City of Healdsburg Climate Mobilization Strategy

Energy Demand Model Workshop

January 29, 2025

Today's Goals

- Review the Goals of the Climate Mobilization Strategy
- What is electrification and why is it happening?
- What are the drivers and impacts of electrification?
- Review the Healdsburg Electrification Model and inputs
- Discuss community input of electrification adoption in Healdsburg
- Receive input on which model scenario Healdsburg should plan for

Agenda

- Part 1: Introduction & Background
- Part 2: Electric Model Development
- Part 3: Activity
- Part 4: Findings and Recommendations
- Part 5: Q & A/ Closeout

Part 1

Introduction and Background

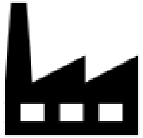
What is Electrification?

Transport

Consumers replacing gasoline or diesel cars with electric vehicles (EVs) or plug-in hybrid electric vehicles (PHEV)

Buildings

Consumers and business owners replacing natural gas, propane, or fuel oil space and water heating with electric heat pumps



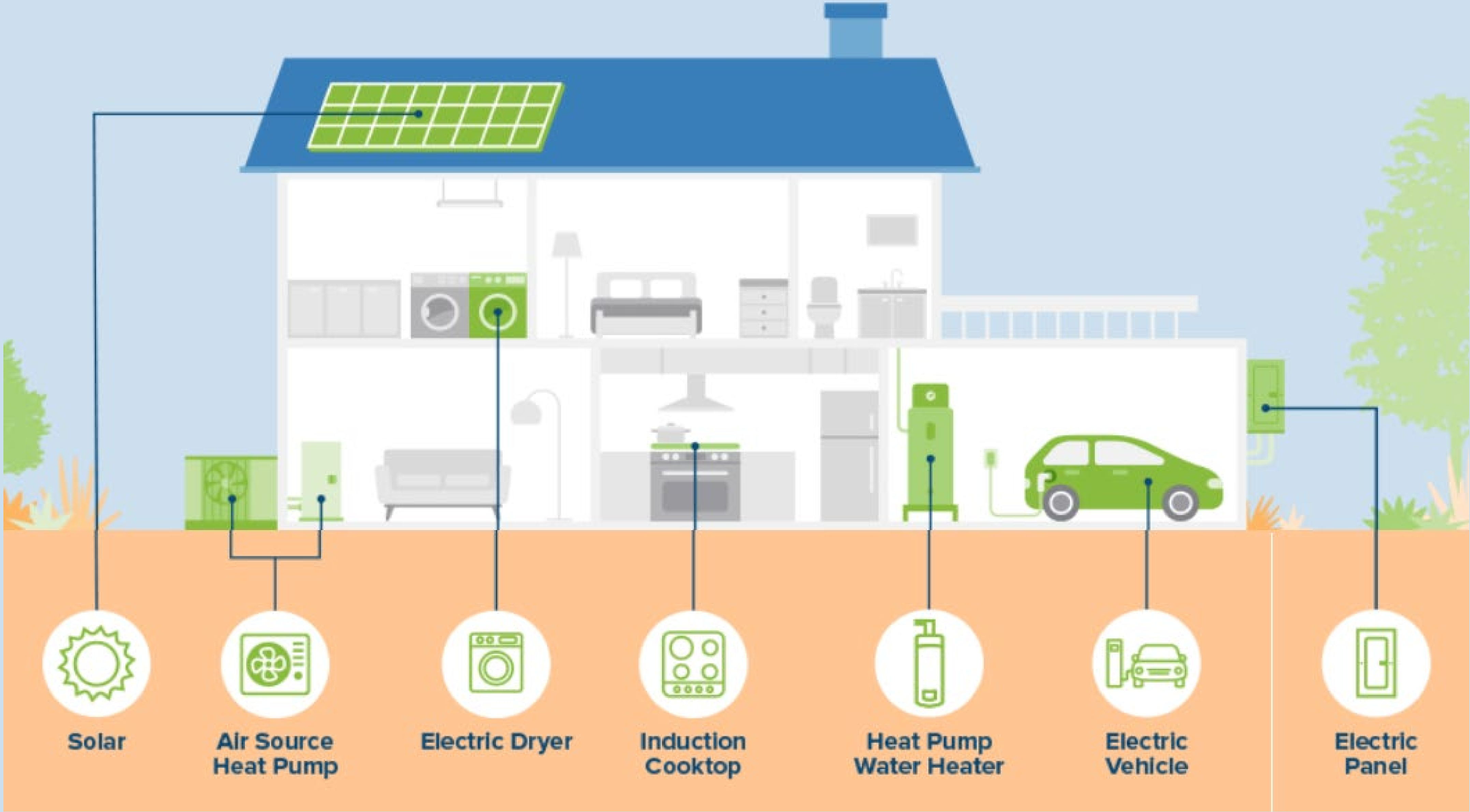
Industry

Industrial business owners replacing natural gas, fuel oil, or coal process heating with electric process heat technologies such as induction melting or infrared drying

Source: "What is Electrification"? By Bob Shively, Enerdynamics President
https://www.enerdynamics.com/Energy-Currents_Blog/What-is-Electrification.aspx

What does an all-electric home look like?

Courtesy of City of Palo Alto



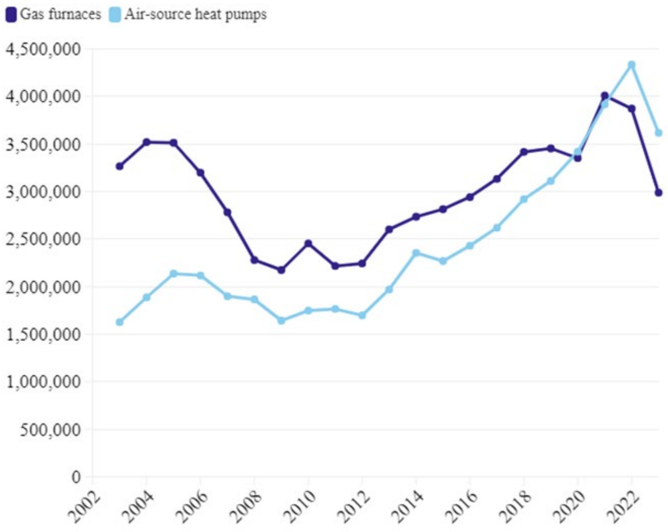
Electrification Drivers: Regulatory

Regulatory Drivers

- AB 32, SB 32, and AB 1279 set California's commitment to GHG emission reduction
- SB100 and SB 1020 mandate 100% zero-carbon & renewable electricity by 2045
- Title 24 building standards require increased energy efficiency & promote electrification
- California Zero-Emission Space and Water Heater Standards (in development)
- Advanced Clean Cars Program: phasing out gasoline vehicle purchases by 2035
- California Environmental Quality Act mitigation increasingly includes electrification of projects
- Inflation Reduction Act of 2022 & Infrastructure Investment and Jobs Act (2021)

Electrification Drivers: Market Trends

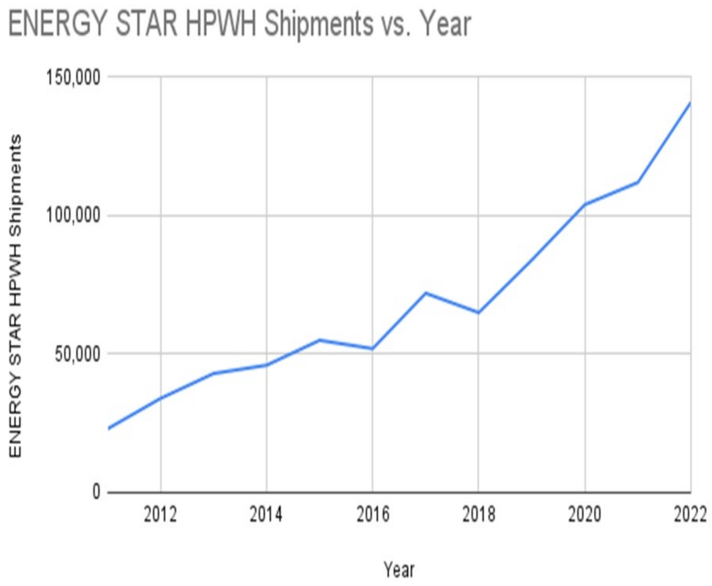
Electric Building Market Trends: HVACs



Source: Air-Conditioning, Heating, and Refrigeration Institute
Chart by Casey Crownhart, MIT Technology Review

