BACKGROUND

With vehicle fleets being a highly visible source of greenhouse gases, fleet operators are feeling increasing pressure from companies, customers and government to configure smarter, cleaner transportation solutions. With advancements in vehicle technology, communication systems and management programs, fleet operators have more opportunities than ever before to optimize fleet performance, reduce emissions, and improve their bottom line. Choosing the right technologies and deploying them in a strategic way will guarantee the road to delivering best-in-class results.

THE PURPOSE OF THIS GUIDE IS TO:

• Provide fleet operators with a methodology designed to configure clean, efficient & cost-effective fleet solutions.
• Provide an overview of the multitude of options available to achieve this mission.
• Help fleet managers determine the optimal path to making a sustainable solution successfully “work”.

THE BENEFIT OF SUSTAINABLE FLEETS

• BETTER FOR THE ENVIRONMENT
  For many organizations, operating a fleet is the single largest contributor to a carbon footprint. Reducing overall fuel consumption and utilizing cleaner fuel alternatives can significantly improve the environmental impact of a fleet.

• BETTER FOR THE DRIVERS
  Drivers of more environmentally-friendly vehicle fleets benefit from increased safety, reduction in vehicle noise, fewer odors, improved climate control, and less inhalation of toxic fumes that are typically emitted from conventionally-fueled vehicles. In some locations, drivers also have access to HOV lanes, boosting driver productivity.

• BETTER FOR THE BOTTOM-LINE
  When rightly-configured, operating a sustainable fleet is better for the bottom line, often producing cost savings in the areas of maintenance and fueling expenses, as well as regulatory compliance.
5 STEPS TO CONFIGURING SMARTER, CLEANER FLEETS

**STEP 1: DEVELOP A STRATEGIC PLAN**
- Capture Your Data
- Define Your Fleet Policy & Objectives
- Prioritize Your Efforts

**STEP 2: OPTIMIZE FLEET UTILIZATION**
- Identify Vehicle Requirements
- Use Telematics
- Evaluate Possibility for Vehicle Pooling & Sharing

**STEP 3: SELECT THE BEST VEHICLE FOR THE JOB**
- Look at the Big Picture
- Configure a Fuel-Efficient Selector
- Know Your Vehicle Availability Landscape
- Geo-Spatially Analyze Your Fleet
- Know Your Fuel Costs
- Leverage Incentives in Your Area

**WHAT YOU NEED TO KNOW ABOUT ELECTRIC-DRIVE VEHICLES**
- Vehicle Technology
- Charging
- CO₂ Emissions

**WHAT YOU NEED TO KNOW ABOUT PROPANE VEHICLES**
- Vehicle Technology
- Fueling
- CO₂ Emissions

**WHAT YOU NEED TO KNOW ABOUT CNG VEHICLES**
- Vehicle Technology
- Fueling
- CO₂ Emissions

**WHAT YOU NEED TO KNOW ABOUT E85 VEHICLES**
- Vehicle Technology
- Fueling
- CO₂ Emissions

**STEP 4: ENSURE PROPER VEHICLE MAINTENANCE**
- Know Your Maintenance Requirements
- Identify Where You Need Maintenance Support
- Determine How You Will Get the Maintenance Support

**STEP 5: MODIFY DRIVER BEHAVIOR**
- Engage Your Drivers
- Explore Using Fuel Reduction Technologies
- Improve Your Performance
STEP 3: SELECT THE BEST VEHICLE FOR THE JOB
- Fuel-Efficient Vehicles
- Optimal Configuration
- Clean Technology Vehicles

STEP 4: ENSURE PROPER VEHICLE MAINTENANCE
- Vehicle Requirements
- Technician Training
- Geographic Coverage

STEP 5: MODIFY DRIVER BEHAVIOR
- Fuel Reduction Technologies
- Driver Training
- Telematics
STEP 1
DEVELOP A STRATEGIC PLAN

CAPTURE YOUR DATA

The road to configuring a best-in-class vehicle fleet begins with establishing a baseline to see where you stand. Data is the most powerful tool fleet managers have to help develop and implement a sustainable fleet strategy. Meaningful data can guide you toward the most effective solution, help establish goals, and recognize when it is the best time to replace your vehicles.

