Berkeley Public Policy
The Goldman School

Funding and Financing the Electrification of Low- and Moderate-Income Residential Buildings in the City of Alameda

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Executive Summary

The City of Alameda is currently considering policy and financing options for electrifying its existing building stock, with a focus on low-to-moderate income residential buildings. U.C. Berkeley Goldman School of Public Policy students have analyzed new funding and financing strategies, sourced from case studies and additional levers within the City's jurisdiction. The strategies identified and analyzed include: vetting and leveraging existing federal, state, and local funding programs and opportunities; supporting tariffed on-bill financing solutions in partnership with Alameda Municipal Power (AMP); and raising and deploying new capital, funding, and financing through municipal tax and bond measures. After evaluating these financing options against effectiveness, efficiency, and political and implementation feasibility criteria, this analysis recommends the following for the City of Alameda:

<u>Immediate Next Steps:</u>

- Continue renter protection and capital improvement engagements, to solve for rental property access and anti-displacement needs.
- Amplify and support applications to existing state and federal household-level funding opportunities, including Alameda Municipal Power's existing rebates, California's Self-Generation Incentive Program, and the California TECH program incentives.
- Apply to city-level grants and funding sources, including the California TECH Quick Start grants, the Cool City Challenge, the California IBanks Climate Tech Finance Loan Program, and federal Low Income Home Energy Assistance Program and Weatherization Assistance Program.
- Continue to assess tariffed on-bill programs to understand the technical and administrative feasibility of updating AMP's billing system if the tariff program proves feasible down the road.
- Continue to assess partnership with BlocPower as a potential implementation and deployment partner, as a promising private financier and partner in driving low-cost retrofits at scale.

<u>High Priority Near-Term:</u>

- Implement Utility User Tax, or similar, with needed exceptions to generate new climate-focused City revenue, within the existing political approval and feasibility of the City Council.
- Assess and deploy bond measures, focused first on General Obligation bonds that can be issued immediately with existing bonding authority.
- If feasible, implement BlocPower pilot project.

<u>Lower Priority Long-Term</u>

- Consider other tax measures, pending political feasibility
- Consider additional bond measures, pending political feasibility, including through a potential green bond certification program.
- If feasible, support implementing a tariffed on-bill program with Alameda Municipal Power.

Using this strategy, Alameda can rapidly and equitably fund and finance building decarbonization for its most vulnerable community members.

Part 1: Defining the Problem

The City does not yet have a strong understanding for what the highest priority, highest impact funding and financing strategies should be to drive electrification retrofits for existing low- and moderate-income (LMI) households. This forthcoming analysis will aim to highlight the highest priority funding and financing strategies for the City, to inform its forthcoming equitable existing buildings energy efficiency and electrification roadmap. The analysis focuses on low- and moderate-income Alameda residents, in particular renters in multifamily buildings, as both the hardest-to-electrify and finance sector for building electrification.

Meeting the City of Alameda's Action and Resiliency Plan Goals

In 2019, the City of Alameda released an ambitious Climate Action and Resiliency Plan (CARP). Alameda set a goal of reducing emissions by 50% below 2005 levels by 2030 and becoming carbon neutral as soon as possible.[1] The strategy includes many tactics, including electrifying transportation, encouraging and supporting public transit, investing in a resilient electrical distribution grid, moving toward zero waste, investing in carbon sequestration, and more. One of the most important components, though, is building electrification, as residential buildings represent a significant GHG reduction opportunity for the City. Natural gas consumption in buildings is responsible for about 30% of the City's greenhouse gas (GHG) emissions. The 2021 Climate Action and Resilience Plan Annual Report outlines 15 priorities for the City of Alameda, the first of which is to "develop an equitable existing buildings energy efficiency and electrification roadmap".[2] The plan also includes goals of encouraging building owners to seismically retrofit residential buildings and vetting and considering applying for the Cool City Challenge, geared to support transportation and building decarbonization.[3]

In May 2021, Master of Public Policy candidates at the Goldman School of Public Policy prepared an analysis of existing residential building decarbonization strategies for Community Action for Sustainable Alameda (CASA) and the City of Alameda.[4] This guide outlined "over twenty actions that building owners can take to either electrify or weatherize their building" along with case studies for citywide decarbonization efforts. In addition to evaluating "points of intervention" when a city or building owners can deploy these actions, this analysis describes building decarbonization financing mechanisms. However, further action is needed to analyze each financing option: effectiveness and challenges for different mechanisms; potential cost impact on consumers, especially low-income consumers and tenants; revenues to the City or AMP; staff resource needs; and barriers to implementation.

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[1] City of Alameda. 2019. "Alameda Climate Action and Resiliency Plan (CARP)".

[2] City of Alameda. 2021. "Climate Action and Resiliency Plan (CARP) 2021 Annual Report."

[3] "Cool City Challenge – Empowering Cities to Become Carbon Neutral by 2030." n.d. Accessed May 3, 2022. https://coolcity.earth/.

[4] Choi, Youngsun, Jane Sadler, and Zachary Zimmerman. (2021). Electrifying Existing Residential Buildings in Alameda. *Communities for A Sustainable Alameda*, May. http://casa-alameda.org/wp-content/uploads/2021/06/FINAL-Electrifying-Exsting-Residential-Buildings-in-Alameda-.pdf.

Policy Objectives and Research Methodology

Methodologically, the research and analysis in this report is informed by review of the growing body of case studies analysis and best practices literature on the topics of building electrification, building energy retrofits, anti-displacement measures, municipal green financing policy, and more. The research team also conducted phone interviews and had written correspondence throughout the process with 13 leading thought leaders and organizations in the space, ranging from nonprofit advocacy organizations to program implementers and contractors, to other municipal utilities, to new innovative technology and financing companies.

The strategies considered were sourced and informed by this process, and include: vetting and leveraging existing federal, state, and local funding programs and opportunities; supporting residential electrification through tariffed on-bill financing solutions, in partnership with Alameda Municipal Power (AMP); and raising and deploying new capital, funding, and financing through municipal tax and bond measures.

This analysis aims to identify the building electrification funding and financing mechanism(s) that will drive the highest number of electrification retrofits for multifamily properties and low- and moderate-income households, while prioritizing equity, affordability, and additional implementation and criteria specific to the landscape in the City of Alameda. The report analyzes the potential trade-offs and considerations for each potential strategy and provides both near and long-term recommendations for meeting City climate goals. The report also includes a subsequent review of opportunities to leverage the recommended funding and financing mechanisms to simultaneously advance EV charging infrastructure deployment, seismic retrofits, and energy efficiency upgrades.

The subsequent sections cover the costs and benefits of building electrification, compared with cost of inaction, as a guidepost for informing the City's funding and financing strategies.

Part 2: The Costs and Benefits of Electrifying Alameda's Low- and Moderate-Income Households

Overview: Evaluating Proactive Electrification vs. Inaction

This report acknowledges that the City of Alameda has identified the benefits of electrification and is committed to electrifying residential buildings as a key pillar in reaching carbon neutrality. The below table outlines the ways in which the very high costs of inaction on building electrification outweigh the costs of a proactive electrification strategy. Those costs of inaction increase and are exacerbated over time, making proactive strategies to electrify increasingly critical.

	Proactive Electrification Scenario	Inaction (Status Quo)
Costs	The costs of electrification retrofits include the cost of the appliance upgrades, panel upgrades, and other building retrofit needs. These are captured below in the "Alameda Building Stock and Retrofit Cost Analysis".	The cost of inaction is the cost of NOT proactively electrifying low- and moderate-income households. This includes: rising gas utility bills and energy burden, negative health impacts, exacerbating climate change, long-term displacement, and not meeting state and city GHG targets. These are captured below in the "Benefits" sections, as avoided costs.
Benefits	The benefits of electrification include: utility bill savings, improved health outcomes, greenhouse gas emission reduction, long-term avoided displacement, and efficiently meeting state and city GHG targets. These are captured below in the "Benefits" sections.	The benefits of inaction include: avoided risks of near-term displacement and rent increases (in the case that building electrification programs are not designed well, and could result in these two outcomes), and the ability for the City to retain funding for other programs.

Cost of Electrification: Alameda Building Stock and Retrofit Cost Analysis

In Alameda, of 18,868 total buildings, 93% are residential, and approximately 14% of residential buildings are multifamily. Despite being a small percentage, that 14% of residential buildings represents 14,697 total units[5]. Among the residential building stock, 70% of the buildings were built before 1978 (meaning they have the most to gain from electrification in terms of overall efficiency), and most are currently served by both electric and gas service. Statewide, nearly 80% of current homes in California are connected to the natural gas system, and the City of Alameda staff estimates that close to 100% of existing residential buildings in their territory are connected to the gas system.[6] Electric service is provided by Alameda Municipal Power (AMP), which already delivers electricity spruced from 100% clean energy. Gas service is provided by PG&E.[7] Building on AMP's clean energy achievements to date, delivering a 100% clean electricity mix to customers, there are still very low rates of fuel-switching within existing buildings, at approximately 1% of appliances each year.[8]

The Building Electrification Institute (BEI) draft report for the City of Berkeley is a representative case study to estimate the total cost of the City of Alameda's building decarbonization and electrification plans.[9] The BEI report demonstrates a recommended methodology and estimate of total costs. It is then possible to generate an estimated total decarbonization and electrification cost analysis for low income and low-to-moderate income buildings by applying the available data for Alameda's building stock. This

[5] Choi, Y., Sadler, J., & Zimmerman, Z. (2021). Electrifying Existing Residential Buildings in Alameda.

[6] Aas, et al. 2020. "The Challenge of Retail Gas in California's Low-Carbon Future."

[7] Choi, Y., Sadler, J., & Zimmerman, Z. (2021).

[8] City of Alameda. 2021. "Climate Action and Resiliency Plan (CARP) 2021 Annual Report."

[9] Bridgers, B., Campbell-Orrock, C., Makous, D., Neely, B., & Romain, B. (2022). *Choose Your Own Adventure: Funding the Decarbonization of Under-resourced Residential Buildings*.

estimate is intended to provide a foundation for future cost analysis work as well as inform the final financing recommendations for the City of Alameda.

Case Study: City of Berkeley Residential Building Decarbonization Costs

The Building Electrification Institute (BEI) and Firefly Energy Consulting partnered with the City of Berkeley to conduct a gross cost analysis to decarbonize all of Berkeley's residential buildings (about thirty-five thousand buildings in total). Gross costs are calculated without any financial incentives or subsidies, and include five scenarios across five building typologies shown below in Figure 1. All numbers below are pulled from ongoing and internal research by BEI and Firefly Energy Consulting, relayed in an April 2022 interview.

Figure 1: Total gross costs ($ in millions) by category and residential building type

	Single-Family	Duplexes	3-4 Unit Buildings	Low Rise MFB	Mid Rise MFB	Total
Electrification	$507	$186	$184	$362	$90	$1,330
Energy Efficiency	$83	$33	$30	$49	$16	$212
Health & Safety	$80	$47	$50	$86	$22	$285
Knob and Tube	$63	$36	$49	$68	$14	$230
Panel Replacement	$55	$34	$33	$67	$17	$207
Total	**$788**	**$336**	**$346**	**633**	**160**	**2,264**

Source: Building Electrification Initiative and Firefly Energy Consulting. Interview regarding ongoing and internal research. May 2022.

The total gross cost for all building types by category is almost $2.3 billion in 2022 dollars. "The costs to electrify buildings are the largest category by far, representing 59% of the total, or $1.3 billion, even after incorporating anticipated modest decreases in capital costs for electrification technologies."

Once incentive funding to support building decarbonization and energy efficiency is factored in, BEI and Firefly Energy Consulting generated an average gap in funding by housing unit. Incentives amount to approximately $12,000 per building based on available local, state, and federal funding. After incentives are deducted from estimated costs, the average gap in funding by housing unit is $25,868.