HP HVACs outpace gas furnace sales starting in 2021

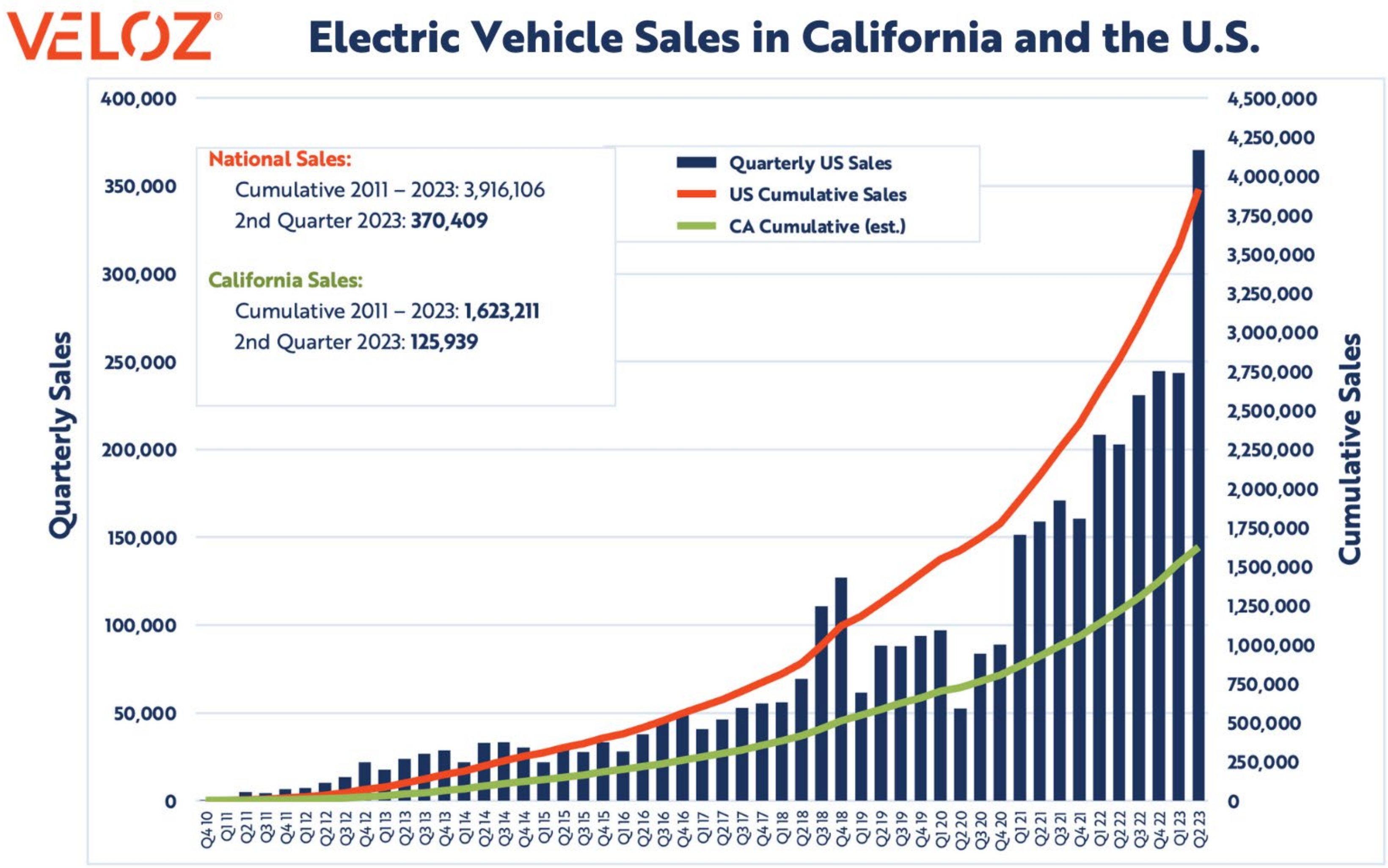
Electric Building Market Trends: Water Heaters



Electric WH have increased from 6 to ~ 15% of market share since 2009

Transportation Market Trends: EVs

Electrification Drivers: Market Trends



Note: According to California Air Resources Board data, California sales are 34% of national sales.
Data source: California Energy Commission (2023). Retrieved July 2023 from energy.ca.gov/zevstats.

Q2 2023 data update: Cumulative data from 2011 – 2023.

Electrification Drivers: Co-benefits

Benefits of Electrification

Public Health

- Eliminating NOx emissions from gas appliances reduces asthma risks.

GHG Reduction

- Natural gas currently accounts for 20% of Healdsburg's emissions.

Safety

- Reduced earthquake risk by moving away from gas infrastructure.

Resilience

- Solar + battery systems enhance energy reliability during outages.

Energy Affordability

- Transitioning to electricity avoids rising gas costs (expected to double by 2050).

Healdsburg Electrification Drivers

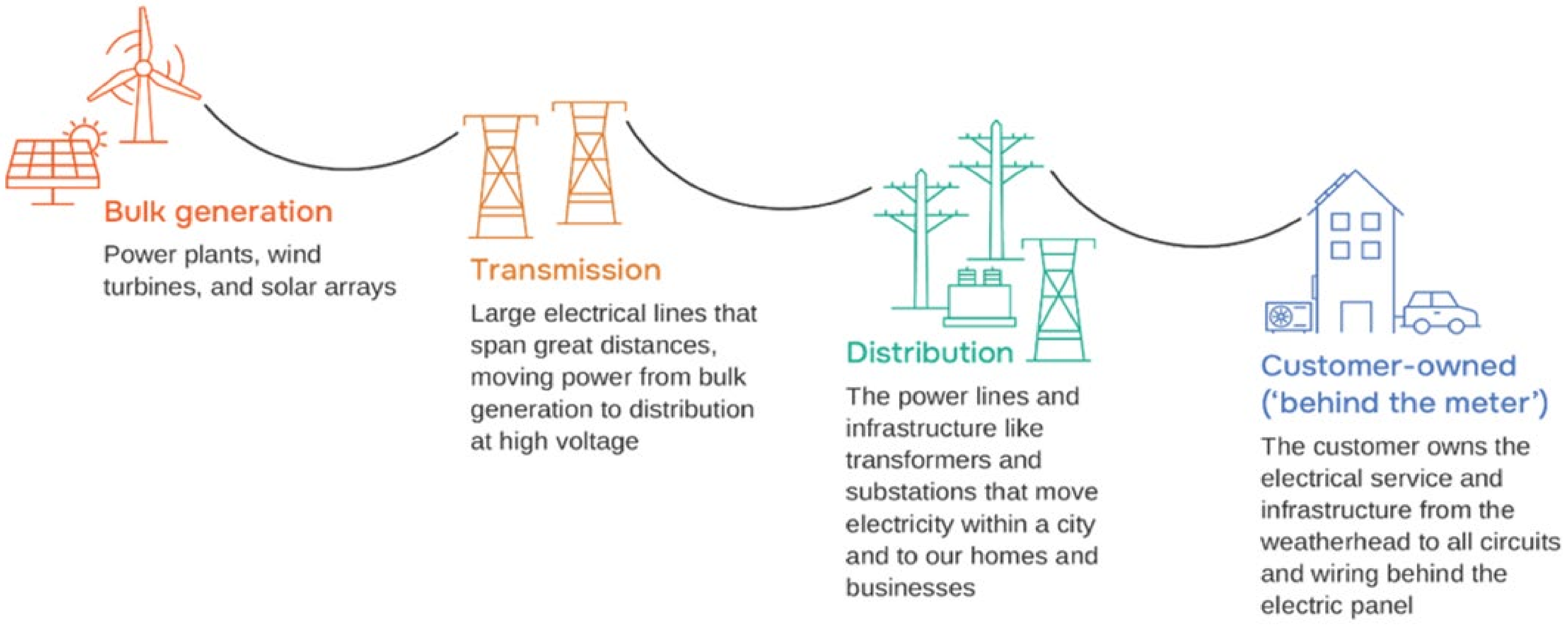
CMS Targets

- Procure 85% renewable and carbon-free electricity by 2030
- Achieve 30% passenger and 40% commercial zero-emission vehicle adoption by 2030
- Decarbonize 8% of residential and 5% of commercial buildings by 2030
- Achieve 100% renewable and carbon-free electricity by 2045

Part 2

Electric Demand Model

The Grid: Peak Demand Vs. Gross Demand



- Electricity demand impacts the grid in two ways
  - Gross electricity demand (bulk generation)
  - Peak demand (transmission, distribution, and customer) = maximum electricity demand at any one time

How does Healdsburg Electric plan for Increased Demand?

