

Cooking

Cooking Fuel Type	Residential Market Rate (baseline - 2018)	Estimated Number in		New Healdsburg			Annual Compound Growth Rate (CAGR)
		Healdsburg	TECH Projects	Healdsburg Rebates	Numbers	New % Distribution	
Electric	42%	2073		20	2093	43%	0.4%
Natural Gas/ Other Fuel	58%	2845			2825	57%	-0.4%

Dryer

Cooking Fuel Type	Residential Market Rate (baseline - 2018)	Estimated Number in		New Healdsburg			Annual Compound Growth Rate (CAGR)
		Healdsburg	TECH Projects	Healdsburg Rebates	Numbers	New % Distribution	
Electric	44%	2160		31	2191	45%	0.2%
Natural Gas/ Other Fuel	40%	1981			1950	40%	-0.2%

Estimated using hot water heater trends

Residential

End-use	Baseline	Distribution By Fuel Type	Recent Adoption Rate (2021-2024)	Adjusted Adoption Rate	Adjusted Current Distribution	Adjusted Current Distribution
Electric Space Heating	21%	23%	1.5%	7.6%		
Heat Pump	5%	7%	1.5%	7.6%	14.5%	12.98%
Electric Water Heating	18%	18%	0.2%	1.1%		
HPWH	0%	0.2%	0.2%	1.1%	1.4%	1.1%
Electric Cooking	42%	43%	0.4%	2.0%	44.6%	44.2%
Electric Dryer	44%	45%	0.4%	2.0%	46.6%	45.9%

*Based on % of

*Based on Resstock for Sonoma County + the recent projects/fuel switch known from rebates numbers from Healdsburg and TECH data

*Based on data of project implementation (Healdsburg Rebates + TECH Projects)

projects that don't apply for permit or rebates - current calcs assume 20% of these projects are permitted

Non-Residential Building Calculation of Equipment Replacements

Building Type	Current RTUs	Gas RTUs	Electric RTUs	Ratio Gas to Total	Includes gas and electric RTUs	Underachieve CMS Implementation - Decarb 2% of Existing Nonres by 2030; replacement trends continues through 2045				Most Likely - Decarb 5% of Existing Nonres by 2030, 45% by 2045				Achieve CMS Implementation - Decarb 5% of Existing Nonres by 2030; replacement trends continues through 2045				Overachieve CMS Implementation - Decarb 15% of Existing Nonres by 2030				Full Electrification by 2045				
						Goal Distribution by 2030		Goal Replacements by 2030		Goal Distribution by 2030		Goal Replacements by 2030		Goal Distribution by 2030		Goal Replacements by 2030		Goal Distribution by 2030		Goal Replacements by 2030						
						by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030		by 2030	by 2030		
Small Office	61	56	5	0.92	49%	44%	55	6	-1.7%	42%	52	9	-2.6%	27%	34	28	-2.8%	42%	52	9	-2.6%	42%	52	9	-2.7%	61
Retail	19	19	1	0.97	33%	32%	19	0	-0.3%	31%	18	1	-0.9%	18%	11	9	-2.8%	31%	18	1	-0.9%	28%	16	3	-2.7%	19
Warehouse	35	24	11	0.69	58%	57%	35	1	-0.3%	55%	34	2	-0.9%	32%	19	16	-2.8%	55%	34	2	-0.9%	49%	30	5	-2.7%	35
Restaurant	15	12	3	0.78	82%	80%	14	0	-0.3%	78%	14	1	-0.9%	45%	8	7	-2.8%	78%	14	1	-0.9%	70%	13	2	-2.7%	15
Small Hotel	13	3	11	0.21	53%	52%	13	0	-0.3%	50%	13	1	-0.9%	29%	7	6	-2.8%	50%	13	1	-0.9%	45%	11	2	-2.7%	13
Other	101	79	22	0.78	61%	60%	99	2	-0.3%	58%	96	5	-0.9%	34%	55	45	-2.8%	58%	96	5	-0.9%	52%	86	15	-2.7%	101

Building Type	Current Gas Boiler	% Current Gas Boiler	Underachieve CMS Implementation - Decarb 2% of Existing Nonres by 2030; replacement trends continues through 2045				Most Likely - Decarb 5% of Existing Nonres by 2030, 45% by 2045				Moderate CMS Implementation - Decarb 5% of Existing Nonres by 2030; replacement trends continues through 2045				High CMS Implementation - Decarb 15% of Existing Nonres by 2030				Full Electrification by 2045					
			Goal Distribution by 2030		Goal Replacements by 2030		Goal Distribution by 2030		Goal Replacements by 2030		Goal Distribution by 2030		Goal Replacements by 2030		Goal Distribution by 2030		Goal Replacements by 2030							
			by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030						
Small Office	8	6%	6%	8	0	-0.3%	6%	8	0	-0.9%	4%	4	-2.8%	6%	8	0	-0.9%	5%	7	1	-2.7%	8	8	27
Retail	27	47%	46%	26	1	-0.3%	44%	26	1	-0.9%	26%	15	12	-2.8%	44%	26	1	-0.9%	40%	23	4	-2.7%	27	6
Warehouse	6	10%	10%	6	0	-0.3%	9%	6	0	-0.9%	5%	3	3	-2.8%	9%	6	0	-0.9%	8%	5	1	-2.7%	6	1
Restaurant	1	6%	5%	1	0	-0.3%	5%	1	0	-0.9%	3%	1	0	-2.8%	5%	1	0	-0.9%	0%	0	1	-100.0%	1	8
Small Hotel	8	32%	31%	8	0	-0.3%	30%	8	0	-0.9%	18%	4	4	-2.8%	30%	8	0	-0.9%	27%	7	1	-2.7%	8	8
Other	29	18%	17%	28	1	-0.3%	17%	28	1	-0.9%	10%	16	13	-2.8%	17%	28	1	-0.9%	15%	25	4	-2.7%	29	23

Building Type	Current Gas Cooking	% Current Gas Cooking	Underachieve CMS Implementation - Decarb 2% of Existing Nonres by 2030; replacement trends continues through 2045				Most Likely - Decarb 5% of Existing Nonres by 2030, 45% by 2045				Moderate CMS Implementation - Decarb 5% of Existing Nonres by 2030; replacement trends continues through 2045				High CMS Implementation - Decarb 15% of Existing Nonres by 2030				Full Electrification by 2045					
			Goal Distribution by 2030		Goal Replacements by 2030		Goal Distribution by 2030		Goal Replacements by 2030		Goal Distribution by 2030		Goal Replacements by 2030		Goal Distribution by 2030		Goal Replacements by 2030							
			by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030						
Restaurant	11	61%	60%	11	0	-0.3%	58%	10	1	-0.9%	34%	6	5	-2.8%	58%	10	1	-0.9%	52%	9	2	-2.7%	11	11

Residential Building Calculation of Equipment Replacements

Residential End Use Using Fossil Fuel	% Fossil Fuel Distribution in 2018	% Change btwn 2018 & 2024	Adjusted % Change btwn 2018 & 2024	% Distribution in 2024	2024 values	Underachieve CMS Implementation - Decarb 5% of Existing Residential by 2030, 15% by 2045				Most Likely Scenario - Decarb 10% of Existing Residential by 2030; 65% by 2045				Achieve CMS Implementation - Decarb 8% of Existing Residential by 2030; 25% by 2045				Overachieve CMS Implementation - Decarb 20% of Existing Residential by 2030				Full Electrification by 2045							
						Goal Distribution by 2030		Goal Replacements by 2030		Goal Distribution by 2030		Goal Replacements by 2030		Goal Distribution by 2030		Goal Replacements by 2030		Goal Distribution by 2030		Goal Replacements by 2030									
						by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030	by 2030								
Single Family					4923																								
Water Heating	86%	-0.2%	-1.1%	84.5%	3407	83%	3336	71	79%	3195	212	81%	3266	141	63%	2560	847	82%	3294	113	76%	3054	353	77%	3125	282	-1.4%	3407	
HVAC	84%	-1.5%	-7.6%	76.1%	3070	73%	2955	115	68%	2725	345	70%	2840	230	42%	1890	1379	72%	2886	184	62%	2495	575	65%	2610	460	-2.7%	3070	
Cooking	63%	-0.4%	-2.0%	60.5%	2441	60%	2431	9	60%	2413	28	60%	2422	19	56%	2329	112	60%	2426	15	59%	2394	47	60%	2403	37	-0.3%	2441	
Dryer	48%	-0.2%	-1.1%	46.4%	1873	46%	1866	7	46%	1852	22	46%	1859	14	44%	1797	86	46%	1862	11	46%	1837	36	46%	1844	29	-0.3%	1873	
Multi Family					885																								
Water Heating	68%	-0.2%	-1.1%	66.5%	589	63%	561	28	57%	505	84	60%	533	56	29%	254	330	61%	544	45	51%	449	139	54%	477	112	-3.4%	589	
HVAC	59%	-1.5%	-7.6%	51.4%	455	50%	442	13	47%	416	38	48%	429	26	34%	301	154	49%	434	21	44%	390	64	46%	403	51	-2.0%	455	
Cooking	39%	-0.4%	-2.0%	37.3%	330	37%	327	3	36%	320	10	37%	323	6	33%	292	38	37%	325	5	35%	314	16	36%	317	13	-0.7%	330	
Dryer	12%	-0.2%	-1.1%	10.4%	92	10%	92	1	10%	91	2	10%	91	1	10%	85	7	10%	91	1	10%	89	3	10%	90	2	-0.4%	92	

EV Input Value Calculations

Inputs and Assumptions		Source				
Total registered vehicles in Healdsburg (2024)	20,357	https://data.ca.gov/dataset/vehicle-fuel-type-count-by-zip-code				
Light Duty	18,510	*includes heavy duty and unknown				
Heavy Duty	1,847					
% Passenger	91%					
% Commercial	9%					
2024 Population	11,137	U.S. Census Bureau QuickFacts: Healdsburg city, California				
Cars per capita	2					
Registered EVs in Healdsburg (2024)	928	https://data.ca.gov/dataset/vehicle-fuel-type-count-by-zip-code				
Passenger ZEV	924					
Commercial ZEV	4					
% Plug in Evs	4.6%					
% Plug in Passenger ZEV	5.0%					
% Plug in Commercial ZEV	0.2%					
EMFAC EPM (kWh/mile)		2025	2030	2035	2040	2045
Passenger	0.36	0.37	0.39	0.40	0.41	
Commercial	1.41	1.37	1.36	1.35	1.35	
Forecasted Total VMT (CMS)	134,170,813	143,346,234	152,521,655	161,697,077	177,948,622	
Forecasted Passenger VMT (CMS)	129,509,112	138,181,316	146,748,605	155,227,390	170,353,381	
Forecasted Commercial VMT (CMS)	4,661,701	5,164,918	5,773,051	6,469,687	7,595,241	
Baseline EV adoption from EMFAC	2025	2030	2035	2040	2045	
Forecasted population	12,025	12,746	12,882	13,018	13,127	
Forecasted Total Cars	21,979.36	23,297.55	23,546.29	23,795.03	23,993.57	
Forecasted Passenger	19,985.16	21,183.75	21,409.92	21,636.10	21,816.62	
Forecasted Miles/Passenger Vehicle Annual	6,480.26	6,522.99	6,854.23	7,174.46	7,808.42	
Forecasted Miles/Passenger Vehicle Daily	17.75	17.87	18.78	19.66	21.39	
Passenger EV (%)	5.19%	7.79%	9.93%	11.26%	11.98%	
BAU Passenger ZEVs	1,141	1,815	2,337	2,680	2,875	
Forecasted Commercial	1994.20	2113.80	2136.37	2158.93	2176.95	
Forecasted Miles / Commercial Vehicle Annual	2337.63	2443.43	2702.28	2996.70	3488.94	
Forecasted Miles / Commercial Vehicle Daily	6.40	6.69	7.40	8.21	9.56	
Commercial EV (%)	0.68%	7.10%	19.18%	29.45%	36.48%	
BAU Commercial ZEVs	14	150	410	636	794	
Total ZEVs	1,155	1,966	2,747	3,316	3,669	
CMS ZEV VMT	7,424,944	12,208,915	17,126,951	21,135,079	25,220,903	
CMS ZEV Passenger VMT	7,393,045	11,841,977	16,019,927	19,229,539	22,450,076	
CMS ZEV Commercial VMT	31,898	366,938	1,107,024	1,905,541	2,770,827	
GWh per year using Model split (80% sedan, 20% heavy duty)	4	7	10	13	15	
Underachieve CMS Implementation - 5% passenger ZEV penetration & 10% commercial ZEV penetration by 2030	2025	2030	2035	2040	2045	
Percentage of passenger vehicles that are electric (%)	5.8%	10.0%	17.8%	31.8%	56.6%	
# of passenger ZEVs	1,164	2,117	3,814	6,873	12,356	
Percentage of commercial vehicles that are electric (%)	1.9%	10.2%	23.5%	36.7%	50.0%	
# of commercial ZEVs	38	216	502	793	1,088	
Total # of ZEVs	1,202	2,333	4,316	7,666	13,445	
CMS ZEV VMT	7,631,994	14,334,611	27,499,491	51,685,210	100,281,462	
CMS ZEV Passenger VMT	7,544,203	13,806,934	26,144,110	49,308,321	96,483,841	
CMS ZEV Commercial VMT	87,791	527,677	1,355,380	2,376,889	3,797,621	
GWh per year	3	6	12	23	45	
Most Likely CMS Implementation - 15% passenger ZEV penetration & 20% commercial ZEV penetration by 2030	2025	2030	2035	2040	2045	
Percentage of passenger vehicles that are electric (%)	10.0%	35.0%	48.3%	61.7%	75.0%	
# of passenger ZEVs	1,997	7,413	10,347	13,342	16,362	
Percentage of commercial vehicles that are electric (%)	1.9%	10.2%	26.8%	43.4%	60.0%	
# of commercial ZEVs	38	216	573	937	1,306	
Total # of ZEVs	2,034	7,629	10,920	14,279	17,669	
CMS ZEV VMT	13,028,207	48,879,940	72,468,379	98,527,565	132,322,180	
CMS ZEV Passenger VMT	12,940,416	48,352,263	70,920,564	95,719,364	127,765,036	
CMS ZEV Commercial VMT	87,791	527,677	1,547,815	2,808,201	4,557,145	
GWh per year	5	19	30	42	59	
Achieve CMS Implementation - 30% passenger ZEV penetration & 40% commercial ZEV penetration	2025	2030	2035	2040	2045	
Percentage of passenger vehicles that are electric (%)	9.2%	30.0%	50.0%	70.0%	90.0%	
# of passenger ZEVs	1,830	6,353	10,704	15,145	19,635	
Percentage of commercial vehicles that are electric (%)	6.9%	40.2%	56.8%	73.4%	90.0%	
# of commercial ZEVs	137	850	1,214	1,585	1,959	
Total # of ZEVs	1,968	7,204	11,917	16,729	21,594	
CMS ZEV VMT	12,182,049	43,520,350	76,646,105	113,404,087	160,153,760	
CMS ZEV Passenger VMT	11,861,174	41,443,197	73,366,374	108,654,980	153,318,043	
CMS ZEV Commercial VMT	320,876	2,077,153	3,279,730	4,749,108	6,835,717	
GWh per year	5	18	33	50	72	
Overachieve CMS Implementation - 40% passenger ZEV penetration & 50% commercial ZEV penetration	2025	2030	2035	2040	2045	
Percentage of passenger vehicles that are electric (%)	11.7%	45.0%	63.3%	81.7%	100.0%	
# of passenger ZEVs	2,330	9,531	13,558	17,669	21,817	
Percentage of commercial vehicles that are electric (%)	8.5%	50.2%	66.8%	83.4%	100.0%	
# of commercial ZEVs	171	1,061	1,427	1,801	2,177	
Total # of ZEVs	2,500	10,592	14,986	19,470	23,994	
CMS ZEV VMT	15,497,472	64,764,039	96,789,890	132,160,918	177,948,622	
CMS ZEV Passenger VMT	15,098,901	62,170,394	92,932,855	126,764,842	170,353,381	
CMS ZEV Commercial VMT	398,571	2,593,645	3,857,036	5,396,076	7,595,241	
GWh per year	6	27	41	58	80	

PV Watts Solar Assumptions

Location and Station Identification

Requested Location	Healdsburg
Weather Data Source	Lat, Lng: 38.61, -122.86 0.5 mi
Latitude	38.61° N
Longitude	122.86° W

PV System Specifications

DC System Size	3.5 kW																								
Module Type	Standard																								
Array Type	Fixed (open rack)																								
System Losses	14.08%																								
Array Tilt	20°																								
Array Azimuth	180°																								
DC to AC Size Ratio	1.2																								
Inverter Efficiency	96%																								
Ground Coverage Ratio	0.4																								
Albedo	<i>From weather file</i>																								
Bifacial	No (0)																								
Monthly Irradiance Loss	<table border="1"> <tr> <th>Jan</th> <th>Feb</th> <th>Mar</th> <th>Apr</th> <th>May</th> <th>June</th> </tr> <tr> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> </tr> <tr> <th>July</th> <th>Aug</th> <th>Sept</th> <th>Oct</th> <th>Nov</th> <th>Dec</th> </tr> <tr> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> <td>0%</td> </tr> </table>	Jan	Feb	Mar	Apr	May	June	0%	0%	0%	0%	0%	0%	July	Aug	Sept	Oct	Nov	Dec	0%	0%	0%	0%	0%	0%
	Jan	Feb	Mar	Apr	May	June																			
0%	0%	0%	0%	0%	0%																				
July	Aug	Sept	Oct	Nov	Dec																				
0%	0%	0%	0%	0%	0%																				

Performance Metrics

DC Capacity Factor	18.0%
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Comparison Between ResStock and Other Data Sources (i.e., CA eTRM and ENERGY STAR)

	HP Water Heater ¹	Std Efficiency HP HVAC ²	Stove/Range	Dryer
Single Family				
ResStock	799	2,741	285	216
eTRM savings	1,592	1,334	375	462
ENERGY STAR website	1,184	N.D.	229	528
Multi Family				
ResStock	498	1,139	246	96
eTRM	1,178	115	263	185
ENERGY STAR website	846	N.D.	202	419

Notes:

1. ResStock, eTRM and ENERGY STAR present increased electricity for heat pump water heater
2. ResStock present minimum-efficiency heat pump for dwelling units with non-electric heating, whereas eTRM presents data for ducted, standard efficiency HVAC with 3 ton capacity when a previous AC unit was present

Survey Language

English

Spanish

Residential EVs

339

Residential Responses

I already have an EV.

I plan to purchase an EV this year.

I plan to purchase an EV within the next 5 years.

I plan to purchase an EV after the next 5 years.

I have or plan to purchase an EV.

I am not sure/do not plan/not applicable.

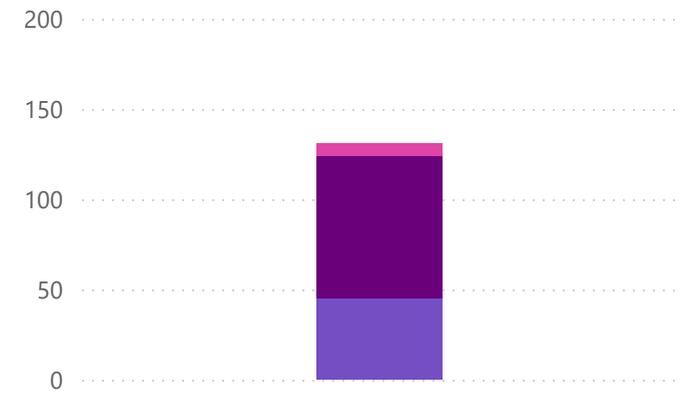
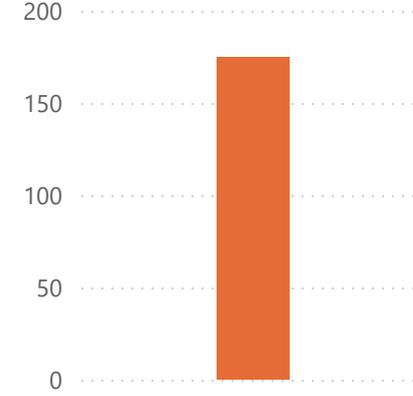
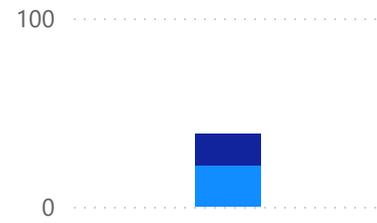
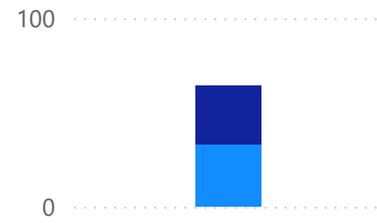
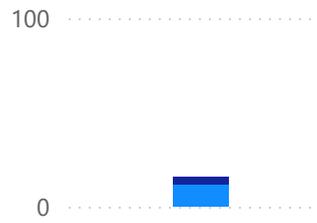
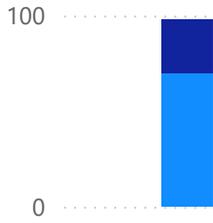
All Electric... Plug-In H...

All Electric... Plug-In H...

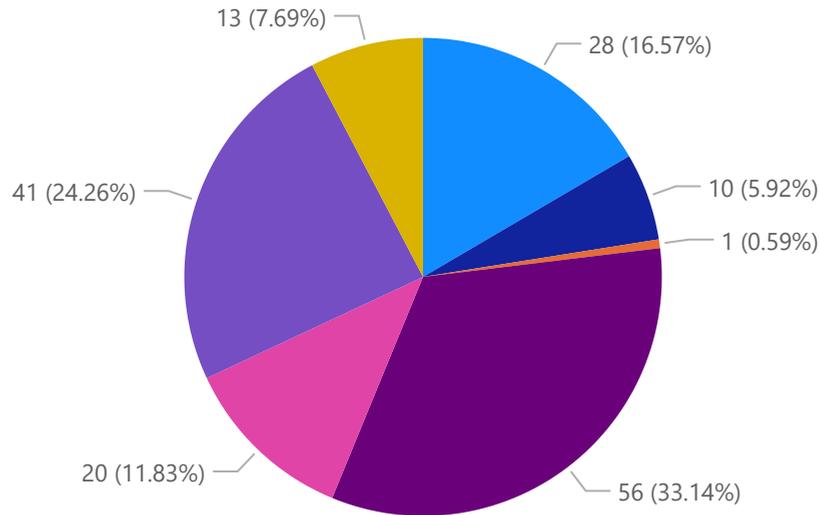
All Electric EV Plug-In Hybri...

