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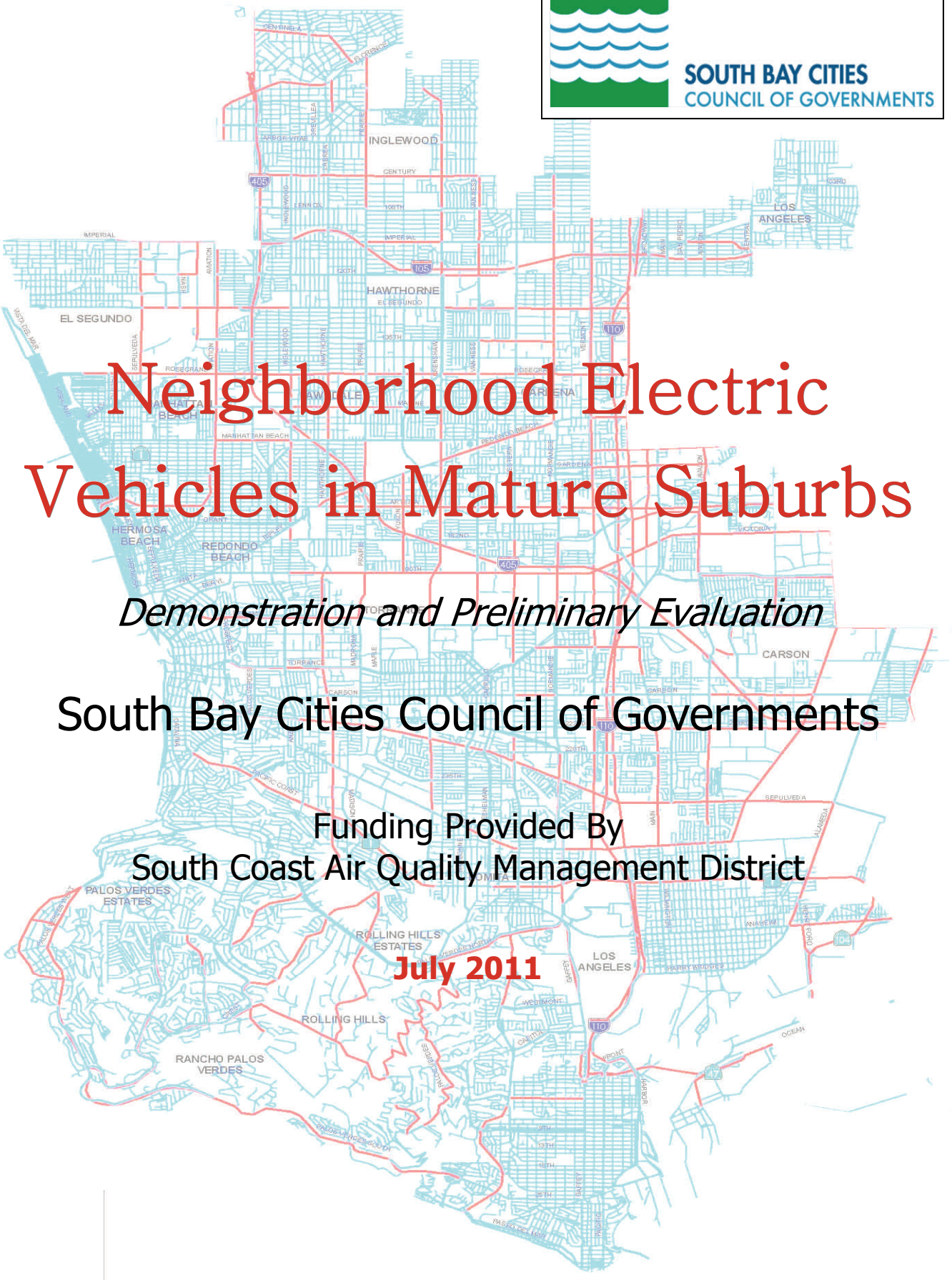

Neighborhood Electric Vehicles in Mature Suburbs

Demonstration and Preliminary Evaluation

South Bay Cities Council of Governments

Funding Provided By
South Coast Air Quality Management District

July 2011

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Map on Cover Page provided by RBF Consulting. Neighborhood electric vehicles can be legally driven on the network of blue streets.

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Introduction

This is a Preliminary Report on a demonstration of Neighborhood Electric Vehicles (NEVs) in the South Bay Subregion of Los Angeles County. The project is sponsored by the South Bay Cities Council of Governments (SBCCOG) and funded by the South Coast Air Quality Management District (AQMD). Active use of the demonstration-vehicles began May 1, 2010 and will run for 18 months until October 31, 2011.

This Preliminary Report, based on the first 12 months of data collection and analysis, is being distributed now because of the extraordinary positive results being obtained in the context of the need to:

- Reduce green house gas emissions, nitrogen oxides and other criteria pollutants, and consumption of fossil fuels by passenger vehicles and light trucks.
- Inform Government plans and policies currently being formulated, including SCAG's 2012 Regional Transportation Plan, California Energy Commission's initiative for electric vehicle readiness, and California Air Resources Board's AB 118 vehicle voucher program for 2011-12.
- Implement the Sustainable South Bay Strategy with its mobility initiative based on transition of the gasoline fueled fleet of passenger vehicles and light trucks to some form of electric vehicle.

