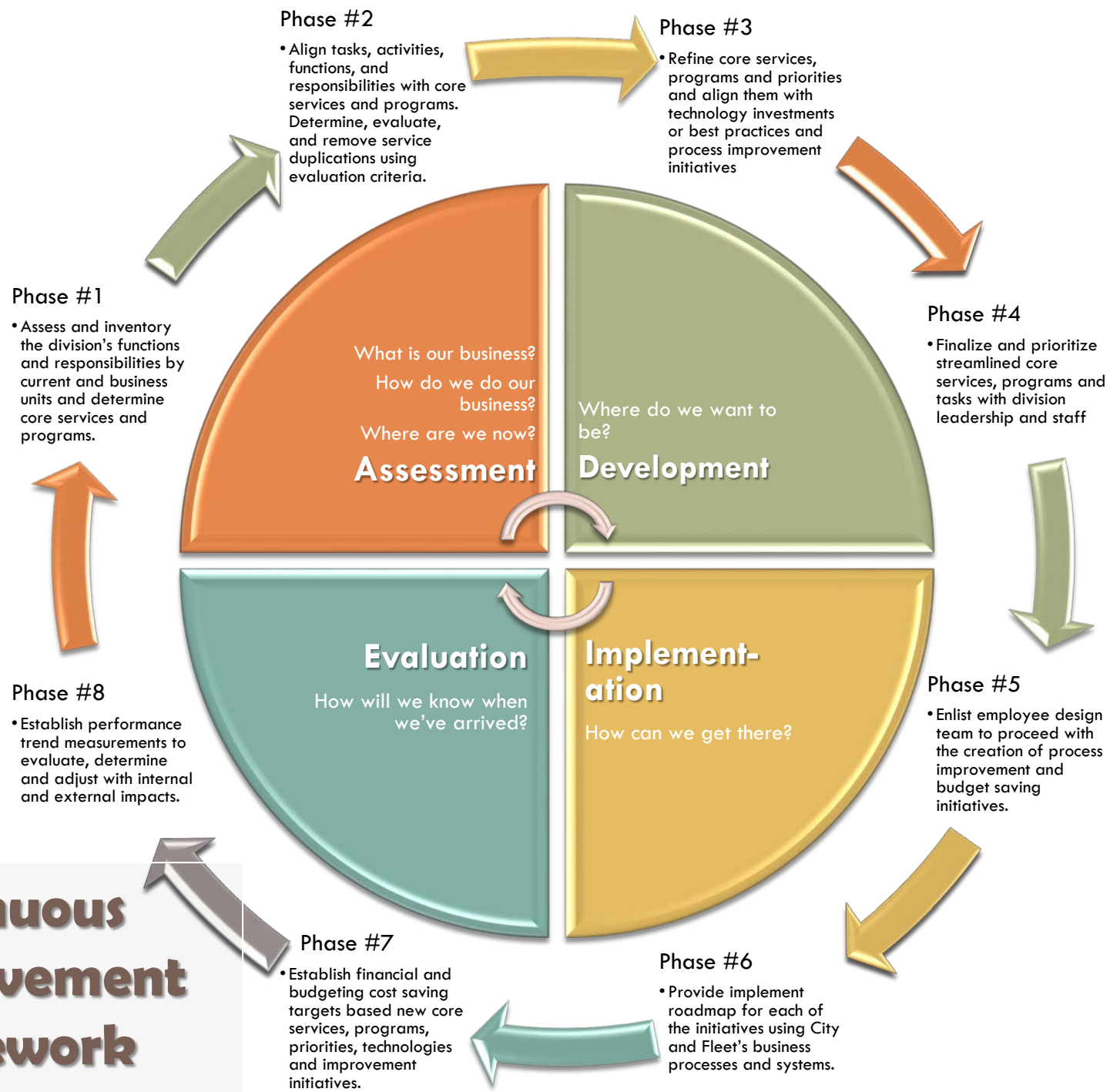


Fleet Business Transformation using Data Driven Decisions

**Sacramento, CA
City & County**





Continuous Improvement Framework

The Approach

- Develop a Clear Strategy
- The Right People and Systems
- Appropriate Tactics
- Structured Work Priorities through planning and scheduling
- Maintenance Optimization
- Best Fleet Management Practices

Where to Start?