Identify future potential gross and peak demand

- Develop energy 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 gross and peak demand trends

- Identify polices/ programs to limited negative impacts on grid

Energy Demand Model

Intent & Approach

Intent

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

Approach

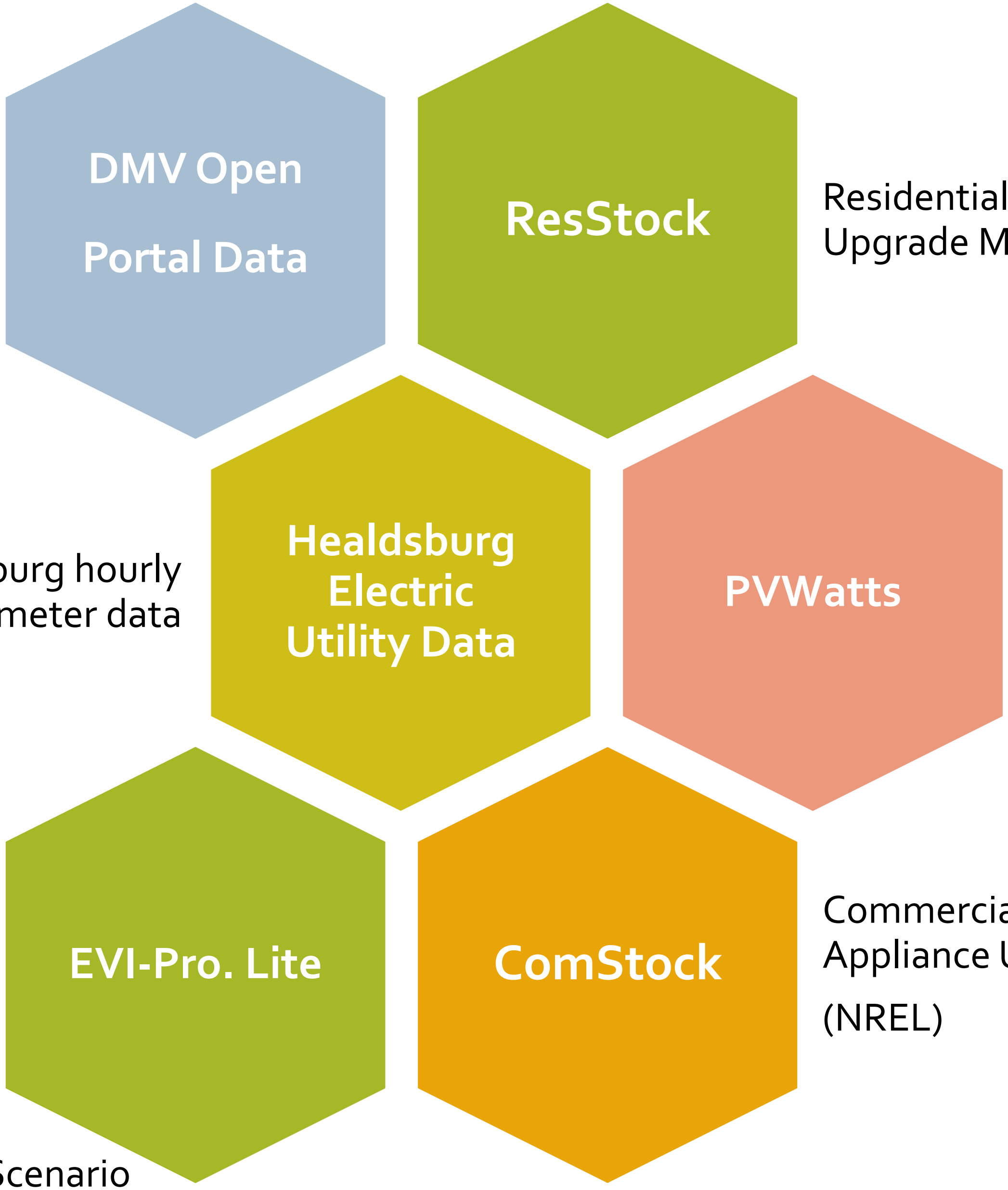
Model uses various data sources to model city-wide baseline energy consumption and forecast future gross and peak demand

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 electricity demand over time
4. Hourly and annual gross and peak demand outputs

Energy Demand Model

Development: Data Sources



Residential Appliance Upgrade Model (NREL)

City of Healdsburg hourly energy meter data

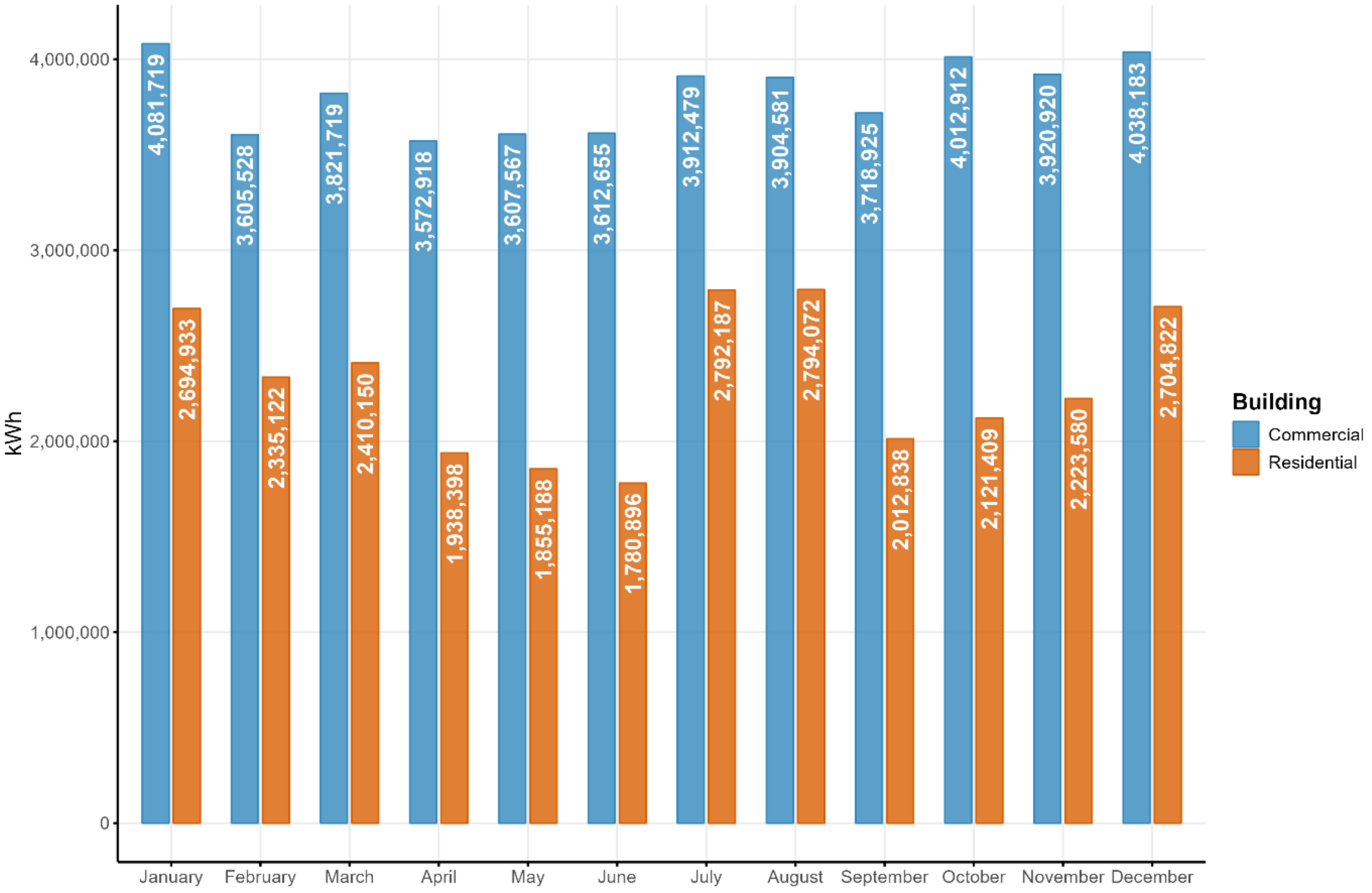
Solar output model (NREL)