All Electric EV Plug-In Hybri...

I am not sure/und... I do not plan t... Not applicable



If you already have or plan to have an EV, when will you charge your electric vehicle most often?



- During the daytime at home
- During the daytime at work or at a public charger
- Overnight at a public charger
- Overnight at home, starting right when I get home in...
- Overnight at home, starting at midnight
- Overnight at home, managed for a 'ready by' time in ...
- Other
- *Not applicable, I do not plan to purchase an EV

If you already have or plan to have an EV, when will you charge your electric vehicle most often Other (please specify)

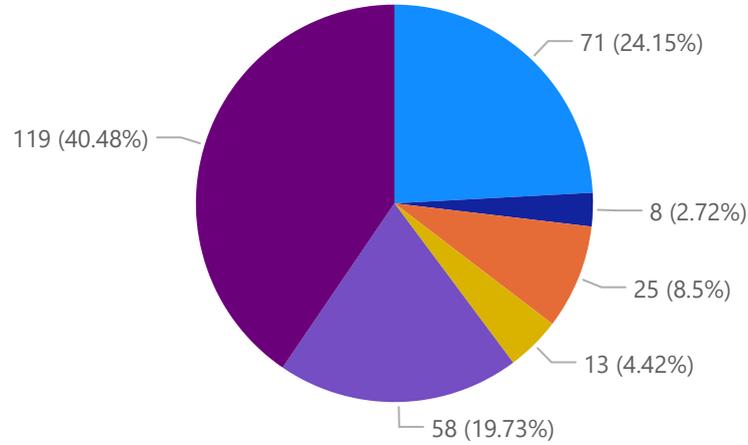
- At Tesla superchargers
- Have no idea.
- Haven't put much thought in that yet.
- I charge prior to when I know I will need the car to have a full battery
- Overnight after 9PM
- Overnight at home starting around 7pm.
- Overnight at home, starting at 9 pm
- Overnight, after prime time
- Uncertain
- undecided
- use the chargers at the city hall I also have charger at home
- Whenever I get home
- whenever it gets down to 20% battery

*NA responses filtered out. (Total of 73 respondents selected NA.)



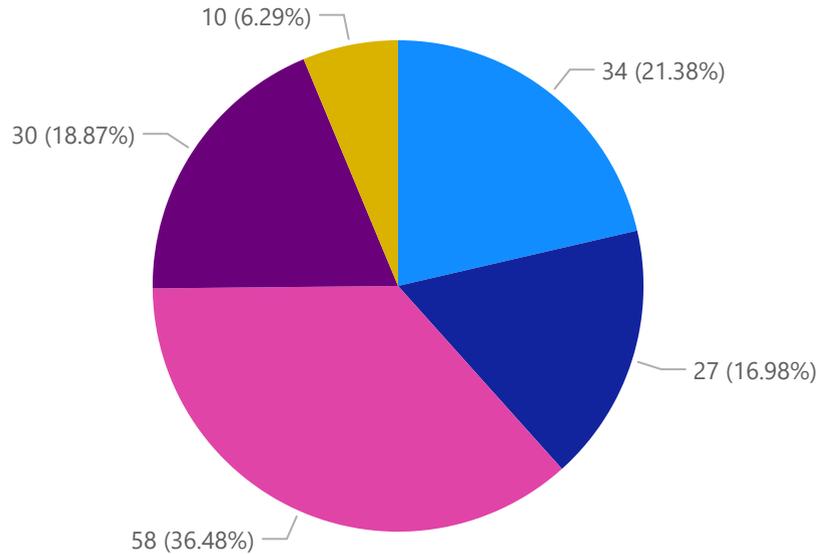
Residential Solar

Do you plan to install solar at your home, or encourage your landlord/property manager?



- I already have solar installed at my home.
- I plan to install solar this year.
- I plan to install solar within the next 5 years.
- I plan to install solar, but probably not for at least 5 years.
- I am not sure/undecided.
- I do not plan to install solar in the future.

If you already have or plan to have solar, will you include battery storage?



- Yes, with battery mainly for back up
- Yes, with battery mainly to avoid peak pricing and exc...
- Not sure/undecided
- No
- Other (please specify)
- None of the above/ Not applicable, I do not plan to i...

If you already have or plan to have solar, will you include battery storage Other (please specify)

- Already have battery
- Depends on City Fees/Requirements, Battery/Equipment installation costs, Rebates from Local & State. Not looking like any Federal rebates in the next 4 years!
- for both
- Generator is installed
- if i can afford it
- I'm sure the installer will tell me how it works.
- We have solar and have battery storage
- We would like to add batteries but they are very expensive. It would have doubled the cost of our installation
- We would love to have a battery but have discovered that since our vendor went out of business, other vendors will not attach a battery to our existing system.
- Will get battery when pricing is better

*NA responses filtered out. (Total of 97 respondents selected NA.)

Survey Language

English

Spanish

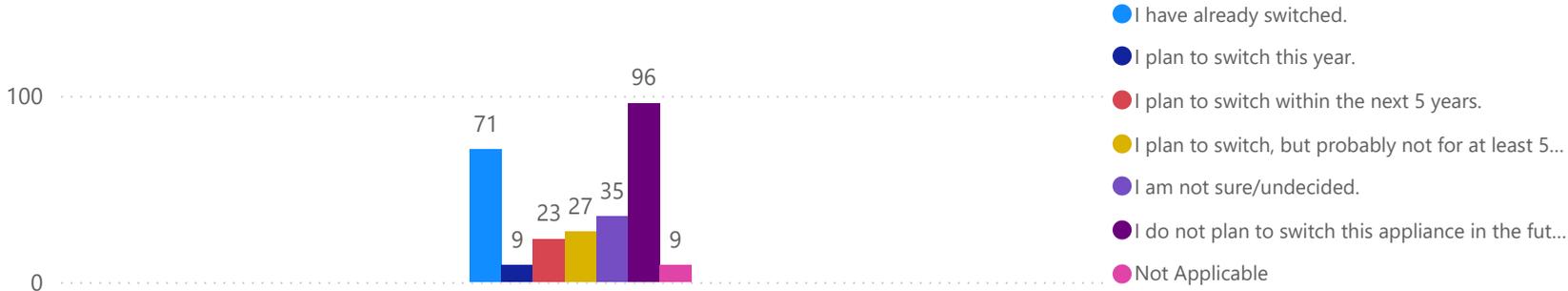


Residential Appliances

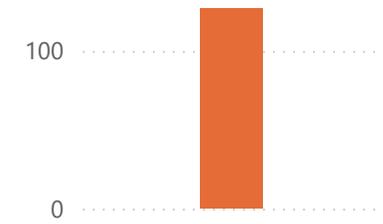
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Residential Responses

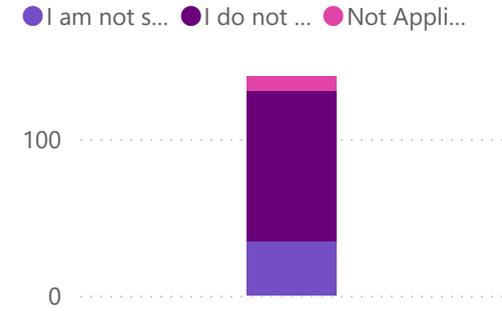
Do you plan to install efficient electric appliances at your home, or encourage your landlord/property manager?
Heating/Cooling (heat pump)



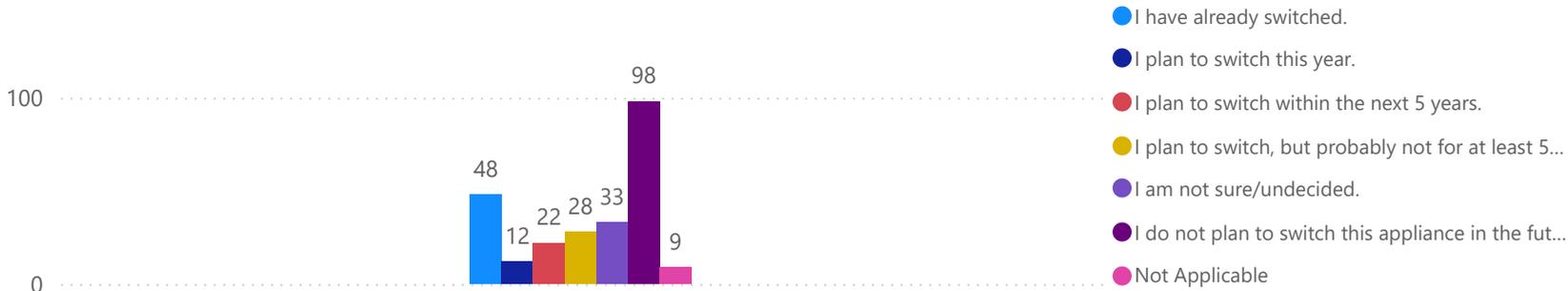
I have or plan to have electric heating/cooling.



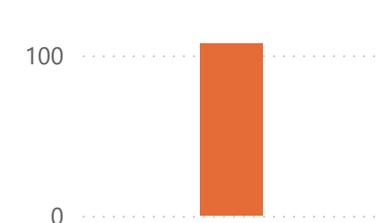
I am not sure/do not plan/not applicable.



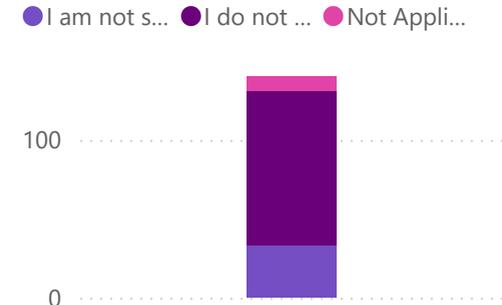
Do you plan to install efficient electric appliances at your home, or encourage your landlord/property manager?
Water Heating (heat pump)



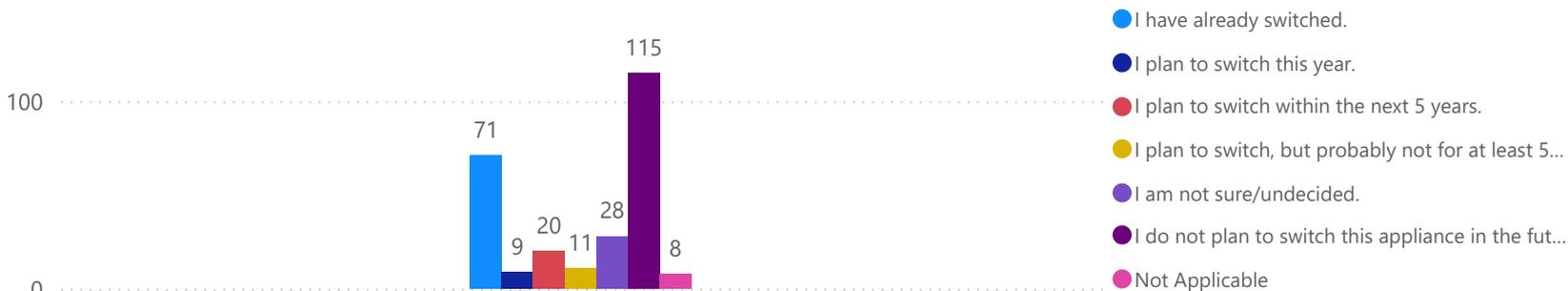
I have or plan to have electric water heating.



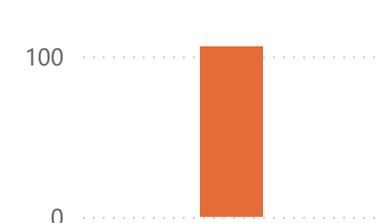
I am not sure/do not plan/not applicable.



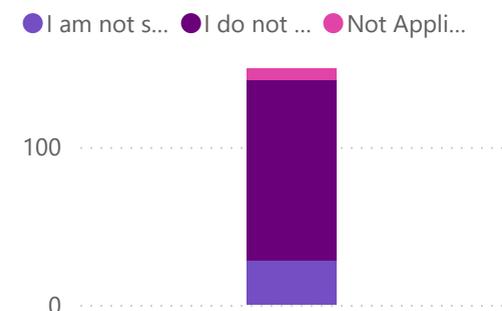
Do you plan to install efficient electric appliances at your home, or encourage your landlord/property manager?
Cooking (stove/range)



I have or plan to have electric cooking.



I am not sure/do not plan/not applicable.



Survey Language

English

Spanish

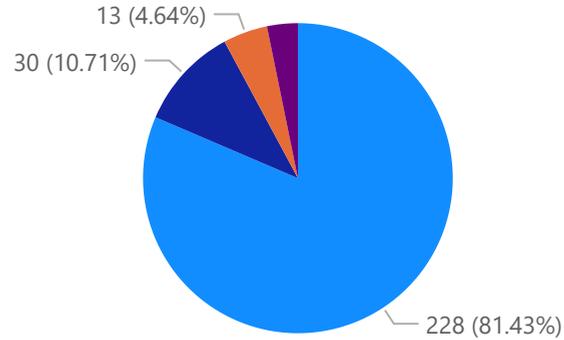


Residential Demographics

339

Residential Responses

Which of the following applies to you?

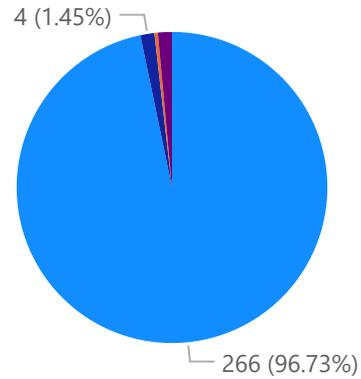


- I own a home in Healdsburg.
- I rent a home in Healdsburg.
- I own multiple homes in Healdsburg.
- Other

Which of the following applies to you Other (please specify)

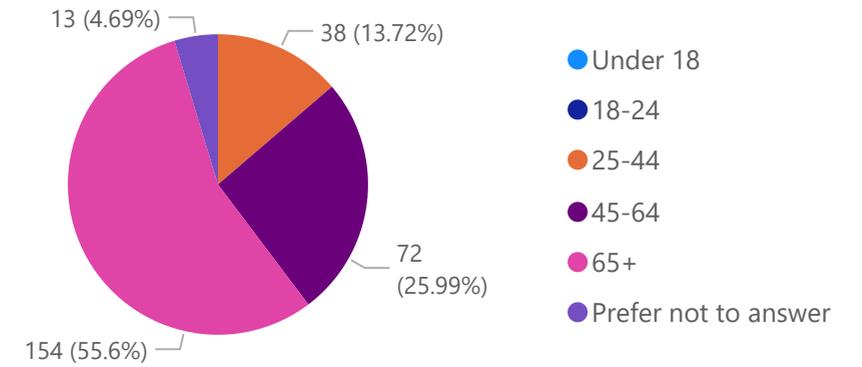
- airbnb
- I am a resident of Enso Village
- I rent an apartment
- My partner owns the home, but I live with him and share all expenses.
- Own 4-plex
- Rent apartment at Oak Grove Apartments
- Retirement community
- Unincorporated Kinley Drive
- Why not ask what the service is at your home and how you plan to charge a car, run an A/c an electric stove, electric dry

Which language is predominantly spoken at your home?



- English
- Spanish
- Other (please specify)
- Prefer not to answer

What is your age group?

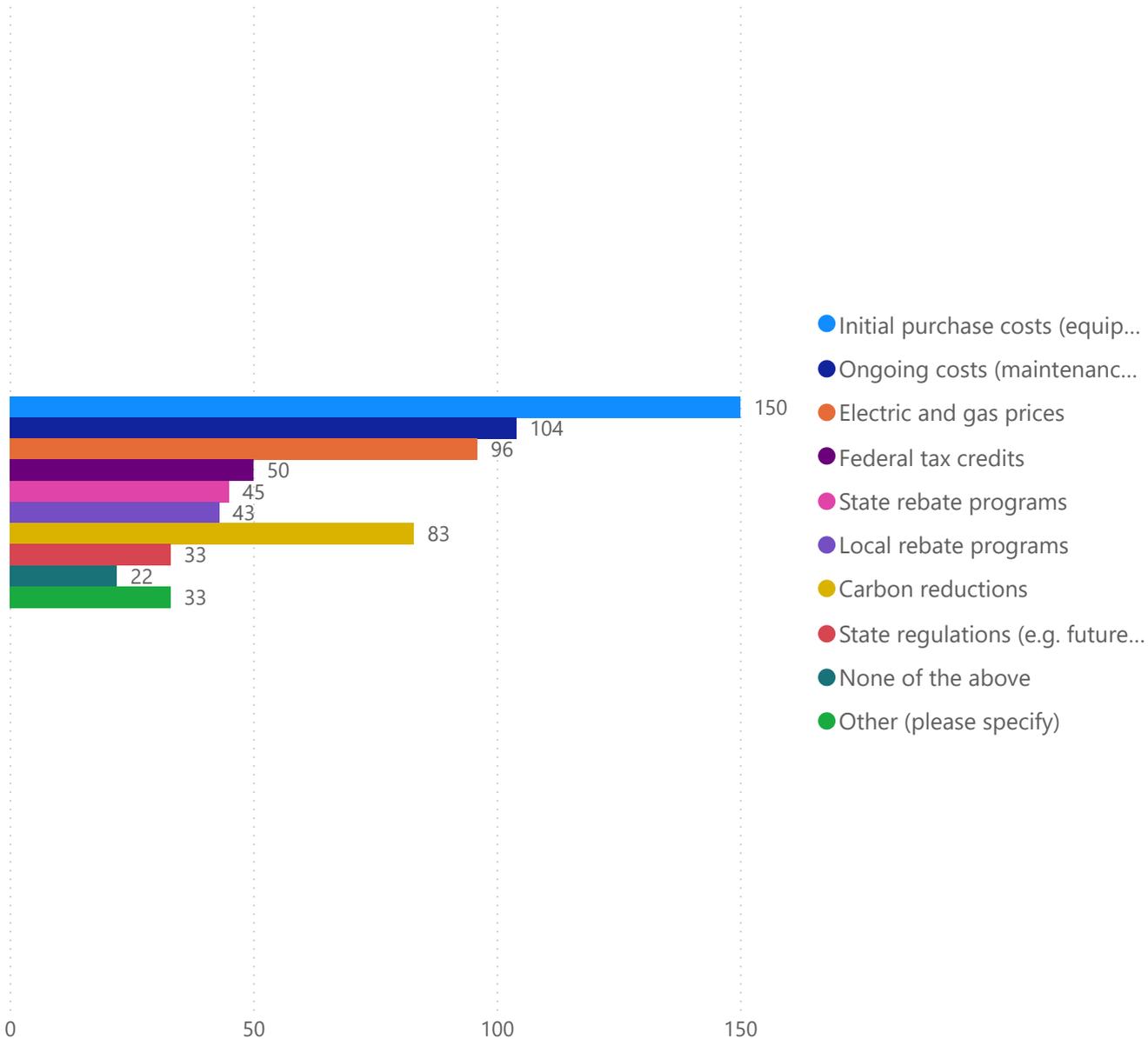


- Under 18
- 18-24
- 25-44
- 45-64
- 65+
- Prefer not to answer



Residential Main Factors

What are the main factors for your energy project decisions?



What are the main factors for your energy project decisions Other (please specify)

- a gas stove top will always be in my kitchen
- all electric is not a sustainable future and its going to be more costly than gas
- Already have thingsset
- As renters we have no control over the decision. What would incentivize the owners?
- Bought a home that is all electric
- City/State/Federal rebates to offset Expen\$e of installation and ROI
- Climatecontrol
- Community decision- cost
- Concern about the reliability of the electric grid.
- elec grid needs upgrades and new generation
- electric generation is inadequate in this area and that is the State's fault
- energy independence and changing the electric utility system
- I no longer drive. I have relatively new appliances.
- I prefer gas
- I rent and don't own my residence.
- If/when I have the ability to remodel I might consider some of these factors.
- Natural gas is more efficient and more reliable. Our power grid is less reliable and gets shut off occasionally.
- Old heating system died in Sept 2024- installed new Heat pump /air
- Power outages incline me to not change our stove. If the power goes out we can still boil water with a gas stove.
- Prefer to cook with gas
- Quality and diversity of source for heat, cooking
- Rebates , tax credits...
- Regular electrical outages and lack of sufficient electricity supply for all electric vehicles and appliances
- Renter and do not get to make these decisions
- Satisfied with current choices
- See number 7. I no longer drive & sold my hybrid.
- Service amperage and carrying capacity
- Since I am a renter, my landlord makes the decisions about upgrading or changing systems. If I could, I'd install solar panels.
- The current price of electricity in Healdsburg
- the long term payback exceeds equipment life
- To retain competitive energy options. Not smart to put all your eggs in the electric basket.
- Too much draw in current power grid
- We rent a home and don't want to invest in someone else's home

English Spanish

Please provide any additional comments that will help Healdsburg Electric Department to forecast future electricity use and demands. (Optional) Open-Ended Response

1. You already know how many solar customers you have and should also know how many customers have EVs and the number of EVs that they have (we have 2 for example). You should also be aware of how much energy storage is on your system right? When you forecast future electricity use and demand, the forecast should be based on your PLAN for the future. What is your plan for the future? How seriously are you considering V2G? When does V2G come into play? How will you "tailor" V2G customer usage? What will be your strategy for monetizing and incentivizing V2G usage to result in the most robust affordable electricity service? Imagine the future that is coming fast. EVs capable of inductive charging and with full FSD like the Tesla Robotaxi. No charge ports necessary because you have a plan for having inductive charging embedded in your parking spots just on the outskirts of town that will allow Healdsburg to close parts of the center of town to through traffic. Solar is becoming more and more affordable, my 400Watt modules cost less than the Enphase microinverters. Have a plan in place where all homeowners can have upgraded electrical, solar, storage and EV charging capacity (unless it is truly impractical or too expensive - this will likely be very few customers). The utility should subsidize this in lieu of new generation or to get off of geothermal in the geysers. But the customers should own the system, not the utility (that doesn't work, refer to Arizona and SMUD). IOUs and munis need to re-think what they do and who they serve. You need to SERVE...I did, its better when you actual serve someone. That is why they called it Civil Service. Power to the People knuckleheads.