- Needed to Establish:
 - Initial baseline of operational metrics
 - Standardization of maintenance practices
 - Ability to report/measure progress
 - Ability to push out data to City Staff

- Required upgrade of Operational Tool Kit

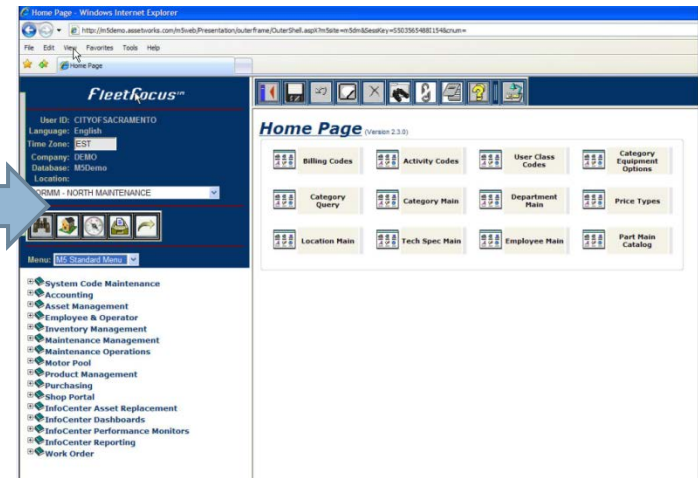
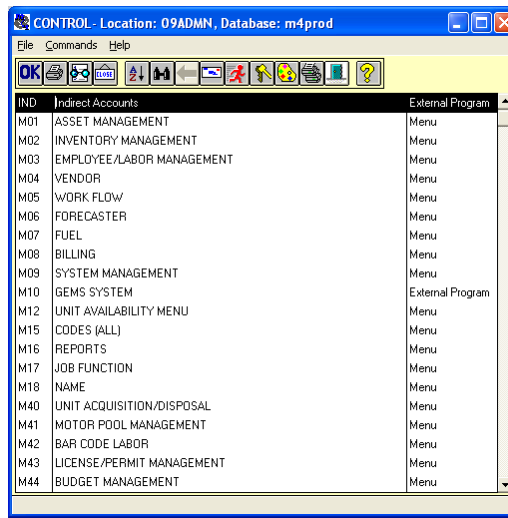
Business Transformation

Operational Overhaul

- “Tuned up” & upgraded fleet system (M5) with full functionality
 - ▣ Provides many more advantages to gather, format and disseminate information
 - ▣ Technology Backbone
- Implemented 3rd Party Solutions to meet specific identified Business Plan Initiatives
 - ▣ AssetWorks Fuel Focus
 - ▣ Verizon Network Fleet with M5 telematics module
 - ▣ Fleet Carma

Upgrading the Technology Toolkit

- AssetWorks M5 v. 16 Provides web-architecture and advanced features and capabilities
 - ▣ Dashboards and KPI's
 - ▣ Crystal Reports are standard
 - ▣ Ability to push out data



Upgrading the Technology Toolkit

- FuelFocus – (City)
 - RF Vehicle Identification Boxes
 - Provide more accurate collection of fueling data
 - Capabilities to capture Telemetrics data

- Integration Capabilities - allow automated capture of specialty data – (County)
 - Better Accuracy
 - No additional County Resources
 - Integrations include:
 - Verizon Network Fleet integrated with M5 telematics module



