Electric Vehicles Save Money for Government Fleets

BILLIONS OF DOLLARS IN SAVINGS POSSIBLE FOR STATE AND LOCAL GOVERNMENTS

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Arizona PIRG Education Fund

FRONTIER GROUP

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Contents

Executive summary

FROM SEDANS TO PICKUP TRUCKS to vans, state and local governments in the United States own more than 4 million vehicles – nearly all of them powered by gasoline or diesel fuel. Buying, fueling and maintaining these vehicles is expensive.

Electric vehicles (EVs) often cost less to own and operate over time than gasoline-powered vehicles, with operating savings on fuel and maintenance more than compensating for any additional purchase costs. By transitioning to electric fleets as fossil fuel vehicles retire, state and local governments can save significant amounts of money for taxpayers.

State and local governments around the country could save a total of nearly $11 billion in lifetime expenses by purchasing EVs as opposed to gasoline-powered vehicles for their light-duty fleets over the next 10 years.

- State and local governments own approximately 4 million vehicles.[2] Of those vehicles, roughly 900,000 are light-duty vehicles that are expected to be retired over the next 10 years and for which electric options are currently at production scale (sedans, pickups, SUVs and vans).
- The number of electric vehicle models available on the market is increasing every year and those vehicles are increasingly able to travel greater distances between charges and to perform more of the tasks city and state governments require of fleet vehicles. Major auto manufacturers have committed to shifting their new vehicle fleets to EVs over the next decade, and proposed new federal vehicle emission standards would result in most new light-duty vehicle sales being EVs by 2032.[3]
- Replacing retiring fleet vehicles with EVs can provide state and local governments with approximately $10.8 billion in lifetime cost-of-ownership savings, with the biggest savings coming in fuel costs (68% reduction) and maintenance costs (37%). These savings do not include the upfront cost of additional infrastructure needed to support EVs, which can be significant, but represents a long-term investment supporting multiple fleet vehicles over time and, in many cases, expanding charging access for the public.

TABLE ES-1. LIFETIME SAVINGS FROM REPLACING RETIRING STATE AND LOCAL FLEET VEHICLES WITH EVS VS. GASOLINE-POWERED VEHICLES OVER 10 YEARS

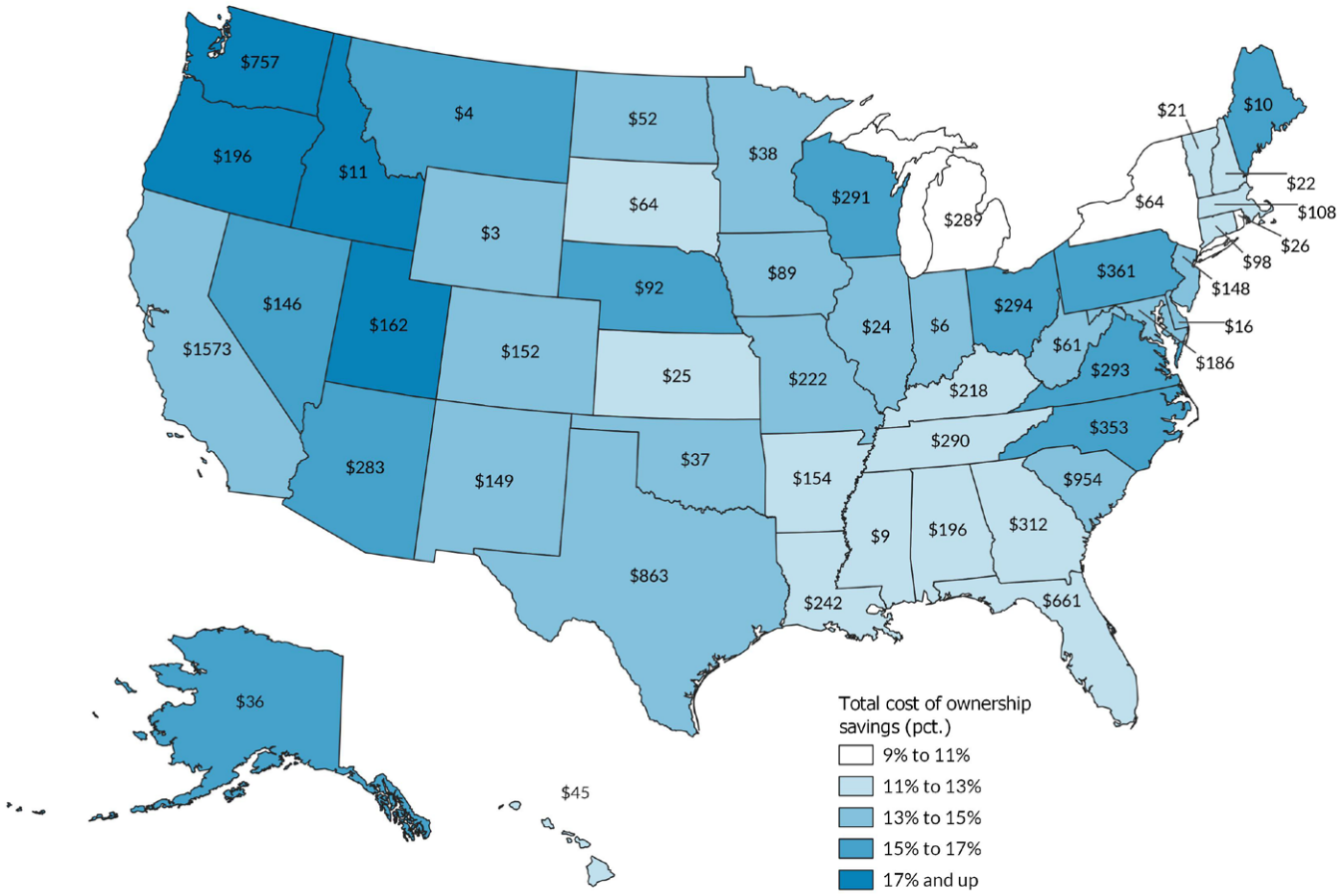
Type of savings	Savings, in billions
Depreciation	-$3.55
Fuel	$8.55
Maintenance	$6.89
Insurance	-$1.13
Total cost of ownership	**$10.76**

- States with the biggest percentage savings from adopting EVs are those in the western U.S., such as Idaho, Utah, Oregon and Washington, where gasoline prices are high and commercial electricity prices are relatively low. (See Figure ES-1.)
- Incentives available for clean vehicle purchases under the 2022 federal Inflation Reduction Act help to make EVs a financial winner for state and local governments. The Commercial Clean Vehicle Credit offers savings of up to $7,500 per light-duty vehicle or $40,000 per heavy-duty vehicle for purchases of EVs by government or private fleets.[4] The credit is available via "direct pay," meaning that governments and nonprofit entities have access to the full value of the credit, and the credit is not subject to the sourcing provisions under the federal clean vehicle (Section 30D) tax credit, meaning that municipalities and states can claim the full value of the credit for any EV they purchase or lease.[5]
- Other incentives – from federal investments in public EV charging to utility incentives and technical assistance programs – can help state and local governments to transition their fleets to electric vehicles.

Transitioning state and local fleets to EVs will also cut air pollution and greenhouse gas emissions.

- Many municipal and state governments have committed to reducing greenhouse

FIGURE ES-1. LIFETIME SAVINGS TO STATE AND LOCAL GOVERNMENTS OF REPLACING RETIRING VEHICLES WITH EVS OVER NEXT 10 YEARS



gases, such as carbon emissions, from government operations, and many others are in areas where pollution from cars and trucks makes the air unhealthy to breathe.[6] Electrifying state and local fleets can help to address these problems. By replacing retiring light-duty vehicles with EVs rather than gasoline-powered cars over the next decade, state and local governments nationwide could:

- Reduce greenhouse gas emissions by nearly 26 million tons (carbon dioxide equivalent), a 63% reduction compared with a scenario in which retiring fleet vehicles are replaced with gasoline-powered vehicles.
- Reduce emissions of volatile organic compounds (VOCs) and nitrogen oxides (NOx), which combine to form ground-level ozone, otherwise known as smog, as well as fine particle pollution ($PM_{2.5}$). Including the emissions produced by power plants that generate the electricity used in EVs, a shift to electric fleet vehicles would result in a 92% reduction in VOC emissions compared with the emissions produced by gasoline-powered vehicles; a 23% reduction in NO_X emissions; and an 11% reduction in $PM_{2.5}$ emissions.
- Achieve even greater air pollution reductions in future years as the electricity grid transitions away from dirty, polluting forms of energy such as coal and toward cleaner forms of energy such as solar and wind power.

State and local governments should commit to electrify their vehicle fleets by replacing retiring fleet vehicles with EVs wherever and whenever feasible. To get the greatest benefit from fleet electrification, state and local governments should:

- **Make bold commitments and stick to them**, setting a clear direction for the future and enabling governments to benefit financially from economies of scale in the purchase of vehicles and in the installation and use of EV charging infrastructure.
- **Develop fleet electrification plans** that identify those vehicles that are the best candidates for electrification (including those vehicles that are driven the most, creating the greatest potential for fuel and maintenance cost savings); determine how best to deploy EV infrastructure; and ensure that electric vehicles are fully utilized and able to perform the tasks required of them by government agencies.
- **Cooperate with other state and local governments** that are embarking on electrification of their fleets to share information and resources, and to pool buying power to negotiate discounts on vehicles and infrastructure.
- **Take full advantage of state, federal and utility incentives.** Governments and, in many cases, electric utilities offer incentives – from rebates to EV-specific electric rates to technical assistance – to help governments electrify their fleets.

Introduction

THINK OF THE SERVICES that state and local governments provide. Fire protection. Maintenance of highways, roads and transit systems. Building inspections, enforcement of food safety laws, and many other essential tasks.

These services have one thing in common: They require the use of vehicles. Cars and pickup trucks that transport workers to worksites or allow government employees to move materials and equipment from one location to another. Vans and buses. Fire trucks. Refuse trucks.

The vast majority of these vehicles are powered by fossil fuels. The internal combustion engines in those vehicles have many moving parts – transmissions, timing belts, spark plugs, oxygen sensors and more – that require frequent and costly maintenance.[7] Add to that the uncertainty of gasoline prices, which can vary dramatically from year to year, and the burden of fossil fuel-powered fleets on taxpayers is significant.

