

# Sustainable Fleet Deployment Best Practices Manual

A How-To Guide for Simple, Sustainable Fleet Planning

**4.7.2014**



## TABLE OF CONTENTS

<b>INTRODUCTION</b> .....	
THE IMPORTANCE OF BEST PRACTICES FOR FLEET DEPLOYMENT .....	
<b>ABOUT CALSTART</b> .....	
CREDENTIALS AND MOTIVATION FOR PUBLISHING THIS GUIDE .....	
<b>ACKNOWLEDGEMENTS</b> .....	
CONTRIBUTING STAFF AND PARTNERS.....	
<b>STEP 1: BASELINE YOUR FLEET</b> .....	
KNOW YOUR VEHICLE AND ROUTE PROFILES .....	
CASE STUDY: TORONTO TRANSIT .....	
<b>STEP 2: KNOW YOUR OPTIONS</b> .....	
USE EFFICIENCY MEASURES AS A STARTING POINT .....	
CASE STUDY: POWERS DISTRIBUTING .....	
<b>STEP 3: MATCH OPTIONS TO YOUR FLEET</b> .....	
CHOOSE OPTIONS BASED ON DAILY MILEAGE AND DRIVE CYCLE INTENSITY .....	
CASE STUDY: UPS .....	
<b>STEP 4: OUTLINE YOUR PATHWAYS</b> .....	
DEFINE TARGETS AND STRATEGIES.....	
GET MAXIMUM BENEFITS FROM ONLINE TOOLS .....	
CASE STUDY: FRITO LAY .....	
<b>STEP 5: PAY FOR YOUR PLAN</b> .....	
BUSINESS CASE ANALYSIS .....	
LEVERAGE INCENTIVE FUNDING .....	
CASE STUDY: THE CITY OF SANTA MONICA .....	
<b>LEVERAGING YOUR FLEET'S SUSTAINABILITY TO CAPTURE MAXIMUM VALUE</b> .....	
GREEN CERTIFICATION PROGRAMS .....	
<b>FLEET FEEDBACK</b> .....	

## INTRODUCTION

### THE IMPORTANCE OF BEST PRACTICES FOR FLEET DEPLOYMENT

One of the biggest concerns fleet managers have with new technologies and alternative fuels is ensuring that they get a favorable return on investment once they put those vehicles into service. Another basic challenge is knowing where to start on developing a “sustainable fleet plan” or greening their fleet. The definition of a “sustainable fleet” is one that manages and reduces net environmental impacts from fleet operations at, or ahead of, the pace required to meet regulatory mandates. This manual provides a framework to help fleet managers implement a simple, cost-effective, step-by-step process for reducing their environmental impacts and operating costs when deploying new technologies and fuels. Since there is no “Silver Bullet” fuel or technology – no single technical or fuel solution that exists today to cover every vehicle, fleet or location – all fleets need a portfolio of technology and fuel options that will save money and reduce their fuel volatility risk. This manual helps outline a framework that most fleets can follow for developing a plan that is consistent with industry best practices.

To date, a number of fleets such as **UPS**, **Frito Lay**, **Coca-Cola**, and **FedEx** have implemented “sustainable fleet plans” in a significant way and are reaping the benefits. Many other fleet managers are being asked to produce similar plans without the time or resources to thoroughly investigate industry best practices. This document is intended to provide a set of clearly-defined, achievable steps to the broader fleet community to reduce their carbon footprint and costs in an immediate, practical and meaningful way.



*Frito Lay Battery Electric Delivery Truck*



## **ABOUT CALSTART**

### **CREDENTIALS AND MOTIVATION FOR PUBLISHING THIS GUIDE**

CALSTART is one of the nation's leading non-profit organizations focused on helping build a clean transportation industry. We identify and knock down barriers to greater deployment of clean technologies - especially in commercial vehicles. Over the past 13 years, CALSTART has managed the US Army's HTUF (High-Efficiency Truck Users Forum) program - the leading high-efficiency commercial vehicle program in the nation. This program involves partnering with truck OEMs, technology suppliers and major fleets to increase deployment of high-efficiency technologies and has been instrumental in accelerating the commercialization of a variety of clean and high efficiency technologies to the market. HTUF has also been recognized as one of the leading national programs in terms of fleet engagement, and CALSTART has expanded that work to help grow the Green Truck Summit, as well as launching the US-China Clean Truck and Bus Forum (which included two Summits in Beijing and Shanghai in 2012 and 2013, respectively). CALSTART's work in China has featured a deliberate and unique focus on real-world fleet managers whose voice is seldom heard at industry conferences.

CALSTART has worked to establish the most significant funding sources for clean technology vehicles in the nation. CALSTART is also responsible for managing several of the largest clean vehicle voucher programs nationwide - specifically aimed at helping fleets purchase new clean vehicle technologies. For example, CALSTART has been instrumental as legislative co-sponsors in getting legislation passed in California (AB-118 and AB-8) that has created over \$3B in funding for clean transportation, with a significant portion aimed at heavy-duty trucks and buses. CALSTART has been responsible for managing the CA-HVIP (California Hybrid Vehicle Incentive Program) which has distributed \$54M in vehicle voucher funds to fleets in California over the past 4 years to assist with the purchase of hybrid and electric vehicles. CALSTART is also responsible for managing the New York and Chicago voucher programs (\$19M and \$15M, respectively). In order to continue expanding the availability of vouchers to new cities and states, CALSTART is now launching a new US-VIP program.

Throughout all of the above work, CALSTART has learned that one of the greatest barriers to broader fleet adoption of these clean technologies is awareness among fleet managers, and their ability to develop and execute a step-by-step plan. Thus, we hope to help lower this barrier through the combination of this manual and a new Green Fleet Certification program that CALSTART and NAFA are jointly releasing. It is our goal to educate and motivate as many fleet managers to save their companies money through smarter fleet deployment and operating practices that ultimately reduce fuel consumption and emissions.



