AECOM

COMPREHENSIVE CAPITAL REGION

CLIMATE PRIORITIES PLAN

APPENDIX H.

IMPLEMENTATION ROADMAPS

DECEMBER 2025

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CONTENTS

ABBREVIATIONS

ACCII	Advanced Clean Cars II
ADU	Accessory Dwelling Unit
BEV	Battery Electric Vehicle
CAPCOA	California Air Pollution Control Officers Associaation
CARB	California Air Resources Board
CBO	Community-Based Organization
CCAP	Comprehensive Climate Action Plan
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CFD	Community Facilities District
CPRG	Climate Pollution Reduction Grant
CSA	Combined Statistical Area
EIFD / IFD / IRFD	Enhanced / Infrastructure / Infrastructure and Revitalization Financing District
EV	Electric Vehicle
GHG	Greenhouse Gas
G2V / V2G / V2X	Grid-to-Vehicle / Vehicle-to-Grid / Vehicle-to-Everything
HCD	California Department of Housing and Community Development
HUD	U.S. Department of Housing and Urban Development
HVAC	Heating, Ventilation, and Air Conditioning
NEPA	National Environmental Policy Act
O&M	Operations and Maintenance
PG&E	Pacific Gas & Electric
PHEV	Plug-in Hybrid Electric Vehicle
RTP / SCS	Regional Transportation Plan / Sustainable Communities Strategy
SacRT	Sacramento Regional Transit
SACOG	Sacramento Area Council of Governments
SacSewer	Sacramento Area Sewer District
SB 1221	Senate Bill 1221 (Neighborhood Decarbonization Pilots)
SMUD	Sacramento Municipal Utility District
SRF / WIFIA	State Revolving Fund / Water Infrastructure Finance & Innovation Act
TDM	Transportation Demand Management
TRPA	Tahoe Regional Planning Agency
VMT	Vehicle Miles Traveled
ZEV	Zero-Emission Vehicle

OVERVIEW

This document presents a set of implementation roadmaps that translate key Comprehensive Capital Region Climate Priorities Plan measures into actionable steps. Measures were selected through a prioritization process conducted with Sac Metro Air District and community-based organizations (CBOs) from the Outreach Advisory Committee. Participants scored the 26 Plan measures across key criteria, such as greenhouse gas (GHG) reduction potential, implementation complexity, funding availability, and benefits for low-income communities and climate resilience, with the highest ranked eight measures emerging as regional priorities. For these eight measures, implementation roadmaps were developed with input from the Climate Pollution Reduction Grants (CPRG) working groups and agency coordination to ensure they are practical, actionable, and aligned with regional priorities.

The following measures have detailed roadmaps.

BE-1
Land Use Improvements

BE-4
Building Decarbonization / Electrification

TR-1
Zero-Emission Vehicle (ZEV) Adoption and Charging Infrastructure

TR-4
Roadway Improvements for Multi-Modal Use and Access

NW-1
Wildfire Resilience and Management

NW-2
Biomass Energy

NW-4
Carbon Sequestration Program / Carbon Farming

E-1A
Onsite Solar Canopies

Together, these roadmaps provide a framework to guide local governments, regional agencies, and partners in delivering these measures across the Captial Region.

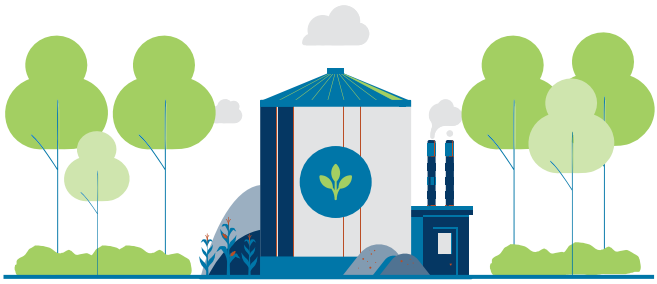
INTEGRATED IMPLEMENTATION

These roadmaps can be implemented individually, but in combination, they can achieve greater GHG reductions and community benefits. A holistic approach toward planning and implementation can account for shared infrastructure needs, create efficiencies, reduce costs, shorten timelines, enhance benefits across sectors, and achieve common goals. As each of these measures address core priorities for the Capital Region, the greatest impact comes when they are planned and executed together. Below are some examples of how measures can work together.

Land Use as a Foundational Action
Land use improvements (BE-1) that encourage infill development directly support many measures, such as active transportation (TR-4) and ZEV adoption (TR-1) by locating housing and jobs closer to transit and services. Compact, mixed-use neighborhoods reduce vehicle miles traveled (VMT), making investments in EV charging and multimodal infrastructure more effective. Additionally, infill development is often associated with smaller dwelling units that are easier to electrify (BE-4), while also decreasing growth in the wildland urban interface, enhancing wildfire resilience and potentially facilitating fuel management work (NW-1).

Shared Infrastructure and Construction Efficiencies
Bundling allows cities to align construction schedules and avoid redundant work. For example, trenching for new EV charging infrastructure (TR-1) can also include conduits for building electrification (BE-4) or underground connections for solar canopies (E-1A). Coordinating these activities reduces material costs, limits construction disruptions, and accelerates project delivery.

Energy and Load Management Synergies
Electrified buildings (BE-4), EV charging infrastructure (TR-1), and onsite solar canopies with battery storage (E-1A) can be paired to balance grid demand. During the day, solar power generated onsite offsets building loads and charges batteries; in the evening, stored energy supports EV charging or essential building operations. During peak demand events, vehicle to grid (V2G) technology and battery systems can reduce building energy demands. This integrated energy system lowers peak demand, reduces utility costs, and increases resilience.



Circular Resource Use in Natural Systems
Forest fuel management (NW-1) can supply the necessary feedstock for biomass facilities (NW-2). Guaranteed purchase contracts can provide financial certainty to all parties involved, enabling both feedstock generators and biomass facilities to move forward. Forest residues can also be processed into biochar and returned to agricultural soils, closing the carbon loop and improving soil health for carbon farming (NW-4). This interrelationship turns what would be waste material into a productive input that enhances carbon sequestration and wildfire resilience.

Governance and Financing Coordination
When measures are bundled together, agencies can coordinate planning, design, permitting, financing, and procurement for multiple activities as a single project, across multiple departments. To support multi-jurisdiction implementation, regional governance models or cooperative purchasing agreements can reduce costs, support participation from lower-capacity agencies, build technical expertise, and enable pooled funding. Bundling can also leverage incentives and funding from different sources (for example, infrastructure, energy, and resilience grants).

Community and Equity Benefits
Communities often have multiple priorities and needs that cannot be addressed through a single project, and a holistic approach enables jurisdictions to be more responsive to community concerns by delivering visible neighborhood improvements on multiple fronts. A coordinated implementation approach can streamline community engagement activities, alleviate outreach fatigue, and strengthen local ownership of climate actions.

HOW TO USE THE ROADMAPS

These roadmaps are modular and can stand alone or be combined as a package. Each roadmap explains the practical steps, key actions, phasing, and other details needed to achieve the targeted GHG reductions and co-benefits identified in the Plan. Each roadmap includes:

Measure description
An overview of the strategy and expected outcomes.

Lead agencies and partners
Roles and responsibilities for key implementing agencies and partners.

Implementation steps and timeline
Actions phased by prerequisite actions and early-, middle-, and long-term actions. Note that in some cases, the roadmaps and the measures in the CCAP may not fully align. The roadmaps take a more comprehensive approach to implementation than the equivalent CCAP measure as it considers the full range of actions needed to support meaningful deployment.

Regional solutions
Actions and best practices to support coordination, funding, and implementation at a regional scale.

Challenges and opportunities
Barriers and strategies to overcome them.

Community benefit considerations
Actions to minimize negative impacts and increase benefits for low-income communities.

Cost effectiveness
The cost-effectiveness analysis evaluates the cost per metric ton of GHG emission reductions achieved by measure implementation. The analysis considers annualized capital costs, operational costs, and any savings resulting from deviations from the business-as-usual approach. Capital costs are annualized over each measure's expected operational lifetime. A uniform real discount rate of 5% was used for all actions to convert future costs into their present value. Where possible, the cost-effectiveness analysis includes operational and maintenance costs and savings, including for residents and businesses. It is important to note that the calculated cost per metric ton does not represent a market price for carbon mitigation but rather serves to compare the relative impacts of different measures. This comparison can help prioritize measures according to their cost-effectiveness and expected impact.

For some measures (TR-4 and BE-1), savings were calculated from anticipated reductions in vehicle miles traveled (VMT) to reflect the benefits of decreased car trips and associated emissions. These savings were incorporated in the cost-effectiveness analysis and are also shown separately as they rely on behavioral changes.

Case studies
Examples of comparable projects and transferable lessons for replication.

CROSS-CUTTING THEMES

Across all roadmaps, common needs and repeatable actions emerged. Applying these cross-cutting themes and solutions consistently across measures will speed delivery, lower soft costs, and improve outcomes.

Note: Each theme is demonstrated by one or more corresponding case studies, designated by the colored dots.

Regional governance and coordination

Standing working groups, shared priority maps, clear lead-agency roles, and multi-jurisdiction delivery protocols.

Utility and infrastructure readiness
Early grid/water/sewer coordination, predictable service timelines, corridor/district capacity planning, and transformer/feeder programs.

Funding architecture and grant readiness
Pooled match funds, joint applications, shelf-ready (10–30%) concepts, phasing to fit award rules, and rolling grant calendars.

Streamlined approvals and compliance
Ministerial/checklist permits, programmatic CEQA/NEPA where applicable, model ordinances, and pre-approved plan libraries.

Workforce and delivery capacity
Regional training and apprenticeships, vetted contractor benches, on-call contracts, and cooperative purchasing to surge delivery.

Data, metrics, and reporting
Standardized monitoring and reporting to inform future projects, priorities, and grant applications. Standardized key performance indicators, dashboards, and annual scorecards tied to budgets.

Equity and community engagement
CBO-led, multilingual outreach; priority siting in low-income areas; tenant/small-business protections; affordability pathways.

Context-specific tailoring
Urban/suburban/rural siting standards, sequencing, and design details to match land use, travel patterns, and market conditions.

Risk and resilience alignment
Delivery linked to evacuation reliability, watershed/source-water protection, heat and comfort strategies, and wildfire risk reduction.

CROSS-DEPARTMENT CLIMATE INTEGRATION

Coordinating climate action implementation across departments can be especially challenging, particularly as many agencies face staffing and budget constraints. Climate change staff can sometimes be siloed within sustainability offices or city manager's offices, making it difficult to effect change within other departments or program projects within capital budgets. Below are some examples of cities that have sought to integrate climate planning, financing, engagement, and implementation.

Climate Resilience Districts — CRD Initiative

Los Angeles, CA

Los Angeles County is evaluating cross-jurisdictional Climate Resilience Districts enabled by SB 852 to coordinate and finance multi-benefit climate projects, using tools such as Enhanced Infrastructure Financing Districts (EIFD) tax-increment, special assessments, grants, and public-private partnerships. The approach explores setting up shared governance across cities and special districts, standardizing delivery and transparent project pipelines, and prioritizing equity-focused site selection and bundled investments (for example, microgrids, cooling centers, and green stormwater systems) to scale regional resilience.

Western Riverside Council of Governments – Energy Resilience Plan

Riverside County, CA

In response to increasing power disruptions, the Western Riverside Council of Governments (WRCOG) developed an Energy Resilience Plan to provide a decision-making framework to identify critical facilities and develop energy resilience strategies including solar photovoltaics with battery storage, microgrids, and community resilience hubs. The Plan was informed by a stakeholder-first approach to identifying the energy resilience needs of the subregion.

Southern Border Coalition

San Diego and Imperial County, CA

As part of the California Jobs First Initiative, the Southern Border Coalition (SBC) brings together data-driven research and community engagement to create strategies to support high-quality, green jobs and green workforce development in San Diego and Imperial County, including in rural and underserved areas. The SBC developed a regional roadmap – the Southern Border Region Regional Plan – to support multijurisdictional collaboration and promote climate strategies such as sustainable agricultural practices and renewable energy. Recommendations were informed by hyperlocal data, oral histories, and public feedback, with over 200 public meetings with CBOs, workforce agencies, Tribal representatives, and private sector leaders. To reduce systemic barriers, 50 percent of decision-making roles were held by representatives from disadvantaged communities.

Grant Center within the Office of Economic Development & Government Affairs

San Diego, CA

San Diego County coordinates grant pursuits and administration across four business units through a centralized Grant Center. Each business unit designates grants coordinators, and the center provides shared tools, schedules, and reporting to leadership so departments move in sync despite lean staffing.

Office of Climate Action, Sustainability and Resiliency (CASR)

Denver, CO

The City of Denver centralizes grants, contracts, and financial administration for climate programs within CASR's Finance and Administration team, which frees technical staff to focus on delivery. The City funds projects in part through a voter-approved Climate Protection Fund and uses shared reporting tools to track outcomes and audit readiness across departments.

Department of Energy and Environment (DOEE)

Washington, DC

DOEE standardizes pre-award and post-award processes through a dedicated Grants Management Division. The agency also partners with an intermediary (the Chesapeake Bay Trust) that runs outreach, applicant support, review panels, and disbursements so DOEE staff can concentrate on technical assistance, equity outcomes, and program oversight.

Maryland Energy Administration (MEA)

State of Maryland

MEA manages a portfolio of efficiency and electrification programs supported by the Strategic Energy Investment Fund. The administration uses multidisciplinary review committees and an end-to-end grants IT system to handle applications, equity targeting, compliance, and performance tracking across many program lines.

Pre-Approved Accessory Dwelling Unit Plan Libraries

California

Many cities in California, including Davis, Galt, Lincoln, Sacramento, and Woodland, offer free, pre-approved, permit-ready accessory dwelling unit (ADU) plans at varying sizes. These plans can significantly reduce plan review fees and speed approvals.

BE-1 LAND USE IMPROVEMENTS

This measure focuses on reducing vehicle miles traveled (VMT) by increasing residential density through infill housing and mixed-use development. Reducing the distance that people must travel to access goods and services and reducing the number of trips by single-occupancy vehicles can lead to reductions in GHG emissions.

Increase Residential Density. Requires new residential developments to achieve a higher density than the average U.S. residential density. Increased density allows people greater options for modes of travel and results in shorter and fewer vehicle trips.

Infill Development. Encourages infill housing development programs that allow residents to live closer to downtown areas, increasing access to jobs and activities. Developing more housing closer to downtown areas leads to VMT and GHG reductions.

LEAD AGENCIES

Cities and counties update general plans and zoning, update, revise or establish parking standards, lead entitlement processes, develop and implement impact fees, establish tax increment financing districts, and invest in streets and public spaces that enable infill and higher residential densities.

Regional planning agencies like the **Sacramento Area Council of Governments (SACOG),** the **Tahoe Regional Planning Agency (TRPA),** and the **Nevada County Transportation Commission** frame regional policy, develop regional transportation plans/sustainable community strategies (RTP/SCS), identify regional priorities, and support local adoption and multi-jurisdiction coordination.

Housing authorities such as **Sacramento Housing and Redevelopment Agency** lead public land disposition, mixed income projects, and gap financing.

IMPLEMENTATION PARTNERS

Water, sewer, stormwater, and sanitation districts, such as Sacramento Area Sewer District (SacSewer), are responsible for infrastructure and capacity upgrades and connection policies that make higher density feasible.

Transit operators such as Sacramento Regional Transit and Capitol Corridor Joint Powers Authority lead station area planning, joint development, and transit-oriented development agreements.

California Department of Housing and Community Development (HCD) sets housing law, certifies Housing Elements, and administers key infill funding.

California Strategic Growth Council (SGC) funds integrated housing, transportation, and climate projects and supports cross-agency alignment.

California Department of Transportation District 3 manages state right of way and can contribute airspace and excess parcels for housing near transit.

United States Department of Housing and Urban Development Region 9 (HUD Region 9) administers Community Development Block Grants and related federal housing programs for infill districts.

Community land trusts and mission-driven housing developers such as the Sacramento Land Trust and Mutual Housing deliver permanently affordable infill and missing-middle projects. Other community land trusts, such as the Yolo Land Trust and Placer Land Trust, support infill indirectly by conserving natural and agricultural lands.

Community development financial institutions and local lenders supply predevelopment, acquisition, and bridge capital tailored to infill timelines.

Business improvement districts and **property-based improvement districts** co-fund streetscape, lighting, and activation that support higher density.

Brownfield and environmental cleanup partners (for example, California Department of Toxic Substances Control and U.S. Environmental Protection Agency) clear contaminated sites or provide grant funding for remediation so infill can proceed.

IMPLEMENTATION STEPS AND TIMELINE

PREREQUISITES & ENABLING CONDITIONS

- ☐ **Update general plans and zoning.** Adopt or update general plans and land use elements to support infill and missing middle housing. Align plans with California's 30x30 targets. Expand areas that allow higher densities and remove barriers such as restrictive setbacks, height transitions, lot coverage limits, and open space minimums. Urban areas can upzone transit corridors and apply by-right standards, suburban areas can convert commercial strips and single-family zones to mixed use and missing middle types, and rural communities can focus higher density development in town centers while protecting agricultural and natural lands.

- ☐ **Update parking and access policy.** Remove or reduce minimum parking requirements and set context-specific maximums at infill sites. Urban areas can eliminate minimums near high-frequency transit and manage curb space, suburban areas can reduce minimums in centers and manage shared parking, and rural communities can right-size parking in town cores; all communities can add walk and bike connections.

- ☐ **Provide accessory dwelling unit (ADU) tools.** Offer preapproved ADU plan libraries and checklist-based submittals to cut soft costs and timelines. Consider adopting ordinances under Assembly Bill 1033 to allow separate sale of ADUs as condominiums and expand attainable homeownership. Urban areas can use ADUs to add gentle density, or small-scale increases in housing units that maintain the area's overall character and scale, within existing neighborhoods. Urban and suburban areas can pair ADUs with lot splits and parking reform and rural communities can focus units in serviced townsites.

- ☐ **Streamline approvals and program alignment.** Use clear, objective project approval standards and align local streamlining with regional priority programs that support near term infill delivery. Urban areas can apply ministerial approvals in specific plans and transit overlays, suburban areas can adopt small area plans for mall and office park conversions, and rural communities can use by-right standards in town centers.

- ☐ **Develop a funding strategy.** Match funding sources to project types and pair value capture and local fee updates with grants to close infrastructure gaps. Reduce impact fees in infill locations with existing access to infrastructure and where travel demand and infrastructure demand is lower due to compact design and mixed-use environments.

- ☐ **Assess brownfield and site readiness.** Screen sites early for environmental conditions and coordinate cleanup funding, environmental review, and site design to shorten delivery.

- ☐ **Align with conservation strategies.** Pair infill and selective greenfield planning with farmland and habitat conservation to meet growth management and conservation goals, including the State of California's 30x30 strategy, together. Build on efforts such as SACOG's Rural-Urban Connections Strategy (RUCS) and the Coordinated Rural Opportunities Plan (CROP) to create a regional "greenprint" plan that identifies and protects important natural and working lands for preservation and habitat corridors. Address habitat connectivity and equitable access to nature as required by SB 1425 and AB 1889.

Focus areas

Urban areas can use value capture near transit, and channel most growth to existing neighborhoods and transit corridors.

Suburban areas can package town center infrastructure with phased housing, and redevelop underused centers before expanding.

Rural communitiess can bundle small sites and target main street programs. Consider vacancy fees to spur development of vacant parcels. Rural communities also can concentrate growth in towns and use conservation easements and land trusts to protect working lands.

BE-1 LAND USE IMPROVEMENTS

IMPLEMENTATION STEPS AND TIMELINE

0–3 YEARS

EARLY PHASE

- ☐ **Adopt infill-ready zoning and design standards.** Update zoning codes and land use policies to enable higher-density, mixed-use, and missing middle housing types. Prepare objective design standards to streamline staff approvals. Adopt by-right approvals in transit corridors, create overlay zones for commercial and mall conversions, and enable small-lot subdivisions within existing town footprints. Create a regional Greenprint Plan to go with the Blueprint, identifying and protecting important natural and working lands for preservation and habitat corridors.

- ☐ **Reform parking and improve access.** Eliminate or reduce parking minimums in infill areas near transit and establish context-specific maximums. Pair parking reforms with first/last-mile access plans that expand walkways, bikeways, and transit connectivity to new housing areas.