Until recently, government agencies seeking to perform valuable services on behalf of the public had few options other than to purchase gasoline- and diesel-powered vehicles. Today, however, that is changing, with the rapid emergence of capable and affordable electric vehicles.

Increasingly, many of the jobs that state and local governments must do can be performed by EVs. Municipal and state governments around the country are responding by adding EVs to their fleets, with several state and local governments around the country already committing to fully electrifying their fleets.[8]

Replacing hundreds of thousands of aging gasoline- and diesel-powered vehicles owned by state and local governments over the next decade with electric vehicles would generate billions of dollars of savings for taxpayers over the lifetime of those vehicles, while also helping to clear the air and improve public health.

This report details the potential financial and air quality benefits of electrifying the light-duty fleets of state and local governments. The benefits reported here are just the tip of the iceberg. As EVs become more common, more technologically advanced and available in a broader array of vehicle types, and as the nation's electricity grid comes to be increasingly powered by clean renewable energy, the benefits of fleet electrification are likely to continue to grow.

However, electrifying a government fleet is not as simple as simply swapping in one type of vehicle for another. Integrating electric vehicles into municipal fleets requires careful planning to provide adequate access to charging infrastructure, to choose the right EV for a given job, and to ensure that electric vehicles are fully utilized.

Realizing the benefits of electric fleets requires municipal and state governments to get to work now. By making bold commitments to electrify their fleets, planning for the transition, and replacing retiring fossil fuel vehicles with EVs whenever and wherever feasible, state and local governments can tap the immense potential for taxpayer savings described in this report – and position themselves to take advantage of even greater opportunities for taxpayer savings and cleaner air in the future.

Electric vehicles are an increasingly viable option for government fleets

AFTER A DECADE of rapid technological improvement and falling prices, electric vehicles are now ready to play a central role in government fleets. Today's electric vehicles travel far greater distances on a charge and cost much less than the EVs of a decade, or even just a few years ago. Every year, new types of EVs come on the market – from sedans to pickups to refuse trucks and even emergency vehicles – enabling EVs to do more of the jobs that state and local governments must perform for the benefit of the public.

Better technology, lower costs

Electric vehicle technology is improving by leaps and bounds. Today's electric vehicles are more capable and cost less than the vehicles on the market just a few years ago, and there are many more models to choose from.

Rapid improvements in batteries have led to EVs that travel farther on a single charge. The median travel range for an EV on a single charge grew to over 250 miles by 2020 – more than triple the range of 2011.[9]

Those improvements have come even as the cost of EVs has declined. A 2020 report by *Consumer Reports* found that the lifetime per vehicle ownership costs of the most popular EV models – including fuel and maintenance costs – are thousands of dollars lower than those of comparable gasoline-powered vehicles, with typical savings of $6,000 to $10,000.[10] Further reductions in battery costs could bring the upfront costs of EVs down to the level of gasoline-powered vehicles by the mid-2020s.[11]

Declining costs and improving technology – along with growing concerns about the impacts of fossil fuels on air quality and public health – have led several major automakers to commit to shifting their fleets toward electric vehicles. The Chrysler brand will offer a fully electric lineup by 2028; Volvo will sell only electric cars by 2030; and GM aims to sell only zero-emission light-duty vehicles by 2035.[12]

In 2023, the Biden administration made a further commitment to EVs, proposing new tailpipe emission standards that could lead to as many as two-thirds of all new light-duty vehicles sold by 2032, and half of all new vocational vehicles such as buses and refuse trucks, being zero-emission.[13] These new standards, if implemented, will further increase the number and variety of electric vehicles available to government agencies for their fleets.

New electric vehicle models are being introduced every year

Electric alternatives currently exist for many vehicles in state and local fleets. As of March 2023, there were 40 models of light-duty electric vehicles available in the United

States.[14] Whereas the first electric vehicles to become available in the United States were small cars, the past several years have seen an increasing variety of the kinds of pickup trucks and vans that are mainstays of many state and local fleets.

The Ford F-150 pickup is not only America's top-selling vehicle, but it is also one of the vehicles most often owned and operated by governments.[15] A recent survey of 10 Arizona municipal fleets found that 1 in 5 light-duty vehicles in those fleets was an F-150.[16] The 2022 release of the Ford F-150 Lightning was a watershed moment in the history of electric vehicles, promising not just clean electric travel but also onboard energy storage capacity and the ability to provide remote power to worksites.[17]

There are fewer models of large pickups and vans currently available, but that, too, is beginning to change. The first shipment of the Ford E-Transit, the electric version of the best-selling commercial van in America, took place in February 2022.[18] Three models of the vehicle are available – the cutaway, chassis cab and cargo van – with three roof heights and three body lengths, and with a maximum payload (the total amount of weight the vehicle can carry) of 4,513 pounds depending on model and configuration.[19] The 2023 model year versions of the vehicles boast a projected range of 108 to 126 miles.[20]

An array of new pickup options is also on the way. In addition to the Ford F-150 Lightning EV, Chevrolet is planning to release an electric version of its Silverado pickup in model year 2024, with a starting price of $41,595 and a travel range of up to 450 miles.[21] Towing capacity varies by model, from 8,000 pounds to 10,000 pounds; Chevrolet intends eventually to produce

Photo: Diego Lopez/Northern Colorado Clean Cities, via National Renewable Energy Laboratory/U.S. Department of Energy

The number of electric vehicle models on the market is expanding rapidly – including Ford E-Transit electric vans, which debuted in model year 2022.

a vehicle with a 20,000-pound towing capacity to the lineup.[22] GMC also offers an EV version of its Sierra pickup.[23] The Toyota Tacoma EV is scheduled for a 2024 release.[24]

The market for electric cars is evolving as well. Early market stalwarts such as the Nissan Leaf and the Chevrolet Bolt (scheduled to be phased out by the end of 2023), have been joined by newer options such as the top-selling Tesla Model Y and Model 3, Kia's EV6 and Niro, and the Nissan Ariya.[25] Automakers are planning to roll out a wide variety of new electric sedans, hatchbacks, crossovers and small SUVs, including options likely to be affordable to municipal and state governments.[26] Chevrolet plans to introduce the Equinox EV in model year 2024, a compact SUV comparable to the Chevy Bolt.[27]

Electric options also exist for many medium- and heavy-duty vehicles in municipal fleets, with more on the way. The U.S. Department of Energy lists dozens of battery-electric medium- and heavy-duty vehicles available to buyers.[28] In addition to the rapidly increasing array of transit and school buses, there are now electric versions of freight trucks, cargo vans, garbage trucks, tractors, and other heavy-duty vehicles and equipment available to municipalities.

Even first responders, with their demand for reliable, high-performance vehicles, have access to an increasing number of options, from patrol vehicles to fire engines.[29]

Because the light-duty segment of the fleet marketplace is the most mature and offers the greatest range of options at a reasonable cost, the analysis in this report focuses on that segment of the market. That does not mean, however, that attractive options do not exist to electrify other segments of municipal fleets.

Electrifying government fleets can save taxpayers billions of dollars

GOVERNMENT AGENCIES spend billions of dollars each year to buy, fuel and maintain fleet vehicles. Operation and maintenance costs for state vehicles across the country are estimated at $2.5 billion per year.[30]

Electrifying state and local government fleets can dramatically reduce expenditures for vehicle fuel and maintenance, while incentives now available under the Inflation Reduction Act significantly reduce the upfront cost of buying electric vehicles. As a result, electrifying state and local government fleets can result in big savings for taxpayers.

State and local governments own more than 4 million vehicles

State and local governments together own more than 4 million vehicles, ranging from motorcycles to heavy-duty trucks – accounting for about 1 in every 70 motor vehicles in the United States.[31] Of those vehicles, 54% are trucks (including light-duty trucks such as pickups), 34% are classified as automobiles, nearly 11% are buses, and nearly 1% are motorcycles.[32] The states with the largest state and local vehicle fleets (as reported to the Federal Highway Administration) are California, with more than 560,000 local-, county- or state-owned vehicles, and Texas, with more than 360,000, followed by South Carolina, Florida and Washington.[33]

Nearly 900,000 light-duty government vehicles are candidates for electrification in the next decade

Of the more than 4 million state and local fleet vehicles nationwide, at least 878,000 of them are light-duty vehicles that are good candidates for electrification over the next decade, based on our estimated characterization of the nation's state and local vehicle fleet, which was informed by data from fleets in five states and multiple municipalities. (See methodology.)

Vehicles that are identified as potential candidates for electrification in this analysis include:

- Light-duty vehicles in categories for which electric alternatives are currently at production scale (specifically, compact and midsize sedans, and light-duty pickups, SUVs and vans) …
- … that will be replaced over the next 10 years (conservatively estimated at half the current fleet), and …
- … are not emergency response vehicles.

Table 1 below shows the estimated number of state and local fleet vehicles in each of these categories.

TABLE 1. NUMBER OF VEHICLES DUE FOR REPLACEMENT OVER NEXT 10 YEARS IN CATEGORIES STUDIED

Vehicle type	Number of vehicles
Compact	167,692
Midsize	209,615
Pickup	244,940
SUV	167,004
Van	89,069
All	**878,321**

Electrifying government fleets over a decade can save nearly $11 billion in lifetime ownership costs

State and local governments can save billions of dollars in costs over the lifetime of vehicles purchased over the next decade by buying electric as opposed to gasoline-powered vehicles as older vehicles are retired.

To estimate these savings, we used the AFLEET 2020 spreadsheet tool developed by Argonne National Laboratory.[34] The AFLEET tool calculates total cost of ownership for vehicles of a variety of fuel types based on inputs of vehicle cost, fuel cost, vehicle efficiency and other factors. (AFLEET 2020 also estimates the differences in air emissions between vehicle types; see "Electrifying state and local government fleets improves air quality," page 18.)

Specifically, our analysis assumed the following:

- For each vehicle category, we identified a model year 2023 gasoline-powered vehicle and an electric equivalent. For each vehicle, we obtained the current vehicle cost (the manufacturer's suggested retail price – MSRP – of a base model, unless otherwise noted) and the estimated fuel economy from the U.S. Environmental Protection Agency (EPA), the vehicle manufacturer, or automotive media sources.
- Gasoline and electricity prices were based on 2021 data from the U.S. Energy Information Administration.
- State and local governments were assumed to be able to take advantage of the Commercial Clean Vehicle Credit created by the Inflation Reduction Act for the entire 10-year period. (See page 15.) No other local, state or federal incentives were included in the analysis.

