



Rincon Consultants,

449 15th Street, Suite 303
Oakland, California 94612

510-834-445

info@rinconconsultants.co

www.rinconconsultants.com

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Andrea Chow

Sustainability Analyst

City of San Mateo | City Manager's Office

[330 West 20th Avenue, San Mateo, CA 94403](#)

O: (650) 522-7007

**Subject: Analysis Framework Memo incorporating Equity and Effectiveness
Electrify San Mateo | Building for the Future: City of San Mateo Sustainable Buildings
Strategy**

Dear Ms. Chow:

This Analysis Framework Memo outlines the proposed framework for development of the San Mateo Sustainable Buildings Strategy (Sustainable Buildings Strategy) policy pathways and actions. The proposed framework includes:

- **Draft organizational structure** for achieving building electrification goals, which breaks down the Sustainable Buildings Strategy into implementable policies and actions organized by building type
- **Draft electrification co-benefits**, which will be used to drive the project's messaging during outreach and engagement and relate to existing building electrification in general
- **Draft equity criteria** that will guide the development and implementation of the Sustainable Buildings Strategy in an equitable manner
- **Draft effectiveness criteria**, which will ensure the electrification actions are feasible and effective

The contents of this memo are meant to be an initial draft for the City's consideration and feedback. Once further developed, the draft electrification co-benefits, equity criteria, and effectiveness criteria are intended to be shared with the community as part of the project's outreach and engagement effort. Outreach and engagement will solicit feedback to inform expansion, re-development, and finalization of the criteria. The initial list of building decarbonization policy options which is currently under development (ex. time of replacement, indoor air quality requirements, building performance standards, infrastructure pruning etc.) will be screened against the equity and effectiveness criteria in accordance with the organizational structure outlined in this memo.

Electrification Actions Organizational Structure

The Sustainable Buildings Strategy will focus on existing building electrification in both the **residential** and **nonresidential** sectors. To define the structure and vocabulary associated with the Sustainable Buildings Strategy electrification actions up-front, Rincon proposes that the Sustainable Buildings Strategy be organized around specific **policy pathways** and **actions** for both residential and

