Sonoma Clean Power

431 E Street
Santa Rosa, CA 95404

sonomacleanpower.org

Project Title:

Enabling Neighborhood-Scale Electrification in a Disadvantaged Community through Energy System Decarbonization

Client:

Sonoma Clean Power

Sonoma Clean Power Authority (SCP) is the public power provider for Sonoma and Mendocino counties, serving a population of about a half-million. In downtown Santa Rosa, SCP operates a Customer Center to help customers understand bills and learn how to transition to 100% renewable energy for their homes, businesses, and cars. SCP is also the only power provider in California offering 100% 24/7 renewable energy generated purely from within its service territory. SCP is dedicated to expanding our renewable portfolio while advancing energy sector decarbonization and enabling equitable access to clean, renewable, and reliable power for all our customers.

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Project Proposal

Objectives

The proposed case study will evaluate the barriers, needs, impacts, and opportunities associated with the full electrification of a disadvantaged community in Santa Rosa, CA. This includes electrification of all homes, businesses, and vehicles within the selected area. It will also assess necessary changes to infrastructure, such as electrical grid upgrades and decommissioning of localized natural gas distribution lines. This effort will determine optimal scenarios in which neighborhood-scale electrification can be implemented across residential, commercial and relevant industrial sector applications, and evaluate which approaches might provide the most benefits to ratepayers, human health, the climate, and the economy.

The overall goal of this case study is to provide a framework for evaluating full electrification at the neighborhood scale, which can be replicated across California

Supporting objectives for this project may include the following, in order of importance:

- Evaluating the dynamics and interactions between the electrical grid and the natural gas distribution system to better understand the challenge of full-scale neighborhood electrification. (Using data sources 1, 3, 4)
- Identifying viable solutions to grid capacity and natural gas system retirement barriers for the purposes of GHG reduction and management of system costs. (Using data sources 3, 4, 8)
- Assessing the full range of costs and benefits to customers, infrastructure, the economy, the climate, and human health. (Using data sources 2, 5, 6, 7)
- Provide evidence-based research to leverage in future policymaking discussions and/or inform development of Sonoma Clean Power's pilot project. (Using data sources 1-8)

Implications

California is leading the way in the global energy transition, with widespread electrification playing a central role in achieving state and local carbon neutrality targets. However, policy, technical, and logistical barriers are increasingly threatening the low-carbon future envisioned by California's leaders and communities. Additionally, underserved populations are at the most risk of being left behind in this transition and are likely to bear disproportionally high social and financial costs. A just transition to a clean energy future will require transparent and grounded consideration of the decisions, trade-offs, and collaboration required from all stakeholders involved.

Since 2014, SCP has designed and implemented innovative programs intended to turn the tide on the climate crisis. These include free EV chargers, smart thermostats, behavioral demand response, and fuel switching incentives. However, the scale of the challenge will require much more ambitious future efforts from all of California's two dozen community choice aggregators (CCAs). Central among these challenges is full neighborhood electrification. Previous research has explored limited applications for retiring gas infrastructure; this project will significantly expand the scope and depth of the existing knowledge base. And, although other CCAs have analyzed territory-wide decarbonization, we do not believe that any peer efforts have fully probed the interactive effects of electrification on gas and electric systems.

This important research will create new insights, findings, and recommendations in this problem space, and set the stage for SCP to access impending grant funds and begin implementing pilot projects. When completed, this project will also provide a localized model for community-scale

decarbonization that will be used by SCP to inform policymakers, legislators, and energy sector partners. Above all else, this effort will provide the tools to ensure that all communities receive equitable access to the enormous public health, economic, and environmental benefits of a decarbonized economy.

Equity

As California works toward its Senate Bill (SB) 1279 goal of statewide carbon neutrality by 2045, disadvantaged communities are already falling behind. With high existing energy and pollution burdens, a lack of available capital for up-front costs, and more pressing concerns, these communities will need significant support to manage this transition. Additionally, current estimates suggest that annual bills could increase by $400 on average for homes that electrify all end-uses, and older homes tend to be less energy efficient.

Roseland, a community in southwest Santa Rosa, CA, constitutes the city's only designated SB 535 Disadvantaged Community (DAC), with about 6,300 residents, 75% of which are minorities. This area also scores in the top 25% in the state's CalEnviroScreen pollution burden assessment and has a median family income that is 57% that of the larger metropolitan area. The housing stock of a little over 1,100 units is primarily single family and 71% of residents are renters. There are about 290 non-residential customers. The area is a hub for Latino arts and culture and is noted for its Mitote Food Park and annual Cinco De Mayo festival. Of the 5,251 metric tons of CO2e from buildings, 70% is associated with natural gas combustion.

In an all-electric future, these residents will experience better indoor and outdoor air quality, reduced health and safety risk associated with natural gas, and the opportunity to earn financial rewards through CCA demand response programs.

Due to its relatively limited geographic extent, urban setting, and demonstrated equity needs, Roseland represents a unique opportunity to examine the commitment and resources required to implement full neighborhood-scale electrification.

