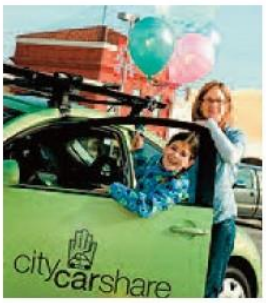

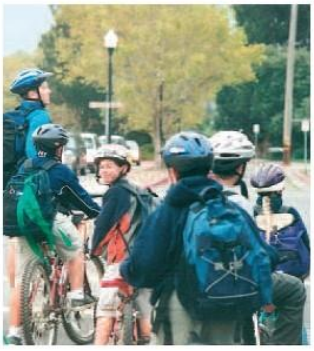

OneBayArea

Innovation Starts Here

Climate Initiatives Program: Evaluation Summary Report

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METROPOLITAN TRANSPORTATION COMMISSION

Contents

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Executive Summary

The Metropolitan Transportation Commission (MTC) has taken bold steps to address the threat of global climate change in the San Francisco Bay Area. These steps respond to the desires of Bay Area residents as well as state mandates. Senate Bill 375 (SB 375), enacted in 2008, requires MTC to demonstrate that the region's long range transportation plan will reduce per-capita greenhouse gas (GHG) emissions as part of a Sustainable Community Strategy (SCS).

In December 2009, MTC programmed $80 million to implement the Climate Initiatives Program, an unprecedented regional effort to reduce transportation GHG emissions. The majority of Climate Initiatives Program funding was allocated to local governments or used by MTC for innovative pilot projects to test their ability to reduce GHG emissions.

MTC committed to further investment in the Climate Initiatives Program with the 2013 adoption of *Plan Bay Area*, which sets aside $226 million to invest in the expansion of the most successful approaches identified in the Climate Initiatives Program.

MTC contracted with ICF International to lead an evaluation of the Climate Initiatives Program. The overall goals of this evaluation were to:

- Determine the emission reductions, cost effectiveness, and co-benefits of each major project and activity. The term *co-benefits* refers to societal benefits that occur in addition to primary emission reduction benefits that each project is expected to generate.
- Identify key lessons learned to improve the design and implementation of future projects or programs and support replication of successful projects elsewhere in the Bay Area.
- Produce accessible resource documents to ensure that performance evaluation results and lessons are transferred to communities throughout the Bay Area.

Data collection to evaluate each project commenced in 2011 and, in most cases, continued through 2013 or 2014, when the project evaluations were completed.

Project Impacts

Table ES-1 summarizes the project evaluations in terms of annual GHG reductions, costs and MTC funding, and emission reduction cost effectiveness. The projects with the largest GHG reductions were:

- Connect, Redwood City! (San Mateo County Transit District)
- Shore Power (Port of Oakland)
- Cold In Place Recycling (City of Napa)

These three projects were also the most cost effective.

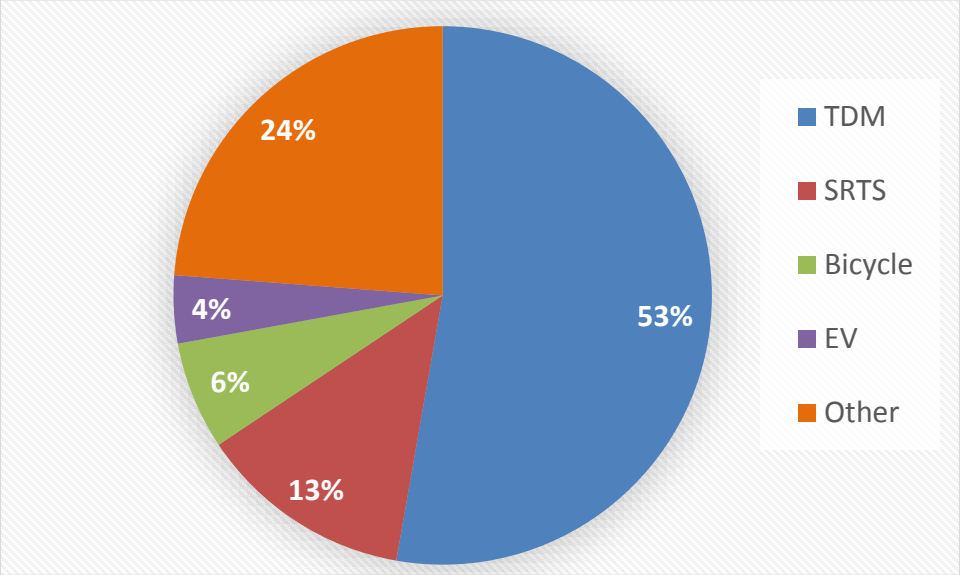
Table ES-1: Summary of Project Impacts

Project Title	Type	GHG emission annual reduction (tons)	Total project costs (as of Dec 2014)	Total MTC funding	Cost Effectiveness ($/ton CO2e reduced)
Connect, Redwood City! [a]	TDM	1,945	$921,386	$1,487,000	$416
Shore Power	Other	534	$9,070,000	$3,000,000	$849
Cold In Place Recycling [b]	Other	493	-$1,221,290	$2,000,000	-$2,477
goBerkeley	TDM	317	$3,100,000	$2,000,000	$9,792
Bay Area School Transportation Collaborative	SRTS	297	$996,447	$867,000	$3,355
Regional Safe Routes To School (5 counties)	SRTS	210	$10,801,000	$15,000,000	$17,124
BikeMobile	Bicycle	201	$565,000	$500,000	$2,811
Local Government EV Fleet	EV	172	$2,879,694	$2,445,000	$1,679
Bike-Sharing Pilot Program	Bicycle	79	$7,000,000	$4,300,000	$17,643
Green Ways to School	SRTS	57	$427,046	$383,000	$7,491
Dynamic Rideshare Programs Demonstrated in Three Counties	TDM	10	$1,750,000	$2,400,000	$86,292
San Francisco Integrated Public/Private Partnership TDM Program	TDM	5	$858,000	$750,000	$171,600
Tribal Community Sustainable Transportation Pilot	EV	3	$409,676	$376,000	$12,274
eFleet: Car Sharing Electrified	EV	0.9	$847,090	$570,000	$100,745
Enhanced Automatic Vehicle Locator System	Other	NQ [c]	$1,483,015	$600,000	N/A
SRTS Education and Encouragement School Route Maps	SRTS	NQ [c]	$249,685	$335,000	N/A
Innovative Bicycle Detection Systems	Bicycle	NQ [d]	$1,710,000	$1,500,000	N/A
"Experience Electric" Campaign	EV	NQ [c]	$845,000	$925,000	N/A
Smart Driving Pilot	Other	NQ [c]	$400,000	$400,000	N/A
Total		**5,165**	**$43,091,749**	**$39,838,000**	

Note (a): GHG reduction and cost effectiveness reflect mid-point of upper and lower bound estimates.
Note (b): Negative figures indicate cost *savings.* The Cold in Place Recycling project resulted in a net cost savings because the process used had a lower cost than traditional paving methods.
Note (c): Not quantified. Project resulted in small GHG reductions but they could not be accurately measured.
Note (d): Not quantified. Project was not completed.

Figure ES-1 shows the share of annual GHG reductions associated with each of the five major project types: transportation demand management (TDM), safe route to school (SRTS), bicycle projects, electric vehicles (EV), and other project types (e.g., Shore Power and Cold In Place Recycling). The four TDM projects accounted for slightly more than half (53 percent) of the total program GHG reductions. EV projects accounted for the smallest share of GHG reductions (4 percent); note, however, that the three EV projects were just beginning to deploy vehicles at the time of the evaluation and are expected to produce significantly larger GHG reductions once they are fully implemented.

Figure ES-1: GHG Reductions by Project Type



Conclusions and Recommendations

The Climate Initiatives Program evaluation provides a wealth of information for MTC and its partners as they seek to fund activities that can help achieve the region's GHG reduction goals. Overall, the program demonstrated a number of innovative approaches to reduce transportation GHG emissions while delivering significant co-benefits. Some of these projects are ripe for expansion or replication in other Bay Area locations; others were less successful and offer lessons for improving future projects. Below are key findings and recommendations for MTC according to major project categories.

Transportation Demand Management Projects

Transportation demand management (TDM) projects showed widely different results, from almost no GHG reductions to the highest GHG reductions of any project. These complex and multi-faceted programs require careful consideration to replicate the successful efforts and improve or weed out the less successful ones. Crucial factors in determining success rates of various programs were:

- The level of buy-in of the target audiences
- Convenience and availability of sustainable travel options

- Institutional barriers among employers, such as a lack of an internal advocate for TDM programs

Safe Routes to School Projects

The Regional SRTS program produced measurable increases in walking and biking and reductions in VMT in most Bay Area counties. Schools initiating new programs showed greater travel and emissions benefits than schools that have had ongoing programs in place for several years. The GHG benefits of the program are modest due to the short length of most school trips. SRTS projects generally result in significant co-benefits by increasing physical activity for youth.

Bicycle Projects

The Bike-Sharing Pilot Program generated more than 300,000 bike-share trips in its first year of operation. The project GHG reductions were modest because bicycle trips tend to be short distance, only 10 to 15 percent of bike-share users would otherwise travel by vehicle, and the bicycling emissions benefits are partly offset by new emissions from bike-share service trucks. The BikeMobile project also produced modest GHG reductions but was relatively cost effective. Future investment in bike sharing should optimize station siting and streamline decision-making when multiple jurisdictions are involved.

Electric Vehicle Projects

Electric vehicle projects can be relatively cost effective at reducing GHG emissions; but if electric vehicles are not well-used or are used incorrectly, they can be among the least effective projects. In order to make investments in EVs and charging equipment cost effective, future grant funding must find a way to shift from more miles driven in conventional vehicles to more miles driven in electric vehicles. The evaluations of the electric vehicle projects highlighted the importance of educating new EV drivers in capturing maximum benefits and cost effectiveness from EVs.

Other Project Types

- **Cold in Place Recycling**. The Cold in Place Recycling project was highly successful in terms of GHG reductions, and especially in terms of cost effectiveness. This was the only project in which public agencies actually *saved* money by implementing an innovative strategy in place of the conventional method. However, it should be noted that Cold in Place Recycling projects cannot be used to help California MPOs meet their SB 375 GHG emission targets since the reductions are not from light duty vehicles.
- **Shore Power.** The Shore Power project produced significant GHG reductions and was relatively cost effective. However, no further MTC investment in this type of project is recommended because all container terminals at the Port of Oakland currently have, or will soon have, shore power, and there are no other ports in the Bay Area that currently are good candidates for this technology. The project cannot be used to help MTC meet SB 375 GHG emission targets since the reductions are not from light duty vehicles.
- **Smart Driving Pilot**. The Smart Driving Pilot project demonstrated the potential for real-time driving feedback devices to improve fuel economy, but it also illustrated the challenges with obtaining

definitive results. The review of previous research found clear evidence that the use of smart driving techniques improves fuel economy and reduces GHG emissions. MTC conducted two smart driving pilots, and the results were also promising for a few of the device types tested, but inconclusive in others. Thus, while a smart driving initiative appears to be promising approach to achieve GHG reductions among Bay Area drivers who are unable or unwilling to shift to less carbon intensive travel modes, future efforts will be altered to the more successful applications.

Future investment in the Climate Initiatives Program and other efforts to reduce transportation GHG emissions in the Bay Area should build on the lessons learned from these evaluations and target funding to those activities that can most cost effectively support state and regional climate change goals.

1. Introduction

Purpose

The Metropolitan Transportation Commission (MTC) has taken bold steps to address the threat of global climate change in the San Francisco Bay Area. These steps respond to the desires of Bay Area residents as well as state mandates. Senate Bill 375 (SB 375), enacted in 2008, requires MTC to demonstrate that the region's long range transportation plan will reduce per-capita greenhouse gas (GHG) emissions as part of a Sustainable Community Strategy (SCS). The California Air Resources Board established GHG reduction targets for all the state's metropolitan planning organizations (MPOs). For the Bay Area, these targets are a 7 percent reduction in per capita GHG emissions from cars and light trucks by 2020 (relative to 2005 levels) and a 15 percent reduction by 2035.

In December 2009, MTC programmed $80 million to implement the Climate Initiatives Program, an unprecedented regional effort to reduce transportation GHG emissions. The majority of Climate Initiatives Program funding was allocated to local governments or used by MTC for innovative pilot projects to test their ability to reduce GHG emissions. The remaining funds went to other regional or local climate initiatives (Spare the Air, SFGo, and projects in Eastern Solano County). MTC committed to further investment in the Climate Initiatives Program with the 2013 adoption of *Plan Bay Area*, which sets aside $226 million to invest in the expansion of the most successful approaches identified in the Climate Initiatives Program.

As part of the Climate Initiative Program, MTC funded projects in several program categories. This report covers the following projects and programs:

- **Innovative Grant Program** – a program that funds projects that have significant potential to generate tangible GHG emissions reductions from transportation sources and to serve as models that can be replicated across the Bay Area region.
- **Safe Routes to School Creative Grant Program** – a program that funds promising, novel approaches that can further best practices in the Safe Routes to School field.
- **Regional Safe Routes to School Program** – a regional Safe Routes to School (SR2S) program focused on education and encouragement, further augmenting the federal and State SRTS programs.
- **Smart Driving Pilot Program** – two studies to test the effectiveness of driver feedback technologies that promote smart driving, which maximizes motor vehicle fuel efficiency by improving driving habits and vehicle maintenance.
- **"Experience Electric" Electric Vehicle Promotion Campaign** – a campaign to build awareness, action, and demand for plug-in electric vehicles (PEV) in the Bay Area by promoting and hosting Ride-and-Drive events where members of public can test drive an electric vehicle.
- **Spare the Air Youth Program** – a program to educate, inspire, and empower youth and families in the region to walk, bike, carpool, and take transit. (This program is still ongoing and therefore not included in this summary report; an assessment of the program is anticipated by the end of 2015.)