This report will be updated and included in a comprehensive Final Report, with complete data, detailed findings and recommendations, by the end of 2011.

The Sustainable South Bay Strategy

The South Bay is a mature, built-out suburban area, much like many other places in Southern California. Despite having pockets of residential density among the highest in Los Angeles County, the South Bay sub-region is transit-poor in terms of both bus services and rail infrastructure. If the fifteen incorporated cities of the South Bay were a single city, it would have the population of Portland, Oregon but with about 50% more residential density and without Portland's transit infrastructure and dominant downtown.

The Sustainable South Bay Strategy is based on the results of a research program that was designed to identify land use and transportation initiatives that would reduce GHG emissions, criteria pollutants and gasoline consumption by building on existing strengths of South Bay cities.

The Board of Directors of the South Bay Cities Council of Governments (SBCCOG) adopted the Sustainable South Bay Strategy (SSBS) in October, 2010 as the basis for the sub-region's contribution to the regional Sustainable Communities Strategy (SCS) and as a guide to land use planning and transportation policy in cities interested in becoming more sustainable. The Local Use Vehicle (LUV) Demonstration Project provides "proof of concept" of one aspect of the mobility component of the SSBS.

SSBS implementation requires much less public sector investment, land use change and social behavioral change than the transit-density strategy being used for meeting SB 375 goals elsewhere in the region. That is possible because the existing development pattern features many horizontal mixed-use neighborhoods where our studies have shown that most trip destinations are within 3 radial miles of home.

The primary land use strategy involves gradually re-organizing low density destinations -- especially commercial strips along major arterials -- into compact, higher density centers in the middle of every neighborhood (for example, at the intersections of major arterials). The low-density commercial strips can be transitioned into new housing, built at densities compatible with the existing adjacent neighborhoods, rather than at the much higher densities needed to make public transit service more economically feasible (funding to improve transit infrastructure in the South Bay is not expected for at least 20 years). These land use changes should dramatically encourage walking and cycling as mode choices as there will be compact commercial destinations within one-half mile of every home and a regular pattern of similar centers every mile in each direction.

There is more to it of course, but those are the land use basics. This strategy is referred to as "neighborhood oriented development" (NOD as distinguished from transit oriented development or TOD).

While NOD is a long-term strategy for improving proximity between residential origins and the variety of regular destinations, the strategy for reducing the negative impacts of mobility within the existing pattern of destinations can be implemented in the short-term. That transportation strategy is based on transforming the private passenger vehicle fleet from predominantly gasoline-fueled to predominantly plug-in electric (PEV) or some future alternative such as hydrogen fuel cells. There are currently two types of PEVs: 1) Plug-in hybrids (PHEV) like the Chevrolet Volt that are mostly electric but still require small amounts of gasoline; and 2) battery electric vehicles (BEV) that run 100% on batteries and produce zero tailpipe emissions. BEVs are range-limited; however this constraint is actually a feature compatible with the existing and future development pattern.

The most significant strengths of this fleet-transition strategy are that household mobility will remain anchored in the door-to-door, on-demand service, which minimizes the need for significant changes in travel behavior; and that the primary source of investment will be private households which minimizes the required level of public sector investment.

"The near-term challenge is to begin the transition of the almost 600,000 private passenger vehicles in the South Bay to some form of PEV"

Although there are segments of the BEV market that will be much lower cost than today's gasoline fueled vehicles, a safety net will be required for those who cannot afford to purchase a vehicle. PEV purchase vouchers, lease-purchase programs, and neighborhood car sharing are among the options. The safety net will also include neighborhood-based vanpools, jitneys, and ride sharing – all part of SSBS implementation.

Transit will play a supportive role as it does today, but we expect that will happen through a variety of innovative services that will rely on a regular pattern of compact commercial destinations rather than high levels of residential density. Small-vehicle, short hop circulators and demand-responsive services are more likely to be effective for the many local trips; rapid long-haul lines with the traditional 40 to 57 seat buses are expected to connect the South Bay to regional transit centers and light rail stations more effectively than today.

The near-term challenge is to begin the transition of the almost 600,000 private passenger vehicles in the South Bay to some form of PEV. Our working assumption is that the first vehicle in most households will need to be capable of long distance travel. Therefore, about 350,000 primary vehicles will need to be gradually replaced by the unlimited range plug-in hybrid vehicles (PHEV) beginning to enter the market. Transition of the approximately 250,000 second and third vehicles per household to range-limited battery electric vehicles (BEVs) can begin immediately.