Available data

Sonoma Clean Power will provide the Project Team with multiple data sets and resources, including but not limited to, the following:

1. From SCP: regionalized and aggregated electric grid data: (a) empirical and modeled electric load profiles; (b) electric grid capacity analysis data; (c) geospatial data for our service territory
2. Home electrification project cost analysis and evaluation data from Sonoma Clean Power's Lead Locally Electric Program Investment Charge (EPIC) study report to the California Energy Commission
3. Electric load forecast and gas demand forecast data from the California Energy Commission (CEC)
4. PG&E gas system attribute data and Electric Distribution Grid Capacity Analysis tools (ICA Maps)
5. Bay Area workforce development data for labor standards and prevailing wages
6. Census tract environmental quality and economic data through CalEnviroScreen 4.0
7. Health impact function models for air quality changes through the U.S. Environmental Protection Agency's BenMAP tool
8. Access to rate data and regulatory proceeding filings

Additional data sets and resources may also be requested by the Project Team, which will be evaluated and fulfilled, if necessary and appropriate. SCP protects the privacy and confidentiality of

customer data by aggregating information prior to distribution and removing personal-identifying information. A standardized non-disclosure agreement will be required, contingent upon project selection and the resources utilized in the study. We recognize that non-disclosure agreements have the potential to impede progress, but are confident this requirement will not pose a barrier to achieving the proposed objectives.

Possible approaches

SCP believes this project can be approached through multiple methodological pathways, and we will support preferred methods and narrowed focus with a Project Team if awarded. Sonoma Clean Power believes any of the following to be feasible and effective:

- *GIS mapping or spatial modeling* solving for GHG mitigation, transition costs, and economic outcomes. An initial review could be scaled for the entire service area, with subsequent comparison of the challenges and needs of Roseland compared to other regions within the service territory. Different models solving for optimal: (a) carbon emissions (CO2e) reductions; (b) lowest cost of fuel transition; (c) available circuit-level grid capacity; (d) customer savings/economic valuation; (e) equity considerations. Any resulting data layers could be subsequently overlayed/compared to identify "opportunity zones." (Using data sources 1, 4, 6)
- *A technological feasibility study* evaluating grid and gas system scenarios to identify critical system needs to safely and effectively transition over time. May include evaluation of microgrids, Distributed Energy Resources (DER), transmission and distribution upgrades, and gas system retirement. (Using data sources 1, 2, 3, 4, 8)
- *An econometric and/or socioeconomic model* of technology transition costs and social costs of carbon, and willingness to pay, cultural valuation of technologies, and interest in workforce development, respectively. (Using data sources 5, 6, 7)
- *Policy analysis evaluating the impacts of the multiple rules and regulations* guiding electrification within Sonoma Clean Power service territory. (Using data source 8)

Deliverables

The particular set of deliverables for this project will be determined based on the final scope and approaches used. However, Sonoma Clean Power would like the Project Team to produce a set of policy recommendations (at state, local, and/or federal levels) alongside any combination of barriers and opportunities analysis. Additionally, Sonoma Clean Power requests that the Project Team prepare and present their findings to the internal team, including the Chief Executive Officer, Chief Operating Officer, Director of Programs and Director of Regulatory Affairs. The results of this work could be broadly shareable in the right circumstances, with the potential opportunity to invite the Project Team into additional appropriate venues, provided team members are available and willing.

Internships

Sonoma Clean Power is willing to provide between 1 and 3 part-time paid student internships to the Group Project team during the summer of 2025 (preferably on-site). Interns will be directly supported by SCP. Placements will be made with respect to each individual intern's abilities and interests, with the majority of tasks dedicated toward the successful completion of the Group Project. Students will be supported by dedicated SCP staff mentors to facilitate ongoing progress and professional development.

SUPPORTING MATERIALS

Citations & Reference Materials

[1] B. Speetles, E. Lockhart, and A. Warren, "Virtual Power Plants and Energy Justice," National Renewable Energy Laboratory (NREL), Golden, CO (United States), NREL/TP-7A40-86607, Oct. 2023. doi: 10.2172/2008456.

[2] N. Naval and J. M. Yusta, "Virtual power plant models and electricity markets - A review," Renewable and Sustainable Energy Reviews, vol. 149, p. 111393, Oct. 2021, doi: 10.1016/j.rser.2021.111393.

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[10] K. Sun, P. Kusumah, W. Zhang, M. Wei, and T. Hong, "Exploring Decarbonization and Clean Energy Pathways for Disadvantaged Communities in California," in Proceedings of the 5th International Conference on Building Energy and Environment, L. L. Wang, H. Ge, Z. J. Zhai, D. Qi, M. Ouf, C. Sun, and D. Wang, Eds., Singapore: Springer Nature, 2023, pp. 2515–2525. doi: 10.1007/978-981-19-9822-5_270.

