APPENDIX C

Cost Technical Appendix

Livermore Climate Action Plan Update

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Introduction

As part of its updated Climate Action Plan, the City of Livermore – in coordination with Rincon Consultants, Inc. (Rincon), the Livermore Climate Action Plan Advisory Committee, and the community of Livermore – has developed a comprehensive strategy to improve resiliency to climate change and for reducing community-wide GHG emissions to net carbon neutrality by 2045. However, achieving carbon neutrality requires significant, strategic investments into many elements of the community including new policies, infrastructure, technology, and behavior change on the part of the community. In order to develop transparency around the prioritization of these investments, Rincon has assembled a technical appendix detailing the estimated cost associated with the implementation of each of the 20 identified strategies based on cost data derived from past projects, case studies, and available research and academia.

Climate Action Plans exhibit high variability in implementation costs depending on the strategies identified, their level of specificity, and the accompanying funding and financing strategies, which may vary depending on the scope of the project. For example, costs may vary from capital-intensive investments like the installation of a microgrid to enhance energy resiliency in the event of climate disasters to setting up bike infrastructure to encourage alternative means of transportation. Furthermore, depending on the type of desired bike infrastructure, costs may vary from $10,000 to $1M per mile.[1] [2] Each reporting entity exhibits their own priorities and funding mechanisms based on the needs of its local community, in addition to having unique backdrops of political climate, land use practices, social equity concerns, and more. Simply put, one size does not fit all. The intent of this appendix is to distill these highly variable cost/benefit considerations into a document that provides a clear understanding of the potential costs and the primary variables that effect cost and provide a replicable pathway towards net carbon neutrality based on the strategies provided.

The strategies listed below have been broken down into 4 cost segments which include:

1. **Low-Cost:** The low-hanging fruit for the community or City, generally delineated as strategies associated with relatively low upfront costs or city staff time, (e.g., policy ordinances or outreach). For community members, this represents costs between $1 and $100 per year.
2. **Moderate-Cost:** Intermediate level of costs associated with consultant and moderate infrastructure changes, (e.g., feasibility studies, program development, and retrofitting existing infrastructure). For community members, this represents costs between $100 per year and $500 per year.
3. **High-Cost:** Longer term projects requiring substantial investments into major infrastructure or technology over time, (e.g., energy storage, bike lanes, or other infrastructure changes). For community members, this represents costs between $500 per year and $1,000 per year.

[1] 2018 Livermore Active Transportation Plan https://www.cityoflivermore.net/civicax/filebank/documents/18254

[2] 2018 Livermore Active Transportation Plan Appendices Table includes estimated cost per project. https://www.cityoflivermore.net/civicax/filebank/documents/18253

Table 1 Strategy Cost Summary

Strategy #	Strategy	Cost Categorization	City Cost Variables	Community Cost Variables	2030 MT CO_2e Reduction or Adaptive Capacity	2045 MT CO_2e Reduction or Adaptive Capacity
Adaptation Strategies						
E-1	Enhance community energy resilience.	High Cost	• Staff time • Microgrid costs Weatherization upgrades	N/A	High Adaptive Capacity	High Adaptive Capacity
D-1	Improve water conservation and reuse.	Low Cost	• Staff time • Ordinance/resolution/plan development • Staff time to develop partnerships	• Cost of water conservation efforts • On-bill water savings	High Adaptive Capacity	High Adaptive Capacity
F-1	Improve stormwater management.	Moderate Cost	• Size of project (acreage) • Staff time • Ordinance development (hardscape)	• Runoff rate • Parcel size • Runoff factor for user type (commercial, industrial, institutional) • Fee increases for new impervious surfaces	Moderate Adaptive Capacity	Moderate Adaptive Capacity

H-1	Increase resilience to extreme heat events.	Moderate Cost	• Staff time • Heat Mitigation Plan cost • Tree planting costs • Shade structure implementation • Backup power at cooling stations	• N/A	High Adaptive Capacity	High Adaptive Capacity
WF-1	Mitigate wildfire risk and improve preparedness.	Low Cost	• Staff time • Cost of personal protective equipment • Creation of fire safe development standards • Creation of community fire fuel load reduction program • Creation and operation of clean air centers • Building retrofits to improve indoor air quality	• Increased development costs	Low	Low
Mitigation Strategies						
B-1	Require new buildings to be all-electric and incentivize electrification retrofits of existing buildings.	Low Cost	• Staff and consultant time required to develop and pass an ordinance • Staff and consultant time required for outreach and education • Staff and consultant time required for conducting a cost analysis and feasibility study	• Cost savings of all electric home compared to fuel mix • Long-term savings on energy bills	27,383	121,559

B-2	Decarbonize electricity from the grid and increase local renewable energy generation.	Moderate Cost	• Staff time • Outreach and education	• Electricity costs per rate plan	25,505	0
T-1	Facilitate a transition to electric vehicles.	Moderate Cost	• Grant or financing availability for EV Readiness Plan • Staff and/or consultant time for ordinance development, outreach, and partnership development • Infrastructure costs for new chargers at municipal locations • Use of public/private partnerships • Electricity and charging rates	• Cost of charging infrastructure • Marginal cost of EV selected (Cost of combustion vehicle compared to EV alternative) • Lifecycle cost of EV ownership • Lifecycle costs of combustion vehicle ownership	49,494	93,458
T-2	Facilitate a transition to transit and shared mobility.	Moderate Cost	• Staff time • Bike share costs (pilot program) • Ordinance development costs	• TDM support actions • Transit Passes	3,033	4,656
T-3	Improve active transportation infrastructure.	High Cost	• Planning and consultant costs • Construction cost • Ongoing maintenance costs	• Costs associated with funding mechanism, e.g., sales tax or parcel tax	2,127	2,111
T-4	Support sustainable land use practices.	Low Cost	• Staff time • Consultant time	None Identified	Supportive	Supportive
W-1	Reduce the amount of waste that is landfilled.	Low Cost	• Staff time to develop an ordinance • Staff time for outreach and education	• Increased cost of food items served in reusable/ compostable food ware	19,379	22,646

			• Development of High Diversion Plan • Staff time for partnership development for food recovery	• Cost to businesses to implement waste diversion techniques • Cost to residents to implement home composting • Cost to businesses to implement composting		
W-2	Expand use of low-carbon and recycled building materials	Low Cost	• Staff time for outreach and education • Development of carbon performance standards and material-efficient building practices for new construction	• Increased cost of building material	Supportive	Supportive
S-1	Maximize local carbon sequestration.	High Cost	• Staff time • New trees • Operating and maintenance cost of trees • Carbon farming study and pilot project • Landscaping standards update • Urban Forest Management Plan preparation & implementation	• Cost of trees • Cost of water/maintenance of trees	58	58
Municipal Strategies						
M-1	Enhance resilience at public facilities.	High Cost	• Cost of microgrid/battery storage • Cost of energy efficiency and AQ upgrades selected • Energy Cost Savings	N/A	Supportive	Supportive

M-2	Electrify municipal facilities and operations.	Moderate Cost	• Staff time • Type of units electrified • Number of facilities	N/A	Supportive	Supportive
M-3	Electrify the City's vehicle fleet and encourage City employees to utilize alternative transportation and teleworking opportunities.	Moderate Cost	• Staff time • Number and type of vehicles electrified • EV charging infrastructure • Alternative transportation incentives	N/A	Supportive	Supportive
M-4	Conserve water in municipal landscaping and improve on-site stormwater management.	Low Cost	• Cost of new fixtures • Cost of new landscaping • Water savings offsets	N/A	Supportive	Supportive
M-5	Purchase more sustainable products to reduce waste from City operations.	Moderate Cost	• Staff time • Update Environmentally Preferable Purchasing Policy • Marginal cost of new products	N/A	Supportive	Supportive

M-6	Utilize public lands to increase local carbon sequestration and reduce urban heat island effect.	Moderate Cost	• Staff time • Open space/landscaping maintenance costs	N/A	Supportive	Supportive
Implementation Strategies						
I-1	Make climate impacts and resilience a standard consideration during planning and development processes.	Low Cost	• Staff time • Consultant time for carbon nexus study • Consultant time for financial risk analysis	N/A	Supportive	Supportive
I-2	Dedicate City resources to CAP implementation and consistently monitor progress.	Moderate Cost	• Staff time	N/A	Supportive	Supportive
I-3	Create a public outreach campaign to educate the community about CAP initiatives.	Moderate Cost	• Staff time	N/A	Supportive	Supportive

I-4	Foster green innovation in Livermore.	Low Cost	• Staff time	N/A	Supportive	Supportive

Cost Considerations

For each strategy, the cost description focuses on both internal costs (municipal-focus) and external costs (community-focus) and provides insight into the variability of these costs including the primary variables that may affect cost effectiveness including several primary considerations:

Upfront versus Lifecycle Costs

When discussing how much a strategy or action costs it is important to differentiate between the upfront costs, the cost of an LED light bulb, versus the lifecycle costs of purchasing, operating, maintaining, and ultimately disposing of that lightbulb. While LED lightbulbs may be more expensive up front when compared to an incandescent bulb, the lifecycle costs of owning an LED lightbulb are significantly lower, providing a significant return on investment.

Incremental or Marginal Costs

When discussing costs, it is important to specify the difference between how much a strategy costs overall and what the incremental or marginal cost is. The incremental or marginal cost is the difference in cost between the new action and the old or standard action. For example, purchasing a new electric vehicle could cost $30,000 which should be considered a high cost. However, the marginal cost of purchasing an electric vehicle versus purchasing a new internal combustion vehicle may be zero or near zero because of reduced long-term operating and maintenance costs including no fluids to replace, fewer moving parts like transmissions, and less brake wear. It is important to consider what the incremental/marginal costs are for each strategy by keeping in mind what the alternative costs are. In many cases, the difference is negligible.