A number of BEVs are currently on the market with more expected in 2011 and 2012. The Nissan Leaf, Coda Sedan, and Wheego Life can operate at freeway speeds with a range of about 100 miles; BMW, Ford, Mitsubishi, BYD and others are also expected to introduce BEVs with similar capabilities in 2011-12. Honda and Toyota are both expected to produce freeway speed, 50-mile range BEVs in 2011-12.

The BEV niche currently with the most number of model options is the Neighborhood Electric Vehicle (NEV). NEVs have a maximum speed of 25 miles per hour, a range of about 25 miles between charges, and are legal only on mixed-flow streets with speed limits of 35 MPH or less. They can also be legally driven on streets with speed limits faster than 35MPH in a specially designated lane, similar to a Class 2 bike lane.

In summary, the short distances associated with long-term sustainability match the limited range of BEVs. This harmonious relationship between development pattern, travel demand and vehicle capability is the basis for what we called the Local Use Vehicle (LUV) Demonstration Project.

The LUV Demonstration Project

For marketing reasons, the term Local Use Vehicle (LUV) was adopted for the demonstration project in place of the more accurate NEV. These vehicles are also sometimes referred to as slow-speed (SSEV) due to their 25 MPH limit. Technically, LUVs would also include Segways, electric mopeds, and others now in prototype such as GM's EN-V. This initial demonstration project focused on assessing the viability of NEVs on typical suburban streets in today's development pattern.

Through a partnership with Enterprise Rent A Car (ERAC), the SBCCOG leased 5 vehicles:

- Vantage Crewcab
- Columbia Summit
- Wheego Whip (2)
- GEM e4

Subsequently, a GEM dealer loaned the SBCCOG a second e4 and the City of Santa Monica loaned the SBCCOG a Miles Sedan.

A removable decal with the project logo for easy identification and a GPS unit for tracking usage were installed on each vehicle. Each vehicle was insured by the SBCCOG.

The plan was to loan each vehicle for 6 months to a selected household for unlimited use with no cost to participants other than for battery charging. The 18 month demonstration period would therefore allow 3 rotations so that in the end the project would include 15-18 households.

The initial recruitment was conducted at a street fair in the Riviera Village neighborhood center in south Redondo Beach/west Torrance. Without further recruitment efforts – the vehicles themselves with their project logo served as a rolling advertisement – there are now over 200 interested households on a waiting list.

Because demonstration participants fall into a driving routine within a few weeks that remains relatively constant; and in light of the long waiting list, the trial period per household has been reduced to between 2 and 3 months. The data presented below represent the experience of 15 households. We estimate that at least 24 households will participate by the end of the project.

Most of the participants to date live in or nearby the Riviera Village neighborhood. That area was originally targeted because of its "high capture rate" (percentage of all trips originating in the neighborhood that were captured by the local center) as identified by the South Bay Transportation Performance Study (the 5 year research project that produced the SSBS). In other words, we focused the LUV demonstration on the area where our research found a relatively high proportion of very local travel. Subsequent rotations have begun what needs to be a broader effort to include residents from neighborhoods adjacent to commercial strips (rather than a center) to determine if there is a difference in vehicle usage.

The usage analysis integrates four sources of data:

- GPS on each vehicle, which provides comprehensive tracking of distances, routes, destination locations, time of day, and speeds.
- Hand held GPS units – added in the 6th month – which provide total household VMT for one-week periods.
- Driver logs supplemented by individual interviews that help identify functional destinations from destination locations.
- Focus groups with drivers of each rotational group.

Three Questions Addressed by the LUV Demonstration Project

1. Will residents regularly drive NEV/LUVs on typical suburban streets without special lanes or signage?
2. Will NEV/LUV usage produce significant environmental and economic benefits?
3. Is large-scale deployment of NEV/LUVs feasible?

1. Will residents regularly drive NEVs on typical suburban streets without special lanes or signage?

Most previous experience with NEVs has been limited to private roads (e.g., on school and medical campuses or in gated communities) and on public roads in golf cart communities. Yet they are legal on

public streets with speed limits no faster than 35MPH. Would participants be willing to drive them on "untreated" (those without lane striping or special signage) streets in typical suburban settings?

Answer: Yes

Both the objective data and the personal testimonials reflect a high level of driver acceptance of the NEV/LUVs under current conditions.

Based on the GPS data from these 15 households, the vehicles were driven between 68 and 472 miles per household per month. The average over all households was 195 miles per month.

Ten of the 15 households also generated trip data from the hand-held GPS units. In those ten households, the NEV/LUV usage ranged between 8% and 51% of total household vehicle miles travelled.

Total transportation demand ranged from 369 to 2,237 VMT per household per month with a 778 VMT average. That average translates to 28.2 VMT per household per day compared to the 2001 regional average of 42.9 per weekday and 34.5 per weekend – which validates the observation that the distances in the South Bay are relatively short.

The Final Report will include data on more households and will provide finer grain analysis including the interaction between usage and development pattern, commercial VS residential uses, and the practice of trip chaining in an NEV/LUV.

This preliminary analysis looks at patterns by age and gender. Drivers under age 60 drove the vehicles the most with an average monthly VMT of 260. Male drivers under 60 averaged 123 VMT per month. Retirees regardless of gender had the lowest monthly VMT average of 133.