## **ACKNOWLEDGMENTS**

### **CONTRIBUTING STAFF AND PARTNERS**

CALSTART wishes to thank the following individuals and organizations for contributing to this Manual:

- Eric Mallia, General Manager, FleetCarma
- Steve Hanson, National Fleet Sustainability Manager, Frito Lay
- Mark Kuhn, Principal, Ricardo Strategic Consulting
- Rick Sikes, Fleet Superintendent, City of Santa Monica

The following CALSTART staff made important contributions to this Manual:

- Bill Van Amburg, Sr. Vice President
- Kevin Beaty, Vice President
- Steve Sokolsky, Senior Project Manager
- Whitney Pitkanen, Senior Project Manager
- Jean-Baptiste Gallo, Project Engineer

DRAFT



## STEP 1: BASELINE YOUR FLEET

### KNOW YOUR VEHICLE AND ROUTE PROFILES

The first step a fleet manager should take is to establish a baseline for the fleet by collecting fuel consumption data. Accurate measurement of your fleet's fuel consumption provides insight into both fuel costs and resulting vehicle emissions. This is the starting point from which to establish aggressive, but achievable fuel consumption reduction goals and timelines for your fleet.

Many fleets track their yearly fuel spending (\$/year) but may not be as familiar with their fuel consumption (gallons/year), especially when it comes to tracking fuel consumption by specific vehicles. Many fleets have a relatively small number of vehicles that consume the majority of their fuel, and those are the vehicles and routes that should receive the most attention up front.

*While medium and heavy-duty commercial trucks account for only 4% of the cars and trucks on the road in the United States, they consume over 20% of the gasoline and diesel used by all U.S. vehicles.*

The goal is to keep it simple by measuring your yearly fuel burn by vehicle. This can be done by gathering billing information such as cost and fuel purchase quantity (gallons). Begin by focusing on heaviest fuel users. At later stages, or if you want to get more sophisticated in the future, it will become more important to know how vehicles are used. This means collecting more detailed information on duty cycle (e.g., route characteristics like daily mileage, start/stop density, idle time, seasonal effects, and other parameters).

If you are like most fleet managers, you may not have the staff or resources to collect this data. One technique for overcoming this resource constraint is to partner with a local community college or university and provide an internship for undergrad, or even graduate-level student(s). In many cases, these students are available at a very low cost and can bring significant capability for collecting and analyzing data to help a fleet get started on their journey.

### CASE STUDY: TORONTO TRANSIT<sup>1</sup>

This particular case study illustrates the value and importance of good fleet baseline data, as well as the occasional need to collect operating data *during* a fleet's deployment of new technologies.

While it is ideal to baseline your fleet at the *beginning* of a sustainable fleet planning process, in certain instances, it can become important to gather accurate operating data *after* a fleet has begun deploying clean technology trucks and buses.

Toronto Transit operates a fleet of heavy-duty city buses in Toronto, Canada and began adopting hybrid electric technology in the mid-2000s. Today, Toronto Transit (TTC) operates 690 Hybrid buses, one of the largest city bus hybrid fleets in North America.

---

<sup>1</sup> Sources: Eric Mallia, General Manager, FleetCarma. "A concise fleet manager guide to matching vehicle options to duty cycle requirements for maximum ROI of high efficiency vehicle deployments." (An adapted excerpt from FleetCarma's eBook: The Insider's Guide to Heavy-Duty Hybrid and Electric Vehicles.)





## STEP 2: KNOW YOUR OPTIONS

### USE EFFICIENCY MEASURES AS A STARTING POINT

While the biggest, long-term impact will come from shifting your fleet to alternative fuel and/or advanced technology vehicles, good short term results can occur with relatively small investments that can add up to significant improvements in fuel economy, operating costs and emissions. Initial actions could include (1) improved route planning (i.e., minimizing the number of vehicle miles traveled), (2) right-sizing vehicles for duty cycle (i.e., matching the duty requirements with the appropriate class and size vehicles), and (3) educating your drivers on fuel reduction techniques (i.e., teaching your drivers how to be more efficient on the road, avoid fast acceleration, hard braking, and unnecessary idling). Even something as simple as a consistent tire-pressure maintenance routine can yield measurable reductions in fuel burn.

Frito Lay, UPS, and FedEx Express are good examples of fleets who have realized significant fuel savings from improved route planning (e.g., UPS' famous "right-turn-routing" technique) and downsizing vehicles where appropriate (e.g., both Frito Lay and FedEx have reduced the GVW of a significant portion of their delivery vehicles to smaller Sprinter and Isuzu Reach vans which has delivered dramatic reductions in fuel consumption compared with their heavier, traditional delivery vehicles). Frito Lay has also implemented extensive GPS-enabled tools and driver-behavior programs to deliver further fuel savings. Many fleets are unaware of the significant impact something as simple as driver-behavior can have on fuel consumption. Cummins reports that driver behavior can have up to a 30% impact on fuel economy variability.<sup>2</sup> This is an opportunity for fuel savings that every fleet should pursue!

In addition to making sure a fleet manager does not overlook the immediately available technologies and best fleet operating practices, fleet managers should also stay abreast of changing alternative fuel and advanced technology options. Several government and non-profit organizations like CALSTART provide industry reference guides that track available technologies through various suppliers and OEMs. The California Hybrid Truck & Bus Voucher Incentive Project (HVIP), managed by CALSTART, provides a list of fully commercialized hybrid and zero-emission trucks/buses at [www.californiahvip.org/eligible-vehicles](http://www.californiahvip.org/eligible-vehicles). The U.S. Department of Energy (DOE) also tracks advanced fuel and vehicle offerings via the Alternative Fuels and Advanced Vehicle Data Center at [www.afdc.energy.gov/fuels/](http://www.afdc.energy.gov/fuels/).