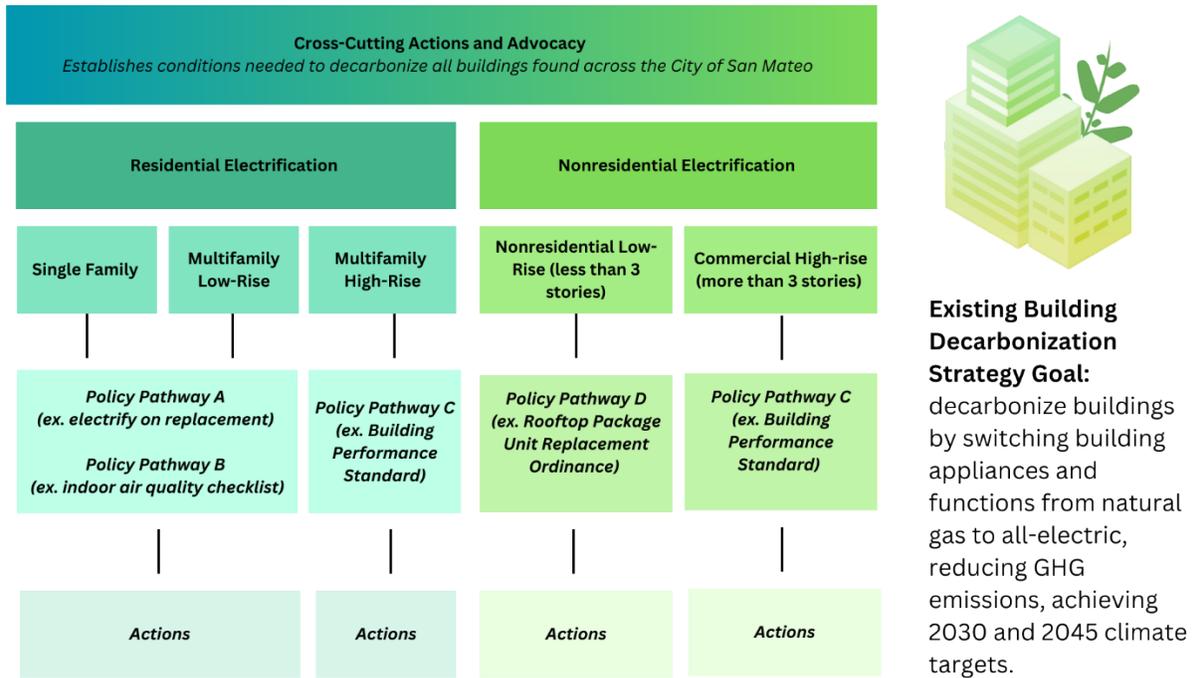


nonresidential buildings since the policy type (electrify on replacement ordinance, electric preferred, voluntary incentives, building performance standards) have the greatest impact on the equity and effectiveness criteria. Residential and nonresidential buildings are further categorized by building size/usage, which can be used as a proxy for equipment types. This categorization is used because building equipment types dictate the specific technical and cost considerations for electrification based on what type of appliance type, or process load is being used in the building. For example, the costs and technical needs of electrifying a single-family home (replacement of all household appliances like hot water heaters, dryers, stoves, with electric technology) versus an industrial kitchen (replacement of commercial gas-powered stoves with all-electric, water heating, etc.) is substantially different, thus requiring different decarbonization strategies.

The structure of the overall strategy will be organized in the following way, and is also described in Figure 1:

- **Cross Cutting or Foundational Actions and Advocacy** are actions that support electrification across sectors and could include education and outreach programs, facilitation of financing options, contractor training, coordination with interested parties, supporting energy security and reliability, and advocacy. These actions span the entire strategy, providing the conditions needed to achieve building decarbonization across all building types.
- **Policy Pathways** identify the high-level policy levers for building electrification that together make up the City’s electrification strategy. Example policy pathways include requiring installation of electric equipment at time-of-replacement, indoor air quality NOx standards or establishing building performance standards.
 - **Policy pathways are organized by building type (residential/nonresidential), and size:** Based on Rincon’s past work with the Cities of Sacramento and Berkeley, building size and equipment type provides an important organizing framework when selecting decarbonization policies. Building size and equipment type can be a useful proxy for characterizing building electrification costs and technical challenges, allowing for the selection of building decarbonization policies tailored to these specific conditions.
 - **Actions** identify the component programs, policies, financial solutions, community engagement, and other commitments that together will make the parent policy pathway equitable and feasible. Each group of actions that support a policy pathway will collectively address the potential hurdles to successful policy implementation: equity impacts, community education gaps, funding gaps, and other specific effectiveness gaps identified during project outreach.

Figure 1: City of San Mateo Sustainable Buildings Strategy Draft Organizational Structure



The organizational structure provides an organized and easily understandable framework for the San Mateo Sustainable Buildings Strategy. Organizing electrification actions in this way will ensure that each policy pathway in the residential and nonresidential sectors are supported by a comprehensive set of concrete, implementable, and specific actions tailored to both building types, and the specific electrification context specific to each one

Electrification Co-Benefits

Electrifying existing buildings is expected to produce many positive outcomes in San Mateo. Communicating these positive outcomes during outreach and engagement requires identification of the important benefits the community will see as a result of the Sustainable Buildings Strategy. These electrification benefits will be refined further in the first stage of outreach in the community engagement strategy. An initial draft list of electrification benefits proposed for the City’s consideration are:

- **Equitable investment in low-income housing & holistic building upgrades:** Housing in low-income areas, frequently lived-in by renters, has been systemically disinvested in through policies like Redlining.¹ Electrification of existing buildings offers an opportunity for the City to catalyze upgrades

¹ Sustainable San Mateo County. Historical Background. <https://sustainablesanmateo.org/home/indicators/2021-key-indicator-report/historical-background/#:~:text=Although%20currently%20illegal%2C%20redlining%20was,neighborhoods%20due%20to%20t heir%20ethnicity.>

to these homes which disproportionately feature poor insulation and higher energy bills, while simultaneously replacing gas-burning appliances with electric and improving the comfort and livability in degraded housing stock. Improvements in building performance and energy efficiency for degraded housing stock may be a prerequisite for low-income households to realize the long-term cost savings associated with all-electric buildings.²