Finally, the BEI and Firefly Energy Consulting research applied this funding gap formula to generate a net cost analysis for low- and moderate-income Berkeley buildings. Low- and moderate-income represents any household under 80% of the Area Median Income and may require financial assistance to electrify their homes, given the soaring cost of living in the Bay Area. (In Berkeley, this reflects an annual income of less than $109,600 for a family of four). Moderate-income households (those that fall below 80% of

Area Median Income and above 200% of the Federal Poverty Line) face a slightly higher funding gap (on average almost $30,000 per unit) than low-income or market rate buildings in that they have the same costs as low-income buildings, but only have access to incentives that are geared for market rate buildings. Low-income residents include only those households that are under 200% of the federal poverty line.

Figure 2: Estimate of low- and moderate-income households in Berkeley by building type

Building Type	# of Buildings	LMI %	LI %	Gap - LMI not served by LI programs
Single-Family Homes	16,156	44%	8%	36%
2 Unit Multi-Family	5,013	69%	18%	51%
3-4 Unit Multi-Family	3,246	83%	23%	60%
Low Rise 5+ Unit Multi-Family	2,476	84%	33%	51%
Mid Rise 5+ Unit Multi-Family	182	85%	60%	25%

Source: Building Electrification Initiative and Firefly Energy Consulting. Interview regarding ongoing and internal research. May 2022.

As indicated in Figure 3 below, the total additional funding needed to support decarbonizing low- and moderate-income residential buildings in Berkeley equates to $1.2 billion over the next 20 to 30 years. This same analytical framework is used to calculate a total decarbonization cost for the City of Alameda.

Figure 3: Total additional funding needed to support low- and moderate-income residential buildings in Berkeley ($ in millions)

Building Type	LI Buildings	LMI Buildings above 200% FPL	Total
Single-Family Homes	$50.0	$261.8	$311.8
2 Unit Multi-Family	$40.8	$127.5	$168.3
3-4 Unit Multi-Family	$57.6	$151.1	$208.7
Low Rise 5+ Unit Multi-Family	$166.2	$275.4	$441.6
Mid Rise 5+ Unit Multi-Family	$75.7	$32.3	$108.0
Total	$390.3	$848.2	$1,238.4

Source: Building Electrification Initiative and Firefly Energy Consulting. Interview regarding ongoing and internal research. May 2022.

Cost Estimates: City of Alameda Low- and Moderate-Income Residential Building Decarbonization

The available City of Alameda residential building stock data is shown in the table below.

Figure 4: City of Alameda Residential Building Stock

Category	Year Built	# of Buildings	Avg Units per Building
	None	483	0.22
	Pre-1978	10421	1.06
	1978 - 1991	2654	1.00
Single-Family	1992 - 2020	1530	0.95
Total Single-Family		*15088*	*0.81*
	None	571	8.99
	Pre-1978	1782	5.26
	1978 - 1991	20	6.85
Multi-Family	1992 - 2020	9	6.00
Total Multi-Family		*2382*	*6.78*
Total Residential		17470	3.79

Source: Choi, Y., Sadler, J., & Zimmerman, Z. (2021). Electrifying Existing Residential Buildings in Alameda.

Based on this information, the City can apply the same methodology as the BEI and Firefly Energy Consulting research to the Alameda housing stock in order to calculate a total decarbonization funding gap. The analysis in this report provides an estimate of the low- and moderate-income and combined total funding gaps for Alameda buildings shown below.

Figure 5: Total estimated funding needed to support low-income (LI) and LMI residential building decarbonization in Alameda

	LI Buildings	LMI Buildings above 200% FPL	Total
Single-Family	$49,072,211	$269,897,162	$318,969,373
Multi-Family	$133,172,076	$197,932,782	$331,104,858
Total	**$182,244,287**	**$467,829,944**	**$650,074,231**

This approach lacks the same degree of accuracy as the BEI and Firefly Energy Consulting research. Given a lack of County Assessor information for the City of Alameda, this report is reliant on BEI and Firefly's low- and moderate-income proportions for the City of Berkeley (shown in Figure 4) as a proxy for Alameda. Additionally, the report is limited to single and multifamily residential buildings; and does not categorize multifamily buildings into duplexes, 3-4 family units, low-rise multifamily and mid-rise multifamily buildings. The goal of this analysis is to provide a sense of the scale of the funding gap needed for low- and moderate-income residential building decarbonization, with a total estimated cost of ~$650 million. Although BEI is presently unable to take on additional client cities, the City of Alameda should review BEI's final report for the City of Berkeley and maintain a connection to BEI and their partner cities.

Benefits of Residential Building Electrification

Through its Climate Action and Resiliency Plan, the City has demonstrated its commitment to electrifying existing buildings. Given the inability of most low- and moderate-income residents to pay for upfront retrofit costs, proactively ensuring that those residents can electrify could be a costly endeavor for the City. In order to electrify all low- and moderate-income households, both single-family and multifamily and both tenant-owned and rented, the City will need to be prepared to cover a substantial portion of upfront retrofit costs. This includes ensuring that the City has financing and funding set aside to provide bill protections for energy burdened households, who might require additional time to adjust to new appliances and electric technologies to realize energy savings.[10]

The cost of inaction is much higher, though. Proactively planning for and funding and financing this transition will bring quantifiable benefits to the City that are tangible and vast - and includes long-term utility bill savings and stability for City residents; tangible health benefits from improved air quality, which in turn improve resident well-being; meaningful reduction of greenhouse gas emissions; and the efficiency benefit of meeting state and City emissions reduction targets on time, and while taking advantage of current windows of opportunity for state and federal co-funding.

Benefit of Electrification: Utility Bill Savings

Despite the high upfront costs of electrification, numerous studies have detailed the long-term utility bill savings achievable through electrification. The full degree and extent of bill impacts depends on several factors - and is generally less pronounced or consistent for multifamily buildings. However, AMP has very low electric rates relative to other utilities across the state - including, on average, 26% lower than PG&E electric rates, the City's gas provider.[11] These low rates amplify the bill saving potential of electrification across customer segments, including multifamily buildings and tenants. It's important for the City of

[10] Harwood, Meghan, Vigen Ralston, Michelle, Newlin, Sean, and Velez, Kiki. 2021. "The Flipside Report: A White Paper on Targeted Geographic Electrification in California's Gas Transition," https://www.buildingdecarb.org/uploads/3/0/7/3/30734489/the_flipside_report_-_targeted_electrification_for_gas_transition.pdf.

[11] "Rate Comparisons | Alameda Municipal Power, CA." n.d. Accessed April 26, 2022. https://www.alamedamp.com/158/Rate-Comparisons.

Alameda to strive for program and policy design that addresses building-specific nuances, and facilitates energy bill savings and stability for low- and moderate-income residents. Factors impacting utility bill savings include:

1) **Climate Zone:** As the City of Alameda is a mild climate zone, there is low penetration of air conditioning in homes. This minimizes total energy usage across households, as air conditioning combined with heating tends to be a driver of household level usage, potentially limiting efficiency and energy savings gains from electrification.[12] This is likely mitigated partially or fully for many households due to AMP's low electric rates, and could change over time as climate change makes the City of Alameda hotter and might drive up demand for air conditioning.[13]

2) **Technology and Retrofit Suite:** Bill savings are significantly improved when electrification is paired with efficiency, weatherization, and other whole-building envelope needs to minimize additional energy loss. In Alameda, where there is a lower both heating and cooling load, these types of building envelope improvements and energy losses are less essential.[14]

3) **Building Type:** Multifamily households, in particular renters, face higher hurdles to accessing the full suite of energy saving technologies - in particular, to PV solar and whole-building efficiency and envelope improvements. Pairing electrification with these two investments increases total bill savings, in particular where PV solar can help offset increased electricity use. While pairing PV solar is less critical in driving down costs given AMP's low electric rates, investing in electrification for multifamily buildings without additional investments to offset usage - whether PV solar, energy efficiency, or envelope improvements - can minimize the total bill savings potential. It is important to note that many statewide studies show an increase in total utility bills with electrification for individual units in multifamily buildings. This is likely partially mitigated partially or fully for many households due to AMP's low electric rates.[15]

4) **Split Incentive Design:** For tenants, bill savings are enabled when they are able to inherit those savings on their utility bills such that they are not offset, exceeded, or impacted by increases in rent. For building owners, bill savings are enabled when they are able to pass through costs to renters or, for low- and moderate-income tenants or affordable housing, when they are provided with sufficient financing support to avoid having to recover retrofit costs via rent increases as a capital improvement.[16]

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[12] Aas, et al. 2020. "The Challenge of Retail Gas in California's Low-Carbon Future."

[13] Bedsworth, Louise, Dan Cayan, Guido Franco, Leah Fisher, and Sonya Ziaja. 2019. "California's Fourth Climate Change Assessment Statewide Summary Report." *California Energy Commission*, 133. https://www.energy.ca.gov/sites/default/files/2019-11/Statewide_Reports-SUM-CCCA4-2018-013_Statewide_Summary_Report_ADA.pdf.

[14] Aas, et al. 2020. "The Challenge of Retail Gas in California's Low-Carbon Future."

[15] "Rate Comparisons | Alameda Municipal Power, CA."

[16] Split incentives are a market failure that exists when the benefits of a transaction are passed to someone other than the party paying. In the sphere of energy upgrades to rental units, this manifests when an efficiency upgrade or new efficiency electric appliance retrofit results in net bill savings that are felt by the tenant, but upfront costs inherited by the landlord. This

5) **Rate Design:** Bill savings are improved when rate design is structured to incentivize and enable customers to concentrate energy use at times of day when electricity is cheapest, through time-varying rate structures. AMP is already piloting this for customers with at-home electric vehicle charging, and who have particularly high electric usage.[17]

6) **Long-Term Gas Prices and Bill Impacts:** Regardless of electric bill impacts, all Alameda residents that remain PG&E gas customers are likely to see rising gas utility rates and higher total energy bills over time. As customers across PG&E territory electrify, those who are least able to proactively leave the system will remain customers, and the costs of operating and maintaining PG&E's gas infrastructure will be spread across fewer and fewer customers. Known as the 'utility death spiral', this will result in a pernicious cycle of a decreasing number of customers paying for the utilities' fixed cost assets, and paying extremely expensive gas bills. If the City does not proactively intervene to electrify low- and moderate-income and otherwise vulnerable residents, those Alameda residents will be stuck with increased energy burden and utility bills.[18] The cost of gas is expected to double from approximately $1.5 per therm to $3 per therm by 2050 due to lower gas throughput.[19] Proactive electrification of those residents gets them out of harm's way in the long-run.

Benefit of Electrification: Improved Health Outcomes

The benefits to electrification span far beyond energy savings - and include improved indoor and outdoor air quality and associated health improvements, as well as emissions reductions. Buildings within low-income and otherwise vulnerable communities are more likely to contain serious health hazards like lead, mold, and asbestos. In presentations to the Energy Commission, the City of Berkeley's low-income efficiency program administrator, Association for Energy Affordability, and Sacramento Municipal Utility District all reported a variety of technical retrofit challenges specific to low-income housing and environmental justice communities that contributed to higher costs - including the need to address poor envelope insulation and sealing, asbestos, and other health needs.[20]

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creates a strong disincentive for landlords to invest in energy upgrades unless they can pass the investment cost through to renters through a capital improvement. The goal for the City should be to ensure on-going net and whole-bill affordability for low- and moderate-income renters, while providing funding and financing solutions that enable landlords to electrify.

[17] Heinbaugh, Heather. 2021. "Overview of Building Electrification Programs and the Electric Vehicle Time-of-Use Rate." Alameda Municipal Power Public Utilities Board, October 15. https://www.alamedamp.com/AgendaCenter/ViewFile/Item/7750?fileID=4116.

[18] Harwood, Meghan, Vigen Ralston, Michelle, Newlin, Sean, and Velez, Kiki. (2021). "The Flipside Report: A White Paper on Targeted Geographic Electrification in California's Gas Transition," July. https://www.buildingdecarb.org/uploads/3/0/7/3/30734489/the_flipside_report_-_targeted_electrification_for_gas_transition.pdf.

