


# Fueling a Better Future

## The Many Benefits of "Half the Oil"

With sound science, advanced technology, and smart policy, we can cut projected U.S. oil use in half in 20 years. This "Half the Oil" plan will ensure a cleaner and safer energy future. It is a future in which our passenger vehicles are powered by fuel-sipping (as opposed to fuel-guzzling) engines that take us nearly twice as far on a gallon of gasoline, and in which biofuels, electricity, and even hydrogen generated from clean and renewable resources—such as the sun, the wind, and waste products—power our cars and trucks. It is a future in which we live in healthier communities, prosper from a strong economy, and help safeguard our planet against the disastrous effects of climate change.

When it comes to oil use, our country is at a crossroads: we can put the United States on a path toward cutting projected oil consumption in half, or we can continue to threaten our health and economic well-being by moving to increasingly dirty and inaccessible (and therefore dangerous) sources of oil. The choice is clear. It is time to commit to and work toward a Half the Oil future. Actually, this work has already begun, and the path ahead looks bright. This effort means that in 20 years we will have cut our country's annual oil spending by $550 billion, created more than 1 million jobs, and eliminated some 2 billion metric tons of global warming emissions per year.

This report shows that we can secure a Half the Oil future that benefits ourselves, our communities, and our country.

***In 20 years we will have cut our country's annual oil spending by $550 billion, created more than 1 million jobs, and eliminated some 2 billion metric tons of global warming emissions per year.***

Union of Concerned Scientists

# Half the Oil and You

Every day, Americans spend nearly $2 billion just to buy oil and other petroleum products, and this expense will rise to more than $2.5 billion by 2035 if we do nothing to curb our oil consumption (UCS 2012d). Fortunately, we can do something: the policies and choices that will help cut projected oil use in half—through greater efficiency and increased use of advanced technology—will lead to serious savings. Reaching a Half the Oil future means cutting projected consumer spending on oil by $550 billion per year in 2035—money that could stay in our pockets and then be well spent elsewhere.


## Savings through Efficiency in Passenger Vehicles

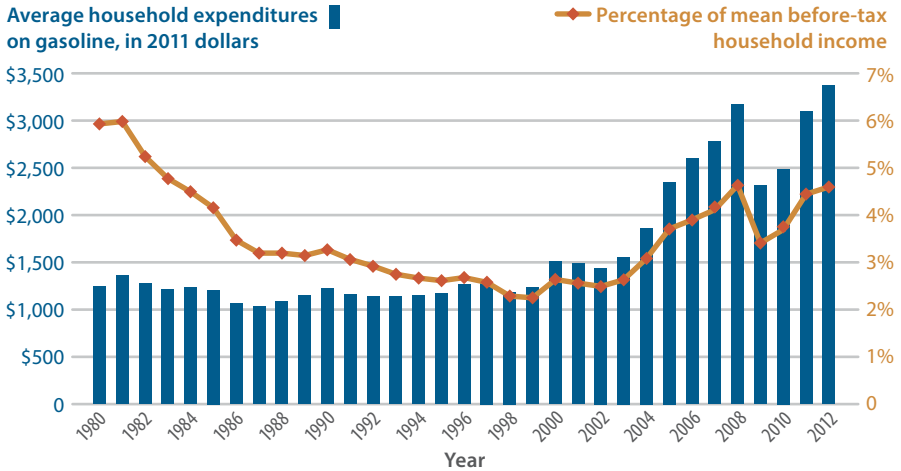
Transportation is the second-largest expense (after housing) for most American households, costing more than food, clothing, and health care (SGA 2012). For most people, much of the money spent on transportation goes to gasoline. Over the last several years, for example, the average U.S. household spent around 4 percent of its pretax income on this fuel (Figure 1) (EIA 2013d). And some states were hit harder than others. Residents of Mississippi and North Dakota, for example, devoted nearly 10 percent of their income to gasoline in 2012 (CNN Money 2013).

Furthermore, over the life of a car bought in 2011, an owner will spend more than $22,000 on gasoline (UCS 2013). That could be as much as the cost of the vehicle itself. Improving the fuel efficiency of passenger vehicles, therefore, is one of the biggest and most immediate ways that consumers will benefit in a Half the Oil future.