The following table shows the age-gender distribution of our participants (based on the primary driver of the NEV/LUV).

NEV/LUV Drivers

	Under 60	**Over 60**
Female	8 (including 1 single-resident household)	1
Male	3 (excluding 1 driver that participated for one week only)	3

The South Bay, like much of Southern California, has an aging population, so one of the sub-questions was whether an NEV/LUV could satisfy the mobility needs of retirees. At this point, we lack sufficient data to draw even tentative conclusions about the utility of NEV/LUVs to seniors.

While NEV/LUV drivers are willing to travel 10-15 miles round-trip, most NEV/LUV driving trips average 5 miles in length with a wide variation among households of from 2 to 9 average miles per trip. The trip leg or segment averaged 1.13 miles.

Distances of 5 radial miles or more from home were rarely recorded; 99% of the destinations visited using a LUV were less than 3 radial miles from home. Participants traveled the farthest to reach schools and

worksites. These distances are consistent with the findings of the South Bay Transportation Performance Study.

The frequency with which participants visited various destination types is listed below:

- **18%** - Dropping-off or picking-up a family member – a destination category that was dominated by parents.
- **17%** - Entertainment
- **17%** - Worksites
- **11%** - Grocery Shopping
- **9%** - Other Shopping
- **7%** - Personal Services
- **8%** - Eat Meals
- **6%** - Work Related Errands
- **3%** - Other
- **2%** - Medical
- **2%** - Community Meetings

> ***"...the average percentage of all household travel (VMT taken in an NEV/LUV was consistently 22% across all groups."***

Two of the drivers reported that they relied so heavily on their LUVs, that when a trip required their regular gasoline-fueled vehicle, the car battery had gone dead from lack of use. Others reported driving a LUV helped them become more familiar with their own neighborhoods.

Charging was not a barrier for our participants. All charged at home without electric service upgrades or special charging units. About 2/3 parked in their single family home, some in garages that had to get cleaned out to make room for the vehicle. About 1/3 parked in front of their garage and used an outdoor outlet. There was only one driver from a multi-family residence and that participant ran an adapter from an overhead light fixture in his parking spot.

In summary: Destinations were less than 3 radial miles from home, about 1 driving-mile apart and round-trips averaged about 5 miles in total length due to trip chaining. While the NEV/LUV VMT varied greatly by individual and by demographic characteristics, ***the average percentage of all household travel (VMT) taken in an NEV/LUV was consistently 22% across all groups. In terms of vehicle trips, the NEV/LUVs mode share averaged 26% of the round trips.*** Finer grain analysis will become possible as the sample size increases, but this initial finding suggests the potential mode share for NEV/LUVs.

The following issues that affect driver acceptance have been identified so far:

Vehicle speed

The most significant issue encountered was on main arterials where the posted speed limit may be 35 MPH but the traffic flows closer to 40 or 45 MPH during many periods. Drivers experienced discomfort holding up traffic. In response, we added a sticker to the back of each vehicle that said “Local Use Vehicle -- Speed 25 MPH MAX.” NEV/LUV drivers reported that other drivers became more courteous once the stickers were added.

While those stickers provided drivers with some peace of mind, the practical solution was to avoid arterials where fast traffic might be encountered. This required route planning and experimentation. The project equipped each vehicle with a map showing streets legal for LUVs but in practice drivers tended to apply trial and error in developing preferred routes. In most cases, a parallel street could be found that carried much lower traffic volumes where a slow speed vehicle does not impede other drivers.

Speed can also affect travel time; however our drivers did not mention time as a problem, most likely because of the short trip lengths.

Neighborhood islands

There are neighborhoods that are difficult to enter and exit because they are bounded by streets with posted speed limits of 40 MPH and faster. For those cases, the remedy will require establishing separate Class 2 lanes with special striping and signage (which could also accommodate bicycles). A more complex alternative would be the development of a 35 MPH NEV (referred to as Medium Speed Electric Vehicle or MSEV) which would require manufacturers to make improvements to the slow speed NEV/LUV models (i.e., electronics, batteries, possibly air bags) and for the National Highway Traffic Safety Administration (NHTSA), which regulates vehicle safety equipment, to approve a medium speed vehicle category.

Safety

No injuries have been sustained in our demonstration and none of our participants mentioned safety as an issue -- but outsiders often do. The exception was that the Beach Cities Health District had agreed to allow case workers to use two LUVs for trips to the homes of clients, but dropped out of the demonstration following a story in the *Los Angeles Times* about two NEVs that had essentially failed a crash test used for full speed autos – neither of the vehicles tested was in our fleet. The withdrawal was based on the perception of risk by the Board of Directors of a large non-profit which suggests participation by such organizations will need to trail rather than lead.

That is not to avoid the reality that NEV/LUVs are generally not as crash-ready as full speed vehicles. Risk is minimized by driving them in slow speed environments as has been done in our Demonstration Project.