Excluding one-time costs for installing electric vehicle charging infrastructure (see page 17), total lifetime cost-of-ownership savings for state and local governments resulting from vehicle electrification over the next 10 years could amount to approximately $10.8 billion. The savings amount to a 14% reduction in the total cost of ownership over the lifetime of the vehicles.

A commitment to shifting to purchases of new electric vehicles would cost state and local governments an additional $3.6 billion in vehicle costs (in the form of depreciation) over the lifetime of those vehicles – a result of the higher upfront cost of EVs; however, those costs would be more than offset by reduced fuel expenditures (a savings of $8.6 billion) and vehicle maintenance costs (a savings of $6.9 billion). (See Table 2.)

TABLE 2. TOTAL-COST-OF-OWNERSHIP SAVINGS FOR GOVERNMENTS FROM ELECTRIFYING LIGHT-DUTY VEHICLES OVER 10 YEARS

Type of savings	Savings, in billions
Depreciation	-$3.55
Fuel	$8.55
Maintenance	$6.89
Insurance	-$1.13
Total cost of ownership	**$10.76**

All 50 states could save significantly by electrifying their light-duty fleets. (See Figure 1 below.) The greatest total savings are in California, where purchases of electric vehicles as opposed to gasoline-powered vehicles over the next 10 years would result in nearly $1.6 billion in lifetime cost savings, followed by South Carolina ($954 million) and Texas ($863 million).

In percentage terms, the greatest savings are in western states with high gasoline prices and relatively low electricity prices, led by Idaho with more than 18% savings, followed by Utah, Oregon and Washington.

The greatest source of savings results from electrifying pickup trucks, due to the large numbers of those vehicles that can be found in government fleets. On a percentage basis, the potential savings in the three light-truck classes – pickups, SUVs and vans – is roughly similar, while savings for the compact car category (20%) are significantly higher due to the presence of a relatively low-cost vehicle (the Nissan Leaf) in the category. Lifetime total-cost-of-ownership savings are very sensitive to the upfront cost of the vehicles, underscoring the importance of effective procurement of EVs and of state and

FIGURE 1. LIFETIME SAVINGS TO STATE AND LOCAL GOVERNMENTS OF REPLACING RETIRING VEHICLES WITH EVS OVER NEXT 10 YEARS

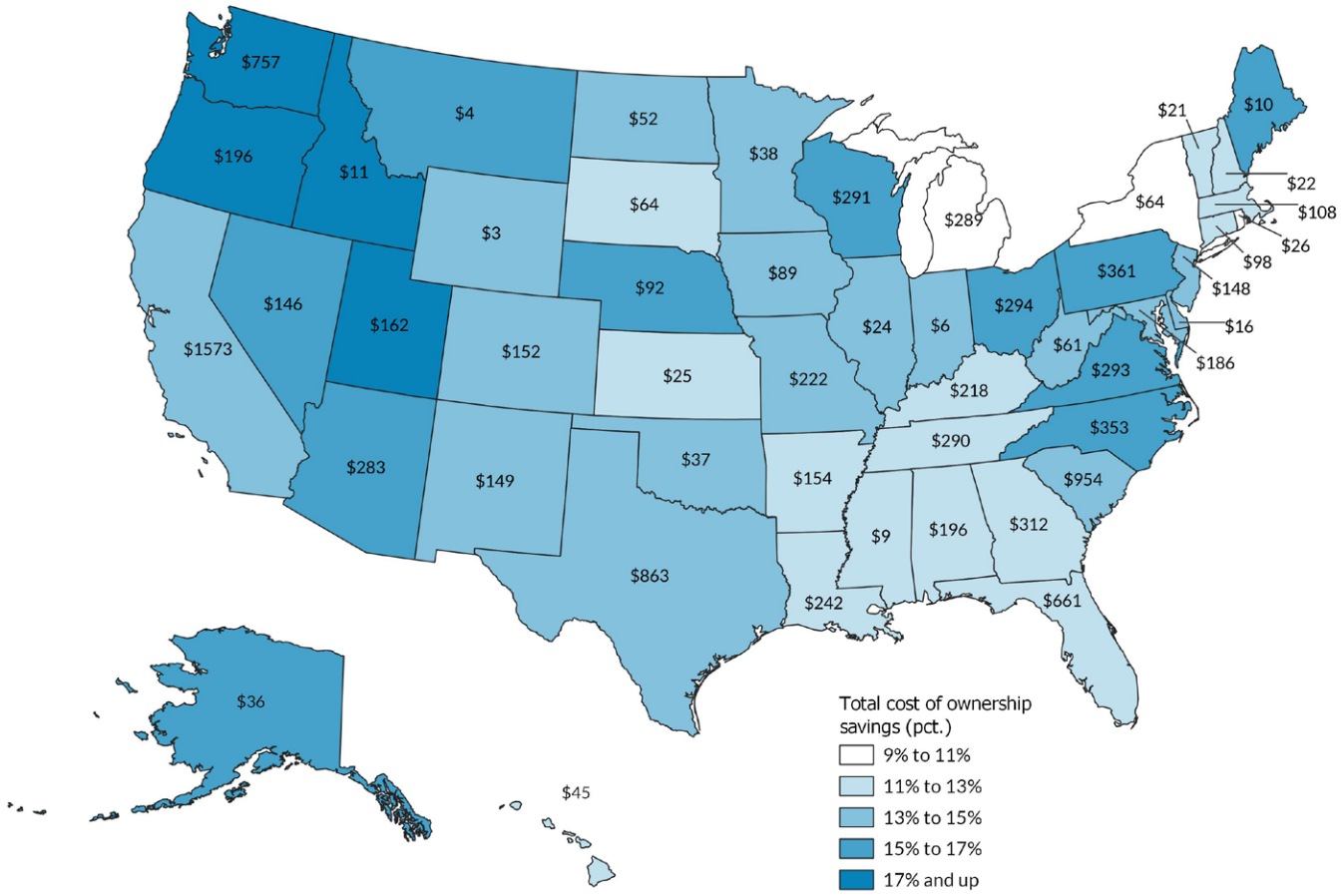


TABLE 3. TOTAL-COST-OF-OWNERSHIP SAVINGS BY VEHICLE CLASS

Vehicle type	Number of vehicles	Total-cost-of-ownership savings (billions)	Total-cost-of-ownership savings (pct.)
Compact	167,692	$2.29	20%
Midsize	209,615	$1.93	12%
Pickup	244,940	$3.42	13%
SUV	167,004	$2.04	13%
Van	89,069	$1.08	13%
All	**878,321**	**$10.76**	**14%**

federal incentives that reduce the cost differential between EVs and conventional vehicles. (See Table 3.)

Inflation Reduction Act incentives make electrification even more attractive

The savings available to states and municipalities through vehicle electrification are largely due to incentives available under the Inflation Reduction Act (IRA), adopted in 2022 – specifically, the Commercial Clean Vehicle Credit.

The Commercial Clean Vehicle Credit is available to businesses, governments or nonprofits purchasing light-duty or heavy-duty electric vehicles and equipment. For vehicles under 14,000 pounds Gross

State fees on EVs can discourage public sector adoption

As of March 2023, at least 32 states required owners of EVs to pay an additional annual fee. EV fees have become a common tool for states to recoup lost revenue from gasoline taxes, which are, in many states, a major source of funding for transportation.[35] In at least some cases, these EV fees are assessed not just to members of the general public, but also to state agencies and local governments, making electric vehicles a less appealing investment for some fleets.

States are split on whether state and local government agencies are subject to EV fees. The state of Georgia, which charges one of the nation's highest EV fees, of more than $210/year, explicitly states that the fee is applied to government vehicles.[36] Other states, such as Virginia, explicitly exclude government vehicles from the EV fee.[37] In several other states, the authors' efforts to reach out to state officials for clarity on the matter were met with uncertain responses.

State EV fees are excluded from our total-cost-of-ownership calculations, which estimate the aggregate potential savings of electrification to state and local governments. Including those fees – which represent transfers within or across state and local government agencies – in that total cost figure is not appropriate. But, in the states where they are assessed to government vehicles, state EV fees *do* affect agency budgets and can make EV adoption significantly less financially attractive.

Vehicle Weight Rating (GVWR) – that is, light-duty and some medium-duty cars and trucks – the incentive is:

- 30% of the purchase price of the vehicle,
- $7,500, or
- the difference between the cost of an electric vehicle and a comparable gas or diesel vehicle, whichever is less.

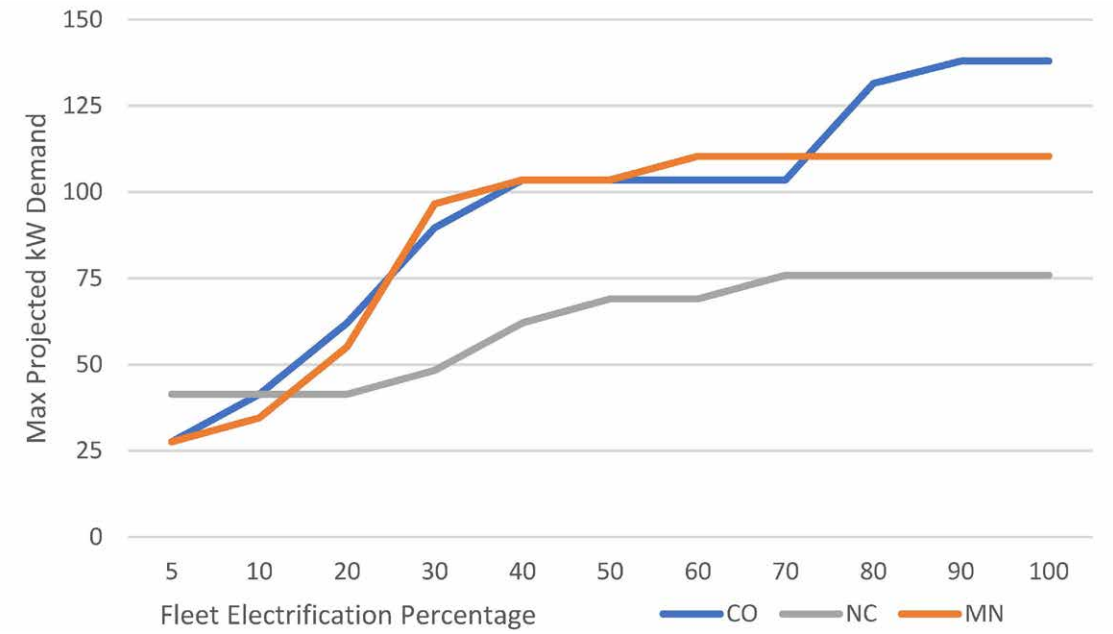
For heavier-duty trucks and equipment, the same incentives apply, except that the cap on the incentive is raised to $40,000.[38]

The Commercial Clean Vehicle Credit is not subject to the sourcing provisions that pertain to the individual EV incentives in the IRA (Section 30D). More importantly for state and local governments, the credit will be available via "direct pay," meaning that entities that do not pay federal taxes (such as state and local governments) will be able to receive the full value of the credit. These two provisions will make it much easier for governments to take full advantage of the tax credits. The Internal Revenue Service is designing the process for claiming this credit as this report goes to press.[39]

This analysis assumes that the Commercial Clean Vehicle Credit – scheduled to expire in December 2032 – is available for the full 10-year period studied here. The analysis does *not* include the value of other state, local or utility incentives for public-sector fleet electrification. These incentives can include direct state grants to local governments; allowing local governments to participate in state vehicle purchasing contracts; and other forms of assistance. As a result, savings from fleet electrification may be greater than estimated here. (See "Recommendations," below.)