Though fuel economy stalled for decades after the first Corporate Average Fuel Economy (CAFE) standards were established in 1975, two new rounds of standards—for fuel efficiency and global warming emissions of light-duty vehicles—are putting fuel savings back on track. The first round began to take effect in 2012, and consumers are already seeing a wider range of affordable fuel-efficient vehicles on showroom floors, with improvements such as stop-start technology, direct injection, and other fuel-saving features becoming increasingly commonplace.

A Half the Oil future means not just expanding the variety of fuel-efficient vehicles—from pickups and minivans to compact cars—but also providing consumers with serious savings. At gasoline prices of $3.50 per gallon, the 2012–2025 fuel efficiency and global warming emissions standards will save the average driver of a new 2025 vehicle some $8,000 over the vehicle's lifetime compared with an average model year 2011 vehicle (EPA 2012c). In 2030 alone, consumers will net $140 billion in savings from the two rounds of standards (UCS 2012a). As conventional and hybrid technologies continue to become more efficient, manufacturers will be able to meet even higher fuel economy targets and provide consumers with even more savings.

**FIGURE 1. Average U.S. Spending on Gasoline** Source: EIA 2013d.



## Savings through Efficiency in Trucks

In a Half the Oil future, not only will we all spend less at the pump, but people and goods will also get where they need to go on less fuel. Strong fuel efficiency standards for medium- and heavy-duty vehicles such as trucks and buses are already benefiting consumers and businesses alike. These standards reduce oil use while enabling businesses with significant transportation costs to save money and maintain workforces.

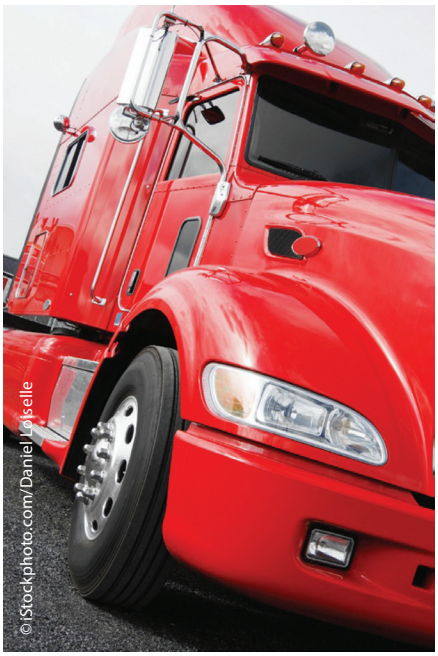
Many companies, including high-profile names such as Coca-Cola, United Parcel Service, and FedEx, are already taking steps to improve the fuel efficiency of their truck fleets (UCS 2012g). But fuel costs remain a major expense for most owners and operators of fleets of large trucks and buses. Despite representing just 4 percent of all vehicles on the road, medium- and heavy-duty vehicles consume about 20 percent of all the transportation fuel used each year (UCS 2010a). And with fuel a major cost for the trucking industry, when fuel prices soar the cost of consumer goods also increases (EIA 2013e).

To address fuel consumption in this part of the transportation sector and to help insulate companies and independent owner-operators against future spikes in the cost of fuel, in 2011 the U.S. Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration developed the first-ever fuel efficiency standards for medium- and heavy-duty vehicles. It is estimated that these standards will cut oil usage by at least 530 million barrels over the life of vehicles built in the 2014 to 2018 model years, and that they will save owners $42 billion even after the up-front cost of the fuel-saving technologies. And this is only the start. This first round of standards could achieve an estimated 23 percent reduction in new tractor-trailer fuel consumption compared with 2010 levels (EPA 2012b). Moreover, additional efficiency technologies could decrease tractor-trailer fuel consumption by 50 percent or more, further expanding savings for owners and consumers (NRC 2010). Many of these technologies are being demonstrated today as part of the Department of Energy's "SuperTruck" program (Barry 2013; Cummins 2013).

Owners of large trucks don't need to wait for these regulations to take effect to start saving money on fuel. The nearly 9 million medium- and heavy-duty trucks on the road today can cut fuel consumption by utilizing currently available aftermarket technologies (EIA 2013a). For example, aerodynamic innovations such as advanced trailer side-skirts can reduce diesel use by 5 percent, and low-rolling-resistance tires can cut diesel use by at least another 3 percent (EPA 2013d; EPA 2013e). One of the most cost-effective means of slashing fuel use right now is to reduce idling. The EPA estimates that at current fuel prices, extended idling can cost long-haul tractor-trailor operators up to $6,000 annually (EPA 2013f).