Again, I don't get to make decisions about the systems in the house I rent. I'd be open to making changes but not my choice to make.

Appreciate this effort!

as a senior household, the current increasing costs of utilities are troublesome. due to our fixed income it impacts the affordability of solar etc.

City electric price tiers thoroughly discourage me from adding induction cooking. Installing a heat pump to replace gas wall heaters stopped my electric conversion. Electric demand water heaters are decidedly inferior to my gas demand heaters, so I'll wait.

City of HBG prices are outrageous.

City of Healdsburg utility costs are absurdly high!!! We are very careful in our usage and hours of use but as one person living in home it's almost unaffordable.

Consider under grounding areas close to wild lands (wui). This will greatly reduce fire hazards

Current estimate is \$50,000-\$65,000 for Heat Pump HVAC and Solar PV for 1800 s.f. residence. That's a huge investment and a LONG timeline for payback. City only returns 50% on excess electricity generated into their grid for re-sale.

Do you plan to add capacity?

Don't cram your agenda down the throats of the citizens. Everyone gets to choose their own adventure.

Don't get rid of the diesel backup generators

Electric Panel Upgrade costs are a barrier to upgrading Heating/AC to heat pump.

Electricity and Energy are egregiously priced in Healdsburg and our roads are terrible. Focus on this fixing this and less on items that don't favorably impact the majority of residents.

Enso Village (where I live) is very environmentally conscious and has electrified everything they possibly could. The commercial grade kitchen is the only place you'll find gas appliances.

Even though I would like my landlord to install solar or change heating to electric, I will never be able to convince the bastard.

Getting rid of gas improves safety

Healdsburg needs to stop penalizing year round citizens and stop increasing energy and water rates. Bloodsuckers!

I am puzzled by the process I thought I signed up for to charge at optimum times from a cost standpoint

I am very frustrated with the city's current rate hike. There are two people in my duplex rental home and our Healdsburg utility bill is \$300. It's unsustainable.

I cannot afford solar, but support its use.

I choose to cook with gas. It is vastly better than electric stoves. It is none of the local government's business how I cook. I would never purchase a home that does not provide me the option of cooking with gas.

I drive a non-plug in SUV and get 45 MPG. The cost of an equivalent EV is not at all affordable when you live on Social Security

I find my heating bill is much higher with electric and less efficient therefore I will not be switching to electric on any other appliances.

I have had a pv system for the past 10 years but have recently added purchased an EV vehicle and am considering expanding my pv system to account for the additional need.

I have solar heat for pool and 2 EV autos

I was astounded that I was gone for 2 weeks in Dec 2024 to early Jan and my electric bill for that period was quite high - I believe that if we have changed over - that there should be a rate for those that have a heat pump (requiring the fan to be operable during the window of heat).

English Spanish

Residential Comments

Please provide any additional comments that will help Healdsburg Electric Department to forecast future electricity use and demands. (Optional) Open-Ended Response

I would love to go solar, but don't use enough electricity to make it financially worthwhile

I wouldn't make any changes that required upsizing our 200a panel or the supply wiring from COH

I'd have installed solar panels, but the city building code won't allow on my roof given the proximity of skylights.

If battery storage became cheaper we would consider adding batteries to our solar system to stretch that power beyond the daylight hours.

I'm not switching anything to electric. I already have an EV, that's all I need. Do not mess with natural gas...its NATURAL!

Increase energy production and storage to keep cost low.

Increasing electricity costs may make me more likely to charge at public chargers.

it is NOT affordable to have to convert gas stove and heater to electric - NOR do i want to be accountable to the electric grid, pge, increased electric costs, no access when power poles go down, lack of trust of pge etc

My water bill is completely unaffordable. Please work on lowering water rates and scrapping the Green New Scam and other waste of taxpayer money initiatives.

our energy use is low and HBG electric rates are low so we are not motivated to install solar or electrify

Please consider a electricity buy back incentive

Please lower the cost of electric, water and sewage

Power shut offs during high fire watch season will deter me from going electric

Range is upscale gas. Gas water heater is newer and tankless, at least. Two gas furnaces (upstairs and downstairs) are operating fine. Doubt owners will replace any of these appliances as long as this is a rental.

Stop raising prices it is becoming more and more difficult to live in Healdsburg.

Thanks for doing this. Also would like to look at options for moving away from the City grid in the future.

Thanks to the Utility Department for providing residents with valuable information. Terra did a great job speaking at the Climate Action Healdsburg meeting last night.

The state does not have the infrastructure to go all electric. We are a free state and we should have all options for energy. Electric batteries cause more harm on the environment than fossil fuels. Your woke plans are too costly. We are being over charged. The city should not tell us how to live our lives. They should focus on providing utilities at an affordable price

There is little or no effort in the rest of the USA to make our sacrifice meaningful. Finally, the cost per citizen is what is making this State unaffordable and is contributing to the homeless crises.

We are in our 80's. If we were younger we would most definitely upgrade our heat.Cooling to heat pump. Unfortunately, our current system is not very old but should it fail, we will definitely switch.

We don't plan on ever changing to Electric. Do not implement any mandates. The Climate mobilization strategy is virtue signaling and should have never been approved. The woke approach of Healdsburg is very unfortunate.

We had new appliances installed in 2014. The cost to replace them with electric ones when they have not worn out is prohibitive

We save water during a crisis and you raise our rates. Once it's all electric, you will just raise the rates even more. Stop greenwashing us about all electric.

We used to have a hybrid/Electric vehicle, but sold it in 2020.

we'd like to switch to more electric appliances, especially the dryer. Preferably a washer/dryer combo machine. But we've maxed out what our electrical box holds, so can't handle what another electric appliance would need without an overhaul of our whole electrical box. Just so you know another factor driving our decisions...

When my EV vehicle lease is up in January 2026, I may switch to EV/hybrid. Road trips take twice as long because of charging times and there is anxiety about finding a charger that works fast. City of Healdsburg appears to have stopped rebates for charging after 7:30 pm, too.

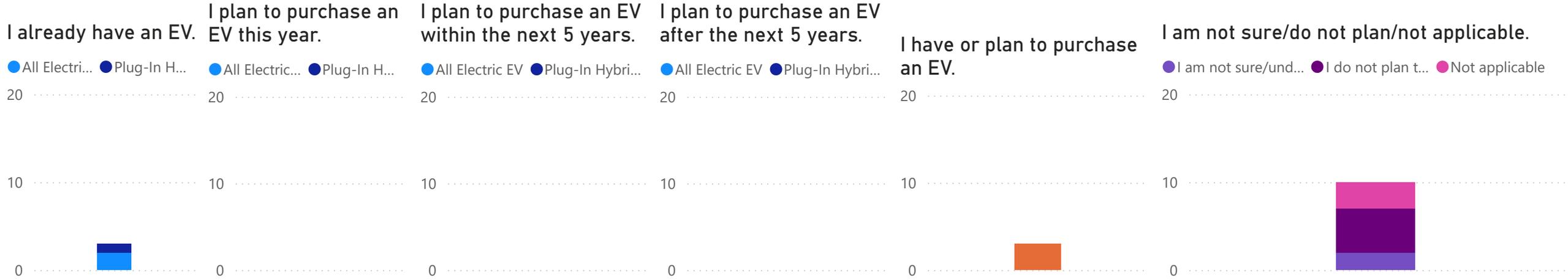
will move to HBG full-time in the next few years

Workshop activity response

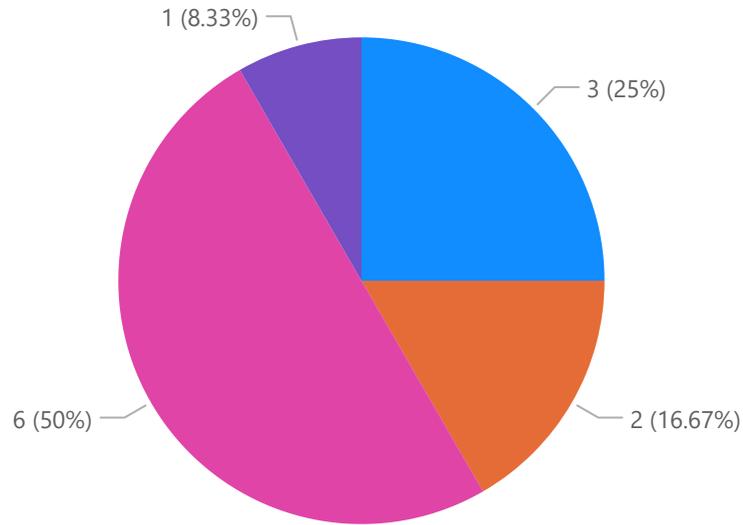
X

You need to be upfront with consumers about the 100 or even 200 amp service that they have not being able to sustain all electric appliances and call three to five local electrical contractors to get real world pricing unlike the information that has been previously disseminated on this topic.

Commercial EVs



Do you plan to install EV chargers at your business, or encourage the property owner? If so, when?



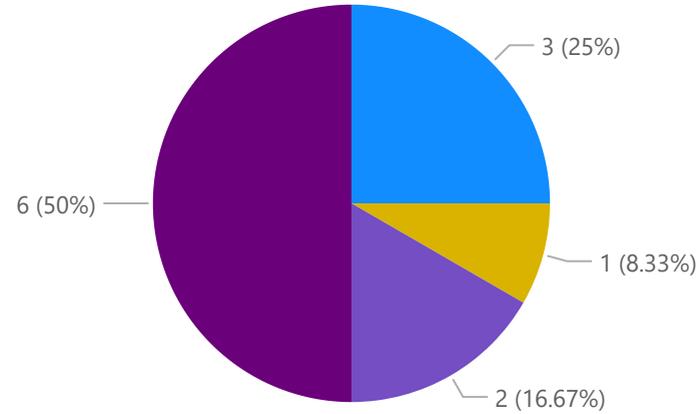
- I already have EV chargers at my business.
- I plan to install EV chargers this year.
- I plan to install EV chargers within the next 5 years.
- I plan to install EV chargers, but probably not for at least 5 ...
- None of the above / Not applicable, I do not plan to install ...
- Other (please specify)

Do you plan to install EV chargers at your business, or encourage the property owner Other (please specify)

City Fees and Cost of installation currently prohibit installation of EV Charger

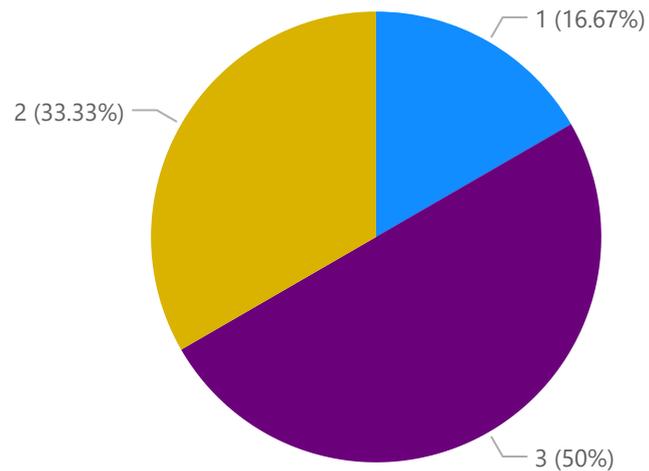
Commercial Solar

Do you plan to install solar at your business, or encourage your landlord/property manager?



- I already have solar installed at my business.
- I plan to install solar this year.
- I plan to install solar within the next 5 years.
- I plan to install solar, but probably not for at least 5 years.
- I am not sure/undecided.
- I do not plan to install solar at my business in the future.

If you already have or plan to have solar, will you include battery storage?



- Yes, with battery mainly for back up
- Yes, with battery mainly to avoid peak/demand pricing
- Not sure/undecided
- No
- Other (please specify)
- None of the above / Not applicable, I do not plan to...

If you already have or plan to have solar, will you include battery storage
Other (please specify)

My system feeds back into the City grid. I get credit for excess energy generated.

City Fees and Cost of installation currently prohibit installation of Battery Storage

*NA responses filtered out. (Total of 4 respondents selected NA.)



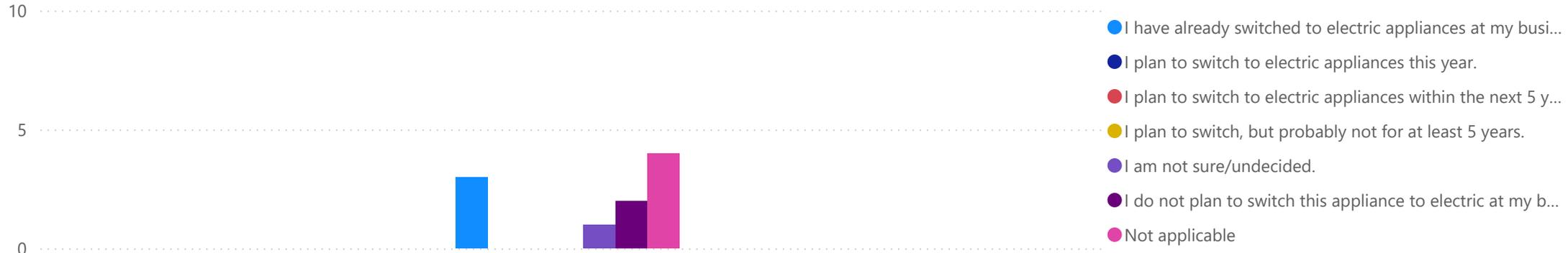
Commercial Appliances

Commercial Responses

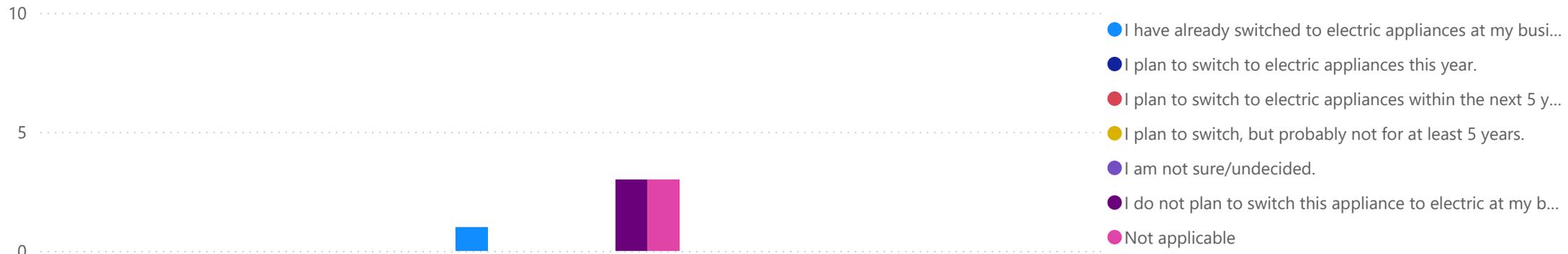
Do you plan to install efficient electric appliances at your business, or encourage the property owner
Other (please specify)

am not hgappy with the switch to heat pump

Do you plan to install efficient electric appliances at your business, or encourage the property owner? Heating/Cooling (heat pump)



Do you plan to install efficient electric appliances at your business or encourage the property owner? Water Heating (heat pump)

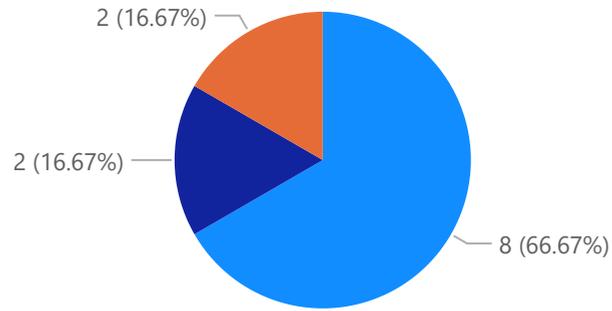


Do you plan to install efficient electric appliances at your business, or encourage the property owner? Cooking (stove/range)



Commercial General, Main Factors & Comments

Which of the following applies to you?



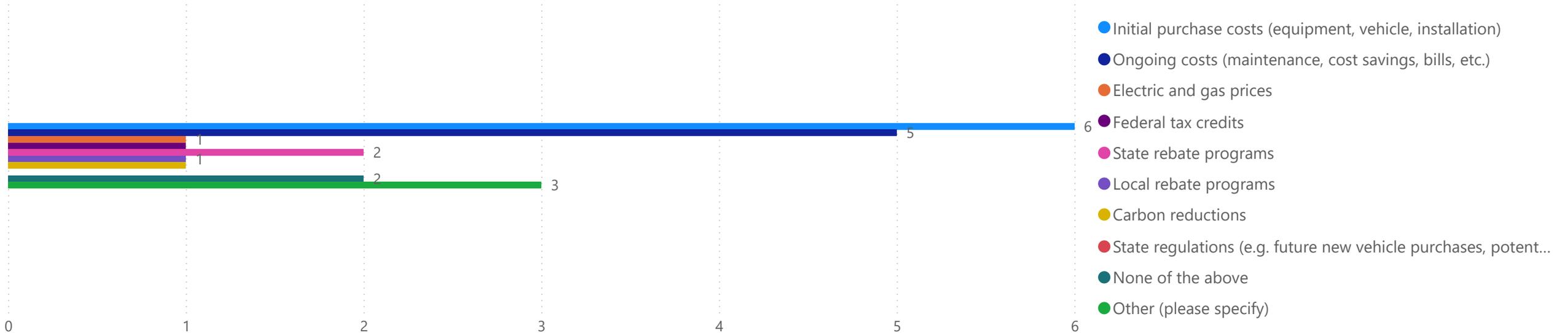
- I own a commercial building in Healdsburg
- I own multiple commercial buildings in Healdsburg
- I rent a commercial building in Healdsburg
- Other

Please provide any additional comments that will help Healdsburg Electric Department to forecast future electricity use and demands. (Optional) Open-Ended Response

Equipment, Contractor Costs, City Regulations/Fees are making it infeasible for improvements to be undertaken.

I have a personal EV that I charge at my warehouse. I use a 50a circuit that was installed for. A welder.

What are the main factors for your energy project decisions?



What are the main factors for your energy project decisions Other (please specify)

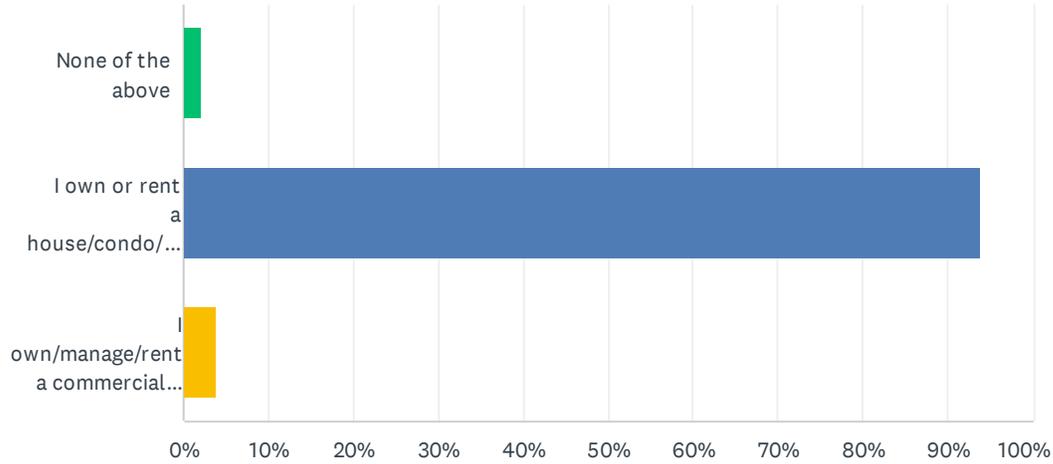
I don't own the building

City Fees and cost of equipment/installation

all rebates offered

Q1 Which of the following best describes you? (If both apply to you, please complete the survey twice, e.g. once for each option.)