Financing

One of the major financial tools available to make large investments into infrastructure, vehicles, or buildings is financing. Financing allows us to leverage the time value of money and put future expected money flows to use today. For example, a solar array may cost $20,000 and result in an energy bill that is $200 less per month. The cost of the solar array could be considered high. However, the loan for the solar array requires a monthly payment of $150 dollars, resulting in a net monthly savings of $50 dollars. Under this scenario the solar array does not carry a high cost, rather it provides an overall savings. The ability to finance can make seemingly high-cost investments low to no cost over time.

Understanding the ranges of cost savings and revenue streams, and how those costs and revenues accrue over time into a payback or ROI calculation, are prudent factors to structuring partnerships, engaging stakeholders, and making optimal financial decisions. For example, energy efficiency retrofits can generate cost savings of more than 30% for 15 to 20 years. If external partners are involved, such as with an energy savings performance contract (ESPC), cities may not need to provide any upfront capital, but the project's cost savings would accrue with a private third party and be lost by the city. An anaerobic digester may need $5M to $10M in upfront capital but could also generate $1 to $2M annually in natural gas delivery revenue. Over 20 years, which can be an attractive financial investment for a city. Cities must consider the estimated return on investment (ROI), how project costs and revenues balance out over the useful life of the project, and whether they are willing to forego long-term cost savings or revenue generation capacity by partnering with a private third party.

The Cost of Doing Nothing

Finally, it's also important to keep in mind that doing nothing to prepare for and mitigate climate change will also carry a cost. The alternative to implementing these strategies is not zero. One immediate example is the cost to install conduit and panel capacity for electric vehicle chargers for all new construction. While this action increases upfront construction costs by a few hundred dollars, doing that same work after the building is completed can be an order of magnitude higher (~$3,000). Given the move towards electric vehicles, the cost of not installing EV infrastructure today could cost the community significantly more in the future. In a similar vein, adaptation strategies will cost the city and the community today. Planting trees, installing microgrids, and setting up cooling centers all have upfront costs. However, it's imperative that we weight these costs against the costs of a future without these adaptive strategies given what we know about the climate. Research published in the journal Nature predict the cost of not decreasing emissions to carbon neutrality by mid-century could range between $149.78 trillion to $791.98 trillion by the end of the century.[3] That same study found that if we mitigate climate change and achieve carbon neutrality by mid-century the world could see a $127-to-$616 trillion-dollar economic benefit after considering the cost of mitigation. The humanitarian impact is also significant. The Red Cross and Red Crescent Societies estimate that the number of people in need of humanitarian aid each year could double to $200 million annually by 2050 due to climate change costing $20 billion per year.[4] Furthermore, the World Resources Institute has found that investing in adaptation and resilience provides a benefit-cost ratio ranging from 2:1 to 10:1, meaning that for every dollar invested in resilience and adaptation we stand to see $2 to $10 dollars' worth of benefits.

Funding and Financing Considerations

There are three major categories of financial pathways available for climate action: funding, financing, and revenue generation. For the purposes of this project, **funding** refers to repayment-free capital that is available from third-parties, **financing** refers to borrowed capital including loans, bonds, and other cost- sharing mechanisms that ultimately require the borrower to pay back the capital in full (typically with interest), and revenue generation from new charges, fees, or taxes, to citizens, beneficiaries, or customers, which can be placed on specific project users or applied to every resident or business in a given area. In some cases, **revenue generation** includes capturing cost savings that accrue from the project. Funding, financing, and revenue generation are often used together to implement major capital projects. While funding can support a capital project as a stand-alone mechanism, financing usually requires identifying a funding or revenue stream that will be used to repay borrowed capital.

Six Major Types of Funding & Financial Mechanisms

This list is ordered by the increasing amount of debt load that would be incurred by the city (or other

[3] Wei, Yi-Ming et al. Nature Communications. 2020. Self-preservation strategy for approaching global warming targets in the post-Paris Agreement era. Accessed at https://www.nature.com/articles/s41467-020-15453-z. Accessed June 9, 2021.

[4] International Federation of Red Cross and Red Crescent Societies. 2019. The Cost of Doing Nothing: The Humanitarian Price of Climate Change and How it Can be Avoided. Accessed at https://reliefweb.int/report/world/cost-doing-nothing-humanitarian-price-climate-change-and-how-it-can-be-avoided. Accessed June 9, 2021.

project lead): starting with free capital from grants and partnerships, continuing to capital borrowed from loans and bonds, and concluding with city funding from budget, taxes, and fees.

1. **Grants** can provide a substantial source of 'repayment-free' capital if cities have the staff capacity to invest in grant management. Grants make the most sense for cities with the necessary staff capacity (1-2 full-time equivalents, either internal or external experts) to track grant opportunities, craft meaningful proposals that link to the goals and mission of the donors, submit applications, and track results required for ongoing reporting.

    - **Pros:**
        - Grants do not have to be repaid
        - Grants can support purchases that enable cities to be the sole owner and operator of a project, and maintain city control over project details
        - Can attract media and generate credibility and prestige when awarded by national institutions, which helps promote cities' climate leadership and innovative projects

    - **Cons**:
        - Often competitive
        - Effort spent applying not always rewarded
        - Grants from federal, state, and other government sources tend to have strict limitations on what funds can be spent on, as well as burdensome reporting requirements
        - Not sustainable, have to reapply often with uncertain outcomes
        - Can sometimes come with 'match' requirements, where the grantee has to come up with ~10-50% of the project budget and the grant will cover the rest

2. **Partnerships** often tap resources, and secure capital, from non-governmental and corporate actors, which can spread the financial risk of a project across multiple public, private, and/or nonprofit entities. Partnerships are well-suited for cities who cannot or do not want to own their project outright, and who are willing to share possible cost savings and revenue generation with a third-party. Examples of partnerships include Energy Savings Performance Contracts (ESCOs), Sponsorships, Public-Private Partnerships, and Power Purchase Agreements.

    - **Pros**:
        - Private partners can expedite project design, initial implementation, and ongoing management
        - Can leverage private sector expertise to spark innovation, and better design, build, and manage projects
        - Can enable public sector to capture tax incentives and other private-market benefits
        - Private actors may fully fund the initiative

- **Cons**:
    - City may not have ultimate ownership of project, and may lose operational control
    - City may not have access to cost savings or revenue generated from project
    - Negotiations can be complex, lengthy, and difficult, and tensions can arise between parties given their divergent operational speeds, with public parties prioritizing safety and durability, and private partners preferring quick decision making and maximizing efficiency and profits.
    - Partnerships are less transparent than budget, bonds, and other mechanisms

3. **Loans** give cities access to upfront capital, whose principal and interest must be repaid over the duration of the loan. While cities should first consider grants and private partners that can provide repayment-free capital, when those pathways are unavailable loans are a dependable alternative. In many cases, municipal borrowers and impact-driven projects can find financing with low-interest rates. Loans can also include Lease-Purchase Agreements which defer upfront costs but require more total capital over the life of the payment.

    - **Pros**:
        - Provides upfront capital on short notice with predictable terms and contracts
        - Spreads the cost of a project across the useful life of the asset, and thus allocates costs to current and future users

    - **Cons**:
        - Loans add debt to the balance sheet
        - Lenders may have stipulations on what the borrowed capital can be spent on (assets vs. wages, etc.)
        - Private investor and bank loans are usually offered with higher interest rates than municipal bonds
        - Loans are less transparent than budget, bonds, and grants, unless cities pursue extraordinary levels of disclosure

4. **Bonds** provide dependable, predictable financing for cities looking to capitalize large infrastructure projects ranging from the millions to billions of dollars. A city can issue a bond directly or apply for funds from a state bonding program. These bonds can be backed either by general city funds, or specific revenue sources. There are multiple types of bond structures including general obligation, revenue, and conduit bonds, as well as certifications like “green” bonds for climate and sustainability that communicate what types of projects bond proceeds are being used for.

    - **Pros**:
        - Bonds enable cities to borrow large amounts of up-front capital with fixed low-interest rates and long repayment periods
        - Bonds spread out costs over useful life of project, which can be decades, and allocates costs to current and future users of the project
        - Tax-exempt municipal bonds can attract capital from high-net-worth investors, especially local wealthy individuals and families who benefit from tax

deductions on bond's interest if they live in your city's county or state.

- **Cons**:
    - Issuing general obligation bonds can be a politically charged process if your city requires voter approval
    - Bonds cannot be repaid through cost savings from a project, they must be repaid through additional topline revenues coming from a project or from reallocated funds within the municipal budget.
        - If a third party is generating revenues from the installation or operation of a project, those revenues can be used to support the bond. When combined with an Energy Savings Performance Contract, this is called a Morris Model Bond.
    - City bond ratings affect the interest rates of municipal bonds, with poorly rated cities having to pay higher interest rates on their bonds. This can pose as a challenge to lower income cities, and in cities that face frequent flooding, fires and other climate threats that threaten financial solvency — as all of these factors can depress city bond ratings.

5. **Budget** refers to using money in a city's general fund to capitalize projects. Every year cities collect tax revenue and other fees to populate their general funds, portions of which are appropriated to new capital projects and infrastructure investments. As the inability of city budgets to cover the expansive list of new costly climate projects in CAPs is a primary motivation for this project, financial mechanisms beyond budget must begin covering a larger share of the load, and other financial mechanisms should be fully explored before cities turn to budget funding. Yet, opportunities remain for climate action to take higher priority in cities' budgeting processes and for city budgets to fund appropriate climate-related expenditures. If using city budget is an option, well-suited projects tend to have total costs that are small enough to fit into 1 to 3 years of the city's budget, and/or have costs incurred in a dispersed manner, ideally evenly distributed over several years or decades, like the costs of staffing for a new program.

