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Title: Climate Readiness: Best Practices and Capacity Building for Local Government Implementation of Climate Action Policies

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Disclaimer

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Abstract

Through this contract, California became the first state to offer comprehensive, searchable, public-facing plan databases of both General Plans and Climate Action Plans. The overall aim of assembling and hosting planning data is to improve plan making, allowing community members to search for policy approaches that are already being piloted in comparable communities. With community-based organizations across the state, this contract enabled demonstrations of these online tools with a focus on three California Air Resources Board climate readiness priorities: zero-emission vehicle (ZEV) uptake, reducing vehicle miles traveled (VMT), and decarbonization of buildings. To inform the workshops, this contract assessed the current state of city and county planning approaches. We find that interest in climate policy adoption is growing. Yet, there are policy approach mismatches between state goals and local actions. Further, few plans explicitly consider equitable approaches. This report detailed equitable policy approaches for the three priority areas as models to inform further policy adoption and implementation.

Executive Summary

Background: To meet state climate goals, local jurisdictions must update plans for physical and social infrastructure. Learning from advances in other jurisdictions will help better inform local policymakers. To survey the many approaches to improving climate readiness across the state, this project created and launched landmark planning tools. Prior this contract, no state had a comprehensive, public database of General Plans or Climate Action Plans (CAP). Through this contract, California became the first state to offer such databases as planning tools for spurring civic engagement. The research team partnered with community-based organizations (CBOs) across the state to demonstrate these tools while providing locally tailored climate readiness workshops in relation to three California Air Resources Board climate readiness priorities: zero-emission vehicle (ZEV) uptake, reducing vehicle miles traveled (VMT), and decarbonization. CBOs were compensated for this collaboration.

Objectives and Methods: The overall objective of this contract is to advance climate readiness. To achieve these aims, the research team created a database of General Plans and CAPs, conducted assessment of both plan types for the priority topics, reviewed existing literature, and supported CBOs in conducting a series of evidence-informed workshops for other partner organizations. Together, the plan evaluations and literature review helped identify discrepancies between state, local, and research climate change emphases. CBOs then tailored the findings to local priorities and immediate policy discussions and hosted workshops with attendees representing over 155 organizations across California. The research team gathered feedback from participants and CBO staff from these workshops to identify barriers and opportunities for future climate readiness planning.

Results: We find that, as of January 2023, 23 of 58 counties (40%) and 230 of 482 cities (48%) have created a CAP, while 25 counties (43%) and 182 cities (43%) refer to CAPs in their General Plans. The cross-referencing of General Plans and CAPs highlights how these plan types work in tandem. Of jurisdictions with CAPs, many prefer a non-California Environmental Quality Act (CEQA) certified CAP. This non-binding planning product can be used to celebrate and set intentions that are later infused into and referred to in the General Plan. For other jurisdictions, the term “climate” is not as favored, and approaches effectively influence climate goals without labeling the action as such (e.g., aiming to improve air quality). In comparison to voluntary plans like CAPs and other alternative documents, all jurisdictions are required to create a General Plan that guides zoning and is CEQA certified. Thus, climate readiness planning often happens in and through the General Plan which can help socialize concepts and allow lead-up organizing around issues of consensus. With such variation at play, we find more fulsome attention to climate readiness policy in CAPs across all three CARB priority topics. We also find that General Plan and CAP planning vehicles are both associated with implementation as evidenced by statistical regression of plan mentions of “electric vehicle” and the siting of charging stations. We found no statistical difference in population nor geographic variation to explain which jurisdictions choose to use CAPs for climate readiness planning. Instead, CBOs note that communities employ a variety of policy approaches, and the state should support diverse pathways to climate planning.

The literature review highlights further recommendations for improving strategic goal setting and technical assistance. To start, we note terminology mismatch that creates confusion in policy dialogues where interested parties talk past one another. For example, while the term "building decarbonization" is common in state policy documents, only one county mentioned "decarbonization" in its General Plan. Scholarly literature also prefers synonyms to "decarbonization" (e.g., carbon neutral). This mismatch should not be confused with an absence of local planning effort. We provide recommendations and methods for state agencies to review policy terminology in local plans before setting state guidelines.

Our comprehensive General Plan and CAP assessments also indicate a lack of local climate readiness effort and weak policy commitments. Even where plans set intentions, most do not commit to actions. Planning scholarship recommends that plans include benchmarks for measuring progress, timelines for reaching deliverables, identified funding sources, and dedicated staff. For example, we found that of the 64 ZEV policies in county General Plans, 20 mention public ZEV use and 35 mention private ZEV use, giving shorter shrift to public ZEV goals compared to private. Even where timelines are included, local plan scoring indicates that California will fall short of its state goal for transit agencies to purchase only zero-emission buses (ZEBs) after 2029, with a goal for full transition by 2040. To explain the broad omission of policy benchmarks, CBOs state that a lack of understanding of available state funding limits their capacity to craft feasible policy that aligns with state goals and funding opportunities.

While attention to climate readiness in both General Plans and CAPs is nascent but growing, we also note a lack of attention to equity in policies. For example, 12 counties (20%) and 126 cities (26%) mention "electric vehicles" in their General Plans, but only six cities address equity considerations, including siting e-bike and electric vehicle charging stations (Alameda City, 2021 General Plan), electric vehicle charging for affordable housing (City of Arcata, 2008 General Plan), and converting public fleets to all-electric (City of East Palo Alto, 2016 General Plan). This finding underscores a need for greater equity planning support, including strong equity guidelines.

Conclusions: To encourage greater progress, CBOs recommend that state agencies consider celebrating planning advances through annual awards and pre-qualification programs for implementation funding based on equitable policy commitments in General Plans or CAPs. They also recommended sustained support for CBOs to ensure that climate readiness planning is ongoing, implemented, and reflects local priorities and targeted efforts to build capacity for equitable climate planning. Targeted CBO support is especially needed in underserved communities that have not yet crafted environmental justice policies. These recommendations rely on local-to-local learning about successful planning approaches. To facilitate such peer learning, we recommend that CARB, Governor's Office of Land Use and Climate Initiatives, and Housing and Community Development, the state agencies that provide guidance for General Plan development, consider adopting planning data guidelines that require plans to follow FAIR standards such that plans are easily Findable, Accessible, and Interoperable, while being provided in a format that is Reusable (e.g. a machine-readable PDF). For plans to be easily located and reviewed, they must contain sufficient metadata on a cover page, including a unique and persistent identifier, and the data must be registered or indexed in a searchable resource. This requirement would bring public planning documents into compliance with federal Americans

with Disabilities Act (ADA) guidelines. Further, CBO partners recommend that CARB offer a jurisdiction-specific template that is pre-filled with greenhouse gas (GHG) inventories. This template can be used by local jurisdictions to estimate the reductions planned over a specific time horizon, helping advocates and state agencies evaluate progress. We provide an example in the appendix.

Introduction

The Best Practices and Capacity Building for Local Government Implementation of Climate Action Policies (Climate Readiness) project's primary goals are to identify best practices for local governments to implement climate planning with a focus on the three priority areas: reducing vehicle miles traveled (VMT), zero-emission vehicle (ZEV) readiness, and building decarbonization. This project seeks to simultaneously inform communities and state agencies about effective methods to address climate readiness planning challenges and implementation barriers at the local level. In May 2022, the California Air Resources Board (CARB) contracted the University of California, Davis (UCD) Center for Regional Change to lead the two-year project.

To meet these goals, this project created novel, public-facing databases of Climate Action Plans (CAPs) and General Plans along with additional materials to support local government climate efforts. Through plan evaluation, the research team scored plans and compared them to local ordinances to identify jurisdictions implementing climate action policies and the policy types best suited for different types of jurisdictions. The information gathered and additional information from CARB, including funding opportunities through CCI, were used to foster statewide capacity building sessions on resources and the priority policies. Sessions were co-hosted with community partners to leverage trusted networks of local leaders and translate state policy and research findings to the local context and priorities. Findings are documented in training materials, informational guides, and the final report, including recommendations for how CARB and CCI can best support climate readiness efforts. The training materials created in this project seek to inform a broad constituency and include a focus on equitable planning.

Background

California can only move development and planning standards forward by understanding regional and local climate planning and implementation approaches. Currently, the state requires local jurisdictions to meet various goals around climate, housing, and the environment. For example, cities and counties with an identified “disadvantaged community” that revise two or more General Plan elements concurrently are required to incorporate environmental justice (EJ) into their General Plans (Gov. Code, § 65302(h)) such that environmental hazards and mitigation costs do not fall disproportionately to historically disadvantaged communities. Further, since the California Legislature passed a suite of housing policies in 2017, there are added opportunities for local governments to receive additional funding and guidance for collectively addressing the housing and climate crisis to reduce vehicle miles traveled and decarbonize buildings while meeting demands for affordable housing.

Such state-level goals and support for environmental justice and climate action may be achieved unevenly as local jurisdictions have different planning priorities and vary widely in capacity and funding for planning and implementing these policies. Further, local jurisdictions often face planning capacity challenges, as evidenced by the many plans that are out of date, with more than half of California's General Plans being older than 15 years, according to the Governor’s Office of Planning and Research (2022), an administrative office that changed title in 2024, becoming the Governor’s Office of Land Use and Climate Initiatives (LCI). With added funding

for planning and additional tools and guidance, there is an opportunity to bring more local jurisdictions up-to-date in both planning for and implementing climate actions.

The project is conducted by the University of California, Davis Center for Regional Change (CRC). an applied policy-oriented research center dedicated to informing the building of healthy, prosperous, sustainable, and equitable regions. To meet these goals, the CRC brings expertise from engaged partnerships in rural and urban communities and a legacy of work focused on environmental justice in addressing the inequalities in land-use, housing and transportation planning, policies and funding. With extensive expertise collaborating with community partners to develop interactive web-based mapping platforms and training programs (e.g., Putting Youth on the Map: training in youth participatory action planning), the CRC has close ties to communities facing the greatest health challenges due to air quality and related environmental health indicators that are located outside the largest and most resource-rich urban areas in California. The platforms CRC has created in past projects are used by leaders in the business, government, nonprofit, and philanthropic sectors to target funding opportunities and support the creation of sustainable, socially responsible development.

Materials and Methods

This project incorporated stakeholder feedback in developing project deliverables. For example, the General Plan and CAP databases provide searchable tools that jurisdictions can use to examine specific language in comparable jurisdictions, such as those in the same region or with a similar population size or demographic composition. Through demonstrations, these public tools were refined so that these resources could better bridge gaps in capacity. For example, jurisdictions with fewer resources are often at a disadvantage when applying for state and federal funding allocated through competitive processes because of a lack of readily available data for benchmarking progress and making comparisons.

To center equity, the project team specifically engaged CBOs representing vulnerable, marginalized, and otherwise disadvantaged populations. Through this contract, the following CBOs were funded to support capacity building workshops: the Bay Area Climate Action Network (BayCAN), Climate Action Campaign, Los Angeles Regional Collaborative for Climate Action and Sustainability (LARC), Robert Redford Conservancy for Southern California Sustainability, and Sierra Business Council. Community engagement included iterative and mutually beneficial co-design of climate capacity building workshop materials, with the project team incorporating input and feedback from stakeholders to improve the tools, as well as the companion materials and media developed to best support broad dissemination, education, and adoption of the findings and recommendations. Such genuine engagement is critical to the long-term goal of this project, which is to identify and disseminate equity-focused policies at the city and county levels for use in capacity-building workshops. The theory of change that was used considered that available data and identification of supporting policies can better allow communities to consider plan updates, including proven policies that have worked in nearby jurisdictions. The project aimed to create communities of learning as cities and counties update plans and learn from policies that have worked in neighboring jurisdictions.

Limitations

While this project focused on a review of planning and policy to support equitable climate readiness, future iterations of this work could be augmented with the following steps: supports for additional CBO partnerships across the state with the option for extension, technical support for CAP and General Plan database updates and maintenance, and interviews with local planning officials and planning boards. Future work could further investigate implementation of plan policies by following VMT reductions on a jurisdictional basis.

Community Based Organization Partnerships

The process for selecting community partners emphasized a fair and balanced approach to prioritize established organizations with track records of success and rising organizations; nonprofits, community groups, and regional/local government organizations. The selection also sought to contract with a range of organizations that work from local to statewide. The contractor worked collaboratively with the CARB contract manager to select five of the selected community partners as compensated subcontractors.

The selection process was designed to provide commensurate funding for the level of time and skill each organization will bring to the collective partnership and the number of capacity-building workshops to be co-hosted. This partnership model aimed to foster equitable distribution of resources to established nonprofit, public institutions, and smaller grassroots organizations. The community partners and their missions are as follows:

The Bay Area Climate Adaptation Network (BayCAN), serving the Bay Area region, is a collaborative effort among local government staff and partner organizations to address climate change impacts, such as water supply, sea level rise, wildfires, and public health, by focusing on equitable adaptation strategies and enhancing existing initiatives.

With 23 staff members, The Climate Action Campaign (CAC) is a coalition of major environmental, justice, and public health organizations working together to push for science-based federal climate action, aiming to reduce pollution, accelerate clean energy transitions, and promote justice, jobs, health, and quality of life for all.

The Los Angeles Regional Collaborative for Climate Action and Sustainability (LARC), with 7 staff, established in 2007, is a network of governments, agencies, nonprofits, businesses, and academics working together to advance climate mitigation and adaptation in LA County through cross-jurisdictional collaboration, peer knowledge sharing, and cutting-edge research, while optimizing regional resources and outcomes.

Founded in 2012 and named in recognition of Robert Redford's dedication to environmental advocacy and service on Pitzer College's Board of Trustees, the Robert Redford Conservancy for Southern California Sustainability at Pitzer College works to promote socio-ecological justice and sustainability in local communities and beyond.

With 19 team members, Sierra Business Council is a nonprofit dedicated to fostering community vitality, economic prosperity, environmental quality, and social equity in the Sierra Nevada by

supporting local economies, enhancing climate resilience, and addressing rural issues through innovative, on-the-ground programs and projects.

The CRC also welcomed additional partners without a compensated subcontract by making training materials cost-free and publicly available online.

The CRC project team worked closely with CARB staff and partner organizations to co-create presentations and materials to be covered at the capacity-building sessions (please see Appendices 2 and 3). These materials aim to explain in clear and accessible language:

1. State-level policies and goals;
2. CARB priority strategies for local climate action;
3. Examples of policies implemented by local jurisdictions, including sample ordinances and language;
4. Strategies identified to overcome barriers associated with local action planning and implementation; and
5. Sources of funding for implementing climate projects, including CCI.

Training and outreach materials aimed to foster ongoing learning through the General Plan and CAP databases. As such, the CRC worked with CARB staff to develop media and collateral materials with the broadest audience of stakeholders, including handouts, videos, and guides (Appendix 3.) for local government, advocacy organizations, and community organizations. The purpose of these materials is to educate local jurisdiction staff and local advocates on available tools and CARB priority strategies. The materials were further informed by community-identified successes and barriers to be used in workshops and beyond the project. Community partners also informed the development of training materials to ensure cultural compatibility and efficacy. The CRC translated materials into Spanish and worked with community partners to target other languages for translation to ensure greater access to research and policy products.

The CRC project leads consulted throughout partner-led climate readiness workshops. Initially, these workshops were designed for CBOs to present materials, building from existing, local, trusted relationships to ensure that questions, feedback, expertise, and empowerment continued to be fostered locally. At the request of multiple partners, CRC project leads and CARB were invited to attend and present at several workshops. The CRC debriefed with partners after each workshop through a short survey. At the conclusion of all workshops, the CRC hosted an informal debriefing for partners to share and compare experiences.

Building tools for informed planning

The idea behind building public-facing online tools for climate readiness planning is that, in part, greater data access and analytics can inform and celebrate more efficient and equitable practices. As part of the Climate Readiness project, this team created two public-facing data platforms. One is focused on California's city and county General Plans. The other is focused on California's local Climate Action Plans (CAPs). To create these tools and predict their long-term impact, this section details similar efforts and outcomes.

Similar planning data democracy efforts are underway across the nation as several states and federal agencies innovate new forms of data infrastructure, the digital platforms necessary for promoting data sharing and use. For example, in 2018, the New York State Division of Homeland Security and Emergency Services and the Federal Emergency Management Agency (FEMA) produced the nation's first web-based State-wide Hazard Mitigation Plan in partnership with Dr. Catherine Lawson (MitigateNY, 2021) to urge counties to update hazard plans to be eligible for federal funding during disasters. The online map of local plans highlights that over half of the New York counties do not have up-to-date plans and many lack a focus on hazards of interest. The tool aims to help advocates urge for plan updates while assisting local jurisdictions by making planning approaches easy to find and assimilate. Similarly, the National Zoning Atlas is a federated data project focused on land use planning through zoning ordinances. The UC Berkeley's Othering and Belonging Institute and UC Davis Center for Regional Change are assembling zoning data from each California jurisdiction, with initial analysis demonstrating that the majority of land is zoned for single family housing with implications for affordable housing supply and CARB's goals to reduce VMT through compact development approaches. Each tool allows the public to consider regional and state-wide implications for equity and climate planning as they engage in local policymaking.

Surveys of developers and consultants involved in planning, design, and impact assessment attest to the importance of such spatial data infrastructure in creating and tracking planning progress in order to meet planning goals (e.g., Campagna and Craglia, 2012). Though such databases are broadly useful, there is good reason for why they have yet to be assembled. The effort to gather and evaluate plans is labor-intensive. Though public documents, like plans, are often physically accessible under sunshine laws like the American Freedom of Information Act, immense labor is involved in assembling plans for comparison, particularly where plans must be translated. Some plans are just scanned documents. Not all are in machine-readable PDF formats. Such varied formatting is an issue and labor-intensive to resolve. The result is that there are few plan evaluation studies overall (Talen, 1996). In their meta-analysis of plan evaluation, Berke and Godschalk (2009) note only 16 plan evaluation studies over a 20-year period from 1997-2007. In addition, most studies compare tens of plans (33 plans in Berke and Conroy, 2000; 34 plans in Conroy and Berke, 2004; 47 plans in Mui et al., 2021). In explanation, many plans are over 2,000 pages in length; qualitative coding or even a simple tally of search terms across plans is only recently available with text mining via computer-based information retrieval. With modern cloud-based storage and advances in machine learning, some of these barriers can be overcome, and plans assembled for one purpose can also be evaluated for other topical areas of interest. The creation of a General Plan search engine and public-facing CAP database can help further such

accountability and monitoring–not only for state agencies, but also for nonprofit organizations working toward climate, equity, and broader planning goals. Next, we detail current state requirements for plan access and review.

California goals and local planning efforts

Multiple California state agencies rely on local plans to deliver state goals. As a result, several state agencies provide guidance for land-use plan development. LCI is required by Government Code Section 65040.2 to adopt and periodically revise the State General Plan Guidelines (LCI, 2021b) which provides a technical how-to" for preparing a General Plan in California. In statute, the general plan is required to address the following "elements" or topic chapters: land use, circulation, housing, conservation, open space, noise, safety, environmental justice, and air quality, each addressing a specific aspect of community development and planning (Gov. Code §65302). These elements guide land use, transportation, housing needs, natural resource conservation, public safety, and pollution reduction, with examples from cities and counties linked throughout the General Plan Guidelines. LCI also serves several important functions in the administration of the California Environmental Quality Act (CEQA; Public Resources Code Section 21000) that requires state and local government agencies to inform decision-makers and the public about the potential environmental impacts of proposed projects and plans, and to reduce those environmental impacts to the extent feasible. As such, LCI provides technical planning assistance for meeting CEQA and other state General Plan mandates and also manages the State CEQA Clearinghouse where many, but not all, plans are submitted for state level review and made available to the public. To assist with the land use and air quality elements of General Plans, the California Environmental Protection Agency and CARB provides guidance through their "Land Use Handbook" (CARB, 2005). Similarly, the state Housing and Community Development (HCD) agency offers a comprehensive housing-element guide (HCD, 2021a). In addition, HCD is empowered to review the housing element, which is updated every 3-8 years (Article 10.6 of Chapter 3 of Planning and Zoning Law, commencing with Government Code Section 65580).

The state does not currently require that cities and counties report planned development in a standard format–nor that plans be maintained in a central repository. Yet, state agencies are moving toward such precedents to enable more timely assessment of local progress toward state goals. For example, with the 2017 Legislative Housing Package (Cal. Gov. Section 65585), HCD now requires that housing elements or amendments adopted on or after January 1, 2021, shall be submitted to HCD electronically using forms pursuant to SB 6 (Chapter 667, Statutes of 2019) in order to standardize reporting on the number of planned housing units.

Similarly, state laws require local plans to meet a variety of accessibility standards. For example, local government documents must be compliant with Section 202 of the Americans with Disabilities Act (42 U.S.C. §12132) which seeks to ensure that public documents are accessible to hearing and visually impaired individuals with formatting that allows screen readers, refreshable Braille displays, alternative text describing images, and resizable text. The Brown Act (Gov. Code § 54950-54963) seeks to guarantee the public's right to attend and participate in meetings of local legislative bodies. Through this legislation, the public is entitled to copies of contracts, settlement agreements, and other documents approved by the public body and subject

to any of these reporting requirements (Gov. Code § 54957.1(b)). As part of accessibility requirements, a federated, central repository of plans will help public engagement across jurisdictions. This project aims to meet such mandates and demands.

The lack of an aggregated and complete dataset of plans as well as an inability to search across plans hinders both state agencies and CBOs in climate readiness planning. To work around these limitations and regularly assess implementation, LCI conducts an Annual Planning Survey (APS) and Annual Progress Reports (APRs) each year per Government Code Sections 65400 and 65700. Notably, the results of such data gathering efforts are incomplete. Only 59% of California cities and counties (319 of the 540) returned the Annual Planning Survey in 2023, leaving many questions unanswered or marking responses as "unsure" regarding survey questions about what policies the General Plan contained. Similarly, HCD found that many cities have not updated their plans in accordance with state mandates as noted through their Housing Element Implementation Tracker (HCD, 2023b).

In response to these data infrastructure concerns and to foster informed community-driven climate planning, this contract developed the first statewide comprehensive database of California's 482 city and 58 county General Plans in addition to the creation of a comprehensive California CAP database. In addition to being first for the state of California, these public-facing data products are the first for any state–or nation. In the following section, we detail the data assembly and design of each product.

General Plan data visualization tool

Following Chen et al. (2020), we engaged in a platform development effort that centered equity through an "iterative process [that] requires peer-review, discussion and edits within the community." First, we examined the current state of data infrastructure for plans in California by studying state-level mandates for land-use planning data infrastructure in California and qualitatively examining the structure and formatting of plans from all cities and counties in California. Second, we designed and tested a pilot database and platform for archiving, searching across, and visualizing the contents of California plans. At each step, we checked our understanding of the current state of planning and the problems with information discovery and accessibility needs with state agencies, policy advocates, and community-based nonprofit organizations (see Poirier et al., 2024). At each stage of the process, the research team presented findings to state agency representatives and nonprofit members with an EJ focus on climate readiness planning. CARB convened meetings with state agencies. The CRC convened meetings with non-profits and partners.

We center state agencies and EJ stakeholders in an intentional effort to build equity and accessibility into the analysis and platform design with partners that are involved in real-time technical planning efforts. Many EJ CBOs were involved in efforts to help motivate the state legislature to pass SB 1000 (Leyva) in 2016 (Cal. Gov. Code, § 65302(h)). This law requires local governments to identify disadvantaged communities (DACs) in their local planning area, engage with communities in developing their plans, and adopt EJ policies that address equity, such as reducing air pollution exposure and promoting local clean energy economies. EJ is further defined in California law as "the fair treatment and meaningful involvement of people of all races, cultures, incomes, and national origins with respect to the development, adoption,

implementation, and enforcement of environmental laws, regulations, and policies" (Cal. Gov. Code, § 65040.12, subd. (e)). Each partner, state and nonprofit, seeks greater plan data infrastructure to allow 1.) monitoring of local jurisdiction compliance with state mandates, and 2.) informed updates to their technical planning toolkit based on the discovery of model EJ policies and best practices in the development of in General Plans. We also sought pilot platform development input from the LCI, HCD, and CARB, state agencies that provide guidance for General Plan development. These early efforts helped take the original platform to its third version through this contract.

Data collection

Most California General Plans are publicly available on city websites, but there are no centralized locations for archiving plans nor standards regarding where such plans should appear on the sites. In 2017, Dr. Brinkley's team collected PDFs of General Plans for 421 of California's 482 cities via their websites (Brinkley and Stahmer, 2021). At that time, we were missing plans for 61 cities, having not been able to locate them on city websites. A second round of data collection was initiated as part of this contract to locate previously missing plans and to incorporate county plans. In addition to reviewing municipal websites, this round involved emailing or calling city planning offices to inquire about plans. By the end of 2022, we obtained plans for every California jurisdiction. While most plans were available as PDFs, some were published as Word documents, html files (e.g., City of Ontario), or text files. In these cases, we converted the documents into a PDF, using Adobe Acrobat.

Plan format analysis

We took a random sample of 100 city plans and documented the availability of certain metadata descriptors such as the plan's creator, when the plan was created, and when the plan was last updated. In providing an overview of current plan structures, this analysis laid the foundation for piloting a platform for federating and searching across General Plans (see Poirier et al., 2024). We found that in a sample of 100 city plans, none of the plans included structured metadata and less than half listed unstructured metadata such as who created the plan, who to contact with questions, or the resolution number. Of note, most plans did not follow standard formatting to enable text recognition nor did any plans provide text for all images per ADA guidelines. As a result, even when the public can access a plan, it can be difficult to discern when the plan was produced, when it was last updated, what it contains, and who to contact with questions. In a few cases, though different elements of the General Plan were adopted or revised in different years, all elements were compiled into a single document. Further, due to local variation in the formatting and naming of plan elements, classifying plan "types" is difficult. For example, some communities refer to their CAP as a "Sustainability Plan." With some General Plans dating back to the 1960s, many PDFs of older General Plans are scanned to city and county websites from typed documents with non-machine-readable text, low contrast, and low image quality. Many existing optical content recognition tools and text extraction packages are limited in their ability to accurately recognize and parse words in such documents. Based on these findings, we recommend that the state of California provide guidelines for plan formatting that include requirements for plans to be accessible as machine readable PDFs with a standard template cover

page that details plan metadata and a digital object identifier (DOI). A DOI is a unique, persistent identifying number for an online document which remains the same even if the document's location on the Internet changes. A summary of recommendations for local and state actions can be found in Appendices 4 and 5.

General Plan Platform Development

The pilot platform was first developed in R and later redeveloped in Python. Because planning language is constantly in flux and relies on specialized phrases, the search engine required sophisticated indexing. For example, California jurisdictions discuss "homelessness," "the unhoused," and "unsheltered." Indexing for accurate search capabilities requires a large vocabulary of terms and phrases to capture synonyms. Thus, we redesigned the platform using Python packages optimized for quickly extracting information directly from PDF documents and ElasticSearch to allow multi-word and phrase search queries (see Banginwar et al., 2023). The resulting search engine for General Plans won the California American Planning Association Award for Academic Excellence in 2023, indicating its welcome reception by practicing planners across the state.

Climate Action Plan database

The California Climate Action Plan Database (CCAP Database) was started in 2010 by Professors Michael R. Boswell and Adrienne Greve of California Polytechnic State University, San Luis Obispo. The purpose of the database was to support research on the nascent field of climate action planning. The database has periodically been made available to researchers and public officials, but for the first time through this contract, it was made widely available with a GIS-based interface and a complete web-based library. The database is regularly updated, and further updates can be submitted by email to: mboswell@calpoly.edu.

The CAP Database includes CAPs with the following criteria:

1. Must be based on a community-wide greenhouse gas (GHG) emissions inventory.
2. Must address community-wide emissions, not just municipal emissions.
3. Must substantially address issues of climate change (may address other areas of sustainability/environment).
4. Should be structured as a plan with standard introductory, background, and policy- type sections (e.g., not just ideas on a webpage).

There is some gray area in interpreting these standards, so some additional clarifications and caveats are specified. For example, the CAPs do not need to be stand-alone documents to be included and can be embedded in other policy documents (e.g., General Plans, Sustainability Plans, Energy Plans) if the criteria above are generally met. There are a few "energy action plans" in California cities and counties. Some of these plans focus narrowly on energy issues and are not consistent with the criteria above, thus are not included. Others, which are included in the database, are based on GHG inventories and have GHG reduction targets, though they often only focus on energy policy. Ideally the CAPs have been formally adopted by the jurisdictions, but this is sometimes difficult to determine, so they are included regardless of their adoption status (unless they were formally rejected). Some regions prepare regional CAPs but then leave the

individual cities and counties to finish the process and formally adopt/accept the CAP. This can be confusing. The CAPs prepared under regional initiatives that appear in this database have been examined for their status and only included if there is evidence of formal action by the individual jurisdiction. Mere participation in the regional effort was not sufficient for inclusion. Of note, the database does not include the nine Priority Climate Action Plans (PCAPs) prepared under the EPA Climate Pollution Reduction Grants (CPRG) program. All the CAPs included in the database address GHG emissions reduction and/or mitigation. They can include adaptation and resilience content as well, but plans that only include adaptation are not in this database, though efforts are underway to add them. For these reasons, we recommend a standard template cover page identifying CAP adoption date, GHG inventory, expected emission reductions over the planning horizon, and CEQA certification.

The CAP database can be accessed at the following:

- CCAP Database Homepage: http://climateactionplanning.com/ccapdbase/
- ArcGIS Online map interface: https://arcg.is/mSXv0
- CAP Library with summary Excel database (via Dropbox): https://bit.ly/CCAPLibrary

Recommendations for furthering equitable planning

In the process of developing the General Plan database and platform (PlanSearch) and CCAP, we reflected on the challenges of archiving and searching across plans given the current state of data infrastructure for California planning. There is a great deal of variation in the formatting of CAPs and General Plan documents from city to city and county to county. Some plans are thousands of pages long, while other plans are fewer than 50 pages. Some cities divide required elements into separate documents while others compile all of the elements into a single document. Some General Plans signpost required elements via text headings, while others reference required element policies throughout the General Plan text. Some plans will include separate sections or PDFs for planning themes such as Recycling, Youth and Education, Recreation, and Agriculture, while others do not. Required content, like the Housing Needs Assessment, may be written in paragraph text, formatted in a table, or summarized in an image, making it difficult to extract affordable housing unit numbers across plans in a standardized manner. Most California General Plans include elements that are more than 15 years old. Even where there are state mandates for basic data infrastructure requirements, like plan updates, many local jurisdictions do not adhere.

Our findings highlight where and how the state of California can help local jurisdictions with planning templates and data management to further equitable planning and state climate action goals alike. For example, a template for formatting a GHG cover page in the General Plan or CAP can help with regional assessments of planning progress toward state goals. Importantly, there are precedents and guidelines for such initiatives. For example, FAIR guiding principles emphasize the need to make data: Findable, Accessible, Interoperable, and Reusable (Wilkinson et al., 2016).

- Findable: For data to be findable there must be sufficient metadata; there must be a unique and persistent identifier; and the data must be registered or indexed in a

searchable resource. The PlanSearch tool and CAP database aim to improve the ability of the public to easily find, read and compare plans.

- Accessible: To be accessible, metadata and data should be readable by humans and by machines, and it must reside in a trusted repository. A plan that is in a machine-readable PDF format allows users to search for key terms rapidly. This format is also useful for visually impaired reading software.
- Interoperable: Data must share a common structure, and metadata must use recognized, formal terminologies for description. This can be accomplished with a standardized cover page that allows readers to see immediately when the plan was adopted, who created the plan, and whether there are newer versions.
- Reusable: Data and collections must have clear usage licenses and clear provenance, and meet relevant community standards for the domain. This could be achieved by registering plans with a DOI with a timestamp.

Guidelines for improving the 'FAIR'-ness of data emphasize the importance of indexing data in a searchable repository, describing the creation, contents, and management of data with rich metadata, and ensuring that links to the data will persist over time. There are currently no such FAIR guidelines for California General Plans or CAPs. We recommend creating such standards.

In addition, we recommend creating standardized cover page templates (see Appendix 7) for use in plan creation. These templates can be voluntarily adopted and partially pre-filled by the state and ready for editing by local jurisdictions. Based on feedback from CBO partners, these templates should include the following information:

- Date plan was adopted;
- Date plan is updated;
- CEQA certification. Many CAPs are not CEQA certified or do not provide information on CEQA certification;
- Jurisdiction with shapefile attributes;
- Plan authorship, information about the firm that prepared the plan or authors of the plan;
- DOI.

Plan Evaluation

We used a comparative plan evaluation to understand the prevalence of terms and planning goals. This information is compared with state goals to understand: alignment and gaps (Berke & Conroy, 2000; Conroy & Berke, 2004); future trends (e.g., Grafakos et al., 2020); and promising policies across plans (e.g., Mui et al., 2021).

Plan Evaluation Methods

In comparing plan contents for the three priority areas, we follow a post-hoc plan evaluation protocol (Berke & Godschalk, 2009; Baer, 1997). We followed standard methods developed in previous studies by categorizing policy strength based on strength of policy language, identified funding, dedicated staffing, and benchmarks for implementation (Berke & Godschalk, 2009). To achieve these goals, one team of coders evaluated General Plans, with an intercoder reliability score of 94% to ensure standard coding across coders. The CAP scoring relied on an individual coder.

To be scored, a policy needed to show commitment. Efforts to explore approaches or set intentions were not scored. A score of "1" indicates that a policy within the plan met one of the three requirements for committed funding, benchmarked timeline for implementation, or dedicated staff. A score of 3 indicated that the plan contained all three levels of commitment (Berke, 1996; Berke & French, 1994). A plan can contain multiple policies, each varying in strength. Similarly, a plan could address the topic or term, but with weak policy language resulting in a score of 0.

Importantly, the strength of policy language is predicated on the presence of enabling language. For example, weak policy language suggested, but did not require action, using words like: "encourage"/ "may"/ "should" / "promote" / "explore" / "continue". As an example: Shasta County (2014) included the following policy: "6.4.4 Policy E-j The County should continue to implement plans to convert more of its vehicle fleet to hybrid or alternative fuels that meet or exceed air quality standards." This policy did not mention timeline, funding, nor personnel and would have scored a 0 as a policy as it lacked any benchmarks for success. Conversely, strong policies included enabling language such as: "will"/ "shall" / "must"/ "participate" / "Require" / "Update or review the code to allow for …" / "processing or permitting priority" / "Develop requirements" / "adopt an ordinance." As an example, Solano County (2008) included the following policy: "Implementation Program RS.I-42: Replace existing County vehicles with alternative fuel vehicles such as electric, hybrids, natural gas, and fuel cell powered vehicles. New County vehicles must be alternative fuel vehicles." This policy included a timeline, identified funding (the general fund), and detailed committed personnel (the Department of General Services). As a result, this policy would have scored a 3. To compare planning language with policy strength, we also include term mentions.

Our scoring method helps indicate where plans mention terms of interest (term counts), and where they follow California Department of Justice best practice guidelines (2023). Per these guidelines, "local governments *should* include metrics to help assess the effectiveness of their engagement efforts and evaluate their progress towards implementing their environmental justice

policies. Metrics, such as timelines for implementation or measures of success, should allow for the community to be able to track and assess progress" (CDJ, 2023, p. 8).

For the county plan score evaluations, all counties with CAPs as of January 2023 were included in the analysis. For city evaluations, a sampling strategy was used. First, as in the General Plan analysis, all city CAPs key term mentions, such as "VMT" and "energy," were noted. The first draw of the city CAP sample was then determined by taking the top 10 term mentions in CAPs; in the case of a tie score, both cities were drawn. The method is meant to score a sample of the plans that mention the search terms the most using the premise that term mentions, and the strength of policy scores will correlate. The second draw on the city sample was taken by using the top 10 term frequency cities for the General Plan analysis. The premise tested in this method is that jurisdictions that mention the term most in their General Plan, were also expected to include strong related policies that will score highly in their CAP. In several cases, cities did not have CAPs so those were obviously excluded from CAP policy scoring. In combination, these methods yield sample city CAP score samples for each search term: the highest "VMT" is 20, "energy" is 17, and "EV" is 20.

As previously noted, counties and cities organize their General Plan and CAP in various ways. For example, the Tulare County 2012 General Plan includes goals, policies, and implementation measures that apply to specific policies. Not all policies are covered in an implementation measure. Of the two ZEV policies (AQ-1.6 and AQ-1.10) in this plan, policy AQ-1.10 was not included in an implementation measure and therefore did not receive points for timeline, funding, or personnel. Similarly, the Marin County General Plan (2007) includes goals and implementing programs that do not necessarily correspond with a specific policy, making assessment of policies difficult. In comparison, the Mono County General Plan (2009) includes goals, objectives, policies, and actions - all of which are directly connected. In some cases, actions or goals containing search terms and resembling policies were treated as policies. For instance, Action CON-3.D was coded as a policy because it contained the term "alternative fuel," even though Albany City (2016) did not have this "action" labeled as a "policy" in its plan.

Limitations

It is important to note that many jurisdictions are currently working toward plan updates. Thus, the plan score and term assessments will likely offer an undercount of efforts. Differences between what the adopted plan covers and what is part of a current, but not yet realized, planning effort are perhaps best illustrated through equity considerations. The Annual Planning Survey (APS) from 2023 found that 20% of reporting jurisdictions are addressing "racial equity" and 35% are addressing "climate adaptation and resilience" in their plans or efforts. With an APS response rate of 59%, the information is incomplete. Yet, we also note that there is very little evidence within plans of such progress. For example, only two cities (0.4%) and three counties (5%) use the term "racial equity" in their General Plans. Similarly, only 46 cities (9.5%) and 13 counties (22.4%) mention "climate adaptation" in their General Plans despite state goals to meaningfully address this topic in every jurisdiction. Clearly, both plans and current efforts are well behind state goals but plans seemingly lag further behind planner-reported efforts to address state priorities.

In the following plan evaluation sections, we will first address plan scores in general plans, followed by those of CAPs.

ZEV plan evaluation results for counties

The ZEV composite score is a sum of the number of strong policies for the following terms: "alternative fuel" and "electric vehicle", with the following terms scored under "electric vehicle": "zero-emission vehicle", "plug-in electric vehicle", "battery-electric vehicle", and plug-in hybrid electric vehicle" (Table 1).

Table 1. ZEV-related term mentions in city and county General Plans

Zero-emission Vehicle Terms	# of City General Plans that mention "electric vehicle" (out of 482)	# of County General Plans that mention "electric vehicle" (out of 58)
Alternative Fuel	142	28
Electric Vehicle	109	11
Zero-emission Vehicle (ZEV)	5	0
Plug-in Electric Vehicle (PEV)	1	0
Battery-electric Vehicle (BEV)	0	0
Plug-in Hybrid-electric Vehicle (PHEV)	0	0

The total ZEV score for county general plans ranged from 0-16, with 34 of California's 58 counties scoring a 0. The average score was 2.6 and the median was 0.0. The top three scoring counties are Yolo, San Luis Obispo, and San Joaquin. The majority of counties with a score over 0 tended to be populous counties of central and coastal California.

The top scoring county overall for ZEV policies was Yolo County with a total score of 16. The 2009 Yolo County General Plan contained 11 policies: two policies used strong policy language, three mentioned a timeline, none mentioned funding, and three mentioned personnel. Here is an example of a policy with weak language, a timeline, and personnel:

> "Action PF-A79 Include incentives for alternative fuel vehicles as part of new County facility development, including charging stations and preferred parking. (Policy PF-12.3)" Timeline: Ongoing. Personnel: County Administrator's Office. (The policy PF-12.3 is mentioned within this action, however that policy itself did not contain the search term, so it was not separately coded.)

The second highest scoring county was San Luis Obispo with a total score of 15. San Luis Obispo (2010) included seven ZEV policies. None used strong policy language or mentioned funding, but four policies had implementation strategies with timelines and personnel. The following is an example of a policy with an implementation strategy:

> "Policy AQ 2.6 - Alternative fuel incentives: Support and seek funding for incentives to residents, fleet operators, school districts, and employers to purchase and use alternative fuel vehicles as local, state, or federal funding sources become available. Implementation Strategy AQ 2.6.3 - Vehicle Charging in New Development: Encourage new construction to include vehicle access to properly wired outdoor receptacles to accommodate zero emission vehicles (ZEV) and/or plug-in electric vehicles (PHEV)." Timeline: Ongoing, start time immediately. Personnel: County Department of Planning and Building, San Luis Obispo County Air Pollution Control District.

The third highest score was San Joaquin County at 12 points. The San Joaquin County 2016 General Plan contains six ZEV policies, all written with strong policy language, and two policies mentioning both timelines and personnel. Here is an example of a policy with strong language, a timeline, and personnel:

> "Implementation NCR-J: Government Automobiles. As vehicles come up for replacement, the County shall evaluate the feasibility of replacing them with hybrids, alternative fuel, or smaller and more energy-efficient vehicles." Timeline: Ongoing. Personnel: Public Works, General Services.

These findings compare to CAP county-level scores. Total ZEV scores for county CAPs ranged from 0-37, with an average score of 10. From this, we see stronger policies occurring in CAPs. The three highest scoring counties were Butte (37), San Diego (31) and Los Angeles (28). Thus, we note that inclusion of strong policies in general plans does not neatly match CAP contents. One explanation may be that plans are updated and adopted step-wise, with newer plans offering bolder policies. For example, five of the 23 counties with CAPs (21%) had no ZEV policies in their CAP, though they were adopted from 2010-2014 thus predating much of the attention to ZEVs.

Policy Approaches

Policy approaches included priority parking for ZEV, charging infrastructure, and encouragement of public (government-owned or neighborhood electric vehicles) or private ZEV use. Neighborhood Electric Vehicles (NEVs) are small, low speed electric vehicles, like golf carts. Considerations for private fleet ZEV uptake outweighed those for public efforts. For example, of the 64 total ZEV policies in county General Plans across all counties, 20 mention public ZEV use and 35 mention private ZEV use.

Example of priority parking ZEV policy:

> **Napa County 2019**: "Policy CIR-29: As a major employer, the County of Napa shall demonstrate leadership in the implementation of programs encouraging the use of transit, walking, and bicycling by its employees, as well as the use of alternative fuels. Example programs may include: Preferential carpool parking and other ride sharing incentives; Flexible working hours or telecommuting where consistent with job duties and customer service needs; A purchasing program that favors hybrid, electric, or other non-gasoline vehicles; Assisting in the development of demonstration projects for alternative fuel

technologies such as ethanol, hydrogen, and electricity; Secure bicycle parking; and Transit incentives." This policy did not mention timeline, funding, or personnel.

Example of charging infrastructure policy:

> **Humboldt County 2017**: "E-P4 Transportation Energy Conservation and Alternative Fuels Substitution: Support revitalization and infill projects within Urban Development Areas as a means to reduce long-term vehicle miles traveled as an energy conservation strategy. Support the development and implementation of Electric Vehicle (EV) charging stations and other alternative fueling infrastructure." Timeline: 2-5 years. Funding: TBD. Personnel: Redwood Coast Energy Authority.

Example of public ZEV uptake:

> **San Joaquin 2016**: "GOAL IS-3 To increase efficiency of County facilities, services, and operations to conserve resources and reduce greenhouse gas emissions. IS-3.5 New Fleet and Equipment Purchases: The County shall purchase lower-emission and/or electric vehicles and energy efficient equipment when purchasing new fleet vehicles and maintenance/construction equipment." Timeline: Annual, ongoing. Funding: None. Personnel: General Services, Public Works.

Example of private ZEV uptake:

> **Calaveras County 2020**: "Goal PF 3: Wide use of alternative energy sources; cost-effective integrated solid waste management and systems emphasizing waste reduction and recycling PF 3.1 Support the development of new energy generating technologies and facilitate the incorporation of these technologies into new development while retaining community character. (IM PF-3A, PF-3B, PF-3E and PF-3F) Implementing Measure PF 3B Alternative Fuel Vehicles Infrastructure and Incentives Amend the zoning code to recognize and permit infrastructure necessary to support alternative fuel vehicles (e.g., charging stations) and encourage their use through the provision of incentives provided in the zoning code. Implements: Policy PF 3.1." Timeline: None. Funding: None. Personnel: Planning Department.

In these findings CAPs contained stronger policy language. Of all the policies examined, 50% used strong language such as "shall" or "will." Los Angeles and Marin counties had the highest number of strong policies. Five of the 21 counties had more than 75% of their total policies characterized as strong.

Example of strong policy:

> **Los Angeles County 2024**: "T6.3—Require all new development to install EVCSs through a condition of approval/ordinance. Residential development must install EVCSs; nonresidential development must install EVCSs at a percentage of total parking spaces."

Note that EVCS refers to Electric Vehicle Charging Stations.

Equity-focused Approaches

No counties included explicitly equity-focused approaches to a ZEV policy in their county General Plans. Such approaches would have considered priority parking for vulnerable populations, siting of charging stations in DACs, or additional funding and support for low-income community members to lease or own ZEVs.

This compares to CAPs, where four counties clearly showed a focus on equity in their policies.

Example of equity policy:

> **Los Angeles County 2024**: "T6.4—Install EVCSs at County facilities and properties for public, employee, and fleet use, prioritizing locations in frontline, BIPOC (Black, Indigenous, and people of color), and disadvantaged communities. Complete an assessment of EV charging locations, identifying gaps in publicly accessible stations for frontline, BIPOC, and disadvantaged communities. Provide EV purchase incentive information in multiple languages to frontline communities."

Timeline

Most timelines for ZEV policies in county General Plans were marked as "ongoing." When counties used "short-term" and "long-term," their definitions varied. For example, Mono County 2015 marked their policy as "Within the 10-year short-term time frame of this plan" and Marin County 2007 marked one of their policies as "Long term (over 7 years)." Such variance made it difficult to predict state-level ZEV achievement goals on the basis of local planning efforts alone. Where timelines are included, local plan scoring indicates that California will fall short of its state goal for transit agencies to only purchase zero-emission buses after 2029, with a goal for full transition by 2040.

The lack of timeline metrics to benchmark progress is echoed in CAPs. Of all the policies examined in county-level CAPs, 45% had a timeline or prioritization for implementation. Butte, Santa Barbara, San Diego, and San Francisco counties state specific years for implementation, while others use the short/medium/long-term convention.

Example of CAP policy with specific timelines:

> **San Francisco City/County 2021**: "TLU.7-2 Expand publicly available EV charging across the city that is financially and geographically accessible to low-income households and renters.
>
> a) By 2022, complete an evaluation framework to develop curbside charging pilots
>
> b) By 2023, expand charging to 10% of spaces in municipally owned parking lots
>
> c) By 2023, expand charging to 10% of spaces within privately owned large commercial garages

d) By 2023, create three “fast-charging hubs” with one serving a disadvantaged community within San Francisco.

e) By 2025, install charging to 10% of SFO-owned parking stalls supported by load management software.”

Funding

Only seven counties identified funding sources or potential funding sources for their county-level General Plan ZEV policies. The most common sources listed were “Planning and Building Department Budget” (San Luis Obispo 2010, three out of six of their ZEV policies) and General Fund (Solano 2008 for their only ZEV policy, and San Luis Obispo 2010, two out of six of their ZEV policies). The only county that listed a specific grant was Madera County 1995: “Air pollution control district grants.” No counties listed an amount, indicating the difficult and uncertain funding landscape for achieving ZEV transitions.