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Sonoma Clean Power

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January 10, 2025

Sean Kerr
Director of Academic Programs
Bren School of Environmental Science & Management
2400 Bren Hall, Rm. 4522
Santa Barbara, CA 93106-5131

Re: Sonoma Clean Power Letter of Support for MESM Group Project Proposal

Dear Director Kerr and MESM Group Project Committee,

Sonoma Clean Power Authority (SCP) is pleased to submit an enthusiastic letter of support for the attached Master of Environmental Science & Management (MESM) Group Project proposal, entitled "*Enabling Neighborhood-Scale Electrification in a Disadvantaged Community through Energy System Decarbonization.*" This proposal has garnered full support within the agency and is submitted with the support of two primary MESM student co-authors, Allison Larko and Isabella Moore, and two additional MESM co-authors, Ryan Stanley and Megan Baker.

SCP is the public power provider for Sonoma and Mendocino counties, serving a population of about a half-million. SCP is dedicated to expanding our renewable portfolio, while advancing energy sector decarbonization and enabling equitable access to clean, affordable and reliable power for all of our customers. SCP believes that this project offers an invaluable opportunity to leverage the skills of MESM students to conduct key electrification research and develop project deliverables critical to the successful decarbonization of the Roseland neighborhood, a Senate Bill (SB) 535 disadvantaged community in Santa Rosa, California. The outputs of this project will enable SCP to identify an implementable framework to support decarbonization within communities facing disproportionate climate risks in times of rising energy costs.

To demonstrate its investment in this project, and to the students dedicating their time and resources to support the proposed objectives, SCP has reserved a comprehensive suite of resources for the Group Project team. These resources include a total of $15,000 in funding, extensive mentorship and professional development opportunities, 1-3 summer internships hosted at SCP's Santa Rosa office, and essential data resources for direct use by the Group Project team.

The following points provide more detailed insights into the resources SCP would commit to the Group Project, if selected:

A. Internships

SCP agrees to support 1-3 paid internships during Summer 2025 in Santa Rosa, California. Details and processes for structuring these internships are as follows:

- Internships will be paid, with up to $11,000 in hourly wages reserved for interns.
- Wages will be paid directly to students at a rate of $22.50 per hour for up to 30 hours a week; no more than 30 hours may be worked by interns within a single week.
- Regular schedules and hours will be decided based upon the following factors:
    - Number of participating interns
    - Duration of internship
    - Number of hours worked per week
- Potential interns will need to undergo a background check and agree to SCP's standardized non-disclosure agreement, which helps protect customer privacy and confidential business interests.
- If Group Project members do not wish to intern with Sonoma Clean Power during Summer 2025, SCP will support that decision and believes that project goals will still be achievable within the Group Project timeline.

B. Organizational Mentorship

- Sonoma Clean Power has identified two senior staff, Scott Salyer (MESM 2012) and Adam Jorge (MESM 2015) to serve as mentors. Both Scott and Adam bring a wealth of career experience, subject matter expertise, and personal understanding of the MESM program that will serve as valuable resources to the Group Project team and any participating interns. Scott and Adam will also provide or facilitate technical support, assistance, and review throughout the Group Project.
- In addition to two staff leads, SCP will facilitate professional networking and career development opportunities throughout the course of the project, based on Group Project team members' interest, engagement, and availability. Additionally, interns will have access to SCP internal events, including technical education events, parties, celebrations, cute dogs, and snacks.

C. Funding

- Sonoma Clean Power has reserved up to $15,000 in total funding to support the Group Project team in its objectives:
    - Up to $11,000 dedicated to wages for paid summer interns, as described in *Internships* section, above.
    - Up to an additional $4,000 in reimbursable expenses for approved training and travel, software licenses and data resources, or other miscellaneous expenses relevant to the project.
        - Any and all reimbursables must be submitted to, and approved by, SCP in advance of payment to qualify for reimbursement by SCP.

D. Data

SCP is a public agency with an obligation to protect customer data. SCP will thereby require a non-disclosure agreement that will be provided to the University for review by its legal team. Any resulting non-disclosure agreement is not intended to constrain the Group Project team's analysis or use of the data, but, instead, is focused on protecting customer privacy, as required by regulation. Sonoma Clean Power agrees to support the acquisition of data for the Group Project, and has identified the following data sets, owned by or otherwise immediately accessible to the agency, which will be provided to the Group Project team:

- Regionalized and aggregated electric grid data
- Empirical and modeled electric load profiles
- Electric grid capacity analysis data
- Geospatial data for our service territory
- PG&E Electric Distribution Grid Capacity Analysis tools (ICA Maps/GRIP)
- Public-facing electrical outage data within PG&E service territory
- Bay Area workforce development data for labor standards and prevailing wages
- Census tract environmental quality and economic data through CalEnviroScreen 4.0
- Sonoma Clean Power aggregated Building Electrification Planning data for emissions, fuel switching projects, load shift projections, and assumptions (see Appendix A)
- Home electrification project cost analysis and evaluation data from Sonoma Clean Power's Lead Locally Electric Program Investment Charge (EPIC) study report to the California Energy Commission

SCP is eager to pursue this collaborative project with the Bren School of Environmental Science and Management. If selected, Sonoma Clean Power agrees to provide the above-stated support to ensure the success of the Group Project team throughout the lifecycle of the project. This work is critical to Sonoma Clean Power's mission, and we eagerly await decisions from the Group Project Committee.