Courtesy of Peterbilt Motors Company

This tractor-trailer (developed by Cummins Inc., Peterbilt Motors Company, and their partners as part of the Department of Energy's "SuperTruck" program) features a high-efficiency engine, improved aerodynamics to significantly reduce drag, and other fuel-saving technologies. Test results showed that this tractor-trailer achieved a 54 percent increase in fuel economy compared with today's long-haul tractor-trailers.



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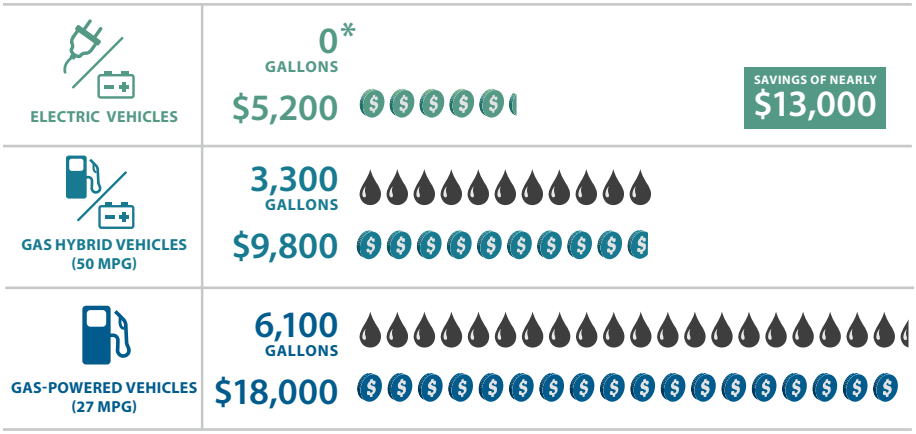
***The nearly 9 million medium- and heavy-duty trucks on the road today consume about 20 percent of all transportation fuel used each year but can cut this consumption by utilizing currently available aftermarket technologies.***

## FIGURE 2. Lifetime Gasoline Consumption and Fuel Costs

Electric vehicles slash oil consumption and cost thousands of dollars less to fuel than gasoline vehicles.




*Electric vehicles consume no gasoline and contribute very little to oil consumption, since less than 1 percent of the electricity in the United States is generated with petroleum.

Note: Fueling/charging costs are based on $3.50-per-gallon gasoline, an electricity price of 11 cents/kWh, a discount rate of 3 percent, 166,000 lifetime miles, and an EV efficiency rating of 0.34 kWh/mile.

## Savings through Electric Vehicles

Reaching a Half the Oil future means having more freedom to choose how our vehicles are powered and what type of vehicle suits our individual needs. While higher fuel efficiency standards save consumers money by giving drivers and businesses options for using less gasoline, technology now provides the option of using none at all.

Electric vehicles (EVs)—such as the plug-in hybrid Chevrolet Volt, fuel-cell cars that run on hydrogen gas, and the battery-electric Nissan Leaf—can cut U.S. oil use by nearly 1.5 million barrels a day in 2035 and save drivers thousands of dollars in fuel costs (UCS 2012d). Compared with a compact gasoline-powered vehicle with average fuel economy, a typical midsize battery EV could save its owner nearly $13,000 on fuel costs over its lifetime (Figure 2) (UCS 2012e). Even compared with the cost of fueling a gasoline hybrid vehicle that achieves 50 miles per gallon (mpg), a battery EV could save drivers more than $4,500 after accounting for the cost of "filling up" with electricity.[1] Such savings go a long way toward offsetting the additional cost of the vehicle and any home-based charging equipment, and prices are expected to decline as investments in EV technology and manufacturing continue (UCS 2012e).