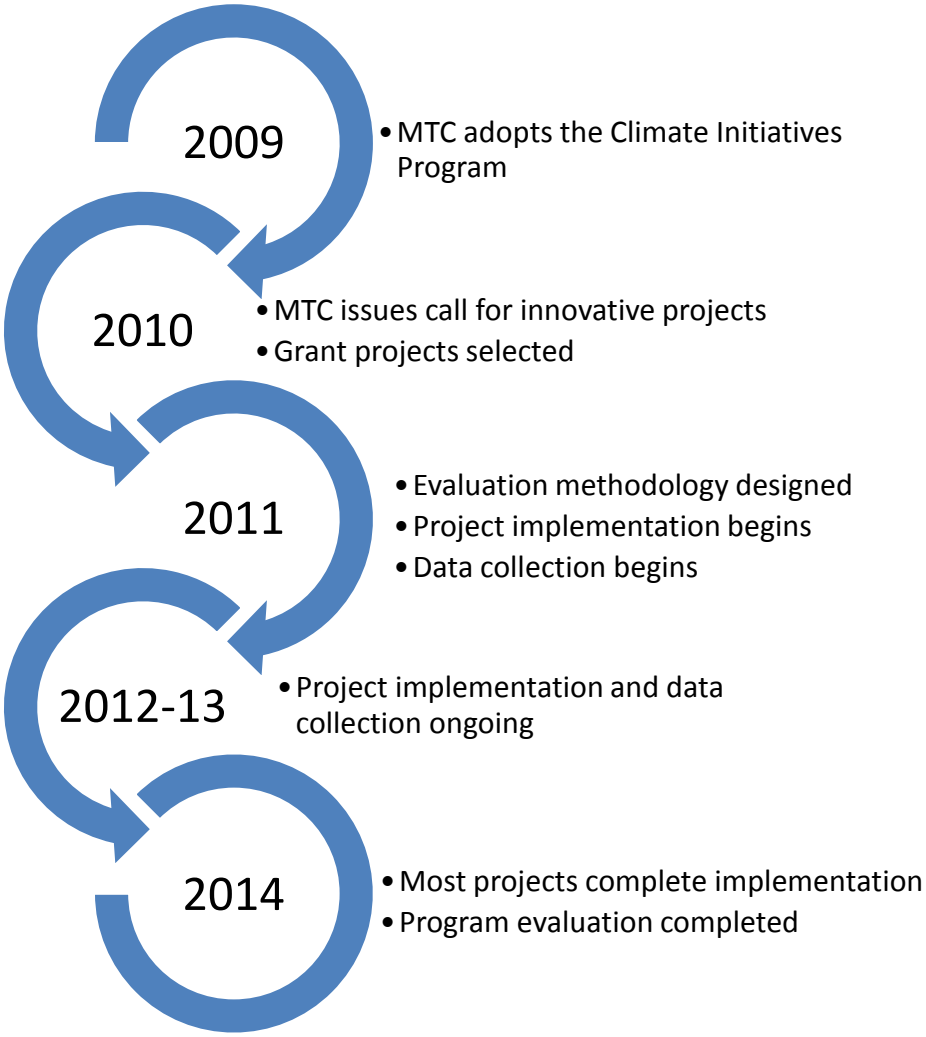
In 2010, MTC issued a call for projects and selected 16 projects for grant funding under the Innovative Grant Program and the Safe Routes to School Creative Grant Program. Also in 2010, MTC contracted with ICF International to lead an evaluation of the Climate Initiatives Program. In addition to the 16 projects in the Innovative Grant Program and the Safe Routes to School Creative Grant Program, this report also includes evaluations of the Regional Safe Routes to School Program, the Smart Driving Pilot Program, and the "Experience Electric" campaign, for a total of 19 projects.

Implementation of the Innovative Grant and Safe Routes to School Creative Grant projects began in 2011. The evaluation team developed an evaluation approach customized to each project. The overall goals of the evaluation effort were to:

- Determine the emission reductions, cost effectiveness, and co-benefits of each major project and activity. The term *co-benefits* refers to societal benefits that occur in addition to primary emission reduction benefits that each project is expected to generate.
- Identify key lessons learned to improve the design and implementation of future projects or programs and support replication of successful projects elsewhere in the Bay Area.
- Produce accessible resource documents to ensure that performance evaluation results and lessons are transferred to communities throughout the Bay Area.

Data collection to evaluate each project commenced in 2011 and, in most cases, continued through 2013 or 2014, when the project evaluations were completed. Figure 1 summarizes the program implementation and evaluation timeline for the Innovative Grant Program and the Safe Routes to School Creative Grant Program. The Smart Driving Pilot, Regional Safe Routes to School, and "Experience Electric" Campaign were completed within the same time period but each along different schedules.

Figure 1. Timeline for the Innovative Grant Program and the Safe Routes to School Creative Grant Program



Summary of Project Funding

Table 1 shows the allocation of funds for the Climate Initiatives Program.

Table 1: Project Funding – Climate Initiatives Program

Funding Program/ Project Type	Project Title	Lead Agency	MTC Funding
SRTS Creative Grant /SRTS	**Bay Area School Transportation Collaborative**: resources to help schools teach students about transportation choices and their impact on the climate	Alameda County Waste Management Authority	$ 867,000
SRTS Creative Grant /Bicycle	**BikeMobile**: a large repair and education van that visits schools, recreation centers, and community events providing free bike repair and safety education to promote bike use	Alameda County Transportation Commission	$ 500,000
Innovative Grant /Bicycle	**Bike-Sharing Pilot Program**: a pilot bike-sharing program with 700 bikes and 70 stations in five Bay Area cities	Bay Area Air Quality Management District	$ 4,300,000
Innovative Grant /Other	**Cold in Place Recycling**: a new method for asphalt recycling that kept existing asphalt concrete pavements in place during the repair process, greatly reducing the need for virgin materials	City of Napa	$ 2,000,000
Innovative Grant /TDM	**Connect, Redwood City!**: a package of transportation demand management strategies targeted to residents and employees in Redwood City	San Mateo County Transit District	$ 1,487,000
Innovative Grant /TDM	**Dynamic Rideshare Programs Demonstrated in Three Counties**: a dynamic ridesharing app for smartphones that promoted instant ridesharing in three Bay Area counties	Sonoma County Transportation Authority	$ 2,400,000
Innovative Grant /EV	**eFleet – Car Sharing Electrified**: a program that deployed 16 plug-in electric vehicles in the City CarShare fleet	City CarShare	$ 570,000
Innovative Grant /Other	**Enhanced Automatic Vehicle Locator System**: an Automated Vehicle Locator (AVL) system deployed within the Santa Rosa CityBus fleet to improve the riders' experience and system management	City of Santa Rosa	$ 600,000
Other /EV	**"Experience Electric" Campaign**: ride-and-drive events that encouraged purchase/lease/use of electric vehicles throughout Bay Area	MTC	$ 925,000
Innovative Grant /TDM	**goBerkeley**: a suite of transportation programs, projects, and policies to better manage parking and travel demand in three neighborhoods in Berkeley	City of Berkeley	$ 2,000,000
SRTS Creative Grant /SRTS	**Green Ways to School**: resources and technical assistance to help schools teach students about transportation choices	Transportation Authority of Marin	$ 383,000
Innovative Grant /Bicycle	**Innovative Bicycle Detection Systems**: bicycle signal detection technologies tested on key bikeway corridors (project not completed; funding reprogrammed to other projects)	City of San Jose	$1,500,000
Innovative Grant /EV	**Local Government EV Fleet**: 90 electric vehicles and 90 Level 2 chargers deployed to ten Bay Area local government agencies	Alameda County and Bay Area Climate Collaborative	$ 2,445,000
Regional SRTS /SRTS	**Regional Safe Routes to School**: funding to each Bay Area county to promote safe walking and biking to school	Congestion Management Agencies	$ 15,000,000

Funding Program/ Project Type	Project Title	Lead Agency	MTC Funding
Innovative Grant /TDM	**San Francisco Integrated Public/Private Partnership TDM Program**: new public/private partnerships focused on transportation demand management strategies	San Francisco County Transportation Authority	$ 750,000
Innovative Grant /Other	**Shore Power**: shore power infrastructure installed at two port berths, enabling ships to run on grid power rather than diesel engines	Port of Oakland	$ 3,000,000
Smart Driving /Other	**Smart Driving Pilot Program**: in-vehicle devices and apps that provide driver feedback to encourage smart driving practices	MTC	$ 400,000
SRTS Creative Grant /SRTS	**SRTS Education and Encouragement School Route Maps**: GIS mapping information created for students and parents to encourage biking and walking	Solano Transportation Authority	$ 335,000
Innovative Grant /EV	**Tribal Community Sustainable Transportation Pilot**: four electric vehicles and six Level 2 chargers deployed to tribal community in Sonoma County	Kashia Band of Pomo Indians	$ 376,000
	Total		**$39,838,000**

2. Evaluation Methodology

The evaluation of the Climate Initiatives Program applied a common analytical framework to all projects, considering:

- Transportation Impacts
- Emissions Impacts
- Costs
- Co-Benefits

Transportation Impacts

Most of the Climate Initiatives Program activities reduce emissions in one of two ways:

- Reduce vehicle miles of travel (VMT)
- Deploy cleaner vehicles

Several projects did not fit neatly in these two categories; individual approaches were developed for each of these projects.[1]

VMT Reduction Projects

Many projects are intended to reduce VMT by improving and encouraging alternatives to single-occupant vehicle travel, such as transit, rideshare, biking, walking, as well as other transportation demand management approaches. Changes in travel patterns were assessed using surveys that asked participants about changes in their travel behavior and data collected on ridership and program participation before and after implementation. Before and after surveys were the preferred method of assessing behavior change but were not possible for all grant projects.

In addition to VMT reduction by the target audience, the evaluations considered any project elements that could increase vehicle activity, such as new bus service or deploying vans to recirculate bike-share bikes.

Assessing the impact of projects on VMT required making assumptions about the baseline scenario—what would have happened to travel behavior in the absence of the project. Baseline assumptions for each project are documented in the individual project evaluation reports.

Clean Vehicle Projects

Several projects focused on deployment of electric vehicles (EVs). For EVs deployed as a result of the project, we collected data on vehicle activity (VMT) as well as charging information (charge duration,

[1] These include the Cold in Place Recycling project (led by Napa County), the Shore Power Initiative (led by the Port of Oakland), the Experience Electric campaign, and the Smart Driving Pilot.

time of day, metered energy use). For projects in which the EVs were not fully deployed and no charging data was available, we used fuel economy (kWh/mile) values provided by EPA for the EV models procured to project the amount of electricity that would be consumed by the vehicles. In general, we assumed the project did not change demand for travel, unless project data suggested otherwise. In other words, we assumed an increase in EV VMT offsets an equal amount of travel by one or more other vehicles.

Other Project Types

The Cold in Place Recycling project was unique in that emission reductions occurred primarily as a result of reducing use of construction equipment and raw materials, which in turn reduce fuel use and upstream energy inputs. We calculated emission reductions using factors available in the literature on construction emissions.

The Port of Oakland Shore Power project reduced emissions by enabling ships to use shore-side grid power for ship operations while at berth, rather than diesel-fueled engines. We calculated impacts on emissions based on the reduction in diesel use and the emissions associated with electricity generation.

Two other elements of the Climate Initiatives Program involved MTC-led efforts to test behavior change campaigns. The Smart Driving Pilot Program involved two field tests of in-vehicle devices and apps that provide drivers with feedback and encourage smart driving practices. For one effort, MTC's evaluation team recruited volunteer participants, measured their baseline vehicle fuel economy before installation of the devices, and then measured fuel economy again after the feedback device had been installed. The other effort also recruited volunteer participants to use an Android app that provided real time feedback to participants on their driving behavior. This effort also measured fuel economy before and after app use.

The "Experience Electric" Campaign involved a series of ride-and-drive events to allow members of the public to test drive an electric vehicle, with a goal of increasing the purchase, lease, and use of electric vehicles in the Bay Area. MTC's evaluation team conducted online and telephone surveys of participants, both at the event and after the event, to determine whether the ride-and-drives later influenced their vehicle purchase decisions.

Emissions Impacts

Projects were evaluated in terms of their impact on emissions of greenhouse gases (GHGs) and criteria pollutants, including nitrogen oxides (NOx), reactive organic gases (ROG), and fine particulate matter (PM2.5).

With few exceptions, California Air Resources Board (ARB) Emission Factors 2011 (EMFAC2011) for model year 2014 vehicles was the source for emission factors for on-road vehicles (EMFAC2014 was released in December 2014, after the evaluation period). A consistent set of factors were developed to cover all nine Bay Area counties, including factors for light duty vehicles, light and heavy duty trucks, and

several types of buses. Factors for both running emissions and starting emissions were incorporated, as applicable.

Costs

Project costs recorded include:

- The MTC grant funding (less any funds unspent at the end of 2014)
- Matching funds from other government agencies
- Matching funds from private partners
- In-kind contribution from partners

Costs to users, such as a reduction in automobile ownership costs, are not included in the project costs. Any potential user cost savings considered were evaluated under co-benefits (below).

Project lifetimes were used to annualize costs according to the following assumptions:

- For projects that provide an on-going service, like support for a ride matching program or a new shuttle service, emissions benefits last only as long as the program is in place. Thus, one year of funding buys one year of emission reduction.
- For projects that include an infrastructure or equipment investment that will last longer than one year, such as Bay Area Bike Share and electric vehicle projects, costs are annualized according to the assumed lifetime of the facility.

Co-Benefits

In addition to GHG emission reduction metrics, a variety of co-benefits were assessed for each project either quantitatively or qualitatively.

For VMT reduction projects, the following were assessed:

- Increase in physical activity – quantified in terms of additional walking and/or biking miles when possible
- Reduction in household transportation costs – quantified in terms of dollars saved per person or per program participant, as applicable
- Increase in public awareness of strategies to reduce emissions – public familiarity with, perception of, and interest in the programs, assessed qualitatively

For clean vehicle projects, the following were assessed:

- Increase in public awareness of strategies to reduce emissions - public familiarity with, perception of, and interest in the programs, assessed qualitatively
- User cost savings – quantified in terms of dollars per year

3. Summary of Findings

The central goal of the Climate Initiatives Program was to test the potential for different innovative projects to reduce GHG emissions in a cost effective manner. This evaluation highlights those projects that:

- Reduce the largest amount of GHG emissions and criteria pollutants
- Reduce GHG emissions most cost effectively (including total project cost, not just MTC funding)
- Have the greatest potential for expansion or replication elsewhere in the Bay Area
- Build more effective collaboration and partnerships between public agencies, businesses, and community-based organizations for purposes of taking collective action on climate change

Table 2 summarizes the results of all projects evaluated. Projects are sorted from highest to lowest annual GHG reductions. (Refer to Table 1 above for brief project descriptions).

