

SELECTING YOUR VEHICLES:

the right fuel for the job



How to select the best vehicles
for your fleet



“Along with vehicle automany and connected car data, vehicle fuelling is set to be the biggest technologic shift for fleets. picking the right fuel type for each vehicle has a big impact of total life costs, so having the tools and knowledge to help make informed decisions is vital.”

Brendan Adams

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Fleet fueling: where do I start?

Before you get into the daily process of managing your fleet, you will have to take steps to select and procure the vehicles you need to help fulfil your tasks ...and there's a lot to consider.

When it comes to deciding what vehicles to use in your fleet, one of the first decisions you will need to make is how these vehicles will be powered.

The drive to develop and utilize more sustainable and cost-effective

vehicles has led to more choices than ever before when it comes to engine and drivetrain options, including:

- Gasoline
- Diesel
- Alternative fuels
- Alternative technologies

This guide provides an overview of the many different fuel types available to fleets, and aims to help you assess what's most beneficial for your operation.



The importance of informed fuel type selection:

While there's no simple or single answer to the question of what fuel type to use in your fleet, a comprehensive selection strategy can help you make a much more informed choice.

When it comes to vehicle selection, careful consideration of fuel type can help you:

1 Improve your fuel economy

Your fleet's fuel consumption can vary substantially depending how and where your vehicles are driven. You may find a vehicle that performs well in one territory or terrain may perform to a completely different level in another. By assessing your operations, considering how different fuel types will help you meet your requirements and selecting vehicles based on your identified needs, you can start to improve your overall fuel economy.

2 Curb your emissions

Fleets are under increasing pressure to be more environmentally-friendly, so taking steps

to measure and reduce your fleet's emissions, through proactive selection of fuel type, can be a good way to show you are serious about sustainability.

3 Comply with legislation

Over recent years some cities have announced initiatives to encourage or discourage various fuel types or vehicles based on their environmental performance, so it's important to understand how the types of fuel that work best for your operation fit in with current and future government-led initiatives.

4 Claim money back

As mentioned, using vehicles with lower emissions can sometimes help you meet regulatory clean air requirements. You may even be able to take advantage of associated subsidies and other incentives designed to encourage the use of specific fuel types.

5 Cut total cost of ownership (TCO)

The initial cost of a vehicle may vary substantially depending on its fuel type or drivetrain, and you may find that certain types of systems, while higher in price, are less costly over their lifecycle. Similarly, certain types of vehicles will retain their value better when it comes to disposal.

The best strategy of assessing how much a vehicle will cost you throughout the period you own/operate it is to adopt a Total Cost of Ownership (TCO) model, assessing all of your anticipated real-world costs and expenses, from insurance to maintenance, fuel costs and beyond.

You could find that the costs, usage and availability of different fuel types could have a big impact on your TCO.

You'll find more on this subject at the end of this guide.

FUEL TYPES: THE FACTS

Let's look at some of the types of fuel currently available for autos and commercial vehicles, and assess some of their pros and cons:



Diesel:

Diesel-powered passenger cars and light trucks are not used as widely in North America's light vehicle market, though diesel is one of the most popular choices for medium and heavy-duty vocational trucks. Around 90% of U.S. freight tonnage is moved by diesel-powered vehicles .

In the past, diesel was often considered a 'dirty' fuel choice due to the fact that it tends to emit higher amounts of NOx and particulate matter (PM), however, new standards and technologies have helped address this issue and new diesel vehicles are now much more environmentally-friendly than their predecessors.

Undoubtedly, diesel's previous bad reputation has impacted on purchasing trends and market availability – diesel

cars, SUVs and light trucks are certainly less commonplace than gas. There are, however, some signs of increasing accessibility in the light vehicle market, with almost 40 new clean diesel car, truck and SUV models released in 2016 . When it comes to cost, initial spending tends to be higher. The purchase cost for diesel vehicles is greater and so too is the cost of fuel due to lower demand and higher excise tax.

The reason diesel offers better fuel economy than gas is that it has a higher power-to-weight ratio and energy density. Diesel contains around 10-15% more energy than gas, meaning that diesel vehicles can often travel further on the same amount of fuel, particularly on highways journeys.

In fact, diesel cars achieve 20%-40% more MPG than gas equivalents, according to the Diesel Technology Forum.

Diesels do, however, retain value better and typically have lower depreciation rates and repair costs, coupled with

higher fuel efficiency. The combination of these factors means it's possible that a diesel vehicle may in fact offer you a lower TCO.

