Policy Options for Expanding the Use of Electric and Efficient Vehicles

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Introduction

In order to achieve deep reductions in transportation GHG emissions, both demand reduction strategies to reduce vehicle miles traveled (VMT), significant improvements to fuel economy, and a move towards much lower carbon fuels will be required. This section will focus on the latter two strategies.

As discussed in the accompanying analysis, the light duty fuel economy standards that have been adopted by the federal government will be a significant driver towards greater fuel economy, and to a lesser extent towards vehicle electrification. We will explore additional strategies that could be employed at a local level. We focus on efficiency and on electrification. There are other potentially important approaches. It is certainly possible that truly low carbon biofuels will be developed, available at scale, which could make biofuels a very important tool, especially in the heavy duty vehicle sector, where electrifications is more challenging. It is also possible that fuel cell technologies will become affordable and practical on a large scale, and that low carbon sources of hydrogen will become available, making hydrogen an important fuel. However, both of these are speculative enough that we do not further discuss them at this point.

One challenge for any local effort aimed at increasing the efficiency of the vehicle fleet is federal pre-emption: The Energy Policy and Efficiency Act and the Clean Air Act pre-empt state or local governments from setting fuel efficiency standards and greenhouse gas (GHG) emission standards different than those set by the federal government. The one exception is for the State of California, which does have the ability to set standards that go beyond the federal standard. Other states may not independently set standards, but do have the authority to adopt the California standards. The city can use financial incentives, social marketing, business partnerships, and infrastructure investments to try to shift the vehicle fleet, but may not directly regulate. This is quite different than other sectors, such as buildings, where the city has more direct regulatory authority.

As the accompanying emissions analysis demonstrates, over the long term vehicle electrification combined with cleaner generation will provide the greatest emissions reductions. In the short to medium term, very high efficiency hybrid vehicles provide the greatest emissions reductions, unless the EVS are powered by renewables rather than by the existing grid mix. Thus, in this section we will discuss both strategies that are focused on electric vehicles and strategies that are focused on more efficient hybrid vehicles.

Consumer surveys[1] show that the top two concerns prospective buyers of EVs have is the vehicle's price and its range. Therefore policies that directly address these two concerns are most likely to have an impact on purchasing decisions. Other concerns expressed by consumers such as maintenance costs, performance and reliability indicate that education can still play an important role in promoting EVs because these concerns are not well founded.

In this section, we will discuss a number of potential strategies that the city can use to encourage more widespread adoption of lower emission vehicles. Some are relatively simple to implement; others could involve significant costs or political challenges, and one case may require state legislation to expand local authority.

We will group these into financing strategies, public vehicle fleets, support for vehicle charging, social mobilization/education, and potential utility roles.

1 http://www.harrisinteractive.com/NewsRoom/HarrisPolls/tabid/447/ctl/ReadCustom%20Default/mid/1508/ArticleId/1216/Default.aspx

Summary of Policy Options

Policy	**Time Frame**	**Difficulty**	**Potential GHG Impact**
Financial Incentives			
Feebate	Short-Medium Term	High (may require state approval, administratively challenging)	High
Rebate for EVs	Short Term	Medium (needs funding)	Medium
Financing to convert tax credit to rebates	Short Term	Medium (program design challenges)	Medium
Incentives for Public Charging	Short Term	Medium (needs funding)	Medium
Public Fleets			
Performance Contracting	Short Term	Low	Low due to small size of fleets – but shows public sector leadership
Transit Electrification Pilot	Short Term	Medium	Low – but paves way for future larger scale
Maximize use of CMAQ rebates for transit electrification	Short Term	Medium	Medium

Building Codes/Parking			
Building Codes	Long-Term (may not take a long time to adopt, but results are not quick)	Low-Medium (depending on how aggressive with existing stock)	Low
Requirement for Existing Buildings	Short-Medium Term	Medium (could be significant resistance from building owners)	Medium
Workplace Charging	Short	Low	Low-Medium
Social Mobilization			
Targeted Efforts with Employers	Short Term	Low	Low
Broadening Energy Smart	Short Term	Low	Low
Support for Bulk Purchases	Short Term	Medium	Medium