Table 2: Summary of Project Impacts

Project Title	VMT annual reduction (miles)	GHG emission annual reduction (tons)	Total project costs (as of Dec 2014)	Total MTC funding	Cost Effectiveness ($/ton CO2e reduced)
Connect, Redwood City! [a]	5,370,000	1,945	$921,386	$1,487,000	$416
Shore Power	N/A[e]	534	$9,070,000	$3,000,000	$849
Cold in Place Recycling [b]	N/A[e]	493	-$1,221,290	$2,000,000	-$2,477
goBerkeley	918,000	317	$3,100,000	$2,000,000	$9,792
Bay Area School Transportation Collaborative	801,000	297	$996,447	$867,000	$3,355
Regional Safe Routes To School (5 counties)[c]	373,000	210	$10,801,000	$15,000,000	$17,124
BikeMobile	570,000	201	$565,000	$500,000	$2,811
Local Government EV Fleet	N/A[e]	172	$2,879,694	$2,445,000	$1,679
Bike-Sharing Pilot Program	314,000	79	$7,000,000	$4,300,000	$17,643
Green Ways to School	212,000	57	$427,046	$383,000	$7,491
Dynamic Rideshare Programs Demonstrated in Three Counties	30,000	10	$1,750,000	$2,400,000	$86,292
San Francisco Integrated Public/Private Partnership TDM Program	13,000	5	$858,000	$750,000	$171,600
Tribal Community Sustainable Transportation Pilot	N/A[e]	3	$409,676	$376,000	$12,274
eFleet: Car Sharing Electrified [d]	N/A[e]	0.9	$847,090	$570,000	$100,745
Enhanced Automatic Vehicle Locator System	NQ[f]	NQ[f]	$1,483,015	$600,000	N/A

Project Title	VMT annual reduction (miles)	GHG emission annual reduction (tons)	Total project costs (as of Dec 2014)	Total MTC funding	Cost Effectiveness ($/ton CO2e reduced)
SRTS Education and Encouragement School Route Maps	NQ[f]	NQ[f]	$249,685	$335,000	N/A
Innovative Bicycle Detection Systems	NQ[g]	NQ[g]	$1,710,000	$1,500,000	N/A
"Experience Electric" Campaign	N/A	NQ[f]	$845,000	$925,000	N/A
Smart Driving Pilot	N/A	NQ[f]	$400,000	$400,000	N/A
Total		**5,165**	**$43,091,749**	**$39,838,000**	

Note (a): VMT reduction, GHG reduction and cost effectiveness reflect mid-point of upper and lower bound estimates. Upper and lower bounds reflect uncertainty about the sample of employees who responded to surveys.
Note (b): Negative figures indicate cost *savings.* The Cold in Place Recycling project resulted in a net cost savings because the process used had a lower cost than traditional paving methods.
Note (c): The Regional Safe Routes to School Program is evaluated in greater depth in a separate report.
Note (d): The project has two components that differ widely in effectiveness. The battery electric vehicle component is expected to reduce GHG emissions by 11 tons over the lifetime of the BEV in the fleet with a cost effectiveness of $13,770 per ton. The plug-in hybrid electric vehicle component is anticipated to *increase* lifetime emissions by 6 tons.
Note (e): Not applicable. These projects were not intended to reduce VMT.
Note (f): Not quantified. While there were likely small VMT and GHG reductions, it was not measurable.
Note (g): Not quantified. Project was not completed.

GHG Reductions

The projects resulting in the largest annual GHG reductions were:

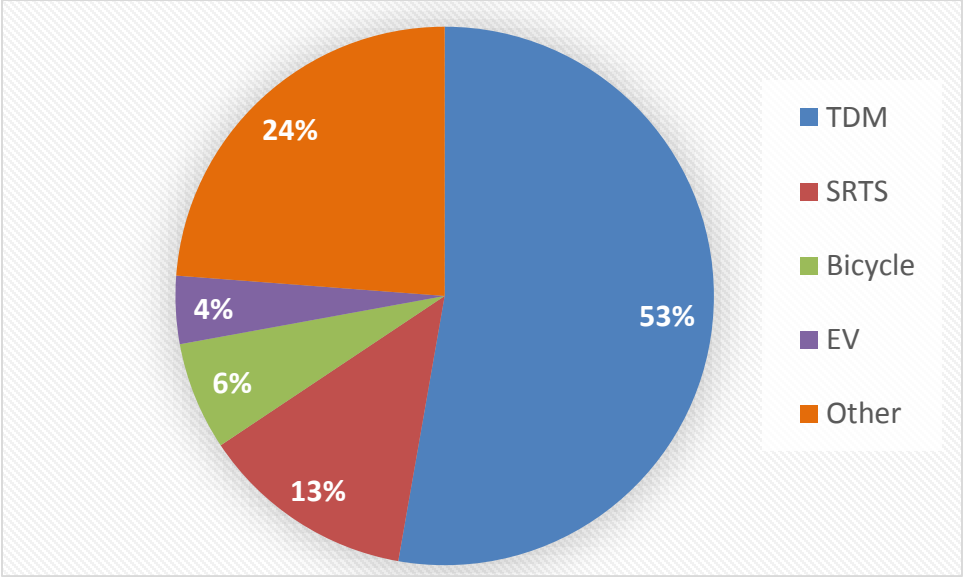
- **Connect, Redwood City!** (San Mateo County Transit District) – reducing 1,100 to 2,800 tons of GHG emissions annually, which is roughly equivalent to taking 240 to 600 passenger vehicles off the road each year[2]
- **Shore Power** (Port of Oakland) – reducing more than 500 tons of GHG emissions annually
- **Cold in Place Recycling** (Napa County) – reducing almost 500 tons of GHG emissions
- **goBerkeley** (City of Berkeley) – reducing more than 300 tons of GHG emissions annually
- **Bay Area School Transportation Collaborative** (Alameda County Waste Management Authority) – reducing almost 300 tons of GHG emissions annually

[2] All GHG equivalencies are calculated using EPA's Greenhouse Gas Equivalencies Calculator (http://www.epa.gov/cleanenergy/energy-resources/calculator.html)

In total, 14 of the 19 projects demonstrated GHG emission reductions. One project, Innovative Bicycle Detection Systems, was not completed. For four projects, survey data did not demonstrate GHG reductions.

Figure 2 shows the percent of annual GHG reductions associated with each of the five major project types: TDM, SRTS, bicycle projects, EV projects, and other project types (Shore Power and Cold In Place Recycling). The four TDM projects accounted for slightly more than half (53 percent) of the total program GHG reductions. EV projects accounted for the smallest share of GHG reductions (4 percent); note, however, that the three EV projects were just beginning to deploy vehicles at the time of the evaluation and are expected to produce significantly larger GHG reductions once they are fully implemented.

Figure 2: GHG Reductions by Project Type



Cost Effectiveness

Due to substantial cost savings, **Cold in Place Recycling** (Napa County), was the most cost effective project. The project produced a net savings to public agencies of more than $1.2 million, because the cold in place recycling process is more efficient than conventional road rehabilitation practices in terms of material and energy usage as well as labor. The project *saved* almost $2,500 per ton of GHG emissions reduced.

The median cost effectiveness among the projects listed in Table 2 was approximately $8,400 per ton of GHG emissions reduced. The next most cost effective projects were:

- **Connect, Redwood City!** (San Mateo County Transit District) – approximately $290 to $735 per ton of GHG emissions reduced

- **Shore Power (Port of Oakland)** – approximately $850 per ton of GHG emissions reduced

Potential for Replication, Expansion, or Improvement

Although not all of the projects funded reduced large volumes of GHG emissions, many of the projects show additional benefits, and thus, are recommended for potential replication or expansion for public investment. Some of the projects that performed relatively poorly could be improved in future iterations.

Top candidates for replication or expansion are:

- **Connect, Redwood City!** (San Mateo County Transit District) – The residential and employer marketing components of this program was particularly effective, and could be replicated in other areas near Caltrain stations and other rail stations.
- **Local Government EV Fleet** (Alameda County and Bay Area Climate Collaborative) – This program could be expanded to other local government agencies throughout the Bay Area that own and operate light duty vehicle fleets. As demonstrated by this project and the Tribal Community Sustainable Transportation Pilot (Kashia Band of Pomo Indians), charging infrastructure must be in place first before the full emission reduction benefits can be realized.
- **BikeMobile** (Alameda County Transportation Commission) – This project could be expanded to cover more locations, including large employers or employment centers and gathering places during special events.[3]
- **Bay Area School Transportation Collaborative** (Alameda County Waste Management Authority) – The program could be expanded to other counties. Additional effort should be focused on recruiting and training teachers that are most interested in participating.
- **Experience Electric** (Metropolitan Transportation Commission) – While the evaluation did not quantify GHG reductions, the event is considered a success. It appears to have influenced decisions to buy or lease an EV.

Several projects show potential for improvement:

- **eFleet: Car Sharing Electrified** (City CarShare) – Reducing GHG emissions through electric vehicles depends on the vehicles being used and charged properly. This program could be more effective if battery electric vehicles (BEVs) were used more frequently (as substitutes for conventional vehicles) and if plug-in hybrid electric vehicles (PHEVs) were charged properly.
- **Green Ways to School** (Transportation Authority of Marin) – The Green Teams component of this project was particularly effective, but Green Teams were not established in all schools. This component should be implemented more widely.

[3] MTC is currently funding a Bay Area-wide BikeMobile through its Spare the Air Youth Program. This BikeMobile serves eight Bay Area counties (other than Alameda County).

- **goBerkeley** (City of Berkeley) – While the parking pricing and carshare component was successful, this program could have been more effective if the TravelChoice and free bus pass components were more widely and smoothly implemented.
- **Smart Driving Pilot** (Metropolitan Transportation Commission) – Newly developed feedback devices, particularly in-vehicle feedback devices and smartphone apps, show more promise than those tested in the pilot. [4]

Some projects are not good candidates for replication or expansion using public investment, although they may reduce GHG emissions with continued private investment:

- **Shore Power** (Port of Oakland) – All container terminals at the Port of Oakland currently have, or will soon have, shore power. There are no other ports in the Bay Area that currently are good candidates for this technology. In addition, state regulations now require shore power for all major California ports serving container ships, refrigerated ships, and cruise ships.
- **Dynamic Rideshare** (Sonoma County Transportation Authority) – There is currently rapid growth of similar offerings driven by the private sector. Public funding is not necessary.
- **Cold in Place Recycling** (Napa County) – This project was the most cost-effective in terms of GHG reductions. Cold in Place Recycling could be substituted for conventional rehabilitation methods on many roads throughout the Bay Area. However, because this approach does not reduce GHG emissions from light duty vehicles, it does not contribute to MTC's required GHG reductions under SB 375.

[4] MTC is providing $500,000 to further the smart driving program over the next year.

4. Project Summaries

This section contains 2-page summaries of each project. Stand-alone evaluation reports have also been prepared for each project.

Bay Area School Transportation Collaborative

Alameda County Waste Management Authority

Alameda County Waste Management Authority provided online resources and technical assistance to help schools teach students about transportation choices through the Bay Area School Transportation Collaborative, a joint effort between Alameda, Sonoma, and San Mateo Counties, as well as the City of San Jose. MTC's funding supported two different programs that encouraged students to reduce the number of trips they take to and from school by car:

- **Green Star Schools (Alameda County, San Mateo County, and the City of San Jose)**. The project was an extension of StopWaste.org's existing Green Star Schools program. Alameda County used MTC funding to expand the Green Star Schools program from its initial focus on waste management to include transportation-related material. The County developed a web-based platform to track the impact of students' efforts on GHG emissions. Alameda County staff also created and promoted a curriculum about transportation and GHG emissions. The project also expanded the Green Star Schools program into the City of San Jose and San Mateo County.
- **ECO_2school (A faction of Cool Schools in Sonoma County).** Cool Schools, run by the Climate Protection Campaign, promoted a student-led transportation emissions reduction campaign called eCO_2ommute, with a focus on student interest clubs. MTC funding went to expanding existing activities to include seven Sonoma County high schools.

Surveys conducted before and after the education programs and campaigns showed that students were taking fewer trips to school in passenger vehicles after the programs. The survey analysis also showed an increase in walking and biking mode shares. Using trip distances between home and school provided by participating students, VMT changes were calculated based on the differences in trips by mode between the before and after surveys.

PROJECT HIGHLIGHTS

Project category: **SRTS Creative Grant**

Project cost: **$996,447**

VMT Reduction: **801,000 miles**

GHG Emission Reduction: **297 tons/yr**

Cost Effectiveness: **$3,355/ton**

Criteria Pollutant Emission Reductions:

ROG: 108 lbs/yr
NOx: 356 lbs/yr
PM2.5: 36 lbs/yr

Active Transportation:

Sonoma County: **Increase in biking mode share from 2.8% to 3.4%**
Alameda County and San Jose: **Increase in biking mode share from 1-2% to 4-5%; Increase in walking mode share from 6-8% to 10-14%**

Household Transportation Costs:

Sonoma County: **$187 saved per year/participant**
Alameda County and San Jose: **$81 saved per year/participant**

Lessons Learned

Recommendations for schools

- **Recruit teachers earlier in the year**: This will help avoid conflicts with testing, allow more time for students to continue taking action during the school year, and potentially create the opportunity for data collection to begin earlier in the year.

- **Standardize the lesson scheduling:** Lessons should be scheduled to mirror the current action project "slot" arrangement (with two weeks between each lesson).
- **Align the project with other school- and district-based programs:** Aligning actions with existing school and district-wide efforts to encourage walking and biking to school can help increase participation and reinforce the educational elements of the project.
- **Supplement the Green Star Schools website with other metrics to more adequately evaluate the effectiveness of the program:** The Green Star Schools website serves as a good medium for posting and promoting the results of student and teacher CO2e emissions reduction initiatives. However, evaluation of program success using the web-based platform alone is difficult and requires supplemental information from trip tracking spreadsheets and other curriculum artifacts produced by students/teachers during the course of their projects.
- **Use a standardized curriculum:** Unlike curricula developed for secondary schools, which had to be highly individualized to best fit each teacher's existing curriculum, the most effective elementary school curricula introduced transportation and GHG emission-related content in a set of standardized Action Project steps.
- **Engage teachers in the program first to solidify their interest in promoting the program:** Participation is greatly affected by teacher involvement in the program. When teachers show interest and hold students accountable, participation increases. Teachers with a greater a sense of ownership of the project had more success.