Standard Practices



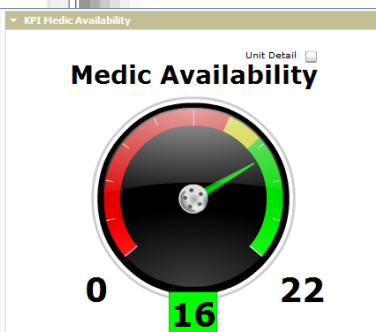
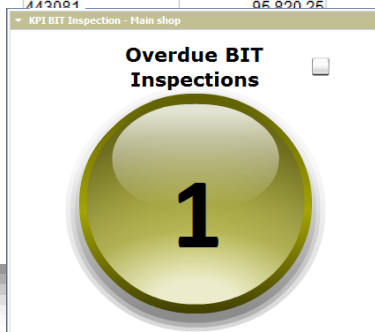
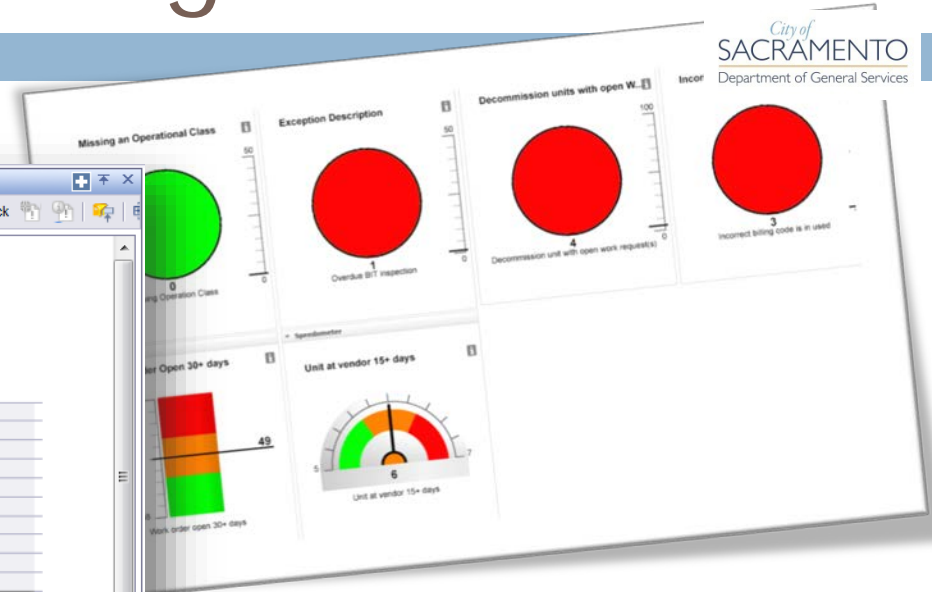
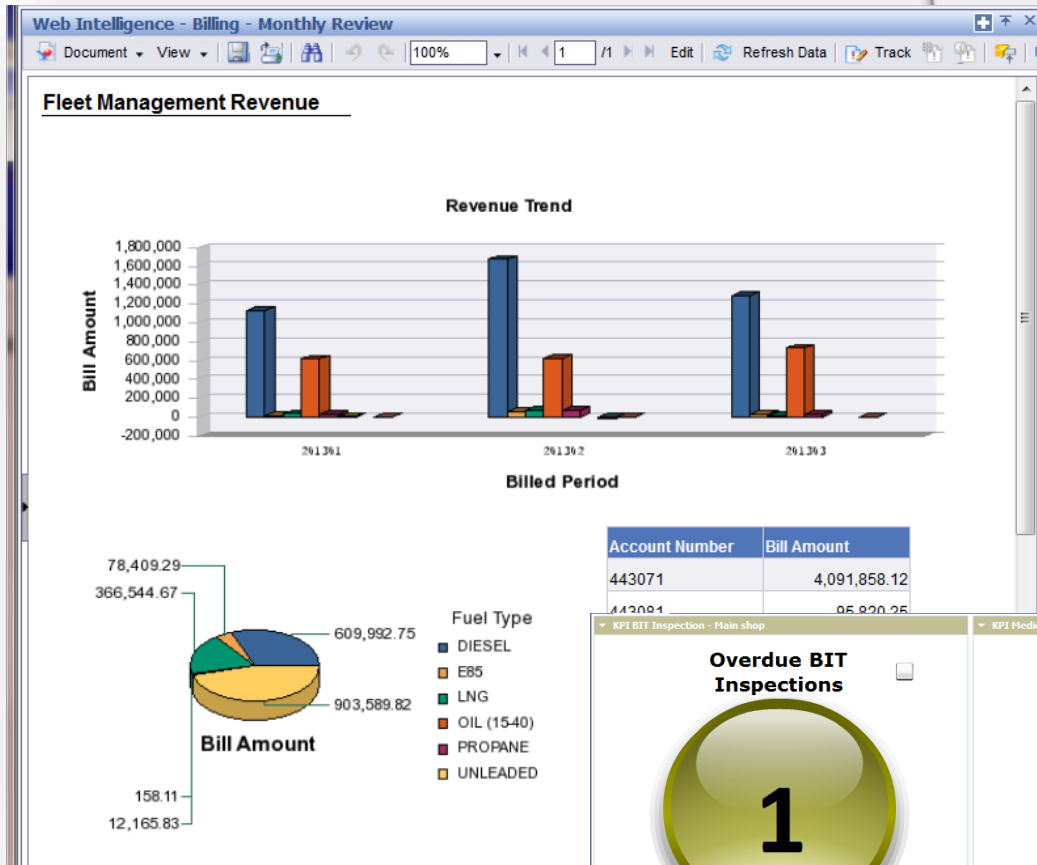
Data Driven Decisions

