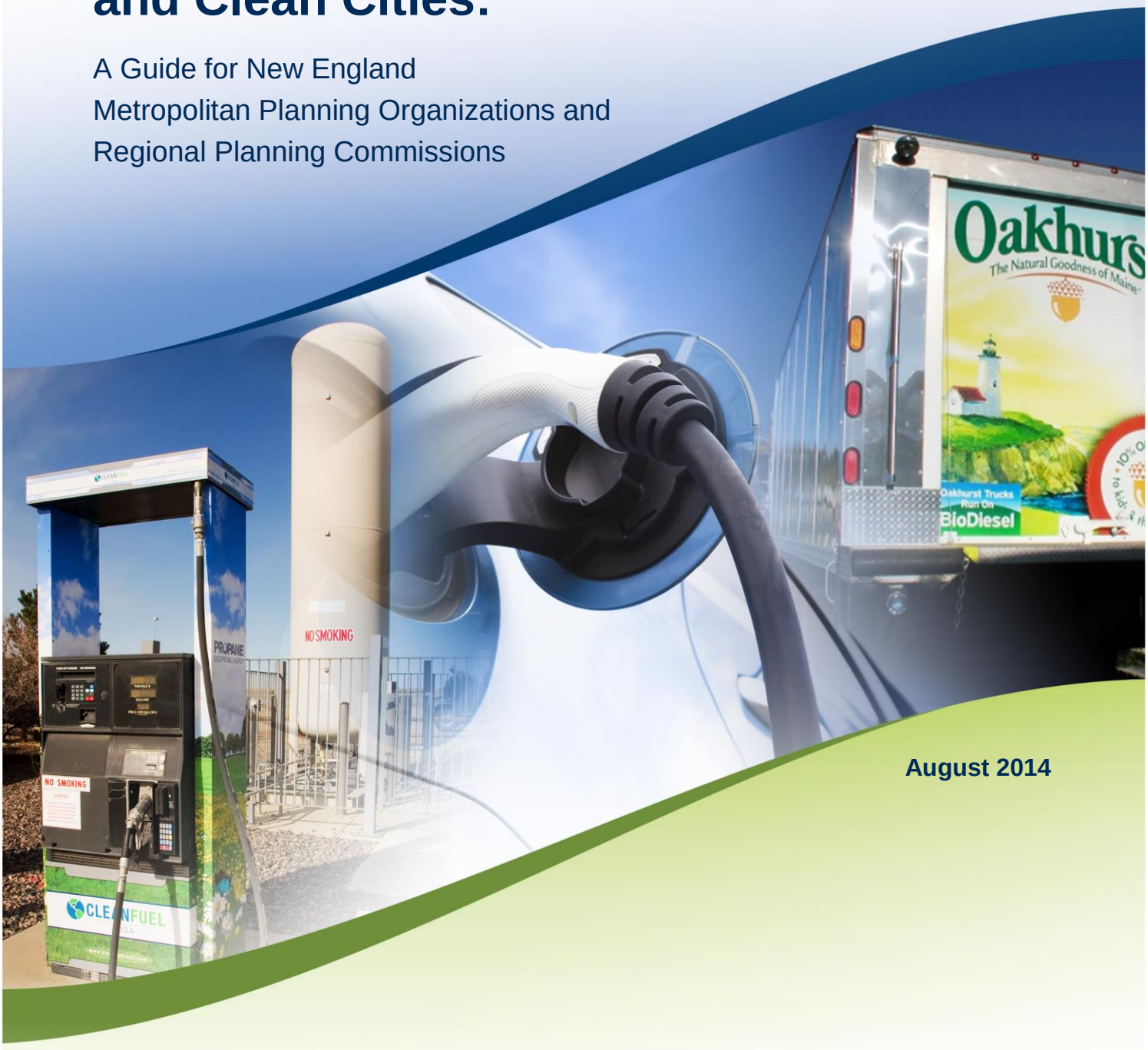
Alternative Fuels, Advanced Vehicles, and Clean Cities:

A Guide for New England
Metropolitan Planning Organizations and
Regional Planning Commissions



August 2014

Maine Clean Communities

Massachusetts Clean Cities

Vermont Clean Cities Coalition

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Introduction

As part of a U.S. Department of Energy (DOE) grant, Clean Cities coalitions in Maine, Massachusetts, and Vermont (along with partners in New Hampshire and Rhode Island) are executing a series of projects aimed at "Removing Barriers, Implementing Policies and Advancing Alternative Fuels Markets in New England." Understanding the importance of involving regional planning organizations in accomplishing Clean Cities' goals, the coalitions committed to work with these organizations as part of the U.S. DOE grant. Specifically, this effort intends to educate metropolitan planning organizations (MPOs) and regional planning commissions (RPCs) about alternative fuel vehicles and infrastructure opportunities.

The purpose of this document is to provide a compendium of information, tools, and resources about alternative fuels for MPOs and RPCs in New England. While you may read through this document in its entirety, it is designed so that you can refer back often with questions about alternative fuels and how you may incorporate them into your daily activities and organization planning. For instance, MPOs and RPCs should consider alternative fuels when:

- Developing short- and long-term **planning documents**, such as transportation improvement programs and long-range transportation plans;
- Considering internal and external **funding opportunities**, particularly vehicle replacement projects, with municipalities and transit organizations;
- Speaking with **stakeholders**, such as municipalities, regarding their vehicle and fueling options, and the associated investments;

What are Alternative Fuels?

Clean Cities follows the Energy Policy Act of 1992 definition of alternative fuels, which includes:

- *Pure methanol, ethanol, and other alcohols;*
- *Blends of 85% or more of alcohol with gasoline;*
- *Natural gas and liquid fuels domestically produced from natural gas;*
- *Liquefied petroleum gas (propane);*
- *Coal-derived liquid fuels;*
- *Hydrogen;*
- *Electricity;*
- *Pure biodiesel (B100);*
- *Fuels, other than alcohol, derived from biological materials; and*
- *P-Series fuels.*

U.S. DOE may designate other fuels as alternative fuels if the fuel is substantially non-petroleum, yields substantial energy security benefits, and offers substantial environmental benefits.

Worcester Regional Transit Authority battery electric transit bus. Photo courtesy of Massachusetts Clean Cities.

- Identifying **partners** for large projects, particularly if your local Clean Cities coalition can be of assistance; and

- Discussing new residential and commercial **development projects**, specifically if there is an opportunity for fueling infrastructure (e.g., electric vehicle supply equipment, or EVSE).

We encourage you to review this guide and contact your local Clean Cities coalition with additional questions.

Why Alternative Fuels?

Alternative fuels and vehicles offer a number of benefits for fleets and individual drivers, and can help MPOs and RPCs meet environmental and economic goals in the transportation sector.

Specifically, alternative fuels:

- *Are produced domestically (and locally), oftentimes from renewable resources;*
- *Reduce greenhouse gas (GHG) and/or criteria pollutant emissions;*
- *Create jobs through fuel production and vehicle manufacturing;*
- *Can save money if used in the right applications;*
- *Improve vehicle performance; and*
- *Provide fuel diversity and reliability in emergency situations.*

In addition to these benefits, some alternative fuels may present challenges in certain vehicle applications. For that reason, there is no one "silver bullet" for all applications and in all locations. Read on to learn more.