- ☐ **Expand accessory dwelling unit (ADU) programs.** Launch preapproved ADU plan sets, checklist-based submittals, and expedited permitting processes. Adopt Assembly Bill 1033 provisions to allow ADU condominiums and expand attainable homeownership. Pair ADU rollout with lot-split and parking reforms to encourage small-scale infill on existing parcels.

- ☐ **Assess infrastructure readiness and timing.** Coordinate early with electric, water, and sewer providers on near-term upgrades in growth areas. Identify infill neighborhoods with infrastructure capacity constraints and plan system upgrades for priority areas. Publish predictable service timelines, coordinate interconnections, and bundle infrastructure upgrades with near-term infill projects.

- ☐ **Launch early funding partnerships.** Establish pooled regional match funds and coordinate formation of EIFDs and Community Facilities Districts (CFDs) to finance utilities, public realm, site-readiness improvements, and other activities demonstrated to expedite private investment and infill development. Use local fee credits, State Revolving Fund / Water Infrastructure Finance & Innovation Act (SRF/WIFIA) financing, and value-capture tools to reduce costs for early projects.

- ☐ **Conduct community engagement early.** Conduct engagement early and build a strong coalition of stakeholders and partners around key infill neighborhoods and project concepts to be ready before grant opportunities become available.

- ☐ **Pilot early sites and build community support.** Identify demonstration projects in target corridors or town centers to showcase infill benefits. Pair early investments in public-realm upgrades with multilingual engagement to address displacement concerns and highlight benefits such as improved walkability, safety, and access to services. Consider funding opportunities and feasibility for modular housing developments to reduce effective costs and increase the amount of housing delivered per dollar.

Focus areas

Urban areas can prioritize transit-oriented districts, mid-rise mixed use, and parking reform.

Suburban areas can adopt corridor and center overlays and enable mall or office conversions.

Rural areas can focus on main-street infill, small-lot subdivisions inside town footprints, and ADUs.

4–7 YEARS

MIDDLE PHASE

- ☐ **Finalize and institutionalize zoning updates.** Adopt citywide zoning and parking amendments and apply ministerial, checklist-based approvals in designated infill districts. Refine design standards to improve predictability for developers and staff.
- ☐ **Scale ADU and small-plex programs.** Expand lot-split and small-plex programs with transparent dashboards that monitor production, affordability, and location trends. Use incentives and streamlined permitting to encourage reinvestment in aging neighborhoods.
- ☐ **Bundle infrastructure upgrades.** Coordinate capital improvement planning across multiple infill corridors to deliver utility and public-realm upgrades concurrently. Phase projects by district and align schedules with private construction timelines to reduce downtime and costs.
- ☐ **Align incentives and financing.** Update impact and connection fees to reflect compact development patterns and lower per-unit infrastructure demand. Pair local fee updates with targeted grant applications, regional match funds, and revolving loan programs to support infill readiness.
- ☐ **Expand partnerships and outreach.** Conduct outreach to residents, community-based organizations, and developers to refine implementation strategies and address barriers such as financing, permitting, and displacement. Share success stories from pilot projects to build momentum for larger-scale redevelopment.
- ☐ **Enhance climate resilience in the public realm.** Counter potential increases in the urban heat island effect due to increased density by investing in parks, open space, bikeways, and transit access and add shade trees, green infrastructure, and cool pavements, roofs, and other passive cooling strategies. Rewild urban areas by adding biodiversity and converting underutilized pavements and empty lots to natural areas.

8–12 YEARS

LATE PHASE

- ☐ **Scale full infill delivery.** Deploy streamlined approvals and infrastructure programs across transit station areas, corridors, and town centers. Integrate infill priorities into long-term capital improvement and Housing Element cycles.
- ☐ **Institutionalize predictable permitting and financing**. Maintain predictable permitting, utility capacity programs, and financing schedules that align with the private development pipeline. Adopt recurring program updates every 3–5 years to sustain housing delivery momentum.
- ☐ **Measure performance and refine programs.** Track annual housing production, infrastructure delivery, and affordability outcomes. Publish transparent performance dashboards and adjust programs based on market feedback, regional goals, and community input.

SOLUTIONS TO DEPLOY MEASURE AT REGIONAL SCALE

- ☐ Coordinate with and support SACOG efforts to seek funding from state and federal sources. Expand Green Means Go-style catalytic funding and pursue replacement resources as older sources wind down.
- ☐ Stand up a regional technical assistance team, share model ordinances and permit templates, and use on-call contracts to surge capacity. Provide regional assistance for smaller jurisdictions looking at joint development opportunities and use of surplus land for infill development.
- ☐ Track production, permits, and infrastructure delivery in designated infill areas and publish annual results to guide the next cycle of investments and reforms.
- ☐ Create a regional vehicle miles traveled mitigation strategy that funds housing supportive infrastructure and projects that reduce driving.

BE-1 LAND USE IMPROVEMENTS

IMPLEMENTATION CHALLENGES AND OPPORTUNITIES

CHALLENGES	OPPORTUNITIES
Underbuilt corridor infrastructure. Streets, utilities, and public spaces are costly to retrofit one project at a time.	Create a regional VMT mitigation strategy that funds housing-supportive infrastructure and projects that reduce driving. Align impact fee policy with infill goals through predictable credits and reductions for affordable housing and compact housing types.
Macro cost headwinds. Interest rates, insurance, and construction inflation erode feasibility.	De-risk with pre-entitlements, public realm upgrades, schedule certainty, and pro-housing designations. De-risk refers to reducing financing, entitlement, and delivery uncertainty so a project becomes bankable, shovel-ready, and predictable to deliver. Create local match funding for conservation to leverage federal and state programs such as the Sustainable Agricultural Lands Conservation program, Proposition 4, and the U.S. Department of Agriculture Natural Resources Conservation Service (USDA NRCS).
Limited ownership pipeline. Condominium liability discourages multifamily ownership delivery.	Explore liability reforms, consider rent-then-convert models, and use land trusts and cooperatives for ownership.
Dispersed greenfield growth. Low-density development increases vehicle miles traveled and emissions.	Focus expansion where needed and pair with conservation so new areas function like infill sooner.
Market and community expectations. Demand is uneven in suburban and rural centers.	Invest in placemaking, parks, lighting, bikeways, and transit access and deliver early mixed-income wins.

COMMUNITY BENEFIT CONSIDERATIONS

Support implementation in low-income communities

- Focus resources inside locally nominated infill zones, pair funding with hands-on assistance, and reserve set asides for lower-income neighborhoods.
- Use early activation grants for infrastructure tied to subsidized affordable projects in priority corridors.
- Broaden housing types to include missing middle formats so projects deliver attainable price points near jobs and services.
- Reduce parking minimums where appropriate and streamline ADUs with preapproved plans and faster staff review.
- Fund corridor-level studies and utility planning for suburban corridor retrofit projects to enable near-term projects in lower income areas.
- Expand infill in high-opportunity neighborhoods to leverage existing infrastructure, mature tree canopy, strong schools, parks, and frequent transit.
- Pair high-opportunity infill with affordability tools, such as inclusionary zoning, community land trusts, and housing voucher acceptance, to broaden access to neighborhood amenities (e.g., transit, schools, and job centers) for lower-income households and mitigate potential gentrification and displacement.

Avoid adverse consequences

- Dedicate a share of infill zone investments to affordable or mixed-income housing so benefits reach lower income residents.
- Align new buildings to neighborhood form with diverse products so communities accept change.
- Calibrate parking reductions and on-street parking management to avoid spillover on adjacent lower-income blocks.
- Plan multi-year allocations so programs do not leave corridors with half-delivered infrastructure.
- Complete essential infrastructure studies and near-term fixes first so initial projects do not stall or shift costs onto residents.

COST EFFECTIVENESS

$36,000,000

Total Costs between 2026 – 2030

\+ $0
O&M Costs

$36,000,000
Upfront Capital Costs

\- $0
Savings (total; for agency)

$38,607,000
Savings (annual; for residents and businesses)

-$135*

per metric ton of GHG emissions reductions

**negative values indicate cost savings per ton.*

Cost estimates are based on the Green Means Go program, which in 2024 allocated $24,788,000 to eight capital improvement projects, which is estimated to support the development of 9,750 infill units in Sacramento, Placer, and Sutter County. This equates to an average funding level of $1,893 per unit. Guided by GHG reduction targets, SACOG's goal is to add 19,000 infill units by 2030—an average of 3,800 units per year. The 19,000 was used as a proxy to provide a reasonable basis for analysis in the absence of finalized data. At the Green Means Go funding rate, this would require approximately $7,200,000 annually, or $36,000,000 total by 2030. No operations and maintenance costs were calculated, as the measure focuses on planning and infrastructure improvements to support infill developments.

By full implementation in 2030, this measure is estimated to result in additional savings of $38,607,000 from VMT reductions. Critically, these are savings for residents and businesses, who can benefit from reduced fuel and vehicle maintainance costs from reduced driving. These savings are reflected in the total cost effectiveness metric. The upfront capital costs is associated with public agency planning costs and infrastructure upgrade costs necessary to enable infill development. It does not include the development cost itself, which is expected to largely come from developers. As such, only a portion of the cost is captured in this analysis.

BE-1 LAND USE IMPROVEMENTS

CASE STUDIES

Green Means Go Infill Acceleration
SACOG's regional initiative targets infill "Green Zones" for housing, infrastructure, and main-street improvements, pairing policy support and technical assistance with funding to speed delivery. Notably, the program provided over $27 million in investments for the critical backbone infrastructure needed to support increased density in Green Zones across the region, with further investments to come pending funding availability. Additionally, SACOG also awards funds to support planning processes such as Housing Element updates, development and zoning code updates, and infrastructure assessments. This case shows how a regional framework can align jurisdictions and concentrate resources for infill.

Pre-Approved Accessory Dwelling Unit Plan Libraries
The City of Sacramento's permit-ready ADU plans cut soft costs and speed approvals; neighboring jurisdictions are adopting similar approaches. This case shows how standard plans remove friction for density infill and speed up the permitting process.

West Sacramento Bridge District Specific Plan
A riverfront district plan guiding mixed-use infill. This case shows how a specific plan can coordinate public realm, parcels, and development standards at a district scale.

Sacramento Railyards Specific Plan
One of the largest urban infill sites in the US, the Railyards converts former rail yards next to Sacramento Valley Station into a mixed-use district with housing, employment, and civic uses on brownfield land. The plan and environmental work lay out phased infrastructure and transit-oriented growth right in the city center. This case shows how a long-range, rail-adjacent brownfield can anchor regional infill with a clear phasing and infrastructure strategy.

Rancho Cordova Mills Crossing Mixed-Use District
A civic campus-anchored district near Mather Field and the Mills light rail area that combines public facilities, open space, and future private development to catalyze infill on Folsom Boulevard. This case shows how a city-led civic investment can unlock adjacent private infill.

Folsom East Bidwell Corridor Infill Program
A central business district effort that organizes mixed-use reinvestment along East Bidwell Street with streetscape, land use, and economic strategies. This case shows how corridor-scale planning can coordinate infill and public realm upgrades.

City of Sacramento Vacant Parcel and Sites Inventory
A web-based sites inventory linked to Housing Element implementation and zoning updates that moves vacant and underused parcels into production. This case shows how a formal inventory can focus infill actions.

Yolo County and City of Woodland Yolano and Donnelly Public Housing Revitalization
A planned partnership to rebuild and expand aging public housing with mixed-income units and services near jobs and transit. This case shows how public sector land and partnerships can deliver equitable infill at scale.

Adopt or update general plans and land use elements to support infill and missing middle housing and align plans with California's 30x30 targets.

BE-4 BUILDING DECARBONIZATION / ELECTRIFICATION

This measure focuses on decarbonizing existing buildings and new developments by promoting the transition from fossil fuel-powered devices to electric appliances and all-electric end uses. The most common fossil fuel-powered energy end uses are natural gas systems for space heating, water heating, and cooking equipment. Appliances (such as stoves, water heaters and fireplaces) powered by natural gas, propane, or wood are more emissions-intensive than their electric counterparts as electricity from the grid increasingly transitions to renewable sources. The implementation of this measure is made up of two parts:

All-Electric Development. This measure supports new residential and commercial developments that use all-electric appliances and end uses. Installing electric systems for space heating, water heating, cooking, pool heating, and any other system that would otherwise use natural gas or propane decreases GHG emissions.

Limit Wood-Burning Devices and Natural Gas/Propane Fireplaces in Residential Developments. The most efficient alternatives to wood-burning devices or gas fireplaces are electric fireplace inserts and electric heat pumps. This measure applies to existing and new residential dwellings.

LEAD AGENCIES

Cities and counties adopt enabling policies and reach codes where allowed under AB 130, update permitting requirements and issue permits, track all-electric versus mixed-fuel permits, streamline inspections, provide incentives and education, and align general plans and climate action plans with electrification.

Electric utilities such as the Sacramento Municipal Utility District (SMUD) and PG&E set rates and incentives; coordinate panel, transformer, and feeder upgrades; and pilot storage and virtual power-plant programs.

County air districts such as the Sac Metro Air District fund targeted incentives, including woodstove to heat pump swaps, and lead public health messaging on indoor air quality.

California Public Utilities Commission (CPUC) administers neighborhood-scale decarbonization pilots with investor-owned utilities.

IMPLEMENTATION PARTNERS

Community-based organizations (CBOs) deliver resident education on heat pumps, induction appliances, incentives, and health benefits and connect customers to vetted installers.

Contractor networks recruit installers, coordinate training, maintain approved vendor lists, and support quality assurance and workforce development**.**

Heating, ventilation, and air conditioning (HVAC) and electrical contractors perform panel upgrades and appliance change-outs, assist with permits, and help customers capture utility and tax incentives.

IMPLEMENTATION STEPS AND TIMELINE

PREREQUISITES & ENABLING CONDITIONS

- ☐ **Evaluate feasibility of building code updates.** Evaluate Assembly Bill 130 to determine if agencies qualify under exemptions that would allow the adoption of reach codes or building codes to enable electrification; exemptions are allowed if the agency has GHG reduction strategies as part of their adopted general plan policies or can justify the code update to protect health and safety.

- ☐ **Evaluate grid capacity.** Coordinate with utilities to identify neighborhoods where service or transformer upgrades are needed to support neighborhood-wide electrification and seek grants to carry out updates on a systemic scale, rather than by customer request. Use hosting-capacity maps and feeder studies to find constraints, hold pre-application meetings to confirm service/protection/metering, sequence transformer/feeder/substation upgrades with electrification programs, assess non-wires options (storage, managed EV, demand response) before new builds, and share typical designs/lead times to inform project schedules.

- ☐ **Assess current utility rates, incentives, and cost signals.** Factor the end of mixed-fuel line-extension subsidies into greenfield economics, and include the avoided costs of gas laterals, meters, trenching, and service upgrades in pro formas. This typically improves the cost-competitiveness of all-electric new construction. Urban and suburban areas can pair time-of-use rates with demand response and smart controls and coordinate utility rebates, while rural communities can emphasize weatherization, and propane-to-electric conversions.

- ☐ **Existing building triggers and program design.** Use triggers like air conditioner replacements to encourage heat pump adoption, paired with simple compliance pathways. Align local programs with available federal and state rebates or tax credits and emphasize multifamily and commercial paths where funding remains. In urban areas, time upgrades to rental turnovers and capital planning cycles; in rural communities, prioritize propane appliance replacements and wood stove changeouts.

0–3 YEARS

EARLY PHASE

- ☐ **Update codes and policies** to enable all-electric new construction where allowed. For reach codes, prepare cost-effectiveness studies and plan for re-adoption each code cycle. Urban areas can adopt strong reach codes in transit and activity centers; suburban areas can use overlays and builder agreements to raise minimum performance; and rural communities can allow simple, prescriptive all-electric paths suited to small projects and manufactured homes.

- ☐ **Support service and panel upgrades.** Offer targeted incentives and streamlined permits for panel upgrades where required. For older neighborhoods, focus on relieving transformer hotspots near high-load pockets and run neighborhood panel programs paired with subdivision transformer upgrades. Rural communities can address long feeders, install storage-ready panels, and build microgrids at critical facilities.

- ☐ **Streamline and simplify permitting.** Offer simple online permit intake for licensed contractors and focus inspections on life-safety essentials so more retrofits are permitted and incentive-eligible. Publish clear checklists to raise permit compliance and reduce rework. For eligible non-combustion retrofits (e.g., heat pumps/heat pump water heaters) with no new gas piping or structural work, use a checklist tailored to the hazard profile, which streamlines delivery without reducing life-safety review and is subject to the inspection department's discretion. Launch express, checklist permits and next-day inspections for heat pump space and water-heating replacements.

- ☐ **Engage and support homeowners.** Align outreach campaigns with federal tax-credit deadlines and run contractor blitzes so households do not miss incentives. Publish a vetted installer and contractor list, and align incentives with utilities. Expand on-bill financing and grants, and target deed-restricted properties first. Leverage letters of intent to coordinate bulk purchasing across property owners and provide tiered support for under-resourced buildings.

- ☐ **Support multifamily adoption.** Tie affordable housing financing and rehabilitation milestones to all-electric upgrades where feasible. Offer owners/landlords electrification packages tied to tenant protections.

BE-4 BUILDING DECARBONIZATION / ELECTRIFICATION

IMPLEMENTATION STEPS AND TIMELINE

- ☐ **Conduct outreach.** Conduct culturally relevant, multilingual outreach to understand and address people's concerns around electrification, particularly for gas stoves. Coordinate with air districts on public health messaging and consider appliance emissions standards that reduce indoor combustion exposure. Provide additional incentives for multi-property or unit owners making a single large purchase and those who transition to heat pumps.

- ☐ **Start workforce, contractor, and realtor education.** Run regional training to counter misinformation about electrification (e.g., heat pump performance) and to simplify participation in incentive networks. Use vetted contractor lists and equipment verification within programs. Use Home Energy Score pilots to target upgrades and pair with training to expand local installer capacity. Potential innovative approaches for contractors include: 1) Facilitating a teaming approach for small businesses (e.g., an HVAC installer teaming with an electrician to upgrade electrical service needed for heat pumps), which can allow smaller or dedicated contractors to group together as "Virtual Mechanical, Electrical, and Plumbing" firms; 2) Providing education and capacity building with leave-behind QR codes linking to informative websites; 3) Providing financial incentives for keeping heat pump technologies in stock, with additional incentives for installation; 4) Collecting letters of intent from property owners to demonstrate interest to the market and contractors; 5) Promoting contractors as "electrification certified"; 6) Offering incentives for including heat pumps as an option in all-replacement quotes (i.e., standard efficiency furnace, high-efficiency furnace, and heat pump options).

- ☐ **Develop a pipeline of projects.** Coordinate a transparent upgrade queue and plan feeder upgrades by district.

- ☐ **Track permits by fuel type.** To support monitoring and tracking, permitting departments can add a permit field that tracks fuel type and determine a baseline of all-electric versus mixed-fuel permits. Progress can be reported in an internal dashboard.

Focus areas

Urban areas can target multifamily and single-family homes and mixed-use districts and coordinate transformer relief.

Suburban areas can target existing buildings in commercial corridors and neighborhood centers and streamline single-family heat pump replacements with express permits.

Rural areas can prioritize reliability with storage, plan propane-to-electric conversions, and address long-feeder constraints.

4–7 YEARS

MIDDLE PHASE

- ☐ **Neighborhood-scale pilots and data.** Participate in neighborhood decarbonization pilots to shift from one-home-at-a-time programs to block-level delivery with utility coordination. Deliver bundled neighborhood or portfolio retrofits that pair heat pumps, water heaters, and induction cooking appliances. Build datasets for rental and owner stock that record existing appliance types and ages to target incentives when programs open. In urban areas, run block-based pilots for multifamily and small commercial; in suburban areas, convert whole subdivisions; and in rural areas, pilot main-street blocks and clusters of public facilities that anchor nearby homes.

- ☐ **Coordinate with utilities to address remaining challenges for low-income households.** Test on-bill financing for lower-income households, such as pathways that cover electrical service panel and whole-home electrification. Track costs, timelines, and participation and refine annually. Work with utilities to explore additional solutions to support electrification for rural areas and low-income households, who could be increasingly burdened with the cost of maintaining aging natural gas infrastructure, as higher-income households electrify. For example, the maintenance cost of gas infrastructure in individual neighborhoods could be used to electrify that neighborhood instead; this is likely to require coordination and tradeoffs between utilities depending on the service territory.

Focus areas

In urban areas, scale multifamily and public or affordable housing conversions.

In suburban areas, retrofit corridors and centers and pilot large-site conversions.

In rural areas, package weatherization, heat pumps, and storage to improve reliability.