- SAP Business Object Reporting Tool
 - Real Time Data From Asset Management System
 - Customers Access
 - Staff Access

- Key Reports:
 - Operations Reports
 - Staff Productivity
 - Vehicle Scheduling
 - Smog/Smoke Check Tracking
 - Unit Utilization Reports
 - Billing
 - Fuel
 - Air Resources CARB mandated Report
 - Budgeting
 - Total Cost of Ownership



Fleet Business Intelligence



Fleet Business Intelligence (FBI)

Share insights & Making
Information Available
Transparency
Synergy



Staff Information

- Provide actual performance Metrics on the Shop Floor for more “interaction”



Employee Score Card



City of Sacramento - Department of General Services
Fleet Management Division

| Dates of Evaluation | |
|---------------------|-----------|
| From: | 2/1/2009 |
| Through: | 1/31/2010 |

Employee Scorecard Report

Employee: BEEBY, CHARLES D. (5039) / eCAPS: 5781
Job Title: EQUIP MECHANIC II
Start Date / Employment Length: 07/11/2005 / 4.82 years

Current Location: 07REFU
Supervisor: BARKER, STEPHEN
Supervisor Title: EQ MAINT SUPVR

Labor Type: DIRECT

| Time Type | Description | Booked Hours | Percentage |
|-----------|--------------------|-------------------------------------|-----------------|
| OSO | Out Of Class OT | 7.72 | 0.36% |
| OCS | Out Of Class Night | 31.70 | 1.47% |
| OVT | Overtime | 65.18 | 3.01% |
| SS1 | Night Shift | 1,440.84 | 66.60% |
| | | Total DIRECT Hours: 1,545.44 | (71.43%) |

Labor Type: INDIRECT

| Time Type | Booked Hours | Percentage | |
|-----------|--------------|-------------------------------------|-----------------|
| CTO | 5.90 | 0.25% | |
| FUR | 56.00 | 2.59% | |
| HOL | 96.00 | 4.44% | |
| HYA | 8.00 | 0.37% | |
| OVT | 1.42 | 0.07% | |
| REG | 294.15 | 13.60% | |
| SIK | 73.00 | 3.37% | |
| VAC | 84.00 | 3.88% | |
| | | Total INDIRECT Hours: 618.07 | (28.57%) |

| Dates of Evaluation | |
|---------------------|-----------|
| From: | 2/1/2009 |
| Through: | 1/31/2010 |

Report

Current Location: 07REFU
Supervisor: BARKER, STEPHEN
Supervisor Title: EQ MAINT SUPVR