DEFINE YOUR FLEET POLICY & OBJECTIVES

Help guide continual improvement in the fleet’s operations by determining your fleet’s specific objectives and by developing realistic, measurable target goals. Consider incorporating these objectives in your fleet policy documentation. A vehicle policy will provide specific guidelines for the management and utilization of vehicles and other mobile assets. Vehicle policies are designed to facilitate and encourage accountability, monitor usage and costs, provide internal control, and serve as a management tool for better decision-making.

- [ ] ____ % IMPROVEMENT IN FUEL ECONOMY BY 20_ _
- [ ] ____ % REDUCTION IN ANNUAL FUEL COSTS
- [ ] ____ % REDUCTION IN FLEET CO₂ EMISSIONS BY 20_ _
- [ ] ____ % INCREASE IN NUMBER OF CLEAN TECHNOLOGY VEHICLES
- [ ] ____ ROI DEMONSTRATED WITHIN _ _ YEAR TIME FRAME
PRIORITIZE YOUR EFFORTS

Prioritize your efforts strategically. For instance, it saves more emissions and fuel expenses to improve a vehicle from 12 to 18 MPG than it does to go from 36 to 44 MPG. Identify the greatest opportunity in your fleet for reducing tailpipe emissions. If the objective is to reduce overall emissions, prioritize your efforts accordingly.
IDENTIFY VEHICLE REQUIREMENTS

Creating an inventory of each vehicle’s unique mission, job requirements, and operating requirements is an important step in determining if you are using the best vehicle for that application and whether or not you are optimizing the size and composition of the fleet. Some factors you may want to take note of, include:

- VEHICLE JOB DUTY
- VEHICLE OVERNIGHT LOCATION
- VEHICLE GEOGRAPHIC FOOTPRINT
- VEHICLE CARGO SPACE REQUIREMENTS
- VEHICLE DISTANCE RANGE REQUIREMENTS
- VEHICLE PAYLOAD REQUIREMENTS

USE TELEMATICS

Get instant tracking and extensive analytic capabilities at your fingertips with vehicle telematics technology. Vehicle telematics technology records and transmits data about a vehicle, equipment, or the operator and can help uncover efficiency gaps and problem areas in order to maximize the utility of the entire fleet. More specifically, it uses global positioning systems (GPS), on-board computers, and cellular or wireless telecommunications systems to capture and relay data on a wide range of parameters, including vehicle location, engine diagnostics, and vehicle operation. Such information can provide you with valuable information to help decrease your vehicle downtime and extend the fleet’s longevity.
EVALUATE POSSIBILITY FOR VEHICLE POOLING & SHARING

Fleet inventories often expand over time to include vehicles that are highly specialized, rarely used, or unsuitable for current applications. By optimizing fleet size and composition, you can not only reduce costs associated with fuel purchases, but also other costs such as maintenance, insurance, and registration. Configuring an optimally-utilized fleet prevents unnecessary financial costs and reduces the fleet’s environmental impact.
SELECT THE BEST VEHICLE FOR THE JOB

LOOK AT THE BIG PICTURE

The acquisition cost of certain vehicle technologies may often be higher than that of conventionally-fueled vehicles. Nevertheless, it is important to note that, when used in the right application, clean technology vehicles can often reduce a fleet’s total cost of ownership (TCO) through fuel and maintenance savings. When evaluating the acquisition of these vehicles it is critical to understand the impacts that vehicle selection will have on your fleet’s operations, cradle-to-grave. Taking this full life cycle approach will allow you to accurately quantify the TCO implications.

CONFIGURE A FUEL-EFFICIENT SELECTOR

Fuel is typically the top expense for vehicle fleets. Selecting vehicles with improved fuel efficiency performance can save you money on fuel expenses while simultaneously reduce your tailpipe emissions. In addition to selecting vehicles with the highest fuel economy rating (while ensuring the intended job function is fulfilled), you can further ensure your vehicle’s selector is maximizing fuel efficiency by doing the following:

- Use aerodynamic drag reduction devices
- Avoid any excess cargo weight
- Avoid unnecessary cargo racks on top of your vehicle
- Use a 2-wheel drive instead of a 4-wheel drive vehicle
- Use vehicles with lower number of engine cylinders
KNOW YOUR VEHICLE AVAILABILITY LANDSCAPE