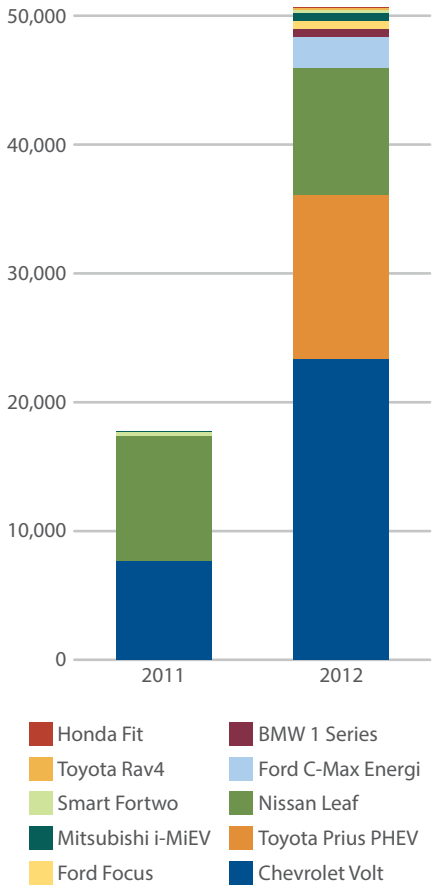
Expanding EVs' share of the automobile market is critical not only to halving our oil use in 20 years, but also to developing a twenty-first-century U.S. auto industry. EVs were just reintroduced by auto manufacturers in 2011, but in the following two years sales grew rapidly, reaching more than 120,000 units worldwide by the end of 2012 (Figure 3) (IEA 2012). It will take time for the market to develop further, but state and federal policies can meanwhile encourage the manufacturing of EVs and their components (such as batteries and fuel cells) and stimulate investment in charging and fueling infrastructure. Such policies could accelerate the market to a point where 30 to 40 percent of new vehicles sold in 2035 will run primarily on electricity or hydrogen instead of oil.

Different drivers need different options, and there is no one-size-fits-all electric vehicle technology. For example, people who live in areas with more developed EV charging infrastructure might opt for battery-electric vehicles, others may pack their families into fuel-efficient minivans powered by hybrid gasoline/plug-in-electric powertrains, and others may pull thousands of pounds of cargo with a fuel-cell-electric truck. Regardless of the type of vehicle one owns, in a Half the Oil future the prevalence and diversity of vehicles will give consumers more ways to use less oil, reduce their environmental footprint, and guard against volatile gasoline prices.

## FIGURE 3. Plug-in Electric Vehicle Sales in Model Year 2012

Despite some bumps in the road, EV sales are charging forward. Automakers are making large investments that will bring dozens of new models to the market, thereby creating more competition and making EVs accessible to more drivers.

Sources: UCS 2012e; WardsAuto 2012.




1 Electricity prices vary across the country. A closer look at the costs of charging an EV at home in 50 major U.S. cities shows that decisions on rate plans and on the time of day when you charge can significantly alter the amount you will pay to power your EV.

# Half the Oil and Your Community

From the Atlantic Coast to the Southwest, strategies to grow our communities in ways that use less oil are taking hold across the country. By better integrating transportation options with the places in which we live and work, people can get where they need to go more efficiently and safely. A Half the Oil future means being able, for example, to commute to work in an electric bus that utilizes a dedicated lane, or to walk to the local grocery or movie theater even if you don't live in a downtown area. Designing communities with more abundant and efficient transportation options falls under a set of principles collectively called "smart growth." Working toward smart-growth policies and practices can not only yield oil savings of nearly 1.5 million barrels per day in 2035 but also reduce commute times, make streets safer, clean up our air, and revitalize local economies.

## Smarter Communities, Smarter Choices

In the mid-1980s, the municipality of Arlington, VA, which abuts Washington, DC, and calls itself an "urban county," began concentrating dense mixed-use development around its bus and rail transit systems. These urban villages emphasized pedestrian access, promoted safety through smarter traffic patterns, provided bike lanes, and created highly desirable living spaces by incorporating public art, small parks, wide sidewalks (often with restaurant seating), and access to public transportation. As a result, heavily traveled Wilson Boulevard saw traffic *drop* nearly 16 percent from 1996 to 2006, even though population in Arlington grew by almost 8 percent over the same period (Arlington County 2013a). Commute time in the county is below the regional average (ACCS 2010) and, at gas prices of $3.50 per gallon, the roughly 200,000 (Arlington County 2013a) Arlington residents have been estimated to save almost 7.2 million gallons of fuel each year—a savings of almost $120 per person (ACCS 2013; Arlington County 2013b).