8–12 YEARS

LATE PHASE

- ☐ **New construction.** Make all-electric delivery standard practice for new construction.

- ☐ **Scale up.** Scale neighborhood-scale programs with batch design, procurement, and synchronized utility upgrades, making sure low-income communities are not left behind.

- ☐ **Track and monitor data.** Publish annual scorecards on production and retrofits and adjust incentives, codes, and staffing.

Focus areas

In urban areas, complete districtwide conversions.

In suburban areas, finish center and corridor programs and scale to all housing types.

In rural areas, sustain resilient retrofits with storage and right-sized utility upgrades.

BE-4 BUILDING DECARBONIZATION / ELECTRIFICATION

SOLUTIONS TO DEPLOY MEASURE AT REGIONAL SCALE

- ☐ Align code updates regionwide with shared model language, a common calendar, and joint hearings so jurisdictions move together.
- ☐ Create a regional study hub, share templates and findings, and offer technical assistance so jurisdictions can utilize common findings to improve overall program delivery and impact.
- ☐ Prepare shared cost-effectiveness studies and adopt consistent reach code language. Provide express, checklist permits for compliant heat pump and panel upgrades.
- ☐ Coordinate predictable service timelines and capacity upgrades with utilities. Stand up a regional electrical panel upgrade program. Align with neighborhood decarbonization pilots under Senate Bill 1221.
- ☐ Launch a one-stop application that auto-bundles federal, state, regional, and utility incentives. Expand on-bill financing and low-income offerings. Provide landlord packages for deed-restricted and naturally occurring affordable housing.
- ☐ Fund recurring regional trainings, maintain vetted contractor lists, and run quality-assurance feedback sessions to improve installation quality.

IMPLEMENTATION CHALLENGES AND OPPORTUNITIES

CHALLENGES	OPPORTUNITIES
Split incentives in multifamily. Owners pay while tenants save.	Use tariffed on-bill offerings, master-meter strategies where feasible, and performance-based incentives for measured savings.
Contractor capacity and quality. Too few trained installers leads to long waits and oversizing.	Fund recurring trainings, require program participation for rebates, publish vetted contractor lists, and add quality-assurance reviews.
Data and reporting gaps. Agencies cannot see where upgrades stall.	Standardize permit fields and dashboards that track permits, timelines, costs, and incentives by neighborhood.
Resistance to electrification and limiting wood-burning and gas fireplaces. Cultural and financial concerns are a deterrence.	Run multilingual outreach with hands-on demos, publish total-cost comparisons, and highlight early adopters. Continue providing rebates for electric inserts and include heat pump packages, provide design guidance, and phase compliance with remodels.
Grid reliability worries. Households fear outages and peak costs.	Bundle storage, demand-response enrollment, and vehicle-to-home options with electrification.
Commercial kitchen electrification. Specialized equipment and practices complicate change.	Plan early with utilities, specify electric equipment, and train staff.
Multifamily water-heating constraints. Space, noise, and venting limit in-unit equipment.	Use shared or central heat pump water heating with load-management and sound-rated enclosures.

COMMUNITY BENEFIT CONSIDERATIONS

Support implementation in low-income communities

- Stack local, utility, state, and federal incentives for heat pumps, panel upgrades, and weatherization. Expand on-bill financing with income-qualified terms. Time upgrades to affordable housing rehab cycles.
- Provide simple checklists, online permit pulls, and navigator services that schedule contractors and inspections.
- Incentivize owners to electrify with tenant protections. Prioritize all-electric upgrades when making financing decisions for affordable multifamily projects.
- Fund training and pre-apprenticeships for heat pump, electrical, and weatherization work. Work with CBOs to recruit residents.
- Offer multilingual, culturally relevant outreach and hands-on demos for induction and heat pump appliances. Direct households to vetted contractor lists.

Avoid adverse consequences

- Avoid shifting costs to tenants. Calibrate incentives to cover common retrofit extras and pair with stable rate plans.
- In rural areas or areas with more grid instability (e.g., due to storms or public safety power shutdowns), combine electrification with weatherization and, when feasible, storage or vehicle-to-home options. Recognize that homes in rural areas may need to have dual-fuel backup and residents may be concerned about the reliability of electrification.
- Minimize inspection visits through standardized scopes and contractor-neutral navigator support.
- Offer comparable programs across service territories so customers outside municipal-utility areas are not left behind.
- Present technologies as options. Offer loaner cooktops and try-before-you-buy events.

BE-4 BUILDING DECARBONIZATION / ELECTRIFICATION

Limit Wood-Burning Devices and Natural Gas/Propane Fireplaces in Residential Development

$1,972,000

Total Costs between 2026 – 2030

\+ $1,261,000
O&M Costs

$10,780,000
Upfront Capital Costs

\- $10,069,000
Savings

COST EFFECTIVENESS

$34

per metric ton of GHG emissions reductions

The first part of the measure focuses on installing electric fireplaces in place of natural gas or wood-burning stoves in residential developments. Based on GHG reduction targets, it is assumed that 5,500 stoves will be installed by 2030, or about 1,100 per year. Research from California-based sources indicate an average unit cost of $1,960 for an electric stove. Applying this to the target results in an annual cost of $2,156,000 and a total cost of $10,780,000 by 2030. Electric fireplaces result in savings for building occupants, as they are cheaper to maintain and operate. This results in an annual saving of $2,014,000 annually, which leaves a total cost of $1,972,000 over the 2026-2030 period.

CASE STUDIES

San Mateo County Whole-Home Electrification Case Study
Pilot retrofits show practical pathways for switching existing homes to heat pumps for space and water heating, induction cooking, and peak management. Findings include ways to avoid some panel upgrades through load management, the value of contractor training and concierge support, variable costs by home type, and measurable GHG reductions, which inform scalable county programs.

Require all-electric development to use electric instead of natural-gas powered appliances in new residential developments

$324,000,000

Total Costs between 2026 – 2030

\+ $261,000,000
O&M Costs

$926,000,000
Upfront Capital Costs

\- $863,000,000
Savings

$1,434

per metric ton of GHG emissions reductions

The second part of the measure covers installing electric appliances in new residential developments instead of natural gas models. It is estimated that the Capital Region forecasts 75,000 new residential units by 2030. The total cost of installing these appliances is $926,000,000. However, electric appliances are generally cheaper than their natural gas counterparts, generating estimated savings of $172,608,000 per year. These savings are offset by higher operational costs, as electricity rates exceed natural gas rates. The additional operational cost is $52,179,000 per year. This results in a total cost between 2026-2030 of $324,000,000 (inclusive of O&M and savings).

May Lee State Office Building, all-electric commercial kitchen
A new State of California office complex in downtown Sacramento demonstrating full building electrification, including a commercial kitchen that uses electric equipment such as an induction stove and an oven, supporting zero-carbon operations and improved indoor air quality. Key lessons include early design coordination with utilities, careful equipment selection, staff training, and operational change management for public facilities.

Create a regional study hub, share templates and findings, and offer technical assistance so jurisdictions can utilize common findings to improve overall program delivery and impact.

TR-1 ZEV ADOPTION AND CHARGING INFRASTRUCTURE

This measure focuses on increasing the use of cleaner fuel and ZEVs by replacing conventional combustion vehicles that generate more GHG emissions, and by increasing access to charging infrastructure for ZEVs. The measure covers light-duty vehicles such as passenger cars and light-duty trucks. The implementation of this measure is made up of two parts:

Use of Cleaner-Fuel Vehicles. Promotes transitioning gasoline- or diesel-powered vehicles to a combination of cleaner-fuel vehicles that include battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). This measure would support fleet transition within the Sacramento-Roseville CSA and would complement the planned transition to ZEV-only sales required by California's Advanced Clean Cars II (ACCII) program. Currently, the ACCII regulation requires that new vehicle sales in California would reach 68% by 2030.

Provide Electric Vehicle (EV) Charging Infrastructure. Promotes installing more EV chargers at buildings with designated parking areas (such as commercial, educational, retail, and multi-family buildings) and investigates curbside charging strategies in urban areas.

This measure also promotes the integration of Grid-to-Vehicle (G2V) and Vehicle-to-Grid (V2G) technologies. G2V technology enables intelligent charging of EVs based on grid conditions and electricity pricing, shifting charging to off-peak hours and times of abundant renewable energy generation, which reduces strain on the grid and lowers costs for drivers. V2G technology takes this a step further by allowing EVs to discharge stored electricity back to the grid, providing additional capacity during peak demand periods and enhancing grid stability. Together, G2V and V2G support a more resilient, cost-effective, and renewable-powered transportation-energy system.

LEAD AGENCIES

Metropolitan planning organizations and councils of governments such as **Sacramento Area Council of Governments (SACOG)**, the **Tahoe Regional Planning Agency (TRPA)**, and the **Nevada County Transportation Commission** guide transportation planning, regional coordination, and funding allocation.

Cities and counties adopt zoning, permitting, and building code updates and oversee implementation within their jurisdictions. This includes city and county sustainability managers who set and measure goals and bring information to their voting body who provide approval for the local implementation of measures. **Public works and transportation departments** install, maintain, and operate public charging in parking lots, curbside locations, and community facilities.

The **California Air Resources Board (CARB)** sets standards and mandates for zero-emission vehicle adoption, and the **California Energy Commission (CEC)** adopts triennial building code updates, and both fund clean transportation programs.

IMPLEMENTATION PARTNERS

PG&E and **SMUD** manage grid capacity, integrate electric vehicle loads, set electricity rates including special rates for EVs, provide rebates for charging infrastructure and vehicles, and partner on G2V and V2G. **Electric utilities**, including community choice aggregators like Valley Clean Energy and smaller utilities like Roseville Electric may also provide rebates.

Transit agencies such as **Sacramento Regional Transit** (SacRT) transition fleets to zero-emission buses and plan depot charging and hydrogen fueling to meet the state requirement for zero-emission bus purchases starting in 2029.

Private charging networks deploy infrastructure, scale commercial installations, expand consumer access, and engage delivery fleet operators to align corridor and workplace charging with direct current fast charging needs.

Workforce and education partners design training for electricians, mechanics, and technicians, including skills for V2G systems.

Community-based organizations lead outreach, education, and engagement, such as to develop mobility hubs in low-income neighborhoods.

IMPLEMENTATION STEPS AND TIMELINE

PREREQUISITES & ENABLING CONDITIONS

- ☐ **Align land use and local policy.** Update zoning and land use policies to streamline EV charger installation. Adopt building code updates and strengthen enforcement to support cost-effective deployment of EV-ready infrastructure, particularly for multifamily and commercial developments. Evaluate suitable locations for charging infrastructure through zoning considerations, as each community type faces different land use patterns and siting opportunities. Urban areas can prioritize infill and multifamily retrofits; suburban areas can focus on commercial corridors, shopping centers, and park and ride hubs; and rural communities will benefit from flexible zoning that enables shared charging facilities along highways.

- ☐ **Upgrade grid capacity and coordinate with utilities.** Engage with utilities early to assess local grid capacity for both fast charging and Level 2 charging and plan upgrades where needed, as inadequate grid infrastructure is one of the biggest barriers to expansion of EV charging in older neighborhoods. Work with utilities to create incentives that offset the cost of panel, service, and/or transformer upgrades where grid capacity is insufficient, and pair with solutions that minimize panel upgrades through load-sharing technology. Both urban and suburban areas may need extensive grid modernization in older residential neighborhoods, while suburban areas may focus on supporting large scale retail and auto malls. Rural communities may explore microgrids, distributed energy solutions, and charging in town centers.

- ☐ **Establish financial and incentive structures.** Offer incentives to encourage retrofits of existing multifamily housing and low-income properties. Develop funding mechanisms such as grants, rebates, and public private partnerships to reduce upfront costs for deployment. Support innovation that lowers retrofit costs, such as low-power chargers or shared infrastructure, to expand access and affordability. Urban areas can focus on subsidies for retrofitting existing housing, suburban areas can benefit from incentives for homeowner associations and commercial plazas, and rural communities may require state or regional grants to overcome limited tax bases.

- ☐ **Build a regional network.** Align city, county, and regional studies to build a more connected and efficient charging network, avoiding fragmentation. Identify and fill gaps on key corridors and highways. Prioritize neighborhoods with grid constraints for early pilots where V2G infrastructure can help reduce peak load stress on the grid during high-demand hours and avoid costly distribution upgrades. Build on existing ZEV plans rather than duplicating efforts and tailor strategies to specific community needs. Scale successful pilots across the region to accelerate adoption and provide visible proof of concept. Coordination strategies should consider differing needs. Urban areas can lead on dense charging networks, suburban areas can coordinate through joint planning bodies such as SACOG, and rural communities can rely on regional hubs and partnerships with utilities for cost-effective siting.

- ☐ **Build capacity and enhance technical assistance.** Provide staffing and technical assistance support to help smaller jurisdictions with limited capacity and bridge resource gaps, particularly in suburban and rural areas. Technical assistance programs should consider the variety of governance structures across the region.

- ☐ **Align fleet planning with AB 39.** Establish a regional working group of fleet, sustainability, and transportation managers. This group will support coordinated compliance. Convene agencies regularly to share best practices, procurement strategies, successful approaches for right-sizing vehicles, ZEV fueling/charging considerations, facility upgrade implications, and timing needs. Use insights from this group to develop high-level guidance and recommended milestones that agencies can adapt to their operational needs and resources. Assign a designated fleet transition lead (e.g., within Public Works or Fleet) to coordinate with Sustainability, Transportation, and the local utility.

- ☐ **Plan for dual-fuel depots.** Where duty cycles require, include hydrogen alongside electricity. Coordinate early with utilities on electric service upgrades and with hydrogen providers on delivery or onsite generation, storage, safety setbacks, and fire authority approvals.

- ☐ **Establish demonstration governance.** Pre-clear design-build-operate (DBO) or P3 contracting options for storage/hydrogen pilots, along with data-sharing and measurement & verification (M&V) requirements.

TR-1 ZEV ADOPTION AND CHARGING INFRASTRUCTURE

IMPLEMENTATION STEPS AND TIMELINE

0–3 YEARS

EARLY PHASE

- ☐ **Map demand, grid capacity, and siting opportunities.** Identify priority land uses such as residential, commercial, and transit hubs that are most suitable for charging. Partner with utilities early to identify pilot sites and plan grid upgrades. Identify priorities such as multifamily housing and low-income areas. Select sites based on factors such as charging gaps, proximity to major corridors and destinations, traffic counts, equity, and grid capacity.

- ☐ **Assess technology and infrastructure readiness.** Plan for the unique charging needs of light-, medium-, and heavy-duty vehicles and delivery fleets when installing charging infrastructure and developing policy for infrastructure siting. Consider hydrogen fueling infrastructure at the regional scale for commercial and truck fleets where battery electric vehicles may be less practical.

- ☐ **Conduct community engagement.** Use community anchors such as libraries, community centers, and transit hubs as both charging locations and outreach points. Maintain consistent messaging, even amidst shifting state or federal policies, to reduce confusion and strengthen community trust. Tailor engagement practices to each community, with multilingual and neighborhood-based outreach and trusted messengers such as schools, civic associations, agricultural cooperatives, and chambers of commerce. Frame EV adoption as a voluntary, cost-saving opportunity rather than a mandate, to help adoption feel like a choice rather than imposed.

- ☐ **Use blended funding from local, state, federal, and private sources.** Create public-private partnerships in which private charging companies manage chargers at multifamily sites. Use pilots to demonstrate success and attract new funding.

- ☐ **Launch a battery–hydrogen storage demonstration.** At one fleet depot or mobility hub, co-locate solar canopies (E-1A), stationary batteries, hydrogen storage/fuel cells, and V2G-ready chargers to support fast charging, peak shaving, and backup power.

- ☐ **Define siting and safety for hydrogen.** Adopt National Fire Protection Association (NFPA)/International Fire Code (IFC) requirements, ventilation, separation distances, and emergency procedures in coordination with local fire authorities; select one or two pilot depots.

Focus areas

Urban areas should prioritize grid-constrained neighborhoods, multifamily retrofits, and curbside charging.

Suburban areas can map opportunities at auto malls, schools, park and ride hubs, and commercial corridors.

Rural areas can plan public charging at highway stops, community centers, and other sites, and consider long-term needs of agricultural communities.

4–7 YEARS

MIDDLE PHASE

- ☐ **Pilot new approaches for multifamily sites and grid-constrained locations.** Pilot charging technologies in these sites to test feasibility in more challenging implementation sites. Implement multifamily retrofits using a cohort approach with standardized specifications, streamlined design and permitting, joint procurement, and technical assistance to reduce transaction costs and accelerate equitable access. Adjust infrastructure design to match different travel and work patterns.
- ☐ **Expand incentives based on performance.** Expand retrofit incentives, especially for low-income and multifamily housing. Evaluate pilot performance to inform scaling decisions.
- ☐ **Establish local workforce pipeline.** Launch workforce training with community colleges and trade schools.
- ☐ **Sustain community engagement.** Maintain clear public messaging to build trust as policies evolve. Listen to community concerns around EV adoption, such as those of the agricultural communities.
- ☐ **Pilot bidirectional charging in grid-constrained areas.** Map grid-constrained neighborhoods and pair them with V2G and bidirectional charging pilot opportunities. Explore policies and pilots for V2G and bidirectional charging to provide opportunities to improve grid resilience.
- ☐ **Scale successful elements of the battery–hydrogen demo.** Expand to additional depots where duty cycles justify hydrogen, and standardize designs (electrical one-lines, hydrogen equipment footprints, safety zones).
- ☐ **Pilot bidirectional operations at public fleets and schools.** Combine managed charging, stationary storage, and V2G to support critical loads and participate in demand response/ virtual power plants.
- ☐ **Update AB 39 plans as needed.** Report ZEV adoption, charger/fueler buildout, costs/savings, equity outcomes, and progress on grid/facility upgrades; adjust procurement and schedules based on market conditions.

Focus areas

Test smart charging and V2G in grid-constrained neighborhoods and install curbside pilots in **urban areas**. Urban areas can emphasize curbside, workplace, and mobility hub charging.

Suburban areas can demonstrate large-scale charging in malls, shopping centers, and workplaces. Suburban areas can expand charging in shopping centers and schools

Rural areas can pilot shared fast-charging hubs at truck stops. Rural communities can prioritize highway corridors and agricultural fleet needs.

TR-1 ZEV ADOPTION AND CHARGING INFRASTRUCTURE

8–12 YEARS

LATE PHASE

- ☐ **Scale and integrate network.** Scale infrastructure regionwide with an equity focus. Integrate charging with solar, storage, and other distributed energy resources. Monitor usage, equity outcomes, and grid impacts to guide upgrades. Develop long-term revenue and cost sharing models for charging operations.
- ☐ **Expand V2G operations.** Expand V2G integration to public fleets, schools, and transit agencies. Build a combined transportation and electric sector business case so V2G and managed charging deliver long term value for site hosts, utilities, and residents.
- ☐ **Integrate depots into a resilient energy network.** Combine solar + storage + hydrogen fuel cells at priority depots to provide firm capacity, support black-start for critical operations following power outages, and enable regional emergency charging.
- ☐ **Expand V2G/V2B operations.** Move from pilots to standard practice for suitable fleets and multifamily/garage contexts, with clear tariffs and revenue models.

Focus areas

Urban areas build dense networks of curbside and workplace charging, and concentrate V2G-ready hubs at fleet depots, mobility hubs, and multifamily garages.

Suburban areas provide robust charging at major commercial centers, schools, and civic campuses, with standardized V2G capability at workplaces, auto malls, and public fleet yards.

Rural areas integrate EV charging and V2G into community microgrids at fire stations, schools, and community centers for resilience.

In all areas, connect highway corridors with fast charging and hydrogen stations for trucks and buses.

SOLUTIONS TO DEPLOY MEASURE AT REGIONAL SCALE

- ☐ Provide technical assistance to jurisdictions with limited staff and align local plans with county and regionwide strategies. Coordinate among utilities and jurisdictions for interoperability and equitable coverage. Technical assistance can be provided through SACOG or similar collaboratives for feasibility studies, site selection, ordinance development, and implementation.
- ☐ Complete a regional zero-emission vehicle-ready charging plan that inventories existing infrastructure, analyzes demand, and identifies gaps and priority sites for community adoption. Coordinate with utilities on distribution upgrades and interconnection.
- ☐ Coordinate with agencies, utilities, and partners to fill charging infrastructure gaps along key transportation corridors and in rural areas to enable freight systems and agricultural stakeholders to meet zero-emissions goals for their respective fleets.
- ☐ Publish a regional AB 39 toolkit. Provide plan templates, duty-cycle analysis methods, siting/safety checklists (including hydrogen), standardized specifications, and a shared procurement cooperative.
- ☐ Create a hydrogen and safety working group. Convene utilities, fire authorities, air districts, depot operators, and OEMs to align on permitting, emergency response, and training.