Recommendations for Program Administrators

- **Provide technical support and training for teachers:** Several teachers expressed an interest in additional technical support related to the online challenge.
- **Create tools that enable schools to more independently operate programs and conduct program evaluations**: Developing an independent program for teachers and schools will allow program staff to reach a greater number of schools.
- **Provide on-site support for teachers:** ECO_2School staff support for teachers is necessary for the program to thrive. A key to teacher's support for and the success of the program at the secondary school level is the presence of dedicated staff on campus, which can be difficult to find due to existing demands on staff time.
- **Secure funding or partnerships with local businesses to cover the costs for incentives:** Incentives for participation in the program were important, but the cost of these was not covered by the grant.
- **Identify a uniform methodology for collecting data to measure the effects of the program as part of the program design:** In Sonoma County, it was challenging to develop a reliable method of sampling secondary school participants to ensure adequate sample size. However, in Alameda County, the project team found that their spreadsheet based "trip tracking tool" provided sufficient guidance for estimating and reporting impacts of school and classroom based projects.

The BikeMobile

Alameda County Transportation Commission

The Alameda County Transportation Commission (ACTC) created the BikeMobile, a "bike repair and encouragement vehicle," and ran it in partnership with Cycles of Change, a non-profit dedicated to increasing the use of bicycles by youth. The BikeMobile (bike-mobile.org) is a specially equipped and branded roving van that visits schools, recreation centers, and community locations throughout Alameda County, providing free bike repairs and safety education. It is the first program of its kind in the Bay Area. The main objective of the BikeMobile is to encourage bike use among school children in Alameda County by providing bike repairs and bike-safety education.

BikeMobile staff taught children how to repair and maintain their bikes under staff supervision, using BikeMobile tools and parts. Staff performed more complicated repairs themselves and explained the process to the bike owner. Staff also taught kids (and interested adults) key bike-related safety procedures such as proper helmet fitting, the "ABC" (air, brakes, chain) bike safety check, and the rules of the road. After an initial repair or lesson at a school, staff gave students reflective stickers for their bikes to indicate that they had been served by the BikeMobile. On follow-up visits to the same school, BikeMobile staff gave out additional incentives (a tire-patch kit, tail light, bike lock) to students seen again with their bike, as a way to encourage biking to school. The BikeMobile's services were coordinated with – and intended to complement – the programs, projects, and activities administered by the Alameda County Safe Routes to Schools Partnership, a program that promotes walking and biking to school in the county.

PROJECT HIGHLIGHTS

Project category: **SRTS Creative Grant**

Project costs: **$565,000**

VMT Reduction: **570,000 miles**

GHG Emission Reduction: **201 tons/yr**

Cost Effectiveness: **$2,811/ton**

Criteria Pollutant Emission Reductions:

- **ROG: 183.2 lbs/yr**
- **NOx: 260.4 lbs/yr**
- **PM2.5: 25.8 lbs/yr**

Active Transportation: **74% increase in bikes parked at schools visited by the BikeMobile**

Household Transportation Costs: **$319,342 total or $308/program participant**

Lessons Learned

Recommendations for local agencies and implementing organizations

- **Institute a formal internship program:** Institutionalize an internship or apprenticeship program that would offer youth the chance to gain valuable experience and contacts as bike mechanics.
- **Create more volunteer opportunities:** Develop a program for volunteers to help with the project's many onsite, non-repair activities such as client intake, surveying, crowd control, and providing safety and encouragement information.
- **Develop activities to fill up waiting time:** Program activities during an event's down time to further engage children with activities focused on safety and encouragement.

- **Ensure supplies of safety-related giveaways**: Set aside funding for giveaway items such as helmets, lights, and bells. Not being able to give out such accessories represents a missed opportunity to engage students on bike safety.
- **Develop more informational materials for customers:** Create tip sheets on bike safety and bike encouragement and a fact sheet on the benefits of cycling, explaining the nexus with climate protection.
- **Conduct more outreach to local bike shops:** To prevent alienating local bike shops, distribute contact information for the shops at BikeMobile events and introduce bike shop staff to community members by bringing them in as volunteer bike mechanics.

Recommendations for regional agencies

- **Disseminate knowledge and information about the BikeMobile so that the project can be replicated elsewhere**: Dedicated funding for disseminating knowledge would allow BikeMobile staff to present the project at conferences, write articles about the project, and advise other agencies and organizations on project implementation.
- **Consider other population segments to serve**: As potential areas of expansion, consider bringing the program to large employers or employment centers and to places of worship during special events.
- **Pursue other funding sources:** Explore other sources to supplement government funding, including sponsorships from large bike manufacturers and large local employers.

Bike-Sharing Pilot Program

Bay Area Air Quality Management District

The Bay Area Air Quality Management District (BAAQMD), in partnership with several local government agencies in the Bay Area, implemented a bike-sharing pilot program in five cities throughout three counties: the City and County of San Francisco; Redwood City in San Mateo County; and the cities of Palo Alto, Mountain View, and San Jose in Santa Clara County.

Bike sharing is a self-service bike-use system designed for short-term rides. The service allows users to access a fleet of bikes from a network of docking stations with kiosks. The bikes are designed to be durable and relatively low-maintenance. Users can check out bikes and return them to any station in the system. Typically, the station network provides twice as many docking points as there are bikes, to make it easy to find an available dock when it is time to return the bike. Bike sharing now exists in a number of cities in North America, including Boston, Chicago, Minneapolis, Montreal, New York, and Washington, D.C, and many more around the world.

PROJECT HIGHLIGHTS

Project category: **Innovative Grant**

Project costs: **$7,000,000**

VMT Reduction: **314,000 miles**

GHG Emission Reduction: **79 tons/yr**

Cost Effectiveness: **$17,643/ton**

Criteria Pollutant Emission Reductions:

ROG: 37.2 lbs/yr
NOx: 47.5 lbs/yr
PM2.5: 14.2 lbs/yr

Reduction in peak-period vehicle trips: **San Francisco, 15,914; San Mateo, 17; Santa Clara, 1,731**

The Bay Area's three-county pilot system is called Bay Area Bike Share (BABS). Launched in late August 2013, it consists of approximately 700 bikes deployed across 70 stations. Half the stations (35) are in San Francisco; the other half are distributed as follows: five in Palo Alto, seven each in Redwood City and Mountain View, and sixteen in San Jose. Stations are located at key destinations such as transit hubs and employment and commercial areas. The system is available 24 hours a day, all year round. (Note that MTC added $2.8 million to the project in May 2013; these funds were not considered as part of this evaluation).

Lessons Learned

- **Streamline decision-making:** BABS is found in three counties and five cities. In addition to the municipalities, project partners include SamTrans, Caltrain, San Mateo County Transportation Authority, and Santa Clara Valley Transportation Authority. The involvement of so many partners slowed decision-making and stretched staff resources. One way to streamline program management is to delegate decision-making to ad-hoc committees. Also, if BABS is to expand to more cities, control of the program might need to be more firmly centralized within one agency, which would establish program guidelines "buy-in" criteria for cities wishing to participate.
- **Seek corporate sponsorships:** Now that the funds for the pilot project are close to expiring and MTC and the Air District are actively working toward expanding the system beyond the current three-county area, it is imperative to develop a mechanism and framework for engaging corporate

sponsors. There are a few types of sponsorship schemes utilized by other bikeshare systems, and program managers will need to find the right one for the Bay Area system. Possibilities include naming rights to the entire system, adoption of individual stations, and advertising panels on bikes.

- **Optimize station siting:** During the initial station siting process, partner cities did not have sufficient expertise regarding siting considerations and options. Future contracts should incorporate one comprehensive round of station relocations, including updated maps and signage, following an assessment of the original locations.
- **Clarify further the pricing structure and 30-minute restriction:** Some customers with one-day memberships were confused by the BABS pricing structure and believe that membership entitles them to unlimited use of the bike during that period. As a result, they kept the bike out longer than necessary and ended up incurring overtime fees. BABS could address this issue by printing reminders on ride-code tickets; adding language to kiosk panels and brochures about the parameters of the 24-hour membership; and making online pricing information available in alternate languages.

Cold in Place Recycling

City of Napa

The City of Napa resurfaced two roadway sections (one in the City of Napa and one in Sonoma County) using cold in place recycling (CIR). CIR recycles existing asphalt concrete pavements in place, eliminating the need to produce new material and transport it to the worksite. Compared to conventional road rehabilitation, CIR can have the following benefits:

- Reduce GHG emissions associated with the production of materials by recycling existing roadway material
- Reduce GHG and criteria pollutant emissions associated with the transportation of new materials to the site and waste from the site
- Reduce GHG and criteria emissions associated with equipment use at the construction site
- Reduce costs to public agencies for materials, equipment, and labor

The project also incorporated outreach components, which included: workshops covering an overview of the CIR process and technical specifications; a visit to the project sites for elected officials and transportation department staff from local governments in the region; and an online learning portal with resources from the workshops.

PROJECT HIGHLIGHTS

Project category: **Innovative Grant**

Project costs: -**$1,221,290***

VMT Reduction: **Not applicable**

GHG Emission Reduction: **493 tons**

Cost Effectiveness: -**$2,477/ton**

Criteria Pollutant Emission Reductions:

ROG: (2.3 lbs increase)
NOx: 26.8 lbs
PM2.5: (0.3 lbs increase)

* Negative figures indicate cost *savings.* The Cold in Place Recycling project resulted in a net cost savings because the process had a lower cost than traditional paving methods.

Lessons Learned

The evaluation results suggest that local and regional agencies should work to maximize the use of CIR in the Bay Area. Recommendations for building upon the successes of the Napa and Sonoma projects are provided below.

Recommendations for local agencies

- **Pay careful attention to project specifications:** The City of Napa and Sonoma County played a key role in ensuring that the CIR projects cost-effectively reduced GHG emissions without compromising construction quality through careful attention to project specifications.
- **Implement projects in warmer months**: Implementation during warmer temperatures helps reduce the amount of cement used as a binding additive. Since cement is GHG intensive, implementation during cooler temperatures results in more GHG emissions.
- **Amend project specifications to require that CIR emulsifying agents come from California**: The City of Napa created sample specifications for CIR projects that other agencies can use when initiating

CIR projects in the future. Amending these specifications to require that emulsion agents be sourced from Northern California could further reduce GHG emissions from transportation.

- **Maximize the use of CIR in CIR projects**: CIR projects require some use of traditional hot mix asphalt (HMA). Every additional square yard that can be paved with CIR instead of HMA reduces GHG emissions.

Recommendations for regional agencies

- **Increase education about and funding for CIR projects**: More education and funding is needed to overcome a lingering negative reputation of CIR due to negative experiences of some early adopters.
- **Create an online information center about CIR for Bay Area transportation agencies**: Though attendees generally considered the CIR workshops a success, the project's webpage(s) only received 49 unique visitors during the evaluation period. The reach of this resource should be expanded through promotion.

Connect, Redwood City!

San Mateo County Transit District

The San Mateo County Transit District (SamTrans) implemented a range of transportation demand management (TDM) strategies targeted at residents, employers, and employees in Redwood City with the goal of shifting users away from single occupancy vehicles (SOV) and conducted targeted marketing in the interest of building awareness and use of these alternatives. Programs included the following:

- **Carsharing**: Working with SamTrans and the County of San Mateo, Zipcar established two carshare stations with three vehicles each in Downtown Redwood City. The stations are located at the Redwood City Caltrain and the San Mateo Courthouse Annex; both areas are high-density and high–traffic locations. Negotiations are currently underway for a third and final carshare lot with three vehicles to be located at the Redwood City Library.
- **Bikesharing**: SamTrans coordinated a series of activities to establish the seven Bay Area Bike Share stations in Downtown Redwood City. (The impact of this program was not quantified since it was not implemented within the evaluation time frame.)
- **Short-distance Vanpools**: The project established nine vanpools serving worksites not accessible by existing transit service and/or shuttle routes. Six vanpools connected worksites to the Redwood City Caltrain station, and three connected worksites to residential areas.
- **Telework and Flex-schedules**: San Mateo County updated and re-launched its Flex-schedule and Telework programs, which were promoted by senior level managers and staff at the County, and which can serve as a model for other cities and agencies. This program's goal is to eliminate, on average, two single-occupancy vehicle (SOV) commutes per month for 50 percent of County employees.
- **Targeted residential and employer/employee marketing**: To promote *Connect, Redwood City!*, SamTrans conducted targeted marketing to residents and employees in Redwood City. The targeted marketing strategies included: sending posters and letters to companies; creating a website;

PROJECT HIGHLIGHTS

Project category: **Innovative Grant**

Project costs: **$921,386**

VMT Reduction**: 3,037,000-7,703,000 miles***

GHG Emission Reduction: **1,100-2,790 tons/yr***

Cost Effectiveness: **$290/ton-$735/ton** **

Criteria Pollutant Emission Reductions:
ROG: 336-857 lbs/yr
NOx: 1,179-3,030 lbs/yr
PM2.5: 129-333 lbs/yr

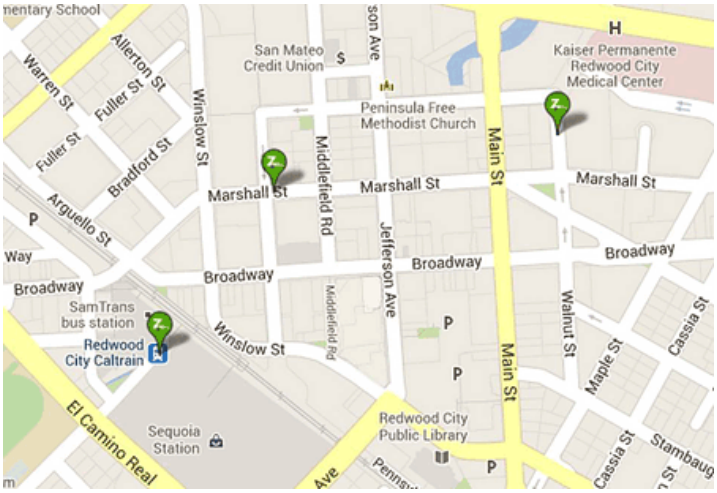
Active Transportation: **If the carshare program had not been present, 10% of associated bike trips and 14% of associated walk trips would have been made using a car**

Household Transportation Costs: **$36 saved per year/program participant**

*Ranges reflect uncertainty about how many employees were impacted by employer marketing, which accounts for the majority of GHG reductions from this project. Lower-end estimates assume that only employees of the businesses that responded to surveys were impacted; upper-end estimates assumes all non-resident employees working in Redwood City were impacted.