Answered: 358 Skipped: 0

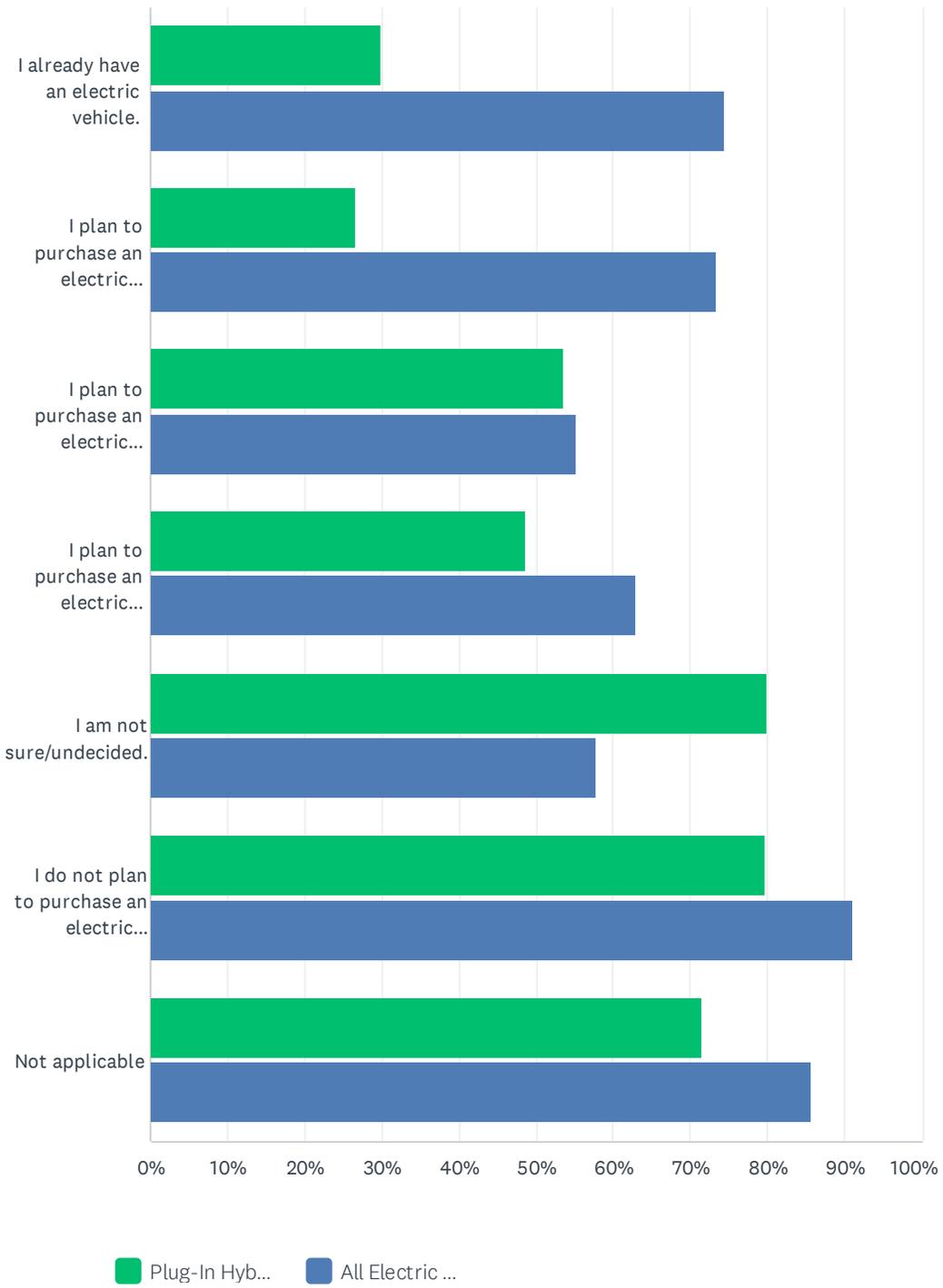


ANSWER CHOICES	RESPONSES	
None of the above	2.23%	8
I own or rent a house/condo/apartment in Healdsburg.	93.85%	336
I own/manage/rent a commercial building in Healdsburg.	3.91%	14
TOTAL		358

Q2 Do you plan to purchase an electric vehicle in the future? If so, when? (Select all options that are applicable. For example, if you already have an EV and plan to replace another gas vehicle in the future, or if you plan to replace more than 1 vehicle with an EV in the future. Please do not count replacing a current EV with a new EV. For any rows that do not apply, you can leave blank.)

Answered: 281 Skipped: 77

Community Electrification Survey

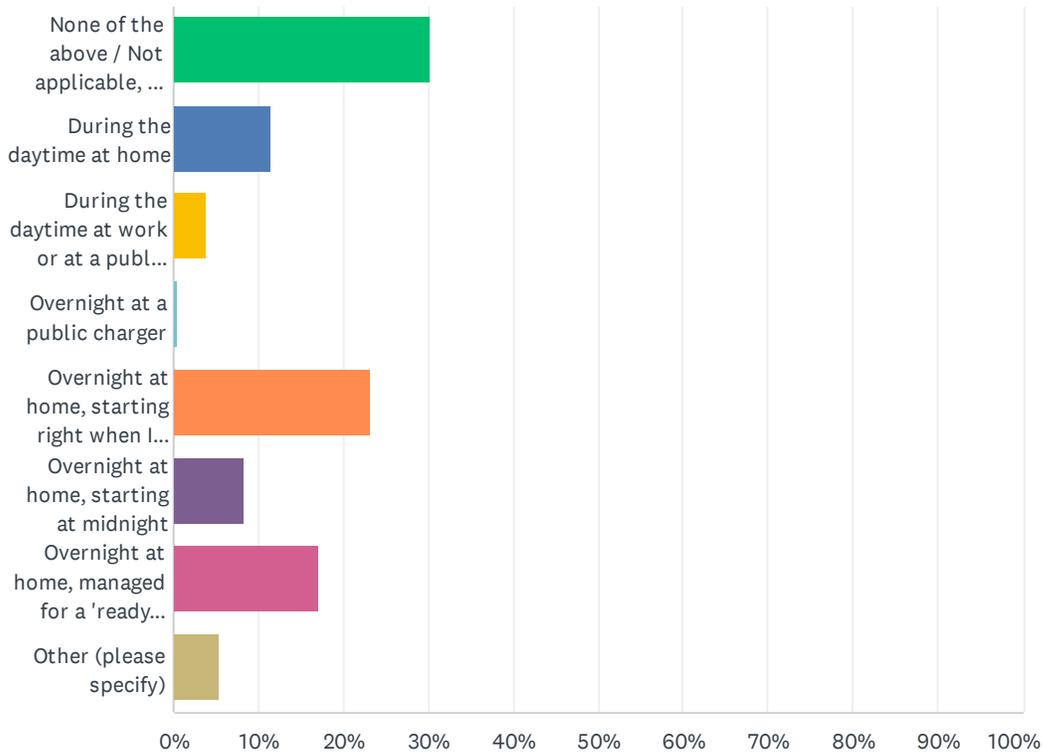


Community Electrification Survey

	PLUG-IN HYBRID EV	ALL ELECTRIC EV	TOTAL RESPONDENTS
I already have an electric vehicle.	29.79% 28	74.47% 70	94
I plan to purchase an electric vehicle this year.	26.67% 4	73.33% 11	15
I plan to purchase an electric vehicle within the next 5 years.	53.45% 31	55.17% 32	58
I plan to purchase an electric vehicle, but probably not for at least 5 years.	48.57% 17	62.86% 22	35
I am not sure/undecided.	80.00% 36	57.78% 26	45
I do not plan to purchase an electric vehicle in the future.	79.75% 63	91.14% 72	79
Not applicable	71.43% 5	85.71% 6	7

Q3 If you already have or plan to have an EV, when will you charge your electric vehicle most often?

Answered: 241 Skipped: 117



ANSWER CHOICES	RESPONSES	
None of the above / Not applicable, I do not plan to purchase an EV	30.29%	73
During the daytime at home	11.62%	28
During the daytime at work or at a public charger	3.73%	9
Overnight at a public charger	0.41%	1
Overnight at home, starting right when I get home in the evening	23.24%	56
Overnight at home, starting at midnight	8.30%	20
Overnight at home, managed for a 'ready by' time in the morning	17.01%	41
Other (please specify)	5.39%	13
TOTAL		241

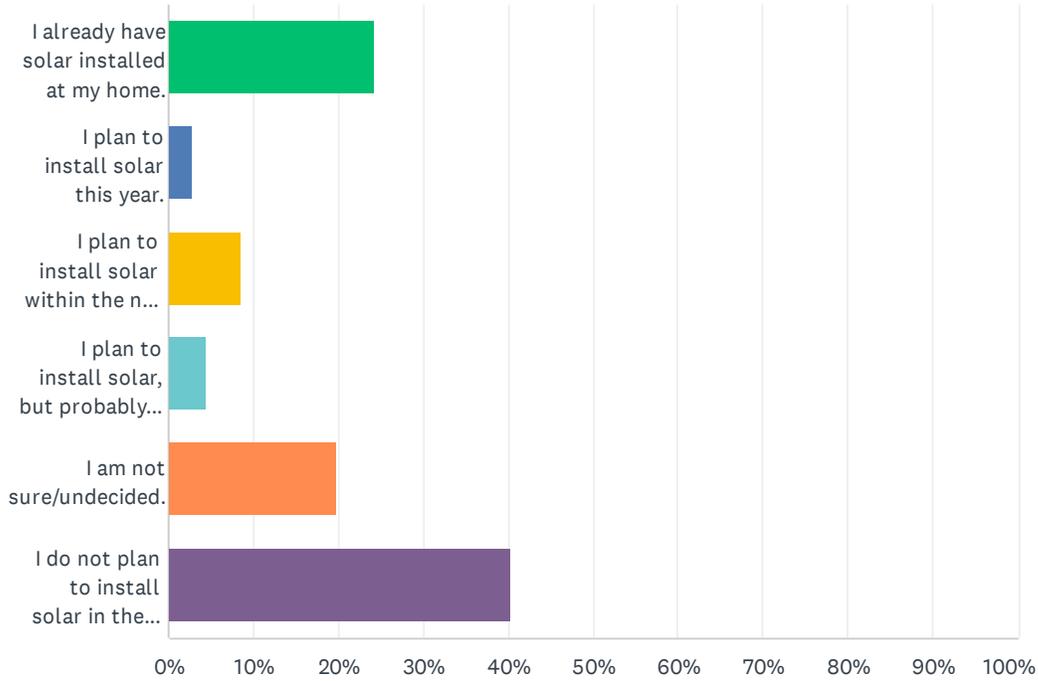
#	OTHER (PLEASE SPECIFY)	DATE
1	whenever it gets down to 20% battery	3/30/2025 1:42 PM
2	Overnight after 9PM	3/27/2025 4:23 PM
3	Whenever I get home	3/17/2025 4:19 AM

Community Electrification Survey

4	Overnight at home, starting at 9 pm	3/12/2025 7:46 AM
5	undecided	3/11/2025 6:44 PM
6	Uncertain	3/11/2025 5:37 PM
7	At Tesla superchargers	3/11/2025 5:00 PM
8	I charge prior to when I know I will need the car to have a full battery	3/11/2025 2:18 PM
9	use the chargers at the city hall I also have charger at home	3/11/2025 1:29 PM
10	Overnight, after prime time	3/11/2025 1:02 PM
11	Haven't put much thought in that yet.	3/11/2025 12:27 PM
12	Overnight at home starting around 7pm.	3/11/2025 12:18 PM
13	Have no idea.	3/11/2025 11:33 AM

Q4 Do you plan to install solar at your home, or encourage your landlord/property manager?

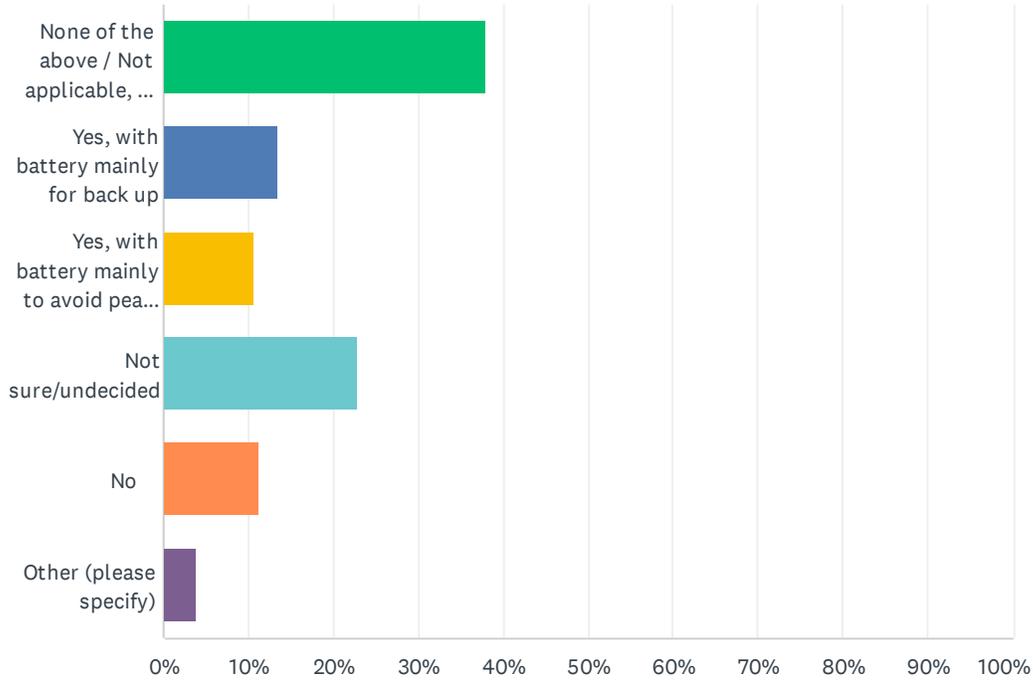
Answered: 293 Skipped: 65



ANSWER CHOICES	RESPONSES	
I already have solar installed at my home.	24.23%	71
I plan to install solar this year.	2.73%	8
I plan to install solar within the next 5 years.	8.53%	25
I plan to install solar, but probably not for at least 5 years.	4.44%	13
I am not sure/undecided.	19.80%	58
I do not plan to install solar in the future.	40.27%	118
TOTAL		293

Q5 If you already have or plan to have solar, will you include battery storage?

Answered: 255 Skipped: 103



ANSWER CHOICES	RESPONSES	
None of the above / Not applicable, I do not plan to install solar	38.04%	97
Yes, with battery mainly for back up	13.33%	34
Yes, with battery mainly to avoid peak pricing and excess generation	10.59%	27
Not sure/undecided	22.75%	58
No	11.37%	29
Other (please specify)	3.92%	10
TOTAL		255

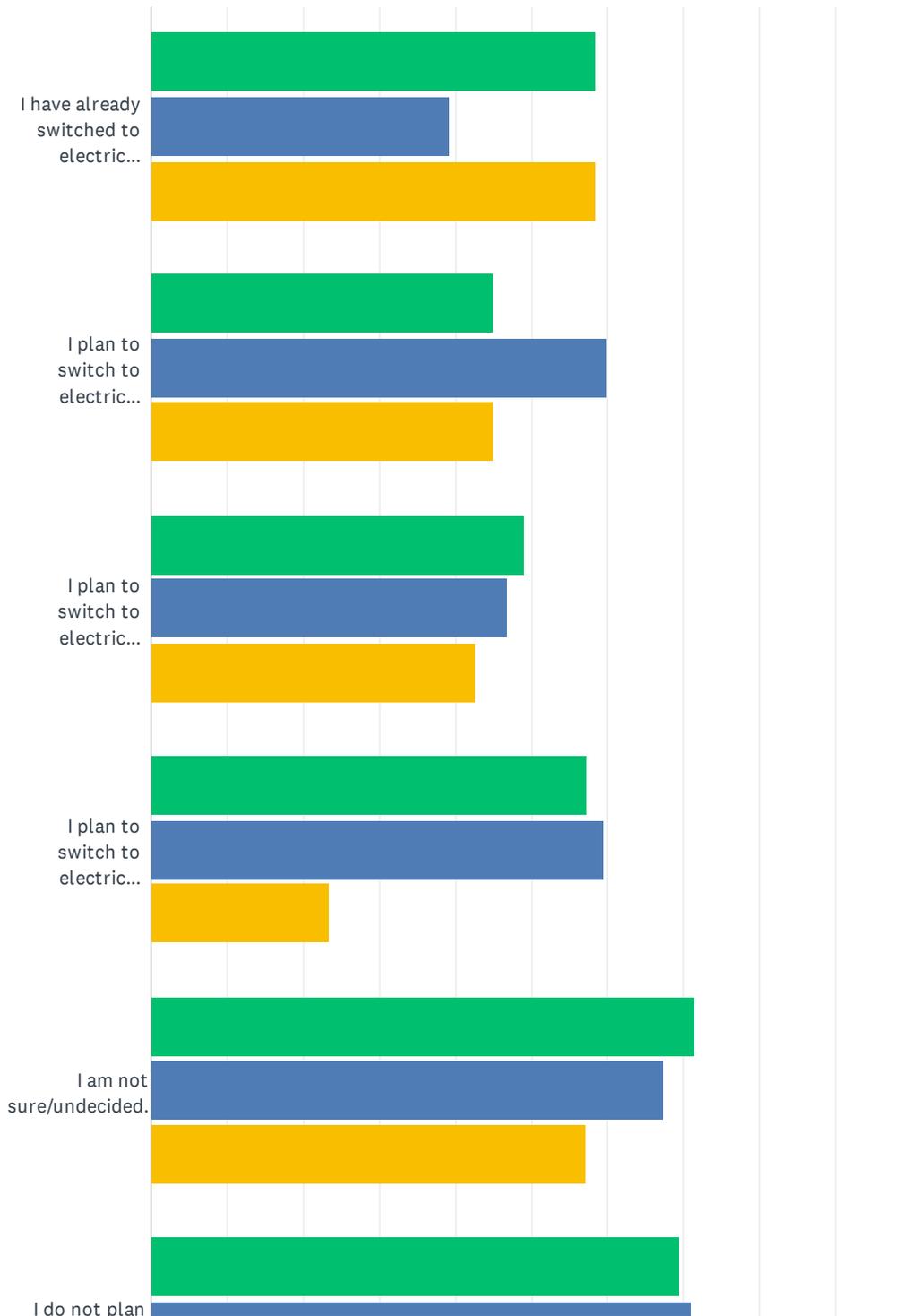
#	OTHER (PLEASE SPECIFY)	DATE
1	We would like to add batteries but they are very expensive. It would have doubled the cost of our installation	3/16/2025 3:07 PM
2	for both	3/16/2025 9:14 AM
3	Already have battery	3/11/2025 9:49 PM
4	We have solar and have battery storage	3/11/2025 2:18 PM
5	I'm sure the installer will tell me how it works.	3/11/2025 2:01 PM
6	We would love to have a battery but have discovered that since our vendor went out of	3/11/2025 1:51 PM

Community Electrification Survey

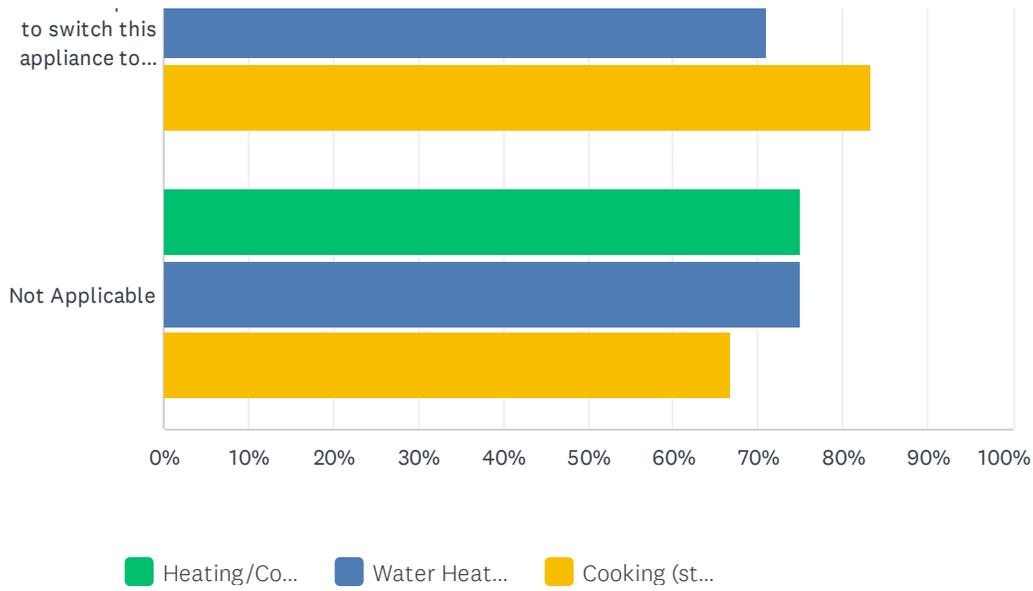
	business, other vendors will not attach a battery to our existing system.	
7	if i can afford it	3/11/2025 1:51 PM
8	Generator is installed	3/11/2025 1:02 PM
9	Depends on City Fees/Requirements, Battery/Equipment installation costs, Rebates from Local & State. Not looking like any Federal rebates in the next 4 years!	3/11/2025 12:40 PM
10	Will get battery when pricing is better	3/11/2025 12:38 PM

Q6 Do you plan to install efficient electric appliances at your home, or encourage your landlord/property manager?(Select all options that are applicable. For example, if you plan to replace appliances on different schedules. Please do not count replacing a current electric appliance with a new one. For any rows that do not apply, you can leave blank.)

Answered: 282 Skipped: 76



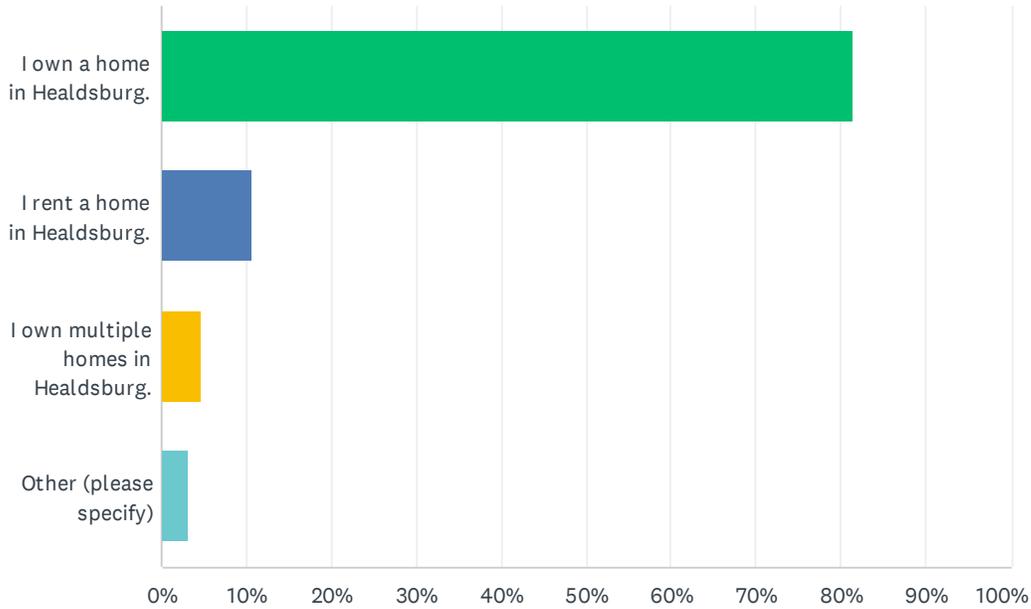
Community Electrification Survey



	HEATING/COOLING (HEAT PUMP)	WATER HEATING (HEAT PUMP)	COOKING (STOVE/RANGE)	TOTAL RESPONDENTS
I have already switched to electric appliances at my home.	58.33% 70	39.17% 47	58.33% 70	120
I plan to switch to electric appliances this year.	45.00% 9	60.00% 12	45.00% 9	20
I plan to switch to electric appliances within the next 5 years.	48.94% 23	46.81% 22	42.55% 20	47
I plan to switch to electric appliances, but probably not for at least 5 years.	57.45% 27	59.57% 28	23.40% 11	47
I am not sure/undecided.	71.43% 35	67.35% 33	57.14% 28	49
I do not plan to switch this appliance to electric in the future.	69.57% 96	71.01% 98	83.33% 115	138
Not Applicable	75.00% 9	75.00% 9	66.67% 8	12

Q7 Which of the following applies to you?