[19] Aas, Dan, Amber Mahone, Snuller Price, and Zack Subin. 2019. "Draft Results: Future of Natural Gas Distribution in California." *Natural Resources Defense Council*, 69. https://berkeleyca.gov/sites/default/files/2022-01/Berkeley-Existing-Buildings-Electrification-Strategy.pdf.

[20] The City of Berkeley. (2021). *City of Berkeley, California: Existing Buildings Electrification Strategy*. *Administrative Draft*, 164. https://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/Draft_Berkeley_Existing_Bldg_Electrification_Strategy_20210415.pdf

Building electrification improves outdoor air quality and public health, particularly in the winter when nitrogen oxide emissions from gas combustion in buildings and power plants contribute to secondary fine particulate matter (PM 2.5) pollution. Research by the Rocky Mountain Institute demonstrates that homes with gas stoves have nitrogen dioxide concentrations that are 50%-400% higher than in homes with electric stoves, for example. Their research also demonstrated how additional pollutants such as carbon monoxide, particulate matter, and formaldehyde from gas appliances can cause negative health effects that exacerbate respiratory conditions. Study results show a 42% higher likelihood of asthma symptoms for children living in a home with a gas stove.[21]

Efficiency, electrification, and other clean energy interventions are directly tied to health improvements such as reductions in mortality, hospital admissions, respiratory illness, asthma, and more.[22] In California, 65% of asthma-related hospitalizations are paid for with public funds, with each hospitalization amounting to $33,000.[23] Electrification of all of the fossil fuel appliances in the Bay Area could save over 130 lives and $1.2 billion in healthcare costs every year.[24] These are unrealized positive externalities from improved health including broader community and economic value.

Benefit of Electrification: Emissions Reduction and Climate Resilience

Natural gas consumption in buildings is responsible for about 30% of the City's greenhouse gas (GHG) emissions. As a City with many climate resilience challenges, including impacts of following and sea level rise, mitigating the worst impacts of climate change by reducing emissions through every lever the City has access to will be critical. Given that the City's electric utility, AMP, already delivers 100% clean energy to its customers, electrifying all end-uses and moving away from fossil gas will have dramatic and significant emissions reductions impacts. As an emissions reduction strategy, electrification also has additional positive externalities related to climate - such as improved resilience and safety. All-electric buildings are much more resilient to power outages and utility-led public safety power shutoff (PSPS) events, for example, in times of high fire risk, as gas appliances cannot function without electricity in the first place. The volatile nature of gas also puts buildings at risk of explosion or fires, in particular in earthquake prone geographies, as has been seen from the 2010 San Bruno and 2019 San Francisco gas pipeline explosions.[25] All of these considerations make building electrification a win-win for the City from an emissions reduction and climate resilience standpoint.

Benefit of Electrification: Avoiding Long-Term Displacement

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[21] Seals, B., & Krasner, Andy. (2020). Health Effects from Gas Stove Pollution. *Rocky Mountain Institute*.

[22] Norton, R. A., Brown, B. W., Malomo-Paris, K., & Stubblefield-Loucks, E. (n.d.). Non-Energy Benefits, the Clean Power Plan, and Policy Implications for Multifamily Housing. Green & Healthy Homes Initiative, 17.

[23] The City of Berkeley. (2021). *City of Berkeley, California: Existing Buildings Electrification Strategy*, 8.

[24] UCLA Fielding School of Public Health, Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California (2020), Appendix B, Tables B-3 and B-4, available at https://coeh.ph.ucla.edu/ effects-of-residential-gas-appliances-on-indoor-and-outdoor-air-quality-and-public-health-in-california/

[25] The City of Berkeley. (2021). *City of Berkeley, California: Existing Buildings Electrification Strategy*, 8.

Residential displacement can be defined as "the process by which a household is forced to move from its residence–or is prevented from moving into a neighborhood that was previously accessible to them because of conditions beyond their control".[26] While there are many variables that can increase displacement risk, an important component is increases in rent or utility burden. A 2016 study by The Utility Reform Network found that one-third of California households did not have sufficient income to meet their basic costs of living for that year, and between 19% and 25% of California families were energy insecure. These families faced at least one 48-hour disconnection notice over the course of a year or were more than a month behind on their utility bills. In 2019, 45% of Californians were renters and about 25% of Californians were renters living on low to extremely low incomes.[27] In Alameda, 7% of the population is "in poverty" according to 2020 U.S. Census numbers.[28] More nuanced information from the Alameda Housing Authority suggests that an estimated 44% of renters in Alameda spend more than 30% of their income on housing costs, making them housing burdened.[29] These numbers do not reflect the many compounding factors that make individuals vulnerable to displacement. Additional factors include whether households have residents who are young children or elderly, with disabilities, who do not speak English as a primary language, and more.

Low-income people often lack capital and capacity to retrofit buildings, live in multifamily structures, and suffer from higher existing rates of air pollution and environmental injustice.[30] In the context of the state's current housing affordability crisis and increasing wealth disparities, the City should assume most low- and moderate-income Alameda residents will have little to no upfront capital to contribute to proactive electrification retrofits. Without funding dedicated to covering early electrification for these residents, they will be unable to transition of their own accord. This makes already vulnerable residents even more vulnerable and exposed - to higher future gas prices and overall energy bills; to potential displacement and rent increases via capital passthroughs from landlords, when and if electrification retrofits are mandated to meet state or local climate goals; and to the continued health impacts of gas use.[31] For all of these reasons, proactively electrifying these populations through programs that guarantee and provide rent and bill protections will be critical for the City.

Benefit of Electrification: Efficiently Meeting State and Local Climate Goals

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[26] Urban Displacement Project. n.d. "What Are Gentrification and Displacement – Urban Displacement." Accessed May 2, 2022. https://www.urbandisplacement.org/about/what-are-gentrification-and-displacement/.

[27] Toney, M., & Sandoval, G. (2018). *Living Without Power: Health Impacts of Utility Shutoffs*. 36. http://www.turn.org/wp-content/uploads/2018/05/2018_TURN_Shut-Off-Report_FINAL.pdf

[28] "U.S. Census Bureau QuickFacts: Alameda City, California." n.d. Accessed May 2, 2022. https://www.census.gov/quickfacts/alamedacitycalifornia.

[29] "Housing for Low and Extremely-Low Income Households Opens in Alameda | HUD USER." n.d. Accessed May 2, 2022. https://www.huduser.gov/portal/pdredge/pdr-edge-inpractice-030518.html.

[30] Lamm, et al. (2021). Building toward Decarbonization: Policy Solutions to Accelerate Building Electrification in High-Priority Communities.

[31] Bridgers, B., Campbell-Orrock, C., Makous, D., Neely, B., & Romain, B. (2022). *Choose Your Own Adventure: Funding the Decarbonization of Under-resourced Residential Buildings*.

Numerous studies have demonstrated that residential building electrification is a pillar of the least-cost pathway for the building sector and most-efficient tools for meeting California's state climate goals[32]. The dedication to full residential building electrification is acknowledged in City of Alameda's Climate Action and Resilience Plan, where the City has committed to reducing emissions by 50% below 2005 levels by 2030 and becoming fully carbon neutral. Taking this outcome as an inevitability to meeting state and local climate goals, the question then becomes how to most efficiently electrify low- and moderate-income residents. Historic underinvestment in building stocks for those communities, paired with high energy burdens and poverty rates, significantly drives up the costs for electrification retrofits.

To meet the State's GHG reduction goals without building electrification, there would be an estimated incremental annual cost ranging between $19-32 billion in California, mostly due to high costs associated with producing renewable gas alternative forms of gas. Comparatively, a high building electrification scenario had an incremental annual cost of approximately $13 billion. A proactive transition to electrified buildings in California can be associated with significant long-term cost avoidance by limiting the amount of new gas infrastructure investments.[33]

The most efficient and cost-effective solution for the City is to electrify these residents early on. At earlier stages, the City can take advantage of generous and ample co-funding from state and federal funding sources targeted at low-income populations. The City can also limit the need for additional bill or rent burden emergency funding, which might become necessary without proactive intervention. More immediate electrification would allow the City to benefit from additional positive externalities associated with workforce development, innovation and technological advancement, and environmental justice.

Part 3: Existing Co-Funding and Financing Support

Lucky for the City of Alameda, the state of California is investing heavily in building decarbonization efforts. While much of this investment is "midstream" and "upstream", meaning focused on market transformation and lowering the cost of electric appliances and technologies, there are also several state and local grants and incentive programs that can be leveraged in the coming years. The table below covers some of the programs that are relevant and could be useful to the City of Alameda.

This funding is of course not enough on its own to cover the high costs of a whole-house retrofit for low- and moderate-income residents of the City. For the City of Berkeley, the Building Electrification Institute found that, "while there is approximately $12,000 in incentive funding to support buildings in their effort to decarbonize and improve overall energy efficiency, the average gap in funding by housing unit was

[32] Aas, et al. 2020. "The Challenge of Retail Gas in California's Low-Carbon Future."
[33] Ibid.

$25,868.[34] The gap was higher for low-income units (due to higher costs for make-ready costs)[35] at $27,837, while the gap for market rate units was $23,898. The funding gap is the highest for single family homes with a gap ranging from $35,000 to $40,000 per home."[36] These programs are a start and will be crucial for Alameda, but same as Berkeley, will not cover the expected average per unit costs of electrification.

The below table has information spruced from individual program websites, from stakeholder interviews with organizations including the Association for Energy Affordability and the Building Electrification Initiative, as well as from switchison.org.

Agency/ Implementer	**Program Type**	**Available Funding Relevant to the City ($)**	**Program Summary/ Specifications**
Alameda Municipal Power (AMP)	AMP Rebate Programs	**Up to $4,250 per household** - Electric Panel upgrade ($2500 for switching from gas to full electricity). - Heat Pump Water Heater ($1500 for Energy STAR type Heat Pump). - Electric Washing Machine ($150 rebate) - Electric Clothes Dryer ($100 rebate)	-These are existing rebates from AMP to residences. The City should confirm the cap on rebate program spending on a regular basis, knowing that AMP budget does not expand to cover maximum rebate for every qualified household.
California Energy Commission	Technology and Equipment for Clean Heating (TECH) Initiative	- **Up to $3,000 per unit** for Central Heat Pump or Mini-Split Heat Pump. - **Up to $1,500 per unit** for Heat Pump Hot Water Heater - **Up to $300 per unit** for electric panel upgrades.	- TECH Clean California provides matched funding to add upon clean heating incentives for utility, initiative administrator, and third-party funder incentives. All incentives can be layered on top of AMP rebates. - New grant funding opportunities will be announced in Spring 2022. City of Alameda should apply for grants from TECH, including Quick Start grants and/or future

[34] The average gap in funding is defined as the difference between the average cost of a full retrofit and approximately $12,000 in local, state, and federal incentive funding to support building electrification. As indicated, this "average gap" varies depending on the housing quality, income status, and other factors.

[35] Make-ready costs refer to electrification upgrades such as electricity panels and knob and tubes. These upgrades are needed to enable and realize the full benefits of whole house electrification.

[36] Bridgers, B., Campbell-Orrock, C., Makous, D., Neely, B., & Romain, B. (2022)

			tariffed on-bill pilot or implementation support.
California Energy Commission	Self-Generation Incentive Program (SGIP)	Includes up to **$4,885 per household** in a single-family home for HPWH unit cost + panel upgrade, and **up to $3,800 per unit** in multifamily or other housing.	-This program is specific to multifamily housing, with higher rebates for low-income households. The program is currently specific to energy storage technology, but is set to launch it's HPHW incentive in late 2022 or early 2023. The total program budget is $44.6M.
U.S. Department of Health and Human Services	Low Income Home Energy Assistance Savings Program (LIHEAP) Weatherization	Up to **$7,669 per household**. California will receive $179M in LIHEAP funding in 2022. It is estimated that Alameda County will receive ~$506,000.	Provides free energy efficiency upgrades to low-income households to lower their monthly utility bills while also improving the health and safety of the household's occupants. Eligibility based on income requirements.
Department of Energy (DOE) & California Department of Community Services and Development	Weatherization Assistance Program (WAP) Enhancement	Up to **$7,776 per household**.	Provide energy efficiency and weatherization for low-income homeowners and renters. California CDS state administers the WAP funds at the local level via Community Services Block Grants. Eligibility is not limited to but is prioritized for: people over 60 years of age; families with children; families eligible for SSI or TANF.