Employee Labor Breakdown

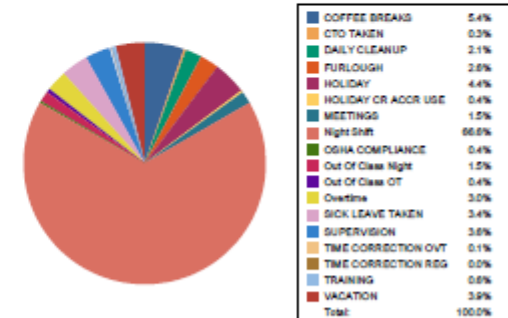
| Labor w/ Planned Hours | | | | Labor w/o Planned Hours | | | |
|------------------------|------|----------|------------|-------------------------|-----|------|-------|
| WOs | Jobs | Hours | Est. Hours | Difference | WOs | Jobs | Hours |
| 545 | 901 | 1,540.54 | 1,724.03 | 183.49 (10.64%) | 18 | 21 | 4.90 |

Shop Average Labor Breakdown For: 07REFU

| Job Classification | Direct Hours | % | Indirect Hours | % | Total Hours |
|------------------------------|--------------|--------|----------------|--------|-------------|
| EQ BODY MECHANIC II | 2.05 | 100.0% | | | 2.05 |
| EQ MAINT SUPVR | | | 2,215.55 | 100.0% | 2,215.55 |
| EQUIP MECHANIC II | 18,293.59 | 65.3% | 9,718.28 | 34.7% | 28,011.88 |
| EQUIP MECHANIC III | 3,162.25 | 38.6% | 5,025.80 | 61.4% | 8,188.05 |
| EQUIPMENT SERVICE WORKER | 7,557.65 | 73.8% | 2,676.40 | 26.2% | 10,234.05 |
| STOREKEEPER | | | 4,339.63 | 100.0% | 4,339.63 |
| VEHICLE SERVICE ATTENDANT | 1,286.40 | 75.7% | 413.18 | 24.3% | 1,699.58 |
| VEHICLE SERVICE ATTENDANT R2 | 2,051.50 | 83.5% | 404.17 | 16.5% | 2,455.67 |

* Indirect "REG" time type can include, but not limited to, the following time types: Supervision, Clerical, Training, Coffee breaks, Cleanup, Meetings, Time Corrections, Inventory, etc.

Time Type Breakdown



Total Cost of Ownership



City of Sacramento
Department of General Services
Fleet Management

Unit TCO Analysis Report

9363 - 2001 LEACH 27 YD S/L TCO: \$845,991

Status: **Sale**

Description:
 In Service Date: 01/02/2002
 In Service Age: 12.3 Years
 Model Age: 13.0 Years
 Current DeptID: 13001731 - RESIDENTIAL RECYCLING
 Maint. Location: Meadowview Fleet Service Facility

Category: C3014 - TRK,REFUSE SL
Asset Class: S LOADER
Expected Years/Meter: 7 / 0
Meter Type: Mile
Current Odometer: 154,055
Original DeptID: 13001311 - FLEET MANAGEMENT ADMIN
Parking Location: Meadowview Fleet Service Facility

Last Meter Reading: 10/24/2012 3:33:10PM

Fuel / Usage 5-Year Trend

| | 2014 | 2013 | 2012 | 2011 | 2010 |
|-------------------------|------|---------|----------|----------|----------|
| Yearly Fuel Consumption | 0 | 542 | 4,896 | 5,534 | 5,142 |
| Monthly Avg Consumption | 0 | 45 | 408 | 461 | 429 |
| Yearly Driven | 0 | 967 | 9,724 | 11,692 | 12,615 |
| Monthly Avg Driven | 0 | 81 | 810 | 974 | 1,051 |
| Yearly Fuel Cost | \$0 | \$2,095 | \$18,450 | \$18,597 | \$14,256 |
| Monthly Avg Cost | \$0 | \$175 | \$1,537 | \$1,550 | \$1,188 |