Targeting Larger Vehicles	Short Term	Low	Medium
EV/PV promotion Pilot	Short Term	Low	Low – but could pave way for larger scale EV/PV programs that would have larger impact
Utility Strategies			
Utility rebates for EVs, charging	Medium term	Medium	Medium
EV rates or appropriate time of use rates for EV charging	Medium term	Medium	Low – but could be important to managing load at high EV penetration
Battery Buyback by Utility, or Battery ownership by utility, leased to customers	Medium-Long Term	Medium-High	Medium-High

Time Frame: Length of time it would take for policy to be implemented and begin providing results. Short term: 1-3 years; Medium 3-10 years; Long Term: 10+

Difficulty: This is based on both the difficulty of getting the policy adopted and the administrative challenges

Strategies involving financial incentives

The first three strategies involve different variations of offering rebates for highly efficient vehicles. The programs range from rebates, which are relatively easy to implement (but require a funding source) to more complicated feebates and vehicle trade-in programs, which can be set up to be self-funding, which are expected to have greater climate benefits but are more complicated to administer.

Fee-bate for EVS and efficient vehicles

The use of "feebates" to incentivize the purchase of high efficiency vehicles has been implemented in Denmark, France, the Netherlands and Norway. Similar policies have been discussed at both the federal level and in a number of states, but have not been implemented anywhere in the United States. However, it may be more politically feasible to implement such a program at the local level. This might require legislation allowing a local option feebate program, implemented at the city or county level.

Under this approach, the city would assess a fee on new vehicles that achieve less than average fuel efficiency, and use that revenue stream for offer incentives to purchase or lease of a new high efficiency vehicle. This program is designed to pay for itself by providing rebates for efficient vehicles, less administrative costs, which do not exceed the impact fees collected from the purchase of new inefficient vehicles. This approach imposes no barriers to the freedom of consumers to purchase any vehicle for sale, so does not trigger federal pre-emption, but would require purchasers of the least efficient vehicles to bear an additional cost to help reduce the burden they place on all consumers as they increase the overall demand for motor fuels and the resulting emissions, drive the price of fuels higher, and reduce our energy security.

Under this approach, fees would be assessed to approximately half of the vehicles sold - those with below average fuel economy. For Boulder, this would be approximately 1750 vehicles per year, and the revenue would go to support the purchase of approximately 1750 more efficient vehicles. The fees would be assessed on a sliding scale – with the size of the fee increasing as the vehicle efficiency gets worse, and rebates would be awarded on a sliding scale, with the largest rebates available for the purchase of electric vehicles.

In its simplest version the fee/rebate would be set as:

> Fee (rebate) = Rate x (emission rate-benchmark), where the benchmark is set at the average carbon emissions per mile of new vehicles.[2]

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[2] Bunch and Green, 2012, Potential Design, Implementation, and Benefits of a Feebate Program for New Passenger Vehicles in California, University of California, Davis, Institute of Transportation Studies

Example:

For 2015, the average combined fuel efficiency under the CAFÉ standards will be 32.7 mpg. This corresponds to tailpipe emissions of 271 gms CO_2/mile. Based on the European examples, a typical rate might be $20/(gm/mile) A zero emission vehicle would be eligible for a rebate of $20*271=$5400 A Toyota Prius getting 50 mpg, with emissions of 178 g/mile, would be eligible for a rebate of $20 x(271-178)= $1881 By contrast, a Subaru Outback M6 getting 24 mpg and emitting 370 gms/mile would pay a fee of $20* (370-271)= $1970

There are many ways such a program could be structured. There could be separate programs for different categories or footprints of vehicles, so for example small cars would be compared to small cars, light trucks to light trucks.

The level of emissions reduction depends on program design. A number of studies have been conducted of potential programs in California and Connecticut have estimated potential reduction in the emissions from an average new car that range from a low of 18 gms/mile up to a high of 1/3 of new car emissions, or about 90 gms/mile.

