

# **Transportation, Land Use and Greenhouse Gases**

## ***A Bay Area Resource Guide***

**Metropolitan Transportation Commission**  
**September 2009**



**METROPOLITAN  
TRANSPORTATION  
COMMISSION**

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This guide was produced in 2009 for the Metropolitan Transportation Commission. The authors, Bruce Riordan and Chris Brittle, compiled this information from interviews and literature review. Staff at the three other San Francisco Bay Area regional agencies — the Bay Area Air Quality Management District (BAAQMD), the Bay Conservation and Development Commission (BCDC) and the Association of Bay Area Governments (ABAG) — provided review and comment. In addition, comments from more than 30 members of the public on the February 2009 draft have been incorporated into this September 2009 version.

This Resource Guide is a *starting point* for the extensive discussions that must take place before climate/transportation policies and programs are determined. The Guide will be modified as we learn more over the next months and years. Please send comments, corrections and suggested additions to this Resource Guide to the Metropolitan Transportation Commission at [info@mtc.ca.gov](mailto:info@mtc.ca.gov).

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## Introduction

Forty percent of the Bay Area’s greenhouse gas emissions (GHGs) — nearly 42 million metric tons a year — come from our cars, trucks, buses, trains, ships and planes. (See charts on page 4). While the Bay Area has begun a serious discussion on ways to reduce transportation GHGs (primarily carbon dioxide, or CO<sub>2</sub>), we need better information to help us understand which strategies will yield the most cost-effective results. In addition, we must develop a clearer understanding of the important roles that each stakeholder — regional agencies, local governments, businesses, community groups and residents — must play if we are to significantly reduce our transportation “carbon footprint.”

The scale of the task ahead is daunting. The chart on page 5 shows the reductions that must be made (both in total and per-capita emissions) for California to reach its climate goals for 2020 and 2050. Since California’s population is expected to grow significantly in this time period, we must strategically focus on transportation strategies that will make a major impact on emissions.

The goal of this guide is to spark discussion and generate new ideas in the Bay Area transportation community. As the title “Resource Guide” implies, we see this report as a *tool* that can be used by transportation planners to better understand the many options available for reducing Bay Area transportation greenhouse gases. We expect that the Metropolitan Transportation Commission (MTC) and other agencies will use the guide as one resource (among many) for identifying the types of transportation strategies that will best help the Bay Area develop a regional approach to climate change.

The guide is a *starting point* for the extensive discussions that must take place before climate/transportation policies and programs are determined. This initial overview clearly shows the need for considerable additional research and analysis over the next few years on a number of issues and strategies. In particular, this compendium illustrates the need for research and analysis on combinations of strategies.

We begin by presenting basic information on 45 potential strategies, divided into five categories:

Part I: Improve Vehicles and Fuels

Part II: Improve Infrastructure

- Travel Options
- Streets and Roads
- Freight

Part III: Focus Growth

Part IV: Shift Transportation Behavior

- Voluntary Actions
- Pricing

Part V: Other Strategies

- Cap and Trade
- In-house emissions reduction
- Adaptation

Each entry provides background on:

- Established projects or initiatives that can serve as models for Bay Area action.
- Suggested potential lead and support roles to define more clearly where each stakeholder can have the greatest impact.
- Web links to in-depth material for each strategy.
- A finding on whether implementation is technically feasible within the next five years. (It is critical to begin reducing emissions now, as we plan for longer-term changes.)

In addition, we have provided some “back of the envelope” analysis to help frame the important, continuing discussion on potential impacts, costs and cost-effectiveness, including:

- A high, medium or low impact rating for reducing Bay Area greenhouse gases by 2020. This rating is based on analysis of the individual strategy, not on combinations of strategies.
- Information on costs associated with one or more elements of a strategy.
- A parallel high, medium or low rating for cost-effectiveness (‘high’ meaning very cost-effective, medium meaning moderately cost-effective, and low meaning very little “bang for the buck”).

This cost-effectiveness rating was especially challenging, as it relies on a series of fairly subjective assumptions. To encourage a lively debate and discussion, we have been as transparent as possible about the assumptions for each strategy or project, hoping that readers will be moved to create their own scenarios for community review. There are many paths to reducing transportation greenhouse gases and we look forward to including your proposals in future editions of this guide.

Finally, here are three key observations on our process.

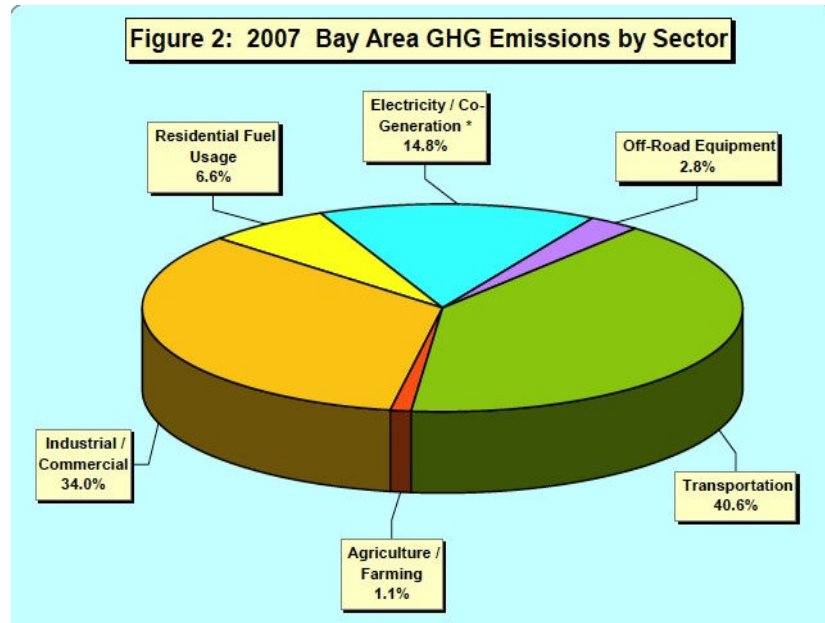
- First, the evaluation focuses solely on reducing carbon dioxide or CO<sub>2</sub> and does not attempt to quantify related benefits, such as reductions in criteria pollutants \*, congestion relief, safety, decreased dependence on foreign oil, etc.
- Second, some strategies were not evaluated for impacts or cost effectiveness because they are very general or there was insufficient information for analysis. These should be the initial focus of additional research.
- Third, it is very likely that some of the impacts described would be greater if strategies were packaged and implemented together. Our initial “back of the envelope” calculations looked at each strategy in isolation. We understand the need for more complex analyses, but they are beyond the scope of this modest report. This is the obvious next step for further Bay Area research into climate and transportation.

Table A (pages 6-11) provides a short summary of the 45 strategies. Table B, at the back of this report (page 112), allows the reader to better understand the relative importance of various transportation market segments for greenhouse gas reductions.

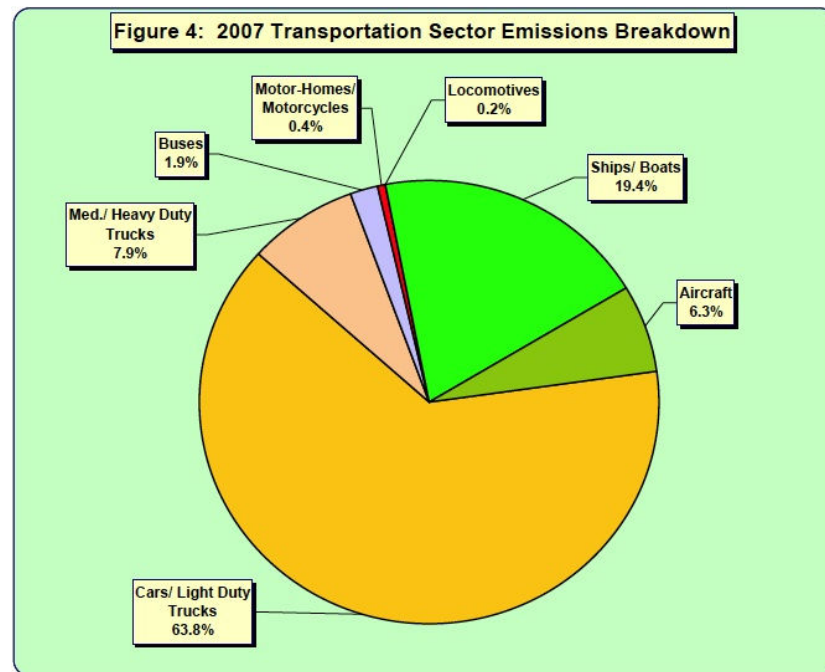
\*Criteria pollutants are commonly found air pollutants regulated by the U.S. Environmental Protection Agency — such as particle pollution, ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead — based on “criteria” for public health and the environment.



# THE CURRENT SNAPSHOT: BAY AREA GREENHOUSE GAS EMISSIONS



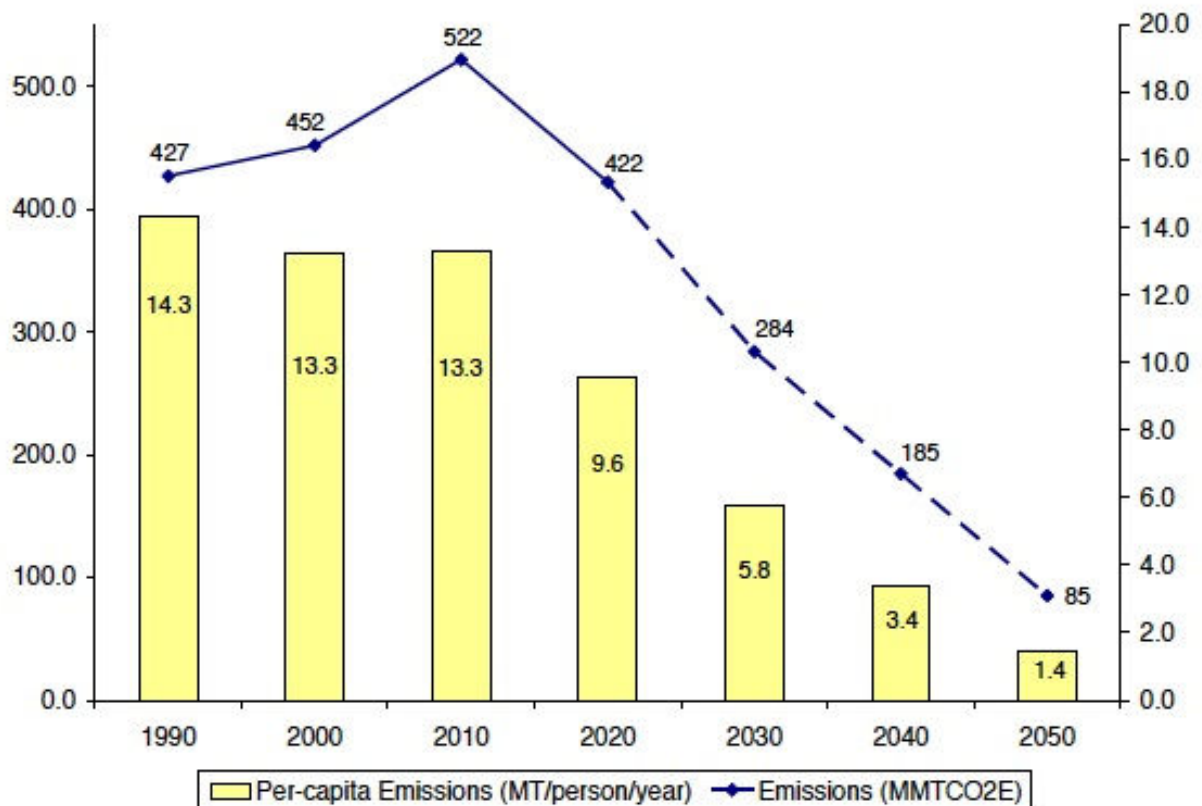
Source: Bay Area Air Quality Management District



Source: Bay Area Air Quality Management District

**NOTES:** Aircraft = emissions within nine-county San Francisco Bay Area  
 Ships/Boats = emissions within 100 miles of coast  
 Emissions for all other categories are for driving within nine-county Bay Area

## THE STATEWIDE TASK AHEAD: MEETING CALIFORNIA'S GREENHOUSE GAS GOALS FOR 2020 AND 2050



Source: California Air Resources Board AB 32 Scoping Plan

**Table A: Strategy Summary Table**

This table lists the 45 strategies and provides basic information on each. The “back of the envelope” analysis shown in “Potential Impact in 2020” and “Cost-Effectiveness” columns uses the key below. A description of the assumptions for each “high-medium-low” estimate is contained in the complete strategy write-up (see page index provided for each strategy). Obviously, different assumptions will yield different results. Columns #5 and #6 are provided to help begin the important discussion on impacts and cost-effectiveness. More detailed research and analysis will be required to give policy makers the complete picture on the choices presented here.

**Potential Impact in 2020:**

***NOTE: Ratings are for single strategy only. Impacts could be significantly higher when strategies are analyzed as packages.***

High	> 2% reduction in transportation CO <sub>2</sub>
Medium	1-2% reduction in transportation CO <sub>2</sub>
Low	< 1% reduction in transportation CO <sub>2</sub>

**Cost-Effectiveness:**

High	< \$100 per ton of CO <sub>2</sub> reduced
Medium	\$100-\$500 per ton reduced
Low	> \$500 per ton reduced

**Note:** In the Cost Effectiveness column, the X means qualitative analysis only.

Strategy/Project	Potential Government Lead	Already implemented somewhere?	Technically possible in 5 years?	Potential Impact in 2020	Cost-Effectiveness	Page Index
<b>Part I: Improve Vehicles and Fuels (Page 12)</b>						
<b>1. Passenger vehicle emission standards</b>	Federal/State	Yes	Yes	High	High	Page 12
<b>2. Heavy duty vehicle emission standards</b>	Federal/State	Yes	Yes	Low	Unknown	Page 15

Strategy/Project	Potential Government Lead	Already implemented somewhere?	Technically possible in 5 years?	Potential Impact in 2020	Cost-Effectiveness	Page Index
<b>3. New car Feebates</b>	Federal/State	Yes	Yes	High	High <sup>x</sup>	Page 17
<b>4. Hybrid vehicles</b> <i>Project: Hybrid tax credits</i>	Federal/State/MTC	Yes	Yes	High	Medium	Page 19
<b>5. Plug-in hybrids &amp; EV infrastructure</b> <i>Project: PHEV tax credits</i>	Cities/Counties, Regional agencies, NGOs, Federal/State	No	Yes	High	Medium	Page 21
<b>6. Neighborhood electric vehicles</b> <i>Project: NEV infrastructure</i>	Cities/Counties	Yes	Yes	Medium	High <sup>x</sup>	Page 24
<b>7. Vehicle buy-back</b>	Regional agencies	Yes	Yes	Low	Medium	Page 26
<b>8. Vehicle efficiency program</b> <i>Projects: low resistance tires, tire pressure monitors, subsidized tune-ups</i>	Regional agencies	Yes	Yes	Low	High, High, Medium	Page 27
<b>9. Cellulosic ethanol</b>	Federal/State	No	No	Medium	Unknown	Page 29
<b>10. Biodiesel</b>	State	Yes	Yes	Low	Unknown	Page 32
<b>11. Vehicle fleets</b> <i>Project: Hybrid buses</i>	Fleet operators	Yes	Yes	Low	Low	Page 34

Strategy/Project	Potential Government Lead	Already implemented somewhere?	Technically possible in 5 years?	Potential Impact in 2020	Cost-Effectiveness	Page Index
<b>Part II: Improve Infrastructure (Page 36)</b>						
<b>12. Transit services</b> <i>Specific projects: Regional Transit Expansion Program, bus, shuttle</i>	Transit agencies, MTC	Yes	Yes	Varies by project	Low, Low, Medium	Page 36
<b>13. Bike facilities</b>	Cities/Counties, CMAs	Yes	Yes	Low	Low	Page 39
<b>14. Pedestrian facilities</b> <i>Project: Safe Routes to Schools</i>	Cities/Counties, CMAs	Yes	Yes	Low	Medium	Page 43
<b>15. Carpooling facilities</b> <i>Project: HOV/HOT lane network</i>	MTC, Caltrans	Yes	Yes	Varies by project	Low	Page 45
<b>16. Car sharing</b>	Car share companies	Yes	Yes	Low <sup>3</sup>	Unknown	Page 49
<b>17. School bus services</b>	State/Schools	Yes	Yes	Low	Low	Page 50
<b>18. High speed rail</b>	State	Yes	No	Unknown	Low <sup>x</sup>	Page 53
<b>19. Traffic signal synchronization and other roadway improvements</b>	Cities/Counties	Yes	Yes	Low	High	Page 54

Strategy/Project	Potential Government Lead	Already implemented somewhere?	Technically possible in 5 years?	Potential Impact in 2020	Cost-Effectiveness	Page Index
<b>20. Signal and roadway lighting</b>	Caltrans, Cities/Counties	Yes	Yes	Unknown	Unknown	Page 57
<b>21. Low-GHG cement &amp; reflective pavement</b>	Caltrans, Cities/Counties	Yes	Yes	Unknown	Unknown	Page 59
<b>22. Freeway operations</b> <i>Project: Freeway Performance Initiative</i>	Caltrans	Yes	Yes	Unknown	High	Page 60
<b>23. Freeway speed limits</b>	State	Yes	Yes	High	High <sup>x</sup>	Page 62
<b>24. Shipping and landside operations</b>	State/ BAAQMD, Port	Yes	No	Unknown	Low <sup>x</sup>	Page 63
<b>25. Truck idling</b>	State	Yes	Yes	Unknown	Unknown	Page 66
<b>26. Truck facility electrification</b>	State, Operators	Yes	Yes	Low	Medium	Page 67
<b>Part III: Focus Growth (Page 69)</b>						
<b>27. Regional FOCUS program</b>	Regional agencies, Cities/Counties	Yes	Yes	Medium	Unknown	Page 69

Strategy/Project	Potential Government Lead	Already implemented somewhere?	Technically possible in 5 years?	Potential Impact in 2020	Cost-Effectiveness	Page Index
<b>28. Affordable housing</b>	Cities/Countries Regional agencies, Developers	Yes	Yes	Low	Unknown	Page 73
<b>29. Indirect source rule</b>	BAAQMD	Yes	Yes	Unknown	Unknown	Page 76
<b>30. CEQA reform</b>	State, BAAQMD	No	Yes	Unknown	Unknown	Page 78
<b>31. SB 375 implementation</b>	Regional agencies	No	Yes	Unknown	Unknown	Page 80
<b>Part IV: Shift Transportation Behavior (Page 84)</b>						
<b>32. Fill underused facilities</b> <i>Projects: Subsidies, TPMs</i>	Transit agencies, Regional agencies	Yes	Yes	Low, Medium	Low, Medium, High	Page 84
<b>33. Smart driving</b> <i>Project: Real-time fuel use gauge</i>	Regional agencies	Yes	Yes	High	High	Page 87
<b>34. Trip linking and elimination</b>	Regional agencies	Yes	Yes	Medium	High <sup>x</sup>	Page 90
<b>35. Air travel</b>	State, regional agencies	No	Yes	Unknown	High	Page 92
<b>36. Buying local</b>	State, Regional agencies	Yes	Yes	Unknown	Unknown	Page 94

Strategy/Project	Potential Government Lead	Already implemented somewhere?	Technically possible in 5 years?	Potential Impact in 2020	Cost-Effectiveness	Page Index
37. Telework and teleconferencing	Regional agencies	Yes	Yes	Low	High	Page 95
38. Parking pricing and management	Regional agencies, Cities/Countries	Yes	Yes	Medium	Unknown	Page 97
39. Bridge, road and area tolls	Regional agencies, Cities/Countries, CMAs	Yes	Yes	Unknown	Unknown	Page 100
40. Fuel and carbon taxes	State, Regional agencies	Yes	Yes	High	Unknown	Page 102
41. Pay-as-you-drive insurance	State	Yes	Yes	Unknown	Unknown	Page 104
<b>Part V: Other Strategies (Page 106)</b>						
42. California carbon trading system	State	Yes	Yes	Unknown	Unknown	Page 106
43. In-house GHG reductions	Transportation agencies	Yes	Yes	Unknown	Unknown	Page 107
44. Climate adaptation	State, Regional agencies, Cities	Yes	Yes	Unknown	Unknown	Page 109
45. GHG measurement/tracking	State, Regional agencies	Yes	Yes	Unknown	Unknown	Page 111



## PART I: IMPROVE VEHICLES AND FUELS

### Strategy 1:

#### Increase greenhouse gas (GHG) emission standards for passenger vehicles

##### Potential Lead:

- State government — Implement the landmark “Pavley Bill” (AB 1493 by then-Assemblymember Fran Pavley, Chapter 200, 2002 Statutes) through 2012. Design “Pavley II” standards that would be implemented starting in 2017.
- Federal government — Develop national fuel efficiency and greenhouse gas (GHG) standards to take effect in 2012.

##### Potential support roles:

- MTC, County Congestion Management Agencies (CMAs), Bay Area Air Quality Management District, Cities/Counties — Advocacy and support for Pavley II standards. Actions to take full advantage of the new standards by turning over the Bay Area fleet swiftly, putting more high-mpg “Pavley” vehicles on the road.

##### Background:

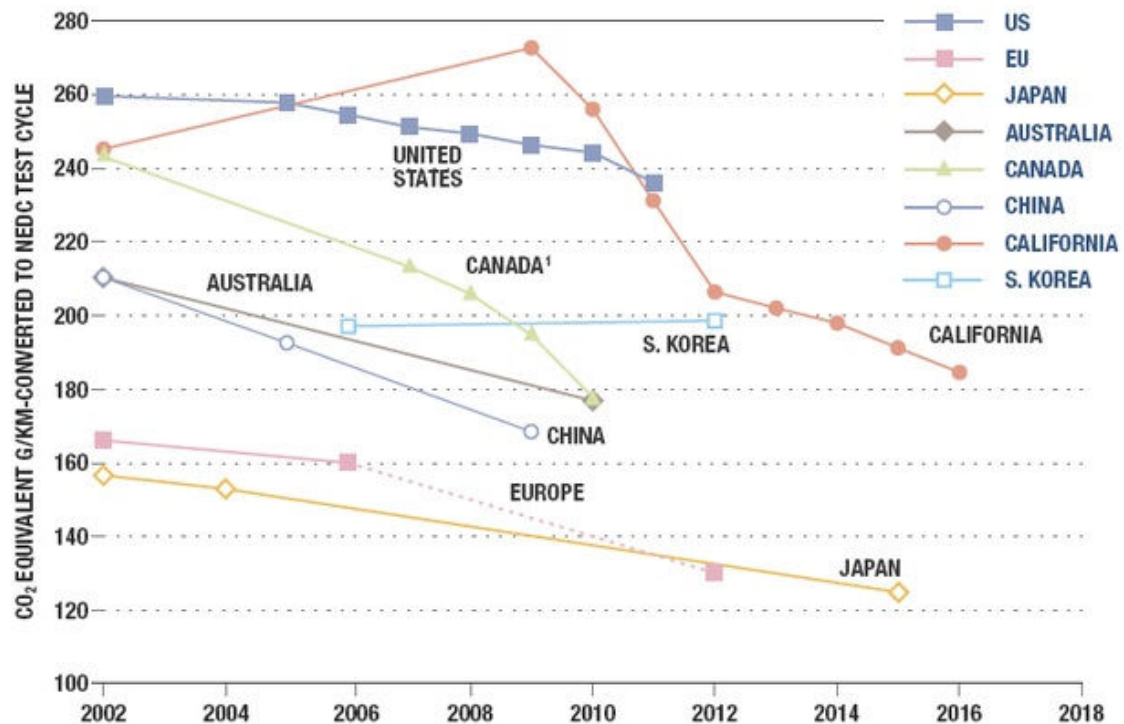
1. As of May 19, 2009, the federal government, State of California and automakers have agreed on new federal vehicle standards for 2012 through 2016 that will basically follow California’s “Pavley” regulations. The new standards will be developed by the U.S. EPA as regulations and will not need approval by the U.S. Congress. California will implement the Pavley bill for the period 2009-2012. At that time, the new national regulations will take over.
2. The Pavley bill, enacted in 2002, has been California’s best regulatory hope for reducing transportation emissions, and the most important strategy for implementing AB 32 — the California Global Warming Solutions Act of 2006 — that requires a statewide reduction of greenhouse gas emissions to 1990 levels or lower by 2020. The California Air Resources Board (ARB) has developed a plan to implement AB 32. In the ARB’s AB 32 Scoping Plan, the Pavley standards for 2009-2016 and the proposed Pavley II standards for 2017 and beyond, together result in the largest single reduction of greenhouse gas emissions (32 million metric tons (MMT)/year) for reaching the 2020 target.
3. Regulations to implement the Pavley bill were designed to reduce greenhouse gases from new California vehicles by 22 percent in 2012 and 30 percent in 2016 compared to new vehicles in 2002. The regulations were originally scheduled to phase-in starting with the 2009 model year, with full implementation in 2016. Eventually, the ARB estimates the standards will reduce greenhouse gases from the California light-duty passenger vehicle fleet by 18 percent in 2020 and 27 percent in 2030.
4. Automakers sued the ARB over the Pavley bill in Fresno federal district court in 2005. In September 2007, a Vermont judge ruled against the automakers in a similar case. In April 2007, the U.S. Supreme Court ruled that CO<sub>2</sub> was a pollutant under the

Clean Air Act and that states could regulate it. California, fifteen other states, and five non-governmental organizations sued the U.S. EPA in January 2008 asking to reverse the denial of California's request for a Clean Air Act waiver. Meanwhile, thirteen other states plus four Canadian provinces have copied Pavley. This totals 40 percent of the U.S. car market. In June 2009, the U.S. Environmental Protection Agency reversed itself and granted the needed waiver.

5. ARB is working on Pavley II which would take effect in 2017. The technologies that might be employed include highly efficient hybrid vehicles, use of lightweight materials to reduce vehicle mass, and reductions in air conditioning-related emissions through the use of low-GWP refrigerants or other approaches.
6. Since new cars make up about four to five percent of on-road fleet each year, it could take considerable time for full federal regulations to transform the fleet.
7. In 2007, the International Council on Clean Transportation (ICCT) released an important report comparing the fuel economy standards in California and seven countries. (See ICCT link below.) The ICCT, sponsored by the Hewlett Foundation and the Energy Foundation, is made up of regulators and experts from leading auto markets around the world. The goal of the ICCT is to dramatically improve the environmental performance and efficiency of cars, trucks, buses and transportation systems in order to protect and improve public health. The ICCT published the "Bellagio Memorandum on Motor Vehicle Policy" in 2001 as a guide for policy makers and automakers and now sponsors workshops, research and publications. The ICCT 2007 report's key findings include:
  - Although Japan and Europe continue to lead the world with the most stringent passenger vehicle greenhouse gas and fuel economy standards (Japan's being mandatory, with Europe poised to transition from voluntary to mandatory), the two are moving in opposite directions. In 2006, Japan increased the stringency of its fuel economy standards, while Europe is in the process of weakening its CO<sub>2</sub> standards by shifting from a target of 120 g/km per vehicle to 130 g/km per vehicle. As a result, Japan's standards are expected to lead to the lowest fleet average GHG emissions for new passenger vehicles in the world (125 g/km) in 2015.
  - California's GHG emission standards for passenger vehicles would achieve the greatest absolute emission reductions per vehicle from any policy in the world, although the emissions endpoint is still higher than that of a number of countries, including China, the European Union and Japan.
  - U.S. passenger vehicle standards continue to lag behind other industrialized nations, both in absolute terms as well as in the relative improvements required under current regulations to 2011.
  - In 2007, Canada established one of the world's first "feebate" programs with significant incentives and levies for vehicles based on fuel consumption. Canada also plans to issue an attribute-based fuel economy regulation to take effect in 2011, while it continues to implement its voluntary agreement with automakers.

- The Chinese government warrants significant notice for reforming the passenger vehicle excise tax to encourage the production and purchase of smaller-engine vehicles, and to eliminate the preferential tax rate that applied to sport utility vehicles (SUVs).

The report table below shows the actual and projected greenhouse gas emissions for seven countries and for California (adjusted to the New European Driving Cycle (NEDC) test cycle).



#### Links:

- New York Times on Federal agreement: [http://www.nytimes.com/2009/05/20/business/energy-environment/20emit.html?\\_r=1&hp](http://www.nytimes.com/2009/05/20/business/energy-environment/20emit.html?_r=1&hp)
- ARB Pavley Web site: <http://www.arb.ca.gov/cc/ccms/ccms.htm>
- ARB Pavley four-page fact sheet: [http://www.arb.ca.gov/cc/factsheets/cc\\_newfs.pdf](http://www.arb.ca.gov/cc/factsheets/cc_newfs.pdf)
- California Clean Cars Campaign (complete coverage): <http://www.calclean cars.org/>
- AB 32 Scoping Plan  
<http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm>
- AB 32 Appendix I has more detail on Pavley and transportation starting on page C-55: <http://www.arb.ca.gov/cc/scopingplan/document/appendix1.pdf>
- International Council on Clean Transportation (ICCT): <http://www.theicct.org/>
- Union of Concerned Scientists *Clean Vehicles 101*:  
[http://www.ucsusa.org/clean\\_vehicles/clean\\_vehicles\\_101/](http://www.ucsusa.org/clean_vehicles/clean_vehicles_101/)

## **Technically feasible to implement and produce results in next five years?**

Yes

### **Preliminary review of potential impact and cost:**

#### *Estimate of Bay Area 2020 Impact:*

High. If the new federal standards follow the Pavley regulations, about a 17.5percent reduction in transportation CO<sub>2</sub> in 2020, using ARB estimates for implementation of Pavley Phases 1 and 2. This equates to a reduction of about 17,000 tons per day of CO<sub>2</sub> in the Bay Area in 2020, around 60 percent of the reduction needed to get the projected Bay Area transportation CO<sub>2</sub> for 2020 back to 1990 levels (mirroring AB 32).