The lack of identifying funding resources is echoed in CAPs. Of the 18 counties that included ZEV policies in their CAPs, only 3 included funding sources for their policies. This finding, combined with climate readiness workshop feedback that funding is a limiting factor for local planning, highlights how state guidelines and mandates should explicitly point local jurisdictions to readily available funding sources.

Staff and Personnel

The identification of dedicated personnel, where listed, provides valuable information about coordinating climate ready ZEV policy. Common personnel identified as responsible for county-level General Plan ZEV policies include: planning departments, public works departments, air districts, general services departments, and the county administrator’s office. Less common personnel identified and mentioned just once include: the board of Supervisors, Department of Health, the Central Coast Clean Cities Coalition, and the Transportation Authority of Marin. Similarly, just over 50% of county-level CAP policies included an assignment to a specific department or agency for implementation, such as community development or public works. These are usually listed in an implementation table and not discussed in detail.

State agencies hoping to convene working groups and spur implementation of ZEV policy would do well to convene those listed as responsible at the local level in future climate readiness planning efforts.

ZEV plan evaluation results for cities

Next, we look to city-level ZEV policies in General Plans and CAPs. Based on term mentions, state policy-making language and use of ZEV terminology is less common at the local level, where jurisdictions more commonly refer to “alternative fuel” and “electric vehicle” (Table 1). Figure 1 shows jurisdictions that mention “electric vehicle” in their general plan. In this spirit, the sample of city-level CAPs was scored for the following terms: “electric vehicle” and “EV.” With the prevalence of terminology in mind, state agencies may wish to change their messaging to reach broader audiences.

Figure 1. City and county jurisdictions that mention “electric vehicle” in their General Plan. As of 9/26/2024, 135 out of 482 cities mention “electric vehicle, " and 19 out of 58 counties mention "electric vehicle." There is no clear geographic pattern across urban and rural jurisdictions in the North, Central and South on the coast and inland. Image created on PlanSearch.

City General Plan ZEV composite scores ranged from 0-25, with 285 cities scoring a 0 (60%). The strongest scoring cities all scored 21 and were: Agoura Hills, Aliso Viejo, Artesia, and Pinole. Similarly, only 125 cities mention “electric vehicle” in their General Plan (26%) demonstrating nascent ZEV policy uptake at the local level. This indicated that about 40% of California jurisdictions use General Plans to move ZEV policy forward by setting intentions and crafting policy commitments. It should be noted that many jurisdictions mention terms without including strong policies, instead referring to additional planning efforts outside of the General

Plan. For example, the City of Alameda (2021) includes the following effort to prepare a separate plan for ZEV uptake:

> "Goal 2: Reduce the community's greenhouse gas emissions which are contributing to global warming, climate change, and environmental and social impacts. Policy CC-6 Climate-Friendly Vehicles and Equipment: Reduce transportation greenhouse gas emissions by promoting, and when appropriate, requiring the use of low and zero emission vehicles and equipment and supporting the use of micro-mobility devices to reduce energy use and carbon emissions from personal vehicles. Action g. EV and Micromobility Action Plan: Partner with Alameda Municipal Power to prepare and adopt an Electric Vehicle Plan that provides a path forward for increased EV and micromobility adoption in Alameda with a focus on renters and low-income residents, increasing charging availability on City owned lots and in multifamily housing, enhancing community awareness, and expanding incentives and rebates for the purchase of a range of EVs, including micromobility devices, and for the installation of chargers."

Further, while many ZEV plans were connected to GHG emission reduction, many others use alternative motivators. As the state continues to develop goals, it will be important to translate these goals into local motivators. Below is an example of strong policy from the City of Commerce (2008) General Plan that motivates conversion of the public fleet to alternative fuels based on both state goals and clean air:

> "8.3.3 Issue: Alternative Fuels: A cornerstone of the state and local clean air strategy involves the development and use of alternative fuels. Towards this end, the city supports these efforts through the following policies. Air Quality Policy 3.6. The city of Commerce will manage the city's transportation fleet fueling standards to achieve the greatest number of alternative fuel vehicles in the city fleet."

Further, many policies within plans refer to municipal code updates and CAPs. For example, the City of Elk Grove (2021) General Plan refers to both municipal code and a CAP for further policy action:

> "Action 1.7 Building Code Update. Review and update Elk Grove Municipal Code Title 16 - Buildings and Construction as needed to incorporate the goals and policies of the General Plan into the City's building code. This should also include any updates that are required by the 2019-2020 update to the California Green Building Standards Code (CALGreen). The following items shall be reviewed and amended: • Update the building code to incorporate higher standards for green building as required by the City's Climate Action Plan (CAP) • A requirement for new single-family residential development to pre-wire for plug-in electric vehicles." Timeline: FY 18/19-FY 19/20. Funding: None. Personnel: Development Services - Planning, Development Services - Engineering, Public Works, Strategic Planning."

These findings compare to city-level CAPs where total scores for "electric vehicle" ranged from 0-55, with an average score of 18. Two cities had no ZEV policies in their CAP; one was from 2018, which is surprising, but the other is from 2013 thus predating much of the attention to ZEVs. Again, local jurisdictions are more emboldened to take strong policy stances in their

CAPs–though many CAPs are not CEQA certified (59%) and lack the same legal basis as the General Plan thereby questioning how such strong policy statements ultimately lead to implementation.

The three highest scoring cities were San Carlos (55), San Mateo (44) and Burbank (39). Again, the strongest scoring CAPs do not match the strongest scoring General Plans, indicating the variance in which plan-making approach local jurisdictions emphasize, a topic further explored in Climate Readiness workshops. In addition, all three of the strongest scoring CAP jurisdictions include municipal ZEV reach codes, municipal codes that that go beyond state requirements. Of the strongest scoring General Plans, only Agoura Hills has a ZEV reach code. This finding may be due to the relative ease and speed of one planning vehicle over the other. Municipal codes are shorter policy prescriptions, and more likely to be passed and updated more quickly than a General Plan, which can take several years of community input to revise and update a single chapter.

Policy approaches

ZEV policy approaches included priority parking for ZEVs, siting charging infrastructure, and encouragement of public (government-owned or NEV) or private ZEV use. Similar to county-level policies, considerations for private ZEV transitions were more numerous than efforts toward public fleets. Of the 455 total ZEV policies identified across all city general plans, 141 mention public ZEV use and 273 mention private ZEV use. This finding indicates a need for greater state support toward local public fleet conversion policies.

An example of example of public ZEV use from the City of Santa Rosa (2020) General Plan underscores the need for greater planning and implementation data infrastructure to celebrate the motivation of local leadership in climate action:

> "OSC-J Take appropriate actions to help Santa Rosa and the larger Bay Area region achieve and maintain all ambient air quality standards. OSC-J-2 Budget for clean fuels and vehicles in the city's long-range capital expenditure plans, to replace and improve the existing fleet of gasoline and diesel powered vehicles. Initiate a policy to make its fleet among the cleanest in the North Bay by: • Purchasing alternative fuel vehicles, such as natural gas, as the existing diesel-powered fleet is replaced. Alternatively, purchase diesel vehicles only if they meet or exceed emission specifications for available natural gas fuel vehicles."

This finding is similar to CAP ZEV scores. Of all the policies examined, 62% used strong language such as "shall" or "will." San Mateo and San Carlos had the highest number of strong policies. Nine of the 20 cities had more than 75% of their total policies characterized as strong.

Examples of strong policy from city-level CAPs:

City of Dublin CAP 2020: Measure SM-1: Adopt an Electric Vehicle Charging Station Ordinance. The City of Dublin will adopt an electric vehicle (EV) charging station ordinance for multifamily and commercial buildings to increase access to charging stations and promote the use of electric vehicles.

City of Encinitas CAP 2020:CAP Measure CET-5: Require Commercial Electric Vehicle Charging Stations. Stating in 2018, require installation of EVCS at 8% of the total number of parking spaces. For 1) all new commercial buildings, including the commercial portion of mixed-use projects, 2) commercial building modifications, alterations, and additions that require building permits with square footage larger than 10,000 sq. ft.

City of Del Mar CAP 2016: "Goal 17: Increase Number of Preferential Parking Spaces for Clean Vehicles

STRATEGIES

· Set aside 10 percent of all on-street parking spots on Camino del Mar and in City-owned lots for high-efficiency and clean vehicles by 2020

· Explore modifying the Del Mar Municipal Code parking standard requirements to incentivize stalls designed for micro-vehicles and to provide a credit toward parking requirements for providing parking stalls for electric vehicles and charging station."

Equity-focused Approaches

In contrast to the counties, six cities listed notable equity-focused ZEV policies within their General Plans. The six cities were Alameda, Arcata, East Palo Alto, Folsom, Lathrop, and Milpitas. It is important to note that five out of the six policies are from General Plans adopted within the last five to six years, suggesting the increasing focus on equity at the local and state level within recent years. The identified equity-focused initiatives to ZEV policy focused on creating dense and affordable housing and infill projects that include transportation infrastructure, working to promote increased access to alternative modes of transportation, and prioritizing the development of electric vehicle charging stations at multi-family residential units.

Examples of equity-focused policy approaches from General Plans:

City of Alameda 2021: LU-13 Green Economy. Promote a green economy that reduces greenhouse gas emissions generated by Alameda businesses. Action b. Green Business Practices. Encourage Alameda businesses and industries to become more sustainable and continue to make positive contributions to the community by, for example, hiring locally, supporting telecommuting, utilizing solar power, reducing waste, and prioritizing active transportation, transit, and electric vehicles. This includes providing electric vehicle and e-bike charging stations, long-term bike parking options, and a variety of transit options.

City of Arcata 2008: Goal B. Housing Quantity - It is the goal of the City of Arcata to provide housing opportunities for people of all income levels through the development of

a wide range of housing types and the preservation of existing housing. Policy HE-13 Support affordable housing and greenhouse gas emissions reduction by prioritizing high-density, mixed-income, infill housing projects that improve alternative transportation infrastructure. Affordable housing and infill projects that include public and/or private infrastructure for public transit, bike and other ride share programs, electric vehicles, and other transportation demand management strategies or alternative transportation modes will receive incentives including deferred fees and reduced development standards, including but not limited to reduced parking, setbacks, or landscaping requirements. (Reference Implementation Measures: 11, 12 and 20)

City of East Palo Alto 2016: Goal HE-10. Improve respiratory health throughout the City and strive to reduce incidence of asthma and other respiratory illnesses. Policy 10.6 Electric vehicle fleet. Improve air quality and respiratory health through City programs and operations such as converting to a clean-air and primarily electric fleet.

City of Folsom 2018: Policy M 4.2.4 Electric Vehicle Charging Stations Encourage the installation of electric vehicle charging stations in parking spaces throughout the city, prioritizing installations at multi-family residential units.

City of Lathrop 2022: Goal Cir-4, Plan for the future of transportation to ensure accessibility for all, reduce the environmental impacts of transportation, and improve the quality of life. Policy CIR-4.4 Electric Vehicle Charging. Support the creation of electric vehicle charging stations at multifamily residential, commercial, government.

City of Milpitas 2021: CIR 6-6 Work with stakeholders to encourage the development of electric vehicle charging stations and other alternative fuel infrastructure at publicly-owned locations, near businesses, and employment sites.

The focus on equity in city-level General Plans is not proportionally greater than the focus on equity in CAPs where two of the 20 sampled cities with the most mentions in CAPs and General Plans clearly showed an equity focus in their CAP policies.

Example of CAP ZEV equity policy:

City of Escondido 2021: "Measure T-1.3: Adopt an Ordinance to Require Electric Vehicle Charging Stations in Developments. Adopt an ordinance, effective in 2023, that requires Level 2 or better EV charging stations to be installed in a minimum of 10 percent of total parking spaces provided in new multi-family and new and existing commercial developments."

Includes the following performance measure:

"Establish a "Clean Energy Equity Plan" to improve equitable access to clean and sustainable energy in priority investment neighborhoods ("PINs") to increase EV ownership, EV car-sharing, installation of EV chargers in existing multi-family projects, etc."

Timeline

Like county-level general plans, few city-level general plans supplied strong timelines for action. This compares to the sample of CAPs with relatively stronger policy scores. Of all the ZEV policies examined in city-level CAPs, 78% had a timeline or prioritization for implementation. Of note, Escondido had specific "target years" for specific performance metrics in each policy.

Example of policy with specific timelines:

> **City of Escondido 2021**:"Measure T-1.4: Require Electric Vehicle Charging Stations at New Model Home Developments. Adopt an ordinance, effective in 2021, requiring new developments to encourage EV charging station installation in new homes by:
>
> - Installing at least one EV charging station (wall mount or pedestal) in new single-family model homes and multifamily model homes with private garages (e.g. townhouse);
> - Including EV charging stations as an add-on option at no cost to new homebuyers in new home subdivisions; and
> - Working with the City to waive permitting and installation fees for EV charging stations in these subdivisions.
>
> The City should consider incentives to offset participant costs of the measure's implementation. The detail and scope of the incentives should be discussed at the time of the ordinance's adoption.
>
> Performance Metric
>
> 2021 Adopt an ordinance requiring EV charging station installation in new single family homes and townhouses.
>
> 2030 Install 200 EV charging stations in new single-family homes and townhouses by 2030
>
> 2035 Install 300 EV charging stations in new single-family homes and townhouses by 2035."

Funding

By far, the most common source of funding cities identified to enact their ZEV policies was the city's General Fund, being cited by cities 15 times out of the 23 total cities that specified funding sources in their General Plans. Additional sources of funding listed by cities consisted of a variety of local fees and grants, namely fee revenues, development fees, the Assembly Bill 2766 Subvention Fund, sales tax revenue, the gas tax fund, and funds allocated and generated by the capital improvement program. Similar to the counties, no cities explicitly identified specific funding amounts allocated to their policy and implementation strategies in their General Plans. Again, this finding signals to state agencies a need to help local jurisdictions match policymaking will with available external funding sources.

Similarly, of the 20 CAP cities scored, nine included funding sources for their policies. This compares to none of the county CAPs listing funding sources for ZEV policy. The City of Burbank (2022) has an impressively detailed appendix (Appendix E) on potential funding of the CAP. This example is too long to reproduce in the report, but we encourage readers to explore this appendix as a model approach.

CAP examples of funding approach:

> **City of Dublin 2020** (summarized from Table 8-1): "Measure SM-1: Adopt an Electric Vehicle Charging Station Ordinance" "The City would use the general operation budget to develop this ordinance. Staff would promote incentives for EV ownership as well as adopt building reach codes to increase the installation of new EV charging stations."
>
> "Measure SM-2: Develop an Electric Vehicle Infrastructure Plan
>
> "The City would use the general operation budget to develop the plan. Incentives and grant funding opportunities may be available for infrastructure and planning efforts. Collaborate with third party businesses to site charging facilities. City and privately-owned facilities could possibly obtain grant funding from Bay Area Air Quality Management District, PG&E, EBCE, or other sources."

Staff and Personnel

Findings reflect the county-level plan evaluations and signal to ZEV policy advocates and state agencies which responsible local staff and departments to include in outreach for policymaking updates, available funding, and implementation guidance. In reference to city personnel and capacity, the majority of personnel identified as responsible for city ZEV policies in General Plans include various city departments, including planning, public works, city manager's office, and community development. Personnel were often listed as responsible for an entire policy, not assigned a specific task. Less frequently identified personnel include the Transportation Management Association, fleet division, and the building division. In addition, implementation strategies were not specific enough in assigning certain personnel, teams or departments to specific tasks. For example, the following policy shows all relevant personnel that would be involved in implementation, but their specific role is vague:

> **City of Los Angeles 2021**: "Policy 1: continue to encourage energy conservation and petroleum product reuse. Program 3: alternative fuel and energy sources research and use." Timeline: None mentioned. Funding: None mentioned. Personnel: Department of Water and Power in cooperation with other agencies that produce alternative energy (e.g., Bureau of Sanitation) and/or operate facilities that have the capability of being converted to alternative energy use.

In the 20 sampled city-level CAPs, just over 74% of ZEV policies included an assignment to a specific department or agency for implementation, such as community development or public works. These are usually listed in an implementation table and not discussed in detail.

Unique Approaches Across Cities and Counties

Examples of unique terms that appeared in city and county planning documents during the search for “zero-emission vehicles” include:

> Renewable Energy Vehicle: Chico City General Plan 2017 - Policy CIRC-8.2 (Parking Improvements): Ensure that new parking facilities and renovations are designed to be safe, efficient, and pedestrian-friendly. Action CIRC-8.2.2 (Public Parking Facilities): When designing new public parking facilities, incorporate preferred parking for renewable energy vehicles and assess the need for electric vehicle charging stations. Timeline: None. Funding: None. Personnel: None.
>
> Properly wired outdoor receptacle: Belvedere City 2010 - Policy SUST-9.1: Encourage use of electric vehicles. Actions: SUST-9.1.1: Encourage new commercial construction to include vehicle access to properly wired outdoor receptacles to accommodate zero-emission vehicles (ZEVs) and/or plug in electric hybrids. Timeline: None. Funding: None. Personnel: None.
>
> Chino City 2010 - Policy P1. The City shall encourage new construction to include vehicle access to properly wired outdoor receptacles to accommodate zero emission vehicles and/or plug in hybrids. Timeline: None. Funding: None. Personnel: None.
>
> Fueling stations for alternative fuel vehicles: Calabasas City 2021 - IV-39 Promote the use of alternative energy sources such as solar energy, cogeneration, and non-fossil fuels. Ways in which alternative energy can be promoted include, but are not limited to, incorporation of solar panels on structures and provision of fueling stations for alternative fuel vehicles. Timeline: None. Funding: None. Personnel: None.
>
> Alternative fuel/recharging facilities: Corning City 2015 - ENERGY Goal: Reduce reliance on non-renewable energy sources in existing and future development and improve the delivery of energy to existing and future users. Policy E-(5): Amend the zoning ordinance to require alternative fuel/recharging facilities in Commercial, Industrial, and Industrial Light districts subject to appropriate standards. Timeline: None. Funding: None. Personnel: None.
>
> Electric plug in recharging stations: Menlo Park City 2013 - Goal OSC4 — PROMOTE SUSTAINABILITY AND CLIMATE ACTION PLANNING: Promote a sustainable energy supply and implement the City’s Climate Action Plan to reduce greenhouse gas emissions and improve the sustainability of actions by City government, residents, and businesses in Menlo Park. This includes promoting land use patterns that reduce the number and length of motor vehicle trips, and encouraging recycling, reduction and reuse

programs. Policy OSC4.4: Vehicles Using Alternative Fuel. Explore the potential for installing infrastructure for vehicles that use alternative fuel, such as electric plug in recharging stations. Timeline: None. Funding: None. Personnel: None.

Electric Vehicle plugs: Oakdale 2013 - PF-5.9 New Residential Development. Require new residential development to incorporate prewiring for solar or other renewable energy systems, and offer optional features that would allow for increased energy efficiency in homes (e.g., electric vehicle plugs, zoned heating and cooling, automated lighting and heating/cooling systems). (RDR, NR-IP5) Timeline: None. Funding: None. Personnel: Community Development & Services, Public Works.

Cleaner-burning fuels: San Leandro City 2016 - Policy EH-3.9 Alternative Fuel Vehicles. Promote the development of infrastructure which supports the use of alternative fuel (i.e., electric) vehicles, including electric charging stations and preferential parking for electric vehicles. Action EH-3.9.A: Replacement of City Vehicle Fleet: Pursue the gradual replacement of the City's passenger vehicle fleet with vehicles using cleaner-burning fuels, such as natural gas and electricity. Timeline: None. Funding: None. Personnel: None.

Recharging Station: San Marcos 2012 - Policy M-3.8: Work with regional agencies, such as SANDAG, to install appropriate recharging stations to support the use of electric vehicles. Work with developers to install recharging stations, employment, and transit centers to support electric vehicle use. Timeline: 2012-2014, Ongoing. Funding: General fund, private development, grants. Personnel: City Manager, Development Services, Public Works.

Low-emission vehicles: Cotati City 2015 - GOAL CI 3 - Reduce Vehicle Miles Traveled (VMT) in Order to Reduce Congestion and Help Achieve Regional Efforts to Reduce Greenhouse Gas (GHG) Emissions. Policy CI 3.3 - Work with major employers and representatives from Sonoma State University to implement Transportation Demand Management (TDM) programs. Examples of TDM programs may include (but are not limited to) subsidized transit passes, guaranteed ride home, carpool matching, telecommuting, alternative work schedules, car sharing, employer-sponsored vanpools, priced workplace parking, and preferential parking for carpools and/or low-emission vehicles. Timeline: None. Funding: None. Personnel: None.

Clean vehicles: Marin County 2007 - GOAL AIR-3 Reduction of Vehicle-Generated Pollutants. Reduce vehicle trips and emissions, and improve vehicle efficiency, as means of limiting the volume of pollutants generated by traffic. Policy AIR-3.1 Institute Transportation Control Measures. Support a transportation program that reduces vehicle

trips, increases ridesharing, and meets or exceeds the Transportation Control Measures recommended by BAAQMD in the most recent Clean Air Plan to reduce pollutants generated by vehicle use. Implementing Program AIR-3.c Consider Model Clean Vehicle Requirements. Research and consider adoption of an ordinance or standards that provide a set of voluntary measures to incorporate clean vehicles in fleets and promote the use of clean alternative fuels. Timeline: Long term (over 7 years). Funding: None. Personnel: Department of Public Works.

Alternative fuel filling stations: Yolo County 2009 - GOAL CI-3 Service Thresholds. Balance the preservation of community and rural values with a safe and efficient circulation system. Policy CI-3.19 The Dunnigan Specific Plan shall incorporate a maximum of 44 vehicle miles of travel (VMT) generated per household per weekday through implementation of all feasible actions including but not limited to specifications contained in Policies CC-3.3 through CC-3.6. As part of the specific plan implementation, the VMT performance shall be monitored at each phase. If VMT performance exceeds the threshold in this policy, then additional actions shall be implemented and may include, the following actions: Action N. Consider unique transportation incentives such as free bikes, recharging stations for electric vehicles, alternative fuel filling stations, plug-in hybrid car-sharing, and carpool concierge services. Timeline: None. Funding: None. Personnel: None.

Decarbonization plan evaluation results for counties

Similar to ZEV policy scoring in the previous section, the decarbonization composite score is based on the strength of policies within the plan. A score of 1 indicates that a policy within the plan met one of the three requirements for committed funding, benchmarked timeline for implementation, or dedicated staff. A score of 3 indicates that a policy within a plan contained all three levels of commitment (Berke, 1996; Berke & French, 1994). A plan could have multiple policies, each varying in strength, yielding a composite score when summed. Similarly, a plan could address the topic or term, but with weak policy language resulting in a composite score of 0.

Strength of policy language was determined by the presence of enabling language. For example, weak policy language suggested, but did not require action, using words like: "encourage"/ "may"/ "should" / "promote" / "explore" / "continue." For example, Lake Forest (2020) included the following: "Goal PF-6 Energy Management: A community with adequate power, provided through economically and environmentally sustainable means. Policy PF-6.6 Public-Private Partnerships. *Investigate* the opportunity to engage in public-private partnerships on energy efficiency, energy storage, and microgrid development to achieve cost savings, reduce energy use, and improve energy reliability." No timeline, funding, or personnel were mentioned. This policy would score a "0". In comparison, Port Hueneme (2021) provides an example of a strong-scoring policy with the following: "4.1 Policy CAP 2-1: Increase electric/alternative fuel vehicle and equipment uptake to 10% by 2030, and 15% by 2045. Action Number CAP 2-1.1: Adopt EV Charging Reach Code for Commercial and Multifamily Buildings that require all new commercial and multifamily buildings to exceed minimum CALGreen standards for "EV Ready" charging spaces and infrastructure. Anticipated Reduction (MT CO2e) - 2030: 3,555; 2045: 4,635." While no funding or personnel were identified, the policy did include a timeline for benchmarking progress.

It is important to note that only one county mentioned the terms "decarbonization," "reach code," or "microgrid" (Table 2). the underrepresentation of in local planning of such state-level goals indicates a policy and language mismatch between state and local efforts. As a result of this mismatch, the following more prevalent decarbonization terms were selected for scoring counties: "energy", "heat pump", and "carbon neutral". Because of the large number of "energy" terms in city general plans, the following terms were scored for city general plans: "decarbonization", "heat pump", "reach code", "microgrid", and "carbon neutral". For CAPs, all 23 counties with CAPs were scored for the terms "energy" and "decarbonization", and a sample of city-level CAPs were scored for the same terms. This sample was selected from the 10 city-level General Plans with the most mentions of "energy" in combination with 10 CAPs with the most mentions of "energy." We note that adopted plans may lead municipal code adoption, or plans may lag and not mention adopted reach codes.

Table 2. city and county decarbonization-related General Plan term mentions

Term	# of city General Plans that mention search term (out of 482)	# of county General Plans that mention search term (out of 58)
Decarbonization	1	1
Heat pump	8	3
Solar	370	54
Reach code	3	1
Energy	413	57
Energy storage	9	4
Energy efficiency	373	54
Microgrid	2	1
Carbon neutral	4	2
Green building	318	47

Policy Approaches

County General Plan decarbonization scores had an average of 52 and median of 37, indicating skewing toward a few counties scoring more highly and lifting the average. This is similar, but less pronounced for the 23 county CAPs with a median plan decarbonization score of 23 and average of 28. County General Plan decarbonization scores ranged from three counties with a score of zero to the counties with the strongest decarbonization scores in their General Plan policies included Marin (176), Solano (156) and Ventura (143)–which are all coastal counties. This compared with county-level CAPs ranging from two CAPs with no score to the strongest scoring counties: Butte (162), Contra Costa (138), and Santa Barbara (134). As with ZEV scoring, strong scores in general plans do not neatly correlate with strong scores in CAPs indicating a mismatch across local jurisdiction policy approaches where one plan may be selected over another for moving climate policy forward. Next, we review policy approaches.

Three counties mention “heat pump” in their General Plan: San Luis Obispo 2010 (one mention), Shasta County 2007 (one mention), and Siskiyou County 1993 (36 mentions). This policy approach compared with the seven county-level CAPs (30%) that mention the term “heat pump”, indicating relatively greater heat pump policy coverage in CAPs. The highest scoring county for “heat pump” was Shasta County with 5 points, the next highest was Siskiyou County with three points, and San Luis Obispo had zero points (mentioned the term once but did not include the term in a policy). Shasta County’s General Plan (2007) “heat pump” policy scored strongly across all categories. Consider, for example, the following policy:

> "Program 65. The County Housing Department will explore opportunities to apply for a CDBG technical assistance grant and other Federal and State grants to establish continuing programs to provide information and assistance to property owners seeking to obtain funding for construction related to energy conservation programs available in Shasta County, including, but not limited to: a. CDBG funds b. USDA Rural Development-Farmers Home Administration funds c. Energy Commission funds d. Self-Help Home Repair Program e. Heat pump energy savers." Timeline: Continuous. Funding: Building permit administrative fees. Personnel: Department of Resource Management, Building Division/Department of Housing.

Relatedly, Siskiyou County's 1993 General Plan includes a section on "geothermal energy," and sets policy supporting its utilization with heat pumps, although it did not use strong language nor include implementation plans. Here's an example of one policy:

> "Policy 12. The County supports utilization of geothermal resources, either with heat pumps, direct applications, or for purposes of generating power. However, such support is conditioned on a determination that the proposed use can be developed in a timely, orderly, and environmentally-sound manner, and that adequate protection of the resource is provided so as to ensure its continued availability and productivity over time." Timeline: none. Funding: none. Personnel: none.

Similarly, two counties mention "**carbon neutral**" in their General Plans: Marin County 2007 (5 mentions) and San Luis Obispo County 2010 (one mention). This compared with 11 county-level CAPs addressing this term (50% of county CAPs), with San Mateo County mentioning this term the most (23 times), and nearly three-times more than the counties with the next most mentions of "carbon neutral" in their CAPs: Butte (7 mentions) and San Francisco (7 mentions). Again, CAPs show greater attention to climate ready terminology.

When comparing mentions to plan scores, we note that term mentions do not correlate neatly with the creation of strong policy language. For example, Marin County's 2007 General Plan scored five points and San Luis Obispo County scored zero points (mentioned the term once but not in a policy). Marin County had three policies that mention "**carbon neutral,**" all of which identified a timeline, funding source, and committed personnel, as seen in the below example:

> "Implementing Program 1.h Promote Resource Conservation. (EN-1.b-f, EN-3.a, EN-3.e-i and EN-3.k) Continue to promote development and construction standards for new and rehabilitated dwellings that encourage resource conservation through materials selection, water conservation, community design, energy efficiency, and the use of renewable energy through the following: c. Evaluate the feasibility of carbon neutral construction for new single-family dwellings." Timeline: Ongoing. Funding: Local resources. Personnel: Community Development Agency.

Marin County's (2007) three policies mentioning "carbon neutral" involved new construction of buildings and carbon neutral transportation technologies.

In comparison to the scantly mentioned term "decarbonization," a total of 57 out of 58 counties mentioned the term "energy"–highlighting the topical representation of energy planning at the

local level and a need for state agencies to align messaging. Below is an example of a Marin County policy with strong language and implementation measures:

> "1.h Promote Resource Conservation. (EN-1.b-f, EN-3.a, EN-3.e-i and EN-3.k) Continue to promote development and construction standards for new and rehabilitated dwellings that encourage resource conservation through materials selection, water conservation, community design, energy efficiency, and the use of renewable energy through the following:
> a. Adopt green building requirements for new single-family and multi-family residential construction projects, additions, and remodels that require compliance with energy efficiency and conservation requirements that exceed State standards. Require verification of these measures.
> b. Consistent with the Countywide Plan, adopt Leadership in Energy and Environmental Design (LEED) Gold certification requirements for development and major remodels of public buildings where feasible.
> c. Evaluate the feasibility of carbon neutral construction for new single-family dwellings.
> d. Continue to enforce the Single-Family Dwelling Energy Efficiency Ordinance that requires new residential projects, additions, and remodels to exceed Title 24 requirements by a minimum of 15%.
> e. Explore a program consistent with AB 811 that provides to homeowners loans repayable through the property tax bill for energy efficiency, water conservation, and renewable energy generation upgrades.
> f. Work with the Marin Housing Authority to provide applicants for rehabilitation loans for upgrading their residences with green materials and energy conserving measures.
> g. Continue to provide free technical assistance to architects, developers, green businesses, homeowners, and other agencies."
> Timeline: Ongoing; Funding: Local resources; Personnel: Community Development Agency

Energy:

County policies generally incorporated one or more of the following approaches: enforcing or encouraging standards above Title 24, promoting energy efficiency programs for residential appliances, and energy conservation. The following is an example of a strong policy with implementation from Placer County 2013:

> "Goal H: To increase the efficiency of energy use in new and existing homes with a concurrent reduction in housing costs for Placer County residents.
> G-1 mPOWER PLACER
> The County shall continue to encourage investments in energy efficiency through the mPower Placer program for commercial and multi-family properties, which provides special assessment financing for energy efficiency and renewable energy projects. The County shall continue to pursue resolution to conflicting directives from the Federal Home Finance Agency to ensure that homeowners have the same opportunities as commercial property owners." Timeline: Ongoing; Funding: General Fund; Personnel: Community Development Resource Agency.

Decarbonization policies frequently referenced reach codes but did not capture state language for technology uptake. We explore the connection between General Plans, CAPs, and municipal reach codes further in the city-level analyses.

Equity-focused Approaches

Many equity-focused policies containing the term "energy" focused on housing programs targeting low-income households. Here's an example from Kings County General Plan (2016) with strong policy language and implementation measures:

> "1.2 Housing Rehabilitation Program: In collaboration with a housing partner, the City will continue providing rehabilitation loans to lower income households, including very-low- and extremely-low-income persons. Initiated in 1988 with CDBG funds, the Housing Rehabilitation Program will provide loans for up to $190,430 for most types of housing repairs, energy conservation improvements, and handicapped accessibility devices." Timeline: Ongoing; Funding: CDBG, HOME, CAL-HOME; Personnel: Community Development Department and Self-Help Enterprises.

Of the 23 count-level CAPs scored, nine counties (40%) clearly showed an equity focus in their policies. This finding suggest that state agencies should continue to provide equity guidance, supportive funding, and reward progress through repeated monitoring of local initiatives if equity-focused goals are to be established and realized.

Example of equity policy from Contra Costa County CAP, 2015:

> "Measure EE-1: Energy Efficiency Retrofits – Residential Buildings
>
> Provide opportunities for residential buildings to become more energy efficient.
>
> Action items:
>
> 3. Increase participation in the existing low-income weatherization program and seek additional program funding.
>
> 4. Identify disadvantaged individuals and households for increased participation in energy efficiency programs."

Policy Strength

Of all the policies examined, 48% used strong language such as "shall" or "will." Butte and San Mateo counties had the highest number of strong policies in their CAPs. Only 4 of the 23 counties had more than 75% of their total policies characterized as strong, indicating a need to support metric-focused policy creation at the local level.

Example of strong policy:

Butte County 2021:

> "4f. Require on-site solar PV systems and/or energy storage for nonresidential buildings
>
> 10,000 square feet or greater."

PV refers to PhotoVoltaic.

Timeline

A majority of the timelines for decarbonization topics in General Plans were "ongoing." For example, Marin County's 2007 General Plan was the only plan to score points for a timeline for "carbon neutral," as each of its three policies included a timeline with a 4-9 year horizon. For example, see:

> "Policy EN-3.k: Evaluate Carbon Neutral Building Incentives. Evaluate the feasibility of incentives and regulations to achieve carbon neutral buildings."

Example of General Plan policy with specific timelines, Butte County 2021:

> "Time Frame: The year by which a strategy should be effective by fiscal year's end. The exact status of a strategy will vary based on its actions, and many strategies will be ongoing through and beyond 2030. An effective strategy is one that will be actively on track to achieve its targeted GHG emission reductions, support adaptation to climate change effects, or achieve long-term resilience. For a strategy to be effective, the necessary programs and efforts should be active, and any infrastructure or other capital improvements should be in place. The effective year is not the end year, as many of the strategies are programs that are intended to remain in effect for the foreseeable future, and so they do not have end dates. Time frames for effectively setting up the strategies are described as follows:
>
> --Immediate
>
> --Near-Term (by 2023)
>
> --Mid-Term (by 2025)
>
> --Long-Term (by 2030)"

Similarly, of all the CAP policies examined, 73% had a timeline or prioritization for implementation. Butte, Santa Barbara, San Diego, and San Francisco counties state specific years for implementation, while others use the short/medium/long-term convention that makes benchmarking policy progress a fuzzy concept.

Example of CAP policy with specific timelines, San Francisco City/County 2021:

> "BO.1-1 By 2021, require newly constructed buildings to be efficient and all-electric with no on-site carbon emissions."

Funding

Reliance on local funding, such as general funds, to meet state-level decarbonization is evident in the few mentions of supporting funding Goals. All three Marin County "carbon neutral" General Plan policies contained a funding source, identifying either the existing budget or local resources. Most of the funding sources listed for "energy" were either the "general fund" or "existing fund." Other funding sources included: grants, Community Development Block Grants, or HOME funds, and permit fees. HOME is the largest federal block grant to state and local governments designed exclusively to create affordable housing for low-income households.

Of the 23 counties with CAPs, only three included funding sources for their policies. No counties have details on funding sources for each policy. Instead, the few that address funding at all provide a list of potential funding sources. Alameda County provided an exemplary funding strategy and list of potential funding sources. San Francisco City/County developed a funding approach to implement their CAP, as shown below.

Example of funding approach, San Francisco City/County CAP 2021:

> "Overall, recommended next steps include:
>
> 1. Create an interdepartmental climate finance working group to assess the economic, social, political, and administrative viability of securing new funding sources.
>
> 2. Develop a detailed cost estimate for implementing CAP actions (beyond high-level estimates in the CAP).
>
> 3. Identify all opportunities to fund CAP strategies from existing funding sources and approved measures.
>
> 4. Assess which CAP strategies are not funded or partially funded to identify funding gaps.
>
> 5. Investigate a new tax (carbon tax, food tax) and/or increase existing taxes (sales tax, property tax) as a major contributor to reducing funding gaps.
>
> 6. Seek out and apply for relevant federal, state, and local grant opportunities which can serve as important seed funding for implementing CAP strategies or other supporting activities such as community engagement or technical analysis."

These findings point to best practices at the local level, but also indicate that there is a need for greater support at the local level for identifying feasible funding opportunities and aligning policies.

Staff and Personnel

For the term "energy" the most common personnel listed in county-level General Plans were community development, planning, public works, housing, and boards of supervisors. For example, Shasta County's "heat pump" policy committed personnel: Department of Resource

Management and Building Division/Department of Housing. Similarly, all three Marin County "carbon neutral" policies contained personnel: Community Development Agency, Marin County Transit District, and Transportation Authority of Marin.

These identified agencies in General Plans are similar to those found in CAPs, but differ slightly from responsible departments in ZEV implementation. For example, about 65% of CAP policies included an assignment to a specific department or agency for implementation, such as community development or public works. These departments are usually listed in an implementation table and not discussed in detail. Notably, Alameda County conducted a detailed assessment of staffing needs for implementing their CAP; see the example below.

Example of CAP section discussing staffing, Alameda County 2014:

> "STAFF TIME FOR CAP IMPLEMENTATION
>
> The successful implementation of the CAP will, in great part, be achieved through voluntary programs that will be managed and overseen by County staff. The emphasis on voluntary programs was a result of feedback from County staff, community members, and local professionals that the CAP should limit the number of mandates imposed on the community. Consequently, many measures require staff time to develop programs, implement outreach campaigns, and oversee policy development such as ordinances. The cumulative staff requirements for each Action Area were assessed, with the results shown in the table below. Since there are many potential synergies in measure implementation (i.e., energy efficiency and solar programs for residences may have joint implementation as the target audience of that suite of measures is the same constituency). Furthermore, as the implementation of many measures only requires staff time (with, for instance, no capital cost requirement), the total staff time requirement and associated cost is aggregated at the level of the Action Area. See Appendix C for more details on the costs and savings analysis. It should be noted that these staff requirements do not necessarily represent additional County hires; the staff time requirements to implement the CAP could potentially be included in an existing staff member's job description."

This emphasis on volunteers to meet decarbonization goals creates policy vulnerability as economic downturns or public health crises may shift the ready supply of able and qualified volunteers. These findings not only indicate where advocates and state agencies should conduct outreach for more meaningful climate readiness capacity building, but also where funding could be aligned with staffing needs to carry out decarbonization policies at the local level.

Decarbonization plan evaluation results for cities

Unlike ZEV policies, decarbonization policies were less discrete, offering room for a greater variety of policy approaches as well as greater difficulty in comparing across approaches. For example, decarbonization could include changing insulation in all public buildings. Or decarbonizing the built environment could include a heat pump rebate program. As a result, city General Plans were not scored. Instead, plan evaluation for city-level General Plans was focused on identifying unique policy approaches. To understand policy strength for decarbonization, we rely on total scores for the terms "**energy**" and "**decarbonization**" in a sample of 17 CAPs

drawn from: the seven cities with the most mentions of "energy" in their city-level General Plan (3 cities with the most mentions in their General Plans lacked a CAP) and the 10 city-level CAPs with the most term mentions of "**energy.**" This CAP scoring resulted in a range from 6-172, with an average score of 48. The three cities with the highest scoring CAPs were San Jose (172), Taft (120) and Sacramento (64).

We also compare these results with the presence of energy efficiency reach codes found in 74 cities (20%). Of the 230 cities with CAPs, 55 also adopted energy efficiency reach codes in 2019 and 2022. Reach codes "reach" beyond state requirements to achieve additional reductions. Thus, the presence of a CAP correlates with adoption of reach codes. For the most common decarbonization terms in General Plans "green building" (occurring in 318/482 city General Plans), "solar" (370), "energy efficiency" (373), and "energy" (413) (Table 2), we also see a strong relation with reach code creation. Of the 318 jurisdictions with city-level General Plans that mention "green building," 193 have CAPs and 69 include reach codes. Of the 370 jurisdictions with city-level General Plans that mention "solar," 206 include CAPs and 69 include reach codes. Of the 373 jurisdictions with city-level General Plans that mention "energy efficiency,", 207 include CAPs and 69 include reach codes. It is not until we consider the full 470 jurisdictions that mention "energy" in their city-level General Plan, that we encompass all 74 jurisdictions that include energy efficiency reach codes. And still, this selection includes 227 jurisdictions with CAPs, and leaves three jurisdictions that create CAPs, but do not address "energy" in their General Plan nor include reach codes. Together, these results do not neatly fit into a Venn diagram of climate readiness policy making. Nor can they be explained by the relatively simplified passage of municipal code in comparison to the more involved creation of a CAP or even more involved creation of a General Plan. Instead, we explain these findings based on the varied approaches taken regionally to decarbonization. Some approaches are better enacted in municipal code, others in CAPs, and still others require robust consensus building and more stringent CEQA review offered through the General Plan process. We explore these concepts in the following sections.

Policy Approaches

Similar to county General Plans, many state policy terms for decarbonization are underrepresented in city General Plans. For example, only one city mentioned the term "**decarbonization**" (Table 2). Relatedly, term mentions do not neatly map onto strong policies. For example, though the City of Port Hueneme (2021) General Plan mentioned the term "**decarbonization**" four times, it was not included in any policies. This finding may hint that state agencies should shift to using terminology that is more policy-relevant and will align better with actionable changes.

Next, we review discrete technology-relevant terms. For example, the term "**heat pump**" is used in eight city General Plans: Waterford 2016 (three mentions), Turlock City 2016 (two mention), Folsom City 2018 (one mention), Lathrop City 2004 (one mention), Los Angeles 2013 (one mention), Port Hueneme City 2021 (one mention), Ukiah city 2016 (one mention). Heat pump policy approaches include increasing community awareness through targeted outreach and engagement and the creation of financial rebate and exchange programs to provide incentives for households to switch to more environmentally friendly models. This term refers to a technology

that is readily implementable, like ZEV charging stations. Yet, while mentioned in city-level General Plans, only two cities included a policy specifically about heat pumps:

Folsom City General Plan 2018: "PFS-23 High-Efficiency or Alternatively-Powered Water Heater Replacement Program: Provide educational material and information on the City's website, as well as through the permit and building department, on the various high-efficiency and alternatively-powered water heat replacement options available to current homeowners considering water heater replacement; develop appropriate financial incentives, working with energy utilities or other partners; and, streamline the permitting process. Replacement water heaters could include high-efficiency natural gas (i.e., tankless), or other alternatively-powered water heating systems that reduce or eliminate natural gas usage such as solar water heating systems, tankless or storage electric water heaters, and electric heat pump systems."

Los Angeles General Plan 2013: "82. Incentives to Conserve Energy: Provide financial rebates and appliance exchanges of old appliances for new energy-saving models. Under the Refrigerator Turn-In and Recycle (RETIRE) program, provide rebates for old refrigerators and freezers. For low-income qualifying households, provide a program where residents can exchange older refrigerators with new more energy efficient models. Rebates also exist for Energy Star Windows, Cool Roofs, Room and Central Air Conditioners, Heat Pumps, Whole House Fans and Variable/Multi-Speed Pool Pumps and Motors. For a limited time, incentives of up to $8,000 are available through Southern California Gas Company and Energy Upgrade California for LADWP customers who conduct whole home energy efficiency retrofits. Distribute Compact Fluorescent Light Bulbs (CFLs). Disseminate information and encourage participation in rebate and incentive programs offered by other agencies, including the Southern California Gas Company and the South Coast Air Quality Management District." Timeline: none. Funding: LADWP Public Benefit Program. Personnel: LADWP, Southern California Gas Company.

This compares to 75 of the 230 CAPs which address "**heat pump**" policy. As in previous sections, CAPs offer more climate ready policy coverage.

Similar to the above, the term "**reach code**" is mentioned in only three city General Plans though 73 cities adopted energy efficiency reach codes in the 2019 or 2022 cycles. Reach code policy approaches include adopting reach codes focused on promoting housing development and exceeding minimum standards for charging spaces and infrastructure. As an example, the City of Port Hueneme (2021) mentioned "**reach code**" twice and included one policy with a specific timeline, but has not adopted a ZEV nor energy efficiency reach code according to the Statewide Reach Codes Tracking Program. The General Plan policy relating to the City of Port Hueneme reads:

> "4.1 Policy CAP 2-1: Increase electric/alternative fuel vehicle and equipment adoption to 10% by 2030, and 15% by 2045. Action Number CAP 2-1.1: Adopt EV Charging Reach Code for Commercial and Multifamily Buildings that require all new commercial and multifamily buildings to exceed minimum CALGreen standards for "EV Ready" charging spaces and infrastructure." Timeline: Anticipated Reduction (MT CO2e) - 2030: 3,555; 2045: 4,635. Funding: none. Personnel: none.

Similarly, the City of Arcata 2019 General Plan mentioned "**reach code**" four times and had one policy with strong language and an implementation plan. Notably, Arcata has a CAP, but has not committed to a municipal reach code:

> "Implementation Measure 24: The City will Evaluate the economic impact on the feasibility of housing development resulting from the REACH Code. Prior to adoption of a REACH Code, the City must demonstrate implementation of the code will be cost effective to the end users. There is no requirement to evaluate whether the extended energy code affects housing development. Action Required: Evaluate the impact on financial feasibility of housing development using a variety of methods, including pro forma for typical project, pro forma for actual projects to the extent available, and effect on housing production if detectable. Result: Determination whether REACH Code is a constraint to housing production and measures to remove or limit the impact of the additional energy code requirements." Timeline: December 2021. Funding: General Fund. Personnel: Community Development Department.

The City of San Luis Obispo 2020 mentioned "reach code" twice but did not provide any policies with the term, yet has adopted a municipal reach code. Such variance in term mentions, the creation of strong policy, and adoption of reach codes acknowledge that the climate readiness planning landscape is varied with intentions and potential lags in policy enactment and implementation.

The same finding is true for "microgrid" policies with only two cities addressing this term in their General Plans. Both jurisdictions provided exploratory policy language without including implementation actions. See, for example, the City of Lake Forest (2020):

> "Goal PF-6 Energy Management: A community with adequate power, provided through economically and environmentally sustainable means. Policy PF-6.6 Public-Private Partnerships. Investigate the opportunity to engage in public-private partnerships on energy efficiency, energy storage, and microgrid development to achieve cost savings, reduce energy use, and improve energy reliability." Timeline: none. Funding: none. Personnel: none.

and the City of Morro Bay General Plan (2021):

> "GOAL C-6: Energy available to Morro Bay residences, businesses, and public buildings is renewable and sustainable. POLICY C-6.4: Partnerships. Support public/private partnerships to implement energy efficiency, energy storage, and microgrid development to achieve cost savings, reduce energy use, and improve energy reliability." Timeline: none. Funding: none. Personnel: none.