Program Cost

The only cost for this type of program would be the administrative costs, as the ongoing rebates would be paid by the fees.

Impact

Using Boulder's current VMT level of 2.4 million daily VMT, each year the feebate program will reduce the carbon intensity of the new vehicles added to the fleet. For 2025, after 10 years, 35000 vehicles, or approximately half the fleet, would be impacted. Since the program is targeted at vehicles registered in Boulder, only resident and student GHG would be impacted.

Reduction at -18 gms/mile	5,800 MT/year, a 1.4% reduction
Reduction at -90 gms/mile	25,000 MT/year, a 7% reduction

However, it is also important to realize that the impact of vehicle strategies on total GHG emissions will be greater than shown here, since these numbers do not capture reduced emissions on longer trips outside of the Boulder area.

By 2050, the impact would grow, as the entire resident fleet would be impacted.

Reduction at -18 g/mile	10,000 MT, a 2.8% reduction
Reduction at -90 g/mile	50,000 MT, a 14% reduction

Challenges

While there is no federal pre-emption, legal analysis would be required of the ability of a home rule municipality to implement such a program under Colorado law. Unlike many of the other strategies, which would likely have support from the auto industry, this strategy would likely be opposed by this industry. Administratively, it would be very difficult for the city to administer, since motor vehicle registration is managed at the county level, so in practice such a program would likely need to be implemented at a county level. This would require legislative authorization.

Vehicle Trade-In Program plus Feebate: "Cash for Clunkers"

Some type of Cash for Clunkers program could be considered. This could work for both light and heavy duty vehicles and would bring more climate benefits than Prius owners switching to EVs, by focusing on replacing less fuel efficient vehicles in the fleet..

A vehicle trade-in or Cash for Clunkers program would operate similarly to the feebate program except that to qualify for the rebate one would have to trade in a relatively inefficient vehicle, perhaps one in the bottom 10% of efficiency, to receive a rebate on a new highly efficient vehicle. Because it ensures that the vehicles receiving a rebate are replacing low efficiency vehicles there is a clearer climate benefit. With the rebate and feebate programs it is not sure that a current Prius owner is just using the rebate to purchase a new Prius, which would have no net climate benefit, for example.

This would entail some additional administrative challenges as far as certifying the trade-ins and disposal of the clunkers, but the primary challenges would be the same as for the feebate option.

Rebates for purchase of electric vehicles

Currently, there is a significant upfront cost premium for purchasing an electric vehicle, driven primarily by the cost of the batteries. While the lifecycle cost may be lower than a conventional vehicle, due to reduced fueling and maintenance costs, the upfront cost is a significant barrier to EV adoption. Over the longer term, this price premium is expected to come down, as the cost of batteries declines.

In order to help address this issue in the near term, both the state and federal governments offer significant tax credits for EVs. The federal credit is currently $7,500, and the state credit is up to $6,000. The city could also offer a local incentive in the form of a rebate at time of purchase. Time of purchase rebates have a greater impact for the same level of incentive than a tax credit, so a rebate in the $1,000 to $2,000 level might be expected to have an impact on adoption rates, even though this is substantially smaller than the combined state and federal credits.

There are approximately 3500 new vehicles purchased per year. Boulder vehicles are fairly evenly split between passenger cars and light trucks. In the near future, EVs are likely a real option primarily for the passenger cars. Note that based on the current vehicle fleet, in the decade since hybrid vehicles have been introduced, market share has grown to about 5%, with 1.3% of the fleet Toyota Priuses. Nationally, EV sales are growing faster than hybrid vehicle sales soon after hybrids were introduced, so it may not be unreasonable to expect a baseline of 5% EVs in the Boulder fleet by 2025, or about 3400 vehicles. This would require that about 340 EVs a year be added to the fleet, or just under 10% of new vehicles sales over the next decade.

If Boulder offered a $2,000 rebate for electric vehicles, it might be possible to push this to a higher share of new vehicle sales.