Selecting the right vehicles for each job is one of the most important steps you can take in configuring a more sustainable fleet solution. And successfully incorporating clean technology vehicles in a fleet is no easy task. When determining the right selection of vehicles, the goal should be to drive down fuel and maintenance costs while increasing residual values. Fortunately, a variety of vehicle technology options exist for fleet operators to choose from—each with an ability to improve your TCO and enhance the environmental performance of a fleet when operated under the right applications.
GEO-SPATIALLY ANALYZE YOUR FLEET

Analyzing your fleet through geographic information system platforms is a powerful way to uncover prime candidates for clean technology vehicles in your fleet. By understanding where fueling infrastructure and vehicle maintenance support is in relation to your vehicles, you can strategically expand your clean vehicle technology deployment.

Note: Red heat map conveys alternative fueling infrastructure.
Fuel prices and energy densities vary by fuel type. To understand these differences in an “apples to apples” way, it is important to compare potential fuel expenses on an energy-equivalent basis. One way to do this is through the measurement called gasoline gallon equivalent (GGE), the amount of alternative fuel it takes to equal the energy content of one liquid gallon of gasoline.

Many types of incentives exist for fleets who wish to adopt clean technology vehicles. To help pay the premium price for certain clean technology vehicles, you can leverage the vouchers and tax incentives available in your region by applying early. Many locations with HOV (High occupancy vehicle) lanes accept drivers of clean technology vehicles, saving drivers time on the road and boosting their productivity.
VEHICLE TECHNOLOGY

While all electric-drive vehicles use regenerative braking to charge the vehicle’s battery, EVs run on 100% electricity and PHEVs and HEVs run on both gasoline and electricity. Limited range may be an issue with EVs, however it is a non-issue for PHEVs and HEVs. If a conversion system is involved, ensure the system is approved by the OEM.

Diagram of an Electric Vehicle Power System

The acquisition costs of electric drive vehicles are typically more expensive than that of conventionally-fueled vehicles because of the high cost of batteries. Because EVs require fewer fluids and moving mechanical parts, these vehicles require less maintenance support. The maintenance requirements for HEVs and PHEVs are also slightly lower due to longer brake life, fewer engine repairs and longer oil drain intervals.

CHARGING

+20,000 Charging Outlets

AC LEVEL 1 CHARGER: 120 VOLT AC PLUG
Adds on average 2 to 5 miles of range to a vehicle per hour of charging time.

AC LEVEL 2 CHARGER: 208 OR 240 VOLT AC PLUG
Adds on average 10 to 20 miles of range per hour of charging time.

AC LEVEL 3 CHARGER: 208 TO 600 VOLT AC PLUG
Adds on average 60 to 80 miles of range to a light-duty plug-in vehicle per 20 minutes.

TARGET APPLICATION

- LIGHT DUTY SEGMENT
- STOP-AND-GO DRIVING PATTERN (I.E., URBAN DRIVING)
- SIGNIFICANT IDLE TIME
- CONSISTENT ROUTE PATTERN (APPLICABLE TO EVS ONLY)
- LIMITED RANGE (APPLICABLE TO EVS ONLY)
Unlike gasoline and diesel, EVs demonstrate zero tailpipe emissions. The life cycle emissions, however, will vary by region. In geographic areas that use relatively low-polluting energy sources for electricity production, plug-in vehicles will typically have a life cycle emissions advantage over similar conventional vehicles running on conventional fuels.

On a GGE basis, electricity is substantially cheaper than gasoline fuel. The more the vehicle can be powered by electricity, the faster the vehicle will recoup its initial capital cost.
Propane autogas vehicles (also known as liquefied petroleum gas vehicles or LPG vehicles) are offered as dedicated or bi-fuel options. Vehicles should be ordered with the gaseous-prepped package from the OEM to avoid engine component failure and be converted by OEM-approved modifiers.

Sample of a LPG Tank System

OEM-approved LPG conversion systems are available for several vehicle models with an incremental cost depending on fuel capacity requirements. Propane is the world’s 3rd most common engine fuel, after gasoline and diesel. Its high octane rating provides for a similar performance feel to gasoline vehicles.