Commercial Base Model & Appliance Upgrade Model (NREL)

EV Demand and Scenario Model (DOE)

Energy Demand Model

Base Model: Gross Demand

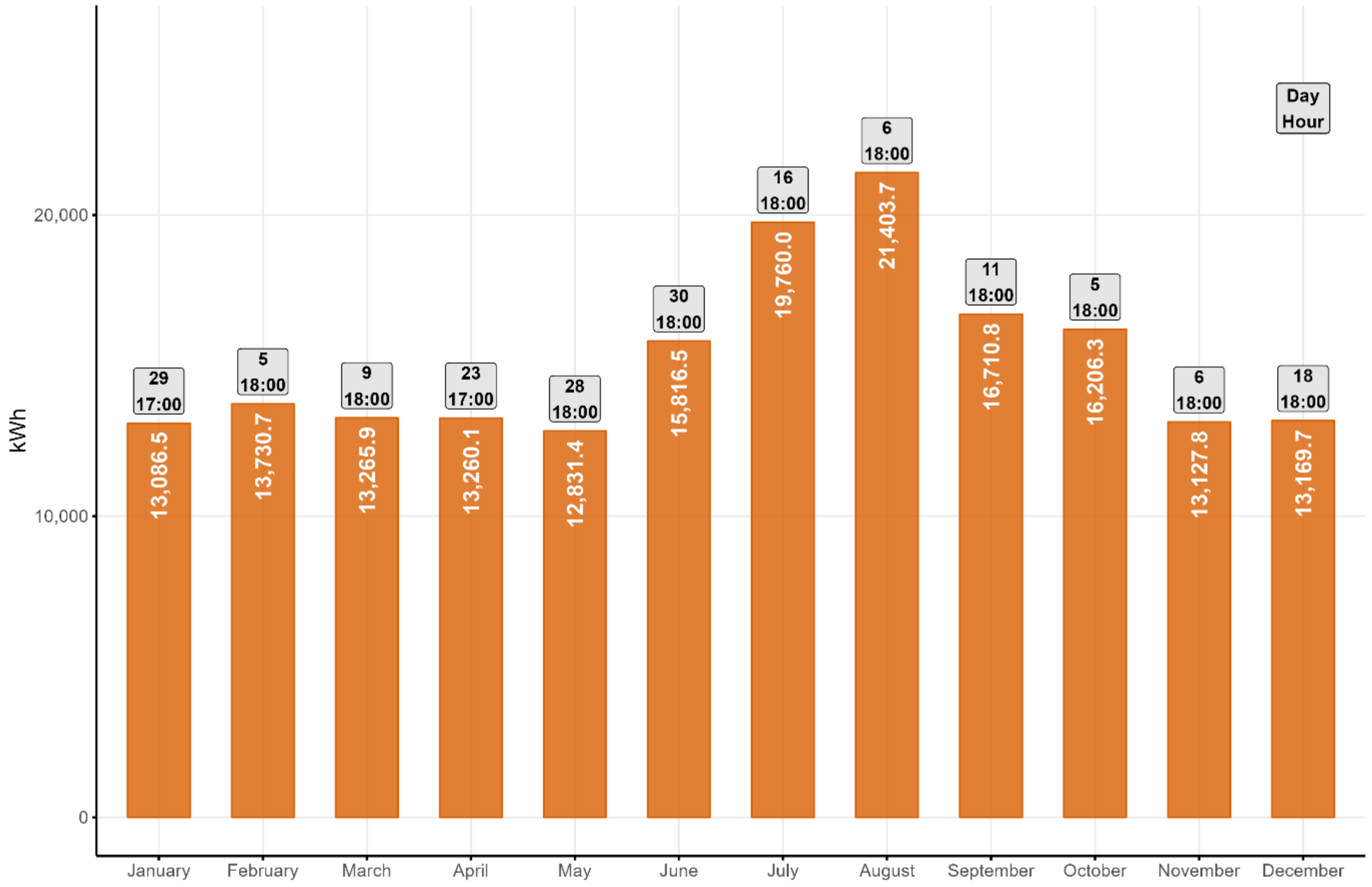


Total Energy Use (kWh) for the Current Base Model Scenario

Gross annual demand for electricity in Healdsburg was 73,743,699 kWh for 2023, with the greatest demand occurring in July and August

Energy Demand Model

Base Model: Peak Demand



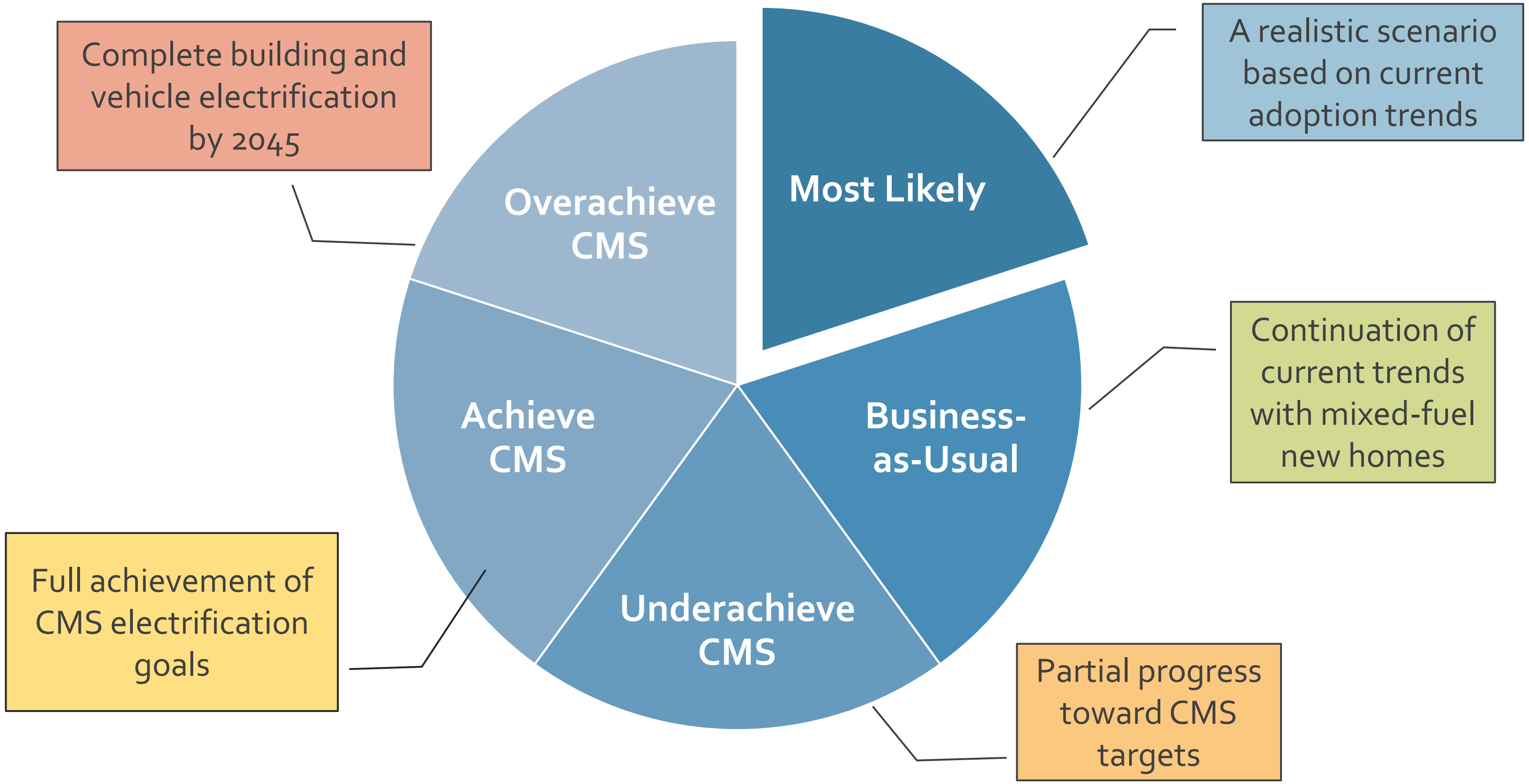
Max Energy Use (kWh) for the Current Base Model Scenario

The peak demand for electricity in Healdsburg in 2023 was 21,403.7 kWh on August 6th at 6:00 PM.