** Cost effectiveness does not include costs for program evaluation since they were not associated with project implementation.

advertising on street banners, signs, and posters; emailing companies; and submitting advertisements to newspapers.



Lessons Learned

Recommendations for program administrators

- **Get the support of senior level management**: In the course of the pilot program, the County experienced internal resistance from their senior level management staff and was unable to fully optimize the potential of teleworking and VMT reduction.
- **Be prepared to reallocate resources to address unforeseen challenges:** The management of this pilot program required addressing unforeseen issues such as higher than anticipated needs for vanpool vehicles and resistance from County staff in implementing the telework program. These issues required amending the program scope, and reallocating funds midway through the project.
- **Increase public outreach:** The program would benefit from more public education regarding the details of each TDM strategy and the availability of public transit resources in downtown Redwood City.

Recommendations for other jurisdictions

- **Consider the cost effectiveness of different TDM strategies.** The SamTrans project consisted of several different components, some of which were more effective than others at reducing GHG emissions. The residential and employer marketing programs produced significant annual GHG reductions for under $500 per ton. The carshare, vanpool, and telework programs produced moderate GHG reductions and were less cost effective, although they may have greater potential in other Bay Area locations. This suggests that travel choice outreach programs can be cost effective ways to reduce GHG emissions, especially when implemented in areas like Redwood City that have considerable transit service but where a large majority of people currently drive to work.

Dynamic Rideshare Programs Demonstrated in Three Counties

Sonoma County Transportation Authority

The Sonoma County Transportation Authority / Regional Climate Protection Authority (SCTA/RCPA), in partnership with the Transportation Authorities of Contra Costa and Marin Counties (CCTA and TAM respectively), demonstrated "dynamic ridesharing" technology throughout the three counties represented by those agencies.

Dynamic, or real-time, ridesharing involves the use of information technology—namely a mobile app—to match drivers and riders in real time. This form of ridesharing does not require commuters to commit to a particular carpool with fixed routes and schedules; instead, it facilitates the matching of riders and drivers on an ad-hoc basis through a smartphone user platform offered by the vendor, Carma, which has developed a ridesharing app for use in a number of U.S. markets.

PROJECT HIGHLIGHTS

Project category: **Innovative Grant**

Project costs: **$1,750,000**

VMT Reduction: **30,000 miles**

GHG Emission Reduction: **10 tons/yr**

Cost Effectiveness: **$86,292/ton**

Criteria Pollutant Emission Reductions:
ROG: 5.1 lbs/yr
NOx: 11.7 lbs/yr
PM2.5: 1.3 lbs/yr

Household Transportation Costs:
Typical savings of $5.57 per trip for riders and $2.63 per trip for drivers

While the three county programs share a software platform (custom-designed for the project by the vendor), the ridesharing effort has been managed somewhat differently in each county. The programs have used different outreach approaches; targeted different "affinity groups" (for example, employers/businesses or colleges and universities); contracted with different parties to provide support for program deployment and delivery; and, at times, offered different incentives to participants (to recruit participants, the programs have offered incentives to both drivers and riders and also have relied on payments from riders to drivers).

Lessons Learned

This evaluation demonstrates that dynamic rideshare, while still limited in its application, has a place in the TDM toolbox; unlike most TDM programs which rely on self-reported data, this type of program generates robust data that track use in detail. Our evaluation suggests that there are a number of challenges and obstacles to overcome before the technology can live up to its promise; the smartphone app had a number of bugs and was confusing to use, and the service did not develop the critical mass necessary for potential users to feel confident that they would find a ride home. Recommendations for building on the achievements of the project, but also on lessons learned, are provided below.

Recommendations for MTC in expanding the project or for other agencies considering implementation of a similar project

- **Ensure that the technology is sufficiently developed before deployment:** Arguably, the dynamic rideshare app was not ready for full-scale deployment when it was launched. Similar projects being

considered elsewhere would benefit from a more careful and critical initial examination of the app technology.

- **Consider geographic and demographic trade-offs in program service:** It is an open question whether dynamic rideshare works better in an urban or suburban/rural environment, and for populations that are more transit-dependent. These questions deserve closer scrutiny before dynamic rideshare is expanded across the Bay Area or replicated in another locality.
- **Offer less-resource-intensive forms of technical support:** The technical-support burden for the project app has been significant. The project team should develop less-resource-intensive tools and forms of technical support such as FAQs, community boards and discussion forums for members, and tutorial videos.
- **Rely on non-traditional and viral marketing to spread the word:** In terms of marketing and outreach, the programs should emphasize strategies that combine a personalized approach with a broader reach. These include enlisting "ambassadors" at key employers and other institutions who could expand the reach of program staff, and posts and targeted ads on Facebook and other social media.
- **Continue to target the project at affinity groups:** The county programs have focused their efforts on "affinity groups" such as employees at the same work site or students at the same university. Affinity groups address safety concerns and increase people's comfort in sharing a ride by creating a higher degree of familiarity and trust. This approach should be continued.

- **Promote the availability of guaranteed rides home:** Concern about the availability of a return ride is a key barrier to dynamic ridesharing. Promoting "Guaranteed Ride Home" programs would address this concern by giving participants confidence that they could get back home in the event that they cannot find a ride through the app.
- **Determine the appropriate role for the public sector:** Since Carma was first conceived, there has been an explosive growth in private sector transportation solutions. To the extent that a public agency decides to support dynamic rideshare in the future, it should determine if public funds are needed to advance the technology.

eFleet: Car Sharing Electrified

City CarShare

City CarShare (CCS) procured and deployed a total of 16 plug-in electric vehicles (PEVs) in their fleet, including five battery electric vehicles (BEVs) and 11 plug-in hybrid electric vehicles (PHEVs). The CCS eFleet project was designed to help address and mitigate barriers that prevent the adoption of electric vehicles in the Bay Area. Such barriers include a lack of driver familiarity with the technology; "range anxiety" (distance and duration one can travel due to a lack of widely implemented and available charging infrastructure); and the high expense for relatively "standard" appointed vehicles.

The deployment of these vehicles and supporting infrastructure was complemented by a public outreach and awareness campaign to existing and new CCS members and to the community at-large to promote electric vehicles and car sharing. CCS also promoted the vehicles by charging a lower rate to motivate utilization.

PROJECT HIGHLIGHTS

Project category: **Innovative Grant**

Project costs: **$847,090**

VMT Reduction: **None**

GHG Emission Reduction: **0.9 tons/yr**

Cost Effectiveness: **$100,745/ton**

Criteria Pollutant Emission Reductions:

ROG: 0.8-14.4 lbs/yr
NOx: 1.5-10.1 lbs/yr
PM2.5: 0.8 lbs/yr

Lessons Learned

Recommendations for Car Sharing Organizations

- **Increase driver education and awareness on vehicle charging:** It appears that many of the vehicle charging failures are due to drivers not following electric vehicle supply equipment (EVSE) instructions properly, rather than forgetting to plug-in the vehicle. Although CCS has provided instructions on how to use PEVs and EVSE on their website, they may not be read or used as often as they should be. The following ideas may help to alleviate this problem:
  - Update the user interface design of the reservation portal so that drivers must watch a short instructional video on EVSE equipment prior to finalizing their first PEV reservation.
  - Improve visibility of EVSE charging instructions in the door side pocket of the vehicle, or post instructions on the EVSE unit.
- **Implement a fee or penalty for drivers who do not plug-in PHEVs:** CCS PHEVs were often not properly charged, even several months into the program after the education and outreach campaign had been launched. A fee would serve as the "stick" to education's "carrot."
- **Focus on purchasing PHEVs:** Given the low reservation rate of BEVs compared to other vehicles, including PHEVs, it appears that CCS should focus its efforts on PHEV deployment rather than BEVs, provided that CCS can ensure consistent charging of the vehicles. The low BEV reservation rates make it very difficult to recoup the upfront investment made in BEVs, which are generally more

expensive than PHEVs. If CCS's efforts to improve the charging of PHEVs (as described in the first two bullets) are successful, it will only justify further a focus on PHEVs.

Recommendations for Regional Planning Organizations

- **Tie funding to performance of existing vehicles:** Funds for fleets like CCS's should be phased in to ensure that they are maximizing their existing PEVs before purchasing additional vehicles. As it stands, there is little incentive to ensure that these vehicles are achieving their maximum GHG reduction potential. Although the improved charging will do more to improve the cost effectiveness of this strategy (by increasing the utilization factor in the cost effectiveness metric), it is also important to find cost reductions. The focus on PHEV deployment, for instance, will help on the vehicle cost side. However, the program operations costs accounted for as much as 35-40% of the overall cost. The other costs – fuel and charging equipment, marketing and outreach, and administration and evaluation – collectively accounted for less than program operations. CCS should be able to demonstrate operational cost reductions if future funding is tied to performance of existing vehicle deployments – as measured by cost, GHG reductions, and cost effectiveness.

Enhanced Automatic Vehicle Locator System

City of Santa Rosa

The City of Santa Rosa deployed an Automated Vehicle Locator (AVL) system within the Santa Rosa CityBus fleet to increase ridership and improve system management. The AVL system tracks the location and ridership of all buses and provides data both to passengers and CityBus staff. Riders can access real-time arrival information provided by the system in a variety of different ways including a website, an iPhone app, a call-in service, and signs at bus stops. Staff can use the system data to streamline reporting and to strategically identify ways to improve the performance and effectiveness of service. The AVL system is intended to reduce emissions by attracting more riders with better information and, eventually, more routes that are regularly on time and better fit the system's ridership patterns. The project also included several customer-facing elements designed to give customers better information about bus headways, including:

- On-board destination signs and stop enunciators
- A My CityBus website and iPhone app with maps showing the current locations and estimated arrival times of buses
- An automated service that provides real-time information to riders who call or send a text message with their stop number
- "Push" technologies that allow customers to receive alerts for the specific routes or stops and their typical departure time via their preferred mode of communication
- Real Time signage and information kiosks at destinations including major senior centers, secondary shopping centers, all secondary transit hubs, and major employment centers
- Integration of real-time data collected by the AVL system with 511.org, MTC's regional traveler information site.

These services are designed to make transit more attractive to riders by providing better information in a variety of formats.

PROJECT HIGHLIGHTS

Project category: **Innovative Grant**

Project costs: **$1,483,015**

VMT Reduction: **No measurable impact***

GHG Emission Reduction: **No measurable impact***

Cost Effectiveness: **Not applicable**

Criteria Pollutant Emission Reductions: **No measurable impact***

Improved service planning and customer service: **4% increase in on-time performance.**

* A very small portion of riders surveyed reported using the AVL system, and overall ridership declined during the period over which the AVL system was deployed.

Lessons Learned

The evaluation found no measurable reductions in VMT or GHG emissions due to the AVL system. A small portion of riders surveyed reported using the system – 12 percent reported using the real-time arrival information on the AVL website or app, and 20 percent of riders reported checking the

information kiosks at bus shelters for information on arrival times – but there was no discernible increase in ridership among those respondents. However, there were confounding factors that made it difficult to identify ridership benefits; during the same time the AVL system was deployed, ridership declined substantially due to increased fares, service reductions, and a change to the transfer policy. Despite the challenges in assessing ridership impacts, the evaluation suggests that promoting awareness of real-time travel information is crucial to maximizing the benefits of AVL systems. It also implies that AVL systems may have more potential to increase ridership and reduce GHG emissions over the long term due to better, more efficient service than by attracting new riders with real-time transit information in the short term. Recommendations for transit operators and regional transportation agencies are provided below.

Recommendations for transit operators

- **Promote awareness of real-time arrival information:** Transit agencies with AVL systems should implement outreach campaigns to promote the apps, websites, information kiosks, and other tools that provide real-time information on bus arrivals when deploying an AVL system.
- **Collect data on the usage of information sources and ongoing costs of the AVL system:** This information is crucial to understanding how to increase system ridership in the long term. Data on usage of smartphone apps is particularly important, since a substantial share of customers access information via apps. This may require collaboration with contractors who install AVL systems to collect data.

Recommendations for regional transportation agencies

- **Consider creating a regional information source for real-time travel information, such as the 511 Real Time Transit system:** As more transit agencies in the Bay Area adopt AVL systems, regional agencies can also play a role in promoting awareness of real-time travel information by creating a regional website that displays such information from multiple agencies in an interactive, easy-to-use format. This will better enable riders to time transfers between different systems using real-time data and help promote awareness of real-time travel information. In the Bay Area, the 511 Real Time Transit system serves this purpose; it is available at 511.org.
- **Work with agencies that have implemented AVL systems to identify and promote best practices to improve service:** AVL systems can provide much richer data than the information that transit agencies traditionally use, and regional agencies can maximize their service planning efforts by promoting best practices from the growing number of agencies in the Bay Area that have implemented these systems.

Experience Electric – The Better Ride

Metropolitan Transportation Commission

MTC, the Bay Area Air Quality Management District, and the EV Strategic Council partnered to develop the Experience Electric – The Better Ride ride-and-drive campaign. The Center for Sustainable Energy implemented the campaign, with support from Charge Across Town and Plug-In America. This campaign sought to build awareness and demand for plug-in electric vehicles through EV ride-and-drive events. The cost of the initial campaign was $925,000, which funded both the creation and implementation of the campaign. The campaign consisted of the following main elements:

- **Ride-and-Drive Events**: Twenty-one events were held in eight of the nine Bay Area counties. At the free events, members of the public were able to test drive battery electric and plug-in hybrid electric vehicles in a casual environment, free from sales pressure. Experts were also available at the events to educate, inform, and answer participants' questions about available models, home charging, rebates, tax incentives, and related EV topics.
- **Message amplification**: Photographs and testimonials from the ride-and-drive events were distributed to a larger network of people through social media (e.g., Facebook, Twitter), cross-promotion, and paid and earned media.