The Good	The Bad	Ideal for..
<ul style="list-style-type: none"> • Greater fuel efficiency than gasoline equivalent – particularly on highway journeys • High torque at low-speed, compared to gas • Lower CO2 emissions than gas 	<ul style="list-style-type: none"> • Vehicle purchase price tends to be more expensive than gas • Pump prices tend to be higher • Traditionally higher NOx and PM emissions • Less pump availability than gas 	<ul style="list-style-type: none"> • Long journeys • Highway use



Biodiesel:

The proportion of fleet vehicles running on biodiesel is substantially lower than gas or diesel. It's estimated that more than 25,000 American fleet vehicles run on biodiesel blends ; which equates to less than 6% of the entire US fleet market .

This renewable fuel can be used either in pure form (B100) or as a blend with petroleum diesel, depending on OEM recommendations. It can often be used in diesel vehicles with minimal or no need for modification .

“All major OEMs selling diesel equipment in the U.S. support at least B5 and lower blends, provided they are made with biodiesel meeting ASTM D 6751. In addition, more than

78 percent of the diesel vehicles coming off production lines today are approved for use with B20 ” – Biodiesel.org

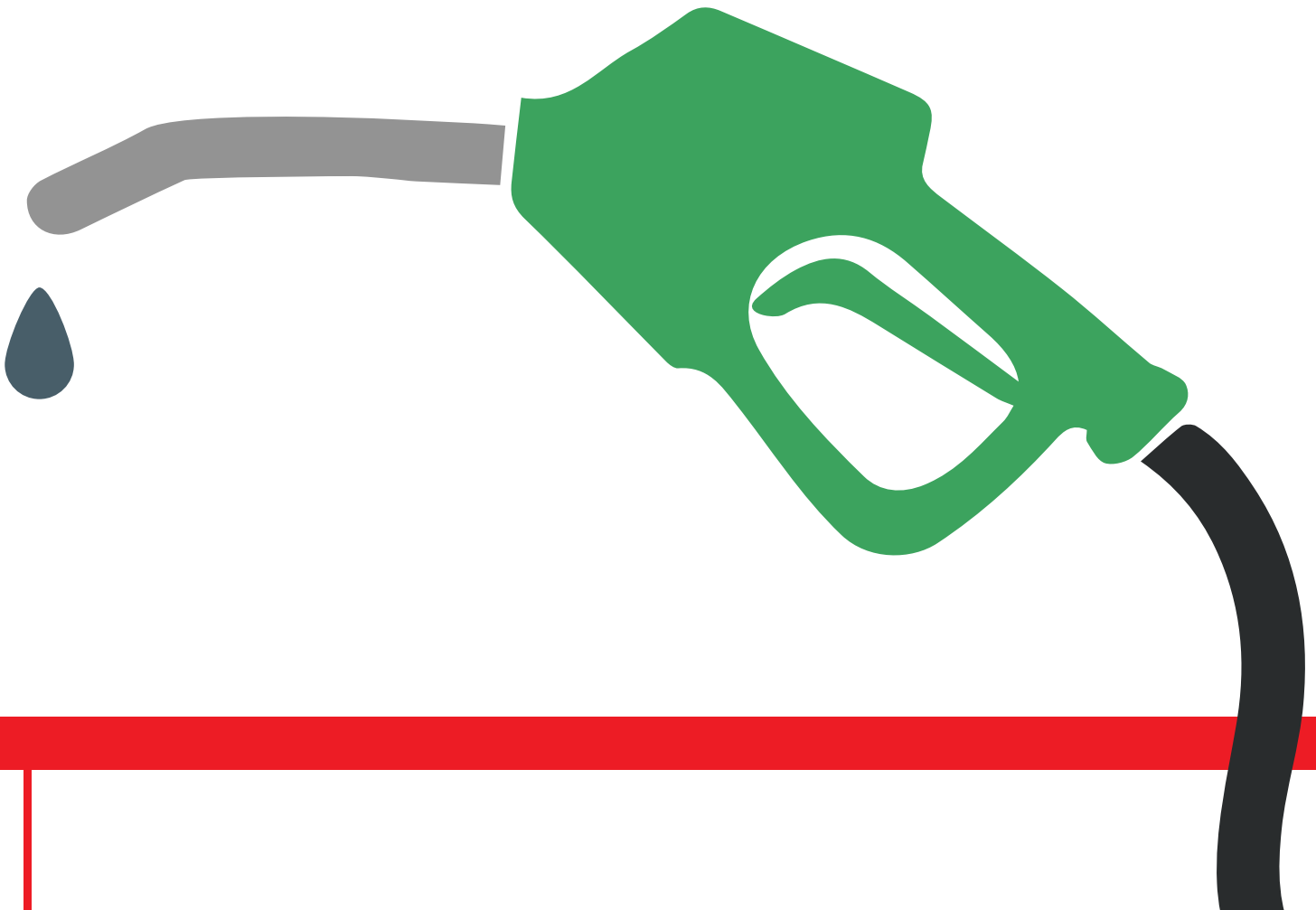
In terms of power and performance, pure biodiesel and petroleum biodiesel blends provide comparable horsepower, torque and fuel efficiency to diesel.