Energy Demand Model

Development: Scenarios

- Scenarios developed to demonstrate future electricity load under different conditions
- Reflect the anticipated energy demand under different levels of CMS implementation
- Scenarios modeled for future electricity demand:



Scenario Specifics

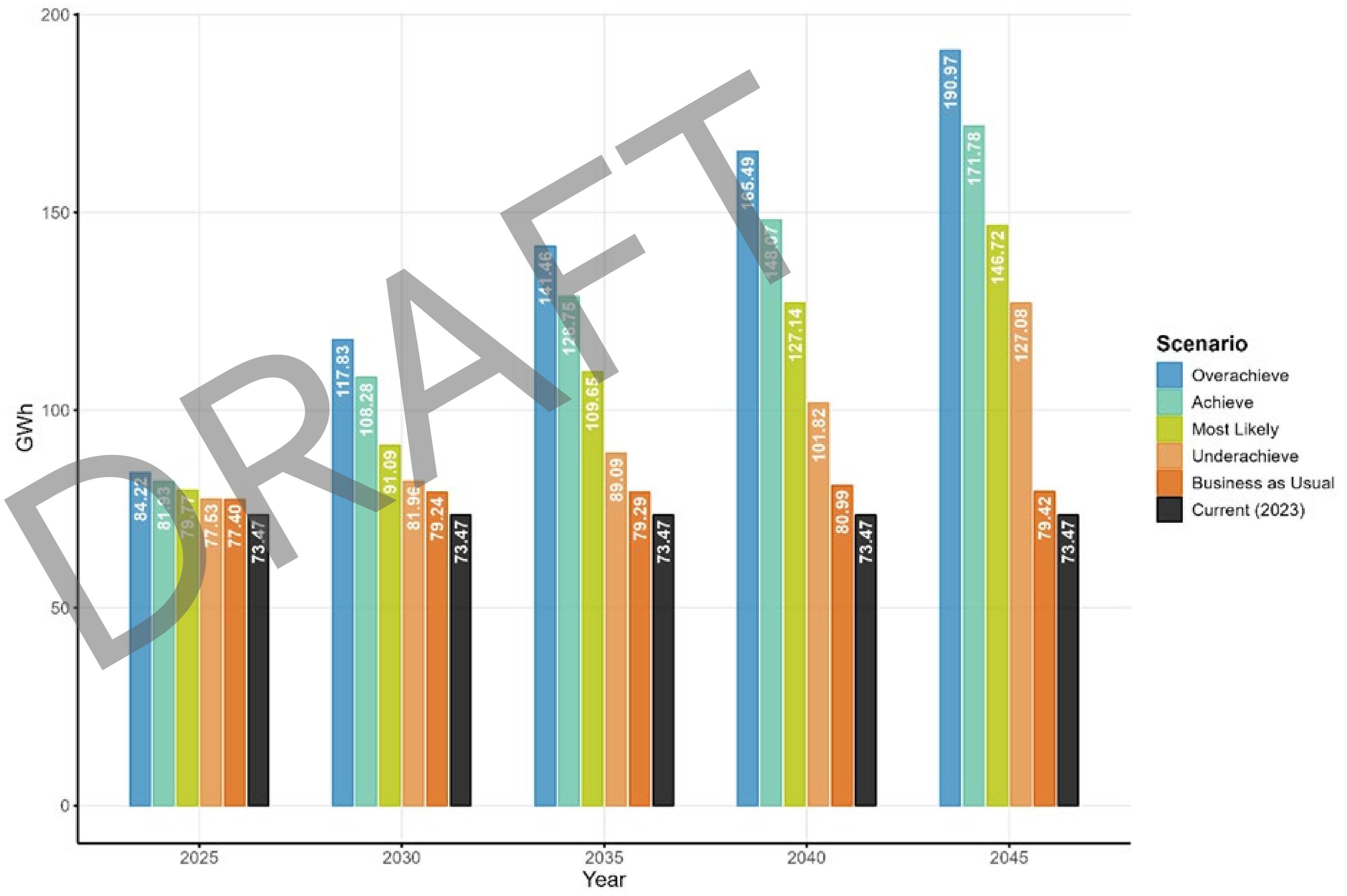
Scenario/Target Year Goals	New Building Electrification	Existing Residential Building Equipment Electrification	Existing Non-residential Building Equipment Electrification	Passenger EV Penetration	Commercial EV Penetration
Business-as-Usual					
2030 Goals	50%	1%	2%	8%	7%
2045 Goals	50%	5%	12%	12%	36%
Underachieve					
2030 Goals	80%	5%	2%	10%	10%
2045 Goals	80%	15%	12%	57%	65%
Achieve					
2030 Goals	95%	8%	5%	35%	40%
2045 Goals	95%	25%	25%	100%	100%
Overachieve					
2030 Goals	100%	20%	15%	45%	50%
2045 Goals	100%	100%	100%	100%	100%
Most Likely					
2030 Goals	90%	10%	5%	20%	20%
2045 Goals	90%	40%	25%	75%	80%