#### *Cost:*

Passenger vehicles meeting the Pavley standards will cost slightly more due to the new technologies that reduce greenhouse gases. ARB estimates that the fully phased-in standards would add an average of \$630 to \$950 to the cost of a new vehicle. Consumers will eventually save money with Pavley vehicles, and will reach the break-even point more quickly if gas prices remain high.

#### *Cost Effectiveness:*

High. Based on an ARB analysis comparing additional consumer costs to savings in gasoline costs.

---

## **Strategy 2:**

### **Increase greenhouse gas (GHG) emission standards for medium-duty and heavy-duty trucks**

#### **Potential lead:**

- Federal government — Create CAFÉ standards for heavy-duty trucks
- State — Create heavy truck diesel/greenhouse gas regulations similar to Pavley.

#### **Potential support roles:**

- Bay Area Air Quality Management District, MTC, County Congestion Management Agencies (CMAs), Cities/Counties — Advocacy for new standards

#### **Background:**

1. Heavy-duty diesel trucks are projected to generate about nine percent of Bay Area on-road transportation CO<sub>2</sub> emissions in 2020. While diesel engines are fairly fuel efficient to begin with, there are opportunities to further improve truck efficiency using lightweight materials, tires with low-rolling resistance (LRR), and reductions in aerodynamic drag.

2. The U.S. Environmental Protection Agency, truckers and major corporations have formed the *SmartWay Transport Partnership* to reduce energy use, greenhouse gases and criteria pollutants.
3. Reduced aerodynamic drag and tire rolling resistance is an Air Resources Board AB 32 “Discrete Early Action” item. Anti-idling measures for heavy-duty trucks are also recommended by ARB as an “Early Action Measure” including better enforcement, possible penalties, etc.
4. Improving the efficiency of medium- and heavy-duty truck engines is a measure included in ARB’s AB 32 Scoping Plan. The plan states: “This measure would likely achieve the greatest benefits on trucks used in urban, stop-and-go applications, such as parcel delivery trucks and vans, utility trucks, transit buses, and other vocational work trucks. For long-haul trucks, heavy duty engine efficiency improvements may involve advanced combustion strategies, friction reduction, waste heat recovery, and electrification of accessories.”
5. In December 2008, ARB passed new tougher regulations on heavy-duty diesel trucks. (<http://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm>) Particulate matter (PM) has a real, but not totally quantified global warming potential. ARB is currently implementing a comprehensive “Diesel Risk Reduction Plan” to improve public health, which calls for reducing diesel PM by 75 percent by 2010 and 85 percent by 2020 (over 2000 levels).
6. Some PM control strategies also improve fuel efficiency and reduce greenhouse gases while others, such as PM traps on exhaust, may decrease fuel efficiency somewhat.
7. Japan is the only country to regulate heavy-duty vehicle greenhouse gas emissions. Japan’s target is to lower heavy-duty truck emissions between 2002 and 2015 by about 12 percent.

**Further Information:**

- SmartWay Transport Partnership: <http://www.epa.gov/smartway/transport/index.htm>
- ARB diesel programs and activities: <http://www.arb.ca.gov/diesel/diesel.htm>
- ARB 2008 diesel regulations: <http://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm>
- ARB Diesel Reduction Plan: <http://www.arb.ca.gov/diesel/documents/rrpFinal.pdf>
- AB 32 Scoping Plan: <http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm>
- AB 32 Appendix I has more detail on heavy- and medium-duty vehicles starting on page C-55: <http://www.arb.ca.gov/cc/scopingplan/document/appendix1.pdf>

**Technically feasible to implement and produce results in next five years?**

Yes. Will depend on lead-time allowed by new regulations.

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Low. Assuming a 20 percent improvement in heavy-duty diesel truck fuel efficiency in 2020 compared to 2000 (Tellus Institute), and that 25 percent of the heavy-duty truck vehicle miles traveled would be from these more fuel-efficient trucks, Bay Area transportation CO<sub>2</sub> would be reduced by about 0.2 percent.

*Cost:*

The additional cost of more efficient diesel engines for heavy-duty trucks is not known. Some heavy duty diesel hybrids qualify for tax credits.

*Cost Effectiveness:*

Unknown. Depends on costs and fuel savings for advanced, more thermally efficient diesel engines.

---

**Strategy 3:**

**Implement new car “feebates” — special fees on new vehicles below a MPG standard and rebates for vehicles above the standard.**

**Potential lead:**

- Federal or state governments (Congress, California Legislature, ARB, Board of Equalization) — Pass legislation and set up program.

**Potential support roles:**

- MTC, County Congestion Management Agencies (CMAs), Cities/Counties, Bay Area Air Quality Management District — Advocacy for state program.

**Background:**

1. Vehicle fleet takes 15 to 20 years to completely turn over, delaying the impacts of new fuel economy standards.
2. Feebates would create monetary incentives for purchasers of new cars to put greater weight on fuel efficiency when making a new car decision. Over the longer term it could alter the product line of auto manufacturers if more consumers purchase more fuel-efficient cars and light trucks. Most often, feebate programs are designed to be revenue neutral.
3. Feebates apply to the entire new car market, whereas current government tax incentives apply only to hybrids.
4. A University of Michigan study (2007) found that feebates could increase California’s Pavley-bill vehicle greenhouse gas reductions by up to 25 percent.
5. In 2007, the Canadian Government began a two-year program called the “Vehicle Efficiency Incentive” (VEI). VEI included a rebate and tax component, both of which were based on vehicle fuel efficiency. The performance-based rebate program, run by

Transport Canada, offered \$1,000 to \$2,000 for the purchase or long-term lease (12 months or more) of an eligible vehicle. Transport Canada provided a list of the eligible vehicles — i.e. new cars achieving 6.5 L/100km (36 mpg) or better, new light trucks getting 8.3L/100km (28 mpg) or better, and new flexible fuel vehicles with a combined fuel consumption E85 rating of 13L/100km (18 mpg of combined fuel) or better. The new excise tax, called a “Green Levy,” was administered by the Canada Revenue Agency on inefficient vehicles. The sliding tax of up to \$4,000 applied only to passenger cars with a weighted average fuel consumption of 302 g CO<sub>2</sub>/km or greater and 18 mpg or less.

Under pressure from automakers (and a number of other sources) the program was not renewed for 2009. Honda reportedly campaigned vigorously against the rebates because its *Fit* initially did not qualify while the Toyota *Yaris* did. An excise tax exemption for pickup trucks (because they were deemed “essential” vehicles) provided a huge loophole that merely shifted SUV buyers to pickups.

6. Several European countries have adopted feebates. Finland and Ireland changed their automobile tax structure to vary based on greenhouse gas emissions, and France in 2007 implemented what they are calling the “bonus-malus” law.
7. While feebates have been studied extensively in the U.S, no state to date has implemented a feebate program. Often, there has been strong opposition from car dealers who are represented in most legislative districts.
8. In 2007, AB 493 (Ruskin), proposed fees/rebates up to \$2,250 in a feebate system designed by ARB and administered by Board of Equalization. It failed to pass the Assembly in June 2007 (35-35). It was reintroduced in 2008 and failed to pass again.
9. The California Air Resources Board’s (ARB’s) draft AB 32 Scoping Plan included feebates as a “measure for further evaluation” and estimated a 2-6 million metric ton (MMT) per year GHG reduction statewide in 2020. The proposed Scoping Plan removed the MMT number and stated: “If the U.S. EPA grants California’s request for a waiver to proceed with implementation of the Pavley regulations, we will analyze the potential for pursuing a feebate program that could complement the Pavley regulations and achieve additional reductions of greenhouse gas emissions.”  
NOTE: The needed waiver was granted in June 2009.

**Links:**

- University of Michigan CA feebates study:  
<http://www.umtri.umich.edu/content/UMTRI-2007-19-1.pdf>
- Canada’s EcoAUTO Rebate Program:  
<http://www.tc.gc.ca/programs/environment/ecotransport/ecoauto.htm>
- Feebates explained: <http://en.wikipedia.org/wiki/Feebate>

**Technically feasible to implement and produce results in next five years?**

Yes

### **Preliminary review of potential impact and cost:**

#### *Estimate of Bay Area 2020 Impact:*

High. Assumes impact is in the range of the Michigan Study. See University of Michigan study above.

#### *Cost:*

Feebates would be revenue neutral and not cost taxpayers. Purchasers of the least fuel efficient passenger vehicles would pay more, while purchasers of the most efficient vehicles would pay less (about \$2,250-\$2,500 in proposed legislation).

#### *Cost Effectiveness:*

High (qualitative analysis). An efficient market mechanism to accelerate purchases of new, high-mpg vehicles; maintains consumer choice and does not require additional public funds.

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### **Strategy 4:**

**Create a regional incentive program to significantly increase the use of hybrid vehicles.**

#### **Potential lead:**

- Federal/State — Extend and expand tax credits for purchases of hybrid vehicles
- MTC — Administer public/private pilot program

#### **Potential support roles:**

- County Congestion Management Agencies (CMAs), Cities/Counties, regional agencies — Advocate for and publicize program, pilot program participation
- Private sector — Employee incentives

#### **Background:**

1. Hybrid vehicle technology represents the most available near-term and consumer accepted technology to significantly improve the overall fuel efficiency of the on-road vehicle fleet. (Some hybrids provide significant gains in fuel economy while other new vehicles use this technology to primarily add power.)
2. Hybrids range from 40 mpg to 55 mpg for sedans (Altimas, Civics, Priuses) to about 30 mpg for smaller SUVs (Escape, Vue, Highlander) to about 18 mpg for trucks (Silverado, Sierra). While high-mpg hybrids provide the greatest absolute emissions reductions, even shifts to low-mileage hybrids can be significant. For example, a person moving from a 15-mpg SUV to an 18-mpg hybrid reduces their tailpipe greenhouse gas production by 17 percent.
3. By March 2008, hybrids had steadily grown to make up 2.8 percent of all new car sales. In that month, hybrid sales rose 10 percent compared with March 2007, while



in the same period purchase of new passenger cars were down 5.4 percent and light trucks declined 17.8 percent. However, as gas prices decreased and the economy worsened in late 2008, hybrid sales dropped dramatically (November 2008 down 50 percent vs. November 2007) to their lowest point in two years.

4. The decision to purchase a hybrid is a consumer choice, but government can influence this choice in several ways, such as via tax credits, feebates (as discussed in #3), carbon taxes on fuel, other vehicle fees (e.g., registration or direct fees on CO<sub>2</sub> emissions), and incentives such as access to California's high-occupancy vehicle (HOV) lanes.
5. The Federal government provides tax credits for hybrids of up to \$3,000, depending on the vehicle. However, each manufacturer was granted an equal number of credits (60,000) and when all are used; subsequent buyers will not receive any tax credits. Toyota, the leading hybrid maker, used all its 60,000 credits by October 2007, so there are no federal credits now for Toyota hybrid purchases. Honda (the number two hybrid maker) hit the 60,000 figure in 2008, so its subsidies have also ended.
6. California HOV lane access stickers for hybrids were discontinued after the 85,000 quota was met.
7. The cities of San Jose, Los Angeles and Santa Monica have reduced or eliminated parking charges for selected hybrid and other super-efficient vehicles.
8. Some insurance companies have initiated 10 percent discounts for hybrids.
9. Hyperion, EMM, Google and other Bay Area companies have provided \$3,000 to \$5,000 incentives to employees for hybrid purchases.

**Links:**

- Hybridcenter.org (UCS site on hybrids): <http://www.hybridcenter.org/>
- Hybridcars.com (everything about hybrids): <http://www.hybridcars.com/>
- Federal tax credits defined: [http://www.fueleconomy.gov/Feg/tax\\_hybrid.shtml](http://www.fueleconomy.gov/Feg/tax_hybrid.shtml)
- Green Car Congress (sustainable mobility): <http://www.greencarcongress.com/>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

High. If nine percent of the vehicle miles traveled in 2020 is produced by light-duty hybrid vehicles, total transportation CO<sub>2</sub> emissions would be reduced by about 2.7 percent ("Well to Wheels" comparison including accounting for some increase in driving due to the lower operating costs of a hybrid).

*Cost:*

Hybrids cost \$3,000 to \$5,000 more than regular vehicles. Tax credits (if available) or employer incentives reduce the cost. The added cost also can be recovered in gasoline cost savings during ownership of the vehicle.

*Cost Effectiveness:*

Medium. Assumes purchasers of hybrids would receive a \$3,000 tax credit; benefits calculated over the 150,000 mile life of the vehicle. Cost effectiveness is based on comparison of a 25-mpg new sedan with a 46-mpg hybrid.

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**Strategy 5:**

**Accelerate Plug-In Hybrid Electric Vehicle (PHEV) deployment and construct a regional electric vehicle (EV) infrastructure**

**Potential leads:**

- Cities/Counties, Bay Area Air Quality Management District, PG&E, MTC, Silicon Valley Leadership Group, Plug In Bay Area, CalCARS — Electric vehicle (EV) infrastructure, Plug-In Hybrid Electric Vehicle (PHEV)/EV advocacy, promotion, soft orders
- Federal/State — Extend and expand tax credits for purchases of PHEVs, develop “smart grids” for electricity system, assist with electric vehicle infrastructure

**Potential support roles:**

- Private companies — Produce vehicles and develop infrastructure
- Universities — Research

**Background:**

1. A growing number of climate/transportation experts believe that the best vehicle strategy is to shift vehicle power to the electrical grid because: (a) the grid will be steadily greened through wind, solar and other renewables, (b) carbon from conventional power plants may eventually be captured and sequestered, and (c) electric motors are significantly more efficient than internal combustion engines.
2. Plug-in hybrid vehicles provide a significant mileage improvement over the regular hybrid technology by having battery packs that allow these vehicles to run on batteries alone for the first 20 miles or more. The average mpg for a compact passenger vehicle with this technology would be in the range of 100 mpg. With new advanced battery packs that are under development, the average mpg might increase to the 170-mpg range.
3. Greenhouse gas emission benefits from plug-in hybrid electric vehicles will depend on the source of electricity. However, a joint report by the National Resources Defense Council (NRDC) and the Electric Power Research Institute (EPRI) on plug-in hybrid electric vehicles titled *Well to Wheels* found that greenhouse gases were reduced in ALL nine scenarios studied compared to gasoline-powered vehicles. The nine scenarios looked at coal-fired and other types of power plants and various levels of PHEV market penetration.

4. If the system is managed correctly, many plug-in hybrid electric vehicles will be re-charged at night; therefore, they will not increase the need for additional power plant capacity. If there is significant charging during the day, a more efficient “smart grid” will take on added importance. The development of a national “smart grid” — where distributed power sources are managed for the greatest efficiency — is a key complement to switching our automobile infrastructure from petroleum-based to electric -based.
5. A number of major automakers are now developing plug-in hybrid electric vehicles, led by GM and Toyota. GM is developing the Chevrolet Volt for projected mass production starting in late 2010. The Volt combines a plug-in electric motor and battery set-up with a range of 40 miles and a small internal combustion engine hooked to a generator that resupplies the batteries for longer trips (purchase price estimated at around \$40,000). Toyota is testing plug-in hybrid electric vehicles (including some at UC Berkeley and Davis), with plans to lease 400 demonstration vehicles to commercial fleets in 2009-2010. At the same time, manufacturers like Nissan and Mitsubishi are developing pure electric vehicles.
6. The Bay Area Regional Electric Vehicle Initiative is working to develop a regional EV infrastructure and boost municipal fleet EV purchases. The initiative was kicked off in November 2008 by the mayors of San Francisco, San Jose and Oakland. In 2009, three task forces — focusing on government, business and advocacy strategies — are advancing the regional approach.
7. Staff in San Francisco Mayor Gavin Newsom’s office have produced a 40-page EV summary titled *Current State of Electric Vehicle Products, Infrastructure and Policy in the San Francisco Bay Area*.
8. Nissan and Sonoma County government agencies are developing a project to test as many as 1,000 EVs starting in 2010.
9. A number of private sector firms are developing Bay Area EV infrastructure plans and programs. For example, Coulomb Technologies is installing EV charging stations in conjunction with city governments in San Francisco, San Jose and Walnut Creek. Silicon Valley-based *Better Place* is developing an electric car infrastructure — charging and battery swap stations that are strategically placed to allow electric vehicles to operate just like gasoline-powered ones. Better Place, founded with \$200 million in venture capital in 2007, is developing the system in Israel and Denmark, and also is exploring a Northern California approach.
10. CalCars (Palo Alto) has been leading the plug-in hybrid electric vehicles “charge” since 2002 (See their Web link below for comprehensive PHEV news and views.)
11. *Plug-In Bay Area* is a public/private advocacy group supported by PG&E, the Silicon Valley Leadership Group and others. *Plug-In Bay Area* (PIBA) is working with governments and businesses to solicit soft orders of plug-in hybrid electric vehicles to spur development.
12. Federal stimulus funding will provide a number of opportunities for electric vehicles. \$300 million is available from the Alternative Fuel Vehicle Pilot Program, administered through

the Department of Energy through the Clean Cities Program. Funding can be used for fleet purchases or infrastructure. \$2.4 billion is available for improved batteries for electric vehicles. The stimulus program also creates a new tax credit for qualified plug-in hybrid electric vehicles (PHEVs) purchased between December 31, 2008, and December 31, 2014. The credit amount is determined based on vehicle weight and battery capacity. A phase-out period will be initiated once 250,000 qualified plug-in cars are sold in the U.S. Section 207 amends the existing alternative fuel infrastructure tax credit by: extending the incentive for one year, through December 31, 2010; and adding electricity to the list of qualified alternative fuels. These credits will be available up to \$7,500 per vehicle sold, and the amount of the credit is based on the amount of energy stored in the battery (4-16kW). Any highway-capable, all-electric car would qualify for the credit based on battery capacity.

13. In Spring 2009, the Air District worked with cities and regional electric vehicle (EV) stakeholders to develop a \$15 million federal stimulus proposal for Bay Area EV charging stations in public parking facilities, along with EV public agency fleet purchases. Federal authorities turned down the proposal in August.
14. At the state level, 2007 legislation (AB 118, Chapter 750) created the Alternative and Renewable Fuel and Vehicle Technology Program and authorized the California Energy Commission (CEC) to spend up to \$120 million per year for over seven years (from 2008-2015) to develop, demonstrate, and deploy innovative technologies to transform California's fuel and vehicle types. This program creates the opportunities for investment in technologies and fuels that will help meet the state's various goals for emissions. CEC and ARB are coordinating implementation of the statute.
15. 150-mile-plus plug-in hybrid electric vehicle prototypes, using converted Toyota Priuses, have been built in California and elsewhere. In the Bay Area, plug-in hybrid electric vehicles are in use by PG&E, the Air District, Google and others.
16. Some Toyota dealers — independent businesses whose main “bread and butter” comes from their ability to obtain, sell and support the automaker's products are, for the first time, supporting an aftermarket conversion. The federally crash-tested systems are provided by A123Systems' Hymotion. Hymotion recently announced the company's six initial installers, which include two independent companies and four Toyota dealers.
17. Researchers are looking at the Bay Area potential for PHEVs to plug back into the electricity grid and supply peak power (“V2G” technology).
18. Any large-scale strategy to use plug-ins and other electric vehicles will require significant improvements to the U.S. electricity distribution system. The development of “smart grids” has become an important energy strategy recently highlighted by Al Gore, President Obama and other national leaders.

**Links:**

- CalCARS (news and info): <http://www.calcars.org/>
- Plug-In Bay Area: <http://www.pluginbayarea.org/>
- Chevrolet Volt: [http://en.wikipedia.org/wiki/Chevrolet\\_Volt](http://en.wikipedia.org/wiki/Chevrolet_Volt)
- Green Car Congress: <http://www.greencarcongress.com/>

- Hymotion: <http://www.al23systems.com/hymotion>
- Better Place: [www.betterplace.com](http://www.betterplace.com)
- “Smart grids” explained: [http://en.wikipedia.org/wiki/Smart\\_grid](http://en.wikipedia.org/wiki/Smart_grid)
- California AB 118 Program: <http://www.energy.ca.gov/proceedings/2008-ALT-1/index.html>

### **Technically feasible to implement and produce results in the next five years?**

Yes

### **Preliminary review of potential impact and cost:**

#### *Estimate of Bay Area 2020 Impact:*

High. Depends on market penetration and miles driven. If nine percent of the vehicle miles traveled in 2020 is generated by plug-in hybrid electric vehicles, total transportation CO<sub>2</sub> would be reduced by about 4 percent. (*Well to Wheels* comparison, which accounts for electricity production and transmission; calculation also includes some increase in driving due to lower operating costs.)

#### *Cost:*

Currently, transforming a regular hybrid to plug-in technology adds \$10,000-\$20,000 to the vehicle cost, but mass-produced PHEVs could cost only \$3,000 to \$5,000 more than regular hybrids. Tax credits could reduce the cost.

#### *Cost Effectiveness:*

Medium. Assumes purchasers of new plug-in hybrids would receive a \$5,000 tax credit. (*Well to Wheels* comparison of a 25-mpg sedan to a plug-in hybrid electric vehicle, assuming a 50 percent reduction in greenhouse gas emissions from a PHEV over the 150,000 vehicle mile life of vehicle.)

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### **Strategy 6:**

**Accelerate development of “Neighborhood Electric Vehicles (NEV)” for millions of short trips made daily.**

#### **Potential lead:**

- Cities/Counties — Charging stations, infrastructure

#### **Potential support roles:**

- MTC, County Congestion Management Agencies (CMAs) — Funding, incentives

#### **Background:**

1. Neighborhood electric vehicles (NEVs) are small, electric, low-speed vehicles (usually restricted to 35 mpg streets) that are used for local driving. NEVs can go up to 25 mpg, cost under \$7,000 new and are cheaper to insure and maintain. Most

NEVs can go 25 to 30 miles on a full charge, well within the daily mileage for many Bay Area residents.

2. Neighborhood electric vehicles in the U.S. produce, on average, 33 percent of the greenhouse gas per mile of a typical gas-powered vehicle. In California, our “greener” electricity generation means that NEVs produce just 15 percent of the CO<sub>2</sub> per mile of the average California gas vehicle. As the PG&E power mix becomes greener, the greenhouse gas savings from NEVs and other electric cars will grow.
3. The 2001 National Household Transportation Survey shows that 20 percent of all trips in California are less than one mile in length, and 44 percent of all trips are less than two miles in length. Many urban trips are very short trips for shopping, recreation or school. The average distance (based on MTC’s travel model) for various types of trips includes: home-based shopping (5.1 miles), home-based social/recreation (6.1 miles), grammar school (2.5 miles), compared to non-home based trips (5.6 miles).
4. The town of Lincoln (population 42,000) near Sacramento has developed an award-winning NEV development plan, with a goal of becoming the NEV capital of the world. The city is providing infrastructure — roadways, paths, charging stations, etc. — and other support.
5. An increasing number of manufacturers are selling neighborhood electric vehicles. In the Bay Area, Green Motors (Berkeley) Eco-Motors (Petaluma) and other dealers now sell electric cars. The vehicles must comply with federal legislation for low-speed vehicles (seatbelts, headlights, windshield, rear and side view mirrors, etc).
6. Most electric vehicles will be re-charged at night; therefore they will not increase the need for more utility system capacity.
7. Batteries have long been the barrier for extending the range and performance of electric cars. Much research is currently being devoted to better and more efficient batteries.

**Links:**

- Neighborhood electric vehicles explained: [http://en.wikipedia.org/wiki/Neighborhood\\_electric\\_vehicle](http://en.wikipedia.org/wiki/Neighborhood_electric_vehicle)
- Lincoln, California NEV plan: <http://www.lincolnev.com/>
- Zenn Motors: <http://www.zenncars.com/>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Medium. If Neighborhood electric vehicles were used for 15 percent of shopping/recreational VMT in 2020, they would reduce transportation CO<sub>2</sub> by 1.7 percent (Well to Wheels comparison accounting for electricity production and transmission).

*Cost:*

One NEV manufacturer states that the cost of ownership is one-third and the fuel efficiency is eight times greater when compared to their gasoline-powered counterparts. Some NEV vehicles also qualify for federal tax credits and, depending on the area, may qualify for local incentives from air districts and other government agencies.

*Cost Effectiveness:*

High (qualitative analysis). Based on the low NEV costs and GHG emissions compared to using a conventional gasoline powered vehicle for the same types of trips.

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**Strategy 7:**

**Expand regional vehicle buy-back program to include high GHG emission light-duty and heavy-duty vehicles.**

**Potential lead:**

- Regional agencies — Administer, provide funding and promote

**Potential support roles:**

- County Congestion Management Agencies (CMAs), Cities/Counties — Promotion

**Background:**

1. Currently, the Bay Area Air Quality Management District's Vehicle Buy-Back program (for criteria pollutants) provides \$650 for pre-1987 vehicles that are registered and in running condition. Funded with \$7.4 million from Air District's Mobile Source Incentive Fund (MSIF) in 2006-07. The program is designed to get the most heavily polluting vehicles in the region permanently off the road.
2. The Air District's Carl Moyer program (created under 1999 state legislation and managed on a statewide basis by the Air Resources Board) provides grants to help heavy-duty diesel vehicle operators to replace and/or retrofit older engines, primarily to reduce diesel particulate emissions. In 2006, the Air District awarded nearly \$16 million for 110 projects with funding from the MSIF and ARB.
3. The Air District's vehicle buy-back calculations assume that the seller then purchases a less polluting vehicle, since the vast majority of vehicles on the market are post-1987. A GHG-reduction buy-back would be more complicated if the criteria used is greenhouse gases per mile or mpg because the market will contain many high greenhouse gas vehicles for a number of years.
4. The Canadian government funds and supports local vehicle scrapage programs to get older vehicles off the road, reducing greenhouse gases and smog-forming pollutants. Vehicle owners receive transit passes, car sharing incentives, rebates towards purchases of newer vehicles or rebates for bicycle purchases.

5. In mid-2009, the federal government conducted a “cash for clunkers” program that provided incentives of up to \$4,500 for the trade-in of low mileage cars and trucks if the owner subsequently purchased a new more efficient vehicle.

**Links:**

- Bay Area Air Quality Management District vehicle buy-back:  
[http://www.baaqmd.gov/pln/grants\\_and\\_incentives/vehicle\\_buyback/index.htm](http://www.baaqmd.gov/pln/grants_and_incentives/vehicle_buyback/index.htm)
- BAAQMD Carl Moyer Web site (heavy-duty engine replacement and retrofit program):  
[http://www.baaqmd.gov/pln/grants\\_and\\_incentives/carl\\_moyer/index.htm](http://www.baaqmd.gov/pln/grants_and_incentives/carl_moyer/index.htm)

**Technically feasible to implement and produce results in next five years?**

Yes.

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Low. Depends on the number of vehicles scrapped and mpg of the replacement vehicles. For every 100,000 older, high-GHG/low-mpg vehicle scrapped in 2020 and replaced with a newer vehicle having an average fleet mpg (assuming Pavley), there would be a 0.2 percent reduction in transportation CO<sub>2</sub> emissions.

*Cost:*

Program costs depend on the buy back amount (currently at \$650 per vehicle to scrap older, more polluting cars). Payments for low-mpg cars may need to be much higher.

*Cost Effectiveness:*

Medium. Assumes a \$3,000 to \$6,000 buy back for older gas guzzlers (15-mpg or less) that are driven 7,000 miles a year and have at least five years of useful life left; must be replaced with new vehicle getting at least 15-mpg better fuel economy.

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**Strategy 8:**

**Conduct a public education program to improve the efficiency of existing vehicles — tires, vehicle tune-ups, weight removal, etc.**

**Potential lead:**

- Regional agencies — Public information/action campaign

**Potential support roles:**

- Automobile Clubs, such as AAA, County Congestion Management Agencies (CMAs), retailers — Offering and distributing incentives, promotional materials
- State — Possible enhancements to the current Smog Check program to include fuel economy items



**Background:**

1. Poor vehicle maintenance can reduce a vehicle's fuel economy and lead to higher greenhouse gas emissions.
2. The U.S. Department of Energy (DOE) Web site estimates the following improvements in fuel economy from proper maintenance: Regular tune-ups (average of 4 percent), correct tire inflation (up to 3 percent), replace a dirty air filter (up to 10 percent), replace a faulty oxygen sensor (up to 40 percent), use manufacturer-recommended oil (1 to 2 percent), and repair of leaky air conditioners (older systems also use refrigerants that are not greenhouse gas-friendly, compared to refrigerants in newer systems) A properly maintained vehicle also saves the owners money.
3. When replacing worn out tires, buying low-rolling resistance (LLR) tires will improve fuel economy. A California Energy Commission study found that LRR tires would save between 1.5 to 4.5 percent of gasoline consumption in the state.
4. Manufacturers commonly use low-rolling resistance tires for U.S. Environmental Protection Agency (EPA) mpg tests, but comparable tires for replacement are not as readily available, and most replacement tires bought by consumers are not as efficient. Consumers have difficulty getting tire efficiency information.
5. California became the first state to require low-rolling resistance tire standards and labeling (2005), with the California Energy Commission charged with creating regulations for the minimum fuel efficiency of replacement tires sold.
6. A correct tire inflation program is included as an Air Resources Board "Discrete Early Action", i.e. it requires tire inflation checks at all locations where vehicles are serviced.
7. Vehicle maintenance is included as part of "ECODRIVEN," a major European Union campaign in nine countries combining an overall goals approach with local initiatives and partners. Vehicle maintenance is also included as part of the United Kingdom Eco-Driving campaign run by the Energy Saving Trust.
8. A Bay Area campaign could combine vehicle maintenance with other greenhouse gas-reducing driver strategies such as Smart Driving (Strategy #33)

**Links:**

- Green Seal (all about low-rolling resistance tires):  
[http://greenseal.org/resources/reports/CGR\\_tire\\_rollingresistance.pdf](http://greenseal.org/resources/reports/CGR_tire_rollingresistance.pdf)
- California (CEC) Fuel Efficient Tire Program:  
<http://www.energy.ca.gov/tires/index.html>
- Move America Beyond Oil: <http://beyondoil.nrdc.org/cars/seven-ways.php>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Low. Assumes smarter maintenance (tires, tune-ups, etc) affects 30 percent of regional travel and improves fuel economy of passenger vehicles an average of 2 percent. This would reduce transportation CO<sub>2</sub>emissions by about 0.5 percent.