One of the most important benefits of biofuel is that it is very clean burning. If you're focused on reducing your greenhouse gas emissions, you may find biodiesel appealing due to the fact it emits less CO2 than both gas and petroleum diesel; in fact, it's estimated that one metric ton of CO2 emissions is saved per every 100 gallons of biodiesel compared

to regular diesel . Vehicles running on the fuel also emit less PM and sulfates. NOx emissions, however, remain higher. At the pump, the price per gallon of biodiesel tends to be similar to diesel , but again more expensive than gasoline,

ruling out the possibility of savings in this area. Pump availability, however, is lower, meaning that increased route and fueling planning might be needed.

The Good	The Bad	Ideal for...
<ul style="list-style-type: none"> • Greater fuel efficiency than gasoline – particularly on highway journeys • Reduced CO2, PM and sulfate emissions • High torque at low-speed, compared to gasoline equivalent 	<ul style="list-style-type: none"> • Pump prices tend to be higher than gasoline • Less pump availability 	<ul style="list-style-type: none"> • Long journeys and highway use (with pre-planned refueling)





Gasoline:

For much of North America, gasoline continues to be the clear fuel of choice: More than 95% of U.S. passenger cars and light trucks run on gas.

In terms of initial costs, gas-powered vehicles are often the least expensive option to purchase outright.

Gas also tends to be less costly at the pump, due to factors such as lower global demand and federal excise tax.

When it comes to availability, gasoline also continues to be far more widely-available on highways than any other fuel type in North America.

So why wouldn't you choose gas?

Well, one of the main reasons is related to emissions and fuel efficiency.

While gasoline vehicles tend to emit low NOx emissions, they emit some 15% more CO2 than their diesel counterparts – and this is identified as a key contributor to climate change.

While the initial purchase cost of a gas-fueled vehicle is often lower than diesel or alternative-fueled models, the price at disposal also tends to be lower.


Add potentially higher costs for depreciation and other factors, and it's possible that the total cost of ownership (TCO) might swing in favor of another fuel type.

The Good	The Bad	Ideal for...
<ul style="list-style-type: none"> Easily available at pumps Tends to be cheaper than diesel Low initial vehicle purchase costs Lower NOx emissions than diesel 	<ul style="list-style-type: none"> Higher CO2 emissions Tend to have lower fuel-efficiency than diesel 	<ul style="list-style-type: none"> Short regular journeys



THE ELECTRIC MOVEMENT

Electric:

 Electric vehicles (EVs) run 100% on electricity supplied from a rechargeable battery pack, and provide a quiet, clean form of transport with a complete absence of tailpipe emissions.

As a fairly new addition to the automotive and truck marketplace, there are a number of pros and cons to using these types of vehicles in your fleet.

In terms of benefits, their low emissions make them a strong contender for town and city driving, where charges or bans might apply for vehicles emitting harmful pollutants.

EVs also have very low 'refueling' costs compared to more conventional vehicles, and it has been said that the cost-per-mile to

fuel an EV represents approximately one-third to one-quarter the cost of petroleum fuels . While the true difference in costs will depend on a number of factors – including electricity prices and the price of fuel at the pump – it's clear that the comparatively low cost of charging EVs provides significant potential for reducing your fuel expenditure, not least when you consider that conventional fuel represents around 33% of the average fleet's costs.

EVs also require less servicing and maintenance than vehicles with internal combustion engines, and some studies have calculated 33%-50% reductions in maintenance costs for every mile travelled in an EV when compared to an internal combustion vehicle.

Despite their potential for emission and fuel



savings, it has taken a long time for electric vehicles (EVs) to start making real headway in fleets, however, there are signs that their popularity may be on the increase.

But despite the upward trend in popularity, overall EV sales figures remain low in comparison to fossil-fueled vehicles. There is also smaller model range and availability, the initial purchase price of many EVs remains higher than fossil-fueled equivalents and the immaturity of the market makes it hard to gauge depreciation and value at disposal. With all this in mind, identifying the TCO for EVs in your fleet can be a challenge.