Answered: 279 Skipped: 79



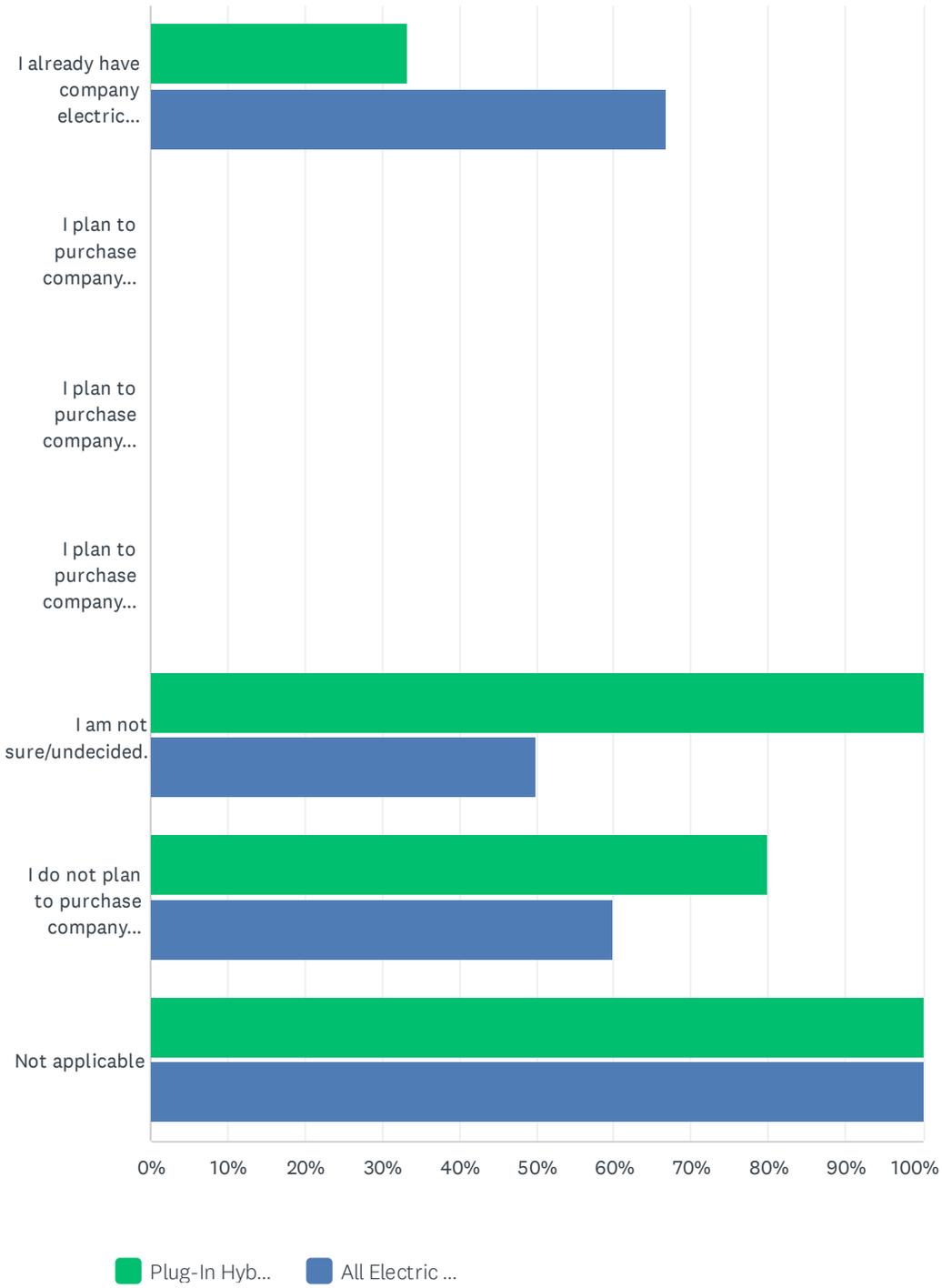
ANSWER CHOICES	RESPONSES
I own a home in Healdsburg.	81.36% 227
I rent a home in Healdsburg.	10.75% 30
I own multiple homes in Healdsburg.	4.66% 13
Other (please specify)	3.23% 9
TOTAL	279

#	OTHER (PLEASE SPECIFY)	DATE
1	airbnb	3/16/2025 9:14 AM
2	Retirement community	3/11/2025 11:36 PM
3	I rent an apartment	3/11/2025 10:15 PM
4	Own 4-plex	3/11/2025 4:22 PM
5	Why not ask what the service is at your home and how you plan to charge a car, run an A/c an electric stove, electric dry	3/11/2025 4:08 PM
6	Rent apartment at Oak Grove Apartments	3/11/2025 12:27 PM
7	My partner owns the home, but I live with him and share all expenses.	3/11/2025 11:46 AM
8	Unincorporated Kinley Drive	3/11/2025 11:42 AM
9	I am a resident of Enso Village	3/11/2025 11:41 AM

Q8 Do you plan to purchase company electric vehicles in the future? If so, when?(Select all options that are applicable. For example, if you already have an EV and plan to replace another gas vehicle in the future, or if you plan to replace more than 1 vehicle with an EV in the future. Please do not count replacing a current EV with a new EV. For any rows that do not apply, you can leave blank.)

Answered: 12 Skipped: 346

Community Electrification Survey

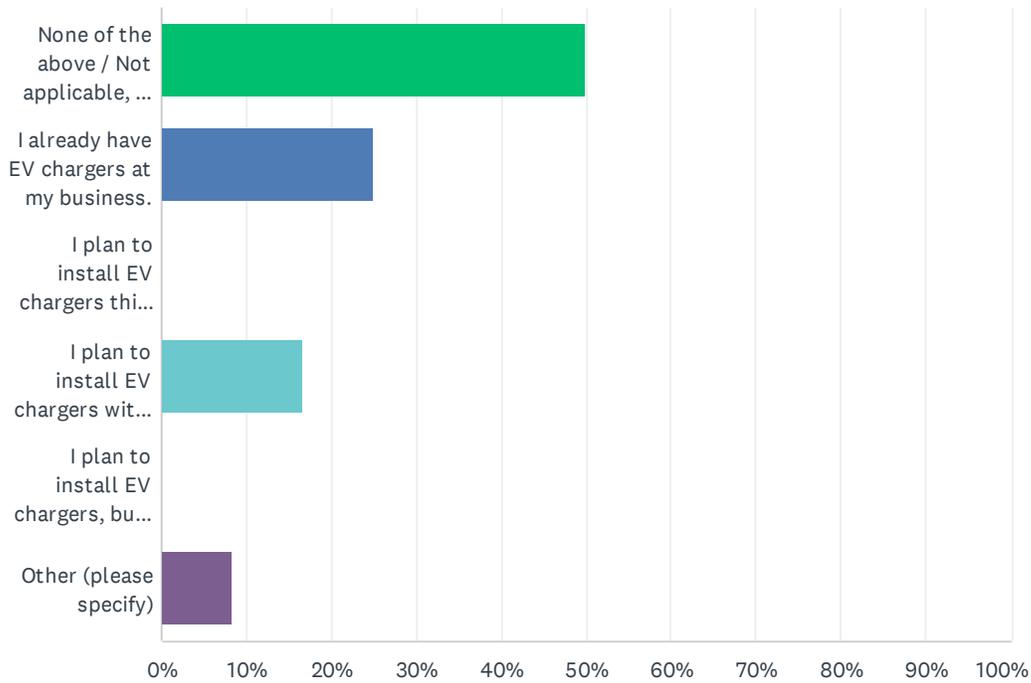


Community Electrification Survey

	PLUG-IN HYBRID EV	ALL ELECTRIC EV	TOTAL RESPONDENTS
I already have company electric vehicles.	33.33% 1	66.67% 2	3
I plan to purchase company electric vehicles this year.	0.00% 0	0.00% 0	0
I plan to purchase company electric vehicles within the next 5 years.	0.00% 0	0.00% 0	0
I plan to purchase company electric vehicles, but probably not for at least 5 years.	0.00% 0	0.00% 0	0
I am not sure/undecided.	100.00% 2	50.00% 1	2
I do not plan to purchase company electric vehicles.	80.00% 4	60.00% 3	5
Not applicable	100.00% 3	100.00% 3	3

Q9 Do you plan to install EV chargers at your business, or encourage the property owner? If so, when?(Select all options that are applicable. For example, if you already have an EV charger and plan to install another in the future. Please do not count replacing a current charger with a new one.)

Answered: 12 Skipped: 346

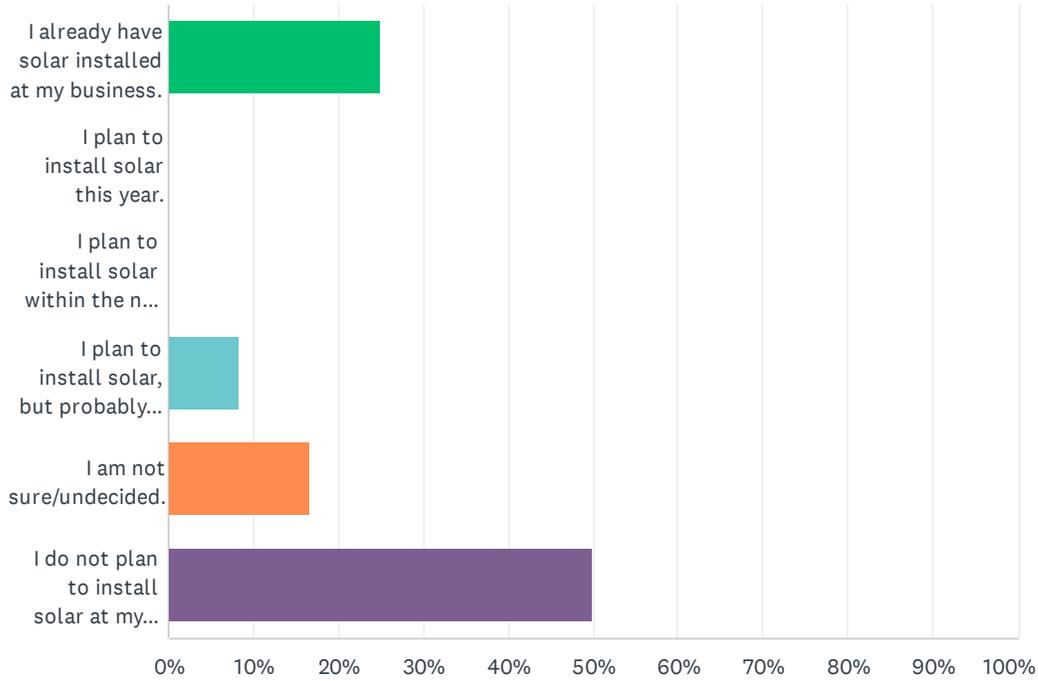


ANSWER CHOICES	RESPONSES
None of the above / Not applicable, I do not plan to install EV chargers	50.00% 6
I already have EV chargers at my business.	25.00% 3
I plan to install EV chargers this year.	0.00% 0
I plan to install EV chargers within the next 5 years.	16.67% 2
I plan to install EV chargers, but probably not for at least 5 years.	0.00% 0
Other (please specify)	8.33% 1
Total Respondents: 12	

#	OTHER (PLEASE SPECIFY)	DATE
1	City Fees and Cost of installation currently prohibit installation of EV Charger	3/11/2025 12:30 PM

Q10 Do you plan to install solar at your business, or encourage the property owner?

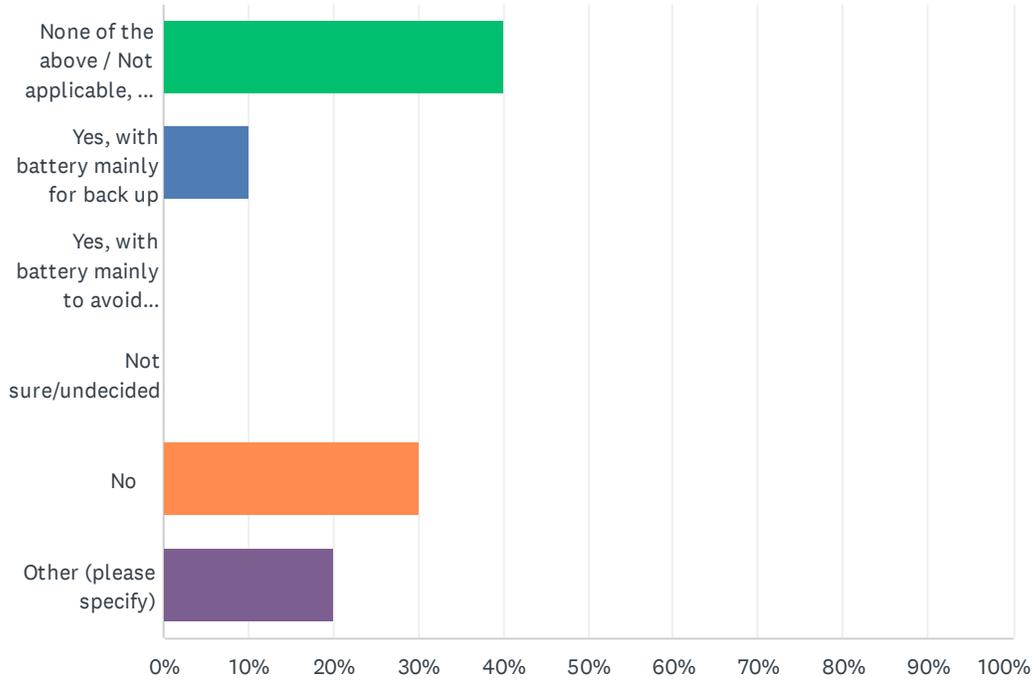
Answered: 12 Skipped: 346



ANSWER CHOICES	RESPONSES	
I already have solar installed at my business.	25.00%	3
I plan to install solar this year.	0.00%	0
I plan to install solar within the next 5 years.	0.00%	0
I plan to install solar, but probably not for at least 5 years.	8.33%	1
I am not sure/undecided.	16.67%	2
I do not plan to install solar at my business in the future.	50.00%	6
TOTAL		12

Q11 If you already have or plan to have solar, will you include battery storage?

Answered: 10 Skipped: 348

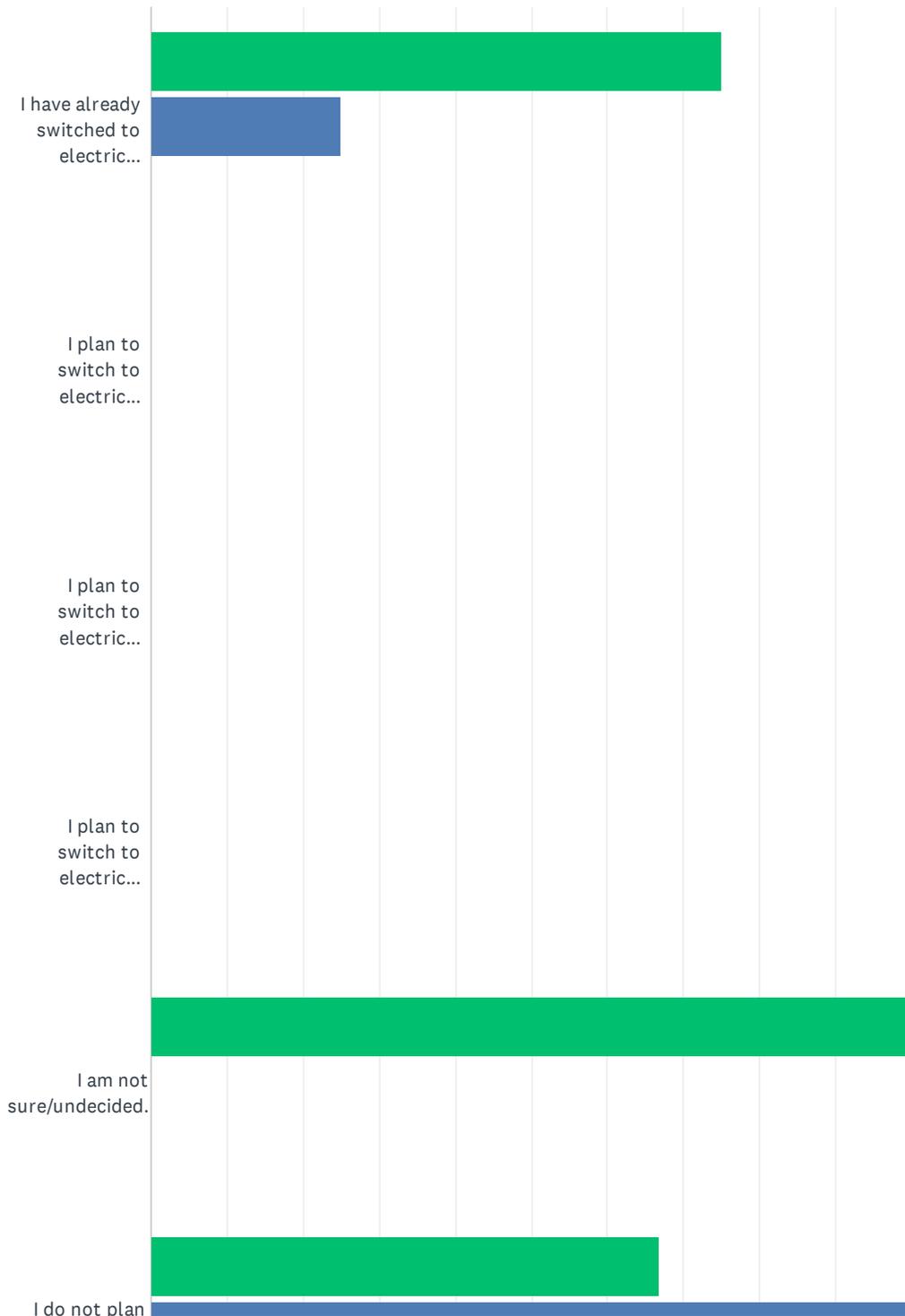


ANSWER CHOICES	RESPONSES	
None of the above / Not applicable, I do not plan to install solar	40.00%	4
Yes, with battery mainly for back up	10.00%	1
Yes, with battery mainly to avoid peak/demand pricing and excess generation	0.00%	0
Not sure/undecided	0.00%	0
No	30.00%	3
Other (please specify)	20.00%	2
TOTAL		10

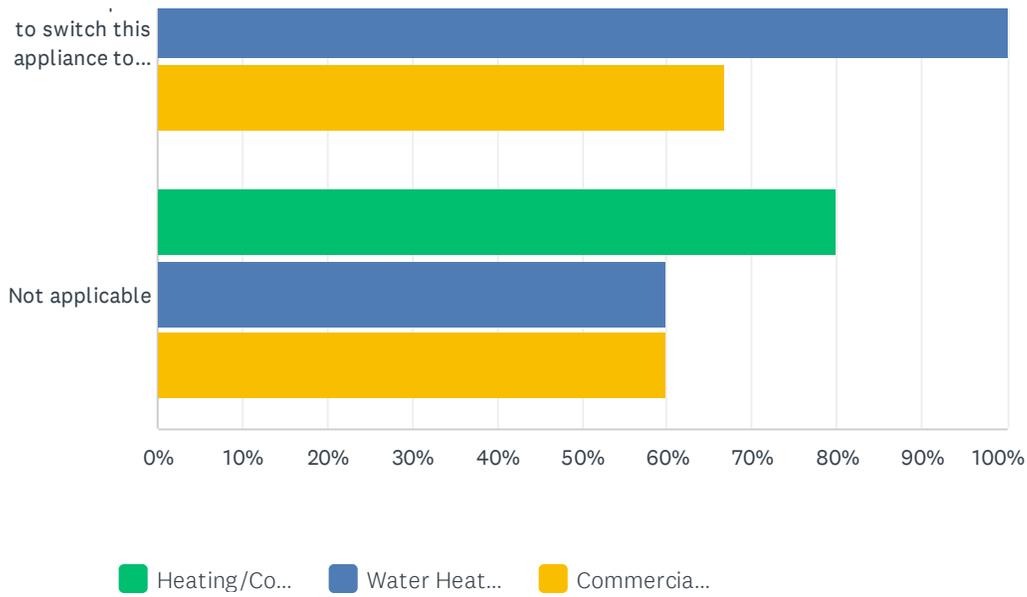
#	OTHER (PLEASE SPECIFY)	DATE
1	City Fees and Cost of installation currently prohibit installation of Battery Storage	3/11/2025 12:30 PM
2	My system feeds back into the City grid. I get credit for excess energy generated.	3/11/2025 12:09 PM

Q12 Do you plan to install efficient electric appliances at your business, or encourage the property owner?(Select all options that are applicable. For example, if you plan to replace appliances on different schedules. Please do not count replacing a current electric appliance with a new one. For any rows that do not apply, you can leave blank.)