### Core Efficiency Improvements

- ✓ **Reduce your fuel burn**
  - Increased efficiency: hybrids; advanced tech engines (EcoBoost); cylinder on demand
  - Eliminate idling (Start-Stop and/or Anti-Idle solutions)
  - Downsize vehicle engine or platform sizes where possible
    - Some fleets like Frito Lay and FedEx Express have discovered they can fulfill their mission profile with a smaller truck and in some cases have improved MPG by up to 100%!
- ✓ **Diversify your fuel mix**
  - Fuel switching: electricity, natural gas, biofuel blends can be cheaper fuels
  - Having a mix of fuels insulates you from price spikes in any one fuel
- ✓ **Change your operations**
  - Take redundant vehicles off the road
    - Where possible, combine routes/missions from 2 vehicles to 1
  - Dispatch best-suited vehicles to job

<sup>2</sup> Sources: "Secrets of Better Fuel Economy", Cummins Document available at: [http://cumminsengines.com/uploads/docs/cummins\\_secrets\\_of\\_better\\_fuel\\_economy.pdf](http://cumminsengines.com/uploads/docs/cummins_secrets_of_better_fuel_economy.pdf)

Bottom Line: Move toward the following core efficiency improvements: *Reduce, Diversify, and Change.*

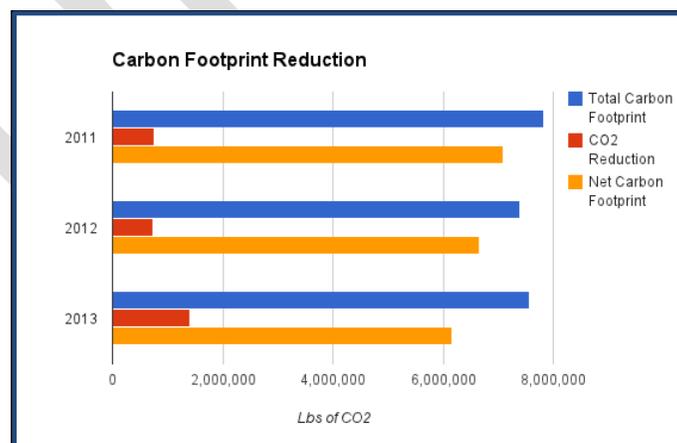
### CASE STUDY: POWERS DISTRIBUTING<sup>3</sup>

Powers Distributing is a regional beer distributor in southeast Michigan. With more than 200 employees and a fleet of 45 beverage trucks, they are a good example of a regional fleet that has analyzed their options and taken serious steps to move toward a more sustainable fleet. And, since their footprint is *regional* (as opposed to *national* or *global*), they provide many other mid-sized fleets with an opportunity to see how sustainable fleet management can be done on a much smaller scale than larger fleets like UPS, Frito Lay, Coke, or FedEx Express.

Powers was one of the first wholesale beer distributors in the country to investigate the use of hybrid technology. As they looked for cleaner, more efficient alternatives to conventional diesel fuel in the 2007/2008 timeframe, Powers identified Hybrid Electric (HEV) and Bio-Diesel (B5 and B20) as the two most attractive options available for the heavy-duty beverage tractors in their delivery fleet at that time. In 2009, Powers became the first beverage wholesaler in the country to convert 50% of its Delivery Fleet to hybrid technology. In addition, Powers fuels all of its delivery fleet (hybrid and conventional diesel) with B5 in the summer, and B20 in the winter. Powers reports they have achieved 18 to 25 percent better fuel efficiency with their hybrid trucks.

In addition to their Delivery Fleet, Powers also looked at the options available for their light-duty sales and management team. That analysis resulted in shifting 23 field sales staff from V8 cargo vans to four-cylinder Saturn Vue's and several newer model Flex-Fuel vehicles. In addition, the sales management staff shifted to hybrid vehicles.

Beyond improving the sustainability of Powers' vehicles, the company has also incorporated company-wide "green initiatives" including recycling, solar, wind, and water reclamation programs. Combined with their sustainable vehicle fleet programs, these cumulative efforts have reduced their CO2 emissions by almost 20% since 2011.



<sup>3</sup> Sources: <http://powersdistributing.com/content/going-green>



## STEP 3: MATCH OPTIONS TO YOUR FLEET

### CHOOSE OPTIONS BASED ON DAILY MILEAGE AND DRIVE CYCLE INTENSITY

The next step is to match your options to your fleet mix, fleet geography, and operational profile. It has been demonstrated that fleet actions can cut payback period in half based on a smart deployment strategy. ***Fine tune*** your fleet by placing the correct technology and fuel into the best use by following these general recommendations:

#### *Fine Tune Your Fleet*

- ✓ *Avoid putting hybrid vehicles into higher speed routes with limited stopping or idling*
- ✓ *Make sure EV's get enough miles/year to deliver a payback (without creating "range anxiety" for drivers)*
- ✓ *Put CNG/LNG/LPG in high mileage routes (where refueling stations are readily available)*
- ✓ *Consider geographic variation*
  - *E85 may be a great option in Midwest, propane better in Texas, electric in California or New York – look for match with growing infrastructure and production*
- ✓ *Be aware of regional air quality regulations or needs – not all fuels work everywhere*

### **More Efficient Vehicle Specifications**

Many fleet managers are discovering that their existing fleet includes vehicles that have been over-specified, or may no longer be used in the same severe-duty application they were originally intended to serve. As a result, fleets like Frito Lay and FedEx Express are finding that they are able to meet their fleet's operational needs with vehicles that consume significantly less fuel, even without switching to alternative fuels or advanced technologies. This is a great place for fleets to begin their sustainable fleet journey.

### **Biofuels**

E85 and B20 can be used to replace conventional gasoline and diesel fuels<sup>4</sup>. Biofuels are generally more expensive than conventional fuels (without incentives), and thus may not be the best solution in high fuel usage applications. One of the positive attributes of biofuels is that they are not drive/duty cycle-dependent and can be applied on virtually every route. However, you may need some vehicle modifications to run on biofuels. Fueling station availability may also be an issue. You may want to determine the feasibility of converting some motor pool pumps to dispense E-85 or biodiesel. The

---

<sup>4</sup> The Biodiesel Board provides good background information and a list of vehicles / engines that can use biodiesel: <http://www.biodiesel.org/>; 2013 Diesel Vehicle List: <http://www.biodiesel.org/using-biodiesel/oem-information>



primary benefit of biofuels is that they help reduce your consumption of non-renewable fossil fuels without a large initial investment, and in most cases, they improve the tailpipe emissions in terms of “black carbon” and particulate matter.

### Hybrid Vehicles

Hybrid vehicles rely on conventional fuel for their primary energy source, so there is no need for specific refueling infrastructure. And, hybrid vehicles are not limited in terms of driving range. The key to hybrid vehicles is their use of an energy storage system (batteries or high-pressure hydraulics) to increase efficiency by capturing kinetic braking energy and optimizing overall energy management strategies. But, higher upfront costs for hybrids require significant fuel savings to achieve an adequate return on investment (ROI). Vehicles that operate in frequent start-stop driving conditions (urban and suburban routes) are good candidates for hybrids. For vehicles that drive long distances on the highway, hybrids are not a good fit. For certain work and vocational trucks, there are a number of applications where hybrids will work well since some allow the engine to be “off” during operation at the worksite and during low speed driving. These types of engine “off” work site operations can yield significant fuel savings.