Your Local Clean Cities Coalitions

Clean Cities is a national initiative supported by U.S. DOE with the goal of reducing petroleum consumption in the transportation sector. Implemented by a national network of nearly 100 Clean Cities coalitions, the program brings together stakeholders in the public and private sectors to deploy alternative fuels, advanced vehicles, idle reduction technologies and measures, fuel economy improvements, and other emerging transportation technologies. The New England region is home to several Clean Cities coalitions, including those outlined below.

Maine Clean Communities

Founded in 1995, the Maine Clean Communities Coalition (MC^2) promotes clean fuel education, implementation, and project support throughout Maine. The coalition's 65+ stakeholders include members of state and local government, fleet managers, community organizations, and alternative fuel providers. Examples include Maine Standard Biofuels, the Maine Department of Environmental Protection, American Natural Gas, and the Conservation Law Foundation. Stakeholders meet biannually to discuss progress and share ideas about future projects. MC^2 is currently involved in expanding compressed natural gas (CNG) infrastructure and increasing the number of CNG fleets throughout the state, replicating the successes of school bus and METRO bus fleets in Portland. The coalition also encourages the installation of EVSE and projects that use solar-generated electricity to charge plug-in electric vehicles (PEVs). Recently, MC^2 received a grant from Central Maine Power for a two-year lease of a 100% electric Nissan Leaf. The coalition assisted with EVSE installations at a number of locations, and the vehicle has been shared with various municipal governments, many of whom are acquiring their own PEVs. MC^2 also supports fleets in the use of propane and biodiesel. MC^2 is located at the Greater Portland Council of Governments (GPCOG) and the GPCOG Board helps manage the coalition.

For more information, *visit the Maine Clean Communities Coalition website at* ***http://mainecleancommunities.gpcog.info/*** *or contact Steve Linnell at* ***slinnell@gpcog.org*** *or (207) 774-9891.*

Massachusetts Clean Cities

Since 1999, the Massachusetts Clean Cities Coalition has offered the training, assistance, and program support necessary to promote alternative transportation throughout the commonwealth. The coalition's 300+ stakeholders include government agencies, private businesses, universities, and non-profit organizations, including the Massachusetts Bay Transportation Authority (MBTA), the U.S. Environmental Protection Agency (EPA), National Grid, and the Sierra Club. Stakeholders meet every two months to discuss progress, learn about

upcoming opportunities, and exchange ideas about alternative fuel innovations. The coalition also provides technical support, safety training, and funding opportunities for alternative fuel projects. Massachusetts Clean Cities administers the Massachusetts Electric Vehicle Initiative (MEVI), which is a collaboration with the Massachusetts Department of Environmental Protection, Massachusetts Department of Public Utilities, Massachusetts Department of Transportation, Massachusetts Clean Energy Center, and Executive Office of Energy and Environmental Affairs. MEVI aims to increase deployment of battery, fuel cell, and plug-in hybrid electric vehicles across Massachusetts through increased incentives for consumers and infrastructure expansion. The coalition also leads the Massachusetts Offers Rebates for Electric Vehicles (MOR-EV) program. The MOR-EV program offers rebates of up to $2,500 to residents who lease or purchase a PEV. Lastly, Massachusetts Clean Cities is involved with the Clean Vehicle Project, an incentive program for fleets to replace 200 conventional fuel vehicles with natural gas, propane, battery electric, hybrid electric, and hydraulic hybrid vehicles. The coalition is housed in the Renewable Energy division of the Massachusetts Department of Energy Resources.

For more information, *visit the Massachusetts Clean Cities website at* ***http://www.mass.gov/eea/energy-utilities-clean-tech/alternative-transportation/clean-cities-coalition.html*** *or contact Steve Russell at* ***stephen.russell@state.ma.us*** *or (617) 626-7325.*

Vermont Clean Cities

Since 2001, the Vermont Clean Cities Coalition (VTCCC) has promoted the transition to alternative fuels throughout the state. With a five member advisory board and over 70 stakeholders, VTCCC represents a diverse array of decision makers and interested parties from both the public and private sectors. Examples of VTCCC's stakeholders include Casella Waste Systems, Vermont Gas, the University of Vermont, and the cities of Burlington and Winooski. Stakeholders receive access to resources like grant support and educational workshops, and make a commitment to reduce their own petroleum consumption. VTCCC is collaborating on projects with transportation providers and waste haulers to increase CNG infrastructure and vehicles statewide. The Coalition is also working closely with distributors like Bourne Energy to increase the availability and use of biodiesel and propane vehicle fuel. Additionally, VTCCC focuses on expanding access to EVSE throughout Vermont. The coalition is housed in the University of Vermont Transportation Research Center.

For more information, *visit the Vermont Clean Cities Coalition website at* ***http://uvm.edu/vtccc*** *or contact Michelle McCutcheon-Schour at* ***mmccutch@uvm.edu*** *or (802) 656- 9864.*

Northern Stars of New England

Know a fleet that should be recognized for their commitment to alternative fuels?

Northern Stars of New England is a recognition program for Northern New England Clean Cities' stakeholders that demonstrate a strong commitment to reducing their petroleum consumption. Benefits include marketing opportunities, access to and support from the Northern New England Clean Cities coalitions, use of the Northern Stars logo, and media outreach. To become a Northern Star, a fleet must be a stakeholder in at least one of the Northern New England Clean Cities coalitions, provide fleet petroleum reduction information for at least one Clean Cities coalition's Annual Report, utilize an alternative fuel in at least 30% of their fleet's vehicles, and demonstrate their commitment in the areas of Clean Cities support and external promotion of alternative fuels, vehicle purchasing, internal policies to reduce emissions, and expanding alternative fuel infrastructure. To learn more, visit ***http://vtccc.w3.uvm.edu/northern-stars-of-new-england/****.*

Alternative Fuel Basics

Biofuels

Biodiesel

Production and Use	• Produced from vegetable oils, used cooking oils, and animal fats • Blended at varying percentages with petroleum diesel • B20 (20% biodiesel, 80% petroleum diesel) is a common biodiesel blend in New England
Major Benefits	• Produced domestically, including in Maine, Massachusetts, and Vermont • Improves fuel lubricity and raises the cetane number of fuel • Significantly reduces air pollutants and GHG emissions • Environmentally friendly
Common Applications	• School and transit buses • Delivery vehicles • Refuse haulers • Long-haul trucks
New England Fleet Examples	• Oakhurst Dairy (Maine) • Boston Coach (Massachusetts) • State Line Farm (Vermont)
More Information	*Biodiesel Basics Fact Sheet* *Alternative Fuels Data Center (AFDC): Biodiesel*

Photo courtesy of MC^2.

Ethanol

Production and Use	• Produced by fermenting sugars from biomass, primarily corn, but also sugarcane and dedicated biomass crops such as switchgrass • Ethanol plants commonly produce multiple products, such as dried distillers grains, which are a high-value livestock feed • Blended at varying percentages with gasoline • 95% of U.S. gasoline contains up to 10% ethanol to boost octane and meet federal air quality requirements • E85 (51% to 83% ethanol) can be used in flexible fuel vehicles (FFVs)
Major Benefits	• Net positive energy production • Lower GHG and particulate pollution emissions • Job creation in rural areas • Able to use existing gasoline infrastructure if properly cleaned and meets certain engineering specifications • FFVs available in nearly 100 light-duty vehicle models at little to no extra cost
Common Applications	• Police vehicles • Municipal light-duty vehicles • Vans
New England Fleet Examples	• Green Passage Transportation (Massachusetts)
More Information	***Handbook for Handling, Storing, and Dispensing E85 and Other Ethanol-Gasoline Blends*** ***AFDC: Ethanol***

Photo credit: NREL Image Gallery #17138.