Please do not hesitate to reach out to me or my staff if any questions or concerns arise. Thank you for your time and consideration.

Sincerely,

Mike Koszalka

CHIEF OPERATING OFFICER
Sonoma Clean Power
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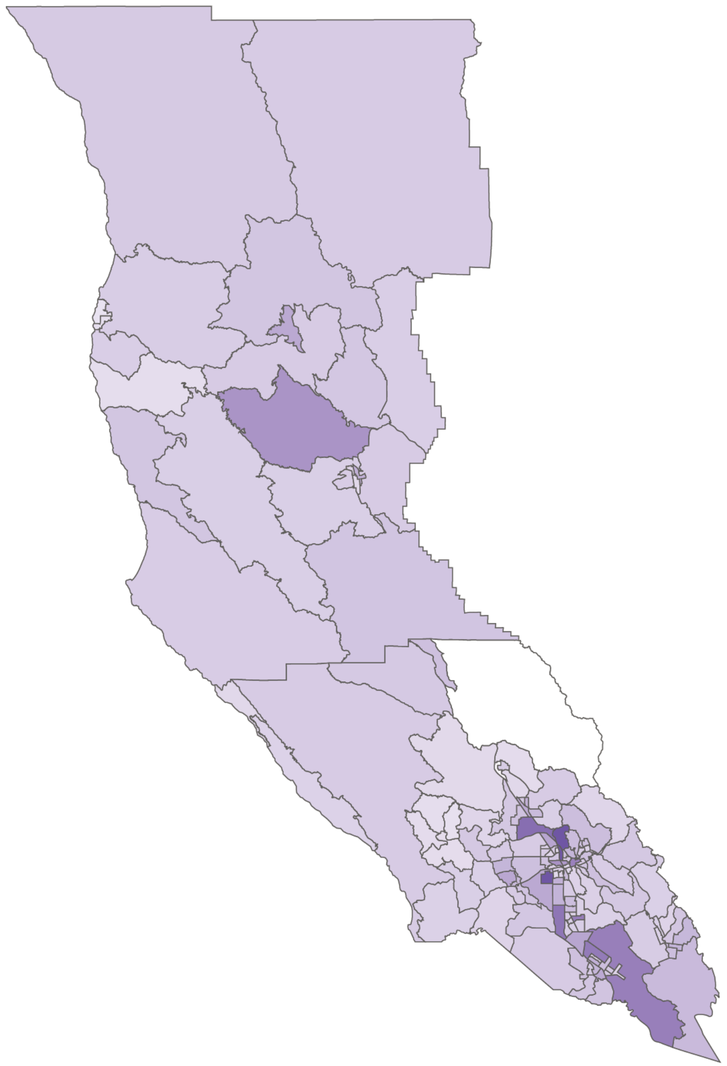
(707) 529-7749

APPENDIX A – Sonoma Clean Power Building Electrification Planning Reports

SCP has provided several Power BI dashboard reports (Appendix A) developed from data and assumptions that can be made available to the Group Project team upon selection. SCP will not provide the Group Project team with customer personal identifying information (PII) or data related to specific customer accounts; all data will be scrubbed or aggregated as necessary to protect PII, and may be used for purposes relevant to the project. SCP supports the use of any data that has been directly provided, and will facilitate its safe and effective use in combination with external data resources.

Building Electrification Planning - Current Emissions

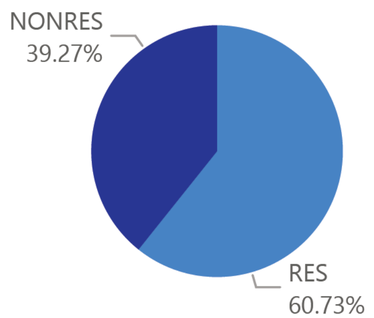
Annual Emissions per Service Point by Census Tract



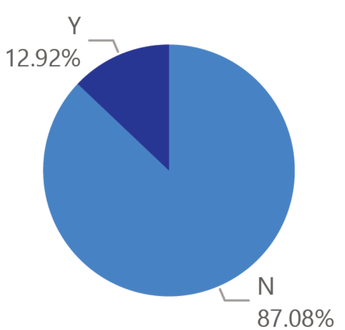
975,109

Annual Emissions (mTonnes)