This compares to the 45 city-level CAPs that address "**microgrid**," demonstrating the forward-thinking efforts in CAPs to move climate readiness policy less conservatively than General Plans. Microgrid policy approaches focused on expanding and building upon existing public and private partnerships to advance microgrid development while also promoting cost savings and energy reliability. As discussed in the literature review, such policy discussions are complicated

by the financial and regulatory landscape, but term mentions in plans indicate growing local interest that can be matched by supportive state policies.

Like the above terms, "**carbon neutral**" is also under-represented in city General Plans with only four cities mentioning the term: Hermosa Beach 2017, Port Hueneme 2021, San Mateo 2015, Santa Clara 2010. None provided policies. This compares to 92 city-level CAPs which mention "**carbon neutral.**"

Other approaches focused on siting low-carbon energy production. For example, the City of Hayward General Plan (2014) offered the following goal:

> "GOAL CS-5 Prepare the Hayward community for future emergencies and disasters to minimize property damage, protect and save lives, and recover as a resilient community. CS-5.7 Energy Assurance Plan The City shall develop, maintain, and implement a citywide Energy Assurance Plan that documents the energy needs of critical City and community facilities and functions, establishes goals and actions to increase energy resiliency during disasters, and prioritizes the use of renewable energy or other sustainable technologies to reduce dependency on the grid during power outages."

Adelanto City, 2014: "GOAL PF 8 Sustainable Public Facilities. Policy PF 8.1 Encourage new municipal construction to achieve Leadership in Energy & Environmental Design (LEED) certification and all existing municipal facilities to achieve LEED certification wherever feasible."

Hemet City, 2012:

> "GOAL CSI-5 Facilitate the provision and maintenance of adequate systems to provide and conserve natural gas, electricity, and telecommunications systems.
>
> CSI-5.8 Agency Coordination: Provide early notification to utility companies regarding new development to ensure that services will be available in a timely manner, and encourage developers of large scale or complex developments to contact local utilities early in the process to insure (sic, ensure) that projected energy and utility demands will be able to be accommodated."

Hayward City, 2014:

> "GOAL NR-4 Reduce energy consumption through increased production and use of renewable energy, sustainable energy purchasing, and improved energy efficiency.
>
> NR-4.13 Energy Use Data: The City shall consider requiring disclosure of energy use and/or an energy rating for single family homes, multifamily properties, and commercial buildings at certain points or thresholds. The City shall encourage residents to voluntarily share their energy use data and/or ratings with the City as part of collaborative efficiency efforts."

Cathedral City, 2009:

> "Policy 1.C. The City shall ensure that new and rehabilitated housing is efficient in its use of energy and natural resources. Program 1.C.2 A list of known incentives for energy and water conservation measures shall be maintained by the Community Development Department and made available for developers and property owners at the City's reception desk."

Dublin City, 2017:

> "12.3.2 WATER CONSERVATION AND EFFICIENCY IN EXISTING DEVELOPMENT A. Guiding Policy 1 . Increase water conservation efforts and strive to maximize water use efficiency in existing residential, commercial, and industrial buildings and grounds. 2 . Support DSRSD in extending recycled water service to established areas of Dublin . **B. Implementing Policies 3.** Continue collaborative efforts and programs with outside organizations such as the California Youth Energy Services (CYES), which trains and employs local youth to provide resource conservation audits and water/energy retrofits to local residences ("Green Home Audits")."

Unique approaches were also noted in CAPs as seen below.

City of Arroyo Grande CAP 2013:

> "TL-7.2: Develop a form-based zoning code for the central business district/downtown. Form-based codes emphasize building form rather than use. This increases flexibility for a variety of complementary uses to be permitted in the same area, and the potential for mixed-use development, which helps to reduce vehicle miles traveled."

Term mentions and lack of corresponding strong policy language or enacted municipal code can help redirect advocacy and state agency messaging to better align with local policy discussions. Indeed, the term "decarbonization" encompasses a wide array of policy and technology interventions that will vary from region to region. In general, we find that Northern California jurisdictions discuss "**heat pumps**" more often than southern jurisdictions though heat pumps are an appropriate technology outside of colder climes. Conversely, "**whole house fan**" is a term mentioned in 14 city General Plans for jurisdictions that can best make use of coastal and Delta breezes. As a last example, 79 out of 482 cities and 37 out of 58 counties mention **"biomass"** in their General Plans. Most of these communities are located in forested regions of the state, and seek to use forestry biomass for low-carbon energy and heating. Unlike ZEV policy support, decarbonization policy supports will need to employ a region-specific approach that encourages and introduces relevant and appropriate technologies based on local climate and available resources.

Equity-focused Approaches

Only one city's General Plan contained an explicit equity-focused decarbonization policy. The City of Los Angeles' specifically supports qualifying low-income households with rebates for purchasing and installing various systems that aim to decarbonize the built environment. Similarly, Hayward City included a suite of policies focused on equity and decarbonization.

The Los Angeles General Plan (2013) equity-focused decarbonization policy is as follows: “82. Incentives to Conserve Energy: Provide financial rebates and appliance exchanges of old appliances for new energy-saving models. Under the Refrigerator Turn-In and Recycle (RETIRE) program, provide rebates for old refrigerators and freezers. For low-income qualifying households, provide a program where residents can exchange older refrigerators with new more energy efficient models. Rebates also exist for Energy Star Windows, Cool Roofs, Room and Central Air Conditioners, Heat Pumps, Whole House Fans and Variable/Multi-Speed Pool Pumps and Motors. For a limited time, incentives of up to $8,000 are available through Southern California Gas Company and Energy Upgrade California for LADWP customers who conduct whole home energy efficiency retrofits. Distribute Compact Fluorescent Light Bulbs (CFLs). Disseminate information and encourage participation in rebate and incentive programs offered by other agencies, including the Southern California Gas Company and the South Coast Air Quality Management District.”

Hayward City, 2014:

“GOAL NR-2. Improve the health and sustainability of the community through continued local efforts to improve regional air quality, reduce greenhouse gas emissions, and reduce community exposure to health risks associated with toxic air contaminants and fine particulate matter. NR-2.6 Greenhouse Gas Reduction in New Development. The City shall reduce potential greenhouse gas emissions by discouraging new development that is primarily dependent on the private automobile; promoting infill development and/or new development that is compact, mixed use, pedestrian friendly, and transit oriented; promoting energy-efficient building design and site planning; and improving the regional jobs/housing balance ratio.”

Hayward City, 2014:

“GOAL HQL-9 Build a foundation for community resilience to future threats and challenges to help ensure the City of Hayward will be able to respond and recover as quickly as possible to such threats and challenges. HQL-9.6 Energy Resiliency The City shall continue to encourage residents and businesses to use less gasoline for transportation, and improve energy efficiency in and renewable energy generation from buildings and industry processes to reduce impacts from rising oil and energy prices.”

Hayward City, 2014:

“Housing Element Implementation Program 1. Housing Rehabilitation Loan Program (HRLP). The City shall continue to provide below market-rate rehabilitation loans to qualified lower-income homeowners to make repairs (costing more than $5,000) to correct major health and safety deficiencies and make needed accessibility modifications. The City shall disseminate information to homeowners who participate in the Housing Rehabilitation Loan Program regarding rehabilitation standards, preventative maintenance, and energy conservation measures.”

Hayward City, 2014:

> "Housing Element Implementation Program 2. Minor Home Repair Grant (MHRP). The City shall continue to provide rehabilitation grants up to $5,000 to qualified lower-income elderly and/or disabled homeowners to make minor home repairs in order to address health and safety problems, correct code deficiencies, and improve the outward appearance of homes. Priority will be given to work that corrects health and safety issues, and to accessibility modifications for people who have disabilities. The City shall disseminate information to homeowners who participate in the Housing Rehabilitation Loan Program regarding rehabilitation standards, preventative maintenance, and energy conservation measures."

Six of the 17 cities with scored CAPs clearly showed an equity focus in their policies.

Example of equity policy, City of Pleasanton 2022:

> "P2. Existing Building Electrification Plan
>
> Equitable implementation will represent property owners and tenants with lower incomes in all implementation phases, have protections in place to avoid increased costs and other negative impacts, and support local installers."

In addition, the following table (Table 9 from the City of Pleasanton 2022 CAP) includes the following scoring:

Table 9. CAP 2.0 focus areas for equitable implementation and applicable actions

	Fair distribution of benefits over time	Financial burden	Community engagement
P2. Existing Building Electrification Plan	●	●	●
P5. Create and implement a Zero Emissions Vehicle (ZEV) Infrastructure Plan	●	●	●
P10. Increase transit ridership	●		
S2. Community energy efficiency upgrades		●	●
P15. Water efficiency and retrofits		●	●
S9. Wildfire preparation, prevention, and education	●		●

Policy Strength

Of all the policies examined across the sampled 17 CAPs, 56% used strong language such as "shall" or "will." Redondo Beach and San Jose had the highest number of strong policies. Only seven of the 17 cities had more than 75% of their total policies characterized as strong indicating a need for additional guidance in crafting actionable planning policies.

Example of strong policy, City of Rancho Cucamonga CAP 2021:

> "Strategy 3.1: Zero Net Electricity for New Residential Buildings
>
> Measure(s): Adopt an ordinance or update development code requiring that new single- and multi-family residential development to meet a standard of zero net energy (i.e., on-site generation of energy is equal to on-site energy consumption)."

As previously mentioned, only two cities, Arcata and Port Hueneme, listed policies related to reach codes in their General Plans. Arcata's 2019 General Plan had a particular strong policy, earning a score of 5. The policy focused on exploring the impact of the reach code on encouraging or constraining housing development. The policy contained strong language, timeline (December 2021), funding source (general fund), and personnel (community development department). For reference, here is the identified policy:

> Implementation Measure 24: The City will Evaluate the economic impact on the feasibility of housing development resulting from the REACH Code. Prior to adoption of a REACH Code, the City must demonstrate implementation of the code will be cost effective to the end users. There is no requirement to evaluate whether the extended energy code affects housing development. Action Required: Evaluate the impact on financial feasibility of housing development using a variety of methods, including pro forma for typical project, pro forma for actual projects to the extent available, and effect on housing production if detectable. Result: Determination whether REACH Code is a constraint to housing production and measures to remove or limit the impact of the additional energy code requirements.

Similarly, only two city General Plans, Folsom 2018 and Los Angeles 2013, contained policies related to heat pumps. Both policies from each city were equally strong, both earning a total score of four. Folsom's policy focuses on community outreach and education in regard to the city's high-efficiency or alternative-powered water heater replacement program. Contrastingly, Los Angeles' policy focuses instead on the provision of financial rebates and appliances exchanges for households that shift from older appliances to new energy-saving models. The two respective policies are listed below:

Folsom City 2018:

> "PFS-23 High-Efficiency or Alternatively-Powered Water Heater Replacement Program: Provide educational material and information on the City's website, as well as through the permit and building department, on the various high-efficiency and alternatively-powered water heat replacement options available to current homeowners considering water heater replacement; develop appropriate financial incentives, working with energy

utilities or other partners; and, streamline the permitting process. Replacement water heaters could include high-efficiency natural gas (i.e., tankless), or other alternatively-powered water heating systems that reduce or eliminate natural gas usage such as solar water heating systems, tankless or storage electric water heaters, and electric heat pump systems."

Los Angeles 2013:

> "82. Incentives to Conserve Energy: Provide financial rebates and appliance exchanges of old appliances for new energy-saving models. Under the Refrigerator Turn-In and Recycle (RETIRE) program, provide rebates for old refrigerators and freezers. For low-income qualifying households, provide a program where residents can exchange older refrigerators with new more energy efficient models. Rebates also exist for Energy Star Windows, Cool Roofs, Room and Central Air Conditioners, Heat Pumps, Whole House Fans and Variable/Multi-Speed Pool Pumps and Motors. For a limited time, incentives of up to $8,000 are available through Southern California Gas Company and Energy Upgrade California for LADWP customers who conduct whole home energy efficiency retrofits. Distribute Compact Fluorescent Light Bulbs (CFLs). Disseminate information and encourage participation in rebate and incentive programs offered by other agencies, including the Southern California Gas Company and the South Coast Air Quality Management District."

No cities had policies related to decarbonization or carbon neutrality in their General Plans. No city policies focused on microgrids (i.e. policies from the Cities of Morro Bay and Lake Forest) were strong, each policy only earning a score of one. These findings help make the argument for state enabling legislation that is better aligned with current local policy discussions. For example, state agencies can review plans to understand where and how local jurisdictions are addressing building decarbonization in order to build onto ongoing momentum at the local level.

Timeline

Very few policies in General Plans included time-sensitive goals related to building decarbonization, microgrids, carbon neutrality, or reach codes; furthermore, even fewer cities include timelines related to the existing policies. Only one city, Folsom, provided a timeline for its heat pump policy, and that was "continuous" with the General Plan horizon. Similarly, of all the policies examined in the 17 sampled city-level CAPs, 59% included a timeline or prioritization for implementation. Stockton has an extensive analysis of costs and benefits that support some discussion on financing; though unique, it is now dated as the CAP is from 2014. Similarly, Taft and Rancho Cucamonga have performance metrics at regular intervals but the implementation timeline to support the measures is not clear. These vague policy benchmarks make assessments of plans and planned implementation difficult.

Funding

Arcata's "reach code" General Plan policy is the only policy that listed a funding source, the general fund. No other policies mentioned funding for identified decarbonization, heat pump, microgrid, and carbon neutral policies. Similarly, of the 17 sample cities with CAPs, only six

included funding sources for their policies. Only a few have details on funding sources for each policy and most just provide a list of potential funding sources. Of note, San Jose includes an extensive discussion of funding options but does not directly connect them to implementation.

Example of funding approach, City of Dublin 2020 (summarized from Table 8-1):

> "Measure EE-1: Achieve All-Electric New Building
>
> Staff will implement and enforce electric preferred building codes. All electric buildings may create construction and occupant operations cost savings. EBCE will provide $10,000 in 2020 to offset costs for staff time to develop electric preferred building codes for possible adoption."

Together, this lack of identified funding and timelines for benchmarking progress indicate local policy will but confusion over feasible timelines and available funding to support policy realization.

Staff and Personnel

About 59% of the sampled city-level CAP policies included an assignment to a specific department or agency for implementation, such as community development or public works. These are usually listed in an implementation table and not discussed in detail. Similarly, the cities of Folsom City and Los Angeles list personnel for their heat pump policies as community development department and Los Angeles Department of Water and Power and Southern California Gas Company, respectively. Arcata lists personnel for their reach code policy as the community development department. The reliance on the community development department for implementation of decarbonization policies indicates that messaging, support and outreach should make staff contacts with community development departments across California a top priority in order to realize ambitious state-level goals.

Vehicle Miles Traveled - plan evaluation results for counties

Methods

Similar to previous plan evaluation sections, plans were scored based on policies that addressed VMT and compact development (Table 3). If a policy's purpose is to comply with standards that the jurisdiction already must meet, then the strength is a 0. For example:

> Mono County 2020 - Action 23.A.1.d. Comply with Mammoth Air Basin SIP requirements for vehicle miles traveled – see the Regional Transportation Plan in the Circulation Element and RTP Objective 7.C.2.

A stronger approach would be specific language detailing how the jurisdiction plans to meet or exceed the standard.

As with previous sections, all county-level CAPs were scored, and a subset of city CAPs were scored based on top term mentions in both general plans and CAPs. This methodology allows us to see where and how general plans and CAPs are aligned.

Table 3. City and county General Plan VMT-related term mentions

Term	# of City General Plans that mention search term (out of 482)	# of County General Plans that mention search term (out of 58)
Vehicle miles traveled	244	47
Compact development	146	34

Policy Approaches

Policy approaches to VMT reductions include promoting dense, compact, and infill development, the construction of complete streets, establishing Transportation Demand Management (TMD) systems, working with employers to provide incentives for the use of alternative transportation methods, and increasing public transit safety and efficiency. The majority of VMT policies also focus on the production of co-benefits, such as improving local air quality, public health and safety, reducing greenhouse gas emissions, and promoting economic development. Recognizing such values can help state agencies align state and local motivations for policy change.

Policy example of promoting dense, compact, and infill development:

El Dorado County, 2019:

> "MEASURE LU-Q Promote Infill Development: The program shall be linked to land-use, housing, air quality, transportation and circulation strategies that support

development within existing communities, reduce vehicle miles traveled, increase energy efficiency, and encourage the development of affordable housing."

Policy example of promoting complete street construction:

"**Sacramento County, 2017**: GOAL: Provide mobility for current and future residents of Sacramento County through complete streets and through a balanced and interconnected transportation system which includes all modes of travel - automobile, transit, pedestrian and bicycling. CI-5. Land use and transportation planning and development should be cohesive, mutually supportive, and complement the objective of reducing per capita vehicle miles traveled (VMT)."

Policy example of establishing Transportation Demand Management systems:

Imperial County, 2008:

"6. Transportation Demand Management

a. Objective. The transportation system envisioned for the County is a balanced system, incorporating the needs of all groups, as well as making provisions for many Planning & Development Services Department (County of Imperial) Circulation and Scenic Highways Element (Revised 3-8-07) (Revised 01-29-08) different modes of transportation. To accomplish this, it is necessary to implement policies encouraging a range of transportation opportunities while reducing the dependency upon automobiles.

b. Policies The County shall encourage the reduction of vehicle miles, reduction of the total number of daily peak hour vehicular trips, and provide better utilization of the circulation system through development and implementation of Transportation Demand Management and Transportation Systems

Management programs. These may include implementation of mandatory peak hour trip reduction, requirements for staggered work hours, telecommunications, increased development of employment centers where transit usage is highly viable, encouraging ride sharing in the public and private sector, provision for park and ride facilities adjacent to the regional transportation system, preparation of Traffic Management Plans and provision for transit subsidies. The County in its role as a major employer shall commit to the use of trip reduction and vehicle miles traveled reduction strategies identified by Transportation Demand Management and Transportation Systems Management programs."

Policy example of employer incentives to reduce VMT:

Sutter County, 2011:

"R2-T1 Employment Based Trip and VMT Reduction. Implementation of this measure would require adopting a voluntary trip reduction ordinance that promotes commuter-choice programs, employer transportation management, guaranteed ride home programs

and commuter assistance and outreach type programs intended to reduce commuter vehicle miles traveled."

Policy example of increasing public transit safety and efficiency:

San Diego County, 2020:

"GOAL M-5 Safe and Efficient Multi-Modal Transportation System. A multi-modal transportation system that provides for the safe, accessible, convenient, and efficient movement of people and goods within the unincorporated County.

Policies M-5.1 Regional Coordination. Coordinate with regional planning agencies, transit agencies, and adjacent jurisdictions to provide a transportation system with the following: ■ Sufficient capacity consistent with the County General Plan Land Use Map ■ Travel choices, including multiple routes and modes of travel to provide the opportunity for reducing vehicle miles traveled ■ Facilities sited and designed to be compatible with the differing scales, intensities, and characteristics of the unincorporated communities while still accommodating regional, community, and neighborhood travel demands ■ Maximized efficiency to enhance connectivity between different modes of travel

Implementation 4.1.1.A Regional Transportation Plan (RTP). Coordinate with SANDAG and adjacent cities during updates to the RTP to identify a transportation network that maximizes efficiency, enhances connectivity between different modes of travel, minimizes impacts when locating new freeways and State highways, and provides regional roads are properly planned, sited, and designed.

Implementation 4.1.1.B RTP Implementation. Coordinate with Caltrans and adjacent jurisdictions during planning and design for improvements to the freeway and State highway network. Caltrans is the design agency to finalize alignment, design, and construct freeways and State highways based on projects and funding priorities identified by the RTP.

Implementation 4.1.1.C Regional Transportation Funding. Coordinate with SANDAG for the County to receive its fair share of TransNet funds for transportation facilities in the unincorporated County."

Example of policy co-benefits:

Mono County, 2017:

"Objective 3.A. Improve the health of all people by incorporating health considerations into decision-making across sectors and policy areas consistent with the Health in All Policies initiative. Policy 3.A.1. Build relationships, work collaboratively with the community, and implement procedures that make health a priority for the community. Action 3.A.1.a. At all levels of decision making and policy development, raise awareness of the connections between General Plan policies and community health, including, but not limited to, the following: • Conservation/Open Space Element: Protects air quality,

establishes resource efficiency policies to reduce energy use and vehicle miles traveled, and protects open space and agricultural lands."

Amador County, 2016:

"Goal C-9: Maintain and improve air quality. Policy C-9.1: Encourage development of commercial or industrial businesses which provide jobs for county residents in order to reduce vehicle miles traveled for residents who must drive elsewhere for employment."

Merced County, 2013:

"Goal ED-1 Support and promote growth and diversification of the County's economy.

Policy ED-1.5: Infrastructure Investment (MPSP/FB) Direct infrastructure investments to infill areas and other areas with the greatest potential for economic growth in an effort to obtain the greatest pay-off in terms of economic development. This will include taking advantage of existing infrastructure such as Interstate 5, State Route 99, UC Merced, Castle Commerce Center and Airport, as well as planned infrastructure such as the California High-Speed Rail. Encourage the grouping of related and complementary activities and discourage isolated facilities, except when necessary based upon their locational or operational characteristics, in order to minimize vehicle miles traveled (VMT), especially for diesel trucks."

San Bernardino, 2020:

"Goal NR-1 Air Quality Air quality that promotes health and wellness of residents in San Bernardino County through improvements in locally-generated emissions. Policy NR-1.1 Land use. We promote compact and transit-oriented development countywide and regulate the types and locations of development in unincorporated areas to minimize vehicle miles traveled and greenhouse gas emissions."

Equity-focused Approaches

Two counties included an equity-focused approach to VMT reductions in the General Plans, Sacramento County and Yolo County. Both policies focused on prioritizing Environmental Justice Communities and tribal groups in the development of infrastructure and land use design necessary to reduce VMT. The Yolo County policy utilizes particularly strong equity language, using terms such as "inclusion," "fair treatment," and "equitable outcomes" within their policy. The policies are listed below:

Sacramento County, 2017:

"Objective: Coordinate private development with the provision of adequate public facilities and services. LU-68. Give the highest priority for public funding to projects that facilitate and encourage infill, reuse, redevelopment and rehabilitation, mixed-use development, particularly in Environmental Justice Communities, and that will result in per-person vehicle miles traveled lower than the County average, and the lowest priority

> for projects that do not comply with public facilities Master Plan phasing sequences (Sacramento County General Plan, 2017)."

Yolo County, 2009:

> "GOAL LU-6 Intra-County Coordination. Ensure inclusion, fair treatment and equitable outcomes for the County in land use planning matters involving other local government entities. Policy LU-6.12 Coordinate with and encourage the Rumsey Band of Wintun Indians to prepare, adopt, and implement a long-range tribal General Plan for tribal trust land and meet or exceed a vehicle miles traveled (VMT) threshold of 44 miles generated per household per weekday."

Similarly, only four counties (17% of the 23 counties with CAPs) clearly showed an equity focus in their CAP VMT policies. San Mateo and San Francisco gave this significant attention.

Example of equity policy:

San Mateo County 2022:

> "T-3.4 PROGRAMS TO FACILITATE TRANSPORTATION EQUITY Facilitate transportation equity through targeted provision of programs and infrastructure that support equity priority communities including but not limited to people of color, low-income households, community members with limited English proficiency to take transit, walk, bike, and use ride- or car-share. "

San Francisco City/County 2021:

"TLU.6-7 Design public space and the transportation system to advance disability justice by codeveloping plans and projects with diverse elements of the disability community and understanding their needs before designs are complete."

Results

The total score for county general plans ranged from 0-40, with 24 counties scoring a 0. Counties with high scores generally are located in the northern section of the San Joaquin Valley, perhaps indicating policy diffusion from the capital. For General Plans, San Luis Obispo County earned the highest total VMT policy score with a score of 40, followed by Tuolumne County with 26 total points, and Riverside County with 23 points.

Similar to previous sections, CAPs scored higher, demonstrating more focused effort in CAPs to address VMT. Total VMT scores in county-level CAPs ranged from 0-126, with an average score of 36. The three highest scoring county-level CAPs were San Diego (126), Butte (109), and Alameda (89). As with other plan evaluations, there was not a neat alignment between high-scoring General Plans and high-scoring CAPs indicating policy lag or local favoring of alternate planning vehicles depending on the goals.

The top scoring county General Plan for VMT policies was San Luis Obispo, which contained 11 policies covering transportation demand management, land use designations and site amenities,

and transit. Below is an example of the strong policy with a specific implementation strategy from San Luis Obispo 2010:

> "Policy AQ 1.2 Reduce vehicle miles traveled: Require projects subject to discretionary review to minimize additional vehicle travel.
>
> Implementation Strategy AQ 1.2.1 VMT reduction strategies: Strategies to reduce new demand for vehicle travel may include, but are not limited to, minimum densities along transit corridors, Transportation Demand Management, and alternative transportation infrastructure as follows:
>
> a. All new development in the Residential Multifamily (RMF) land use category located within 1/2 mile of a transit node, existing bus route, or park and ride facility with regularly scheduled, daily service should have a minimum density of 15 dwelling units per acre.
> b. New multi-family projects subject to discretionary review should include Transportation Demand Management (TDM) measures, such as reduced parking for affordable, workforce, or senior housing projects, subsidized public transportation passes, car sharing, vanpools, shuttles, or ride-matching programs, based on site-specific review.
> c. New or expanded commercial, industrial, public, or mixed- use projects with 25 employees or more should provide TDM programs such as parking cash-out, subsidized transit passes, ridesharing incentives, vanpools, employee showers, and bicycle parking and storage facilities.
> d. Install adequate and secure bicycle racks and storage facilities at a ratio of 1 per every 10 vehicle spaces in new commercial and public buildings with a corresponding reduction in required automobile parking spaces. Showers and changing facilities should also be encouraged.
> e. Incorporate design features and infrastructure into new projects that enable access by transit, bicycling, and walking.
> f. Establish minimum residential densities on appropriate sites in urban areas where resources are available.
> g. Rezone land to Residential Multi-Family (RMF) in existing urban areas where resources and services are available and expanded.
> h. Reduce parking requirements in areas such as central business districts where a variety of uses and services are planned in close proximity to each other and to transit. Work with communities and developers to fund additional parking where needed, for example, through in-lieu parking fee programs."
> Timeline: 2010; Funding: Department Budget; Personnel: Planning and Building.

The second highest scoring county General Plan for VMT policies was Tuolumne County with six policies covering alternative transportation, traffic impact fees, and transit-oriented development. The following is the policy on traffic impact fees from Tuolumne County 2013:

> "2.B.s Traffic Impact Fees to Reduce Offset Vehicle Miles Traveled Where appropriate, consider developing a traffic impact fee program whereby all development would

contribute payment of fees for construction of pedestrian facilities to reduce vehicle miles traveled consistent with Senate Bill 743. (BOSPC)"

Timeline: Ongoing; Funding: General Fund, Road Fund; Personnel: Board of Supervisors, Community Resources Agency.

Riverside was the third highest scoring county General Plan with nine VMT policies covering workplace strategies to reduce VMT, construction equipment and fleets, transit-oriented development, and adoption and implementation of a climate action plan. Below is an example of a policy from Riverside 2015 with specific action items:

"AQ 22.1 The County shall implement programs and requirements to achieve the following objectives related to reducing greenhouse gas emissions associated with transportation (AI 110, 111, 120, 146, 147): a. Reduce vehicle miles traveled by providing or requiring expanded multi-modal facilities and services that provide transportation alternatives, such as transit, bicycle and pedestrian modes. b. Reduce vehicle miles traveled by facilitating an increase in transit options. In particular, coordinate with adjacent municipalities, transit providers and regional transportation planning agencies to develop mutual policies and funding mechanisms to increase the use of alternative transportation.

Action Item 110: Participate in the development and update of the regional air quality management plans required under Federal and State law.

Action Item 111: Develop Air Quality policies for the South Coast, Salton Sea, and Mojave Air Basins. (Coordinate policy efforts with the following agencies; Environmental Protection Agency (EPA), South Coast Air Quality Management District (SCAQMD), Southern California Association of Governments (SCAG), Western Riverside Council of Governments (WRCOG), Coachella Valley Association of Governments (CVAG), and the Mojave Desert Air Quality Management District (MDAQMD).

Action Item 120: Develop stricter control measures for the length of time commercial trucks may be idled, in collaboration with the EPA, SCAQMD and MDAQMD.

Action Item 146: Adopt and implement a Climate Action Plan (CAP) and incorporate the included Implementation Measures (IMs) into the General Plan as an Appendix. The CAP includes a variety of IMs set forth by the Federal and State governments (known as Reduction Measures, A.K.A. "R-measures") Reduction Measures required by Federal and State law are shown as "R-1" Measures and are already required of all development applications and municipal operations. The CAP expands further on this practice and incorporates local Reduction Measures or R-2 Measures. The list of R2 measures divided into eight major categories, which are transportation, land use, energy use, water and biota use, waste generation, municipal (i.e., County) operations and existing uses not otherwise covered. efficiency the County can incorporate into the new development projects are to achieve an AB 32 compliant reduction target of 15% below existing emissions levels by the year 2020.

Action Item 147: Adopt, implement, and update a set of community protocol implementation and design measures to aid in the reduction of GHG emissions from new development authorized under the Land Use Element of the General Plan. The CAP includes Appendix F (Screening Tables) which incorporates the R-1, R-2, and the voluntary R-3 Reduction Measures from the CAP along with standardized reduction values (or points) that are associated with each set of reduction measures. In order for new development projects to achieve compliance with the County's CAP and therefore with the County's General Plan, each project must achieve a minimum of 100 points for their project or provide an independent GHG emissions reduction analysis with equivalent reductions in GHG emissions."

Timeline: Ongoing; Funding: None; Personnel: Transportation and Land Management Agency-Planning Department.

Policy Strength

Of all the policies examined in CAPs, 52% used strong language such as "shall" or "will." San Francisco and Butte counties had the highest number of strong policies. Six of the 23 counties had more than 75% of their total policies characterized as strong.

Example of strong CAP VMT policy:

San Diego County 2018:

"T-2.4: Shared and Reduced Parking in New Non-Residential Development

MEASURE SUMMARY

Require shared and reduced parking for all new nonresidential development to reduce new commute Vehicle Miles Traveled (VMT) by 10% by 2030"

*includes the following statement in the description: "This measure is a requirement."

Similarly, out of Riverside County's nine VMT policies, six used strong policy language, the most out of all the counties. The following is a policy with specific, strong language with its associated action item:

"AQ 29.1 The County shall implement programs and requirements to achieve the following Objectives related to reducing greenhouse gas emissions from County transportation, such as fleet composition, construction equipment, employee commuting and travel on County business (AI 146): c. Reduce total vehicle miles traveled by County employees, both commuting to work sites and travel for the conduction of County activities.

Action Item 146: Adopt and implement a Climate Action Plan (CAP) and incorporate the included Implementation Measures (IMs) into the General Plan as an Appendix. The CAP includes a variety of IMs set forth by the Federal and State governments (known as Reduction Measures, A.K.A. "R-measures") Reduction Measures required by Federal

and State law are shown as "R-1" Measures and are already required of all development applications and municipal operations. The CAP expands further on this practice and incorporates local Reduction Measures or R-2 Measures. The list of R2 measures divided into eight major categories, which are transportation, land use, energy use, water and biota use, waste generation, municipal (i.e., County) operations and existing uses not otherwise covered. efficiency the County can incorporate into the new development projects are to achieve an AB 32 compliant reduction target of 15% below existing emissions levels by the year 2020."

Another example of a strong policy with specific directives:

> "**El Dorado County 2019** - MEASURE LU-Q Promote Infill Development: The program shall be linked to land-use, housing, air quality, transportation and circulation strategies that support development within existing communities, reduce vehicle miles traveled, increase energy efficiency, and encourage the development of affordable housing. The program shall include, but not be limited to:
>
> a) Adopt criteria to be used within existing communities with developed areas currently capable of being served by public water, recycled water, and public or private sewer;
> b) Provide incentives for residential and commercial infill development including financial incentives for pedestrian-oriented and transit-friendly design features;
> c) Amend the zoning code to include a new Traditional Neighborhood Design zone within Commercial and Multi-Family Land Uses;
> d) Support medium and high density residential or mixed use development along commercial and transportation corridors;
> e) Develop and utilize approved standard plan types (i.e. zero-lot line, duplex with carriage house unit over garage, z-lot, bungalow, etc.) to streamline the approval process for infill projects. Standard plans shall include various housing and commercial types and styles. Standard plan(s) approved as part of a project shall be compatible with neighboring residential or commercial district patterns for which the development is located; and
> f) Develop or update, as considered necessary, applicable community plans, specific plans and design guidelines to incorporate pedestrian-oriented, transit-friendly, and or energy efficient configurations design as primary goals."

Timeline

Most counties listed "ongoing" for their VMT policies. For example, the San Luis Obispo 2010 General Plan included a timeframe to start but no duration:

> "Implementation Strategy AQ 4.4.3 Reduce GHG emissions from community-wide transportation activities: Reduce greenhouse gas emissions resulting from communitywide transportation activities through expanded use of alternative fuel vehicles, increased use of alternative transportation modes, decreased VMT, development of compact, mixed-use, infill projects in established communities and urban areas, and other strategies identified in the Climate Action Plan." Timeframe to start: Immediately; Funding: Planning and Building Department Budget; Personnel: County Department of Planning and Building, cities, San Luis Obispo Council of Governments.

Yuba County 2011 - Policy timelines include milestones and plans for action:

> "Goal CD16. Level of Service: Roadway System. Maintain a roadway system that provides adequate level of service, as funding allows, and that is consistent with the County's planning, environmental, and economic policies
>
> Policy CD16.5 Where a new development would exceed the County's Level of Service policies, applicants shall first consider feasible revisions to the proposed development that would increase connectivity, enhance bicycle/pedestrian/transit access, provide additional travel demand management measures, and/or provide other revisions that would help to meet LOS standards by reducing vehicle miles traveled on roads exceeding the target LOS, prior to consideration of adding capacity to roadways and intersections.
>
> Action CD2.1 Revise Standards. Following the General Plan adoption, the County will review and revise zoning, development standards, impact fees for all County facilities (library, parks, jail, roads, etc.), and related plans and standards to ensure consistency with the General Plan. As a part of these amendments, the County will focus on removing constraints and creating incentives for mixed-use, infill development that is consistent with the General Plan. Time Frame: Update Zoning Ordinance and development standards by 2013
>
> Action CD14.1 Impact Fees and Tax/Revenue Agreements Following General Plan adoption, the County will coordinate with the cities and other public service agencies on revenue sharing, redevelopment pass-through funding, development impact fees, and other important fiscal arrangements to implement General Plan policies. Time Frame: Ongoing during General Plan buildout."

As in previous sections, county-level CAPs offered stronger timeline commitments for action. Of all the policies examined in county CAPs, 63% had a timeline or prioritization for implementation. Butte, Santa Barbara, San Diego, and San Francisco counties state specific years for implementation, while others use the short/medium/long-term convention.

Example of policy with specific timelines, **San Francisco City/County 2021**:

> "TLU.1-6 By 2025, implement 50 miles of Muni Forward transit priority improvements, including 30 miles of new transit-only lanes. to increase reliability, frequency and safety for riders."

Example of implementation with specific years, **Butte County 2021**:

> "Time Frame: The year by which a strategy should be effective by fiscal year's end. The exact status of a strategy will vary based on its actions, and many strategies will be ongoing through and beyond 2030. An effective strategy is one that will be actively on track to achieve its targeted GHG emission reductions, support adaptation to climate change effects, or achieve long-term resilience. For a strategy to be effective, the necessary programs and efforts should be active, and any infrastructure or other capital improvements should be in place. The effective year is not the end year, as many of the strategies are programs that are intended to remain in effect for the foreseeable future,

and so they do not have end dates. Time frames for effectively setting up the strategies are described as follows:

--Immediate

--Near-Term (by 2023)

--Mid-Term (by 2025)

--Long-Term (by 2030)"

Funding

Solano, Tuolumne, and Yuba counties had funding sources listed for all of their VMT policies. Common sources of funding listed among all counties include: general funds, planning department budgets, road funds, and grants. Only one policy specified a grant:

San Luis Obispo 2020:

> "Program C Designation of Additional Land for Residential Uses; Description: Consider and, if appropriate, amend the Land Use and Circulation Elements to designate additional land for residential uses in areas described under Policy HE 1.01. While adequate land has been identified in the inventory of sites to accommodate the County's share of the regional housing needs allocation, as described in "Chapter 7: Sites Analysis", additional land for residential uses will be necessary to accommodate future population growth beyond 2028. Newly designated additional land for residential uses may contribute to the inventory of sites in future Housing Element cycles. Implementation of this program can assist in reducing housing price escalation, vehicle miles traveled, and resource consumption. Additionally, larger parcels (i.e. five (5) acres or larger) would allow for additional site amenities, such as open space and parks". Target Start: Spring 2021; Target Completion: Spring 2027; Funding: General Funds, LEAP Grant; Personnel: Department of Planning and Building.

This strong focus on funding in General Plans contrasts with weak funding commitments in CAPs, perhaps demonstrating the differences in plan types where General Plans are often more closely tied to planning general fund expenditures. Of the 23 county CAPs, only three included funding sources for their policies. No counties provide details on funding sources for each CAP policy. Instead, the few that address funding at all provide a list of potential funding sources. For example, the Alameda County CAP (2014) provided an exemplary funding strategy and list of potential funding sources. Similarly, San Francisco City/County developed a funding approach to implement their CAP, as shown below.

Example of funding approach, San Francisco City/County 2021:

> "Overall, recommended next steps include:

1. Create an interdepartmental climate finance working group to assess the economic, social, political, and administrative viability of securing new funding sources.

2. Develop a detailed cost estimate for implementing CAP actions (beyond high-level estimates in the CAP).

3. Identify all opportunities to fund CAP strategies from existing funding sources and approved measures.

4. Assess which CAP strategies are not funded or partially funded to identify funding gaps.

5. Investigate a new tax (carbon tax, food tax) and/or increase existing taxes (sales tax, property tax) as a major contributor to reducing funding gaps.

6. Seek out and apply for relevant federal, state, and local grant opportunities which can serve as important seed funding for implementing CAP strategies or other supporting activities such as community engagement or technical analysis."

Staff and Personnel

Calaveras, Inyo, Los Angeles, Merced, San Mateo, Solano, Stanislaus, Tuolumne, and Yuba counties listed personnel for all of their VMT policies. The top three highest scoring county-level General Plans (San Luis Obispo, Tuolumne, and Riverside) designated personnel for most of their policies (60%). Common internal departments listed across counties were: planning, public works, community development, building, and transportation. Other personnel listed included: air pollution control districts, council of governments, transit agencies, arts commission, board of supervisors, and land management agencies.

CAPs showed similar staff commitments. Just over 57% of county-level CAP policies included an assignment to a specific department or agency for implementation, such as community development or public works. These are usually listed in an implementation table and not discussed in detail. Notably, Alameda County conducted a detailed assessment of staffing needs for implementing their CAP; see the example below.

Example of CAP section discussing staffing, Alameda County 2014:

"STAFF TIME FOR CAP IMPLEMENTATION

The successful implementation of the CAP will, in great part, be achieved through voluntary programs that will be managed and overseen by County staff. The emphasis on voluntary programs was a result of feedback from County staff, community members, and local professionals that the CAP should limit the number of mandates imposed on the community. Consequently, many measures require staff time to develop programs, implement outreach campaigns, and oversee policy development such as ordinances. The cumulative staff requirements for each Action Area were assessed, with the results shown in the table below. Since there are many potential synergies in measure implementation (i.e., energy efficiency and solar programs for residences may have joint implementation

as the target audience of that suite of measures is the same constituency). Furthermore, as the implementation of many measures only requires staff time (with, for instance, no capital cost requirement), the total staff time requirement and associated cost is aggregated at the level of the Action Area. See Appendix C for more details on the costs and savings analysis. It should be noted that these staff requirements do not necessarily represent additional County hires; the staff time requirements to implement the CAP could potentially be included in an existing staff member's job description."

Vehicle Miles Traveled plan evaluation for cities

Policy Approaches

Similar to the county-level plan evaluation, the terms coded for this section include "vehicle miles traveled" and "compact development." Policy approaches to reducing vehicle miles traveled among cities cover compact, transit-oriented, and infill development; alternative transportation; growth management; and transportation demand management.

Example of compact development policy, City of Campbell 2001:

> "H-4.3a Achieve Target Densities. Promote compact development by encouraging properties to develop to General Plan densities. Inform developers of policy to strive to achieve at least 75% of General Plan density within specified areas. Review development proposals for residential and mixed-use projects to strive to achieve "planned-for" densities." Timeline: 2015-2023; Funding: General Fund; Personnel: Community Development.

Example of reducing VMT policy, City of Elk Grove 2021:

> "Policy MOB-1-1: Achieve State-mandated reductions in VMT by requiring land use and transportation projects to comply with the following metrics and limits. These metrics and limits shall be used as thresholds of significance in evaluating projects subject to CEQA. Projects that do not achieve the daily VMT limits outlined below shall be subject to all feasible mitigation measures necessary to reduce the VMT for, or induced by, the project to the applicable limits. If the VMT for or induced by the project cannot be reduced consistent with the performance metrics outlined below, the City may consider approval of the project, subject to a statement of overriding considerations and mitigation of transportation impacts to the extent feasible, provided some other stated form of public objective including specific economic, legal, social, technological or other considerations is achieved by the project.
>
> (a) New Development – Any new land use plans, amendments to such plans, and other discretionary development proposals (referred to as "development projects") are required to demonstrate a 15 percent reduction in VMT from existing (2015) conditions.
>
> (i) Land Use – Development projects shall demonstrate that the VMT produced by the project at buildout is equal to or less than the VMT limit of the project's

General Plan land use designation, as shown in Table 6-1, which incorporates the 15 percent reduction from 2015 conditions.

(ii) Cumulative for Development Projects in the Existing City-Development projects within the existing (2017) City limits shall demonstrate that cumulative VMT within the City including the project would be equal to or less than the established Citywide cumulative limit of 6,367,833 VMT (total daily VMT).

(iii) Cumulative for Development Projects in Study Areas – Development projects located in Study Areas shall demonstrate that cumulative VMT within the applicable Study Area would be equal to or less than the established limit shown in Table 6-2.

(b) Transportation Projects – Transportation projects likely to lead to a substantial or measurable increase in VMT shall:

(i) Not increase VMT per service population. Projects must demonstrate that the VMT effect of the project does not exceed the project's baseline condition VMT.

(ii) Be consistent with the regional projections and plans. The project shall be specifically referenced or listed in the region's MTP/SCS and accurately represented in the regional travel forecasting model. Qualifying transportation projects that are not consistent with the MTP/SCS shall also demonstrate that the cumulative VMT effect does not increase regional VMT per service population.

Action 1.4 Development Review Requirements and Process Refinements. Update the submittal requirements and review processes for land use applications for consistency with General Plan policies, as follows:

- Require development applications, as appropriate, to include plans for necessary infrastructure improvements (e.g., roads, stormwater drainage and treatment facilities, utilities). (LU-3-29, LU-3-32, MOB-7-1)
- Prepare and regularly update guidelines for the preparation of transportation impact analyses for consistency with vehicle miles traveled (VMT) policies. As part of the guidelines, the City shall:
    - Identify appropriate methodologies for calculating VMT for both land use and transportation projects.
    - Monitor citywide VMT and identify areas of the City that may be exempt from subsequent analysis.
    - Monitor the effectiveness of VMT reduction strategies and update a list of appropriate strategies on an ongoing basis. (MOB-1-1)
- Update City guidelines for the preparation of transportation impact analyses for consistency with Roadway Performance Target policies. (MOB-1-3, MOB-1-4, MOB-1-5, MOB-1-6)

- Update requirements for acoustical analysis to be submitted with applications for development of noise-sensitive land uses for:
    - noise-sensitive land uses proposed in areas exposed to existing or projected exterior noise levels exceeding the levels specified in Table 8-3 or the performance standards of Table 8-4 (N-1-5), and proposed nonresidential land uses likely to produce noise levels exceeding the performance standards of Table 8-4 at existing or planned noise-sensitive uses (N-1-6).
- When applications are received to establish sensitive land uses in proximity to air pollution sources, refer the application to the Sacramento Metropolitan Air Quality Management District for comment. (NR-4-9)"

Time Frame: FY 18/19 - FY 19/20; Funding: None; Personnel: Development Services Planning; Development Services Engineering, Public Works, Strategic Planning.

Example of transportation demand management policy, City of Culver 1995:

"MEASURE 3. CONTINUE TRANSPORTATION DEMAND MANAGEMENT (TDM), While the proposed highway, bus, and rail programs would increase the supply of transportation option, Transportation Demand Management (TDM) Programs promote the demand for alternative transportation by creating incentives to reduce single occupant auto trips and overall trip-making, TDM programs are intended to: Enhance the attractiveness of ridesharing as a alternative to single 'occupant automobile travel; maximize ridership on the evolving bus and rail systems and carpool lane networks; reduce overall trips and vehicle miles traveled.

A. Participate in MTA's 30 Year Plan Long Term Planning. Coordination between MTA and AQMD has resulted in compatibility between AQMP and CMP requirements. Participation by Culver City in MTA's TDM programs fulfills its obligations under the CMP. City TDM programs included in the Circulation Element and Air Quality Plan will also meet the current requirements for Transportation Control Measures under the AQMP (see the Air Quality Plan).

B. Adopt a Transportation Demand Management Ordinance. Under the Congestion Management Plan, prior to the approval of a specific development project, TDM improvements must be included. The type and amount of TDM would vary with the size of the project but could include items such as providing a bulletin board displaying transportation information such as current maps, routes and schedules for public transit routes serving the site and ridesharing information; providing preferential parking for car and van pools; and providing bicycle facilities. The City should take a proactive approach to TDM and reduction of Vehicle Miles Traveled (VMT), beyond minimum regional requirements. In high density commercial and industrial areas (such as Fox Hills, Downtown, Hayden Tract, studio areas) determine what TDM goals are desirable and attainable, and who should be implementing and monitoring these measures. Provide incentives, such as reduced parking requirements, for developments that encourage

alternate commute modes. These facilities could include showers, lockers, bike racks, and "in-lieu" payments for not driving to work."

Example of growth management policy, City of Norco 2013:

> "Program Action 6.1 Sustainable Land Use Planning. The City of Norco recognizes that long term planning efforts should focus on sustainability and the reduction of greenhouse gases. To progress towards these goals the City understands that it must provide an adequate supply of housing that is sufficient for a range of income groups thereby excluding long commutes in search of affordable housing. This requires planning for sufficient housing supply in the right locations - close to jobs, services, and amenities = which will in ur reduce congestion and long commutes. To achieve this, the City will promote infill and compact development patterns, has adopted higher densities in the Housing Development Overlay zone and will conserve habitat and environmentally sensitive areas including residential lots that are appropriate for animal keeping and agricultural uses. Objectives: Identify and advertise development opportunities within the Housing Development Overlay zone at City Hall, on its website to encourage compact development in key growth areas. Promote use of the Multifamily Green Building Guidelines. Investigate opportunities to reduce fees and provide priority processing for residential development to promote development within specific growth opportunity areas." Timeline: Ongoing, 2014-2021; Funding: Departmental Budget; Personnel: City of Norco Planning Division.