Answered: 10 Skipped: 348



Community Electrification Survey

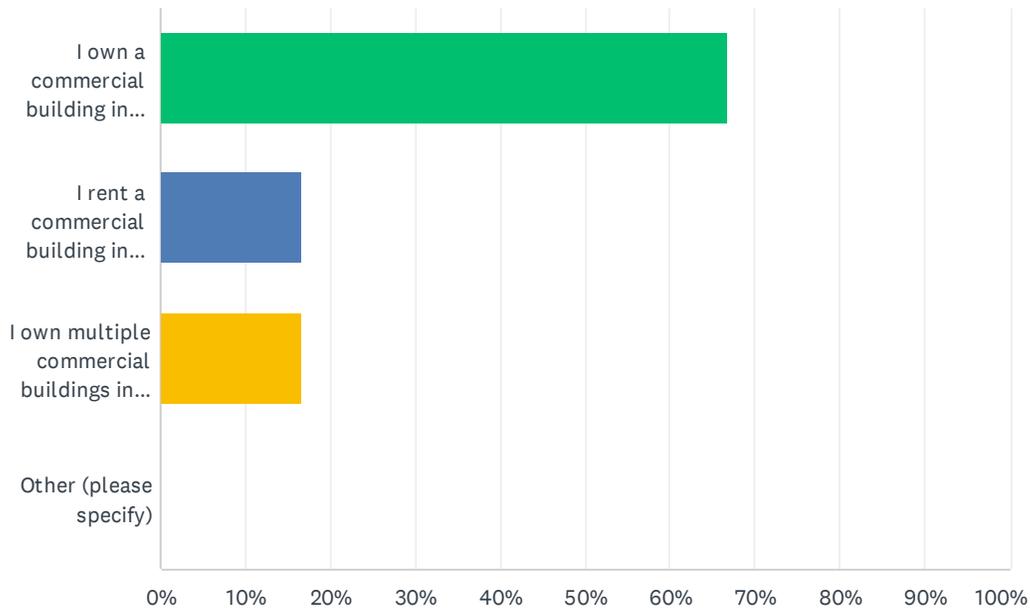


	HEATING/COOLING (HEAT PUMP/RTU)	WATER HEATING (HEAT PUMP/BOILER)	COMMERCIAL KITCHEN (STOVE/OVEN)	TOTAL RESPONDENTS
I have already switched to electric appliances at my business.	75.00% 3	25.00% 1	0.00% 0	4
I plan to switch to electric appliances this year.	0.00% 0	0.00% 0	0.00% 0	0
I plan to switch to electric appliances within the next 5 years.	0.00% 0	0.00% 0	0.00% 0	0
I plan to switch to electric appliances, but probably not for at least 5 years.	0.00% 0	0.00% 0	0.00% 0	0
I am not sure/undecided.	100.00% 1	0.00% 0	0.00% 0	1
I do not plan to switch this appliance to electric at my business in the future.	66.67% 2	100.00% 3	66.67% 2	3
Not applicable	80.00% 4	60.00% 3	60.00% 3	5

#	OTHER (PLEASE SPECIFY)	DATE
1	am not hgappy with the switch to heat pump	3/11/2025 12:38 PM

Q13 Which of the following applies to you?

Answered: 12 Skipped: 346

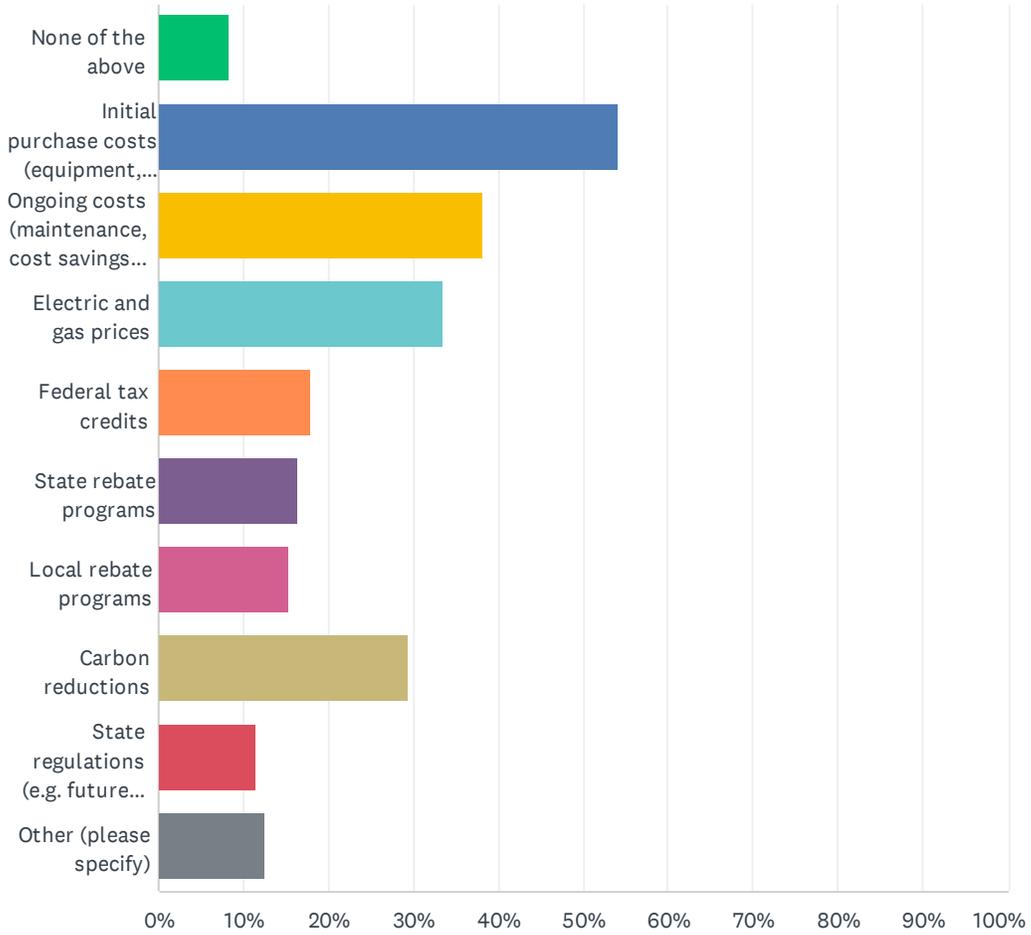


ANSWER CHOICES	RESPONSES	
I own a commercial building in Healdsburg.	66.67%	8
I rent a commercial building in Healdsburg.	16.67%	2
I own multiple commercial buildings in Healdsburg.	16.67%	2
Other (please specify)	0.00%	0
TOTAL		12

#	OTHER (PLEASE SPECIFY)	DATE
	There are no responses.	

Q14 What are the main factors for your energy project decisions? (Select up to 3.)

Answered: 286 Skipped: 72



Community Electrification Survey

ANSWER CHOICES	RESPONSES
None of the above	8.39% 24
Initial purchase costs (equipment, vehicle, installation)	54.20% 155
Ongoing costs (maintenance, cost savings, bills, etc.)	38.11% 109
Electric and gas prices	33.57% 96
Federal tax credits	17.83% 51
State rebate programs	16.43% 47
Local rebate programs	15.38% 44
Carbon reductions	29.37% 84
State regulations (e.g. future new vehicle purchases, potential future appliance replacement requirements)	11.54% 33
Other (please specify)	12.59% 36
Total Respondents: 286	

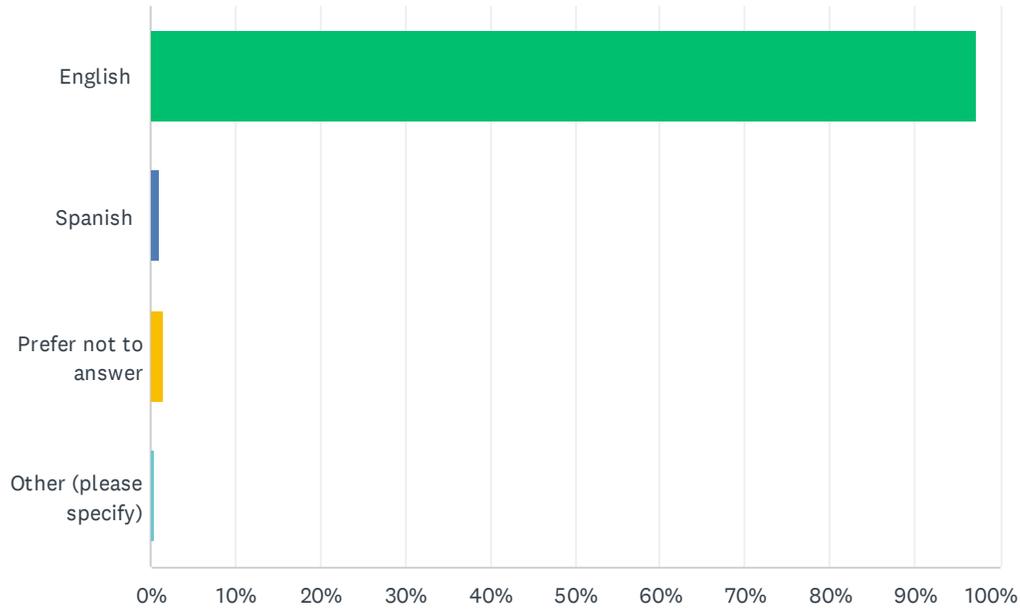
#	OTHER (PLEASE SPECIFY)	DATE
1	I rent and don't own my residence.	3/17/2025 6:35 PM
2	Power outages incline me to not change our stove. If the power goes out we can still boil water with a gas stove.	3/16/2025 3:09 PM
3	energy independence and changing the electric utility system	3/16/2025 9:43 AM
4	Since I am a renter, my landlord makes the decisions about upgrading or changing systems. If I could, I'd install solar panels.	3/15/2025 6:56 PM
5	electric generation is inadequate in this area and that is the State's fault	3/13/2025 9:15 AM
6	Satisfied with current choices	3/13/2025 9:03 AM
7	elec grid needs upgrades and new generation	3/12/2025 4:15 PM
8	all electric is not a sustainable future and its going to be more costly than gas	3/12/2025 2:54 PM
9	Community decision- cost	3/11/2025 11:37 PM
10	The current price of electricity in Healdsburg	3/11/2025 7:06 PM
11	Concern about the reliability of the electric grid.	3/11/2025 5:35 PM
12	Already have things set	3/11/2025 5:00 PM
13	Regular electrical outages and lack of sufficient electricity supply for all electric vehicles and appliances	3/11/2025 4:53 PM
14	Service amperage and carrying capacity	3/11/2025 4:11 PM
15	We rent a home and don't want to invest in someone else's home	3/11/2025 3:06 PM
16	To retain competitive energy options. Not smart to put all your eggs in the electric basket.	3/11/2025 2:40 PM
17	a gas stove top will always be in my kitchen	3/11/2025 2:04 PM
18	the long term payback exceeds equipment life	3/11/2025 1:53 PM
19	Quality and diversity of source for heat, cooking	3/11/2025 1:41 PM
20	As renters we have no control over the decision. What would incentivize the owners?	3/11/2025 1:23 PM
21	Renter and do not get to make these decisions	3/11/2025 12:52 PM

Community Electrification Survey

22	City/State/Federal rebates to offset Expens\$e of installation and ROI	3/11/2025 12:47 PM
23	Rebates , tax credits...	3/11/2025 12:41 PM
24	Natural gas is more efficient and more reliable. Our power grid is less reliable and gets shut off occasionally.	3/11/2025 12:39 PM
25	Climatecontrol	3/11/2025 12:35 PM
26	City Fees and cost of equipment/installation	3/11/2025 12:34 PM
27	all rebates offered	3/11/2025 12:10 PM
28	I prefer gas	3/11/2025 12:01 PM
29	Old heating system died in Sept 2024- installed new Heat pump /air	3/11/2025 12:01 PM
30	If/when I have the ability to remodel I might consider some of these factors.	3/11/2025 11:55 AM
31	Too much draw in current power grid	3/11/2025 11:55 AM
32	Bought a home that is all electric	3/11/2025 11:53 AM
33	See number 7. I no longer drive & sold my hybrid.	3/11/2025 11:47 AM
34	I no longer drive. I have relatively new appliances.	3/11/2025 11:45 AM
35	Prefer to cook with gas	3/11/2025 11:37 AM
36	I don't own the building	3/11/2025 11:36 AM

Q15 Which language is predominantly spoken at your home?

Answered: 285 Skipped: 73

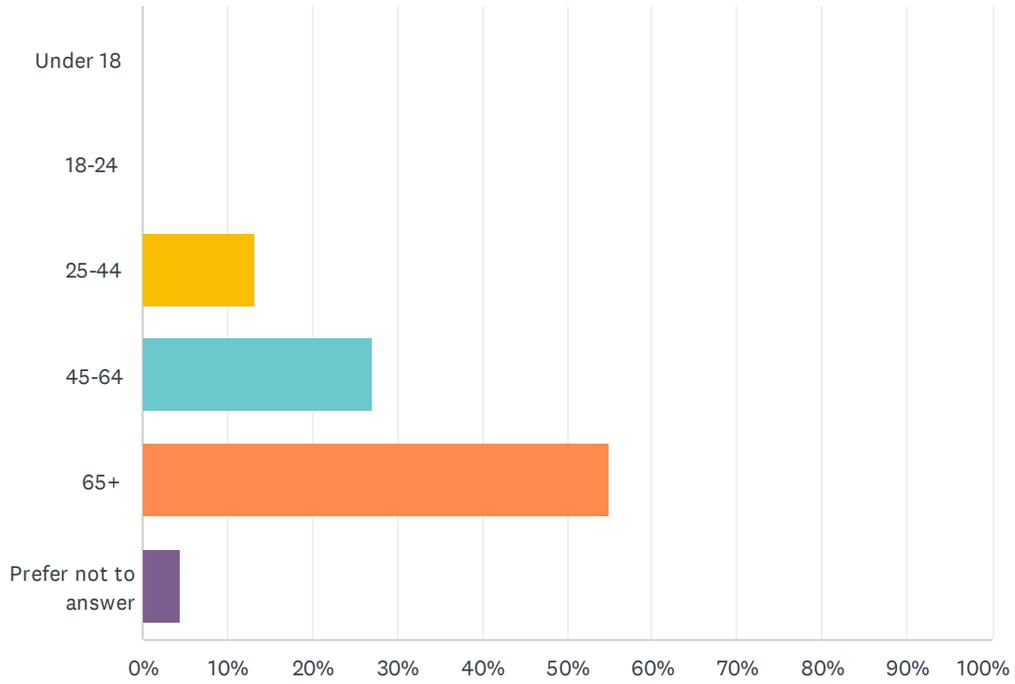


ANSWER CHOICES	RESPONSES
English	97.19% 277
Spanish	1.05% 3
Prefer not to answer	1.40% 4
Other (please specify)	0.35% 1
TOTAL	285

#	OTHER (PLEASE SPECIFY)	DATE
1	U	3/11/2025 12:35 PM

Q16 What is your age group?

Answered: 287 Skipped: 71



ANSWER CHOICES	RESPONSES	
Under 18	0.00%	0
18-24	0.00%	0
25-44	13.24%	38
45-64	27.18%	78
65+	55.05%	158
Prefer not to answer	4.53%	13
TOTAL		287

**Q17 Please provide any additional comments that will help Healdsburg Electric Department to forecast future electricity use and demands.
(Optional)**

Answered: 75 Skipped: 283

#	RESPONSES	DATE
1	Workshop activity response	4/2/2025 9:11 AM
2	Workshop activity response	4/2/2025 9:10 AM
3	Workshop activity response	4/2/2025 9:09 AM
4	Workshop activity response	4/2/2025 9:09 AM
5	Workshop activity response	4/2/2025 9:08 AM
6	Workshop activity response	4/2/2025 9:07 AM
7	Workshop activity response	4/2/2025 9:07 AM
8	Workshop activity response	4/2/2025 9:06 AM
9	Workshop activity response	4/2/2025 9:05 AM
10	Workshop activity response	4/2/2025 9:04 AM
11	Workshop activity response	4/2/2025 9:02 AM
12	Workshop activity response	4/2/2025 9:00 AM
13	Workshop activity response	4/2/2025 8:57 AM
14	Workshop activity response	4/2/2025 8:55 AM
15	Workshop activity response	4/2/2025 8:52 AM
16	Workshop activity response	4/2/2025 8:49 AM
17	Workshop activity response	4/2/2025 8:46 AM
18	I wouldn't make any changes that required upsizing our 200a panel or the supply wiring from COH	3/31/2025 10:17 AM
19	We had new appliances installed in 2014. The cost to replace them with electric ones when they have not worn out is prohibitive	3/30/2025 1:45 PM
20	Appreciate this effort!	3/25/2025 4:15 PM
21	City of Healdsburg utility costs are absurdly high!!! We are very careful in our usage and hours of use but as one person living in home it's almost unaffordable.	3/17/2025 10:46 AM
22	If battery storage became cheaper we would consider adding batteries to our solar system to stretch that power beyond the daylight hours.	3/16/2025 3:09 PM
23	1. You already know how many solar customers you have and should also know how many customers have EVs and the number of EVs that they have (we have 2 for example). You should also be aware of how much energy storage is on your system right? When you forecast future electricity use and demand, the forecast should be based on your PLAN for the future. What is your plan for the future? How seriously are you considering V2G? When does V2G come into play? How will you "tailor" V2G customer usage? What will be your strategy for monetizing and incentivizing V2G usage to result in the most robust affordable electricity service? Imagine the future that is coming fast. EVs capable of inductive charging and with full FSD like the Tesla Robotaxi. No charge ports necessary because you have a plan for having inductive charging embedded in your parking spots just on the outskirts of town that will allow	3/16/2025 9:43 AM

Community Electrification Survey

Healdsburg to close parts of the center of town to through traffic. Solar is becoming more and more affordable, my 400Watt modules cost less than the Enphase microinverters. Have a plan in place where all homeowners can have upgraded electrical, solar, storage and EV charging capacity (unless it is truly impractical or too expensive - this will likely be very few customers). The utility should subsidize this in lieu of new generation or to get off of geothermal in the geysers. But the customers should own the system, not the utility (that doesn't work, refer to Arizona and SMUD). IOUs and munis need to re-think what they do and who they serve. You need to SERVE...I did, its better when you actual serve someone. That is why they called it Civil Service. Power to the People knuckleheads.

24	Again, I don't get to make decisions about the systems in the house I rent. I'd be open to making changes but not my choice to make.	3/15/2025 6:56 PM
25	Don't cram your agenda down the throats of the citizens. Everyone gets to choose their own adventure.	3/15/2025 6:07 PM
26	City electric price tiers thoroughly discourage me from adding induction cooking. Installing a heat pump to replace gas wall heaters stopped my electric conversion. Electric demand water heaters are decidedly inferior to my gas demand heaters, so I'll wait.	3/14/2025 8:45 PM
27	We used to have a hybrid/Electric vehicle, but sold it in 2020.	3/14/2025 3:34 PM
28	There is little or no effort in the rest of the USA to make our sacrifice meaningful. Finally, the cost per citizen is what is making this State unaffordable and is contributing to the homeless crises.	3/13/2025 9:15 AM
29	We save water during a crisis and you raise our rates. Once it's all electric, you will just raise the rates even more. Stop greenwashing us about all electric.	3/12/2025 2:54 PM
30	Please consider a electricity buy back incentive	3/12/2025 11:54 AM
31	I find my heating bill is much higher with electric and less efficient therefore I will not be switching to electric on any other appliances.	3/12/2025 11:06 AM
32	Power shut offs during high fire watch season will deter me from going electric	3/12/2025 10:35 AM
33	Even though I would like my landlord to install solar or change heating to electric, I will never be able to convince the bastard.	3/11/2025 10:17 PM
34	I am very frustrated with the city's current rate hike. There are two people in my duplex rental home and our Healdsburg utility bill is \$300. It's unsustainable.	3/11/2025 9:26 PM
35	The state does not have the infrastructure to go all electric. We are a free state and we should have all options for energy. Electric batteries cause more harm on the environment than fossil fuels. Your woke plans are too costly. We are being over charged. The city should not tell us how to live our lives. They should focus on providing utilities at an affordable price	3/11/2025 7:42 PM
36	Consider under grounding areas close to wild lands (wui). This will greatly reduce fire hazards	3/11/2025 5:52 PM
37	Thanks for doing this. Also would like to look at options for moving away from the City grid in the future.	3/11/2025 5:39 PM
38	I have have had a pv system for the past 10 years but have recently added purchased an EV vehicle and am considering expanding my pv system to account for the additional need.	3/11/2025 5:10 PM
39	Please lower the cost of electric, water and sewage	3/11/2025 4:54 PM
40	Don't get rid of the diesel backup generators	3/11/2025 4:21 PM
41	You need to be upfront with consumers about the 100 or even 200 amp service that they have not being able to sustain all electric appliances and call three to five local electrical contractors to get real world pricing unlike the information that has been previously disseminated on this topic.	3/11/2025 4:11 PM
42	I'm not switching anything to electric. I already have an EV, that's all I need. Do not mess with natural gas...its NATURAL!	3/11/2025 4:09 PM
43	Electricity and Energy are egregiously priced in Healdsburg and our roads are terrible. Focus on this fixing this and less on items that don't favorably impact the majority of residents.	3/11/2025 2:51 PM
44	I would love to go solar, but don't use enough electricity to make it financially worthwhile	3/11/2025 2:26 PM