Part 4: Identifying Strategies for New Funding and Financing

In addition to seeking state and federal co-funding, it will be important that the City works with other stakeholders to bring resources to the table. That includes working with AMP to optimize existing ratepayer funded programs and partnering with private sector entities to drive effective and accessible financing. In addition to continuing to focus on new partnerships, his report focuses on three additional levers: tariffed on-bill financing, municipal tax policy, and municipal bond solutions. These three strategies were elevated as the most prominent funding and financing levers for municipalities to raise and deploy new funds to deliver and advance residential building electrification for low- and moderate-income households and rental properties. While each of these strategies are defined and discussed independently below, they are not mutually exclusive. Part 5 of this report evaluates each strategy collectively to recommend the highest priority combination and suite of solutions.

Ratepayer Funding

One major localized source of funding for climate-focused programs in the City has been and will continue to be funds from customers of AMP. Ratepayers funds, for example, cover the cost of AMP's existing rebate programs. Ratepayers are a captive audience of the utility (AMP in this case), and therefore ratepayer funds a low-cost source of capital as a result. This is a limited resource, as AMP will not want to increase its customer bills substantially, in particular in any way that harms already low-income or vulnerable customers. AMP could consider tiered rate structure based on income to cover program costs for low-income individuals (often referred to as percentage-of-income payment plans, or PIPPs), but no jurisdiction in California has implemented this yet. The California Public Utilities Commission is looking at such proposals in a current proceeding, but any resulting guidance would likely only apply in the near-term for investor-owned utilities.[37] For now, additional rate-based solutions shouldn't be a high priority to fund low-income programs .

Leveraging Private Capital

It is always prudent to seek out co-funding in the form of private capital, to minimize costs to the public. However, this is incredibly challenging in the sphere of building electrification, in particular for low- and moderate-income households that have little to no upfront capital to contribute and where the customer energy usage and bill savings are less dramatic. It is often too challenging for private companies to get to meaningful scale a retrofit financing solution with the smaller savings margins from residential electrification as a result. Despite that, the City should continue conversation with and keep an eye out for opportunities to partner with private lenders, such as where there are opportunities for the City to be an attractive partner in driving down the cost of capital. For example, the City should continue conversation with companies such as BlocPower, who are pursuing a model focused on low- and moderate-income residences.[38] The City should also start conversations with the Climate Tech Finance Low-Interest Loan Program, managed by the Bay Area Air Quality Management District (BAAQMD) and California Infrastructure and Economic Development Bank (IBank). The program provides direct, low-interest loans of up to $30M to municipalities, schools and public agencies for terms of up to 30 years.[39]

Tariffed On-Bill Financing Programs

In an on-bill program, the utility serves as a conduit between consumers and third-party loan providers or as the loan provider themselves, and repayment is made through the utility bill.[40] Tariffed on-bill programs, such as the Pay As You Save® (PAYS®) model, differ from on-bill loans in that the cost recovery is tied to the location's utility meter rather than the individual or household account. The utility pays for

[37] California Public Utilities Commission. R. 18-07-006. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M218/K186/218186836.PDF

[38] "BlocPower.Io." Accessed April 3, 2022. https://www.blocpower.io//.

[39] Bay Area Air Quality Management District. n.d. "Climate Tech Finance." Accessed May 3, 2022. https://www.baaqmd.gov/funding-and-incentives/businesses-and-fleets/climate-tech-finance.

[40] American Council for an Energy-Efficient Economy. "On-Bill Energy Efficiency," February 16, 2017. https://www.aceee.org/toolkit/2017/02/bill-energy-efficiency.

the electrification upgrades at a specific residence or building and recovers the costs over time through a dedicated charge on the utility bill. Ideally and typically, the contract is structured such that the additional bill charge is less than the estimated bill savings from the energy efficiency improvements, thereby net saving the customer money on a monthly basis.[41] Additionally, tariffs are not considered customer loans, so this transaction does not add to the debt profile of the property owner. To further minimize risk for low- and moderate-income consumers and tenants, utilities can avoid disconnection of utility services; allocate partial payments to preserve utility service; administer the program with an independent entity; and prohibit abusive marketing.[42]

In order to ensure that monthly bill charges are less than the estimated bill savings, there is an obligation for tariffed on-bill programs to be either below or close to bill neutral. This means that the payback period on an electrification retrofit can become very long due to high electric rates relative to gas rates, mild climate zones that correlate with low total energy usage and therefore smaller efficiency gains, or the more challenging economics of low-income and multifamily buildings (see Part 2, Utility Bill Savings).

The best way to reduce the payback period, in particular for vulnerable and low- or moderate-income households, is to limit or reduce the total project costs that need to be financed through an on-bill tariff. This can be achieved either by reducing the cost of the project by bringing additional funding like rebates or incentives to the table, or by reducing the cost of financing through alternative low-interest loan solutions.

Case Studies - Tariffed On-Bill Financing for Building Electrification and Clean Energy Deployment

While Southern California Edison, PG&E and Plumas-Sierra Rural Electric Cooperative all offer on-bill loans, there are currently no cities in California offering tariffed on-bill financing for electrification or energy efficiency upgrades, though this will likely change in the coming year. The Clean Energy Financing Proceeding at the CPUC is currently examining tariffed on-bill financing options for investor-owned utilities.[43] The table below captures some early adopters and movement on tariffed on-bill financing.

City or Agency	**Description**
California State TECH Program	TECH is funding pilot tariffed on-bill programs across select Community Choice Aggregators (CCAs) in California, the outcomes of which will help inform program structure for utilities more broadly.[44]

[41] Mast, Bruce, Holmes Hummel, and Jeanne Clinton. "Towards an Accessible Financing Solution: A Policy Roadmap with Program Implementation Considerations for Tariffed on-Bill Programs in California." Building Decarbonization Coalition, 2020. http://www.buildingdecarb.org/uploads/3/0/7/3/30734489/bdc_whitepaper_final_small.pdf.

[42] Stanton, Tom, and Sklar Scott. Utility Tariff On-Bill Financing: Provisions and Precautions for Equitable Programs. January 2020. https://pubs.naruc.org/pub/0E0B2716-947E-B0A8-2899-3DCA0F0C8F16

[43] California Public Utilities Commission. "Clean Energy Financing." https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/energy-efficiency/clean-energy-financing

[44] A CCA Proposal for a Tariffed On-Bill Investment Pilot. Presented by Peninsula Clean Energy and Silicon Valley Clean Energy In partnership with TECH Clean California. March 25, 2022.

BayRen	BayRen utilizes the tariffed on-bill PAYS model for water efficiency financing. Among pilot projects, multifamily water use was reduced by 30 percent and single-family water use was reduced by 20 percent on average.[45]
Ouachita Electric Cooperative (OECC), AR	Outside of California, rural cooperatives have been leaders in offering tariffed on-bill financing options.[46] (OECC) worked alongside its program operator, EEtility, to prioritize renters in multifamily homes and 100% of eligible customers who were offered the program opted to proceed with upgrades. Additionally, more than 80% of the residents in eligible single-family homes proceeded with upgrades, demonstrating the program's effectiveness across all residential sectors. The average cost per project was $5,634, and the average estimated energy savings was 22%.[47]

If AMP were to adopt and run a tariffed on-bill program, the City could play a crucial role in securing low-interest capital and supplemental funding to drive down retrofit project costs and offset the total costs that need to be financed via a customer's utility bills. The City would need to work with key stakeholders, namely AMP, to ensure that the outcome is a funding stack that results in net bill savings, stability, and affordability for low- and moderate-income customers.

Despite the opportunities that tariffed on-bill financing poses for AMP customers, the utility has indicated that they are unable to facilitate a tariffed on-bill program with their current billing structure. To the extent possible, the City can encourage and partner with AMP to better understand the full extent of potential electrification projects a tariffed on-bill program would make possible, and support additional due diligence to see if there are feasible alternative billing solutions that could support such a program.

Summary: City of Alameda Role and Additional Stakeholders

- City of Alameda: Facilitate capital funding sources and financing solutions. Support program feasibility analysis and potential roll-out.
- AMP: Perform lending and banking functions, or contract with a third-party to support these functions. Implement an on-bill solution and tariff.
- Third-party Billing Provider: Contract with AMP to upgrade and/or manage the utility billing system.
- Contractors: Implement electrification upgrades. Work with AMP or lender to finance the retrofit.

[45] Water Upgrades $ave. Regional Climate Protection Authority. 2022. https://rcpa.ca.gov/what-we-do/water-upgrades-save/

[46] Annie Gilleo. "On-Bill Financing Gains Ground but Faces Barriers to Wider Adoption." American Council for an Energy Efficient Economy, April 18, 2019. https://www.aceee.org/blog/2019/04/bill-financing-gains-ground-faces.

[47] Wesley Holmes, Cyrus Bhedwar, Kate Lee, and Emme Luck. "Utility Guide to Tariffed On-Bill Programs." The Southeast Energy Efficiency Alliance (SEEA), February 2020. https://www.seealliance.org/wp-content/uploads/SEEA_TOBGuide_FINAL_UPDATED_2020_04_13.pdf.

New Tax-Based Funding and Financing

One of the most prominent and flexible mechanisms cities are using to source new capital to support climate initiatives is new municipal tax policy. While proposing and passing new tax measures can be challenging politically, they can serve as an incredibly flexible and predictable source of new funding in jurisdictions where there is an existing climate action plan, such as Alameda.

Tax policy is particularly useful when a city is looking to raise funds in a manner that limits risk to low-income and otherwise vulnerable residents. This includes funding initiatives to support adoption of clean energy and climate resilience measures, given the societal benefit to be gained from the emissions reductions and health benefits from electrification and the minimal ability to pay for retrofits of low- and moderate-income households. By comparison, raising funds via more blunt structures like universal fees or utility bills can be highly regressive, as all users, residents, or program participants pay regardless of income or other economic factors. This is because raising new funds from utility bills or other participant fees naturally means that all energy users or program participants must pay an additional fee, regardless of income or other economic factors.[48]

A growing number of cities across the U.S. have passed new municipal tax measures that are targeted specifically at higher-income residents, corporations including larger and higher-revenue corporations, and large polluters. The positive externalities and societal benefits of building electrification have justified such tax measures, allowing new funding to be raised to support the cost of electrification or other local climate resilience measures, without further burdening those who can least afford it. Such a measure should be designed carefully and in proactive, continued consultation with all relevant City stakeholders, to be sure there are no unintended consequences.

The table below covers a series of case studies from other municipalities across the U.S. who have passed new tax measures to fund electrification, energy efficiency, and other local climate resilience programs and initiatives. A few critical considerations and takeaways for the City of Alameda in evaluating new tax policy include political feasibility, and adaptability and flexibility of tax measure funding design.

The right tax measure will depend on the political and economic landscape in the City of Alameda, to ensure that the measure can pass, will raise sufficient funds, and won't unintentionally impact any already vulnerable populations. One approach would be for the City to evaluate a more inherently progressive and nuanced design, like the City of Portland's Receipts Tax for large non-locally headquartered retailers that bring in $1 billion or more in gross sales nationally. While this exact structure wouldn't likely be a good fit for Alameda, which has fewer "big box" stores, engaging City stakeholders, including historically underinvested communities who stand to benefit from new investment, could elevate a similar opportunity.

[48] Borenstein, Severin, Meredith Fowlie, and James Sallee. 2021. "Designing Electricity Rates for An Equitable Energy Transition." *Energy Institute at Haas*, February. https://haas.berkeley.edu/wp-content/uploads/WP314.pdf.