Electricity

Production and Use	• Most electricity in New England is produced from natural gas, nuclear energy, and coal at large base load facilities; distributed renewable energy comprises a small percentage of total generation • PEVs are charged by the electric grid through EVSE; hybrid electric vehicles (HEVs) are powered by an internal combustion engine (ICE) and an electric motor that uses energy stored in a battery, which is charged through regenerative braking • EVSE is available in certain public locations but also commonly used in residences • Fleets and consumers may choose between HEVs, plug-in hybrid electric vehicles (PHEVs), and all-electric vehicles (EVs)
Major Benefits	• Better fuel economy and lower fuel costs than conventional vehicles • Zero tailpipe emissions from EVs
Common Applications	• Light- and medium-duty fleet vehicles • Delivery trucks • School and transit buses
New England Fleet Examples	• Frito-Lay (Massachusetts) • Town of Winooski (Vermont)
More Information	***Hybrid and Plug-In Electric Vehicles*** ***AFDC: Electricity***

Photo courtesy of MC^2.

Hydrogen

Production and Use	• Produced from diverse, domestic resources including natural gas and biomass • Produced through natural gas reforming, electrolysis, gasification, renewable liquid reforming, or fermentation • Used in fuel cell electric vehicles, which employ electricity produced by a fuel cell powered by hydrogen
Major Benefits	• Produced domestically • Only tailpipe emission is water • Fuel cell drivetrains are about two or three times as efficient as ICEs
Common Applications	• Light-duty vehicles becoming commercially available in select markets • Transit buses
More Information	***AFDC: Hydrogen***

Photo courtesy of Massachusetts Clean Cities.

Natural Gas

Production and Use	• Conventional natural gas is extracted from gas and oil wells • Renewable natural gas is produced from decomposing organic matter from landfills, livestock operations, wastewater treatment facilities, or other sources • Distributed through an extensive, existing pipeline system • Available in compressed (CNG) or liquefied form (LNG) • Used in ***dedicated, dual-fuel, or bi-fuel*** natural gas vehicles (NGVs) from original equipment manufacturers (OEMs) or conversions
Major Benefits	• Abundant domestic resource • Nontoxic, noncorrosive, and noncarcinogenic • Lower particulate pollution and GHG emissions • Low and consistent fuel prices
Common Applications	• Passenger cars and light-duty trucks • Vans and shuttles • Refuse haulers • School and transit buses • Long-haul trucks
New England Fleet Examples	• Portland METRO (Maine) • National Grid (Massachusetts) • University of Vermont
More Information	***Natural Gas Basics*** ***AFDC: Natural Gas***

Photo courtesy of MC^2.

Propane

Production and Use	• Also known as liquefied petroleum gas (LPG) • Produced from liquid components recovered during natural gas and oil processing • Odorless, nontoxic hydrocarbon gas at normal pressures, but a liquid when pressurized • Used in dedicated or bi-fuel propane vehicles from OEMs or conversions
Major Benefits	• Produced domestically • Less expensive than gasoline, particularly for fleets with fuel contracts • Lower levels of air pollutants and GHG emissions than conventional vehicles • Reduced maintenance costs
Common Applications	• Vans • Pick-up trucks • School and shuttle buses
New England Fleet Examples	• Island Explorer, Bar Harbor (Maine) • Knight's Limousine Service (Massachusetts) • Proctor Propane (Vermont) • Schwan's
More Information	***Propane Basics Fact Sheet*** ***AFDC: Propane***

Photo courtesy of Vermont Clean Cities.

Top 10 Alternative Fuel Questions Answered

Are alternative fuel vehicles (AFVs) and infrastructure expensive?

Depending on the fuel, some AFVs and the associated infrastructure can be costly. However, the return on investment can be high and the payback period as little as two to three years. Before purchasing a vehicle or installing infrastructure, fleets should closely analyze their vehicle use and fueling patterns, and use available tools to determine the return on investment. In addition, fleets should look for ways to reduce costs through partnerships with others who will commit to use the infrastructure or split the initial investment. Individuals and fleets can also benefit from a variety of federal and state incentives in place for AFVs and the associated infrastructure.

The upfront cost for natural gas and propane vehicles and infrastructure can be quite high compared to the low cost of integrating biodiesel, ethanol, or electric drive vehicles in a fleet. For example, B20 can be used in many heavy-duty vehicles with little to no modifications and existing diesel tanks may hold biodiesel blends if they are properly cleaned. On the other hand, the incremental cost of a new NGV or the cost to convert an existing vehicle is high. That said, the fuel is significantly less expensive than diesel or gasoline, providing a favorable payback, particularly for high mileage fleets that can use existing fueling infrastructure.

The ***Clean Cities Alternative Fuel Price Report*** provides information on average fuel prices in the region on a quarterly basis. There are several AFDC tools available to determine if alternative fuel investments are right for a fleet. In particular, the Vehicle Cost Calculator, Petroleum Reduction Planning Tool (PREP), and AFLEET tool, all described in the Top 10 Alternative Fuel Tools section below, can be helpful in determining vehicle cost, return on investment, payback period, and annual costs over the lifetime of the vehicle.

A natural gas refuse truck. Photo courtesy of Vermont Clean Cities.

What incentives are available for alternative fuels, AFVs, and infrastructure?

To help mitigate the initial investment associated with alternative fuels and encourage adoption of new technologies, there are many federal, state, and local incentives in place. To determine what incentives are available in your area, see the AFDC Laws & Incentives database, described in the Top 10 Alternative Fuel Tools section below. Some examples of federal and New England state incentives are in the box on the following page.

Federal

Qualified Plug-In Electric Drive Motor Vehicle Tax Credit*: This federal tax credit is available for the purchase of new qualified PEVs. The credit amount ranges from $2,500 to $7,500, based on each vehicle's traction battery capacity and gross vehicle weight rating. The credit will begin to be phased out for each manufacturer in the second quarter following the calendar quarter in which a minimum of 200,000 qualified PEVs have been sold by that manufacturer for use in the United States. For more information, see the Internal Revenue Service (IRS)* ***Plug-In Electric Vehicle Credit*** *website and IRS Form 8936, which is available via the* ***IRS Forms and Publications*** *website.*

State and Local

Massachusetts Alternative Fuel Vehicle and Infrastructure Grants*: The Massachusetts Department of Energy Resources' Clean Vehicle Project offers grant funding for public and private fleets to purchase AFVs and infrastructure, as well as idle reduction technology. Eligible vehicles include those fueled by natural gas, propane, and electricity, including hybrid electric, solar electric, and hydraulic hybrid vehicles. Eligible infrastructure includes natural gas fueling stations and EVSE. For information about how to apply for funding, visit the* ***Massachusetts Clean Cities*** *website.*

Massachusetts PEV Rebates*: Massachusetts Department of Energy Resources' Massachusetts Offers Rebates for Electric Vehicles (MOR-EV) Program offers rebates of up to $2,500 to customers purchasing or leasing a PEV or zero-emission motorcycle. Rebates are only available to Massachusetts residents for vehicles registered in the commonwealth for a minimum of 36 months. For more information, including application and eligibility requirements, visit the* ***MOR-EV*** *website.*

Maine Biofuels Production Tax Credit*: A certified commercial biofuel producer is eligible for an income tax credit of $0.05 per gasoline gallon equivalent of biofuel produced for use in motor vehicles or otherwise used as a substitute for liquid fuels. Biofuel is defined as ethanol, biodiesel, hydrogen, methanol, or any other transportation fuel derived from agricultural crops or residues, or from forest products or byproducts. A taxpayer claiming this credit must receive a letter from the Maine Department of Environmental Protection that certifies the biofuels produced during the taxable year are eligible for the tax credit. For biofuels blended with petroleum or other non-biofuels, the credit is allowed only on the biofuels portion of that blend. Any portion of unused credits may be carried over for up to 10 taxable years.*

Vermont Natural Gas Tax Exemption*: Natural gas used to propel a motor vehicle is not subject to the state gasoline tax.*

Source: AFDC, ***Federal & State Laws & Incentives*** *search*

Are AFVs safe?