*Costs:*

Vehicle owners will save gas and money if they maintain their vehicles and tires.

Estimated cost savings for various fuel economy measures can be found at

[www.fueleconomy.gov](http://www.fueleconomy.gov)

*Cost Effectiveness:*

*Tire Pressure Monitors*

High. Assumes tires equipped with low cost (\$25) flag-type tire pressure monitors; 25 percent of vehicle-miles traveled occurs with under-inflated tires. Correcting the tire pressure improves fuel economy 2 percent. Greenhouse gas reductions were calculated over the 150,000-mile life of a vehicle.

*Low-rolling resistance (LLR) tires*

High. Assumes a \$40 rebate paid to vehicle owners who purchase certified low-rolling resistance replacement tires and assumes that these tires improve fuel economy 2 percent over the life of the tires (45,000 miles).

*Pay for Tune-ups*

Medium. Assumes that \$400 is paid to tune up old cars that are noticeably out of tune and that have poor (15-mpg or worse) fuel economy and that the tune up benefits would last 30,000 miles and improve fuel economy by 4 percent.

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## **Strategy 9:**

### **Develop cellulosic ethanol to blend with gasoline.**

**Potential lead:**

- Federal government/State (Air Resources Board, California Energy Commission)  
— Low Carbon Fuel Standard and implementing legislation

**Potential support roles:**

- Oil companies and fuel producers
- Universities and other researchers
- MTC, County Congestion Management Agencies (CMAs), Cities/Counties — Advocacy/information

**Background:**

1. Cellulosic ethanol (CE) is an alternative to other types of ethanol that are produced from food crops (e.g., corn). Cellulosic ethanol is produced from switchgrass, slash and agriculture by-products.
2. More research is needed to make the large-scale production of CE cost competitive with gasoline and corn-based ethanol fuel. Later in 2009, a commercial CE plant will open in Iowa (fuel will be produced via a biological process) while two other plants (using a gasification process) are scheduled to open in Pennsylvania and Georgia.
3. Large-scale use of cellulosic ethanol-based gasoline could provide significant greenhouse gas reductions for light-duty vehicles now powered by regular gasoline. Research is underway to determine how to cost effectively produce this fuel. The use of E95 (95 percent cellulosic ethanol and 5 percent gasoline) results in at least a 78 percent reduction in greenhouse gases compared to conventional gasoline, and potentially as high as 90 percent (Well to Wheels comparison).
4. The use of alternative fuels will provide greenhouse gas-reduction benefits in addition to those anticipated from the Pavley vehicle standards.
5. The California Low Carbon Fuel Standard (LCFS) (Executive Order, January 2007) requires a 10 percent reduction in carbon intensity of transportation fuels sold in California by 2020. The AB 32 Scoping Plan lists the LCFS as one of the top five strategies, producing a 16 MMT/year reduction in 2020.
6. The California Environmental Protection Agency is charged with leading this implementation effort with support from the University of California, the California Energy Commission, Air Resources Board and others. ARB made Low Carbon Fuel Standard an Early Action measure for AB 32.
7. Second generation (beyond corn ethanol) Bay Area biofuel companies have been attracting joint venture capital, bringing in nearly \$1 billion in 2008, according to the Cleantech Group, a consulting firm. These firms are focusing on the use of marine algae, bacteria, and non-food crops to make biofuels.
8. Replacing 5 percent of the U.S. gasoline supply with cellulosic ethanol from switchgrass, slash and agriculture by-products would require 35 million acres, roughly the size of New York State. There have been no such large-scale production projects to date.
9. In the near term, vehicles running on E85 corn ethanol would get (at best) about a 10 to 30 percent reduction in greenhouse gases vs. gasoline (varies depending on how the corn is grown and harvested). Replacing 5 percent of the U.S. gasoline would require 117 million acres (land equaling the size of Oregon and Idaho). In the U.S. in 2007, 5.7 billions gallons of E85 were produced.
10. Nearly all cars can run on E10 (10 percent ethanol blended into gasoline), but E85 requires a flex-fuel vehicle (FFV). There were over six million FFVs on the road in the U.S. in 2008. There are few flex-fuel filling stations (only 1,800 in the U.S.) so most flex-fuel vehicles are using regular gasoline. In a 2005 survey, 68 percent of U.S. flex fuel vehicle owners did not know they had purchased a flex fuel auto or truck.

11. Large-scale ethanol use will require a new national distribution pipeline system.
12. Biofuels can reduce greenhouse gas emissions, but even with cellulosic ethanol there are environmental and social issues with converting fertile growing lands or forested areas to the cultivation of switchgrass or other cellulosic stocks. A recent article in *Conservation Magazine* (see Links) summarizes these critical issues now being studied more closely in the U.S. and worldwide. The article includes an MIT study looking at the potential impacts of large-scale production of crops for cellulosic ethanol.
13. As with all market-based strategies, financial conditions will play a major role in the speed of ethanol development. For example, California's largest ethanol producer (Pacific Ethanol) recently closed two plants due to rising corn prices and falling fuel prices.
14. A recent article in *Science* reports on research by Stanford and University of California scientists showing that an acre of ethanol could power a small SUV for 15,000 miles if turned into electricity, while it would only go 8,000 miles on liquid ethanol.
15. A new study by the Congressional Budget Office reports that only 10 to 15 percent of the increase in food price of corn-based products between April 2007 and April 2008 was due to making ethanol for fuel and the rest was attributable to skyrocketing energy costs. The same study says -one-fourth of all corn grown in US is for ethanol, and that 9 billion gallons of ethanol were produced in 2008. The use of this ethanol for fuel decreased greenhouse gases by less than 1 percent.

**Links:**

- California Low Carbon Fuel Standard Report (policy):  
[http://www.arb.ca.gov/fuels/lcfs/lcfs\\_uc\\_p2.pdf](http://www.arb.ca.gov/fuels/lcfs/lcfs_uc_p2.pdf)
- California Low Carbon Fuel Standard Report (technical):  
[http://www.arb.ca.gov/fuels/lcfs/lcfs\\_uc\\_p1.pdf](http://www.arb.ca.gov/fuels/lcfs/lcfs_uc_p1.pdf)
- Flex fuels explained: [http://en.wikipedia.org/wiki/Flex\\_fuel](http://en.wikipedia.org/wiki/Flex_fuel)
- Conservation Magazine on impacts of 2<sup>nd</sup> Generation biofuels:  
<http://www.conservationmagazine.org/articles/volume-10-number-2/biofuels-deja-vu/>

**Technically feasible to implement and produce results in next five years?**

Probably not.

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Medium. Running 3 percent of Bay Area passenger cars and light trucks on cellulosic ethanol in 2020 would reduce transportation CO<sub>2</sub> by 1.8 percent (Well to Wheels comparison).

*Cost:*

With current technology, cellulosic ethanol is significantly more expensive on a per BTU basis, perhaps twice as expensive as the gasoline fuel it replaces. Future large-scale production could reduce costs.

*Cost Effectiveness:*

Unknown. Depends on future price to consumers.

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**Strategy 10:**

**Replace regular diesel with biodiesel in buses, trucks, cars and other vehicles.**

**Potential lead:**

- State (California Environmental Protection Agency, Air Resources Board, California Energy Commission) — Low Carbon Fuel Standard implementation

**Potential support roles:**

- Cities/Counties — Standards, mandates, purchases

**Background:**

1. The California Low Carbon Fuel Standard requires a 10 percent reduction in the carbon intensity of California fuels by 2020.
2. Biodiesel reduces CO<sub>2</sub> when used as a fuel source in diesel vehicles. Certain biodiesel blends provide significant reductions in CO<sub>2</sub> (e.g., B100).
3. The majority of biodiesel is made from soybean or canola oils, but some is made from waste, such as used cooking oil and animal fat. Current research is also looking at algae biodiesel (which can produce substantially more oil per acre than crops), but scaling up to the needed production levels is a challenge.
4. Although tailpipe CO<sub>2</sub> emissions are similar for diesel- and biodiesel-operated engines, biodiesel is better when the full lifecycle CO<sub>2</sub> emissions are calculated (i.e., the total CO<sub>2</sub> generated from production, transportation, and end use). With plant-based biodiesel, CO<sub>2</sub> consumed in plant growth offsets the CO<sub>2</sub> produced from combustion. Plant-based B100 reduces the lifecycle CO<sub>2</sub> by 75 percent compared to standard diesel, and the more vehicle-engine friendly B20 reduces CO<sub>2</sub> by about 15 to 16 percent.
5. Soybean biodiesel (the dominant biofuel in Europe) reduces greenhouse gases by 60 percent over gasoline, plus reduces particulate matter (PM) by 50 percent and other pollutants 60 to 90 percent over regular diesel (although NO<sub>x</sub> increases by 10 percent).
6. Soybean biodiesel would require a significant amount of land to make a significant contribution to U.S. fuel consumption. For example, it would take 140 million acres (the land mass of Arizona and Colorado combined) to replace just 5 percent (7 billion gallons) of U.S. gasoline. There are increasing concerns that production of large amounts of biofuels will reduce the supply and, increase the costs of food while

creating new, harmful impacts on the natural environment. The impacts would result from the wide-scale conversion of land for biofuel production.

7. Cooking grease biodiesel reduces greenhouse gases by 75 percent vs. gasoline. Other reductions are similar to soybean biodiesel. Fifty-two million gallons were made in the U.S. in 2007.
8. The city of San Francisco operates SFGreasecycle to collect grease and cooking oil from restaurants and turn it into biodiesel. San Francisco has mandated that all of its diesel vehicles switch to B20 (20 percent biodiesel/80 percent petroleum diesel).
9. Portland, Oregon requires five percent biodiesel for all on-road diesels sold in the city (and 10 percent ethanol for all on-road gasoline sold). Portland is the first city in the U.S. to create a Renewable Fuels Standard (RFS). Portland is working with Oregon farmers and biodiesel producers to increase local biodiesel production.
10. A number of Bay Area cities use biodiesel blends in their fleets. All 1,500 municipal vehicles in San Francisco now use biodiesel.
11. Most Bay Area biodiesel is soybean biodiesel shipped from the Midwest.

**Links:**

- Biodiesel primer: <http://www.blueskybio-fuels.com/biodiesel.html>
- National Biodiesel Board: <http://www.biodiesel.org/>
- SFGreasecycle: [www.sfgreasecycle.org](http://www.sfgreasecycle.org)
- Biodiesel Oasis: <http://www.biofueloasis.com/>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Low. For example, an estimated 0.7 percent reduction in transportation CO<sub>2</sub> (Well to Wheels) can be achieved, assuming that 10 percent of heavy trucks in Bay Area run on B100.

*Cost:*

Biofuel costs more per gallon than regular diesel, but this could change over time as the cost of petroleum increases.

*Cost Effectiveness:*

Unknown: Depends on the future price to consumers.

**Strategy 11:****Replace public and private high-GHG fleet and transit vehicles with vehicles with lower GHGs.****Potential lead:**

- Fleet operators, Transit operators – Purchase

**Potential support roles:**

- Bay Area Air Quality Management District, MTC, County Congestion Management Agencies (CMAs) — Possible funding and incentive programs
- Association of Bay Area Governments (ABAG) — Information/assistance to members

**Background:**

1. Large private and public fleets generate correspondingly large amounts of CO<sub>2</sub> in their operations. Replacing standard fuel vehicles with alternative fuel and hybrid vehicles could provide helpful CO<sub>2</sub> emission reductions. While efforts have and continue to be made to reduce pollution from various fleets related to criteria pollutants, new programs could also be considered to encourage a transition to more fuel efficient vehicles as well. Fleets with central refueling stations lend themselves to biofuels.
2. Hybridization of heavy- and medium-duty trucks (particularly medium-duty delivery trucks) is a measure in the Air Resources Board's draft AB 32 Scoping Plan.
3. Wal-Mart has set a goal of doubling fuel efficiency of their new heavy-duty trucks from 6.5-mpg to 13-mpg by 2015.
4. A number of Bay Area cities and counties are increasing their use of alternative vehicles and fuels. For example, Santa Clara County has purchased 154 lower greenhouse gas vehicles — 60 hybrid vehicles, 50 neighborhood electric vehicles (NEVs), 32 electric forklifts and 12 propane forklifts.
5. Some Bay Area transit agencies are using lower greenhouse gas-emitting vehicles. The Alameda-Contra Costa Transit District (AC Transit) is testing three hydrogen fuel cell buses and is developing a set of 30-foot, gasoline-hybrid neighborhood buses. Sonoma Transit has the largest compressed natural gas (CNG) bus fleet in the region and also supplies CNG to local school buses. Muni has a large electric trolley fleet.
6. The San Francisco Municipal Railway has purchased 85 diesel-hybrid buses. Muni's analysis states they are 30 percent more fuel efficient than regular buses and will save at least 20,000 gallons of fuel over the 12-year life of the bus (200 tons of CO<sub>2</sub>).
7. Seattle and New York City are each operating 200+ hybrid buses. In these two cities, hybrid buses are getting 3.2 mpg vs. regular diesel 2.5 mpg.
8. A PG&E study on BART showed substantial energy savings by taking energy efficiency actions on existing and future BART cars — advanced regenerative

braking, HVAC (heating, ventilating and air conditioning) improvements and lighting. Moving trains accounts for about 75 percent of the overall BART energy use and greenhouse gas emissions.

9. 14 percent of San Francisco's 1,400+ taxis are hybrids and the goal is to get taxi emissions 20 percent below 1990 levels. In New York City, 15 percent of the 13,000 taxis are hybrids and the city is aiming to convert all taxis to hybrids by 2012. Other cities are also attempting to hybridize their fleets.
10. The Air District's Lower Emission School Bus Program provides grants to school districts to replace and retrofit older buses (mainly for particulate matter reduction).
11. The Napa Unified School District is now using the first Plug-In Hybrid school bus in California, getting 12 mpg (vs. normal 6 mpg), cutting CO<sub>2</sub> by 30 percent and NO<sub>x</sub> by 60 percent. The bus uses biofuel to run the diesel engine.
12. A recently-adopted "Regional Climate Compact" for government agencies and businesses in the cities of San Jose, San Francisco and Oakland calls for zero-emission vehicles (ZEVs) and ultra-low emission vehicles (ULEVs) to make up 10 percent of their commercial and municipal fleets in 2013, growing to 25 percent in 2018.
13. See also Strategy #5 for additional info on EV use in fleets.

**Links:**

- AC Transit Hy-Road bus program:  
[http://www.actransit.org/environment/hyroad\\_main.wu](http://www.actransit.org/environment/hyroad_main.wu)
- Napa Plug-In Hybrid School Bus:  
<http://www.napavalleyregister.com/articles/2007/08/10/news/local/doc46bcca6521e51974045742.txt>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Low. Converting all public diesel buses to hybrid buses would reduce transportation CO<sub>2</sub> by about 0.3 percent. Unknown for private fleets, but on the low side given the percentage of fleet vehicles compared to private vehicles.

*Cost:*

Current hybrid public buses cost around \$500,000 each, as opposed to \$300,000 for regular diesel buses. The Napa School District hybrid school bus (above) costs \$250,000 versus the normal \$100,000, but has lower operating costs.

*Cost Effectiveness:*

Low: Assumes hybrid buses cost \$200,000 more than a regular diesel bus and have lifetime greenhouse gas reductions similar to those estimated for San Francisco Municipal Railway hybrid buses (20,000 gallons of diesel fuel saved over the 12-year life of the bus).



## PART 2: IMPROVE TRANSPORTATION INFRASTRUCTURE

### TRAVEL OPTIONS

#### Strategy 12:

**Expand transit services — new routes, added seats, higher frequencies and faster services — in conjunction with focused growth policies.**

#### Potential lead:

- Transit Agencies — New and expanded services
- MTC — Through its 2035 Regional Transportation Plan (providing funding for new services and better coordination of services)

#### Potential support roles:

- County Congestion Management Agencies (CMAs), Cities/Counties — Planning, funding, services

#### Background:

1. Transit carries about 1.3 million riders a day in the Bay Area. This is 11 percent of daily work trips, and 5.5 percent of the total daily trips taken by Bay Area residents.
2. MTC/Caltrans *State of the System Report* shows that Bay Area transit ridership increased to 486,535,000 boardings in 2006-07. The San Francisco Municipal Railway carried 46 percent of the total, BART 21 percent, Alameda-Contra Costa Transit District (AC Transit) carried 14 percent, Santa Clara Valley Transportation Authority carried 8 percent, the San Mateo County Transit District 3 percent, Golden Gate Transit 2 percent, Caltrain 2 percent and all others 5 percent.
3. Large scale investments in transit (such as those evaluated in MTC's Transportation 2035 Vision Analysis for the update of its regional transportation plan — Rail/Ferry and High-Occupancy Toll /Express Bus alternatives), show regional increases in transit ridership of 11 percent to 14 percent in 2035 compared to a scenario in which no new investments are made in transit expansion.
4. Developing new transit services as part of an integrated system of public policies is clearly more effective than a singular focus on building new transit routes. For example, Curitiba's (Brazil) highly successful rapid bus project is strongly supported by parking restrictions, employee travel subsidies, integrated land-use planning and transit prioritization in the roadway network. Curitiba's rapid bus project has qualified as an international offset program under the Kyoto Clean Development Mechanism (CDM) protocols. Similarly, Bogota's urban form is being redeveloped by an integrated system of public policies, including:
  - Creation of the "Transmilenio" rapid bus network, which enjoys dedicated rights of way on roadways.

- The “Pico y Placa” program that reduces traffic congestion by prohibiting cars with certain numbered license plates from traveling twice a week.
  - Improvements to the public realm, including sidewalks and parks, with car parking restrictions enforced to enhance pedestrian safety and comfort.
  - Construction of a world-class bicycle network of paths and parking facilities, plus bicycle-only times on designated roadways.
5. The full impacts of transit expansion on greenhouse gases can be more clearly identified as part of “focused growth” transit/land use strategy packages. An American Public Transportation Association (APTA) study in 2008 quantified the “transit multiplier” for greenhouse gases, showing that for each passenger mile on transit, there are significant secondary greenhouse gas impacts. The study finds that transit supports efficient land use patterns, making it possible for individuals living near transit to take shorter driving trips, own fewer cars per household and make more bike/walk trips.
  6. MTC’s “Regional Transit Expansion Program” (MTC Resolution 3434) identifies nine new rail extensions, significant service expansions to existing rail lines, a comprehensive regional express bus program, new ferry service and eight enhancement programs for existing rail and bus corridors.
  7. Transit ridership increased on a number of Bay Area systems in 2008 as gas prices rose. At the same time, driving indicators decreased. For example, BART set an all-time one-day ridership record on September 8, 2008, carrying 405,000 riders.
  8. In an MTC telephone poll (October 2007), “provide more bus, rail and ferry service” was the second highest priority for reducing greenhouse gas emissions, just behind “research into alternative fuels and vehicles” and ahead of seven other choices. In the same poll “extend rail lines” was the overwhelming #1 investment priority vs. improve freeway performance, increase carpool lanes and implement high-occupancy toll (HOT) lanes.
  9. Some Bay Area transit agencies are analyzing climate impacts for their systems. BART has been conducting an extensive analysis of various GHG reduction strategies (ridership, trains, stations, etc.) over the last 2 years. The San Francisco Metropolitan Transportation Authority (SFMTA) has produced a comprehensive climate plan for San Francisco transit services, bicycle and pedestrian facilities, etc. In the South Bay, the Valley Transportation Plan 2035 includes a new element called the Transportation Energy and Air Quality (TEAQ) Program. The program is a guideline for enhancing regional partnerships with local environmental agencies. TEAQ provides a planning framework for conducting research to help address climate change, energy issues and new environmental legislation,
  10. Faster transit services have proven to increase ridership. For example, the Caltrain Baby Bullet express service has produced a 30 percent ridership gain.
  11. New access services are a key issue for expanding transit ridership. On Caltrain’s extensive shuttle system (35 routes) connecting employers, schools, and other

destinations, more than 60 percent of riders are ex-solo drivers who have shifted to trains/shuttles.

12. There may be possibilities for transit to participate in some cap and trade carbon trading programs, but the opportunities are not well defined. The Bay Area's Altamont Commuter Express (ACE) and King County (Seattle, Washington) transit systems have joined the Chicago Climate Exchange program. BART is studying the potential implications of selling offsets as part of a cap and trade program as well as the potential impact on ridership and electricity costs.
13. Improving bicycle and pedestrian access to transit stations and transit vehicles is important to increasing ridership and further reducing the greenhouse gas emissions from auto trips to transit. Caltrain's Bikes on Board program provides space for 16-48 bikes per train, depending on configuration. The program has been so successful that demand to bring bikes on board exceeds current capacity and Caltrain is working to find ways to increase the bikes on board capacity. BART's Bike Space car modification is an exemplary project funded by Safe Routes to Transit. Providing bike sharing stations at transit hubs would also provide a flexible alternative to driving.

**Links:**

- MTC Transportation 2035 Analysis: [http://www.mtc.ca.gov/planning/2035\\_plan/tech\\_report.htm](http://www.mtc.ca.gov/planning/2035_plan/tech_report.htm)
- TALC's platform for RTP: [http://www.transcoalition.org/c/sus\\_rtp/rtp\\_home.html](http://www.transcoalition.org/c/sus_rtp/rtp_home.html)
- APTA: Broader Connection Between Public Transportation, Energy Conservation and Greenhouse Gas Reduction: [http://www.apta.com/research/info/online/land\\_use.cfm](http://www.apta.com/research/info/online/land_use.cfm)
- APTA draft guidance on quantifying greenhouse gas emissions from transit: [http://www.railvolution.com/rv2008\\_pdfs/rv2008\\_230b.pdf](http://www.railvolution.com/rv2008_pdfs/rv2008_230b.pdf)
- SFMTA Climate Plan: <http://www.sfmta.com/cms/rcap/capindx.htm>
- Curitiba Transport: <http://en.wikipedia.org/wiki/Curitiba#Transport>
- Bogota transportation: [http://architecture.suite101.com/article.cfm/bogotas\\_transit\\_system](http://architecture.suite101.com/article.cfm/bogotas_transit_system)
- MTC 2007 Opinion Poll: [http://www.mtc.ca.gov/planning/2035\\_plan/poll.htm](http://www.mtc.ca.gov/planning/2035_plan/poll.htm)
- MTC Transit Expansion Program: <http://www.mtc.ca.gov/planning/rtep/index.htm>

**Technically feasible to implement and produce results in next five years?**

Yes (some services)

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Depends on types of projects implemented by 2020. The MTC Vision 2035 Analysis showed that the Regional Rail/Ferry Alternative would increase transit ridership by 10.7 percent and would reduce regional transportation CO<sub>2</sub> by 2.3 percent in 2035. Net greenhouse gas benefits would need to factor in the emissions from expanded transit operations.

*Costs:*

Depends on the type of transit expansion and associated capital, and operating costs.

*Cost Effectiveness:*

*Regional Transit Expansion Program*

Low. Based on results from MTC Vision 2035 Analysis.

*New Motor Bus Route.*

Low. Based on creating new local bus routes with frequent service; assumes additional vehicles required above those in the current fleet along with additional operating costs; assumes 6,700 new riders a day (riders who would have formally used a car for their trip, but now take transit) who travel an average distance of 3.3 miles on transit. Includes adjustments for diesel bus emissions. **NOTE: This estimate is based on regional averages. Results may be different for specific operators and routes.**

*New Last Mile Shuttle*

Medium. Assumes new shuttles from rail stations to employment centers (could be BART, Caltrain, ACE, Sonoma Marin Area Rail Transit (SMART), etc.). New routes would serve 200 new transit riders a day and cost \$150,000 a year to operate. Assumes the shuttles would be responsible for new transit riders; therefore, greenhouse gas reductions are based on longer trip distances (16 miles assumed).

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**Strategy 13:**

**Expand/improve bike facilities — new lanes, paths, routes, parking, crossings.**

**Potential lead:**

- Cities/Counties, Congestion Management Agencies (CMAs) — Planning, funding

**Potential support roles:**

- MTC, Employers, Schools — Funding
- Bike/walk organizations — Advocacy

**Background:**

1. Since much of the Bay Area's home and work areas are on relatively flat ground and the region enjoys a mild climate year-round, an expansion of bicycling at low cost is very possible if key safety barriers and social barriers are addressed. With 43 percent of trips in California being two miles or less, there is real potential to capture more of these short trips through non-motorized infrastructure.
2. According to the 2000 Census, 1.5 percent of daily Bay Area work trips were made by a bike. County bicycle use varies from San Francisco (2.8 percent) to Contra Costa (.5 percent).

3. Getting accurate bike-use data (rate of use, former mode of transportation, distance) is a challenge. For example, the 2000 Census shows Boulder, Colorado with a 6.9 percent bike rate, while Boulder's Travel Diary Study (conducted since 1990) shows a 20.5 percent rate for 2006. Similarly, the Bay Area Bicycle Coalition points out that the Census tends to undercount the number of bicycle commuters, as those surveyed are asked to choose "the method used for most of the distance," thus missing those who use a bike to commute to transit. Without a standardized data collection method, cities have resorted to manual and automated counts, intercept surveys, diaries, etc. In the Bay Area, Alameda County conducts counts at 12 locations, while San Francisco uses 35 count locations. There are now several new technologies available that provide automated bike counts, which would give much more accurate data on bicycle use. MTC is currently working to build a consistent regional policy for bicycle counts based on the ALTA/ITE National Bicycle and Pedestrian Documentation project.
4. The Marin County "Bicycle and Pedestrian Master Plan" will create a system of bike/walk facilities and key destinations, with the goal of having 20 percent of all trips made on foot or by bicycle by the year 2020. Marin is the recipient of a \$25 million federal grant (one of four in the U.S.) to establish a system of north-south and east-west separated paths that follow railroad right of ways. The grant includes other components, such as safe routes to schools, bicycle parking, educational programs, and swift connections on the streets within each of Marin's 11 towns. The north-south route will make Marin County easy to navigate via biking or walking and will connect to seven transit hubs, two ferry terminals, many large employers and shopping centers, and come within two miles of 51 schools.
5. The city of Oakland recently adopted a comprehensive update to its Bicycle Master Plan. The vision statement explains that "Oakland will be a city where bicycling is fully integrated into daily life, providing transportation and recreation that are both safe and convenient." Key elements in the plan include a policy of routine accommodation, a greater emphasis on Safe Routes to Transit, and a detailed evaluation of all streets in the Proposed Bikeway Network.
6. The city of Berkeley has established a citywide network of seven bike boulevards on low-traffic streets that link key destinations. Boulevards have distinctive signage and markings to identify routes.
7. Each county in the Bay Area has a countywide bike plan and planning process. For example, Santa Clara County has a Bicycle Master Plan, a set of Bicycle Technical Guidelines, and a Bicycle Expenditure Program. Valley Transportation Authority's Bicycle Program envisions a countywide corridor of bicycle trails and routes that connect north to south and east to west. The Bicycle Technical Guidelines are a best-practices guide to bike-lane design and are required when projects are being developed. The Bicycle Expenditure Program identifies the most important bicycle projects that require funding through regional, local and state sources.
8. Various MTC programs support bicycling and walking. The Regional Bicycle Plan for the San Francisco Bay Area (2009 Update) includes the Regional Bikeways

Network (the Transportation 2035 Plan commits \$1 billion over 25 years) and the Safe Routes to Transit program (\$22 million, administered by the nonprofit groups TransForm and the East Bay Bicycle Coalition). The 2035 Plan also includes funding for Safe Routes to Schools/Transit as part of the Climate Action Campaign. Local Transportation Development Act Article 3 funds are a dedicated source of bike/pedestrian funding.