Smart-growth principles have also been applied in Albuquerque, NM, where, for example, a former municipal building has been repurposed into an apartment building that is 40 percent more efficient than conventionally designed counterparts. These savings are a particular boon to the building's first tenants, more than half of whom earn 60 percent or less of the area's median income. With more than 130 people on the wait list for the second phase of apartments under construction, the project's center-city location and easy access to public transit is expected not only to decrease the need for driving but also to help transform and revitalize downtown Albuquerque (EPA 2011).


View of the central urban corridor developed along Fairfax Drive and Clarendon Boulevard in Arlington County, VA.

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The Silver Gardens Apartments in Albuquerque, NM, which provide homes for residents with a mix of incomes in a transit-accessible location, include energy-saving design features that make the apartments 40 percent more efficient than conventionally built counterparts.

## Increasingly Healthy Communities

Most people don't always think about the health impacts associated with how goods are transported and stored, but for communities near ports, large markets, and other distribution hubs that create heavy truck traffic, the consequences can be dire. Scientific studies from the National Institute for Occupational Safety and Health and from the Centers for Disease Control and Prevention, among others, have linked diesel exhaust to increased rates of respiratory illness, asthma attacks, heart attacks, strokes, and premature death, and in 2012 the World Health Organization found that there is sufficient evidence that diesel exhaust causes cancer (Loury 2012). Moving toward a Half the Oil future means reducing the harmful emissions and adverse health effects from our oil use while still being able to get goods where they need to go.

From coast to coast, oil-saving solutions are demonstrating public health benefits. For example, in 2010 the Pacific Northwest Pollution Prevention Resource Center, in partnership with a major trucking fleet in the region, received a federal grant to install more than 2,000 aerodynamic side-skirts on trailer trucks. In addition to saving 16 million gallons of diesel fuel over its lifetime, this project will also reduce emissions of particulate matter (PM)—a harmful type of pollution that can affect the heart and lungs and cause serious health effects—by nearly 25 tons (EPA 2013c; WCC 2010). These PM reductions will provide estimated public health benefits of between $7 million and $30 million in 2030 (EPA 2012a).

In the Northeast, the Hunts Point Truck/Trailer Electrification Project is addressing the emissions and public health concerns associated with idling trucks parked at New York City's Hunts Point Terminal Market—one of the largest produce and meat markets in the world (Hunts 2009). It is not uncommon for long-haul trucks at Hunts Point to idle their engines for 8 to 12 hours at a stretch in order to keep produce refrigerated. For each hour spent idling, a typical truck burns approximately one gallon of diesel fuel and emits pollutants that have been shown to contribute to premature mortality from bronchitis and respiratory illnesses, for example (EPA 2002). Similarly, asthma incidence in the Hunts Point neighborhood is alarmingly high. One out of every three children is afflicted with the disease, and Hunts Point has one of the highest asthma-related hospitalization rates in the country (NYCDPR 2003).

To help address this public health problem, the Electrification Project has installed electrical hookups at 28 parking bays, allowing truck drivers to power their onboard appliances and keep their perishable goods cold without running their engines. This project not only saves participating truck companies the cost of extensive idling but is also estimated to eliminate nearly 900 tons of pollutants each year (EPA 2003).

Such innovative programs illustrate how we can continue to transport goods while protecting our families and environment through higher efficiency and the use of advanced technology. Similar examples will only become more common as we continue to move toward a Half the Oil future.

# Half the Oil and Our Country

Today, the United States still faces the choice of whether to increase investment in clean transportation technology or remain with the status quo. Failing to act will cause us to fall behind as other nations build their economies around oil-saving solutions and seize the global clean-transportation market. We cannot afford to veer off the path to a Half the Oil future—the United States should be leading the way. The benefits to our country will be manifold.

## Powering American Employment

From the automobile and the airplane to the microchip and the Internet, the United States has long adopted a "can-do" attitude of aggressive technology development and implementation that has created millions of jobs and enormous wealth. Investments in the science and technology needed to reduce oil use provide our country with yet another opportunity to continue this trend. Just through investing in efficiency in cars and trucks, we can create as many as 1 million new U.S.-based jobs, many of which will be directly held by employees of the light- and heavy-duty vehicle and parts-manufacturing industries. Jobs will also be created as consumers spend less on gasoline and diesel and shift those dollars to buying goods and services in other parts of the economy, thereby stimulating employment, real wages, and state revenues. When compared with purchasing oil-based fuels, spending money in other sectors—such as retail, education, or construction—created as many as 16 times more jobs in 2012 (Figure 4) (BLS 2012; Roland-Holst 2012).