On-site fueling installations are available at little to no cost. Depending on your available space and fuel needs, above ground, portable, skid-mounted tanks can be used. Alternatively, fleet owners can buy propane directly from a local supplier for regular delivery.

TARGET APPLICATION

- MEDIUM-DUTY FLEETS (TRUCKS AND VANS); SCHOOL BUSES
- “HOME-BASE” FLEETS PARKED IN ONE LOCATION OVERNIGHT
- SIGNIFICANT IDLE TIME AND/OR HIGH MILEAGE FLEETS
In addition to reducing tailpipe CO₂ emissions on an energy-equivalent basis, propane autogas cuts more emissions of toxins, carcinogens and nitrogen oxide emissions compared to conventional fuels.

Even though propane has a lower energy density than conventional fuels, it is still substantially less expensive on a GGE basis. Because of this reduced energy density, fuel tanks may occupy space originally available for cargo inside the vehicle.
Compressed natural gas (CNG) vehicles are offered in dedicated, bi-fuel, or dual fuel options. Dual fuel vehicles are traditionally limited to heavy-duty applications, using diesel fuel for ignition assistance. Vehicles should be ordered with the gaseous-prepped package from the OEM and be converted by OEM-approved modifiers.

OEM-approved CNG conversion systems are available for several vehicle models with an incremental cost depending on fuel capacity requirements. The horsepower, acceleration, and cruise speed of CNG vehicles are comparable with those of equivalent conventionally fueled vehicles. Maintenance is similar to equivalent conventionally fueled vehicles too. Tank inspections are required by law every 36 months/36,000 miles.

Target Application

- Heavy-duty fleets and some medium-duty fleets.
- “Home-base” fleets parked in one location overnight (slow-fill application)
- Significant idle time and/or high mileage fleets

Fast-Fill
A similar fueling experience to gasoline; storage required; more expensive to install

Slow-Fill
Good for fleets that refuel at a central location every night; less expensive to install
In addition to reducing tailpipe CO₂ emissions on an energy-equivalent basis, CNG autogas cuts more emissions of toxins, carcinogens and nitrogen oxide emissions compared to conventional fuels.

Even though CNG has a lower energy density than conventional fuels, it is still substantially less expensive on a GGE basis. Because of this reduction in energy density, fuel tanks may occupy cargo space in the vehicle. The amount of fuel capacity demanded significantly impacts the conversion system cost.
VEHICLE TECHNOLOGY

Vehicles that can be fueled with E85, also known as flexible fuel vehicles (FFVs), have an internal combustion engine and are capable of operating on gasoline, E85 (a gasoline-ethanol blend containing 51% to 83% ethanol, depending on geography and season), or a mixture of the two.

Labeled Identification on Vehicles that Support E85

FFVs are available nationwide as standard equipment with no incremental costs. The only perceivable difference is that the fuel economy is lower when FFVs run on ethanol because of the reduction in energy density of E85 fuel. Their power, acceleration, payload, and cruise speed are comparable whether running on ethanol or gasoline. Because E85 is a caustic compound, it is important to use E85 in accordance with the manufacturers’ specifications to prevent any deterioration in the automotive system. Since 2008, all new FFV models in the US feature proper flex-fuel badging indicated by a bright yellow gas cap to remind drivers of the E85 capability.

TARGET APPLICATION

- ALL VEHICLE TYPES LABELED AS FFV
- “HOME-BASE” FLEETS PARKED IN ONE LOCATION OVERNIGHT
- VEHICLES IN THE MIDWEST U.S.
In addition to reducing tailpipe CO₂ emissions on an energy-equivalent basis, the consumption of E85 fuel cuts emissions of toxins like benzene when compared to conventional fuels.

On an energy-equivalent basis, E85 sold at retail sites is often more expensive than gasoline and diesel.
KNOW YOUR MAINTENANCE REQUIREMENTS

Keeping your vehicles on a Preventative Maintenance (PM) schedule is one of the simplest and most effective ways to ensure a fuel-efficient and sustainable operation. Each vehicle technology type has unique maintenance requirements that need to be fulfilled to ensure the vehicle is operating properly. OEMs fully back the clean technology vehicles they produce with standard warranties, adequate parts inventory, and trained technicians. To the right is an overview of some of the unique maintenance differences, organized by clean technology vehicle type.