IMPLEMENTATION CHALLENGES AND OPPORTUNITIES

CHALLENGES	OPPORTUNITIES
Political Resistance and Equity Barriers. Some communities resist mandates, and low-income households have the least access to vehicles and chargers.	Use incentives and voluntary programs and pair deployment with education on cost savings and air quality benefits. Provide targeted subsidies for low-income households such as rebates, used vehicle incentives, and lower charging rates.
Uncertainty Around Market Dynamics and Innovation. Costs of equipment and materials necessary for ZEV deployment may not always decline overtime as predicted because of tariffs and supply chain issues, and rapid innovation creates a risk that policies become outdated.	Adopt flexible and adaptive policies that respond to market conditions. Support innovation pilots, monitor cost trajectories, and update building requirements and incentive programs regularly.
Multifamily and Existing Development Retrofits. Existing properties lack charging and face high panel upgrade costs.	Use load managed and shared charging to avoid upgrades. Offer rebates, on-bill financing, or low interest loans for panel and service upgrades when needed. Pair funding with technical assistance to reduce soft costs and project complexity.

COMMUNITY BENEFIT CONSIDERATIONS

Support implementation in low-income communities

- Target incentives and education toward low-income and rural communities to address disparities in adoption, as these groups face higher barriers to electric vehicle ownership.
- Offer rebates or financing for multifamily and existing buildings to add shared chargers or app-based metering to avoid panel upgrades.
- Where feasible, have the utility own or operate chargers so residents can access affordable electric vehicle rates for installations within multifamily buildings.
- Team utilities, affordable housing developers, and nonprofit organizations to co-fund and deliver projects.
- Partner with CBOs, agencies, and utilities to establish mobility hubs in low-income communities, community centers, and CBO-owned spaces to provide charging and other services.
- Explore curbside chargers in dense areas and at community anchors where designated parking is limited.
- Provide incentives to assist residents in older homes to upgrade panels and build capacity to enable at-home charging installations.
- Align charging infrastructure installs with refinancing and rehabilitation schedules to reduce costs and disruption.

Avoid adverse consequences

- Use grants, cost share programs, or utility-owned models rather than shifting expenses to residents.
- Provide multilingual, culturally relevant education and outreach that frames adoption as a choice with cost and health benefits and dispels misconceptions or safety concerns around EVs. Employ peer-to-peer education to address cultural or identity-related attachments to gasoline-powered vehicles.

TR-1 ZEV ADOPTION AND CHARGING INFRASTRUCTURE

COST EFFECTIVENESS

Use of Cleaner-Fuel Vehicles

-$21,755,000

Total Savings between 2026 – 2030

+	$2,203,570,590	ZEV O&M Costs
	$896,764,000	Upfront Capital Costs
-	$918,518,496	Savings

-$404

per metric ton of GHG emissions reductions

To estimate the costs associated with ZEV adoption, a business-as-usual (BAU) scenario was compared to a ZEV transition scenario. Achieving the goal of transitioning 30% of light-duty vehicles to ZEVs by 2030 would require roughly 325,000 internal combustion engine (ICE) vehicles under the BAU scenario to switch to ZEVs. Capital costs were calculated by assessing the difference between the average prices of ICE and ZEV vehicles, assuming price parity is reached by 2030. Results indicate that the premium paid for new ZEVs would result in an upfront capital cost of $896,764,000 across the 2026–2030 horizon. While ZEVs are more expensive than ICE vehicles to purchase, their operations and maintenance (O&M) costs are lower. Compared to the BAU scenario, O&M costs for these 325,000 cars generate $918,518,000 in savings, based on per-mile cost differences between ICE and ZEVs. In the first two years under the transition scenario, capital costs will be greater than savings from fuel and O&M, but starting in 2028, cost savings will start to set in. Across the 2026-2030 horizon, upfront capital costs are more than offset by O&M savings, resulting in a net savings of $21,755,000 for residents, businesses, and fleet operators.

Charging Infrastructure

$270,763,000

Total Costs between 2026 – 2030

+	$8,364,000	O&M Costs
	$262,399,000	Upfront Capital Costs
-	$0	Savings

$2,530

per metric ton of GHG emissions reductions

To estimate the costs of installing 6,500 new EV chargers between 2025 and 2030, the assessment developed assumptions around charger types, installation costs, and deployment timelines, modeling a steady annual rollout. The focus was on expanding access to chargers at buildings with designated parking. Cost estimates therefore assumed using a mix of Level 2 and DC fast chargers (DCFC), based on estimates from the Southern California Association of Governments' Plug-In Electric Vehicle Infrastructure Plan. Charger type distribution was determined using the U.S. Department of Energy's Electric Vehicle Infrastructure Projection Tool, which estimates the number of chargers needed based on fleet size. The total upfront capital costs for 6,500 new chargers are $262,399,000, while the total costs inclusive of operations and maintenance are estimated to be approximately $270,763,000 by 2030.

CASE STUDIES

East Palo Alto – Multifamily Housing (MFH) Low-Cost Charging Retrofit

A condominium complex successfully installed shared EV charging infrastructure at a cost of just $405 per parking spot, demonstrating that retrofitting existing multifamily housing can be affordable and scalable. The project used shared Level 2 chargers paired with residents' own charging handles, reducing electrical panel upgrades and lowering infrastructure costs. This model is highly replicable for other multifamily properties seeking cost-effective solutions.

SacRT Mobility Hubs Project

SacRT, the Sac Metro Air District, and the Sacramento Clean Cities Coalition are partnering to develop mobility hubs within low-income communities to support low-carbon mobility options, including access to EV charging infrastructure, EV carshare, and electric microtransit shuttles. Three light rail stations have been selected for the initial pilot stage as the result of a community-driven implementation plan. The pilot can provide a replicable model for the development of similar mobility hubs both at transit stations and within neighborhoods.

PG&E Vehicle-to-Everything (V2X) Pilot

PG&E launched a V2X pilot program that enables certain electric vehicles to send power back to homes and the grid. The pilot provides incentives for participants and tests the potential for EVs to act as distributed energy resources, supporting grid reliability and reducing peak demand. Lessons from this pilot can inform policies for regional V2G integration.

SMUD / ARV Heavy- and Medium-Duty Zero Emission Vehicle Blueprint

SMUD is planning hydrogen and electric fueling/charging stations for medium- and heavy-duty vehicles. For example, the plan includes two hydrogen stations at the Port of West Sacramento to support both port fleet pilots and public hydrogen fueling. This case shows how to build infrastructure for fleets (which need larger fuel or charging capacity) and scale regionally.

TR-4 ROADWAY IMPROVEMENTS FOR MULTI-MODAL USE AND ACCESS

This measure focuses on the improvement and expansion of multi-modal transportation routes to encourage a mode shift from single-occupancy vehicles to active modes of transportation such as bicycling or walking. The implementation of this measure is made up of three parts:

Provide Pedestrian Network Improvements. This measure will expand the sidewalk network to improve connectivity and access. Increasing the number of well-maintained pedestrian sidewalks will enhance the pedestrian experience and encourage people to walk instead of drive. The GHG reductions associated with this measure are based on the displacement of light-duty VMT.

Construct or Improve Bike Boulevards. This measure will construct or improve peripheral Class III bicycle boulevards that connect to the larger bikeway network. These supplementary Class III bikeways create safe, low-stress connections to encourage a mode shift from driving to bicycling, thus displacing VMT and reducing GHGs.

Expand Bikeway Network. This measure will expand bikeway networks. A bicycle network is an interconnected system of bike lanes, boulevards, and paths that improve the bicycling conditions of a community, often redesigning streets to accommodate protective infrastructure, signage, and paint to facilitate a safe and convenient route of travel. Bicycle networks also have the capacity to increase the "catchment area" of existing transit hubs through increased access, ultimately increasing public transit ridership.

LEAD AGENCIES

City and county public works and transportation departments adopt and implement street standards; approve encroachment permits and implement permit conditions; manage the public right of way; and fund, design, build, and maintain bike lanes and sidewalks.

Metropolitan planning organizations and **councils of governments** such as **Sacramento Area Council of Governments (SACOG)** and the **Tahoe Regional Planning Agency (TRPA),** guide transportation planning, lead travel demand modeling, coordinate among agencies, and allocate state and federal transportation funding for active transportation.

Regional and county transportation planning agencies, such as the Placer County Transportation Planning Agency and the Nevada County Transportation Commission, coordinate cross-jurisdictional projects, program regional funds for active transportation, and develop and align local plans.

City and county parks districts and departments plan, build, and maintain off-street pathways and trail facilities.

California Department of Transportation (Caltrans) owns and operates sidewalks and roadways on state routes and issues permits for construction within the state right of way.

State land managers, such as **California State Parks,** own and maintain certain trail facilities and coordinate trail connections with local jurisdictions.

Federal land managers, such as the United States Forest Service, the Bureau of Reclamation, and the United States Army Corps of Engineers, manage trails, roads, and shoreline segments on federal lands where local networks connect.

Some sidewalks and path segments are owned or maintained by **other entities** such as homeowners associations, school districts, universities, business campuses, and trail conservancies. Within those boundaries, these owners act as the lead agency for design, access, and maintenance.

IMPLEMENTATION PARTNERS

Community-based organizations (CBOs) and neighborhood associations lead corridor outreach, walk and ride audits, multilingual engagement, and community advisory roles.

Contractors deliver design, permitting, and construction within the public right of way.

Employers and business districts coordinate wayfinding and maintenance at interfaces with public facilities and may provide funding or access easements.

IMPLEMENTATION STEPS AND TIMELINE

PREREQUISITES & ENABLING CONDITIONS

- ☐ **Update or align with adopted plans and standards.** Update or align with existing active transportation plans, bicycle and pedestrian plans, trails master plans, and general plan policies to authorize and guide projects. Apply development and street improvement standards that require sidewalks and bikeway elements in new projects. Keep plan maps and standard drawings current to match up-to-date design practices.

- ☐ **Tailor designs, roles, and requirements** to each agency's adopted policies and standards. Urban areas can update modal network maps and street typologies for dense grids; suburban areas can add connectivity standards for large parcels and superblocks; rural communities can focus on paved shoulders, context-sensitive trail alignments, and simple standards that fit low volume roads.

- ☐ **Adopt policies to improve safety and comfort.** Develop policies to monitor and better enforce vehicle speed limits, such as speed camera auto ticketing and speed feedback signs. Implement traffic-calming projects and add shade infrastructure in targeted pedestrian/bicycle zones.

- ☐ **Coordinate with capital projects.** Scan five-year capital improvements plans and programs and bundle walking and bicycling improvements where feasible. Use change orders to add sidewalk, crossing, and bikeway elements when nearby projects mobilize. Sequence construction to avoid demolishing recent work and to reduce traffic control costs. Urban areas can pair street resurfacing with protected bike lanes and curb extensions; suburban areas can attach path segments and crossings to school modernizations and arterial widenings; rural communities can combine shoulder paving and bridge rehabs with new crossings and trail connections.

- ☐ **Policy backstop for contested projects.** Adopt clear local policies for walking and bicycling and reference them in staff reports and hearings. Codify street design standards and frontage requirements so projects advance consistently. Integrate active transportation priorities into general plans and capital programs to support delivery when projects face opposition. Where supportive policies and standards are absent, expect greater risk of delay, deferral, or denial due to project pushback; adopt clear multi-modal policies before advancing corridor designs. Urban areas can adopt network-level complete streets policies and street design standards that apply to arterials and transit corridors; suburban areas can adopt safe routes policies and street retrofit standards for commercial arterials; rural communities can adopt shoulder widening, crossing safety, and trail access policies that fit lower speeds and volumes.

TR-4 ROADWAY IMPROVEMENTS FOR MULTI-MODAL USE AND ACCESS

IMPLEMENTATION STEPS AND TIMELINE

0–3 YEARS

EARLY PHASE

- ☐ **Select priority corridors.** Based on latest plans, prepare a short list of priority corridors identified in local plans for grant applications. Begin outreach in coordination with CBOs and partners to build public support.
- ☐ **Establish funding and grant readiness.** Move toward grant readiness for priority corridors with clear scopes, planning level costs, and community support. Align grant applications with program criteria and priorities and prepare match strategies and phasing plans that adhere to grant program rules and timelines. Hold early coordination meetings with Caltrans and other funders. Maintain shelf-ready concepts or preliminary designs to accelerate delivery when funds arrive. Urban areas, including smaller cities, can package large- and small-scale complete streets projects for competitive state programs; suburban areas can phase projects by school and employment center catchments; rural communities can target safety and tourism-oriented grants and bundle small segments into one deliverable.
- ☐ **Complete baseline analyses and assessments.** Collect traffic counts and walk and bike audits at multiple times of day; run intercept surveys; establish equity and performance metrics; and map approaches and last-mile connections to transit or other active transportation facilities. Conduct night audits and identify lighting gaps and visibility needs along corridors and last-mile connections to transit, and add lighting to project scopes if needed.
- ☐ **Clarify projects that span multiple owners.** Map ownership early and clarify ownership and maintenance responsibilities. If needed, draft access and maintenance agreements for private or institutional links and set campus edge connection standards; assign a lead agency for each boundary segment.
- ☐ **Develop initial designs.** Complete 10 to 30% corridor concepts, update planning-level costs and grant ready scopes, and align with utility and public works schedules. Prototype with quick-build materials; adjust designs based on observed behavior before committing to capital. Include electricity conduits in resurfacing projects; coordinate with utilities for metering and rebates.
- ☐ **Identify corridors for bicycle boulevards (low-stress bike routes).** Not every local street is suitable for low-stress routing and diversion, and crossings require careful selection. Map low-volume streets parallel to arterials; start with speed management and crossings and add diversion where support exists; monitor outcomes and scale to similar corridors.
- ☐ **Engage communities and build support.** Budget a dedicated outreach line item and partner with CBOs to support a robust outreach process. Use regional technical assistance funds for engagement. Provide multilingual, plain language visuals, pop-up demos, and walk audits. Provide businesses with clear access plans and loading zones. Provide decision-makers with data and information on the positive economic and quality of life benefits.

Focus areas

Urban areas can target priority corridors in plans and last-mile connections to transit stations, and close gaps in sidewalk networks.

Suburban areas can target school catchments, superblock connections, and commercial arterials.

Rural communities can target paved shoulders, highway crossings, and shared use path links to parks, trails, and schools.

4–7 YEARS

MIDDLE PHASE

- ☐ **Fund projects and complete planning.** Secure funding and advance projects through environmental review, utility coordination, right of way, and design to bid readiness.
- ☐ **Expedite permitting with clear submittal expectations.** Use pre-application meetings and checklists; standardize traffic control and restoration details; leverage on-call construction; set an escalation path to resolve review conflicts.
- ☐ **Develop corridor-scale quick-build pilots.** Evaluate and convert successful pilots to permanent construction. Build near-term segments that close gaps to schools, transit hubs, town centers, and employment areas.
- ☐ **Maintain momentum.** Keep a living pipeline with 10 to 30% concepts and planning-level costs; align corridor packages to program criteria; refresh priority lists after each grant cycle.
- ☐ **Minimize impact to communities.** Maintain recurring outreach and communications on project progress and manage construction to protect resident, business, and emergency access.
- ☐ **Avoid utility conflicts and costly rework.** Uncoordinated trenching and resurfacing damages new facilities and missed conduit raises future costs. Publish a two- to five-year look ahead; adopt a joint trench and spare conduit policy; preapprove restoration details for bikeways; add scope via change orders when nearby crews mobilize.
- ☐ **Plan for maintenance and collect data.** Create operations and maintenance plans and publish before and after results on safety, usage, access, and equity. Write maintenance agreements that assign sweeping, vegetation, storm response, lighting checks, and pavement repair; stock shared spare parts; add assets to each agency's asset management system; address use of assets by people experiencing homelessness. Adopt shared metrics for safety, usage, access, and equity; collect synchronized counts and near-miss indicators; publish annual scorecards tied to funding.

Focus areas

Urban areas can focus on protected lanes, safer crossings, sidewalk gaps, curbside upgrades, and station access lighting.

Suburban areas can complete off-street path spines, school access routes, and mid-block connections.

Rural communities can deliver shoulder widening, trailheads, and town to park path segments.

TR-4 ROADWAY IMPROVEMENTS FOR MULTI-MODAL USE AND ACCESS

8–12 YEARS

LATE PHASE

- ☐ **Complete networks.** Scale construction to close remaining gaps in bike networks and sidewalks and complete corridor transformations. Integrate walking and bicycling projects with transit priority, first- and last-mile access, regional trail links, and corridor lighting. Sustain delivery with ongoing grant cycles and public-private partnerships and publish annual reports tied to budget decisions.
- ☐ **Execute maintenance plans.** Fund long-term operations and maintenance, and update local street design standards on a set schedule. Track performance annually using safety, usage, mode share, access, and equity metrics and adjust programs and budgets.

Focus areas

Urban areas can aim to build dense, connected networks with protected facilities, frequent crossings, and well-lit corridors and transit station approaches.

Suburban areas should focus on providing strong access at schools, commercial centers, and civic campuses and finish long shared-use path segments.

Rural communities can connect towns with shoulder and path projects and link paths to regional recreation assets and intercity transit stops.

SOLUTIONS TO DEPLOY MEASURE AT REGIONAL SCALE

- ☐ Create a regional working group of cities, counties, transit agencies, school districts, state land managers, and federal land managers. Meet regularly, track issues, and use one set of rules for permits and maintenance.
- ☐ Use a shared-corridor priority map and annual targets for miles built, gaps closed, and station approaches lit. Publish progress.
- ☐ Apply and target project funding within SACOG's identified mobility zones and Green Means Go zones. Coordinate cross-jurisdictional projects to build or close gaps between sidewalks and bike lanes. Use the SACOG regional trails plan to align routes and staging.
- ☐ Establish a pooled regional match fund.
- ☐ Submit joint grant applications for multi-corridor packages and keep a rolling two-year grant calendar with ready templates.
- ☐ Use federal, state, regional, and local programs as appropriate, and keep standard benefit, cost, and performance text up-to-date to help expedite grant application processes, especially for programs that require complex cost-benefit analysis.
- ☐ Publish a regional design toolkit for sections, protection, crossings, lighting near stations, trail junctions, and curb management. Set a regional bicycle boulevard policy with diversion thresholds and device options. Use common specifications and adopt a regional policy for low-stress bike routes with clear thresholds and device options.

IMPLEMENTATION CHALLENGES AND OPPORTUNITIES

CHALLENGES	OPPORTUNITIES
Limited local staff capacity. Small jurisdictions juggle many programs, and may lack capacity for scoping and grants.	Stand up a regional technical assistance team; share model ordinances and permit templates; use on-call contracts to surge design and outreach capacity.
Rising construction costs and supply volatility. Price spikes shrink scope and long lead times delay construction schedules.	Use cooperative purchasing; include additive alternates; deploy quick-build materials first, then convert to permanent construction; use prefabricated materials and reused materials; incorporate bicycle and pedestrian scope to vehicular street and infrastructure projects.
Limited right of way width. Narrow streets lead to tradeoffs and may create controversy and delays.	Apply context-sensitive cross sections; use side paths; acquire targeted easements; manage curbs for loading, micromobility, and pick up and drop off; coordinate with fire departments to ensure active transportation projects do not impede emergency access.
School schedule constraints. Work windows are short, and changes during the school year disrupt families and create safety risks.	Coordinate with school calendars; plan projects near schools during breaks; provide temporary routes and crossing guards during construction.
Overlapping mobility zones and cross-jurisdiction corridors. Overlaps create confusion about lead roles and standards and staging drifts without a regional view.	Apply mobility zones to set common priorities; when zones overlap, assign a lead agency and shared standards; use the regional trails plan to synchronize staging.

CHALLENGES	OPPORTUNITIES
Traffic stress and speed. Heavy volumes and high speeds suppress comfort and reduce bike lane use, especially on unprotected facilities.	Calm traffic with lane reallocation, speed management, and signal timing; build protected bikeways on arterials; route trucks and through traffic to appropriate corridors; build parallel low-stress networks on side streets.
Personal security and bike theft. Fear of crime lowers ridership and discourages bike parking at destinations.	Apply appropriate crime prevention through environmental design; add secure bike parking cages and lockers; use cameras where appropriate; fund corridor ambassadors; support bike registration and recovery; improve lighting at entrances and racks.
Political support and approvals. City Council or Board of Supervisors hesitancy can stall or water down projects despite technical readiness.	Adopt strong policy frameworks; present pilot results with before and after data; provide businesses with access plans; gather letters of support from schools, businesses, and community groups; brief decision-makers early and often.