Electricity Rate (\$/kWh)	eGallon <sup>5</sup>
\$0.05	\$0.54
\$0.06	\$0.65
\$0.07	\$0.76
\$0.08	\$0.86
\$0.09	\$0.97
\$0.10	\$1.08
\$0.11	\$1.19
\$0.12	\$1.30
\$0.13	\$1.40
\$0.14	\$1.51
\$0.15	\$1.62
\$0.16	\$1.73
\$0.17	\$1.84
\$0.18	\$1.94
\$0.19	\$2.05
\$0.20	\$2.16
\$0.21	\$2.27
\$0.22	\$2.38
\$0.23	\$2.48
\$0.24	\$2.59
\$0.25	\$2.70
\$0.26	\$2.81
\$0.27	\$2.92
\$0.28	\$3.02
\$0.29	\$3.13
\$0.30	\$3.24

Source: The U.S. Department of Energy eGallon

### Battery Electric Vehicles

Battery electric (or full electric) vehicles (BEV) operate entirely on electricity and require charging station infrastructure which can be costly in some instances. BEV’s are also limited in driving range to usually less than 80-100 miles per charge. Like with hybrids, the higher upfront cost for BEV’s requires offsetting large enough amounts of fuel to achieve an acceptable ROI, and they should be driven as close as possible to their daily maximum range to achieve the best ROI. This means that, contrary to popular opinion, BEV’s are not ideal for extremely short driving route applications since the baseline fuel consumption on short routes is often too small to generate a large fuel savings when diesel (or gasoline) fuel is replaced with lower cost electricity. BEV’s are also more (or less) attractive depending on the location of the fleet, since electricity rates vary throughout the US. Rates per kWh for residential electricity in the USA range from \$0.0728 (Idaho) to \$0.166 (Alaska) and \$0.2783 (Hawaii). The table to the left shows how much it costs to drive an electric vehicle the same distance as on one gallon of diesel. For instance, at a rate of \$0.12 / kWh, it costs \$1.30 to drive an E-Truck the same distance that a vehicle powered by an internal combustion engine can go on a gallon of diesel.

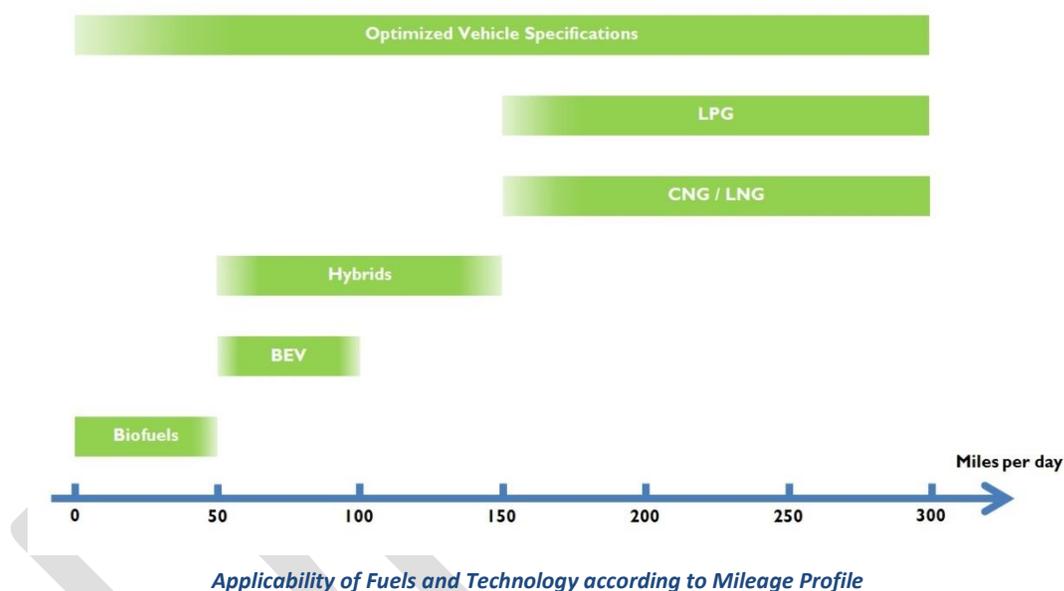
### Natural Gas (LNG/CNG)

The recent emergence of abundant, low-cost shale gas in the U.S. has increased the interest in natural gas-fueled trucks among many fleet managers. Although natural gas vehicles can help reduce fuel costs by up to 40% vs. Diesel fuel, Liquefied Natural Gas Vehicles (LNGV’s) or

<sup>5</sup> Assumes a conventional diesel vehicle with a fuel economy of 12 MPG and an E-Truck with an efficiency of 0.90 kWh / mile.

Compressed Natural Gas Vehicles (CNGV's) are significantly more expensive to acquire and often require infrastructure installation as well. In many cases, infrastructure costs include refueling and service bay modifications for detecting and handling methane gas leaks. Thus, NGV's are ideal for high-mileage applications where the fuel savings are maximized in order to help pay the higher upfront costs. As long as the NG engine provides sufficient power and torque for the truck's mission profile, these vehicles are not drive/duty cycle dependent and can be successfully applied on virtually every high-mileage route. CNG tanks and fuel systems can be retrofitted on certain vehicles, and natural gas vehicle retrofit kits are EPA-certified to deliver equivalent emissions performance.

The following chart is intended to provide fleet managers with a general framework for considering where these various technologies best fit into vehicle usage profiles. While this chart is not intended to be an engineering application guide, it can be a useful reference tool as a fleet manager begins considering where to deploy various fuels and technologies into a specific fleet.