Life To Date Fuel Qty Consumed: 63,875 Life To Date Fuel Costs: \$160,448

Service Job Cost History

| | In-House Work | | Outsourced Work | | Capitalization | Total |
|--------------|------------------|-------------|-----------------|-------------|----------------|------------------|
| | Yearly Sum | Monthly Avg | Yearly Sum | Monthly Avg | Yearly Sum | |
| 2013 | \$16,516 | \$ 1,376 | \$275 | \$ 23 | \$0 | \$16,791 |
| 2012 | \$57,440 | \$ 4,787 | \$2,444 | \$ 204 | \$0 | \$59,884 |
| 2011 | \$62,128 | \$ 5,177 | \$3,387 | \$ 282 | \$354 | \$65,870 |
| 2010 | \$60,975 | \$ 5,081 | \$18,194 | \$ 1,516 | \$1,606 | \$80,775 |
| 2009 | \$55,328 | \$ 4,611 | \$4,673 | \$ 389 | \$0 | \$60,002 |
| 2008 | \$45,672 | \$ 3,806 | \$3,674 | \$ 306 | \$0 | \$49,345 |
| 2007 | \$33,552 | \$ 2,796 | \$7,756 | \$ 646 | \$33 | \$41,341 |
| 2006 | \$31,585 | \$ 2,632 | \$14,797 | \$ 1,233 | \$0 | \$46,382 |
| 2005 | \$29,545 | \$ 2,462 | \$10,947 | \$ 912 | \$0 | \$40,492 |
| 2004 | \$23,031 | \$ 1,919 | \$16,037 | \$ 1,336 | \$0 | \$39,067 |
| 2003 | \$15,066 | \$ 1,256 | \$4,866 | \$ 405 | \$0 | \$19,932 |
| 2002 | \$10,076 | \$ 840 | \$700 | \$ 58 | \$0 | \$10,776 |
| Total | \$440,915 | | \$87,748 | | \$1,993 | \$530,656 |

Accounting Information

Vendor: - Offroad Use: 40%
 Purchase Price: \$154,532.33 Acquisition Prep: \$0.00 Accessory Cost: \$354.29 Total: \$154,886.62

Technical Specification - (013014)

Gross Vehicle Weight: EPA Fuel Economy City (MPG): Fuel Type Tank Size Max Transactions Daily Qty
EPA Fuel Economy Hwy (MPG): DIESEL 60 3 180
EPA Fuel Economy Combined (MPG): OIL (15-40) 18 3 54

Preventive Maintenance Schedule: 3/6/9/SMOKE/BIT

SMOG Required?: No

SMOKE Required?: No

| Job Code | Job Description | Time Interval | Usage Interval | Last Done On | Job Count |
|------------|---|---------------|----------------|--------------|-----------|
| PM-INS-BIT | PM SERVICES BIT INSPECTION | 90 Days | | 09/28/2012 | 58 |
| PM-PMM-PMB | PM SERVICES PM-(B) LUBE/OIL/INSPECTIONS | 181 Days | 3,000 Miles | 07/04/2012 | 34 |
| PM-PMM-PMC | PM SERVICES PM-(C) LUBE/OIL/TRANS+FILTERS | 365 Days | 9,000 Miles | 02/14/2012 | 20 |

TCO, Low-High Cost after 6 Years

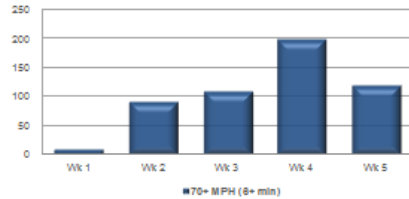
| Model | TCO Year 1 | TCO Year 2 | TCO Year 3 | TCO Year 4 | TCO Year 5 | TCO Year 6 |
|------------------------|------------|------------|------------|------------|------------|------------|
| Fusion SE 2.5L | \$ 24,360 | \$ 26,385 | \$ 28,410 | \$ 30,434 | \$ 32,459 | \$ 34,484 |
| Fusion Hybrid | \$ 27,889 | \$ 29,009 | \$ 30,129 | \$ 31,250 | \$ 32,370 | \$ 33,490 |
| Fusion Energi | \$ 39,770 | \$ 40,591 | \$ 41,411 | \$ 42,232 | \$ 43,052 | \$ 43,873 |
| C-Max (Hybrid) | \$ 28,290 | \$ 29,410 | \$ 30,530 | \$ 31,651 | \$ 32,771 | \$ 33,891 |
| C-Max Energi | \$ 36,009 | \$ 36,992 | \$ 37,975 | \$ 38,958 | \$ 39,940 | \$ 40,923 |
| Taurus 2.0L Ecoboost | \$ 29,703 | \$ 31,728 | \$ 33,752 | \$ 35,777 | \$ 37,802 | \$ 39,827 |
| Prius | \$ 31,841 | \$ 32,894 | \$ 33,947 | \$ 35,000 | \$ 36,053 | \$ 37,106 |
| Prius Plug-In | \$ 30,618 | \$ 31,580 | \$ 32,543 | \$ 33,505 | \$ 34,468 | \$ 35,430 |
| Volt | \$ 12,598 | \$ 13,925 | \$ 15,251 | \$ 27,849 | \$ 29,175 | \$ 30,502 |
| Impala 3.6L (gasoline) | \$ 28,959 | \$ 31,352 | \$ 33,745 | \$ 36,138 | \$ 38,531 | \$ 40,924 |
| Impala 3.6L (E85) | \$ 29,509 | \$ 32,451 | \$ 35,393 | \$ 38,336 | \$ 41,278 | \$ 44,221 |
| Civic Natural Gas | \$ 27,725 | \$ 28,144 | \$ 28,564 | \$ 28,983 | \$ 29,403 | \$ 29,822 |