The Inflation Reduction Act also included other grant programs that can be used to support state and local government purchases of EVs.[40] The availability of funding through these programs is not included in our estimates of the cost savings of electrification.

FIGURE 2. CHARGING DEMAND AT DIFFERENT LEVELS OF EV PENETRATION[42]



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Upfront transition costs are significant, but resources exist to help

Transitioning a fleet from fossil fuels to electricity is more complicated than simply switching out one fuel for another. Charging equipment must be installed, electrical service to charging sites improved, maintenance facilities reconfigured, and fleet scheduling and monitoring systems updated to ensure that electric vehicles are well-integrated into fleets.

The good news is that effective planning and smart infrastructure investments can help to achieve economies of scale that spread the initial costs of electrification across multiple vehicles, and even multiple generations of vehicles.

The potential savings from these economies of scale are significant. A 2022 study published by the National Renewable Energy Laboratory looked at the potential for electrification of several state fleets, and specifically the resulting increase in demand for charging at various levels of EV penetration.[41] As can be seen in Figure 2, page 16, the amount of charging demand in two of the three studied fleets increases sharply until 30% to 50% EV penetration, at which point it plateaus (with one state experiencing another bump in demand at 70% penetration). In other words, the majority of the investments that public fleets will need to make in charging infrastructure and electricity supply will need to be made when electrifying the first half of their fleets. Additional EVs beyond that point may largely be able to share existing infrastructure and capacity – enabling governments to spread the upfront cost of those initial investments across a greater number of vehicles.

In addition, there are numerous sources of funding that may be available to local or state governments to support the installation of EV charging infrastructure.

- **Federal:** Incentives for EV charging infrastructure under the 2021 Infrastructure Investment and Jobs Act (also known as the Bipartisan Infrastructure Law) will help build out the nation's network of publicly available charging facilities. In many circumstances, this public charging infrastructure can also be used by fleet vehicles. The IIJA provided $5 billion in funding over five years to build out a network of fast chargers along designated alternative fuel corridors and $2.5 billion to provide grant funding for additional community- and corridor-based expansion of charging networks.[43]

  In addition, the Alternative Fuel Vehicle Refueling Property Credit (Section 30C) provides a credit of up to 30% of the cost of installation of EV charging equipment. The credit is only available for equipment located in low-income or rural census tracts and varies in size depending on whether certain labor conditions are met. Installers of EV charging equipment for governments and nonprofit entities are able to claim the credit and pass along the savings.[44]

  Many additional federal funding opportunities to support EV infrastructure are also available; details can be found using the Electrification Coalition's "EV Funding Finder," available at https://electrificationcoalition.org/ev-funding-finder.

- **State:** States may offer grants or incentives to support installation of charging infrastructure by local governments. Massachusetts, for example, provides grants covering up to 60% of the eligible costs of installing Level 1 or Level 2 EV charging equipment for government fleets.[45]

- **Utilities:** Some electric utilities also provide incentives for governments seeking to electrify their fleets. In Arizona, for example, the public utility Salt River Project (SRP) offers rebates of $4,000 per Level 2 charging port for governments, municipalities, schools and nonprofits to help with the installation of networked EV charging infrastructure. SRP also offers up to $20,000 for fleets to conduct electrification studies.[46]

Electrifying state and local government fleets improves air quality

ELECTRIC VEHICLES DO MORE than save money. Switching to electric vehicles also curbs our dependence on oil, reduces emissions of air pollutants that threaten public health, and reduces emissions of greenhouse gases, such as carbon dioxide, that contribute to climate change. The air quality and public health benefits of electric vehicles will continue to grow as the grid shifts increasingly toward clean, renewable electricity.

Pickup trucks are among the most common vehicles in state and local government fleets. New electric pickups such as the Ford F-150 Lightning will enable government fleets to unlock new opportunities for cost savings and reductions in air pollution.

Electrifying fleets cuts health-threatening air pollution

Shifting to electric vehicles reduces emissions of several key air pollutants that threaten human health – with even greater reductions in air pollution to come as the electric grid increasingly transitions to clean, renewable energy.

Nationwide, nearly 120 million Americans live in areas with unhealthy levels of ground-level ozone (otherwise known as "smog") and/or fine particles ($PM_{2.5}$) in the air.[47] Ozone pollution irritates the lungs, worsens asthma symptoms and can contribute to the development of asthma in children, and has even been linked to metabolic disorders like diabetes, impacts on the central nervous system, and premature death.[48] Exposure to fine particulates has been linked to nearly 48,000 premature deaths in the United States each year and to a wide range of health problems, from lung cancer to cardiovascular symptoms to increased fetal and infant mortality, and even to increased risk of Parkinson's and Alzheimer's disease.[49]

A shift to electric vehicles by state and local fleets over the next 10 years would reduce emissions of the two chemical components of ozone smog: volatile organic compounds (VOCs) and nitrogen oxides (NO_X), cutting more than 41 million pounds of VOC emissions and approximately 7.1 million pounds of NO_X emissions over the lifetime of the vehicles. (Here and elsewhere, estimated emission reductions include emissions from the power plants generating electricity for use in EVs, but not emissions related to vehicle manufacturing. See methodology.) On a percentage basis, electric fleet vehicles studied here would produce 92% fewer VOC emissions and 23% less NO_X than equivalent gasoline-powered vehicles. (See Table 4, page 21.)

Similarly, emissions of fine particulates ($PM_{2.5}$) would be reduced by nearly 327,000 pounds over the lifetime of the electric vehicles when compared with gasoline-powered vehicles, a reduction of 11%. The analysis in this report assumes that emission rates for electricity generation remain constant at 2022 levels for the lifetime of the EVs purchased. As described below (see "Electric vehicles are likely to get even cleaner over time," next page), this is an extremely conservative assumption, as the nation is moving rapidly to phase out highly polluting sources of electricity such as coal and increase the amount of electricity generated from emission-free sources such as solar and wind power.

In states where the electric grid is still heavily reliant on coal, power plants release significant amounts of particulate matter and sulfur oxides. Sulfur oxides are not emitted in large amounts by gasoline-powered light-duty vehicles, with highway vehicles producing only 1% of the nation's sulfur dioxide pollution in 2019.[50] By shifting to electricity as an energy source, sulfur oxide emissions from transportation (and, in some areas, particulate emissions) may increase for a time. But those increases are likely largely temporary and do not outweigh the overwhelming benefits of vehicle electrification for air quality and public health.

Electrifying fleets cuts climate pollution

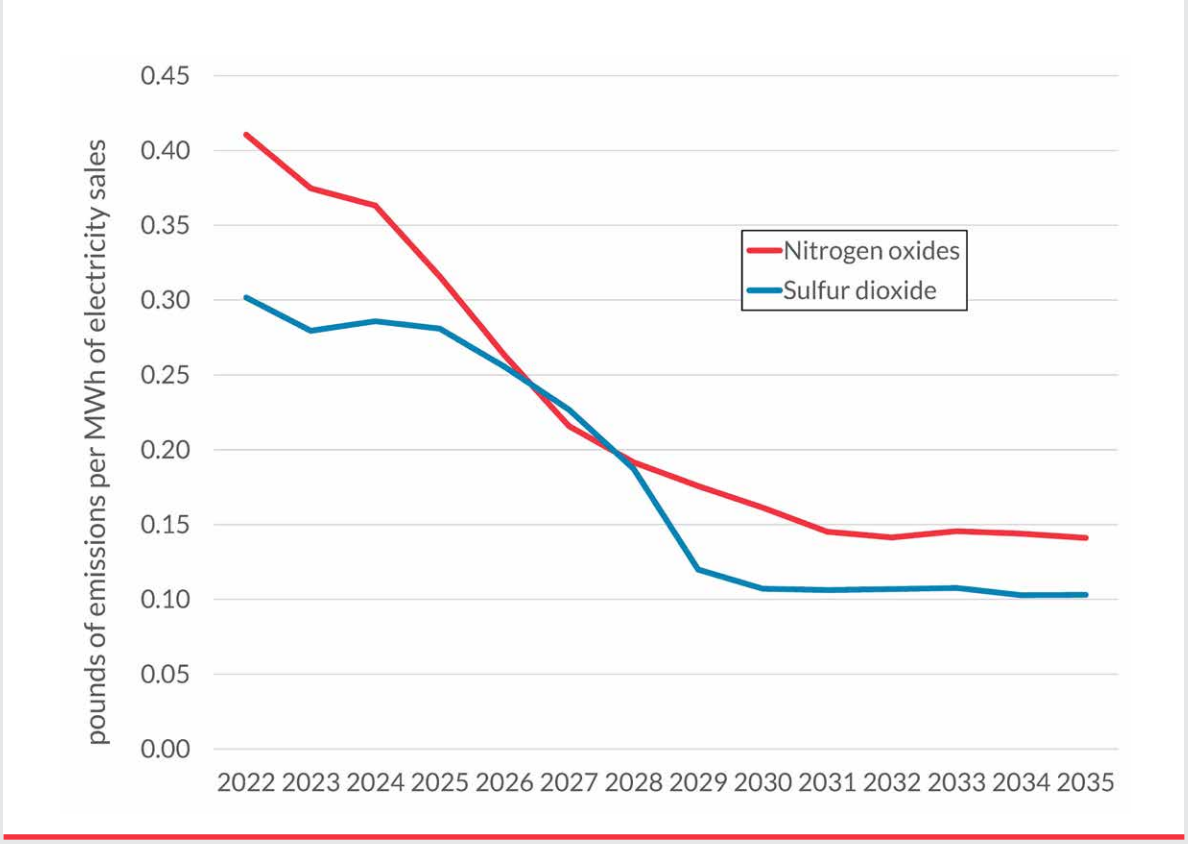
Transportation is now the nation's largest source of climate pollution.[53] Electric vehicles are far more efficient than gasoline-powered vehicles, converting more than three-quarters of the energy they draw from the grid into motion, compared with 12% to 30% for internal combustion vehicles.[54] As a result, even with today's electric grid, transitioning to electric vehicles delivers

Electric vehicles are likely to get even cleaner over time

America's electric grid is getting cleaner with every passing year, as dirty coal-fired power plants are retired – increasingly, in favor of clean, renewable energy from the sun and the wind. As a result, electric vehicles purchased today are likely to produce significantly *less* air pollution five, 10 or 15 years from now than they do today.