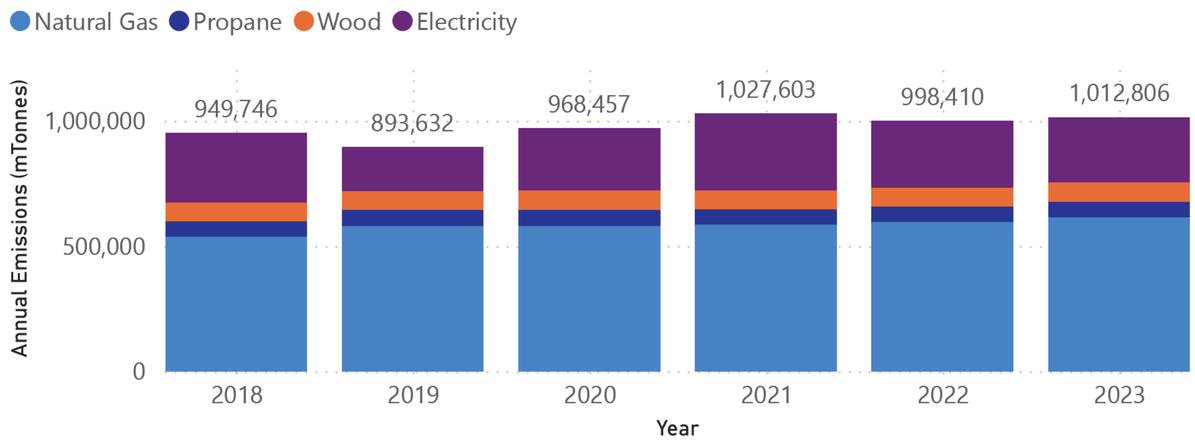
Annual Emissions by Customer Class



Annual Emissions by CARE Enrollment



Annual Emissions by Fuel

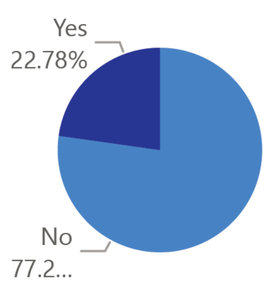


163,920
Gas Meters

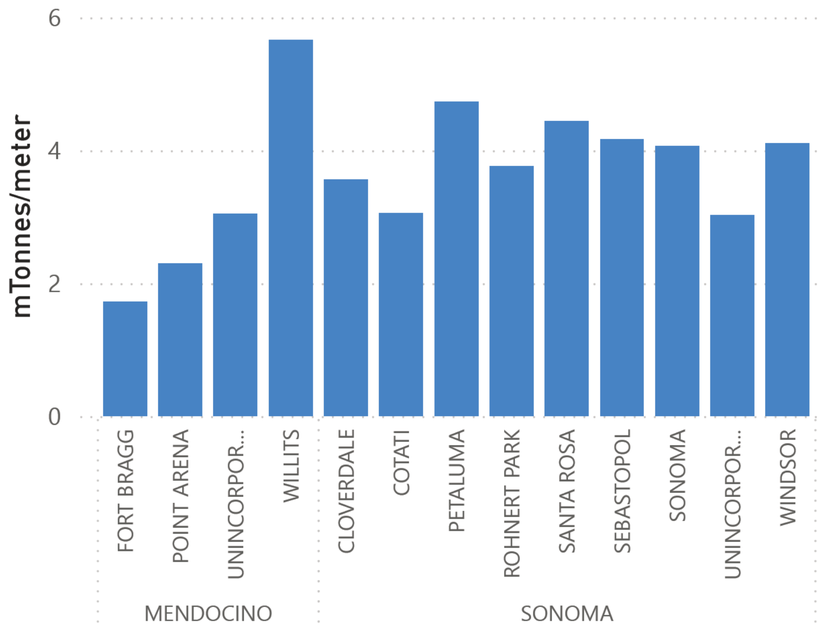
22,536
Est. Propane Meters

16,360
Est. Wood Meters

Electric Heating



Annual Emissions per Service Point



Building Electrification Planning - Residential Projects

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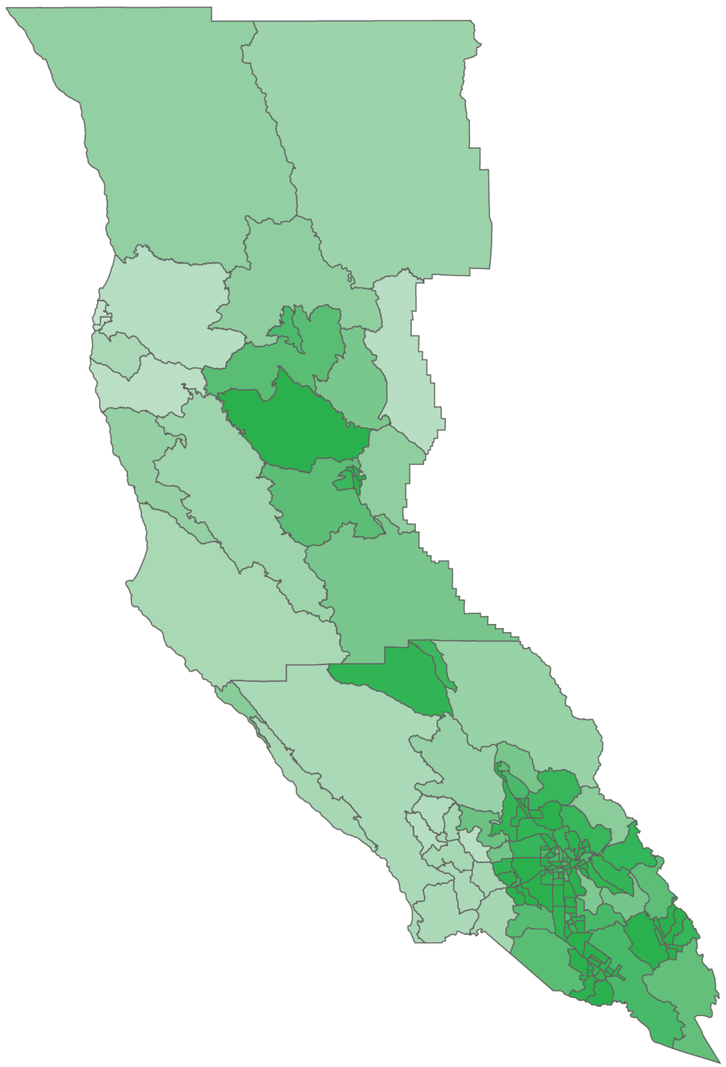
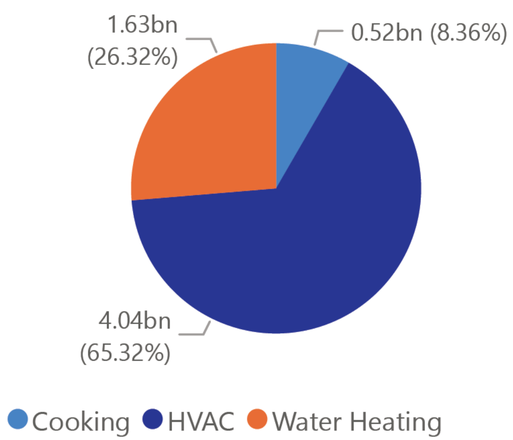
Residential Electrification Cost per Service Location