Example of VMT comparative approach, City of Long Beach CAP 2022:

> "T-9: Integrate SB 743 Planning with the CAAP Process
>
> Evaluate the effectiveness of VMT reductions resulting from SB 743 compliance in achieving the City's GHG reduction target.
>
> T-9.1: Evaluate the effectiveness of new VMT thresholds, metrics, and mitigations as the City's updated Transportation Impact Analysis (TIA) guidelines are implemented.
>
> T-9.2: Monitor what types of mitigation strategies are working in other cities that could apply in the Long Beach context to reduce emissions and meet aligned City objectives.
>
> T-9.3: Consider strategies to fund the implementation of VMT mitigation strategies, such as collecting in lieu fees and participating in a regional mitigation bank program.
>
> T-9.4: Evaluate VMT mitigations and adjust as needed to maximize effectiveness on an ongoing basis."

Results

Total VMT policy scores in city General Plans ranged from 0-18, with 323 cities scoring a zero. The highest scoring cities were: Santa Clara with 18 points, followed by Milpitas and Paso Robles with 15 points each. Total scores ranged from 0-9 for "compact development" with 411 out of 482 cities scoring a zero in their General Plans. The top four cities for "compact

development" were Rancho Cordova with nine points, and Azusa, Tulare, and Windsor with eight points each. High scoring city General Plans (including both terms) were primarily located in the greater San Francisco Bay region and greater Los Angeles region, perhaps indicating an emphasis on population and commuting.

This contrasts with the sample of city-level CAPs. Total VMT plan scores in city-level CAPs ranged from 0-127, with an average score of 29. The three highest scoring cities were San Leandro (127), Long Beach (58), and Hughson (52). Again, CAPs show a stronger climate readiness policy focus than their General Plan counterparts even in the same cities.

Equity-focused Approaches

Equity focused VMT and compact development policies were rare. This is of interest as anti-development (NIMBY) and pro-development (YIMBY) discourses can both run counter to environmental justice efforts to prevent displacement. On the one hand, no-growth scenarios can result in limited housing and rising rental rates which spur displacement. Similarly, pro-growth scenarios can create displacement where new development caters primarily to higher income earners by providing luxury apartment buildings or large-lot development. The lack of focus on equity in VMT policies in both General Plans and CAPs should signal a need for state agencies to more closely align policy guidance between housing, transportation, and EJ.

City of Corona 2004:

> "Objective C-11A: Improve air quality and public health and reduce ambient noise by promoting Active Transportation programs. Recommendation C-11.3: Increase pedestrian and bicycle trips, thereby reducing vehicle trips and vehicle miles Traveled."

Compact Development, City of Folsom 2018:

> "LU 1.1.12 Infill Development. Coordinate with the real estate development community to encourage infill development in key parcels north of U.S. Highway 50. Infill development should follow these guidelines: Respect the local context. New development should improve the character and connectivity of the neighborhoods in which it occurs. Physical design should respond to the scale and features of the surrounding community, while improving critical elements such as transparency and permeability. 2. Work with neighbors. Infill development requires neighborhood consultation to understand the concerns, goals, and needs of existing neighborhoods. Ensure the planning and design process provides proper avenues for neighborhood input while fulfilling the community's larger goals for walkability and compact development."

City of Greenfield 2014: "Policy 6.7.2 Provide transportation choices and travel efficiency in housing areas. Program 6.7.G Promote infill and compact development to facilitate non-motorized transportation. In the approval of subdivision maps and site plans, facilitate land use patterns and development densities that place services close to residences and promote use of lower-energy means of transportation, including walking, bicycling, and car-pooling to make less costly transportation alternatives available and feasible and reduce costs associated with transportation, especially for low income residents."

Only two cities clearly showed an equity focus in their VMT policies, Long Beach and San Leandro. The City of Long Beach CAP (2022) includes an equity statement in all of their VMT policies, offering a laudable model.

Example of equity policy, City of Long Beach 2022:

> "T-3: Increase Bikeway Infrastructure Citywide
>
> Equity Strategy
>
> Assess existing and planned bikeway infrastructure to ensure equitable distribution based on CalEnviroScreen and other environmental justice indicators. Increase accessibility of active transportation and micro mobility options for low-income individuals by working with providers and by exploring subsidies and specialized programs."

Policy Strength

All of the VMT and "compact development" policies from the cities of Alhambra, Dixon, Dublin, and Gilroy General Plans used strong language. Gilroy is the best example of this with three VMT policies and two "compact development" policies, all of which were descriptive and specific.

Gilroy 2016:

> "Growth Management Goal: A clearly defined, well-managed development process that ensures that (a) the rate of growth does not outpace the City's and other agencies' ability to provide necessary infrastructure and services; (b) the demands created by new growth do not exceed resource and system capacity constraints; (c) new growth is directed first to areas where municipal services are available and capacity exists; (d) the incremental public service costs generated by new growth are paid for by new growth; and (e) the resulting pattern of development is compact, efficient, and contiguous.
>
> Policy 2.01 Location of Growth. Maximize existing infrastructure and service investments— and avoid premature investment for facility and service extensions—by directing new growth to vacant and under-utilized lands within the Urban Service Area, consistent with the Urban Growth Boundary ("UGB") adopted by initiative in 2016. As a second-tier priority, direct new development to areas that border on existing urban development or are immediately adjacent to the Urban Service Area, prohibiting costly "leap frog" development and ensuring a compact development pattern, consistent with the UGB." Timeline: None; Funding: None; Personnel: None.

Rancho Cordova 2006:

> "Policy LU.2.8 - Grant density bonuses and other related incentives, consistent with state law and local policy, for the provision of affordable housing.
>
> Action LU.2.8.1 - Amend the Zoning Code to include flexible parking standards and parking reductions to encourage compact development, shared parking, and higher

> density projects in specified locations throughout the City. Timeline: 2006-2007, ongoing; Funding: General Fund; Personnel: Planning Department, Public Works."

In CAPs, of all the policies examined, 44% used strong language such as "shall" or "will." Long Beach and San Leandro had the highest number of strong policies. Seven of the 21 cities in the sample had more than 75% of their total policies characterized as strong.

Example of strong policy: City of San Leandro CAP 2021:

> "AT-1: Transportation Demand Management (TDM). Require local employers above a certain number of employees to develop programs that promote ridesharing, flextime, telecommuting, and other means to reduce commute trips and congestion, and target 10% mode shift."

Timeline

Most policies did not have a timeline, but of those that did, common timelines were "ongoing." Without firm benchmarks listed in plans, it is difficult for local communities to hold their planning process accountable. The lack of timelines also hinders a statewide understanding of when and how communities will meet targets.

Example of specific timeline, Ceres 2018:

> "Goal 3.A Provide for the long-range planning, development, and maintenance of the city's roadway system to ensure the safe and efficient movement of people and goods through a variety of travel modes. 3.A.4 Reduce Vehicle Miles Traveled (VMT). Support statewide efforts to reduce vehicle miles of travel (VMT) from existing and new development by encouraging infill and mixed-use development, providing a multi-modal transportation network, and incorporating transportation and parking demand management measures into new development by design." Timeline: 1-3 years, update every 3-5 years; Funding: None; Personnel: Engineering, City Council, Community Development, Public Works.

CAPs included bolder timelines for implementation. Of all the policies examined in the sample of 21 CAPs, 65% had a timeline or prioritization for implementation. Some cities used a specific year such as Hughson, while other would use the short/medium/long-term convention. It should be noted that this same of city-level CAPs is meant to draw from the strongest policies and may not represent CAPs overall.

Example of CAP VMT policy with detailed timelines, City of Escondido 2021:

"Measure T-3.5: Update Bicycle Master Plan. Update the City's Bicycle Master Plan and install new or improve existing Class II or better bicycle lanes.

> 2023 Develop an Active Transportation Plan that includes an update to the City's Bicycle Master Plan.
>
> 2024 Develop and implement a citywide bike rack policy.

2025 Complete construction of the Class I Escondido Creek Bike Path, funded through Prop 68, to facilitate a larger network of active transportation access points and opportunities.

2025 Develop and implement a program to incentivize City employees commuting to work by bike or other modes of alternative transport as a model for other local employers.

2030 Install at least 19 miles of new Class II or better bicycle lanes by 2030.

2035 Install at least 30 miles of new Class II or better bicycle lanes by 2035."

Funding

Similar to timelines, most policies in General Plans did not list a funding source. Those that had a funding source listed "general fund", "department budget", or "grants." The emphasis on local funding indicates a bottleneck in climate readiness planning and implementation as many cities indicate that they will look for internal funds to support implementation.

specific grants, City of Oxnard 2017:

> "Program 4: Urban Village Program The Urban Village Program (UVP) is part of the 2030 General Plan. The UVP is conceptually described in the 2030 General Plan. The UVP initially designated seven villages that are envisioned as mixed-use areas designed to encourage persons to live near their place of employment and/or support services and readily accessible to transit. Urban Villages should occur in the designated areas but may be proposed in others as a General Plan Amendment. The integration of land uses is intended to provide and promote a pedestrian orientation to reduce trips and vehicle miles traveled in order to reduce greenhouse gas emissions. Urban Villages are implemented with a specific plan or a strategic plan similar to the Central Business District Strategic Plan. UVP guidelines may be developed if useful to qualify for Affordable Housing and Sustainable Communities (AHSC) Program funding. A minimum of 15 percent of the UVP housing would be affordable. The UVP would consider the rezoning and reuse of commercial and industrial land for housing, the consolidation of parcels, and mandating a local preference program for affordable housing. The City will also consider renaming this program "Transit-Oriented Development Neighborhood, District, or Corridor." By 2021, 290 affordable units are anticipated within the Teal Club and East Village UV's." Timeline: End of 2021, ongoing; Funding: General Fund, SGC AHSC Grant (Cap & Trade) EDC set-aside for highly qualified census tracts; Personnel: Development Services.

Examples of specific external sources of funding, Point Arena 2019:

> "3-1.4 Encourage construction of new houses in or near downtown core area to reduce the need for City utility extension and reduce vehicle miles traveled (VMT) by:
>
> - Encouraging development projects near or adjacent to the urban core to fund off-site pedestrian and bicycle facilities for non-vehicular access to downtown.

- Encouraging development of new clustered or attached housing for efficient land, materials and energy use, and for a more sustainable community.
- Permit solar power and water heating, water conservation devices, and energy-saving construction materials. Promote grid-tie solar system use.
- Encourage development of microgrids. Promote battery backup systems.
- Promote energy efficiency measures in new developments such as building siting, energy efficient windows and doors, and drought tolerant landscaping. Review applications for compliance when such provisions are adopted."

Timeline: Ongoing; Funding: PG&E, North Coast Energy Services assistance, Housing Trust Fund, Sonoma Clean Power; Personnel: City, PG&E, North Coast Energy Services.

Tustin 2018:

"Air Quality GOAL 2: Improve air quality by influencing transportation choices of mode, time of day, or whether to travel and to establish a jobs/housing balance.

Policy 2.2: Reduce total vehicle miles traveled (VMT) through incentives, regulations and/or Transportation Demand Management.

Implementation 1. Non-Motorized Transportation: Amend the City's TDM ordinance incorporating non-work trip reduction provisions requiring: (1) major retail centers to offer customer mode-shift travel incentives and provide facilities for non-motorized transportation needs; and (2) large capacity special event centers (over 10,000 seating capacity) to include park-n-ride and off-site facility lots, auto free zones, street closure during peak periods, and enhanced transit performance as appropriate (implements measure TCM-01 of 1997 AQMP)

Implementation 2. Rideshare and Transit Incentives: Adopt or amend a TDM ordinance incorporating strategies for employers of over 250 people and those of over 25 people, encouraging the formation of Transportation Management Associations, and encouraging employer van pool programs and use of clean fuel vans (implements TCM-01 of the 1997 AQMP).

Implementation 8. Congestion Management: Participate with the Orange County Transportation Authority in defining and implementing the County's Congestion Management Plan (implements measure TCM-01 of the 1997 AQMP).

Implementation 9. Interagency Communication/Coordination: Participate in available communication networks with key elected officials and staffs involved in air quality planning as the basis for identifying and implementing programs which effectively reduce airborne pollutants. Implementation 10. Development Projects: Continue to require participation in transportation demand management programs for development projects which have been determined to have a potential impact on air quality (implements measure TCM-01 of the 1997 AQMP)."

> Timeline: Ongoing; Funding: City General Fund, TDM Fees, Measure M, Proposition III Funds; Personnel: Community Development, Public Works, Administrative Services, All Affected Departments.

Of the 21 city CAPs examined, only six included funding sources for their policies and in most of those cases there was little detail beyond listing a source such as the "general fund" or "grants." The Dublin CAP was notable in the level of detail included in their funding plan, which included the source of funding and how the funding would be used. Of note, some cities showed policies that required only staff time as low or no funding required.

Example of policy with funding, City of Dublin 2020:

> "Measure SM-5: Update the Bicycle and Pedestrian Master Plan
>
> The Metropolitan Transportation Commission collects Transportation Development Act (TDA) funds. Two percent of TDA funds are allocated to TDA Article 3 (TDA 3) funds which are redistributed to each county and must be used for bicycle and pedestrian projects. In Alameda County the TDA 3 funds are distribute to jurisdictions based on population.
>
> Measure B was approved by Alameda County voters in 1986 and renewed in 2000. It provides a one-half-cent sales tax to improve transportation throughout Alameda County.
>
> Voters passed Measure BB in November 2014 and collection of the initial half-cent transportation sales tax by the Board of Equalization began on April 1, 2015 and will extend through March 31, 2022. The full one-cent sales tax authorized by Measure BB will begin April 1, 2022 and will extend through March 31, 2045. Starting in July 2015, Alameda CTC began making monthly local distribution payments to local jurisdictions and transit agencies, per the 2014 Transportation Expenditure Plan, for the following programs: local streets and roads (including county bridges), bicycle and pedestrian, transit and paratransit."

Staff and Personnel

Most cities did not list specific personnel to implement General Plan VMT policies, but of those that did, the most common were: community development, public works, planning, city manager and city council, and engineering.

Example of General Plan policy with many internal and external personnel listed as responsible for policy implementation, Burlingame 2019:

> "Goal M-6: Create an integrated transportation program that reduces peak-period vehicle trips and vehicle miles traveled." Timeline: 5 years; Funding: General Fund, Grants; Personnel: Community Development, Central County Fire Department, City Attorney, City Manager (Sustainability Coordinator), Parks and Recreation, Public Works.

Unlike General Plans, the sample of 21 city CAPs showed a strong focus on identifying responsible staff to carry out policies. About two-thirds of CAP VMT policies included an

assignment to a specific department or agency for implementation, such as community development or public works. These are usually listed in an implementation table and not discussed in detail.

Example of CAP section discussing staffing, City of Del Mar 2016:

> "Implementation of the recommended mitigation measures will require ongoing management, oversight, and staffing. The implementation plan identifies departmental responsibility for overseeing or leading implementation of the individual mitigation measures based on consistency of the mitigation measures with the department's scope of responsibility. In addition, the City Council-appointed Sustainability Advisory Board will monitor and advise the City Council and staff on implementation of the CAP."

Unique approaches to decarbonization across cities and counties

Albany 2016:

> "GOAL T-2: SUSTAINABLE TRANSPORTATION Reduce the consumption of non-renewable resources and the emission of greenhouse gases and other air pollutants related to transportation.
>
> Action T-2.I: Multi-Modal Levels of Service Establish multi-modal level of service (MMLOS) standards for arterial streets, and apply these standards in the evaluation of future development proposals and planning studies. In support of the City's efforts to reduce greenhouse gas emissions, service standards should utilize vehicle miles traveled (VMT) as the primary metric, rather than the total number of trips generated or projected motor vehicle delays." Timeline: None; Funding: None; Personnel: None.

Azusa 2004:

> "EC 2 EMPLOYMENT DISTRICT PROGRAM. Employment District Planning. Encourage efficient use of land through compact development, high densities, reduced parking ratios (with effective alternatives), and proper incentives for redeveloping underutilized land. Users that are amenity sensitive, operate at relatively high densities, and are most likely to make use of transit infrastructure should be accommodated in the vicinity of the future Gold Line station and Downtown." Timeline: 2006; Funding: General Fund; Personnel: Community Development, Economic Development/Redevelopment.

Coachella 2015:

> "Goal 3. Water Resources. Protected and readily available water resources for community and environmental use. 3.10 Retention Basins. Encourage storm water retention basins to be underground in future development so as to achieve the most efficient use of land and compact development and promote the urban character goals of the General Plan." Timeline: None; Funding: None; Personnel: None.

Norco 2013:

"Policy 6.2 Adopt higher densities and promote infill and compact development patterns to 'encourage housing affordability, maximize existing land resources, reduce pressure to convert agricultural resources, and conserve habitat and environmentally sensitive areas." Timeline: None; Funding: None; Personnel: None.

City of Orange 2010:

"GOAL 2.0: Create commercial and mixed-use areas of varying scale and function that are visually distinct and complement the City's identity.

Policy 2.1: Transform corridors such as Chapman Avenue, Main Street, The City Drive, and Katella Avenue into active, pedestrian-friendly streets that balance auto, transit, and pedestrian mobility. These streets should accommodate compact development that is oriented to the sidewalks to promote active street life.

Program III-1 California Environmental Quality Act. Comply with all provisions of CEQA. In addition to thresholds that may be established or adopted by the City in the future, use the following thresholds and procedures for CEQA analysis of proposed projects, consistent with policies adopted within the General Plan:

Circulation & Mobility

- Level of service (LOS) D (volume-to-capacity [V/C] ratio less than or equal to 0.90) shall be the lowest acceptable level of service for both roadway segments and peak- hour intersection movements.
- Orange County's Congestion Management Plan (CMP) specifies LOS E (V/C ratio less than or equal to 1.00) as the operating standard for roadways on the CMP highway system. o Projects that increase V/C by .01 or more on affected roadway segments or intersections experiencing LOS E or LOS F conditions without the proposed project are considered to create significant impacts, and mitigation is required.

Parks and Recreation

- The City shall require dedication of parkland at a rate of 3.0 acres per 1,000 anticipated residents or payment of in-lieu fees for new residential projects.

Noise

- The City shall apply the noise standards specified in Tables N-3 and N-4 of the Noise Element to proposed projects analyzed under CEQA.
- In addition to the foregoing, an increase in ambient noise levels is assumed to be a significant noise impact if a proposed project causes ambient noise levels to exceed the following:

- Where the existing ambient noise level is less than 65 dBA, a project related permanent increase in ambient noise levels of 5 dBA CNEL or greater.
- Where the existing ambient noise level is greater than 65 dBA, a project related permanent increase in ambient noise levels of 3 dBA CNEL or greater.

Historic and Cultural Resources

- "Historical resource" for the purposes of CEQA shall mean "historic district" in the case of a contributor to a historic district.
- Historic resources listed in the Historic Register shall have a presumption of significance pursuant to CEQA Section 21084.1 and shall be treated as historical resources under CEQA.
- The historical significance of an archaeological historic resource is evaluated using the criteria of Public Resources Code Section 5024.1 and Section 15064.5 et seq. of the state CEQA Guidelines.

All future development proposals shall be reviewed by the City for potential regional and local air quality impacts per CEQA. If potential impacts are identified, mitigation will be required to reduce the impact to a level less than significant, where technically and economically feasible. Time Frame: Ongoing; Funding: General Fund, development fees; Personnel: Community Development Department, Public Works Department, Community Services Department.

Program IV-6 Transportation Demand and System Management: Participate in regional efforts to implement TDM requirements and support implementation of the employer TDM provisions of the South Coast Air Quality Management District's Air Quality Management Plan by working with the SCAQMD to identify employers within Orange most suitable for participation in the TDM programs to achieve major reduction of VMT. Complete intersection capacity improvements and coordinate traffic signals as necessary to improve traffic flow. Time Frame: Ongoing; Funding: General Fund; Personnel: Community Development Department, Public Works Department.

Program V-3 Adjacent Jurisdictions and Special-Purpose Agencies and Organizations: Continue to coordinate with adjacent jurisdictions and special-purpose agencies and organizations for the following purposes:

- Land use planning efforts;
- Growth and facility planning, management, and maintenance;
- Planning and developing major east/west and north/south arterials and rapid transit;
- Ensuring that Orange benefits from the planned Anaheim Regional Transportation Intermodal Center (ARTIC);

- Connecting City trails to trails in adjacent jurisdictions and regional trails networks, including Santiago Creek, the Santa Ana River, and the proposed Tustin Branch Trail;
- Completing vision plans for Santiago Creek and the Santa Ana River;
- Maintaining an appropriate level of transportation impact fees and other public service fees;
- Continuing and adopting mutual-aid agreements;
- Maintaining flood control facilities and implementing a capacity analysis;
- Developing trails along service roads for flood control channels;
- Aircraft corridor planning, minimizing aircraft overflights in the City, and coordinating approval of heliport/helistop operations;
- Disaster preparedness and emergency response for earthquakes and wildland fires;
- Participating in interjurisdictional planning forums through the established Growth Management Areas (GMAs) adopted by the Regional Advisory Planning Council as well as the City's Joint Powers Agreements with adjacent cities to address cumulative traffic impacts and to coordinate improvements in transportation facilities; and
- Monitoring and compiling information on faults within the planning area.

Time Frame: Ongoing; Funding: General Fund, development fees, gas tax funds; Personnel: Community Development Department, Public Works Department, Fire Department, Policy Department.

Program V-5 Orange County Transportation Authority: Work closely with the OCTA to achieve the following objectives:

- Maintain consistency with the County Master Plan of Arterial Highways, including the reclassification of roadways described in the Circulation & Mobility Element, such as La Veta Avenue.
- Implement provisions of Renewed Measure M.
- Implement the OCTA Congestion Management Plan (CMP).
- Expand and improve the efficiency of bus service within the City.
- Encourage the expansion of alternative local transportation options such as a community circulator bus service between transit centers and major commercial, employment, and residential areas.
- Improve paratransit or other public transportation systems that enhance the mobility of Orange's senior and youth populations, and the disabled.
- Encourage provision of attractive and appropriate transit amenities.
- Support and implement the OCTA Commuter Bikeways Strategic Plan and participate in future updates and revisions to the Plan.
- Reduce noise impacts of OCTA operations and facilities.

Time Frame: Ongoing; Funding: General Fund, State Transit Assistance funds; Personnel: Public Works Department, Community Development Department.

Program V-6 California Department of Transportation and Transportation Corridor Agency:

Work closely and coordinate with the California Department of Transportation (Caltrans) and the Transportation Corridor Agency (TCA) on all plans, activities, and projects that may affect state roadway facilities or transportation corridors passing through Orange. Additionally, work with these agencies to achieve the following objectives:

- Provide appropriate screening to control the visual impacts of transportation facilities.
- Provide landscaping within transportation facilities.
- Study the potential for a future interchange at State Route 55 and Meats Avenue.
- Determine the feasibility of conversion or joint use of surplus or otherwise underutilized lands under Caltrans or TCA control for open space.
- Plan for noise abatement along freeways and highways.
- Install, maintain, and update freeway and highway right-of-way buffers and soundwalls.
- Provide adequate visual buffers such as berms or landscaping between freeways and railways and adjacent land uses."

Time Frame: Ongoing; Funding: General Fund, gas tax funds; Personnel: Public Works Department, Community Development Department.

Yountville 2015:

"Policy C 1.3 The Town's current operating standards call to maintain all street intersections at a level of service "C" or better. Consider replacement of vehicle Level of Service standards for traffic conditions in Yountville with Vehicle Miles Traveled (VMT) or other recommended metrics once Senate Bill 743 is implemented." Timeline: None; Funding: None; Personnel: None.

ZEV Implementation Evaluation

This section research reviews 1) where CAPs have been created in relation to socioeconomics and geography to understand community characteristics in creating CAPs, 2) where CAPs and general plans address ZEV readiness.

Methods

Socioeconomic data were collected from the 2020 Census and aggregated with data from the 2014-2019 American Community Survey. Census tracts were aggregated to the city level. To address whether or not jurisdictional socioeconomic status and geography influence the adoption of a CAP, we used multivariate logistic regression to assess associations between CAPs, total population, median household income, and percent white population.

To understand plan mentions, policy strength and implementation, we combined city-level plan scores and term mentions with the prevalence of EV charging stations from the federal EV charging station database, which includes 15,688 station locations and 45,891 Electric vehicle supply equipment (EVSE) charging ports for California. Data were downloaded on Nov 13, 2023. We did not use the California Energy Commission data on 87,707 public and private EVSE because this data is only available at the county-level and not the city-level. An EVSE port provides power to charge one vehicle at a time. Based on federal data, there are 14,200 charging stations within California cities, and 1,964 charging stations outside of city jurisdictions on county land.

We used ordinary least squares (OLS) multivariate regression models. To understand the influence that jurisdictions have on neighboring jurisdictions' likelihood of having a CAP and on the number of EVSE charging ports, we used the spectral normalization weighting matrix. Because California cities are spatially clustered around two main areas (the Bay Area and the Los Angeles region), we employed Moran's I to assess if the errors were spatially correlated as a post-estimation test for each of our adjusted regression models. Where spatial autocorrelation was present, we fit generalized spatial two-stage least-squares autoregressive (GS2SLS) models with spatial lags on the dependent variables. Our data analyses were conducted using the logistic, regress, estat moran, spatbinary, spregress, and estat impact commands in STATA/BE version 18 (SataCorp, 2023).

Limitations

More recent plans are more likely to have ZEV-related policies. Further, a county may have strong ZEV policies that benefit a city without such policies, leading to temporal and spatial mismatch.

Cities with a CAP and ZEV implementation

We found no association between a city having a CAP and the city's population size (Figure 2). Whether or not a city has a CAP was not significantly associated with total population, median household income, or the percent of the population identifying as white. This finding aligns with a similar study conducted by Bery et al., 2022, which found that "only two factors—(a) city staff dedicated to environmental/energy policy and (b) the presence of an institution of higher education—had statistically significant effects on the level of ambition of a city's climate action plan."

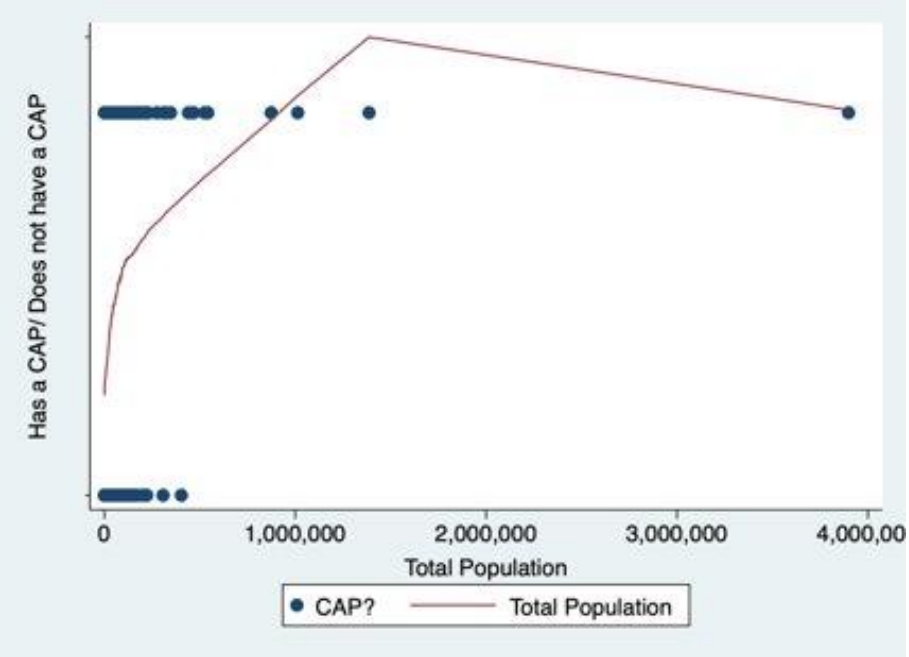

Figure 2. A scatter plot graph of a logistic regression displaying data points plotted on a scatter graph depicting the relationship between a city adopting a CAP and a city's total population size.

Planning and siting EV charging ports

We find that ESVE charging ports are not randomly distributed across cities in California. The number of ESVE charging ports was significantly associated with whether or not a city had a CAP (B = 30.05; 95% CI = 9.87, 50.23; p = .004) when controlling for percent white population and median household income. For every city with a CAP, we can expect an increase of 30 ESVE ports compared to cities without a CAP.

Moran's I revealed significant evidence of spatial autocorrelation ($p < .001$), indicating the the need for a spatial regression model. Spatial regression results were similar to the linear regression results in showing a positive, statistically significant relationship between having a CAP and implementing more ESVE charging posts (B = 19.5; 95% CI = .60, 38.48; p = .04). There was also a significant positive correlation between the number of ESVE charging ports in

one city and the number of ESVE charging ports in a neighboring city (B = .07; 95% CI = .02, .12; p = .01).

We also find a significant positive association between ESVE charging ports and EV mentions in CAPs (B = .68; 95% CI = .05, 1.31; p = .04). Thus, the more a plan addresses the topic of ZEV readiness, the greater the likelihood of implementation outside of the plan. For every mention of "electric vehicle" in a CAP, we can expect an increase of nearly 1 charging port. Again, Moran's I revealed significant evidence of spatial autocorrelation (p < .001). As with the linear regression model, spatial regression results were similar and significant (B = .61; 95% CI = .02, 1.20; p = .04). Further, there was a significant positive correlation between ESVE charging port numbers in one city and ESVE charging port numbers in neighboring cities.

As a point-in-time measurement, these results do not indicate whether jurisdictions with more ESVE ports are more likely to create a CAP or whether the CAP resulted in more ESVE charging ports being sited. Causality aside, the results do underscore the correlation between creating a CAP, addressing ZEV readiness, and siting ESVE charging stations.

Summary comparison with municipal reach codes

To understand if plans and policies correlated with actions in municipal codes, the research team explored a subset of terms in plans, overall policy scores, and the presence of municipal reach codes.

Table 4. This table compares term mentions related to ZEV adoption across city-level CAP and General Plans. Note: 56 cities (11%) adopted reach codes for "Electric Vehicle Ordinances" in 2019 and 2022 according to the Statewide Reach Codes Program

	Alternative Fuel	Electric Vehicle	Zero-Emission Vehicle (ZEV)	Plug-In Electric Vehicle (PEV)	Battery-Electric Vehicle (BEV)	Plug-In Electric Hybrid Vehicle (PHEV)
CAP (of 231)	76%	92%	50%	26%	18%	0%
General plan (of 482)	35%	26%	1%	0%	0%	0%

Table 5. This table compares term mentions for decarbonization across city-level CAP and General Plans. For reference, 73 cities (15%) adopted reach codes for “energy efficiency" + "all electric" during the 2019 and 2022 cycles according to the Statewide Reach Codes Program

	Decarbonization	Heat pump	Solar	Reach code	Energy	Energy storage	Energy efficiency	Microgrid	Carbon neutral	Green building
CAP (of 231)	20%	32%	99%	25%	100%	36%	98%	19%	40%	96%
General plan (of 482)	0%	2%	91%	1%	100%	2%	91%	1%	2%	78%

Table 6. This table compares term mentions for VMT reduction across city-level CAP and General Plans. There are no commiserate VMT-related reach codes for municipal code comparison.

	Vehicle miles traveled	Compact development
CAP (of 231)	95%	21%
General Plan (of 482)	49%	37%

To understand how planning for one policy objective is related to planning for others, we use correlation of term mentions and plan scores. Correlation indicates the relationship of two variables whenever one variable changes. If an increase in one variable results in an increase in the other variable, both variables are said to have a positive correlation. A perfect positive correlation is equal to “1”, while no correlation is equal to “0” and a perfect negative correlation is equal to “-1”.

We find that the number of mentions of “electric vehicle” in county General Plans did not correlate with policy score strength (Pearsson product correlation: -0.01). Thus, the number of times a plan mentions EV does not neatly correlate to the strength of EV policies within the county plan. Similarly, the number of mentions of “electric vehicle” in city General Plans did not

correlate with policy strength in city plans (Pearsson product correlation: 0.08) nor the presence of a municipal reach code for electric vehicle ordinances (Pearsson product correlation: 0.07).

Similarly, we find no correlations between the number of mentions of the term "energy" and the strength of policies that support decarbonization. The number of mentions of "energy" in county General Plans weakly correlated with policy score strength for decarbonization (Pearsson product correlation: 0.048). At the city level, the number of mentions of "energy" did not correlate with the presence of reach codes for Energy Efficiency of "All Electric ordinances" according to the 2019 & 2022) (Pearson product correlation: -0.01).

In planning for VMT, we also found little correlation between the number of times a term was mentioned and the strength of policies within the plans. The number of mentions of "vehicle miles traveled" in county General Plans weakly correlated with policy score strength for VMT (Pearsson product correlation: 0.42), but no relationship was found at the city-level which includes a larger sample size (Pearsson product correlation: 0.34)

Nor did term mention or scores correlate across terms. In other words, a jurisdiction may mention a term often, but that does not correlate with strong policies that would score highly. Further, a jurisdiction may mention or craft strong policies in one domain (such as ZEV), but that does not correlate with similar attention in other domains (such as reducing VMT).

Climate readiness workshop feedback

CBOs conducted 13 workshops on climate readiness planning from October 2023 through April 2024. Across the 13 workshops, there was a combined attendance of 367 attendees representing over 155 organizations.

Please see below for a list of selected attendee organizations in alphabetical order:
Aequor Solutions - American Federation of Teachers - Bay Conservation and Development Commission - Belle Haven Community Development Fund - Belle Haven Empowered - Breakthrough Communities Institute - Black & Veatch - BlueSphere Partners - Building Decarbonization Coalition - Burbank Water & Power - CA State Assembly - CAC - Cal Poly - Cal Trans - California Coastal Commission - CARB - Catalyst SD - CCL - Center for Energy Efficiency - Center for Policy Initiatives - City Heights CDC - City of Alhambra - City of Beaumont - City of Chico - City of Encinitas - City of Gardena - City of Irvine - City of La Mesa - City of Long Beach Department of Health and Human Services - City of Los Angeles - City of Los Angeles, Department of City Planning - City of Los Angeles, Department of Transportation - City of Los Angeles, General Services Department - City of Los Angeles, LA Sanitation & Environment - City of Malibu - City of Oceanside - City of Pico Rivera - City of Pomona - City of Redlands - City of San Francisco - City of San Leandro - City of Santa Monica - City of San Rafael - City of West Hollywood - Clean Power Alliance - Climate Action Campaign - Climate Reality Project - Climate Resolve - Climate Resilient Communities - Coalition for Earth Justice - Coastal Hazards Adaptation Resiliency Group - Community Action for a Sustainable Alameda - Community Agency for Resources and Services (CARAS) - CORE Response - Council for Watershed Health - County of San Mateo - County of Santa Clara - County of San Diego - County of Santa Barbara - CPUC - Cumming Group - County of Marin - East Bay Municipal Utilities District (EBMUD) - Encino Conservancy - Energy Coalition - ESA - evolveEA - Fehr

& Peers - FFF OC - Fridays for Future OC - Friends of Ballona Wetlands - Great Basin Bakery - Green New Deal Alliance - In Good Company - Interfaith - Karuk Tribe - LA Cleantech Incubator - LA County - LA Metro - LACP - LADOT - LADPH - LADWP - Los Angeles County - Los Angeles Regional Collaborative for Climate Action and Sustainability - Marin City Climate Resilience - Metropolitan Transportation Commission - Move LA - MPNA - Mt. Shasta Mountain - Mycelium Youth Network - National Oceanic and Atmospheric Administration (NOAA) - Nevada County - Ninth Root - NRDC - Nuestra Casa - Pathways Climate Institute - Placer County - Policy Studio - Raimi + Associates - RAND - Redwood Energy - Reform and Sustain - Retired from Los Angeles County Sheriff's Department - Renewable Technologies - Rhie Planning LLC - Rincon - San Diego Regional Climate Collaborative - San Diego State University Center for Environmental Justice and Sustainability - San Diego Urban Sustainability Collaborative - San Francisco Bay Area Planning and Urban Research Association (SPUR) - San Francisco Estuary Institute - San Francisco International Airport - Save the Bay - SCAG - SCEDD - Scripps Institution of Oceanography - SD350 - Sierra Club - Siskiyou County - Siskiyou Outdoor Alliance - SoCal Edison - Solano County - Sonoma County Regional Climate Protection Authority - Student Conservation Association - Sustainable Solano - Sunrise Movement OC - Surfrider - Sustainable Ramona - The Catalyst Group - The Climate Registry - The Collective Identity Mentoring - The Educator Collective for Environmental Justice - The Energy Coalition - The Sohagi Law Group, PLC - The Tenacious Group - Three Valleys Municipal Water District - Thrive Alliance - Town of Corte Madera - Town of Truckee - Trinity County - TRPA - UC Davis Center for Regional Change - UCLA - UCLA Luskin Center for Innovation - UCLA Sustainability - UN Association OC - Urban Collaborative Project - USC Sea Grant - USGBC-LA - Valley Transportation Authority - Veterans for Peace - Wellbeing Economy Alliance – Willdan

Table 7. CBO climate readiness workshop attendees by organizational representation

Organization type	Percentage
Government	42%
Nonprofits	44%
Industry	13%
Tribes	1%

CBOs expertly managed attendee lists for the workshops. For example, to create a collaborative learning and sharing environment, a nonprofit might attend one workshop while the utility company would be invited to a separate workshop. Workshops were primarily attended by local nonprofits and local government staff. CBOs reported a focus on building long-term relationships with career staff in local jurisdictions to promote institutionalized change that would extend beyond those holding elected office. Workshops also included tribal representation and were attended by industry representatives (13%), including planning firms. Overall, CBOs reported that virtual meetings have proven effective, drawing participants from various counties across the state. Further, CARB's role as an invited and attentive listener in select workshops was reported as valued and advantageous. Local communities reported feeling acknowledged when the agency actively participates, and they requested future opportunities for CARB to attend and listen, noting that is was a "*good look for CARB"* and local communities feel heard when *"CARB comes to us.*"

Additionally, CBOs expertly juggled messaging strategies. While CARB's motivational framing, particularly GHG reduction, resonates with some communities, it fails to strike a chord with others. Notably, the 280-page 2022 Scoping Plan, references "rural" nine times without offering specific actions for these areas, such as low population exemptions for SB 1232 food waste collection. Motivations for climate action vary significantly across communities, including considerations of financial benefits, clean air and water, and local power and ownership, as seen with Community Choice Aggregation (CCA) programs. However, concepts like VMT are unfamiliar or carry negative connotations due to concerns around mileage taxes, or dependence on gas tax funding, in certain regions. To address these disparities, it is recommended to continue collaborating with CBOs to align state goals with locally valued approaches. As one CBO noted, "*there are other needs of greater importance in many communities right now (health care access, poverty, wildfire threat), and understanding rural needs will be crucial in having the state's climate goals adopted*." Thus, not only will CARB's desired policies need to be reframed in local values for adoption and implementation, but those priorities will also need to be aligned with local priorities to even be considered in policy making circles.

Barriers to success

CBO Quote, "*A significant barrier is access to funding and grant opportunities - either due to a lack of capacity or knowledge about these opportunities*."

While workshops offered opportunities to showcase new funding and tools, they also hosted conversations about the various approaches that local public and private agencies were taking toward climate readiness. Funding was consistently reported as a general barrier to climate action implementation across local governments. In part, some of the funding limitations related to technical assistance. For example, CBOs frequently face inquiries that fall within the state's purview, such as equitable access to funding and transparency in allocation. Similarly, CBOs request the state create and support a standardized GHG inventory methodology and as well as analysis for each jurisdiction. It is worth noting that a bill that would have provided funding for this (SB 511) was not ultimately adopted by the legislature last year.

CBOs also highlighted the importance of recognizing that rural areas, while they may not always meet criteria for Disadvantaged Community (DAC) status or diversity requirements, present distinct challenges that warrant consideration. Despite not fitting traditional metrics, rural regions often have significant populations of BIPOC individuals, lower median household incomes, and face high costs of living. Further, rural regions often advocated for geographic equity over population-based metrics to rectify historical injustices. This approach would celebrate city- and county-level advances instead of weighting results by population. Such approaches may require different funding efforts that are more focused on landscape-level treatments, such as carbon sequestration credits for forest management. Staggered compliance requirement timelines were also mentioned as a way to support policy transfer from early adopted jurisdictions hat have piloted new technologies or policies to success.

Further, attendees expressed a desire for state agencies to provide assistance with grant writing and to reduce the burdensome requirements for grant acceptance. For example, CBOs suggested

that when a community-generated plan promised a strong focus on ZEV-readiness, the state could award such policies with non-competitive, automated ZEV funding. These non-competitive funding opportunities could help reduce the amount of effort needed to search and apply for grants. In addition, reading and rewarding promising plans and policies would close the loop on local-to-state policy coordination. As one CBO also reported, there are "*constricted grant funding timelines for implementation* [that are] *not aligning with time needed to build local relationships and capacity*." If already existing local relationships and capacity is what is ultimately rewarded, then the state could use planning documents like CAPs and the General Plan to award partnerships and planned programs toward faster implementation.

Moreover, attendees also highlighted an important consideration: certain communities face deficiencies in funding for planning, while others encounter challenges in securing funding for implementation. CBOs stressed the importance of funding for community-driven design to result in plans and policies with wide public buy-in. Oversubscribed grant programs do not provide CBOs with enough capacity to engage in these important processes. When querying their partners, a CBO contracted through this project reported, "*funding was by far the most common answer*" to barriers to implementation. Despite excitement about new funding opportunities, partners expressed concern over the posed challenges of grantees' requirements in applying for funding, particularly funding restrictions based on the source of funds.

Recommendations

CBOs recommend several strategies for state agencies to improve funding access and support for local governments and organizations. First, they suggest establishing a state agency liaison to facilitate direct communication and engagement with counties and cities. It is also essential for state representatives to meet local entities in their communities, reducing the need for them to travel to the state capitol. Simplifying language and minimizing technical jargon can enhance accessibility and engagement, ensuring that barriers are not created from the outset.

Collaboration among state and regional agencies is crucial to streamline requests and avoid overwhelming local governments and CBOs with individual requests. Moreover, providing comprehensive support such as training, materials, equipment assistance, and letters of support can bolster their capacity. Strategies aimed at reducing bureaucratic hurdles in funding acquisition are essential, alongside facilitating connections to relevant resources, funding opportunities, and continuing with capacity-building initiatives. Further, collaborating with individual communities to pinpoint their specific needs and offering customized assistance will lead to optimal solutions for overcoming these barriers. As a CBO noted when asked about what would be most helpful for spurring climate readiness planning and implementation: "*lead regional collaboration and conversations in this space so we can be better coordinated in our approach and go after funding.*" A recommendation emerged to sustain and nurture relationships beyond the current contract.

Recommendations from CBOs also focus on methods. Regarding methods, there is a call to account for ecosystem services in the next update of the scoping plan, allowing for the crediting of natural and working land management practices toward local mitigation mandates. For instance, there is an ongoing pilot approach with tribes, demonstrating the potential effectiveness

of this strategy. Outreach and engagement efforts should continue to ensure that marginalized communities have decision-making power while offering support both financial and technical. To this end, CBOs noted that state agencies can bolster CBO actions by encouraging local governments to actively involve CBOs in the development of CAPs and General Plans, facilitating accessibility to documents for public input. This access and input has the added advantage of helping to validate climate data analysis with lived experiences to inform social vulnerability mitigations and resource allocation. One CBO called attention to the California Strategic Growth Council Regional Climate Collaborative (CA SGC RCC): "*The CA SGC RCC grant program would be a place the state could increase investment in, as for two years programs have organized structures to propose to this program that achieve goal, but the grant program is oversubscribed with only 6 awards last year and a similar number anticipated for this year."* When communicating with the public, rather than inundating them with hard data, it is beneficial to guide them through the rationale of how these measures impact their daily lives. As one CBO reported: "*oftentimes communities don't know about the options available to them - it is the responsibility of the state/local government to provide these options, make technical info more accessible, and take the communities input and interpret it into policy actions*." Another CBO concluded: "*By taking proactive steps and engaging with stakeholders, regional agencies can help address these challenges and create a more sustainable and equitable energy future for all*."

In addition, CBOs advocate for various climate readiness approaches, distinguishing between CAPs and General Plans. General plans are commonly utilized in rural areas, while CAPs are high-visibility documents. Safety and hazard mitigation plans are typically revised for Federal Emergency Management Agency (FEMA) compliance, also making them optimal avenues for engagement.

CBOs also seek various forms of support. They desire research assistance, including both quantitative and qualitative analysis of General Plans and CAPs. They note a scarcity of California Environmental Quality Act (CEQA) certified CAPs and lack of standardized formats for both CAPs and General Plans. Additionally, there is a need for cover pages outlining zero emissions timelines, such as by 2040 or 2050.

CBOs also emphasized the need for free, automated, standardized GHG inventories, as well as planning templates and Environmental Justice (EJ) element templates. Some CBOs already work with local jurisdictions to provide GHG inventories. CBOs noted that inventories would need to be tailored to each jurisdiction, and that help from CARB would entail CBOs assisting local jurisdictions with data gathering and review of a standardized output from a state agency. To provide such GHG inventories free of cost to all local governments, a legislative appropriation or philanthropy would need to support CBO and state involvement. Notably, a Senate Bill proposed in 2023 (SB 511) would have appropriated funding to CARB to assist with preparing GHG inventories. This bill was not ultimately adopted by the legislature.

CBOs also advocate for more opportunities to provide feedback to CARB and to facilitate small, local gatherings to foster community relationships. To meet these needs, one CBO recommended that state agencies, "*hire full-time staff dedicated to integrating and communicating with coalition networks across communities."*

The feedback from CBOs encompasses both community aspirations and the challenges encountered by local governments in implementing decarbonization, reducing VMT, and promoting ZEVs. Reflections underscore the importance of addressing barriers to effective climate action at the local level. Moreover, the feedback outlines possible next steps for achieving community goals, emphasizing the need for coordinated support from state agencies. By identifying ways to overcome obstacles and providing tailored assistance, state agencies can play a pivotal role in empowering local governments and CBOs to drive meaningful progress in equitably addressing climate change within their communities.

Discussion

Communities spend many years assembling plans. Many years can also pass where plans are under review before being adopted. The resulting, varied, and slow-moving timelines mean that community-level goal-setting dialogues may run in tandem with policy action and well before a plan is adopted and in place. To improve upon this process, this contract created climate readiness tools and presentations for community groups across California in relation to three CARB climate readiness priorities: Zero Emission Vehicle (ZEV) uptake, reducing Vehicle Miles Traveled (VMT), and decarbonization. These deliverables were designed to help communities learn from each other about the many approaches to improving climate readiness while reducing the level of effort needed for future plan updates.