Passenger car adoption rate	Vehicles/year	Annual Cost	2025 EV fleet
5%	175	$350000	1750
15%	263	$525,000	2630
25%	620	$1.24 million	6200
50%	1750	$3.5 million	17500

Note that these are very aggressive scenarios. The Energy Information Administration in the 2014 Annual Energy Outlook only projects total sales of battery electric vehicles and plug in hybrids together at 1% of new vehicles sales in 2025. The most aggressive national forecast [3]projects 2025 EV sales at approximately 10% of new LDV sales, the equivalent of approximately 20% of passenger cars. Currently the highest adoption rate in the country is in the state of Washington, where 1.6% of new vehicles sold in 2013 were EVs. Colorado is in the top ten states, with 0.4% of new 2013 vehicles. California is aiming to reach 15% of new vehicle sales by 2025.

Such rebates could also be used to incentivize the purchase of extremely fuel efficient conventional vehicles.

This would be a relatively straightforward program - there are no legal challenges, and the number of transactions is small enough that the administrative burden should ne manageable. However, it would require a significant ongoing funding mechanism, and could raise equity concerns that these rebates might be going largely to wealthier households that are more likely to buy new cars.

Financing program to convert tax credits to time of purchase incentive

The current tax credits for EVs are significant – up to $13,500. However, the impact of tax credits is much less than the impact of point of sale incentives. One approach the city could take is to create

[3] Edison Electric Institute, April 2013, Forecast of On-Road Electric Transportation In The United States, 2010-2035

an upfront rebate, but tie it to recapture of the same amount from the tax credits – essentially to finance the tax credits.

For customers who are leasing, the dealer is generally able to take the $7,500 federal credit, and apply this upfront to lower the cost of the lease. This is not possible given the current structure of the state tax credit.

It would be theoretically possible to create a rebate program, but have the cost, or a portion of the cost, paid for by capturing a portion of the tax credits received by the customers. There are clearly significant administrative challenges, and some level of financial exposure, but this potentially a lower cost way to create an upfront rebate incentive.

A variant to this would be to work to amend the state statute, to allow dealers to take the credit in the case of leasing, and pass the savings on to the lessees. This would allow the private sector to use the tax credits to lower the upfront cost , at least for those consumers who choose to lease.

Public Vehicle Fleets

While most of the vehicles in Boulder are privately owned, public sector leadership can be very important in developing broader public awareness and support. In addition, because some of the public sector vehicles are larger vehicles that are driven many miles, the emissions impact can be significant, as for transit vehicles.

Use of performance contracting

Last year, legislation passed in Colorado to expand the allowable uses of performance contracting by government agencies to include financing efficient vehicles, with the upfront costs paid back through fuel savings, in much the same way that upfront costs of building energy improvements are financed through performance contracting. The City of Boulder is working with McKinstry to acquire 30-35 electric vehicles in what we believe will be the first such contract in the state. This could provide a model for large-scale fleet replacement by other large public agencies (Boulder County, BVSD, the University, the national labs) as well as other private institutions that are large enough for performance contracting to work. Historically, the Colorado Energy Office has actively supported performance contracting; there could be an opportunity for the city to partner with the Energy Office to actively promote its use for vehicles.

This could be used both for passenger vehicles, but also for medium and heavy duty vehicles as more options become available in these sectors. To give a sense of the scale, the BVSD has approximately 250 buses and 150 light duty vehicles; Boulder County has approximately 60 heavy duty vehicles and 440 light duty. Among all of the fleets, the total might be on the order of 1,000 light duty vehicles, and several hundred buses or trucks.

Transit electrification

This strategy would require working with the major providers of transit service – the BVSD, RTD, and VIA. Currently, the vast majority of these buses are diesel vehicles. A number of manufacturers are now making electric buses for transit agencies, including ProTerra and BYD, and one company 9transTeach) is manufacturing electric school buses. In the United States the use of electric buses is largely in a pilot phase, with a handful of transit agencies in locations including LA, New York and Nashville trying out small numbers. However, in China the market has expanded to thousands of electric buses.