The flip side of driver safety is the potential threats that motorized vehicles pose to pedestrians, cyclists and other motorists. As the organization Safe Routes to Schools reminds us, 12% of all trips in the SCAG region are done via walking and/or bicycling, yet 25% of all roadway injuries and fatalities in the region are pedestrian and bicyclists. NEVs/LUVs are smaller, lighter, and slower than typical motor vehicles and consequently by themselves will make walking and cycling safer.

Terrain

The South Bay has 3 distinct districts; beach, basin, and Palos Verdes Peninsula (PVP). While the first two are relatively flat, the PVP is quite hilly. The NEVs in our demonstration were occasionally driven on the PVP, but the hills slowed their speed and tended to drain their batteries. The more powerful BEVs are better candidates for residents of the PVP cities. However, some small market niche for NEVs probably exists as a second vehicle for those living adjacent to one of the commercial centers on the PVP (there are no commercial strips).

Range anxiety

The resistance to driving a BEV for fear of getting stranded with a dead battery is often mentioned as a potential barrier. This has not emerged as a factor so far. Part of the reason is that NEV/LUVs are specifically for local use. With trips of 3 miles or less and a range of 20+ miles, home charging is more than adequate for most households.

The exception was in the households with the heaviest use in which drivers took multiple trips in one day. The battery would run down by the end of the day forcing the driver to take the gasoline-fueled car sitting in the garage. Even in those cases, elaborate charge port infrastructure (CPI) would not have helped since the LUV was not stopped anywhere for extended lengths of time.

So far there have been two cases of drivers getting stranded. One involved a trip onto the PVP where the batteries wore down from the demands of driving hills -- surprising the driver. The other occurred in the first week of the rotation before the driver had the experience of managing the charge levels. In one case the driver simply waited for the battery to recover (regain its equilibrium) and in the other access to a 110 outlet was borrowed from a friendly resident.

2. Will NEV usage produce significant environmental and economic benefits?

Since adoption of NEV/LUVs is not proceeding at a rapid pace on its own, some public policy initiatives will be required to reach fleet transition targets in the South Bay. Is the effort worth it in environmental and economic benefits?

Answer: Yes – emphatically

An interesting result is that NEV/LUVs have a more pronounced impact on criteria pollutants than on GHG emissions. The reason is that high volumes of criteria pollutants are emitted when a gasoline engine is first started (a "cold start") and before the catalytic converter reaches a sufficient temperature to eliminate the particulates. Longer trips tend to produce the GHG emissions and our drivers took few long trips. Nevertheless, the overall environmental impact from such a simple technology is substantial.

Participating households have reduced their personal transportation related Carbon Dioxide emissions by an average 23%. Average participating households criteria air pollutants were reduced by 26% - 33% depending on the specific pollutant being measured.

	Household Emission & Gasoline Reductions From One NEV		
	Ave	Min	Max
Hydrocarbons	33%	13%	66%
Carbon Monoxide	30%	10%	66%
Nitrogen Oxides	29%	9%	67%
Particulate Matter 10	28%	7%	66%
Sulfur Oxides	26%	7%	67%
Carbon Dioxide	23%	6%	57%
CO2 e (Carbon dioxide equivalent)	23%	6%	58%
Gasoline	27%	8%	51%

Environmental and Economic Projections: As a near-term target (target date to be determined in discussion with South Bay cities), we hope to replace approximately 60% of the second and third vehicles in the South Bay with NEV/LUVs and other BEVs. Of the 591,250 passenger vehicles in the South Bay 243,800 of them are second and third vehicles[1]. At 60% of the secondary fleet, they would replace about 150,000 gas-powered cars. Since there are multiple NEV/LUV options available in the market today, this process need not wait for new product introduction to begin.

Replacing 150,000 gasoline-powered autos would save over 17 million gallons of gas per year. The carbon emission offsets would be the equivalent of planting over three million trees each year.[2]

	Annual Projected Emissions based on 150,000 LUVs		
LUV emission reductions	Based on Average Users	Based on Lowest Users	Based on Highest Users
Hydrocarbons - Tons	138.5	68.5	245.8
Carbon Monoxide - Tons	1,806.6	871.2	3,179.5
Nitrogen Oxides – Tons	165.4	79.7	299.8
Particulate Mater 10 – Tons	7.8	3.7	13.6
Sodium Oxides – Tons	1.5	0.7	2.8
Carbon Dioxide – Tons	134,814.9	66,706.3	248,288.5
GHG (CO2 equivalent) – Tons	141,801.8	70,220.2	262,337.5
Gasoline consumption – Gallons	17,422,632	5,953,500	41,655,932

Switching 150,000 gas-powered cars to electric-powered cars would save South Bay residents $65 million per year.[3] This would be approximately $439 of savings per year for each participating household. $65 million added to the disposable income of South Bay residents each year would constitute a significant stimulus to the local economy.