9. The MTC Regional Bicycle Plan represents the sustained efforts of MTC staff, the local agencies, advocacy groups, and countless dedicated citizens in the Bay Area. It is intended to be a resource document for Bay Area town, city, and county planners and for advocates. The plan is regional in focus and is, therefore, oriented around policies and programs and defers to local decision making about specific routes and facilities. The plan provides a framework for identifying regional priorities for routes and facilities and recommends a series of activities and policies to encourage bicycling at the regional level. An important part of the plan is the Regional Bikeway Network, which sets criteria for selecting bicycle routes and facilities of regional importance that will be eligible for the \$1 billion in funding that MTC is committing to the project. When completed, the network will be 2,140 miles long. Currently about half of the network is built. The final plan was adopted along with MTC's Transportation 2035 Plan in April 2009.
10. The Alameda County Transportation Improvement Authority (ACTIA) is the lead agency for the "2010 Campaign for Active Transportation in Alameda County," the product of a year-long collaboration among many county stakeholders. The campaign outlines how the county will allocate \$50 million (if received through a new "active transportation" section of the next federal transportation bill) to "take bold action to address fuel costs, global warming, increasing auto congestion, and the poor health of our community, by shifting people from cars to walking, biking and an array of transit." The campaign will build on the \$100 million already allocated from Measure B for biking and walking, as well as numerous city-based bike/walk plans and programs. The campaign will make "last mile" connections to transit stations (including bike parking) and complete key routes like the Bay Trail, the Iron Horse Trail and the proposed East Bay Greenway. It will also bring Safe Routes to School to every elementary school, create a Safe Routes for Seniors Program and promote adoption of local "complete streets" policies.
11. The California Legislature recently passed AB1358 (Chapter 657, 2008 Statutes), the Complete Streets Act policies, which requires cities and counties to develop plans to ensure that roads are designed to serve the needs of all users. While many cities and counties are still in the process of developing these plans, MTC and Caltrans have already established complete streets policies. MTC's Resolution 3765 requires all project sponsors to complete a detailed Routine Accommodations Checklist, explaining how their project impacts bicycle and pedestrian access. Caltrans Deputy Directive 64 makes addressing the needs of bicyclists, pedestrians and transit users an implicit objective of all planning.
12. Paris is now home to the largest "city bike" program among the many such programs in Europe. The Paris "Velib" program now has 1,400 automated bike stations with

more than 20,000 bikes for rent. It is designed mainly for commuters, not tourists. According to the *New York Times*, the system averages 120,000 trips per day. Riders pay a subscription fee (€1 per day, €5/week or €29/year). A subscriber has 30 minutes to reach his/her destination before any charge is made. An unlimited number of 30-minute free rides can be taken each day. After 30 minutes, the costs rise steeply; 2 hours costs 7 Euros. For this reason, 96 percent of rides are less than 30 minutes. Stations are open 24/7. The bike program is operated by the city but financed by JCDecaux (one of the world's leading outdoor advertising companies) as a part of a larger public advertising deal. A credit card or “Maestro” debit card is required to sign up for the program and to rent the bikes. The credit/debit card will be charged €150 if a rented bike is not returned.

13. Copenhagen, Amsterdam and other cities synchronize some traffic signals to provide a green light for a flow of cyclists. In Copenhagen, a “green wave” on the arterial street “Nørrebrogade” facilitates 30,000 cyclists to maintain a 12 mph (19.3 km/h) speed for 2.5 kilometers. In Amsterdam, cyclists riding at a speed of 15 to 18 km/h will be able to travel without being stopped by a red signal. Tests show that public transport can benefit as well and cars may travel slightly slower.

#### **Links:**

- MTC Regional Bicycle and Pedestrian Program: <http://www.mtc.ca.gov/planning/bicyclespedestrians/regional.htm#bikepedprog>
- Bay Area Regional Bicycle Coalition: <http://www.bayareabikes.org/corner.htm>
- WalkBikeMarin: <http://www.walkbikemarin.org/>
- Marin Safe Routes to Transit: <http://www.saferoutestoschools.org/index.shtml>
- Santa Clara Countywide Bicycle Plan: [http://www.vta.org/schedules/bikeways\\_plan.html](http://www.vta.org/schedules/bikeways_plan.html)
- 2010 Campaign for Active Transportation in Alameda County: [www.actia2022.com/transportation.html](http://www.actia2022.com/transportation.html)
- National coalition on Complete Streets: <http://www.completestreets.org/CaliforniaCS.html>
- Streetsblog on “green wave” signals for bikes: <http://sf.streetsblog.org/2009/01/15/bicycle-signal-priority-%E2%80%9Cgreen-wave%E2%80%9D-project-stalled/>
- Paris “Velib” System: <http://en.wikipedia.org/wiki/Velib>
- Paris Velib blog (en francais): <http://blog.velib.paris.fr/blog/>
- World City Bike: <http://citybike.newmobility.org>

#### **Technically feasible to implement and produce results in next five years?**

Yes

#### **Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Low. If the number of bike trips in 2020 increased by 20 percent over the currently projected 2020 total, transportation greenhouse gases would be reduced by 0.1 percent,

assuming all these trips replaced a vehicle trip. Shorter trip lengths and overall number of trips keeps the impact down.

*Cost:*

Depends on type of bicycle/pedestrian project. The Bay Area Air Quality Management District has collected data on bike use and costs associated with its Transportation Fund for Clean Air (TFCA) program.

*Cost Effectiveness:*

Low. Based on data collected by the Air District on costs and benefits of various bicycle infrastructure projects implemented with TFCA funds; assumes a 15- to 20-year life for the project and a four percent discount rate to determine annual costs.

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## **Strategy 14:**

### **Expand/improve pedestrian facilities — sidewalks, paths, crossings, signals**

**Potential lead:**

- Cities/Counties, Congestion Management Agencies (CMAs) — Planning, funding

**Potential support roles:**

- MTC, Developers, School districts — Planning, funding

**Background:**

1. Statistics show that 9.3 percent of all trips in the region (including 3.3 percent of work trips) are walking trips.
2. In a study of King County (state of Washington) neighborhoods (as described in Lawrence Jackson's "Many Pathways from Land Use to Health"), he found that a 5 percent increase in neighborhood walkability was associated with a 6.5 percent reduction in vehicle miles traveled, a 5.5 percent reduction in volatile organic compounds (VOCs) and nitrogen oxides (NOx), and a 32 percent increase in time spent in physical activity.
3. Researchers in a study of walkable mixed-use neighborhoods have found that residents have higher levels of "social capital" compared with those living in car-oriented suburbs. Residents of walkable neighborhoods were more likely to know their neighbors, participate politically, trust others and be socially engaged. (Leyden, American Journal of Public Health, 2003)
4. Safe Routes to Schools (SR2S) is a nationwide program designed to decrease traffic and pollution and improve the health of children by promoting walking and biking to school through education, incentives and capital improvements. The program also addresses parents' safety concerns by encouraging greater enforcement of traffic laws, educating the public, and exploring ways to create safer streets. Marin County



has been at the forefront of the SR2S movement, beginning in 2000 when the National Highway Traffic Safety Administration provided funding to develop a pilot program. A consultant's evaluation of SR2S in Marin County in 2004-05 found that student walking trips increased from 14 percent to 20 percent, while bike trips increased from 7 percent to 9 percent and carpooling increased from 17 percent to 22 percent. The Marin County program now receives regular funding from the Measure A transportation funds (half-cent local county transportation sales tax).

5. Safe Routes to Schools Alameda County, spearheaded by the nonprofit group Transform, is a collaboration with the Alameda County Public Health Department, Cycles of Change and many other local agencies and organizations. The program provides training, resources and customized support at no cost. The program is funded in part with a major grant from Measure B -- Alameda County's half-cent transportation sales tax, administered by the Alameda County Transportation Improvement Authority.
6. The Solano County Transportation Authority is now building an extensive countywide Safe Routes to Schools Program including "education, encouragement, enforcement and engineering" strategies. STA approved a countywide plan for SR2S in 2008.
7. Increasing walking trips is a major goal of the Bay Region's FOCUS/Smart Growth plan. Comprehensive smart growth strategies (beyond just adding more dense housing) can create significant improvements in walkable communities.
8. Climate and walking strategies tie in very well with public health initiatives by counties, the state of California, Kaiser Permanente and other health providers.
9. Various MTC programs support bicycling and walking such as the Regional Bicycle and Pedestrian Program (\$200 million over 25 years) and the Safe Routes to Transit program (\$22 million, administered by TransForm and the East Bay Bicycle Coalition. The Climate Action Campaign, a part of the Transportation 2035 Plan (-T2035), adopted by MTC in April 2009, also designates funding for Safe Routes to Schools/Transit. In addition, the Transportation for Livable Communities (TLC) program, whose funding was just doubled in T2035, provides strong support for pedestrian environments.
10. Complete Streets: See #9 in Strategy 13.

**Links:**

- Safe Routes to School: <http://www.saferoutestoschools.org/>
- Alameda County Safe Routes to School: <http://www.transcoalition.org/c/sr2s/index.html>
- Solano County Safe Routes to School: <http://www.sta.dst.ca.us/sr2s.html>
- MTC Regional Bicycle and Pedestrian Program: <http://www.mtc.ca.gov/planning/bicyclespedestrians/regional.htm#bikepedprog>
- Social Capital and the Built Environment: The Importance of Walkable Neighborhoods: <http://www.ajph.org/cgi/content/abstract/93/9/1546>
- National coalition on Complete Streets: <http://www.completestreets.org/CaliforniaCS.html>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Low. If the number of walk trips in 2020 increased by 20 percent over the currently projected 2020 total, transportation CO<sub>2</sub> would be reduced by 0.3 percent, assuming all these trips replaced a vehicle trip.

*Cost:*

Safe Routes to Schools infrastructure projects, funded by state and federal dollars, have significant costs. The other side of SR2S — education and encouragement — is designed to increase use of both existing and new walk and bike facilities. The Marin County Safe Routes to Schools Program annually spends \$115,000 and \$100,000, for education and encouragement programs, respectively. These activities engage more than 12,000 kindergarten to fifth grade students each year, for a per student cost of \$18.

*Cost Effectiveness:*

Medium, based on a 2005 evaluation of Marin County's SR2S program. The program reduced CO<sub>2</sub> by 1,060 tons for the year. Costs include \$215,000 for education and enforcement and \$165,330 in annualized capital costs for four major projects that improve bike and walk access to schools (15-year project life and 4 percent discount rate).

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**Strategy 15:**

**Expand carpooling facilities — new HOV or HOT lanes, preferential parking, etc.**

**Potential lead:**

- MTC — Regional funding for high-occupancy vehicle/high-occupancy toll (HOV/HOT) lane network
- California Department of Transportation/Highway Patrol — high-occupancy vehicle lane construction/enforcement

**Potential support roles:**

- Congestion Management Agencies (CMAs) — HOV/HOT lane development
- Cities/Counties, Businesses — Advocacy

**Background:**

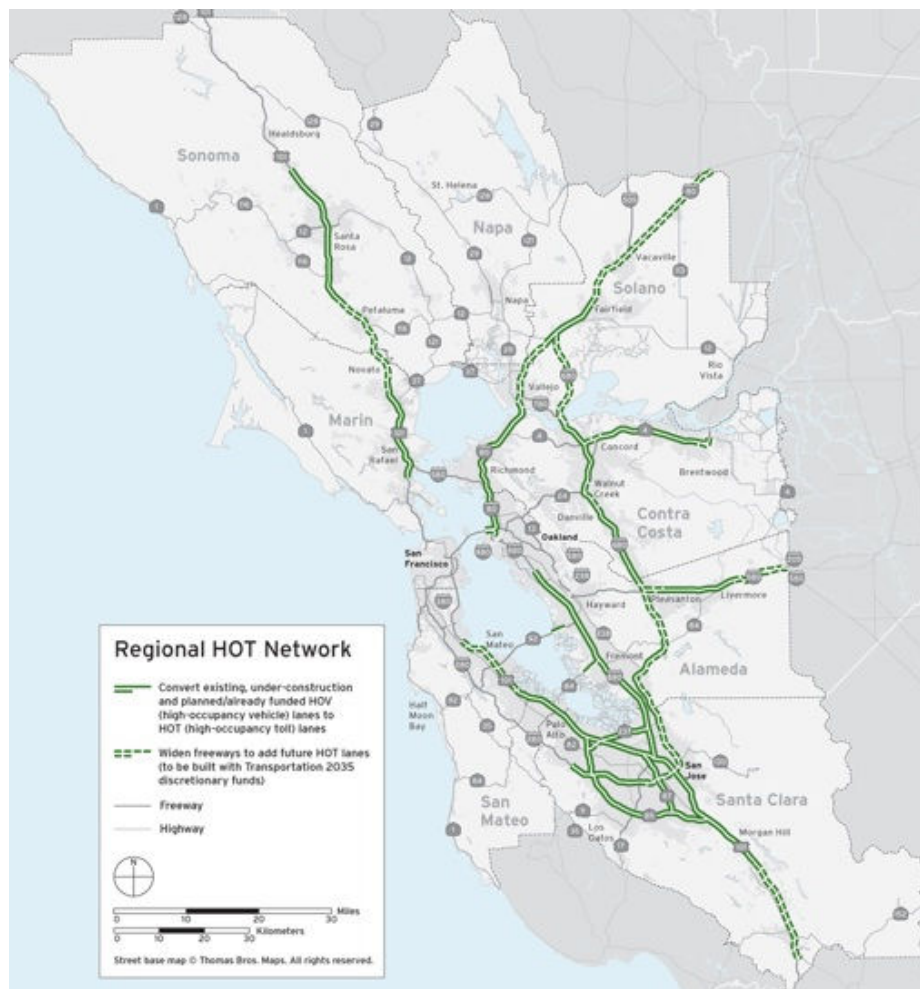
1. In 2000, 13.9 percent of all work trips in the region were in carpools and vanpools.
2. Time savings from high-occupancy vehicle (HOV) lanes provide powerful incentives for carpoolers and regional express bus riders. In 2005, HOV lanes carried 16 percent

of the vehicles and 30 percent of the people in the peak hours on freeway segments with carpool lanes.

3. Currently, there are 421 miles of HOV lanes in Bay Area.
4. Some HOV lanes are becoming overly crowded due to carpool growth and hybrid access (as noted in Strategy #4, the law allowing access by hybrids was extended to 2011). In addition, there are on-going enforcement issues with some HOV lanes.
5. Employers can support HOV lanes through various incentives. For example, Google is running 50 commute buses to its campus in the city of Mountain View. Genentech has started an in-house ridematching system and is paying carpool drivers. Through 511.rideshare, hundreds of employers are helping their employees form carpools using HOV lanes.
6. High-occupancy toll lanes, or HOT lanes, are HOV lanes that allow solo drivers to use them when they pay a fee. HOT lanes have been in operation for over 10 years in Southern California and in Houston, and in the past five years have opened in Seattle, Denver, Miami, Minneapolis and Salt Lake City.
7. The Santa Clara Valley Transportation Authority (VTA) Express Lanes Project proposes the conversion of existing HOV or carpool lanes on State Route (SR) 237/I-880 direct connectors, SR 85 and U.S. 101 into high-performance Express Lanes to better use existing capacity in carpool lanes. Express Lanes will allow solo drivers the option of paying a toll to use the Express Lanes. Carpools with two or more occupants, motorcycles, transit buses and eligible hybrids will continue to use Express Lanes free of charge.
8. MTC and Caltrans, in cooperation with the county congestion management agencies and other partners, completed a “Regional High-Occupancy/Toll (HOT) Lanes Network Feasibility and Implementation Study” (September 2007). The study was designed to determine whether a regional network of HOT lanes is feasible, define a phased implementation plan and provide a regional context for demonstration projects under development in Alameda and Santa Clara counties. The study also informed regional policies related to HOT lanes. The study proposes building on the existing HOV system to create a regional network of HOT lanes by converting existing HOV lanes to HOT lanes and expanding the HOV/HOT system where possible. In July 2008, MTC adopted principles for the cooperative development and operation of a future HOT lane system for the Bay Area.
9. AB 744, pending in the 2009-2010 session of the California Legislature, would authorize BATA (MTC’s affiliate agency that currently administers toll revenue from the region’s state-owned toll bridges) to create an 800-mile Express Lane Network on Bay Area freeways. Existing state legislation permits the development of a limited number of express lanes in the Bay Area, two of which are now under construction — on Interstates 580 and 680. The new bill would extend the express lane network regionwide. MTC’s HOT Lane analysis shows that revenue generated by vehicles using HOT lanes, and the dedication of this revenue to the expansion of HOV lanes, would allow the HOV system to be completed 20 years faster than if the region used

only conventional financing. MTC's analysis shows a 7 percent reduction in CO<sub>2</sub> in 2030 compared to normal pay-as-you-go HOV lanes.

10. MTC estimates that it will cost \$3.7 billion to build the HOT Lane Network, and another \$3.9 billion to operate it over the next 25 years, for a total cost of \$7.6 billion. With gross HOT lane toll revenues forecast to reach \$13.7 billion over the same period, the remaining \$6.1 billion in net revenue could be used to fund express bus service, rail extensions and rail-service enhancements along the HOT corridors, as well as interchange improvements and the like. The MTC plan is to convert to HOT lanes some 400 miles of carpool lanes that already exist or are under construction, plus 100 new miles of fully funded diamond lanes scheduled to be built in the next four years. The revenue initially generated could finance bonds that could be used to construct an additional 300 miles of HOT lanes that close gaps and extend the system.



11. Questions are often raised about equity issues for HOT lanes. The Federal Highway Administration has done a summary of the research on equity issues and congestion pricing, including HOT lanes. (See link below.) The FHWA summary states: “Project experience has shown, particularly for the most common projects funded under the

early phases of the program (e.g., HOT lanes), that the perception of unfairness may be exaggerated. Data from the various cities that have implemented projects or have projects underway are discussed below. Most of the data have been obtained from projects involving “partial” pricing on one or more lanes of a freeway facility. Equity impacts relating to income have not been evaluated in the case of “full facility” pricing projects, such as those implemented on tollways and tolled water crossings. Overall, the perception that congestion pricing is an inequitable way of responding to the problem of traffic congestion does not appear to be borne out by experience.”

12. Concerns have also been expressed about the long-term impacts of Bay Area HOT lanes on solo driving and on transportation greenhouse gases. These are mainly focused on “induced demand,” making single-occupant vehicle travel more attractive, and the ability of travel demand models to capture these effects. While MTC’s analysis shows HOT lanes have a positive and significant impact on greenhouse gases, we have included some of the stated concerns (and MTC’s response letters) in the links section below to encourage more discussion and strategy refinement in the coming months.

**Links:**

- MTC HOT Lanes Study: <http://www.mtc.ca.gov/planning/hov/index.htm>
- MTC Transportation 2035 Performance Assessment Report: [http://www.mtc.ca.gov/planning/2035\\_plan/](http://www.mtc.ca.gov/planning/2035_plan/)
- Santa Clara VTA Express Lanes Project: <http://www.vta.org/expresslanes/>
- AB 744: [http://www.totalcapitol.com/?bill\\_id=9234](http://www.totalcapitol.com/?bill_id=9234)
- Income-Based Equity Issues of Congestion Pricing — A Primer (FHWA): [http://ops.fhwa.dot.gov/publications/fhwahop08040/cp\\_prim5\\_04.htm](http://ops.fhwa.dot.gov/publications/fhwahop08040/cp_prim5_04.htm)
- Correspondence about HOT lanes in Transportation 2035 development: April 8, 2009 (Pages 27, 40, 102, etc.) March 2, 2009 (Page 165): [http://www.mtc.ca.gov/planning/2035\\_plan/](http://www.mtc.ca.gov/planning/2035_plan/)
- HOT Lanes: A Tool, Not A Panacea (Breakthrough Institute and Environmental Defense): <http://www.edf.org/pressrelease.cfm?ContentID=4787>

**Technically feasible to implement and produce results in next five years?**

Yes (some areas)

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact*

Depends on HOV or HOT projects implemented by 2020. The *Vision 2035 Analysis* showed that an expanded HOV/HOT network, together with new regional bus service, would reduce transportation CO<sub>2</sub> by 4 percent, due to the combined mode shift and delay reduction effects.

*Cost:*

Depends on the specific project. Costs would include construction, enforcement, administration and operating costs (for HOT lanes). HOT lane revenues would pay for a portion of the infrastructure and operating costs.

*Cost Effectiveness:*

*Regional HOV/HOT Lane system:*

Low. Based on results from MTC's *Vision 2035 Analysis*.

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### **Strategy 16:**

### **Expand car sharing services using low-greenhouse gas and super-low greenhouse gas vehicles**

#### **Potential lead:**

- Car share companies—City CarShare, Zip Car

#### **Potential support roles:**

- MTC, Bay Area Air Quality Management District, Congestion Management Agencies (CMAs), Businesses — Provide incentives
- Cities/Counties — Develop public/private partnerships with car sharing companies
- Employers

#### **Background:**

1. Two car sharing companies are operating now in the Bay Area — Zip Car and City CarShare. Car share programs include hybrids and other lower-greenhouse gas vehicles.
2. According to the Victoria Transportation Policy Institute (VTPI), “In a study of the San Francisco City CarShare program, Cervero and Tsai (2003) found that when people join, nearly 30% reduce their household vehicle ownership and two-thirds stated they avoided purchasing another car, indicating that each CarShare vehicle substitutes for seven private cars, and that the average member drives 47% fewer annual miles after joining.” However, since car sharing tends to attract motorists who already drive relatively low mileage, total travel reductions may be relatively small.
3. Considerable research has been conducted by Northern California researchers (Susan Shaheen, Adam Millard-Ball, etc.) concerning car sharing costs, benefits, barriers and other factors. The conclusion from this research is that there is much untapped potential for car sharing to reduce vehicle miles traveled and greenhouse gas emissions.
4. The city of Berkeley and others have negotiated an agreement with car sharing companies that benefit both parties. Berkeley's deal includes car sharing vehicles that are used by city employees during the day and by the public at night and on weekends. This saves the city money on its own fleet and expands car sharing opportunities for residents. In addition, the city has negotiated parking space deals with car sharing companies in exchange for the expansion of services.

5. Transit station car sharing was evaluated as a “Further Study Measure” in the *2001 Ozone Attainment Plan* for the Bay Area. The analysis concluded that the use of hybrids and plug-ins for vehicles at transit stations would further reduce greenhouse gas emissions for transit riders.
6. The city of Emeryville’s shuttle bus service (Emery Go-Round) has been expanded to include a car-sharing element.

**Links:**

- Adam Millard-Ball, et al(2005): *Car-Sharing – Where and How It Succeeds*, TCRP Report 108, Transportation Research Board ([www.trb.org](http://www.trb.org)); [http://gulliver.trb.org/publications/tcrp/tcrp\\_rpt\\_108.pdf](http://gulliver.trb.org/publications/tcrp/tcrp_rpt_108.pdf)
- Daniel Sperling (2000), Susan Shaheen and Conrad Wagner: *Carsharing And Mobility Services: An Updated Overview* <http://www.communauto.com/abonnes/SperlingShaheenW.html>
- Car sharing at VTPI’s Transportation Demand Management (TDM) Encyclopedia: <http://www.vtpi.org/tdm/tdm7.htm>
- City CarShare: <http://www.citycarshare.org/>
- Zip Car/Flex Car: <http://www.zipcar.com/press/>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Low. No analysis performed to date, but the size of the car sharing market would indicate low CO<sub>2</sub> reductions.

*Costs:*

Car sharing is currently a private enterprise. Members of car sharing programs save on vehicle maintenance, insurance and other costs associated with owning a vehicle.

*Cost Effectiveness:*

Unknown. Would vary by individual household travel characteristics.

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**Strategy 17:**

**Expand/improve school bus services — new services and clean fuels.**

**Potential lead:**

- State — Funding
- School Districts — Administration, operations, funding

**Potential support roles:**

- Transit Agencies — Operations
- MTC, County Congestion Management Agencies (CMAs), Cities/Counties — Funding
- Bay Area Air Quality Management District — Funding for clean buses

**Background:**

1. Driving children to school (or high school students driving themselves) has become a significant issue for local congestion, student health, air pollution and greenhouse gas emissions.
2. School trips constitute at least 10 percent of the morning peak trips in the region, and are higher in predominantly residential cities.
3. California ranks last in U.S. for percentage of students using school buses — 16 percent vs. the national average of 59 percent. (Source: California Department of Education). Home-to-school busing is an allowable (not mandatory) service in the state education code. When Proposition 13 limited school revenue increases, home-to-school busing was often one of the first programs eliminated to cut costs.
4. The number of school district bus programs has declined sharply due to funding constraints. However, there are still a number of robust school busing programs in the Bay Area operated by school districts, transit agencies and cities. Often these services are provided on a fee basis with fee waivers for low-income students. (NOTE: While transit agencies cannot provide dedicated “school service” by law, some agencies in the state provide extensive school-oriented bus services that are mainly used by students but are open to the public.)
5. AC Transit operates an extensive system of buses that are targeted to K-12 students, but open to all riders.
6. Contra Costa County devotes sales tax funding specifically to school bus services. Measure C (a voter-approved transportation sales tax measure) funds a school bus service to 11 schools in Lafayette, Moraga and Orinda that serves 1,800 students a day. According to the latest parent survey, the system eliminates 462,000 vehicle trips per school year. Measure J (the continuation of Measure C to be implemented starting in 2009) includes \$64 million in funding over 25 years for “Safe Transportation for Children.” This represents 3.3 percent of the total expenditures of Measure J funds. Eligible projects include the continued operation of the Lamorinda School Bus Program (\$26.4 million), and the inauguration of a San Ramon Valley School Bus Program. Other projects in the San Ramon Valley that reduce school related congestion, or improve the safety of children traveling to and from schools, are also eligible for funding (\$40 million). In a study of the San Ramon area, 33 percent of elementary students, 43 percent of middle schoolers and 35 percent of high school students were “very likely” to ride the bus. Currently about 5 percent of students in Contra Costa County are school-bus riders.



7. While improving school bus service can provide greenhouse gas emission reductions in the near-term, long-term strategies must include improved school siting that will allow more students to walk, bike and take public transit to their schools.
8. The lack of adequate school bus service can be a transportation equity issue, since some lower-income families cannot afford a car to drive their children to school. Statewide, children in households with incomes less than \$25,000 a year use private vehicles for 53 percent of all trips with biking and walking accounting for 29.5 percent of these trips. In households with incomes more than \$75,000 per year, children use private vehicles for 85 percent of trips with biking and walking accounting for just 10 percent of these trips. (Source: Caltrans “Statewide Household Travel Survey”)
9. School buses that are clean (i.e. low emitting for particulate matter and greenhouse gases) are preferred. The first electric plug-in hybrid school bus in the Bay Area is now in service in the city of Napa.

**Links:**

- Contra Costa Measure J School Bus Program: [http://www.co.contra-costa.ca.us/depart/cd/transportation/Measure%20J%20School%20Bus%20Program/Measure\\_J\\_School\\_Bus\\_Program.htm](http://www.co.contra-costa.ca.us/depart/cd/transportation/Measure%20J%20School%20Bus%20Program/Measure_J_School_Bus_Program.htm)
- AC Transit Buses to School: <http://www.actransit.org/riderinfo/schools.wu>
- Napa County plug-in hybrid biodiesel school bus: <http://www.podtech.net/home/3987/californias-new-hybrid-school-bus>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Low. If 10 percent of students riding in cars to school switched to school buses, walking or biking, transportation CO<sub>2</sub> emissions would be reduced by 0.1 percent.

*Cost:*

School districts can own their bus fleets, lease buses or contract service with a private operator. A 2003 review of school bus systems in Alameda County showed annual costs ranging from \$475 to \$1,900 per pupil.

*Cost Effectiveness:*

Low. Based on results from Contra Costa County Lamorinda School Bus program (Measures C & J sales tax revenues). The program serves 1,800 students a day at 11 schools at an annual cost of \$1,780,000. The average trip distance to school is 3.4 miles and school is in session 180 days a year. Adjustments were made for school bus emissions.

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**Strategy 18:****Build a High-Speed Rail system to reduce intra-state air and car travel.****Potential lead:**

- State — Planning, funding

**Potential support roles:**

- MTC, County Congestion Management Agencies (CMAs), Cities/Counties — Funding and advocacy

**Background:**

1. If planned in conjunction with a focused growth development strategy, the proposed high-speed rail (HSR) system in California has the potential to reduce greenhouse gases. This could be accomplished in two ways. First, HSR could replace long-distance intrastate air and car travel. Second, by properly developing cities around HSR stations (and local transit, walk and bike networks) intraregional car travel, particularly in the Central Valley, could also be reduced. The HSR plan calls for trains up to 220 mph, completing a trip between downtown San Francisco and downtown Los Angeles in about two-and-a-half hours.
2. According to the California High Speed Rail Authority, high speed trains use one-third of the energy of air travel and one-fifth of automobile travel.
3. In the last few decades, air travel has been one of fastest growing transportation sectors for greenhouse gas emissions worldwide.
4. Fast trains are an integral part of Europe and Japan's transportation networks and are seen there as important greenhouse gas reduction tools. *The Economist* has recently stated that "Europe is in the grip of a high-speed rail revolution." Railteam, a new consortium of European countries, is aiming to increase high-speed rail to 25 million passengers per year by 2010 (over 15 million in 2007). *The Economist* notes that European railways are now carrying 60 percent of leisure travelers making six-hour journeys. According to the *Guardian's* (U.K.) January 13, 2009 edition: "Spain's sleek new high-speed trains have stolen hundreds of thousands of passengers from airlines over the last year, slashing carbon emissions and marking a radical change in the way Spaniards travel. Last year's drop in air travel, which was also helped by new high-speed lines from Madrid to Valladolid, Segovia and Malaga, marks the beginning of what experts say is a revolution in Spanish travel habits."
5. MTC and the California High Speed Rail Authority have recently completed new ridership and revenue forecasts.
6. High-speed rail's greenhouse gas reduction benefits depend on the mix of electric power used and the relative fuel efficiency of passenger cars and aircraft. Over time, the mix of electric power is likely to become greener, while aircraft and cars will likely become more fuel efficient as well.