### CASE STUDY: UPS<sup>6</sup>

UPS is a great example of a fleet that has put considerable effort into matching technology and fuel options to their fleet. UPS has been working to better understand and support alternative fuels and vehicle technologies for decades. They currently have more than 2,500 "clean-tech" vehicles in revenue operation worldwide, and are expanding their "clean-tech" fleet dramatically in the coming year. In

<sup>6</sup> Sources: [http://www.ngtnews.com/e107\\_plugins/content/content.php?content.9541#.Uystyie9KSM](http://www.ngtnews.com/e107_plugins/content/content.php?content.9541#.Uystyie9KSM);  
[http://www.nrel.gov/vehiclesandfuels/fleettest/research\\_hybrid\\_ups.html](http://www.nrel.gov/vehiclesandfuels/fleettest/research_hybrid_ups.html);  
<http://green.autoblog.com/2013/02/08/ups-puts-100-electric-trucks-into-service-in-central-california/>;

Presentation entitled: "Planning America's Largest LNG-Fueled Truck Fleet" by Scott Lavery (UPS) at World LNG Fuels Conference, January 21, 2014; Presentation entitled: "UPS LNG Technologies" by Mike Britt (UPS) at HTUF National Meeting, October 8, 2013

fact, UPS first began experimenting with “clean-tech” vehicles in the 1930’s with the deployment of 15 electric vans in New York City!

Because UPS operates a large, diverse, global fleet, they are uniquely well positioned to illustrate the



*UPS LNG Delivery Truck*

importance and value of matching technology and fuel options to their fleets. At the same time, the steps UPS has taken to match technology and fuel to their fleet can be applied to virtually any fleet with more than 20-30 vehicles and a range of operating duty cycles and locations.

**Fleet Mix** - UPS has tailored their approach differently for each specific vehicle application (e.g., parcel delivery vs. line haul truck). In the case of HD Line Haul, UPS selected Liquefied Natural Gas (LNG) fuel as the preferred option for its Class 8 tractors (by placing 114 LNG tractors into service since 2001). In 2013, UPS placed an additional 272 LNG and 35 CNG tractors into service, demonstrating an interest in evaluating CNG as a possible supplement to their LNG tractor fueling strategy. And in 2014, UPS plans to place 674 more LNG tractors in service. Clearly, natural gas (primarily LNG) is UPS’ alternative fuel of choice for the Class 8 tractor segment of their fleet.

At the same time, UPS chose a combination of electric and hybrid technologies for their parcel delivery application. UPS placed 100 all-electric parcel delivery vehicles into service in 2012 and 2013, after putting hundreds of Hybrid Electric (and Hydraulic Hybrid) parcel delivery vehicles into service over the past 10 years (380 HEV’s and 41 HHV’s). The all-electric vehicles are placed into routes with fewer miles (<75 miles/day) than the hybrid vehicles (often well above 100 miles/day). Thus, UPS fleet practices illustrate the importance of matching technologies and fuels with the fleet mix.

**Fleet Geography** - UPS has also adopted much different fuel and technology strategies in different geographies. As mentioned above, UPS has deployed the majority of their all-electric parcel delivery vehicles in California where incentives (CA-HVIP) and recharging infrastructure are more readily available. Prior to 2014, 852 of UPS’ 870 LPG vehicles were located outside the US (Canada), due to unique fuel pricing and supply characteristics. In 2014 and 2015, UPS plans to deploy 1,000 additional LPG vehicles in the US, but specifically on rural routes in Oklahoma and Louisiana (where daily driving range is above average for these types of vehicles). Similarly, 100% of UPS’ Ethanol vehicles (50) and Biomethane vehicles (20) are located outside the US. Thus, UPS has adopted a very strategic approach to “where” they deploy certain “clean-tech” fuels and technologies.

**Operational Profile** - Similar to Fleet Mix and Fleet Geography considerations outlined above, UPS has also tailored their use of various technologies and applications to match their fleet Operational Profile. Natural gas (LNG and CNG) has been deployed in high mileage, heavy-duty line haul routes. LPG is being deployed among the longest daily route (rural) parcel delivery applications. Hybrid Electric (HEV) and Hydraulic Hybrid (HHV) technologies have been deployed in lower mileage parcel delivery routes where stop & go driving conditions are prevalent. And all-electric (EV) technology is being deployed in urban parcel delivery operations where the daily driving range is low (<75 miles).



## STEP 4: OUTLINE YOUR PATHWAYS

### DEFINE TARGETS AND STRATEGIES

The next step is to outline your fuel reduction plan pathways – your planned shift in fleet technology, fuel and operations - over the next several years. One approach to building your pathway is to develop several possible scenarios using relatively simple spreadsheet analyses. In addition, online value calculators can help you identify the impact of new fuels and technology on fuel reduction, environmental, and financial benefits. As you use these methods and tools to explore various scenarios for your fleet, it is important to look for solutions where expansion of capacity and/or productivity improvements will occur. In other words, keep your eyes open for opportunities to improve fleet functionality and performance with these new technologies.

The first step is to identify “what” you are planning to achieve and “when”. In 2007, Frito Lay decided to set a goal of reducing their fleet fuel consumption by 50% by 2020. This goal is meaningful because it is measurable (gallons per year) and time-bound (by the year 2020). Each fleet should identify the metrics and timeline that are most relevant and meaningful to their strategic and operational goals. The next step is to define an achievable plan to achieve those goals.

One simple approach for developing a pathway for your own fleet could include the following steps:

1. Create a simple (executive summary) spreadsheet that captures your top-level plans for each of the next 5-10 years
  - a. This can be as simple as having 10 columns (Years 1-10) with rows that define the following key business parameters:
    - i. Capital Spend (planned incremental investments in new technologies/vehicles)
    - ii. Fuel Savings (estimated fuels savings resulting from above investments)
    - iii. Cost Savings (estimated operating cost reductions related to fuel savings)
  - b. Then, create a separate worksheet that lists the actions, investments, fuel and cost savings anticipated for each of the years of your plan
    - i. These worksheets are the place to include specific technology costs, efficiency improvements, fuel price projections, etc..
    - ii. These supporting worksheets will help track assumptions and forecasts so that plans can be revised and updated on an annual basis.
2. A separate spreadsheet can be used for archiving the fleet baseline data and analyzing specific opportunities for optimization related to vehicle specifications, route characteristics, etc.
3. An additional element of this exercise can include using online technology and value-calculators as outlined below to explore various scenarios within the above framework (see discussion below for additional thoughts on using these online tools). These more detailed planning tools can also provide supporting detail for your finance group which is likely to ask for supporting assumptions and due diligence.