Yes, AFVs are just as safe as conventional vehicles. They must meet the Federal Motor Vehicle Safety Standards (FMVSS) and undergo the same rigorous safety testing as conventional vehicles sold in the United States. To help ensure the safety of AFVs and the associated infrastruture, the National Fire Protection Association (NFPA) and other organizations also have standards in place for alternative fuel vehicles and infrastructure. For more information, see the AFDC ***Codes and Standards*** page. The text box below includes several resources and examples of codes and standards.

In addition to safety codes and standards, there are a number of first responder trainings available for AFVs. One example is the National Alternative Fuels Training Consortium (NAFTC)'s ***First Responder Safety Training*** program. Your local Clean Cities coalition is also available to assist you in planning safety trainings for first responders and fleet personnel.

Example Safety Regulations and Standards

- *The National Highway Traffic Safety Administration regulates vehicle safety in the United States through the **Federal Motor Vehicle Safety Standards**.*
- ***NFPA 52: Vehicular Gaseous Fuel Systems Code** includes standards for CNG and LNG vehicles and fueling infrastructure. **NFPA 58: Liquefied Petroleum Gas Code** includes propane vehicle and equipment standards.*
- ***NFPA 30A: Code for Motor Fuel Dispensing Facilities and Repair Garages** includes standards for AFV maintenance facilities.*
- ***SAE International** has a variety of standards in place for PEVs, including SAE J-1766 (Recommended Practice for Electric and Hybrid Electric Vehicle Battery Systems Crash Integrity Testing) and J -2464 (Electric and Hybrid Electric Vehicle Rechargeable Energy Storage System Safety and Abuse Testing).*

Are alternative fuels beneficial to the environment, even when you consider the lifecycle emissions?

Yes, tailpipe and lifecycle (well-to-wheels) emissions of alternative fuels are generally lower than those of petroleum fuels, making these fuels beneficial to the environment. Highlights of each alternative fuel's emissions benefits are below. However, emissions can vary significantly based on fuel, vehicle type, and fuel source (or feedstock). Individual fleets and consumers may use the AFLEET, PREP, and AFDC Vehicle Cost Calculator tools described in the Top 10 Alternative Fuel Tools section to calculate their estimated emissions.

A Knight's Airport Limousine Service passenger van being fueled with propane. Photo courtesy of Massachusetts Clean Cities.

- **Biodiesel**: B100 use **reduces carbon dioxide emissions by more than 52% compared with petroleum diesel**. Biodiesel also decreases tailpipe emissions of particulate matter (PM), carbon monoxide (CO), and hydrocarbons (HC).[1]

- **Electric**: PEVs running solely on electricity have **no tailpipe emissions**. The lifecycle emissions of PEVs depend on the source of electricity, which can vary. AFDC's ***Emissions from Hybrid and Plug-In Electric Vehicles*** page allows you to calculate lifecycle vehicle emissions based on your location.

- **Ethanol**: On a lifecycle analysis basis, corn-based ethanol production and use **reduces GHGs by up to 52% compared to gasoline**. Cellulosic ethanol use could reduce GHGs by as much as 86%.[2] Ethanol also reduces emissions of harmful toxics, like benzene.

- **Natural Gas**: Based on the Argonne National Laboratory's (ANL) GREET model, natural gas **emits about 6% to 11% fewer GHG emissions than gasoline** on a lifecycle basis. In addition, CNG fuel systems are completely sealed, so they produce no evaporative emissions.[3]

- **Propane**: ANL's GREET model found that propane reduces GHGs by nearly 10%.[4]

- **Hydrogen**: Fuel cell vehicles have no harmful substances; their only emissions are water and warm air. Hydrogen can also be used to store excess electricity from renewable generation during off-peak periods.

Are alternative fuels suitable for cold weather climates and mountainous areas?

Yes, AFVs can operate without sacrificing performance in cold weather climates and mountainous areas. See the following question for examples of fleets that are operating AFVs in the New England climate and geography. Some fuels, such as biodiesel and ethanol, may benefit from seasonal blend variation to maximize performance in the winter months. Biodiesel, for example, has a freeze point about 20° to 30°F above petroleum diesel. To prevent gelling (freezing) during the winter, biodiesel can be blended with a higher percentage of petroleum diesel or a cold flow additive. For more information, see the National Renewable Energy Laboratory's (NREL) ***Biodiesel Handling and Use Guide***. In addition, E85 sold during colder months often contains lower levels of ethanol to ensure the vapor pressure necessary to start a vehicle in cold temperatures. For more information, see NREL's ***Handbook for Handling,***

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[1] *"Biodiesel Vehicle Emissions". AFDC. U.S. DOE. August 2013. Accessed August 11, 2014. http://www.afdc.energy.gov/vehicles/diesels_emissions.html*
[2] *ANL, Life-cycle Energy and Greenhouse Gas Emission Impacts of Different Corn Ethanol Plant Types, 2007. http://iopscience.iop.org/1748-9326/2/2/024001/pdf/erl7_2_024001.pdf*
[3] *"Natural Gas Vehicle Emissions". AFDC. U.S. DOE. November 2013. Accessed August 11, 2014. http://www.afdc.energy.gov/vehicles/natural_gas_emissions.html*
[4] *"Propane Vehicle Emissions". AFDC. U.S. DOE. November 2013. Accessed August 11, 2014. http://www.afdc.energy.gov/vehicles/propane_emissions.html*

Storing, and Dispensing E85 and Other Ethanol-Gasoline Blends. Finally, PEV batteries are affected by extreme temperatures. However, some manufacturers are incorporating battery heaters or other technology to improve efficiency in cold weather.

Where can I find fleets in my area or in a specific sector that are using alternative fuels?

For information on how others in your area are using alternative fuels and vehicles, see the AFDC Case Study database (described in the Top 10 Alternative Fuel Tools section below). Some examples are:

- ***Leadership Drives Alt Fuel Success at National Grid***: National Grid is a leader in alternative fuels use through its investment in NGVs, including vans, sedans, dump trucks, and crew trucks. They also have propane forklifts, HEVs, and EVs in their fleet.
- ***Maine Fleets Make Progress with Propane***: Several MC^2 stakeholders are running their fleets on propane to help safeguard the state's natural wonders. In 2011, the coalition displaced more than 180,000 gallons of petroleum through the use of propane vehicles.