7. In California, a high-speed rail bond issue of \$10 billion was approved on the November 2008 ballot (Proposition 1A) to help fund an initial system between San Francisco and Anaheim. The system would not be in operation until 2020 at the earliest.

**Links:**

- California High-Speed Rail Authority: <http://www.cahighspeedrail.ca.gov/>

**Technically feasible to implement and produce results in next five years?**

No

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Unknown. There has not been an analysis performed by MTC to date. The benefits of high-speed rail are statewide. High-speed rail could attract five to eight percent of Bay Area airport users to rail, based on earlier studies.

*Cost:*

The cost of the current proposed system is over \$45 billion. Fares may be able to cover a substantial portion of operating costs, according to studies by the California High-Speed Rail Authority.

*Cost Effectiveness:*

Low (qualitative). Based on the high capital and operating costs and greenhouse gases generated from construction.

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## **STREETS and ROADS**

### **Strategy 19:**

#### **Expand traffic signal synchronization and other roadway improvements**

**Potential lead:**

- Cities/Counties — Planning, funding

**Potential support roles:**

- MTC, Congestion Management Agencies (CMAs), Bay Area Air Quality Management District — Funding

**Background:**

1. The initial impetus for traffic signal coordination came from the Organization of Petroleum Exporting Companies (OPEC) oil embargo in the early 1970s, and was seen as an important way to reduce fuel consumption. Poorly coordinated traffic

signals waste fuel by creating excessive idling and causing vehicles to constantly accelerate and brake.

2. MTC and the Bay Area Air Quality Management District have provided funding for numerous signal coordination and retiming projects around the region. However, signals along a route need to be periodically retimed to ensure they are providing maximum benefits as traffic conditions change over time.
3. Signal timing programs have been used to generate greenhouse gas emissions offset credits. Portland, Oregon funded more than \$500,000 in signal synchronization on 20 busy streets by selling the emission offsets to a new power plant in Eastern Oregon. The transaction, arranged by the Climate Trust, saves drivers more than 1.6 million gallons of gasoline annually and eliminates 15,000 metric tons of greenhouse gases. The power plants are complying with a state law that requires on-site emissions reductions or the financing of greenhouse gas cuts somewhere else.
4. Concerns have been expressed that improving traffic flows on local streets encourages more traffic and decreases safety for bicyclist and pedestrians. Some of these issues can be mitigated through proper design.
5. Funding for signal improvements could be prioritized to high frequency bus corridors, improving transit trips and providing multiple greenhouse gas benefits.
6. As more hybrids enter the Bay Area fleet, signal timing will become less effective since hybrids are more efficient than gas powered cars in start-and-stop operations.
7. Adaptive signal control systems perform real-time optimization of traffic signals based on current traffic conditions, demand and system capacity. Adaptive control software adjusts traffic signal splits, offsets, phase lengths and phase sequences to minimize delay and reduce the number of stops. Mobility benefits have been realized from deployments of adaptive signal control systems in Los Angeles; Broward County, Florida; Newark, Delaware; Oakland County, Michigan; and Minneapolis, Minnesota. Delay reductions ranged from 19 percent to 44 percent.
8. An alternative, widely used in Europe and increasingly in the U.S., would be to install roundabouts instead of signals, particularly for new developments. Roundabouts can typically result in 30 to 50 percent lower emissions (ROG, CO<sub>2</sub>, CO, NO<sub>x</sub>) than all-way stop-controlled intersections and 15 to 50 percent lower emissions than traffic signals. A 2000 study in Burlington, Vermont, found that replacing traffic signals with roundabouts at 25 busy intersections would save 60,000 tons of CO<sub>2</sub> per year, about 25 percent of the city's total greenhouse gas reduction target for 2005.

States such as Florida, Maryland, Utah, Colorado, Arizona, Washington and Oregon have installed hundreds of roundabouts, with many on state highway facilities. In California, the state Department of Transportation is increasingly recognizing roundabouts' benefits, with several existing installations on state facilities and plans for many more. In some retrofit cases, roundabouts may be as cost effective as traffic signal projects where widening for turn lanes is required to ensure adequate capacity for the traffic signal. Roundabout installations don't require widening for lengthy turn lanes. Retrofitting roundabouts into street systems in urban areas may be difficult due

to right-of-way constraints, but there are a number of intersections around the Bay Area not surrounded by development that are in need of traffic control improvements. These may be appropriate locations for roundabouts.

**Links:**

- Oregon Signal Optimization Project:  
[http://www.climatetrust.org/offset\\_traffic.php](http://www.climatetrust.org/offset_traffic.php)
- U.S. Department of Transportation report on adaptive signal timing:  
<http://www.itscosts.its.dot.gov/its/benecost.nsf/ID/CE988804D1F94B838525733A006D5590?OpenDocument&Query=BApp>
- Modern Roundabouts and Global Warming:  
[www.nh.gov/oep/resourcelibrary/referencelibrary/r/roundabouts/documents/vermontctrfpaper.doc](http://www.nh.gov/oep/resourcelibrary/referencelibrary/r/roundabouts/documents/vermontctrfpaper.doc)
- Whitehorse Transportation Showcase (Page 12):  
<http://ww3.whitehorse.ca/pdf%20files/engineering/Whitehorse%20Showcase%20Proposal.pdf>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Low. A 6 percent reduction in fuel consumption on signalized streets managing 12 percent of regional vehicle miles traveled would reduce transportation CO<sub>2</sub> by 0.2 percent in 2020. Coordinated signals only control a portion of the regional road systems VMT. Similarly, the potential impacts of roundabouts would likely be restrained by their relatively low numbers in the region.

*Cost:*

Cost depends on whether a project is a retiming of existing coordinated signals or the initial coordination of signals along a route. Retiming an existing system typically costs around \$2,500 per signal.

*Cost Effectiveness:*

High. Based on the results of a large scale signal retiming project (223 signals) in the cities of San Jose, Campbell, Milpitas and Santa Clara conducted in 2002 -2003. The study estimated the annual fuel savings from full implementation.

**Strategy 20:****Replace signal lighting and street lighting with LEDs and other energy-efficient devices.****Potential lead:**

- California Department of Transportation (Caltrans), Cities/Counties — Planning, funding

**Potential support roles:**

- MTC, Congestion Management Agencies (CMAs) — Funding
- Pacific Gas & Electric (PG&E) — Revised lighting fee structure

**Background:**

1. Many Bay Area cities and counties have replaced conventional traffic signal lights with light emitting diodes, or LEDs, largely due to incentive programs that have been offered in the past by utility companies.
2. LEDs in traffic signals are an energy-efficient alternative to commonly used incandescent bulbs. They can cost 20 times as much as a regular bulb, but their advantages include:
  - LEDs are brighter and last longer. LEDs normally last up to five to seven years compared to normal bulbs' one to two year life span. However, replacing bulbs also requires money for trucks and staff time, and can tie up traffic.
  - LEDs are considerably more energy efficient, normally requiring as little as 10 to 30 percent of the power consumed by normal incandescent bulbs.
  - If a traffic light uses 100-watt incandescent bulbs and the light is on 24 hours a day, it uses 2.4 kilowatt-hours per day. With power costs at \$0.08 per kilowatt-hour, one traffic signal costs about \$0.20 per day to operate, or about \$73 per year. If there are eight signals per intersection, the cost is almost \$600 per year in power per intersection. A big city has thousands of intersections, so it can cost millions of dollars just to power all the traffic lights.
  - Low-energy LEDs also (a) present the possibility of using solar panels for power and (b) allow a battery back-up for two or more hours in the event of a power outage.
3. The State of California has been helping to fund LEDs since the electric energy shortage of 2001. According to the California Energy Commission, more than 85 cities, counties and public agencies have secured state or federal grants and loans to finance LEDs.
4. Street lighting (for traffic, pedestrian visibility and public safety) is responsible, on average, for about 40 percent of a city's electricity spending. The city of San Jose, Caltrans and others are now experimenting with LED street lighting. However, since

street lighting is generally charged at a flat rate (unmetered), cities and utilities will have to create a new “LED rate” so government agencies will “see” the savings. DOE estimates that 2 percent of the electricity used in the U.S. is for street and highway lighting. LED street lighting could save 10 percent to 60 percent on energy costs, depending on brightness.

5. Ways to reduce energy consumption and greenhouse gas emissions include replacing bulbs with lower energy consumption bulbs, adding sensors for turning lights on and off, and providing real time control of light levels based on the time of day, traffic and weather information transmitted by the individual street lights to a central control.
6. One street light manufacturer estimated that if real-time light management was implemented in New York City, it would reduce annual greenhouse gas emissions from street lighting by 275,000 metric tons, equivalent to removing 50,000 cars from the road.
7. In Oslo, Norway, where a real-time street lighting management system is being installed, energy use has dropped 62 percent so far. Two-thirds of the decrease is attributed to installation changes with the rest from reduced lamp-burning hours. Another 10 percent to 15 percent reduction is anticipated when the program is complete. The city expects the new lighting management system to pay for itself in five years.

**Links:**

- State Energy Program Case Studies: LEDs:  
<http://www.nrel.gov/docs/fy04osti/35551.pdf>
- U.S. Department of Energy information on LEDs:  
[http://www.eere.energy.gov/states/alternatives/traffic\\_management.cfm](http://www.eere.energy.gov/states/alternatives/traffic_management.cfm)
- San Jose LED Streetlights (*Wall Street Journal*):  
<http://online.wsj.com/article/SB124035903357241327.html>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Unknown. No analysis performed to date.

*Cost:*

See cost information above.

*Cost Effectiveness:*

Unknown. Likely varies over wide range depending on the type of installation and staffing costs to city for light maintenance and replacement.

**Strategy 21:****Increase use of low--greenhouse gas cement and reflective pavements on Bay Area roads.****Potential lead:**

- Caltrans, Cities/Counties — Planning, funding

**Potential support roles:**

- MTC, County Congestion Management Agencies (CMAs) — Funding

**Background:**

1. Globally, the cement industry produces 5 percent of man-made greenhouse gas emissions, of which 50 percent is from the chemical process and 50 percent from burning fuel to produce heat for the process.
2. California's 11 major cement facilities produce 10 to 15 percent of U.S. cement.
3. California cement production in 2004 was responsible for 11 MMT (million metric tons) of greenhouse gases, out of a total California greenhouse gas inventory of 469 MMT, or about 2 percent of the total.
4. Commercially available and cost-effective options exist today to improve the energy efficiency, and therefore the potential of greenhouse gas reduction, in the manufacture of cement. These include process improvements and improvements in fuel combustion. At the same time, some companies are exploring advanced technology solutions, which will require research, development and demonstration.
5. Greenhouse gases are also reduced by the addition of blending materials, such as limestone, fly ash, natural pozzolan and/or slag, to replace some of the clinker in the production of Portland cement.
6. Caltrans could encourage the use of limestone Portland cement in public works projects, including roads, bridges and highways.
7. For blended concrete, Caltrans would need to evaluate the effects of the cement's integrity and safety, and approve the use of ASTM standards used in other countries as a California standard.
8. These cement measures were recommended as additional early action items in the California Air Resources Board's October 2007 Early Actions report.
9. An energy efficiency standard for cement manufacturers is one of the "Other Measures Under Evaluation" in the AB 32 Draft Scoping Plan.
10. Researchers at Lawrence Berkeley Lab have conducted considerable research that shows that using "cool pavements" that are more reflective can lower temperatures in urban areas. This can lead to less electricity demand for building air conditioning and reduced greenhouse gases from power plants. Scaling-up this strategy could also increase the albedo of urban areas and potentially directly reduce some amount of global warming. If all major urban areas in the world used reflective pavements and



roofs, it would offset the growth in worldwide greenhouse gas emissions expected over the next 10 years.

**Links:**

- Cement explained: <http://en.wikipedia.org/wiki/Cement>
- LBL report on U.S. cement production and GHGs: <http://www.climatevision.gov/sectors/cement/pdfs/44182.pdf>
- Lawrence Berkeley Lab Heat Island Group: <http://eande.lbl.gov/heatisland/>

**Technically feasible to implement and produce results in next five years?**

Yes, in some areas.

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Unknown. No analysis performed to date.

*Cost:*

California Air Resources Board's Scoping Plan indicates that fuel and process improvements to lower greenhouse gas emissions by the cement industry could cost \$1 billion annually, which could lead to higher cement costs.

*Cost Effectiveness:*

Unknown.

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**Strategy 22:**

**Improve freeway operations to reduce congestion.**

**Potential lead:**

- California Department of Transportation (Caltrans) — Planning, funding

**Potential support roles:**

- MTC, Congestion Management Agencies (CMAs) — Funding

**Background:**

1. Greenhouse gas emissions are reduced through less stop-and-go driving and through maintaining more efficient vehicle travel speeds. Improving freeway operations includes such strategies as ramp metering, improved incident management, roving tow trucks, coordinated arterial operations and closing short gaps in the high-occupancy vehicle lane system.
2. A significant source of delay and extra vehicle emissions is the result of accidents and vehicle breakdowns on Bay Area freeways. Since typically half of the freeway vehicle delays are caused by accidents and/or incidents, strategies to clear blockages quickly, like

quicker incident detection and response, can significantly reduce congestion-related emissions.

3. Studies of freeway ramp metering benefits in Minnesota showed freeway collisions decreased by about 26 percent, average speeds increased by 22 percent and overall freeway capacity increased by about 14 percent. However, greenhouse gas emissions increased overall due to the idling at freeway on-ramps. Results are likely to vary significantly between different areas, depending on scope of the system, design and operation.
4. Taken together, these operational strategies can create a slight increase in vehicle miles traveled (VMT) as quicker travel times create some additional driving. The Transportation 2035 Vision Analysis found a 0.7 percent increase in VMT from the Freeway Performance Scenario. (NOTE: As with all strategies in this report, the analysis looks only at VMT and greenhouse gas impacts from this single strategy. Results would be different if freeway operations were implemented with elements of other scenarios.) Reduced freeway congestion may also decrease the incentive to use transit and carpooling if single-occupant vehicle travel times improve.
5. Related strategies to reduce peak-period freeway congestion, and hence contribute to reduced greenhouse gas emissions, include flexible or staggered work hours, telecommuting, enhanced carpool and transit alternatives in the corridor, and congestion pricing on tolled facilities.
6. See Strategy #15, Background item #12, for additional related discussion and links.

**Links:**

- MTC Freeway Performance Scenario in Transportation 2035 Target Analysis (Page 8): [http://www.mtc.ca.gov/planning/2035\\_plan/tech\\_report.htm](http://www.mtc.ca.gov/planning/2035_plan/tech_report.htm)

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Unknown. 2020 impacts have not been analyzed. However, similar strategies in the MTC *Vision 2035 Analysis (The Freeway Performance Initiative)* showed a very significant (9 percent) reduction in transportation CO<sub>2</sub> emissions through improved operations and reduced delays.

*Cost:*

MTC's Transportation 2035 Plan allocates \$1.6 billion towards this initiative over the next 25 years.

*Cost Effectiveness:*

High. Based on MTC's *Vision 2035 Analysis: Freeway Performance Initiative*.

## **Strategy 23:**

### **Reduce and/or enforce freeway speed limits**

#### **Potential lead:**

- State — New legislation
- California Highway Patrol (CHP) — Enforcement of speed limits

#### **Potential support roles:**

- MTC — Funding, advocacy

#### **Background:**

1. The 55 mph speed limit was one of the primary national strategies to reduce fuel demand during the 1970s energy crunch.
2. The power required to overcome a moving car's air resistance goes up with the cube of the speed (i.e., speed raised to the third power). Driving at 90 km/h (56 mph) reduces fuel consumption roughly 20 percent relative to driving at 110 km/h (68 mph).
3. In the Bay Area, past MTC studies have shown that 34 percent of freeway vehicle miles traveled (VMT) are by vehicles traveling over 65 mph and 72 percent of all freeway VMT is by vehicles traveling over 55 mph.
4. Relationships between speed vs. fuel economy trace back to studies by the federal government conducted between 1973 and 1997 and are now somewhat outdated, although the basic findings still hold true.
5. Germany is debating lower speed limits on its highways to save fuel and reduce greenhouse gases. About one-third of the country's highways have speed limits; the rest have a recommended speed of about 80 mph, but many drive much faster. The German Federal Environment Agency says that setting a 75 mph speed limit would reduce highway greenhouse gases by 30 percent.
6. Reducing the highway speed limit would also cut criteria pollutants as shown in previous MTC studies conducted as part of the federal air quality planning process.
7. Slower freeway speeds could lead to fewer highway injuries and fatalities, but the diversity of studies and range of results on this topic make it difficult to provide a definitive answer. Caltrans posts the following message on some of its freeway signs: "Don't Speed, Save Lives, Save Fuel."
8. A recent MTC public opinion survey (November 2007) showed that enforcing the freeway speed limit of 65 mph to reduce greenhouse gas emissions had the least support of any strategies suggested to address climate change.

#### **Links:**

Drive 55: [www.drive55.org](http://www.drive55.org)

#### **Technically feasible to implement and produce results in next five years?**

Yes

### **Preliminary review of potential impact and cost:**

#### *Estimate of Bay Area 2020 Impact:*

High. Limiting the speed limit to 65 mph on freeways would reduce transportation CO<sub>2</sub> by 2.3 percent, and limiting speeds to 55 mph would reduce transportation CO<sub>2</sub> by 4.5 percent. Limiting all heavy-duty trucks on freeways to 55 mph would save fuel and reduce transportation CO<sub>2</sub> by 0.4 percent.

#### *Cost:*

Lowering speed limits would probably increase California Highway Patrol (CHP) enforcement costs.

#### *Cost Effectiveness:*

##### *Lower Freeway Speed Limit to 55 mph.*

High (qualitative). May increase enforcement costs initially as the lower speed limit takes effect; new signage required as well.

##### *Lowering all Freeway Speed Limits to 65 mph.*

High (qualitative). Affects only those freeways with posted limits of 70 mph. Same comments as above.

##### *Additional Enforcement of 65 mpg freeway speed limits (55 mph for trucks)*

High. Assumes additional CHP staffing (100 new officers plus salary and benefits). Based on the MTC studies that showed 34 percent of VMT is at speed levels above 65 mph (with an average speed of 72 mph). Reducing speeds to 65 mph would result in a 13 percent reduction in CO<sub>2</sub> emissions. This also assumes that enforcement is 50 percent effective in terms of lowering speeds for the entire system.

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## **FREIGHT**

### **Strategy 24:**

#### **Reduce GHGs from shipping and related landside operations**

#### **Potential lead:**

- State, Bay Area Air Quality Management District (Air District) — Regulations or market based incentives
- Port of Oakland, Shipping companies, Railroads — Implementation

#### **Potential support roles:**

- MTC — Planning, funding

#### **Background:**

1. According to the Air District's greenhouse gas inventory, ships and boats produce nearly one-fifth of the transportation greenhouse gas emissions in the region. This is 8 percent of greenhouse gases from all Bay Area sectors. The Air District is counting emissions from ships and boats within 100 miles of Bay Area ports.
2. The Port of Oakland's *Maritime Air Quality Improvement Plan* (MAQIP) is a collaborative effort co-chaired by the Port, the Air District and the West Oakland Environmental Indicators Project. It is designed to reduce local air pollution, but a number of the strategies will also reduce greenhouse gases from trucks, ships and port operations. A revised final MAQIP was produced in April 2009. Greenhouse gases are not directly addressed in the plan, but "will be added in future updates, after GHG emissions have been calculated in an emissions inventory."
3. From the International Council on Clean Transportation (ICCT) report *Air Pollution and Greenhouse Gas Emissions from Ocean-Going Ships*: "Although ocean-going vessels are among the most efficient modes of freight transport, they also generate substantial quantities of greenhouse gas emissions. Currently, carbon dioxide (CO<sub>2</sub>) emissions from the international shipping sector as a whole exceed annual total greenhouse gas emissions from most of the nations listed in the Kyoto protocol as Annex I (industrialized) countries.  
  
"Ocean-going vessels also contribute significantly to global emissions of nitrogen oxides (NO<sub>x</sub>), sulfur oxides (SO<sub>x</sub>), and particulate matter (PM). It is estimated that by 2020, ship emissions contributions to the European Union (EU) NO<sub>x</sub> and SO<sub>x</sub> inventories will surpass total emissions generated by all land-based mobile, stationary and other sources in the twenty-five nations. Air quality impacts from ocean-going vessels are especially significant in port cities and nations with extensive coastlines adjacent to shipping corridors. Studies making use of geographic marine activity data have estimated that about 70–80 percent of all ship emissions occur within 400 km (248 miles) of land."
4. The ICCT report recommends (a) completing accurate baseline inventories of shipping greenhouse gas impacts, (b) developing market mechanisms to reduce emissions, and (c) directly linking all portside activities with local air quality and climate protection plans.
5. Shipping by rail generally produces fewer greenhouse gases, and fewer criteria pollutants per unit of goods than shipping by truck, due to lower rolling resistance of a steel wheel on steel rail, relatively flat railroad routes, and electrification of some lines.
6. A 1991 Federal Railroad Administration study analyzed relative freight rail and truck fuel efficiency. The study found that rail achieved higher ton-miles per gallon than trucks, carrying similar commodities over 32 routes studied. The ratio of truck fuel usage to rail fuel usage ranged from 1.40 to 5.61 for these Class I railroad scenarios. For routes less than 100 miles, comparing regional, local rail and truck service, trucks used from 4.03 to 9.00 times more fuel than rail.

7. According to the U.S. Department of Energy's 1995 *Transportation Energy Data Book*, in 1993 rail moved 39 percent of U.S. freight ton-miles carried by truck, rail and water, yet consumed less than 12 percent of the total energy required for movement of freight by these modes.
8. The Utah GHG Reduction Report (2005) states "the OTA has estimated that the ratio of energy use of trucking compared with rail is 8:1 for intercity transportation. What are unknown are the destinations of freight carried on interstates that would need to be on rail for this savings to be realized. It is assumed that most major cities and many smaller communities have access to both rail and interstates. It is unknown, however, how much of any given shipment would differ in trip distance if it were made by rail rather than by interstate. As a safe assumption, it is probable that even with differing trip lengths, the average shipment could still realize an energy efficiency gain by switching modes from truck to rail."
9. Currently, only thirty-five percent of the cargo leaving the Port of Oakland is by rail, with 65 percent traveling by truck. The Port's strategic business plan calls for an increase to 50 percent by rail. The Port's Joint Intermodal Terminal was originally estimated to remove 20,000 truck trips from Interstate 80 a year.
10. By 2020, the Port expects trade with Asia to double and imported cargo to triple. Obviously, changing economic conditions could alter these projections.
11. The Port's rail partners are working to expand rail capacity to the Central Valley. The Port is also investigating shipping containers by barge to Sacramento and/or Stockton.
12. The MTC *Regional Rail Plan* (2007) found that there is limited rail capacity to accommodate growth in freight and passenger rail services.

**Links:**

- MTC Goods Movement Study: <http://www.mtc.ca.gov/planning/rgm/>
- Port of Oakland planning strategy: [http://www.portofoakland.com/pdf/omar\\_speech.pdf](http://www.portofoakland.com/pdf/omar_speech.pdf)
- Port of Oakland Air Quality Improvement Plan: [http://www.portofoakland.com/envirom/prog\\_04c.asp](http://www.portofoakland.com/envirom/prog_04c.asp)
- West Oakland Environmental Indicators Project and Pacific Institute proposal for collaborative process: [www.portofoakland.com/pdf/maqip\\_08.pdf](http://www.portofoakland.com/pdf/maqip_08.pdf)
- ICCT Report on Shipping GHGs and Air Pollution: [www.theicct.org/documents/MarineES\\_Final\\_Web.pdf](http://www.theicct.org/documents/MarineES_Final_Web.pdf)

**Technically feasible to implement and produce results in next five years?**

No.

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Unknown. No analysis performed to date.

*Cost:*

The cost of the original Port of Oakland Joint Intermodal Terminal project was \$38 million. Subsequent expansions are planned. Private railroad costs are unknown.

*Cost Effectiveness:*

Low (qualitative). Assumes this strategy would involve major infrastructure improvements to encourage/accommodate more freight on rail.

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**Strategy 25:  
Reduce truck idling.**

**Potential lead:**

- State (Air Resources Board) — Anti-idling law

**Potential support roles:**

- Port of Oakland, California Air Resources Board (ARB), Local police — Enforcement

**Background:**

1. The California Air Resources Board (ARB) passed an anti-idling regulation in 2004 that restricts thousands of diesel buses and trucks to five minutes of idling. By 2010, the regulations are projected to save more than 100 million gallons of diesel fuel, 700,000 tons of greenhouse gases and 153 tons of diesel particulate matter (PM) annually.
2. Non-essential idling from commercial heavy-duty diesel vehicles (e.g., to warm up the engine when it is not required, run heating and/or air conditioning, and run electrical accessories while the truck is parked) accounts for approximately nine percent of the on-road diesel exhaust emissions. Over half of these emissions are from diesel trucks equipped with sleeper cabs. A heavy-duty diesel engine burns about one gallon of diesel fuel for every hour of idling.
3. An ARB early action measure for AB 32 includes increased enforcement of anti-idling regulations for heavy-duty trucks (current fines are \$300 up to \$1,000 per day).
4. Consistent with this ARB early action measure, 2007 legislation (AB 233, Jones) (Chapter 233, 2007 Statutes) enhances enforcement, increases penalties and links truck registration to enforcement violations.
5. Also, an enhanced version of the anti-idling law that would eliminate the exemption for trucks with sleeper berths went into effect in January 2008. A variety of technologies are available for maintaining cab comfort.
6. High diesel fuel costs may also discourage some discretionary idling. In 2008, it cost between \$700 and \$1,100 to fill up a long-haul truck with diesel fuel.

**Links:**

- SmartWay Transport “Idle Reduction” Fact Sheet:  
<http://www.epa.gov/otaq/smartway/documents/apu.pdf>
- Union of Concerned Scientists Fact Sheet:  
[http://www.ucsusa.org/assets/documents/clean\\_vehicles/CA-CARB-Diesel-Idling-Reg-2005.pdf](http://www.ucsusa.org/assets/documents/clean_vehicles/CA-CARB-Diesel-Idling-Reg-2005.pdf)

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Unknown. No analysis performed to date

*Cost:*

Additional public costs for enforcement of anti idling laws.

*Cost Effectiveness:*

Unknown. Depends on the incidence of excessive truck idling and enforcement costs. There would be co-benefits through the decrease in particulate matter (PM) emissions leading to healthier air to breathe and lower health costs for the neighboring community.

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**Strategy 26:**

**Expand truck facility electrification.**

**Potential lead:**

- California Energy Commission (CEC) — Planning, funding
- Truck Facility Operators — Implementation, funding

**Potential support roles:**

- MTC — funding
- Cities/Counties — local ordinances

**Background:**

1. According to the U.S. Environmental Protection Agency (EPA), the use of one of several idle control technologies — such as auxiliary power units (APU) and truck stop electrification (TSE) that provide heat, air conditioning and electrical power — can minimize fuel consumption. A typical long-haul combination truck can use up to 1,900 gallons a year from engine idling. Under federal regulations, truck drivers must rest 8 to 10 hours between driving, and drivers spend much of this time in their cab. Reducing or eliminating prolonged idling of long-haul trucks can save fuel, reduce pollution emissions and lower engine maintenance costs.



2. According to the California Energy Commission, truck stop electrification typically reduces 1,800 gallons of diesel fuel, five tons of oxides of nitrogen, and 21 tons of carbon dioxide per truck annually.
3. The California Energy Commission has begun a program to increase truck stop electrification.
4. The Climate Trust has contracted with a firm to provide greenhouse gas offsets by electrifying 275 truck parking spaces at seven truck stops in the states of Washington and Oregon. Using electric power from the grid reduces net greenhouse gas emissions. The truck stops include television and Internet connections. The estimated greenhouse gas reductions are about 13,000 tons per year at the seven truck stops.

**Links:**

- California CEC Truck Stop Electrification Fact Sheet:  
[http://www.energy.ca.gov/afvs/vehicle\\_fact\\_sheets/truck\\_stop.html](http://www.energy.ca.gov/afvs/vehicle_fact_sheets/truck_stop.html)
- U.S. Department of Energy:  
[www.eere.energy.gov/cleancities/idle/truck\\_elec.html](http://www.eere.energy.gov/cleancities/idle/truck_elec.html)
- Oregon Climate Trust Truck Stop Electrification Project:  
[http://www.climatetrust.org/offset\\_truckstop.php](http://www.climatetrust.org/offset_truckstop.php)
- National truck stop electrification locator: [www.afdc.energy.gov/afdc/locator/tse/](http://www.afdc.energy.gov/afdc/locator/tse/)

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Low. Assuming electrification of 1,000 truck parking spots, transportation CO<sub>2</sub> would be reduced 0.05 percent, based on California Air Resources Board (ARB) data.

*Cost:*

ARB has estimated costs of \$4,000 to \$20,000 per parking space and around \$4,000 for truck modifications to use the electric power.

*Cost Effectiveness:*

Medium. ARB estimates the cost effectiveness of this strategy to be between \$83 and \$415 per ton of greenhouse gases reduced.