- **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 benzene, nitrogen oxides, sulfur oxides, carbon monoxide, formaldehyde, particular matter and other harmful pollutants that increase the risk of respiratory disease.^{3,4,5,6} Health impacts related to cooking with gas appliances in particular can be serious, but are generally not widely understood by consumers.⁷ Peer reviewed studies have documented that residences with gas stoves have 50 to 400% higher average nitrogen dioxide concentrations than homes with electric stoves.⁸ Living in a home with a gas stove may increase children's risk of asthma by 42%.⁹ Given that Californians spend 70% of a given day indoors,¹⁰ and potentially more given the context of the COVID pandemic, 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

² Equitable Building Decarbonization, Building Energy, Equity, and Power (BEEP) Coalition. ARB. 2022. https://ww2.arb.ca.gov/sites/default/files/2022-03/BEEP%20Letter%20and%20Report_Equitable%20Decarb%20March%202022.pdf

³ 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-airpollution-asthma/docview/2505418593/se-2?accountid=201395>.

⁴ 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>.

⁵ 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>.

⁶ 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/>.

⁷ Nicole, Wendee. (2014). Cooking up Indoor Air Pollution: Emissions from Natural Gas Stoves. *Journal of Environmental Health Perspectives*, 122(1). <https://doi.org/10.1289/ehp.122-A27>.

⁸ U.S. EPA. Integrated Science Assessment (ISA) for Oxides of Nitrogen – Health Criteria (Final Report, Jul 2008). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-08/071, 2008. <https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=194645>.

⁹ Weiwei, L., Brunekreef, B., & Gehring, U. (2013). Meta-analysis of the effects of indoor nitrogen dioxide and gas cooking on asthma and wheeze in children. *International Journal of Epidemiology*, 42(6), 1724–1737. <https://doi.org/10.1093/ije/dyt150>.

¹⁰ 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.

emissions than all in-state power plants combined.¹¹ Outdoor air pollution from buildings has been linked to pre-mature deaths in California.¹²

- **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. Nationwide, gas ignites over 4,000 home structure fires annually, causing on average 40 deaths and \$54 million in property damage each year.¹³
- **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.¹⁴ 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 - \$19 per therm by 2050 depending on how the transition is managed.¹⁵ 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 many people think having gas appliances provides 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. More local solar and 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 heat pump 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 green economy. A UCLA Luskin Center analysis found that a statewide transition to all-electric buildings could support more than 100,000 construction jobs and 4,9000 manufacturing jobs annually for 25 years, driving significant increases in employment in the electricity industry.¹⁶

¹¹ California Air Resources Board. 2016 SIP Emission Projection Data: 2012 Estimated Annual Average Emissions. <https://www.arb.ca.gov/ei/emissiondata.htm>

¹² 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.

¹³ 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>.

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

¹⁵ Gridworks. (2019). California's Gas System in Transition: Equitable, Affordable, Decarbonized and Smaller. https://gridworks.org/wp-content/uploads/2019/09/CA_Gas_System_in_Transition.pdf

¹⁶ UCLA Luskin Center. 2019. <https://innovation.luskin.ucla.edu/2019/11/13/move-to-all-electric-buildings-will-trigger-significant-demand-for-skilled-workers/>

- **Greenhouse Gas Reduction:** Gas usage in buildings (including upstream and end use methane leakage) accounted for 31% of the City of San Mateo’s greenhouse gas (GHG) emissions in 2019.¹⁷ The proportion of emissions coming from gas is projected to increase through 2030 and 2045 as emissions from electricity decline, and eventually reach zero due to State targets to provide 100% carbon-free electricity to by 2045.¹⁸ This means that any appliance converted from gas to electric will have GHG-free operations by 2045. Peninsula Clean Energy (PCE) already provides the vast majority of the City’s electricity for commercial and residential customers, with a goal of providing 100% renewable energy to match demand (‘24/7 renewable energy’) by 2025.¹⁹ Electrifying existing buildings, reducing GHG emissions produced by natural gas use in buildings, will be critical in achieving the GHG reduction targets set by San Mateo’s CAP, which aim for an emissions reduction of 40% below 1990 levels by 2030 and 85% below 1990 levels by 2045, consistent with the state’s goals.