Rather than being a complicated mathematical exercise, the above process illustrates that building a spreadsheet is really just a convenient method for keeping track of your notes and plans. One key to success for the above exercise is the critical element of building in a timeline to your plan. *“Rome was not built in a day,”* and every fleet must identify affordable and practical steps that are constrained by



time and budget realities to have a probability of sticking with the plan. This is why we recommend creating a specific plan for each year, then rolling those actions up into an executive summary.

### GET MAXIMUM BENEFITS FROM ONLINE TOOLS

Online calculators can be an important tool to help fleets optimize their approach to procuring, placing and using their vehicles. For example, with the Argonne National Laboratory's GREET Fleet Footprint Calculator,<sup>7</sup> fleet managers can quickly insert their data to generate petroleum use and GHG emissions on a well-to-wheels (WTW) basis. A WTW analysis can be divided into two stages: well-to-pump (WTP) and pump-to-wheels (PTW). The WTP stage starts with the fuel feedstock recovery, followed by fuel production, and ends with the fuel available at the pump, while the PTW stage represents the vehicle's operation activities. It is important for fleet managers to examine transportation fuels and technologies on a WTW basis in order to properly compare alternatives, as activities upstream of vehicle operation can use significant amounts of energy and subsequently produce a large amount of emissions. For example, although electric vehicles produce no tailpipe emissions, generating electricity to power them can produce a considerable amount of emissions.<sup>8</sup>

The U.S. Department of Energy's Alternative Fuels Data Center also offers a large collection of helpful online tools<sup>9</sup>, including calculators, interactive maps, and data searches that can assist fleets in their efforts to reduce petroleum use. The following tools are available:

- Petroleum Reduction Planning Tool
- Vehicle Cost Calculator
- Alternative Fueling Station Locator
- Truck Stop Electrification Sites
- Light-Duty Vehicle Search
- Heavy-Duty Vehicle and Engine Search

### CASE STUDY: FRITO LAY<sup>10</sup>

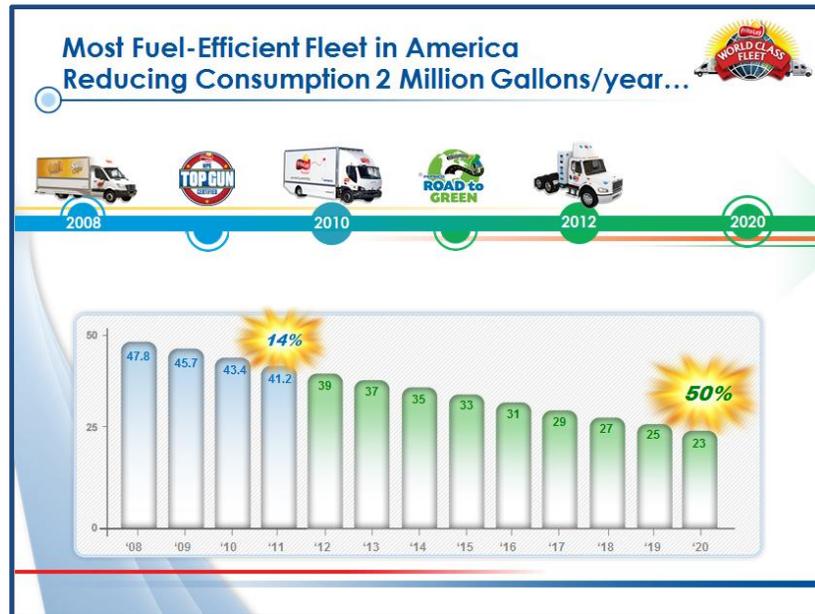
Frito Lay launched an aggressive plan in 2007 to reduce their total fleet fuel consumption by 50% by the year 2020. One aspect that makes the Frito Lay example so impressive is that they defined the specific year-over-year fuel reductions that would be required, beginning in 2008 and continuing through 2020. This set of annual fuel savings targets is shown below, and includes "actual" results for 2008-2011.

<sup>7</sup> Argonne National Laboratory: GREET Fleet Footprint Calculator: [http://greet.es.anl.gov/fleet\\_footprint\\_calculator](http://greet.es.anl.gov/fleet_footprint_calculator)

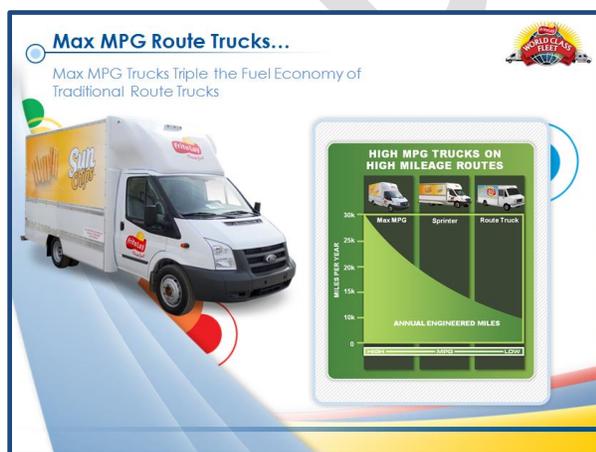
<sup>8</sup> For a good example of how the GREET Calculator works for an individual fleet, visit [http://www.afdc.energy.gov/uploads/publication/greet\\_fs\\_june\\_2013.pdf](http://www.afdc.energy.gov/uploads/publication/greet_fs_june_2013.pdf). In the given example, the fleet is considering running 12 conventional buses on diesel, 12 hybrid buses on diesel, 12 conventional buses on B20, 12 CNG buses, and 12 propane buses.

<sup>9</sup> U.S. Department of Energy, Alternative Fuels Data Center, Tools: <http://www.afdc.energy.gov/tools>

<sup>10</sup> Sources: <http://www.forbes.com/sites/stevebanker/2013/11/07/procter-gamble-general-mills-and-frito-lay-transition-to-natural-gas-fleets/>; <http://www.FritoLay.com/our-planet/improving-our-fleet.html>; <http://www.FritoLay.com/about-us/press-release-20130619.html>; <http://www.FritoLay.com/about-us/press-release-20130913.html>; <http://www.channel3000.com/new/new-fuel-may-help-reduce-carbon-footprint/20639552>; Presentation entitled: "Fleet Deployment Best Practices at PepsiCo/Frito Lay" by Steve Hanson (Frito Lay) at HTUF National Meeting, October 8, 2013; Presentation entitled: "Frito Lay Fleet Sustainability" by Steve Hanson (Frito Lay) provided directly (March 25, 2014)



After clearly defining their fuel savings goals, Frito Lay developed a plan for deploying new truck specifications, technologies and operational strategies necessary to meet these targets over the same time frame. One of the first major steps on Frito Lay’s “pathway” was replacing traditional route trucks with high MPG trucks, especially on high-mileage routes. Frito Lay also deployed a large number of all electric (EV) trucks in their lower mileage routes where the technology was a good fit.