In addition, this tool includes case studies from similar climates and geographies. For example, the ***City of Fort Collins, Colorado*** is using biodiesel, CNG, ethanol blends, PEVs, and HEVs in their fleet.

Additional local case study resources are available on the Clean Cities TV YouTube channel, including videos on ***State Line Farm Biodiesel*** and ***EVs in Vermont***.

What is involved in planning fueling infrastructure?

There are several things to consider when planning to install new alternative fueling infrastructure, such as financing, potential partners, and applicable safety codes and standards.

Refer to the AFDC Laws & Incentives database (see Top 10 Alternative Fuel Tools section below) to determine if incentives in your area may help subsidize alternative fueling equipment. In addition, Clean Cities (see Your Local Clean Cities Coalitions section above) can be a helpful resource when applying for grants and other funding opportunities. Clean Cities coalitions are also great partners when installing alternative fueling equipment. Other possible partners include your local fuel distributor, utility company, the manufacturer of the fueling equipment or fueling supplier, governing authority, and property owners or facility managers. These partners can help ensure that you are meeting all applicable safety requirements, codes, and standards needed to have a compliant alternative fueling station. In addition, by working with a fuel distributor, fleets may be able to install free or discounted infrastructure in exchange for a fuel volume commitment over time.

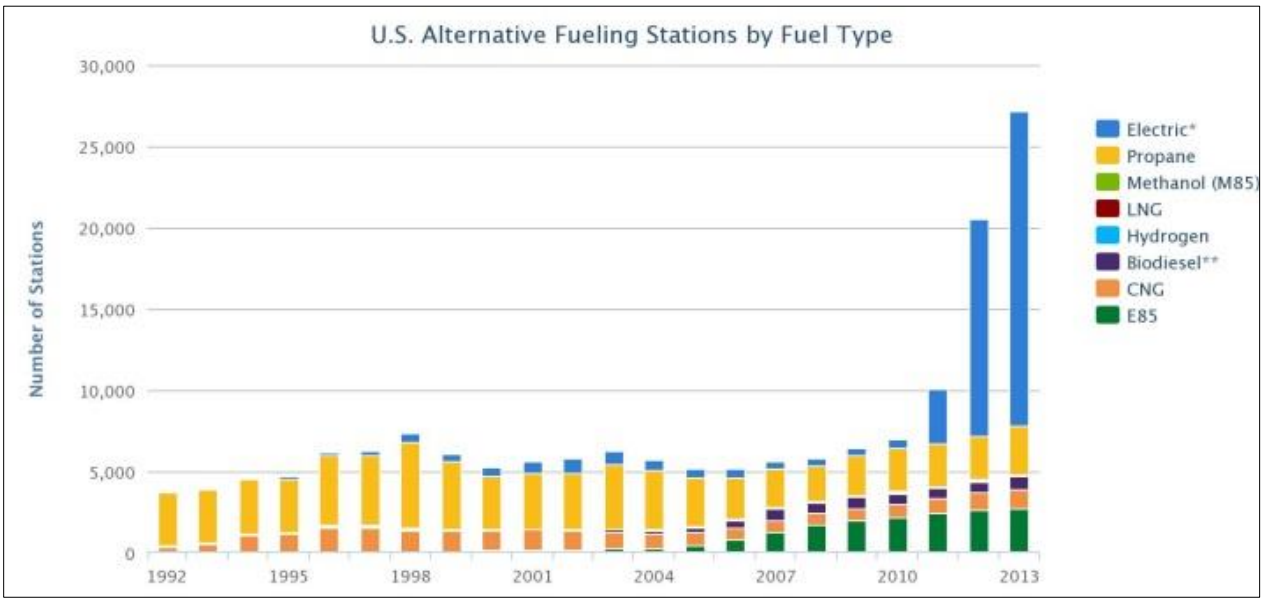
Several publications provide step-by-step instructions and guidelines for best practices for implementing alternative fueling stations. For example, NREL's ***Clean Cities Handbook for***

Handling, Storing, and Dispensing E85 and Other Ethanol-Gasoline Blends includes a checklist for installing E85 and E15 dispensing equipment. In addition, the Clean Cities Plug-In Electric Vehicle Handbooks for ***Public Charging Station Hosts*** and ***Workplace Charging Hosts*** provide outlines for implementation of public and workplace PEV charging.

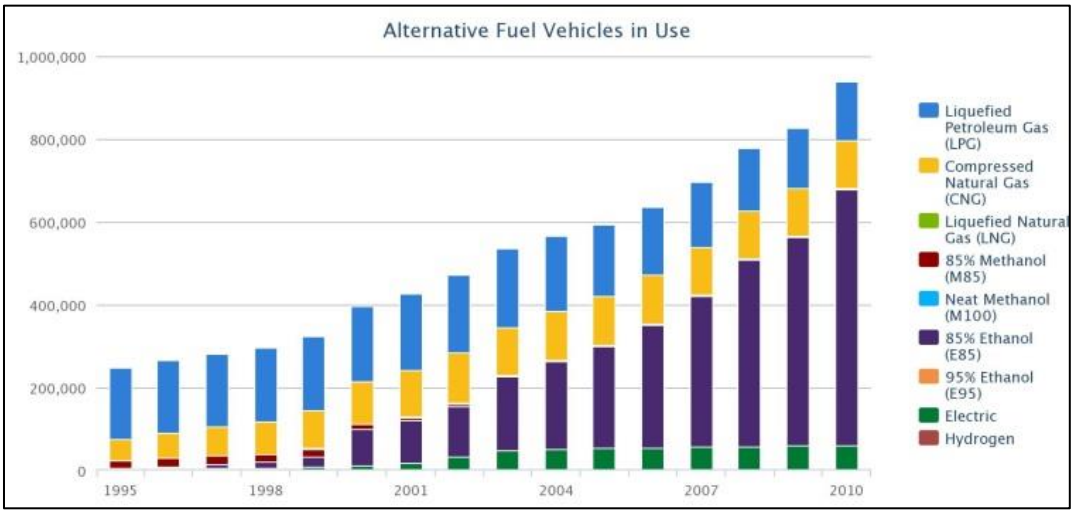
What are the current trends in alternative fuels?

In general, the number of alternative fuel stations, AFVs in use, and alternative fuel consumption have grown steadily in the last several years. The graphs below provide trend data over time. For information on the current trends in alternative fuels and vehicles, see the AFDC ***Maps & Data*** page. Some notable items include:

- The number of **biodiesel** fueling stations dipped between 2010 and 2011 due to changes in the federal tax incentives, but has been steadily increasing since.
- The amount **CNG and LNG** consumed in NGVs has steadily increased over the last 20 years.
- The number of **PEV** chargers increased dramatically over the last several years, following the 2010 introduction of PEVs by major automakers.
- **FFVs** continue to make up the largest share of the AFV market.
- The number of **propane** vehicles on the road has been relatively steady since 1995.