More likely, the City could consider a more simple Sales, Carbon, or Utility User Tax. Recent polling in the City indicated potential support for a Utility User Tax, similar to the City of Albany's tax. If the City pursued this, it would be essential to pair it with adequate exceptions and protections to protect low- and moderate-income and otherwise vulnerable populations, and/or ensure distribution of funding prioritizes investment into those same populations and negates any unintended consequences. City polling has also indicated that climate is less of a priority for residents than housing affordability and disaster preparedness/climate resilience. To the extent that the intersection of building electrification with long-term affordability and climate resilience can be accurately highlighted in any new tax or bond proposal, in particular in cost-effectively meeting climate goals and reducing energy bill burden, that could help ensure success.

A key principle in much of the municipal tax measure case studies covered is that the revenue raised is dedicated to achieving a general goal - whether local climate resilience, building health, improved transit, or other - but not to a particular program or specific intervention. In the case of building electrification, raising general funding for building retrofits and/or building health enables cities to fill gaps as they arise that existing technology-specific or retrofit intervention-specific state incentives programs don't fill, for example. This is particularly helpful in addressing needs with target populations such as low- and moderate-income households and multifamily rental properties, where buildings tend to be of an older vintage and age, and oftentimes require other health and safety interventions to ensure the house is healthy and efficient. As has been discussed, it's oftentimes critical for long-term bill savings to ensure that electrification is paired with efficiency and weatherization measures. Flexible and holistic interventions ensure that the outcomes are aligned with broader societal benefits that in turn further justify taxation strategies, such as maximizing for emissions reduction and/or community-wide affordability.

Summary: City of Alameda Role and Additional Stakeholders

- City of Alameda Staff: Work with the City Council, with substantial resident, business, and stakeholder input, to design a new tax measure. Implement relevant programs once funded;
- Mayor and City Council: Passes the new tax ordinance, with a 2/3 vote required on new measures;[49]
- Taxpayers: Pay the relevant new municipal tax, contributing to a new municipal funding pool for climate projects that include building electrification;
- Contractors: Responsible for project installations.

Case Studies - Municipal Tax Measures for Building Electrification and Clean Energy Deployment

City	Tax Category and Recipient	Description	Expected Revenue (Annual)

[49] Insight into Alameda's political process and feasibility was informed by conversations and interviews with the City itself.

Bay Area Air Quality Management District (BAAQMD)	Carbon Tax (High-Emitting Corporations)	In 2008, the Bay Area Air Quality Management District, passed a 4.4 cent per carbon ton fee that applies to 500 businesses; generates $1.1 million per year in revenue.[50]	$1.1 million
Albany, CA	Utility User Tax (Utility Users, with Exceptions)	The City of Albany proposed Measure DD to increase the UUT from 7% to 9.5% for electricity and gas and apply a tax to water service at 7.5%. The measure passed. The measure is estimated to generate an additional $675,600 in new revenues annually for the City.[51] All residents except low-income residents will begin paying the increased 9.5% blanket utility service tax to go into a general fund for various climate preparedness, emissions reduction, and environment projects.[52]	$675,600
Denver, CO	Sales Tax (Sale of Non-Staple Goods)	In 2020 the City of Denver Ballot passed Measure 2A, a new sales tax to fund programs aimed at GHG emissions, air pollution and climate adaptation. It is a 0.25% sales tax on nonessential items, i.e. not staples like food, water, medicine or feminine hygiene products. The fund is explicitly designed to "maximize investments in communities of color, under-resourced communities, and communities most vulnerable to climate change", with the explicit goal of investing 50% in community projects focused on racial and social justice outcomes. A significant portion of this funding will go toward building decarbonization.[53]	$40 million
Cincinnati, OH	Sales Tax (Transit)	The City of Cincinnati Ohio Issue 7 transit-oriented sales tax passed in 2020. It raised the county sales tax by 0.8% to create new funding for Metro bus services.[54]	$130 million

[50] Climate Xchange. 2018. "Implementing a Carbon Price at the Municipal Level." https://climate-xchange.org/wp-content/uploads/2018/08/Implementing-a-Carbon-Price-at-the-Municipal-Level-Climate-XChange-compressed.pdf.

[51] Farahmand, Farhad. 2021. "Existing Building Electrification and Multifamily Electric Vehicle Charging: Policy and Financing Literature Review and Analysis." Peninsula Clean Energy, June. https://bayareareachcodes.org/wp-content/uploads/2021/06/Policy-and-Financing-Literature-Review-for-Existing-Building-Electrification_20210612.pdf.

[52] Dane, Alexander, and Alisa Petersen. 2021. "Six Innovative Funding Methods to Achieve Climate Action and Equity in US Cities." RMI (blog). May 6, 2021. https://www.wri.org/insights/funding-models-climate-equity-cities-us.

[53] Dane, Alexander, and Alisa Petersen. 2021.

[54] Ibid.

Portland, OR	Receipts Tax (Large Retailers)	In 2018 Portland passed the Clean Energy Community Benefits Fund, expected to bring in $44-$61 million annually to advance climate action rooted in racial and social justice. The entire cost burden is placed on retailers not headquartered in Portland (Walmart, Target, Best Buy), placing a 1% receipts tax on large retailers that make $1 billion or more in gross sales nationally. It distributes funding every year for renewable energy, energy efficiency, job training, green infrastructure, and future innovation for all Portlanders, prioritizing low-income residents and people of color.[55]	$44- $61 million
Boulder, CO	Carbon Tax (Industrial, Commercial, Residential)	In 2006 the City of Boulder passed the Carbon Action Plan tax. It brings in about $1.8M annually to fund climate initiatives; industrial customers pay the largest share ($9,600/year, on average), followed by commercial customers ($94/year) and then residential customers ($21/year). It also funds a program that requires rental properties to undergo retrofits.[56]	$1.8 million
Long Beach, CA	Carbon Tax (Fossil Fuel Producers)	In 2020 the City of Long Beach, CA passed a fossil fuel barrel production tax, the Barrel Tax. It serves as a carbon tax effectively, collecting from oil producers/emissions sources. It increased the existing tax by an additional $0.15/barrel for general purpose climate and environment related funding.[57]	$20 million
Seattle, WA	Heating Oil Law (Oil Providers)	In 2021, Seattle passed a 24 cents per gallon tax on heating oil providers. Revenue supports a City program to support low income households switch from oil to an energy-efficient electric heat pump, and workforce transition for oil industry workers.[58]	$1 million
Berkeley, CA	*Utility User Tax (With Exceptions)*	*[Not passed] City of Berkeley proposed Measure HH in 2020 to increase the UUT from 7.5% to 10% for electricity and 12.5% for methane gas. Despite strong community support from a survey, the ballot measure was ultimately defeated.[59]*	*$2.4 million*

[55] Ibid.

[56] Ibid.

[57] Ibid.

[58] "Seattle's Heating Oil Law - Environment | Seattle.Gov." n.d. Accessed May 2, 2022. https://www.seattle.gov/environment/climate-change/buildings-and-energy/seattles-heating-oil-law.

[59] Farahmand, Farhad. 2021. "Existing Building Electrification and Multifamily Electric Vehicle Charging: Policy and Financing Literature Review and Analysis." Peninsula Clean Energy, June. https://bayareareachcodes.org/wp-content/uploads/2021/06/Policy-and-Financing-Literature-Review-for-Existing-Building-Electrification_20210612.pdf.

San Luis Obispo, CA	*Carbon Tax (Fee for Fossil Fuel Use in New Construction)*	*[Not passed] In 2019, San Luis Obispo proposed a greenhouse gas in-lieu fee for new construction projects that installed fossil fuel consuming appliances, ranging from $6,013 for a typical single-family residence up to $89,000 for a 54,000 ft2 office. This measure has been delayed for adoption due to political pressure. The level of the in-lieu fee is tied directly to the effects of developing a new mixed-fuel building and the investments required to help offset the carbon emissions. The in-lieu fee is expressed as a cost per therm and calculated at $27.33 per therm generated.*[60]	

Municipal Bond Solutions

Municipal bonds are used by cities to raise debt from outside investors to cover costs and/or to fund projects and programs. Municipal bonds usually fall into two categories: general obligation bonds and revenue bonds. General obligation bonds, or GO bonds, are backed by general revenue from the issuing municipality (paid through taxation) whereas revenue bonds use revenue from a specific source (e.g. toll roads). There are other creative applications that involve bonds to generate a source of sustainable project-based capital. For example, a GO bond can be issued from which a low-interest revolving loan fund can be established (analogous to a green bank). These solutions are inherently more complex and less common for municipalities. The table below captures case studies of other municipalities that have utilized municipal bonds for climate investments.

Cities must incorporate multiple considerations when deciding how to structure and source bond debt given equity implications. For a GO bond, which places repayment on future populations, how much tax revenue can be apportioned to debt service payments and over what timeline? Will voters approve a bond measure? For revenue bonds, what source of revenue will reliably service debt payments? How will the City navigate any legal challenges without voter approval? These are some of the key questions that will help the City of Alameda illuminate whether a bond is the right capital raising mechanism.

From an investor standpoint, GO bonds tend to be lowest risk for a few reasons, especially in California. First, since most California cities revenue comes from property taxes, bondholders tend to see this as a stable source of income to local governments overall tax base. This allows for reliable forecasting and increases confidence in repayment with interest. Additionally, GOs in California have to be approved by voters, limiting the City's legal liability. Revenue bonds tend to be higher "enterprise risk" given the potential for volatility in the revenue repayment source. Moreover, revenue bonds do *not* require voter approval, which may introduce legal concerns.

[60] Ibid.

An analysis of Alameda's "long-term debt" financial statement for FY21 shows $6.5 million in in outstanding GO bonds, $8.6 million in outstanding revenue bonds, and $6.2 million in outstanding certificates of participation (COPs).[61] COPs, or lease revenue bonds, are a common way of issuing debt using government property as a revenue source to effectively pay this debt back through budget appropriation.

Finally, green bonds or climate bonds are growing in popularity as a source of debt for use in sustainability-focused projects. Green bonds can be structured as GO or revenue bonds, however, they are often formalized in a specific framework focused on sustainability such as energy efficiency or renewable energy. Green bond certifiers such as the Climate Bonds Initiative offer these frameworks and/or certification for bond issuers. This certification process increases costs while offering benefits such as a trusted certification and standardized reporting, which can increase awareness and interest from investors.