TR-4 ROADWAY IMPROVEMENTS FOR MULTI-MODAL USE AND ACCESS

COMMUNITY BENEFIT CONSIDERATIONS

Support implementation in low-income communities

- **Funding and resources.** Reserve set asides, waive or lower local match, provide grant writing help with templates, and pair corridors with low-cost programs such as helmet and light kits, repair vouchers, and income-qualified micromobility passes.
- **Community engagement and language access.** Contract CBOs to cohost audits, pop ups, and door to door outreach; compensate residents for time, childcare, food, and translation; define whether engagement will inform, consult, co-create, or empower; provide multilingual, plain language materials; meet at schools, faith venues, markets, clinics, parks, and transit hubs; and use trusted messengers.
- **Site understanding and prototyping.** Observe corridor use at different times of day and week, run intercept surveys at key destinations, and test concepts with quick build materials before capital construction.
- **Design and accessibility.** Add universal design elements such as tactile paving, accessible pedestrian signals, and compliant cross slopes at all new crossings and curb ramps.
- **Heat and climate comfort.** Add shade trees, shade canopies, drinking water access, and cooling spots along priority corridors, especially on routes to schools and transit.
- **Safety and personal security.** Add lighting and clear sightlines, install secure bike parking at libraries and community centers, apply appropriate crime prevention through environmental design, and where supported, fund corridor ambassadors or unarmed safety teams.
- **Micromobility affordability and safety.** Offer income qualified electric bicycle programs and provide secure charging, parking, and battery safety guidance at community facilities.
- **Jobs and local capacity.** Set local hire goals where allowed, fund pre-apprenticeship and apprenticeship pathways, train residents for sweeping, vegetation control, sign replacement, and lighting checks, and favor contracts with paid internships and on the job training for local youth.
- **Delivery and maintenance from day one.** Install near-term safety fixes, collect feedback and performance data, convert successful pilots to permanent construction, execute maintenance agreements, stock spare parts, and add new assets to the asset management system with service life and replacement schedules.
- **Housing and small business coordination.** Phase construction to protect access and deliveries, add secure bike parking near entrances, and coordinate with tenant stabilization and small business support programs.

Avoid adverse consequences

- **Construction access.** Maintain Americans with Disabilities Act access and signed detours, provide temporary crossings and protected walkways, and schedule school area work during breaks and off-peak periods.
- **Displacement and cost burdens.** Track rent, sales, and vacancy trends, use right to return preferences and small business stabilization grants where risk rises, align corridor investments with affordable housing, avoid shifting maintenance or utility costs to tenants or small property owners, coordinate utility metering and tariffs for corridor lighting and signals, and offer targeted rebates for security lighting and bike parking.
- **Non-punitive safety and profiling.** Rely on self-enforcing designs such as protection, speed management, signal timing, and lighting; emphasize outreach and education with lights, bells, and locks; minimize discretionary stops of people walking, biking, or rolling; use trained ambassadors and service referrals instead of police-led engagement where feasible; and provide simple incident reporting with quick resolution.
- **Data and privacy.** Collect anonymous, disaggregated before and after data on safety, harassment, and profiling; share findings with community partners; and co-design responses such as lighting upgrades, safe passage routes, and staffed hubs.
- **Curb access and disability needs.** Reserve accessible parking and paratransit zones near key destinations, set delivery windows and loading areas before removing parking, and communicate changes with wayfinding signs, mailers, and onsite ambassadors.

- **Traffic stress and comfort.** Build protected bikeways on busier streets, calm traffic with lane reallocation and speed management, provide parallel low stress routes on side streets, and upgrade wide arterial crossings with refuge islands, signals, or beacons.
- **Accountability and grievance process.** Provide a multilingual hotline and web form with response timelines, publish contact information on corridor signage, and track issue resolution to closure.

COST EFFECTIVENESS

Provide Pedestrian Network Improvements

$18,478,000

Total Costs between 2026 – 2030

+	$300,000 O&M Costs
	$61,922,000 Upfront Capital Costs
-	$43,744,000 Savings (annual)

-$1,031

per metric ton of GHG emissions reductions

Construct or Improve Bike Boulevards

$11,991,000

Total Costs between 2026 – 2030

+	$1,083,000 O&M Costs
	$12,243,000 Upfront Capital Costs
-	$1,335,000 Savings (annual)

-$221

per metric ton of GHG emissions reductions

Expand Bikeway Network

$76,159,000

Total Costs between 2026 – 2030

+	$2,537,000 O&M Costs
	$2,537,000 Upfront Capital Costs
-	$1,143,000 Savings (annual)

$4,021

per metric ton of GHG emissions reductions

TR-4 ROADWAY IMPROVEMENTS FOR MULTI-MODAL USE AND ACCESS

All unit cost estimates were derived from the City of Elk Grove's 2021 Bicycle, Pedestrian, and Trails Master Plan, which included construction and soft costs such as engineering, administration, and project management. Land acquisition costs are not accounted for. Annual maintenance costs are assumed to cost $2,732 per mile, based on data from Rails to Trails. However, since new sidewalks and bike paths typically do not need major repairs in the first few years following construction, this estimate is likely to overstate actual maintenance costs early on.

To estimate the costs of expanding pedestrian sidewalks across the region, existing sidewalk lengths were sourced from the 2022 Sacramento County Active Transportation Plan. The total upfront capital costs are $61,922,000, while the total costs inclusive of operations and maintenance are estimated to be $62,222,000 total for the expansion project. By 2030, additional savings of $43,744,000 annually are estimated from fuel and maintenance savings due to vehicle miles traveled (VMT) reductions. These savings will benefit residents.

To estimate the number of bike boulevards needed to displace 20% of VMT in the region, the analysis used the mileage of existing bicycle boulevards from Sacramento's 2018 Bicycle Master Plan, as the 2022 Active Transportation Plan did not have estimates on bike infrastructure mileage. VMT reduction was calculated using CARB's 2021 Quantification Methodology, which factors in trip length, usage frequency, and mode share. The total upfront capital costs are estimated to be $12,243,000, while the total costs inclusive of operations and maintenance are estimated to be $13,326,000 total. By 2030, additional savings of $1,335,000 annually are estimated from fuel and maintenance savings in VMT reductions. These savings will be experienced by households as they can reduce their driving needs.

To estimate the cost of expanding the bicycle network, existing network mileage was referenced from Sacramento's 2018 Bicycle Master Plan. Total upfront capital costs are estimated to be $74,765,000, while the total costs inclusive of operations and maintenance are estimated to be $77,302,000 total. By 2030, residents can benefit from an additional savings of $1,143,000 annually due to reductions in fuel and maintenance costs as a result of reduced VMT.

All costs were scaled across the broader Capital Region using county-level population data from the California Department of Finance and proportionally adjusted to Sacramento County's estimates based on each county's share of the regional population.

CASE STUDIES

Sacramento Area Council of Governments – Regional Trail Network Action Plan

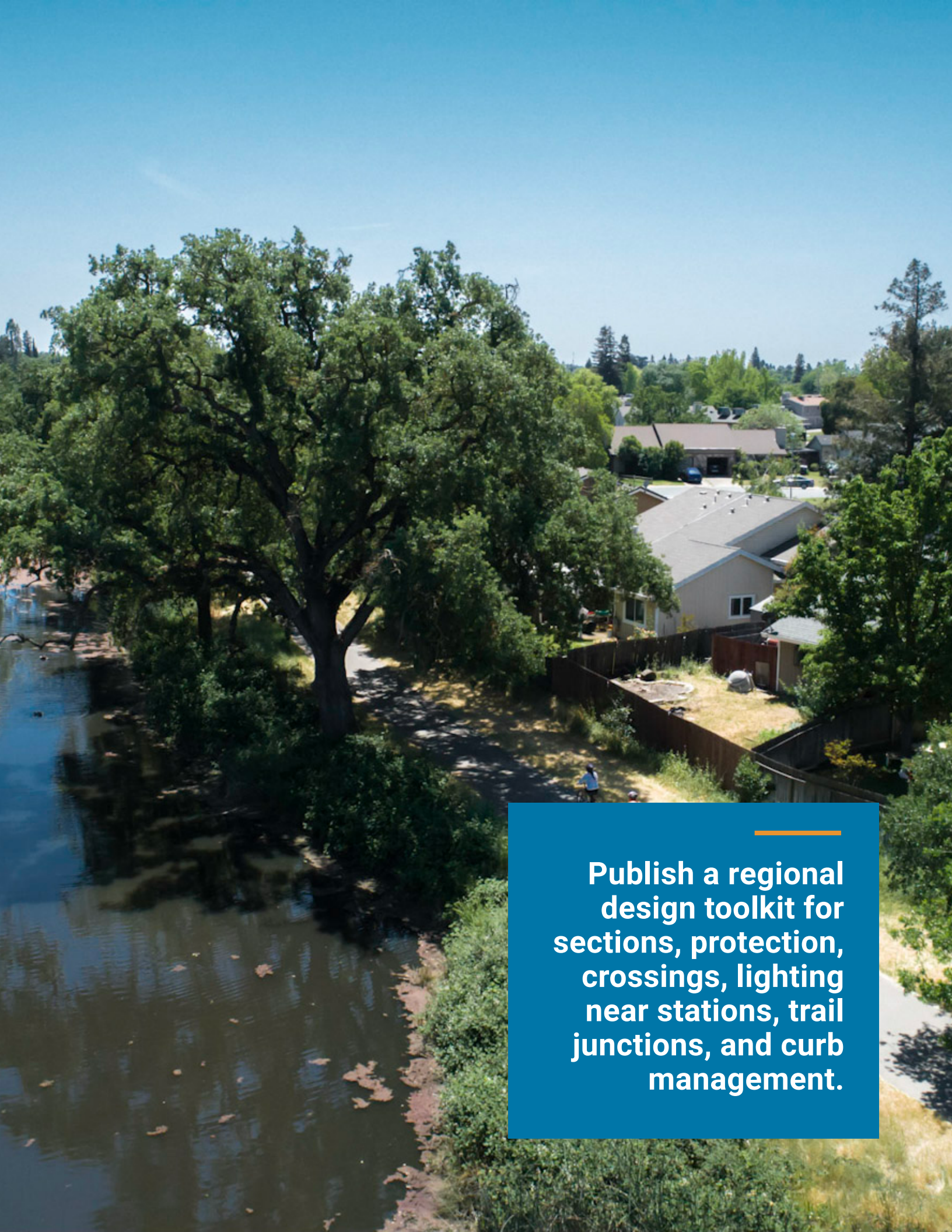
The Action Plan advances a connected, multi-county Sacramento Regional Trail Network, with a prioritized map and a technical assistance program that helps jurisdictions move projects from plan to delivery. It provides a regional framework to stitch together city and county segments into a continuous system. This case shows how a regional map, shared standards, and hands on technical assistance can accelerate multi-jurisdiction delivery.

Placer and Sacramento Gateway Corridor (PSGC)

The PSGC bundles multimodal improvements along the I-80 and Capitol Corridor gateway, including transit capacity, station access, and first and last mile pedestrian and bicycle upgrades positioned for the Solutions for Congested Corridors Program. It demonstrates how to package linked investments to reduce delay while improving active mode connections. This case shows how to assemble corridor scale multimodal packages and pursue joint state funding to deliver linked projects across county lines.

East Bay Greenway – Lake Merritt BART to South Hayward BART

Alameda County Transportation Commission is advancing a 16-mile regional trail and bikeway that generally follows the BART alignment through Oakland, San Leandro, Ashland, Cherryland, and Hayward, connecting multiple stations with a mix of multi-use paths and protected on-street facilities delivered in phases. The project creates a continuous north–south spine that links neighborhoods to high-capacity transit. This case shows how to leverage rail corridors and phased delivery to build long regional spines that connect communities to transit and services.



Publish a regional design toolkit for sections, protection, crossings, lighting near stations, trail junctions, and curb management.

NW-1 WILDFIRE RESILIENCE AND MANAGEMENT

This measure focuses on mitigating the intensity of wildfires in forested areas by implementing fuel treatments. Fuel treatments include thinning, prescribed burning (broadcast and pile burning), managed fire, pruning, grazing, and mechanical understory treatments, such as mastication or mowing to reduce fuel. During a wildfire event, the majority of GHG emissions are released from the burning of live tree biomass. After fuel treatments, forest stands often have lower fire severity than untreated forest stands, leading to lower GHG and co-pollutant emissions from mitigating combustion of dead and live biomass in a forest. Lower-intensity wildfires also often burn with slower spread, improving containment outcomes and protection for nearby communities. Notably, this measure roadmap also emphasizes the importance of maintenance – follow-up fuel treatments applied over time to sustain lower vegetation densities – which is often overlooked by funders and excluded from project scopes and budgets.

Wildfire Resilience and Management. Requires the use of fuel treatments on public and private lands to reduce future wildfire intensity. Treated forest stands will result in less severe wildfires and will reduce the amount of stored carbon released during wildfires.

Maintenance. Plan and fund recurring maintenance activities, including follow-up prescribed fire, selective thinning, slash removal, invasive species control, and fuel load reduction, to sustain initial treatment effectiveness and extend benefits over time.

LEAD AGENCIES

United States Forest Service (USFS) manages national forest lands and leads planning, permitting, and implementation of landscape-scale thinning and prescribed fire on federal lands.

Bureau of Land Management (BLM) and Bureau of Reclamation manage fuels work on their lands and facilities, including reservoirs and canal corridors, and coordinate permits and access.

California Department of Forestry and Fire Protection (CAL FIRE) funds and implements fuel treatments, administers prescribed fire in state responsibility areas, and partners with local agencies and landowners.

Cities and counties lead vegetation management and fuel treatment, working through key departments such as Parks, Public Works, and the Office of Emergency Services.

Resource conservation districts (RCDs) such as the Placer County RCD and the El Dorado County RCD coordinate cross-jurisdictional projects through wildfire preparedness and resilience offices, develop grants, provide technical assistance, and manage implementation.

Water agencies such as the Yuba County Water Agency safeguard source water watersheds and treatment facilities by leading priority fuels work around critical infrastructure and intake corridors, while **electric utilities** manage vegetation along power line corridors and coordinate shaded fuel breaks and access.

Other state agencies such as **California State Parks** and the **University of California** conduct forest restoration activities on land they own or manage. Similarly, the **California Tahoe Conservancy** conducts forest restoration on its managed properties and funds, plans, and leads forest management activities in their area of jurisdiction.

Railroads and **transportation agencies** manage vegetation along rail and highway rights of way that can function as linear fuel breaks and access lines.

Tribal cultural fire practitioners conduct cultural burns and forest restoration activities.

County and community Fire Safe Councils and Firewise Communities organize neighborhood-scale readiness, secure grants, engage residents, and deliver on-the-ground fuel reduction and defensible space work. Activities vary by individual organization.

Industrial timberland owners and small forest landowners implement treatments with the goal of and prescription to reduce wildfire severity within private forests that connect public land projects and provide access for haul routes.

IMPLEMENTATION PARTNERS

The **Sierra Nevada Conservancy** funds, plans, and leads forest management activities, with an increasing focus on multi-jurisdictional, multi-benefit, large-scale projects. Other state partners include the **California Wildfire and Forest Resiliency Task Force** as a key coordinator.

Federal partners include the Natural Resources Conservation Services (NRCS), which help private landowners and Tribes restore forests, the Federal Emergency Management Agency, and the Department of Housing and Urban Development.

Fire protection districts fund and assist in providing labor for wildfire mitigation projects.

Multiparty partnerships such as French Meadows, North Yuba Forest Partnership, and Truckee River Watershed Forest Alliance, align priorities across owners and move large landscape projects through planning and delivery.

Registered Professional Foresters, Licensed Timber Operators, burn bosses, and **fuels contractor teams** provide environmental compliance support and deliver mechanical thinning, pile burning, and prescribed fire.

Prescribed burn associations organize landowner-led prescribed fire, training, and shared risk arrangements that expand capacity on private and mixed ownership lands. Some assist with planning, permitting, and implementation.

California Conservation Corps and local conservation corps deliver hand-thinning, pile-building, chipping, and post fire stabilization while training local workers.

Local air quality management districts regulate smoke and issue prescribed burn permits and smoke management plans.

Biomass and wood utilization partners, including bioenergy plants, sawmills, biochar firms, and specialty wood producers, accept small-diameter material to reduce piles and lower treatment costs. The Greater Sacramento Economic Council and local economic development departments can support industry attraction and market development for biomass and wood-utilization products.

Targeted grazing operators and rangeland specialists manage fine fuels along shaded fuel breaks, utility corridors, and community perimeters.

Insurance carriers and resilience finance partners offer community mitigation credits and risk modeling to prioritize treatments.

IMPLEMENTATION STEPS AND TIMELINE

PREREQUISITES & ENABLING CONDITIONS

- ☐ **Establish baseline implementation funding.** Create dedicated pre-project funding and pooled regional match for environmental review and planning. Commit seed funding to match grants, support environmental compliance and permitting, and bridge timing gaps between planning and project implementation.
- ☐ **Streamline environmental review.** Develop streamlined programmatic California Environmental Quality Act (CEQA), National Environmental Policy Act (NEPA), Endangered Species Act (ESA), and National Historic Preservation Act reviews to enable faster, project-specific approval and implementation. Create standard checklists, model scopes, survey protocols, and biological and cultural resource checklists and preapproved methods to accelerate repeat projects. Bundle permitting across adjacent projects to share costs; however, issues with one project can slow down others.
- ☐ **Develop and expand regional workforce training programs.** Invest in regional workforce training opportunities in forestry work, environmental review, biomass utilization, and other efforts. Build partnerships to fund and develop regional workforce training programs, such as through community colleges and regional California Jobs First initiatives (e.g., Sierra Jobs First), for both forestry maintenance work and environmental permitting and compliance. Fund apprenticeships and certifications, guarantee multiyear talent pipelines, and coordinate contractor mobilization across neighboring projects.
- ☐ **Catalyze biomass and wood product utilization industry.** Plan end markets and logistics for removed material before implementation so fuel treatments do not stall for lack of outlets. Coordinate with partners to establish robust regional biomass utilization and value-added wood products manufacturing industries through pilot projects, public-private investments, catalyst funding (e.g., regional California Jobs First initiatives), and job training. Work with economic development initiatives to advance diversified biomass outlets beyond power generation, including biochar, specialty wood products, mass timber construction materials (e.g., cross-laminated timber), and small combined heat and power (CHP).

NW-1 WILDFIRE RESILIENCE AND MANAGEMENT

IMPLEMENTATION STEPS AND TIMELINE

0–3 YEARS

EARLY PHASE

- ☐ **Conduct landscape-scale planning and prioritization.** Develop or update Community Wildfire Protection Plans and conduct a countywide or region-wide prioritization process to identify priority treatment areas and coordinate on project development, focusing on the wildland urban interface (WUI) and evacuation corridors. Other focus areas include greenbelts, riparian corridors, undeveloped vegetated areas, canyons, community buffers, and large forest blocks and rangelands that influence fire spread.

- ☐ **Establish collaborative governance and community plans.** Convene or participate in standing collaboratives, which are likely to vary by region but could include state and federal agencies (e.g., USFS, CAL FIRE), local agencies and special districts such as resource conservation districts, Fire Safe Councils, Firewise communities, Tribes, land trusts, and counties or cities.

- ☐ **Identify grants and funding opportunities.** Consider financing mechanisms such as climate resilience districts (CRDs), forest resilience bonds, and carbon credits. Package multi-partner projects to enable joint funding applications.

- ☐ **Include full scale of needs in project scopes and budgets.** Include transport, processing, and storage costs for biomass in project budgets and agreements. Develop maintenance plans and budgets at project start to maintain previously treated areas and establish maintenance set-asides or escrow per project. Maintenance plans should also incorporate previously treated areas where maintenance has not been funded and areas that have burned under managed fire or unmanaged wildfire regimes.

- ☐ **Conduct environmental reviews and execute agreements.** Conduct environmental reviews if not covered under existing programmatic reviews. Execute land access and stewardship agreements across public, private, and federal parcels. Coordinate and execute any needed memoranda of understanding (MOUs) and coordinate with partners such as utilities, special districts, and other stakeholders.