$6.19bn
Total Install Cost

511,430
Emissions Mitigation (metric tonnes)

Total Install Cost by Project Type



Electrification Project Scope

182,134
Heat Pump HVAC Installs

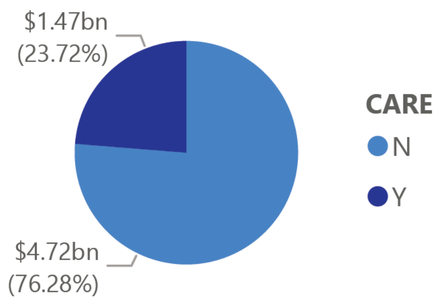
226,258
HPHW Installs

147,938
Cooking Installs

$2,025
Install Cost per Tonne

$27,543
Cost per Electric Meter

Total Install Cost by CARE



New Air Conditioning Capability

67,390
Sites With New Cooling

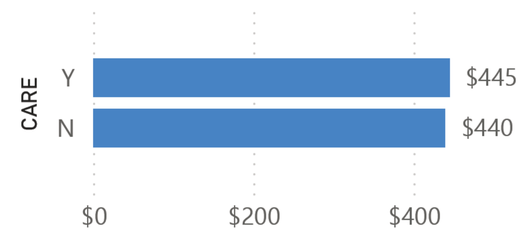
27,765
New Annual Load (MWh)

$9,499,366
Total Annual Bill Impact

802,764
New Annual Load (MWh)