Moreover, driving range tends to be limited compared to conventional vehicles – and this means that longer journeys will require more recharging stops. EV charging stations are less common than fuel pumps, though there are a

number of websites and apps designed to help locate stations and support routing. Plus, an EV battery pack can take between 4 and 8 hours to charge fully, though ‘rapid’ charge points can provide an 80% charge in 30 minutes .

It’s worth noting that research is underway on how to solve charging and range woes and electric ranges (miles between charges) are often growing as new models enter the market. For now, it seems that EVs are ideal for use on short journeys and for driving in urban areas, but less well suited for longer journeys unless the driver has a solid recharging plan and time to do so.

As of 2017, it’s worth noting that EV technology is still very much under development, with potential for further improvements.

The Good	The Bad	Ideal for...
<ul style="list-style-type: none"> • Cheaper to 'fill-up' than conventionally-fueled vehicles • Fuel cost not driven by oil prices • Negligible tailpipe emissions • Reduced 'wear and tear' costs • No noise pollution • Financial incentives may be available 	<ul style="list-style-type: none"> • High initial cost • Limited comparable mileage per journey • Limited makes and models available • Longer 'fueling' time • More powerful models can be costly • Lower servicing/maintenance costs • Young market means uncertain disposal values 	<ul style="list-style-type: none"> • Short journeys • Town and city driving • Longer journeys allowing recharge time

Hybrid:

A hybrid vehicle is one that is capable of utilizing a conventional fuel engine as well as electric battery power. In April 2016, hybrid electric vehicles accounted for 36% of the 11million+ hybrids sold worldwide, and the US ranks as the world's second largest hybrid market after Japan, with over 4 million sales.

There are several main types of hybrid vehicles:

- Hybrid Electric Vehicles (HEVs)
- Plug-In Hybrid Electric Vehicles (PHEVs)
- Hydraulic Hybrid Vehicles

HEVs capture energy for their batteries through regenerative braking and the internal combustion engine, and PHEVs can also use charging points.

PHEVs can also run purely on electricity – making them a good choice for drivers regularly operating in and out of urban areas.

Hydraulic hybrid systems incorporate a hydraulic pump and a lightweight accumulator to brake the vehicle and then send that braking energy to hydraulic accumulators, where the energy is stored and used to provide power to the wheels and increase acceleration power.

The aim of hybrids is to get the best of both worlds when it comes to conventional or electric drivetrains. By selectively utilizing either of the above, these vehicles can achieve reduced emissions, higher fuel economy and provide power as required.

This makes them particularly suited to adaptive driving.

In comparison to conventional fuel equivalents (i.e. gasoline and diesel) hybrids improve fuel economy by around 20%-25% and cut emissions between 25-35% in average driving conditions .

In terms of initial purchase price, new hybrids tend to be more expensive than

conventional vehicles but maintenance tends to be less frequent and this can reduce downtime and associated costs.

Some hybrids, like EVs, may benefit from some government-led financial incentives. You can view some personal and business incentives here:

<https://pluginaustralia.org/why-go-plug-in/state-federal-incentives/>

The Good	The Bad	Ideal for...
<ul style="list-style-type: none"> • Cheaper to 'fill-up' than conventionally-fueled vehicles • Fuel cost not driven by oil prices • Negligible tailpipe emissions • Reduced 'wear and tear' costs • No noise pollution • Financial incentives may be available • Exempt from some taxes and charges 	<ul style="list-style-type: none"> • High initial cost • Limited comparable mileage per journey • Limited makes and models available • Longer 'fueling' time • More powerful models can be costly • Lower servicing/maintenance costs • Young market means uncertain disposal values 	<ul style="list-style-type: none"> • Long journeys • Motorway and dual carriage use

Other/alternative fuels:

Here is a list of some other alternative fuels that have already entered the market, are in development or under concept:

- Flex/Bi-Fuel
- Compressed Natural Gas (CNG)
- Liquified Natural Gas (LNG)
- Liquified Propane Gas (LPG)

Benefits of Natural Gas Vehicles (NGVs)

Natural gas is a clean alternative fuel that is both less expensive and more environmentally friendly when compared to diesel or gasoline. Whether in the form of compressed natural gas (CNG) or liquefied natural gas (LNG), this domestically produced fuel offers many economic, environmental and policy benefits.