Increasing the efficiency of our cars and trucks is not the only way to create jobs while reducing oil use and cutting pollutant emissions. Ramping up the production of cellulosic biofuels made from nonfood crops, farm residues, and other waste products offers economic opportunities for numerous professions, including farmers who grow cellulosic materials, construction workers who build state-of-the-art refineries, and scientists and engineers who develop the science and technology to turn nonfood crops and diverse waste streams into fuel (UCS 2012f).

Companies across the country are building and starting operation at the first commercial-scale cellulosic biofuel refineries, and these facilities mean jobs. For example, the Indian River County BioEnergy Center in Florida, which will produce 8 million gallons of biofuels per year from renewable biomass such as yard, wood, and vegetative wastes, has created more than 380 direct and indirect jobs during construction and expects to employ 60 full-time staff members once the refinery is in operation (Ineos 2013; Ineos 2012). Abengoa Bioenergy is also finalizing a commercial-scale biorefinery that is expected to generate 300 jobs in nearby Hugoton, KS, a town of about 4,000 (Abengoa Bioenergy 2011; Wichita Business Journal 2011). And these plants are just the beginning. With additional facilities of this kind currently under construction (Figure 5, p. 8), the amount of cellulosic biofuel in the marketplace is expected to increase—and its price to decrease—as the industry gains experience operating at commercial scale (BNEF 2013).


**FIGURE 4. Job Intensity by Economic Sector**

By saving money on oil, consumers can spend more in other sectors of the economy that create more jobs. Source: BLS 2012.

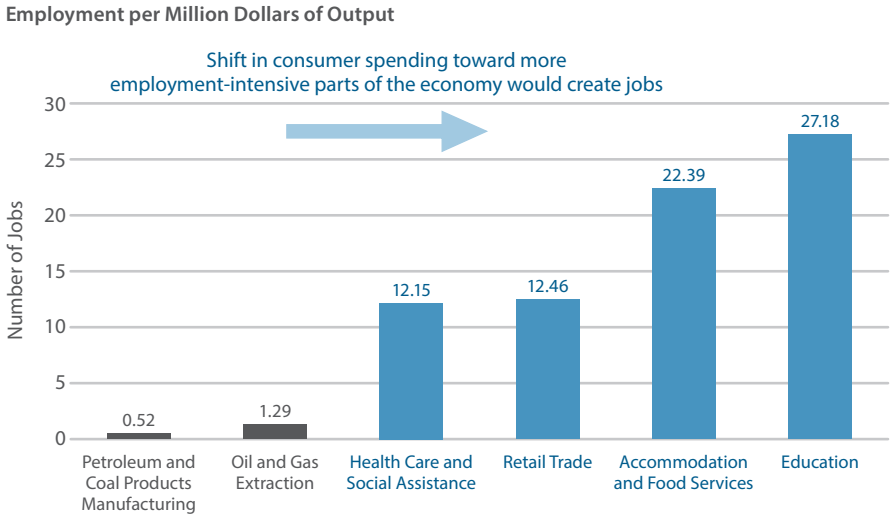
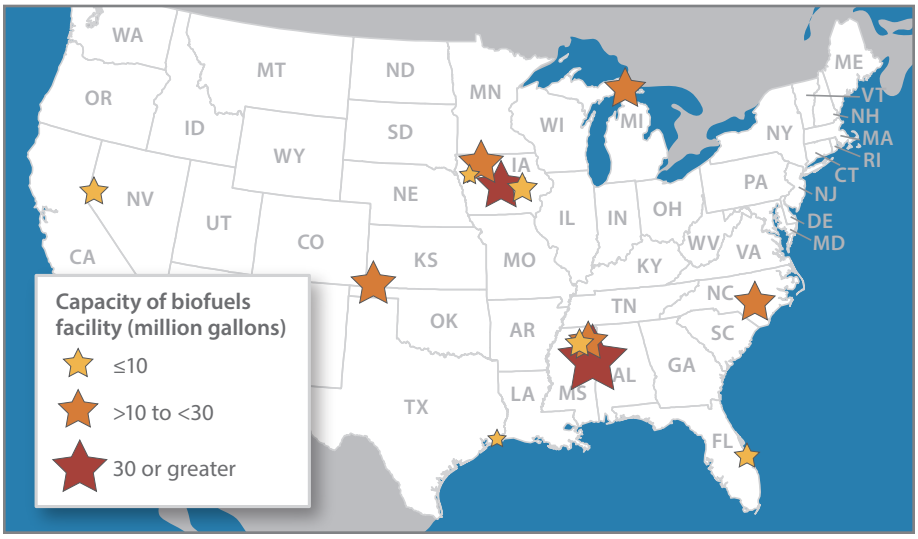