A program in Boulder would likely need to begin as a pilot effort with one of the transit agencies, to try a small number of electric buses and address operational issues, including how recharging would take place. This would also allow cost data to be collected; electric bus manufacturers have argued that the higher upfront costs of the vehicles will be outweighed by much lower fuel and maintenance costs, but local experience will likely be required for transit operators to take this seriously. Given the smaller scale, and the pre-existing relationship between the City and VIA, it might be the most likely candidate for a pilot project.

There is a window of opportunity over the next our years. The Colorado Energy Office and the Regional Air Quality Council will be administering a $15 million fund for replacing trucks and buses in the metro area with alternative fuel vehicles, including both electric and CNG vehicles. With many other rebate programs (such as the Xcel DSM and Solar Rewards programs), Boulder has had a much higher uptake rate than the statewide average. The city could have a focused campaign to maximize the use of these truck and bus funds, in order too kick start pilot or larger scale electrification.

Support for EV Charging

Access to charging infrastructure is another barrier to more widespread adoption of electric vehicles. Most daily travel is well within the range of a typical electric vehicle, but it is important for vehicle purchasers to be comfortable that they can make longer trips. Evidence to date suggests that most charging will take place at home, with workplace charging the next largest slice of the pie. In addition, it may be important to have fast charging locations available at destinations outside of Boulder that are important to Boulder residents.

In addition, if the city is successful at achieving high levels of market penetration, the nature of workplace and public charging needs will change. For example, there may be many employees who commute and park all day in a single private parking lot, or municipal parking structure. Meeting this demand may require large banks of charging outlets. In order for this to be practical, future charging needs may require larger numbers of level 1 chargers, which are significantly less expensive to install than the faster charging level 2.

There are a number of potential actions Boulder could take to enhance the charging network.

Building Codes

A number of jurisdictions have begun to adopt building codes that mandate either pre-wiring for EV charging, or mandate that a certain number of spaces in new parking facilities are wired for charging. Adopting building codes that include language supporting the provision of charging in new commercial and residential structures is important to enabling a charging network. Establishing capacity for charging during construction (or during planned renovation) costs significantly less than retrofitting, as retrofitting often requires retrenching, rewiring or upgrades to electric panels. For commercial installations, retrofitting can cost an additional $1,100 per station for surface lots and $800 for parking garages.[4] For residential single-family homes, the Vancouver Electric Vehicle Association estimates that, on average, the cost of retrofitting for Level 2 charging is at least $900 more than preparing that home during new construction.[5]

Building codes will utilize three primary mechanisms to promote charging adoption: a) require that all buildings install the electrical capacity for a certain level of charging, b) require a minimum number of EVSEs per parking space, or c) require that all businesses of a certain size provide EVSE.

Several local governments throughout the US and Canada have already enacted these regulations, as shown below.

[4] Electric Vehicle Charging Infrastructure Recommendations to Fairfax County. Available at : http://www.mitre.org/work/tech_papers/2011/11_2916/11_2916.pdf

[5] EV Infrastructure Costing Worksheet. Available at http://www.veva.bc.ca/home/index.php

	Single Family Residential	Multi-Family Residential	Commercial
Boulder County, Colorado[6]	240 volt outlet or upgraded wiring or conduit for future installation .		
Vancouver, British Columbia[7]	Conduit for future dedicated outlet for EV charging in the parking area	Conduit for EV charging in the parking area; 20% of parking spaces accommodate EVSE	
Los Angeles, California[8]	A 240 volt outlet or sufficient panel capacity and conduit for future installation	A 240 volt outlet or sufficient panel capacity and conduit for 5% of parking spaces	Enough 240 volt outlets for 5% of total parking spaces
State of California[9]	Conduit from service panel to the parking area.	3% of all parking spaces would have the capacity to support future charging.	Capacity and conduit for 1-4 future chargerss, depending on the number of spaces.
Hawaii[10]			Places with at least 100 parking spaces will have one charging location near the building entrance.