Given limited time and resources, our findings could help guide local jurisdictions and the state in considering policy avenues. Our finding that the population size of the city does not correlate with creating a CAP runs counter to many policy discussions that consider CAPs the product of large, well-funded cities. For example, An et al., (2022) asserted that larger cities are more likely to adopt CAPs than smaller cities. An et al. (2022) found that 49 cities among 190 cities within the five county Southern California Region adopted climate action plans (CAPs) from 2000 to 2018. This data compares to that in our CAP database in that we show 98 city-level CAPs, with 66 adopted in the same region between the same time period of 2000 to 2018. In working with a more comprehensive dataset, we are better positioned to provide more accurate results. In explanation, An et al. (2022) drew data from a state-level CAP-Map portal that is out of date and labels some jurisdictions as having a CAP though the reference policies are actually found in municipal code or the general plan. Such discrepancies in findings highlight the need for high fidelity, public-facing, accurate planning data. Easy access to plans and policy can improve uptake of promising approaches.

This is precisely the data infrastructure built through this contract. With PlanSearch and the CAP portal, the public can also more easily research planning approaches–learning from the advances of their neighbors. One drawback to such tools is the steep learning curve for public involvement. For example, many people will not know what a heat pump or a microgrid is. Nor will the public know which plans or municipal codes are appropriate for addressing various

topics. By way of example, we note that, in general, energy planning is under-represented in General Plans and CAPs. Only three counties mention "heat pump" in their General Plans. The public might not recognize heat pump programs as decarbonization or energy policy. Further, CBOs explain the lack of plan emphasis on decarbonization by calling attention to the role of Municipal Building and Reach Codes that are more commonly used to regulate individual buildings. Thus, while CAPs and General Plans contain many policies, they may not present an accurate reflection of *all* policies. Our review of municipal reach codes in relation to terminology in General Plans and CAPs helps highlight where various local policy documents crosstalk, and where there will be gaps in assessing local action.

In part, some gaps in policy coverage are the result of a lack of coordination. For example, CBOs note that the state regulatory framework in California does not financially encourage local responsibility for clean energy distribution, an important topic for decarbonization. To help open additional opportunities for local decarbonization planning, state agencies may reconsider the financial implications of enabling local clean energy production, storage, and distribution as well as the rate at which utilities would reimburse neighborhoods and cities for low-carbon electricity contributed to the grid. Such conversations will take coordination, and CBOs are well positioned as trusted conveners.

Summary and Conclusion

We find that communities are choosing to address climate policies in different planning vehicles, perhaps due to timing of policy windows and perhaps due to planning capacity. We also find that the language used in state goal-setting documents is often discordant with both research and local policy action. For example, the term "decarbonization" occurs in only one city-level and one-county level general plan though this term is well-represented in research and state policy. In part, varied language choice is a byproduct of the rapidly evolving landscape of climate readiness. As previous data infrastructure products, like CapMAP have demonstrated, pre-coding of policies is both labor-intensive and will not generate an accurate reflection of planned actions. Similarly, one-size-fits-all state-level recommendations often fail to resonate across the geographically, politically, and socially varied state. Instead, CBOs emphasize the need for peer-to-peer, regionally specific collaboration to advance climate readiness planning at the local level.

To foster immediate, real-time planning advances for equitable climate readiness, there is a great need for public, transparent data. Local jurisdictions often operate with few staff and limited time for information-seeking. We recommend that the state better support local planning with greater access to aggregated public data. For example, state level EV charging station data is only available at the county-level. Offering more fine-grained analysis at the city-level for the public, local staff, or CBOs would allow local municipalities to better mark progress and urge action. Similarly, though plans are required to be publicly available, they are often sequestered on individual jurisdictional websites, difficult to find, and difficult to understand. Creating more

standardized language in more accessible plans would facilitate finding examples for local planning boards to consider.
The lack of Findable, Accessible, Interoperable, and Reusable data guidelines for land-use plans, incomplete compliance with existing mandates and guidance, and variation in structure and formatting of General Plans and CAPs creates particular challenges to designing data infrastructure. This contract has overcome some of these obstacles, with the notable benefit of the PlanSearch tool winning the 2023 California American Planning Association Award for Excellence. To maintain and expand these early efforts, we recommend the state provide guidance or regulation on the accessibility of plans (standardized formatting available in machine readable PDFs available at local government websites). This guidance could come from LCI in the next General Plan Guideline update and be reiterated by additional state agencies. Encouraging that plans be published in machine-readable formats (such as computer-generated or OCR-readable PDFs) and that images be described with machine-readable tags would help to support text extraction and search while also bringing plans into compliance with ADA. With better formatting and data storage protocols, updates to a plan database could be automated, for example with an API that notifies database coordinators when a new plan is submitted for state agency review. CBOs involved with climate readiness planning also note a desire for a standardized GHG inventory methodology to galvanize action and simplify the planning process.

Practically, new data tools open opportunities for greater plan coordination. Additional roles need to be supported with new enabling legislature and funding. For example, we encourage the consideration of new legislation that requires local jurisdictions to report when individual elements and General Plans are updated and submit adopted documents to a central agency. The agency could scan such documents to ensure that mandates were achieved. These concerns will be of interest to multiple state agencies and could reduce staff time elsewhere spent searching for documents. For example, in reporting on meeting EJ mandates, the Attorney General could note how disadvantaged communities were defined, identified, and mapped, as well as cross-reference which goals and policies are EJ-related.

By making planning more transparent, it will be important not to lose sight of the rationale for mandates or the value of local efforts that feed into the planning process and implementation. “Plug and play” cover forms that are easy to fill out or prefilled will simplify plan updates and strengthen community involvement by facilitating the use of common language aligned with desirable state policies. Such forms would enable better indexing of plans and comparison of policies, thereby helping local communities to explore promising policies that community members support. At the same time, it is also important to allow plans to use a format that is flexible enough to incorporate unique and valuable insights that will be useful to local communities.

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Appendices

Appendix 1. Literature Review

The overall goal of the below literature reviews is to assess the barriers to creating local climate policies with an emphasis on climate justice. We identify relevant policies in relation to the three priority areas: reducing VMT, ZEV readiness, and building decarbonization. Material from the literature reviews was used to shape informational handouts for use in Capacity Building Workshops.

Zero Emissions Vehicles

- California Code Terms
    - Near-zero-emission vehicles
    - Clean Vehicles
    - Clean transportation
    - Battery
    - Fuel cell
    - Clean burning vehicles
    - Emission controls

- Scientific Scholarly Terms
    - Charging infrastructure
    - Battery
    - Low-carbon transportation
    - ZEV mandates
    - GHG targets
    - ZEV uptake
    - Non-compliance penalties
    - ZEV credits
    - High occupancy vehicle (HOV) lanes
    - Plug-in electric vehicles (PEV)
    - special electricity rates for PEV owners
    - Electrifying public transportation fleets
    - Municipally-owned charging station networks
    - EV car sharing service
    - Parking privileges
    - Fuel cell vehicles
    - ZEV sales target
    - Technology adoption model

Building Decarbonization

- California Code Terms
    - Energy efficiency
    - Green Buildings
    - Low emissions development
    - Near-zero-emission building technologies
    - All-electric buildings
    - Energy storage systems
    - Incentives greenhouse gas emissions reductions
    - Heat pumps
    - Solar thermal systems
    - Advanced energy efficiency systems
    - Solar photovoltaic system
    - Energy storage system

- Scientific Scholarly Terms
    - Insulation
    - Energy-efficient end-use appliances
    - Building thermal properties
    - Less carbon-intensive fuels
    - Hourly service demand
    - Building optimization
    - Decarbonization of electricity supply
    - Building efficiency
    - Building energy codes
    - Retrofitting
    - Energy efficiency gap
    - Embodied energy (energy used to produce materials for a building)
    - Net-zero energy buildings
    - On-site carbon-free renewable energy
    - Off-site carbon-free renewable energy
    - Carbon offsets
    - Electric heat pumps
    - Peak electricity demands
    - Low-carbon heating
    - Dual source systems
    - Alternative fuels
    - Building refurbishment
    - Weatherization
    - Air infiltration/ sealing
    - Energy efficiency standards
    - Water efficient appliances
    - Landscape irrigation
    - Passive solar heating systems
    - Indoor air quality
    - Energy burden

- Ventilation

Reducing Vehicle Miles Traveled

- California Code Terms
  - Emissions per-passenger-mile traveled
  - Average vehicle ridership
  - Reduce vehicle trips
  - Transportation control requirements
  - Vehicle emissions
  - Vehicle maintenance practices
  - Clean burning vehicles
  - Transit system ridership
  - Transformative capital improvement

- Scientific Scholarly Terms
  - Work related VMT
  - Home related VMT
  - High density development
  - Micro mobility
  - Vehicle efficiency standards
  - Transit investment
  - Employment density
  - Pricing policies for driving and parking
  - Road use fees
  - Gas tax
  - Carbon offsets
  - GHG mitigation
  - Transportation land use
  - Ridesharing
  - Multimodal transportation networks
  - Traffic congestion
  - VMT co-benefits
  - Travel behavior
  - Average trip length
  - Pedestrian-friendly design
  - Non-motorized transportation modes
  - Smart growth
  - Transit-oriented development
  - First mile/ last mile
  - Private vehicle use
  - Behavioral mode choice
  - Coordinated transportation systems

Appendix 1A. Zero Emission Vehicle (ZEV) Readiness

The role of ZEVs in California Climate Policy

ZEV Challenges

With this review on Zero Emission Vehicle (ZEV) readiness, we focus on the state of research and California policy to identify opportunities and barriers for local jurisdictions in California. ZEV readiness includes actions described by the California Air Resource Board's (CARB) ZEV Readiness guidelines,[1] such as:

- Siting adequate and appropriate refueling infrastructure to meet the jurisdiction's transportation needs for all vehicle classes, including emerging electric mobility.
- Accessible clean mobility transit options, including zero-emission, reliable and safe multi-modal transportation and new and used ZEVs available for purchase or lease.
- Supportive policies and programs for ZEV uptake, including permit streamlining, incentives, and public outreach to develop a ZEV-informed population; and
- Training a skilled workforce with access to high road jobs that support ZEVs, ZEV infrastructure, and the ZEV industry.

In particular, this review is focused on ZEV readiness for California's vulnerable populations who often serve at the frontline of new industries, commute long distances for work, and bear a great percentage of the cost-burden for job-housing mismatches that necessitate commuting. To achieve broad and equitable ZEV adoption, ZEV readiness policies must support historically Disadvantaged Communities (DACs) and low-income families.

The main findings of this review are:

1. The first major barrier to ZEV adoption is that battery electric vehicles (BEVs) cost up to one quarter more than manufacturing internal combustion engines (ICEs) (Slowik et. al, 2019). The slow production of BEV batteries is another key bottleneck for both market price and uptake (Rietmann et. al, 2020). However, recent price analysis studies show costs dropping below the price of conventional vehicles by 2027, with the lowest range of ZEVs reaching price parity in 2024 (Shaheen et. al, 2020). This is an especially important factor to consider as higher household income is significantly correlated with greater ZEV adoption (Javid and Nejat, 2017). **This barrier can be overcome in the near term with increased rebates, cost offsets, and education about the package of financial incentives that exist, particularly for low-income families.**
2. A second major barrier is insufficient charging infrastructure: consumers are reluctant to purchase ZEVs without wide availability of dense refueling infrastructure. Yet, fuel suppliers are hesitant to build public infrastructure until enough alternative fuel vehicles are on the road to make it profitable (Gnann and Plötz, 2015, Melaina et al., 2017). There is also a lack of charging infrastructure in multi-unit dwellings where much of Californians reside (Horesh et al., 2023).

Charging at home is the most convenient and economical means to charge one's vehicle. The lack of dense charging station infrastructure increases range anxiety, which diminishes interest in plug-in vehicles (Carley et al., 2013). **To overcome this barrier, local jurisdictions can engage the community in siting ZEV charging stations, streamline permitting processes, offer incentives to reduce the cost of charging infrastructure, adopt voluntary CALGreen ZEV charging building codes, establish ZEV-friendly zoning codes and ordinances, and offer parking incentives. All of these policies should explicitly include and support DACs and low-income families. Further, regional and state infrastructure plans can offer options for corridor charging that enable long-range driving.**[2]

3. The third area of concern is the carbon intensity of the electricity generation mix that ZEVs rely on. Currently, about 33.6% of California's electricity comes from renewable sources (the largest shares are solar and wind), 37.9% from natural gas, and only 3% from coal, most of which is generated outside the state (California Energy Commission, 2021). **To overcome this barrier, local jurisdictions, in coordination with utilities, will need to plan energy infrastructure: siting new renewable facilities, safeguarding transmission, balancing local grids and energy storage. This includes siting and support for microgrids and automatic adjustment of charging coordinated with grid load.** Historically, energy infrastructure has been sited in low-income communities resulting in Locally Unwanted Land-Uses (LULUs) that depress housing values and impact health. As new energy infrastructure is sited, attention to equitable siting and clean technologies will be especially needed to demonstrate that the energy transition will not result in legacy LULUs and create or compound DACs.
4. Concern over the uncertainty of future ZEV incentives increases hesitation over private and public transitions to ZEV (Cano et al., 2018). Trencher (2020) recommends that **a combination of legislative mandates with incentives can build long term confidence in ZEV-related investments**.

How ZEV Impacts Greenhouse Gas Emissions

Below, we review the state of the research on ZEV policy recommendations and California government codes. We then discuss models for reaching GHG emissions reductions goals through ZEVs while comparing these models to the policies currently in place. Last, we identify gaps between how California codes and current research are framing the problems and solutions.

In California, the transportation sector is responsible for 40% of greenhouse gas (GHG) emissions, making it the largest contributing sector of state emissions (CARB, 2022). Light-duty vehicles produce the majority of transportation sector emissions. Because of this, reducing carbon emissions from the transportation sector has emerged as a priority action by the state to

combat climate change. ZEV technologies have been presented by policy makers as one solution for this decarbonization task in the form of battery electric vehicles (BEVs), plug-in electric hybrid (PHEVs), and fuel cell electric vehicles (FCEVs). ZEVs offer a path not only for larger GHG emissions reduction goals due to operating solely on electricity (depending on the source of electricity used for charging), but will also gradually improve regional air quality by reducing exhaust (Rietmann et al., 2020).

Energy science and policy experts credit California as a leader in statewide ZEV adoption due to the recent Advanced Clean Cars II regulation, adopted by CARB in 2022 (CARB, 2022). To ensure a gradual phase-out of new sales of internal combustion engine vehicles, this mandate sets annual sales requirements for ZEV and plug-in hybrid vehicles from model years 2026 to 2035 and stricter exhaust and evaporative emission standards. Through the ZEV mandate and Executive Order N-79-20 (Governor Newsom, 2021), the state aims to achieve 100% light-duty ZEV sales by 2035 and 100% medium- and heavy-duty ZEV sales in California by 2045. Executive Order B-48-18 (Governor Brown, 2018) targets five million ZEVs in California by 2030 an and the installation of 200 hydrogen fueling stations and 250,000 ZEV chargers statewide by 2025. .

Because of these mandates and regulations in California, and the rapidly expanding uptake of these programs in other states, ZEVs are a growing segment of the automotive market and reached 25.4% market share in California (CEC, Quarter 4 of 2023).

ZEV Background on Terms: State of the Research

This section reviews federal, state and local policies pertaining to ZEV adoption.

Vehicle Emissions Standards (VES) specify the maximum GHG emissions (in grams of CO2-equivalent/ km) from newly sold light-duty vehicles, and can be used for both GHG reduction and ZEV sales goals. In an attempt to raise VES, **ZEV mandates** have been used to force a proportion of major automaker's sales to come from ZEV. As an incentive, automakers receive **ZEV credits**, which are earned when manufacturers sell ZEV vehicles in ZEV states (such as California). One sale does not equal one credit, rather they are awarded based on the type and range of the vehicle sold. A full ZEV is worth more than a hybrid ZEV, and long-range vehicles are worth more than short range vehicles. The ZEV credit policy ultimately encourages automakers to build long range electric vehicles over other options. Automakers can also sell their surplus ZEV Credits to other automakers who have not met their quota for the year, thereby increasing profits for companies that sell the most ZEVs. ZEVs include plug-in hybrid electric vehicles (PHEVs) that use batteries to power an electric motor and another fuel, such as gasoline, to power an internal combustion engine (ICE). PHEV batteries can be charged using a wall outlet or charging equipment, by the ICE, or through regenerative braking. The vehicle typically runs on electric power until the battery is nearly depleted, and then the car automatically switches

over to use the ICE. A fuel cell electric vehicle (FCEV) generates electricity using oxygen from the air and compressed hydrogen. Most fuel cell vehicles are classified as zero-emissions vehicles that emit only water and heat. Battery-electric vehicles (BEVs) run solely on electricity stored in a battery pack that energizes one or more electric motors and produces zero tailpipe emissions. Their driving ranges on a full charge vary widely from about 80 to more than 300 miles.

In an effort to increase ZEV adoption, there are various mandates and regulations offering several incentives to ZEV owners. A common incentive is the **Clean Vehicle Rebate Project (CVRP)** offered by CARB. This initiative provides rebates to California residents who meet certain eligibility for the purchase of PHEV, BEV, or FCEV's (CARB, 2023). The DMV also offers reduced registration fees. State and federal governments offer tax credits.[3] Other incentives are special ZEV electricity charging rates to residential charging stations, or time of use (TOU) rates. All of these incentives result in driver savings that are accrued from lower operating costs. Other incentives come in the form of convenience privileges, like being able to use High Occupancy Vehicle (HOV) lanes, or free or reserved parking for ZEV owners.

Other ways that ZEV adoption has been promoted is through making municipally owned charging station networks publicly available, electrifying public transportation fleets, and ZEV carsharing and ridesharing services. A community can support further ZEV adoption by taking ZEV readiness actions as described by the California Air Resource Board's ZEV Readiness guidelines.[4] Much of the literature discussed in following sections analyzes which of the incentives in combination are the most successful at promoting ZEV adoption.

California Codes

According to California legislative code, "electric vehicle" means a vehicle that uses a plug-in battery to provide all or part of the motive power of the vehicle, including battery electric, plug-in hybrid electric, or plug-in fuel cell vehicle. Codes also used terms like clean transportation and clean burning transportation as other identifiers of ZEV. Various efforts to promote ZEVs occur through emission control and rebate programs, covered in the previous section. State codes also specify electricity price privileges for EV owners, and time of use (**TOU**) rates. These are seen as part of an **electric vehicle grid integration strategy**, which is defined as any method of altering the time, charging level, or location at which grid-connected electric vehicles charge, in a manner that optimizes plug-in electric vehicle interaction with the electrical grid and provides net benefits to ratepayers. There are special ZEV **parking privileges** outlined in these codes, where ZEV spaces can count as more than one parking space depending on the compliance with applicable minimum parking space requirements established by a local jurisdiction. Most of the codes address **electric vehicle charging station infrastructure** for residential, commercial, industrial, and agricultural zones, and laws that would make that installment process easier.

Research on ZEVs: ZEV Program in California

This section discusses the history and impact of the ZEV program in California.

California implemented a ZEV program in 1990. A policy brief by McConnell and Leard (2021) examined the motivation for the ZEV program in California, and how it has achieved outcomes such as innovation in electrification, rising rates of vehicle sales, and reductions in costs. The results showed evidence of electrification innovation by auto manufacturers through the number of patents related to ZEVs which jumped from none in 1990 to more than 70 per year by the late 1990s. The results also showed a decline in battery costs over time, which have translated into slight declines in vehicle purchase prices and greater ZEV range. While ZEVs still have not achieved cost and convenience parity with gasoline vehicles, most forecasts predict such parity sometime between 2022 and 2030, depending on vehicle size and type (Lutsey and Nicholas, 2019). Overall research consensus is that the California ZEV mandate can be effectively combined with price-based policies like a carbon tax to encourage greater ZEV uptake.

Additional California legislative codes broadly address the goals of ZEV adoption across the state. For example, under SB 350 (Deleon, 2015), the California Public Utilities Commission (CPCU) prioritizes energy procurement decisions that effectively reduce GHG emissions. The bill sets a target of achieving a 40 percent reduction in emissions below 1990 levels by 2030 and 80 percent GHG reductions below 1990 levels by 2050. To reach this goal, the California Public Utilities Commission (CPUC) must prioritize procuring a minimum of 50 percent renewable energy, doubling energy efficiency, and promoting transportation electrification. Additionally, this legislation emphasizes the importance of improving air quality and economic conditions in disadvantaged communities. This approach aims to drive significant progress in reducing emissions and advancing sustainable energy practices while ensuring that the benefits of clean energy and pollution reduction extend to all Californians. Achieving these goals requires better grid management and integration from renewable energy resources. AB 2127 (Ting, 2018) continues to support the goals of the ZEV adoption by requiring that the State Air Resources Board and the Public Utilities Commission prepare a statewide assessment of the electric vehicle charging infrastructure needed to support the levels of electric vehicle adoption required for the state to meet its goals of putting at least five million zero-emission vehicles on California roads by 2030, and of reducing emissions of greenhouse gasses to 40 percent below 1990 levels by 2030.

The California Energy Commission's Second Electric Vehicle Charging Infrastructure Assessment: Assessing Charging Needs to Support Zero-Emission Vehicles in 2030 and 2035 was completed in 2024 and looks at existing infrastructure and future infrastructure needs throughout California, including in low-income communities. According to the analysis outlined in this report, it is estimated that California will require 1.01 million chargers (including 39,000 direct current fast chargers) to accommodate 7.1 million light-duty plug-in electric vehicles by 2030. Further, it is projected that by 2035, California will require 2.11 million chargers

(including 83,000 direct current fast chargers) to adequately sustain a fleet of 15.2 million light-duty plug-in electric vehicles. California will also require about 109,000 depot chargers and 5,500 public chargers for 155,000 vehicles in 2030 and 256,000 depot chargers and 8,500 public chargers for 377,000 vehicles by 2035 to support medium and heavy-duty plug-in electric vehicles.

A third code that addresses statewide ZEV goals is the Charge Ahead California Initiative, or AB 1275 (De Leon, 2014). The goal of AB 1275 is to place in service at least 1 million zero-emission and near-zero-emission vehicles by 2023. This is part of an effort to establish a self-sustaining California market for ZEVs in which they are a viable mainstream option for vehicle purchasers, businesses, and public fleets. AB 1275 identifies the need to increase access for disadvantaged, low-income, and moderate-income communities in order to enhance air quality, lower greenhouse gasses, and promote overall benefits for those communities and consumers.

The Advanced Clean Cars II rule (Executive Order N-79-20) establishes a year-by-year roadmap so that by 2035 100% of new cars and light trucks sold in California will be ZEVs, including plug-in hybrid electric vehicles (CARB, 2022). To meet federal air quality standards, the regulation is expected to deliver a 25% reduction in smog-causing pollution from light-duty vehicles by 2037. From 2026 through 2040 the regulation is estimated to result in cumulative avoided health impacts worth nearly $13 billion including 1,290 fewer cardiopulmonary deaths, 460 fewer hospital admissions for cardiovascular or respiratory illness, and 650 fewer emergency room visits for asthma (CARB, 2022). The regulation also includes provisions that enhance equity in the transition to zero-emission vehicles and provides consumers certainty about the long-term emission benefits, quality, and durability of batteries for clean cars and trucks.

In focusing on public fleets, the California Air Resources Board (CARB) passed the Innovative Clean Transit Regulation in 2019, requiring all public transit agencies to transition to zero emission technologies by 2040 (CARB, 2019). Beginning in 2029, 100% of new purchases by transit agencies must be zero-emission buses (ZEBs), with a goal for full transition by 2040. A ZEB Rollout Plan is required from each transit agency, and must be approved by its Board, to show how it is planning to achieve a full transition to zero-emission technologies by 2040 (CARB, 2019). Large transit agencies must submit their Rollout Plan by July 1, 2020, and small transit agencies by July 1, 2023. The regulation also encourages transit agencies to provide innovative first and last-mile connectivity and improved mobility for transit riders.

Interface between Statewide, Municipal, and Regional ZEV Programs

Many municipalities, along with their parent counties and regional governments, offer a variety of incentives to owners and operators of ZEVs to make adoption more convenient and affordable. A study by Clark-Sutton et. al (2016) presents an index that ranks the “readiness” of

36 major U.S. cities to deploy electric vehicles. They define readiness as the degree to which adoption of electric vehicles is supported, as reflected in policy instruments, infrastructure development, and municipal investments in PEV technology. They also compared cities within states that participate in a ZEV program with those that do not. The results from a weighted scoring system showed that the highest-scoring cities all offer substantial purchase incentives for ZEVs and charging equipment, and they offer time of use electricity rates. The results also showed no statistically significant difference between ZEV and non-ZEV states, indicating the importance of local policies; some cities in ZEV states rank quite highly (e.g., Portland, Oregon, and Los Angeles, California), some cities in non-ZEV states (e.g., Washington, DC, Denver, and Atlanta) also rank highly. This study identified factors that local jurisdictions may control (e.g., city parking access for ZEV owners, city-subsidized charging stations, and streamlined permitting procedures for home charging station installation) and how they interplay with state policies (e.g., HOV-lane access, state-level cash rebates or tax credits for ZEV owners, the state's gasoline tax rate, and the structure of electricity pricing). Considering the complex interactions that state and city level policies exert upon each other, this study concludes that in order to increase ZEV adoption, policies at both scales need to complement each other. For California, these findings demonstrate the need to celebrate and support local jurisdictions that demonstrate strong ZEV adoption and provide capacity building for jurisdictions that have not yet adopted ZEV-supporting policies (see plan evaluations for more information).

Two California-focused studies, Javid and Nejat (2017) and Searle et. al (2016) review the degree to which counties and cities have adopted ZEV policies as well as the policies' effectiveness at making ZEV more convenient and accessible. Javid and Nejat use a multiple logistic regression analysis of the 2012 California Household Travel Survey dataset, to understand the influence of demographics and travel-related characteristics, socioeconomic variables, and infrastructural and regional specifications. The results show that the average level of ZEV penetration across the state appears to be associated with infrastructural factors such as greater availability of public charging stations per capita and higher retail gas prices. These findings suggest that local efforts should target siting charging stations for public and private fleets. Searle et al. (2016) use a multivariate regression analysis to show that ZEV model availability, public electric vehicle charging network, local promotion activities for ZEVs (e.g., outreach events, informational websites, electric car sharing services, and government and fleet programs) and high median income in California cities are all positively correlated with new electric vehicle sales share. These findings note that higher income households are more likely to adopt ZEV use, indicating the care needed to craft equity-focused policies that support lower income households that often rely more on their vehicles for long commutes to and from work. Both studies note that policy support in California is bolstering the electric vehicle market. Major metropolitan areas in California had 3 to 13 times the average U.S. electric vehicle uptake in 2015 (Searle et. al, 2016). Furthermore, the 30 cities in California with the highest electric vehicle uptake —with 8 to 25 times the U.S. electric vehicle uptake—are also those with the

most implementation of abundant, wide-ranging electric vehicle promotion programs (Searle et. al, 2016).

Approved in 2015, AB 1236 focuses on local ordinances related to ZEV charging stations. The bill requires local governments to adopt an ordinance that establishes an expedited and streamlined permitting process for ZEV charging stations. Sharing a common objective with AB 1236, AB 970 (McCarty, 2022) describes how existing law requires a city, county, or city and county to administratively approve an application to install a ZEV charging station through the issuance of a building permit subject to a limited review by the building official of that city, county, or city and county. Existing law requires every city and county to create an expedited and streamlined permitting process for ZEV charging stations. State law also requires local jurisdictions to create an application checklist to expedit review of ZEV infrastructure proposals. This bill clarifies that these provisions apply to all cities, including charter cities. Monitoring to ensure compliance with AB 1236/970 can occur through climate action capacity building coalitions—particularly where municipal code and plans are readily available for comparative policy analysis and community-to-community learning.

ZEV Uptake in Disadvantaged Communities

This section discusses ZEV uptake in disadvantaged communities, the challenges that exist, and legislative codes addressing these concerns.

While the previous studies investigate socioeconomic and demographic characteristics, they did not delve specifically into equity and environmental justice (EJ). Disadvantaged Communities, or DACs, as defined by the California Environmental Protection Agency in Health and Safety Code (Cal. Gov. Code § 39711), are defined as "areas disproportionately affected by environmental pollution and other hazards that can lead to negative public health effects, exposure, or environmental degradation" and "areas with concentrations of people that are of low-income, high unemployment, low levels of home ownership, high rent burden, sensitive populations, or low levels of educational attainment" (California Gov. Health and Safety Code - HSC § 39711). Guidelines for incorporating EJ from the Governor's Office of Land Use and Climate Initiatives (LCI) require both distributional and procedural EJ focus through the identification of disadvantaged communities within the planning area and creation of objectives and policies to (1) "reduce the unique or compounded health risks in disadvantaged communities by means that include, but are not limited to, the reduction of pollution exposure, including the improvement of air quality, and the promotion of public facilities, food access, safe and sanitary homes, and physical activity," (2) "promote civil engagement in the public decision-making process," and (3) "prioritize improvements and programs that address the needs of disadvantaged communities" (Gov. Code Sec. 65302(h)). Ultimately, adoption of a new element, usually the housing element, triggers the mandatory revision of several other components of the general

plan, including identifying “disadvantaged communities” (Gov. Code § 39711) and the state mandate to address Environmental Justice (Gov. Code § 65302(h)).

A study by Canepa et. al (2019) reviews PEV adoption in DACs, considering PEV market share, socioeconomic characteristics of PEV owners, and PEV charging infrastructure, including questionnaire survey data, department of motor vehicle (DMV) registration data, and infrastructure data. They find that adoption of both new and used PEVs in DACs occurs at comparatively low rates of 5.7% and 8.7% of all PEV sales (Canepa et. al, 2019). Owners of new or used PEVs in DACs have slightly lower incomes ($135,102) than PEV owners in non-disadvantaged communities ($153,175). However, as a group, PEV owners in DACs have higher incomes, are more educated, and fewer are home-renters than the DAC average, indicating that PEV-owners in DACs are not representative of the communities in which they live. Canepa et. al also map the charging infrastructure present in DAC census tracts (0.93 level 2 chargers per 1000 households, and 0.61 DC fast chargers per 1000 households), suggesting that further PEV adoption could be supported with greater siting of charging infrastructure. Additionally, there are higher proportions of used PEVs in DACs than new PEVs, which indicates reliance on used PEV markets to reach DAC households. Key barriers to ZEV adoption in DACs are the prohibitive price of the technology, lack of knowledge about or ease of accessing PEV incentives, and lack of access to public or private charging infrastructure located near multi-unit housing. These barriers require a combination of state and local efforts with intentional focus on engaging DAC households.

Some current California legislative codes respond to ZEV barriers for low-income households. One example of this is the California Clean Vehicle Rebate Project (2023), which allocates additional funds to low income consumers. The incentive program offers up to a $7500 rebate to buyers of BEVs and $6500 to buyers of PHEVs. This applies to households with an income cap of $135,000 for single filers, $175,000 for head-of-household filers, or $200,000 for joint filers (CARB, 2023). However, these incentives are currently only applicable to new PEV purchases or leases. Similarly, the AB 193 Zero-Emission Assurance Project (2018) allocates rebates for battery and fuel cell replacements on used ZEV vehicles. Furthermore, pursuant to SB 1000, which mandates the California Energy Commission assess ZEV infrastructure deployment in California (Lara, 2018), the CEC found that public Level 2 and direct current fast chargers are unevenly distributed among air districts and counties (CEC, 2020). Findings also indicated that low income communities in California have fewer public Level 2 chargers deployed per capita. Limited availability of Level 2 chargers in low income communities can act as a barrier to ZEV adoption. Thus, the results from this report and the ongoing assessment will help inform program investments to ensure equitable access to charging infrastructure.

Some of the California legislative codes have tried to make ZEV information more accessible through other initiatives. For example, SB 68 (2022) supports building owners in decarbonizing

buildings and adding energy storage or electric vehicle charging capacity to buildings. The Public Utilities Commission, the Department of Housing and Community Development, the California Building Standards Commission, and other relevant state agencies, are required to develop and publish on the commission's internet website guidance and best practices to help building owners, the construction industry, and local governments overcome barriers to electrification of buildings and installation of electric vehicle charging equipment. Similarly, in an effort to make information on PHEVs and PEVs more widely accessible, SB 1455 (2011), says that the State Energy Resources Conservation and Development commission, in consultation with the Public Utilities Commission, shall develop and maintain a website containing specific links to electrical corporation and local publicly owned electric utility web sites that contain information specific to plug-in hybrid or fully electric vehicles. This resource information is intended to direct a consumer on how to find out if their residence will require a utility service upgrade, basic charging circuit requirements, and utility rate options. Both of these codes, however, do not offer information on rebates to ZEV owners.

Effectiveness of ZEV Consumer Financial Incentives and Rebates

This section discusses the effectiveness of financial incentives and rebates to encourage consumers to choose ZEV.

One priority area for equitable ZEV adoption by low-income households is the development and funding of price supports and rebates. Hardman et al. (2017) aim to understand the effectiveness of purchase incentives in increasing ZEV sales and find through a systematic literature review that ZEV rebates play a significant role in the increase of ZEV adoption. Narassimhan and Johnson (2018) quantify the influence of key incentives on PEV adoption, and through a regression of vehicle purchase data from 2008–2016, find that rebates are usually more effective in driving ownership decisions than tax credits. Another study by Wu and Kontou (2022) looks at a planning horizon of the next 30 years using the 2021 National Household Travel Survey trip data to calculate average daily vehicle miles traveled (VMT) in the US. They also use historical ZEV registration data from the year 2011 (when electric vehicles entered the market) to the year 2020. Their analysis indicates that rebates should be provided earlier than chargers due to neighborhood effects of ZEV adoption and the minimization of expenditure. They conclude that rebates are more effective for modest drivers while charging stations should be prioritized for frequent drivers. In sum, rebates are successful in spurring adoption and can be further aimed at supporting ZEV purchases by low-income households. After a critical mass of ZEV purchases, incentivizing ZEV charging stations in DACs would sustain ZEV adoption further.

Challenges for Increasing ZEV Charging Infrastructure

This section discusses the challenges for increasing ZEV charging stations and their role in promoting consumer confidence.

While the previous section identifies rebates as the primary motivator to purchase a ZEV, many studies quantify the value of charging infrastructure in ZEV uptake. One such study by Greene et. al (2020) analyzes the value of public charging infrastructure to owners of PEVs through a willingness-to-pay (WTP) survey that was derived from simulation modeling and econometric estimates of the value of enabled miles of vehicle travel powered by electricity. Through their case study on California's public charging network in 2017, they find that for a ZEV owner, public charging infrastructure is worth between $1500-$6500 a year. Charging at home, work, or public locations also significantly increases consumers' willingness to purchase ZEVs. Similarly, Kontou et al. (2019) analyze GPS travel survey data from three metropolitan areas and find that the most frequently used and most important piece of infrastructure in convincing consumers to purchase a PEV is home charging. Without access to charging at or near home, consumers are unlikely to purchase a PEV. Their results show that the next most important charger location for consumers is the workplace. Finally, like Greene et al. (2020), they conclude that charging infrastructure in public locations and on travel corridors is instrumental in encouraging consumers to purchase PEVs, however they find that these are utilized less often than home or work location chargers. These findings suggest that for equitable ZEV adoption, local jurisdictions should consider fast-track, low-cost permitting for charging stations in DACs. Public financing for siting charging infrastructure in DACs will also benefit equitable ZEV uptake.

With this framing, it is unsurprising that charging infrastructure is the most commonly cited aspect of ZEV uptake in California legislative code. For example, SB 1340 (Added by Stats, 2011), recognizes that the upfront cost of installing electric vehicle charging infrastructure for residential, commercial, industrial, and agricultural zones, prevents many property owners from making those improvements. In response, SB 1340 proposes that public agencies finance the installation of ZEV charging infrastructure. Another code, AB 1092 (Levine, 2014), specifies mandatory building standards for the installation of future ZEV charging infrastructure for parking spaces in multifamily dwellings and nonresidential development. SB 676 (2020), specifies time-of-use rates for customers with ZEVs to incentivize charging at periods of low demand and low grid congestion. SB 626 (2010), outlined how the Energy Commission, State Air Resources Board, electrical corporations, and the motor vehicle industry, promises to further evaluate policies to develop infrastructure sufficient to overcome any barriers to the widespread deployment and use of ZEVs. Topics of concern addressed in this code are:

- The impacts upon electrical infrastructure, including infrastructure upgrades necessary for widespread use of plug-in hybrid and electric vehicles and the role and development of public charging infrastructure.
- The role the state should take to ensure that technologies employed in plug-in hybrid and electric vehicles work in a harmonious manner and across service territories.

- The impact of ZEVs on grid stability and the integration of renewable energy resources.
- The technological advances that are needed to ensure the widespread use of plug-in hybrid and electric vehicles and what role the state should take to support the development of this technology.
- The existing code and permit requirements that will impact the widespread use of plug-in hybrid and electric vehicles, and any recommended changes to existing legal impediments.

ZEV in Other Sectors

Ride sharing is another opportunity for ZEV adoption. Shaheen et. al (2020) review the impact of car sharing services in ZEV uptake through a nationwide survey of car2go, DriveNow, eGo, CarShare, and Zipcar members. Results show that users who shared PHEVs or BEVs more frequently were more likely to support ZEV policies. The results also suggest that exposure to PHEVs or BEVs through carsharing increased a user's reported likelihood to purchase a ZEV in the future. Collectively, the results note that temporary exposure to ZEVs through ca sharing improves perceptions that may lead to an expanded ZEV market share. Findings hold promising implications for ZEV ridesharing and ZEV municipal fleets.

Supporting ZEV rideshare policies at the state level can further bolster ZEV adoption. For example, in 2021, CARB adopted the Clean Miles Standard to reduce emissions from transportation network companies (TNCs) like Uber and Lyft.[5] The standard sets goals for ZEV fleet adoption in TNCs and offers optional credits for trips that connect to transit. To focus on heavy-duty vehicles, the California Clean Truck, Bus, and Off-Road Vehicle, and Equipment Technology Program was created by AB 992 (Cooley, 2022). The program funds development, demonstration, and early commercial deployment of ZEV trucks, buses, off-road vehicles, and equipment technologies. According to the 2007 State Alternative Fuels Plan analysis by the Energy Commission and the State Air Resources Board, light-, medium-, and heavy-duty vehicle electrification will result in approximately 70 percent fewer greenhouse gasses emitted (AB 1007, Pavley). AB 992 also outlines how priority shall be given to projects benefiting DACs. CARB's Moving California Heavy-duty Project in Action[6] specifically addresses the environmental challenges that heavy-duty vehicles pose, aiming to facilitate the transition to cleaner transportation for both on- and off-road fleets in disadvantaged communities. Similarly, the Light-duty Projects in Action focuses on increasing access to long-term clean transportation for income-qualified residents and residents of disadvantaged and tribal communities. These initiatives address transportation equity to ensure that all residents have access to cleaner transportation options while seeking to improve neighborhoods that host commercial heavy-duty traffic.

Conclusion: Feasibility of Reaching GHG Emissions Reductions Goals through ZEV

B-48-18 states that California ZEV goals include placing in service at least 1 million ZEVs by 2023, with 1.5 million ZEVs on the road by 2025. B-48-18 and SB 589 both discuss how ZEV will be part of the strategy to reduce emissions of greenhouse gasses to 40 percent below 1990 levels by 2030, and to 80 percent below 1990 levels by 2050. For all of the ZEV owners who are a part of that electrified transportation transition, they can expect benefits like fuel savings, maintenance savings, reduced vehicle prices (after parity), and greenhouse gas emission reductions. Excluding the benefits from reduced greenhouse gas externalities, the 2020–2050 cumulative benefits outweigh the cost of ICE by a factor of about 7 in the United States (Slowik et. al, 2019).

While this literature review has laid out feasibility and incentives to increase ZEV adoption, the benefits are expected to accrue not only to ZEV owners but the state as air pollution is reduced. Yet, the rate of change may not be quick enough to reach GHG emissions reductions goals. Studies suggest that while reductions in CO2 emissions can be achieved with the predicted ZEV growth, given the current energy mixes, CO2 emissions will continue to rise until 2035 (Rietmann et. al, 2020). Of the twelve California legislative codes that were found to address ZEV adoption, eight went into effect in the last three years. This suggests that supportive ZEV codes are increasing as reaching GHG emissions reductions goals grow more dire. Clearly, more ZEV regulations and mandates at the state and local scale are needed to achieve emissions reduction goals.

Table 1. California's Electric Vehicle Legislation

AB 1092	2014	Specifies mandatory building standards for installing future electric vehicle charging infrastructure for parking spaces in multifamily dwellings and nonresidential development.
AB 1275	2014	Place at least 1 million zero-emission and near-zero-emission vehicles in service by 2023 while increasing access for disadvantaged, low-income, and moderate-income communities to enhance air quality, lower greenhouse gasses, and promote overall benefits for those communities and consumers.
AB 1236	2015	Focuses on local ordinances related to electric vehicle charging stations. The bill requires local governments to adopt an ordinance establishing an expedited and streamlined permitting process for ZEV charging stations.

AB 193	2018	Allocates rebates for battery and fuel cell replacements on used ZEV vehicles.
AB 2127	2018	Requires CARB and the Public Utilities Commission to prepare a statewide assessment of the electric vehicle charging infrastructure needed to support the levels of electric vehicle adoption required for the state to meet its goals of putting at least five million zero-emission vehicles on California roads by 2030, and of reducing emissions of greenhouse gasses to 40 percent below 1990 levels by 2030.
AB 970	2022	Requires every city, county, and county to create an expedited, streamlined permitting process for electric vehicle charging stations and to adopt a checklist under which an application that satisfies the information requirements in that checklist shall be deemed complete and, therefore eligible for expedited review. This bill clarifies that these provisions apply to all cities, including charter cities.
AB 992	2022	Specifies funding for The California Clean Truck, Bus, and Off-Road Vehicle and Equipment Technology Program initiative. It also outlines how priority shall be given to projects benefiting disadvantaged communities.
B-48-18	2018	The state aims to deploy five million ZEVs by 2030 in the public sector and achieve 50% ZEV auto sales by 2035. Executive Order B-48-18 also targets installing 200 hydrogen fueling stations and 250,000 EV chargers statewide by 2025
N-79-20	2022	Establishes a year-by-year roadmap so that by 2035, 100% of new cars and light trucks sold in California will be ZEVs, including plug-in hybrid electric vehicles
SB 626	2010	the Energy Commission, State Air Resources Board, electrical corporations, and the motor vehicle industry shall evaluate policies to develop infrastructure sufficient to overcome barriers to the widespread deployment and use of ZEVs.
SB 1340	2011	Proposes public agencies finance electric vehicle charging infrastructure installation on these types of properties.
SB 1455	2011	The State Energy Resources Conservation and Development Commission, in consultation with the Public Utilities Commission, shall develop and maintain a website containing specific links to electrical corporations and local publicly owned electric utility websites that have information specific to plug-in hybrid or fully electric vehicles.

SB 350	2015	The bill targets achieving a 40 percent reduction in emissions by 2030. To reach this goal, the CPUC must prioritize procuring at least 50 percent renewable energy, doubling energy efficiency, and promoting transportation electrification. Additionally, this legislation emphasizes the importance of improving air quality and economic conditions in disadvantaged communities.
SB 1000	2018	Mandates the California Energy Commission to assess ZEV infrastructure deployment in California.
SB 589	2021	ZEV will be part of the strategy to reduce emissions of greenhouse gasses to 40 percent below 1990 levels by 2030 and to 80 percent below 1990 levels by 2050
SB 68	2022	Supports building owners in decarbonizing buildings and adding energy storage or electric vehicle charging capacity.

Key Words

BEV	Battery Electric Vehicle run solely on electricity stored in a battery pack that energizes one or more electric motors
CARB	California Air Resources Board
DAC	Disadvantaged Communities, census tracts in California that suffer from a combination of economic barriers and environmental burdens
EV	Electric Vehicle, a vehicle that uses a plug-in battery to provide all or part of the motive power of the vehicle, including battery electric, plug-in hybrid electric, or plug-in fuel cell vehicle
FCEV	Fuel-cell electric vehicle, generates electricity using oxygen from the air and compressed hydrogen
GHG	Greenhouse Gas
HOV	High Occupancy Vehicle
ICE	Internal Combustion Engine

PEV	Plug-in Electric Vehicle, draws electricity from a battery and does not have the ability to be propelled by gasoline
PHEV	Plug-in Electric Hybrid Vehicle, use batteries to power an electric motor and another fuel, such as gasoline, to power an internal combustion engine
Ridesharing/ Ridesourcing	Form of shared vehicles, bikes, and scooters, enabling users to gain short-term access to transportation modes on an "as-needed" basis.
TOU	Time of use rate for electric charging
VES	Vehicle Efficiency Standards; how much Co2 per mile can be emitted by a vehicle, and the fuel efficiency of vehicles miles per gallon.
ZEB	Zero Emissions Bus
ZEV	Zero Emission Vehicles, use a plug-in battery to provide all or part of the motive power of the vehicle, including battery electric, plug-in hybrid electric, or plug-in fuel cell vehicle
ZEV credits	Earned when manufacturers sell ZEV vehicles in ZEV states. Awarded based on the type and range of the vehicle sold
ZEV mandates	Require a proportion of major automaker's sales to come from ZEV

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Appendix 1B: The Role of Building Decarbonization in California Climate Policy

We review the state of research on building decarbonization adoption to identify opportunities and barriers for local jurisdictions in California. Building decarbonization refers to the umbrella of strategies to reduce residential and commercial building emissions, which include maximizing energy efficiency, use of low- and zero-carbon electricity, demand flexibility, eliminating fuel combustion by electrifying appliances and equipment, and reducing the embodied carbon of building materials, among other actions. To center the needs of the most vulnerable Californians, this review focuses on equity.

Building Decarbonization Challenges

While energy efficiency technology has the potential to reduce emissions from the building sector by half (IEA, 2020), the main challenge to adoption is 1) inconsistent policy frameworks and 2) public knowledge. For example, building decarbonization includes state and local plans for transitioning away from legacy energy infrastructure to lower emission energy supply, as well as updates to individual buildings. One obstacle to success during these simultaneous transitions is the misalignment between local, state, and federal agency goals, metrics, and utility incentives. In part this misalignment is the result of policy flux. While the state and federal governments set goals and building codes, cities and local jurisdictions are innovating new reach building codes and alternate approaches. In turn, the state is observing and recommending successful local building codes and policies, resulting in a ground-up approach with some time lag between the creation of local policy and support for such policies (e.g., retrofit requirements at point-of-sale ordinances, reach codes that require carbon neutrality for new buildings and renovations). Further, research reports insufficient coordination among supportive organizations (e.g., policymakers, local governments, and research institutions) with similarly focused initiatives such as the building weatherization support programs, the California Solar Initiative, and electric vehicle adoption (Building Decarbonization Coalition, 2019). Concurrently, the state plan for transitioning away from legacy infrastructure responsibly and cost-effectively is unclear. In response, local jurisdictions grapple with legacy energy infrastructure, which is often sited in low-income communities resulting in Locally Unwanted Land-Uses (LULUs) that depress housing values and impact health. As new energy infrastructure is sited, DACs and environmental justice communities are wary that siting will not be equitably distributed, and that design and clean technology considerations will not be enough to prevent new energy infrastructure from becoming a LULU.