    - **Pros**:
        - City budget funds are available immediately, and thus can respond to pressing time-sensitive funding needs
        - City budget funds come with few restrictions, and can be tailored to match project needs exactly
        - Funding from the city budget does not increase debt burden, and frees up future budget that would otherwise be spent servicing debt payments with interest
        - Budget funding utilizes existing contractual relationships, and does not require creating new partnerships or entering into new legal arrangements

    - **Cons**:
        - The amount of funding available each year is limited, so large projects can exhaust an agency's entire capital budget for the year.
        - Similarly, it can take decades to accumulate enough to pay upfront costs of major infrastructure projects. If cities do save portions of the budget for several

years in order to have enough capital to cover the upfront costs of a project, cities can end up paying more for the project due to inflation.

6. **New taxes and fees**, as well as cost savings and other revenues, can create new flows of capital to fund climate action. Most often, however, ongoing revenue generation is not earmarked for a particular project and accumulated in a savings account. Rather, new revenue flows are funneled into cities' general funds, or leveraged through financing, as is the case with revenue bonds. Revenue generation via new taxes and fees makes sense for cities that have not significantly raised taxes or fees on residents in the past year or two, for projects that do not need immediate upfront capital, or for cities pursuing a revenue bond that needs a source of project-based revenues.

    - **Pros**:
        - New or raised taxes and fees provide cities with stable sources of ongoing revenue that can provide consistency and budget flexibility for decades
        - With adequate political support and restrictive legislation, revenues from taxes and fees can be set aside to create funds for very specific purposes, with revenues generated from specific stakeholder groups

    - **Cons**:
        - New or raised taxes and fees require significant political capital and community support to implement
        - There may be state-level regulation affecting which tax and fee structures a city can use
        - Certain tax structures can be regressive, placing a higher burden on low-income communities
        - Revenues generated from specific taxes and fees can fluctuate based on economic conditions and personal behavior, which can create last minute budget shortfalls

Strategy Cost Benefit Analysis

The following section discusses the primary variables impacting costs for each of the strategies as well as information on the potential costs to the City and community based on the cost considerations listed above. Strategies are organized into 4 categories: Adaptation, Mitigation, Municipal, and Implementation.

Adaptation Strategies

The strategies listed in this section aim to increase Livermore's resilience to climate change impacts, prioritizing vulnerable communities and vital public facilities. These strategies cover Energy Resilience, Drought, Flooding, Extreme Heat, and Wildfire.

Energy Resilience

Strategy E-1: Enhance community energy resilience

City Costs

City Cost Variables

- Staff time
- Microgrid costs
- Weatherization upgrades

City Cost Discussion

The climate resiliency of buildings is a primarily a factor of its capacity to withstand intense weather disasters. Municipal costs associated with E-1 include enhancing and promulgating microgrid resiliency, including staff time allocated towards developing partnerships, seeking grants, and conducting weatherization upgrades, the latter of which can reduce the energy consumption of buildings by up to 35%, resulting in long-term savings from reduced operating and maintenance costs.[5] The City costs associated with this strategy range from low costs (for staff time), to moderate costs (for facilitating weatherization upgrades) to high costs (micro grid expansion). The best strategy of the cost of microgrids is the cost per unit capacity ($/MW). In California, the average cost per MW of storage added is $3.5M.[6]However, these costs can be financed or even completed through public private partnerships. Furthermore, a single microgrid would help meet the goals of several strategies.

Community Costs

Community Cost Variables

- N/A

[5] Statewide Energy Efficiency Collaborative. Weatherization Guide for Local Governments. Accessed at https://californiaseec.org/wp-content/uploads/2017/01/Weatherization-Guide-for-Local-Governments.pdf. Accessed June 1, 2021.

[6] Asmus, Peter, Adarm Forni, and Laura Vogel. Navigant Consulting, Inc. 2017. Microgrid Analysis and Case Study Report. California Energy Commission. Accessed at https://ww2.energy.ca.gov/2018publications/CEC-500-2018-022/CEC-500-2018-022.pdf. Accessed June 1, 2021.

Community Cost Discussion

Costs incurred by the community for E-1 are focused largely on weatherization and other building upgrades. Costs will remain highly variable for existing buildings depending on their existing infrastructure and capacity to retrofit or enhance their surrounding environment, such as including fire safe or stormwater best management practices in their outdoor landscaping, reducing energy demand on the grid, converting to electric heating and cooling, construction of rooftop solar, and more. However, single family homes can make significant weatherization progress for <$1000.[7] Several weatherization assistance programs are currently available and more may be developed by the City.[8] Furthermore, weatherization has been found to pay back over $2 for every $1 invested over time.[9]

Drought

Strategy D-1: Improve water conservation and reuse

City Costs

City Cost Variables

- Staff time
- Ordinance/resolution development
- Staff time to develop and maintain partnerships for demonstration program and efficiency devices subsidy

City Cost Discussion

Promoting water efficiency is one of the most cost-effective means to not only conserve water but reduce GHG emissions. As opposed to retrofitting infrastructure or creating new programs to reduce emissions, promoting behavioral change requires little investment for immediate benefits of avoided emissions and costs associated with water treatment and delivery. Municipal costs to promote efficient water use, develop policies, and implement the water efficient landscape ordinance will require additional staff time.

Community Costs

Community Cost Variables

- Cost of water conservation efforts
- On-bill water savings

Community Cost Discussion

Using less water means lower water bills for the community. Community costs may include investment into smarter watering practices, like the City's water efficient lawn conversion rebate, weather-based irrigation controller rebate, or high-efficiency clothes washer rebate. Costs incurred by the community are relatively low compared to other strategies and added incentives provided by the City lead to quicker returns on investment, saving money on their bills in the long-term. Depending on the property, more efficient outdoor watering practices may reduce bills by 50%. When considering lifecycle costs, many water conservation actions provide a return on investment especially when considering rebates

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[7] https://www.homeyou.com/ca/weatherization-livermore-costs

[8] https://www.benefits.gov/benefit/1844

[9] https://www.energy.gov/eere/wap/about-weatherization-assistance-program

and incentives. Costs for onsite water reuse systems vary greatly from hundreds to hundreds of thousands of dollars depending on the size and complexity. However, these costs are offset over time based on water and wastewater savings.[10]

Flooding

Strategy F-1: Improve stormwater management

City Costs

City Cost Variables

- Size of project (acreage)
- Type of retrofit
- Staff time
- Staff time
- Cost and maintenance of permeable surfaces

City Cost Discussion

Increasing permeable surfaces effectively reduces urban runoff and returns water to the ecosystem, offsetting marginal costs associated with wastewater treatment. The cost of different permeable retrofit projects is dependent on the scale of the project and the costs associated with design, permitting and construction. The most effective method of assessing cost for permeable projects is notated on a dollar per acre of pervious surface basis. Project costs with a scope of less than ½ acre of pervious cover tend to be two orders of magnitude more expensive than storage retrofit practices. Costs may range depending on the type of pervious surface desired. Porous surfaces like gravel are relatively much cheaper alternatives to more expensive urban solutions like permeable concrete. On the low end, constructed wetlands and basic retention systems may cost as low as $2,200 while urban on-site retrofits may cost as high as $150,000.[11] Lifecycle considerations include cost savings associated with the method of pervious surface selected, such as a simple greenspace, or the avoidance of paving areas that would otherwise be paved and instead covered with porous material, such as gravel.

Municipal costs associated with this strategy involve staff time allocated towards the ongoing programmatic implementation of the City's Stormwater Management Plan, Green Infrastructure Plan, and Capital Improvement Program. Direct costs include expenses for maintaining infrastructure, constructing new devices, or monitoring water quality. Costs vary widely depending on the type of infrastructure installed. However, it's important to understand the savings that can be gained by using low impact development and green infrastructure.

By improving flood resiliency from future storms, the City can expect to save money in the long-term by avoiding reconstruction resulting from the damage of these storms under a business-as-usual approach. Urban trees also reduce stormwater runoff and water pollutants, improving ecosystem health, and provide barriers to urban flooding as a pervious surface.[12] A meta-analysis of green infrastructure

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[10] https://living-future.org/wp-content/uploads/2022/05/2019-Water-System-Financial-Case-Studies-1.pdf

[12] United States Environmental Protection Agency. 2013. Stormwater to Street Trees: Engineering Urban Forests for Stormwater Management. Accessed at https://www.epa.gov/sites/production/files/2015-11/documents/stormwater2streettrees.pdf. Accessed June 1, 2021.

systems found that green infrastructure can be less expensive than standard infrastructure alone even before taking into account lifecycle benefits.[13] A study of tree planting in five US cities found that "The five cities reported here spent $13– 65 annually per tree, but benefits returned for every dollar invested in management ranged from $1.37 to $3.09."

Community Costs

Community Cost Variables

- Runoff rate
- Parcel size
- Runoff factor for user type (commercial, industrial, institutional)
- Cost of incorporating pervious materials
- Savings associated with decreased flood damage

Community Cost Discussion

With the requirement of passive rain capture features for new infrastructure and development projects, the community may expect costs to rise for new construction projects. However, these costs covered by developers may lead to savings by the community at-large because of reduced damage to nearby communities vulnerable to flood risks. While most of the costs associated with stormwater management are accrued by the City, homeowners would receive monetary benefits through higher property values as a result of an improved quality of life.[14] Currently, under the City's Stormwater System Enterprise Fund, every resident owning property within the incorporated City limits but discharging stormwater to a collection and conveyance system owned and operated by the City shall pay a service charge calculated in accordance with Municipal Code Section 13.46.050. The annual service charge is dependent on the parcel size, runoff factor associated with user type, and the runoff rate per acre.[15]

Similar to the costs incurred by the City, community costs vary depending on pervious material chosen and the marginal cost of the impervious material that would be selected under a business-as-usual approach. These costs would only be applicable to new construction or replacement projects. Some simple solutions like bioswales or simply less hardscapes like concrete or paving can be low to no cost.