Another important element of Frito Lay's Pathway was the implementation of their "Road to Green" Driver Behavior program. This program represented a major cultural change within Frito Lay to increase focus on reducing fuel **consumption**, not just fuel **cost**. And, Frito Lay identified natural gas as a key strategy for reducing their dependence on oil imports for their over-the-road trucks.



**Road to Green Driving Behaviors...**  
Fuel-Efficient Driving Behaviors are Important Across all Vehicle Types

**ROAD TO GREEN**  
Driving Behavior

**C**oasting Saves  
**H**igh Speed & Acceleration Burn  
**I**dling Wastes  
**P**acing Traffic Conserves  
**S**pace Protects

Think G.H.I.N.S.



**Natural Gas Tractors...**  
Adding 183 New Tractors to our Fleet will Save the Company over 1 Million Gallons of Diesel Fuel Annually

Regular	4 0 6
Premium	4 4 7
Natural Gas	2 5 0
Diesel	4 9 5

Reduces greenhouse emissions by 23% when compared against diesel

The overall result of Frito Lay's planning approach was a well-defined pathway that showed "how" Frito Lay would achieve their targeted fuel savings. This "pathway" established real credibility and confidence in the plan and allowed fleet leaders at Frito Lay to obtain strong buy-in and financial backing from their senior leaders. In addition to securing management support, Frito Lay's "pathway" has enabled them to evaluate their progress to plan each and every year, while making adjustments in the plan.

This annual pathway review (comparing "actual" vs. "planned" results) has enabled Frito Lay to reduce their focus on strategies that did not deliver the anticipated results, while placing additional emphasis on those activities that have exceeded expectations. And, in some cases, they have realized there is a need for improved execution of their strategies to achieve targeted results. In total, Frito Lay's pathway has helped them remain On-Track to deliver a 50% fuel reduction by 2020, even while absorbing a 3-4% annual sales increase in their base business. Great work Frito Lay!



## STEP 5: PAY FOR YOUR PLAN

### BUSINESS CASE ANALYSIS

Once you've outlined a broad vision (pathway) for making your fleet more sustainable, the next step is preparing the financial analysis required to support your company's capital procurement and approval process. This exercise requires drilling into the next level of detail on important financial assumptions regarding the number of miles traveled per year, the baseline vehicle fuel economy, the improvement in fuel economy, the increased acquisition price, the price of diesel (and possibly electricity and natural gas over the planning horizon), maintenance and repair costs, residual value of the vehicle, and more. Rather than representing another round of detailed analysis, this is really just a matter of building the next level of detail and due diligence into the "Pathways" plan as discussed in Step 4.

For example, CALSTART's "E-truck Business Case Calculator" allows a fleet manager to estimate the number of years it takes to pay for a sustainable fleet plan involving the purchase of electric trucks. With this tool, the fleet manager can determine how long it takes to recoup the initial purchase investment through various operational savings and assumptions about the availability of government subsidies (e.g., vehicle incentive vouchers), fuel prices, and vehicle usage. The CALSTART calculator allows the user to analyze the business case of replacing conventional diesel (or gasoline) trucks with battery electric trucks. It is designed to be a transparent and easy-to-use business decision making tool.

Additionally, DOE's Argonne National Laboratory and Clean Cities program have released the Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) tool, which uses simple spreadsheet inputs<sup>11</sup>. The AFLEET tool provides three calculation methods. First, the Simple Payback Calculator estimates a simple payback of the purchase of a new alternative-fuel vehicle compared to a conventional counterpart. The calculator factors in acquisition and annual operating costs, as well as average annual petroleum use, greenhouse gases, and air pollutant emissions.

The tool also offers the Total Cost of Ownership Calculator, which estimates the net present value of operating and fixed costs over the years of planned ownership of a new vehicle, as well as lifetime petroleum use, greenhouse gases, and air pollutant emissions.

Lastly, the Fleet Energy and Emissions Footprint Calculator estimates the annual petroleum use, greenhouse gases, and air pollutant emissions of existing and new vehicles, taking into consideration that older vehicles typically have higher air pollutant emission rates than newer ones. The tool uses data from Argonne's GREET fuel-cycle model to generate well-to-wheels petroleum use and greenhouse emission coefficients for key fuel production pathways and vehicle types. In addition, the Environmental Protection Agency's Motor Vehicle Emission Simulator and certification data are used to estimate tailpipe air pollutant emissions. Various sources are used to provide default cost data, including the Clean Cities Alternative Fuel Price Report and American Recovery and Reinvestment Act awards.

---

<sup>11</sup>Argonne National Laboratory and U.S. Department of Energy, Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool: [http://greet.es.anl.gov/afleet\\_tool](http://greet.es.anl.gov/afleet_tool).



Other online tools are available from some truck OEMs and their suppliers for evaluating various advanced technologies.<sup>12</sup> While these tools may not be as unbiased as independent sources, we encourage fleet managers to use these tools for comparison and reference purposes. In some cases, these calculators have customized algorithms and variables that more accurately predict their operating results and may, in fact, be more insightful than generic, independent tools. We encourage fleet managers to take a close look at these supplier-specific calculators and use your own best judgment for integrating these results into your operational and financial planning activities.

If your company's capital approval process requires more detailed financial modeling and analysis, Ricardo has developed an even more detailed Life-Cycle Cost model that will provide further due diligence on hidden costs further out in the ownership cycle. Their model is available online at <http://www.ricardo-aea.com/cms/>.