Scenario Conditions in 2030 and 2045

Energy Demand Model

Draft Results: Gross Demand

Total Energy Use (GWh) for Each Year of Each Modeled Scenario

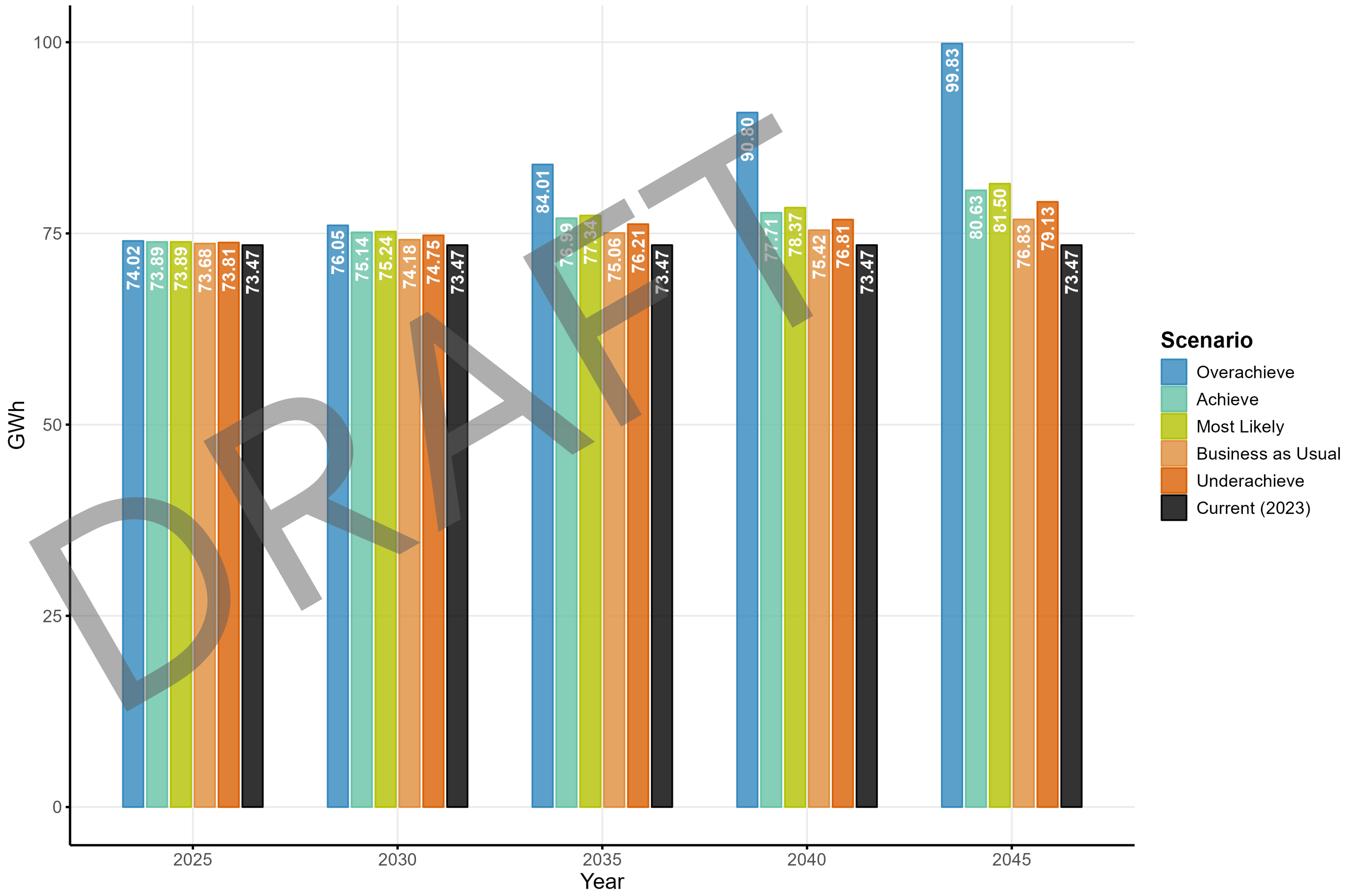


*Includes relatively large solar offset

Energy Demand Model

Draft Results: Gross Demand

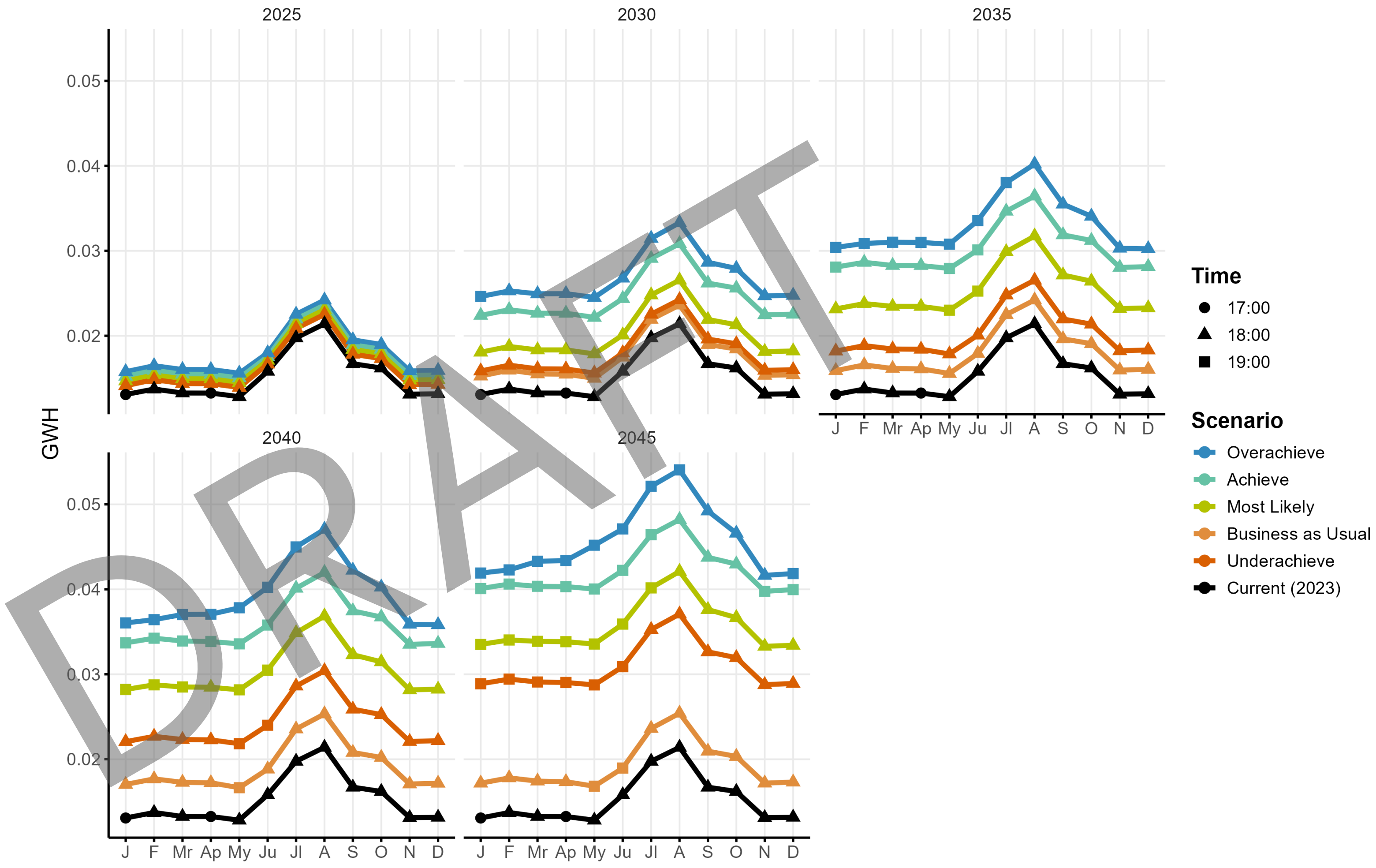
Total Energy Use (GWh) for Each Year of Each Modeled Scenario without EVs or Solar Offset



*Building electricity demand projected to increase between ~5-36% by 2045

Energy Demand Model

Draft Results: Peak Demand



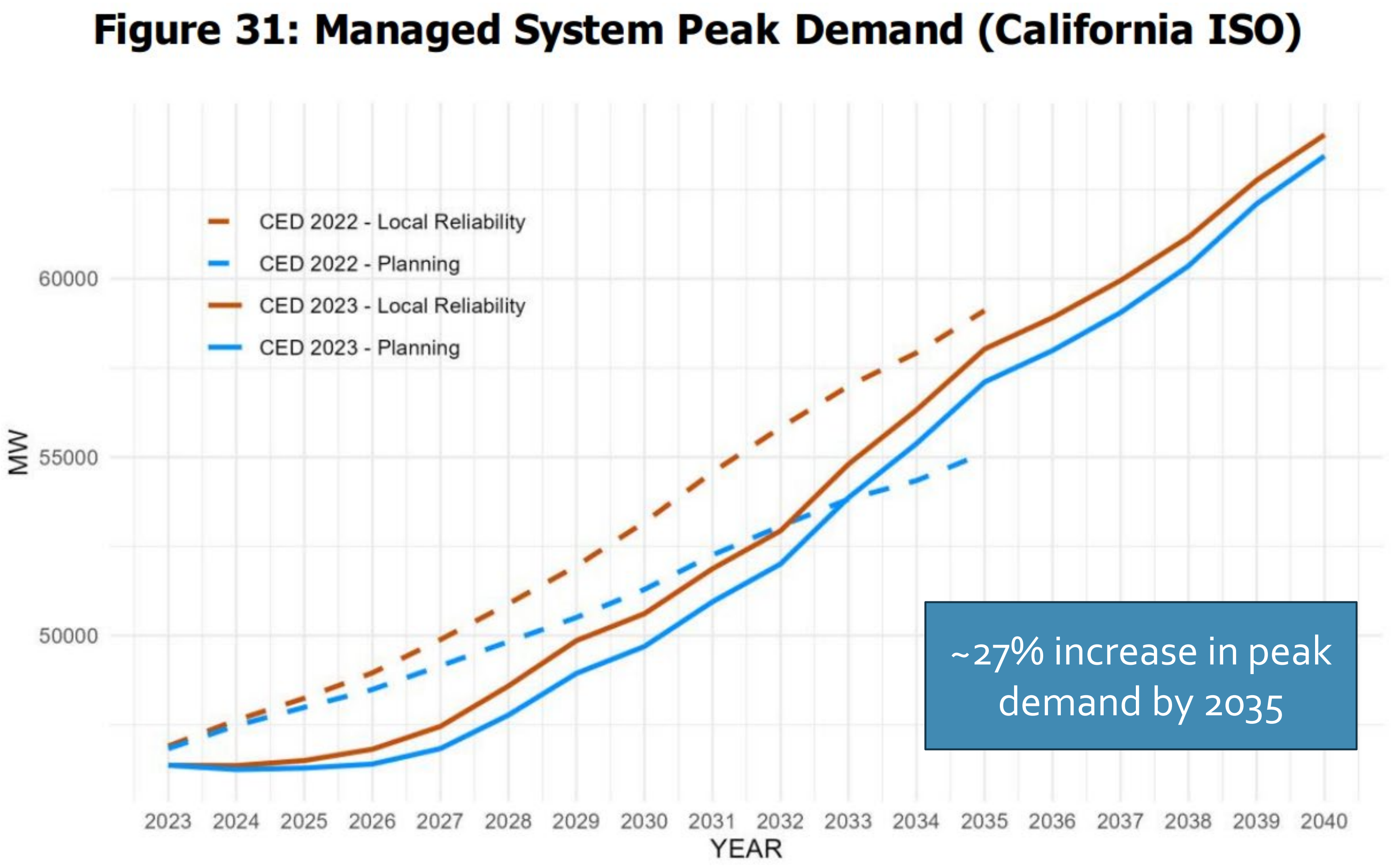
Max Energy Use (GWh) Per Hour by Month for Each Year of Each Modeled Scenario

Energy Demand Model

Draft Results

- **Forecasted Peak and Annual Demand**
  - Significant increases driven by EV charging needs
  - 100% building electrification would increase gross demand by ~35% by 2045
  - By 2045, EVs could contribute an ***additional*** ~20-140% increase in annual electricity 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

How does the Healdsburg Model compare to potential Statewide projections?