The U.S. Energy Information Administration projects that the amount of sulfur dioxide pollution produced per megawatt-hour of electricity sold in the United States will fall by 65% from 2022 to 2030, while emissions of nitrogen oxides will fall by more than 60%.[51] (See Figure 3.) If realized, these emission reductions will result in significantly greater emission reductions from vehicle electrification than are estimated here.

FIGURE 3. FORECAST ELECTRIC POWER EMISSIONS PER MEGAWATT-HOUR OF ELECTRICITY SALES, UNITED STATES[52]



significant reductions in climate pollution, with greater savings likely over time as the grid transitions to cleaner forms of energy.

By replacing retiring light-duty fleet vehicles with electric vehicles, as opposed to gasoline-powered ones, state and local governments could achieve lifetime greenhouse gas savings of 26 million tons – equivalent to the carbon dioxide pollution produced in providing electricity to nearly 4.6 million American homes for a year.[55] Measured on a well-to-wheels basis (that is, including emissions produced in the production of gasoline and electricity), shifting to electric vehicles for light-duty fleets would reduce greenhouse gas emissions from those vehicles by 63%, with even greater savings likely as clean forms of electricity generation increasingly dominate the grid. At a time when state and local governments and corporations around the country have made ambitious commitments to achieve net-zero greenhouse gas or carbon emissions, electrification of vehicle fleets can play an essential role in fulfilling those commitments.

TABLE 4. LIFETIME CHANGE IN AIR POLLUTANT EMISSIONS WITH FLEET ELECTRIFICATION

Pollutant	Reduction	Percentage reduction vs. gasoline vehicles
Greenhouse gases (short tons, CO_2 equivalent)	25,936,629	63%
Carbon monoxide (pounds)	238,331,731	94%
Nitrogen oxides (pounds)	7,081,117	23%
Particulates (PM_{10}, pounds)	(1,384,125)	-15%
Fine particulates ($PM_{2.5}$, pounds)	326,717	11%
Volatile organic compounds (pounds)	41,088,719	92%
Sulfur oxides (pounds)	(29,247,613)	-235%

Recommendations: A roadmap for electrifying government fleets

ELECTRIFYING STATE AND LOCAL vehicle fleets can deliver significant cost savings for taxpayers while reducing emissions of health-threatening air pollutants. Government adoption of electric vehicles can also help make EVs more familiar to consumers, reducing a key hurdle to broader adoption of EVs among the public.[56]

But electrifying a state or municipal fleet is not as easy as simply swapping out one type of vehicle for another – states and local governments also need to plan for how and where the vehicles will charge, as well as ensure that EVs are well-integrated into fleets and are able to perform all the tasks that government agencies require them to perform on behalf of the public.

To start, state and local governments should take the following steps:

Make bold commitments and stick with them

Governments will be more likely to gain the full benefits of electrification by setting bold goals and sticking with them. Adopting a bold goal – such as committing to purchasing electric vehicles whenever they are available – enables governments to maximize the benefits of investments in EV charging infrastructure (see page 17), and allows for an orderly, predictable, phased-in approach to transitioning the fleet to electricity. Moreover, the adoption of such a goal sends a message to fleet managers, agency leaders, and others in municipal or state government that there is commitment behind electrification, allowing employees to focus on the task of how best to integrate EVs into fleets.

Develop a detailed fleet electrification plan

To ensure that electrification proceeds rapidly and without disruption, state and local governments should engage in detailed planning for the fleet transition that includes all relevant government offices and agencies. At minimum, this should include agencies responsible for vehicle procurement and maintenance, fleet operations management, facilities management, utility purchases and government operations. A fleet electrification plan should include a detailed evaluation of the existing fleet, identifying the best near-term candidates for replacement with electric vehicles (including those vehicles that are driven the most miles and could deliver the greatest savings in fuel and maintenance costs), and a detailed assessment of vehicle use and likely charging patterns to guide decisions regarding EV infrastructure investment. To the extent that local or state budget cycles

or existing regulations create barriers to electrification, the plan should also include recommendations for adapting to or working around those constraints.

Publicly available tools exist to help state and local government agencies assess the benefits of fleet electrification and target those vehicles that are the best candidates for replacement with EVs. The Dashboard for Rapid Vehicle Electrification (DRVE) tool, produced by the Electrification Coalition and Atlas Public Policy, is a desktop Excel-based tool that allows fleet managers to evaluate the potential costs and savings of electrification at scales ranging from an entire fleet to an individual vehicle. The tool can be found at https://electrificationcoalition.org/resource/drve.

Developing a fleet electrification plan can also enable government agencies to take a fresh look at their fleet operations to identify opportunities for greater efficiency. Governments may use the planning process to reevaluate, for example, whether the vehicles currently deployed in their fleets are the best vehicles for the purpose, whether those vehicles are being fully utilized, and whether there may be opportunities to share vehicles and facilities across employees or departments, which can result in additional savings for taxpayers.

Cooperate across fleets and government agencies

There are considerable benefits to cooperation for governments and agencies that are electrifying their fleets. Governments can learn from one another's experiences with electrification, share resources and information, achieve cost savings by pooling purchases of vehicles and equipment, and advocate for policies that eliminate barriers.

In some states, municipal governments may be eligible to purchase vehicles made available under state procurement contracts, potentially enabling significant cost savings.[57] Municipalities can also take advantage of existing networks of cities and towns, such as the nationwide Climate Mayors Electric Vehicle Purchasing Collaborative, which can help provide planning guidance and support, models for electrification, and discounts or other tools to reduce costs and streamline the process of procuring charging infrastructure.[58]

Take full advantage of utility, state and federal incentives

There are a number of incentives available for government agencies seeking to "go electric." As noted earlier, the Commercial Clean Vehicle Credit available under the Inflation Reduction Act provides a powerful financial incentive for the purchase of light-duty and heavy-duty electric vehicles, while federal funding to expand the nation's EV charging network could benefit fleet operators that depend on the ability to charge their vehicles in the field or that rely on public charging networks. States and utilities may offer both financial incentives and technical assistance to governments seeking to electrify their fleets. In Arizona, for example, the state's largest public utilities offer technical assistance to public and private entities seeking to electrify their fleets, while in Massachusetts, the state offers similar technical support to private fleets.[59]

State and local governments should work to identify available incentives and take full advantage of them, while also exploring opportunities to offer generous incentives and support to public and private fleets, and to individual residents seeking to electrify their vehicles.

Methodology

THIS ANALYSIS MODELS the effects of shifting state and local government fleet purchases from gasoline-powered to electric light-duty vehicles over the course of a decade, using the Argonne National Laboratory's AFLEET 2020 spreadsheet tool to calculate the differences in lifetime ownership costs, emissions and energy consumption.

The analysis uses national assumptions about the composition and use of public fleets, as well as simplified assumptions about the characteristics and costs of conventional and electric vehicles based on real-world data from the U.S. Environmental Protection Agency (EPA) and other sources. Individual government fleets vary significantly in their composition and utilization, so these data should be interpreted as providing a general assessment of the benefits of electrification and not as a substitute for more detailed local analysis.[60]

Fleet characterization

The number of vehicles owned by local, county and state governments by state was obtained from the U.S. Federal Highway Administration (FHWA), *Highway Statistics 2021*, Table MV-7, February 2023.[61] Data for Alabama, Connecticut, Missouri and Nevada were not included in Table MV-7, and only partial data for those states' fleets was available in *Highway Statistics 2021*, Table MV-1.[62] Data for these states were estimated by multiplying the total number of registered motor vehicles for each of these states by the percentage of state- and locally owned vehicles in the fleets of the remaining 46 states (1.6%).

The FHWA breaks publicly owned vehicles into three categories: automobiles; trucks and truck tractors; and buses. For the four states listed above, the breakdown between automobiles and trucks and truck tractors was estimated based on the average of their proportions in the state- and local-owned fleets of the other 46 states. Buses were excluded from this analysis.

The truck and truck tractor category was then divided into light-duty and medium/heavy-duty trucks, and both the automobile category and the light-duty segment of the truck category were subdivided into classes of vehicles based on estimates derived from fleet characterization data from the following states and cities:

- States: California[63], Massachusetts[64], Missouri[65], Texas[66] and Washington[67]
- Cities: Austin, Texas[68]; Naperville, Ill.[69]; Seattle, Wash.[70]; Tulsa, Okla.[71]; and the 10 Arizona cities and towns included in the authors' previously published *Electric Fleets for Arizona* report.[72]

In addition, we consulted the *2018 Benchmarking Survey Report* compiled by the National Conference of State Fleet Administrators.[73]

Wherever possible, emergency vehicles including police pursuit vehicles and fire/EMS vehicles were excluded from the

estimates. The reports and data sources characterizing state and local fleets used different methods for categorizing vehicles and cover different universes of vehicles. For each of the calculations that follows, the numbers of vehicles in each report or data source were converted into percentages of the relevant fleet. These percentages were averaged across the states or cities reporting that data point (states or cities that did not report that data point were excluded from the averages). Then, a composite percentage covering all nonfederal publicly owned fleets was calculated by weighting the state and local averages based on the share of the publicly owned fleet assumed to be operated by states, derived from an estimate of the size of state fleets from the American Council for an Energy-Efficient Economy (ACEEE) and the total number of nonfederal publicly owned vehicles reported in *Highway Statistics*, Table MV-7, as described above.[74]

After public safety vehicles were removed from the data set, the automobile segment of the fleet was divided as follows:

- First, into sedans vs. minivans.
- Then, within sedans, into compact (incorporating both subcompact and compact vehicles reported by state/local governments), midsize and large segments.