Source: AFDC, Maps & Data



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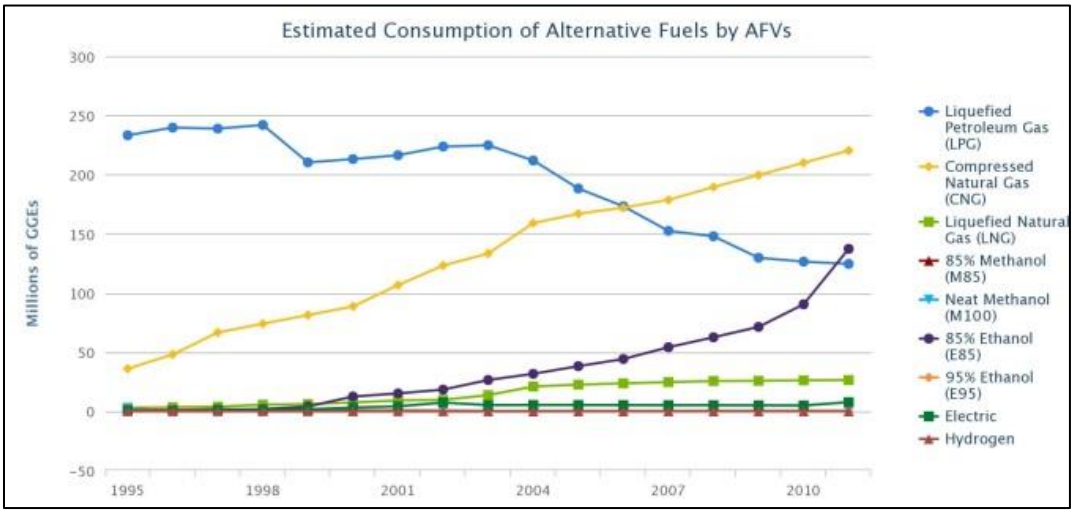
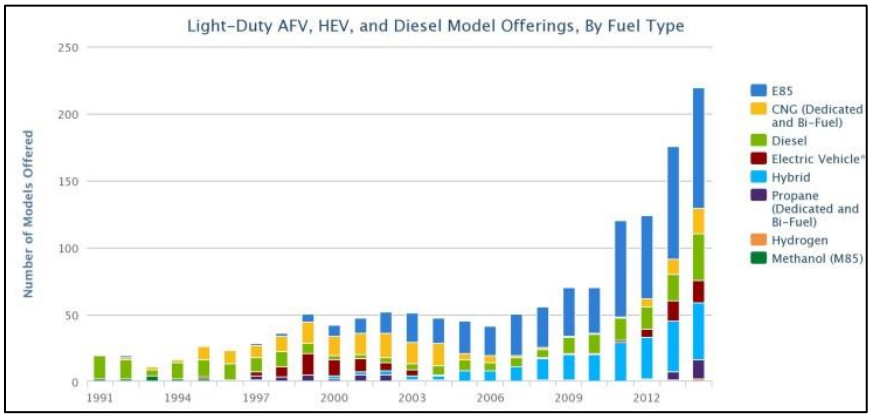


Source: AFDC, Maps & Data

What AFV models are available?

As of Model Year 2014, there were nearly 200 light-duty AFV models available from OEMs. This is in addition to numerous conversion technologies and medium- and heavy-duty offerings. For information on the available OEM AFV models, see the AFDC Vehicle Searches and Clean Cities Vehicle Guides (covered in Top 10 Alternative Fuel Tools below), which provide searchable tools, as well as comprehensive lists of light-, medium-, and heavy-duty AFV offerings by fuel and technology type. For a full list of vehicle conversions that are approved by U.S. EPA, please visit the U.S. EPA's ***Alternative Fuel Conversion*** website.

See the AFDC ***Maps & Data*** page for trend data, including the number of AFV and HEV model offerings by fuel type displayed in the graph on the following page.



What if I do not want to pursue alternative fuels? Are there other things I can be doing to reduce petroleum consumption?

Yes, there are many other ways to reduce petroleum consumption. Methods include:

- **Idle reduction**: Idle reduction describes technologies and activities that reduce unnecessary idle time. Idle reduction technologies are available for all vehicle classes, and many states have implemented incentives and regulations to help encourage idle reduction. For example, heavy-duty vehicles may benefit from on-board technology, such as auxiliary power units, and off-board technology, such as truck stop electrification.

- **Driver Behavior**: By making simple changes to their driving behaviors, fleet managers and drivers can improve vehicle efficiency, conserve fuel, save money, and reduce emissions. These include reducing hard breaking, combining trips, and reducing vehicle load.

- **Vehicle Maintenance:** By staying up-to-date on a vehicle's maintenance schedule, fleet managers and drivers conserve fuel. Specifically, proper tire inflation, using the manufacturer's recommended grade of motor oil, and completing regular engine tune-ups can improve vehicle fuel economy.

- **Parts and Equipment:** Equipment, such as low rolling resistance tires, trailer skirts, data collection devices, and speed control modules, can help fleet managers and drivers conserve fuel and maximize efficiency.

- **Fleet Rightsizing:** This management practice focuses on reducing the number of highly specialized, rarely used, or oversized vehicles in a fleet inventory.

- **Transportation System Efficiency:** Improvements to transportation systems that reduced the miles vehicles traveled can significantly reduce petroleum consumption. These include ridesharing, mass transit, active transit, multi-modal transportation, and telework.

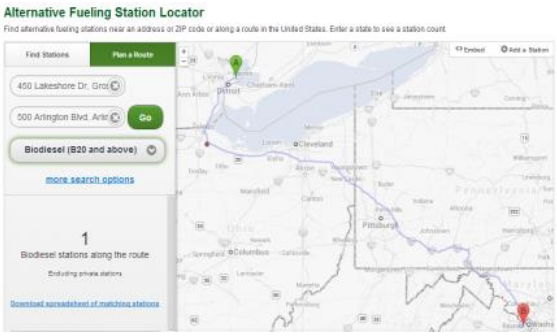
For detailed information on this topic, see the AFDC ***Conserve Fuel*** page.

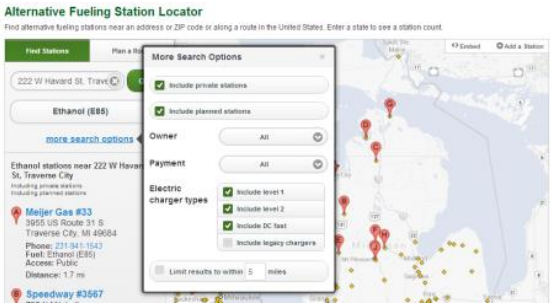
Top 10 Alternative Fuel Tools

AFDC Station Locator, *www.afdc.energy.gov/locator/stations/*

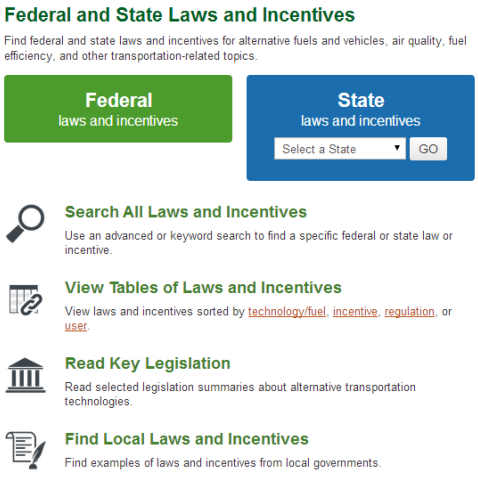
The AFDC Station Locator Tool allows users to locate alternative fueling stations near specified locations, identify fueling stations along a predetermined route, and view counts of the number of alternative fueling stations in the United States by fuel and state. You can select your station of interest for additional information including location, accessibility, payment methods accepted, and fuel-specific details. For example, CNG station information includes fill type, compression, and vehicle size limitations. The Station Locator is also available on a mobile webpage, as a smart phone app, and as a website widget.