PROJECT HIGHLIGHTS

Project category: **Other Project**

Project costs: **$845,000**

VMT Reduction: **Not applicable**

GHG Emission Reduction: **Not quantified**

Cost Effectiveness: **Not applicable**

Criteria Pollutant Emission Reductions: **Not quantified**

Impact on EV purchasing: **11% of participants later purchased EVs; three quarters of those stated that the event influenced their decision to purchase/lease an EV**

Lessons Learned

- **Effective advertising:** Given the limited funds available for the marketing component of the campaign, most participants who attended the ride-and-drive events found out about them from work, friends and family, newspaper articles, and social media. Experience Electric had a lot of walk-ins as well, since most ride and drive events were part of an existing community event. Participants were informed of and wanted to participate in the test drives because they saw a sign or information posted at an event.
- **Barriers to EV ownership:** Despite viewing electric vehicles as outperforming similar gas-powered vehicles on most of the performance criteria tested, most participants also perceived one or more barriers to owning an EV. Overall, difficulty finding a charging station on the road (62% big or medium barrier) and limited driving range (62%) were the most widely perceived barriers to owning an electric vehicle.

- **Short term v. long term impacts:** While the event did have long lasting positive impacts on perceptions of operating costs, the fun of owning an EV, and the availability of tax rebates, there were some lingering questions about EV ownership. In the short term, the experience of attending a ride-and-drive event mitigated the concerns of some regarding potential barriers to owning an electric vehicle. However, in later follow-up surveys, participants viewed the limited range as an even larger barrier than before their test drive.
- **Participants share their experiences:** In the several months subsequent to the ride-and-drive event, the vast majority of participants had spoken with family or associates about electric vehicles (85%), indicating that ride-and drive campaigns are effective messaging tools.

goBerkeley

City of Berkeley

The City of Berkeley implemented a suite of transportation projects and policies to better manage parking and travel demand in central and south Berkeley. The City of Berkeley Department of Public Works, Transportation Division led the project. The City's partners on the project were AC Transit, City CarShare, TransForm, and business associations for the three affected neighborhoods.

The project was originally known as the Berkeley Transportation Action Plan, or B-TAP, but was subsequently rebranded as goBerkeley. It consisted of several distinct yet complementary elements:

- **Demand-based parking management**: The project established time limits on parking and adjusted parking rates in three pilot areas to achieve parking occupancy rates of 65-85% per block (for on-street parking) and at City-controlled lots and garages. The pilot areas were: downtown Berkeley; the Southside/Telegraph commercial district (along Telegraph Avenue, immediately south of the UC Berkeley campus); and the Elmwood commercial district (centered around College and Ashby Avenues).
- **Enhanced parking enforcement**: Managed spillover parking into neighborhoods adjacent to the project areas due to parking pricing.
- **Discounted AC Transit passes**: The project included free AC Transit passes and tailored marketing of travel demand management (TDM) strategies for area employees. Residents of transit-oriented developments (TODs) in the project area received subsidized AC Transit passes.
- **Car-share pods and vehicles (including accommodations for plug-in hybrid or fully electric vehicles)**: The project established new car-share pods in the Southside and Elmwood commercial districts and provided discounted car-share memberships for area employees and residents.

PROJECT HIGHLIGHTS

Project category: **Innovative Grant**

Project costs: **$3,100,000**

VMT Reduction: **918,000 miles**

GHG Emission Reduction: **317 tons/yr**

Cost Effectiveness: **$9,792/ton**

Criteria Pollutant Emission Reductions:
ROG: 169 lbs/yr
NOx: 356 lbs/yr
PM 2.5: 41 lbs/yr

Demand-responsive parking management: **Percentage of surveyed drivers who found it "very easy" to find a parking space increased from 2% to 38%; percentage who found it "very" or "somewhat difficult" fell from 63% to 22%**

Employee-oriented TDM strategies: **494 employees registered for bus passes, generating 6,000–7,000 monthly transit trips; 82% used transit more as a result of the pass**

Lessons Learned

- **Effective outreach and support from city leadership contribute to success:** Berkeley's demand-responsive parking pilot program was highly successful. In November 2014, the City's Transportation Commission voted unanimously to not only support continuation of the pilot but also to expand demand-responsive parking to all metered-parking areas of the city.

Part of this success is due to the extensive outreach by city staff including community meetings, signage, frequent update to the City Council, and involvement of the business associations for the three affected neighborhoods.

- **Couple parking management with automated data collection:** Instituting demand-responsive parking management requires a significant upfront commitment of money, time, and staff resources. More importantly, parking management requires extensive and regular collection and analysis of occupancy data in order to track and respond to changes in demand. As an affordable solution, the City of Berkeley has tested two technology systems that detect and read license plates automatically through vehicle-mounted cameras. The systems tested by the City have proven to be accurate, and City staff believes using the automated system would reduce the costs of parking data collection while improving on-street parking enforcement.

- **Use more highly targeted employee TDM strategies:** Despite the significant financial incentives for employers and intensive marketing efforts, the goBerkeley carshare component enrolled only ten new businesses. Business use of car sharing did rise somewhat over the program period and non-business members benefitted from the addition of vehicles; however, these are very limited benefits that came at a substantial monetary cost. In hindsight, providing incentives for other modes—namely BART, for employees who commute long distances, and biking, for those with short commutes—were missed opportunities.

- **Make it easier to enroll in the free bus pass program:** Employers and employees expressed frustrations related to enrollment in the program. Some of the reasons given for not using the free passes were: filling out the enrollment paperwork was cumbersome; it was not clear how to enroll after the in-person enrollment period had ended; and language barriers or lack of access to a computer made it difficult to submit enrollment forms. The benefits of an employee transit pass program could be substantial, but enrollment and participation should be as easy and convenient as possible.

- **Improve buy-in of property managers to support Travel Choice:** The impact of the goBerkeley TravelChoice program depended on the level of involvement of property managers, largely because they function as the "gatekeepers" to a building's residents. In general, the greater the buy-in of the property manager, the higher the participation rate of residents in the program. Such personalized attention from property managers was the most effective outreach method. This individualized attention combined with the free bus passes increased mobility options, allowing residents to better capture the value of living in transit-oriented developments.

Green Ways to School

Transportation Authority of Marin

The Transportation Authority of Marin (TAM) and its partners provided resources and technical assistance to help teachers educate students about transportation choices. TAM partnered with schools throughout Marin County to implement the program.

The Green Ways to School program provided marketing and public outreach using different tools in order to shift parents and students to alternative modes of transportation. The project used existing and new technologies to better connect with the program's target audience in order to monitor travel behavior and provide incentives for behavior change.

The Green Ways to School program included the following programs:

- **SchoolPool:** The online Marin-based SchoolPool program enables parents to seek or offer transport to and from school. SchoolPool options include carpooling, walk pools ("walking school buses"), bike pools ("bike trains"), and arranging bus buddies for school buses or public transit.
- **Trip-Tracking Capability:** The Green Ways to School program used the Active4.me's web-based trip tracking program, allowing school staff to scan students as they arrived. This allowed school staff to keep detailed records of walking and biking activity.
- **Green Teams**: Green Teams were responsible for coordinating Green Ways to School events. Green Team events included an International Walk to School Day event, a performance of the SRTS GO Green Play, participation in Spare the Air Youth teen summit, and meetings with SRTS Coordinators and teachers to map out typical routes to/from school and identify safety concerns.
- **Marketing Technology Tools**: TAM used a number of tools to promote the Green Ways to School program: contents for a media kit, social marketing strategies, and a schedule for implementation; a SRTS Facebook site to promote events and general information regarding Safe Routes to School; a blog for Marin Patch online forum to promote the Green Ways to School program; and an expanded e-newsletter.
- **School-Site Organizing Tools:** TAM created four educational guides as part of the Green Ways to School program, which can be found online on Marin's Safe Routes to School website.

PROJECT HIGHLIGHTS

Project category: **SRTS Creative Grant**

Project costs: **$427,046**

VMT Reduction: **212,000 miles**

GHG Emission Reduction: **62 tons/yr**

Cost Effectiveness: **$6,888/ton**

Criteria Pollutant Emission Reductions:
ROG: 17 lbs/yr
NOx: 61 lbs/yr
PM2.5: 7 lbs /yr

Active Transportation: **Walking to school increased by 5%**

Decrease in Household Transportation Costs: **$26/student at participating schools**

Lessons Learned

- **Establish more Green Teams at middle and high schools:** Green activities have been highly productive in promoting green transportation in middle and high schools; however, they were present in only a small percentage of the schools that participated in the overall program.

- **Implement trip tracking programs to maximize the visibility and impacts of the program and accurately track data:** The addition of trip tracking tools to classroom educational programs can help increase engagement. Students enjoyed electronically tracking their behavior.
- **Use programs to increase interaction among families:** SchoolPool provides an excellent opportunity to develop institutionalized programs to foster everyday walking and biking at the neighborhood level. This tended to create long term relationships among families.
- **Conduct on-the-ground organizing in addition to web-based tools:** On-site, in-person organizing tools are much more effective than web-based tools. Parents tend to prefer word-of-mouth (where they know the people involved) over anonymous web site tools.
- **Organize contests as an effective tool for changing travel behavior:** The schools organized contests within and between schools, challenging students to walk or bike to school. These contests were effective because they had a visible presence in each classroom and stimulated friendly competition.
- **Create an overall school culture that supports walking and biking:** Green Ways to School fostered cooperation within each classroom, creating a culture for walking and biking within each school.

Local Government EV Fleet

Alameda County and Bay Area Climate Collaborative

Alameda County, Bay Area Climate Collaborative, and government agency partners deployed nearly 90 electric vehicles (EVs) and 90 Level 2 chargers (EVSE) to ten Bay Area local government agencies:

- Alameda County (26 EVs)
- Concord (10 EVs)
- Fremont (2 EVs)
- Marin Municipal Water District (MMWD) (1 EV)
- Oakland (3 EVs)
- San Francisco (14 EVs)
- San Jose (3 EVs)
- Santa Rosa (4 EVs)
- Sonoma County (22 EVs)
- Sonoma County Water Agency (SCWA) (5 EVs)

PROJECT HIGHLIGHTS

Project category: **Innovative Grant**

Project costs: **$2,879,694**

VMT Reduction: **None**

GHG Emission Reduction: **172 tons/yr**

Cost Effectiveness: **$1,679/ton**

Criteria Pollutant Emission Reductions:

ROG: 18-146 lbs/yr
NOx: 42-122 lbs/yr
PM2.5: 17 lbs/yr

The deployment of EVs in government fleets showcased the potential for clean vehicles and reducing a fleet's vehicle-related emissions. Placing EVs in a government fleet setting offered the opportunity to collect operating data in a closely monitored setting. Note that this project was just beginning to deploy vehicles at the time of the evaluation, and some of the local government participants had not yet installed all their chargers; the project is expected to produce significantly larger GHG reductions once fully implemented.

Lessons Learned

Local government agencies should identify ways to improve the cost effectiveness of EV deployment. Recommendations for maximizing the utilization of EVs in a government fleet are provided below.

Recommendations for local agencies

- **Manage EV deployment to maximize use:** Make sure EVs are placed in the locations or fleet applications that maximize their use and draw drivers away from gasoline vehicles.
- **Collect detailed trip, fueling, and charging data for all fleet vehicles:** Track vehicle usage to pinpoint vehicle or driver issues and to help identify ways to increase EV usage.

- **Educate drivers on proper EV use and charging:** Familiarize new drivers with the EVs to encourage use in place of gasoline vehicles. Education, especially during the initial deployment period, can increase proper use of the vehicles and charging equipment.

Regional Safe Routes to School

Congestion Management Agencies (CMAs)

Through the Climate Initiatives Program, MTC provided Regional SRTS funding to all nine county CMAs, which have discretion about how to implement activities in their respective jurisdictions. Safe Routes to School is a nationally-recognized program established in 2005 to empower communities to make walking and biking to school a safe and routine activity. The San Francisco Bay Area has some of the longest-running Safe Routes to School programs in the country.

SRTS activities vary from county to county and school to school, but often include many of the following elements:

- Education – family biking workshops, parent outreach, suggested route maps, bike safety lessons, assemblies, bike rodeos, in-class lessons
- Encouragement – school pools, bike trains, walking school buses, friendly competitions, promotional contests, walk and bike to school day
- Enforcement – letters to parents, police enforcement during drop-off/pick-up times, safety campaigns
- Infrastructure – bike parking, drop-off/pick-up infrastructure improvements, sidewalk improvements, crosswalk improvements, bikeway improvements

PROJECT HIGHLIGHTS

Project category: **Other Program**

Project costs: **$10,801,000**

VMT Reduction: **373,000 miles** (in the five counties that had sufficient data)

GHG Emission Reduction: **210 tons/yr** (in the five counties that had sufficient data)

Cost Effectiveness: **$17,124/ton**

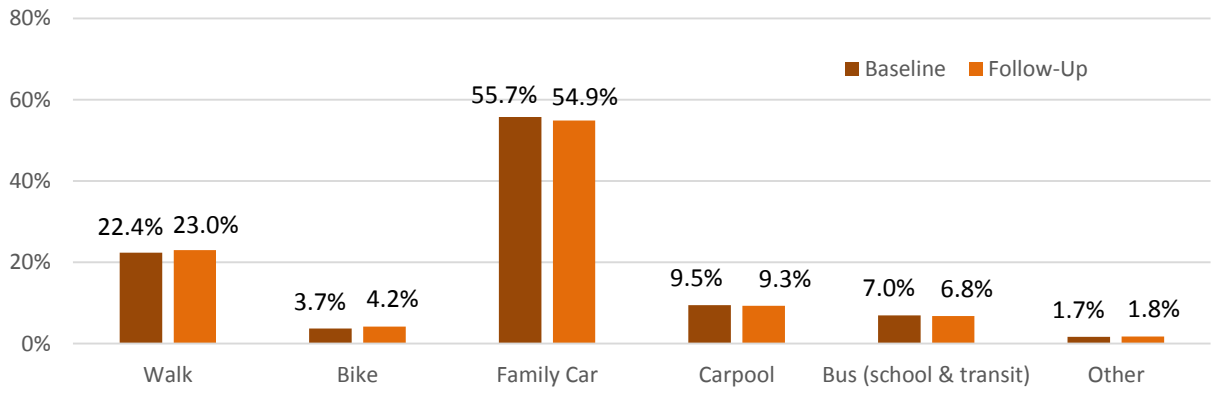
Criteria Pollutant Emission Reductions:

ROG: 602 lbs/yr
NOx: 562 lbs/yr
PM2.5: 22 lbs/yr

Active Transportation: **Students involved with Regional SRTS programs walked 200,000 miles and biked 150,000 miles more than they did before the program.**

Lessons Learned

MTC's Regional Safe Routes to Schools programs increased walking and biking to school and reduced VMT. The figure below shows travel mode share before and after the program for all reporting schools.