3. Is large scale deployment of NEVs feasible?

The SBCCOG's previous research into the interaction between development pattern and transportation choices suggested that off-the-shelf NEV/LUVs hold great promise for satisfying a significant portion of driving needs without major changes in land use policy, transportation policy or significant infrastructure investments. The LUV Demonstration so far validates that promise.

[1] Based on data supplied by SCAG
[2] Equivalents are based on the average of LUV test users and EPA GHG Equivalencies Calculator http://www.epa.gov/cleanenergy/energy-resources/calculator.html
[3] Assuming $5/gallon gas, and $0.06/mile electric car rates as promised by SCE and as measured with energy monitoring devices attached to charging equipment

However, NEV/LUVs have been available on the market for 13 years (the first GEM was introduced in April, 1998), and consumers have not embraced them in large numbers. Are there too many barriers or can NEV/LUVs actually help the family of BEVs replace the second (and third) vehicle in many households?

Answer: Yes -- conditionally

It appears that a concerted, coordinated effort by leading public and private stakeholders could overcome existing barriers and stimulate the private market for NEV/LUVs (and other range-limited BEVs). Here are the areas identified so far where action would probably make a difference.

Vehicle Price: Prices must come down. The following table shows the vehicle category, speed and range capabilities, current price (without government subsidy) and a target price that could be achieved through economies of scale as production increases and that would most likely lead to consumer acceptance.

Vehicle Type	Speed	Range	Current Price	Target Price
NEV/LUV	25	20-30	$8,000-$20,000	$7,000-$10,000
Possible MSEV	35	30-40	No such category	$12,500
BEV 50	Freeway	50	$24,000 anticipated	$20,000
BEV 100	Freeway	100	$34,500-$90,000	$30,000
PHEV	Freeway	Unlimited	$45,000	$40,000

Honda and Toyota are producing vehicles for the BEV-50 niche and are expected to reach the market in 2012. Nissan (Leaf), Coda, Mitsubishi, and Ford, to name some early entrants, are producing vehicles for the BEV-100 niche, some of which are currently available while the others are expected in 2012.

The NEV/LUV market niche is dominated by small players with very low production runs. This means they cannot subsidize market development like Nissan, Chevrolet, Honda, and Toyota; nor can they capture economies of scale until demand increases.

The need to lower those price points in the long run illustrates ***the critical importance of Federal tax credits and State vouchers in the immediate future***. The public subsidies should be large enough to bring the price to the consumer close to the targets. California Air Resources Board's (CARB) existing NEV/LUV vouchers of $1,000 per vehicle (which may be phased out due to State budget constraints) are inadequate to stimulate the market. Substantial environmental benefits could be captured with a temporary subsidy of $5,000 per vehicle.

Vehicle Quality: While quality varied considerably between manufacturers, in general, vehicle quality -- from driver amenities to workmanship and materials – needs to improve. For example, seats can be difficult to adjust in one model and the motor on/off switch is placed where it can be accidentally tripped in another. Some vehicles tested had plastic body and/or interior components that were broken or needed adjustment within the first year of ownership due to the use of flimsy plastics and low levels of quality control. All of these quality issues would probably improve with full-scale production. Quality was not a significant deterrent to vehicle use by our participants but their comments suggest that quality will be an issue if the market is to dramatically increase.

While quality is an area for improvement, it is worth noting that quality has dramatically improved from the early "golf cart" days. Some of our demonstration vehicles have a stylish design, radios and air-conditioning. All had doors. Progress in these areas should improve so long as the NEV/LUV market niche remains viable.

Local Government: A range of local government incentives should help. For example; free parking in public lots (considered to be a very attractive incentive by our participants but difficult to sustain as the number of EVs increase), parking preference, Class 2 lanes on mixed flow streets where necessary to eliminate speed islands, public charge port infrastructure (CPI), and streamlined permits for private charge port infrastructure by households and businesses wanting to install new or upgrade existing electric meters.

Large-scale use of low speed vehicles is dependent on a network of low speed roads that in some neighborhoods are widely available. In others, there are speed islands (neighborhoods that are bounded by streets posted at 40MPH and faster) or large specialized centers like an industrial park or retail mall that block low speed travel. Complete streets plans and policies are one way to eliminate speed islands.

Consumer Education: Consumers must become more aware of their own driving needs in terms of the proximity to destinations that they currently frequent; and be encouraged to use the vehicle type most appropriate to the trip. This will require a substantial public education program. Gasoline price escalation provides a "teachable moment" as drivers seek fuel-cost relief and become more open to alternatives. A fast moving, multi-channel campaign could dramatically increase the rate at which the fleet, particularly the secondary vehicles in a household, can transition away from gasoline fuels to BEVs, especially NEV/LUVs.

"Consumers must become more aware of their own driving needs in terms of the proximity to destinations that they currently frequent; and be encouraged to use the vehicle type most appropriate to the trip."

It is also true that almost all policy makers are either unaware of or have prematurely dismissed the potential contributions of NEV/LUVs. Some effort should be invested in reaching the technical staff and decision makers at the regional, state and federal levels.