Source: https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2023-integrated-energy-policy-report

Part 3

Activity

Overview of Evening Activities

1. Feedback
   - Which electrification scenario is more likely that Healdsburg should prepare for?
   - What timeline works for you?
     - When would you adopt an EV?
     - When would you convert to a heat pump?
   - Are you saving to make transition ASAP or waiting for equipment to burn out?
   - What does electrifying your home look like?
2. Posters around the room to respond to feedback questions
3. At each poster, use stickers to place by timeline/category
   - Write any comments directly on poster or on notepads at tables
4. Discuss any questions or comments with the team member present

Do you plan to install efficient electric appliances at your house (or encourage your landlord/property manager)?

I have already switched to electric appliances at my home.

Heating/Cooling (heat pump)	Water Heating (heat pump)	Cooking

I plan to switch to electric appliances this year.

Heating/Cooling (heat pump)	Water Heating (heat pump)	Cooking

I plan to switch to electric appliances within the next 5 years.

Heating/Cooling (heat pump)	Water Heating (heat pump)	Cooking

I plan to switch to electric appliances, but probably not for at least 5 years.

Heating/Cooling (heat pump)	Water Heating (heat pump)	Cooking

I do not plan to switch these electric appliances in the future.

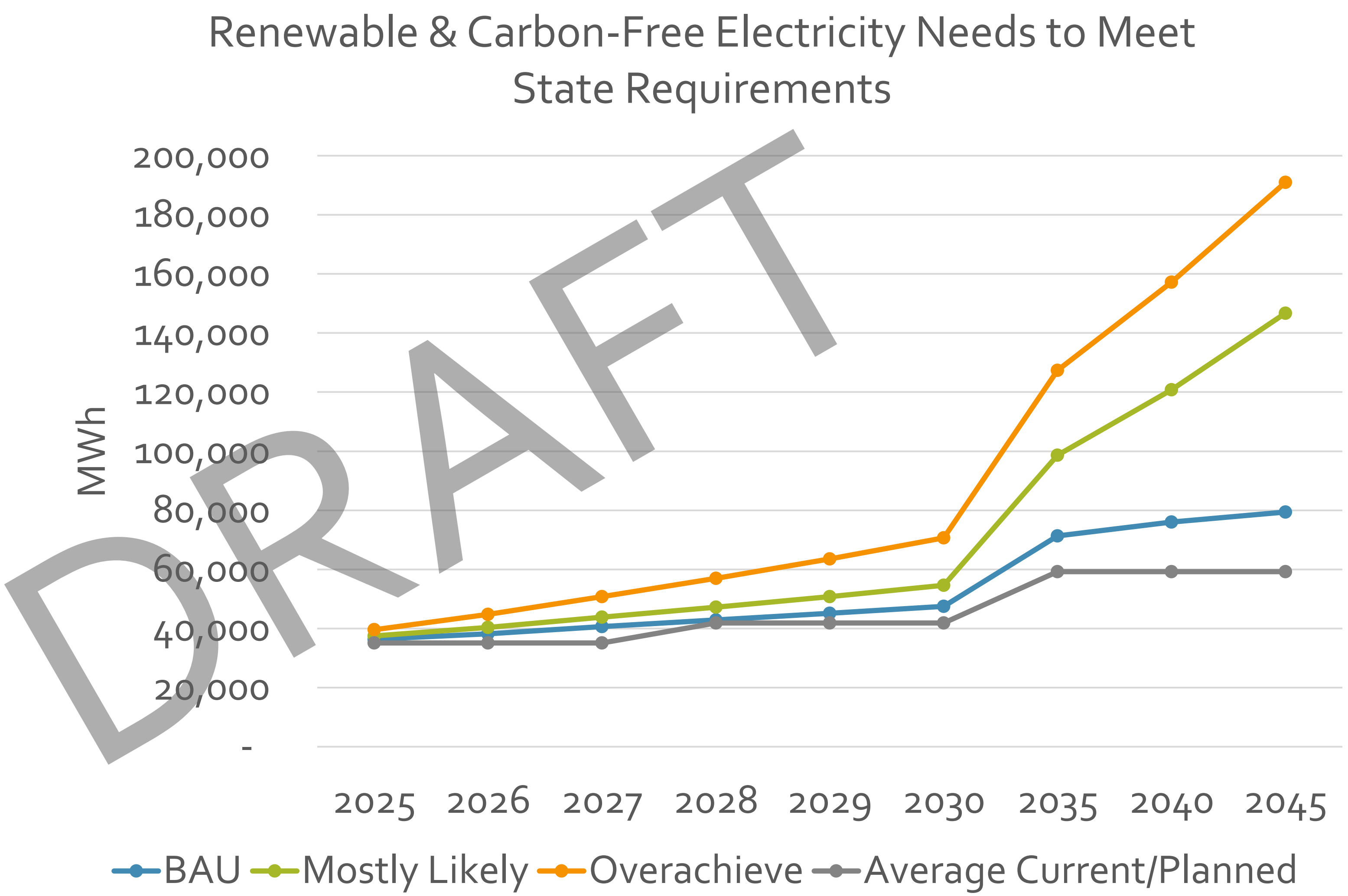
Heating/Cooling (heat pump)	Water Heating (heat pump)	Cooking

I am not sure / I am undecided.

Part 4

Findings and Recommendations

Renewable Energy Needs: *Draft Results*



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

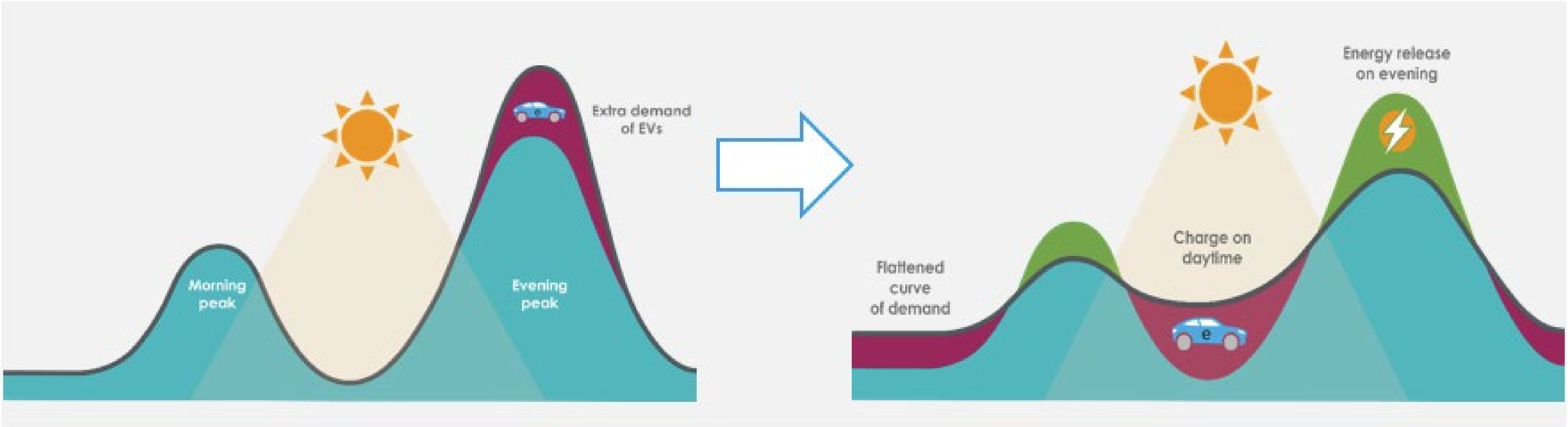
(Chart shows eligible renewables only until 2030, then includes other carbon-free sources to 2045.)