### **LEVERAGE INCENTIVE FUNDING**

Of course, one of the best ways to improve your ROI is to use outside money to help pay the premium price for some of these technologies. There are several very important Voucher Incentive Programs available in specific locations (e.g., California, New York and Chicago). Links to these programs are provided below and fleets should work with their local DOE Clean Cities offices to stay abreast of incentives that are available in their specific region:

- California Hybrid Truck & Bus Voucher Incentive Project (CA HVIP) website: <http://www.californiahvip.org/>
- New York Truck Voucher Incentive Program (NY HVIP) website: <https://truck-vip.ny.gov/>
- Drive Clean Chicago – Drive Clean-Truck Voucher Fund: <http://www.drivecleanchicago.com/>
- US-DOE Clean Cities locations: <http://www1.eere.energy.gov/cleancities/>

### **CASE STUDY: CITY OF SANTA MONICA**

The City of Santa Monica provides an excellent example of how to leverage public funding to purchase light, medium and heavy-duty alternative fuel vehicles. Rick Sikes, Fleet Superintendent of the City of Santa Monica, emphasizes that grant funding can bring down the lifecycle costs of these vehicles so that they are competitive with conventional fuel vehicles in any fleet. In March 2014, Santa Monica announced that 24 new alternative fuel vehicles had been purchased and placed into service and were partially funded with a grant from the Mobile Source Air Pollution Reduction Review Committee (MSRC) of the South Coast Air Quality Management District (SCAQMD). Some of these vehicles include aerial lifts, street sweepers, refuse collection trucks, and other heavy-duty vehicles, powered by compressed natural gas (CNG) and liquefied petroleum gas (LPG).

The purchase price of the vehicles on this grant totals to \$5.4 million, of which the MSRC contributed \$600,000. The grant helps offset the incremental cost of CNG and LPG vehicles and assists the city to comply with AQMD Fleet Rules and the City's Sustainability Plan. The City of Santa Monica's fleet is

---

<sup>12</sup> Roush Clean Tech, Savings and Emissions Calculator: <http://www.roushcleantech.com/content/ipad>; Via Motors, VTRUX Lifecycle Savings Calculator: <http://www.viamotors.com/vtrux/calculator/>



made up of 70% alternative fuel vehicles, including CNG, LPG, electric, biodiesel and hydrogen. These vehicles emit considerably fewer emissions compared to conventional, unleaded gasoline and diesel vehicles.

Santa Monica has 90,000 residents and a daytime population averaging 300,000. This urban City covers just 8.4 square miles. The City's Fleet Management Section supports the municipal fleet of about 800 vehicles. These include refuse collection, police, light duty fire department vehicles, water and wastewater services, public landscape, facility maintenance, administration, etc. The City's bus agency, Big Blue Bus, maintains buses and large fire apparatus.

The City supplies its vehicles with CNG for less than half the cost of diesel and gasoline. Fueling stations have been installed at the city's corporate yard and at the municipal bus yard. Clean Energy, the largest provider of natural gas for vehicle use in North America, has also opened a natural gas station available to the public within the city limits. The City was an early adopter of alternative fuels and has been using CNG since the mid-1990s. Because more than half the fleet is powered by natural gas, the City pays substantially less for fuel than if it was conventional fuel.

Because vehicles travel fewer miles in this urban environment than they would in suburban or rural areas, fuel costs are not enough to offset the higher incremental cost of alternative fuel vehicle purchases. The City is not eligible for the federal tax credit on BEVs and PHEVs so there is a substantial incremental cost to purchase EVs. Grant money has been successfully used over the years to offset most of the incremental costs of purchasing alternative fuel vehicles.

Santa Monica uses MSRC grants, such as the one mentioned above, for vehicles over 14,000 lbs. GVWR. The City has also been able to use funding from the **California Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP)** for medium-duty vehicle purchases and the Clean Vehicle Rebate Project (CVRP) for light-duty electric vehicles.

Another source of funding is the AB2766 Subvention Program. Local governments in California receive 30% of a Motor Vehicle Registration fee surcharge to use toward meeting federal, state and regional clean air rules. Santa Monica receives about \$100,000 per year in AB2766 funds and spends it primarily on electric vehicles and electric vehicle infrastructure. \$10,000 per vehicle is used from the AB2766 fund to help pay for new EVs. This fund has also paid for leasing the earlier generation EVs, some of which are still in service. Additional EV infrastructure is also partially paid from this funding.

Santa Monica has also been able to take advantage of manufacturers' incentives for alternative fuel vehicles. In 2013 the City received a \$100,000 incentive from Toyota with the purchase of ten RAV4 EVs and \$6,000 in incentives for three Natural Gas Civics.

For more information on incentives in your area talk to your Clean Cities coordinator, local air district and state regulatory agencies.



## LEVERAGING YOUR FLEET SUSTAINABILITY TO CAPTURE MAXIMUM VALUE

### GREEN CERTIFICATION PROGRAMS

With public concerns about the environment reaching an all-time high, companies are under increasing pressure to set and achieve energy efficiency and environmental goals. Customers have growing expectations that both regional and national fleets have a strategy for dealing with high energy prices and exhaust emissions. Reducing fuel cost and carbon emissions not only makes good business sense, but also fulfills the expectation of corporate environmental responsibility. A sustainable fleet manages and reduces net environmental impacts from fleet operations at, or ahead of, the pace required to meet regulatory mandates.

There are several voluntary Green Fleet Certification programs available that can be used as a powerful marketing tool to demonstrate that a fleet is taking responsibility for its choices and is a good corporate citizen. For example, a new NAFA program, developed in partnership with CALSTART, will help fleets – small or large – quantify their sustainability activities and track their progress. It will help fleets just starting out to measure their current fuel consumption and start down the road to sustainability, and will reward those fleets already taking action with accreditation levels they can achieve. This will all be part of an on-going program to help move sustainable fleet leadership forward.

Be sure to work with your sales and marketing department to ensure your shippers appreciate the low-carbon footprint that your fleet is achieving. This can create enhanced customer loyalty and provide a point of differentiation compared with other fleets.



## **FLEET FEEDBACK**

We want to hear from you on whether this manual has been helpful, and how we can make it more relevant and valuable for you and other fleet managers. Please send us your suggestions and feedback to: [HTUF@calstart.org](mailto:HTUF@calstart.org)

In order to ensure that future versions of this report as are useful as possible, we especially want to hear from fleet managers regarding these key questions:

- How can we improve the layout/wording/content/format to make this Guide most accessible and useful to other fleet managers?
- What information is missing that we need to add?
- What information is redundant or less valuable and should be eliminated or de-emphasized?

DRAFT