Extreme Heat

Strategy H-1: Increase resilience to extreme heat events

City Costs

City Cost Variables

- Staff time
- Tree planting costs
- Shade structure implementation

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[13] https://www.epa.gov/sites/production/files/2015-10/documents/lid-gi-programs_report_8-6-13_combined.pdf

[14] Sacramento State University, Environmental Finance Center. 2019. Estimating Benefits and Costs of Stormwater Management. Accessed at https://www.efc.csus.edu/reports/efc-cost-project-part-1.pdf. Accessed June 10, 2021.

[15] City of Livermore Stormwater System Enterprise Fund. Municipal Code 13.46.010. Accessed at https://www.codepublishing.com/CA/Livermore/Municipal/Livermore13/Livermore1346.html#13.46.050. Accessed June 1, 2021.

- Backup power at cooling stations

City Cost Discussion

This strategy includes several actions that would incur upfront and ongoing City costs. Municipal costs included in this strategy involve staff time allocated towards the development of a heat vulnerability index and mitigation plan which could be completed by existing staff or creating a full-time Climate Action Program Manager for a cost of approximately $150,000. Conducting tree canopy surveys to identify shade deficient areas in the City would be completed by a consultant for a cost between $75,000 and $150,000, which is also included under actions for sequestration. The cost of implementing additional shade structures at bus stops are likely between $10,000 and $15,000 per stop.[16] Backup power at cooling stations could be completed through the development of a microgrid system that would provide backup power to several buildings. Microgrids costs are significant. However, these costs can be financed or even completed through public private partnerships. Tree planting and maintenance costs can average around $1,300 per tree for installation, watering, maintenance, and reporting.[17]

Community Costs

Community Cost Variables

- N/A

Community Cost Discussion

Due to the actions of this strategy in the development of a heat pump retrofit program, community members may opt-in to the financial incentive offered by the City to retrofit their own homes and improve indoor air quality. This cost would be incurred on a voluntary basis for the benefit of the community. Otherwise, there are no more costs to the community associated with this strategy.

Wildfire

Strategy WF-1: Mitigate wildfire risk and improve preparedness

City Costs

City Cost Variables

- Staff time
- Cost of personal protective equipment
- Creation of fire safe development standards
- Creation of community fire fuel load reduction program
- Creation of clean air centers
  Building retrofits to improve indoor air quality

City Cost Discussion

Municipal costs associated with this strategy can be largely covered with the onboarding of a Climate Action Program Manager to manage the supportive actions therein. Additional costs may include the purchase of additional reserves of personal protective equipment, staff time dedicated to outreach and

[16] Wesoff, Eric. 2011. Solar Bus Shelters From GoGreenSolar. Accessed at https://www.greentechmedia.com/articles/read/solar-bus-shelters-from-gogreensolar#:~:text=A%20traditional%20bus%20stop%20costs%20anywhere%20from%20%2410%2C000%20to%20%2412%2C000. Accessed June 9, 2021.

[17] Ainsworth, Greg. 2021. RE: Medea Tree Estimate. Email. Message to Ryan Gardner and Camila Bobroff.

education associated with the use of AC alert systems, the creation of fire safe development and landscaping standards, such as a Fire Safe Garden Program, updating hazard planning for wildfires, establishing a community fire fuel load reduction program, and the creation of clean air centers.

Community Costs

Community Cost Variables

- Additional cost for new construction in fire zones
- Savings associated with reduced fire damage

Community Cost Discussion

Due to the actions of this strategy falling on the responsibility of the City, there are no direct costs incurred by the community for this strategy. However, additional considerations may be made for including fire safe construction practices into new construction projects. Variables within these costs are dependent on the marginal cost of implementing fire safe practices versus a business-as-usual approach. Long-term savings from reduced fire damage are difficult to quantify but could equal the cost of each structure hardened against fire.

Mitigation Strategies

As the City works to protect the community from climate impacts, it will continue its efforts to reduce community-wide emissions across all sectors. These strategies cover Buildings and Energy, Transportation and Land Use, Waste and Materials, and Carbon Sequestration.

Buildings and Energy

Strategy B-1: Require new buildings to be all-electric and incentivize electrification retrofits of existing buildings

City Costs

City Cost Variables

- Staff and consultant time required to develop and pass an ordinance
- Staff and consultant time required for outreach and education
- Staff and consultant time required for conducting a cost analysis and feasibility study

City Cost Discussion

This strategy would predominately be implemented through an ordinance. A benefit to ordinances is that they tend to be relatively cost-effective to implement, while providing effective long-term change for the benefit of the community in accordance with the City's CAP. Passing the electrification ordinance would include staff time to be covered by existing staff as well as consultant time. Variability within these costs are dependent staff or consultant time dedicated to ordinance development and outreach but are estimated below $30,000 total. Therefore, the upfront costs to the City are considered low and the lifecycle costs to the city are also low due to the need for a one-time investment.

Community Costs

Community Cost Variables

- Cost savings of all electric home compared to fuel mix
- Long-term savings on energy bills

Community Cost Discussion

Cost effectiveness studies completed for Livermore's climate zone show that new building electrification costs less to build than mixed fuel buildings.[18] Single family homes are $6,171 dollars less expensive to build all-electric compared to a mixed fuel home. When built with heat pumps instead of resistance heating, homes are both cheaper to construct and cheaper to live in offering up to $177 per year of on bill savings while saving approximately $4,613 in construction costs. Therefore, this strategy is considered low cost, but will be a significant cost savings for community members purchasing new homes.

Strategy B-2: Decarbonize electricity from the grid and increase local renewable energy generation

City Costs

City Cost Variables

- Staff time
- Outreach and education

City Cost Discussion

The primary action in this strategy is opting up the City of Livermore into a 100% carbon free or renewable electricity tier through East Bay Community Choice Energy. This is a one-time action by City Council and therefore, the major costs are staff time to prepare staff reports and conduct community outreach. Other substantial strategies include amending the building code to include major remodels in energy efficiency upgrades and solar requirements. Staff time will also be required to conduct outreach and generate staff reports prior to City Council adoption.

Community Costs

Community Cost Variables

- Electricity Costs per Rate Plan

Community Cost Discussion

Externally, B-2 may cost the community a marginal increase in money spent per kWh. However, this increased electricity cost depends on the rate plans used by the household/business. Based on the rate schedule of Strategy B-1 (Require new buildings to be all-electric and incentivize electrification retrofits) and an average monthly usage of 416 kWh, monthly bills would not increase under the East Bay Community Energy (ECBE) Brilliant 100 rate plan and would increase by approximately $4 per month under the ECBE Renewable 100 rate plan for both standard and CARE rates.[19]

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[18] City of Livermore. 2019. Existing Low-Rise Residential Buildings. Accessed at https://explorer.localenergycodes.com/livermore-city/forecast/12-PGE/studies/1,2,3. Accessed June 9, 2021.

[19] PG&E – EBCE Joint Rate Comparisons. Accessed at https://www.pge.com/pge_global/common/pdfs/customer-service/other-services/alternative-energy-providers/community-choice-aggregation/ebce_rateclasscomparison.pdf. Accessed June 1, 2021.

Transportation and Land Use

Strategy T-1: Expand electric vehicle infrastructure to support zero emission vehicles

City Costs

City Cost Variables

- Grant or financing availability for EV Readiness Plan
- Staff and/or consultant time for ordinance development, outreach, and partnership development
- Infrastructure costs for new chargers at municipal locations
- Use of public/private partnerships
- Electricity and charging rates

City Cost Discussion

Costs associated with improving electric vehicle (EV) infrastructure include the development of an EV Readiness Plan to promote sustainable, equitable charging infrastructure deployment. EV readiness ordinance costs are wrapped into the electric building ordinance calculated in Strategy B1. Costs to develop an EV Readiness plan are estimated to cost $70,000.[20] Needs of staff managing this project, such as outreach and education, partnership development, and more, may result in additional staff time. The City has several options for installing public chargers. The first option is for the City to own and operate a charger. Under this scenario the City should expect EV chargers to cost between $1200 and $3,000 per charger for level 2 charges.[21] The City would then charge for the rate of electricity and maintenance for charging. These costs may be financed through the CalCAP program.[22] Another option is a public/private partnership where the City contracts with a third party to own and operate the infrastructure.[23] This could help the City decrease its upfront costs. Finally, the City may be able to support/encourage local businesses and building owners to install additional chargers by educating them on the benefits such as increased customer satisfaction or by connecting them to funding/financing or third-party vendors.

Community Costs

Community Cost Variables

- Cost of charging infrastructure
- Marginal cost of EV selected (Cost of combustion vehicle compared to EV alternative)
- Lifecycle costs of EV ownership
- Lifecycle costs of combustion vehicle ownership

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[20] City of Berkeley. 2018. RFP for Electric Vehicle Roadmap: Strategies for Transitioning from Fossil Fuel Vehicles. Accessed at https://www.cityofberkeley.info/uploadedFiles/Finance/Level_3_-_General/RFP%2018-11229-C%20EV%20Roadmap%20Strategic%20Plan%207-10-18.pdf. Accessed June 10, 2021.

[21] Nicholas, Michael. 2019. International Council of Clean Transportation. Estimating Electric Vehicle Charging Infrastructure Costs Across Major US Metropolitan Areas. Accessed June 1, 2021. Accessed at https://theicct.org/sites/default/files/publications/ICCT_EV_Charging_Cost_20190813.pdf

[22] https://www.treasurer.ca.gov/cpcfa/calcap/evcs/summary.asp

[23] https://www.pge.com/en_US/large-business/solar-and-vehicles/clean-vehicles/ev-charge-network/program-participants/approved-program-vendors.page

Community Cost Discussion

Externally, the community may see increased costs of new construction because of new requirements to include EV capable charging spaces in new lots. Community members should expect to pay between $400-$800 per space for added conduit and panel capacity.[24] This is compared to $2,500-$6,000 to install EV capable spaces as a retrofit depending on the type of parking space (surface, structure, etc..).[25] The cost to install a EV charger that is ready to use is approximately $1000 per charger for non-networked Level II chargers.