Community Electrification Survey

45	Healdsburg needs to stop penalizing year round citizens and stop increasing energy and water rates. Bloodsuckers!	3/11/2025 2:19 PM
46	City of HBG prices are outrageous.	3/11/2025 2:00 PM
47	as a senior household, the current increasing costs of utilities are troublesome. due to our fixed income it impacts the affordability of solar etc.	3/11/2025 1:53 PM
48	it is NOT affordable to have to convert gas stove and heater to electric - NOR do i want to be accountable to the electric grid, pge, increased electric costs, no access when power poles go down, lack of trust of pge etc	3/11/2025 1:53 PM
49	I choose to cook with gas. It is vastly better than electric stoves. It is none of the local government's business how I cook. I would never purchase a home that does not provide me the option of cooking with gas.	3/11/2025 1:36 PM
50	I have solar heat for pool and 2 EV autos	3/11/2025 1:31 PM
51	Range is upscale gas. Gas water heater is newer and tankless, at least. Two gas furnaces (upstairs and downstairs) are operating fine. Doubt owners will replace any of these appliances as long as this is a rental.	3/11/2025 1:23 PM
52	I am puzzled by the process I thought I signed up for to charge at optimum times from a cost standpoint	3/11/2025 1:03 PM
53	our energy use is low and HBG electric rates are low so we are not motivated to install solar or electrify	3/11/2025 12:57 PM
54	Stop raising prices it is becoming more and more difficult to live in Healdsburg.	3/11/2025 12:52 PM
55	Current estimate is \$50,000-\$65,000 for Heat Pump HVAC and Solar PV for 1800 s.f. residence. That's a huge investment and a LONG timeline for payback. City only returns 50% on excess electricity generated into their grid for re-sale.	3/11/2025 12:47 PM
56	I have a personal EV that I charge at my warehouse. I use a 50a circuit that was installed for. A welder.	3/11/2025 12:42 PM
57	We don't plan on ever changing to Electric. Do not implement any mandates. The Climate mobilization strategy is virtue signaling and should have never been approved. The woke approach of Healdsburg is very unfortunate.	3/11/2025 12:42 PM
58	Getting rid of gas improves safety	3/11/2025 12:41 PM
59	Equipment, Contractor Costs, City Regulations/Fees are making it infeasible for improvements to be undertaken.	3/11/2025 12:34 PM
60	When my EV vehicle lease is up in January 2026, I may switch to EV/hybrid. Road trips take twice as long because of charging times and there is anxiety about finding a charger that works fast. City of Healdsburg appears to have stopped rebates for charging after 7:30 pm, too.	3/11/2025 12:32 PM
61	Increase energy production and storage to keep cost low.	3/11/2025 12:27 PM
62	Do you plan to add capacity?	3/11/2025 12:26 PM
63	Increasing electricity costs may make me more likely to charge at public chargers.	3/11/2025 12:23 PM
64	We are in our 80's. If we were younger we would most definitely upgrade our heat.Cooling to heat pump. Unfortunately, our current system is not very old but should it fail, we will definitely switch.	3/11/2025 12:21 PM
65	will move to HBG full-time in the next few years	3/11/2025 12:12 PM
66	My water bill is completely unaffordable. Please work on lowering water rates and scrapping the Green New Scam and other waste of taxpayer money initiatives.	3/11/2025 12:01 PM
67	I was astounded that I was gone for 2 weeks in Dec 2024 to early Jan and my electric bill for that period was quite high - I believe that if we have changed over - that there should be a rate for those that have a heat pump (requiring the fan to be operable during the window of heat).	3/11/2025 12:01 PM
68	we'd like to switch to more electric appliances, especially the dryer. Preferably a washer/dryer	3/11/2025 11:58 AM

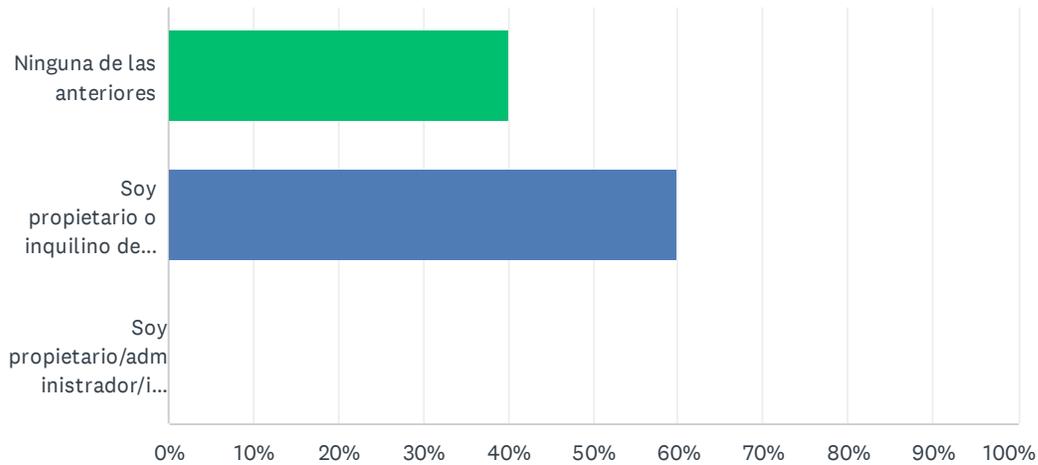
Community Electrification Survey

combo machine. But we've maxed out what our electrical box holds, so can't handle what another electric appliance would need without an overhaul of our whole electrical box. Just so you know another factor driving our decisions...

69	I'd have installed solar panels, but the city building code won't allow on my roof given the proximity of skylights.	3/11/2025 11:55 AM
70	X	3/11/2025 11:50 AM
71	I drive a non-plug in SUV and get 45 MPG. The cost of an equivalent EV is not at all affordable when you live on Social Security	3/11/2025 11:48 AM
72	Enso Village (where I live) is very environmentally conscious and has electrified everything they possibly could. The commercial grade kitchen is the only place you'll find gas appliances.	3/11/2025 11:47 AM
73	I cannot afford solar, but support its use.	3/11/2025 11:45 AM
74	Thanks to the Utility Department for providing residents with valuable information. Terra did a great job speaking at the Climate Action Healdsburg meeting last night.	3/11/2025 11:37 AM
75	Electric Panel Upgrade costs are a barrier to upgrading Heating/AC to heat pump.	3/11/2025 11:34 AM

Q1 ¿Cuál de las siguientes opciones se describe mejor? (Si ambas opciones se aplican a su caso, complete la encuesta dos veces - por ejemplo, una vez para cada opción.)

Answered: 5 Skipped: 0

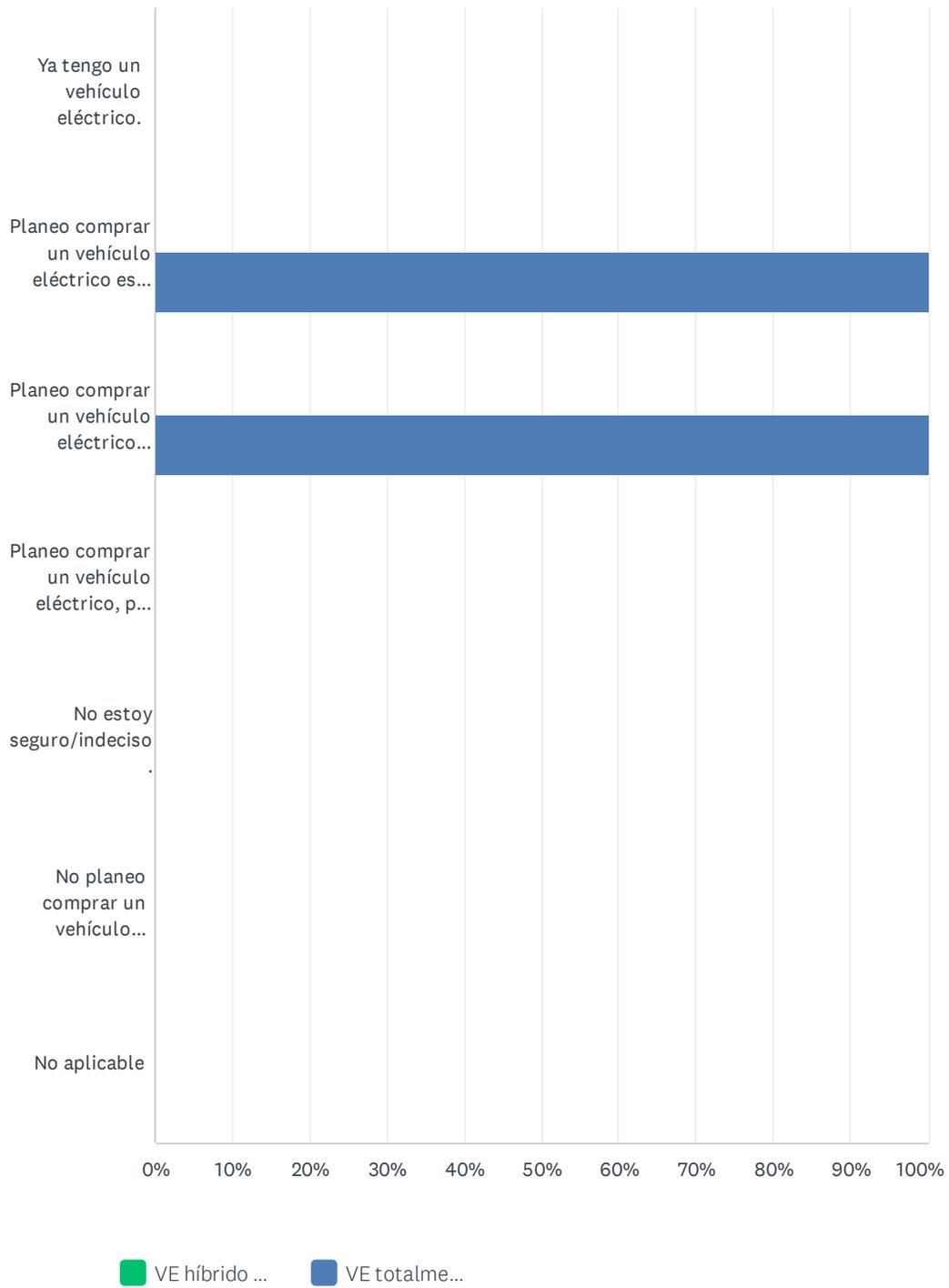


ANSWER CHOICES	RESPONSES	
Ninguna de las anteriores	40.00%	2
Soy propietario o inquilino de casa/condominio/apartamento en Healdsburg.	60.00%	3
Soy propietario/administrador/inquilino de un edificio comercial en Healdsburg.	0.00%	0
TOTAL		5

Q2 ¿Planea comprar un vehículo eléctrico (VE) en el futuro? Si es así, ¿cuándo?(Seleccione todas las opciones que correspondan. Por ejemplo, si ya tiene un vehículo eléctrico y planea reemplazar otro vehículo a gasolina en el futuro, o si planea reemplazar más de un vehículo con un vehículo eléctrico en el futuro.No cuente el reemplazo de un vehículo eléctrico que ya tiene por uno nuevo.Puede dejar en blanco las filas que no correspondan).

Answered: 1 Skipped: 4

Encuesta sobre Electrificación en la Comunidad

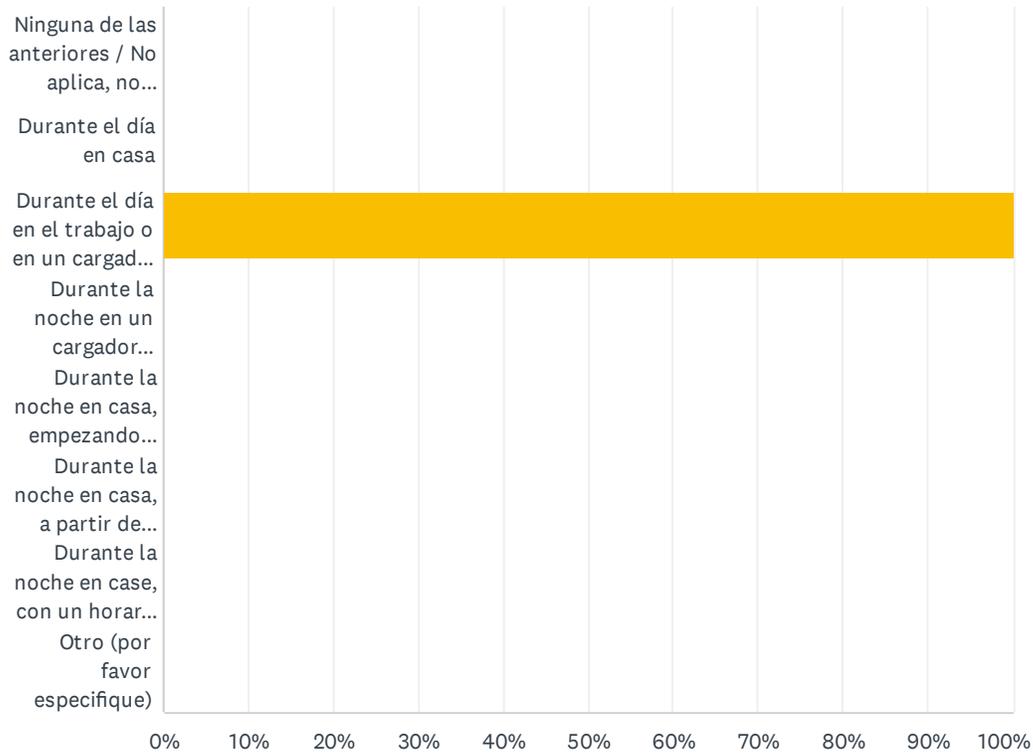


Encuesta sobre Electrificación en la Comunidad

	VE HÍBRIDO ENCHUFABLE	VE TOTALMENTE ELÉCTRICO	TOTAL RESPONDENTS
Ya tengo un vehículo eléctrico.	0.00% 0	0.00% 0	0
Planeo comprar un vehículo eléctrico este año.	0.00% 0	100.00% 1	1
Planeo comprar un vehículo eléctrico dentro de los próximos 5 años.	0.00% 0	100.00% 1	1
Planeo comprar un vehículo eléctrico, pero probablemente no durante al menos 5 años.	0.00% 0	0.00% 0	0
No estoy seguro/indeciso.	0.00% 0	0.00% 0	0
No planeo comprar un vehículo eléctrico en el futuro.	0.00% 0	0.00% 0	0
No aplicable	0.00% 0	0.00% 0	0

Q3 Si ya tiene o planea tener un vehículo eléctrico, ¿cuándo cargará su vehículo eléctrico con mayor frecuencia?

Answered: 1 Skipped: 4

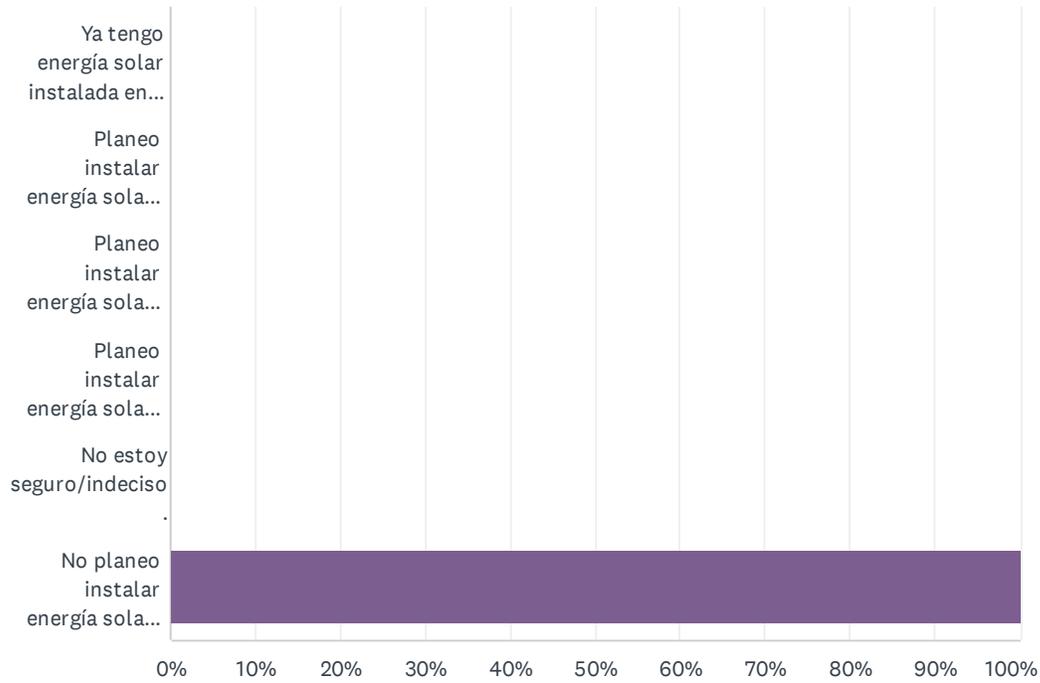


ANSWER CHOICES	RESPONSES
Ninguna de las anteriores / No aplica, no planeo comprar un vehículo eléctrico	0.00% 0
Durante el día en casa	0.00% 0
Durante el día en el trabajo o en un cargador público	100.00% 1
Durante la noche en un cargador público	0.00% 0
Durante la noche en casa, empezando cuando llegue a casa por la tarde	0.00% 0
Durante la noche en casa, a partir de medianoche	0.00% 0
Durante la noche en casa, con un horario para "estar listo" por la mañana	0.00% 0
Otro (por favor especifique)	0.00% 0
TOTAL	1

#	OTRO (POR FAVOR ESPECIFIQUE)	DATE
	There are no responses.	

Q4 ¿Planea instalar energía solar en su casa, o alentar a su propietario/administrador de la propiedad?

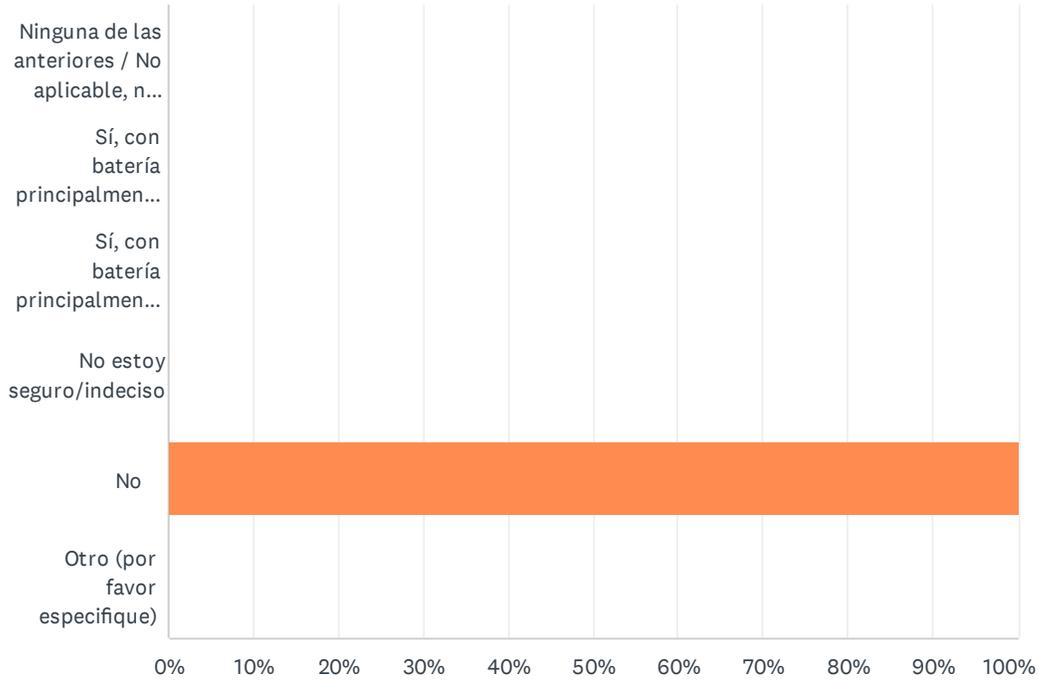
Answered: 1 Skipped: 4



ANSWER CHOICES	RESPONSES	
Ya tengo energía solar instalada en mi casa.	0.00%	0
Planeo instalar energía solar este año.	0.00%	0
Planeo instalar energía solar dentro de los próximos 5 años.	0.00%	0
Planeo instalar energía solar, pero probablemente no durante al menos 5 años.	0.00%	0
No estoy seguro/indeciso.	0.00%	0
No planeo instalar energía solar en el futuro.	100.00%	1
TOTAL		1

Q5 Si ya tiene o planea tener energía solar, ¿incluirá almacenamiento de batería?

Answered: 1 Skipped: 4

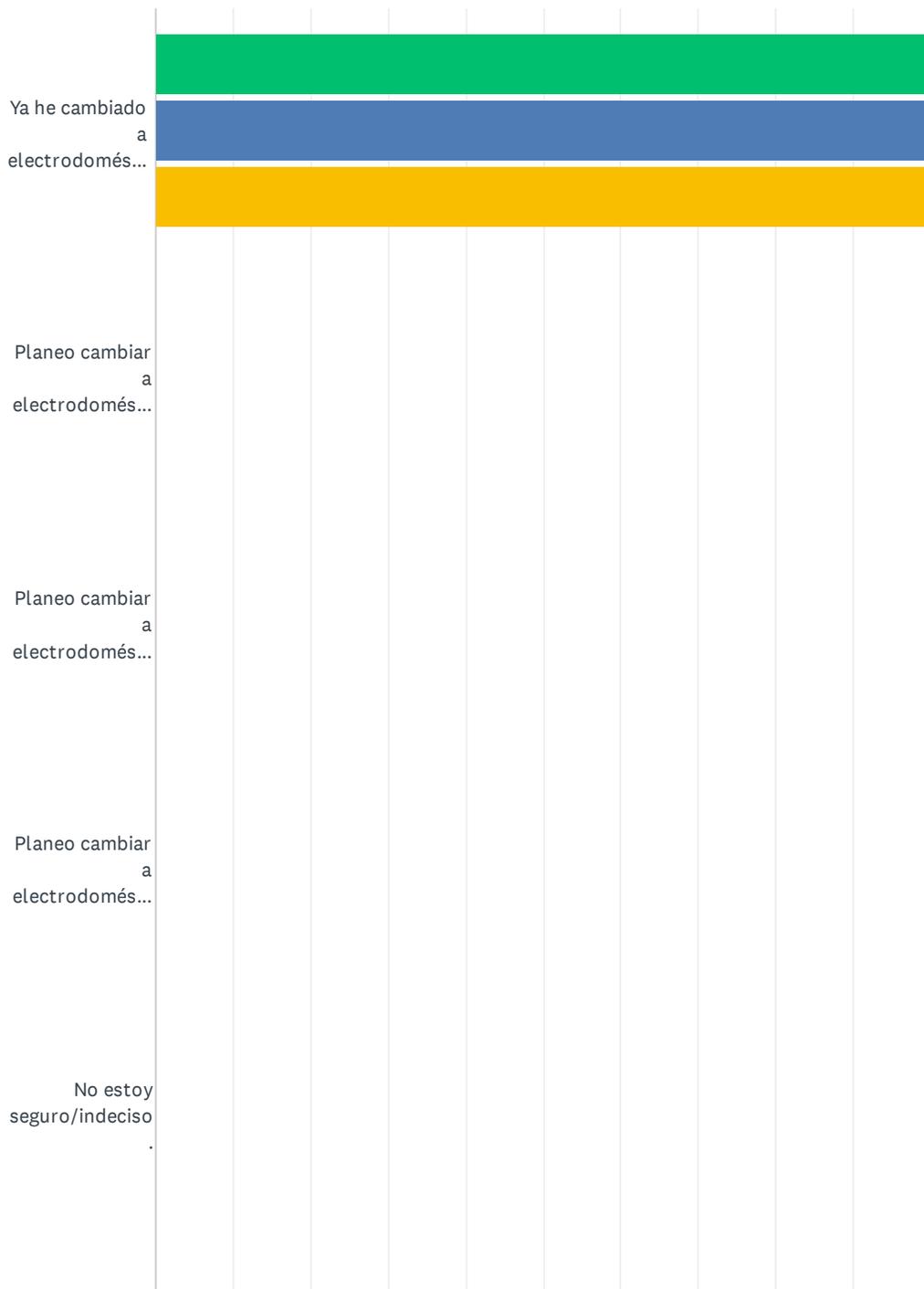


ANSWER CHOICES	RESPONSES
Ninguna de las anteriores / No aplicable, no planeo instalar energía solar	0.00% 0
Sí, con batería principalmente como respaldo	0.00% 0
Sí, con batería principalmente para evitar picos de precios y exceso de generación	0.00% 0
No estoy seguro/indeciso	0.00% 0
No	100.00% 1
Otro (por favor especifique)	0.00% 0
TOTAL	1

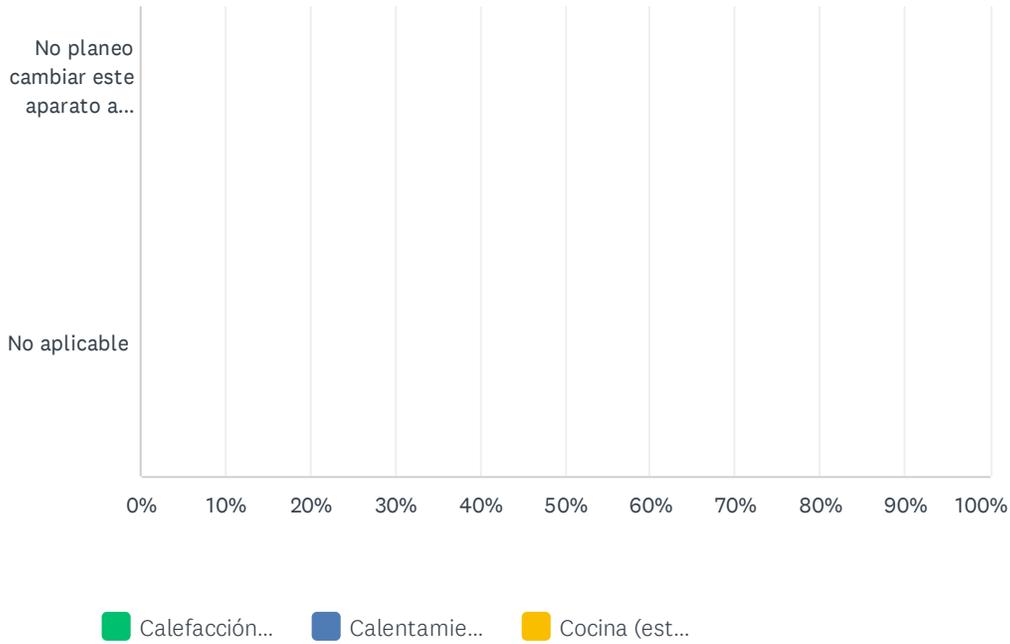
#	OTRO (POR FAVOR ESPECIFIQUE)	DATE
	There are no responses.	