- ☐ **Engage communities, stakeholders, and Tribes.** Conduct community outreach around planned activities, benefits, and proposed end uses for biomass.

- ☐ **Plan for biomass end-uses.** Map biomass outlets and hauling logistics and line up near-term uses such as biochar and small CHP.

4–7 YEARS

MIDDLE PHASE

- ☐ **Secure funding and execute.** Secure grants, permits, and right-of-entry and move projects to implementation readiness. Deliver priority fuel treatments including mechanical thinning, pile-burning during safe windows, and prescribed broadcast burning.

- ☐ **Scale up capacity and maintain project pipeline.** Ramp up workforce training with contractors and training partners. Expand crews, trucking, and equipment capacity and keep qualified contractor benches active. Maintain a rolling list of shovel-ready, pre-cleared or pre-approved, or tiered projects with costs, benefits, and lead implementers to improve grant competitiveness.

- ☐ **Scale up biomass utilization opportunities.** Pilot and scale biomass utilization contracts so material leaves sites reliably and does not accumulate. Aggregate feedstock across projects, make long-term supply commitments, and coordinate hauling so material leaves the forest promptly.

- ☐ **Track and monitor progress.** Track treatments and observations of monitored regrowth in a shared database and schedule reentry based on results, before fuels rebound. Track acres treated, cost per acre, air quality impacts and risk reduction. Monitor vegetation regrowth in treated areas and adapt treatment plans based on observed conditions rather than a calendar-based schedule.

- ☐ **Explore creative insurance mechanisms.** Develop solutions to pair fuel treatment activities with reductions in insurance premiums for nearby residents and businesses.

8–12 YEARS

LATE PHASE

- ☐ **Conduct maintenance based on monitoring outcomes.** Institutionalize, treat, and maintain rotations matched to vegetation type and fire behavior. Set adaptive maintenance schedules for treated acres, including reentry intervals, invasive species control, and follow-up burning or mastication. Create a dedicated maintenance funding mechanism that blends county funds, grants, and stewardship contracts with landowners.

- ☐ **Update plans and scale across jurisdictions.** Refresh plans, priorities, and agreements every three to five years using monitoring data and community input. Scale cross-jurisdictional operations with shared crews, staging, and equipment. Publish annual outcomes and adjust prescriptions, maintenance frequency, and workforce investments.

SOLUTIONS TO DEPLOY MEASURE AT REGIONAL SCALE

- ☐ Stand up a multi-county, multi-jurisdiction collaborative to plan, fund, and deliver treatments across boundaries. Use MOUs and joint work plans, and align with Fire Safe Councils and watershed partnerships.

- ☐ Define roles for counties, resource conservation districts, Fire Safe Councils, federal land managers, water agencies, air districts, etc., and use shared priority maps and joint work plans.

- ☐ Explore multi-benefit partnerships to protect headwaters, improve air quality, and harden energy and water infrastructure. Use joint agreements to co-fund priority treatments in source water and utility corridors.

- ☐ Adopt landscape-level prioritization and a project design process that ranks treatment areas using transparent criteria such as community protection, evacuation routes, habitat, and water supply to support coordinated project development. Seek input from community members and stakeholders to select high-return treatment areas.

- ☐ Use decision-support tools to map priority polygons and publish an annually refreshed treatment pipeline of both new areas for treatment and areas requiring maintenance treatments.

NW-1 WILDFIRE RESILIENCE AND MANAGEMENT

IMPLEMENTATION CHALLENGES AND OPPORTUNITIES

CHALLENGES	OPPORTUNITIES
General funding scarcity. Partners lack dedicated funds to advance ready plans.	Coordinate applications to state and federal programs to reduce piecemeal delivery. However, note that this may result in an extended environmental review process. Create pooled match funds, pursue resilience financing, and enlist water and air districts where co-benefits exist.
Funding program misalignment. Most grants focus on implementation. Pre-project work and maintenance compete with new acre implementation.	Establish separate, stable funding tracks for planning, environmental compliance, permitting, implementation, and multi-cycle maintenance. Value upkeep equal to initial treatment.
Limited end-uses and markets for removed biomass. Lack of buyers for removed biomass make it difficult for fuel treatment projects to be self-sustaining after initial grant funding runs out.	Provide technical assistance and investment to pilot community-scale and distributed biomass and wood utilization facilities as part of economic development activities.
Prioritization gaps on non-federal lands. Private and mixed-ownership areas lag prioritization.	Extend risk-based tools and community wildfire protection planning to private and institutional lands and confirm priorities through public forums and steering committees.
Fragmented coordination across jurisdictions. Multiple owners and programs slow cross-boundary work.	Align local and federal priorities so projects stack into contiguous, defendable fuel breaks. Use access agreements and right-of-entry templates to streamline work on mixed-ownership landscape mosaics. Align treatment prescriptions so transitions across property lines do not create weak links. Maintain a single coordination calendar for scoping, permitting, implementation, and maintenance to reduce duplication.

COMMUNITY BENEFIT CONSIDERATIONS

Support implementation in low-income communities

- Prioritize fuel treatments where communities face the highest wildfire risk and where water and power infrastructure need protection, and coordinate delivery with Fire Safe Councils, Firewise communities, and resource conservation districts.
- Create paid local workforce development pathways by funding training and apprenticeships for key roles (e.g., foresters, operators, trucking, and compliance support), and include local hire targets in contracts. Actively conduct job training outreach in low-income or under-represented communities.
- Partner with Tribes to develop Tribally led and implemented projects incorporating cultural burning, Traditional Ecological Knowledge, and other practices.
- Partner with water agencies and utilities to co-fund work that protects headwaters, hydropower assets, and electric infrastructure, and align treatment schedules with their capital programs.
- Engage communities early and often through multilingual meetings and field days on treatment sites, treatment types, burn windows, and biomass utilization options.

Avoid adverse consequences

- Ahead of controlled burns, communicate activities and risks to sensitive groups, distribute N95 respirator masks or HEPA filters, and provide clean air refuges. Explore diversion of material to utilization options such as bioenergy or biochar when feasible.
- Site biomass processing facilities (e.g., any combustion or CHP facilities) away from sensitive receptors and engage communities throughout process.
- Reduce process burdens by streamlining compliance where appropriate and coordinate permits across agencies so projects do not stall or shift costs to residents.
- Frame activities and biomass facilities as fuel-reduction tools, highlight wildfire risk reduction, watershed protection, and safety benefits, and use local case studies to build support.
- Engage communities throughout the process to address issues proactively and incorporate local priorities in identification of treatment areas, development of biomass utilization opportunities, and job training.
- Publish results on risk reduction, air quality, economic development, and other community benefits to sustain support.

COST EFFECTIVENESS

$16,627,000

Total Costs between 2026 – 2030

\+ $300,000
O&M Costs

$16,627,000
Upfront Capital Costs

\- $0
Savings

$1,151

per metric ton of GHG emissions reductions

Cost estimates are based on the French Meadows Forest Reduction Project (2023), which implemented wildfire mitigation measures including mechanical thinning, mastication, hand thinning, road improvements, and the staffing costs to carry out these measures. Timber harvested for biomass helped offset project costs, resulting in an average cost of $1,907 per acre. Adjusted to 2025 prices, the cost is estimated at $2,078 per acre. Based on GHG reduction targets, 8,000 acres are to be treated by 2030—about 1,600 acres annually. At this rate, total upfront capital costs are estimated to be $3,325,307 per year, or $16,626,538 total from 2026 to 2030. No operations and maintenance or savings calculations were made for this measure. These figures reflect only the per-acre treatment costs of wildfire reduction measures and do not include operational expenses. This estimate only captures the upfront costs associated with this measure.

NW-1 WILDFIRE RESILIENCE AND MANAGEMENT

CASE STUDIES

French Meadows Forest Restoration Partnership
A watershed-focused collaboration in Placer County aligned the county, Placer County Water Agency, the USFS, and other partners to plan and implement large-scale fuel treatments to protect hydropower and drinking water assets while reducing wildfire severity. This case study shows how a water utility-led partnership can unlock funding, prioritize high-value headwaters, and deliver multi-benefit landscape-scale forest resilience.

North Yuba Forest Partnership
A landscape collaboration in Sierra and Yuba Counties organized partners around a large planning area, used shared prioritization pillars, and advanced treatments through coordinated pathways, with projects lined up for the next 20 years. This example shows how a multi-jurisdictional partnership can set common priorities, phase projects, and keep community protection and biodiversity goals aligned.

Placer County Cabin Creek
After community opposition to a traditional biomass-to-energy facility, Placer County re-scoped to a smaller biochar production approach supported by purchase commitments, preserving an outlet for treatment residues. The project illustrates how adaptive project design and right-sizing technology can maintain social license while still solving material disposition challenges.

Colfax I Forest Resilience Bond
The first forest resilience bond to be led and implemented by a Tribal organization, the Colfax I Forest Resilience Bond (FRB) brings Indigenous knowledge and cultural fire treatments to restoration activities spanning Tribal trust lands, private holdings, and Bureau of Land Management lands across Placer and El Dorado counties. The project demonstrates how innovative financing mechanisms can be applied to strengthen the capacity of Tribal stewardship, community-led restoration activities, and Tribal workforce activities.

Tahoe Central Sierra Initiative
A region-wide collaboration of federal, state, local, Tribal, utility, and nonprofit partners aligning forest and watershed resilience across the Central Sierra Nevada region. The initiative advances shared priority maps, joint planning, and coordinated delivery that spans multiple ownerships and counties. This case shows how a multi-partner framework can synchronize funding, permitting, and operations at the landscape scale.

Nevada County Biomass Pilot Project
Nevada County is testing community-scale biomass solutions to provide reliable outlets for treated fuels, with work on siting, technology selection, air quality coordination, and funding. The pilot pairs hazardous fuel removal with local utilization to keep residues moving off treated acres. This case study shows how a county can de-risk first mover projects that support ongoing maintenance of fuel breaks and treatment units.

Local air district mitigation funds for forest health
The Placer County Air Pollution Control District directed development-related air quality mitigation fees to a forest health and wildfire mitigation fund that can pay for permitting and early studies. This demonstrates how local mitigation dollars can seed pre-project compliance and planning to unlock implementation funding.

Water agency early-stage funding in Yuba County
The Yuba County Water Agency provided early de-risk capital for shovel-ready biomass projects linked to watershed protection goals, helping bridge financing gaps for private investors in advance of permitting approvals. This case study shows how water agencies can anchor predevelopment and accelerate projects that reduce wildfire risk to critical infrastructure.

Coordinate with partners to establish robust regional biomass utilization and value-added wood products manufacturing industries through pilot projects, public-private investments, catalyst funding and job training.

NW-2
BIOMASS ENERGY

This measure focuses on the local generation of electricity (or cogeneration) with biomass to displace fossil fuel-based electricity generation. Biomass energy has lower lifecycle GHG emissions than conventional fossil fuel energy because of the carbon uptake from plants grown to produce biomass fuel.

Biomass Energy. This measure would support new biomass fuel electricity generation capacity to produce electricity, or electricity and heat (cogeneration). By installing biomass energy generation locally, the carbon intensity of the electricity supply would decrease, reducing GHG emissions from local electricity consumption.

Counties and cities plan, permit, and approve local biomass electricity and combined heat and power (CHP) projects and align policies with climate and air quality goals.

Water agencies, wastewater districts, and special districts host facilities at wastewater and energy campuses, procure equipment, secure interconnection, and use electricity and useful heat for onsite loads.

Regional planning bodies coordinate cross-county siting, environmental review, and schedule alignment for multi-jurisdictional projects, including basin specific approvals where required.

Utilities and community choice aggregators coordinate interconnection studies, metering, and tariffs; procure energy and execute power purchase agreements; and enable grid services and demand response.

Solid waste and biomass operators aggregate, chip, and deliver feedstock from transfer stations, landfills, forest operations, and agricultural removals and manage hauling and storage logistics.

United States Forest Service and state forestry agencies secure long-term feedstock through stewardship contracts and vegetation management projects and coordinate access and timelines.

Project developers and technology providers site, design, finance, build, commission, operate, and maintain biomass facilities and provide performance guarantees and training.

Resource conservation districts and University of California Cooperative Extension deliver technical assistance, producer outreach, workforce training, and monitoring, reporting, and verification.

Air districts permit biomass facilities, offer incentive funding for cleaner engines and controls, verify emissions, monitor air quality, and document exceedances in criteria air pollutants.

Economic development and finance partners structure public and private funding, apply bioeconomy investment zone ratings, and arrange credit enhancements or insurance for feedstock supply and offtake risk.

Tribal governments and community-based organizations (CBOs) lead local engagement, workforce pathways, and benefit sharing and help align projects with community priorities.

IMPLEMENTATION STEPS AND TIMELINE

PREREQUISITES & ENABLING CONDITIONS

- ☐ **Establish Bioeconomy Development Opportunity (BDO) Zones.** Identify and pursue Ecostrat BDO Zone ratings for Placer, El Dorado, and Nevada counties, noting that Yuba County is paired with Butte County, and Yolo County has already applied. After rating has been achieved, run a three-to-six-month promotion phase with economic development teams to recruit hosts and investors.
- ☐ **Align with plans and policies.** Align with Climate Action Plans, natural and working lands strategies, wildfire protection plans, and Senate Bill 1383 organics diversion. Reference any strategic plans that include biomass to energy to align actions and budgets.
- ☐ **Conduct advocacy.** Advocate for the importance of extending or replacing the Bioenergy Market Adjusting Tariff to avoid project attrition if current procurement sunsets. Coordinate with state agencies to regionalize bioenergy generation and procurement targets and keep funding stable for technical assistance and implementation.
- ☐ **Pre-screen candidate sites.** Review and pre-screen potential implementation sites at wastewater plants, transfer stations, industrial parks, and energy campuses for utility access, noise, traffic, and buffer requirements. If possible, gather community input.
- ☐ **Plan for feedstock supply and contracts.** Plan for procurement reality. The primary challenge is securing reliable feedstock for at least 3-5 years; contract terms should explicitly address quality specifications, shipping frequency, and onsite storage capacity to keep moisture and contamination within targets. Execute long-term feedstock contracts with price and quality specifications and delivery schedules — 3-5 years as a baseline, targeting 10-to-20-year U.S. Forest Service stewardship agreements where feasible. Stand up aggregation nodes and preprocessing for chipping, moisture reduction, and contamination control, sized to match contracted delivery cadence and storage dwell times. Use insurance or reserve mechanisms to backstop volume and price risk during wildfire, flood, or market disruptions.
- ☐ **Identify heat load and thermal use.** Identify year-round thermal hosts for CHP such as wastewater plants, industrial users, and district energy loops. Design heat recovery and distribution to meet temperature and reliability needs and to maximize overall efficiency.

0–3 YEARS

EARLY PHASE

- ☐ **Select and permit sites.** Based on pre-screening criteria, feasibility, and community input, select candidate site. Address site control constraints early, especially at privately owned mill or industrial properties. Use option agreements, leases, or public site control to keep schedules reliable and maintain contingency sites.
- ☐ **Secure funding and incentives.** Secure near-term funding for feasibility, permitting, engineering, and site control. Secure multi-year capital and operating funds from county, state, and federal programs for equipment, interconnection, and emissions controls. Combine grants, bonds, and private capital with credit enhancements. Apply for rapid grants to fund feasibility, front-end engineering and design, and site control. Where available, stack resources from air quality programs, wildfire and fuels management funds, and organics recycling programs to lower delivered cost.
- ☐ **Select technology.** Select proven technologies matched to feedstock such as combustion steam cycle, gasification with engine or turbine, or pyrolysis with biochar co-product. Complete front-end engineering and design with performance guarantees, availability targets, and spare parts plans. Include fire protection, odor control, and noise mitigation in baseline design.
- ☐ **Engage communities.** Conduct early outreach with nearby residents, Tribes, and CBOs and provide clear, transparent information on planned site designs and environmental impacts, using non-technical language. Listen to community concerns and reflect input in siting and design. Share community benefits such as reduced open burning, reduced wildfire risk, local jobs, backup power potential, and biochar or heat access where applicable.
- ☐ **Complete environmental review and permitting.** Conduct California Environmental Quality Act (CEQA) reviews, align with local general plans and zoning, and secure all required permits. Use best available control technology for emissions and prepare air permit applications with validated stack test data.
- ☐ **Reduce air quality impacts.** Work with the local air district to comply with emission limits and establish monitoring and reporting methods. Select controls for nitrogen oxides, carbon monoxide, volatile organic compounds, and particulate matter appropriate to unit size and technology.

IMPLEMENTATION STEPS AND TIMELINE

Plan for visible emissions observations and continuous monitoring as required.

☐ **Coordinate grid interconnection and tariffs.** Start utility pre-application meetings to confirm interconnection pathway, protection requirements, and meter configuration. Select tariffs that support export or net energy metering where eligible and evaluate resource adequacy and demand response options. Define power purchase agreement terms with utilities or community choice aggregators and set milestones for testing and commissioning.

☐ **Coordinate logistics and infrastructure.** Build or contract for chipping, staging, and storage with stormwater and fire safety measures, right-sized to haul frequency and seasonal variability to maintain fuel quality. Plan haul routes and hours and coordinate with transfer stations and landfills for inbound and outbound traffic. Provide calibrated scales and moisture testing to manage payment and performance.

☐ **Secure feedstock supply.** Map feedstock by source and season and execute letters of intent with operators. Include contingency sources and storage plans to provide reliable year-round supply. Prioritize local suppliers and community-based operators to strengthen regional economic benefits.

Focus areas

In urban areas, site small units at wastewater plants and transfer stations with strict emissions controls and traffic management.

In suburban areas, co-locate at materials recovery and transfer nodes and design for both electricity and thermal use or combined heat and power units by public facilities.

In rural areas, place facilities near feedstock sources and sawmills, prioritize CHP for industrial or water-agency loads, and build regional aggregation yards.

4–7 YEARS

MIDDLE PHASE

☐ **Procure, build, and commission** a small, CHP pilot at a public facility with a year-round thermal host. Finalize interconnection, witness testing, and commissioning and begin grid services or demand response enrollment. Stand up parts inventory, uptime reporting, and preventative maintenance schedules.

☐ **Build workforce.** Hire and train operators, electricians, and mechanics with clear standard operating procedures. Establish local hiring standards and coordinate with local colleges, workforce boards, and conservation corps for training and internships.

☐ **Aggregate biomass supply.** Stand up aggregation yards and preprocessing for chipping, staging, moisture management, and contamination control. Execute multiyear feedstock contracts and delivery schedules, including stewardship contracts and seasonal access where federal lands are involved.

☐ **Reduce financial risk.** Secure long-term purchase agreements (offtake) with programs such as the Bioenergy Market Adjusting Tariff or successor procurement programs and reference supportive statutes such as Senate Bill 1109 in procurement strategies. Bundle projects into portfolios and advance each to shovel-ready status with site control, interconnection progress, permits, and offtake before seeking private investment. Ideally, de-risk the pipeline by carrying one small behind-the-meter project to shovel-ready and one larger site to advanced design for investor review. Use insurance or reserve accounts to backstop feedstock and offtake risk.

☐ **Scale up.** Advance a second wave of projects in parallel, including very small units in sensitive basins where cleaner profiles are required, taking into account lessons learned.

☐ **Monitor and report data.** Publish annual data and metrics on air quality impacts, biomass tonnage diverted, GHG reductions, jobs created, and other co-benefits. Provide clear data and accountability to community members through a complaints hotline and email.

8–12 YEARS

LATE PHASE

- ☐ **Continue to scale up.** Establish a distributed network of right-sized facilities near feedstock sources and public thermal loads.
- ☐ **Lock long-term risk tools** and use insurance or reserve mechanisms to backstop feedstock and interconnection risk.
- ☐ **Institutionalize workforce pipelines** with community colleges, workforce boards, and conservation corps.
- ☐ **Maintain procurement signals** and integrate biomass utilization into climate, air quality, wildfire, and organics plans.

SOLUTIONS TO DEPLOY MEASURE AT REGIONAL SCALE

- ☐ Prioritize small, modular CHP units behind the meter in sensitive areas and use them as test cases to update basin rules when cleaner profiles are proven. Document pivots to smaller kiln-based designs where larger plants face opposition: In places where community opposition blocks large biomass plants, show that shifting to smaller, modular "kiln-based" systems (i.e., biochar units) can be an acceptable, lower-impact alternative.
- ☐ Standardize fuel specifications and sign multi-year supply agreements with local refuse and disposal operators to stabilize delivered cost and volume. Leverage utility and program procurement to support offtake, pair projects with county promotion windows and designated investment zones, and present bundled, shovel-ready portfolios to investors.
- ☐ Partner with existing forest resilience projects to provide a stable outlet and market for forest biomass, supporting the long-term sustainability of fuel treatment and maintenance projects.
- ☐ Show workable scales through early pilots and publish measured emissions and air quality benefits compared to open-pile burning. Share operations, cost, and performance data to build confidence.
- ☐ Collaborate with experienced counties and districts as technical leads and replicate large landscape collaborations that coordinate fuel reduction, feedstock flows, and siting across county lines. Formalize collaboration through a Joint Powers Authority or a Memorandum of Understanding so counties can coordinate siting, procurement, and shared services.