Because trips to and from school are relatively short in length, the VMT and GHG reduction benefits of SRTS programs are modest. SRTS provides significant co-benefits through increased physical activity for youth.

The largest reductions in driving come from counties new to the program.

- Marin and Alameda Counties, which have each been involved in Safe Routes to School programs for most of the past decade, showed lower mode shifts than counties newer to the program, such as San Mateo and Sonoma.
- Counties with lower baseline levels of active and shared travel modes experienced larger shifts to these modes. Counties with the highest baseline active mode shares (Alameda and Santa Clara) experienced more moderate increases in active travel modes.
- Experience with SRTS programs indicates that the greatest shifts occur in schools with high parent volunteerism and teacher/staff involvement. These are the schools which often take advantage of SRTS resources as soon as they become available. But counties that have been part of the program for some time already made changes at these schools that were especially receptive to the program.

Safe Routes to School programs run at the countywide level resulted in greater mode shift than programs run at the sub-regional or city level.

- Alameda, Marin, San Francisco, San Mateo, Solano, and Sonoma Counties all operate SRTS programming at the countywide level, and all counties experienced increases in walking and biking.
- Contra Costa and Santa Clara Counties both allocate funding to three sub-regional programs, and experienced more limited increases in walking and biking. Such programs that are sub-allocated within the county may lack the coordination benefits and resources of a countywide program, limiting effectiveness.

Recommendations for future evaluations

- **Continue collecting student travel mode data**: Collect mode split data primarily through twice-yearly student hand tallies, preferably near the beginning and end of each school year.
- **Continue assessing transportation options**: Survey parents about their perceptions of transportation options but do so every three years, rather than annually, to maximize participation.
- **Make sure activity data collection is consistent between schools**: Consistently track activity participation at schools around the Bay Area to promote comparisons between programs.
- **Target schools where vehicle miles traveled have increased**: Work directly with schools that have shown increases in family car use to determine outside factors that may be diminishing the impacts of the Safe Routes to School programming.

San Francisco Integrated Public/Private Partnership TDM Program

San Francisco County Transportation Authority

The San Francisco County Transportation Authority (SFCTA) created new public/private partnerships focused on Transportation Demand Management (TDM). This project was a collaboration between SFCTA, the San Francisco Municipal Transportation Agency (SFMTA), the San Francisco Department of the Environment (SFE), and the San Francisco Planning Department (DCP).

PROJECT HIGHLIGHTS

Project category: **Innovative Grant**

Project costs: **$858,000**

VMT Reduction: **13,000/yr**

GHG Emission Reduction: **5 tons/yr**

Cost Effectiveness: **$171,600/ton**

Criteria Pollutant Emission Reductions:

ROG: 1.5 lbs/yr
NOx: 4.8 lbs/yr
PM2.5: 0.6 lbs/yr

Household Transportation Costs: **$0.25 savings per year per SF State student, or $7,455 total**

The TDM program consisted of four separate projects:

- **Shuttle Partners**: This project developed a policy and implementation framework for coordinating and regulating boarding locations for local and regional private shuttle providers in San Francisco. SFMTA designed an agreement whereby the shuttles could use the Muni stops for a fee; SFMTA also requested data sharing and compliance with operating guidelines.
- **Voluntary employer collaborations**: The SFCTA and SFE created three pilot projects involving voluntary collaborations among interested employers:
  - Downtown/Showplace Square Employers: This pilot aimed to create a shared shuttle service across different employers located in the same area.
  - Medical Institutions: This pilot aimed to create a shared ridesharing platform for employees at several medical institutions.
  - Southwest San Francisco: This pilot aimed to promote travel by alternative modes at San Francisco State University and the Park Merced housing development.
- **Employer Parking Management**: SFE led this exploration to provide technical assistance and other support to employers interested in developing a parking cash-out/alternative commute incentives program.
- **Inter-Agency Transportation Demand Management Strategy**: This project reviewed existing policies and programs at the four participating public agencies to establish a coordinated policy framework and identify steps to implement the framework.

Lessons Learned

Recommendations for local agencies seeking to replicate employer-focused TDM programs

- **For voluntary programs, focus on employers or institutions that have an internal champion:** The voluntary initiatives that were most successful were those in which there was an individual within the private sector or institutional entity that was responsible for seeing the project through from start to finish.
- **Improve business outreach and marketing techniques for voluntary programs, and consider offering competitive grants as incentives for private partners:** Voluntary initiatives were the most successful when the project addressed the needs and interests of the private sector partner. Public agencies should provide more persuasive arguments to gain the buy-in of private partners by emphasizing the possible financial and recruitment benefits. Providing competitive grants to employers may be a way to help identify those who are most interested in making changes and need support to do so.
- **Use existing collaboration structures where possible:** Working with groups of employers can be more successful in the future if there is an existing structure for collaboration in place, such as a Business Improvement District. Collaborations among employers with weakly aligned interests, or without a pre-existing forum for coordination, are less likely to be successful.
- **Consider, account for, and communicate possible business risks to outreach targets:** Where existing stakeholders perceived that they had anything to lose, resistance to change was particularly high. Identifying and mitigating perceived threats to existing stakeholders early in the process would increase the chances of success.
- **Carefully consider the administrative requirements for implementation, and budget time and resources accordingly:** Contracting, liability, and insurance requirements for implementing TDM programs can be prohibitive for both public and private agencies. This is particularly the case for programs that involve sharing transportation services between companies or institutions.
- **Define specific criteria to guide future TDM efforts:** As public agencies continue to learn what kinds of efforts are most impactful, criteria will be needed that can be used to screen for potential opportunities up front. The Inter-Agency TDM Strategy aims to provide this kind of structure for evaluating future TDM opportunities in San Francisco.

Recommendations for regional agencies

- **Consider providing technical assistance for TDM project design and delivery through use of pre-qualified consultants' services.** Employing the services of on-call consultants who are pre-approved by an agency such as MTC could speed up project delivery. Some local agencies spent considerable resources lining up consultants to execute their projects; if they had been able to employ the services of on-call consultants/experts who were pre-approved by an agency such as MTC, the process could have moved forward both faster and more efficiently.

Shore Power

Port of Oakland

The Port of Oakland installed shore power technology infrastructure at two of its berths. This technology allows ships to turn off their auxiliary diesel engines and plug into the electrical grid while loading or unloading cargo, thus reducing emissions and local air pollution. Shore power has been promoted in California primarily as a strategy to reduce emissions from port activity and thereby improve air quality in surrounding neighborhoods.

The shore power design for Berths 30 and 32 was completed in 2011 with construction starting in March of 2012. Construction was completed by mid-2013, followed by testing and commissioning (a quality assurance process to make sure the system runs as planned) by the Port. Ships that plan to call at the Port of Oakland and intend to plug into shore power at these berths must also be commissioned by the Port prior to plugging into the shore power system. The shore power system was on-line and fully operational by the end of 2013.

PROJECT HIGHLIGHTS

Project category: **Innovative Grant**

Project costs: **$9,070,000**

VMT Reduction: **Not applicable**

GHG Emission Reduction: **534 tons/yr**

Cost Effectiveness: **$849/ton**

Criteria Pollutant Emission Reductions:

ROG: N/A
NOx: 35,000 lbs/yr
PM2.5: 1,040 lbs/yr

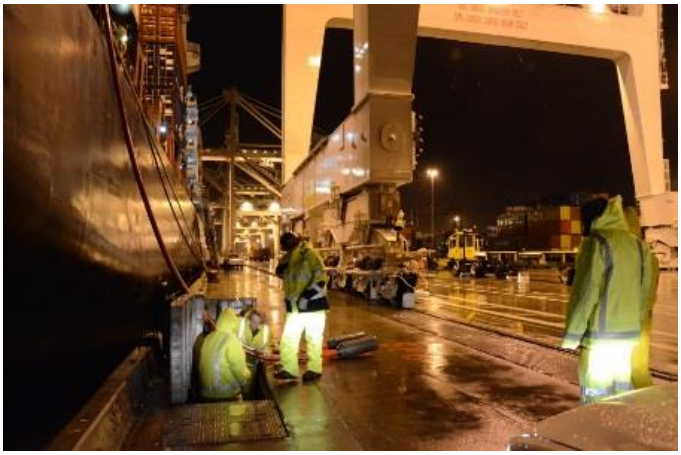
The project is part of a larger effort at the Port of Oakland to electrify the 8 marine terminals and 18 international berths that comprise the marine component of the Port's intermodal system.

Shore power is highly effective at reducing emissions that contribute to local and regional air pollution. Ships at the Port of Oakland are a large contributor to particulate matter, particularly in West Oakland, and particulate matter has been linked to health impacts such as aggravated asthma, chronic bronchitis, heart attacks, and elevated cancer levels. Compared to typical (pre-shore power) operation, shore power eliminates more than 99% of NOx and PM emissions from a ship at berth. Shore power reduces CO2 emissions by 55% compared to the baseline case.

Lessons Learned

Although the lessons learned from this project are not highly transferable to other ports in the Bay Area due to differences in capacity and use, the results may be applicable to other large container ports throughout the United States.

- **Coordinate between shipping lines and ports/landside construction**: Make sure there is frequent and detailed coordination and technical interface between shipping lines and ports/landside construction. Minor changes in the system design and location can lead to incompatibilities between various ports and vessels. While some of this should be alleviated due to the new international standard for shore power land-side and vessel-side infrastructure, there is still the potential for minor variations in design, which may cause connection issues.



- **Additional shore power grants not needed:** Additional grants to the Port of Oakland for shore power infrastructure are likely not needed because shore power is already required under state regulations.
- **MTC role in funding emission reductions at major transportation terminals and freight hubs**: This project demonstrates a successful outcome for a recipient that is often not engaged in MTC grant programs. Although additional grants for port shore power are not warranted at this point, MTC should look for other opportunities to fund emission reduction projects at ports, airports, and other similar concentrated sources of emissions.

Smart Driving Pilot Program

Metropolitan Transportation Commission

"Smart driving" refers to a set of strategies and techniques that maximize motor vehicle fuel efficiency by improving driving habits and vehicle maintenance. MTC, with assistance from ICF International and UC Davis, conducted two pilot studies to evaluate the impacts of real-time driving in-vehicle devices, smartphone apps, and educational elements on driver behavior and fuel economy. The pilot programs tested the ability of the following strategies to improve fuel efficiency:

- **In-Vehicle Device**: ICF International led the first pilot that included an in-vehicle device called the Ecometer, a fuel consumption gauge that helps drivers visually monitor how their driving style impacts their vehicle's fuel consumption. Driver feedback is provided from two sources: a digital readout of instantaneous fuel economy and an "ecograph" – a display of green, yellow, and red lights that moves in a circular patterns to display fuel economy.
- **Smart driving lessons**: The ICF-led pilot also included six smart driving video lessons that were delivered to all participants in the pilot study via email. After a week, participants were prompted to answer a question about the video lesson on a private Facebook page for pilot participants.
- **Smartphone app**: UC Davis tested four app variations also with the goal of helping drivers visually monitor how their driving style impacts their vehicle's fuel consumption. The app variations included: trip MPG; driver rank (compared to others using the app); driver rank plus trip cost; and driver rank plus trip CO_2 emissions.

PROJECT HIGHLIGHTS

Project category: **Other Program**

Project costs: **$400,000**

VMT Reduction: **Not applicable**

GHG Emission Reduction: **Not quantified**

Cost Effectiveness: **Not quantified**

Improvements in fuel efficiency:
Only smart driving lessons: -2.5%
Ecometer: 1.6%
Smart driving app: 15.5%

Reductions in hard accelerations: **20%**

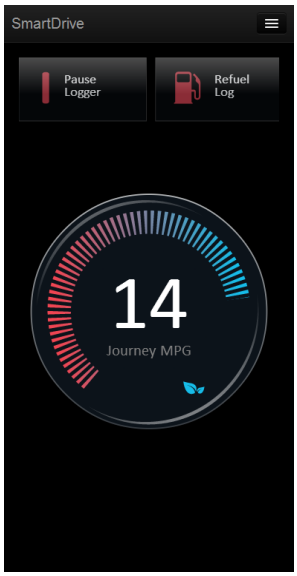
Reduction in high-speed travel: **10%-16%**

Ecometer influence: **Nearly half of respondents indicated that the device had a "strong influence" on driving behavior**

Lessons Learned

- **Devices to measure fuel economy are incompatible with some vehicles:** The programmed device was effective at capturing fuel economy, although it was incompatible with approximately 25% of participating vehicles, resulting in a loss of potentially useful pilot study data.
- **Scheduling and performing device installation and removal is difficult:** The time and effort required to install and remove the smart driving devices was much greater than expected. Many participants were slow to respond to scheduling requests, and those that did respond sometimes failed to appear for scheduled appointments.
- **Identifying candidate participants was relatively easy:** Candidates were eager to sign up for participation in the pilot study when recruiting was done using the 511.org website. However, the

UC Davis study required advertising through Facebook and other online sites to get the sufficient number of participants.



- **Most participants found the Ecometer functional and useful:** Participant comments on the Ecometer were generally quite positive. Asked to rate the Ecometer device on a scale of 1 (poor) to 5 (excellent) in terms of ease of use and quality of the display, the average rating was 4.2. Seven participants reported a noticeable improvement in fuel economy following the installation of the Ecometer.
- **Trip MPG was the most effective phone app screen:** Initial results show that this app type had a statistically discernable (at the 95% confidence level) effect of a 15.5% reduction in fuel consumption, while the other app types tested had no statistically significant findings.
- **Smart driving techniques are quickly learned:** With the phone app, the majority of the improvements occurred in the first 25 trips spent with the app with less significant changes occurring over time.
- **Small sample sizes limit results:** The limited sample size of the pilot makes it difficult to draw robust and statistically significant conclusions. In the future, larger sample sizes should be used.