NEV Retailing: NEV retailers should develop a higher profile. Most people have never heard of Wheego, Miles or Columbia. There are no "auto-rows "which feature competing brands in close proximity to one another. With so many auto dealerships closing during the recession, it should be possible for local governments using state or federal economic development grants in partnership with vehicle manufacturers to re-purpose one such vacant car lot on a demonstration basis.

MSEV: It appears that a medium speed class of NEV capable of 35MPH (i.e., a medium speed electric vehicle or MSEV) would help speed the transition away from gasoline-fueled autos. While most of our drivers enjoyed driving at low speeds, some NEV/LUV drivers stated that they would not purchase a LUV unless it was capable of driving at 35mph. An MSEV alternative would reduce the need for Class 2 lanes.

The National Highway Transportation Safety Administration (NHTSA) of the US DOT does not recognize a medium speed vehicle category. Some states such as Wyoming and Hawaii have defied federal regulations by passing MSEV legislation, but California is not one of them. However, some structural changes to the existing slow speed NEV would also be required, so policy change would take a collaborative effort between manufacturers and government regulators.

Because of the difficulty of developing an MSEV category, some research into consumer interest should be conducted as soon as possible. See this discussion in Next Steps for the SBCCOG (below).

The Role of NEV/LUVs in the BEVs Marketplace: One of the questions that can only be answered in the marketplace is whether the 25 MPH NEV/LUV will compete with the freeway speed BEVs. The five factors identified above would contribute to consumer acceptance, especially price reductions. Once performance needs are better understood, it would seem more likely for consumers to choose the lowest-cost vehicle that meets their travel needs.

Active government intervention in the market place is justified since NEV/LUVs serve the broad public interest more effectively than other vehicle options. One reason is that as a vehicle class they are smaller than the more powerful vehicles, including the full-speed BEVs. Size translates into less street congestion and less space for parking in order to accommodate a given volume of vehicles. This also means that parking requirements for new residential and commercial developments can be reduced, thereby lowering construction costs and potentially making NODs more feasible.

NEV/LUV drivers typically avoid the high volume, main arterials. This diversion of traffic will also contribute to congestion relief on the high volume roadways.

Another reason is that the charging requirements can be less than with larger vehicles. For example, the Nissan Leaf, a freeway speed BEV with a 100-mile range, has a 24kWh battery capacity. In contrast, the Miles has a 10kWh battery capacity with a range of 30-40 miles when the battery is new (20-30 on an old battery). A Level 1 charging station (110/120 volts) currently found in every home and most garages is adequate for such small battery capacity; whereas the Leaf would justify a Level 2 (220/240 volt) charger which could trigger upgrades including a new circuit, new electric meter, in addition to a separate charging station. The simplicity that comes with low-level technology has its benefits.

Finally, low price, if it can be achieved through economies of scale, would hasten the transition away from gasoline-fueled autos because replacement would occur simultaneously at multiple price points, especially at the low end.

Passenger Fleet Conversion

According to projections provided by SCAG, 1,400 secondary vehicles per household will be purchased on average annually in the South Bay for the foreseeable future. Beginning in 2012, if all 1,400 are some form of BEV, then the fleet of secondary vehicles will be contained at its current level of 260,000. From that perspective, 1,400 BEVs per year should be the minimum target.

In order for the secondary passenger fleet to consist of 60% BEVs (the level used earlier for the projections of environmental and economic impacts) by 2025, almost 13,000 BEVs will need to be purchased every year between 2012 and 2025.

In order for the secondary passenger fleet to become 100% BEV by 2025, over 21,000 will need to be purchased every year between 2012 and 2025; closer to 15,000 in the early years and 25,000 or more in later years.

To put those targets in context, the Luskin Center at UCLA, using data from the US DOE, forecasts national BEV production in 2012 to be around 52,000 (several manufacturers are not included in the estimate so actual supply will be greater). In other words, for the South Bay to seriously pursue its target of 60% replacement of secondary vehicles, consumers will need to purchase about 25% of the projected national output annually over the next few years. The NEV/LUV component is not included since those vehicles were not factored into the national supply forecast.

Assuming that NEV/LUVs will make up a very ambitious 40% of the total BEV market in the South Bay, the target sales numbers would be 560 per year just to keep pace with growth, 5,200 per year contribution to reach 60% of the secondary passenger fleet by 2025, and 8,400 per year contribution toward a 100% battery electric secondary passenger fleet by 2025.

These figures are daunting, especially considering that the totals for 2011 in all EV categories will be close to zero; and that no more than 60,000 NEVs have been sold over 13 years in the entire nation. In order to meet the proposed targets, the South Bay, by itself, will require that many over the next 8 to 12 years.

Although production capacity will be a limiting factor, on the positive side, the transition will be funded mostly by private households - supported by fuel-cost savings. Public sector contributions will be strategically important but not monetarily great. Behavioral change will be minimal since door to door, on-demand service will be maintained as the basic mobility service level. Land uses changes will facilitate more active mobility (walking and cycling) and can come later in the process.