Requirements for existing buildings
Boulder has adopted requirements for energy upgrades for existing residential rental property (Smart Regs). The city could consider adding an EV charging requirement for existing multifamily residential, and could consider EV charging requirements in a future commercial energy

[6] 2012 Boulder County Building Code Amendments. htttp://www.bouldercounty.org/property/build/pages/buildingamends.aspx
[7] http://vancouver.ca/sustainability/EVcharging.htm
[8] Sections 99.04.106.6 and 99.05.106.5.3.1 http://ladbs.org/LADBSWeb/LADBS_Forms/PlanCheck/2011LAAmendmentforGreenBuildingCode.pdf
[9] Sections: A4.106.6, A4106.6.1, A4.106.6.2 A5.106.5.3 and A5.106.5.3.1 http://www.iccsafe.org/cs/codes/Errata/State/CA/5570S1002.pdf
[10] http://www.capitol.hawaii.gov/session2012/Bills/SB2747_.htm

conservation ordinance. Because most of the projected 2050 building stock in Boulder has already been built, regulatory requirements for existing parking areas may be an important strategy.

Financial Incentives for installing charging:

The city could also provide financial incentives for installation of EV charging. For example, Nevada Energy, for example, provides incentives to businesses of 50% of the cost of installing charging stations. An order of magnitude estimate might be $10,000 per site for purchase and installation of a level 2 charging stations, so a city incentive of 50% would be apprioximately$5,000 per station

Workplace charging

The greatest need beyond residential charging is likely for workplace charging. Workplace charging not only makes it easier for commuters to use electric vehicles, but also serves as an important marketing tool, making EVs visible to other employees. This can lead to additional demand, and the need for a bank of EV charging locations. Because many employees will park for many hours at a time, inexpensive level 1 chargers could be a good application for providing multiple charging locations at a worksite, or in a publically owned parking lot or parking structure used by regular commuters. The city could provide matching funds to encourage installation of workplace charging, and could tie this to a phased-in regulatory requirement, perhaps requiring that charging be installed when parking areas are resurfaced.

The city could also consider a workplace charging challenge, in which businesses receive recognition for efforts to expand charging for their employees. This could be a standalone effort, or incorporated into existing efforts such as the Partners For a Clean Environment (PACE) program administered by Boulder County Public Health.

City partnership effort to install chargers at key destinations outside the city

While many EVs are likely to replace second cars in two-car households, thus allowing the other vehicle to be used for longer trips, high levels of EV penetration will require people to be confident that they can use the EV for longer distance trips outside the city. The use of PHEVs can certainly help to address this concern, allowing most urban trips to be driven on electricity while using gasoline for longer trips. In addition, over time lower costs and higher energy density in batteries may also help address this concern. But another important strategy may be to place charging at destinations that are important to Boulder residents. While we would need to do additional analysis to understand more about out of city destinations for Boulder travelers, given the strong outdoor recreation culture in Boulder, we would anticipate that recreational destinations such as the Eldora Ski Area, major trailheads in the Indian Peaks and Rocky Mountain National Park might be appropriate locations. The city could either directly invest funds, or could serve in a role that helped to organize projects and seek funds from sources such as the Electric Vehicle Infrastructure Fund administered by the state energy office.

Social Mobilization Approaches

The city could create a focused effort to promote the adoption of both electric vehicles and more efficient gasoline or diesel vehicles by the community. There are a number of programs the city, the county, and other local partners have developed to impact public behavior in related areas, including GO Boulder's programs to promote alternative modes of transportation, and the Energy Smart program's effort to get residences and businesses to make home energy upgrades, and the partners For a Clean Environment (PACE) program that works to promote environmentally responsible practices in local businesses.. These programs have combined financial incentives, infrastructure improvements, and thoughtful community based social marketing efforts. The Electrification Coalition has also taken a mobilization approach in the communities that they have identified. Such an effort would require funding for dedicated staff or a community partner, and could require integrating elements around efficient vehicles into existing workplans.
We would strongly recommend that vehicle efficiency and electric vehicles be incorporated into the mission, programs, and messaging of these existing programs.