Equity Criteria

City of San Mateo’s Understanding of Equity

The Equity Criteria drafted here builds off the work done by the City of San Mateo’s Diversity, Equity, and Inclusion Committee, and draws inspiration from equity work conducted in conjunction with its housing element from 2022, the DEI Strategic Framework Report, and City Council resolution work. The local understanding of equity includes:

- Promote infill development and socioeconomic equity, protect environmental and agricultural resources, encourage efficient development patterns and achieving greenhouse gas emissions reduction targets (Statutory Framework, Lets Talk Housing, San Mateo County, 2021)²⁰
- The City of San Mateo defines equity as “Fair treatment, access, opportunity, and advancement for all people. To create conditions that allow all to reach their full potential. One’s identity cannot predict the outcome.” (DEI Committee)²¹
- Housing element feedback from 2022 includes highest equity priorities for San Mateo to focus on included prevention of evictions, support for houselessness, and more education and programmatic support for low-income residents²².
- The DEI Strategic Framework includes a goal to “Proactively address inequity by undoing all forms of systemic or environmental bias, discrimination, and harassment, which impact quality of life.” (DEI Strategic Framework)

¹⁷ 2019 RICAPS GHG Inventory Update

¹⁸ [https://www.energy.ca.gov/sb100#:~:text=Senate%20Bill%20\(SB\)%20100%20established,end%2Duse%20customers%20by%202045.](https://www.energy.ca.gov/sb100#:~:text=Senate%20Bill%20(SB)%20100%20established,end%2Duse%20customers%20by%202045.)

¹⁹ <https://www.peninsulacleanenergy.com/power-mix/>

²⁰ <https://www.cityofsanmateo.org/DocumentCenter/View/85088/Lets-Talk-Housing---All-About-RHNA-4-21-2021---Presentation-Slides?bidId=>

²¹ <https://www.cityofsanmateo.org/DocumentCenter/View/90987/DEI-Strategic-Plan>

²² <https://www.cityofsanmateo.org/DocumentCenter/View/86889/Fair-Housing-Workshop-Discussion-and-Poll-Summary-from-1-13-2022?bidId=>



The City of San Mateo has taken strong stances through two Council Resolutions denouncing stigmatization of hateful racism and xenophobia, and declarations of black lives matter in 2020. However, there is no current sustainability-focused definition of Equity in relation to building electrification.

Defining Equity in Building Electrification

The concept of **Energy Equity** recognizes that disadvantaged communities have been historically marginalized and overburdened by pollution, underinvestment in clean energy infrastructure, and lack of access to energy efficient housing and transportation (Department of Energy, Office of Energy Efficiency and Renewable Energy)²³. The initial draft of the equity criteria proposed for the Sustainable Buildings Strategy for the City's consideration are included below and draw primarily off existing resources like the Department of Energy Rocky Mountain Institute, and Greenlining Institute. These equity criteria should be updated based on feedback gained through community outreach and engagement, especially with feedback from renters, disadvantaged communities, and small local businesses. Every policy pathway included in the Sustainable Buildings Strategy should incorporate the following equity criteria:

- **Ensure Equitable Access to Health, Safety, and Comfort Benefits:** Ensure renters²⁴ and environmental justice communities have equitable access to the health, safety, and comfort benefits from building electrification, like improved indoor air quality and cooling for hot days. This means prioritizing electrification of lower income homes, even though electrifying lower income homes may require preliminary, and potentially more complex, energy efficiency and electrical upgrades due to the legacies of decades of racist housing policy and disinvestment reflected in housing stock in the City.²⁵
- **Encourage Concurrent Housing Condition Improvements:** Ensure that low-income communities have equitable access to solar installation, energy efficiency, building envelope upgrades, and lead

²³ <https://www.energy.gov/eere/energy-equity-and-environmental-justice>

²⁴ It is expected that renters will need financial support for access to high-quality upgrades and the benefits of electrification due to the “split incentive” issue of building electrification in rental units. The split incentive between property owners and renters refers to the issue that renters may want to experience the benefits of electrification but do not own the building and therefore, may not experience the benefits of electrifying long term and have reduced incentive to electrify. On the other hand, because property owners will not experience the benefits of electrification themselves, they also have reduced incentive to electrify.