The truck/truck tractor segment was divided as follows:

- Into light-duty vs. medium/heavy-duty segments.
- Within the light-duty segment, into SUV, pickup truck and van categories.

The percentages for each category were then rounded and adjusted slightly to arrive at the following fleet splits:

TABLE M-1. DIVISION OF FHWA-REPORTED PUBLIC FLEETS BY VEHICLE TYPE

Automobiles		**Trucks/Truck tractors**	
Compact	24%	Light SUV	15%
Midsize	24%	Light van	8%
Large	6%	Light-duty pickup	22%
Minivan	15%	*Emergency and other excluded light-duty trucks*	*17%*
Emergency and other excluded vehicles	*31%*	*Medium-/Heavy-duty*	*38%*

** shaded cells = excluded from analysis*

For the purpose of this analysis, large sedans were combined with midsize sedans, due to the limited availability of electric large sedans on the market. Minivans were excluded from the analysis entirely, as there is not currently a fully electric minivan model on the U.S. market and there are no obvious substitutes for minivans within the light-duty class. (Chrysler currently sells a plug-in hybrid version of its Pacifica minivan, which offers an opportunity for municipalities or states seeking to replace minivans currently powered by fossil fuels, but is outside the scope of this analysis.)[75]

Fleet turnover: The data sources for the states and municipalities referenced above, plus the state of Arkansas, were consulted to develop estimates of the average age of the fleets and the percentage of the fleet that can be expected to be replaced over a 10-year period. Data on state fleets from California and Arkansas show that 48% and 60% of the fleets, respectively, are under 10 years old.[76] In the 10 Arizona cities studied, 70% of the light-duty fleet had been replaced within the latest 10 full model years, while in Seattle, 80% of the vehicles listed with an "expected replacement date" in the city's

fleet database were due for replacement by the end of 2032. Based on these data, we therefore assumed conservatively that 50% of the state and local fleets evaluated here would turn over during the next 10 years.

Vehicle utilization: Data on vehicle utilization – either average odometer reading per year or miles traveled in the most recent year – were obtained from the state and city data sources noted above, where available, plus New York City.[77] These data suggest that state fleet vehicles are driven more miles per year on average than vehicles in local fleets. As was the case for the fleet breakdowns discussed above, the average number of miles traveled per type of vehicle was determined separately for states and cities, and the averages were weighted by the state/local share of public fleets estimated as described above to arrive at the following estimates of annual vehicle mileage. (See Table M-2.)

TABLE M-2. ESTIMATED NUMBER OF MILES TRAVELED ANNUALLY BY STATE/LOCAL GOVERNMENT VEHICLES, BY VEHICLE TYPE

Vehicle type	Annual mileage
Sedan	6,750
Light SUV	7,250
Light pickup	7,620
Light van	4,230
Minivan	5,170

Vehicle cost and fuel economy assumptions

For each of the five types of vehicles studied, we identified a common gasoline-powered vehicle in that category and a comparable electric equivalent, using data from the federal government's fueleconomy.gov website, the EPA's fuel economy database,[78] manufacturer websites and automotive trade press to obtain information about the vehicles' cost and fuel economy (expressed in miles per gallon or, for electric vehicles, miles per gallon gasoline equivalent). Table M-3 below shows the vehicles chosen to represent each class, their cost (typically MSRP) and assumed fuel economy (in miles per gallon or miles per gallon gasoline equivalent, mpgge), as of February 2023.

Note that vehicle pricing can be volatile and is affected by dynamics such as chip availability and vehicle demand. Note also that this represents vehicles offered for sale in the U.S. market in early 2023; manufacturers are regularly adding new EV models.

TABLE M-3. CHARACTERISTICS OF REPRESENTATIVE VEHICLES FOR EACH CLASS

Class	Conventional vehicle	Conv. Vehicle cost	Conv. vehicle mpg[79]	Electric vehicle	EV cost	EV fuel economy (mpgge)[80]
Compact	Toyota Corolla	$21,550[81]	35	Nissan Leaf	$28,040[82]	111
Midsize	Honda Accord	$27,295[83]	32	Tesla Model 3	$39,990[84]	132
SUV	Ford Escape AWD	$33,540[85]	28	Volkswagen ID.4 AWD Pro	$46,295[86]	99
Pickup	Ford F-150 XL 4WD	$40,745[87]	20	Ford F-150 Lightning	$55,974[88]	68
Van	Ford Transit cargo van	$46,350[89]	17.2[90]	Ford eTransit T-350 regular cargo van	$55,685[91]	63.25[92]

Each electric vehicle was assumed to be able to take full advantage of the Commercial Clean Vehicle Tax Credit established in the 2022 Inflation Reduction Act (IRA). All vehicles were assumed to be eligible for the IRA's full $7,500 credit with the exception of the Nissan Leaf, whose price differential compared with its conventional equivalent is below $7,500. The "after-incentive" cost of the Leaf was assumed to be the same as its comparative compact vehicle, the Toyota Corolla.

License and registration cost assumptions

AFLEET 2020 includes default assumptions regarding EV-specific fees assessed by state governments. Some states assess these fees to state and local government fleets, others do not. However, because these are fees that state government agencies pay to one another, or that a local government pays to a state government, they do not reflect a net cost to state and local governments taken as a whole. As a result, the cost of state EV fees was excluded from this analysis.

Fuel price and electricity mix assumptions

The total-cost-of-ownership analysis uses state motor gasoline prices for 2021 from the U.S. Energy Information Administration's State Energy Data System, downloaded from www.eia.gov/state/seds/sep_fuel/html/csv/fuel_mg.csv, 7 March 2023. Prices in mmbtu/barrel were converted to dollars per gallon based on a heat rate of 5.05 mmbtu/barrel from the U.S. Energy Information Administration[93] and 42 gallons per barrel. Commercial electricity prices for 2021 by state were obtained from the U.S. Energy Information Administration's Electricity Data Browser, downloaded from www.eia.gov/electricity/data/browser/#/topic/7?agg=1,0&geo=00vvvvvvvvvvo&endsec=4&freq=A&start=2001&end=2022&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin=, 6 March 2023.

The AFLEET tool includes assumptions regarding the electricity mix by fuel for various regions of the country. In order to update the assumptions to reflect recent changes in the composition of the electric grid, and to develop estimates of the mix of electric generators serving each state, we obtained data on electricity sales and generation from the U.S. Energy Information Administration Forms 861 (for 2021) and 923 (for 2022), downloaded 2 March 2023. From Form 923, we summed net generation by fuel type and balancing authority for all electricity generating units in the database, and then assigned the fuels in the Form 923 database to the fuel categories in AFLEET as follows:

- Residual oil: Distillate petroleum, petroleum coke, residual petroleum, waste oil
- Natural gas: Natural gas
- Coal: Coal, waste coal
- Nuclear: Nuclear
- Biomass: Biogenic municipal solid waste and landfill gas, wood and wood waste
- Others (Wind, Solar, Hydro, etc.): Solar PV and thermal, geothermal, hydroelectric pumped storage, hydroelectric conventional, other gases, other renewables, other, wind.

The Form 861 spreadsheet for sales of electricity to ultimate customers was used to calculate the percentage of each state's electricity sales that came from each balancing authority. This was done by calculating the total amount of electricity sold for each balancing authority within each state by entities selling bundled electricity services or delivery services only for all ownership types except behind-the-meter electricity providers and retail power marketers. The resulting sales figures were then divided by the total amount

of electricity sales in each state to arrive at the percentage of sales in each state by balancing authority. These percentages were then applied to the breakdown of generation by fuel type, calculated above, to arrive at a weighted average electricity generation mix for each state.

This method yielded reliable results for all states except Alaska and Hawaii. The electricity generation mixes for those states were obtained from the U.S. Energy Information Administration's *State Electricity Profiles* for 2021, downloaded from www.eia.gov/electricity/state on 7 March 2023.

Other assumptions

Emission and energy consumption data represent "well-to-wheels" estimates from AFLEET, not counting emissions from vehicle manufacturing.