The cost to purchase an EV is another major consideration on the success of this strategy. The cost of an electric vehicle varies significantly depending on the EV chosen. Since the purchase of an EV will likely offset the purchase of an internal combustion vehicle, the marginal cost should be considered here. EVs also offer considerable opportunities for lifecycle cost savings compared to their internal combustion (ICE) or hybrid vehicle counterparts since they do not need oil changes, transmission fluid changes, spark plugs etc. For example, the electric MINI cooper emits approximately half of the greenhouse gas emissions than that of its ICE and hybrid models while costing considerably less per month in fuel, maintenance, and total vehicle costs per month.[26] In general, new electric vehicles may or may not cost more upfront, but generally cost less over their lifetime compared to combustion vehicles.

Strategy T-2: Improve shared mobility programs and transit service

City Costs

City Cost Variables

- Staff time
- Bike share costs
- Ordinance development costs

City Cost Discussion

Many of the costs associated with implementation for this strategy involve partnership development to expand and improve City transit systems and outreach and education to promote innovative new programs. While building new transit infrastructure and running more buses and more routes can be expensive, this is largely outside the City's responsibility. The City will need staff time to work with LAVTA, ACE, and others to promote the expansion of transit within the City.

Developing a bike share program is estimated to cost as much as $4,000 per bicycle, which covers the cost of docking stations and kiosks.[27] However, many mobility as service options are available that could provide these options at no cost to the city such as scooters and electric mopeds. Staff time needs may

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[24] California Air Resources Board. 2019. EV Charging Infrastructure: Nonresidential Building Standards. Accessed at https://ww2.arb.ca.gov/sites/default/files/2020-08/CARB_Technical_Analysis_EV_Charging_Nonresidential_CALGreen_2019_2020_Intervening_Code.pdf. Accessed June 10, 2021.

[25] Property Manager Insider. 2019. How Much do EV Charing Stations Cost? Accessed at https://www.propertymanagerinsider.com/how-much-do-ev-charging-stations-cost/. Accessed June 10, 2021.

[26] MIT Trancik Lab. Carbon Counter. Accessed at https://www.carboncounter.com/#!/explore?cars=35870;35756;36427. Accessed June 1, 2021.

[27] Beitsch, Rebecca. 2016. PEW Trusts. Despite Popularity, Bike Share Programs Often Need Subsidies. Accessed at https://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2016/03/24/despite-popularity-bike-share-programs-often-need-subsidies. Accessed June 10, 2021.

be better managed with the onboarding of a full-time Climate Action Program Manager to manage the implementation of these projects, programs and ordinances, shared ride services ordinance, and more. Variable costs include staff time dedicated to TDM implementation, work with partners, and consultant and/or staff time required for surveys and ordinance development.

Community Costs

Community Cost Variables

- Transit Passes
- TDM Compliance

Community Cost Discussion

Variable costs to the community lie largely in new requirements resulting from future ordinances that consider a shift away from single-occupancy vehicles, such as parking reductions or minimums, bike parking requirements, parking pricing, and more. No specific community costs were identified as part of this strategy and is therefore considered no to low cost.

Strategy T-3: Improve and expand active transportation infrastructure

City Costs

City Cost Variables

- Planning and consultant costs
- Construction costs
- Ongoing maintenance costs

City Cost Discussion

Costs associated with T-3 include staff time dedicated towards the implementation of the City's Active Transportation Plan, which may include the development of bike lanes, bike boulevards, separate and mixed-use paths, and separated bikeways, the latter of which could cost between a range of $1.5M-$3M per mile. On the other hand, designated bike lanes and bike boulevards may cost as low as $10,000 per mile.[28] The Active Transportation Plan identifies capital and maintenance cost per unit and per project. Additionally, the Active Transportation Plan identifies implementation strategies to construct bicycle and pedestrian improvements as part of private development and public capital improvements such as the resurfacing or streets.

In addition, costs may include staff time dedicated towards partnership development, outreach and education, workshops, and community events. Variable costs depend largely on the type of infrastructure the City believes is best suited to address the needs of its local community, while best enabling diversion from passenger vehicles within the greater context of lowering greenhouse gas (GHG) emissions.

[28] Melanie Curry. Streets Blog 2019. Breaking Down CalTrans' Cost Estimate of the Complete Streets Bill. Accessed at https://cal.streetsblog.org/2019/08/30/breaking-down-caltrans-cost-estimate-of-the-complete-streets-bill/#:~:text=On%2Dstreet%20bike%20lanes%2C%20buffered,use%20paths%3A%20%241M%2Fmile. Accessed June 1, 2021.

Community Cost

Community Cost Variables

- Costs associated with funding mechanism, e.g., sales tax or parcel tax

Community Cost Discussion

Additional community costs may include potential funding mechanisms for this infrastructure, such as a parcel tax, sales tax, and more. However, substantial cost savings opportunities exist within diverting drivers from the road to improve health and quality of life. Furthermore, the institution of car-free days downtown can enable more active transportation, and more pedestrian friendly events, like farmers markets.

Strategy T-4: Support sustainable land use practices

City Costs

City Cost Variables

- Staff and consultant time required to develop and pass an ordinance
- Required outreach and education
- Staff time to update City planning and zoning documents
- Staff time to review and approve infill development applications

City Cost Discussion

The cost of this measure would require additional staff time by expanding opportunities for infill development within City planning and zoning documents. In addition, various CEQA exemptions and streamlining provisions have been provided for infill projects located near transit, including SB 375 and SB 743. These exemptions would reduce staff time required to conduct the necessary operations for this measure. Additional actions would be accomplished through rezoning and the general plan update which is currently underway.

Community Costs

Community Cost Variables

- Infill development costs compared to green field development

Community Cost Discussion

With the costs of this strategy being fully absorbed by the City, no direct costs incurred by the community were identified. However, indirect costs should be considered as infill development to support sustainable land use practices, compared to green field development, could increase development costs and overall building costs.

Waste and Materials

Strategy W-1: Reduce the amount of waste that is landfilled

City Costs

City Cost Variables

- Staff time
- Staff time to develop ordinance
- Staff time for outreach and education

- Development of High Diversion Plan

City Cost Discussion

Implementation and compliance with SB 1383 are required by state law. Municipal costs to implement this strategy are dependent on rate increases, current and future infrastructure requirements, and potential need for the onboarding of new staff to manage and implement programs, including coordination with partners like StopWaste and waste haulers. Variables within the cost of implementation include staff time required to update waste hauler contracts, estimate capacity planning for organic food waste and edible food recovery, conduct outreach and education, and more. In addition, the integration of waste management practices to enable better composting programs for the City may result in savings, while improving the health and resiliency of local soils.

To effectively reduce the amount of waste that is landfilled, it is critical to understand what feasible opportunities exist for waste diversion with more granular waste data. The development of a High Diversion Plan can help inform this strategy, which, including the cost of staff time set aside to draft the RFP and implement the Plan, is estimated to cost approximately $100,000.[29,30] Additional costs include staff time dedicated to outreach and education, as well as $10,000[31] for the development of a compostable food ware ordinance, which would create an upstream, systemic change in how waste is processed in the City. Variables within these costs include staff or consultant time dedicated to developing a High Diversion Plan, staff time dedicated to plan implementation and education, and additional time allocated towards the passing of the food ware ordinance.

Community Costs

Community Cost Variables

- Cost to implement composting at home
- Cost to businesses to implement composting
- Increased cost of food items served in reusable/compostable food ware
- Cost to businesses to implement waste diversion techniques

Community Cost Discussion

To satisfy the requirement of SB 1383, CalRecycle estimates the cost to the community to be $17 per household per year after full implementation, and $662 annually for small businesses.[32] However, the costs for individuals will vary significantly, as the cost is dependent on the amount of waste that is currently disposed and the ability of the business to reduce the amount of organic disposal.

As for the community, costs incurred are relatively low while providing great benefit to the City's emissions reduction. Ordinances are known to be an effective means to influence consumer behavior.

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[29] City of Los Banos. 2020. RFP for Residential and Commercial Garbage, Recyclable Material and Organic Waste Collection Services. Accessed at https://sjc.granicus.com/MetaViewer.php?view_id=3&clip_id=1524&meta_id=87614. Accessed June 10, 2021.

[30] City of San Juan Capistrano. 2017. RFP for Sustainable Waste Diversion Projects. Accessed at http://www.losbanos.org/wp-content/uploads/2020/03/Los-Banos-Solid-Waste-RFP-Package-Final.pdf. Accessed June 10, 2021.

[31] Estimated cost for staff/consultants to complete ordinance

[32] CalRecycle. 2016. Proposed Regulation for Short-Lived Climate Pollutants: Organic Waste Methane Emissions. Accessed at https://www.dof.ca.gov/Forecasting/Economics/Major_Regulations/Major_Regulations_Table/documents/Final_Sria_11-16%20.pdf#search=%22SB%201383%20Economic%20Analysis%22. Accessed June 1, 2021.

For example, after the passing of the 2013 Alameda County Reusable Bag Ordinance, which charged $0.10/bag, bag purchases by affected retail stores declined 85%.[33] For businesses, costs include the marginal cost of providing compostable food ware compared to the cost of food ware already in practice. In Alameda County, the *Rethink Disposable* program, in partnership with StopWaste, demonstrated that several businesses that voluntarily minimized single-use food ware saw net cost savings of $1,000-$22,000 per year.[34] Developers may see additional operating costs associated with the separation of waste for proper reuse and recycling for better rates of waste diversion and consumers may see variable cost increases to food items as a result of these food items being provided in new compostable food ware.