²⁵ **Rocky Mountain Institute. Oct 2021. Decarbonizing Homes: Improving Health in Low-Income Communities through Beneficial Electrification.** Because of decades of discriminatory housing practices and disinvestment (ex. Redlining), low-income, and BIPOC (Black, Indigenous, People of Color) populations disproportionately experience lack of secure housing tenure, proportionately lower rates of home ownership, and poor-quality housing that introduces poor ventilation, pests, moisture, water, and higher energy bills. For these reasons, degraded housing stock, and its disproportionate overlap with low-income and BIPOC residents, may be considered ‘difficult to electrify’. Electrification upgrades for degraded housing stock may be more ‘difficult’ for degraded and disinvested housing stock as they may first require holistic building upgrades to high-performance building envelopes, panel upgrades, and ventilation upgrades that newer, invested housing stock does not require. Without these efficiency upgrades, energy bills could be proportionately more expensive, increasing the cost of energy to run appliances for households that are already energy burdened.

and asbestos abatement at the time that electrification retrofits occur. Electrification of a building provides opportunities for other whole-building improvements that may come with additional up-front costs but would otherwise be more expensive to implement separately. These opportunities for concurrent whole-building improvements should be financially accessible for low-income populations.

- **Advance Energy Equity:** Ensure that building electrification supports access to affordable energy for all community members, especially disadvantaged communities, renters, and small businesses. This includes affordable utility bills, equitable access to funding and financing mechanisms for electrification, and the agency to avoid increasing future natural gas prices.
- **Support High-Road Job Opportunities:** Ensure disadvantaged communities have access to fairly paid high-road training and job opportunities as a result of the increased need for an electrification-trained workforce.
- **Maximize Ease of Installation:** Ensure that incentives and programs for the community create meaningful support for renters and disadvantaged communities and include a simple process that minimizes the burdens and impacts associated with the installation of high-quality electric equipment.
- **Promote Affordable Housing and Prevent Renter Displacement:** Ensure electrification upgrades do not displace renters, result in increased rents, or overburden homeowners. Programs should support housing production, housing preservation, and tenant protection. Programs should also protect against the displacement of small local businesses and organizations.

Effectiveness Criteria

In addition to being equitable, the Sustainable Buildings Strategy must be effective. Broader “effectiveness criteria” are used in addition to the equity criteria to ensure that the benefits of electrification are fully realized and do not come at the cost of other City priorities and projects and do not harm residents and business owners. These criteria or goals should also align with feedback from the community. Similar to the application of the equity criteria, policy pathways and their associated actions will be evaluated against the effectiveness criteria to identify and prevent gaps in the electrification approach. Each policy pathway should include at least one action that directly addresses each of the effectiveness criteria. The initial draft of the community goals proposed for the Sustainable Buildings Strategy for the City’s consideration are:

- **Cost-effective:** Ensure that costs associated with new requirements are minimized or offset through funding and financing strategies for residents and business owners and efficiently use limited City, PCE, and other resources.
- **Feasible:** Ensure that electrification policies effectively reflect the most up-to-date electrification practices and regulatory requirements, considering long-term legal viability and thus; enforceability by the City
- **Measurable and Sustained Impact:** Ensure that electrification policies are impactful and enforceable and will provide evidence-based results of greenhouse gas emission reduction over the long-term.
- **Reliable:** Ensure that energy security and reliability are preserved or improved throughout the community in the long-term.



- **Enforceable:** allowing for continued City monitoring and enforcement of selected electrification policy

Conclusion and Next Steps

As part of the analysis framework development process, Rincon requests that the City of San Mateo review the proposed draft framework to identify changes or additions that should be made to meet the needs of the community. Updates to the electrification co-benefits, equity, and effectiveness criteria will be shared during future community engagement events and efforts associated with development of the Sustainable Buildings Strategy, and community feedback on the effectiveness criteria will be requested as part of that effort. Upon receipt of community feedback, the effectiveness criteria will be finalized and utilized to evaluate, modify, and improve the equity and effectiveness of the initiatives and actions to be included in the Sustainable Buildings Strategy.