## PART 3: FOCUS GROWTH

### Strategy 27: Implement the regional FOCUS program

#### Potential lead:

- Regional agencies, Cities/Counties — Planning, funding, implementation

#### Potential support roles:

- Congestion Management Agencies (CMAs), State — Funding, incentives, technical assistance

#### Background:

1. FOCUS is the Bay Area's development and conservation program to promote compact and equitable development. FOCUS aims to protect and enhance our quality of life; preserve open space and agricultural resources; strengthen existing city centers; locate more housing near existing and future rail stations and bus lines; encourage more compact and walkable suburbs; and protect regional open space. FOCUS is a voluntary and incentive-driven program that is being directed by the regional Joint Policy Committee (JPC) and implemented by ABAG and MTC with support from the Bay Area Air Quality Management District and the Bay Conservation and Development Commission. FOCUS includes two key concepts: Priority Development Areas (PDAs) and Priority Conservation Areas (PCAs).

In the last year, sixty cities and counties have designated over 120 PDAs. These areas must: 1) be within an existing community, 2) be near existing or planned fixed transit or comparable bus service and 3) have a plan, or be in the process of planning, for additional housing. The PDAs are projected to absorb 56 percent of the Bay Area's growth in the next 25 years on just 3 percent of the region's land area. Some cities have said they can accommodate even more growth if sufficient assistance with infrastructure is available.

PCAs are areas of regional significance that have broad community support and an urgent need for protection. These areas provide important agricultural, natural resource, historical, scenic, cultural, recreational, and/or ecological values and ecosystem functions. In the fall of 2007, local governments, public agencies, and nonprofit organizations nominated over 100 areas for consideration as Priority Conservation Areas. Nominations were reviewed by staff, a review panel, regional committees and local governments. Recommendations were based on three nomination criteria: level of consensus, regional significance and urgency for protection. The ABAG Executive Board adopted a set of Priority Conservation Areas on July 17, 2008.

The FOCUS program relies heavily on incentives to help local governments develop their PDAs. These incentives, which include Station Area Planning Grants and

technical assistance, help cities and counties turn potential development areas into well-planned complete communities.

FOCUS faces a number of challenges, including funding significant infrastructure to accommodate new residents, arranging complex financing, addressing local traffic and gentrification issues, and developing PDAs that are sometimes located near freeways or industry. At the same time, FOCUS will have to address housing costs, schools and personal safety issues that have convinced many individuals and families to move to Bay Area suburbs and beyond. (This may be changing. In a recent MTC poll, 74 percent of Bay Area residents said they would prefer a smaller house and yard with a shorter commute as opposed to a larger house and yard with a longer commute, a significant shift from just four years ago when 57 percent stated the same preference.) Perhaps most importantly, FOCUS must overcome being “different” for planners, financiers and residents.

2. A number of regional and local programs and policies provide key support for FOCUS.
  - Since 1998, MTC’s Transportation for Livable Communities (TLC) program has awarded over \$80 million to more than 80 local projects that support multimodal travel, more livable neighborhoods and the development of jobs and housing in existing town centers. Successful projects aim to foster community vitality by improving walking and bicycle access to public transit hubs and stations and to major activity centers and neighborhood commercial districts. The program provides technical assistance and capital grants to help cities, neighborhoods, transit agencies and nonprofits develop transportation-related projects fitting the TLC profile. The Transportation 2035 long-range plan proposes to double TLC funding to \$2.2 billion over the next 25 years.
  - MTC’s Transit-Oriented Development (TOD) policy requires that future transit extensions in the Bay Area be matched by supportive local land-use plans and policies. To assist cities in meeting these goals, MTC has implemented a Station Area Planning grant program to fund city-sponsored planning efforts for the areas around future stations. These station-area plans are intended to address the range of transit-supportive features that are necessary to support high levels of transit ridership.
  - The Great Communities Collaborative is a joint effort of Greenbelt Alliance, the Nonprofit Housing Alliance of Northern California, Transform and Urban Habitat. The Great Communities Collaborative is designed to:
    - Shape plans for specific transit-oriented developments in Bay Area communities and encourage resident participation in planning for these developments.
    - Create tools that will help community leaders make better decisions about transit-oriented developments across the Bay Area and help citizens better understand, participate in, and influence plans for TOD.
    - Secure increased private and public funding that will help to catalyze sustainable and equitable transit-oriented development in the Bay Area.

The goal of the collaborative is to have half of the Bay Area's new homes, between now and 2030, located in walkable neighborhoods near transit. These neighborhoods will have a mix of jobs, shops, community services and homes affordable for families of all income levels. The members of the collaborative are committed to promoting this vision of sustainable and equitable development and to ensuring that residents are deeply engaged in planning for transit-oriented development in their neighborhoods.

- A growing number of local and sub-regional agencies in the Bay Area are developing policies and programs that strongly link land use and transportation planning. For example, Santa Clara Valley Transportation Authority (VTA) has adopted the Community Design and Transportation (CDT) program as their primary program to implement best practices and planning, design and construction projects, and unite under one program VTA's land use activities such as Transit Oriented Development( and development review.
3. Key findings from MTC's Bay Area Travel Survey (2000) support the FOCUS approach.
- **Average weekday daily vehicle miles of travel (VMT) increases with the distance from rail and ferries and decreasing density.** Households within one-half mile of rail/ferry stations produce about half of the VMT of their suburban and rural counterparts.
  - **People who live close to transit use transit extensively.** People living within one-half mile of a rail or ferry station are four times as likely to use transit as people living further than a half-mile from a rail/ferry stop. Non-motorized mode shares are also higher for station area residents who are twice as likely to walk and three times as likely to bike as residents living more than one-half mile from a transit stop.
  - **People who live and work close to rail/ferry stops use transit even more extensively.** Individuals living and working within a half mile of a rail or ferry stop use transit for 42 percent of their work *commute trips*. Individuals who neither live nor work within a half mile of a station use transit for only 4 percent of their work commute trips.
  - **People who live close to transit make as many trips per day as those who live in the rest of the region, but these residents have a much higher tendency to use transit, walk and bike.**
  - **Land use density has an impact on transit use levels, even beyond one-mile from a station.** Urban residents outside the one-mile distance from rail or ferry are still twice as likely as suburban residents and about four times as likely as rural residents to use transit.
  - **People living close to rail or ferry transit are about twice as likely to walk for short trips (trips of one mile or less) than people living farther from transit.**

4. While FOCUS will clearly reduce Bay Area transportation greenhouse gas emissions, housing added in the inner core of the Bay Area will also generally produce fewer overall greenhouse gas emissions than housing in the outer Bay Area and Central Valley. This is due to less heating and cooling (milder weather), smaller sized homes, fewer detached structures, etc.
5. Nationally, the Urban Land Institute's *Growing Cooler: The Evidence on Urban Development and Climate Change* shows that meeting the growing demand for conveniently located homes in walkable neighborhoods could significantly reduce the growth in the number of miles Americans drive, shrink the nation's carbon footprint and give people more housing choices. Depending on several factors, from mix of land uses to pedestrian-friendly design, compact development reduces driving from 20 to 40 percent, and more in some instances. Typically, Americans living in compact urban neighborhoods where cars are not the only transportation option drive a third fewer miles than those in automobile-oriented suburbs, the researchers found.

*Growing Cooler* describes how urban development is both a key contributor to climate change and an essential factor in combating it. The authors warn that if sprawling development continues to fuel growth in driving, the projected 48 percent increase in the total miles driven between 2005 and 2030 will overwhelm expected gains from vehicle efficiency and low-carbon fuels. Even if the most stringent fuel-efficiency proposals under consideration are enacted, vehicle emissions still would be 34 percent above 1990 levels in 2030. (California's global warming target for 2050 is an 80 percent reduction below 1990 levels.) The authors argue for a "three-legged stool approach" — improved vehicle efficiency, cleaner fuels and a reduction in driving.

6. The Transit Cooperative Research Program (TCRP) Report 74, *The Costs of Sprawl-2000*, details the costs of sprawl development on local infrastructure (water, sewers, roads, public services, etc.) as well as the personal costs of sprawl — quality of life, travel costs, livability of cities, etc.

#### **Links:**

- Bay Area FOCUS program: <http://www.bayareavision.org/index.html>
- MTC study of Bay Area station area residents: [http://www.mtc.ca.gov/planning/smart\\_growth/stars/index.htm](http://www.mtc.ca.gov/planning/smart_growth/stars/index.htm)
- MTC Smart Growth web site: [http://www.mtc.ca.gov/planning/smart\\_growth/](http://www.mtc.ca.gov/planning/smart_growth/)
- MTC TLC/Smart Growth web links: [http://www.mtc.ca.gov/planning/smart\\_growth/tlc\\_links.htm#local](http://www.mtc.ca.gov/planning/smart_growth/tlc_links.htm#local)
- Growing Cooler: The Evidence on Urban Development and Climate Change: <http://www.smartgrowthamerica.org/gcindex.html>
- Great Communities Collaborative: <http://www.greatcommunities.org/>
- GCC TOD Resource Guide: [http://www.greatcommunities.org/resources/copy\\_of\\_great-communities-toolkit](http://www.greatcommunities.org/resources/copy_of_great-communities-toolkit)
- TCRP Report 74: The Costs of Sprawl — 2000: [http://gulliver.trb.org/publications/tcrp/tcrp\\_rpt\\_74-a.pdf](http://gulliver.trb.org/publications/tcrp/tcrp_rpt_74-a.pdf)
- Reconnecting America: <http://www.reconnectingamerica.org/>

- Smart Growth America: <http://www.smartgrowthamerica.org/>
- Smart Growth and Smart Schools:  
<http://www.smartgrowthamerica.org/children.html>
- New Places, New Choices: Transit-Oriented Development in the Bay Area:  
<http://www.mtc.ca.gov/library/TOD/index.htm>
- Parking Best Practices and Strategies to Support TOD:  
[http://www.mtc.ca.gov/planning/smart\\_growth/parking\\_study.htm](http://www.mtc.ca.gov/planning/smart_growth/parking_study.htm)
- Making TODs Work: Lessons from Portland's Orenco Station:  
<http://www.planetizen.com/node/92>
- Ahwahnee Principles for Resource-Efficient Communities:  
<http://www.lgc.org/ahwahnee/principles.html>
- Santa Clara VTA Transit Oriented Development Program:  
<http://www.vta.org/projects/tod.html>

**Technically feasible to implement and produce results in next five years?**

Yes, but mostly limited to projects already in the development process.

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Medium. Depends on pace of focused growth in the region. The 2002 "Smart Growth Strategy" was estimated to reduce daily regional travel by 3.6 million miles, which would equate to about a 1.5 percent reduction in transportation CO<sub>2</sub> for the inventory being used for this analysis. In the MTC "Vision 2035 Analysis," a very dense land use pattern for the Bay Area showed a 6 to 7 percent reduction in transportation CO<sub>2</sub>.

*Cost:*

Focused growth would lower household travel costs, but no estimates have been made. There are unknown public and private costs to implement new land use plans.

*Cost Effectiveness:*

Unknown.

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**Strategy 28:**

**Build affordable housing in the "inner core" of the region to reduce commute lengths for low- and middle-income workers**

**Potential lead:**

- Cities/Counties, Regional agencies, Housing developers — Planning, incentives, regulations

**Potential support roles:**

- Congestion Management Agencies (CMAs), State — Funding, incentives, technical assistance

### **Background:**

1. The high price of housing in the inner core of the Bay Area forces residents to “drive until you qualify,” searching for more reasonably priced housing in outer areas of the region and in the Central Valley. For example, median home prices in San Francisco, San Mateo, Santa Clara and Marin counties are all significantly higher than in Solano, Sonoma and eastern Contra Costa counties. This lack of affordable housing near the largest job centers produces longer commutes for Bay Area residents and greater transportation greenhouse gas emissions. At the same time, if present trends continue, commuting into the nine-county Bay Area from San Joaquin and other neighboring counties is projected to increase by 65 percent to 120 percent, depending on the corridor, by 2030.
2. There are numerous studies on the difficulties of low- and moderate-income workers in finding affordable housing in metropolitan areas. According to the Center for Housing Policy's 2007 “Paycheck to Paycheck: Wages and the Cost of Housing in America” study, licensed practical nurses would not qualify to purchase the median priced home in 187 of the 202 metropolitan areas studied. Registered nurses were priced out of 115 metropolitan areas and nursing aides and home health aides were priced out of every metropolitan area studied. Similarly, a national study in 2006 by the National Low Income Housing Coalition found that in order to afford a two-bedroom rental, the minimum wage would have to be set at \$16.51.
3. The Smart Growth Network’s “Affordable Housing and Smart Growth — Making the Connection” (2001) explains why affordable housing must be central to smart growth development.

*“The experiences of communities struggling with the challenges of development demonstrate the need to address them with the integrated problem-solving approach represented by smart growth. Because of the benefits of smart growth, many initiatives are now being labeled as such even when they address only one issue, such as open space, transportation, or affordability. These single-issue initiatives, although they may contribute to smart growth if they are linked to a community's broader goals, do not by themselves represent a comprehensive smart growth approach. Unfortunately, their narrow focus sometimes leads to conflicts about the perceived benefits of the smart growth approach and costs incurred by the failure to consider other, broader, issues during the development process.*

*“In particular, conflicts have arisen around these single-issue “smart growth” initiatives and their negative impact on affordable housing, leading some observers to claim that smart growth and affordability are inherently in conflict. Affordable housing, however, is an explicit goal of smart growth. Policies that reduce housing affordability are not smart. With its focus on the effect of development patterns and practices on the quantity and quality of affordable housing, smart growth is a critical part of the solution. Communities and states can use smart growth to improve affordability in the following ways:*

- *Increase the supply of affordable housing by loosening restrictions against low-cost housing such as townhouses, live-work spaces, accessory dwelling units, etc.;*
  - *Provide more scattered affordable units and promote mixed-income neighborhoods;*
  - *Reinvest in existing neighborhoods to improve the tax base and the availability of jobs and amenities;*
  - *Implement policies and revitalization practices that benefit existing residents and prevent their displacement;*
  - *Reduce household transportation costs and increase transportation choices and*
  - *Create incentives for regional cooperation on affordable housing.”*
4. The Brookings Institution’s “The Link Between Growth Management & Housing Affordability” argues that smart growth policies provide more affordable housing than today’s land use policies.
- “Rising concerns about traffic congestion, loss of farmland, urban disinvestment, and the costs of public infrastructure have led an increasing number of state and local governments to adopt new policies to better manage metropolitan growth. Such programs often involve a package of tools such as zoning, comprehensive plans, subdivision regulations, development fees and exactions, and infrastructure investments and are sometimes described as growth controls, growth management, sustainable development, or smart growth. Despite these efforts' increasing popularity, some observers are concerned that such efforts adversely affect land and housing markets and lead to problems of housing affordability. This paper is a comprehensive review of academic literature on the link between growth management and housing affordability. The paper concludes that the market is the primary determinant of housing prices, and that sound growth management policies provide more affordable housing than traditional land use policies.”*
5. In the Bay Area, Urban Habitat’s Smart Growth and Equitable Development program links affordability and development with four goals and strategies:
- Develop and promote a regional equity vision and agenda that strategically links equitable development advocacy and organizing efforts to the broader movement for smart growth at the regional level and beyond.
  - Advance equitable policies that effectively meet the needs of the Bay Area’s low-income communities and communities of color for affordable housing, mobility, jobs, education, and healthcare.
  - Create long-term systemic change and a fundamental shift of power in the region by increasing the capacity of the most impacted communities to effectively participate in land use decision-making processes that affect their lives.
  - Create more effective partnerships and alternative problem-solving strategies by working in cross-sector, cross-issue coalitions.



**Links:**

- Affordable Housing and Smart Growth (Smart Growth Network): [www.epa.gov/smartgrowth/pdf/epa\\_ah\\_sg.pdf](http://www.epa.gov/smartgrowth/pdf/epa_ah_sg.pdf)
- The Link Between Growth Management & Housing Affordability (Brookings Institution): <http://www.brookings.edu/es/urban/publications/growthmanagexsum.htm>
- Greenbelt Alliance's Smart Infill: <http://www.greenbelt.org/resources/reports/smartinfill/index.html>
- Urban Habitat's Smart Growth and Equitable Communities Program: <http://urbanhabitat.org/development>

**Technically feasible to implement and produce results in next five years?**

Yes, but mostly limited to projects already in the development process.

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Low. Moving 10 percent of the projected growth in households in the four North Bay counties plus eastern Contra Costa County into the central Bay Area core (above and beyond what is already assumed in ABAG's Projections) would reduce regional transportation CO<sub>2</sub> by about 0.1 percent due to reduced commute distances. Impact would be greater if the effects of transit/walking/biking opportunities are also included.

*Cost:*

Unknown.

*Cost Effectiveness:*

Unknown.

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**Strategy 29**

**Develop and implement an Indirect Source Rule to mitigate transportation emissions linked to new residential developments, schools, businesses, entertainment centers, etc.**

**Potential lead:**

- BAAQMD — Rule development and implementation, incentives, technical assistance

**Potential support roles:**

- Cities, Congestion Management Agencies (CMAs) — Incentives, technical assistance

**Background:**

1. Under an Indirect Source Rule (ISR), new developments above a certain size must mitigate emissions that will be produced by the construction and operation of their project. ISR can be applied to any project that generates transportation trips — new homes, industry, businesses, government buildings, schools or entertainment centers.
2. The Bay Area Air Quality Management District is currently developing an Indirect Source Rule for the Bay Area. The Air District expects to have a concept paper in Summer/Fall 2009 and a draft rule Fall/Winter 2009-2010. The ISR will be part of a larger strategy called the “Bay Area Clean Air Initiative.”
3. The San Joaquin Valley Air Pollution Control District (APCD) and the Imperial County APCD have both adopted ISR rules. The rules include quantitative emission reduction targets and offsite mitigation fees. Targets and fees are structured to encourage lower polluting development and focus solely on emissions from transportation sources. For the operational phase, the San Joaquin Valley ISR requires a 33 percent reduction for NO<sub>x</sub> (nitrogen oxides that contribute to the formation of ground-level ozone and fine particle pollution) and 50 percent reduction for PM<sub>10</sub> (particulate matter suspended in the air, smaller than 10 microns in diameter). All residential projects over 50 units fall under the ISR, while commercial, industrial and other non-housing projects must surpass various square footage thresholds. Project applicants can choose to perform onsite mitigation, e.g., measures to reduce vehicle miles traveled or pay a fee to the district for offsite mitigation.
4. The South Coast Air Quality Management District is developing an ISR. They are currently proposing qualitative targets, without mitigation fees. The Sacramento Metropolitan AQMD is developing an ISR for construction emissions. They propose to develop an ISR for emissions from project operations in the future.
5. The AB 32 Scoping Plan includes the following statement in the discussion of actions to support the SB 375 process:

“Indirect source rules for new development have already been implemented by some local air districts and proposed by others for purposes of criteria pollution reduction. Regions should evaluate the need for measures that would ensure the mitigation of high carbon footprint development outside of the sustainable communities strategies or alternative planning strategies that meet the targets established under SB 375. In developing and implementing indirect source rules, local governments should consider the full spectrum of factors including affordable housing availability, economic impacts, other existing mitigation requirements (including fees), and potential unintended consequences.”
6. The Bay Area Joint Policy Committee (JPC) regional climate program includes recommendation for commenting on major projects. Strategy M states:

“That ABAG build upon its Federal and CEQA clearinghouse functions and upon its connections with local-government planning agencies to provide an early-warning system, identifying proposed private developments and public investments which are potentially inconsistent with regional climate protection objectives and THAT these be brought to the attention of JPC for regional review and comment.”

7. The Attorney General of California reached an agreement with the Conoco-Phillips refinery concerning their proposed expansion in Rodeo. Conoco-Phillips agreed to: (1) pay \$7 million to a greenhouse gas offset fund created by the Bay Area Air Quality Management District; (2) fund \$2.8 million for reforestation in California estimated to capture 1.5 million metric tons of greenhouse gases; (3) pay \$200,000 to the Audubon Society for restoration of San Pablo Bay wetlands; (4) remove another facility from operation eliminating its greenhouse gas emissions, and; (5) audit all its California facilities to identify greenhouse gas emissions sources and reduction opportunities.

**Links:**

- San Joaquin Valley APCD ISR: <http://www.valleyair.org/ISR/ISRHome.htm>
- ARB AB 32 Scoping Plan: <http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm>

**Technically feasible to implement and produce results in next five years?**

Rule development and initial implementation only

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Unknown. No analysis performed to-date.

*Cost:*

Unknown.

*Cost Effectiveness:*

Unknown.

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**Strategy 30:**

**Reform the CEQA process to promote focused growth**

**Potential lead:**

- State, BAAQMD — Reform of the California Environmental Quality Act (CEQA) rule and process

**Potential support roles:**

- ABAG, MTC, Cities/Counties — Advocacy in support of reform

**Background:**

1. The Bay Area Air Quality Management District is developing a CEQA guidance update on greenhouse gas emissions for cities and other project sponsors in the nine-county Bay Area. The guidance will include significance thresholds, analytical methodologies and mitigation strategies.

2. In January 2008, the Air District staff produced of a white paper on CEQA and climate change for the California Air Pollution Control Officers Association (CAPCOA).
3. In January 2009, the Governor's Office of Planning and Research (OPR), as required by SB 97, released DRAFT CEQA guidelines. OPR must prepare these guidelines and transmit them to the Resources Agency by who must then certify and adopt the guidelines by January 1, 2010.
4. San Francisco is studying an auto-trips generated approach to determining the impact of a project. The San Francisco County Transportation Agency's (SFCTA) "Auto Trip Generation (ATG) Impact Measure Final Report" recommends a new measure based on net new automobile trips generated by a project. Using this approach, projects that do not generate net new automobile trips would not be considered to have transportation impacts under CEQA. Projects that do generate automobile trips would be able to mitigate their impacts by paying a new transportation impact mitigation fee that would fund a set of citywide and local area projects designed to address environmental impacts caused by the project. SFCTA staff considers this approach a better indicator of environmental effect than Traffic Level of Service or LOS; it is consistent with the city's Transit First policy and other environmental and health goals; it is more efficient and transparent for the Planning Department to implement and for project sponsors to understand; and it is a more effective approach to transportation impact mitigation.
5. At a November 2008 All-Stars Conference in San Francisco, Nelson/Nygaard's Jeff Tumlin listed "CEQA reform" as #1 in his "Top 5 Transportation and Land Use Solutions for a Carbon Neutral Future." Tumlin's main point: CEQA actually makes it a lot easier to do sprawl and a lot harder to do infill and transit-oriented development (TOD). CEQA guidelines focus on localized traffic impacts and ignore regional (greenhouse gas emissions and trip reduction) impacts. The guidelines also assume scarce parking (a prime motivator for trip reduction) to be an environmental impact. Therefore, the unintended consequence of CEQA is the following: If a project sponsor wants to mitigate a negative transportation impact they should reduce density, widen roadways, add parking or move the project to a more isolated location with less existing traffic congestion. Tumlin proposes modifications to CEQA including:
  - Changing local guidelines and significance thresholds;
  - Excluding TOD and infill;
  - Replacing the congestion measurement with per capita VMT generated or CO<sub>2</sub> emissions; and
  - Using an Auto-Trips Generated Impact Fee (Los Angeles and San Francisco are pursuing this).
6. A Safe Routes to Transit planning study of alternatives to improve bicycle access to the proposed MacArthur BART station TOD found that smart growth population projections for the year 2035 prevent the near-term development of continuous

bicycle lanes serving the station. This outcome arises from the Level of Service (LOS) thresholds used by the city of Oakland, combined with the countywide transportation model of the Alameda County Congestion Management Agency and the ABAG smart growth land use forecasts. Similar barriers to bicycle access and safety occur near proposed TODs throughout the Bay Area. One resolution to this smart growth paradox is to delete CEQA's protection of LOS criteria as proposed in OPR's draft CEQA guideline revisions.

**Links:**

- CAPCOA white paper on climate and CEQA:  
[www.climatechange.ca.gov/publications/others/CAPCOA-1000-2008-010.PDF](http://www.climatechange.ca.gov/publications/others/CAPCOA-1000-2008-010.PDF)
- California Office of Planning and Research greenhouse gas guidance:  
<http://www.opr.ca.gov/index.php?a=ceqa/index.html>
- SFCTA Auto Trip Generation Impact Measure Report:  
<http://www.sfcta.org/content/view/515>

**Technically feasible to implement and produce results in next five years?**

Yes.

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Unknown. No analysis performed to-date.

*Cost:*

Unknown

*Cost Effectiveness:*

Unknown

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**Strategy 31:**

**Implement SB 375, the landmark legislation to reduce greenhouse gas emissions through transportation and land use planning**

**Potential lead:**

- Regional agencies — Target setting, planning

**Potential support roles:**

- Cities, Counties, County Congestion Management Agencies (CMAs), Advocacy groups — Planning

**Background:**

1. SB 375 (Steinberg), enacted into law in 2008, requires a) the California Air Resources Board (ARB) and metropolitan planning organizations (MPOs) to set

regional greenhouse gas emission reduction targets for autos and light trucks; (b) MPOs to adopt a “Sustainable Communities Strategy” (SCS) as part of their regional transportation plans, and (c) an “Alternative Planning Strategy” (APS) if ARB determines the Sustainable Communities Strategy will not achieve the regional target. In return, the bill provides CEQA relief for certain types of projects consistent with a region’s SCS or APS. The legislation also requires coordination with the Regional Housing Needs Allocation (RHNA) process and reform of that process.

2. Staff for the Bay Area Joint Policy Committee (JPC) has developed a set of draft policies for the implementation of SB 375 in the Bay Area. The policies are currently being discussed at the JPC and at other regional forums. No action will be taken on the policies until considerable further discussion and refinement has taken place.
3. SB 375 MTC Fact Sheet (reprinted verbatim below)

SB 375 (Steinberg):

Establishes a process for the California Air Resources Board (ARB) to implement the state’s global warming legislation (AB 32) for the transportation sector. Requires ARB to adopt by September 30, 2010 regional greenhouse gas (GHG) targets for emissions associated with the automobile and light truck sector. Establishes a Regional Targets Advisory Committee to recommend protocols for setting the targets by September 30, 2009 and requires ARB to release draft targets by June 30, 2010.

Requires metropolitan planning organizations (MPOs) such as MTC to develop a Sustainable Communities Strategy (SCS) – a new element of the regional transportation plan (RTP) – to strive to reach the GHG reduction targets. MTC is already developing our 2009 RTP with the AB 32 GHG reduction targets in mind. Our 2013 RTP would be the first plan subject to SB 375.

In the Bay Area, the SCS shall be developed in conjunction with the Association of Bay Area Governments (ABAG), as has been the historic practice for the land use assumptions of the RTP. The SCS adds three new elements to the Regional Transportation Plan (RTP) including: (1) a land use component that identifies how the region could house the entire population of the region over the next eight and 20 years; (2) a discussion of resource and farmland areas to be protected; and (3) a demonstration of how the development pattern and the transportation network can work together to reduce GHG emissions.

If the SCS falls short of the ARB targets, SB 375 requires an MPO to adopt an “alternative planning strategy” (APS) to achieve them. Because the APS stands outside of the RTP it can include bolder ideas that might be necessary to reach the targets, but that requires additional funds or changes in law.

AB 375 empowers the ARB to review and approve the SCS, but not to modify it. Instead, the MPO must revise the documents until ARB agrees that at least the APS would reach the GHG reduction targets.

It also requires the MPO to conduct extensive outreach with local government

officials and adopt a public participation plan for the SCS that includes a minimum number of workshops in each county as well as three public hearings on the draft SCS prior to adoption of a final RTP.

It provides assurance that transportation projects programmed for funding prior to 2012 and contained in the 2009 federal Transportation Improvement Program (TIP), funded by Proposition 1B, or a voter approved sales tax measure approved prior to 2009, will not be subject to new environmental scrutiny under the bill's provisions.

It synchronizes the regional housing needs assessment (RHNA) process with the RTP process, requires local governments to rezone their general plans, consistent with the updated housing element within three years of adoption, and provides that RHNA allocations must be consistent with the development pattern in the SCS. It moves RHNA to an eight-year cycle from a five year one.

It provides a California Environmental Quality Act (CEQA) exemption or a streamlined process for housing and mixed-use projects that meet specified criteria, such as proximity to transit.

4. The Air Resources Board's AB 32 Scoping Plan highlights the critical importance of land use as a long-range strategy for reducing transportation greenhouse gases in California and the Bay Area. ARB's Proposed Scoping Plan (September 2008) estimated that transportation emissions could be reduced by 5 MMT (million metric tons) statewide through smart growth in 2020. Some stakeholder groups in the state argued that the potential for land use-related GHG reduction by 2020 is higher than the ARB estimates. A September 2008 report "CO<sub>2</sub> Reductions Attributable to Smart Growth in California" by Reid Ewing (University of Maryland) and Arthur C. Nelson (University of Utah) projected a 4.1 MMT to 5.7 MMT reduction in 2020 from compact development, an additional 4.0 MMT from "smart transportation policies," plus other reductions from related building energy savings. After intensive lobbying from all sides on this issue, ARB's December 11, 2008 resolution on the AB 32 Scoping Plan included the following:

"BE IT FURTHER RESOLVED that the Board recognizes that through the SB 375 (Stats. 2008, Chapter 728) process, local governments and transportation agencies are key partners in ARB's efforts to reduce greenhouse gas emissions, that improved land use and transportation planning is needed to provide Californians with affordable, high quality options for housing and mobility that will result in reduced greenhouse gas emissions, and that the greenhouse gas reductions associated with more sustainable growth will increase over time.