Appendix

TABLE A-1. TOTAL-COST-OF-OWNERSHIP SAVINGS BY STATE

State	Number of vehicles	Total cost of ownership				Savings by category of expense				Percentage savings by category			
		Gasoline vehicles	Electric vehicles	Total cost savings	Savings (pct.)	Depreciation	Fuel	Maintenance	Insurance	Depreciation	Fuel	Maintenance	Insurance
ALABAMA	18,748	$1,558,619,605	$1,362,467,528	$196,152,077	13%	$(75,797,085)	$148,843,862	$147,026,453	$(23,921,153)	-14%	63%	37%	-7%
ALASKA	2,414	$225,358,192	$189,361,068	$35,997,125	16%	$(10,904,955)	$30,663,697	$19,579,883	$(3,341,500)	-14%	60%	37%	-8%
ARIZONA	19,640	$1,746,009,337	$1,463,100,209	$282,909,129	16%	$(79,083,136)	$228,902,105	$153,840,302	$(20,750,142)	-14%	74%	37%	-5%
ARKANSAS	13,626	$1,201,495,667	$1,047,124,978	$154,370,689	13%	$(57,998,251)	$126,527,128	$108,508,896	$(22,667,084)	-14%	70%	37%	-7%
CALIFORNIA	122,515	$11,624,433,921	$10,051,710,954	$1,572,722,968	14%	$(468,163,126)	$1,280,188,468	$945,384,836	$(184,687,211)	-14%	59%	37%	-6%
COLORADO	11,479	$1,079,730,261	$927,839,383	$151,890,878	14%	$(48,965,697)	$127,624,901	$91,470,174	$(18,238,501)	-14%	71%	37%	-7%
CONN.	9,458	$857,094,548	$759,453,551	$97,640,997	11%	$(38,238,438)	$73,073,127	$74,172,535	$(11,366,227)	-14%	54%	37%	-5%
DELAWARE	1,214	$109,338,251	$93,582,366	$15,755,886	14%	$(4,858,552)	$12,520,783	$9,493,267	$(1,399,612)	-14%	74%	37%	-5%
DISTRICT OF COLUMBIA	4,662	$377,118,608	$320,785,533	$56,333,074	15%	$(16,647,565)	$42,067,967	$35,311,271	$(4,398,599)	-13%	66%	37%	-5%
FLORIDA	56,200	$5,408,732,453	$4,747,644,648	$661,087,805	12%	$(221,313,651)	$508,767,802	$437,387,886	$(63,754,231)	-14%	71%	37%	-3%
GEORGIA	28,973	$2,456,398,378	$2,143,904,975	$312,493,403	13%	$(116,314,606)	$239,410,689	$226,745,845	$(37,348,525)	-14%	67%	37%	-6%
HAWAII	4,385	$372,203,881	$326,751,626	$45,452,255	12%	$(17,740,674)	$32,574,296	$34,394,610	$(3,775,976)	-14%	38%	37%	-6%
IDAHO	690	$58,450,704	$47,699,223	$10,751,481	18%	$(2,962,044)	$9,028,961	$5,510,672	$(826,107)	-14%	80%	37%	-8%
ILLINOIS	1,903	$158,590,042	$135,070,690	$23,519,352	15%	$(7,691,566)	$18,587,732	$14,923,586	$(2,300,401)	-14%	72%	37%	-7%
INDIANA	523	$42,087,509	$36,152,865	$5,934,644	14%	$(2,174,580)	$4,549,438	$4,134,351	$(574,565)	-14%	65%	37%	-7%
IOWA	7,337	$606,074,685	$517,526,017	$88,548,667	15%	$(31,189,294)	$70,662,680	$58,403,406	$(9,328,124)	-14%	70%	37%	-9%
KANSAS	2,185	$188,991,550	$164,361,954	$24,629,595	13%	$(9,103,700)	$20,269,477	$17,289,023	$(3,825,204)	-14%	69%	37%	-8%
KENTUCKY	19,088	$1,814,145,755	$1,596,279,442	$217,866,313	12%	$(78,287,157)	$179,582,282	$150,327,853	$(33,756,665)	-14%	69%	37%	-6%
LOUISIANA	22,156	$2,172,536,503	$1,930,439,416	$242,097,086	11%	$(92,183,231)	$194,907,200	$175,231,356	$(35,858,238)	-14%	68%	37%	-5%
MAINE	798	$63,344,376	$53,677,329	$9,667,046	15%	$(3,386,489)	$7,436,772	$6,349,981	$(733,218)	-14%	64%	37%	-7%
MARYLAND	14,584	$1,237,874,242	$1,051,588,711	$186,285,531	15%	$(57,085,467)	$144,936,685	$113,307,878	$(14,873,565)	-14%	72%	37%	-5%
MASS.	10,768	$914,640,297	$806,936,967	$107,703,330	12%	$(43,343,188)	$77,761,794	$84,339,165	$(11,054,442)	-14%	52%	37%	-5%
MICHIGAN	28,057	$3,123,384,442	$2,834,309,923	$289,074,519	9%	$(119,212,301)	$243,158,675	$223,312,184	$(58,184,039)	-14%	63%	37%	-5%
MINNESOTA	3,233	$271,045,995	$233,061,398	$37,984,596	14%	$(13,584,817)	$29,889,391	$25,643,277	$(3,963,255)	-14%	67%	37%	-7%
MISSISSIPPI	793	$67,339,952	$58,741,073	$8,598,878	13%	$(3,217,582)	$6,669,319	$6,227,534	$(1,080,393)	-14%	66%	37%	-6%
MISSOURI	19,228	$1,674,620,002	$1,453,116,020	$221,503,983	13%	$(77,738,815)	$179,402,618	$150,792,899	$(30,952,719)	-14%	72%	37%	-7%
MONTANA	312	$28,408,217	$24,028,802	$4,379,415	15%	$(1,367,152)	$3,769,178	$2,506,688	$(529,298)	-14%	73%	37%	-8%

Continued on page 30

Continued from page 29

State	Number of vehicles	Total cost of ownership				Savings by category of expense				Percentage savings by category			
		Gasoline vehicles	Electric vehicles	Total cost savings	Savings (pct.)	Depreciation	Fuel	Maintenance	Insurance	Depreciation	Fuel	Maintenance	Insurance
NEBRASKA	7,211	$603,622,793	$512,104,809	$91,517,984	15%	$(30,407,243)	$75,764,054	$57,263,941	$(11,102,768)	-14%	75%	37%	-9%
NEVADA	9,182	$872,710,632	$727,017,149	$145,693,483	17%	$(37,123,920)	$122,522,851	$72,010,663	$(11,716,110)	-14%	81%	37%	-5%
NEW HAMPSHIRE	2,133	$169,583,545	$147,744,664	$21,838,881	13%	$(8,866,246)	$15,955,674	$16,864,327	$(2,114,873)	-14%	54%	37%	-7%
NEW JERSEY	12,897	$1,118,404,639	$970,682,476	$147,722,163	13%	$(51,017,461)	$110,313,120	$100,502,132	$(12,075,628)	-14%	63%	37%	-4%
NEW MEXICO	12,840	$1,069,351,918	$919,989,843	$149,362,076	14%	$(53,349,173)	$116,275,647	$101,510,333	$(15,074,731)	-14%	68%	37%	-6%
NEW YORK	6,514	$575,763,893	$512,190,483	$63,573,410	11%	$(26,573,347)	$46,971,372	$51,220,484	$(8,045,098)	-14%	53%	37%	-5%
NORTH CAROLINA	26,943	$2,086,640,270	$1,733,448,708	$353,191,562	17%	$(108,886,414)	$271,987,535	$211,268,235	$(21,177,794)	-14%	75%	37%	-6%
NORTH DAKOTA	3,970	$349,342,168	$296,925,338	$52,416,830	15%	$(17,664,746)	$44,515,277	$32,048,739	$(6,482,441)	-14%	74%	37%	-9%
OHIO	23,213	$1,819,542,880	$1,525,942,879	$293,600,001	16%	$(93,514,867)	$227,053,390	$181,852,898	$(21,791,420)	-14%	72%	37%	-7%
OKLAHOMA	3,153	$282,717,479	$245,569,296	$37,148,183	13%	$(13,208,022)	$30,772,865	$24,987,695	$(5,404,354)	-14%	74%	37%	-7%
OREGON	12,164	$1,099,138,486	$902,849,576	$196,288,910	18%	$(50,320,728)	$163,399,838	$96,043,825	$(12,834,025)	-14%	79%	37%	-5%
PENN.	26,733	$2,283,705,397	$1,923,139,157	$360,566,241	16%	$(109,024,835)	$295,212,582	$210,186,457	$(35,807,964)	-14%	76%	37%	-7%
RHODE ISLAND	2,545	$236,300,893	$210,358,531	$25,942,362	11%	$(9,938,946)	$19,898,018	$19,758,246	$(3,774,956)	-14%	57%	37%	-5%
SOUTH CAROLINA	85,474	$7,092,029,478	$6,137,554,012	$954,475,466	13%	$(345,259,846)	$721,455,099	$670,137,842	$(91,857,629)	-14%	67%	37%	-6%
SOUTH DAKOTA	5,457	$492,879,151	$428,653,365	$64,225,787	13%	$(23,861,677)	$56,223,203	$43,816,926	$(11,952,665)	-14%	71%	37%	-10%
TENNESSEE	26,204	$2,225,820,169	$1,935,374,210	$290,445,959	13%	$(107,714,955)	$235,134,786	$206,507,160	$(43,481,032)	-14%	67%	37%	-8%
TEXAS	73,819	$6,177,249,035	$5,313,815,842	$863,433,193	14%	$(306,844,174)	$680,624,206	$583,676,466	$(94,023,305)	-14%	72%	37%	-7%
UTAH	10,526	$901,343,490	$739,812,298	$161,531,192	18%	$(43,098,951)	$131,739,838	$82,854,413	$(9,964,108)	-14%	79%	37%	-5%
VERMONT	2,028	$163,343,099	$142,295,007	$21,048,092	13%	$(8,628,260)	$16,012,345	$16,149,566	$(2,485,559)	-14%	54%	37%	-9%
VIRGINIA	22,850	$1,757,649,288	$1,464,336,757	$293,312,531	17%	$(91,439,687)	$226,729,126	$178,659,827	$(20,636,736)	-14%	77%	37%	-7%
WASH.	49,102	$4,260,022,335	$3,502,718,139	$757,304,196	18%	$(198,424,609)	$617,674,402	$385,020,709	$(46,966,306)	-14%	78%	37%	-5%
WEST VIRGINIA	4,727	$415,803,328	$354,520,645	$61,282,683	15%	$(20,140,322)	$50,569,116	$37,653,520	$(6,799,632)	-14%	73%	37%	-7%
WISCONSIN	23,412	$1,931,406,077	$1,640,560,067	$290,846,010	15%	$(97,859,861)	$231,832,541	$185,423,118	$(28,549,787)	-14%	69%	37%	-8%
WYOMING	254	$23,114,874	$19,735,267	$3,379,606	15%	$(1,141,531)	$2,937,804	$2,054,605	$(471,272)	-14%	74%	37%	-10%
U.S. total	**878,321**	**$77,445,552,687**	**$66,684,055,167**	**$10,761,497,520**	**14%**	**$(3,552,862,942)**	**$8,553,351,709**	**$6,889,087,939**	**$(1,128,079,186)**	**-14%**	**68%**	**37%**	**-6%**