NW-2 BIOMASS ENERGY

IMPLEMENTATION CHALLENGES AND OPPORTUNITIES

CHALLENGES	OPPORTUNITIES
High and/or variable grid interconnection costs and long timelines. Distribution upgrade costs can exceed budgets and timing can jeopardize grants.	Engage utilities early, choose sites near available capacity, and prioritize behind-the-meter CHP.
Community acceptance and siting near sensitive receptors. Some residents associate biomass with older high-emission plants without measured performance data.	Site at wastewater plants, transfer stations, or industrial campuses and share verified performance data.
Weak markets for biochar and other co-products. Without contracted buyers, co-product revenue is speculative.	Secure buyers before build and target water treatment and agriculture uses.
Policy and procurement uncertainty for biomass power. Changes in program rules, mandates, and tariffs can strand projects.	Use community choice aggregators and local power purchase agreements and advocate for program continuity and successor procurements.
Hauling distance and delivered feedstock cost. Long routes raise trucking expense and increase moisture loss and contamination risk.	Co-locate near feedstock and transfer stations and optimize routes, staging, and moisture management.

COMMUNITY BENEFIT CONSIDERATIONS

Support implementation in low-income communities

- Set local hire goals, fund training, and advertise openings so residents benefit from new facilities and feedstock operations.
- Offer workshops, school partnerships, and site tours to explain modern biomass systems, air controls, and how projects reduce open burning and wildfire smoke.
- Place smaller, cleaner, behind the meter CHP units where they can serve public facilities in communities that face frequent outages.
- Work with air districts to direct mitigation and incentive dollars toward forest health, wildfire mitigation, and biomass utilization near overburdened neighborhoods.
- Secure letters of intent for biochar and other co-products to create regional value chains and stable revenue that supports community jobs.
- Engage water agencies, utilities, Tribes, and CBOs to co-invest in projects that improve watershed health and grid resilience.

Avoid adverse consequences

- Prefer distributed, small-scale facilities with modern controls and avoid locations with a history of air quality concerns. Conduct early engagement to address community concerns and perceptions shaped by legacy plants.
- Reduce truck impacts by co-locating near transfer stations or landfills that already handle woody material and by shortening haul routes.
- Adjust scale and technology when projects face opposition and involve basin planning agencies early in sensitive locations.
- Include local hire, training, and transparent air monitoring in agreements so benefits are delivered, and concerns are addressed throughout development and operations.

COST EFFECTIVENESS

$6,617,000

Total Costs between 2026 – 2030

\+ $786,000
O&M Costs

$5,831,000
Upfront Capital Costs

\- $0
Savings

$675

per metric ton of GHG emissions reductions

Cost estimates are based on the CAPCOA Handbook Update example and other publicly available sources. The estimated upfront capital cost to construct a 1 MW biomass facility is $5,831,000. Annual operating expenses are projected at $157,000, totaling $786,000 over a typical five-year period. Total costs inclusive of operations and maintenance and savings are therefore estimated to be $6,617,000. These figures are derived from the U.S. Energy Information Administration's 2020 study, adjusted for inflation to reflect 2025 values. For smaller-scale applications, a biomass generator capable of producing 50 kW is estimated to cost $100,000. This estimate is based on the 2018 study Estimated Costs of New Utility-Scale Generation in California, also adjusted to 2025 prices.

CASE STUDIES

Placer County — French Meadows Headwaters Partnership and Biomass Utilization
Forest-thinning projects protect drinking water and hydropower headwaters while routing woody material to local biomass uses. This case shows how to link watershed resilience, fuels reduction, and biomass markets to deliver air quality and climate benefits.

Yuba County — North Yuba Forest Partnership and Watershed-Linked Biomass
A landscape-scale partnership coordinates fuels work with nearby biomass outlets to keep projects moving from plan to construction. This case shows how aligning restoration, feedstock logistics, and procurement builds a durable project pipeline.

Tahoe Basin — Small CHP Pilot at Public Site
A very small, behind the meter unit with modern controls serves a public thermal load and gathers measured emissions data. This case shows how right-sized pilots can unlock siting in sensitive basins and update local rules with real performance.

Placer County — Cabin Creek Biochar Pilot
The county shifted from a large energy concept to a smaller kiln that produces biochar backed by buyer commitments. This case shows how a market-first approach can reduce risk, improve financing, and speed approvals.

Placer, El Dorado, and Nevada Counties — Bioeconomy Investment Zones
Designated investment zones and county promotion windows signal low risk and help attract private capital to priority sites. This case shows how clear siting pathways and standardized reviews crowd in investors for regional replication. El Dorado, Placer, and Nevada partners convened to address investment barriers, long term feedstock contracting, and risk reduction tools needed to finance facilities that can accept forest treatment byproducts. This case shows how multi-county coordination and shared analytics can aggregate supply, lower investor risk, and accelerate siting of outlets essential to sustained fuel reduction.

Yuba County — Interconnection Lesson and Early Funding Bridge
A project relocated after interconnection costs proved prohibitive, then advanced to shovel ready with early public funding. This case shows why early utility vetting and bridge financing prevent stranded development and keep projects on track.

City of Grass Valley — Small Biomass Pilot with West Biofuels and Pioneer Community Energy
A small project proceeds toward interconnection with Pacific Gas and Electric while pairing generation with local resilience goals. This case shows how early utility engagement and a committed community choice aggregator can move a pilot from planning to commissioning.

NW-4 CARBON SEQUESTRATION PROGRAM/CARBON FARMING

This measure will establish carbon sequestration or carbon farming projects. Carbon emissions are sequestered through the absorption of CO_2 from the atmosphere into a carbon sink (e.g., tree planting) or storage (e.g., injection into underground reservoirs). Carbon sequestration can occur through biological, chemical, or physical processes.

Establish a Carbon Sequestration Project. The measure reduces GHG emissions by implementing projects that follow the Natural Resources Conservation Service (NRCS) conservation practice standards from the U.S. Department of Agriculture (USDA). These projects sequester carbon by conserving, maintaining, and restoring natural resources on ranches, farmland, and forestland. Some example projects include:

- Converting irrigated cropland to permanent unfertilized grass cover.
- Replacing synthetic nitrogen fertilizer with beef feedlot manure on managed irrigated pasture.
- Replacing a strip of cropland with one row of woody plants.
- Converting grasslands to a farm woodlot.
- Adding legume seasonal cover crop to irrigated cropland.
- Restoring highly disturbed areas by planting permanent vegetative cover.
- Adding compost or biochar as a soil amendment to irrigated cropland.

LEAD AGENCIES

Resource Conservation Districts (RCDs) such as the Yolo County RCD lead county-level delivery, provide technical assistance (TA), manage cost-share funds, and oversee on-farm projects.

County and city sustainability and land use departments co-lead program design, sequencing, permitting alignment, and reporting.

The California Conservation Planning Partnership (C2P2)—which includes the U.S. Department of Agriculture Natural Resources Conservation Service (USDA NRCS), California Department of Food and Agriculture (CDFA), University of California Agriculture and Natural Resources (UC ANR), and California Association of Resource Conservation Districts (CARCD)—coordinates project standards, funding alignment, training, and regional consistency.

IMPLEMENTATION PARTNERS

Research and extension institutions turn science into field guidance, train technical assistance staff, and lead monitoring and reporting. Example institutions include UC ANR, University of California Cooperative Extension, and the California Farm Demonstration Network, and the Center for Regenerative Agriculture and Resilient Systems (CRARS) at CSU Chico, which runs a robust training program and conducts research on NRCS practices.

Industry and commodity groups signal market demand, spread best practices, support outreach, and help set procurement preferences. Examples include farm bureau chapters, commodity boards, processors, and food hubs.

Nongovernmental and community-based organizations (CBOs) provide trusted outreach, producer coaching, application support, workforce development, and education for climate smart products. Examples include the California Association of Resource Conservation Districts, Carbon Cycle Institute, American Farmland Trust, California Rangeland Trust, Community Alliance with Family Farmers, Kitchen Table Advisors, conservation corps, conservancies, land trusts such as the Sierra Cascade Land Trust Council, Center for Land Based Learning, community colleges, and Future Farmers of America chapters.

Air districts provide burn alternatives and clean equipment incentives, coordinate permits, and verify air quality benefits.

IMPLEMENTATION STEPS AND TIMELINE

PREREQUISITES & ENABLING CONDITIONS

- ☐ **Policy alignment and advocacy.** Align with climate action plans and Natural and Working Lands (NWL) strategies and fast-track permits for priority practices. Align with Senate Bill 1383 organics and local compost procurement to enable free or low-cost compost with subsidized hauling. Align with AB 1757, which calls for coordination to provide a bottom-up regional approach to nature-based climate solutions that can be more effective than top-down mandates.
- ☐ **Establish compost and biomass infrastructure.** Explore opportunities such as composting, chipping, mastication, pyrolysis, and whole-orchard and whole-vineyard recycling. Coordinate with solid waste programs and air districts to align supply, specifications, timing, and low-particulate matter technologies.
- ☐ **Enhance workforce and capacity.** Fund full-time planners and field technicians, and provide safety and equipment training. Share specialist staff across counties for outreach, planning, and grant writing through memoranda of understanding (MOUs). Create quick-hire rosters for seasonal workloads that include planting, mulch application, and fencing. Partner with workforce boards, CBOs, universities and community colleges, and cross-train RCD crews.
- ☐ **Build market development and partnerships.** Enhance and align ongoing projects and prioritize upgrades to projects already underway. Explore compost, biochar, and other byproduct sales, green procurement premiums, and service contracts (e.g., biomass handling, soil testing) to stabilize cash flow and diversify revenue streams while credit markets mature.
- ☐ **Assess 'carbon credit-readiness' of regional partners.** Evaluate existing structures and systems to determine best investments to develop pathways for future participation in the carbon market. Work with commodity groups, food hubs, and processors to add premiums and specialized marketing opportunities for goods grown with climate-smart practices. Develop public and private pilots for soil carbon amendments like biochar and compost where carbon credits are not yet viable. Explore pathways for future participation in carbon markets through partnerships with experienced organizations.

0–3 YEARS

EARLY PHASE

- ☐ **Build partnerships and relationships.** Identify county leads and RCD teams, and map practice priorities by crop, soil, and farm economics. Build relationships with CDFA, California Natural Resources Agency (CNRA), and USDA NRCS to align regional priorities with upcoming program design and secure longer term funding streams.
- ☐ **Complete carbon farm plans, if needed.** Build practice packages using COMET tools, Carbon Planner, and NRCS conservation standards. Deliver site-specific carbon farm plans with standardized tools and specifications to reduce farmer paperwork.
- ☐ **Identify effective, tested, priority carbon farming practices by county.** Partner with RCDs, Farm Bureau chapters, producers, and other stakeholders to identify priority sequestration practices best suited to local conditions (e.g., soil, crops, and land use types) for each county. This can support seeking funding for carbon sequestration practices that have greater buy-in and support and can be implemented successfully at the local level.
- ☐ **Secure funding and incentives.** Align funding cycles with NRCS, CDFA, air districts, and county block grant programs. Secure multi-year cost-share and incentive funds from state, federal, and local programs to de-risk compost, cover crops, reduced tillage, and hedgerows. Allocate flexible dollars for technical assistance, quality assurance and quality control (QA/QC), and post-installation maintenance, with set-asides for small and low-income producers. Explore county block grants and federal and commodity costshare programs. Build contingency timelines and diversify funding sources to maintain delivery during federal or state program slowdowns. In partnership with organizations experienced in credit generation, design and implement a local carbon offset program that supports and helps fund carbon farming activities.
- ☐ **Streamline information-sharing and technical assistance (TA).** Build a one-stop online portal with practice menus, specifications, and unified incentive applications. Designate county or regional TA providers or hire and train TA providers to prepare carbon farm plans, conduct site visits, select practices, navigate funding, and host mobile clinics and office hours. Establish MMRV (measuring, monitoring, reporting, and verification) protocols and provide simple

IMPLEMENTATION STEPS AND TIMELINE

reporting kits to growers. Launch a farmer-ambassador network and seasonal field days with the California Farm Demonstration Network to accelerate peer learning. Ask producers about problems, goals, rotations, soils, and constraints to better tailor technical assistance program offerings.

- ☐ **Reduce costs of hauling.** Address hauling-cost barriers with shared services or transfer nodes near farms. Pilot proof-of-concept and deploy mobile roll-off pyrolyzers and onsite chipping or mastication for orchard, vineyard, and rangeland biomass where feasible; include rangeland-fuels chipping and mastication.

- ☐ **Provide support and guarantees to farmers.** Reduce risks for participating farms by establishing supply chains for local purchasers, such as institutions (schools, hospitals, local grocery stores) and supporting the development of local food hubs, such as the Yolo Food Hub and the Spork Food Hub, which can help aggregate produce and provide value-added processing.

4–7 YEARS

MIDDLE PHASE

- ☐ **Launch and execute pilots.** Issue cost-share awards and standard agreements and deploy prequalified vendors and field crews. Install the first wave of practices that include compost application, cover crops, no-till, hedgerows, whole-orchard recycling, whole-vineyard recycling pilots, and rangeland-fuels chipping. Launch pilots aligned with Natural Climate Solutions (NCS) strategies (e.g., riparian restoration, agroforestry, prescribed grazing) to stack benefits and speed delivery. Prioritize practices that fit existing operations with immediate economic benefit.

- ☐ **Establish shared compost depots and transfer nodes** to reduce hauling costs and increase participation. Pair free or low-cost compost with subsidized hauling where needed.

- ☐ **Host on-farm demonstrations** and farmer-to-farmer learning events to show yield gains and input-cost savings. Stand up a farmer-ambassador and demonstration network to accelerate peer-to-peer adoption. Support farmer-led demonstration sites and storytelling to showcase co-benefits.

- ☐ **Conduct measuring, monitoring, reporting, and verification.** Assign a monitoring lead such as UC Cooperative Extension to design light-lift protocols, periodic site visits, and reporting templates. Track specific metrics to quantify benefits i.e., soil organic carbon, GHG reductions, particulate matter reductions, water use, yield, and input reductions (fertilizer, diesel). Use accepted planning/estimation tools (e.g., COMET-Planner, Carbon Planner) to estimate and cross-check GHG and soil benefits; align field data with tool assumptions for consistency. Train growers and crews to use photo logs and basic soil and practice tracking and provide TA, simple MMRV kits, and app-based reporting tools.

- ☐ **Adjust practices based on monitoring and outcomes.** Establish feedback loops to track, monitor, and adjust carbon farming practices based on outcomes, evaluating not only carbon sequestered but also agricultural yield, soil amendments applied, cost, and other criteria. Summarize results each season, convene producer/stakeholder debriefs, update practice guidance and incentives, and flag policy refinements for advocacy. Publish anonymized outcomes on yield, input reductions, soil metrics, etc., to build social proof-of-concept. Conduct quality assurance and quality control (QA/QC) site visits to ensure compliance without adding to farmers' workload.

- ☐ **Plan for future projects.** Maintain a live matrix of eligibility, timelines, and stackability across NRCS, the CDFA Healthy Soils Program (HSP), air-district programs including Carl Moyer, the U.S. Environmental Protection Agency (EPA) Targeted Airshed program, and local grants. Partner with food hubs, processors, and cooperatives to build procurement preferences for climate-smart commodities. Use public and private project readiness funds and institutional procurement to unlock private investment ahead of credit market maturity while continuing to advance a local carbon offset program.

- ☐ **Provide continuity strategies for long-term sustainability** and braid multi-year funding streams, reserve O&M/TA set-asides in every award, create pooled regional match and revolving bridge funds, pre-approve on-call TA contracts, and consider endowment-style reserves to maintain funding and technical assistance beyond program establishment. Create workforce development programs, internships, and quickly hire seasonal crews to provide field support and build a regional bench of skilled practitioners.

8–12 YEARS

LATE PHASE

- ☐ **Scale successful practices regionwide** and institutionalize cross-region mentoring, standardization of specifications, and equipment fleet sharing. Fund field support and onsite coaching to install practices that go beyond typical operations, including tribal projects. Right-size delivery and operate hybrid TA in which county-based navigators are supported by regional hubs that train staff and fill knowledge gaps.

- ☐ **Secure multi-year funding** for TA, implementation support, and MMRV with dedicated resources for small and low-income producers. Rebalance incentives toward high-uptake, high-impact measures. Expand rolling application windows. Formalize partnerships with processors, food hubs, and commodity groups to create value-added markets for climate-smart products.

- ☐ **Advocate for agriculture inclusion in statewide resilience investments,** such as 30 by 30 conservation efforts – which calls for conserving 30 percent of California's natural land and waters – and air quality incentive guidelines.

NW-4 CARBON SEQUESTRATION PROGRAM / CARBON FARMING

SOLUTIONS TO DEPLOY MEASURE AT REGIONAL SCALE

- ☐ Convene counties, RCDs, Farm Bureaus, growers, Tribes, and CBOs to identify locally relevant practices by soil type, crop type, and economic feasibility.
- ☐ Publish and update a regional practice menu annually.

IMPLEMENTATION CHALLENGES AND OPPORTUNITIES

CHALLENGES	OPPORTUNITIES
Upfront costs for compost, cover crops, and reduced tillage make adoption difficult for farmers operating on thin margins. Farmers often lack cash flow and credit to prepay and then wait for reimbursement.	Expand cost share and microgrant programs; braid local, state, and federal funding to reduce out of pocket costs and improve adoption rates.
Limited and inconsistent funding for TA and carbon farm plan development. Programs open and close unpredictably, which interrupts support and delays project pipelines. The capacity required to administer these TA programs is often also a barrier to small local organizations working with farmers towards implementation.	Secure multiyear funding for TA providers; formalize regional soil hubs to mentor staff and maintain a steady pipeline of trained planners. Publish a rolling calendar of program windows for NRCS, CDFA, and air district programs with prefilled forms.
Lack of a streamlined process for stacking multiple incentive programs. Different eligibility rules and timelines force producers to navigate multiple portals and forms, which lowers participation.	Tap into the C2P2, a locally led technical assistance group focused on easing communication between TA providers to allow for less complex processes for farmers seeking TA and funding. Operate a one-stop portal that stacks NRCS, CDFA, and air district programs. Provide microgrants with rapid approvals and flexible timelines.
	For regional technical assistance and workforce, establish hubs, train carbon farm planners, build seasonal crews and internship pipelines, and share equipment fleets.
Reduce financial risks. Farmer participation is critical to implementation, but many may be concerned about impacts of carbon sequestration practices on yield.	Build strong relationships with local buyers and establish branding to strengthen the local market for farms that practice carbon sequestration, such as a regenerative farming label. Collaborate with local food hubs and farm shops to enable aggregation of produce and shared hauling to market. Convene farmer-to-farmer roundtables to share information and discuss issues of concern, such as potential impacts on yield, cost, and savings. Develop research or demonstration projects with UC Davis and other universities.
Market volatility for crops like walnuts and grapes leads to orchard removal and burning. Disposal costs and lack of alternatives push producers toward open burning that harms air quality.	Pilot whole orchard and whole vineyard recycling and biochar production programs to divert biomass from open burning and create soil amendments.
Farmer fatigue and mistrust of government programs. Complex rules and past delays reduce confidence and willingness to participate.	Center engagement around peer-to-peer learning, highlight co-benefits like soil health and water savings, and design simple, flexible participation processes.

COMMUNITY BENEFIT CONSIDERATIONS

Support implementation in low-income communities

- Direct funding and technical assistance to small producers and farms in low-income census tracts.
- Provide multilingual materials, community navigators, and mobile clinics.
- Base valuable resources for carbon farming and carbon sequestration where they are most accessible to underserved rural communities.
- Pair projects with heat mitigation, water quality improvements, and job creation.
- Define and report equity outcome metrics (e.g., percent of total funds reaching low-income producers, percent of TA hours delivered in DACs, number of producers served, jobs created in target areas).
- Track participation by geography and demographics and adjust outreach to close gaps.
- Include Tribes as priority partners and provide technical assistance plus labor support where capacity is constrained.
- Launch educational programs that engage non-farming residents on the importance of carbon farming, soil health, and climate action. Use school partnerships, libraries, public workshops, and demonstration field days to build broad public support.
- Establish an Equity Advisory Board and hold regular listening sessions to gather community input on program design, eligibility criteria, scoring, and outreach.