Note that differences in methodologies and inclusion criteria may result in slight variations between NREL's database and those maintained by other organizations. NREL collaborates with alternative fuel industry groups, Clean Cities coalitions, fuel and infrastructure providers, and others to maintain the data.





AFDC Laws & Incentives Database, *www.afdc.energy.gov/laws*

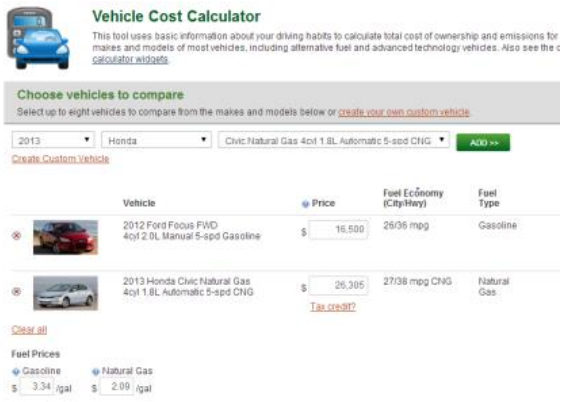


The AFDC Laws & Incentives database allows users to view state and federal laws and incentives related to alternative fuels and vehicles, air quality, vehicle efficiency, and other transportation-related topics. State-level information is updated annually after each state's legislative session ends. The database also includes an example local laws and incentives section.

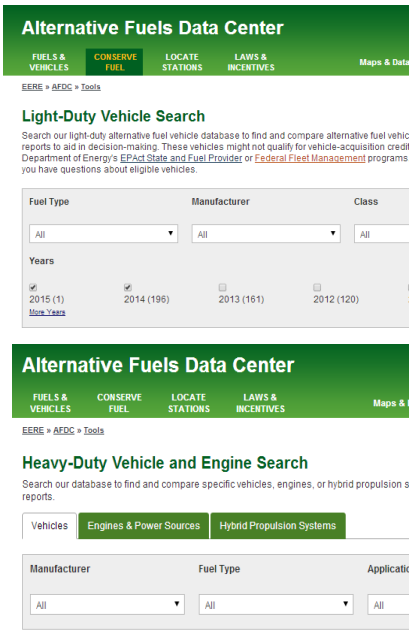
In addition, NREL maintains a list of useful points of contact for every state. Tangible and unique financial incentives that utilities and private organizations offer are also included on the website. Additional features include a Key Federal Legislation page, which summarizes the history of key legislative actions related to alternative fuels and advanced vehicles, as well as a Recent Federal Actions page, summarizing recent relevant federal rulemakings.

AFDC Vehicle Cost Calculator, *www.afdc.energy.gov/calc/*

The AFDC Vehicle Cost Calculator allows users to compare the cost of ownership and emissions for OEM vehicle models. This tool is also available on mobile devices and as a website widget. The first step in using this tool is choosing vehicles – you can either create a custom vehicle by entering a vehicle name, purchase price, fuel type, and fuel economy, or simply select vehicles from the drop down menu. The tool allows you to fill in specific information about the purchase price and fuel prices in their area or use the defaults. Next, you must tell the calculator how you use your car, including how often you drive, how far you drive, what percent of your driving is on the highway, and extra trips you take outside of normal daily use. If one of the vehicles chosen is capable of using an alternative fuel, you may enter in the percent driving time that you plan to use the alternative fuel. Results include annual operating costs and annual emissions, and are displayed as figures or graphs.



AFDC Vehicle Searches and Clean Cities Vehicle Guides, *www.afdc.energy.gov/vehicles/search/light/, www.afdc.energy.gov/vehicles/search/heavy, http://www.afdc.energy.gov/publications/*

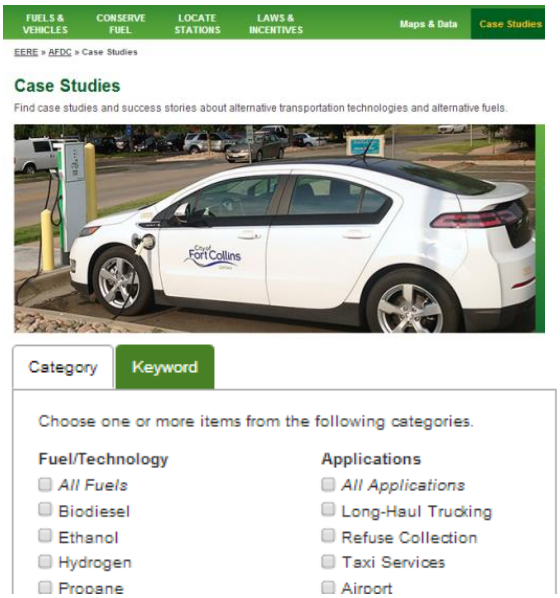


Clean Cities has a number of tools available to find a vehicle model for your specific fuel and application. The AFDC Light-Duty Vehicle Search allows users to search by fuel type, manufacturer, class, and model year, while the Heavy-Duty Vehicle and Engine Search allows users to search by manufacturer, fuel type, and application for vehicles, engines and power sources, and hybrid propulsion systems. Both of these tools allow you to conduct a side-by-side comparison between vehicles.

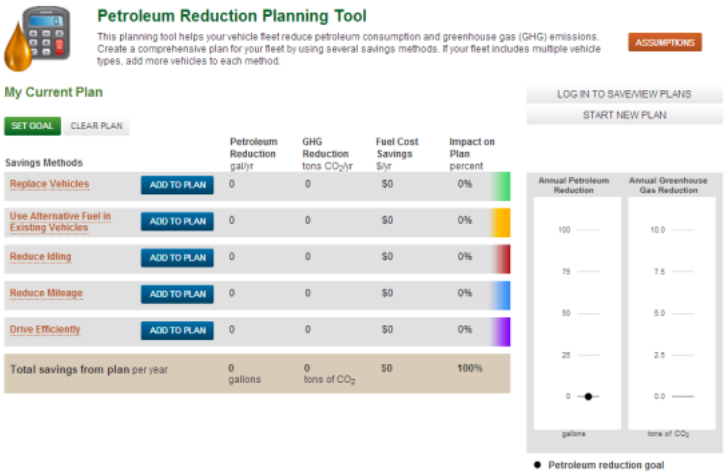
Additionally, the Clean Cities Vehicle Buyer's Guide and Clean Cities Guide to Alternative Fuel and Advanced Medium- and Heavy-Duty Vehicles are released annually and include a full listing of natural gas, propane, electric drive, FFV, and diesel (biodiesel) vehicles for the appropriate model year. For the most recent guides, refer to the AFDC ***Publications*** search.

AFDC Case Studies Search, *http://www.afdc.energy.gov/case*

The AFDC Case Studies tool allows users to search quickly and easily for success stories about alternative transportation technologies and alternative fuels. To identify case studies related to the fuel or technology and application you are interested in, simply select the appropriate fuel or technology and application or search by keyword. Results may include both web stories and videos. Case studies listed in this database often include the names and contact information for Clean Cities coordinators who assisted with the project or the fleet manager involved, which can be helpful if you need assistance with a project.