BE IT FURTHER RESOLVED that the Board recognizes that the technical work of the SB 375 Regional Targets Advisory Committee (RTAC) is critical to building a solid foundation for Board consideration of regional targets.

BE IT FURTHER RESOLVED that as input to the SB 375 target setting process, the RTAC should recommend a method to evaluate the full potential for reducing

greenhouse gas emissions in each major region of the state, and statewide, using improved land use patterns, indirect source rules, enhanced bike, walk, and transit infrastructure, and pricing policies where applicable (including congestion, toll, and parking pricing). This evaluation should be done for 2020 and 2035, employ the best available data and models, and identify barriers to achieving this full potential.

BE IT FURTHER RESOLVED that it is the Board's intent that the greenhouse gas emission reductions associated with the SB 375 regional targets represent the most ambitious achievable targets. The estimated reductions in the Scoping Plan will be adjusted to reflect the outcome of the Board's decision on SB 375 targets."

**Links:**

- Climate Plan resources on SB 375 and related issues:  
<http://www.climateplanca.org/resources.html#sb375resources>
- SB 375 Is Now Law — But What Will it Do? (California Planning and Development Report): <http://www.cp-dr.com/node/2140>
- SB 375 Regional Targets Advisory Committee (RTAC)  
<http://www.arb.ca.gov/cc/sb375/rtac/rtac.htm>
- Bay Area Joint Policy Committee Draft SB 375 policies:  
<http://www.abag.ca.gov/jointpolicy/jpc-sb375-implementation.htm>

**Technically feasible to implement and produce results in next five years?**

Yes.

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Unknown. No analysis performed to-date.

*Cost:*

Unknown

*Cost Effectiveness:*

Unknown

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## PART 4: CHANGE TRANSPORTATION BEHAVIOR

### VOLUNTARY ACTIONS

#### **Strategy 32:**

**Reduce vehicle miles traveled (VMT) by filling empty seats on trains, city/school buses, ferries, autos and increasing the use of bike and walk facilities.**

#### **Potential lead:**

- Transit agencies — Fares, promotions, incentives
- Regional agencies — Funding, “Umbrella” public information/action campaign, 511 program

#### **Potential support roles:**

- Cities/Counties, County Congestion Management Agencies (CMAs) — Information, incentives, promotions
- Businesses — Employee incentives, commute services, promotions, etc.
- School districts and individual schools — Programs to increase use of school buses

#### **Background:**

1. Filling empty transit seats, adding carpool riders to cars, adding users to bike lanes and similar strategies can be a very cost-effective approach to reducing greenhouse gas emissions, since it makes better use of existing facilities and existing system capacity.
2. The key for making significantly better use of the existing transit system is to increase ridership where there is unused capacity — midday, evenings, weekends, in non-peak direction, etc. The significant funding challenges currently facing transit operators will have to be addressed if transit is to play an increased role in reducing transportation greenhouse gas emissions.
3. The city of San Francisco recently passed a new ordinance requiring all employers with more than 20 employees to take action to increase transit use and ridesharing. Businesses can choose from 3 options: (a) offer free transit passes or vanpool reimbursement; (b) provide door-to-door shuttles; and (c) offer pre-tax commuter benefits programs such as Commuter Check. Employer commuter benefit programs, such as Commuter Check, have been proven to increase transit use among participants. Similarly, transit agency programs like Santa Clara Valley Transportation Authority’s (VTA’s) Eco Pass and AC Transit’s Class Pass (at UC Berkeley) have increased employee use of transit.

4. Genentech has started a new program to pay carpool drivers \$4 to bring other workers to their South San Francisco site. The new program includes a text-messaging based ride matching service for employees.
5. Free transit on six Spare the Air days in 2006 increased transit ridership by 15 percent and two free days in 2007 increased transit ridership by 22 percent.
6. Bike to Work Day has become a major annual transportation event in the region, involving cities, employers, non-government organizations, media and thousands of participants. Bike to Work Day is the largest event promoting bicycle commuting in the San Francisco Bay Area. Funded by MTC and organized by the Bay Area Bicycle Coalition, Bike to Work Day has seen increasing participation every year since the first event in 1994. In 2008, over 150,000 people rode past energizer stations throughout the Bay Area on Bike to Work Day, a 40 percent increase over the participation from previous years. Related programs such as the Team Bike Challenge work to connect potential bicycle commuters with veteran cyclists through a competition that encourages teams to ride their bikes for as many trips as possible in the month of May.
7. The regional 511 program provides extensive information via Web and phone on ridesharing, transit and other modes to help shift travelers from solo driving. These services include the transit trip planner, ride matching, bike route maps, carpool incentives, employer outreach, etc. Similarly, 511 Contra Costa, the Peninsula Traffic Congestion Relief Alliance, Solano Napa Commuter Info and other Bay Area entities provide incentives and assistance to increase use of transit, carpools, vanpools, carpools-to-BART and other modes.
8. “Travel Choice” is a user-focused program that provides personalized information and incentives for riding transit, ridesharing, bicycling, car-sharing and walking via in-home visits and the phone. An eight-week 2006 pilot project with 4,800 households in Alameda produced a 14 percent decrease in drive-alone trips and a 34 percent increase in transit use. The project was funded by the Alameda County CMA, Alameda County Public Health, BART, AC Transit and the city of Alameda. It was managed by Transform. Similar programs have been operated in Portland, Seattle and other cities.
9. BART conducted a “Kids Ride Free Day” on December 22, 2007, sponsored by Kaiser Permanente, aimed at promoting healthy lifestyles and encouraging families to use BART for holiday shopping. A Nestle-sponsored “Kids Ride Free Day” in 2008 allowed two kids to ride free on BART along with one paying adult, with the purpose of increasing familiarity and use of BART.
10. Transit fare policies can be modified to fill more seats in off-peak and reverse-commute directions. With the new TransLink fare card it will be easier to provide variable fares for a variety of conditions, including discounted fares.
11. The New York Metropolitan Transportation Authority (MTA) has taken actions to produce an 8.5 percent increase in subway ridership from 2000 to 2006 with a

corresponding 7.5 percent reduction in energy use per passenger and a 6.0 percent reduction per passenger-mile.

12. Bay Area surveys by the BayCAP Shuttle Project show that shuttles to transit can increase ridership on transit and that 60 percent of last-mile shuttle riders were previously drive alone commuters. .
13. Flexible work hours and staggered work hours can encourage transit use by allowing employees to use transit when it is not overcrowded.
14. Employers can encourage their employees to carpool. A modest increase in carpooling could help alleviate congestion in a number of highway corridors, saving gas and reducing congestion generated greenhouse gas emissions.
15. Public information campaigns can encourage solo drivers to consider other modes and could be combined with “Smart Driving” and trip elimination messages.
16. The MTC Transportation Climate Action Campaign contained in the Transportation 2035 Plan (adopted April 2009) includes measures designed to improve transit performance and attract new riders.

**Links:**

- APTA Report: Role of Public Transit in Reducing Greenhouse Gas Emissions: [http://www.apta.com/research/info/online/climate\\_change.cfm](http://www.apta.com/research/info/online/climate_change.cfm)
- VTPI Commute Financial Incentives: <http://www.vtpi.org/tdm/tdm8.htm>
- Travel Choice: [http://www.transcoalition.org/travelchoice/alameda\\_presentation.pdf](http://www.transcoalition.org/travelchoice/alameda_presentation.pdf)
- 511.org: <http://511.org/>
- 511 Contra Costa: <http://www.511contracosta.org/>
- Peninsula Congestion Relief Alliance: <http://www.commute.org/>
- TransLink: <http://www.translink.org/index.do>
- Commuter Check Benefits Solutions: <http://www.accorservicesusa.com/services/CommuterCheck.aspx>
- Wage Works: <https://www.wageworks.com/home.aspx>
- Commuter Choice.com: [http://www.commuterchoice.com/index.php?page=employers&sub=employers\\_supporting](http://www.commuterchoice.com/index.php?page=employers&sub=employers_supporting)
- Bike to Work Day: [www.btwd.bayareabikes.org](http://www.btwd.bayareabikes.org)

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Low. Increasing transit ridership by 15 percent by filling empty seats would reduce transportation CO<sub>2</sub> by 0.8 percent, assuming all new riders formally drove and excluding emissions to access transit. If 5 percent of workers who drive alone were to carpool, greenhouse gases would be reduced 1.3 percent. .

*Cost:*

Depends on type of program. Some promotions and incentives like “Travel Choice” or “Commuter Benefits” can be done fairly inexpensively. At the high end, free transit on Spare the Air days cost approximately \$1.8 million per day.

*Cost Effectiveness:*

Pay drivers of single-occupant vehicles to ride transit:

Low. Assumes free fare for new transit riders (a rider who formally drove for the same trip). Evaluates transportation CO<sub>2</sub> reductions for various transit trip lengths and fares on BART, Caltrain, and local bus. Assumes new transit riders would not generate greenhouse gases from auto access to transit.

Subsidize New Long Distance Vanpools:

Medium. Assumes payment of the \$10,600 annual lease cost for a large, 11 passenger van traveling 30 miles one way. These result in 15,000 annual miles reduced per vanpool passenger, assuming the driver and passengers each travel three miles to a common pickup point.

Subsidize New Carpools:

Medium. Assumes employee is paid \$115 per month (the allowable pre-tax commute benefit) to find and drive another employee to work who is currently driving alone; assumes 20-mile commute trip.

Transit Priority Measures (TPM):

High. Transit priority measures will produce quicker, more reliable bus service; MTC’s Vision 2035 Analysis shows an average cost of \$3,860 per mile for transit priority treatment; assumes transit priority measures for a 10-mile route (annualized over 10 years with 4 percent discount rate) will produce 500 new transit riders per day who travel an average of 3.3 miles.

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**Strategy 33:**

**Increase use of “Smart Driving” to increase vehicles’ miles per gallon.**

**Potential lead:**

- Regional Agencies — “Umbrella” public information/public action campaign

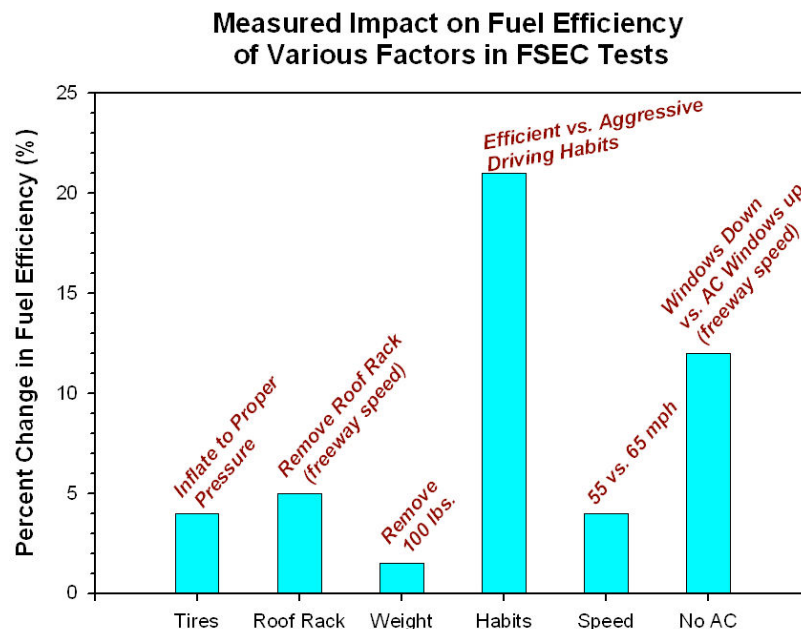
**Potential support roles:**

- Businesses, Cities/Counties, County Congestion Management Agencies (CMAs)  
— Local activities, funding
- Schools — Driving training courses

**Background:**

1. “Smart Driving” has been proven in U.S. studies to produce up to a 30 percent improvement in miles-per-gallon (mpg) for in-town driving. Messages include:
  - Drive less aggressively. Improved driving habits can increase mpg by 5 percent around town and 30 percent at highway speeds.
  - Reduce idling. An idling car typically uses about a gallon of fuel per hour. For example, get out of the clogged drive-through line, turn off your vehicle and go order and eat your food.
  - Get rid of extra weight. An extra 100 lbs can reduce mpg by 1 to 2 percent. .
  - Take luggage racks off car roof when not in use (less weight and drag) and increase mileage by up to 20 percent.
  - Choose to drive the household’s vehicle with the best gas mileage.
  - Maintain and limit use of air conditioning (AC). Air conditioning drains engine power and can reduce gas mileage by 5 to 15 percent.
2. The International Energy Association (IEA) conducted a two-day workshop in 2007 on all aspects of eco-driving. See links below for presentations and findings.
3. Research has shown that in-vehicle instrumentation on fuel use (such as the real-time mpg gauge in the Toyota Prius) can improve fuel savings by about 5 percent. There are now a number of fuel gauges that can be added to most passenger vehicles.
4. Transport for London’s FORS project (Freight Operators Recognition Scheme) focuses efficient driving for freight operators in the United Kingdom.
5. Greenroad.com is an in-vehicle system that trains drivers to drive more safely and efficiently. Using a complex series of sensors, the system modifies driving behavior. Greenroad has been shown to reduce fuel use by about 10 percent.
6. The European Union is implementing “ECODRIVEN,” a major three-year smart driving campaign in nine countries with numerous local public and private partners. The campaign was organized with support of the European Commission and the Intelligent Energy Europe Programme.
7. Eco-driving training programs in Europe and Canada have documented reductions in fuel consumption for individual drivers of 16 percent to 25 percent.
8. In the United Kingdom, the Energy Trust’s “Eco-drivers wanted” campaign focuses on ten behaviors:
  1. Check your revs - change up before 2,500 rpm (petrol) and 2,000 rpm (diesel).
  2. Anticipate road conditions and drive smoothly, avoiding sharp acceleration and heavy braking. This saves fuel and reduces accident rates.
  3. Use air conditioning sparingly as it significantly increases fuel consumption.
  4. The most efficient speed depends upon the car in question but is typically around 55 - 65mph. Faster speed will greatly increase your fuel consumption.
  5. Drive away immediately when starting from cold, when safe to do so - idling to heat the engine wastes fuel and causes rapid engine wear.

6. Accessories such as roof racks, bike carriers, and roof boxes significantly affect your car's aerodynamics and reduce fuel efficiency, so remember to remove them when not in use.
7. Avoid short journeys - a cold engine uses more fuel.
8. Plan your journeys to avoid congestion, road works and getting lost.
9. Check your tyre pressure regularly - under-inflated tyres are dangerous and can increase fuel consumption by up to 3 per cent.
10. If you're stuck in a jam, switch the engine off if you expect to be there for more than a minute or two. Cutting the engine will save fuel and reduce emissions.



Source: Florida Solar Energy Center

**NOTE: SEE LINK BELOW FOR DISCUSSION OF “AC VS. WINDOWS DOWN”**

9. Adding “smart driving” to driver training courses in schools will instill low-greenhouse gas driving habits in new drivers.
10. In August 2008, the governors of California and Colorado announced their endorsement of the first U.S. eco-driving campaign, “EcoDrivingUSA”, operated by the Alliance of Automobile Manufacturers.
11. Eco-driving also applies to freight. One freight company in the United Kingdom (Hardstaff) offers a bonus to drivers based on their mileage per gallon. Drivers are rewarded for every .1 mpg increase above a benchmark set for a three-month period. The result so far has been an average of a .6 mpg increase in fuel efficiency, representing a savings of \$5,053 per vehicle annually.

**Links:**

- International Energy Association Eco Driving Workshop (2007) presentations/findings: <http://www.internationaltransportforum.org/Topics/ecodriving/ecodriving07.html>
- European campaign for Smart Driving: <http://www.ecodrive.org/>
- Eco-driving summary (Wikipedia): [http://en.wikipedia.org/wiki/Fuel\\_economy-maximizing\\_behaviors](http://en.wikipedia.org/wiki/Fuel_economy-maximizing_behaviors)
- EcoDrivingUSA: <http://www.ecodrivingusa.com/#/what-is-ecodriving/>
- Greenroad.com: <http://www.greenroad.com/>
- Transport for London FORS project: <http://www.wired-gov.net/wg/wg-news-1.nsf/0/DE6AB6CF7B7BFCD9802575140044FC01?OpenDocument>
- Air Conditioning (AC) vs. Windows Down (in-town, freeway): <http://www.slate.com/id/2194536/>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:***Estimate of Bay Area 2020 Impact:*

High. Assuming smarter driving practices apply to 30 percent of daily travel and drivers improve their fuel economy an average of 10 percent (conservative estimate), transportation CO<sub>2</sub> would be reduced by 2.2 percent.

*Cost:*

Smart driving will save consumers money. Cost savings for some smart driving techniques are shown on [www.fueleconomy.gov](http://www.fueleconomy.gov).

*Cost Effectiveness:*

High. Assumes a \$150 tax credit for vehicle owners who install a real-time fuel economy gauge. Also assumes that changes in driving behavior will produce a 10 percent reduction in fuel consumption over the life of the vehicle.

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**Strategy 34:**

**Reduce daily individual vehicle miles traveled (VMT) by linking trips and by eliminating and shortening trips.**

**Potential lead:**

- Regional Agencies — “Umbrella” public information campaign

**Potential support roles:**

- Businesses, Cities/Counties, County Congestion Management Agencies (CMAs) — Local activities, funding

**Background:**

1. Seventy-five percent of daily trips and more than 50 percent of daily vehicle miles traveled (VMT) are from non-work trips. Many of these trips for shopping, recreation, visiting family/friends and entertainment are somewhat or even highly discretionary.
2. In many suburban car-focused communities, trip linking and trip elimination may be the best greenhouse gas reduction strategies after buying or using a more efficient vehicle.
3. Trip linking will also help reduce “criteria” pollutants (commonly found air pollutants regulated by the U.S. Environmental Protection Agency). The Bay Area’s Spare the Air campaign promotes linking trips to avoid cold starts that produce more ozone pollution. A cold car, one whose catalytic converter is not warmed up, pollutes up to five times more than a warm car. A one-mile trip to the dry cleaners emits up to 70 percent as much pollution as a 10-mile excursion with several stops. By linking trips together and keeping a car’s engine warm, emissions are reduced.
4. A proposed Bay Area climate public information campaign will include trip linking and trip elimination suggestions to help individuals reduce their vehicle miles traveled. The campaign may also support actions like using local shops, entertainment and parks as opposed to driving long distances.
5. While an informational program on trip linking and elimination can provide helpful information and reminders, the biggest motivating factor for this strategy will be high gasoline prices. Throughout 2008, as gas prices rose dramatically, major media outlets were filled with stories of individuals modifying their travel trips.

**Links:**

- BAAQMD on trip linking: <http://www.baaqmd.gov/pio/triplinking.htm>
- Eight Ways to Green Your Road Trip: <http://www.edf.org/article.cfm?contentID=7910>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Medium. A 10 percent reduction in shopping and recreational trips would reduce transportation CO<sub>2</sub> by 1.4 percent by 2020.

*Cost:*

Households that combine trips will save fuel and money due to reduced travel.

*Cost Effectiveness:*

High (qualitative).



## **Strategy 35:**

### **Reduce air travel and other long-distance travel**

#### **Potential lead:**

- State, Regional agencies — “Umbrella” public information/action campaign

#### **Potential support roles:**

- Bay Area recreation/vacation entities
- Businesses

#### **Background:**

1. Long distance out-of-region trips for business, vacation or other purposes obviously generate more greenhouse gases than shorter trips, no matter what the mode of travel used. Strategies for addressing greenhouse gases from these trips include elimination (for discretionary trips), substitution (accomplishing the trip by another means, such as teleconferencing) or conducting the trip but offsetting the greenhouse gas emissions.
2. For long distance travel, distance is more of a factor for CO<sub>2</sub> emissions than the relative efficiency of the long distance travel mode. Flying roundtrip from San Francisco to New York produces about 2.5 MT (metric tons) of CO<sub>2</sub> per passenger (ClimateFriendly.com) while driving solo for the same route in a 21-mpg car would produce about the same amount of CO<sub>2</sub>. This trip produces about 85 percent of the CO<sub>2</sub> produced by a hybrid passenger car driven for an entire year.
3. Air travel in general is a significant generator of greenhouse gas emissions, and accounts for about 2 to 3 percent of worldwide emissions. Air travel has been one of the transportation sector’s fastest growing contributor to greenhouse gas emissions, growing at about 5 percent per year.
4. The Intergovernmental Panel on Climate Change (IPCC) reports that the commercial aircraft fleet is 70 percent more efficient than 40 years ago and that another 40 to 50 percent improvement is expected by 2050. However, because of increasing air travel the IPCC has projected that aircraft emissions would increase to 15 percent of global greenhouse gas emissions over the next 50 years. (High fuel costs and airline financial problems may alter these projections.)
5. The global warming impact of air travel is approximately 2.7 times that of fuel alone (per the IPCC). This is due to other effects of air travel such as nitrogen oxides that convert to ozone at high altitude, contrails and ice clouds.
6. The air transportation system will see improved fuel efficiency over time due to several trends. The satellite based Next Generation Air Transportation System (NextGen) will allow aircraft to fly more direct routes and reduce landing and takeoff delays, saving significant amounts of fuel. This system will also enable aircraft to make more efficient Continuous Descent Approaches into airports using reduced engine power. Over a six-month period, three airlines flying oceanic routes over the

Pacific and landing at San Francisco International Airport were able to save 343,000 gallons of fuel (over 500 tons of CO<sub>2</sub>). New aircraft entering the fleet in the future will have more efficient engines and will be equipped with winglets that reduce drag and increase cruise fuel efficiency by 5 percent to 6 percent.

7. For long distance business travelers, teleconferencing and video-conferencing may become an even more viable option in the future as technology is vastly improving this option.
8. If travelers cannot avoid long-distance trips, they can purchase greenhouse gas offsets that basically fund projects that reduce an equivalent amount of greenhouse gases to the amount produced by their air, train or car trip. An experimental offset program, scheduled to begin spring 2010 at San Francisco International Airport (SFO) will allow travelers to easily purchase offsets for their air travel through kiosks in airport terminals. A portion of the offsets will go to local projects through the San Francisco Carbon Fund. The city of San Francisco is also currently exploring a program to offset business travel by city employees.
9. *Getting There Greener*, produced by the Union of Concerned Scientists, is the first comprehensive analysis, peer-reviewed by experts, on low- and high-carbon vacation travel.

**Links:**

- Intergovernmental Panel on Climate Change (IPCC) Special Report: Aviation and Global Climate Change: <http://www.ipcc.ch/ipccreports/sres/aviation/index.htm>
- Salon.com on air travel and GHGs: [http://www.salon.com/news/feature/2007/07/18/air\\_travel/](http://www.salon.com/news/feature/2007/07/18/air_travel/)
- 3Degrees (SF-based company that will operate SFO program): <http://www.3degreesinc.com/>
- Union of Concerned Scientists *Getting There Greener*: [http://www.ucsusa.org/clean\\_vehicles/solutions/cleaner\\_cars\\_pickups\\_and\\_suvs/greentravel/getting-there-greener.html](http://www.ucsusa.org/clean_vehicles/solutions/cleaner_cars_pickups_and_suvs/greentravel/getting-there-greener.html)

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

No analysis performed to date.

*Cost:*

Various Web sites can be used to determine the cost of purchasing CO<sub>2</sub> offsets for long distance air or car trips. Costs range between \$5 to \$100 per ton of CO<sub>2</sub> reduced.

*Cost Effectiveness:*

High. Based on the range of offset costs reported above.

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**Strategy 36:****Reduce vehicle miles traveled (VMT) by airlines, ships and freight trucks by “buying local.”****Potential lead:**

- State, Regional Agencies — “Umbrella” public information/public action campaign

**Potential support roles:**

- Businesses, Cities/Counties, County Congestion Management Agencies (CMAs)  
— Local activities, funding

**Background:**

1. Buying locally produced food and goods will reduce freight emissions created by moving these products long distances to local markets. In terms of the “big picture,” moving freight consumes 20 percent of the total energy used by the transportation sector. Sixty-six percent of all freight in the U.S. is shipped by truck compared to 16 percent by rail. Truck and rail freight consumes 35 billion gallons of diesel fuel per year, producing 350 million metric tons (MMT) of carbon dioxide.
2. Ground freight movement (diesel trucks, trains) is also responsible for 40 percent of the NO<sub>x</sub> (nitrogen oxides) and 30 percent of the particulate matter produced in the U.S.
3. There are many potential partners in the Bay Area for a “buy local” campaign. Farmers markets have exploded in popularity in the last 20 years in the Bay Area, linking local and regional farmers directly with residents. At the same time, an increasing number of restaurants promote their local food sources.
4. The national organization “100 Mile Diet” is promoting “local eating for global change.”
5. In addition to smaller farmers markets, large retailers such as Whole Foods and Wal-Mart are also seeing the benefits of buying locally. Wal-Mart now buys peaches from local suppliers in 18 states instead of just a few long-distance suppliers, and the company estimates it reduces shipping travel by 672,000 food-miles a year (the distance produce travels from farm to customer’s plate). Wal-Mart plans to sell \$400 million worth of produce grown by local farmers this year. Customers will see signs indicating produce is from the same state.

**Links:**

- 100 Mile Diet: <http://100milediet.org/>
- London “Buy Local and Organic” food project:  
<http://www.organicconsumers.org/btc/london022706.cfm>
- Local Food @ Wikipedia: [http://en.wikipedia.org/wiki/Local\\_food](http://en.wikipedia.org/wiki/Local_food)

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

No analysis performed to date

*Cost:*

For the example above, Wal-Mart estimates it saves 100,000 gallons of diesel fuel a year, and lowers transport cost by \$1.4 million a year.

*Cost Effectiveness:*

Unknown. Would vary depending on markets.

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**Strategy 37:**  
**Increase use of telework and teleconferences.**

**Potential lead:**

- Regional agencies — Program design and funding

**Potential support roles:**

- Silicon Valley Leadership Group, Bay Area Council, Businesses — Planning, funding
- County Congestion Management Agencies (CMAs), Cities/Counties — Incentives

**Background:**

1. Council of Government (COG)-led telework programs have shown impressive results in the last few years in Washington D.C., Santa Barbara, Denver and other cities. These programs, which focus on manager and employee telework training, have produced part-time teleworkers at a cost of about \$100 per person.
2. Studies estimate that 10 percent to 15 percent of all workers have jobs suitable for telecommuting. Telecommuters typically work at home one-to-three days a week.
3. Telecommuting currently replaces about two percent of daily work trips in the Bay Area. In Marin County, recent household travel surveys indicate that 10 percent of the county's residents engage in telecommuting.
4. Sun Microsystems' "iWork" program and others have proven that employees like telework programs. Seventy percent of Google employees telecommute on a part time basis.
5. The "Telework Impact Estimation Tool," developed by the "Consortium on Green Design and Manufacturing" at the University of California in Berkeley, allows

companies to estimate and compare the benefits and costs of telework and non-telework scenarios. It covers not only transportation but also energy used to light, heat and cool buildings and run equipment.

6. The city of Phoenix eliminates 1.3 million commuter vehicle miles and avoids more than 47,000 pounds of air pollutant emissions each day through telework.
7. AT&T estimates its teleworkers have increased the number of commuting miles they avoid from 87 million miles in 1999 to 154 million miles in 2002.
8. A broad review of telework impact data by the World Resources Institute (WRI) and the US Energy Information Agency (EIA) found that telecommuting reduces overall passenger vehicle-miles traveled.
9. Four-day work weeks or 9/10 work schedules (work 9 out of 10 days every two weeks) would produce similar greenhouse gas reduction benefits if workers do not travel extensively on their off days.

**Links:**

- Denver COG telework program: <http://www.drcog.org/index.cfm?page=Telework>
- The Telework Coalition: <http://www.telcoa.org/>
- Telework Impact Estimation Tool: <http://cgdm.berkeley.edu/telework/>
- Gaining the Air Quality and Climate Benefit from Telework: <http://pdf.wri.org/teleworkguide.pdf>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Low. Assuming that five percent of the workers who drive alone shift to telecommuting an average of 1.6 days a week (typical), transportation CO<sub>2</sub> would be reduced about 0.4 percent in 2020.

*Cost:*

For several telecommuting projects reviewed that focused on government agencies, the cost ranged from \$50 to \$100 per new telecommuter.

*Cost Effectiveness:*

High. Assumes government sponsored assistance to employers to set up a new program would cost \$100 per new telecommuter. Also assumes an average one-way commute distance of 11.8 miles and 1.8 days of telecommuting a week.

## EXPAND PRICING

### Strategy 38:

### Implement parking pricing programs and parking policies.

#### Potential lead:

- Regional agencies — Policy, coordination
- Cities/Counties — Implementation

#### Potential support roles:

- County Congestion Management Agencies (CMAs), businesses — Planning, support

#### Background:

1. Parking pricing and parking policies are two of the most potent strategies for reducing driving and greenhouse gases.
2. Parking expert and UCLA Professor Donald Shoup has conducted research for over 20 years that shows the high impact of free parking on commute mode choice. Shoup's work has demonstrated that parking pricing and policies are key tools in shifting commuters to transit, biking and walking. Shoup's book, *The High Cost of Free Parking*, and his Facebook group "The Shoupistas" are centers for parking research and advocacy.
3. Currently, parking charges are usually seen as a way of raising revenue for cities, not regulating demand. Similarly, local parking policies and regulations for new development are most often focused on minimum parking requirements to avoid spillover parking, not on affecting mode choice.
4. There are many different parking pricing strategies; the key barrier continues to be the lack of political and popular support for rationing a commodity that in most areas has been free and in ample supply.