$99M
Total Annual Bill Impact

Annual Bill Impact per Meter



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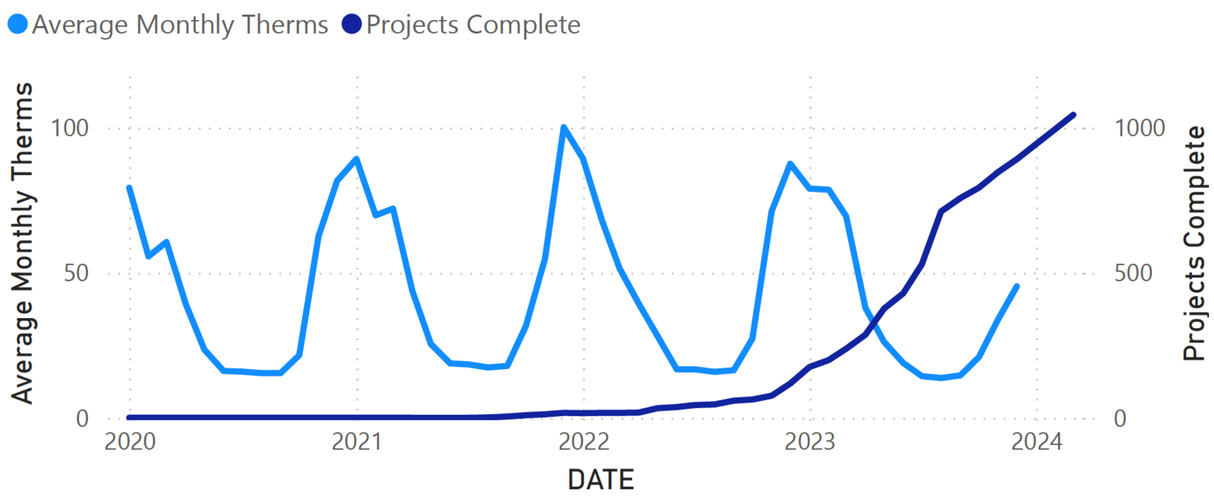
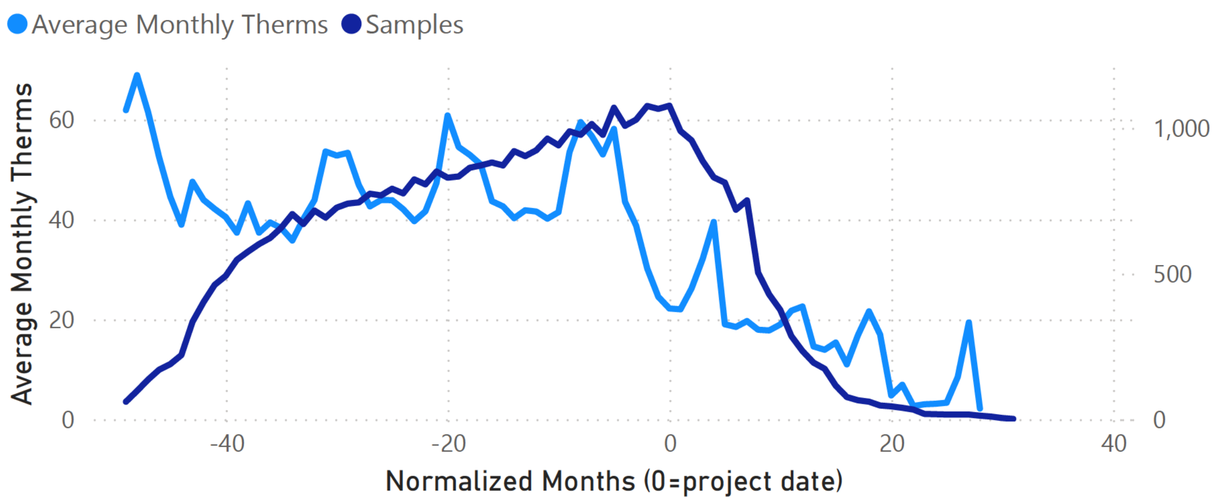
Building Electrification Planning - Tracking Progress

Data from projects receiving SCP rebates for building electrification technologies

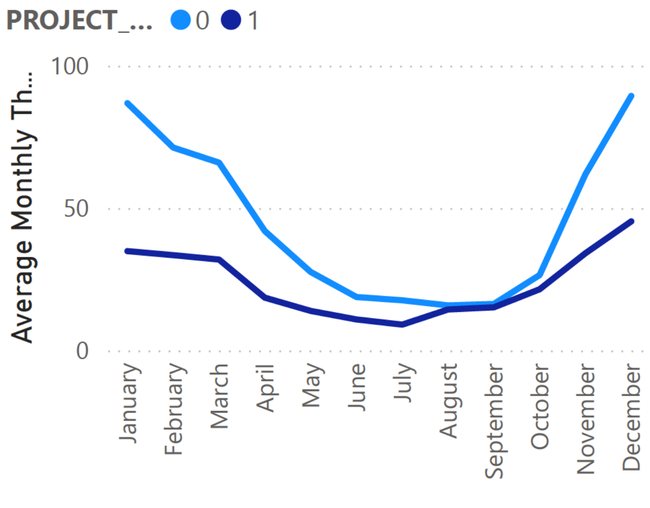
Average Monthly Therms and Projects Complete vs. Date



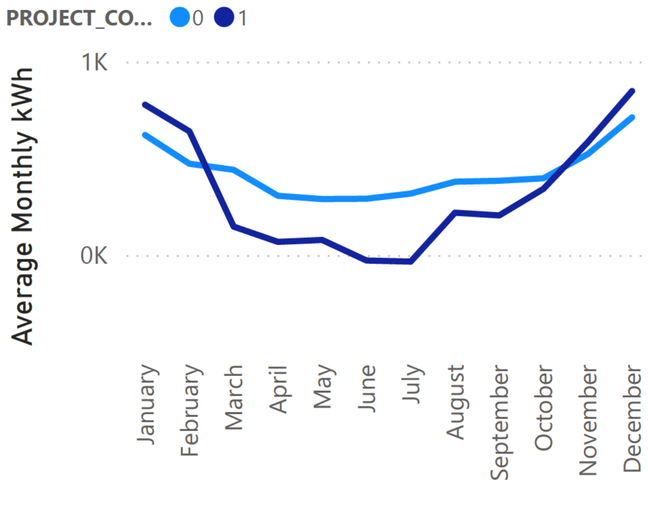
Normalized Monthly Therms vs. Project Date