There are at least two significant challenges: The size of the installed base; and alternative strategies that compete over policy choices (such as land use) and funding decisions.

For example, an alternative strategy for reducing the size of the gasoline-fueled passenger fleet would be through a massive expansion of public transit. What mode share would be required to retire 50,000 gasoline-fueled second and third vehicles per year, or at least reduce their usage close to zero VMT? With a current mode share of less than 3% across the region and in the South Bay, would an increase to as much as 10% be feasible? If so, how much would it cost?

Land use changes are equally significant. A decentralized investment policy of Neighborhood Oriented Development will make significant contributions as the economy recovers and investment funds become available again. TOD and NOD have far different costs and outcomes. To some extent, one is an opportunity cost of the other.

While escalating gasoline prices will provide incentives to purchase some form of EV, virtually all of the actions identified above will be required to succeed. The Board of Director's adoption of the Sustainable South Bay Strategy provides guidance to interested cities for the various inter-related land use and transportation policies.

Next Steps for the SBCCOG

The current LUV demonstration will continue until October 31, 2011 and a final report will be published before the end of the year. But given what we've learned so far, what should we do next? The SBCCOG is seeking funding for the following priorities:

1. Expand the current Demonstration Project

The SBCCOG has developed the organizational capacity and technical infrastructure for testing and evaluating a range of alternative fuel vehicles. The most cost-effective next step would be to build on these new capabilities and expand the research and demonstration in several dimensions.

- Rotate the existing vehicles into neighborhoods of different types, e.g., more typically suburban adjacent to strip commercial or retail malls rather than to mixed-commercial centers.
- Obtain and demonstrate BEVs that are full-speed with longer range, specifically 50 miles and 100 miles; as well as the complete family of low speed, local use vehicles including Segways, mopeds, EN-Vs, and electric scooters and bikes.
- Research the potential impact of MSEVs by acquiring full-speed BEVs and limiting them to 35MPH and 50 mile range.
- Test market acceptance through a purchase voucher subsidy (rather than a vehicle loan) in exchange for GPS tracking of use.
- Collect more data in the next demonstration phase (i.e., acquire additional hand held GPS units); deepen the analysis of data generated by the initial demonstration.

2. Develop a South Bay Charge Port Infrastructure (CPI) Plan

BEVs must be plugged in to the electric grid at least every 25 to 100 miles, from as many as 8 hours with a regular 110 outlet to just one half hour at a high voltage charging station. Home based charging will serve most drivers, just as it has in our demonstration project. However, multi-family residences may not be properly equipped. Barriers to multi-family EVSE infrastructure deployment pose a a significant social equity issue. Eventually a network of charge stations at prominent destinations such as employment centers, on-street parking spaces or public parking lots will be needed. The SBCCOG is currently in the process of seeking funding to develop a sub-regional CPI plan within the next 12 months.

3. Develop a public education program

Publication of the LUV Demonstration Project's complete findings and recommendation near the end of 2011 should become the basis for a multi-channel public education program for alerting consumers to the viable electric vehicle options. No funding sources for the public education initiative have been identified. At the least the SBCCOG's Environmental Services Center will become a clearinghouse for EV manufacturers' technical and promotional materials.

4. Introduce a car sharing service to the South Bay

Easy access to a low cost long-range vehicle should help some households replace one or more of their vehicles with BEVs. Preliminary discussions have been held with ERAC about introducing car sharing to the South Bay.

5. Demonstrate a complete streets plan that will eliminate speed islands in a participating city.

NEV/LUVs cannot be legally driven out of those neighborhoods that are speed islands. This effectively constrains the mode options for residents of those neighborhoods. Many speed islands have been identified through this project and the SBCCOG intends to work with a participating city to eliminate some through a demonstration of complete streets planning and creation of Class 2 lanes. The SBCCOG is collaborating with the South Bay Bicycle Coalition in the hopes that some of the proposed Class 2 bicycle lanes will be implemented as "combo lanes" that will accommodate NEV/LUVs as well as bicycles.

6. Develop an online "center" for BEV market information

In the absence of a LUV/BEV sales center in the South Bay, the SBCCOG wants to create an online information resource and EV driver social network as a way to promote the sales of EVs. This effort could grow into an actual multi-vendor bricks and mortar sales center as there are a number of vacant motor vehicle sales lots in the South Bay that could be re-purposed.

Resources

For more information see the following resources: **www.SouthBayCities.org**

And other related links:

A LUV Facebook Page	http://www.facebook.com/SouthBayLUV
The SBCCOG's LUV website	http://www.southbaycities.org/LUV
Video - LUV Driver Testimonials	http://www.youtube.com/watch?v=vqigy0XRNm8
Video - made by a PRI reporter	http://www.youtube.com/watch?v=Z3b3mKc7JIs
Video - made by LUV Drivers	http://www.youtube.com/watch?v=XhryJS01QsE&feature=youtu.be
LUV on Public Radio	http://bit.ly/em8yvu
Sustainable South Bay Strategy	http://www.southbaycities.org/node/684