Strategy W-2: Expand use of low-carbon and recycled building materials

City Costs

City Cost Variables

- Staff time for outreach and education
- Staff time for development of carbon performance standards and material-efficient building practices

City Cost Discussion

Costs to expand the use of low-carbon and recycled building materials may include staff time to raise awareness for low-carbon and recycled building materials, and staff time required to develop standards for new construction that limit embodied carbon emissions. Working with local, regional, and state partners to raise awareness around the availability and cost-effectiveness of low-carbon and recycled building materials will ensure that best practices and the most up-to-date information is incorporated in communitywide efforts to reduce embodied carbon emissions in construction.

Community Costs

Community Cost Variables

- Potential for increased cost of building material

Community Cost Discussion

With the expansion of low-carbon and recycled building material, there is potential for increased building costs due to higher material costs. More and more studies are finding, however, that embodied carbon reductions in new construction result in little to no cost premiums. Optimizing concrete mix, using high recycled content rebar, and selecting low- or no-embodied-carbon insulation products are shown to reduce embodied carbon significantly at little to no cost premiums. [35] In instances where embodied carbon performance standards and material-efficient building practices implemented by the City do increase costs, exemptions for cost barriers will be included as needed to prevent these changes from directly increasing housing or rent costs.

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[33] City of Berkeley Zero Waste Department. 2020. Passing a Single-Use Food ware and Litter Reduction Ordinance in Berkeley, CA. Accessed at https://zwconference.org/wp-content/uploads/presentations/nrc-nzwc_detournay_c.pdf. Accessed June 1, 2021.

[34] City of Berkeley. 2018. Single Use Disposable Food ware and Litter Reduction Ordinance. Accessed at https://ecologycenter.org/wp-content/uploads/2018/11/Disposable-Free-Dining-Ordinance.pdf. Accessed June 10, 2021.

[35] https://rmi.org/insight/reducing-embodied-carbon-in-buildings.

Carbon Sequestration

Strategy S-1: Maximize local carbon sequestration

City Costs

City Cost Variables

- Staff time
- New trees
- Operating and maintenance cost of trees
- Carbon farming study and pilot project
- Green scaping ordinance

City Cost Discussion

Costs to maximize local carbon sequestration may include staff and/or consultant time dedicated towards the development and implementation of an Urban Forest Revitalization Program, the preservation of open spaces, the development of a carbon farming study and pilot project, and the adoption of a green scaping ordinance. Unbeknownst to many, trees are one of the few assets of a city than increase in value over time. Investment in a healthy urban forest can provide greater returns on investment for the City and its citizens. Over the lifetime of the project, costs to fully implement an urban canopy program for a large city like San Francisco costs as much as $2.4M towards the purchase of vegetation and $3.2M towards operating and maintenance.[36] However, smaller programs are likely to be significantly less. In addition to the benefits of carbon sequestration, an urban canopy would provide co-benefits in cooling urban areas and providing healthier, more equitable, and higher quality air.

Community Costs

Community Cost Variables

- Cost of trees
- Cost of water/maintenance of trees

Community Cost Description

Community costs associated with local carbon sequestration focus on new construction, which may expect increased development costs associated with including more urban trees, shading, and permeable surfaces in proposed projects for the benefit of the overall community. Community members may also choose to plant their own trees. The cost of a new tree varies by species and size but could be anywhere from $25 to $200. Watering and other maintenance is likely to be minimal (a few dollars a summer) while trimming costs may increase in the future once the tree is larger. Co-benefits of carbon sequestration projects to the community include more open spaces, savings on electricity bills if trees help shade your home, more greenery in the surrounding environment, and enhanced climate resiliency against natural disasters, like flooding, urban wildfires, and drought, improving the overall health and well-being of the community.

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[36] AECOM. 2012. Financing San Francisco's Urban Forest. Accessed at https://healthyplacesindex.org/wp-content/uploads/2018/02/san_francisco_cost_benefits_comprehensive_municipal_street_tree_program.pdf. Accessed June 10, 2021.

Municipal Strategies

Because municipal strategies are intended to reduce emissions that are a subset of larger community emissions, the municipal strategies provided have been grouped into their own category below in this appendix, rather than integrating municipal strategies with community strategies grouped into low, moderate, or high-cost categories. Each strategy is still assigned a cost category, but this accommodation for municipal strategies is intended to centralize all information required to reduce emissions internally and make it easily accessible to the City.

Strategy M-1: Enhance resilience at public facilities

City Costs

City Cost Variables

- Cost of microgrid/battery storage
- Cost of energy efficiency and AQ upgrades selected
- Energy Cost Savings

City Cost Discussion

Municipal costs incurred to enhance energy resiliency at public facilities would include the infrastructure costs associated with new energy generation technologies like solar PV or fuel cells as well as the cost of batteries to store energy. As described in Strategy H-1 and E-4, microgrid costs are significant. The best strategy of the cost of microgrids is the cost per unit capacity ($/MW). In California, the average cost per MW of storage added is $3.5M.[37]However, these costs can be financed or even completed through public private partnerships. Furthermore, a single microgrid would help meet the goals of several strategies including H-1 and E-4.

Strategy M-2: Electrify municipal facilities and operations

City Costs

City Cost Variables

- Staff time
- Types of units electrified
- Number of facilities

City Cost Discussion

Municipal costs incurred to electrify facilities and operations, while increasing energy efficiency and renewable energy, include staff time dedicated towards the installment of a new policy banning natural gas infrastructure, regular energy audits of existing facilities, costs of LED bulbs for streetlight retrofit projects and more. Costs are highly variable depending on the types of units electrified, the number of facilities, and marginal costs between existing infrastructure and appliances selected. However, there exist several opportunities to engage in energy service contracts, which significantly decrease upfront costs. Overall, the return on investment from this strategy will result in significant long-term savings over the lifecycle of the project as result of lower operating and maintenance costs, while exemplifying

[37] Asmus, Peter, Adarm Forni, and Laura Vogel. Navigant Consulting, Inc. 2017. Microgrid Analysis and Case Study Report. California Energy Commission. Accessed at https://ww2.energy.ca.gov/2018publications/CEC-500-2018-022/CEC-500-2018-022.pdf. Accessed June 1, 2021.

leadership in the community. One example are heat pumps, the dominant technology for electric heating and cooling, which are significantly more efficient than their natural gas counterparts, leading to bill savings that typically outweigh any higher upfront costs.[38] The expansion of renewable energy will require additional staff time dedicated towards engagement with PGE and staff and/or consultant time dedicated towards battery storage project development.

Strategy M-3: Electrify the City's vehicle fleet, and encourage City employees to utilize alternative transportation and teleworking opportunities

City Costs

City Cost Variables

- Staff time
- Number and type of vehicles electrified
- EV charging infrastructure
- Alternative transportation incentives

City Cost Discussion

Costs to electrify the City's vehicle fleet include the addition of new EV chargers on municipal grounds and staff time dedicated towards the development of a policy that requires electrification of the City fleet. In addition, costs may include the establishment of bike lockers for public use across the City, such as at City Hall and off-street parking lots for resident use. Cost variability is dependent on the number and type of electrified vehicles selected for deployment, new EV charging infrastructure, and additional savings incurred through the utilization of alternative transportation. The long-term trend of EVs points towards lower upfront costs and higher returns on investment through significantly decreased operating and maintenance costs.[39] As in M-1, there exist several opportunities for low energy service contracts, which would further decrease upfront costs of the project.

Strategy M-4: Conserve water in municipal landscaping and improve on-site stormwater management

City Costs

City Cost Variables

- Staff time
- Low flow water fixtures
- Low water use landscaping

City Cost Discussion

Municipal costs associated with this strategy are embedded in new staff time allocated towards costs associated with reviewing existing water use and identifying low water use alternatives for fixtures and municipal landscaping. Other costs include fixture costs and landscaping costs associated with the

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[38] Energy, Environment, Economics (E3). 2019. Residential Building Electrification in California. Accessed at https://www.ethree.com/e3-quantifies-the-consumer-and-emissions-impacts-of-electrifying-california-homes/. Accessed June 1, 2021.

[39] Heisel, Rebecca. 2020. Consumer Reports Study Finds Electric Vehicle Maintenance Costs are 50% Less than Gas-Powered Cars. Accessed at https://www.betterenergy.org/blog/consumer-reports-study-finds-electric-vehicle-maintenance-costs-are-50-less-than-gas-powered-cars/. Accessed June 10, 2021.

chosen upgrades. However, water savings and increased resiliency benefits should also be included in the decision-making process.

Strategy M-5: Purchase more sustainable products to reduce waste from City operations

City Costs

City Cost Variables

- Staff time
- Update Environmentally Preferable Purchasing Policy
- Marginal cost of new products

City Cost Discussion

Municipal costs associated with the reduction of landfilled waste include staff time, such as the work of the City's Green Team, to employ an Environmentally Preferable Purchasing Policy to integrate upstream strategies to reduce waste by the City. By selecting work with vendors who use more environmentally friendly materials, the City maintains a considerable opportunity to lower its operating costs and environmental footprint, decreasing demand for downstream strategies such as waste organization, diversion, and recycling.[40] Variable costs depend on program implementation, education and outreach, and the marginal cost of using more environmentally sustainable materials versus a business-as-usual approach. This strategy expects long-term savings associated with reduced operating costs and more durable and reusable materials.

Strategy M-6: Utilize public lands and open spaces to increase local carbon sequestration and reduce urban heat island effect.