**FIGURE 5. Commercial-scale Cellulosic Biofuel Facilities**

Companies are opening commercial-scale biofuel facilities across the country, bringing low-carbon fuel and more jobs to our economy.




## Driving Down Global Warming Emissions

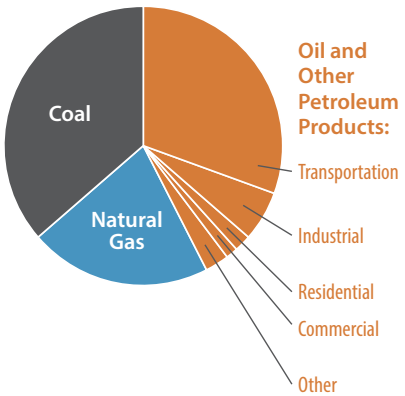
Our planet is warming—there is no longer any doubt about it in the scientific community—and it's clear that human activity is playing a significant part. Unchecked global warming causes an array of problems that range from extreme heat, droughts, and storms to acidifying oceans and rising sea levels. Recent studies have shown that these measurable impacts are occurring more quickly, and often more intensely, than was earlier projected (UCS 2012c).

Including the "cradle-to-grave" emissions caused by gasoline use—from the oil well all the way to burning it in our cars—the average American was responsible for about six metric tons of $CO_2$ emissions from a single vehicle in 2012 (EPA 2013a). That's approximately three times the car's weight in heat-trapping emissions, which the atmosphere would be far better without. Indeed, burning oil and other fossil fuel products is the largest source of carbon pollution in the United States (Figure 6) (EPA 2010). Reaching a Half the Oil future, however, means cutting global warming emissions by 2 billion metric tons per year.

To achieve this goal, we need not only to use less fuel but also to use cleaner fuel. And to accurately determine whether fuels such as biofuels and hydrogen achieve real reductions in emissions, they each must be evaluated on a life-cycle basis. This means examining the emissions caused directly or indirectly by the production, distribution, and use of each fuel, as was done above for gasoline. Cellulosic biofuels, for example, are an integral part of a Half the Oil future because on a life-cycle basis they have been shown to

**FIGURE 6. Sources of $CO_2$ Pollution in the United States**

By cutting oil use, we will reduce emissions from the largest source of U.S. $CO_2$ emissions. Source: EPA 2010.




*Cellulosic biofuels can cut $CO_2$ emissions by 164 million metric tons in 2035—or as much as the annual $CO_2$ emissions from the electricity used by more than 24 million of today's homes.*

reduce global warming emissions by as much as 90 percent compared with gasoline (UCS 2012f). Realizing the potential of cellulosic biofuels can cut $CO_2$ emissions by 164 million metric tons in 2035—or as much as the annual $CO_2$ emissions from the electricity used by more than 24 million of today's homes—without putting increased pressure on our food supply and global food markets (EPA 2013b).

Advanced vehicles can also significantly reduce driving-related emissions by using electricity as a "fuel" source. Although generating the electricity needed to charge EVs produces global warming emissions, the amounts of these emissions vary significantly with the mix of energy sources that power regional electricity grids (UCS 2012e). Regardless of where one lives, however, EVs are responsible for lower global warming emissions compared with the average gasoline-based vehicle sold today. Charging an EV in California, for example, achieves a 65 percent reduction in global warming emissions relative to a 27 mpg gasoline vehicle (UCS 2012e). And when powered by renewable resources, electric vehicles can nearly eliminate pollution from vehicle operation.[2] By investing in more renewables and retiring more coal plants over the next decade, electricity can increasingly be used as a transportation fuel and deliver substantial global warming benefits.