Solutions include state legislation and regulations that align program and agency metrics to areas of local progress (e.g., utility and community choice aggregation programs). For example, not all utility service territories offer bill savings programs (Pacific Consulting Group, 2023). State policies could encourage or require equity-focused programs. In addition to the mismatched

policies between levels of government, geographic disparities and patchwork implementation create inequities for consumers. To promote equity between jurisdictions and within, the state will need to provide guidance and transparency around where new energy infrastructure is needed to balance the grid.

There is also the need for coalition building to further economic and political support for decarbonization, altering energy consumption incentives, and harnessing market forces (Bernstein and Hoffmann, 2018; Stokes and Warshaw, 2017; Tozer, 2020). Coalition building will also help raise awareness of low-cost policy pathways such as the adoption of heat pumps. Amongst the public, there is a broad, critical lack of awareness and interest in decarbonized technology (e.g., heat pumps, district energy) for residential and commercial buildings. For example, consumers are often confused and misinformed about the benefits of replacing gas with electric appliances (Pacific Consulting Group, 2023). This is due to insufficient customer education on the health and economic benefits of electrification. This challenge can be addressed by raising awareness and educating customers, policymakers, product distributors, and the building trades on the technology's availability and its financial, health, safety, and comfort benefits. In addition to building informed consumer demand, outreach is needed to address the split incentives of decarbonization as landlords invest in improvements, but tenants reap the benefits of lower utility bills and better health. Here, tenant protection and local rental policies are needed to bridge the transition.

In addition to these challenges, there are insufficient financing solutions[7] to incentivize customer adoption or help manage up-front costs. Financing concerns are particularly relevant for low-income customers or people who live in rental housing. This could be remedied through state-level rebate programs, special use rates for low-carbon appliances,[8] and support programs for low-income customers[9], which include the "one-stop shop"[10] of a vetted contractor network, energy savings guarantees, strong incentives, and integrated project design support by program staff (Less et al., 2022).

Last, building decarbonization has an undeveloped business-friendly environment. There are few paths to market for electric load shift, a lack of markets to monetize grid and climate values, and a lack of coordination at a national level necessary to increase manufacturing. Solutions require removing regulatory and market barriers that are hindering market development (Atwa et al., 2009; Starke et al., 2016). Research suggest that these solutions can be accomplished through production incentive programs, limitations on fuel-switching programs, and rate design. For example, solar producers can be better incentivized to sell energy back to the grid during peak demand. Such market transitions can accelerate product research, development, and deployment programs as they boost demand and open opportunities for micro clean energy businesses. Technical capacity is another barrier due to inadequate electrical paneling at many homes and

businesses and a lack of experts who can install new systems (Sovacool, 2009). To overcome this requires investing in training to expand the clean energy workforce.

How Building Decarbonization Impacts Greenhouse Gas Emissions

In addition to the state, many local governments, organizations, institutions, and businesses have committed to net zero greenhouse gas emissions, a goal and process known as deep decarbonization. Achieving this goal requires a state-level, economy-wide transformation in energy production across five sectors: electricity, transportation, industry, land-based carbon sinks, and buildings. Below, we provide a background on building decarbonization as a priority area for reducing GHG emissions, followed by a review of the state of the research on building decarbonization policy recommendations and California government codes. We then discuss models for reaching GHG emissions reductions goals through building decarbonization, comparing these models to the policies currently in place.

In California, energy use from buildings is responsible for 26% of statewide greenhouse gas emissions, making it the second largest contributor to emissions after transportation (California Energy Commission, 2018). Further, countries that have successfully reduced overall GHG emissions per capita have had more success decarbonizing the built environment than reducing per capita emissions in the transportation sector (Brinkley, 2014), revealing the promise of transitioning the built environment. As a result, many feasibility models for reaching decarbonization rely on significant changes to energy infrastructure and building codes across the residential, commercial, and industrial sectors (review: Hsu et al., 2021). Decarbonizing buildings has thus emerged as a central priority area for meeting CARB's 2022 Scoping plan, which aims to reduce California's GHG emissions 48% below 1990 levels by 2030 and achieve net zero emissions by 2045.[11],[12]

Building decarbonization encompasses several methods, including:

- Building codes and inspection enforcement that prioritize decarbonization
- Weatherization and renovation of existing buildings
- Decarbonizing electricity by growing the low-carbon share of the generation portfolio (such as natural gas, and wind and solar power)
- Growing localized renewable energy production through rooftop solar photovoltaic (PV) and onsite battery storage
- Expanding the use of energy efficiency technology, like district energy and heat pumps
- Increasing the efficiency standards of appliances
- Providing incentives to consumers to shift their electricity use in response to the timing of energy costs, GHG emissions intensity, or electricity grid emergencies.

These strategies address both the direct and indirect sources of emissions from buildings, with direct emissions released by on-site combustion of fossil fuels and biomass (8%), as well as from

indirect emissions attributed to electricity consumption in buildings and district heating (15%) (Levesque et al., 2019). Improving the energy efficiency of buildings is, fortunately, one of the most effective and affordable ways to reduce GHG emissions on a large scale, with the Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report projecting that cost-effective energy-efficiency measures in buildings would save the equivalent warming potential of 5.3–6.7 billion metric tons of CO2 globally per year (Gt CO2eq/year) by 2030 (Metz et al., 2007). Through the combined efforts of energy efficiency upgrades, reducing the carbon content of energy resources and appliances, and shifting energy usage with available technology, decarbonizing buildings can achieve multiple policy objectives, like reaching state climate goals, saving consumers money through reduced energy bills, supporting grid resiliency and reliability, improving indoor and outdoor air quality, and reducing health risks from buildings (California Energy Commission, 2018).

Regulatory Framework

The primary tool used by the state to regulate building decarbonization is Title 24, or building efficiency energy codes (California Energy Commission, 2022). These codes are written by the California Energy Commission (CEC) and outline a broad set of requirements for structural, mechanical, electrical, and plumbing systems that prioritize energy conservation, green design, fire safety and health, and accessibility. These codes are updated every three years and primarily focus on new construction. The latest version of Title 24 was adopted in 2021 and contained significant strides toward zero-carbon emissions buildings. The code sets energy requirements such as minimum efficiency of walls, windows, and heating and cooling equipment for both new and existing buildings; expanded the requirements for rooftop photovoltaic solar panels and storage for most new single-family and multifamily homes; and a shift to electric heat pump space and water heating. They estimate that an efficient heat pump will save at least 75% of greenhouse gas emissions over its life (California Energy Commission, 2019). These building efficiency energy codes discourage continued use of higher energy and emissions of fossil-fueled heating and hot water, but they are not mandates requiring homes to be solar-powered and all-electric. These codes can better be described as technology-neutral, performance-based incentive programs that strongly encourage lower energy cost solutions and carbon emissions (Delforge, 2021). They provide incentives to builders through compliance credits and penalties. For example, if builders choose high-efficiency electric water or space heating instead of gas furnaces and water heaters, they do not have to make any other energy efficiency upgrades to the rest of the building. However, if they use gas for both space and water heating, they must offset the higher energy use and carbon emissions of gas appliances by including other energy efficiency measures such as more insulation or better windows. This incentive approach gives builders strong financial encouragement to transition off fossil fuels while leaving implementation flexibility for their internal processes, such as training their workforce and evolving their marketing practices. Such considerations are needed as many California

communities depend, in part, on fossil fuels like propane, for heating. With grid instability, winter storms, and sparse rural electrification, fuel flexibility is needed.

Beyond such building codes, more than 50 local jurisdictions in California, including Sacramento, Los Angeles, Santa Barbara, San Jose, and San Francisco, have adopted electric-friendly "reach codes" (Velez and Borgeson, 2022).[13] In addition to model local and state codes, local jurisdictions may also follow the CALGreen building codes.[14] The California Green Building Standards Code has the authority to propose CALGreen standards for nonresidential structures that include new buildings or portions of new buildings, additions and alterations, and all occupancies where no other state agency has the authority to adopt green building standards. As a result of local success, the 2022 Energy Code follows the lead of early adopter California Cities and Counties that have implemented more robust local building energy codes.

Several agencies are providing support and incentives for state and local building code adoption. For example, the Bay Area Regional Energy Network (BayREN) offers a suite of electrification programs for businesses and single- and multi-family homes. Multifamily properties that undergo energy and water efficiency upgrades can earn cash-back rebates of up to $750 per unit; single-family upgrades can earn up to $2000 cash-back for heat pump water and space heater installations, $300 for induction cooktops, and $800 for duct sealing or replacement; and small and medium businesses can earn on HVAC, refrigeration, and lighting upgrades. BayREN's online Home Learning Center also provides multilingual educational and planning resources to help customers transition to electric appliances (Velez and Borgeson, 2022). A second pilot program is the San Joaquin Valley Pilot.[15] This program is a $56 million initiative to replace wood and propane appliances in nearly 2,000 homes in the San Joaquin Valley with electric appliances. The pilot will retrofit homes in disadvantaged communities at no cost to the participating household, with the aim of reducing participants' total energy costs. The goal is to demonstrate the feasibility and benefits of efficient electrification to residents so it can be scaled to all San Joaquin Valley residents currently burdened by high energy costs (Velez and Borgeson, 2022). These local efforts demonstrate how nonprofit, city, and county leadership is essential for equitable local climate action (Faddoul, 2021).

Several additional building decarbonization efforts are led by the state through assessments, incentives, and regulations. For example, AB 3232 (Friedman, 2018) requires the CEC to prepare a Building Decarbonization Assessment, working in consultation with the California Public Utilities Commission (CPUC) and other state agencies, to explore the potential for California to reduce GHGs from buildings by 40 percent below 1990 levels by 2030. The assessment illustrates the state's pathway to decarbonizing single-family, multifamily, and commercial buildings; identify challenges and opportunities from decarbonizing; estimate the impact of decarbonization activities on the electricity grid; and illustrate topics and data gaps needing additional analysis.[16] While AB 3232 explores the potential building decarbonization

landscape across the state, Senate Bill (SB) 1477 (Stern, 2018) calls on the CPUC to develop, in consultation with the CEC, two programs (BUILD and TECH) aimed at reducing greenhouse gas emissions associated with buildings. The Building Initiative for Low-emissions, or BUILD Program, offers up to $20 million per year for four years to promote the construction of new residential housing that utilizes near-zero-emission building technologies and provides additional incentives for all-electric new residential construction. Technology for Clean Heating, or the TECH initiative, will help develop the market for low-emission space and water heating technologies for new and existing residential buildings through consumer education, contractor training, vendor training, and the provision of upstream and midstream appliance incentives. TECH also offers up to $30 million annually for four years to promote purchases of low-emission space and water heating equipment (CPUC, 2019). AB 209 (2022) authorizes the Equitable Building Decarbonization Program,[17] which CEC is developing to reduce GHG emissions in homes and advance energy equity through a direct install program that provides retrofits to low- and moderate-income households. The program strives to encourage resilience to extreme heat, improve indoor air quality, improve energy affordability, provide electric grid support, and increase payment of prevailing wage to the implementing workforce. Further, SB 49 (Skinner, 2019) requires CEC to adopt standards for appliances to facilitate the deployment of flexible demand technologies. CEC is currently undergoing a rulemaking to establish these standards and labeling requirements to expand on efforts to facilitate and deploy flexible demand technologies for appliances. Finally, AB 2446 (Holden, 2022) tasks CARB with developing a framework for measuring and reducing the average carbon intensity of the materials used in the construction of new buildings.

State codes also regulate how local jurisdictions can create, procure, and distribute energy. For example, Section 218 of the California Public Utilities Code requires that any entity wishing to sell energy to more than two contiguous parcels become a regulated electrical corporation. These requirements help ensure that the utility is meeting public customer service expectations, public safety standards, and just and reasonable terms and conditions of utility service (Public Utilities Code §§ 451, 454 and 728). Such regulations make small-scale neighborhood microgrids costly to start-up. Similarly, rules developed by the state's investor-owned utilities (PG&E Electric Rule 18, SCE Electric Rule 18, and SDG&E Electric Rule 19; collectively known as Rule 18/19) also govern the supply of electricity to separate premises and often prohibit one premise from supplying electricity to a different premise. In 2021, CPUC issued Decision 21-01-018, directing Southern California Edison Company (SCE) and Pacific Gas and Electric Company (PG&E) to revise their Rule 18, and San Diego Gas & Electric Company (SDG&E) to revise its Rule 19. The Decision allows for microgrids owned by public agencies or by a third party serving public agencies to supply electricity to critical facilities owned or operated by a public agency on adjacent premises without becoming a regulated, electrical corporation. The Decision also directs IOUs to develop a Microgrid Incentive Program to fund clean community microgrids that support the critical needs of vulnerable populations most likely to be impacted by grid outages.

These developments will likely encourage local planning and development of distributed energy approaches.

Zero-emission standards for appliances and equipment are another strategy for achieving building decarbonization. As a part of the 2022 State Strategy for the State Implementation Plan adopted in 2022,[18] CARB has committed to develop a regulation to require zero-emission GHG space and water heaters to reduce emissions from new residential and commercial heaters sold in California. The Bay Area Air Quality Management District has adopted rules to require the sale of zero-emission NOx space and water heaters sold in the air district.[19] The South Coast Air Quality Management District has proposed similar rules.[20]

Aside from legislative bills and building codes, two other well-known voluntary efficiency programs exist: Energy Star and LEED. The Environmental Protection Agency administers the Energy Star program, which assigns the Energy Star label to appliances that meet its efficiency standards. This provides consumers with an easily interpretable signal that these products are energy-efficient. Empirical research has found that consumers are willing to pay [21] more for Energy Star appliances—meaning that such appliances are often out of the price range for lower income households, resulting in equities in adoption (Environmental and Energy Study Institute, 2011). Consumers using Energy Star products prevented more than 300 million metric tons of greenhouse gas emissions in 2014 alone, and saved homes and businesses $34 billion in utility costs (Environmental and Energy Study Institute, 2011)—underscoring the compounding inequality as such technology primarily benefits higher income households. In comparison with communities that did not implement Energy Star, total disclosure of both energy use and Energy Star together can be credited with a 6% reduction in building energy use intensity (EUI) three years later and a 14% reduction in EUI four years later (Meng et al., 2017). Disclosure of Energy Star scores decreased building EUI by 9% three years later and 13% four years later in New York (Meng et al., 2017). Similarly, the LEED program is a building energy performance and environmental criteria rating system overseen by the U.S. Green Building Council. LEED buildings generally use less energy per unit floor area than non-LEED counterparts and can command higher sales and rental prices (Fuerst and McAllister, 2011; Leibowicz et al., 2022)—thereby catering to higher income families. In sum, these price signals send a message that higher income households care more and will invest more in decarbonization, when in fact, lower income households are simply priced out of joining many decarbonization programs. To counter such signals, outreach programs paired with rebates for low income households can help bring parity to the decarbonization produced and housing markets.

History, Impact, and Feasibility of CA Building Decarbonization

This section discusses the history and impact of the building decarbonization programs in California with attention to feasibility of equitable policy adoption at the local level.

Building Codes for Electrification

Research has shown that reducing GHG emissions in the building sector by electrifying buildings is the most cost-effective near-term decarbonization opportunity. According to a study by Zhu et al. (2022), using renewable energy in the electricity sector can account for roughly 72% of generation in 2050 in high-alignment scenarios (Zhu et al., 2022). Further, Victor et al. (2018) find that achieving 80% GHG emissions reduction below the 2005 levels by 2050 is technically feasible by deploying existing or near-commercially available technologies. GHG reductions are primarily achieved through high levels of electricity sector decarbonization, electrification of end uses, and exchange of the remaining end-uses to lower carbon fuels such as natural gas (Victor et al., 2018). Through preliminary analysis that examines the potential impacts of widespread electrification on the U.S. energy sector, Steinberg et al. (2017) find that electrification, in the absence of any additional power sector carbon policy, can result in 41% reductions (below the 2005 level) in economy-wide fossil fuel combustion emissions. The level of electrification and the degree of decarbonization explored in these scenarios are not, in isolation, sufficient to achieve reductions in economy-wide GHG emissions of 80% below the 2005 level. Yet, despite the need to involve additional strategies for reduction, these cost-feasibility studies demonstrate that electrification will play a significant and vital role in achieving a low-carbon future (Steingberg et al., 2017).

While cost-effective overall, such studies often do not address the household-level economies of building decarbonization. Indeed, the above studies note that to implement changes, the construction phase presents the best opportunity to make buildings more efficient, as many energy and cost-saving options are lost if they are not built into the original design (Brown and Southworth, 2008). Here, Building Energy Codes (BECs) have the potential to reduce these lost opportunities by requiring existing buildings to achieve at least a minimum level of energy efficiency. However, codes vary considerably by region and often lack consistent enforcement and support programs. Uncoordinated efforts result in an overall shortfall in energy performance (Brown and Southworth, 2008). Lower-income households often rent and can achieve cost savings by renting older building stock. According to the 2020 census, renter-occupied households made up 52.9% of households in the lowest income quintile and 42.4% of households in the second lowest income quintile. Not only will local decarbonization-focused building codes need to target landlords without passing the cost burden on to renters, but stronger Zero Emissions Building Codes and enforcement at the state and local level are also needed to help overcome these obstacles (Ürge-Vorsatz et al., 2007). For example, one study that evaluated the BECs of European countries found that a policy mix with multiple equity-focused strategies is the most effective approach to not only achieving decarbonization goals, but preventing the cost burden from being shouldered by already vulnerable populations of renters and low-income people (Kern et al., 2017; Rogge and Reichardt, 2016).

Not only do BECs encourage technology uptake in the construction phase, but the US

Department of Energy projects that the energy cost savings from building efficiency codes will result in $125 billion by 2040 (Athalye et al., 2016). Some of these cost savings are passed on to renters with direct equity benefits. Koirala et al. (2014) estimate the net implicit price of energy-efficient building codes for American households using sample data from the American Community Survey 2007. They find that BECs provide families a compensating differential of about a 6.47% reduction (about $7.71) in monthly energy expenditure. Results indicate that the mean household net implicit price for BECs is about $140.87 monthly in 2006 dollars ($163.19 in 2013 dollars) (Koirala et al., 2014). However, this estimated price varies significantly by region, energy type, and the rent gradient. With cost savings and reduced emissions, BECs are politically feasible and popular policy instruments (Gillingham and Palmer, 2014). They are especially suitable when dealing with a target group that is unwilling to act or difficult to address (e.g., landlord-tenant energy upgrade spilt incentives) or when aiming at removing the worst products or services from the market with regard to energy consumption (Harmelink et al., 2008). Consequently, implementing effective, coordinated BECs has been proposed as a key issue for building decarbonization in the research (Evans et al., 2018). To help balance these considerations, local jurisdictions should consider estimates of cost savings for households to adopt decarbonization policies. These estimates can be included in the local energy bill and outreach to inform consumers.

As landlords come into compliance with BECs, rent control policies may also need to be put in place. For example, a study on ten US cities and 159,000 rental properties found that as energy efficiency standards and compliance occurred, the implementation of energy efficient features increased the units' rent, overall from 6% to 14% (Im et al., 2017).

Weatherization and Renovation of Existing Building Stock

Weatherization and retrofit policies are also needed to address the energy efficiency of pre-existing buildings. Existing buildings represent a significant component of the building decarbonization arena, as 80% of the existing buildings in 2050 have already been built (Lucon et al., 2014). Since retrofit and weatherization technologies, policies, and costs often differ from those associated with new buildings, they require their own implementation pathways (Coffey et al., 2009).

These strategies are a critical policy arena for low-income areas and disadvantaged communities living in the least energy-efficient buildings in the housing stock. One report from the PEW research center described how low-income households in the US spend, on average, 14% of their income on energy needs, compared with the 3.5% of income spent by other households, based on the authors building sector policy analysis (Brown, 2005; Brown and Southworth, 2008). The federal government has long recognized the importance of renovation and weatherization of low-income homes, dating back to the U.S. DOE's creation of the Weatherization Assistance Program (WAP) in 1976. The purpose and scope of the program are to increase the energy efficiency of

homes owned or occupied by low-income persons, reduce their total residential energy expenditures, and improve their health and safety, especially for low-income persons who are particularly vulnerable, such as older adults, persons with disabilities, families with children, high residential energy users, and households with high energy burden.

To achieve these goals, DOE provides grants to states, territories, and tribes. In 2022, the U.S. Department of Energy (DOE) announced $32 million to fund following generation building retrofit projects to develop fast, cheap, low-carbon building renovation and construction techniques. These techniques focus on prefabricated walls, air sealing, insulation (e.g., wall, attic, windows), ventilation, and drop-in replacements for high-efficiency heating, cooling, and hot water systems. Together, these measures could cut thermal energy use in buildings by 75% (DOE, 2022). In support, Leibowicz et al. (2022) develop an optimization model to determine the least-cost decarbonization pathways based on the residential buildings sector of Austin, Texas, and find that improving the thermal efficiency of residential buildings through renovation and weatherization generates substantial cost savings and significantly lowers the cost of climate policy. For instance, upgrading building thermal efficiency to a LEED Gold standard reduces annual utility costs. The shift to more efficient energy-use homes reduces costs for peak generation capacity, battery electricity storage, space cooling and heating appliance capacity, and energy consumption (Leibowicz et al., 2022). Such upgrades also present non-energy benefits for the household through income, household expenditures, reduced utility costs, environmental benefits, and improved health and safety, as one study found after conducting a national occupant survey of random samples of weatherized households (Tonn et al., 2014). Descriptive statistics generated from these surveys suggested that post-weatherization, homes are more livable; the physical condition of homes is improved; residents experience fewer ‘bad’ physical and mental health days; household members suffer fewer persistent colds and headaches; households are better able to pay energy and medical bills; and households are better able to pay for food (Tonn et al., 2014). Unfortunately, progress on weatherization, renovation implementation, and enforcement has been slow, hindered by challenging project economics and landlord-tenant split incentives where landlords bear the cost of upgrades, and tenants reap the benefits of lowered utility bills. Local governments can educate and create awareness about federal funding, health benefits, and state laws. Again, rent protections for compliance may help reduce instances where costs of weatherization are passed on to lower-income renters.

Efficiency Standards for Appliances

Within the building, most electricity and energy use goes to residential and commercial end uses from appliances. For example, more than 76% of all U.S. electricity use and more than 40% of all U.S. energy use and associated greenhouse gas (GHG) emissions are used to provide comfortable, well-lit residential and commercial buildings—and to provide space conditioning and lighting for industrial buildings (DOE, 2015). Electricity and energy powers appliances and

equipment, like lighting, refrigerators, water heaters, gas-powered stoves, clothes dryers, central air conditioners and heat pumps, ceiling fans, and dishwashers. Efficiency standards are the most commonly cited tool to reduce appliance GHG emissions. These appliance efficiency standards are developed and proposed as federal regulations, with input from manufacturers, energy experts, consumer advocates, and other stakeholders. Together, they establish technical feasibility and cost-effectiveness parameters and use federal efficiency standards to compel product designers and manufacturers to reduce the amount of energy and water necessary to operate appliances and other building equipment properly. Efficiency standards ensure that minimum efficiencies are met by all regulated products sold while prohibiting the least efficient products from appearing on the market. Appliances and building equipment typically need to be replaced every 15 years, providing a regular opportunity to improve a building's energy efficiency (Delforge, 2021). Studies confirm the significant and widespread benefits of efficiency standards, with the DOE estimating that these standards reduced our national energy bill by about $80 billion in 2015, the equivalent of the electricity needs of nearly one in three American households (DOE, 2022). An earlier study by Meyers et al. (2003) echoed these cost-effective findings by analyzing initial standards and updates for nine different products from 1988 to 2000. Their study showed that appliance standards cut US electricity use by 2.5% annually, primary energy consumption by 1.3%, and US carbon emissions from fossil fuel use by 1.7%, jumping to 8–9% by 2020. The cumulative net benefit to consumers and businesses is nearly US $80 billion by 2015 and will grow to US $130 billion by 2030 (Meyers et al., 2003).

Some appliances and equipment are more important for targeting efficiency standards than others. For residential buildings, 63% of cumulative efficiency savings come from lighting, refrigeration, and central air-conditioning. For commercial buildings, these three uses contribute 81% of the savings (Brown et al., 2005). For example, in reducing cooling emissions, the whole house fan works by producing a wind chill effect, which flushes the house with high volumes of outside air, thereby preventing temperatures from building inside. It also reduces the temperature of attics by about 10 degrees F on a warm summer day, this cooling effect significantly reduces the mean radiant temperature (MRT) of the ceiling (which has a high impact on our comfort level). There are additional benefits in that a whole house fan can quickly remove pollutants such as smoke, cooking odors, and harmful chemicals. A properly selected, installed, and operated fan can reduce overall cooling costs by as much as 50% (Cook, 1992) while costing about as much as a good ceiling fan ($150-300). Savings usually pay for the fan in less than three years.

Further, emissions from lightbulbs have decreased by more than half due to increased efficiency from LED bulbs, and reducing the use of incandescent bulbs (Leung, 2018). An LED (light-emitting diodes) bulb can last up to 25 times longer than an ordinary incandescent bulb, uses 75 percent less energy to produce the same amount of light, and saves consumers $119 in operational costs for each bulb throughout its lifetime (Leung, 2018). LEDs are the product of the DOE's partnerships with lighting manufacturers to research, develop, and test solid-state lighting technologies. This technology can be paired with sensors for use in infrequently visited

areas (like restrooms) to further reduce energy use. Local governments can create education programs about these technologies as well as incentive programs for adopting these technologies.

While these cooling, lighting, and refrigeration innovations have allowed a decrease in GHG emission, almost a third of the energy consumed by residential buildings is for space heating, followed by water heating and lighting (both 12%) and air conditioning (11%) (EIA, 2004b). The remaining third of the energy consumed in homes is used for the rest of the appliances, electronics, and other purposes (EIA, 2004b). These energy uses suggest that the most obvious opportunities to reduce GHG emissions beyond the initial focus on lighting, refrigeration, and cooling are through improvements to space and water heating (especially in the residential sector) (Brown and Southworth, 2008). For these reasons, local jurisdictions should focus on demonstrating energy efficient products in public buildings to raise awareness about rebate programs, opportunities to recycle and upgrade appliances for low-income households, and standards for rental codes.

Expanding the use of energy efficiency technology

Public education and outreach is especially important in California where nearly 90 percent of homes use gas for heat or hot water or both, with burning gas for furnaces and water heaters contributing more than half of the emissions from the building sector (Hopkins et al., 2018). Transitioning to clean electric heat is critical to reducing carbon emissions, especially as the electric grid becomes more stable, buildings become more efficient, and utilities align their pricing with carbon-cutting goals (Hopkins et al., 2018).

Heat pumps offer a highly efficient, cost-effective electric alternative that could further cut California's buildings emissions by 7 million metric tons per year by 2030 if a third of California's buildings switched to clean electric heating technology (Hopkins et al., 2018). Electric heat pumps transfer heat from the air into water stored in a tank using compression technology, such as those found on all household refrigerators, instead of burning fuel to create heat. More than emissions reductions alone, heat pumps increase electrical efficiency by replacing electric resistance water heaters and provide utility bill savings for ratepayers due to technology efficiencies and the ability to shift electric consumption to parts of the day when renewable energy resources are abundant, and electricity prices are lowest. In addition to heating homes and water heaters, heat pump technology can be used to power induction cooktops as alternatives to gas cookstoves, dryers, and even HVAC cooling systems. A study by Waite and Modi (2020) synthesize several disparate publicly available datasets (e.g., monthly state-level energy usage, local hourly temperatures, census tract-level heating fuel, and building floor area) to model the impact of building space heating electrification across the United States and find that currently available electric heat pumps can reduce fossil fuels to 43% of total heating energy supply (currently 70%). Future advances in heat pump technology could reduce this further to 23% (Waite and Modi, 2020). Walker et al. (2022) conduct a state-by-state analysis of space

heating electrification in the US and find that weighted average carbon savings of 35% (and a 1% energy cost increase) were possible nationally using currently available high-performance heat pumps compared with high-performance gas furnaces at 95% efficiency (Walker et al., 2022). Unfortunately, these technologies represent a small share of California's market due to regulatory barriers and high upfront installation costs in older homes. Contractors are unaware and not trained in installation. These market barriers need to be addressed to meet GHG emissions reductions goals by 2030, as explored by Mahone et al. (2018), who develop long-term energy scenarios through 2050 using the California PATHWAYS model, an economy wide, technology-specific scenario tool developed by Energy and Environmental Economics (E3) from 2009 through the present. Their results show that 50% of new HVAC and water heating equipment sales must use heat pump technology by 2030 (Mahone et al., 2018). Heat pumps also benefit from policy support to jump start sales, reduce consumer costs, and make them more broadly available (examples: BUILD, TECH, Self-Generation Incentive Program, the Equitable Building Decarbonization Program). At the federal level, the 2023 federal tax credit for heat pumps is 30% of the purchase and installation cost, up to $2,000. One review of home heating electrification programs in the US, published by ACEEE, noted the significance of rebates as an incentive for heat pump uptake, ranging from $165– $1,600 per ton, and water heating and cooking incentives were commonly $91- $800 per unit (Cohn and Esram, 2022). Additional financial incentives include electric rates with a significant difference in peak and off-peak pricing opportunities for customers to set their heat pumps to operate when electricity is cheapest and cleanest (Hopkins et al., 2018). To ensure equitable adoption, local jurisdictions can raise the profile of these cost-saving technologies by encouraging adoption and demonstrating use.

District Energy

Beyond the home, at the scale of neighborhoods and campuses, District Energy (DE) further offers a highly efficient solution to heat and cool multiple buildings simultaneously, reducing operating costs and keeping more energy dollars local. Instead of every home and office operating an individual boiler, heat is produced centrally by water heated in a boiler and distributed through underground insulated pipes to heat exchangers at the point of use for hot water, ambient heat, and cooling (Bouffaron and Koch, 2014; Brinkley 2018). This network of underground pipes is a highly efficient way to heat and cool many buildings in a given locale from a central plant, such as a downtown district, college or hospital campus, airport, or military base. Fuel for the central boiler is highly versatile and can be coupled with various large and small-scale heat sources, such as geothermal and heat produced as a byproduct of industry (Lund et al., 2014). Providing heating and cooling from a central plant requires less fuel and displaces the need to install separate space heating, cooling, and hot water systems in each building. Further, district energy systems also allow for low-cost heat storage during overproduction from more volatile renewable energy sources, such as wind and solar (Lund, 2005; Connelly et al., 2014).

The United Nations estimates that transitioning to DE systems, combined with energy efficiency measures, could result in a 30–50% reduction in primary energy consumption, thereby reducing CO2 emissions by 58% in the energy sector by 2050 and allowing global temperature rises to stay within 2–3 °C (UNEP, 2018). Sweden presents one case example of implementing district energy on a large scale, as GHG emissions were reduced by 60% from the 1970s, and the energy supply turned from importing 75% of the energy in the form of fossil fuel to greater reliance on locally produced energy, particularly biofuels from forest and agriculture byproducts (Summerton, 1992; Palm, 2006). In Sweden, as elsewhere, thermal planning started at the neighborhood scale and grew with support of national policies (Lund, 2005; Connolly et al, 2014; Han et al.; 2021). DE also offers a transition path for balancing the grid during volatile renewable energy production as energy can be stored as heat (Connolly et al., 2014).

In California, DE is a primary decarbonization pathway for campuses, like schools and hospitals. For example, to align with the state target, the University of California's climate policy, adopted in 2023, expects to eliminate emissions by 2045 largely through upgrading to DE on all 10 campuses. Demonstrating success, since UC began tracking its climate impact in 2009, it has cut carbon emissions by a quarter despite significantly increasing its enrollment, and saved $400 million in energy costs by improving efficiency. At UC Davis, upgrades to the DE will reduce fossil fuel use on campus by 80%.[22] Similarly, updates to Stanford University's DE system in 2014 cut campus GHG emissions by 68% and fossil fuel use by 65% (Lapin and Chelsey 2015). These campuses offer demonstrations and there is potential to connect neighborhoods and buildings off-campus to DE systems (Han et al., 2021). Local jurisdictions can explore DE extensions from these established DE systems, building out and plugging in, just as other jurisdictions have joined DE networks. Such effort will take concerted energy planning.

DE benefits communities by reducing their operating costs due to a decreased need to import fuel for heating and cooling. Environmental impacts from heating and cooling are significantly reduced because of these systems' greatly improved efficiency. Developing district energy and Combined Heat and Power (CHP) systems can help ease the power sector's transition as older, polluting coal plants are shut down and removed from the grid. District cooling can cut peak electrical demand that typically occurs in the late afternoon – reducing strain on the grid and avoiding expensive peak power costs (Environmental and Energy Study Institute, 2011). The district nature helps ensure heating and cooling equity as multiple buildings and campuses are joined into a heat and/or cooling grid. In addition to the added resilience of the neighborhood network, DE opens opportunities for microbusinesses to sell heat back to the grid. For example, a bakery can sell excess heat back to the DE grid when there is demand (Werner, 2017).

Importantly, low-cost deployment of DE systems relies on higher density development to ensure that the cost of new pipes carrying heated or chilled water is cost and energy effective. To achieve a lower cost DE system, local jurisdictions will need to review their zoning and land-use planning to encourage high density development. Further, a transition to DE requires

infrastructure investment. Even though the studies above show the significant long term energy savings and environmental benefits – and the fact that projects generate many good paying jobs – the upfront costs of constructing DE systems can discourage developers. Connecting CHP systems to the power grid can also present challenges. Here, the federal government can play an essential role in encouraging investment in DE/CHP systems through various financing and regulatory mechanisms (Environmental and Energy Study Institute, 2011) while local jurisdictions should be mindful to not make new energy infrastructure into LULUs, but desired architectural features—just as many European cities have done with their newly sited DE systems (Brinkley, 2018).

Siting Renewable Infrastructure

Broadly, renewable energy infrastructure is needed to meet the growing demand for clean electricity generation, including bioenergy, wind turbines, solar power, transmission lines, and nuclear power. In the near term, local governments can support renewable energy generation by permitting and siting new renewable energy infrastructure to guarantee adequate clean electricity generation, satisfy rapidly growing demand from end-use electrification, and transition away from fossil fuel sources (Zhu et al., 2022). A study by Waite and Modi (2020) quantifies the relative capacities of fossil fuels and electricity delivery infrastructure and estimated heat pump (HP) penetration possible with current electricity delivery capacity in the US. They estimate that an ‘‘all-electric’’ approach could require a 70% increase in nationwide electricity system capacity—and thus the development of new, local energy infrastructure (Waite and Modi, 2020).

Each renewable energy source presents its own list of challenges and possibilities, with impacts varying by region. For example, the Central Valley (which encompasses 15% of CA by area) has great potential for photovoltaic (PV) solar energy development. Hoffacker et al. (2017) report that the Central Valley comprises a capacity-based energy potential of at least 17,348 TWh year–1 for PV solar power. Accounting for technology efficiencies, this exceeds California’s 2025 projected electricity demands by up to 13 times (Hoffacker et al., 2017). Similarly, biomass and waste incineration have been broadly adopted in European and Asian countries. This renewable resource is in demand in California’s colder, northern counties. Yet, combustion and the placement of affiliated smokestacks are often contentious. Similarly, wind turbines and transmission lines are often criticized for disturbing viewsheds. Brinkley and Leach (2019) reviewed 54 studies spanning over forty years of statistical multivariate housing price assessments about energy supply infrastructure and provided a comparative meta-analysis of both the negative and positive local impacts of siting energy infrastructure locally. They concluded that of all energy infrastructure, only rooftop solar consistently positively impacts home value (Brinkley and Leach, 2019)—leaving local planning to grapple with design decisions to not create LULUs when siting and building new energy production infrastructure.

Indeed, public demand for low-cost and renewable energy often does not match a community’s

willingness to host energy supply infrastructure. The decision to site energy facilities occurs largely at the local level, requiring community support for permitting and construction. As communities consider energy production, they often weigh such benefits against concerns for how facilities may impinge on the local quality of life (Brinkley and Leach, 2019). Zhao et al. (2019) compare decarbonization pathways in California that focus on electrification and those that require siting clean, renewable energy infrastructure. Zhao et al. (2019) estimate that, compared with business-as-usual, a decarbonization pathway that combines electrification and clean renewable energy will reduce concentrations of fine particulate matter (PM2.5) by 18–37% in major metropolitan areas of California and subsequently avoid about 12 100 (9600–14 600) premature deaths. In contrast, only a quarter of the avoided deaths could be achieved through a pathway focusing more on combustible renewable fuels, like biomass boilers. These co-benefits of decreasing GHG emissions while improving local air and water quality are often not considered when citing renewable infrastructure. To help local jurisdictions weigh cost, local environmental impacts, and potential benefits, state and regional governments can create data dashboards and provide tools to help with CEQA review. Where possible, Health Impact Assessments (NRC, 2011) can also be used to quantify human health impacts in addition to expected environmental impacts reviewed under CEQA.

Producing energy locally has also emerged as a priority area for communities and policymakers as it can protect regional economies from volatile import-driven energy markets, reduce the environmental impact of energy production and distribution, and diversify the energy supply (Carbajal, 2016). Andrews (2008) recommends that localization of energy supply requires new conceptual models for thinking about how to right-size demand to distributed supply in an ever-changing landscape. DeRolph et al. (2019) illustrate how creating annual city energy shed snapshots using GIS and grid data provides a visual representation of a respective area's energy portfolio, the extent of the grid required to meet energy demands, and the resulting environmental impacts. Computational models integrating the built environment components with supply side considerations can also help optimize efficiency and loss from the energy shed (Schuler and Cajot, 2019). Kammen et al. (2006) report that transitioning to a renewable energy portfolio can also grow local economies and create jobs; a 20% national renewable energy portfolio by 2020 consisting of 85% biomass, 14% wind energy, 1% solar PV is expected to create 163,669 new jobs for the United States. In addition, community energy aggregation and storage solutions give neighborhoods and homeowners options for uninterrupted renewable electricity during periods of shifting renewable generation and peak load (Atwa et al., 2009; Starke et al., 2016). Here, local jurisdictions can use the energy planning process to help scope out these potential benefits that fall outside of strict cost-feasibility project assessments.

Communities' increased appetite to meet local energy needs through renewables often includes considerations for decentralized microgrids and familiarization with DE generation, representing relatively new approach in local planning (APA, 2004). For example, East Bay Community Energy (EBCE), a community choice aggregator in the San Francisco Bay Area, launched 30

microgrids in San Leandro, Berkeley, Hayward and Fremont, California, with 3.1 MW of solar panels and 6.2 MWh of battery storage. The decision to site such energy facilities occurs mainly at the local level, requiring community support for permitting and construction. Many such demonstration projects face considerable hurdles as a result of Section 218 of the California Public Utilities Code (CPUC) which requires any entity that sells energy to more than two contiguous parcels or across the street to become an electrical corporation regulated by the CPUC. While difficult to quantify, the design of new energy projects can significantly impact reception and spillover impacts on surrounding land and housing values as evidenced by mega projects, like Copenhagen, Denmark's state-of-design Ammager Bakke biomass plant, which is driving new development as an attraction for nearby neighborhoods (Hulgaard and MSc, 2018).

The transition to renewable energy supply also presents a need to store the excess energy–with a role for local governments in siting new energy storage facilities (Hampton et al., 2017). In 2020, the U.S. accounted for 40% of the world's currently operational energy storage projects, and the National Renewable Energy Laboratory expects the U.S. to \more than quintuple its storage capacity in the next 30 years (Hicks, 2020). California leads the country with 4.5 gigawatts (GW) of operational pumped hydro storage capacity, about 1.5 GW from batteries operating by Spring 2021 (California Energy Commission, 2015). Governments, utilities, and energy companies are increasingly looking for additional energy storage technologies to extend the availability of variable renewable power sources such as solar and wind. Turley et al. (2022), map and analyze landscapes of renewable energy storage emerging across the Western United States, focusing on the rollout of several interrelated leading technologies: utility-scale lithium-ion batteries and proposals for new pumped storage hydropower. They find that many of the projected transformations and impacts of storage rollout will occur in rural California, presenting just energy transition issues as rural communities bear the burden of hosting energy infrastructure that urbanites refuse. Turley et al. (2022) argue that a full accounting of renewable energies' environmental and social impacts should not be diminished despite the urgency of climate change and the need for climate solutions. Instead, it should be acknowledged that, like any technical solution, energy storage technologies and techniques will have spatial consequences and justice dilemmas (Williams et al., 2019).

Energy storage solutions are also included in California building codes. Building codes from 2019 specify rooftop solar requirements from new single-family and low-rise residential apartments to solar and storage in new multifamily and non-residential buildings. The solar and storage requirements are modest but very cost-effective for the building occupant, saving far more over their lifetime than they cost upfront. They will result in buildings that are more resilient to power outages and can reduce their use of grid electricity at peak times when electricity is scarce, expensive, and dirty. Together, these changes will save Californians $1.5 billion in costs and 10 million metric tons of greenhouse gas emissions over the 30-year life of the buildings, per CEC estimates (Delforge, 2021).

Energy and Decarbonization Planning

While siting energy facilities remains a contentious planning issue largely under local jurisdictional control, a lack of comparative studies on the local impacts of energy infrastructure makes scenario building difficult for many communities. Land-use planning is an under-represented discipline in energy scholarship, as Sovacool (2014) noted in an analysis of 4,444 research articles covering the past 15 years. Only 1.1 percent of energy articles consist of studies on the role of infrastructure scale and spatial considerations (Sovacool, 2014). In general, land and housing values are influenced by different energy infrastructures *and* their design (Brinkley and Leach, 2019). In addition, planning's role in energy infrastructure has changed. Pitt et al. (2013) noted the shift to a collaborative planning approach focusing initially on municipal facilities, followed by incentives for businesses and residents. DeRolph et al. (2019) and Pitt et al. (2013) assert that the first step toward cities transitioning to renewables is municipal commitment to such a transition that entails coalition building and value setting.

Local governments are well-equipped to work with communities in visioning strategies that match public preferences in energy sourcing with public preferences in local siting. Furthermore, long-range planning can ensure that current policies and pathways are consistent with long-term goals. Building on these approaches, numerous cities and the state of California have adopted Climate Action Plans (Wheeler, 2008; Bassett and Shandas, 2010), many of which include a broad approach in assessing total energy use and seeking simultaneously to reduce use and relocalize energy sources to low-risk, low-impact infrastructure.

Relocalization is increasingly taking the form of Community Choice energy Aggregation (CCA). In 1997, Massachusetts became the first state to allow CCAs, enabling cities and counties to aggregate the electric loads of residents, businesses, and public facilities to facilitate the purchase and sale of electricity. The Cape Light Compact in Massachusetts bought power on behalf of 197,000 customers who saved between 11 and 22% on the generation portion of their bill (Whitcomb, 2002), demonstrating the power of local control over energy efficiency and cost. Ohio was the second state. There, the Northeast Ohio Public Energy Council served 455,000 customers in 112 communities through an agreement with Green Mountain Energy to provide two percent of generation from renewable sources (Brown, 2002). Customer-specific savings ranged from 1 percent to 15 percent, with total cost savings over the life of the five-year contract estimated to be $10 million (Brown, 2002). California communities have increasingly adopted CCAs—such that 60% of consumers are covered since 2020 (Kennedy and Rosen, 2021)—with the majority being those in wealthier, more urban communities. As some communities can choose cleaner energy, the transition has created tensions with larger-scale utility companies that maintain equipment and have mandates to serve lower income and rural populations.

As communities begin to form value statements around their energy supply, there is room for local planners to engage in conversations about how to match the demand for low-cost, low-

emission energy with housing infrastructure and ensure the transitional costs are met equitably. Tax rebates, such as solar power credits, often privilege the already wealthy (Zycher, 2016). Current regressive energy pricing prompted the federal Low Income Home Energy Assistance Program (LIHEAP) in 1981, which helps low-income families with electricity and heating bills (Kaiser and Pulsipher, 2003). Updating and transitioning energy supplies equitably will require similar progressive measures to not continue overburdening low-income families within local jurisdictions or regionally.

Co-Benefits and Equity

Building decarbonization offers many co-benefits while exposing equity issues rampant within the built environment and resource consumption. Due to structural racism in housing and economic systems in the US, communities of color are disproportionately exposed to pollution, energy costs, and poor housing quality. Many of these communities are also highly vulnerable to extreme weather from climate change, lacking access to cooling and resilient infrastructure (Tan and Jung, 2021).

Low-income families pay a higher percentage of their finances toward energy (Fankhauser and Tepic, 2007; Walker and Day, 2012; Kontokosta et al., 2020) and experience 'fuel poverty.' Among lower income households, households of color experience higher energy cost burdens (Kontokosta et al., 2020). Families cannot afford to cool their homes during heat waves or heat their homes during the winter, with fatal outcomes. The negative effect of extreme heat on people in low resourced neighborhoods was apparent during the 1995 heat wave in Chicago. Multiple studies have concluded that heat-related mortality was highest in less affluent neighborhoods and limited access to community-based resources (Browning et al., 2006; Klinenberg, 1999). In addition, low-income families are more likely to rent older housing stock, which is less energy efficient (Nevin, 2010). Renters usually pay the utility bills but face the split incentive of not being able to make energy efficiency upgrades to insulation, boilers, or renewable energy. Low-cost energy improvements could save low income households about $1,500 annually (Kontokosta et al., 2020). On the other hand, property owners are not directly incentivized to pay for upgrades that benefit their tenants. Thus, equitable policies should include a focus on renter protections.

Numerous reviews of the scientific evidence have concluded that housing interventions that support home warmth, reductions in fuel poverty, and energy upgrades can potentially improve health, particularly for sensitive populations (Ortiz et al., 2019; York et al., 2022). The International Energy Agency (IEA) published a report on the multiple benefits of energy efficiency (2014) describing how positive health outcomes are consistently most robust among vulnerable groups, including children, the elderly, and those with pre-existing illnesses. Another study echoes these findings, describing how health impacts are greater in low-income communities due to health outcomes disparities, location-based exposure, in-home exposure, and

increased vulnerability to the “heat or eat” dilemma (Tan and Jung, 2021). Other studies estimate that health improvements represent as much as 75% of the total return on the investment for the retrofit interventions, with one study from Massachusetts surveying several hundred low-income households in multifamily buildings finding an estimated annual savings of US $1,537 for these non-energy benefits (NMR, 2021). These benefits extend out to the neighborhood, with a study on the case of a public housing project in Phoenix, AZ, using several tools to calculate different economic, environmental, and health metrics associated with three levels of energy efficiency. Their results demonstrate that avoided health and climate costs could total around 40% direct utility savings, in addition to energy-saving strategies that cool the neighborhood, make buildings more resilient to heat, improve indoor air quality, and reduce the transmission of airborne disease (Baniassadi et al., 2022). Given the many equity considerations in a just decarbonization transition, local governments will need to create additional tools and outreach materials that help frame benefits and challenges with local values.