COUNTY OF SACRAMENTO

Data for the month of July 2017 vs that of Prior Period Nov 2015

SAFETY

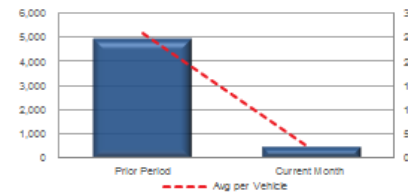
Speeding Incidents



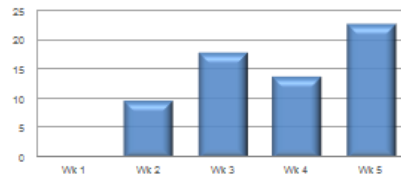
SPEEDING

Current Month 529
 Prior Period 4,963
 Change (+/-) ✔ (4,434)

Speeding vs. Prior Month



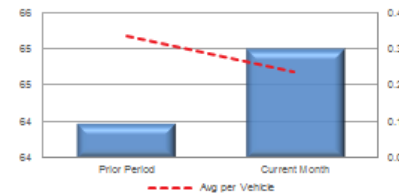
Hard Acceleration



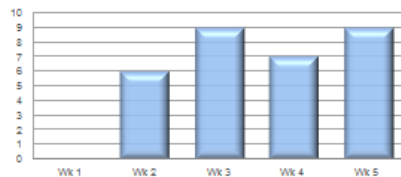
HARD ACCELERATION

Current Month 65
 Prior Period 64
 Change (+/-) ✘ 1

Hard Acceleration vs. Prior Month



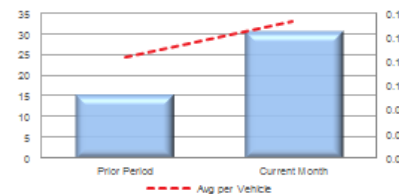
Hard Braking



HARD BRAKING

Current Month 31
 Prior Period 16
 Change (+/-) ✘ 15

Hard Braking vs. Prior Month

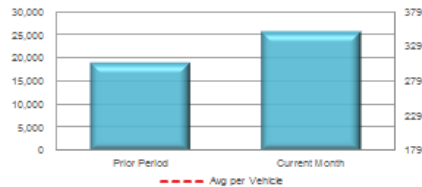


COUNTY OF SACRAMENTO

Data for the month of July 2017 vs that of Prior Period Nov 2015

UTILIZATION

Total Trips



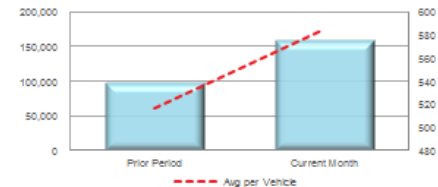
TRIPS

Current Month 25,705
Prior Period 18,853
Change (+/-) 6,852

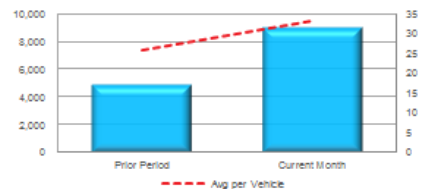