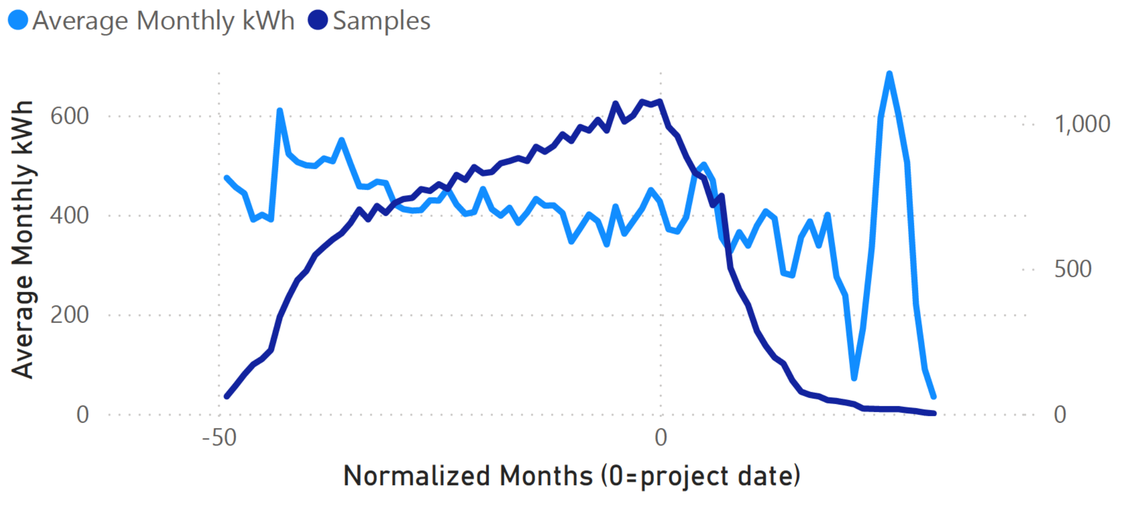
Average Therms by Project Status



Average kWh by Project Status



Normalized Monthly kWh vs. Project Date



Assumptions

Emissions Factors

Natural Gas CO2 Emissions: 0.0053 metric tonnes/therm

Propane CO2 Emissions: 0.235 metric tonnes/barrel / (42 gallons/barrel) / 0.91647 therms/gallon = 0.0061 metric tonnes/therm

Wood CO2 Emissions: 0.0102 metric tonnes/therm

Electricity CO2 Emissions: Uses data from PSD for relevant ESP (DA customers use California grid average)

Emissions impacts assume zero emission electricity

Source: https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references

Wood & Propane Estimates

Wood & propane meters estimated using 2020 Census ACS data on household share by tract and applying to # of residential electric meters

Usage assumed to be equivalent in therms to territory-wide average natural gas usage per residential meter

Project Types

Heat pump HVAC installs based on total residential B_UNITS reported by PG&E (Basic service / no elec heating)

HPHW water heater installs based on following:

- 96.2% of B_UNITS (based on 2019 PG&E RASS results of NG/propane water heating % with a non-electric primary heat source)
- 78.9% of H_UNITS (based on 2019 PG&E RASS results of NG/propane water heating % with an electric primary heat source)
- Comparison: RASS shows 78.9% of water heating from NG/propane in North Coast

Cooktops based on following:

- 62.9% of B_UNITS (based on 2019 PG&E RASS results of NG/propane cooktop % with a non-electric primary heat source)
- 38.8% of H_UNITS (based on 2019 PG&E RASS results of NG/propane cooktop % with an electric primary heat source)
- Comparison: RASS shows 52.7% of cooktops from NG/propane in North Coast

Ovens based on following (FYI only -- using cooktop figures):

- 47.6% of B_UNITS (based on 2019 PG&E RASS results of NG/propane oven % with a non-electric primary heat source)
- 28.7% of H_UNITS (based on 2019 PG&E RASS results of NG/propane oven % with an electric primary heat source)

New HVAC load based on 37.0% of B_UNITS (2019 PG&E RASS results of "NO COOLING" for NG/propane)

Project Costs

Heat pump HVAC - $22,200 (from TECH average for Sonoma & Mendocino Counties)

HPHW - $7,200 (TECH average for Sonoma & Mendocino Counties)

Induction - $3,500 (placeholder)

Electric Consumption Impact

7.4 kWh/therm for HPHW (from TECH Ex Ante estimate for Sonoma & Mendocino Counties)

5.5 kWh/therm for Heat Pump HVAC (from TECH Ex Ante estimate for Sonoma & Mendocino Counties)

29.3 kWh/therm for cooking (energy converstion)

412 kWh/site adder for cooling (based on 2019 RASS for PG&E Climate Zone 2 central air conditioning)