SRTS Education and Encouragement School Route Maps

Solano Transportation Authority

MTC funded the Solano Transportation Authority to provide high-quality, geographic information systems (GIS) mapping information to students and parents to encourage the use of alternative modes such as biking and walking to schools. The Google and GIS-based mapping tools developed through this project filled a need that was not currently being covered under current SRTS programming. This project also offered an opportunity for collaboration between schools, parents, and the County Department of Public Health to work together to develop safe walking routes. The mapping tools showed the following:

- Suggested safe routes for walking and biking
- Presence of sidewalks, bike infrastructure, and multi-use paths
- Presence of crosswalks, traffic signals, stop signs, and crossing guards
- Access points to school grounds
- 10-minute and 20-minute "zones" for walking to/from school

The project developed 85 electronic maps in total, covering every public elementary, middle, and high school in Solano County. STA supplemented readily available GIS data with:

- "Virtual audits" using Google Streetview to confirm the data and identify challenging areas
- "GPS field audits" to clean and correct data gathered through the virtual audit

PROJECT HIGHLIGHTS

Project category: **SRTS Creative Grant**

Project Costs: **$249,685**

VMT Reduction: **Not quantified**

GHG Emission Reduction: **Not quantified**

Cost Effectiveness: **Not quantified**

Criteria Pollutant Emission Reduction: **Not quantified**

Active Transportation:
Increase in walking mode share: From 20.2% to 21.5%
Increase in biking mode share: From 1.9% to 2.5%
Decrease in family vehicle use: From 60.4% to 59.9%

Lessons Learned

The response rate for the parent surveys was poor, which prevented an accurate assessment of changes in vehicle miles traveled (VMT) and emissions associated with the program. The reasons for the poor response rate appear to be related to changes in program administration staff, limited outreach at many schools, and a general lack of interest in responding to the survey among Solano County households. In the future, we suggest that achieving adequate survey response rates should be required for SRTS-related funding in Solano County.

Recommendations for local agencies

Based on the outcomes of the project, the project team made the following recommendations for future school route mapping efforts:

- **Choose the appropriate data collection tool:** In Solano County many of the cities did not have or use GIS extensively, so the use of Google-based maps was a good alternative. This revision will allow STA staff, Public Health staff, and walking school bus coordinators to modify and keep the online Google mapping tool current, both for suggested routes and walking school bus details.
- **Consider the frequency of updating data:** One of the key advantages of the GIS-based system is the ability to update route information (presence of crossing guards, recommended crosswalks, etc.) based on feedback from users and their own observations. Google Maps and GIS mapping platforms are preferred over static print maps because they allow users to see current conditions.

- **Design maps for replicability:** STA intended the GIS maps and templates to be easily used by other jurisdictions; staff developed technical memoranda outlining how to standardize and replicate the tool for future use in other programs (e.g., MTC's 511 Bike Mapper and SchoolPool programs).
- **Evaluate the availability of information and how to most effectively collect it:** Depending on the location, up-to-date GIS information may not be available. STA depended on input from the Community Task Forces to revise existing map layers.
- **Use maps as an outreach strategy to promote SRTS efforts:** The maps can raise awareness about SRTS programs and events while also encouraging parents to participate in activities such as Walking School Buses. Asking parents to provide feedback and input on the maps can help engage them in the overall SRTS school effort and increase their awareness of programs and services offered by SRTS.
- **Provide initial training as well as follow-up support:** For the GIS portion of the map development, STA's project team provided an easy-to-understand written description that included screen snapshots and other graphics, to instruct map developers on the use of GIS and Network Analyst to develop school route maps. The project team also provided a separate training manual that covered the use, editing, and administration (e.g. data hosting, permissions) of the online Google mapping tool, plus two half-day training workshops for STA staff and other stakeholders regarding the online web mapping application.

Tribal Community Sustainable Transportation Pilot

Kashia Band of Pomo Indians

The Kashia Band of Pomo Indians of Stewarts Point Rancheria deployed four electric vehicles (EVs) and is in the process of installing six Level 2 chargers on tribal lands. The EVs will be used for administrative, social service, and cultural and educational trips in lieu of traditional gasoline-powered vehicles; the charging stations will be used to charge the tribal EVs during the evening and will be open to the public during the day. The project also includes a community outreach component that consists of two workshops to educate the tribal community about the project and its findings.

PROJECT HIGHLIGHTS

Project category: **Innovative Grant**

Project costs: **$409,676**

VMT Reduction: **None**

GHG Emission Reduction: **3 tons/yr**

Cost Effectiveness: **$12,274/ton**

Criteria Pollutant Emission Reductions:

ROG: 0.03-1.7 lbs/yr
NOx: 0.07-1.9 lbs/yr
PM2.5: 0.03 lbs/yr

The Kashia Tribal Office provides transportation services for its tribal members to meet their essential health and human services needs. To provide these services, the agency required vehicles that could comfortably seat four adults and handle travel over hilly terrain and back roads. Prior to this project, the Tribal Office owned or leased only pickup trucks and SUVs. In December 2013, they purchased two all-electric RAV4 EVs and two Ford C-MAX Energi Plug-In Electric Hybrids. Currently, all four vehicles are placed at the Tribal Office in Santa Rosa, but one or two will eventually be placed at Stewarts Point Rancheria once the charging stations are installed.

Lessons Learned

Convenient access to charging stations is essential to realizing the full benefits of electric vehicles. Without accessible charging opportunities, EVs will be underutilized and plug-in hybrids will only be used as standard gasoline-powered hybrids.

Recommendations for maximizing the full benefits of electric vehicles are provided below.

- **Select vehicles based on typical driving patterns:** The Kashia Tribal Office purchased two all-electric vehicles and two plug-in hybrid electric vehicles. Although both types of EVs take advantage of on-board batteries to drive emission-free miles, the selection of electric-only versus plug-in hybrid can have broad implications on benefits and costs. The battery electric vehicles have longer electric ranges than the PHEVs, but the range is less than a hybrid's combined electric and gasoline range. If a vehicle is needed for a mix of short and long trips (current BEVs have ranges of 80-100 miles), a PHEV is probably advised. But, if the vehicle is only going to be used for long trips, it may be more cost effective to acquire a standard hybrid vehicle; when driving beyond the first 20 miles, the plug-in hybrids have the same or slightly lower fuel economy as a standard hybrid.
- **Plan for convenient access to charging stations:** Before acquiring a plug-in vehicle, it is important to confirm there is or will be easy and convenient access to charging equipment at locations where the

vehicle is typically parked. Although this may seem an obvious recommendation, it is easy to overlook the need for convenient charging opportunities when focused on acquiring an EV. As seen in this evaluation of EVs deployed before charging stations were available, EV benefits cannot be fully realized without accessible EVSE. It should be noted that the agency was able to acquire valuable discounts by moving quickly to purchase EVs, improving their value proposition.

- **Educate drivers and monitor use to identify potential improvements:** The deployment of electric vehicles to users unfamiliar with the driving and fueling characteristics of EVs will benefit from EV education. A typical concern expressed by new drivers is the shorter range and more restrictive fueling requirements. However, a review of the trip data may show that such range anxiety is unnecessary. For example, the trip logs from this project show that 50% of the trips taken by the PHEV could have instead been taken in the underutilized all-electric vehicle. Shifting these trips to the BEV would reduce emissions and reduce fuel costs.

5. Recommendations for Future Funding

The Climate Initiatives Program evaluation provides a wealth of information for MTC and its partners as they seek to fund activities that can help achieve the region's GHG reduction goals. Overall, the program demonstrated a number of innovative approaches to reduce transportation GHG emissions while delivering significant co-benefits. Some of these projects are ripe for expansion or replication in other Bay Area locations; others were less successful and offer lessons for improving future projects. This section describes key findings and recommendations for MTC according to major project categories.

Transportation Demand Management Projects

Transportation Demand Management (TDM) projects showed widely different results, from almost no GHG reductions to the highest GHG reductions of any project. These complex and multi-faceted programs require careful consideration to replicate the successful efforts and improve or weed out the less successful ones. Crucial factors in determining success rates of various programs were:

- The level of buy-in of the target audiences
- Convenience and availability of sustainable travel options
- Institutional barriers among employers, such as a lack of an internal advocate for TDM programs

Recommendations

1. Develop methods to identify particular geographic areas that are best candidates for targeted TDM. As exemplified by the employee response in Redwood City, areas with the capacity to add fixed guideway transit service (e.g., more frequent service on existing commuter rail lines) provide large opportunities for behavior change and GHG reductions; first/last mile TDM solutions such as bikeshare pods and vanpool drop offs located at stations and stops improve access to the transit service.
2. Require future grant applicants to include specific project details, including infrastructure, institutional, and outreach components of their proposed TDM project. Awarding grants to vaguely defined or exploratory projects is less likely to result in GHG reductions.
3. Encourage future grant applicants to review and refine elements of the TDM projects funded. Among the four TDM projects (San Francisco Integrated Public/Private TDM Partnership; Dynamic Rideshare; goBerkeley; and Connect, Redwood City!) there were approximately 15 distinct sub-components targeting different audiences and promoting different modes and institutional arrangements. Each of these sub-components provides separate lessons learned about how they could be improved in the future.
4. Continue to invest in evaluation of TDM programs to further highlight what works and what doesn't. "What factors drive behavior change?" is one of the most challenging and important questions in transportation research presently.

Safe Routes to School

The Regional SRTS program produced measurable increases in walking and biking and reductions in VMT in most Bay Area counties. Schools initiating new programs showed greater mode shifts than schools that have had ongoing programs in place for several years. The GHG benefits of the program are modest due to the short length of most school trips. Additionally, SRTS results in significant co-benefits by increasing physical activity for youth.

Recommendations

5. Continue distributing Safe Routes to School funding to counties based on public school enrollment to ensure an equitable distribution of SRTS funds.
6. Consider requiring countywide program implementation to decrease administrative costs and encourage greater collaboration at the county level.
7. Provide technical assistance for data collection and evaluation to ensure consistent and regular data collection. This could include training or assistance for administering hand tallies and parent surveys, as well as developing tools for collecting program activity participation and implementation data.
8. Encourage local jurisdictions to seek outside funding through the Active Transportation Program (ATP) and other grant programs, as well as tax measures and vehicle registration fees, which can provide ongoing funding for Safe Routes to School programming.
9. Incorporate the successes from the Safe Routes to School Creative Grant Program – particularly Green Team components targeting middle and high school students – in the Regional SRTS Program.

Bicycle Projects

The Bike-Sharing Pilot Program generated more than 300,000 bike-share trips in its first year of operation. The project GHG reductions were modest because bicycle trips tend to be short distance, only 10 to 15 percent of bike-share users would otherwise travel by vehicle, and the bicycling emissions benefits are partly offset by new emissions from bikes-hare service trucks. The BikeMobile project also produced modest GHG reductions but was relatively cost effective.

Recommendations

10. Investments in bike-share program expansion should seek to streamline decision-making when multiple jurisdictions are involved.
11. Optimize bike-share station siting for program expansion to maximize usage and emissions benefits.
12. Continue funding for the BikeMobile, while considering opportunities to expand the program to serve other population segments and pursue other funding sources.

Electric Vehicle Projects

Electric vehicle projects can be relatively cost effective at reducing GHG emissions; but if electric vehicles are not well-used or are used incorrectly, they can be among the least effective projects. In order to make investments in EVs and EVSE cost effective, future grant funding must find a way to shift from more miles driven in conventional vehicles to more miles driven in electric vehicles.

The evaluations of the electric vehicle projects highlighted the importance of educating new EV drivers in capturing maximum benefits and cost effectiveness from EVs. Potential drivers may avoid using EVs because they are concerned about the range or are uncomfortable with operating these new types of vehicles. Additionally, most drivers are unfamiliar with charging vehicles and may not use the charging equipment correctly. Outreach and educational efforts such as those implemented in the Experience Electric project can address many of these concerns, improving proper use of the EVs and promoting adoption of the vehicles.

Recommendations

13. Require that grantees install charging infrastructure before vehicles are purchased.
14. Require that grantees create a communication strategy to educate vehicle users about proper use and charging of EVs. Consider expanding promotional activities like Experience Electric to educate potential users of electric vehicles.
15. Ensure that EVs and EVSE are strategically sited to provide best access to the vehicles and charging infrastructure
16. For future grant applicants that already have EV and PHEV fleets, consider how effectively their existing advanced vehicles are already deployed and utilized (e.g., total electric miles driven).
17. Conduct additional events and continue to collect data on their impact. While attributing GHG reductions to these events would be challenging, they do have a positive impact on penetration of PEVS in the Bay Area market.

Cold in Place Recycling

The Cold in Place Recycling (CIR) project was highly successful in terms of GHG reductions, and especially in terms of cost effectiveness. This was the only project in which public agencies actually *saved* money by implementing an innovative strategy in place of the conventional method. However, it should be noted that CIR projects cannot be used to help California regions meet their SB 375 GHG emission targets since the reductions are not from light duty vehicles.

Recommendations

18. Continue to promote CIR as a viable, cost effective, and eco-friendly technique for roadway rehabilitation. A CIR campaign could be linked with a broader pavement preservation campaign.

19. Consider whether the availability of CIR equipment in the Bay Area is adequate to meet the existing and potential demand for CIR. If the supply of equipment is constrained, consider public funding of the equipment.

Smart Driving Pilot

The Smart Driving Pilot project demonstrated the potential for real-time driving feedback devices to improve fuel economy, but it also illustrated the challenges with obtaining definitive results. The review of previous research found clear evidence that the use of smart driving techniques improves fuel economy and reduces GHG emissions. Thus, a smart driving initiative appears to be promising approach to achieve GHG reductions among Bay Area drivers who are unable or unwilling to shift to less carbon intensive travel modes. Newly developed feedback devices show more promise than some of those tested in the pilot.

Recommendations

20. Continue to fund smart driving activities through an initiative that involves dedicated in-vehicle feedback devices or smartphone apps.

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