Natural gas vehicles typically cost more than gasoline or diesel vehicles, which is largely due to the cost of high-pressure and insulated fuel tanks that are necessary to store CNG or LNG. The cost of natural gas fuel, however, is now \$0.50 to \$1.00 less per gallon – and these fuel-cost savings can be significant over the life of a

vehicle, depending on fuel efficiency and the number of miles driven.

The greatest savings are currently being seen in heavy-duty, high mileage fleets. These vehicles consume enough fuel for owners and operators to see a pay back in as little as 18–24 months. As the price of fuel tanks comes down, light-duty passenger vehicles will become less expensive and have a shorter payback period.

- There are about 165,000 NGVs on U.S. roads today, and more than 15.2 million worldwide
- There are 1,640 CNG and 123 LNG fueling stations in the U.S., and refueling appliances are available for home use
- In the U.S., approximately 50 different manufacturers produce 100 models of light, medium and heavy-duty vehicles and engines
- Natural gas currently costs from \$1.50 to \$2.00 less per gasoline gallon equivalent (GGE)
- In the U.S. alone, NGVs offset the use of about 500 million gallons of gasoline in

2014

- NGVs meet the strictest emission standards, including California's AT-PZEV standard

According to the American Public Transit Association, about one-fifth of all transit buses were run by compressed natural gas (CNG) or liquid natural gas (LNG) in 2014. Currently, transit buses are the largest users of natural gas for vehicles.

The fastest growing NGV segment is waste collection and transfer vehicles, and more than 50% of the trash trucks purchased in 2014 are powered by natural gas.

More than 35 airports in the U.S. have natural gas vehicles in their own fleets, or

have policies that encourage use by private fleets operating on premises – making this sector the third largest in vehicular natural gas use.

NGV Global estimates there will be more than 50 million NGVs worldwide within the next 10 years, about 9% of the world's transportation fleets. The U.S. currently ranks 17th in the world with less than 1% of the NGVs in use. North America, however, is expected to see some of the fastest growth due to abundant proven reserves and the low cost of domestically produced natural gas.

Development also continues other AFVs, including hydrogen and fuel cell technolo-

INCENTIVES

To offset the higher cost of AFVs, federal and state incentives are sometimes available. The Alternative Fuels Data Center has updates in the latest federal and state laws and incentives for alternative fuels and vehicles at <https://www.afdc.energy.gov/laws>.

Recent programs have included:

- 50 cents per gallon alternative fuel tax credit and alternative fuel mixture tax credit.
- \$1.00 per gallon tax credit for biodiesel and biodiesel mixtures.
- credit for the installation of alternative fuel vehicle (AFV) refueling property
- tax credits for EV charging supply equipment

For additional information on EV credits see pluginamerica.org

Selecting your vehicles:

how to make informed choices

With so much information to take into consideration – from fueling infrastructures to fuel costs, vehicle efficiency or tax implications or incentives – it can be hard to know what vehicles are best for your fleet.

One of the best ways to assess what works best for you is to bring together all

information regarding planned vehicle use and what TCO to expect. Compare how different fuel types can help you meet your needs in practice and achieve the best return on investment.

To sum up, you should be considering things such as:

- WHO uses it:** Will your vehicle be allocated to a bus driver picking up passengers? A medical professional? A salesperson? Would their use of a certain type of fuel improve your image or help meet your KPIs?
- WHAT it's used for:** A vehicle being used for long, regular highway journeys will need a good range and the ability to be fueled quickly, so an electric or hybrid engine might be less suitable than a vehicle being used to travel short “stop-start” distances.
- WHERE it's used:** A heavy goods vehicle being driven on highways will benefit from high fuel efficiency, however, a vehicle travelling in built-up urban areas may be more focused on clean-burning fuel that supports air quality.
- WHEN it's used:** How often a vehicle is used can impact its TCO. For example, an electric vehicle might be expected to have a high purchase/lease costs offset largely through significant savings in fuel and maintenance, so if it's rarely used it will be unlikely to achieve ROI. Similarly, a petroleum fuel-powered vehicle traveling many miles every day could be expected to have higher maintenance costs.
- WHY you need it:** How would different fuel types support you in meeting legislative requirements, as well as your own policies, such as those relating to emissions and company image?



Some of the most important aspects of vehicle selection are to ensure that the vehicles you pick match your company image; help you meet regulations; and keep costs to a minimum.

Overall, there's a lot of things to consider. The fact is, taking steps to pick the best vehicles for your fleet early on can help you make real improvements and drive valuable long-term savings, in numerous areas.

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