City Costs

City Cost Variables

- Staff time
- Open space/landscaping maintenance costs

City Cost Discussion

Costs to better utilize public lands and open spaces include staff time dedicated towards the development of a map or database identifying public spaces that can be converted to green spaces, including parking spaces and freeways, and walls and rooftops for gardens. The US EPA notes the use of trees, vegetation, and open spaces can considerably lower urban heat island effects, deflecting radiation from the sun, and releasing moisture into the atmosphere.[41] Where applicable, the City may also consider evaluating landscaping plans to improve the utilization of native species. The USDA encourages use of native species to strengthen wildlife populations, boost conservation benefits, and improve the

[40] Little, Shelley. 2021. 10 Reasons You Should Use Sustainable Building Materials. Accessed at https://www.mymove.com/home-renovation/guides/reasons-you-should-use-sustainable-building-materials/. Accessed June 10, 2021.

[41] United States Environmental Protection Agency. Reduce Urban Heat Island Effect. Accessed at https://www.epa.gov/green-infrastructure/reduce-urban-heat-island-effect#:~:text=Trees%2C%20green%20roofs%2C%20and%20vegetation,releasing%20moisture%20into%20the%20atmosphere.. Accessed June 10, 2021.

value of ecosystem services.[42] Variable costs include the number and type of flora selected, planting time, and ongoing operating and maintenance costs of the green spaces.

Implementation Strategies

Important to meeting the objectives of Livermore's CAP is how the strategies and actions will be implemented in the community and how success or hurdles are monitored and discussed over time. Dedicating City resources to climate efforts, tracking implementation progress, considering climate change in all City plans and processes, and communicating important initiatives to residents and business will be key to the successful implementation of the CAP. This section includes strategies for ensuring successful implementation of all the strategies and actions listed in the CAP.

Strategy I-1: Make climate impacts and resilience a standard consideration during planning and development processes

City Costs

City Cost Variables

- Staff time

City Cost Discussion

Municipal costs associated with this strategy are embedded in new staff time allocated towards climate planning considerations for future construction projects as well as the integration of climate considerations into City plans. The opportunity for integration of adaptation planning with other City plans includes the Local Hazard Mitigation Plan, General Plan, Active Transportation Plan, Green Infrastructure Plan, Emergency Response Plan, and zoning land use codes are additional variables to project costs. Additional costs may include outreach and education to the community on local and regional climate impacts.

Community Costs

Community Cost Variables

- N/A

Community Cost Discussion

There are little to no community costs associated with this strategy. Costs may include additional operating expenditures associated with including climate consideration into future construction projects, but the community will largely receive a net benefit in value as a result of being part of a more resilient, socially equitable community.

Strategy I-2: Dedicate City resources to CAP implementation and consistently monitor progress

City Costs

City Cost Variables

- Staff time

[42] Taylo, Ciji. United States Department of Agriculture. Accessed at https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/home/?cid=STELPRDB1166100. Accessed June 10, 2021.

City Cost Discussion

The internal cost of implementing this strategy would be optimally accounted for by creating a Climate Action Program Manager position for an estimated annual cost of approximately $150,000. This could be achieved by creating a new position or redesignating an existing staff position. Costs include staff time dedicated to regular progress reports on CAP strategy updates and work with stakeholders to implement the Climate Action Plan actions. Variability within this internal cost depends on staff time allocated to the project, and the cost of onboarding new staff.

Community Costs

Community Cost Variables

- N/A

Community Cost Discussion

Given that the focus of this strategy is to provide transparency on CAP progress to the community, there are relatively few community costs. In fact, the City would benefit from employing a more open and transparent approach to the reporting of their CAP data, enabling better engagement with the community.

Strategy I-3: Create a public outreach campaign to educate the community about CAP initiatives

City Costs

City Cost Variables

- Staff time
- Outreach Platform

City Cost Discussion

Internal costs implementing I-3 are strongly dependent on the outreach platform selected, which range from $100-$10,000 annually depending on the City's needs for basic outreach software or complete software with insights provided.[43] The City should seek to dedicate staff time towards developing a suite of marketing materials to promote transparency, develop a brand and identity, and regularly engage with the community at outreach events, workshops, focus groups, and more. A staff member designation as Climate Action Coordinator may increase costs for this project, but ultimately would result in a more engaged and informed community that strongly support the City's climate objectives. Variable costs include staff time and costs of the outreach platform. However, many municipalities generally already have budget allocated towards the use of different outreach platforms, which may already be embedded into existing operating costs.

Community Costs

Community Cost Variables

- N/A

[43] Capterra. 2020. Marketing Automation Software Pricing Guide and Comparison. Accessed at https://www.capterra.com/marketing-automation-software/pricing-guide/. Accessed June 10, 2021.

Community Cost Discussion

Because the community would be on the receiving end of this outreach, this strategy features zero costs to the community. In fact, creating a more open and transparent approach to sharing information about CAP updates and initiatives are known to lead to a more unified community and holistic support of the City's CAP objectives.[44]

Strategy I-4: Foster green innovation in Livermore

City Costs

City Cost Variables

- Staff time

City Cost Discussion

Costs associated with innovation development include staff time dedicated towards stakeholder and community engagement to attract future businesses to the community, and increased outreach, education, and coordination with consulting groups to identify new technologies and pilot projects to bring to the City. Innovation in the City can significantly contribute to economic productivity. Generally, innovation generates greater output with the same input, enhancing economic resiliency against climate disasters.[45] Additional considerations may be made for the development of a Product Review Board, where outside businesses and potential contractors may showcase their product or services to a selected team of City staff members.

Community Costs

Community Cost Variables

- N/A

Community Cost Discussion

Given that the focus of this strategy is for the City to accelerate green growth in Livermore, there are no direct community costs.

Climate Action Finance Map

While Livermore's Climate Action Plan strives to identify cost effective, low cost, and no cost actions that will help mitigate and adapt to climate change, some measures still carry significant upfront costs. However, there are options to both fund and finance these strategies that can significantly improve the cost effectiveness of these strategies. The following Climate Action Finance Map was developed to identify these strategies and provide links to case studies that demonstrate their effectiveness.

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[44] CallHub. 2019. Guide to Devising Great Community Outreach Strategies That Win Big. Accessed at https://callhub.io/community-outreach-strategies/. Accessed June 10, 2021.

[45] European Central Bank. 2017. How does Innovation lead to growth? Accessed at https://www.ecb.europa.eu/explainers/tell-me-more/html/growth.en.html. Accessed June 10, 2021.

Climate Action Finance Map

Pathways to Capital for Projects in Livermore's 2021 Climate Action Plan

September 2021

Livermore Climate Action Measures	Capital Types	Top Funding and Finance Pathways	Programs and Partners	Case Examples
BUILDINGS **Measure B-2** Affordable Electrification and Efficiency Retrofits Explore Electrifying existing buildings to reduce natural gas consumption 10% by 2030 and 61% by 2045	GRANT	State Grant via CA Energy Commission	Building Initiative for Low-Emissions Development (BUILD)	N/A: New Program
	GRANT	State Grant via CA Strategic Growth Council	Affordable Housing + Sustainable Communities (AHSC)	2019 Awardees
	GRANT	Federal and State Grants	LIHEAP or Spectrum Community Services	CA WAP
	PARTNER	Utility-Led Incentives	PG&E Rebate Program	CA CPUC
	LOAN	On-Bill Financing (Tariff)	PG&E, East Bay Community Energy	Kansas City, MO - P&L
	LOAN	PACE or C-PACE Financing	PACENation	Greenville, MI - Cambridge Court Apts
	LOAN	Green Bank or Revolving Loan Fund	Coalition For Green Capital	CT Green Bank
	LOAN	Federal or State Loan Program	GoGreen Financing	CAEATFA - REEL
	LOAN	HomeStyle Energy Mortgage	Fannie Mae	Portland, OR
	LOAN	Federal Loan Guarantee	DOE Loan Program	Project Portfolio
BUILDINGS **Measure B-2-3** Tariff On-Bill Financing, Green Bank, and/or Revolving Loan Fund (RLV) Partner with stakeholders to develop funding pathways for electrification upgrades	GRANT	Government and Foundation Grants	Building Decarb Coalition	Baltimore, MD
	PARTNER	Local Economic Development Corporation Partnership	Office of Innovation and Economic Development	NYC RLF (eg. of PPP, but for development)
	LOAN	Program Related Investment or Endowments	Coalition for Green Capital	CT Green Bank + MacArthur
	LOAN	Private Investment or Bank Loan	Coalition for Green Capital	Colorado Clean Energy Fund
	BOND	Green or Revenue Bonds	California iBank	CT Green Bank - Green Liberty Bond
	FEE	Ratepayer Surcharge	PG&E, East Bay Community Energy	CT Green Bank
BUILDINGS **Measure B-4** Residential and/or Commercial Solar and Battery Increase generation and storage of local renewable energy	PARTNER	State-Led Utility Incentive Program	Solar on Multifamily Affordable Housing - SOMAH	Eligible Properties
	PARTNER	Community-Owned Solar Partnership	Solar in Your Community Challenge	Yale University
	PARTNER	Utility Rebates and Incentives	California PUC via PG&E	PG&E Solar Incentives
	LOAN	On-Bill Financing (Tariff)	PG&E, East Bay Community Energy	Fort Collins Utilities
	LOAN	PACE or C-PACE Financing	CaliforniaFIRST	Saratoga, CA
	LOAN	Green Bank or Revolving Loan Fund	Coalition For Green Capital	PosiGen - Solar Lease
	LOAN	CA State Loan Program	GoGreen Financing	CAEATFA - REEL
	LOAN	HomeStyle Energy Mortgage	Fannie Mae	Portland, OR
	LOAN	Federal Loan Guarantee	DOE Loans Program	DOE Project Portfolio
	FEE	Ratepayer Surcharge or Utility Fee	PG&E, East Bay Community Energy	CT Green Bank

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pathways highlighted in darker gray are particularly applicable and/or accessible to Livermore