Renewable Energy Needs: *Draft Results*

- 2027: 52% Renewable
  - Sufficient renewables, up to Needing 25,000 MWh additional renewables
  - Likely use historic RECs to meet State compliance
- 2030: 60% Renewable
  - Most Likely need 13,000 MWh
  - New solar project in Southern California to be completed 2028
- 2035: 60% Renewable + 30% Carbon-Free
  - Most Likely need 24,000 MWh of additional renewables
  - Most Likely need 15,500 MWH of additional carbon-free
- Meeting the 2030 requirement would need 29 acres of solar
- Meeting the 2035 requirement ***could*** *need up to* 121 acres of solar, converting Lodi Energy Center gas plant to hydrogen, and doubling average large hydroelectric generation

Potential Cost Implications

- Generation
  - ~$750,000 per acre of solar installation
  - There is increased cost associated with new renewable and carbon-free energy
- Infrastructure
  - Much like the rest of the State, Healdsburg will need to reinvest in its electric distribution system:
    - 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, predicted by long-range energy and peak demand forecasts



How Can We Reduce Grid Impacts?

Energy Demand Model

Findings

Importance of Energy Efficiency

- Energy efficiency reduces electricity demand, especially for heating and cooling.
- Transitioning to high-efficiency electric appliances can significantly lower gross energy consumption.

Impact of Solar

- Solar PV systems can offset electricity demand during daylight hours.
- When paired with battery storage, solar PV systems can be used to reduce peak demands.

EV Charging Behavior

- EV charging behavior significantly impacts peak electricity demand.

Energy Demand Model

Recommendations

Load Smoothing Techniques

What This Means

Reducing fluctuations in electricity demand to maintain consistent grid performance

- **Importance**
  - Mitigates grid overloads during peak hours
  - Improves stability and reliability of electricity system
- **Ways to Do This**
  - Energy Storage Systems
  - Demand Response Programs
  - Smart Grid Technologies
  - Distributed Energy Resources
  - Load Shifting
  - Building Efficiency

Energy Storage Systems

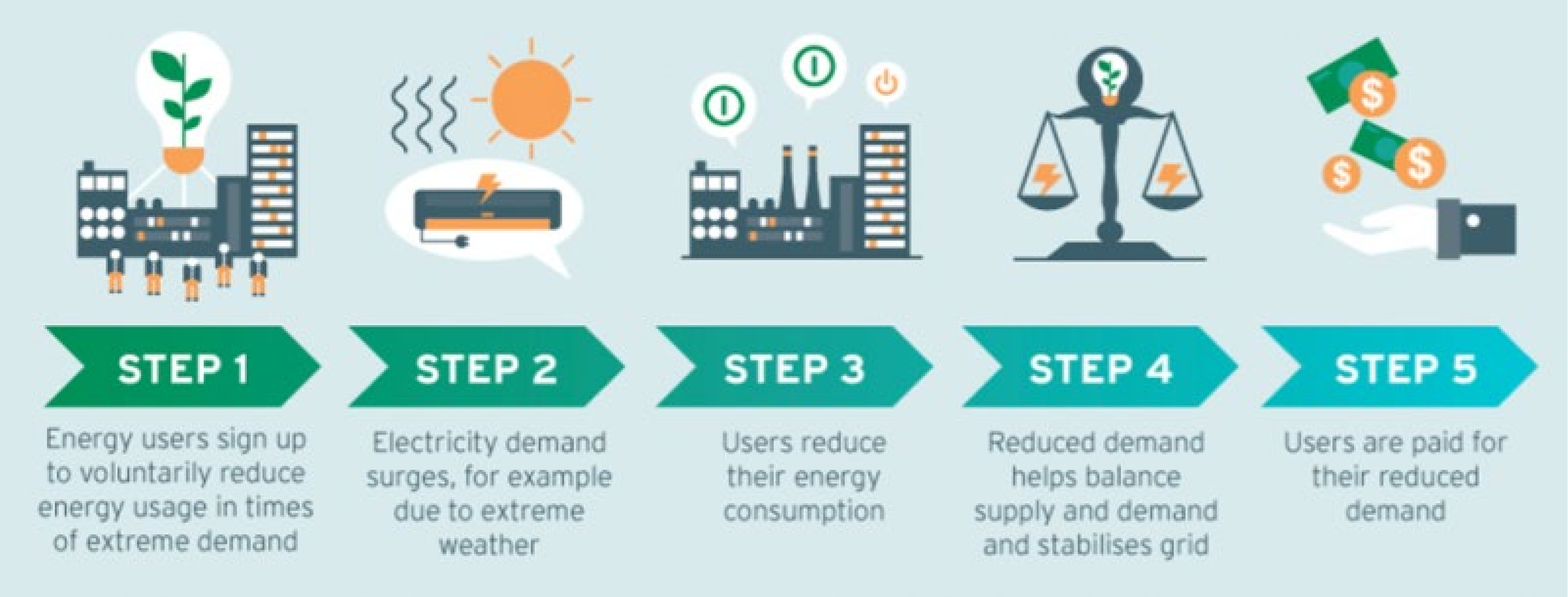
Adding Resilience and Lowering Grid Impacts

Dedicated Home Battery Backup

V2H Charging

Demand Response + Smart Grid Technologies

- Demand response allows utilities to automatically reduce distributed load (e.g., appliances) when peak demand is too high.
- Heat pump water heaters can be programmed to automatically reduces draw during evening, such as between 5-6 PM.
- EV Chargers can be remotely reduced during peak demand hours



Distributed Energy Resources

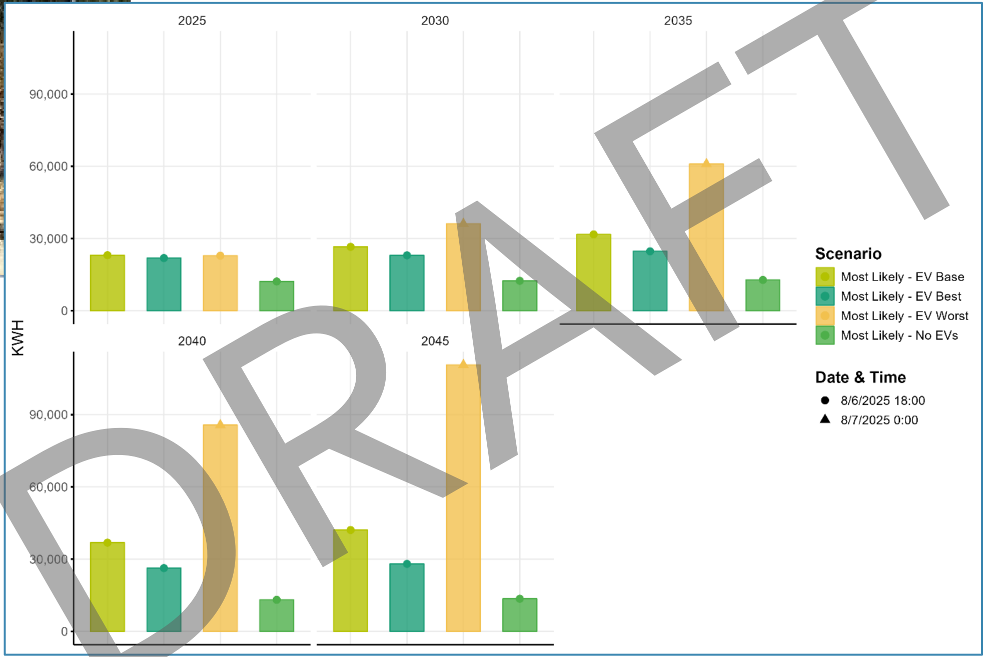
Adding Resilience and Reduces Strain on Grid

Source: Synapse Energy Economics Inc.
Distributed Energy Resources | Synapse Energy

Load Shifting

EV Charging Strategies

- Spread out EV charging across the day
- Workplace charging coincides with high solar availability
- Charge with level I/II whenever possible



Maximum Energy Use (kWh) for Most Likely Future Scenarios

Building Energy Efficiency

High Efficiency HVAC Impacts

High efficiency HVAC compared to standard efficiency heat pump HVAC could save around 1 GWh of annual usage in the Most Likely scenario.

Energy Demand Model

Next Steps

- Healdsburg Electric will Identify Infrastructure and Bulk Electricity Gaps
  - Model can help plan for transmission + distribution upgrades
  - How much more electricity do we need to purchase
  - Continue to meet RPS requirements (renewable and carbon free electricity)
  - Identify policies and programs to reduce peak loads
    - Load management
    - Time of use rates
    - Battery storage
    - Variety of charging options

Discussion / Q&A

Thank you for your time!

conservation@healdsburg.gov
www.SmartLivingHealdsburg.org

CITY OF HEALDSBURG
CALIFORNIA SINCE 1867