A number of elements that would be possible include'

Targeted efforts with employers, including events at large employers with EV drive-along opportunities

Evidence suggests that anyone who actually rides in an electric car is far more likely to buy one than someone who has not been in an EV. The city could work with employers to organize opportunities for their employees to try out EVs; this could be linked to efforts to promote workplace charging. The existing network of Employee Transportation Coordinators could be used to work with businesses on efficient and electric vehicles in addition to the current work focused on commute mode choice.

Broadening Energy Smart

Energy advisors who are working with residents on home energy improvements could also provide advice on efficient vehicles. This could be particularly effective if there are even small rebates or financing available that the advisors can connect customers to.

Support for bulk purchase of EVs, EV charging, or EV and PV together

As the Solarize program in Portland focused on solar PV has demonstrated, there can be significant uptake if there is a focused effort among a particular group (it could be a neighborhood or an employer) to promote a clean technology, and to provide a time limited opportunity to buy at a preferential rate.

This approach could be used to promote the purchase of electric vehicles, combined with installation of home chargers. It could also be combined with bulk purchase on PV in order to incentivize people to move towards transportation with close to zero net emissions.

This could be piloted among city employees, as a relatively manageable size for an initial effort. This could be an opportunity to develop partnerships with private sector entities that the city has not previously had a close relationship with, such as auto dealers of car manufacturers. This could be an opportunity to pilot the use of rebates paid back by tax credits on a small scale. If successful, such a program could potentially be expanded to other large employers in the city.

Appendix 2 describes in somewhat more detail how a pilot project for City of Boulder employees might be implemented.

Targeting users of larger vehicles

The analysis of the Boulder fleet showed that Boulder has a higher percentage of light trucks than the national average. This may reflect the wealthier population, or the strong emphasis on outdoor recreation. At this point, the EVs that are available are really replacements for smaller passenger vehicles. One effort could focus on encouraging Boulder residents to consider the most fuel efficient larger vehicles that are available.

For example, the Prius V actually has as much cargo capacity as a small SUV. It is not clear that this is widely known, but for many applications that are currently served by minivans and small SUVs, a Prius V could provide the same service at 40 mpg, as compared to the current average new light truck at 22 mpg.

Utility Role

There could be a major role for the electric utility to play in the expansion of use of electric vehicles, whether the utility service is provided by Xcel Energy or a new municipal utility. A municipal utility may be more able to experiment and develop innovative programs such as the battery storage ideas listed below.

From a financial perspective, there is a real value to utilities associated with electric vehicles. Because EVs increase consumption of electricity, and most of the new demand comes during off peak hours when power is cheap, greater sales are available to cover the fixed costs of the system. It should be possible to capture at least some of this value for investment into expanding the number of electric vehicles. This is the logic, for example, that led Nevada Energy to offer rebates covering half the costs of commercial charging.

Potential utility roles in the short term could include offering rebates for purchase of EVs or installation of charging, and structuring time of use rates to incentivize EV charging at off peak hours..

Over the longer term there are very interesting possibilities involving the use of EV batteries for storage. One that has drawn significant attention is the potential for use of EVs as highly distributed storage through “Vehicle to Grid” energy transfer.

However, another that has great opportunity is the use of EV batteries for stationary storage after the end of their useful life in the vehicle. Estimates are that the current generation of EV batteries will typically last on the order of 10 years or 100,000 miles before their capacity to hold a charge drops to about 80% of the original capacity. That reduces the range to the point that the batteries are no longer useful for vehicle applications, but they still could have many years of use for stationary storage.

There could be an interesting opportunity to both develop storage and increase the uptake of EVs by committing to the purchase of the batteries at the end of their useful life; or acquiring the batteries up front, and essentially renting them to customers for use in their vehicles until they are ready to be used for stationary storage. Current estimates suggest that the residual value of the EV batteries could be $6,000, although this may come down if battery improvements make lower cost batteries available by the time current batteries are useful for resale.

To give a sense of scale here, a Nissan Leaf has a 24 kwh battery pack. After the capacity has declined to 80%, there will be about 19 kwh storage capacity in the remaining batteries. So the batteries from 50 Leafs would allow about 1 MWH of storage. At high EV penetration rates, there could be significant storage capacity available from used EV batteries.