Q6 ¿Planea instalar electrodomésticos eficientes en su hogar, o alentar al propietario/administrador de la propiedad?(Seleccione todas las opciones que correspondan. Por ejemplo, si planea reemplazar electrodomésticos en diferentes horarios.No cuente el reemplazo de un electrodoméstico que ya usa electricidad por uno nuevo.Puede dejar en blanco las filas que no correspondan).

Answered: 1 Skipped: 4



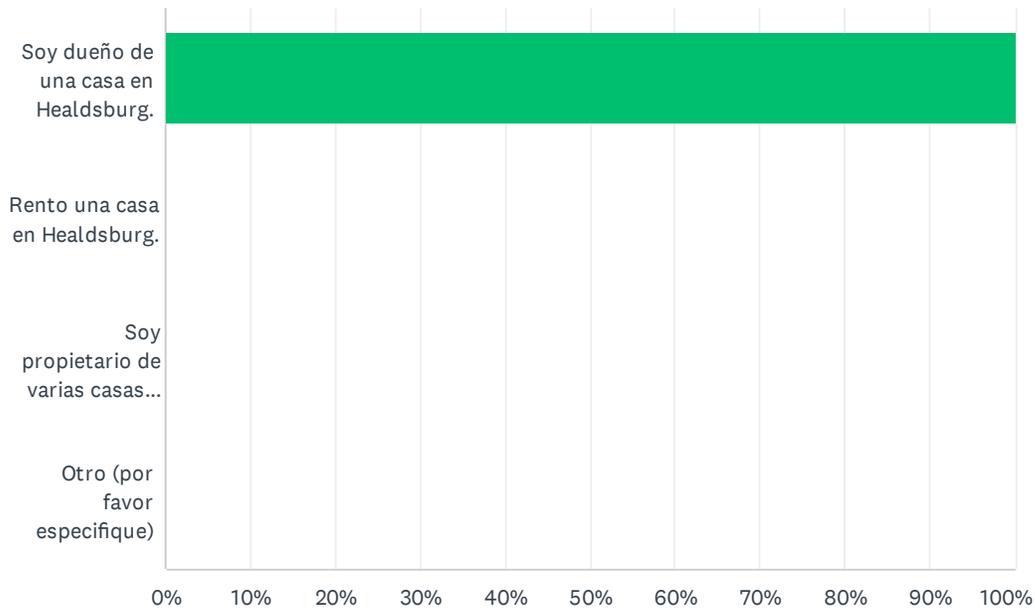
Encuesta sobre Electrificación en la Comunidad



	CALEFACCIÓN/ENFRIAMIENTO (BOMBA DE CALOR)	CALENTAMIENTO DE AGUA (BOMBA DE CALOR)	COCINA (ESTUFA/HORNO)	TOTAL RESPONDENTS
Ya he cambiado a electrodomésticos en mi casa.	100.00% 1	100.00% 1	100.00% 1	1
Planeo cambiar a electrodomésticos este año.	0.00% 0	0.00% 0	0.00% 0	0
Planeo cambiar a electrodomésticos dentro de los próximos 5 años.	0.00% 0	0.00% 0	0.00% 0	0
Planeo cambiar a electrodomésticos, pero probablemente no durante al menos 5 años.	0.00% 0	0.00% 0	0.00% 0	0
No estoy seguro/indeciso.	0.00% 0	0.00% 0	0.00% 0	0
No planeo cambiar este aparato a eléctrico en el futuro.	0.00% 0	0.00% 0	0.00% 0	0
No aplicable	0.00% 0	0.00% 0	0.00% 0	0

Q7 ¿Cuál de las siguientes opciones se aplica a usted?

Answered: 1 Skipped: 4



ANSWER CHOICES	RESPONSES	
Soy dueño de una casa en Healdsburg.	100.00%	1
Rento una casa en Healdsburg.	0.00%	0
Soy propietario de varias casas en Healdsburg.	0.00%	0
Otro (por favor especifique)	0.00%	0
TOTAL		1

#	OTRO (POR FAVOR ESPECIFIQUE)	DATE
	There are no responses.	

Q8 Planea comprar vehículos eléctricos para su negocio en el futuro? Si es así, ¿cuándo?(Seleccione todas las opciones que correspondan. Por ejemplo, si ya tiene un vehículo eléctrico y planea reemplazar otro vehículo a gasolina en el futuro, o si planea reemplazar más de un vehículo con un vehículo eléctrico en el futuro.No cuente el reemplazo de un vehículo eléctrico que ya tiene por uno nuevo.Puede dejar en blanco las filas que no correspondan).

Answered: 0 Skipped: 5

⚠ No matching responses.

	VE HÍBRIDO ENCHUFABLE	VE TOTALMENTE ELÉCTRICO	TOTAL RESPONDENTS
Ya tengo vehículos eléctricos para la compañía.	0.00% 0	0.00% 0	0
Planeo comprar vehículos eléctricos este año.	0.00% 0	0.00% 0	0
Planeo comprar vehículos eléctricos dentro de los próximos 5 años.	0.00% 0	0.00% 0	0
Planeo comprar vehículos eléctricos, pero probablemente no durante al menos 5 años.	0.00% 0	0.00% 0	0
No estoy seguro/indeciso.	0.00% 0	0.00% 0	0
No planeo comprar vehículos eléctricos para la compañía.	0.00% 0	0.00% 0	0
No aplicable	0.00% 0	0.00% 0	0

Q9 ¿Planea instalar cargadores de vehículos eléctricos en su negocio, o alentar al propietario? Si es así, ¿cuándo?(Seleccione todas las opciones que correspondan. Por ejemplo, si ya tiene un cargador de vehículos eléctricos y planea instalar otro en el futuro.No cuente el reemplazo de un cargador ya instalado por uno nuevo).

Answered: 0 Skipped: 5

⚠ No matching responses.

ANSWER CHOICES	RESPONSES	
Ninguna de las anteriores / No aplicable, no planeo instalar cargadores para vehículos eléctricos	0.00%	0
Ya tengo cargadores de vehículos eléctricos para la compañía	0.00%	0
Planeo instalar cargadores para vehículos eléctricos este año.	0.00%	0
Planeo instalar cargadores para vehículos eléctricos dentro de los próximos 5 años.	0.00%	0
Planeo instalar cargadores para vehículos eléctricos, pero probablemente no durante al menos 5 años.	0.00%	0
Otro (por favor especifique)	0.00%	0
Total Respondents: 0		

#	OTRO (POR FAVOR ESPECIFIQUE)	DATE
	There are no responses.	

Q10 ¿Planea instalar energía solar en su negocio, o alentar al propietario?

Answered: 0 Skipped: 5

 No matching responses.

ANSWER CHOICES	RESPONSES	
Ya tengo energía solar instalada para la compañía.	0.00%	0
Planeo instalar energía solar este año.	0.00%	0
Planeo instalar energía solar dentro de los próximos 5 años.	0.00%	0
Planeo instalar energía solar, pero probablemente no durante al menos 5 años.	0.00%	0
No estoy seguro/indeciso.	0.00%	0
No planeo instalar energía solar para la compañía en el futuro.	0.00%	0
TOTAL		0

Q11 Si ya tiene o planea tener energía solar, ¿incluirá almacenamiento de batería?

Answered: 0 Skipped: 5

 No matching responses.

ANSWER CHOICES	RESPONSES	
Ninguna de las anteriores / No aplicable, no planeo instalar energía solar	0.00%	0
Sí, con batería principalmente como respaldo	0.00%	0
Sí, con batería principalmente para evitar picos de precios/tarifas de demanda y exceso de generación	0.00%	0
No estoy seguro/indeciso	0.00%	0
No	0.00%	0
Otro (por favor especifique)	0.00%	0
TOTAL		0

#	OTRO (POR FAVOR ESPECIFIQUE)	DATE
	There are no responses.	

Q12 ¿Planea instalar electrodomésticos eficientes en su negocio, o alentar al propietario?(Seleccione todas las opciones que correspondan. Por ejemplo, si planea reemplazar electrodomésticos en diferentes horarios.No cuente el reemplazo de un electrodoméstico que ya usa electricidad por uno nuevo.Puede dejar en blanco las filas que no correspondan).

Answered: 0 Skipped: 5

⚠ No matching responses.

	CALEFACCIÓN/ENFRIAMIENTO (BOMBA DE CALOR/RTU)	CALENTAMIENTO DE AGUA (BOMBA DE CALOR/CALDERA)	COCINA COMERCIAL (ESTUFA/HORNO)	TOTAL RESPONDENTS
Ya he cambiado a electrodomésticos para la compañía.	0.00% 0	0.00% 0	0.00% 0	0
Planeo cambiar a electrodomésticos este año.	0.00% 0	0.00% 0	0.00% 0	0
Planeo cambiar a electrodomésticos dentro de los próximos 5 años.	0.00% 0	0.00% 0	0.00% 0	0
Planeo cambiar a electrodomésticos, pero probablemente no durante al menos 5 años.	0.00% 0	0.00% 0	0.00% 0	0
No estoy seguro/indeciso.	0.00% 0	0.00% 0	0.00% 0	0
No planeo cambiar este aparato a eléctrico para la compañía en el futuro.	0.00% 0	0.00% 0	0.00% 0	0
No aplicable	0.00% 0	0.00% 0	0.00% 0	0

Q13 ¿Cuál de las siguientes opciones se aplica a usted?

Answered: 0 Skipped: 5

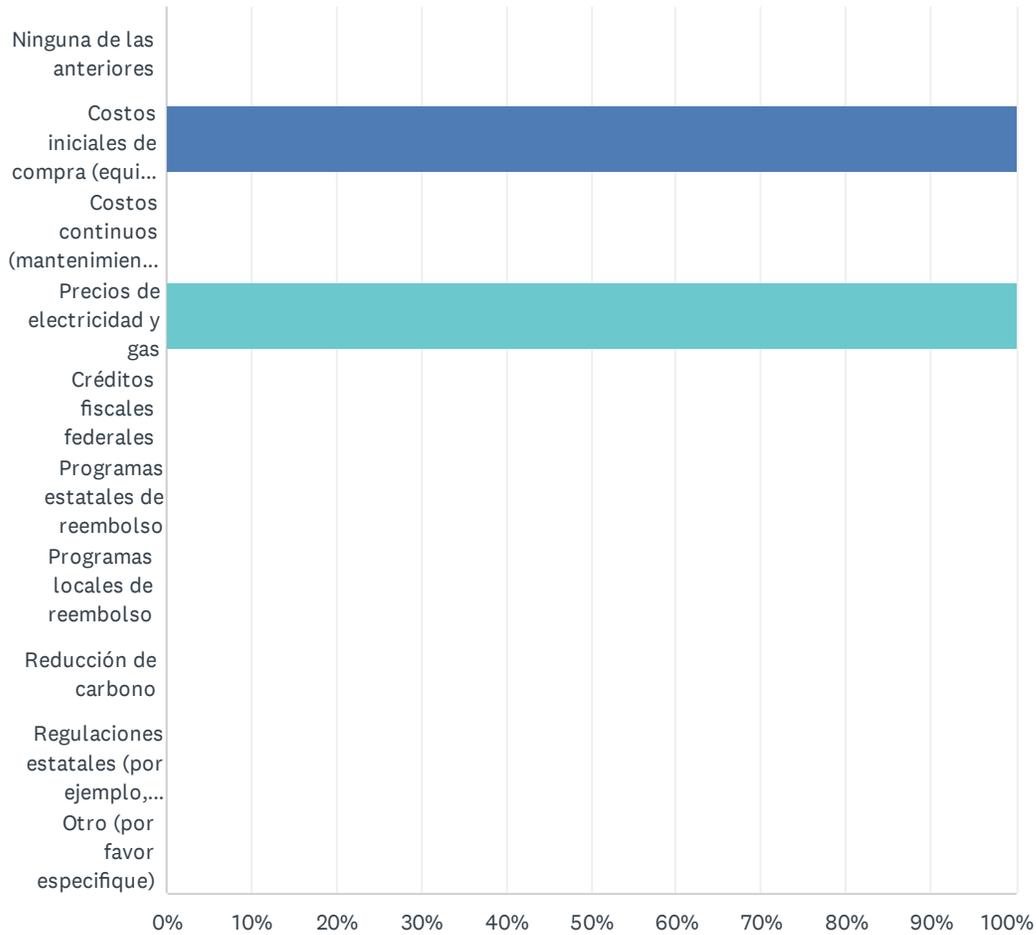
 No matching responses.

ANSWER CHOICES	RESPONSES	
Soy dueño de un edificio comercial en Healdsburg.	0.00%	0
Rento un edificio comercial en Healdsburg.	0.00%	0
Soy propietario de varios edificios comerciales en Healdsburg.	0.00%	0
Otro (por favor especifique)	0.00%	0
TOTAL		0

#	OTRO (POR FAVOR ESPECIFIQUE)	DATE
	There are no responses.	

Q14 ¿Cuáles son los principales factores que influyen en las decisiones sobre sus proyectos energéticos? (Seleccione hasta 3.)

Answered: 1 Skipped: 4



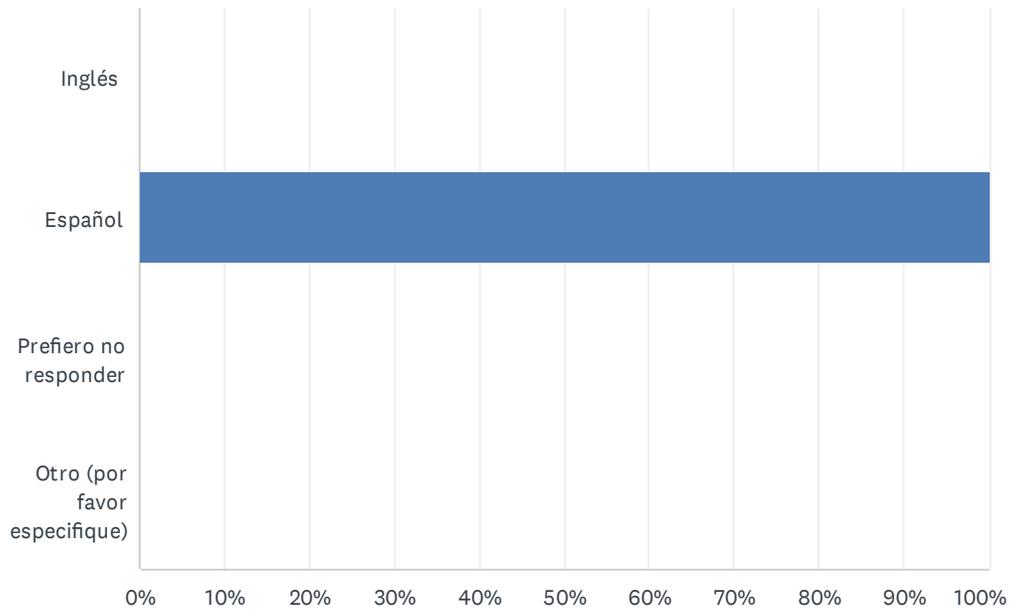
Encuesta sobre Electrificación en la Comunidad

ANSWER CHOICES	RESPONSES	
Ninguna de las anteriores	0.00%	0
Costos iniciales de compra (equipo, vehículo, instalación)	100.00%	1
Costos continuos (mantenimiento, ahorro de costos, facturas, etc.)	0.00%	0
Precios de electricidad y gas	100.00%	1
Créditos fiscales federales	0.00%	0
Programas estatales de reembolso	0.00%	0
Programas locales de reembolso	0.00%	0
Reducción de carbono	0.00%	0
Regulaciones estatales (por ejemplo, futuras compras de vehículos nuevos, posibles requisitos futuros de reemplazo de electrodomésticos)	0.00%	0
Otro (por favor especifique)	0.00%	0
Total Respondents: 1		

#	OTRO (POR FAVOR ESPECIFIQUE)	DATE
	There are no responses.	

Q15 ¿Qué idioma se habla predominantemente en su casa?

Answered: 1 Skipped: 4

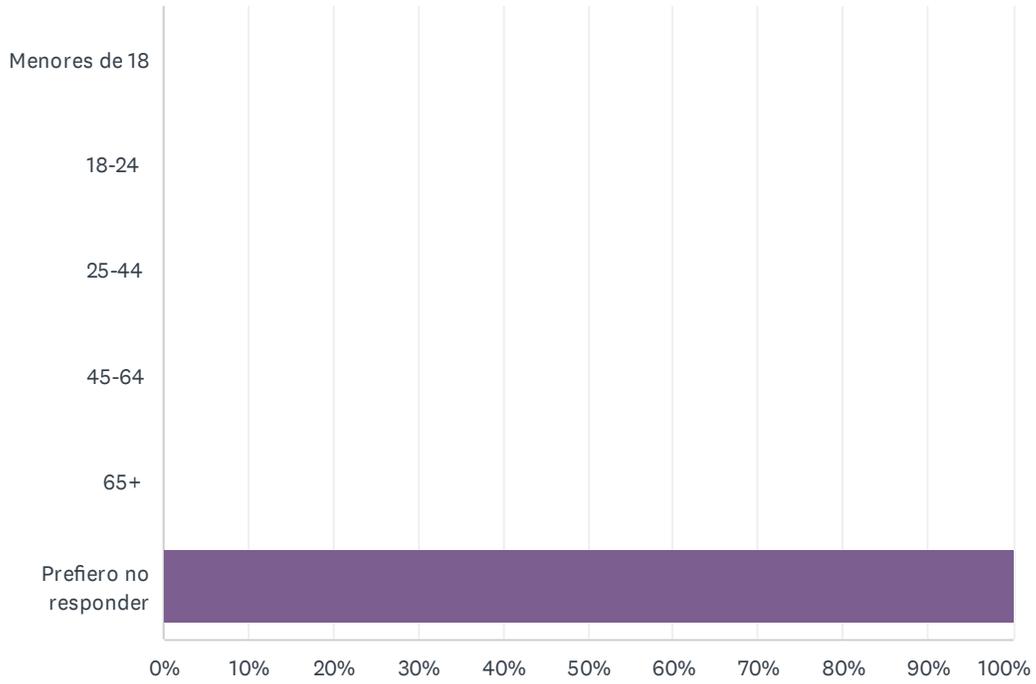


ANSWER CHOICES	RESPONSES
Inglés	0.00% 0
Español	100.00% 1
Prefiero no responder	0.00% 0
Otro (por favor especifique)	0.00% 0
TOTAL	1

#	OTRO (POR FAVOR ESPECIFIQUE)	DATE
	There are no responses.	

Q16 ¿Cual es su grupo de edad?

Answered: 1 Skipped: 4



ANSWER CHOICES	RESPONSES	
Menores de 18	0.00%	0
18-24	0.00%	0
25-44	0.00%	0
45-64	0.00%	0
65+	0.00%	0
Prefiero no responder	100.00%	1
TOTAL		1

Q17 Proporcione comentarios adicionales que ayuden al Departamento de Electricidad de Healdsburg a pronosticar el consumo y la demanda de electricidad en el futuro. (Opcional)

Answered: 0 Skipped: 5

#	RESPONSES	DATE
	There are no responses.	