Conclusion

Building decarbonization in the US can potentially reduce CO2 emissions by 72%–78% relative to 2005 levels, just shy of the 80% emissions reductions 2050 goal (Langevin et al., 2019). This can be achieved through a combination of aggressive efficiency measures, electrification, and high renewable energy penetration. Greater political alignment across local, state, and federal levels can enable electrification to play a more significant role as a central component of decarbonization. If the political environment allows more ambitious climate policies, deeper decarbonization could be achieved at a lower average abatement cost (Zhu et al., 2022). Through the combined efforts of energy efficiency upgrades within the building (by reducing the carbon content and use of energy resources and appliances), to the building (with weatherization), and regionally (by shifting energy usage with available technology), decarbonizing buildings can achieve multiple policy objectives, like reaching state climate goals, saving consumers money through reduced energy bills, supporting grid resiliency and reliability, improving indoor and outdoor air quality, and reducing health risks from buildings (California Energy Commission, 2018). Thus, meeting the State's 2050 GHG target is feasible and often desired by multiple constituents. Still, it requires a portfolio of local measures and a commitment to integrating and coordinating policies in the electricity, buildings, transportation, and industrial sectors (Wei et al., 2013).

Table 1. Key Terms

BAU	Business as usual
BEC	Building energy codes, control and regulatory mechanisms that traditionally set minimum requirements for energy use and generation in buildings
Biomass	A plant-based material used as fuel to produce heat or electricity. Includes wood and wood residues, energy crops, agricultural residues, and waste from industry, farms and households.
CCA	Community Choice Aggregation. Allows cities and counties to aggregate the electric loads of residents, businesses and public facilities in order to facilitate purchase and sale of electricity
CEC	California Energy Commission
CHP	Combined Heat and Power
CPUC	California Public Utilities Commission
DE	District Energy
DOE	Department of Energy
Electricity end uses	The energy directly consumed by the user, includes electricity, gasoline, and natural gas.
Energy efficiency gap	Many energy-saving opportunities are not realized even when they are cost-effective
ENERGY STAR	A program which assigns the Energy Star label to appliances that meet specific efficiency standards, administered by the EPA
EPA	Environmental Protection Agency
GHG	Greenhouse gas

Gt CO2eq/year	Gigaton of carbon dioxide, used to estimate global GHG emissions
HP	Heat pump
HVAC	Heating, ventilation, and air conditioning
IEA	International Energy Agency
LED	Light-emitting diode bulb
LEED	Leadership in Energy and Environmental Design, a building energy performance and environmental criteria rating system, overseen by the U.S. Green Building Council
MRT	Mean radiant temperature
PV	Photovoltaic Solar
TWH	Terawatt-hour
WAP	Weatherization Assistance Program
ZCB	Zero carbon buildings

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Appendix 1C: Reducing Vehicle Miles Traveled (VMT)

The Role of VMT in California Climate Policy

We review the state of research on reducing Vehicle Miles Traveled (VMT) to identify opportunities and barriers for local jurisdictions in California. Reducing VMT refers to an umbrella of strategies to reduce the total number of miles driven by personal cars across a given area. Policies include changes to the built environment to promote compact, walkable places where people can live near places they work and play without reliance on a car. VMT reduction also includes efforts to minimize miles driven through incentive and disincentive programs to bolster multi-modal transit, institute congestion pricing, and regulate parking. To center the needs of the most vulnerable Californians, this review focuses on equity.

VMT Reduction Challenges

One of the main barriers to reducing VMT is that local jurisdictions lack reliable, standardized VMT quantification measures and evaluation tools. Jurisdictions lack clarity on preferred tools to clearly state the amount of VMT generated by a proposed project, the impact of specific mitigation measures, and the overall effectiveness of combined measures over time. Assessment of VMT under California Environmental Quality Act (CEQA) uses varied and varying regional thresholds, creating confusion for local jurisdictions. To better align state and local level policy goals, the development, maintenance, and mandated use of a standard VMT model tool is desired. This tool must account for the size and available resources of metropolitan planning organizations and local jurisdictions, the impact of enhanced transit service levels on vehicle ownership and VMT, regional job-housing balance, and the relationship between land use density and household vehicle ownership. For example, developing new highways and roadways can increase VMT and induce travel. With a standardized VMT assessment tool, local jurisdictions can rethink investments in road diets and other modes of travel. Similarly, a standardized VMT tool can help local jurisdictions better quantify the amount and type of jobs and housing to reduce VMT.

Notably, CEQA does not have a solid existing case law legal foundation for VMT assessment - which has only recently replaced the level of service (LOS) reporting. The lack of relevant case laws for VMT makes it difficult for local governments to know to what extent they can rely on their VMT reduction goals to meet CEQA standards (Alexander et al., 2021). A stronger legal framework for VMT within CEQA would encourage local governments toward development projects that anticipate VMT reductions.

Similarly, there is not a direct and standard VMT-based fee (such as mileage fees, cordon pricing, etc.). A VMT-based fee would discourage VMT, and new funds could help fill the growing gap in transportation funding. This policy would entail charging users a fee based on when and where the vehicle was driven, the impacts of that vehicle on the environment, and the

damage to the infrastructure. Odometer readings during smog checks may be used for monitoring, coupled with financial incentives to encourage mode shift. To ensure that such a fee would not disproportionately burden vulnerable individuals who are often forced to travel long distances due to job-housing mismatches, this fee should have an equity component to both collection and distribution of funds.

Further, technical assistance for designing and implementing VMT reduction strategies is lacking. For example, a limiting factor in California's ability to reduce VMTs is job-home mismatch, resulting in longer distances between centers of employment and places to live. This, coupled with declining employment density, creates challenges for implementing walk/bike and public transit options as housing and job centers are more spread out. Research has shown that employment density matters more than residential density in encouraging transit use as an alternative to driving (Boarnet and Wang, 2019), yet telecommuting with COVID and post-COVID necessitates the creation of new studies to support adequate technical planning assistance. Similarly, there are insufficient financial, informational, and collaborative resources for local governments. The state should, therefore, provide a general body of knowledge about VMT reduction strategies and identify a primary hub for local governments. Such a hub could include parking requirements and model equitable commuter benefit ordinances. Additional programs could include employer-paid benefit programs, whereby the covered employer offers employees a subsidy to offset the monthly commuting cost via public transit, vanpool, or bicycle. Last, technical assistance should also offer more grant programs and funding to VMT projects undertaken at the regional and city level.

How VMT Impacts Greenhouse Gas Emissions

In this review, we first describe why reducing VMT is a priority area for greenhouse gas (GHG) emissions reductions and how policies addressing land use, employment density, active transportation, ridesharing, pricing incentives, and equity are essential policy components. Then, we review the state of the research on VMT reduction policy. Each section is followed by California legislative codes in place to support policy objectives. The conclusion then discusses how effective these methods are at reaching stated GHG emissions reductions goals and where priority areas lie for making these goals a reality.

Reducing VMT is essential in reducing GHG emissions. Polizin et al.(2024) use US National Household Travel Survey information from 2002 to estimate VMT scenarios through simple model formulations, and show that between 1977 and 2001, household vehicle trips increased by 115% and personal miles of travel increased by about 114%, demonstrating a climb in vehicle activity over the past few decades. In California, emissions from passenger vehicles are the source of 28.5% of the total 418.2 million metric tons of carbon dioxide equivalents (MMT CO2e) emitted annually (CARB, 2022). The upward trend in personal travel miles has resulted in

increases in local and global pollution from particulate matter and GHG emissions (Ward et al., 2019). Even with lower carbon fuels and increased ZEV uptake in the transportation sector, a policy report by the Center for Climate Change estimates that in the absence of substantial reductions in VMT per capita, low-carbon fuels will only slow, not reverse, the rise in per capita CO2 emissions (Condon, 2008).

To achieve VMT reductions, local actions for planning development are essential. Wheeler et al. (2013) model three 2050 urban-growth scenarios for Yolo County (a predominantly agricultural area near Sacramento, California) and find a scenario that prioritizes efficient land use is able to reduce GHG emissions from transportation and residential building operations by more than 50% in 2050 compared with business-as-usual development (Wheeler et al., 2013). Similarly, Elkind et al. (2017) found infill-focused housing could avert at least 1.79 million metric tons of greenhouse gasses annually compared to the business-as-usual scenario, based on reduced driving miles and household energy usage alone. Such housing density and land-use development is the purview of local jurisdictions.

In addition to improvements in the local environment and quality of life, reducing VMT reduces the consumption of fossil fuels needed to run internal combustion vehicles as well as investments and materials in road infrastructure. Both reductions offer solutions to the environmental degradation and resource consumption issues presented by high levels of VMT (Cervro and Murakami, 2010). Reducing VMT will also provide the additional co-benefits of alleviating traffic congestion, vehicle-related fatalities, water pollution, and wildlife mortality, improving public health through alternative transportation and increased exercise, and enhancing interactions within communities (Salon et al., 2012). Further, higher density development can provide local economic development opportunities, conserve natural resources, and preserve farmland. Such benefits motivate VMT reductions beyond GHG emissions reductions alone.

California Code

Terms used in the California legislative code address **transportation control measures**, encompassing any strategy to reduce vehicle trips, vehicle use, vehicle emissions, VMT, vehicle idling, or traffic congestion. In terms of land use and VMT, **transformative capital improvement** is commonly referred to and means investment in rail, bus, or ferry transit projects that will significantly reduce VMT, congestion, and GHG emissions by creating a new transit system or increasing the capacity or ridership of an existing transit system. Another land use term is **transformative planning** and implementation activities, which refers to housing, planning, infrastructure investments supporting infill housing, and other actions that enable meeting housing goals that result in per capita VMT reductions. Strategies may include accelerating infill development, multimodal communities, shifting travel behavior through reducing driving, and increasing transit ridership. Codes also mention vehicle maintenance

practices that can make vehicles run cleaner. Legislative codes define **transportation network companies** as providing pre-arranged transportation services for compensation using an online-enabled application to connect passengers. Codes also describe **emissions per passenger mile traveled**, which means the total miles completed by drivers of shared vehicles divided by the number of passengers. Terms user to describe travel behaviors are average vehicle ridership, single occupant ridership, and transit system ridership.

VMT Regulatory Frameworks

Historically, GHG emissions from vehicles have been regulated in California through fuel efficiency standards, like the Corporate Average Fuel Economy (CAFE) and Low Carbon Fuel standards. These fuel efficiency standards mandate the average miles per gallon for vehicles industry-wide. VMT, however, has not received as much legislative attention and, therefore, has been growing faster than the population or the economy (Fang et al., 2017). Consequently, a "VMT gap" exists in the current regulatory structure for GHG emissions reductions (Litman, 2013). To bridge this gap, Assembly Bill 32 (Nunez, 2006), or the Global Warming Solutions Act, was established to reduce greenhouse gas emissions from passenger travel. AB 32 created a comprehensive multi-year program to reduce GHG emissions to 40% below 1990 levels by 2030 and 80% below 1990 levels by 2050. Since then, additional legislation has supported reduced GHG emissions. For example, AB 1279 (2022) calls for carbon neutrality by 2045. To meet the carbon neutrality goal, the CARB Scoping Plan proposes reducing VMT from 24.6 miles per day in 2019 to 18.4 miles by 2030 (a 25 percent reduction) and to 17.2 miles per day by 2045 (a 30 percent reduction) in keeping with projections by Boarnet and Handy (2017). Since passing AB 32, two additional major laws have been passed that aim to reduce VMT: Senate Bill 375 (Steinberg, 2008) and SB 743 (Steinberg, 2013). SB 375, or the Sustainable Communities and Climate Protection Act, calls on Metropolitan Planning Organizations (MPOs) to prepare a Sustainable Communities Strategy (SCS) that integrates land use, housing, and transportation strategies into the regional transportation plan that reduces GHG emissions through VMT reduction. These SCSs must meet GHG reduction targets set by CARB. Beginning in 2018, CARB has presented a progress report every four years to the legislature, as directed by SB 150, that assesses each MPO's progress in meeting the regional GHG emission reduction targets set by CARB as part of SB 375. The 2022 report includes information in a Data Dashboard.[23] In the 2022 progress report, CARB also includes for the first time, information about the VMT metric by region, destination accessibility, housing development by income level, units with a density bonus or inclusionary deed restrictions, and Greenhouse Gas Reduction Fund spending. Though 2020 census data were unavailable for the 2022 report, the progress report on SB 375 notes that major trends moved away from limited progress and inequality worsened (CARB, 2022). Obviously, these are not the desired trends and more local capacity building work is needed to meet state targets for VMT reduction and equity. In addition, CARB found that California is still not reducing GHG emissions from personal vehicle travel as needed under SB

375. The report also noted that per capita GHG emissions and per capita VMT continue to increase, though more slowly than in the 2018 progress report. To better reach goals, the state curates a set of Quantification Methodologies and Calculator Tools for estimating GHG emission reductions and co-benefits of new projects. These include the Sustainable Communities Strategy which outlines metrics to track MPO progress across four dimensions: policy commitments, policy implementation, incremental progress, and equity.[24] In 1992, California enacted legislation (AB 2109, Katz) enabling qualified employers to offer employees the option to choose to "**cash-out**" of firm parking subsidies. Employees who have access to workplace parking are usually more car-oriented (Tscharaktschiew and Reimann, 2022). Where wage income is taxed, employer parking is seen as a fringe benefit in kind that is usually not taxed. Thus, the government loses income tax revenue for each parking space that firms offer, and local governments lose revenue from paid parking. Updates in 2022 with AB 2206 (Lee) expanded the program and added a requirement for employers to inform employees who receive a parking subsidy of their right to receive the cash equivalent of the parking subsidy and maintain records of that communication. Further, the California Climate Investments provides funding from Cap-and-Trade. To evaluate proposals, this program includes Benefit Criteria Tables for determining benefits to priority populations and templates for reporting outcomes. From December 2022 through the end of May 2023, California Climate Investments programs supported 7,326 projects that are expected to reduce greenhouse gas emissions by 3.3 million metric tons of carbon dioxide equivalent over project lifetimes.[25] Over 84%, or $436 million, in implemented funds from this period are benefiting DACs and low-income households. Focused on advancing environmental quality in the state, SB 743 (Steinberg, 2013) further revised the guidelines for transportation impacts under the California Environmental Quality Act (CEQA). The bill changes how lead agencies evaluate transportation impacts under CEQA to advance the state's goals of reducing GHGs and traffic-related air pollution, promoting the development of a multimodal transportation system, and providing clean, efficient access to destinations. SB 743 led to the adoption of vehicle-miles traveled (VMT) to replace level-of-service (LOS) as the standard for transportation impact analysis under CEQA. Local planners broadly support the change to VMT (Volker et al., 2019). Yet, mitigating VMT impacts of new projects creates the opportunity or potential need to conduct mitigation at locations other than the project site to ensure job-housing balance among other concerns. Further off-site VMT mitigation could include off-site banking or exchange programs that let developers fulfill their mitigation obligations without incorporating changes in the immediate project site (Fang et al., 2017). In sum, state-level bills have language that sets goals, but they often lack explicit strategies and quantification tools to accomplish these goals on a city or county basis.

Additional legislative codes enable local strategies to reduce VMT. For example, SB 310 (Hancock, 2012), or the Transit Priority Project Program, provides a process for cities and counties to adopt an ordinance indicating intent to participate and form an infrastructure financing district. To meet the requirements, projects must be located in a designated transit

priority area within one-half mile of a transit station, provide onsite bicycle parking, and provide car sharing in the city or county. Another bill that addresses these themes is Ch. 832, Sec 3 (Added by Stats, 2001), which outlines how each transportation planning agency with a population that exceeds 200,000 persons may prepare at least one "alternative planning scenario" for presentation to local officials, agency board members, and the public during the development of regional transportation plans. The alternative planning scenario shall accommodate the same amount of population growth as projected in the plan but can be based on an alternative scenario that reduces the growth in traffic congestion and VMT, makes more efficient use of existing transportation infrastructure, and reduces the need for costly future public infrastructure. These alternative plans aim to increase housing and commercial development around transit facilities, jobs, and commercial activity centers. This development should encourage public transit usage, ridesharing, walking, and bicycling. An economic incentive program is also encouraged that may include transit vouchers and variable pricing for transportation.

Measuring VMT

There are several methodology options available for calculating and estimating VMT. This includes High-Performance Monitoring System Data published by Caltrans, Vehicle Registration Data and Smog Check Program Data, CEC Retail Fuel Outlet Annual Reporting Data, and travel demand models. CARB developed an estimate of VMT for new projects. Cal EPA also includes a method for assessing current VMT per jurisdiction using motor vehicles registered and operated in California. Each method is described below.

1. Current CARB Auto VMT Reductions Quantification Method (CARB, 2019)
    - $Auto\ VMT\ Reduced = (D) * (ADT) * (A + C) * (L)$
        - D = days of use per year (default is 200 days; units are in days)
        - ADT = annual average two-way daily vehicular traffic on the parallel road (project-specific data, with a maximum of 30,000; units are in trips/day)
        - A = adjustment factor (table lookup value)
        - C = activity center credit (table lookup value)
        - L = walking trip length (1.0 miles/trip in one direction) Miles/trip

    Current EPA VMT Odometer Readings (Bureau of Automotive Repair, 2000)
2. VMT results are calculated as a function of:
    - Model year: From 1974 to the current model year
    - Fuel type: Includes vehicles powered by gasoline, liquefied propane gas, compressed natural gas, methanol, ethanol, or a combination of these fuels
    - Vehicle type: Passenger cars, light-duty trucks, medium-duty vehicles, and heavy-duty trucks

Background on VMT Terminology

A term commonly used in transit is **active transportation investment**. This term refers to the amount of money that the federal government, state agencies, cities, and regions spend on transit (capital and operations) with an emphasis on supporting active modes such as biking, walking, skateboarding and others. **Vehicle efficiency standards** is another common term and tool used by the state. This term refers to how much CO2 per mile is emitted by a vehicle and the fuel efficiency in miles per gallon. VMT policies also rely on the **state gas tax** to disincentivize fueling up on gasoline and to generate revenue for the transportation system. Other terms outlined in VMT policies are **road use fees** in the form of tolls, driving pricing policies, and parking prices. Guidelines target VMT also aim to decrease traffic congestion. For example, mixed-use, high-density development, aims to reduce the **job-housing mismatch** by increasing the compactness and access between residential, office, and commercial land-uses. Several additional designs can be used to promote reduced VMT in high density areas, such as pedestrian-friendly design, which prioritizes narrow streets that slow and alert motorists, and interconnected parks, trails, sidewalks, and pathways. **Transit-oriented design** is similar to pedestrian-friendly design but focuses on compact, mixed-use, pedestrian- and bicycle-friendly designs and how these can be closely integrated with mass transit by clustering jobs, housing, services, and amenities around public transport stations and stops. These designs also rely on coordinated transportation systems, wherein buses, trains, ferries, and biking and walking paths are all well integrated to ensure passengers can reach their destinations without using a private vehicle. This is primarily a concern for addressing the **first mile/ last mile problem** between destinations, where public transit may not directly go. When such inconveniences arise, people are more likely to rely on personal car transit or taxi services. Another term in transportation and land use is *smart growth*, a way to build economically prosperous, socially equitable, and environmentally sustainable cities, towns, and neighborhoods over time. Many smart growth designs aim to embrace **VMT reduction co-benefits**, such as increased exercise and better air quality, with the creation of greenbelts that allow walking and biking but limit outward urban sprawl. Other VMT-related terms address travel behavior, including **average trip length** and **behavioral mode choice**, which together reference the time to a destination in relation to the transportation options available. **Ridesharing** refers to carpooling, on-demand transit, and Transportation Network Companies (TNCs). As TNCs and other new mobility services become more popular in cities through shared vehicles, bikes, and scooters, they enable users to gain short-term access to transportation modes on an "as-needed" basis. Such shared mobility is often made possible through smartphone apps and information technology, which aggregate and optimize mobility options (Shaheen et al., 2020). While they can offered through ridesharing, **micromobility** includes lightweight devices that operate at low speeds, like bicycles, scooters,

and skateboards, and may be either privately owned or publicly owned and shared. These can be either human-powered or electric. The value of micromobility solutions for cities is that they represent a shift towards low-carbon and sustainable modes of transport and can positively disrupt private vehicle use, especially for short-distance travel (Sperling et al., 2020). Last, **parking requirements** also impact VMT.

Research on VMT Reduction Feasibility and Policy

Integrating Land Use and Transportation Decisions

Land use practices are a significant component of VMT, influencing transportation choices, including how far, how frequently, and by which mode people travel. Therefore, most VMT reduction strategies urge tailored local and regional land use decisions to decrease transportation sector emissions through design. The most frequently cited attributes influencing driving behavior are proximity to urbanized areas, development density, mixed-use buildings, and access to alternative transit infrastructure. Addressing these factors can significantly reduce VMT (Malaczynski and Duane, 2009). Yet, with road investments continuing to outpace other aspects of transit investment, it is not surprising that VMT has not been reduced, as shown in the SB 150 draft report (2022). Thus, scholars urge local jurisdictions to consider not only the development of compact, mixed-use TOD, but also the ratio of investment in this infrastructure compared to local, regional, state, and federal spending on road infrastructure such that development works in step with transit planning.

In further support, studies demonstrate that high population densities are strongly and positively associated with lower VMT per capita. One such study uses data from 370 US urbanized areas and structural equation modeling and found that the largest VMT reductions would come from creating compact communities that have below-average roadway provisions, more pedestrian/cycling infrastructure, and in-neighborhood retail activities that invite nonmotorized travel (Cervero and Murakami, 2010). Cervero and Murakami (2010) describe these communities as “sustainable urbanism, " prioritizing more walkable, transit-friendly urban landscape designs. They contend this will reduce VMT, curb GHGs, energy consumption, and local air pollution, and provide more housing and lifestyle choices (Cervero and Murakami, 2010). Similar to sustainable urbanism, transit-oriented development (TOD) and smart growth policy, like the measures proposed in SB 375, are found to be inversely related to per capita VMT. Woldeamanuel and Kent (2014) use multivariate regression to isolate determinants of per capita VMT in California from the National Household Travel Survey (NHTS). In their study they also use the Chow Test to identify structural change between the 2001 and 2009 NHTS. Using two regressions, they find that the most relevant variables were: distance to work, population density, travel day trips, and number of vehicles in household. These findings are consistent with results from other studies (Lui 2007, Ewing and Cervero 2010, Akar and Guldmann 2012). These findings contrast the dominant development trend of single, family

housing enclaves far from work and commercial centers. Indeed, this is the dominant pattern of development *planned* for the future of California based on findings from the California Zoning Atlas, a project by the UC Davis Center for Regional Change and UC Berkeley Othering and Belonging Institute (2024). For example, the incorporated areas in Fresno County dedicated to single family zoning comprise 61% of the total area (OBI, 2023). Similarly, over 50% of land is zoned for low-density single family housing development in Sacramento, San Diego, Los Angeles, and the Bay Area regions.

California's current zoning highlights the missed opportunities to reduce VMT through compact, mixed-use development. For example, Heres-Del-Valle et al. (2011) research the impacts of compact development through a multivariate two-part model using survey data on household travel patterns and socio-economic characteristics in California. Their results indicate that when all else remains equal, a 10% increase in *residential* density would reduce VMT by 1.9%. The scale of this impact is limited because of the effects of residential compactness alone. Similarly, Chatman (2008) uses data from a survey of metropolitan households in California and finds that increasing residential density is unlikely to significantly change travel behavior without concomitant policy changes for commercial and office land-uses, like maintaining minimum levels of roadway capacity and parking provisions. Ewing and Cervero (2010) conduct a meta-analysis of the built environment-travel literature. They conclude that density and VMT must also be understood within regional accessibility. For example, many studies that analyze VMT and density fail to consider commute times across the region, regional mass transit options, and job-housing dynamics across paired districts.

In terms of built structures that increase VMT, Noland and Cowart (2000) use the Texas Transportation Institute annual congestion report and metropolitan-level data to determine urbanized land area and lane miles of highway capacity. Their analysis found that road lane expansion accounts for 15% of per capita VMT growth (Noland and Cowart, 2000). These findings should add caution to highways expansion projects, like that currently underway along I-80 in the Sacramento region. Other studies provide strong empirical evidence that household increases in income and number of vehicles, workers, adults, and children all led to higher VMT. Conversely, higher population densities and high gasoline cost negatively affect VMT (Lui, 2007; Ewing and Cervero 2007; Akar and Guldmann, 2012). Nelson (2017) uses Tucson, Arizona as a case study, to look at the relationship between urban form and personal travel by assessing the following variables on travel: density, diversity, design, destination accessibility, and distance to travel. Nelson (2017) categorized infill-redevelopment as having all future development occur in existing developed areas. Nelson (2017) finds that with infill redevelopment, the mean distance a person travels from the downtown decreases by 20%; anticipated transit expansions cut the mean distance to transit by half; and there was a 50% increase in job accessibility. Through the infill-development scenario, between 2011 and 2050, VMT per capita was estimated to fall by 42.6%. Although metropolitan Tucson is expected to grow by 52%, its total VMT in 2050 would be less than its VMT in 2011. This scenario could

redirect $3 billion from building 1,500 lane miles of new roads (to serve the predicted 4 billion more VMT in metropolitan Tucson) to improve existing roads, enhance pedestrian and bicycle ways, expand transit, and make other strategic investments that improve quality of life (Nelson, 2017). The research demonstrates the cost savings as well as numerous other benefits to be had in infill-redevelopment.

Employment Density

Employment density may have more potential to reduce VMT than increases in residential density. Employment density is the ratio of the number of employees divided by land area (e.g., employees per acre or employees per square mile). Boarnet and Wang (2019) identify 46 employment sub-centers in the Los Angeles Combined Statistical Area and calculate access to jobs within and beyond these sub-centers. They measure household VMT using data on employment from the National Employment Time Series (NETS) matched to geocoded firm locations and the 2012 California Household Travel Survey. The results from this study suggest that infill opportunities that are near, but not within, city sub-centers offer the best land use approach to reduce VMT—as opposed to focusing on redeveloping already accessible downtowns (Boarnet and Wang, 2019). Ding et al. (2014) look at the effects of built environment factors on work-related VMT, considering urban form at home and workplace locations. They use the Maryland and Washington DC Regional Household Travel Survey 2008 in a cross-classified multilevel model using the Bayesian approach to study spatial heterogeneity in Washington DC. The results reveal that development densities at the workplace have more critical roles than at home. These studies highlight that policies aiming to reduce work-related VMT through residential density alone will not be as effective at reaching GHG emissions reduction goals through mixed use and commercial densification.

California legislature sought to address such work-related VMT with the Guidebook for Jobs-Housing Balance, Ch. 843, Sec 1 (Added by Stats, 1990). This guidebook aims to describe and evaluate the various tools available to local, regional, and state governments to measure, assess, and improve the balance of jobs and housing to be completed before 1993. The guidebook also describes efforts by cities, counties, and regional agencies to improve the balance of employment and housing, including the methodologies for measuring trip generation and VMT to and from employment centers. While this one-time guidebook has not been updated, researchers have built on its methods. For example, Blumenberg and King (2021) use census data from Longitudinal Employer–Household Dynamics Origin–Destination Employment Statistics (LODES) to find that the majority of California's cities are becoming less self-contained between 2002 and 2015, with more people commuting outside the city. These findings demonstrate that local planning should recommit to higher density job development.

At the same time, scholars caution that the COVID pandemic spurred the creation of mega commutersheds as housing affordability forced lower-wage workers to “drive until they

qualified" for housing rents and mortgages (Wang et al., 2024a). Using mobile phone data for the Bay Area region in Northern California Wang et al. (2024b) show that lower-income and essential workers commuted more during the pandemic while higher-income workers benefited from teleworking. These findings underscore the need to address VMT with an equity approach that centers high density affordable housing near high density job centers.

Parking Requirements

With ample, free curb parking available through **minimum parking requirements** for all development, most rides by private automobile are essentially free. In addition, surface parking lots, curb parking, and parking structures all remove space that could be used for housing, office, commercial, and industrial purposes. With a career focused on studying parking requirements, Shoup recommends removing off-street parking requirements (Shoup, 1995, 1999, 2018, 2021a), charging market rate for curbside parking (Shoup, 2018, 2021a and b), and investment of resulting revenue to improve public services (Shoup, 2018 and 2021a). In sum, the failure to charge market rates for curb parking, increases cruising to find available, low-cost parking, congests traffic, pollutes the air, wastes fuel, and results in greater traffic fatalities. Yet, there are also equity implications as parking is often more restricted for disadvantaged communities and users (Savignano, 2023) and more heavily policed and ticketed in communities of color (Brazil, 2020; Barajas, 2021). Even outside of DACs, low-income, and disabled riders often pay a greater percentage of their budget on parking (Venkataram et al., 2024), necessitating equitable approaches that allow preferential parking (eg. handicap designated parking spots near entrances) and progressive fees for parking until active and public transit can reach convenience, access, and cost parity with driving.

Similar equity concerns apply to cash-out employer-paid parking. In a case study of eight cash out programs that allowed 1,694 employees to receive between $36 to $165 per month in lieu of their parking, solo driving to work fell by 17 percent while carpooling increased by 64 percent; transit ridership increased by 50 percent; walking and bicycling increased by 33 percent, and commuter parking demand fell by 11 percent (Shoup, 1997). Yet, local policymakers remain reluctant to enable and require such employer parking policy programs. In an example from the UK Government's 2000 "workplace parking levy" which enabled local authorities in England to charge employers for the parking they provided for staff, only one jurisdiction has enacted the law in twenty years (the City of Nottingham; Dale et al., 2023). To spur greater adoption of cash out programs, local governments can encourage and address firm parking requirements—with attention to how such benefit programs interface with firm parking requirement bonuses. After all, many workplaces will be incentivized to simply remove parking benefits without increasing wage benefits to employees. To further encourage equitable shifts, all the above efforts will need to be assessed as part of VMT reduction calculations for meeting CEQA requirements.

Active Transportation and Micromobility

Micromobility is increasingly recognized as a promising mode of urban transport for its environmental, economic, and social benefits, including the potential to reduce private vehicle use for short-distance travel and reduce emissions, crashes, and congestion (De Hartog et al., 2010). Micromobility refers to bikeshare, e-scooters, e-bikes, and semi-motorized variants of these modes, such as pedal assist and pedal-electric bikes. The active transit offers benefits in terms of the increased physical activity (DeMaio, 2009). In addition, micromobility services can provide access to suburbs and locations not well-served by public transport or easily accessed by private vehicles (Shaheen et al., 2013). In this manner, micromobility is an essential component in first and last mile connectivity, helping users access services and economic opportunities faster than using public transport, private vehicles, or walking (Milakis et al., 2020). In the US, more than half of the private car trips are used for trips that are less than five miles. As a result, scholars estimate that micromobility can replace about 30% of car trips (Fitt and Curl, 2019). These options also connect residential and commercial areas to public transport hubs, which helps to make public transport commutes more attractive and feasible. Supporting micromobility includes the creation of designated bike lanes, regular pavement upgrades with curb cuts, and bike and scooter parking.

While micromobility options can include personally owned bikes or semi-motorized variants, some cities offer micromobility options maintained by a city or private organizations and operated on a shared, charge-per-trip basis. This kind of micromobility service is often made available on a smartphone app or through a sharing economy model where users are charged a small fee for sharing a bicycle or scooter for short periods.

Studies find that increased micromobility options can result in decreased congestion and improved air quality regionally, with added benefits to users of time saving and convenience. Some studies find that people give up their vehicles altogether as a result of increased micromobility and public transit options. In a systematic literature review of 328 journal articles from 2000 to 2020, Abduljabbar et al. (2021) find that the most micromobility studies focus on quantifying time-savings, accessibility, congestion, and air quality.. This study also finds that emerging micromobility solutions have helped address several transportation challenges by reducing congestion addressing inequality in accessibility to services and opportunities, and were shown to be a positive force for reducing pollution. The study also finds that the main appeal of micromobility options is that they contribute to shifting road users away from private vehicles and high-pollutant modes of transport to more energy-efficient mobility solutions (Abduljabbar et al., 2021). For example, Basu and Ferreira (2021) examine the impact of bikesharing on reducing auto-dependence in Metro Boston. Using a longitudinal dataset containing millions of geo-referenced vehicle registrations and odometer readings in Massachusetts over six years, the researchers ran the data through a spatial DiD (difference in differences) model. The results

show that new bikeshare stations reduce vehicle ownership per household by 2.2%, VMT per person by 3.3%, and per-capita vehicular GHG emissions by 2.9%, with vehicle ownership reduced almost immediately. These results provide strong evidence for local jurisdictions site bikeshare stations. Another study across North Americas and European cities analyzes mode shift to bikesharing and found that personal car and taxi use both reduced as people were drawn to bikesharing modes of travel (Shaheen et al., 2013).

Broadly, convenience and proximity are significant factors in utilizing alternate modes of transportation according to a study by the San Francisco Bay Area Metropolitan Transportation Commission conducting a survey of residents based on proximity to a rail/ferry station and population density of the area surrounding the household. They report that people who live half a mile or less from a rail or ferry station were four times as likely to use it than all others and ten times as likely to use public transit if they were also working within a half mile of public transit. This access to transit also had behavioral change implications, as these same individuals were twice as likely to walk or bike for short trips (up to one mile) than all others (Metropolitan Transportation Committee, 2006). Comparatively, no state-level California legislative codes address micromobility nor bikesharing.

Ridesharing and Ridesourcing

Ridesharing and ridesourcing services (like Uber and Lyft) are offered by Transportation Network Companies (TNCs) and microtransit to provide on-demand mobility services. This section describes how on-demand mobility is part of a larger transformation of shared mobility that complements and can compete with personal vehicle ownership and public transit use. Shared mobility encapsulates ridesharing and ridesourcing but is a broader term describing modes of transportation where people use vehicles owned by a third party on an as needed basis. This category includes carpooling, bikesharing, and shuttle services.

On-demand shared mobility has contributed to a change in urban travel patterns, affecting energy use and GHG emissions reductions (Ward et al. 2019). Ward et al. (2019) estimate how much ride hailing services impact per-capita vehicle ownership, energy use, travel distances, and emissions in U.S. states from 2005 to 2015, using a difference-in-difference propensity score-weighted regression model. They study find that TNC entry appears to cause an average decline in state per-capita vehicle registrations by 3% (Ward et al. 2019). An effect of this magnitude would correspond to a reduction in vehicle ownership of 4.1%, on average, across all urban areas (Ward et al. 2019). Further, using EPA estimates of passenger transportation emissions, this research estimates that TNC service availability is associated with a reduction in state per-capita VOC emissions by 4.8%. Using the Department of Transportation's (DOT) average per-mile estimates of the externality costs of air pollutant emissions, this emissions reduction level represents social cost savings of $600 million over the analysis period (Ward et al., 2019).

Martin (2016) surveys car2go members (a shared vehicle company) in five cities in North America to determine the impacts of shared vehicle usage on vehicle ownership, modal shift, VMT, and GHG emissions. In addition to surveys, this study uses vehicle activity data to evaluate the total driving that car2go vehicles travel in a city during a year and a profile of the frequency of use by the broader car2go population. The results show that usage of shared mobility translated into a reduction in GHG emissions, with estimated changes of car2go VMT, impacts at the household level decreasing -6% to -16%, and GHG emissions changing by -4% to -18% per car2go household (Martin, 2016). Overall, the results of this study suggest that car2go car sharing is substantively impacting travel behavior, miles driven, GHG emissions, and the number of vehicles on urban roads within the regions in which they operate. In another study, Martin and Saheen (2011) survey 6,281 people in North America who participated in car sharing programs in the United States and Canada and found that one-quarter of the study participants sold a vehicle due to carsharing, and another quarter postponed a vehicle purchase. The authors estimate that one car-sharing vehicle replaced 9 to 13 cars among carsharing members, with household annual VMT declining from 27% to 43% and household annual GHG emissions declining from 34% to 41% (Martin & Shaheen, 2011).

The only California legislative code that addresses the role of ridesharing and ride-sourcing in reducing VMT is SB 1014 (Skinner, 2019), which established the California Clean Miles Standard and Incentive Program. This program requires CARB to set a baseline for emissions of greenhouse gasses for vehicles used on the online-enabled applications or platforms by transportation network companies on a per-passenger-mile basis. This bill outlines annual goals for increasing passenger miles traveled using zero-emission vehicles and proposes that each transportation network company develop a greenhouse gas emissions reduction plan. This plan shall include an increased proportion of participating drivers with zero-emission vehicles using transportation network companies, an increased proportion of vehicle miles completed by zero-emission vehicles relative to all vehicle miles, decreased gram-per-mile greenhouse gas emissions rates, and increased passenger miles in proportion to overall vehicle miles. The goals of this bill also state that they should have a minimal negative impact on low-income and moderate-income drivers, ensure that the program complements and supports the sustainable land-use objectives, and support the goals of clean mobility for low- and moderate-income individuals.

Pricing Incentives

Even with a focus on compact urban morphologies and alternative transportation mode strategies described in previous sections, research often calls for additional transportation pricing policies to encourage a transition away from auto dependence. This section explains how VMT-based pricing policies and demand management may deter people from using private vehicles more

effectively than the current gas tax.In the book *Driving Change*, published by the Public Policy Institute of California (2011), the authors describe how SB 375 will require pricing policies to accompany any land use and transportation strategies, even though this policy often receives the most public resistance. The gas tax has been stagnant over the past three decades but is also depreciating in relation to inflation and lower reliance on gas due to improved fuel economy and greater use of ZEVs. Consequently, the gas tax revenue contributions to infrastructure are inadequate in relation to the list of priority improvements. An alternate approach includes VMT-based fees, which rely on new electronic toll collecting and geographic positioning system technologies. VMT-based tolls can be more flexible than the gas tax in that they can be varied according to time of day, type of road, household economics, and type of vehicle (PPIC, 2011). Pricing policies may also include congestion pricing and increased parking fees, all of which provide incentives to reduce driving while also helping to fill the growing gap in transportation funding (Rodier, 2009). Kim et al. (2008) conducted a VMT-fee pilot test involving more than 200 vehicles in Oregon. From the pilot test, they conclude that the implementation of a VMT-fee scenario has great potential to reduce GHG emissions. However, it will only become feasible as VMT toll technology improves (Kim et al., 2008). Salon et al. (2012) conducted a literature review for 14 distinct commute factors and VMT. In this review, they identify studies that quantify how much VMT can be expected to change in response to transport policies and programs such as transit improvements, road pricing, and programs aimed at changing people's travel choices. Their findings emphasize four strategies: link or point tolling-where users pay for access to a roadway segment such as a toll road or bridge; cordon pricing-where drivers are charged when crossing the boundary of a predefined tolling area (typically a downtown or central business district); distance charging-where users pay according to distance driven on the road network; and time charging whereby road users are charged for the time spent on a road. Their results show that travelers are most responsive to VMT charges. They cite one example from Sacramento where a simulated 5-cent per mile VMT charge resulted in a 10% VMT reduction (Rodier, 2002). Further support comes from Safirova et al. (2007), who find that a simulated 10-cent-per-mile VMT charge in the Washington DC area would result in a 14.5% drop in VMT. In addition to VMT pricing policies, the literature describes "demand management" incentives such as carpool lanes, employee shuttles, and other employer inducements to use transit. These strategies create financial or time-saving incentives to shift trip timing away from peak periods, making alternatives, such as transit, carpooling, and telecommuting, relatively more attractive (Deakin et al. 1996). One such study by Rodier et al. (2016) reviewed emerging ridesharing systems with the potential for a new demand management strategy that may be more politically palatable while simultaneously reducing the number of VMTs. This study used the California Bay Area activity-based travel demand model to simulate business-as-usual, transit-oriented development, and auto pricing scenarios with high, medium, and low ridesharing participation levels. Their analysis suggests that relatively significant VMT reductions are possible from moderate and high ridesharing participation levels, but at low participation levels, VMT reductions are negligible. Their analysis suggests a potentially

promising policy combination: a regional dynamic ridesharing system with a 10 to 30-cent increase in auto travel per mile cost may reduce VMT by 11% to 19% (Rodier et al., 2016). While many of the codes in previous sections mention pricing policy briefly as part of more extensive programs, the only California legislative code that more explicitly addresses pricing policy and VMT is Ch. 533, Sec. 8. (1989). In this bill, the Legislature declares that each state should have the freedom to develop the kind of highway user tax structure that it determines to be most appropriate and that annual taxes or fixed fees, which are not imposed on an amount used basis, should be apportioned based on VMT within each of the states. Local jurisdictions do not have the authority to implement gas tax changes or the authority to implement cordon pricing but will respond to legislative shifts. Thus, much of VMT pricing policy and decision-making relies on the state—not local action.

VMT and Equity

Generally, larger carbon footprints and increased VMTs correlate with higher income households. The top decile of earners contribute 30%–45% of emissions (Hubacek et al., 2017; Chancel and Pikkety, 2015). Nationwide, 3.3% of total household expenditures are for vehicle fuel, and over 50% of annual household expenditures on energy are for transportation. Larger-income households spend a greater total amount on vehicle fuel and energy for transportation; thereby contributing more to travel-related GHG. This is explained, in part, by larger-income households owning more vehicles. In a San Francisco-based survey of 2,207 households (2019), 53% of households with an annual income of less than $100,000 do not have access to a vehicle. By contrast, for households with incomes at or above $100,000, 57% have one vehicle and 17% have two or more vehicles (SFMTA, 2019). In addition to higher income earners having more vehicles, higher income households also tend to drive alone more and accrue more VMT per vehicle according to National and Household Travel Trends (2024, Exhibit 3-24; Akar and Guldmann, 2012).While national-level models demonstrate that VMT-based fees may be mildly progressive for all household incomes below $200,000 (Weatherford, 2011; Metcalf, 2022), several scholars have reviewed additional equity considerations. For example, Larsen et al. (2012) use data from the 2009 National Household Travel Survey to consider the equity impacts of four VMT-fee scenarios in Texas. In this study, Vertical Equity “is concerned with the distribution of impacts between individuals and groups that differ in abilities and needs, in this case, by income or social class” (Litman, 2002, pp 10). Conversely, Horizontal Equity “is concerned with the distribution of impacts between individuals and groups considered equal in ability and need” such that funds received are linked to where the captured revenue will be spent to establish improvements (Toutkoushian and Michael, 2007, pp 396). Each scenario was run statically and dynamically, assuming the VMT fee would replace the state gas tax. All scenarios were Vertically Equitable, and the most Horizontally Equitable VMT fee resulted from the scenario where vehicles would be charged a user fee that would be assessed based on when and

where the vehicle was driven, the impacts of that vehicle on the environment, and the damage to the infrastructure. Horizontal Equitability emphasized that charging different rates for travel on urban roadways and rural roadways corresponding to funding needs associated with that roadway type as well as vehicle type. In support, Yang et al (2016) use travel data from Maryland to show that income-based VMT fees can protect lower-income households while generating greater revenue. Equity-focused policies are also needed as low-income households are often forced to drive long distances due to job-housing mismatch. Restrictive zoning and limited affordable housing near jobs spurs a "drive until you qualify" search for housing that is within rent and mortgage range for lower-income households (Wang et al., 2024a). In comparison, higher income households often chose to drive longer distances for leisure. Reflecting these mismatches, Zhou et al. (2021) use actual VMT with odometer readings to show that lower-income groups spend from 1.2% to 8% of their income on fuel and personal transportation. In contrast, the range for the highest income group ($125,000+) is from 0.15% to 3.9%. These ranges hint at the range of impacts experienced by different demographic groups while highlighting a need for equity-focused policies that do not exacerbate burdens on already burdened populations. For example, policies that raise the cost of VMT may disproportionately impact low-income households—particularly where the job-housing ratios do not align affordable housing opportunities with available, qualified jobs. In support, Choi and Hu (2008) found that variables like population growth, age, ethnicity, immigration, income, female labor force participation, and household size affect aggregate VMT. Modeling two significant data sets (2035 US and the SCAG region's population projections by age, sex, and race/ethnicity and age-sex-race/ethnicity-specific VMT), they show that the peak of the VMT level per person (by age) was from the age group of 35-54 (family households with children). These findings are supported by Polizin et al. (2004), and indicate a need for equity-focused pricing that does not result in undue burdens for households with children who may drive longer distances to access higher quality schools. Choi and Hu (2008) also estimate that up to 65% of VMT growth was driven by population growth (Choi and Hu 2008). Thus, growing regions will need particular focus as urban form and affordable housing dynamics shift VMT patterns.

State Funding Programs that Address VMT

Several California State funding programs address transportation and land use through improved public transportation networks, compact housing, and transit-oriented development. The **Transit and Intercity Rail Capital Program** funds transformative capital improvements to modernize California's intercity, commuter, urban rail, bus, and ferry transit systems. The policy goals of this program are to achieve reduced emissions of greenhouse gasses, expand and improve transit service to increase ridership, integrate the rail service of the state's various rail operators, including integration with the high-speed rail system, and improve transit safety. The **Affordable Housing and Sustainable Communities Program** funds a variety of programs that include intermodal, affordable rental, or owner-occupied housing projects that support infill and compact

development; transit capital projects and programs supporting transit ridership; active transportation capital projects, including pedestrian and bicycle facilities and supportive infrastructure, and connectivity to transit stations. This program promotes transit-oriented development projects and other projects designed to reduce greenhouse gas emissions and other criteria air pollutants by reducing automobile trips and VMT within a community. Another program that addresses these broad goals of land use and VMT is the **Regional Early Action Planning (REAP) Grants Program**. REAP 2.0 provides a one-time infusion of funding through a largely formula-based approach. The program also includes competitive grants, funding for high impact transformative projects, and support for tribal and rural communities. Funds from this program are meant to address issues in housing, land use, transportation, climate change, equity, and other planning priorities. To receive these funds, a city or region must describe how housing goals will also result in per capita VMT reductions in furtherance of the region's sustainable communities strategy. Any entity that receives an allocation of funds from this program must establish priorities for eligible transformative planning and implementation activities that include accelerating infill development by performing infrastructure planning and investing in upgrading infrastructure, shifting travel behavior through reducing driving, funding the establishment of a local VMT impact fee or regional VMT mitigation bank. Those who receive these funds must also write a report (to be made publicly available) using guidelines[26] to include land use maps and VMT generation maps produced for their Sustainable Communities Strategy.

Some other funding programs address more specific aspects of VMT, such as traffic congestion. SB 1 allocates two hundred fifty million dollars ($250,000,000) in the State Highway Account to be made available to the Department of Transportation annually for the **Solutions for Congested Corridors Program**. Projects funded by this program are designed to achieve a balanced set of transportation, environmental, and community access improvements within highly congested travel corridors throughout the state. This program encourages high-occupancy vehicle lanes, increased transportation options for residents, advances to state highways, local streets, and roads, improved public transit facilities, bicycle and pedestrian facilities, and restoration or preservation work that protects critical local habitat or open space.

The Prohousing Designation Program (PDP) creates incentives for jurisdictions that are compliant with the State Housing Element. The program was established with the passage of the fiscal 2019-2020 budget, and Sacramento earned the first designation in 2024. Actions taken by local jurisdictions earn points across four scoring categories: (1) Favorable Zoning and Land Use (2) Acceleration of Housing Production Timeframes (3) Reduction of Construction and Development Costs, and (4) Providing Financial Subsidies.