Summary: City of Alameda Role and Additional Stakeholders

- City of Alameda: Bond issuer
- Investors: Provide capital for project, receipt repayment with interest
- Underwriter: Usually a bank, responsible for scoring the bond based on creditworthiness
- (Optional) Green Bond Certifier: Pre-Issuance report to certify bond up to sustainability and other standards.
- Third Party Monitor: Observed impact, post-issuance reports. Can be the same entity as the Green Bond Certifier.
- Contractors: Responsible for project installations

Climate Bond Case Studies

City / County	Description	Revenue Raised	Projects Funded
Miami, FL	Voters approved a general obligation bond, "Miami Forever Bond" in November 2017. This one-time $400 million GO bond is being used to invest in climate reliance and mitigation as well as affordable housing projects detailed in this table. The City designed the bond around five themes: modernization, safety, wellness and quality of life, equity and economic return. The bond kicked off with 100 ready projects completed in three years, with additional funding available for longer-term investments. The City works with a Citizens'	$400 million	Roadway Improvements ($23 million) Parks and Cultural Facilities ($78 million) Public Safety ($7 million) Sea-Level Rise Mitigation and

[61] City of Alameda, California. (2021). *Annual Comprehensive Financial Report* [Fiscal Year Ended June 30, 2021]. https://www.alamedaca.gov/files/assets/public/finance/annual-financial-report-fye-06-30-21.pdf

	Oversight Board to ensure investment benefits are fairly distributed across neighborhoods and income groups.[62]		Flood Prevention ($192 million) Affordable Housing ($100 million)
San Francisco, CA	Started in 2015 and certified by the Climate Bonds Initiative, San Francisco's Green Bonds Program has raised $1.7 billion to invest in climate-resilient infrastructure. This program is a key component to actualizing SF's goal of achieving carbon neutrality by 2050. This bond works closely with the San Francisco Public Utilities Commission (SFPUC) to prioritize low-impact development and green infrastructure. Another green bonds-financed capital project is the Sewer System Improvement Program (SSIP), a 20-year, $6.9 billion investment in improving the City's aging sewer system.[63]	$1.7 billion (Green Bonds Program) $6.9 billion (Sewer System Improvement Program)	GBP: projects range from solar energy and green rooftops to specialized landscaping. SSIP: improve waste and stormwater systems, assure operational permit compliance.
Los Angeles County, CA	Los Angeles County Metropolitan Transportation Authority issued two half-billion-dollar bonds to finance climate-related projects as well as electrifying light and heavy-duty transportation. Using CBI's framework, LA County Metro has deployed funds in line with the Countywide Sustainability Planning process around climate, equity, and economic and workforce development.[64]	2017 Bond: $471 million 2019 Bond: $419 million	2017 Bond: 20 projects improving Metro's electrified rail. 2019: Funding four projects to address connectivity, refurbish tracks, and improve facilities.
Burlington, VT	The city passed a Net Zero Energy Revenue Bond to invest $20 million over the next three years on grid upgrades to support	Net Zero Energy Revenue Bond: $20 million	NZERB: Grid upgrades, dynamic rate

[62] City of Miami. *Miami Forever Bond - Miami*. City of Miami. https://www.miamigov.com/My-Government/Departments/Office-of-Capital-Improvements/Miami-Forever-Bond

[63] *Cities100: San Francisco is financing resilience with the Green Bonds Program.* C40 Knowledge Hub. https://www.c40knowledgehub.org/s/article/Cities100-San-Francisco-is-financing-resilience-with-the-Green-Bonds-Program?language=en_US

[64] Cadmus Group, First Environment, & Red Brow, LLC. (2021). *Analysis of Green Bond Financing in the Public Transportation Industry*. The National Academies of Sciences. https://nap.nationalacademies.org/read/26066/chapter/9

	wide-ranging electrification; technology systems to offer customers dynamic rates; maintain renewable generation plants and convert a gas turbine peaker plant to renewable biodiesel; and expand new EV charging stations and related operations. The bond is intended to continue to invest in reliability and climate progress while reducing upward rate pressure over the next several years. Moreover, the City is allocating $5.3 million over three years from its annual general obligation-backed bonds to double funding to its Green Stimulus program. This program provides customer incentives to support a faster pace of adoption while continuing high incentive levels for heat pumps and EVs. Most importantly, extra funding has "increased access to these technologies for our low- and moderate-income customers with enhanced rebates that, for example, cover up to 75% of the cost of a single heat pump."[65]	Green Stimulus: $5.3 million	technology, renewables plant maintenance and parker plant conversion, EV charging Green Stimulus: Extra funding for heat pumps and EVs, with an emphasis on increasing access for low- and moderate-income communities

Part 5: Analyzing Financing and Funding Solutions

<u>Criteria for Analyzing Policy Alternatives</u>

Each program will be analyzed against a consistent set of criteria:

1. Effectiveness
    a. How many and how rapidly are low- and moderate-income buildings electrified?
    b. How much building electrification is happening in low- and moderate-income communities, to reduce historic inequities and disparities? Do low- and moderate-income residents have access to funding and financing?
2. Efficiency
    a. Are the benefits associated with whole-home electrification maximized for low- and moderate-income residents, relative to the cost of implementation?
3. Political and Implementation Feasibility
    a. Will this alternative survive the political and/or regulatory process?

[65] *Net Zero Energy Revenue Bond | City of Burlington, Vermont*. City of Burlington, VT. https://www.burlingtonvt.gov/CT/Elections/December-7-Special-Election/Net_Zero_Energy_Revenue_bond

b. Will this alternative best advance the policy objectives while minimizing administrative burden?

Criteria 1: Effectiveness

Existing Programs and Incentives

*The effectiveness of existing programs and incentives is **high** because the programs are readily available and can be adopted by residents immediately.*

Existing programs offer significant opportunities to electrify many low and low-to-moderate income residential buildings. As covered in Appendix A, existing programs will likely be able to contribute up to $28.38 million for low- and moderate-income single-family homes, and $12.2 million for low- and moderate-income multifamily. The total funding gap, as covered in the earlier Cost Analysis, estimated at $316.5 million for single-family and $331 million for multifamily low- and moderate-income households. This funding will be critical but, for all Alameda low- and moderate-income residences to electrify, will not be sufficient.

Tariffed On-Bill Financing

*The effectiveness of tariffed on-bill financing is **high** because it is directly tied to building electrification funding and a unique and specific solution for renters and low- and moderate-income residents that isn't fully addressed elsewhere.*

Since tariffed on-bill financing is attached to the meter rather than individuals, upgrades can be made at any residential property regardless of income, credit score, or home ownership, and is therefore more inclusive of Alameda's low-income households who are typically renters. The tariff recovers costs through utility bills, and can be carried across foreclosures, changes in tenancy, and periods of vacancy.[66] These features make tariffed on-bill financing an attractive way to equitably finance low- and moderate-income building electrification. As building electrification has both a private and societal benefits, including in enabling the City to meet emissions reduction commitments, tariffed on-bill allows private contributions to be paired with parallel increases in public and City funding. However, without many proof points it is unclear this option will rapidly scale in time to meet Alameda's 2030 climate and building electrification goals.

Municipal Tax Measures

*The effectiveness of municipal tax measures is **high** because it is a flexible funding source that raises large amounts of capital to directly fund retrofits.*

Municipal tax measures are very effective at driving project volume and implementation where funding is the challenge, once they are in place. As highlighted, in most jurisdictions that have passed new tax

[66] Mast, Bruce, Holmes Hummel, and Jeanne Clinton. "Towards an Accessible Financing Solution: A Policy Roadmap with Program Implementation Considerations for Tariffed on-Bill Programs in California."

measures to fund climate policy, the funding is raised for a general and flexible budget to support emissions reductions goals and project deployment. As a result, new funding can be optimized to maximize emissions reduction, and to specifically target residential buildings. The challenge with tax measures is that they require political approval and passage - making them not a less rapid, "off the shelf" solution to deploying projects on a very near-term basis.

Municipal Bond Measures

*The effectiveness of municipal bond measures is **high** because it is a flexible funding source that raises large amounts of capital to directly fund retrofits.*

Bonds represent an effective way to quickly raise capital for large, multi-million-dollar infrastructure projects. This kind of financial instrument will likely be needed to achieve rapid and widespread low- and moderate-income residential electrification. However, the *type* of bond structure determines how quickly capital can be raised and deployed. For example, general obligation bonds take longer due to a need for voter approval whereas revenue bonds do not have this same requirement and thus can be quickly issued. If Alameda can strategically structure a bond for rapid approval and funding, it can offer the best pathway to rapidly raise and deploy capital for large low- and moderate-income residential electrification projects.

Criteria 2: Efficiency

Existing Programs and Incentives

*The efficiency of existing programs and incentives is **high** because the programs are already implemented and do not require additional cost to implement.*

Utilizing existing programs and incentives represent the most cost-effective strategies. There are some costs associated with researching and managing applications to programs, however, these are minimal compared to other analyzed financing sources. Additionally, time horizons from project application to completion may vary, representing barriers to rapidly assisting residents and decarbonizing buildings. However, without the need to secure net new funding streams or operationalizing a new billing system, existing programs and incentives should be prioritized.

Tariffed On-Bill Financing

*The efficiency of tariffed on-bill financing is **high** because it is directly tied to the property's meter and to affordability/bill savings associated with building electrification outcomes.*

Utilities that have offered tariffed on-bill programs in the past have reported results that indicate consistently high adoption rates for building energy efficiency upgrades and low default rates of nonpayment (0-3%), even in areas characterized by conditions of persistent poverty.

To maximize and ensure customer bill savings, tariffed on-bill financing programs require additional upfront capital investment to lower and drive down total project costs.[67] In Alameda's climate, this would be particularly important in the near-term, where bill savings are less drastic.[68] As building electrification has significant societal benefits, the City should be prepared to contribute additional public funding in parallel. Sourcing third-party capital is one additional potential solution but creates an issue of repayment allocation (or who gets paid first) when customers partially pay their utility bills.[69] Despite the need for additional upfront capital, tariffed on-bill programs are the most direct way to tie financing directly to both the private and social benefits of metered bill savings and emissions reductions through energy savings from building retrofits.

Municipal Tax Measures

*The efficiency of municipal tax measures is **low** because of the potential distortionary nature of taxation and broad funding application of new tax revenue.*

From an efficiency perspective, funding via new tax measures represents a flexible and reliable source of income for the City of Alameda to deploy. This will depend on the final structure - as certain tax structures might be more subject to volatility in total capital raised on an annual basis, in particular with a carbon tax where the tax base might shrink over time as the City decarbonizes. From an efficiency perspective, the challenge with taxes is that they tend to be distortionary. Taxes placed on utility usage could help internalize an externality, both the negative externality of natural gas emissions or the positive externalities of energy efficiency. New tax revenue also will likely not translate into revenue that will fund a broader suite of climate resilience and decarbonization priorities, making it less efficient than funding directed exclusively for building retrofits.

Municipal Bond Measures

*The efficiency of municipal bond measures is **moderate** because they are non-distortionary and raise flexible and reliable funding. There are still significant costs related to cost-of-capital and implementation that must be considered.*

Municipal bonds can represent a flexible and low-risk way to raise revenue, however, the "cost-of-capital" for municipal bonds depends on credit ratings, interest rates, and other market factors.[70] Moreover, there are implementation costs associated with bond administration and certifications (especially with green bonds). Municipal bonds represent a stronger alternative to municipal taxes for financing large projects given they are not as susceptible to distortionary effects; that is, funding is clearly allocated to specific goals and projects (e.g. climate mitigation and resiliency infrastructure). Nonetheless, bonds represent a secondary cost-effective alternative to existing programs and incentives.

[67] Choi, Y., Sadler, J., & Zimmerman, Z. (2021).

[68] Choi, Y., Sadler, J., & Zimmerman, Z. (2021).

[69] U.S. Department of Energy. "On-Bill Financing and Repayment Programs." Energy.gov. https://www.energy.gov/eere/slsc/bill-financing-and-repayment-programs.

[70] MSRB. (2105). *Facts about Municipal Bonds*. MRSB Education Center. https://www.msrb.org/msrb1/pdfs/Facts-About-Municipal-Bonds.pdf

Criteria 3: Political and Implementation Feasibility

Existing Programs and Incentives

*The political and implementation feasibility of existing programs and incentives is **high** because the programs are already implemented.*

As with any grant application or incentive program, there will be hurdles to implementation. If existing programs, including AMP rebates, see a surge in adoption, there will need to be additional resources allocation for application acceptance, fund disbursement, project development and implementation, and reporting and impact assessments. However, none of these elements are insurmountable and present an opportunity for city agencies and stakeholders to work collaboratively to implement effective programs.

Tariffed On-Bill Financing

*Political and implementation feasibility of tariffed on-bill financing is currently **low** because of restraints from AMP's billing platform and lack of program pilot data to justify changes to the billing platform.*

AMP currently uses the Northstar billing system, a software for municipal utilities that is limited in functionality and not conducive to implementing on-bill capabilities. Implementing tariffed on-bill financing would therefore require new resources to manage the program, potentially contracting a third-party vendor to take on risk and manage the program on behalf of AMP. AMP is open to exploring creative options to adopt tariffed on-bill financing if it is found to be a critical mechanism to advancing electrification.

Tariffed on-bill financing assumes an inherent risk in depending on customer bill savings as a primary offering. Statewide programs such as the current Net Energy Metering proceedings or other regulatory changes could impact the overall cost-effectiveness of the program in the long-term.