AFDC Petroleum Reduction Planning Tool (PREP), *www.afdc.energy.gov/prep/*



The AFDC PREP Tool allows users to determine the fuel savings and emissions reductions achieved by replacing or converting vehicles, as well as using alternative fuels in current fleet vehicles, idle reduction technologies, mileage reductions, and efficient driving practices.

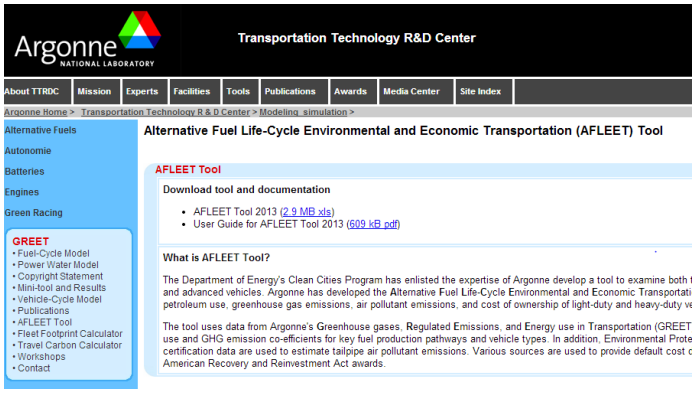
The main purpose of the tool is to help fleets achieve a pre-determined petroleum or emissions reduction goal by calculating how different savings methods will contribute to reaching the goal. Once you have input fleet data, the tool provides information on how successful each method is in helping you reach the stated goal. Results are displayed as petroleum reduction (gallons), GHG reduction (tons of carbon dioxide), fuel cost savings (dollars), and impact on plan progress (percent).

IdleBox, *www1.eere.energy.gov/cleancities/toolbox/idlebox.html*

The Clean Cities IdleBox Toolkit for Idle Reduction Projects is a compendium of print products, templates, presentations, and informational resources to assist with idle reduction projects. Many of the materials are available in two versions: ready-to-use print products and customizable templates.

IdleBox tools can be used to educate and engage policymakers, fleet managers, drivers, and other decision makers about the benefits of reducing idling. It covers engine idling laws and ordinances and information on how to organize an idle reduction campaign for outside organizations.

ANL's AFLEET Tool, *greet.es.anl.gov/afleet_tool*



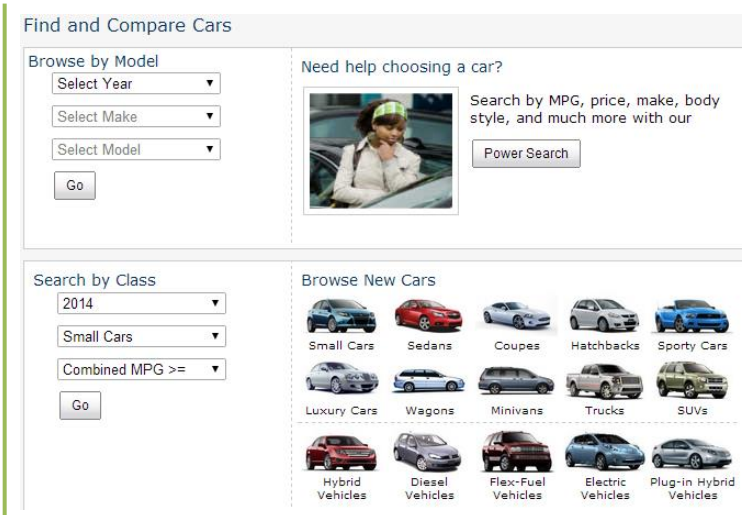
AFLEET analyzes the environmental and economic costs and benefits of alternative fuels and advanced vehicles. Using simple spreadsheet inputs, it can help fleets estimate petroleum use, GHG and air pollutant emissions, and cost of ownership of light-, medium-, and heavy-duty vehicles.

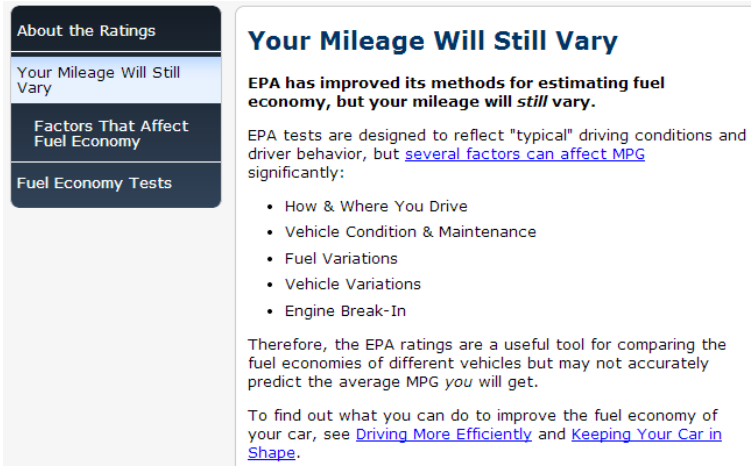
To use the AFLEET tool, you first need to update the Inputs tab with your state, vehicle type(s), and number of vehicles. You can also update the vehicle fuel economy and purchase price inputs to get a more accurate picture of a specific fleet, but default numbers can be used if exact fuel economy and pricing is not available. The subsequent tabs will then include information on vehicle payback, total cost of ownership, and environmental footprint in numerical and graphical format.

FuelEconomy.gov, *www.fueleconomy.gov/*

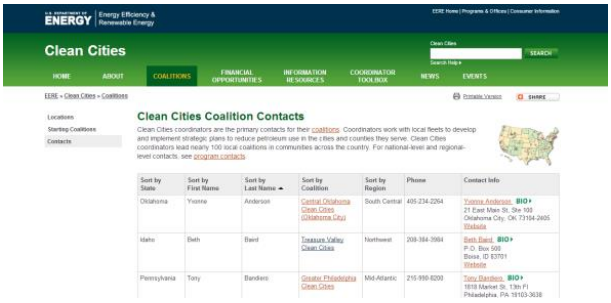
FuelEconomy.gov provides information on the fuel economy of light-duty vehicle models from 1984 to present. To view the fuel economy of a vehicle, you can either select a vehicle model through the “Find a Car” drop down search or select “Compare Side-by-Side” under the Find a Car tab. The advantage of the Compare Side-by-Side option is that you can compare the fuel economy of two vehicles with the same or different fuel types, including PEVs, FFVs, and conventional vehicles. The “Fuel Economy” tab within individual vehicle record shows the approximate annual fuel cost, cost and fuel needed to drive 25 miles, and when the data is available, tank size. The “Environment” tab allows you to view the energy impact score, as well as the vehicle’s GHG emissions.

Other great resources on FuelEconomy.gov include information on how vehicles are tested for fuel economy and how your mileage will vary from that estimate. You will also find lists of the vehicles with the best and worst fuel economy.





Your Local Clean Cities Coalition, *www.afdc.energy.gov/cleancities/coalitions/coalition_contacts.php*



Clean Cities coordinators are an excellent source of information on alternative fuels and advanced vehicles, as well as on funding and other opportunities, right here in New England and around the country. To contact the coordinator closest to you, see the Your Local Clean Cities Coalitions section above or search the Clean Cities Coalition Contacts website by state.

Prepared by ICF International under contract with the
Massachusetts Department of Energy Resources