Local Initiatives

Many of the policy goals outlined in the previous section fall under city, county, and regional planning purview. For example, PDP designation can include but is not limited to the following local actions:

- Eliminate parking requirements citywide for accessory dwelling unit (ADU) developments
- Expand residential and mixed uses allowed by-right
- Eliminate maximum density for mixed-use projects;
- Reduce parking requirements for affordable and senior housing, small lots, and vertical mixed-use developments
- Offer incentives for higher-density developments near transit by eliminating or reducing parking requirements;
- Creation of a Master Environmental Impact Report (EIR) to streamline development;
- Permit multi-unit dwellings by-right;
- Eliminate the requirement for planning and design commission public hearings where projects are consistent with zoning and the general plan;
- already zoned by right;
- Reduce development impact fees for new affordable dwelling units—$0 rate for regulated affordable units up to 120% of the area median income;
- Eliminate housing impact fees for mobile home parks, owner occupied single-family, affordable units, high-density housing, and ADUs;
- Adopt policy for Enhanced Infrastructure Financing Districts (EIFDs), most recently the Aggie Square EIFD included a 20% set-aside for affordable housing paired with a Community Benefit Agreement;
- Adopted transit-oriented development land use zoning overlay.

Alexander et al. (2021) describe the challenges in implementing these policies at the local level through qualitative interviews with transportation practitioners. Practitioners mention three broad challenges: 1) a lack of reliable, standardized VMT measures and evaluation tools for planning; 2) a lack of strong legal case law for VMT in the CEQA; and 3) the challenge of distributing off-site VMT mitigation equitably. Dr. Susan Handy has reviewed 247 Environmental Impact Reviews (EIRs), finding that most (≥64%) estimated VMT, primarily for air quality purposes prior to the implementation of SB 743 (Steinberg, 2013) requiring VMT to be measured for CEQA. None of the EIRs analyzed VMT as an impact by itself. Of those 136 EIRs that estimated VMT, most (86%) used CalEEMOD or URBEMIS, and only 3% used a travel demand model. These challenges highlight the growing pains as local jurisdictions convert to alternate VMT measurement and GHG inventory methodologies.

Additional bills encourage VMT reduction in targeted jurisdictions and regions. For example, both AB 2548 (Friedman, 2019) in Los Angeles County and SB 1128 (Glazer, 2017) in San Francisco outline how MPOs and county transportation commissions are encouraged to work with local employers to adopt policies that encourage commuting by means other than driving

alone. One such strategy in both bills is to adopt a commuter benefit ordinance that offers all covered employees a pretax option program to exclude commuting costs (such as public transportation passes) from their taxable income. SB 1128 in San Francisco goes even further by offering an employer-paid benefit program, whereby the covered employer offers employees a subsidy to offset the monthly cost of commuting via public transit, vanpool, or, in some cases, bicycle. This bill also encourages employer-provided transit, which is transportation furnished by the covered employer at no cost, to the covered employee in a vanpool or bus. Similarly, in Sacramento County, one of the local initiatives is the Air Quality Improvement Strategy (Ch. 1541, Sec. 3, 1988). This bill describes air pollution in the Sacramento metropolitan region caused by the operation of more than 1,000,000 vehicles. To successfully develop and implement a comprehensive air quality plan for the region, the air quality management district in Sacramento County is given additional authority to reduce motor vehicle emissions, implement reduction measures, and expand the use of cleaner-burning fuels. Yet, this code does not describe the air quality management district's strategies to achieve these goals.

Conclusion

This literature review explored policy areas most crucial for reducing GHG emissions through VMT reduction and which policies from the California legislature are currently in place to support them. The literature revealed that VMT could only be substantially reduced through a policy mix of high-density land use, employment density, increased active transportation, transit, and micromobility and ridesharing options, pricing incentives, and equity considerations. These policy areas are strengthened through their combined implementation. However, policies that are currently in place tend to favor specific strategies over others and broadly lack metrics for evaluating local policy adoption or success. This review also found that few bills support local agencies and organizations in transitioning to reduced VMT, nor do they penalize them if they fail to reduce it. The synergy between state and regional VMT policies is crucial for meeting statewide GHG and VMT reduction targets.

Table 1. Key Terms

Behavioral mode choice	The process where the means of traveling is determined, whether that be by private automobile, public transportation, walking, bicycling, or other means
CARB	California Air Resources Board

CEQA	The California Environmental Quality Act of 1970, the state-level environmental protection statute
DOT	Department of Transportation
Employment density	The number of jobs in an area divided by the resident population aged 16-64 in that area.
GHG	Greenhouse Gas
Land Use Mix	Accommodating more than one type of function within a building, a set of buildings, or a specific area. These functions include residential, office, retail, personal services, parks, and open space.
LOS	Level of service; a measure of delay used to relate the quality of motor vehicle traffic service
Micromobility	Lightweight devices that operate at low speeds, like bicycles, scooters, skateboards. Either human powered or electric
Mitigation Bank	A way to offset impact of a development project by compensating/ reducing its impact on an area. Mitigation efforts are converted to credits, which can be exchanged as currency.
Mixed-use development	Characterized as pedestrian-friendly development that blends two or more residential, commercial, cultural, institutional, and/or industrial uses.
MMT CO2e	Million metric tons of carbon dioxide equivalents

MPO	Metropolitan Planning Organization
Off-site banking	The exchange program allows developers to fulfill their mitigation obligations without incorporating changes in the immediate project site.
Residential density	The number of dwelling units per gross acre of residential land area, including streets, easements, and open space portions of a development
Ridesourcing	On-demand services that do not require users to own the vehicle
Ridesharing	Form of shared vehicles, bikes, and scooters, enabling users to gain short-term access to transportation modes on an "as-needed" basis.
Road use fees	Motorists pay for roadway network use, including tolls, vehicle registration, and parking prices.
Shared Mobility	Mode of transportation where people use vehicles owned by a third party on an as needed basis. This includes carpooling, bike-sharing, and shuttle services.
TNC	Transportation Network Company
TOU	Time of Use rate for electric charging
VES	Vehicle Efficiency Standards: how much CO2 per mile can be emitted by a vehicle, and the fuel efficiency of vehicles miles per gallon.
VMT	Vehicle-Miles Traveled: a measure of how many miles a person has driven

VMT based fees	Charging users a fee based on when and where the vehicle was driven, the impacts of that vehicle on the environment, and the damage being done to the infrastructure
ZEV	Zero Emissions Vehicle

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[3] For information on federal and state incentives, please see the Alternative Fuel Data Center website for information on federal and state incentives and programs: https://afdc.energy.gov/laws
[4] For more information and updates, please see: https://ww2.arb.ca.gov/resources/fact-sheets/local-government-zero-emission-vehicle-readiness
[5] For more about the Clean Miles Standard, please see: https://ww2.arb.ca.gov/our-work/programs/clean-miles-standard
[6] https://ww2.arb.ca.gov/sites/default/files/movingca/projectheavyduty.html
[7] A good example of financing solutions is BlocPower: BlocPower — Smarter, Greener and Healthier Buildings
[8] The CPUC has approved special residential rates for heat pumps (and EV chargers) for at least one utility (PG&E): Electric Home (pge.com)
[9] Such as CEC's Equitable Building Decarbonization which provides direct install incentives for low- and moderate-income households: https://www.energy.ca.gov/programs-and-topics/programs/equitable-building-decarbonization-program
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Appendix 2. Community Partner Materials

Partner solicitation/application

With generous support from the California Air Resources Board (CARB), the University of California at Davis (UC Davis) and California Polytechnic State University at San Luis Obispo (Cal Poly SLO) are collaborating on the development and application of tools and training to support local and regional governments in California to reach their sustainability and climate planning goals and align them with the State's climate commitments. We invite you to learn more about these efforts and the opportunity to serve as a project partner organization or in an advisory role. Interested parties may join us for one of two webinars. Details on this opportunity and the webinars are provided below.

Background
Led by Dr. Catherine Brinkley, Faculty Director of the UC Davis Center for Regional Change, this research project seeks to inform communities and state agencies about effective strategies for addressing climate action planning challenges and barriers to implementation at the local level. This effort seeks to engage local governments and their representatives in the implementation of tools to support climate planning, including the first databases of California General Plans and Climate Action Plans. You can learn more about the General Plan Database currently in beta mode here. This project is also supported by Dr. Michael Boswell, Department Head of the Cal Poly SLO Department of City and Regional Planning, who developed the first database of Climate Action Plans.

Objectives
This effort has three major objectives:
(1) identify barriers that local governments face in implementing climate action policies and ways in which these barriers can be overcome in alignment with the State's climate commitments;
(2) identify ways for CARB to support local governments and community-based organizations in tackling climate actions at the local level; and

(3) conduct capacity-building sessions for local government and regional government representatives, community-based organizations, climate action advocates, and other stakeholders around implementing priority climate policies, focused on education about state climate goals, resources, and priority policies using existing partnerships and networks.

Partnership Opportunity
UC Davis will contract with approximately five non-profit and community-based organizations for a series of more than a dozen capacity-building workshops for local and regional government agencies targeted for Fall 2023. Potential partner organizations will have a demonstrated track record of community engagement, education, and/or advocacy in one or more of the following cluster areas. Partner organizations will be vetted through a process to ensure an inclusive approach to represent California's geographic and demographic diversity. Contracts are anticipated to be approximately $10,000 each for the period of May 2023-April 2024.

Focus Areas
Each contracting partner will support approximately two to three workshops in at least one of the cluster areas listed below. Contractors may propose to conduct workshops in more than one of these clusters but should demonstrate familiarity and experience with these areas. The seven cluster areas by county are:

- Southern Coastal: Santa Barbara, Ventura, Los Angeles, Orange, and San Diego
- Southern Inland: Fresno, Inyo, Kern, Kings, Tulare, Riverside, Imperial
- Northern Inland: Butte, Colusa, El Dorado, Glenn, Lassen, Modoc, Nevada, Placer, Plumas, Shasta, Sierra, Siskiyou, Sutter, Tehama, Yuba, Lake, Trinity
- Northern Coastal: Del Norte, Humboldt, Mendocino, Napa, Sonoma
- Bay Area: Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara, Solano
- Central Valley: Alpine, Amador, Calaveras, Madera, Mariposa, Merced, Mono, San Joaquin, Stanislaus, Tuolumne, Sacramento, Yolo
- Central Coast: Monterey, San Benito, San Luis Obispo, Santa Barbara, Santa Cruz, Ventura

Application Process
It is our intention for the application process to not put undue demands on partner organizations. We recommend that interested parties submit as many of the following documents as they deem necessary to demonstrate how they meet the scoring criteria described below. Applicants should not be discouraged from applying if they have limited or no experience in one or more of the qualification areas.

- Contact information for applicant representative
- Resumes or CVs for team members
- Narrative describing how the organization meets the following scoring criteria, not to exceed three pages.
    - Demonstrated track record of community engagement, education, and/or advocacy in one or more of the cluster areas
    - History of commitment to climate action and/or environmental justice
    - Experience conducting workshops and/or delivering training
    - Experience working with local government officials

○ Qualifications of team members on topics of sustainability and climate planning, (such as resilience and adaptation)
○ Familiarity with land use planning, including General Plans and the State's climate change policy framework, including the AB 32 Scoping Plan, SB 375, and other relevant legislation, regulations, and executive orders

Application materials should be submitted via THIS SUBMISSION LINK by the application period close date. We recommend submitting materials in Word or PDF format.

Interested parties are encouraged to attend an informational webinar or view recordings. Questions can be directed to crcinfo@ucdavis.edu. Questions submitted less than three business days before the application close date may not receive an answer before the application deadline.

Table 1. Metrics for Partner Selection

Qualifications	Score
Demonstrated track record of community engagement, education, and/or advocacy in one or more of the cluster areas	25 points
History of commitment to climate action and/or environmental justice	25 points
Experience conducting workshops and/or delivering training	20 points
Experience working with local government officials	10 points
Qualifications of team members on topics of sustainability and climate planning, (such as resilience and adaptation)	10 points
Familiarity with land use planning, including General Plans and the State's climate change policy framework, including the AB 32 Scoping Plan, SB 375, and other relevant legislation, regulations, and executive orders	10 points
TOTAL	100 points

Webinars

Webinars will be held virtually via Zoom. The presentation portion of one of the webinars will be recorded and posted on the CRC website. A question-and-answer portion will follow the presentation. Please register for a webinar here: Informational Webinar Registration.

Table 2. CBO recruitment deadlines

Application and Project Timeline	Date
Application released	9/19/2022
Webinars	9/ 26 /2022 to 10/ 6/2022
Application period opens	10/03/2022
Application period closes	10/28/2022
Application scoring completed	November 2022
Top candidates notified	12/1/ 2022
Contracting process	January 2023-March 2023
Contract start	May 2023
Contract completed	April 2024

Decarbonization in the built environment;
https://regionalchange.ucdavis.edu/sites/g/files/dgvnsk986/files/inline-files/Decarbonization_DRAFT_for%20CBOs%20%281%29.docx

Building Planning Capacity for Building Decarbonization

Building Decarbonization is an umbrella term for reducing greenhouse gas (GHG) emissions in the building sector through the following actions:

- Increasing energy efficiency and insulation
- Increasing reliance on renewable electricity (utility and distributed generation)
- Electrification of end uses (for example, water heating or air conditioning)
- Implementing distributed energy resources like rooftop solar and batteries
- Switching to climate-friendly refrigerants and improving refrigerant management

State Supports

The State of California aims to achieve an 80% reduction in CO_2 emissions relative to 2005 levels by 2050 and has created the following supports and funding for local governments:

- Senate Bill 100 (De León, 2018) requires that renewable and zero-carbon energy resources supply 100% of the electricity for retail sales to customers by 2045.
- Over 70 jurisdictions have adopted all electric requirements for new construction. Find model building codes in the California's Green Building Standards (CALGreen) Code and at the Statewide Reach Codes Program
- Zero-Emission Appliance Standards – includes support for zero-emission GHG standards for new space and water heaters sold in California as part of the 2022 State Strategy for the State Implementation Plan. It would require new sales of space and water heaters for residential and commercial buildings to be zero-emission starting in 2030.

Regional Challenges

Feasibility: In California, the energy use from buildings is responsible for about one-quarter of statewide greenhouse gas emissions, making it the second largest contributor to emissions after transportation. At the same time, the energy and the built environment sectors are also most responsive to reduction measures for reducing GHG (Brinkley, 2014). Using existing technologies for private, community, and rooftop solar and wind generation, models show that renewable energy can feasibly and cost-effectively provide approximately 72% of electricity generation by 2050 (Langevin et. al, 2019). Local jurisdictions can help by enabling, fast-tracking permitting, and siting more renewable and net-zero energy infrastructure.

Equity: Low-income communities and communities of color are disproportionately exposed to local pollution while living in lower quality housing and bearing a higher proportion of energy costs as a percentage of total household budget. These communities are also highly vulnerable to extreme weather from climate change, and they lack access to cooling and resilient infrastructure (Tan and Jung, 2021). Renters usually pay the utility bills but face the split-incentive of not being able to make energy efficiency upgrades to insulation, boilers, or renewable energy. Low-cost energy improvements could save low-income households about $1,500 annually ((Kontokosta et al, 2020). Property owners, on the other hand, are not directly incentivized to pay for upgrades that would only benefit their tenants.

In considering equity, Building Energy Codes (BECs) have the potential to reduce energy costs by $125 billion by 2040 and provide households with a 6.47% reduction in monthly energy expenditure. Weatherization and renovation of existing buildings can generate substantial cost savings while improving health, safety, and overall living conditions (Zhu et. al, 2022). When such programs are directed at rental buildings, they have the potential to benefit the most vulnerable community members, particularly with added rent protection programming.

Example Policies

Strong planning at the local level includes setting feasible goals with measurable benchmarks, identifying potential funding sources, dedicating staff, and creating an implementation timeline that can ensure policies move forward even as administrations cycle. Local jurisdictions can include policies in General Plans, climate action plans, and municipal codes. Few General Plans have focused on holistic decarbonization efforts, leaving room for local jurisdictions to celebrate new advances at the leading edge. For example, while decarbonization is a term commonly used by state agencies, local plans favor terms such as “climate neutral” or focus on technologies such as “microgrid” and “heat pump” adoption. Further, few include equity approaches that address decarbonization. We provide sample policies below for further consideration:

Example policies:

Lake Forest, 2020: “Goal PF-6 Energy Management: A community with adequate power, provided through economically and environmentally sustainable means. Policy PF-6.6 Public-

Private Partnerships. Investigate the opportunity to engage in public-private partnerships on energy efficiency, energy storage, and microgrid development to achieve cost savings, reduce energy use, and improve energy reliability." Timeline: none. Funding: none. Personnel: none.

Rancho Cucamonga, 202:"Goal 3: Green Building. Development practices that demonstrate high environmental performance through decarbonization, sustainable design, and zero net carbon buildings.

Strategy 3.1: Zero Net Electricity for New Residential Buildings

Measure(s):

· Adopt an ordinance or update development code requiring that new single- and multi-family residential development to meet a standard of zero net energy (i.e., on-site generation of energy is equal to on-site energy consumption).

· Encourage future residential development projects to be designed as Net Positive Energy Homes and take advantage of the State's Net Energy Metering 2.0 policy, allowing customers to receive credits on their electricity bills for excess electricity generated by photovoltaic systems."

Timeline: 4646 MTCO2E reduction by 2030; 3380 MTCO2e reduction by 2040; Funding: none. Personnel: none.

We invite you to search for additional policies and approaches as your community considers actionable steps!

References:

Langevin, J., Harris, C. B., & Reyna, J. L. (2019). Assessing the potential to reduce US building CO2 emissions 80% by 2050. *Joule*, *3*(10), 2403-2424.

Brinkley, C. (2014). Decoupled: successful planning policies in countries that have reduced per capita greenhouse gas emissions with continued economic growth. *Environment and Planning C: Government and Policy*, *32*(6), 1083-1099.

Kontokosta, C. E., Reina, V. J., & Bonczak, B. (2020). Energy cost burdens for low-income and minority households: Evidence from energy benchmarking and audit data in five US cities. *Journal of the American Planning Association*, *86*(1), 89-105.

Zhu, Q., Leibowicz, B. D., Busby, J. W., Shidore, S., Adelman, D. E., & Olmstead, S. M. (2022). Enhancing policy realism in energy system optimization models: Politically feasible decarbonization pathways for the United States. *Energy Policy*, *161*, 112754.

Zero emission vehicle adoption;

https://regionalchange.ucdavis.edu/sites/g/files/dgvnsk986/files/inline-files/ZEV_DRAFT_for%20CBOs_1.docx

Building Planning Capacity for Zero Emission Vehicle Uptake

Goal: The Governor's Executive Order N-79-201 (2021) aims to achieve 100% light-duty zero-emission vehicle (ZEV) sales by 2035, 100% ZEV medium- and heavy-duty vehicles in California by 2045, and 100% zero-emission off-road vehicles and equipment operations by 2035. To meet these goals, local jurisdictions can support through:

- Adopting voluntary tiers for CALGreen EV-ready charging infrastructure codes.
- Engaging the community in siting charging infrastructure equitably.
- Ensuring streamlined permitting for EV charging.
- Converting public city fleets to ZEVs

State Support: The State offers ZEV guidance and funding programs for local jurisdictions to advance multi-modal ZEV and ZEV infrastructure to achieve its ZEV goals. Key guidance and support are highlighted below:

Guidance

- The Department of Business and Economic Development (GO-Biz) ZEV Resources and Readiness includes GO-Biz Electric Vehicle Charging Station Readiness with a permitting guidebook, best practices, and resources.
- GO-Biz Resources for Transitioning to a Zero-Emission Fleet
- Local Government Multi-Modal ZEV Readiness and Actions defines a "ZEV-ready" community and provides a list of actions that can be tailored to each community's needs. Includes links to examples of ZEV community readiness plans and blueprints.

Funding Support

- GO-Biz ZEV Funding Resources (includes Clean Cars 4 All, hybrid and electric truck and bus (HVIP), Off-Road Equipment (CORE), infrastructure incentives, utility transportation electrification incentives, financing programs, California budget and funding plans, and federal funding.
- California Air Resources Board (CARB) Low Carbon Clean Transportation Funding Programs
    - Clean Mobility Options (CMO) and CMO funding for zero-emission mobility projects and needs assessments.
    - Planning and Capacity Building, Clean Mobility in Schools (CMiS) and the Sustainable Transportation and Equity Project (STEP)
- California Energy Commission (CEC) Clean Transportation Program funding
    - CALeVIP for regional charging infrastructure

Challenges and Opportunities: ZEV Costs and Equity

ZEVs have been significantly more expensive than gasoline vehicles for many years, however, that gap is closing. ZEV price analysis shows that ZEV costs will drop below the price of gasoline vehicles by 2027, with the lowest range ZEVs reaching price equality with gasoline cars by 2024. To reduce barriers to ZEV ownership and use, local governments can provide outreach and education about state rebates and incentives as well as supporting ZEV car-share programs.

The State has programs that help a community assess its transportation needs and access funding for planning and capacity building, transportation pilots and needs assessments as well.

Over 30% of Californians live in multi-family homes without access to a dedicated charger. This is a significant barrier for many. The State is addressing this issue by providing incentives and grants for multi-family dwelling owners, options for nearby charging hubs, and the CALGreen code has increased requirements for EV chargers in new multi-unit buildings. Some communities lack sufficient charging infrastructure but the State's CALeVIP program provides significant rebates for charging infrastructure in every region of the state. Regions and communities need to be aware of opportunities such as this to increase the density of chargers in their areas.

Example Policies:

Strong planning at the local level includes setting feasible goals with measurable benchmarks, identifying potential funding sources, dedicating staff, and creating an implementation timeline that can ensure policies move forward even as administrations cycle. Local jurisdictions can include policies in General Plans, climate action plans, and municipal codes. Please see examples below:

Port Hueneme City, 2021: "4.1 Policy CAP 2-1: Increase electric/alternative fuel vehicle and equipment adoption to 10% by 2030, and 15% by 2045. Action Number CAP 2-1.1: Adopt EV Charging Reach Code for Commercial and Multifamily Buildings that require all new commercial and multifamily buildings to exceed minimum CALGreen standards for "EV Ready" charging spaces and infrastructure."

> Timeline: Anticipated Reduction (MT CO2e) - 2030: 3,555; 2045: 4,635. Funding: none. Personnel: none

City of Burbank Climate Action Plan, 2022: "T.3.1 Increase zero-emission vehicle adoption to 23% of all passenger vehicles by 2030 and 100% by 2045."

> "T-3.1a Adopt an EV Charging Retrofits in Existing Commercial and Multifamily Buildings Reach Code requiring major retrofits, with either a building permit with square footage larger than 10,000 square feet or including modification of electric service panels, to meet CalGreen requirements for "EV Ready" charging spaces and infrastructure."
>
> Timeline: phase I of plan implementation (1-3 years)
>
> Funding: none
>
> Personnel: anticipate needing staff and consultant time

Reducing Vehicle Miles Traveled;
https://regionalchange.ucdavis.edu/sites/g/files/dgvnsk986/files/inline-files/VMT_DRAFT_for%20CBOs_1.docx

Building Planning Capacity for Reducing Vehicle Miles Traveled (VMT)

VMT measures the distance that vehicles travel. Encouraging walkable communities with more transportation options reduces VMT. Reducing VMT also helps to avoid expensive road expansions, traffic, air pollution, and loss of natural and working lands.

Goals:

To meet California's carbon neutrality goal by 2045, the California Air Resources Board (CARB) 2022 Scoping Plan targets reducing VMT per capita from 24.6 miles per day in 2019 to 18.4 miles by 2030 (a 25 percent reduction) and to 17.2 miles per day by 2045 (a 30 percent reduction). This translates to every California reducing how often or how far they are driving by about 7 miles per day in 2045. The goal of reducing VMT is to reduce greenhouse gas emissions, air pollution, traffic associated with vehicle traveled, and encourage walkable communities with less traffic and more transportation options to destinations. To help support this goal there is a need to:

- **Shift planning and investments** to create a sustainable transportation system that will reduce the need to drive and provide high-quality alternatives that are more convenient, efficient, and low-cost than driving.
- **Improve alignment of land use planning and development** with climate and equity goals to accelerate infill development, affirmatively further fair housing, and increase natural and working lands protection, in furtherance of the State's planning priorities.

State VMT Legislation:

Senate Bill 743 changed the way transportation impacts are measured under the California Environmental Quality Act (CEQA). Replacing the previous Level of Service (LOS) method, which measured vehicle delay in traffic jams- for example, with VMT, which measures the distance vehicles travel. Under CEQA, jurisdictions will use new metrics, thresholds, and develop mitigation measures around VMT that may include:

> **Transportation Demand Management (TDM)** that reduces reliance on the single-occupant vehicle (SOV) by supporting infrastructure for biking, walking, transit, ridesharing and carpooling such as bicycle parking, streetscape improvements (e.g., sidewalks, crosswalks, curb-extensions, lighting, etc.), carshare parking and membership, and transit passes.
>
> **Land use management** through changes in project design such as including units in the project be affordable to lower-income residents and including a mix of uses within the project to support the provisions of services closer to where people live.
>
> **Parking management** through reducing or eliminating project parking, unbundling parking from renting or owning a unit, cashing out parking, or pricing parking, which can encourage other forms of transportation and maintain ideal occupancy rates in high value parking spaces. These tools can also educate people about the cost of vehicle trips.

Funding Support:

- The State has a variety of funding programs, such as the Transit and Intercity Rail Capital Program, Low Carbon Transit Operation Program, Active Transportation Program, Clean Mobility Options, Planning and Capacity Building, Clean Mobility in Schools, Sustainable Transportation Equity Project, Affordable Housing and Sustainable Communities Program, Transformative Climate Communities, and Regional Early Action Planning Grants Program 2.0. These address VMT reduction through investments in mobility choices and infrastructure to support public transportation, walking, biking, carsharing, and transit-oriented development.

Challenges and Opportunities:

A potentially limiting factor in California's ability to reduce VMT is **job-housing balance**, resulting in longer distances between where people work and places people live. This, coupled with the lack of affordable housing and declining **employment density** creates challenges for implementing walk/bike and public transit options as both housing and job centers are more spread out. The COVID-19 pandemic has exacerbated these challenges. To address these regional challenges and support VMT reduction the following actions could be considered:

- Zoning reforms to allow flexible transit-oriented, mixed-use, mixed-income development at higher densities.
- Incentivize employers to locate in housing-rich communities served by transit.
- Encourage affordable and market rate housing near employment centers.
- Transform aging malls, office parks, and publicly owned land into neighborhoods with housing, office, commercial development, and multimodal transportation facilities.

Example VMT Policies:

Strong planning at the local level includes goal setting with measurable actions and benchmarks, identified funding, dedicated staff, and an implementation timeline that can ensure policies move forward even as administrations cycle. Local jurisdictions can include such policies in General Plans, climate action plans, and municipal codes. Achieving VMT reduction requires a complex and synergistic policy approach that combines high density land use, employment density, increased active transportation, transit, new mobility, and ridesharing options, pricing incentives, and equity considerations. These policy areas are strengthened through their combined implementation. Below are a few examples of policy approaches that address VMT.

El Dorado County, 2019: "MEASURE LU-Q Promote Infill Development: The program shall be linked to land-use, housing, air quality, transportation and circulation strategies that support development within existing communities, reduce vehicle miles traveled, increase energy efficiency, and encourage the development of affordable housing."

Sacramento City, 2023: LUP-1.1: Compact Urban Footprint. The City shall promote a land- and resource-efficient development pattern and the placement of infrastructure to support efficient delivery of public services and conserve open space, reduce vehicle miles traveled, and improve air quality.

Sacramento County, 2017: "Objective: Coordinate private development with the provision of adequate public facilities and services. LU-68. Give the highest priority for public funding to projects that facilitate and encourage infill, reuse, redevelopment and rehabilitation, mixed-use development, particularly in Environmental Justice Communities, and that will result in per-person vehicle miles traveled lower than the County average, and the lowest priority for projects that do not comply with public facilities Master Plan phasing sequences (Sacramento County General Plan, 2017)."

City of San Jose, 2023: Goal LU-5 – Neighborhood Serving Commercial. Locate viable neighborhood-serving commercial uses throughout the City in order to stimulate economic development, create complete neighborhoods, and minimize vehicle miles traveled.

City of Los Angeles, 2016: 5.2 Vehicle Miles Traveled (VMT): Support ways to reduce vehicle miles traveled (VMT) per capita. Reducing VMT requires a combination of sustainable approaches working together:

- Land use policies aimed at shortening the distance between housing, jobs, and services that reduce the need to travel long distances on a daily basis.
- Increasing the availability of affordable housing options with proximity to transit stations and major bus stops.
- Offering more attractive non-vehicle alternatives, including transit, walking, and bicycling
- Transportation Demand Management (TDM) programs that encourage ride-sharing
- Pricing mechanisms that encourage commuters to consider alternatives to driving alone, including:

    § Congestion or cordon pricing, which would charge vehicles entering into a congested area (such as downtown during rush hour)

City of Arroyo Grande, 2013: "TL-7.2: Develop a form-based zoning code for the central business district/downtown. Form-based codes emphasize building form rather than use. This increases flexibility for a variety of complementary uses to be permitted in the same area, and the potential for mixed-use development, which helps to reduce vehicle miles traveled."

Appendix 3. Links to videos and presentations

Slide deck to learn and share more about climate planning in your community:

https://regionalchange.ucdavis.edu/sites/g/files/dgvnsk986/files/inline-files/Capacity%20Building%20Presentation%20Draft%20for%20CBOs.pptx

Best Practices and Capacity Buidling for Local Governments Implementing Climate Action Plans:

https://www.youtube.com/watch?v=myrSrX0cyqQ

Climate Readiness Capacity Building Workshop Summary Form:

https://ucdavis.co1.qualtrics.com/jfe/form/SV_eQf54tsXN7KlgJo

Appendix 4. White paper on Best Practices for Local Actions

Advancing Climate Readiness Planning in California: Strategies for Local Governments

Abstract:

Climate change poses significant challenges to California, threatening its ecosystems, communities, and economy. Local governments play a pivotal role in climate readiness planning, as they are on the frontline of addressing climate impacts and implementing resilience strategies. This white paper recommends actionable steps that local governments can take to enhance their climate readiness planning efforts. Recommendations draw from three sources: 1.) feedback gathered from over 155 organizations that attended community partner-led workshops, 2.) a literature review of recent research and state-level programs, and 3.) plan evaluation of California's 482 city and 58 county General Plans as well as 251 Climate Action Plans (CAPs).

Introduction:

California faces increasingly severe wildfires, droughts, heatwaves, and sea-level rise. Recognizing the urgency of addressing these challenges, local governments across the state are ramping up their efforts to develop and implement local policies that go beyond state-level mandates. Navigating the complexities of climate readiness requires comprehensive strategies that encompass multiple sectors and stakeholders. This white paper presents a roadmap for local governments in California to bolster their climate readiness planning and build resilient communities. We focus on equity throughout-out as a key consideration. Improving the health and wellness of the most vulnerable community members reduces the risks faced by the entire jurisdiction.

Key Strategies for Climate Readiness Planning:

1. Conduct Assessments:

Local governments should conduct comprehensive asset maps and vulnerability assessments to identify areas and populations most susceptible to climate impacts. These assessments should analyze various factors such as exposure to extreme weather events, socioeconomic vulnerabilities, and critical infrastructure at risk. By understanding these vulnerabilities, municipalities can prioritize resources and interventions where they are most needed.

A climate asset inventory is a visual representation or interactive tool that identifies and catalogs various resources within a community or region related to climate resilience, mitigation, and adaptation. The resulting database serves as a comprehensive inventory of natural, built, social, and economic resources that can help communities prepare for and respond to climate change impacts. A climate asset inventory might include:

Natural Assets:

- Ecosystems: Identify key ecosystems such as forests, wetlands, and coastal areas that provide valuable ecosystem services like flood control, carbon sequestration, and biodiversity preservation.
- Water Resources: Map rivers, lakes, aquifers, and watersheds critical for drinking water supply, irrigation, and habitat preservation.
- Land Cover: Highlight areas of vegetation, open space, and natural habitats that contribute to climate regulation, heat mitigation, and stormwater management.

Built Assets:

- Infrastructure: Identify critical infrastructure such as transportation networks, energy facilities, and communication systems vulnerable to climate hazards like sea-level rise, extreme heat, and wildfires.
- Green Infrastructure: Locate green infrastructure projects like parks, green roofs, permeable pavements, and urban forests that enhance resilience to climate impacts and improve urban livability.
- Buildings: Assess the vulnerability of buildings and structures to climate risks and identify opportunities for energy efficiency upgrades, retrofitting, and resilient design. This section can include respite centers and cooling centers.

Social Assets:

- Community Organizations: Map community-based organizations, nonprofits, and advocacy groups engaged in climate resilience, social justice, and community empowerment.
- Social Networks: Identify social networks, cultural institutions, and informal networks that foster community cohesion, knowledge sharing, and collective action on climate issues.
- Public Services: Catalog public services and amenities such as healthcare facilities, schools, emergency shelters, and community centers critical for disaster preparedness and response.

Economic Assets:

- Businesses and Industries: Inventory businesses and industries contributing to local economic vitality and assess their vulnerability to climate risks, supply chain disruptions, and regulatory changes.
- Employment Opportunities: Identify job sectors, workforce skills, and training programs relevant to climate resilience, renewable energy, green technology, and sustainable agriculture.
- Tourism and Recreation: Highlight tourism destinations, cultural heritage sites, and recreational assets vulnerable to climate impacts and opportunities for sustainable tourism development.

Policy and Planning Assets:

- Regulatory Frameworks: Document existing policies, regulations, and planning documents related to climate change adaptation, land use, zoning, and environmental protection.
- Planning Initiatives: Highlight ongoing climate resilience planning efforts, hazard mitigation plans, and adaptation strategies at the local, regional, and state levels.
- Stakeholder Engagement: Identify key stakeholders, decision-makers, and partnerships involved in climate resilience planning and community engagement processes.

A climate asset inventory provides valuable insights into a community's strengths, vulnerabilities, and opportunities for enhancing resilience to climate change. By visualizing and synthesizing diverse assets, stakeholders can prioritize investments, allocate resources, and develop targeted strategies to build more sustainable and resilient communities.

2. Develop Feasible Plans:

Based on the findings of asset maps and vulnerability assessments, local governments should develop robust sets of policies that outline specific strategies and actions to mitigate risks. Key components of climate ready policies include upgrading infrastructure, enhancing emergency preparedness response systems, promoting carbon capture through conservation of green spaces, and integrating climate considerations into land use planning.

Policies can be implemented on a short time frame with municipal code updates. For example, “reach codes” reach beyond state requirements and can include: building codes for materials, energy codes that regulate appliances, and electric-vehicle charging ordinances. Gather ideas for municipal code updates by reviewing recently adopted ordinances through the Statewide Reach Codes Program.

Jurisdictions use General Plans and Climate Action Plans (CAPs) to create the overarching vision and goal of how municipal codes will work in tandem with other policies and financing. Such plans can require several years of community dialogue. While every jurisdiction is required to adopt and update a General Plan, CAPs are voluntary. Both plan types can reference one another, and both can and do address climate readiness. However, our plan evaluation shows that CAPs include greater attention to climate readiness and stronger policies when compared to General Plans. We also show that CAPs are associated with implementing electric charging stations. We caution that many communities may not have the funding nor consensus base necessary to embark on adopting a CAP. Community partners working across the state recommend that jurisdictions use an approach that best fits their constituents and planning budget. We note that General Plans are commonly utilized for climate readiness planning in rural areas and often include policies that adapt and mitigate without labeling such policies as “climate” actions. Comparatively, CAPs are high-visibility documents that signal policy willingness to neighboring jurisdictions. This can be an advantage. For example, CAPs that promote electrical vehicle charging stations can embolden neighboring jurisdictions to site more

charging stations. Similarly, safety and hazard mitigation plans are typically revised for Federal Emergency Management Agency (FEMA) compliance, also making them optimal avenues for engagement.

To understand local support for policies, jurisdictions should **gather public input** from diverse stakeholders, including community members, businesses, and environmental experts. Effective climate readiness planning requires meaningful engagement with local communities, particularly those disproportionately affected by climate change. Engaging community-based organizations, conducting outreach in multiple languages, and providing education on climate risks are essential steps toward fostering resilient and socially just communities. Such engagement will ensure a plan that is more responsive–especially during emergencies and for those on the frontlines of climate change. One approach to achieve robust community engagement is to advertise public feedback events in partnership with local community-based organizations.

The planning process should **draw from the latest scientific understandings** of what is feasible and economical. The public and local jurisdictions can **look to neighboring jurisdictions** for policies in progress by utilizing the California PlanSearch tool for General Plans and the California Climate Action Plan Database. We also recommend that communities consider a **One Health** approach that considers the human, animal, and environmental health impacts of any proposed policy. This **Health in All Policies** approach will help foster community dialogues about building equity locally.

With such input from the public, research, and practice, local communities should be emboldened to draft actionable policy language that will ensure timely implementation. This includes:

1. Use of strong policy language such as "the jurisdiction *will* do the following actions" as opposed to "the jurisdiction *may* do the following actions"
2. Policies should include a timeline for implementation to benchmark planning progress
3. A responsible office or staff position should be designated for carrying out the policy
4. To ensure feasibility, policies should identify potential funding sources

3. Enhance Implementation Collaboration and Coordination:

Climate change transcends municipal boundaries, requiring collaborative efforts among neighboring jurisdictions, regional agencies, and other stakeholders. Local governments should foster partnerships with neighboring municipalities, county governments, state agencies, nonprofits, and academic institutions to leverage resources, share best practices, and coordinate climate adaptation initiatives. Regional collaboration can facilitate the development of integrated strategies that address shared climate challenges more effectively. For example, some non-profits, like the Sierra Business Council, offer free greenhouse gas mitigation inventory preparation. Local jurisdictions can grow collaboration efforts with community and non-profit partners through seeking joint funding opportunities, through grants and fundraising.

Conclusion:

As climate change continues to pose significant risks to California's communities and ecosystems, local governments must proactively adapt to these challenges through robust climate readiness planning. By implementing the strategies outlined in this white paper, municipalities can strengthen their resilience to climate impacts, protect vulnerable populations, and foster sustainable development. Building climate-ready communities requires concerted efforts, collaboration, and innovation at the local level, laying the foundation for a more resilient and sustainable future in California.

Appendix 5. White paper on CARB Actions

Enhancing Local Climate Readiness Planning in California: Recommendations for the California Air Resources Board

Abstract:

The California Air Resources Board (CARB) plays a pivotal role in addressing climate change and air quality issues statewide. As climate impacts intensify, there is a growing need for coordinated efforts to bolster local climate readiness planning across California. This white paper outlines actionable recommendations for CARB to enhance its support for local governments in their climate readiness planning endeavors. By leveraging its expertise, resources, and regulatory authority, CARB can empower municipalities to build more resilient communities and mitigate the adverse effects of climate change.

Introduction:

California is at the forefront of confronting the challenges posed by climate change, experiencing increasingly severe wildfires, heatwaves, droughts, and rising sea levels. Local governments bear the frontline responsibility for preparing their communities to withstand and adapt to these impacts. Recognizing the critical role of local climate readiness planning, CARB can serve as a catalyst for enhancing preparedness efforts statewide. This white paper presents actionable recommendations for CARB to support and strengthen local climate readiness planning initiatives across California.

Recommendations for CARB:

1. Deliver Technical Assistance:

CARB should offer regionally relevant technical assistance and guidance to local governments for conducting vulnerability assessments, developing adaptation plans, and integrating equity considerations into climate planning. Community partners recommend that CARB establish a state agency liaison to facilitate direct communication and engagement with counties and cities. Partners underscore that it is essential for state representatives to meet local entities in their communities, reducing the need for local jurisdictions to travel to the state capitol.

CARB should also develop and **equity checklist** to assist jurisdictions in considering a Health in All Policies approach to plan-making. Our review of General Plans and Climate Action plans shows a broad omission of policy benchmarks and equity considerations in current plans. For example, only six of the 126 cities that address “electric vehicles in their General Plans include equity considerations, such as electric vehicle charging for affordable housing (City of Arcata, 2008 General Plan) or converting public fleets to all-electric (City of East Palo Alto, 2016 General Plan). Updates to the CARB Scoping Plan should consider including a list of adopted and recommended equitable actions related to each priority area for local jurisdictions to consider.

2. Tailor Recommendations to the Locale:

To better inform technical assistance, CARB should **review city and county-level plans** and implementation progress to provide more feasible, real-time guidance. For example, CARB technical assistance can take the form of evaluating how other cities within the same county are addressing priorities and mandates. CARB could proactively promote promising local planning approaches by monitoring plan adoption and celebrating newly adopted plans or unique approaches. Partners also recommend that CARB offer a **jurisdiction specific GHG inventory template** that is pre-filled and can be edited based on local context adjustements. CARB should work with local community-based organizations and jurisdictions to assemble preliminary data for this analysis. Local jurisdictions can further modify and update this inventory based on local conditions. This inventory can be used by local jurisdictions to estimate the reductions planned over a specific time horizon. The template can also help CARB better tailor recommendations based on regional actions that have produced results.

3. Develop and Maintain Knowledge-sharing Platforms:

By leveraging its expertise in climate science, air quality management, and regulatory compliance, CARB can provide valuable resources, tools, and best practices to support municipalities in their climate readiness planning efforts. These tools currently include the **California PlanSearch** tool for General Plans and the **California Climate Action Plan Database.** CARB should continue to maintain and update these public-facing platforms to inform inter-agency technical assistance efforts as well as public engagement in plan-making. To more easily update and maintain these platforms, the State of California should provide **guidelines for plan formatting**, including requirements for plans to be accessible as machine readable PDFs with a standard template cover page that details plan metadata: date of adoption, jurisdiction name, plan author, date of CEQA certification, and a digital object identifier (DOI). Community partners also recommend a **greenhouse gas inventory portal**, helping advocates and state agencies evaluate progress.

4. Funding and Incentives:

CARB should **reduce the competitive grant application burden** to support local climate readiness planning initiatives. This may include pre-qualifying local jurisdictions based on an evaluation of their planned actions in municipal code, General Plans, or Climate Action Plans. Such pre-qualification would encourage local jurisdictions to address priorities in plans and code while reducing the qualification burden on the local jurisdiction. CARB and other state agencies should also continue to provide funding and support for jurisdictions to update plans so that they can qualify for such funding. By leveraging state and federal funding sources, CARB can maximize resources and encourage innovative climate solutions at the local level.

5. Capacity Build in Partnership:

CARB should invest in capacity building and training programs in partnership with community-based organizations. CARB piloted this approach in this contract, enabling a feedback loop between state, regional, local, and nonprofit partners. Further fostering such collaboration will

enhance the technical expertise of CARB as well as the knowledge base of local government staff responsible for climate readiness planning. Continuing partnerships may involve co-sponsoring workshops, webinars, and educational resources on climate science, adaptation strategies, and regulatory compliance. By building the capacity of local officials and practitioners, CARB can strengthen the effectiveness and sustainability of climate readiness planning efforts statewide. This approach allows local governments and organizations to hold expertise, maintaining efforts over time. In addition, working in partnership with local organizations bolsters trust in CARB, while helping CARB to update approaches based on new, locally-pertinent information. Such partnerships should compensate local experts for their time and engagement, while allowing time for the relationships to inform one another. For example, through this contract, the first months of engagement with community-based organizations included dialogues to simplify language and minimize technical jargon.

This effort of translating CARB priorities to the local context helped the team collectively enhance the applicability and accessibility of outreach materials tailored to each regional context, ensuring that barriers were not created from the outset. To start, these efforts surfaced areas of terminology confusion. Where CARB is focused on "building decarbonization," this is not a term commonly used at the local level, necessitating synonyms. Similarly, local jurisdictions often use the term "green building requirement," which is functionally similar to "reach code." Next, community partners raised the profile of local priorities–some of which dovetailed with CARB priorities while others did not. In some cases, the mismatch in priorities relegated climate planning to a future consideration. In other cases, CARB priorities could be seamlessly infused in local planning discussions. To this end, partners advocated that CARB support a variety of climate readiness approaches, not limited to CEQA-qualified CAPs. Partners noted that General Plans are commonly utilized for climate readiness planning in rural areas, while CAPs are high-visibility documents that help signal for region collaboration. Safety and hazard mitigation plans are typically revised for Federal Emergency Management Agency (FEMA) compliance, also making them optimal avenues for engagement and future research. By fostering a collaborative ecosystem involved in capacity building, CARB can not only adjust policy language, but also align priority actions and policy approaches, thereby accelerating progress toward building climate-resilient communities across California.

6. Update Regulatory Frameworks:

CARB should develop and implement regulatory frameworks based on local actions. Such integration will require not only reviewing local plans for their actions, but also continuous conversation with local policymakers. More specifically, the CARB Scoping Plan update should include a more robust focus on rural jurisdictions, which can include mitigation measures that consider ecosystem services, allowing for the crediting of natural and working land management practices toward local mitigation mandates. Regulatory updates may also include updating air quality regulations, land use guidelines, and transportation policies to prioritize climate resilience and emission reductions on a more regional and context-specific basis. We note that regular plan review and feedback from community partners can help CARB better tailor target local priorities (e.g. building decarbonization through biomass generation or reducing VMT through new, mixed-use healthcare center development).

To this end, we recommend that CARB adopt concrete policy targets for two priority areas: reducing VMT and building decarbonization. Partners across the state noted that concepts like VMT are unfamiliar or carry negative connotations due to concerns around mileage taxes, or dependence on gas tax funding, in certain regions. Instead, CARB may wish to focus on mixed-use density targets for development, aligning the priority of reducing VMT with updated CEQA metrics. Similarly, while the term "building decarbonization" is common in state policy documents, only one county mentioned "decarbonization" in its General Plan. Scholarly literature also prefers synonyms (e.g., carbon neutral). As an alternate approach, CARB may wish to promote updates to municipal building codes and siting low-carbon energy supplies. By better aligning regulatory requirements with local approaches and measurable benchmarks, CARB can present shared local and state priorities in a planning language that is mutually understood. To create and refine this language, CARB will need to continuously review local approaches and maintain dialogues with local partners across the state.

Conclusion:

As California confronts the escalating impacts of climate change, CARB has a pivotal role to play in supporting local governments in their climate readiness planning efforts. By implementing the recommendations outlined in this white paper, CARB can enhance its support for municipalities, empower communities to build resilience, and advance statewide climate objectives. Strengthening local climate readiness planning is essential for safeguarding public health, protecting vulnerable populations, and ensuring a sustainable future for all Californians.

Appendix 6. Matrix table

Link to matrix table dataset on the UC Davis Center for Regional Change website:

https://regionalchange.ucdavis.edu/projects/climate-readiness-through-local-planning

Link to download data:

https://regionalchange.ucdavis.edu/sites/g/files/dgvnsk986/files/inline-files/County%20and%20City%20Climate%20Readiness%20Data.pdf

Appendix 7. Example of standardized plan cover page

Plan title:

Jurisdiction:
Link to jurisdictional boundaries/shapefiles:

Date each plan was adopted:
- Dates for each element adopted within the plan:
  - Housing:
  - Land use:
  - Conservation:
  - Open Space:
  - Transportation:
  - Noise:
  - Safety:
  - Environmental Justice:
  - Air quality:

CEQA certification date:

Plan authorship: *information about the firm that prepared the plan or authors of the plan*

DOI:

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