Municipal Tax Measures

*The political and implementation feasibility of municipal tax measures is currently **low** because any measure will require the introduction and passage of a new tax. While there is enough support for a natural gas user fee in tax form, building electrification is lower priority then other climate adaptation/resilience measures.*

On the implementation feasibility front, there are upfront political and time burdens associated with introducing and passing the measure. As mentioned, polling suggests that there is potentially political will for a natural gas usage tax. However, there is little political will for an additional tax measure to fund climate initiatives specifically, making it unlikely to receive a ⅔ vote in the near-term. Regardless of political will, a natural gas user fee would require formal introduction and passage, a medium lift. Any other tax measure would be a high lift unless the political landscape changed to re-prioritize clean energy and climate action over other priorities.

Municipal Bond Measures

*The political and implementation feasibility of municipal bond measures is **moderate** because it can be structured with or without additional political hurdles, and authority and precedent already exist. The exception to this is GO bonds which would require voter approval.*

Lease revenue bonds (COPs) represent the easiest bonds to implement. Cities do not need voter approval, unlike general obligation (GO) bonds. That said, recent polling indicates strong support for an infrastructure bond in the City of Alameda, which could result in a larger climate mitigation and adaptation bond. Finally, bonds come with significant upfront costs involving multiple stakeholders as well as ongoing internal and external review to ensure funds are being allocated and debts are being serviced appropriately.

Additional Considerations: Focusing on Rental Protections

As this report focuses on low- and moderate-income residents and renters, the success of electrifying those buildings is highly contingent on making funding and financing programs accessible, comprehensive, and effective for residents who have little or no upfront capital to contribute. As a result, the City should ensure that it has a robust process in place to engage community members to inform and guide programs and policies supporting building electrification for low- and moderate-income residences and rental properties. This includes both the design of rebates, incentives, and financing programs that will cover the costs of electrification retrofits, as well as the design of protections for low-income and vulnerable community members to assure they are not negatively impacted in the process - such as through anti-displacement measures, rent and bill protection measures, and more.

It is critical that financing and funding solutions balance responsibilities between the City, building owners, and tenants. In the case that building owners are mandated to electrify their properties and retrofit costs are not recouped through a financing tool like tariffed on-bill, the City would need to proactively plan to prevent rent hikes and capital improvement pass-throughs from building owners to low-income and vulnerable tenants. Tariffed on-bill enables a financing solution that might be more attractive to landlords, as the retrofit cost is recouped via utility bills. For tenants, it is similarly attractive given that utility bills, on net, remain stable or ideally decrease with increased efficiency. Both goals can be more easily achieved if a tariffed on-bill program is paired with additional funding and support from the City (or other state or federal funding sources).

Alameda residents and community-based organizations have demonstrated interest in electrification, but fear that the costs of building retrofits will be passed through under capital improvement programs. This program allows costs to be passed through rent above the 8% cap, leading to rent increases that are untenable for most renters. Alameda should continue to engage to define and explore policy solutions that tie funding or other City support to non-displacement requirements, something the City of Berkeley

is exploring as well.[71] The City of Oakland is also exploring potential exemptions for building electrification, to make it unallowable to pass through via capital improvement programs.

Part 6: Recommendations for the City of Alameda – Financing, Funding, and Implementation Priorities

To meet the City of Alameda's building electrification goals in an equitable manner, it is crucial that the City identify new funding sources and financing solutions to increase the total pool of available funding to cover proactive electrification of existing low- and moderate-income households, in particular multifamily rental properties. As identified in the earlier section, *Cost of Electrification: Alameda Building Stock and Retrofit Cost Analysis*, the total funding required to electrify existing low- and moderate-income single family residential buildings is estimated at **$316.5 million**, and for low- and moderate-income multifamily residential buildings is estimated at **$331 million.** In the table below, these numbers are compared against the total estimated funding that could be applied through existing state programs accessible for City of Alameda residents (California SGIP and TECH incentives, primarily), as well as AMP rebates. It is estimated that existing programs could contribute up to **$28.38 million** for low- and moderate-income single-family homes, and **$12.2 million** for low- and moderate-income multifamily. This leaves a funding gap for the City of **$288.12 million** for low- and moderate-income single-family homes, and **$318.8 million** for low- and moderate-income multi-family homes.

Residential Building Type	**Funding Source 1: Existing State Programs**	**Funding Source 2: Existing AMP Rebates**	**Net Costs for LMI residential buildings (City of Berkeley)**	**Estimated Funding Gap**
Single Family Homes	$1,800 x 4,690 = $8.45 million	$4,250 x 4,690 = $19.93 million	$316.5 million	$288.12 million
Multifamily (All Non-Single Family)	$3,800 x 1,515 = $5.76 million	$4,250 x 1,515 = $6.44 million	$331 million	$318.8 million
Total	$647.5 million	$14.12 million	$26.37 million	$606.9 million

**See Appendix A for cost calculations and further details on cost assumptions.*

The following is a recommended approach for the City of Alameda to most effectively, efficiently, and feasibly fill this gap.

[71] The City of Berkeley. (2021). *City of Berkeley, California: Existing Buildings Electrification Strategy*, 8.

Immediate Next Steps (2022 - 2023)

Continue renter protection and capital improvement engagement.
This will be crucial in defining the template and "guardrails", using City of Berkeley's framing, by which the City can start to fund electrification in rental properties while ensuring vulnerable renters are not burdened. The City can and should convene with other cities, with housing development experts and professionals, and renter advocates to understand what the policy options are for limiting capital improvement pass throughs while still enabling electrification.

Amplify and support applications to existing state and federal household-level funding opportunities.
Existing household-level programs are expected to contribute approximately $48.45 million (see Appendix A). Access to this funding requires residents to apply directly to programs, including AMP, TECH, and SGIP. It is therefore in the City's best interest to prioritize outreach and marketing efforts to amplify awareness and uptake of existing programs among residents. Increasing resident participation in these programs will increase implementation of electrification updates in both multifamily and single-family homes, thereby lowering the total cost of capital needed for remaining electrification projects.

Apply to city-level grants and funding sources.
In addition to amplifying opportunities for residents to apply to existing programs, the City should also apply to existing and upcoming state and federal funding opportunities to attract new funding. This should include: keeping an eye out for potential summer/Fall 2022 Quick Start grant solicitations with the California TECH program, applying to the Cool City Challenge as soon as possible, potentially applying to the Climate Tech Finance Low-Interest Loan Program, and seeking out opportunities to attract funding from federal LIHEAP and WAP fundings pools.

Continue to assess tariffed on-bill programs for implementation and deployment support.
Tariffed on-bill financing has the potential to support Alameda's electrification goals as a mechanism to recoup upfront capital expenditures, and is uniquely situated to minimize risk and address split incentive concerns for renters and rental properties. The city should conduct an in-depth evaluation of capacity restraints, capabilities, and contracting needs as it relates to AMP's ability to implement tariffed on-bill financing. Additionally, the City should track existing pilots and source opportunities to learn alongside other California municipalities considering tariffed on-bill implementation. Results of this evaluation and learnings from programs currently underway will clarify the true feasibility of a tariffed on-bill solution. The city should stop pursuing tariffed on-bill solutions should challenges prove insurmountable for AMP or if expected bill savings for Alameda residents are too low.

Continue to assess partnership with BlocPower as a potential implementation and deployment partner. As BlocPower learns from and refines their strategy in other Alameda County cities, they will be both a critical potential financing partner as well as a thought leader and partner in successfully designing and implementing electrification retrofits for low- and moderate-income populations nearby.

Near-Term Priorities (2024 - 2025)

In the near-term, additional funds made available for low- and moderate-income residential building electrification should be used for upfront capital and retrofit costs (whether through comprehensive financing, or new incentives and rebates), as well as to backstop against rent or bill increases for a period as needed. Bonds and Tax Revenue can be used to target the lowest hanging fruit first, including offering free audits for all of the lowest income households to better understand their building needs. From there, the City can focus on the lowest income and most vulnerable households, fully funding retrofit and electrification costs for those households most in need and with the most energy savings potential (to ensure they won't see increased bills), with anti-displacement and bill control measures in place.

Implement a Utility User Tax.
This was already discussed as a potential measure in the original Climate Action and Resilience Plan planning process, with strong initial support. If this is still the case and this measure is considered more politically feasible, the City should move forward with assessing and proposing such a tax. The City should reference other similar measures, including the City of Albany's Utility User Tax that provides exemptions for all low-income households and otherwise vulnerable customers. The City of Alameda could consider a Natural Gas User Tax paired with proactive electrification of LMI residents, which might also expedite voluntary electrification. The City could also consider a broader utility user tax across electric and gas service, which could take advantage of AMP's already very low electric rates (i.e. ensuring electrification is still cost-effective). It will be critical to ensure the measure doesn't result in higher utility bills for low-income households.

Assess and deploy bond measures/existing bonding authority.
The city should explore how electrification could leverage capital from a new or existing infrastructure bond, which met the 2/3rds threshold in a recent survey. Exact bond structure will be recommended based on feedback from the Alameda Finance Authority, but emphasis should be placed on those that can be issued immediately (GO bonds or similar), and that are most likely to meet voter support benchmarks for implementation. If Alameda can strategically structure a bond for rapid approval and funding, it can offer the best pathway to rapidly raise and deploy capital for large low- and moderate-income residential electrification projects.

If feasible, implement BlocPower pilot project.
With more lessons learned from BlocPower's partnerships in nearby cities, and if early engagement proves the partnership is possible, the City should move forward with a pilot project with BlocPower. The likely first candidates would be moderate-income single-family homeowners, who are more likely to see greater natural energy efficiency improvements from electrification and who might be able to afford small increases in monthly bills to cover the electrification retrofit.

Long-Term Priorities (2026 - 2030)

Consider other tax measures, pending political feasibility.
Using the assessed total electrification costs (through a robust analysis like the BEI Berkeley study), the City should lay the groundwork for potential additional tax measures to contribute to climate resilience and clean energy funding pools.

Consider additional bond measures, pending political feasibility.
Using the assessed total electrification costs (through a robust analysis like the BEI Berkeley study), the City of Alameda should issue revenue or general obligation bonds based on Alameda Finance Authority recommendation, and similarly determine if a green bond certification is recommended. Finally, look for opportunities to structure bonds to apply to other residential climate mitigation and resilience needs (i.e. seismic retrofits, affordable housing, and safety).

When feasible, support implementing a tariffed on-bill program.
The city should support AMP in implementing tariffed on-bill solutions should the program prove feasible. Some indicators of potential tariffed on-bill feasibility include the observation of successful pilot projects, commitment from AMP to update its existing billing structure, and/or evidence of significant bill savings from electrification in Alameda.

Part 7: Conclusion and Future Research

The City of Alameda can lead in the residential building decarbonization and equitable finance space, utilizing existing programs and incentives and taking other actions outlined in this report's recommendations. Now is a critical time to be focused on building electrification, and Alameda should continue to leverage the growing federal, state, and local city policy, funding, and financing leadership in this space.

Taking these financing and implementation actions are important steps toward actualizing an equitable residential building electrification strategy. Additional opportunities for research include but are not limited to:

- Conducting a highly specific and robust building decarbonization and electrification cost analysis for the City of Alameda, referencing Building Electrification Institute (BEI) and Firefly Consulting analysis for the City of Berkeley as an example.
- Building on Appendix C to integrate EV charging, energy efficiency and seismic retrofit upgrades in future funding and financing strategies.
- Engage with other early adopter cities and municipal utilities to develop residential building decarbonization and electrification frameworks - inclusive of financing, community engagement, and implementation strategies - that can be leveraged by other municipalities.

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- Bruce Mast of Ardenna Energy, LLC
- Danielle Makous of Building Electrification Initiative
- Jennifer West of StopWaste.