TABLE A-2. ENERGY SAVINGS AND EMISSION REDUCTIONS BY STATE

State	Number of vehicles	Energy savings/pollution reduction								Percentage reduction							
		Petroleum use (barrels)	Greenhouse gas emissions (short tons CO_2 equivalent)	Carbon monoxide emissions (pounds)	Nitrogen oxides emissions (pounds)	Particulate (PM_{10}) emissions (pounds)	Fine particulate ($PM_{2.5}$) emissions (pounds)	Volatile organic compound emissions (pounds)	Sulfur oxide emissions (pounds)	Petroleum use	Greenhouse gas emissions	Carbon monoxide emissions	Nitrogen oxides emissions	Particulate (PM_{10}) emissions	Fine particulate ($PM_{2.5}$) emissions	Volatile organic compound emissions	Sulfur oxide emissions
ALABAMA	18,748	1,553,621	537,173	4,860,346	134,943	(49,340)	945	1,048,806	(581,870)	99%	61%	92%	21%	-25%	1%	92%	-219%
ALASKA	2,414	189,319	69,533	637,688	(97,268)	(4,727)	(1,289)	138,861	(128,067)	87%	57%	93%	-107%	-18%	-15%	92%	-348%
ARIZONA	19,640	1,621,841	462,312	6,736,787	143,413	(37,214)	3,313	915,775	(1,373,765)	99%	50%	97%	21%	-17%	5%	91%	-495%
ARKANSAS	13,626	1,160,550	338,802	3,722,458	75,982	(38,915)	(1,389)	711,663	(996,914)	99%	51%	95%	15%	-29%	-3%	92%	-500%
CALIFORNIA	122,515	9,812,057	4,081,821	30,190,846	1,480,012	64,626	134,881	5,383,641	244,504	100%	73%	93%	36%	5%	34%	92%	15%
COLORADO	11,479	985,176	306,035	3,056,684	112,237	(20,876)	3,295	651,987	(724,150)	99%	55%	95%	27%	-17%	8%	93%	-430%
CONN.	9,458	772,978	326,712	2,237,535	47,852	(27,845)	128	455,815	19,116	98%	73%	89%	14%	-28%	0%	92%	14%
DELAWARE	1,214	99,927	36,226	303,715	12,967	(766)	833	56,366	(38,264)	99%	64%	94%	31%	-6%	20%	92%	-224%
DISTRICT OF COLUMBIA	4,662	356,820	129,967	1,213,484	47,867	(2,436)	3,086	284,384	(134,975)	99%	64%	95%	31%	-4%	18%	94%	-221%
FLORIDA	56,200	4,560,127	1,574,413	19,058,969	122,019	(47,188)	26,935	2,514,238	(659,851)	99%	60%	93%	6%	-7%	13%	89%	-84%
GEORGIA	28,973	2,389,253	791,043	7,480,651	147,455	(100,216)	(6,909)	1,318,662	(966,809)	99%	58%	91%	15%	-32%	-7%	90%	-237%
HAWAII	4,385	146,223	60,477	1,558,149	(952,179)	(61,279)	(31,594)	212,634	(805,116)	40%	29%	93%	-619%	-121%	-201%	90%	-1296%
IDAHO	690	59,508	23,860	158,158	5,502	(9,597)	(2,114)	34,872	(12,093)	99%	70%	82%	22%	-144%	-89%	91%	-119%
ILLINOIS	1,903	157,204	52,869	491,381	15,792	(2,674)	753	92,985	(85,745)	99%	59%	94%	24%	-13%	12%	92%	-318%
INDIANA	523	43,845	13,239	141,807	2,805	(1,285)	6	26,497	(33,220)	99%	53%	95%	15%	-24%	0%	91%	-441%
IOWA	7,337	623,438	177,854	1,982,784	31,283	(21,959)	(1,285)	358,659	(540,761)	99%	50%	95%	12%	-31%	-5%	91%	-504%
KANSAS	2,185	184,504	57,994	603,148	24,466	(5,062)	343	106,038	(152,302)	99%	55%	96%	31%	-24%	5%	92%	-483%
KENTUCKY	19,088	1,591,245	393,071	5,133,055	66,016	(66,333)	(7,338)	879,049	(1,667,351)	99%	43%	95%	10%	-37%	-11%	90%	-611%
LOUISIANA	22,156	1,856,177	533,755	6,811,703	89,979	(64,219)	(3,358)	992,195	(1,591,373)	99%	50%	95%	11%	-28%	-4%	90%	-498%
MAINE	798	67,426	29,151	187,394	5,997	(2,091)	142	40,523	2,332	98%	75%	89%	21%	-29%	6%	93%	20%
MARYLAND	14,584	1,183,254	429,341	3,665,369	154,538	(8,877)	9,935	674,037	(452,040)	99%	64%	94%	31%	-6%	21%	92%	-224%
MASS.	10,768	877,523	370,917	2,578,351	56,324	(31,587)	153	521,209	21,719	98%	73%	89%	15%	-26%	0%	92%	14%
MICHIGAN	28,057	2,382,962	686,601	7,670,524	117,376	(81,630)	(4,170)	1,374,129	(2,007,663)	99%	50%	95%	11%	-27%	-4%	91%	-489%
MINNESOTA	3,233	272,496	77,857	856,352	12,954	(9,572)	(563)	165,383	(234,343)	99%	50%	95%	11%	-30%	-5%	91%	-499%
MISSISSIPPI	793	65,652	21,705	211,390	5,680	(1,688)	133	36,261	(36,957)	99%	58%	94%	20%	-22%	5%	91%	-328%
MISSOURI	19,228	1,585,639	434,311	5,122,637	107,560	(58,979)	(4,021)	921,358	(1,538,117)	99%	48%	96%	16%	-33%	-7%	91%	-565%

Continued on page 32

Continued from page 31

State	Number of vehicles	Energy savings/pollution reduction								Percentage reduction							
		Petroleum use (barrels)	Greenhouse gas emissions (short tons CO_2 equivalent)	Carbon monoxide emissions (pounds)	Nitrogen oxides emissions (pounds)	Particulate (PM_{10}) emissions (pounds)	Fine particulate ($PM_{2.5}$) emissions (pounds)	Volatile organic compound emissions (pounds)	Sulfur oxide emissions (pounds)	Petroleum use	Greenhouse gas emissions	Carbon monoxide emissions	Nitrogen oxides emissions	Particulate (PM_{10}) emissions	Fine particulate ($PM_{2.5}$) emissions	Volatile organic compound emissions	Sulfur oxide emissions
MONTANA	312	26,570	5,604	83,801	(939)	(1,714)	(349)	16,155	(41,336)	97%	36%	97%	-8%	-61%	-34%	91%	-887%
NEBRASKA	7,211	613,635	188,058	1,997,164	77,711	(18,200)	609	359,240	(532,136)	99%	54%	96%	30%	-27%	3%	92%	-507%
NEVADA	9,182	762,752	270,206	2,607,049	65,692	14,022	11,523	476,468	(80,424)	100%	62%	93%	20%	14%	37%	91%	-62%
NEW HAMPSHIRE	2,133	177,516	74,973	469,320	10,569	(6,443)	12	104,868	4,333	98%	73%	88%	14%	-31%	0%	92%	14%
NEW JERSEY	12,897	1,053,528	382,137	3,244,145	137,171	(7,979)	8,817	630,636	(402,740)	99%	64%	94%	31%	-5%	20%	92%	-224%
NEW MEXICO	12,840	1,083,545	377,530	3,541,136	162,755	(13,939)	7,427	617,414	(610,994)	99%	61%	96%	35%	-11%	17%	92%	-330%
NEW YORK	6,514	538,455	236,542	1,666,570	71,914	3,686	7,391	341,265	37,431	99%	76%	93%	31%	5%	34%	94%	40%
NORTH CAROLINA	26,943	2,235,119	954,030	7,189,101	436,843	(2,897)	27,117	1,287,810	(273,887)	100%	75%	94%	46%	-1%	30%	94%	-72%
NORTH DAKOTA	3,970	349,039	104,647	1,061,431	32,683	(11,017)	(60)	222,062	(295,343)	99%	52%	95%	22%	-30%	0%	92%	-493%
OHIO	23,213	1,918,851	695,430	6,296,608	252,595	(14,796)	15,961	1,143,634	(735,287)	99%	64%	95%	31%	-6%	20%	92%	-224%
OKLAHOMA	3,153	267,152	82,104	865,101	32,995	(7,772)	313	150,804	(229,203)	99%	54%	96%	29%	-26%	3%	92%	-502%
OREGON	12,164	1,027,094	438,559	3,149,643	185,793	22,979	19,274	572,318	83,060	100%	75%	94%	43%	18%	47%	93%	48%
PENN.	26,733	2,227,620	807,021	7,124,952	292,334	(17,357)	18,463	1,308,385	(854,170)	99%	64%	94%	31%	-6%	20%	92%	-224%
RHODE ISLAND	2,545	203,369	86,026	604,009	13,292	(7,263)	56	118,885	5,099	98%	73%	89%	15%	-26%	1%	92%	14%
SOUTH CAROLINA	85,474	7,068,710	2,364,148	22,428,885	645,230	(307,929)	(20,750)	3,717,560	(3,867,612)	99%	59%	93%	22%	-35%	-7%	91%	-320%
SOUTH DAKOTA	5,457	474,389	124,858	1,482,704	35,655	(19,794)	(1,873)	267,425	(506,172)	99%	46%	96%	17%	-41%	-11%	91%	-622%
TENNESSEE	26,204	2,197,157	856,425	7,147,285	358,984	(3,463)	24,168	1,241,216	(624,240)	100%	69%	95%	39%	-1%	27%	93%	-166%
TEXAS	73,819	6,234,624	2,194,336	21,603,345	756,002	4,953	65,471	3,332,335	(2,372,875)	100%	62%	95%	29%	1%	26%	91%	-223%
UTAH	10,526	876,496	173,164	2,741,497	21,047	(47,958)	(8,250)	503,844	(1,215,491)	99%	35%	96%	6%	-44%	-23%	90%	-809%
VERMONT	2,028	171,407	72,352	502,028	10,805	(6,258)	(1)	103,149	4,142	98%	73%	89%	15%	-35%	0%	92%	14%
VIRGINIA	22,850	1,880,589	679,393	5,864,596	242,342	(15,098)	15,417	1,055,415	(733,899)	99%	63%	94%	30%	-7%	20%	92%	-228%
WASHINGTON	49,102	4,078,115	2,039,736	12,583,045	1,123,034	(154,392)	16,182	1,891,949	347,947	100%	88%	93%	65%	-31%	10%	95%	50%
WEST VIRGINIA	4,727	405,426	146,601	1,264,677	52,617	(3,289)	3,312	227,214	(156,260)	99%	63%	94%	30%	-7%	20%	92%	-226%
WISCONSIN	23,412	1,966,365	561,273	6,073,481	91,690	(69,181)	(4,134)	1,464,725	(1,691,267)	99%	50%	95%	11%	-30%	-5%	93%	-499%
WYOMING	254	22,485	4,435	68,792	732	(1,297)	(229)	17,911	(32,214)	99%	35%	96%	8%	-57%	-27%	92%	-835%
U.S. total	**878,321**	**72,458,775**	**25,936,629**	**238,331,731**	**7,081,117**	**(1,384,125)**	**326,717**	**41,088,719**	**(29,247,613)**	**99%**	**63%**	**94%**	**23%**	**-15%**	**11%**	**92%**	**-235%**

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