Climate Action Finance Map

Pathways to Capital for Projects in Livermore's 2021 Climate Action Plan

September 2021

Livermore Climate Action Measures	Capital Types	Top Funding and Finance Pathways	Programs and Partners	Case Examples
BUILDINGS **Measure B-4-1** Community Solar and Storage Coordinate with stakeholders to provide local energy generation and storage support and incentives. This could include a co-located community solar and storage facility.	**GRANT**	Federal Grant via FEMA Hazard Mitigation Assistance	Building Resilient Infrastructure and Communities (BRIC)	St. Croix, U.S.
	GRANT	State Grants via CA Public Utilities Commission or CA Energy Commission	CPUC - SGIP, EPIC Grant	Fremont, CA
	PARTNER	Community Choice Aggregation	East Bay Community Energy	Silicon Valley Clean Energy (SVCE)
	PARTNER	Utility Rebates and Incentives	PG&E Community Microgrid Enablement Program	Redwood Coast, CA
	PARTNER	Power Purchasing Agreement	ENGIE, Ameresco	Enovity EE in CA
	PARTNER	Collaborative Community Ownership	Clean Energy Co.	Boardman Hill, VT
	PARTNER	Collaborative Purchasing	R-REP Bay Area	SV-REP
	LOAN	Tax-Exempt Lease Purchase Agreement	GS $mart	DGS Building Retrofits
	LOAN	On-Bill Financing	PG&E, East Bay Community Energy	EESI Case Studies Grand Valley, CO
	LOAN	Green Bank or Revolving Loan Fund	Coalition For Green Capital	San Antonio, TX
	LOAN	Federal or State Loan Program	NREL	Orange County Library
	LOAN	Private Investment Firm Loan	Generate Capital	NYC Hudson, Hillsborough, FL
	BOND	General Obligation Bond (Green)	California iBank	Lakeport, CA
	FEE	Ratepayer Surcharge or Utility Fee	PG&E, East Bay Community Energy	Hawaii Microgrid Tariff
	TAX	Enhanced Infrastructure Financing District	Office of Innovation and Economic Development	New Orleans, LA

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LIVERMORE CALIFORNIA

Climate Action Finance Map

Pathways to Capital for Projects in Livermore's 2021 Climate Action Plan

September 2021

Livermore Climate Action Measures	Capital Type	Top Funding and Finance Pathways	Programs and Partners	Case Examples
TRANSPORTATION **Measure T-1** Bike and Pedestrian Improvements Improve active transportation infrastructure to achieve greater than 7% mode shift away from passenger vehicles by 2030 and maintain that through 2045 Active Transportation Funding Resource: https://catc.ca.gov/-/media/ctc-media/documents/programs/atp/2020/funding-programs-that-fund-active-transportation-a11y.pdf	**GRANT**	State Grant via Caltrans	Active Transportation Program	Santa Barbara, CA
	GRANT	State Grant via CA Strategic Growth Council	Transformative Climate Communities (TCC)	Ontario, CA
	GRANT	State Grant via CA Natural Resources Agency	Urban Greening Program	2020 Awardees
	GRANT	Foundation Grants	People for Bikes, Outride	Santa Cruz, CA
	PARTNER	PPP or Sponsorship (ex: Adopt-a-Roadway)	Livermore Chamber of Commerce	Google and Mountain View, CA
	LOAN	State Government Loan Program	ISRF Loan Program	Santa Cruz, CA
	LOAN	Federal Government Loan Program	TIFIA Loan	State of Maryland
	BOND	General Obligation Bond	CA Transportation Finance Authority	San Diego County, CA
	FEE	Transportation Fee	Dept. of Transportation	Chicago, IL
	FEE	Developer Impact Fee	Dept. of Transportation	Santa Monica, CA
	TAX	Enhanced Infrastructure Financing District	Office of Innovation and Economic Development	Santa Rosa, CA
TRANSPORTATION **Measure T-2** Privately-Owned EV Charging Infrastructure Improve electric vehicle infrastructure to achieve passenger vehicle shift to zero emission vehicles greater than 25% by 2030 and 50% by 2045, and commercial vehicle shift greater than 10% by 2030 and 50% by 2045	**GRANT**	Government Grants *see this federal incentives list*	CEC CTP, Federal Transit Administration	Santa Clara, CA
	PARTNER	Public Private Partnership	Blink, ChargePoint	Laguna Beach, CA
	PARTNER	State Infrastructure Incentive Program	CALeVIP	Current Projects
	PARTNER	Utility Incentives or Rebates	PG&E	EV Charge Network
	LOAN	State Loan (with Loan Loss Reserve)	CalCAP (current lender list)	Los Angeles + Noodoe
TRANSPORTATION **Measure T-3** Public Transportation Infrastructure Improve shared mobility programs and transit infrastructure to reduce passenger VMT 2% by 2030, and 4% by 2045	**GRANT**	Federal or State Grants	CalTrans Transit + Intercity Rail Capital Program (TIRCP)	SamTrans + more
	PARTNER	PPP or Sponsorship	Livermore Chamber Of Commerce	San Diego, CA Metro Transit System
	PARTNER	PPP with Transportation Operator	Livermore Amador Valley Transit Authority	Los Angeles Transportation Electrification Partnership
	LOAN	Federal or State Loan Programs	TIFIA Loan	San Luis Obispo, CA
	BOND	Green Bond or Revenue Bond	CAEATFA, CA Transportation Finance Authority	Ventura County, CA
	FEE	Transportation Fee	Livermore Amador Valley Transit Authority	Chicago, IL
	TAX	Enhanced Infrastructure Financing District	Office of Innovation and Economic Development	Los Angeles County

Climate Action Finance Map

Pathways to Capital for Projects in Livermore's 2021 Climate Action Plan

September 2021

Livermore Climate Action Measures	Capital Types	Top Funding and Finance Pathways	Programs and Partners	Case Examples
FLOODING **Measure F-2** Stormwater Management Improve stormwater management to reduce flood risk	GRANT	Federal Grant via National Fish and Wildlife Foundation (NFWF)	Five Star and Urban Waters Restoration	2020 Awardees
	LOAN	Federal Loan via Environmental Protection Agency (EPA)	Clean Water State Revolving Fund	Brookhaven, GA
	BOND	Environmental Impact Bond (defined here)	Quantified Ventures	Washington DC Water
	FEE	Developer Impact Fee or Stormwater Utility Fee	California Stormwater Quality Association	Los Altos, CA
	TAX	Enhanced Infrastructure Financing District	Office of Innovation and Economic Development	Chicago, IL
SEQUESTRATION + RESTORATION **Measure S-1** Urban Forestry Maximize local carbon sequestration by increasing urban canopy cover by at least 10% by 2030, preserving existing open spaces, and developing carbon farming projects	GRANT	Federal Grant via National Park Service	River, Trails, and Conservation Assistance Program	Los Angeles, CA
	GRANT	Federal Grant via National Fish and Wildlife Foundation (NFWF)	Resilient Communities Program	2020 Awardees
	GRANT	State Grant via California Natural Resources Agency	Urban Greening Program	2020 Awardees
	GRANT	State Grant via CAL FIRE	Urban and Community Forestry Program	2020 Awardees
	GRANT	State Grant via California Strategic Growth Council	Transformative Climate Communities (TCC)	San Fernando, CA
	PARTNER	Federal Partnership with Department of Agriculture Forest Service (USDA)	Urban and Community Forestry Program	2020 Awardees
	LOAN	Federal Loan via Environmental Protection Agency (EPA)	Clean Water State Revolving Fund	Yurok Tribe, CA
	BOND	Environmental Impact Bond (defined here)	Quantified Ventures	SW Colorado
	FEE	Developer Impact Fee or Stormwater Utility Fee	TreePAC	Portland, OR
	TAX	Enhanced Infrastructure Financing District	Office of Innovation and Economic Development	West Carson, LA (consideration)

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Climate Action Finance Map

Pathways to Capital for Projects in Livermore's 2021 Climate Action Plan

September 2021

Livermore Climate Action Measures	Capital Types	Top Funding and Finance Pathways	Programs and Partners	Case Examples
MUNICIPAL **Measure M-1** Municipal Energy Efficiency Electrify municipal facilities and operations, while increasing energy efficiency and renewable energy	GRANT	State and Foundation Grants	EPIC Grant, CPUC-SGIP	Fremont, CA
	PARTNER	Utility Energy Services Contract (UESC)	PG&E Sustainable Solutions Turnkey Program	Cal Poly University
	PARTNER	Energy Savings Performance Contracts	ENGIE, Ameresco	Enovity EE
	PARTNER	Collaborative Purchasing	Sourcewell	MAPC
	LOAN	Tax-Exempt Lease Purchase Agreement	GS $mart	DGS Building Retrofits
	LOAN	On-Bill Financing	PG&E, East Bay Community Energy	Mass Saves
	LOAN	Green Bank or Revolving Loan Fund	Coalition For Green Capital	San Antonio, TX
	LOAN	Government Loan Program	CA CLEEN	Huntington Beach, CA
	LOAN	Investment Firm	Generate Capital	Hillsborough, FL
	BOND	General Obligation Bond (Green)	California iBank	Lakeport, CA
MUNICIPAL **Measure M-2** City-Owned EV Charging Infrastructure Electrify the City's vehicle fleet, and encourage City employees to utilize alternative transportation and teleworking opportunities	PARTNER	Utility Incentive	PG&E EV Fleet Program	Pittsburg Unified School District, CA
	PARTNER	Public Private Partnership	Charge Point	Alameda, CA
	PARTNER	Collaborative Purchasing	Sourcewell	Chula Vista, CA, and Encinitas, CA
	PARTNER	State Infrastructure Incentives Program	CaleVIP - Inland Counties	Current Project List
	LOAN	State Loan Program	CA CLEEN Loans	Fresno, CA Airport
	BOND	General Obligation or Conduit Bond (Green)	California iBank	Westchester, NY

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