Avoid adverse consequences

- Monitor farmland conversion pressure, displacement of small growers, and cost burdens from maintenance.
- Fund long-term maintenance and training to minimize ongoing costs.
- Rely on peer-to-peer ambassadors and trusted partners to reduce program fatigue.
- Offer multilingual guidance and prefilled forms to streamline participation.
- Engage Tribes, CBOs, and small producers early and continuously to identify and mitigate risks.

NW-4 CARBON SEQUESTRATION PROGRAM / CARBON FARMING

COST EFFECTIVENESS

$39,629,000

Total Costs between 2026 – 2030

+	$0 O&M Costs
	$39,629,000 Upfront Capital Costs
-	$0 Savings

A cost-effective metric for this measure was not calculated due to the wide variety in costs, implementation outcomes, and timelines across various carbon sequestration practices on agricultural lands. Some practices, like cover cropping, occur annually, while others, such as biochar application or agroforestry, may be one-time or infrequent interventions. This inconsistency makes it difficult to standardize costs or compare outcomes over time as a single number. Additionally, the effectiveness of these practices varies significantly by region, soil type, and climate, and measuring carbon gains is complex and often uncertain. These factors undermine the comparability and reliability required for a meaningful analysis, making alternative evaluation methods more appropriate for assessing agricultural carbon strategies.

One-off measures include soil carbon amendment, prescribed burning, filter stripping, grassed waterways, and range planting. Annual measures include herbaceous weed treatment, conservation crop rotation, cover cropping, mulching, prescribed grazing, strip-cropping, nutrient management, and various tillage management techniques.

Cost estimates are based on the USDA Environmental Quality Incentives Program (EQIP), which provides incentive payments for sustainable agricultural practices:

- Average cost per acre for one-off measures. $839
- Average cost per acre for annual measures. $286

Costs greatly varied based on practices, from $1.86 per acre for strip-cropping to $2,485 per acre for grassed waterway. To facilitate cost estimation for the 100,000-acre target assumed for 2030, an 80/20 split was applied between annual and one-off measures—80% of the land (80,000 acres) is assumed to adopt annual practices, while 20% (20,000 acres) is allocated to one-off measures. This assumption is not prescriptive but serves as a practical modeling approach to reflect the likely predominance of ongoing land management practices in large-scale sequestration efforts, while still accounting for the upfront impact of foundational changes.

The total upfront capital cost to implement and support these practices across the 100,000-acre target is estimated at $39,629,000 by 2030, with an average annual cost of $7,926,000. These costs reflect USDA incentive levels and are intended to support adoption of carbon-sequestering practices by landowners and farmers.

CASE STUDIES

San Joaquin Valley — Orchard Biomass to Energy Pilots
A multi-county effort bundles orchard and vineyard removals into coordinated chipping and conversion projects. The program shows how mobile units and shared logistics can cut open burning, reduce particulates, and create usable energy streams.

Marin County — Biomass to Compost Pathway
County partners divert agricultural woody debris to composting instead of burning. The model demonstrates how local compost production and farm application can close the loop and lower hauling costs.

San Mateo County — Carbon Fund for Local Sequestration
A county-run fund channels mitigation fees into climate-smart projects on working lands. The case shows how a stable, local funding source accelerates implementation across multiple practices.

Santa Clara County — Agricultural Resilience Initiative One-Stop Incentives

A unified portal and pre-vetted practice menu let growers stack funding in a single application. The playbook proves that streamlined intake and standard agreements speed delivery and increase participation. For example, the County reported more than $200,000 awarded in 2023 and, since launch, over $561,000 to 36 growers by early 2025.

Yolo County — "Good Grains" Value-Added Labeling

Growers package wheat products with clear descriptions of soil-health practices. The case shows how transparent labeling can capture premium markets and reward climate-smart production.

Yolo County — Food Hub for Local Processing and Packaging

A local food hub supports small-scale farmers by consolidating aggregation, processing, storage, packing, and transport closer to farms. The Yolo Food Hub envisions a food hub - housed in a historic barn - that enables value-added services to help boost farm revenues, create new market opportunities, and keep jobs local. The food hub can also increase consumer access to local foods and strengthen relationships between farmers, institutions, and local communities.

E-1A ONSITE SOLAR CANOPIES

This measure installs shade structure solar energy systems over parking lot areas or adjacent to playgrounds at K-12 schools and can also be applied to industrial, commercial, and other public sites. This measure would offset the building's electricity consumption from electricity utility providers by using onsite renewable energy and is cost-effective in locations with high electricity costs. Expanding this model supports affordable electrification and energy self-sufficiency across diverse property types, including schools, warehouses, commercial centers, and public facilities. In addition to reducing grid reliance and utility costs, solar shade structures provide valuable secondary benefits such as shaded parking for staff and visitors, reduced heat island effect on school and site grounds, efficient outdoor lighting opportunities such as the integration of light fixtures under canopies and improved outdoor comfort and safety for visitors and students—particularly in play areas.

LEAD AGENCIES

School districts (such as Davis Joint Unified School District and Elk Grove Unified School District) plan, procure, permit, interconnect, operate, and maintain solar canopy, battery storage, and microgrid projects on campuses.

Cities and counties align zoning and shading ordinances, streamline permits, coordinate right-of-way needs, and link projects to resilience hub plans.

Private companies, local governments, and commercial property owners can design, finance, construct, and maintain canopy and storage systems on their properties, supporting long-term affordability and innovation.

IMPLEMENTATION PARTNERS

Electric utilities such as SMUD and PG&E coordinate interconnection studies, net-metering, and tariffs and enable storage, demand response, and virtual power plant (VPP) enrollment.

Grant funders and program administrators provide capital, incentives, and technical assistance for schools, commercial properties, and community sites.

School facility planners and energy consultants align projects with bond programs, modernization/retrofit schedules, and procurement rules.

Local permitting and fire authority staff publish checklists, enable online permit intake, and coordinate inspections.

Community-based organizations and teachers support outreach, student learning, and campus programming that build buy-in.

EV charging providers install managed and bidirectional vehicle-to-building (V2B) chargers for staff fleets and community use.

Multifamily, warehouse, and commercial property owners replicate canopy-plus-storage models at large parking lots.

Community center operators and industrial site managers can adopt similar canopy and storage approaches to lower energy costs and increase resilience.

IMPLEMENTATION STEPS AND TIMELINE

PREREQUISITES & ENABLING CONDITIONS

- ☐ **Streamline solar permitting by using Division of the State Architect (DSA) pre-check canopy systems.** Submit complete structural, electrical, and anchorage packages. Standardize online intake and checklists with consolidated inspections.
- ☐ **Adopt a site and design playbook.** Reconcile parking shade ordinances, tree retention goals, and stormwater management best practices with solar canopy designs and layouts.
- ☐ **Complete utility pre-application reviews.** Lock metering, tariff choices, export rules, and any net billing or aggregation details. Coordinate early on Electric Rule 21 interconnection, transformer capacity, and feeder upgrades. Publish predictable timelines so summer construction windows hold.
- ☐ **Establish delivery and governance.** Explore options such as power purchase agreements, leases, or direct ownership. Stack incentives including federal direct pay. Bundle campuses through cooperative purchasing with a single Owner's Requirements Manual to scale projects and lower prices. Create a regional working group with other interested schools to share best practices. Prepare to run batch preapplication screenings, publish an interconnection queue, and bundle transformer or service upgrades by feeder or substation.

0–3 YEARS

EARLY PHASE

- ☐ **Select lead districts and sites and map facility planning cycles.** Define the first cohort of school sites and large non-school lots (e.g., large parking lots at commercial, public, or industrial developments) to establish a project pipeline, prioritizing Title I schools and low-shade schools or neighborhoods. Site selection should consider factors such as socioeconomic and demographic data, urban heat island effects, parking lot size, and existing shade coverage. Potential data sources include the Healthy Places Index, Trust for Public Land's Heat Severity map, and the California Board of Education's Free or Reduced-Price Meal data.
- ☐ **Coordinate with utilities to plan electrical integration in advance.** Coordinate inverter siting, conduit routing, combiner and alternating current (AC) disconnect locations, and transformer placement to minimize voltage drop and trenching. Set direct current (DC)-to-AC ratios and stringing. Manage shading. Meet rapid-shutdown requirements. Confirm switchgear, meter, and interconnection capacity for bidirectional EV charging, battery storage, and building loads. Explore opportunities for demand response and VPP participation.
- ☐ **Run batch utility pre-application reviews.** Publish an interconnection queue for diverse site types. Scope feeder and substation upgrades for bundled sites. In urban districts, manage multiple interconnections in parallel; in suburban districts, phase work by feeder; in rural communities, start long-lead interconnections early.
- ☐ **Set up commercial delivery and prequalify vendors.** Choose the financing approach for each campus/site. Standardize drawings, specifications, and agreements across districts and non-educational partners through a regional solicitation that supports power purchase agreements, leases, and direct purchase. Sequence federal, state, and utility incentives. Apply a regional financial model that compares options, including operations, maintenance, and inverter replacements. Urban districts can stack multiple sources across large portfolios. Suburban districts can form medium bundles, while rural communities can assemble smaller portfolios with simple financing.

E-1A ONSITE SOLAR CANOPIES

IMPLEMENTATION STEPS AND TIMELINE

4–7 YEARS

MIDDLE PHASE

- ☐ **Complete concept designs.** Pair photovoltaic canopies with battery storage by default. Balance shade ordinances with tree retention and integrate stormwater controls. Assess potential glare issues and mitigate with module tilt, setbacks, screening, anti-glare coatings, or angled canopies. Protect bus loops, drop-off and pick-up lanes, fire lanes, and accessible routes during and after construction. Maintain clear sightlines and well-lit walkways where canopies cross pedestrian paths. Ensure foundations, column locations, and overhangs do not obstruct vehicle turning or emergency access. Meet DSA pre-check requirements. Plan for future canopy height and clearance needs. For urban sites, prioritize urban heat island mitigation. In suburban areas align with landscape standards.

- ☐ **Develop an equity and education plan for all host sites.** Consider outdoor learning opportunities and clear onsite information and signage. Include shade over playgrounds and lunch areas where it improves comfort and health.

- ☐ **Integrate resilience hubs.** Consider critical loads in sizing solar system and battery capacity so that schools, community centers, and other public facilities can function as resilience hubs during climate emergencies. Define resilience hub functions such as providing cooling, clean air, and shelter and plan for staffing and operational needs. Evaluate opportunity for microgrids.

- ☐ **Finalize commercial commitments and approvals.** Execute power purchase agreements or secure funding. Submit interconnection applications. Complete detailed engineering.

- ☐ **Procure equipment and prepare sites.** Purchase canopies, battery systems, controls, and bidirectional EV charging equipment. Pre-wire for future bus charging and vehicle-to-building pilots. Install EV-ready conduit, panels, and stub-outs at staff, fleet, and visitor parking for all facility types.

- ☐ **Build, commission, and operate the first cohorts.** Shift solar production to school loads with storage so that the electricity generated by solar panels can be used by the school's own facilities rather than sent immediately to the grid. Test weekend export along with demand-response and VPP revenue to improve project payback. Implement microgrid use cases where they fit site needs.

- ☐ **Integrate, replicate, and communicate.** Explore opportunities to integrate solar photovoltaics into curriculum. Work with local partners (e.g., county public health departments and offices of emergency services) to launch high-visibility pilots at schools, industrial campuses, and community hubs in combination with a coordinated communications plan. Use shared templates, schedules, and owner standards to roll out additional solar projects at additional schools. Bundle upgrades to reduce time and cost and develop a standard "solar + storage + EV charging" package schools can slot into bond or modernization programs.

- ☐ **Measure and improve while growing the workforce.** Track performance, costs, savings, thermal comfort, and shade benefits. Publish results and update designs, permitting workflows, and financial models. Set local-hire and apprenticeship goals. Offer student learning modules and onsite training. Continue to prioritize low-income campuses with high cooling loads and heat-island exposure. In urban districts, pair projects with community hubs at transit-adjacent campuses. In suburban districts, emphasize district-wide programs at larger lots.

8–12 YEARS

LATE PHASE

- ☐ **Complete district and regional portfolios and expand to other large parking lots.** Plan refresh cycles for inverters, batteries, and control systems to maintain performance.
- ☐ **Deepen grid integration.** Optimize dispatch through VPP and coordinated export. Integrate EV fleets. Pilot bidirectional charging (vehicle-to-grid and vehicle-to-building) where feasible.
- ☐ **Revise shade, planting, and facility standards to account for both trees and solar canopies.** Coordinate urban forestry with solar performance. Keep requirements for accessibility, safety, lighting, and circulation current.
- ☐ **Strengthen governance and finance.** Maintain regional coordination. Refresh the Owner's Requirements Manual. Update incentive strategies. Refine operations and maintenance practices and long-term financial models to sustain affordable electrification and lifecycle cost savings.
- ☐ **Report results.** Publish annual scorecards on savings, reliability, educational use, heat mitigation, and community benefits. Complete networks of school-based resilience hubs in urban districts. Finish campus and corporation yard conversions in suburban districts. Sustain microgrids at priority schools and community facilities in rural communities.

SOLUTIONS TO DEPLOY MEASURE AT REGIONAL SCALE

- ☐ Create a regional clean energy working group of school districts, county offices of education, local governments, community center operators, utilities, and private sector facility directors to align timelines, specs, and interconnection queues; share best practices and provide solutions; and coordinate on joint financing mechanisms and other funding opportunities to support affordable electrification across all property types.
- ☐ Develop a master set of agreements, memoranda of understanding (MOU), and checklists so each participating district, local agency, or entity follows the same path from screening to operation.
- ☐ Run utility pre-application screenings for all candidate campuses and additional commercial, industrial, and public sites at once and publish an interconnection queue with target dates.
- ☐ Bundle transformer and service upgrades by feeder or substation to shorten schedules and cut mobilization costs.
- ☐ Adopt regional and cross-sector design standards for clear height, column spacing, wind criteria, integrated LED lighting, ADA paths, sightlines, and drop-off circulation.
- ☐ Require EV-ready conduit, panels, and stub-outs at staff, fleet, and visitor parking areas. Include shade for play areas and outdoor gathering spaces at community centers or commercial plazas where space allows.

E-1A ONSITE SOLAR CANOPIES

IMPLEMENTATION CHALLENGES AND OPPORTUNITIES

CHALLENGES	OPPORTUNITIES
Upfront cost and funding gaps. Schools, local governments, and small businesses may lack capital for canopy and battery systems.	Pursue grants and incentives; pair solar with battery storage and VPP and/or demand-response to improve payback and create resilience value. Aggregate funding opportunities regionally to lower soft costs and extend affordability to smaller or disadvantaged property owners.
Storage integration and use-case fit. Summer or off-hours loads limit onsite use.	Right-size batteries, enable weekend export, and design microgrids that serve school, commercial, and community center loads and generate revenue off-hours.
Many districts on different capital cycles. Hard to time projects. Similarly, private entities and municipalities operate on different budget cycles.	Work through facilities master plans; offer a standard "solar + storage + EV charging" package that any partner can integrate into capital or retrofit programs.
Utility alignment and interconnection. Programs and tariffs must support the business case.	Engage utilities early to align tariffs, net-metering, interconnection, demand-charge management, and VPP enrollment; tie projects to affordable electrification and resilience hub objectives.
Equity and resilience delivery. Benefits may miss low-shade, high-need neighborhoods.	Prioritize sites in low-income areas; pair canopies with batteries, EV charging, and resilience hub functions for cooling and clean air during extreme events. Include community centers and small businesses in lower-income areas for shared regional benefits.

COMMUNITY BENEFIT CONSIDERATIONS

Support implementation in low-income communities

- Prioritize schools, commercial corridors, and public facilities in neighborhoods with limited shade, high climate vulnerability, low air conditioning access, or high heat exposure. Pair solar canopies with battery storage to provide cooling and clean air during outages, wildfire, and extreme heat events. Explore staffing and operational needs for schools and community centers to function as resilience hubs, providing services and resources during emergency events.
- Work with utilities to explore innovative financing mechanisms and affordability programs (e.g., community solar tariffs, inclusive utility investment models, and on-bill repayment) that lower upfront costs and enable small businesses and nonprofits to participate alongside public entities.
- Combine solar canopies, storage, and grid programs such as VPP participation to reduce electricity utility charges and generate off-hour revenue that districts, agencies, and business owners can reinvest (e.g., in community or workforce programs).
- Use canopies as shaded outdoor classrooms, community gathering spaces, or public event areas with signage and curriculum tie-ins. Offer student internships, workforce training, and site tours during installation.
- Site structures to preserve and expand tree canopy rather than replace it. Integrate planting and landscaping so all sites gain both clean power and natural cooling.
- Provide multilingual outreach through trusted school channels, and cohost meetings with community partners so that community input can shape design and access and build community ownership in the project.

Avoid adverse consequences

- Avoid removing healthy trees; meet shading ordinances through a mix of canopy structures and new planting.
- Right-size battery storage and interconnection to avoid export constraints in summer and ensure the system supports resilience and maximizes financial benefits.
- Schedule construction outside school or business hours and testing windows, maintain safe circulation and drop-off patterns, and protect play areas.
- Address glare, lighting, and views with thoughtful orientation and finishes; invite input from adjacent residents and businesses.
- Use transparent criteria so early projects do not cluster only in well-resourced school districts or higher-income commercial centers.

COST EFFECTIVENESS

$140,833,000

Total Costs between 2026 – 2030

\+ $1,885,000
O&M Costs

$165,844,000
Upfront Capital Costs

\- $26,846,000
Savings

$16,859

per metric ton of GHG emissions reductions

To estimate the cost of installing 27 MW of solar capacity across 77 schools by 2030, the analysis assumed a steady rollout of installations at about 16 schools per year. Installation costs were calculated by multiplying the average cost per watt by the number of MW installed each year. The cost per watt was obtained from the California Distributed Generation Statistics site, and a premium of $1.38 per watt was added to account for the costs of the solar canopy structure, based off previous AECOM costing work for solar canopies in California. Operations and maintenance costs were sourced from the National Renewable Energy Laboratory's (NREL) 2024 Solar Installed System Cost Analysis, specifically for commercial rooftop systems. To estimate annual electricity savings, the average commercial electricity rate in California—sourced from the U.S. Energy Information Administration—was multiplied by the expected energy production per kilowatt-hour (kWh). These savings were then subtracted from annual installation and operations and maintenance costs to determine the annual electric premium associated with installing solar canopies across the school sites. Total upfront capital costs are estimated to be $165,844,000, while the total costs inclusive of operations and maintenance as well as savings are estimated to be approximately $140,883,000. While the original cost model focused on schools, comparable cost-per-watt estimates can apply to commercial, industrial, and public facilities, with total lifecycle savings improving as system scale and shared infrastructure increase.

E-1A ONSITE SOLAR CANOPIES

CASE STUDIES

Davis Joint Unified School District — Solar Canopies on Multiple Campuses
District-wide parking lot solar canopies provide onsite generation and shade; this roadmap's measure was modeled on their program. This case shows how a school district can standardize designs across sites and scale quickly while delivering visible heat relief and energy savings.

Long Beach Unified School District — District-wide Solar for Schools
A large, multi-campus rollout demonstrates how bundling sites under one procurement and schedule can lower costs and accelerate delivery. This case shows how school systems can adopt repeatable canopy-and-storage packages that fit varied campuses.

Denver (City and County) — Solar Canopies as Learning and Cooling Assets
Solar canopies double as shaded outdoor classrooms and include signage to support curricula, linking energy literacy with heat-mitigation benefits. This case shows how to pair generation with education and public visibility to build community support.

Petaluma Affordable Housing Microgrid — Solar, Storage, and Bidirectional EV
An affordable housing project integrates solar canopies, battery storage, a microgrid, and bidirectional EV charging to enhance resilience and reduce costs. This case shows how the solar-plus-storage model used at schools can transfer to multifamily sites and resilience hubs.

Define the first cohort of school sites and large non-school lots to establish a project pipeline, prioritizing Title I schools and low-shade schools or neighborhoods.

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Contact Information

For questions or additional information about the Comprehensive Capital Region Climate Priorities Plan, please contact cprg@airquality.org.