**Electric Drive**

Electric-drive vehicles typically require less maintenance than conventional gasoline vehicles, as a result of less brake wear and fewer moving parts. Because the advanced batteries used in these vehicles have a limited number of charging cycles, it is important to research battery life and warranties before moving forward with a decision to add these vehicles to your fleet.

**Propane**

Some states require periodic certification of the tank or filling systems. Propane’s high octane rating and low carbon and oil contamination characteristics can result in prolonged engine life, when compared to that of gasoline engines.

**CNG**

Most states require a licensed technician to work on CNG vehicle systems. The most important added maintenance requirement for CNG vehicles is an inspection to be performed regularly or after accidents or suspected damage and to replace tanks when they reach the end of their useful life.

**E85**

Fuel systems and engines that have not been designed or modified to use E85 may experience increased wear and may fail prematurely. Some OEMs have no special maintenance requirements for their E85 ethanol flex-fuel vehicles, but other manufacturers may require use of specific engine lubricants. If fueling with E85, share this information with your dealer or parts supplier when ordering replacement parts.
IDENTIFY WHERE YOU NEED MAINTENANCE SUPPORT

Because of the limited number of clean technology vehicles on the road, there are limited technicians certified to work on these vehicles and limited maintenance facilities to support them. Locations with a mature network of alternative fueling infrastructure are typically supported by a relatively strong maintenance support network.

DETERMINE HOW YOU WILL GET THE MAINTENANCE SUPPORT

A growing number of training programs are available for mechanics to get the knowledge they need to properly service clean technology vehicles. For clean technology vehicles approved by major OEMs, OEM dealerships can typically get the training and vehicle parts they need relatively quickly.
ENGAGE YOUR DRIVERS

Keeping drivers informed of and actively engaged with the fleet’s sustainability efforts are vital to ensuring the fleet is operating in the most efficient manner. Today’s technology can help you find, monitor and deal with lead-footed drivers. Some ways to manage or encourage desired driver behavior, include:

- DEVELOP AN EFFECTIVE DRIVER POLICY ADDRESSING FUEL EFFICIENCY AND ALTERNATIVE FUEL USE
- COMMUNICATE AND PROPERLY TRAIN DRIVERS ON FUEL SAVINGS AND MAINTENANCE TIPS AND POLICY ADHERENCE
- LEVERAGE DATA FROM FUEL CARDS AND TELEMATICS TO REWARD AND INCENTIVIZE FUEL-EFFICIENT DRIVING

Interactive Online Driver Training Courses Can Encourage Drivers to Drive More Fuel-efficiently
EXPLORE USING VARIOUS FUEL REDUCTION TECHNOLOGIES

A number of technologies are available for fleet operators to reduce vehicle idling and fuel consumption without compromising driver comfort or vehicle equipment operations. Incorporating fuel reduction technologies into vehicles that consume a lot of fuel while idling typically provides a favorable return on investment.

Telematics is another technology that can prevent increased wear-and-tear on your vehicles by monitoring poor driving habits which inflate your operating costs. How much information you want to collect will depend on how much you want to spend for the telematics system. Options range from minimal plug-in devices to complex systems that are hardwired in the vehicle.

IMPROVE YOUR PERFORMANCE

Successfully modifying driver behavior can deliver substantial results that reduce expenses and enhance the environmental performance amongst the fleet.

- **APUs (Battery, Solar)**
- **Electric plug-in**
- **Automatic engine start/stop systems**
- **Truck stop electrification**
- **Shut-off timers**
- **Grid-powered technologies**

**Fuel Reduction Technologies**

- **Electric plug-in**
- **APUs (Battery, Solar)**
- **Automatic engine start/stop systems**
- **Truck stop electrification**
- **Shut-off timers**
- **Grid-powered technologies**
ARI’s SustainableWorks™ consulting offering is dedicated to driving best-in-class vehicle fleet solutions. Committed to optimizing fleet TCO and environmental performance, SustainableWorks’ approach is tailored to a fleet’s unique objectives, needs and operating requirements. For more information, contact your ARI representative or Brian Matuszewski, ARI Manager of Sustainable Strategies at: SustainableWorks@arifleet.com

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