2 There are emissions associated with the manufacturing of advanced vehicles and their components (as with conventional vehicles).


The U.S. Navy has recognized the importance of reducing oil use and has begun testing a 50/50 blend of petroleum and an algae-derived biofuel on ships like this decommissioned destroyer.

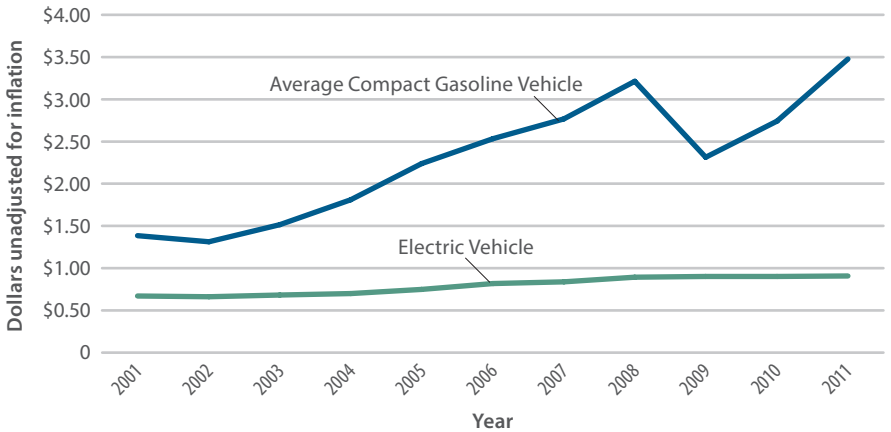
## Securing Our Future

A Half the Oil future is one in which, by using alternative energy sources not associated with the global oil market, we have an insurance policy against oil price shocks. According to the Energy Leadership Council, a group of former military officers and energy industry leaders, our oil use is one of the "greatest threats to U.S. national security, and it deeply undermines our ability to achieve an enduring period of American economic growth and prosperity" (SAFE 2012). Our oil use poses such a large security threat because the price of oil reacts to events in oil-producing and oil-consuming countries alike. As a result, changes in oil supply or demand *anywhere* tend to affect prices *everywhere*. For the U.S. economy, this volatility creates uncertainties that affect planning and budgetary decisions at the federal level and all the way down to the individual level.

By contrast, an energy source such as electricity can power a family's vehicle without subjecting its household finances to the unpredictable and inflationary nature of gasoline prices. While electricity prices do vary throughout the country, they are relatively stable—the average retail price of electricity rose less than three cents per kilowatt-hour from 2001 to 2011. Moreover, to travel the same distance as a similar conventional vehicle could go on a gallon of gasoline, the average cost for a fully electric vehicle increased from 67 cents to only 91 cents over the same period (Figure 7) (EIA 2013b). The average price of gasoline, on the other hand, more than doubled over that period—from $1.41 in January 2001 to $3.26 in December 2011—and can spike as much as 23 cents in a week (Baker 2013; EIA 2013c). Overall, driving on electricity is like paying one dollar for a gallon of gasoline, and as a result, EV owners can save $750 to $1,200 per year compared with the cost of operating the average compact gasoline vehicle (27 mpg) at a gasoline price of $3.50 per gallon (UCS 2012e). These savings are also coupled with the notion that future electricity rates are expected to maintain a significant cost advantage compared with gasoline (EIA 2013c).

**FIGURE 7. Gasoline vs. Electric: Cost to Drive 27 Miles**

Comparison assumes a 27 mpg gasoline vehicle (average compact fuel efficiency) and an electric vehicle efficiency of 0.34 kWh/mile (Nissan Leaf). Sources: EIA 2013a; EIA 2013b; EIA 2013c.




# Conclusion

The choice is clear. It is time to commit to a Half the Oil future, which will cut oil spending by $550 billion, create more than 1 million jobs, and eliminate some 2 billion metric tons of global warming emissions annually in 2035. Other countries are already moving in this direction, and we should do so too. We should even strive to *lead* the global effort. By doing so, we will reach a Half the Oil future, equip our transportation system to meet the challenges of the twenty-first century, and reap diverse benefits for ourselves, our communities, and our country.

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# Fueling a Better Future

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