Typical parking policy and pricing strategies include:

- Reduced parking requirements
- Shared parking
- Parking requirements friendly to transit-oriented development (TOD)
- Parking maximums
- Coordinated off- and on-street parking programs
- Variable-rate parking
- "Unbundled" parking costs for new development (pay parking costs separately from the mortgage or lease)
- Real-time parking availability information
- Parking assessment districts
- Residential permit parking

5. Chicago is planning possibly the most ambitious U.S. parking program ever, completing privatizing the city's parking-meter system, using "congestion pricing" for parking throughout downtown, creating sliding-scale truck loading zones and significantly expanding bus rapid transit on dedicated lanes. A \$153 million congestion pricing grant from the U.S. government is helping to finance the plan.
6. San Francisco is planning an innovative demonstration program covering more than 6,000 curbside parking spaces that use parking meters (25 percent of the city's total stock) in 10 neighborhoods. The program, called "SFpark" aims to reduce congestion and greenhouse gases by pricing meters to always provide some available parking. Rates would change by time of day, day of week and duration of stay. Users could pay with credit cards, cash and cell phones. The program will also experiment with unlimited parking stays during evening hours and other flexible features. High-tech meters make the program possible. Funding is largely coming from an \$18 million federal grant.
7. Redwood City in San Mateo County has instituted a comprehensive "Downtown Redwood City Parking Management Plan" that has been featured in the *New York Times*, *Wall Street Journal*, Salon.com and other media outlets. The program features "free market" or congestion pricing using high-tech meters.
8. SB 728 in the state 2009-2010 legislative session proposes to strengthen and expand parking cash out. California state law (1992) requires the Air Resources Board to implement parking cash out, where employers who subsidize parking also must offer employees a cash allowance in lieu of the parking space. Cash out has long been popular with planners, but it has never taken hold because it only applies to a small set of employers who:
  - employ at least 50 persons (regardless of how many worksites);
  - have worksites in an air basin designated non-attainment for any state air quality standard;
  - subsidize employee parking that they do not own;
  - can calculate the out-of-pocket expense of the parking subsidies they provide;
  - can reduce the number of parking spaces without penalty in any lease agreements.
9. "Unbundling" parking costs from building space costs is also seen as an important parking pricing strategy. AB 1186 in the state 2009-2010 legislative session would require a lessor of a nonresidential building, located within a non-attainment air basin and that offers parking to tenants of the building, to list the parking costs as a separate line item in all lease agreements. The bill would make this requirement applicable only to a nonresidential building that has a maximum occupancy of 50 or more persons.
10. Tod Litman's "TDM Encyclopedia" outlines a number of key pricing techniques for parking:

- Wherever possible, charge motorists directly for using parking facilities. If parking must be subsidized, offer comparable benefits for use of other travel modes, such as cash-out payments.
  - Apply performance-based parking prices, which means that prices are set so that about 15 percent of parking spaces are unoccupied during peak periods (Shoup, 2006).
  - Avoid discounts for long-term parking leases (i.e., cheap monthly rates).
  - Set parking prices to equal or exceed transit fares.
  - Unbundle parking, so people who rent or purchase building space can choose how much parking is included. Similarly, unbundle parking from housing, so apartment and condominium residents pay only for the parking spaces they need (Location Efficient Development).
  - Avoid excessive parking supply. Use parking management to encourage more efficient use of existing parking facilities and address any spillover problems that result from pricing.
  - Encourage businesses to price, cash out and unbundle parking by providing rewards to those that do, legislating it, or by imposing special property taxes on unpriced parking.
  - If parking must be subsidized, use targeted discounts and exemptions, rather than offering free parking to everybody. For example, to subsidize customer parking, allow businesses to validate parking tickets or provide free parking coupons to customers. To subsidize parking for people with low incomes or disabilities, provide discounts directly to those individuals.
  - Tax parking spaces, and encourage or require that this cost be passed on to users. Reform existing tax policies that favor free parking. For example, tax land devoted to parking at the same rate as land used for other development.
  - Price on-street parking in residential neighborhoods. Create “Parking Benefit Districts”, with revenues used to benefit local communities (Shoup, 1995).
  - Allow motorists to lease on-street parking spaces (Solomon, 1995). For example, let residents and businesses lease the parking spaces in front of their homes or shops, which they could use themselves, reserve for their visitors and customers, or rent to other motorists.
  - Use parking pricing revenues to fund transportation programs.
11. In the United Kingdom in 2006, the Richmond-on-Thames Council proposed “green parking fees” that calls for charging permit fees on a sliding scale based on the vehicle’s pollution level. Electric cars would pay nothing, while at the other end of the scale, low-mpg/high-greenhouse gas emitting single occupant vehicles would pay the most.
12. U.S. tax laws generally consider employer provided parking a free benefit as employees are not taxed on this benefit unless it is worth more than \$220 per month. The value is determined based on nearby market-rate parking.



**Links:**

- MTC Smart Parking Seminar and Parking Toolbox/Handbook: Reforming Parking Policies to Support Smart Growth:  
[http://www.mtc.ca.gov/planning/smart\\_growth/parking\\_seminar.htm](http://www.mtc.ca.gov/planning/smart_growth/parking_seminar.htm)
- Parking Pricing Research at On-Line TDM Encyclopedia:  
<http://www.vtpi.org/tdm/tdm26.htm>
- Professor Donald Shoup (UCLA) parking reports and articles:  
<http://shoup.bol.ucla.edu/>
- Pricing the Curb (Washington, D.C., San Francisco, Chicago):  
[www.transalt.org/files/newsroom/reports/pricing\\_the\\_curb.pdf](http://www.transalt.org/files/newsroom/reports/pricing_the_curb.pdf)
- Redwood City parking program:  
<http://www.redwoodcity.org/cds/redevelopment/downtown/Parking/parkingbigpicture.htm>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:***Estimate of Bay Area 2020 Impact:*

Medium. Assigning parking charges to all work place parking could reduce transportation CO<sub>2</sub> by 1 percent to 2 percent. Parking charges were evaluated in MTC's Vision 2035 Analysis, but were included in a suite of pricing strategies, so their impact cannot be isolated. A prior MTC regional transportation plan analysis ("*Blueprint for the 21<sup>st</sup> Century*") applied a uniform charge (\$2.60) to all work parking, which reduced personal vehicle miles traveled by 1.7 percent (or, about a 1 percent reduction in regional CO<sub>2</sub>).

*Cost:*

Unknown. Depends on particular approach (many variations possible). Public costs to set up and administer new programs could be offset by new parking revenues. Some drivers may not be able to avoid increased parking charges at work or other locations.

*Cost Effectiveness:* Unknown. Depends on type of program, administration costs, equipment requirements, number of trips diverted to low greenhouse gas modes, etc.

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**Strategy 39:****Increase use of tolls for bridges, roads and targeted geographic areas.****Potential lead:**

- Regional agencies, Cities/Counties, County Congestion Management Agencies (CMAs) —

**Potential support roles:**

- State

**Background:**

1. London's Congestion Zone was initiated in early 2003 in central London and was extended to West London in 2007. Vehicles entering the zone between 7 a.m. and 6 p.m. pay eight pounds. The purpose is to reduce congestion, discourage vehicle use and provide more funding for public transport. London surface transportation produces 22 percent of the total greenhouse gas emissions with cars producing half of that amount. Drivers pay the e-fee by phone, text-message, Web or at local shops. Certain types of alternative fuel vehicles are given exemptions. Residents of the zone receive a 90 percent discount. The key technology is a set of CCTV cameras that record all vehicle license plates entering the zone and compare that to a database of fee payers. By 2007, the number of chargeable vehicles was down 21 percent vs. 2002 levels and there were significant increases in taxi and bus use and a 43 percent increase in bicycling. Traffic delays in 2007 were 2.27 minutes per kilometer vs. 2.30 prior to the zone. While congestion was very significantly reduced in the first six months of the zone implementation, in subsequent years the congestion relief decreased even though the number of vehicles continued to decline. Increased construction in the zone has been offered as a possible reason for this. Also, public transport use has increased only modestly.
2. Some other cities around the world already use or have tried congestion charging, including Singapore (the first scheme in the world, started in 1975, upgraded in 1998), Rome and Stockholm. Others have implemented a city centre charging zone as a road toll to pay for capital investment in transport infrastructure, including Oslo, Trondheim, and Bergen. New York City mayor Michael Bloomberg has made a congestion charge the centerpiece of his plan for sustainable growth and quality of life in the 21st century. The program was voted down in the state legislature.
3. The San Francisco County Transportation Authority is currently conducting a "Mobility, Access and Pricing Study." The study will explore the feasibility of congestion pricing through technical, economic, financial and legal/institutional evaluations of alternative pricing and mobility packages. The study will also involve the public in the evaluation of these alternatives, including assessing their respective benefits, costs and impacts.
4. Congestion Pricing is listed in the California Air Resources Board's (ARB) Scoping Plan as a measure for further evaluation.
5. See Strategy #15 for information on high-occupancy toll (HOT) lanes.

**Links:**

- Transport for London: <http://www.tfl.gov.uk/roadusers/congestioncharging/>
- London Congestion Charge: [http://en.wikipedia.org/wiki/London\\_congestion\\_charge#\\_note-75](http://en.wikipedia.org/wiki/London_congestion_charge#_note-75)
- San Francisco congestion study: <http://www.sfcta.org/content/view/415/241/#5>
- Road pricing at TDM Encyclopedia: <http://www.vtpi.org/tdm/tdm35.htm>
- MTC HOT Lane Study: <http://www.mtc.ca.gov/planning/hov/index.htm>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

No Bay Area analysis has been conducted. London's congestion pricing program is estimated to reduce transportation CO<sub>2</sub> by 16 percent in the central area.

*Cost:*

Varies depending on strategy. London's program pays for all administrative costs through fees and fines.

*Cost Effectiveness:*

Unknown. Depends on type of program, administration costs, monitoring equipment requirements, number of trips diverted to low greenhouse gas modes, etc.

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**Strategy 40:**

**Implement/increase fuel and carbon fees and taxes.**

**Potential lead:**

- State — Legislation
- Regional agencies — Regional Climate/Gasoline Fee

**Potential support roles:**

- Business groups

**Background:**

1. Gas taxes and fees could be raised to produce revenue for transit, carpooling, biking and walking and other lower-greenhouse gas travel options. Carbon taxes on gasoline could be used in a similar manner. Depending on the level of the tax or fee, they could also act to change travel behavior and shift trips to more fuel efficient modes.
2. In 2008, federal and state gas tax revenues suffered a sharp decline as motorists curtailed driving and purchased more fuel efficient vehicles in the face of high gasoline costs.
3. A 10 cent per gallon gas fee or tax in the Bay Area would produce about \$300 million per year. A fee would require majority approval while a tax would be more flexible but would require a two-thirds voter approval.
4. AB 2558 (Feuer) proposed to allow the Bay Area and other parts of the state to vote to increase either gas taxes or vehicle fees to fund climate and transportation projects. It passed the Assembly in 2008, but did not make it out of the 2007-2008 Legislative Session. It would have authorized MTC and the Metropolitan Transportation

Authority in Los Angeles, with voter support, to impose a fee on gas, up to 3 percent of the retail sale price, or a regional increase in the vehicle registration fee, to fund a climate change mitigation and adaptation expenditure plan. The expenditure plan would have guided how the funds are prioritized and spent. Two-thirds of the revenues would go to public transportation and the other third would be eligible for congestion management projects.

5. The National Surface Transportation Policy and Revenue Study Commission released its report in December 2007. The report spotlighted the need for a 25 percent to 40 percent increase in the federal gas tax (and indexing thereafter) to maintain, operate and strategically expand the surface transportation system. The report further suggested the country would need to transition to a revenue fee structure based on vehicle miles traveled (VMT) after 2025.
6. Oregon is preparing to shift to a VMT tax in place of a gas tax, partially to guard against gas tax revenue decline due to cars becoming more efficient. In 2007, the state concluded a pilot project in Portland that used GPS technology to measure VMT from project participants. The project's final report concluded that the Oregon mileage fee concept is feasible as an alternative to gas tax, but that the technology needs refinement.
7. One proposal gaining more national discussion is a "tax swap" in which a carbon tax would be offset by a decrease in sales or other taxes. For transportation, a gas tax aiming to decrease driving could be paired with a decrease in local sales tax. Those who drive more and/or drive lower mpg vehicles would pay more for travel. People that purchase fuel efficient cars and/or drive less would pay less tax.
8. A key consideration for a carbon or fuel tax is the potential impact on low-income individuals and communities. There are a number of ways that these impacts could be mitigated through rebates, tax credits, increased transit services and other means.

**Links:**

- Oregon Road User Pilot Project:  
<http://www.oregon.gov/ODOT/HWY/RUFPP/mileage.shtml>
- National Surface Transportation Policy and Revenue Study Commission:  
<http://www.transportationfortomorrow.org/>

**Technically feasible to implement and produce results in next five years?**

Yes.

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

High. High gasoline costs (over a 100 percent increase in real price) could reduce transportation CO<sub>2</sub> by 2 percent to 3 percent, depending on price elasticity.

*Cost:*

Unknown

*Cost Effectiveness:*

Unknown. Depends on magnitude of fees in relation to the cost of programs that are funded and resulting greenhouse gas emissions.

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**Strategy 41:**  
**Implement pay-as-you-drive insurance and other distance-based cost strategies.**

**Potential lead:**

- State — Legislation

**Potential support roles:**

- Regional agencies, County Congestion Management Agencies (CMAs) —Pilot projects

**Background:**

1. The AB 32 Scoping Plan (approved in December 2008 by the California Air Resources Board) states: “Another way to encourage greenhouse gas reductions from vehicle travel is through pay as you drive insurance (PAYD), a structure in which drivers realize a direct financial benefit from driving less. The California Insurance Commissioner recently announced support for PAYD and has proposed regulations to permit PAYD on a voluntary basis.”
2. Pay-As-You-Drive (PAYD) Insurance (and other distance-based driving charges) can reduce vehicle-miles traveled and greenhouse gas emissions. PAYD means that a vehicle’s insurance premium is based directly on how much it is driven during the policy term. The more people drive the more they would pay and the less people drive the more they would save. This can be done by changing the unit of exposure (i.e., how premiums are calculated) from the vehicle-year to the vehicle-mile, vehicle-kilometer or vehicle-minute. Existing rating factors are incorporated, so higher-risk motorists pay more per unit than lower-risk drivers. For example, a \$375 annual premium becomes 3 cents per mile, and a \$1,250 annual premium becomes 10 cents per mile. An average U.S. motorist would pay about 6 cents per mile.
3. King County in the state of Washington is developing a three-year, \$6 million pilot PAYD project with Unigard Insurance, as part of the county’s program to reduce driving. The goals of the pilot project are to test the PAYD concept and to reduce vehicle-miles traveled among participants by 12 percent over four years while increasing transit, biking and walking by 5 percent. .
4. MyRate is a car insurance program developed by Progressive Insurance in the United States. It is a voluntary program that gives drivers a customized insurance rate based on how, how much, and when their car is driven. MyRate is currently available in Alabama, Kentucky, Louisiana, Michigan, Minnesota, Maryland, New Jersey and

Oregon. Driving data is transmitted to the company using an on-board telematic device. The device connects to a car's OnBoard Diagnostic (OBD-II) port (all automobiles built after 1996 have an OBD-II.) and transmits speed, time of day and number of miles the car is driven. Cars that are driven less often, in less risky ways and at less risky times of day can receive large discounts.

5. GMAC Insurance instituted a PAYD program in the United States in 2004. The GMAC Insurance Low-Mileage Discount is offered to OnStar subscribers in 34 states, where those who drive less pay less on their auto insurance. Eligible active OnStar subscribers sign up to save on their premiums if they drive less than 15,000 miles annually. Subscribers who drive even less than that can save more (up to 54 percent). Under the program, new GMAC Insurance customers receive an automatic insurance discount of approximately 26 percent upon enrollment (existing OnStar customers receive a discount based on historical mileage). With the subscriber's permission, the odometer reading from the OnStar Vehicle Diagnostics report is forwarded to GMAC Insurance. Based on those readings, the company will decrease the premium using discount tiers corresponding to miles driven.
6. Other distance-based driving cost strategies such as vehicle registrations and emissions fees have also been proposed as greenhouse gas-reduction approaches.

**Links:**

- Pay-as-You-Drive (PAYD) explained: <http://en.wikipedia.org/wiki/PAYD>
- King County PAYD Pilot Project: [www.metrokc.gov/exec/news/2007/pdf/Payasyougofacts.pdf](http://www.metrokc.gov/exec/news/2007/pdf/Payasyougofacts.pdf)
- PAYD at TDM Encyclopedia: <http://www.vtpi.org/tdm/tdm79.htm>
- Distance-based driving: <http://www.vtpi.org/tdm/tdm10.htm>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

No analysis performed to date.

*Cost:*

Drivers could lower their insurance costs if implemented.

*Cost Effectiveness:*

Unknown. Depends on costs for program administration, monitoring equipment, etc. and greenhouse gas reductions achieved.

## PART 5: OTHER STRATEGIES

### Strategy 42:

### Incorporate the transportation sector into California's carbon trading system

#### Potential lead:

- State — Design and operation of a trading system and/or offset system

#### Potential support roles:

- Regional agencies, County Congestion Management Agencies (CMAs), Cities/Counties — Examine implications of a cap and trade system for the San Francisco Bay Area

#### Background:

1. The California Air Resources Board's AB 32 Scoping Plan (approved in December 2008) calls for a cap and trade system in California that is linked to the Western Climate Initiative, which includes seven states and four Canadian provinces. The current plan includes the transportation sector in the cap and trade program beginning in 2015 and calls for "transportation fuel combustion to be regulated where the fuel enters into commerce." This would focus primarily on about 30 refineries statewide.
2. While this would not directly impact regional transportation services, there are a number of ways that Bay Area transportation services could be funded and strengthened through a California or multi-state carbon trading network. The following opportunities may arise from the statewide program:
  - Use revenues raised through California carbon allowance auctions or similar federal programs to fund Bay Area transportation improvements. MTC and others could lobby to make sure transportation is targeted for such revenues.
  - Create certified projects that can qualify for emissions trading under the Kyoto Accords or other system. While this is a difficult process and the economics might not work in developed countries, it is worth investigating. Bogota, Columbia's Bus Rapid Transit System has been certified through Kyoto and is being partially financed by emitters in other countries.
  - Sell Bay Area transportation offsets to fund local transportation improvements. Portland, Oregon recently funded a comprehensive traffic signal timing project through the Oregon Climate Trust's offset program for new power plants in the state.
3. In addition, there are other "carbon offset" opportunities that could be explored:
  - The California Attorney General's settlement with Conoco Phillips for its refinery expansion in Rodeo included \$7 million for the Bay Area Air Quality

Management District, to be used for local/regional greenhouse gas reduction projects.

- The state could implement greenhouse gas offsets from a fee on new vehicle sales and either fund transportation projects that clearly reduce greenhouse gases or fund greenhouse gas abatement projects in other sectors (utility industry, reforestation, methane capture projects, etc.). For example, offsets could provide Pavley-like emission reductions whereby purchasers of new vehicles would pay to offset the “extra” greenhouse gas emissions over the useful life of the vehicle compared to the lower emissions they would have produced under the Pavley requirements (if Pavley is delayed or the weaker federal standards go into effect instead). Another example would be to use offsets to fund a statewide electric vehicle (EV) infrastructure.

**Links:**

- AB 32 Scoping Plan: <http://www.arb.ca.gov/cc/scopingplan/scopingplan.htm>
- California Air Resources Board’s Market Advisory Committee (trading system proposal): <http://www.climatechange.ca.gov/publications/policy.html#mac>

**Technically feasible to implement and produce results in next five years?**

Yes (if California or Western Climate Initiative markets are up and running)

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Depends on the amount of revenues and types of projects funded through offsets or cap and trade allowances, but could be potentially significant.

*Cost:*

Cost of cap and trade allowance unknown.

*Cost Effectiveness:*

Unknown.

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**Strategy 43:**

**Implement in-house greenhouse gas (GHG) reductions by Bay Area transportation agencies**

**Potential lead:**

- Transportation agencies — Inventory, strategy development, implementation

**Potential support roles:**

- County Congestion Management Agencies (CMAs), MTC



**Background:**

1. Strategies could address power use by vehicles; lighting, heating and cooling of stations and offices; waste policies; employee commutes; etc.
2. BART has conducted a comprehensive inventory of its in-house emissions from its trains, stations, etc. to determine which energy-saving measures could be most effective. Seventy-five percent of BART power usage is for moving trains. BART is a member of the California Climate Action Registry through the Northern California Power Association.
3. AC Transit is a member of the California Climate Action Registry and has inventoried all of its operations. AC Transit is currently developing an extensive alternative fuel program featuring three hybrid-electric hydrogen fuel cell buses, including on-site hydrogen production in partnership with Chevron.
4. The Altamont Commuter Express (ACE) is a member of the Chicago Climate Exchange (CCX) and has inventoried its emissions through the rigorous CCX process.
5. San Francisco Municipal Railway (Muni) is aiming to reduce its emissions by 30 percent by 2012 and to become greenhouse gas emissions-free by 2020 (much of Muni's system is powered by electricity). In 2007, Muni's first of 86 hybrid-electric buses went into service, reducing fuel consumption by 19 percent over regular diesel buses.
6. Operators can also look at scheduling and service adjustments to reduce fuel consumption. Muni's "Transit Effectiveness Project" is an example of a significant service review that could also have greenhouse gas emission reduction benefits. Santa Clara Valley Transportation Authority's "Comprehensive Operations Analysis" looks at similar issues.
7. Bay Area airport operators (OAK, SFO, SJC) are evaluating and implementing a range of measures to reduce on-airport greenhouse gas emissions. This includes using electric power from the airport instead of running the plane's auxiliary power unit while it is at a gate, towing aircraft to runways, use of alternative fuels for airport operations and green rental car fleets.

**Links:**

- AC Transit Hy-Road: [http://www2.actransit.org/environment/hyroad\\_main.wu](http://www2.actransit.org/environment/hyroad_main.wu)
- APTA Report: Role of Public Transit in Reducing Greenhouse Gas Emissions [http://www.apta.com/research/info/online/climate\\_change.cfm](http://www.apta.com/research/info/online/climate_change.cfm)

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

No analysis performed to date.

*Cost:* Unknown

*Cost Effectiveness:*

Unknown. Depends on strategy.

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**Strategy 44:**

**Develop adaptation strategies for transportation infrastructure and services to address rising sea levels, extreme rainfall events, etc.**

**Potential lead:**

- California Resources Agency, Regional agencies, California Department of Transportation (Caltrans)

**Support roles:**

- Cities/Counties — Planning, funding

**Background:**

1. The Bay Conservation and Development Commission (BCDC) has been awarded a number of grants to coordinate sea level rise planning and adaptation in the Bay Area. In addition, BCDC is sponsoring *Rising Tides*, an international design competition for resilient Bay Area shoreline development.
2. The Pacific Institute, with funding from Caltrans, PIER and the Ocean Protection Council, released a new study in 2009 that updates its 1980 study of the economic impacts of sea level rise on California's infrastructure along the coast and in the San Francisco Bay. The report finds that "480,000 people, a wide range of critical infrastructure, vast areas of wetlands and other natural ecosystems, and nearly \$100 billion in property along the California coast are at increased risk from flooding from a 1.4-meter sea-level rise – if no adaptation actions are taken."
3. BCDC, using data supplied by Noah Knowles at the United States Geological Survey (USGS), has developed maps based on two scenarios – a 16-inch sea level rise at mid-century and a 55-inch sea level rise at the end of century. The maps identify a number of Bay Area transportation facilities that would potentially be compromised — including Interstate 80, US-101, Highway 37, I-880, Highway 237, Capitol Corridor trains, BART's Embarcadero Station, Port of Oakland, San Francisco International Airport, and Oakland International Airport.
4. The state Resources Agency is leading the development of California's climate change adaptation strategy to improve the state's preparedness for expected climate change. The strategy will address the potential impacts in California from higher temperatures, shifting precipitation patterns, extreme weather events and sea level rise, as well as impacts on public health, wildlife and other issues of concern. Several state agencies are participating in the effort by preparing strategies for various sectors. Caltrans is currently developing the portion of the State's adaptation plan

related to transportation infrastructure. In describing the approach that Caltrans is taking, Caltrans staff has indicated it will include both adaptation to climate impacts and greenhouse gas reduction strategies together as a way to address adaptation.

5. At this time, there is no overall coordination of Bay Area-wide impacts nor Bay Area specific research and strategy formation beyond sea level rise. Urban heat island impacts, extreme rainfall events, fires, etc. will all potentially affect Bay Area transportation infrastructure.
6. Some strategies can work for both adaptation/resiliency planning and greenhouse gas reduction. For example, tidal marshes can provide flood protection while removing carbon from the system.

**Links:**

- Our Changing Climate (California Impacts):  
[www.energy.ca.gov/2006publications/CEC-500-2006-077/CEC-500-2006-077.PDF](http://www.energy.ca.gov/2006publications/CEC-500-2006-077/CEC-500-2006-077.PDF)
- BCDC Sea Level Rise Mapping:  
[http://www.bcdc.ca.gov/planning/climate\\_change/climate\\_change.shtml](http://www.bcdc.ca.gov/planning/climate_change/climate_change.shtml)
- California Resources Agency Climate Adaptation Strategy (CAS):  
<http://www.climatechange.ca.gov/adaptation/index.html>
- Preparing California for a Changing Climate:  
<http://www.ppic.org/main/publication.asp?i=755>
- Impacts of Sea Level Rise on the California Coast (Pacific Institute):  
[http://www.pacinst.org/reports/sea\\_level\\_rise/index.htm](http://www.pacinst.org/reports/sea_level_rise/index.htm)

**Technically feasible to implement and produce results in next five years?**

Yes (to develop plans)

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

The Pacific Institute study provided a preliminary look at the extent of impact of sea level rise on shoreline land uses, including transportation infrastructure.

*Cost:*

Unknown. Cost to protect transportation infrastructure is potentially very high.

*Cost Effectiveness:*

Unknown. The benefit/cost comparisons for various types of strategies to protect the transportation infrastructure would need to be performed.

**Strategy 45:**

**Design and implement an improved greenhouse gas tracking system to measure progress and evaluate strategies at regional and local levels.**

**Potential lead:**

State, Regional agencies

**Potential support roles:**

County Congestion Management Agencies (CMAs), Cities/Counties

**Background:**

1. The current system for estimating vehicle miles traveled (VMT) and greenhouse gas emissions from transportation is not sufficient to accurately track progress by state, regional and local agencies.
2. Improvements in motor vehicle emission models (like the Emission Factor Model or EMFAC), VMT measurement, data on real-world vehicle miles per gallon, regional travel forecasting models and/or the collection of regional gasoline and diesel fuel sales volumes would be necessary to provide a more accurate tracking system for greenhouse gas emissions from transportation.
3. MTC and other regional agencies called for much improved greenhouse gas and VMT measurement as part of their comments on the AB 32 draft scoping plan. The California Air Resources Board (ARB) has acknowledged that transportation greenhouse gas measurement is a problem and that it must be improved to effectively implement AB 32 and SB 375 (Chapter 728, 2008 Statutes).
4. Oregon recently conducted a pilot project to test a GPS-based system in cars to measure VMT. Oregon and others states are concerned about declining revenues from per gallon fuel taxes as cars become more efficient.

**Links:**

Oregon Road User Fee Pilot Project:

<http://www.oregon.gov/ODOT/HWY/RUFPP/index.shtml>

**Technically feasible to implement and produce results in next five years?**

Yes

**Preliminary review of potential impact and cost:**

*Estimate of Bay Area 2020 Impact:*

Unknown.

*Cost:*

Unknown, but probably modest to obtain new data, if needed.

*Cost Effectiveness:*

High (qualitative). Benefits of having an accurate GHG measurement system would be substantial.

**Table B: Bay Area Sources of Transportation CO<sub>2</sub>**

The impact of new strategies to reduce CO<sub>2</sub> from transportation depends on both the amount of CO<sub>2</sub> that the strategy could potentially affect and the effectiveness of the strategy in reducing CO<sub>2</sub> from the particular source. The chart below lists estimated amounts of CO<sub>2</sub> from different transportation sources in 2007.

<b>Sources of Transportation CO<sub>2</sub></b> (Daily Tons of CO <sub>2</sub> in 2007)	
	<u>Daily Tons of CO<sub>2</sub></u> (1,000's of Tons)
1. All Bay Area car and truck travel	92.4
2. All travel by passenger cars	67.7
3. All freeway travel	59.9
4. Freeway travel above 55 mph	43.1
5. Travel by passenger cars 6 years and newer	34.4
6. Travel on arterial roads	32.5
7. Truck travel	24.7
8. Work commuting	23.1
9. Freeway travel above 65 mph	20.4
10. Shopping/recreational travel	13.0
11. Passenger cars 10 years and older	15.9
12. Inter-regional commuting	11.2 *
13. Travel on arterial roads controlled by signals	4.9
14. Heavy duty truck travel above 55 mph	1.1
15. K-8 school travel	1.1

\* Includes CO<sub>2</sub> produced both within and outside the Bay Area