Appendix A: Existing Program Funding Estimates for Alameda

The total amount of funding that will be available from the existing programs highlighted is subject to variation depending on program scope and targeted demographic. Existing research and analysis to date can be used to calculate the scale of the funding gap the City will need to meet. Informing assumptions and numbers include:

1) **Multifamily Housing**
   Out of 1,782 pre-1978 multifamily buildings, it is estimated that 85%, or 1,515 MF units, are low- and middle-income.
   a) Deployment of the full expected SGIP program rebate for low-income multifamily properties, assuming maximum eligibility for Heat Pump Hot Water Heater and electric panel upgrade incentives. SGIP could contribute an estimate of $3,800 per home, for both a HPHW and electric panel upgrade.
   b) Deployment of existing AMP rebates across all qualifying buildings, assuming no budget cap. AMP rebates could contribute an estimate of $4,250 per home.

2) **Single-Family Housing**
   Out of 10,421 pre-1978 single family homes it is estimated that 45%, or 4,690, are low- and middle-income.
   a) Deployment of the full TECH program rebates for all single-family homes, assuming maximum eligibility for HPHW and electric panel upgrade incentives. TECH program rebates could contribute an estimate of up to $1,800 per home, for both a HPHW and electric panel upgrade.
   b) Deployment of existing AMP rebates across all qualifying buildings, assuming no budget cap. AMP rebates could contribute an estimate of $4,250 per home.

Residential Building Type	**Funding Source 1: Existing State Programs**	**Funding Source 2: Existing AMP Rebates**	**Net Costs for LMI residential buildings (City of Berkeley)**	**Estimated Funding Gap**
Single Family Homes	$1,800 x 4,690 = $8.45 million	$4,250 x 4,690 = $19.93 million	$316.5 million	$288.12 million
Multifamily (All Non-Single Family)	$3,800 x 1,515 = $5.76 million	$4,250 x 1,515 = $6.44 million	$331 million	$318.8 million

The above analysis does not include potential federal funding from LIHEAP or WAP. The Building Electrification Initiative estimates that Alameda County will receive $506,000 in LIHEAP funding, for example. Given the absence of formal disadvantaged communities and very low-income populations, this report does not attempt to estimate the funding amount for the City of Alameda specifically.

For reference, the City of Berkeley has put forth their own cost and funding analysis, which estimates that existing state and regional programs could contribute up to $12,000 per household in incentives for low-income multifamily and single-family homes. This calculation also excludes funding from LIHEAP or WAP. The $12,000 includes BayRen programs, but not AMP rebates.

Appendix B: Additional Emerging Policy Tools for Building Electrification

The 2020 study conducted by previous Goldman School of Public Policy student consultants, "Electrifying Existing Residential Buildings in Alameda", provides a thorough overview of policies to target the entire residential building sector in the City. The report recommends Point of Sale and Point of Permit interventions for all households, including energy audits, alongside a split utility user tax, inclusive financing, and expanded rebated programs. Those policies should continue to be top of mind for the City - as they will be critical in driving long-term and cross-building sector electrification. In particular, when it comes to driving electrification of low- and moderate-income households, permitting and permit-triggered appliance conversions could be particularly useful. If designed as such, point of sale or permit fees can target higher-income residents, simultaneously driving electrification of those households while generating new revenue for low- and moderate-income retrofits.[72]

There are a few additional and more recently emerging policies that the City should consider that are being proven out in neighboring jurisdictions. They include:

1) Building Performance Standards: Setting performance standards and enforcing compliance via a timeline is an effective mechanism to drive long-term planning toward electrification and can allow for the flexibility needed for building owners, helping mitigate pushback from landlords and reduce split incentive challenges.[73] This has been explored in cities including Berkeley and Boston.[74]
2) Existing Building Reach Code: The City of Berkeley, in partnership with East Bay Community Energy, are considering a building reach code that would apply to substantial renovation or other electrification requirements at time of building permit. The ordinance being considered would now require all retrofits over a cost or square foot threshold to electrify affected appliances. The City of Alameda can and should track progress on this measure, including success or challenges in intervening through existing permitting processes.[75]

[72] Farahmand, Farhad. 2021. "Existing Building Electrification and Multifamily Electric Vehicle Charging: Policy and Financing Literature Review and Analysis." Peninsula Clean Energy, June. https://bayareareachcodes.org/wp-content/uploads/2021/06/Policy-and-Financing-Literature-Review-for-Existing-Building-Electrification_20210612.pdf.
[73] Ibid.
[74] September 22, and 2021 Emily Barkdoll. n.d. "Boston Passes Equitable Building Performance Standard." NRDC. https://www.nrdc.org/experts/emily-barkdoll/boston-passes-equitable-building-performance-standard.
[75] The City of Berkeley. 2021. "City of Berkeley, California: Existing Buildings Electrification Strategy".

Appendix C: Applicability for EV Charging Infrastructure, Seismic Retrofits and Energy Efficiency

The analyzed funding and financing mechanisms for residential building electrification can be applied to other electrification and climate mitigation and adaptation needs. Below is a preliminary analysis of existing and new funding and financing options for residential electric vehicle charging, seismic retrofits, and energy efficiency.

Residential Electric Vehicle Charging Infrastructure

Existing Programs and Incentives

AMP offers a rebate worth up to $800 for customers that purchase and install a level 2 electric vehicle charger at home. This rebate can also be applied to the permitting of a new, permanently installed level 2 home charger. Given that the average total cost of charger installations ranges from $750 - $2000+, this rebate generally covers a portion of the total charger costs and additional incentives are needed.[76] Moreover, there is a limit of one rebate per charging station and two charging station rebates per customer. Since level 2 charging times generally take 3-8 hours, this rebate limitation may pose a challenge for covering the cost of multiple chargers in multifamily units and does *not* address split-incentive issues.

Tariffed On-Bill Financing

Similar to other electrification measures, on-bill financing can be utilized as a means to cover the full costs of residential electric vehicle charging stations. As noted in a previous evaluation of this financing mechanism, tariffed on-bill financing offers the most equitable means of offering low-interest capital. When paired with time-of-use electricity rates for EV owners - which AMP currently offers as discounted rates to incentivize charging during "off-peak" periods - this can be an attractive way to scale EV residential charging to low-income households. There are no examples of utilities offering tariffed on-bill financing for EV residential charging, however, there may be organizations such as the Environmental and Energy Study Institute (EESI) or Rocky Mountain Institute (RMI) interested in piloting a program to this effect. Additionally, low or zero-interest on-bill loans may be an attractive alternative.

Municipal Tax Measures

Taxes can offer a sustainable source of funding for infrastructure projects. However, with this generally flexible and potentially large source of capital, this capital is usually allocated to climate mitigation and resiliency funds. For this reason, it is important to evaluate the estimated cost and impact of funding residential EV charging stations relative to other decarbonization or climate resiliency efforts. The City of

[76] 2*022 EV Charging Stations Cost | Install Level 2 or Tesla*. HomeGuide. https://homeguide.com/costs/electric-car-charging-stations-cost

Albany, CA Utility Users Tax or Denver, CO Sales Tax offer strong models for this kind of municipal tax to drive equitable residential EV charging installations. Moreover, municipalities can get the most "bang for their buck" when pairing EV charging installations with other property upgrades such as landscaping and lighting.[77]

Municipal Bond Measures

Many of the dynamics outlined for municipal tax measures can be applied to municipal bonds. Although it is unclear whether any cities have earmarked municipal bond financing for residential EV charging stations, the City of Burlington, Vermont "Green Stimulus" program offers an attractive financing model. As noted in the municipal bonds case studies, Burlington recently passed a bond totaling $5.3 million to offer residential electrification incentives. Residential EV charging stations did not make the list of approved rebates, however, future iterations could add EV station funding and target low- and moderate income customers.[78]

Seismic Retrofits

Existing Programs and Incentives

The California Earthquake Agency (CEA) periodically issues grants for seismic retrofits and safeguards against earthquakes, especially for older buildings.[79] The City of Alameda should monitor for the next "Earthquake Brace + Bolt" grant application round.

At the federal level, the Federal Emergency Management Agency (FEMA) grants up to $20 million to California residents as an ongoing funding. The City of Alameda can help low- and moderate-income families and multifamily renters apply for this grant.[80]

Tariffed On-Bill Financing

There are few if any examples of municipalities and municipal utilities using tariffed on-bill financing for seismic retrofits. However, it may be worthwhile to engage with AMP on this topic to better understand how municipal power systems could benefit from more resilient, seismically retrofitted homes. This exercise may yield a shared-cost approach to funding seismic upgrades along with electrification initiatives.

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[77] *Resources for Property Owners*. CALeVIP. https://calevip.org/resources-for-property-owners

[78] *Green Stimulus – Burlington Electric Department*. Burlington Electric Department. https://www.burlingtonelectric.com/greenstimulus

[79] "2020 Earthquake Safety and Emergency Response Bond" https://sfpublicworks.org/sites/default/files/ESER%202020%20Bond%20Report.pdf.

[80] FEMA Grants $20M to California to Increase Earthquake protection :https://www.fema.gov/press-release/20210318/fema-grants-20m-california-increase-earthquake-protection

Municipal Tax Measures

Seismic retrofits are a city-wide priority given the potential scale of impact from earthquakes. Given that taxes are an efficient way to raise large amounts of capital, this is a strong financing option for the City. Moreover, seismic retrofits scored as a high priority for the City of Alameda based on recent polls. Therefore, there is a higher likelihood taxes for this purpose will receive the required greater than 50% voter support.

The City of Berkeley represents an interesting case study in that it uses a refundable property transfer tax for voluntary seismic upgrades to residential properties. Up to one-third of the base 1.5% transfer tax rate may be refunded on a dollar-for-dollar basis. This program applies to structures that are used exclusively for residential purposes, or any mixed-use structure that contains two or more dwelling units.[81] Berkeley offers applicants up to one year to complete all seismic retrofit work after the date of transfer. This flexible timeline makes the program more attractive to a variety of stakeholders from realtor groups to new homeowners.

Municipal Bond Measures

The City of San Francisco $628.5 million Earthquake Bond voted and passed by residents. The City of Alameda is classified as a liquefaction zone which is considered a high risk of experiencing earthquakes. Pursuing an earthquake bond will be an ideal way to raise funds for seismic retrofits and weatherization for older housing stock in the City.

The Miami Forever Bond $400 million general obligation bond is being used to invest in climate reliance and mitigation as well as affordable housing projects. A similar bond could be adapted for residential seismic retrofit needs.

Energy Efficiency

Existing Programs and Incentives

Alameda Municipal Power offers low-income residents enrolled in the Energy Assistance Program free energy efficiency upgrades. Upgrades include refrigerator replacement, home weatherization, efficient LED lighting and occupancy sensors, and advanced power strips.[82] Other federal programs noted in the existing co-funding table such as Low Income Home Energy Assistance Savings Program (LIHEAP) Weatherization and Weatherization Assistance Program (WAP) offer low-income residents additional energy efficiency funding.

[81] *Funding for Seismic Retrofits*. City of Berkeley. https://berkeleyca.gov/construction-development/seismic-safety/funding-seismic-retrofits

[82] *Alameda Municipal Power (AMP) Energy Assistance Program (EAP*) https://www.alamedamp.com/331/EAP-Plus

Tariffed On-Bill Financing

Tariffed on-bill financing offers a promising option to fund energy efficiency upgrades for low-income consumers and tenants. The City of Alameda can plan to define what energy efficiency upgrades should be eligible for tariffed on-bill financing.

Municipal Tax Measures

Given that energy efficiency is technology specific, similar to EV charging stations, using taxes to fund this initiative may be less effective. Tax revenue tends to be used for broad-based climate resilience and mitigation purposes. Therefore, driving energy efficiency benefits from incentives and rebates, as well as any additional tax or bond funding.

Municipal Bond Measures

Municipal bonds are a common financing option for energy efficiency upgrades. These bonds can be structured as general obligation, revenue-based, and/or "green" certified bonds. Energy efficiency projects can be rapidly implemented with quick payback periods, so these can be especially attractive to investors.[83]

[83] Hamilton, K. *Energy efficiency*. Climate Bonds Initiative. https://www.climatebonds.net/projects/models/energy-efficiency