MILEAGE

Current Month 159,776
Prior Period 98,584
Change (+/-) 61,192

Total Mileage



Total Engine Hours



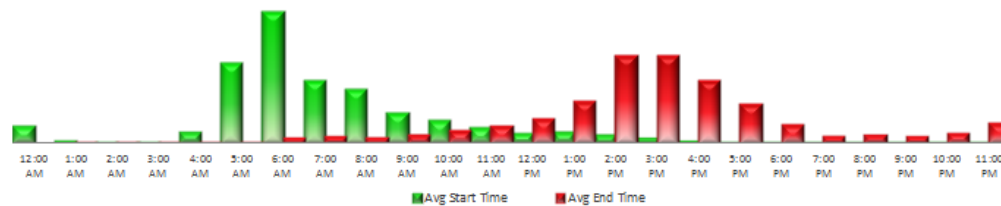
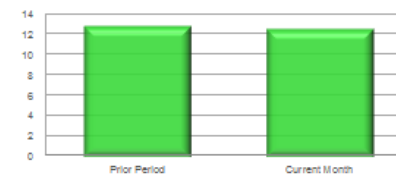
ENGINE HOURS

Current Month 9,016
Prior Period 4,928
Change (+/-) 4,088

AVERAGE DAYS

Current Month 12.6
Prior Period 12.9
Change (+/-) (0.3)

Average Days Utilized



3-Step Approach to Reliable EV Adoption Planning

How are ICE fleet vehicles currently being used?

Step #1

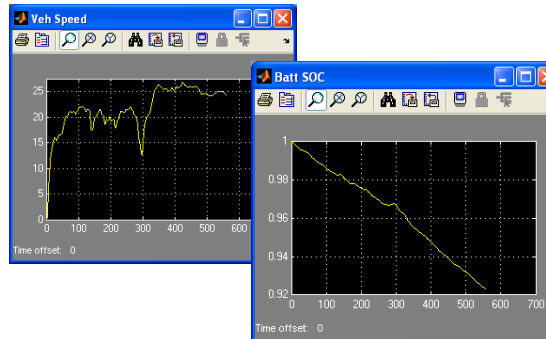
Data log existing vehicles



Will EVs be range/charge capable?
Will they reduce total costs?

Step #2

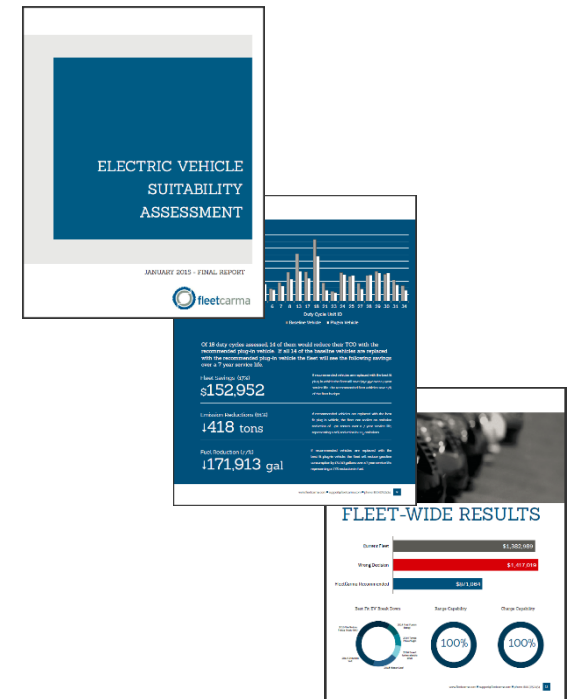
Simulate duty cycle data in EV modelling and simulation software



How do I begin incorporating EVs into my fleet?

Step #3

Build multi-year EV adoption and charging infrastructure plan



Benchmarking ICE Vehicle Duty Cycles



FleetCarma C2 Vehicle Monitoring Device Clipped Into OBD II Port

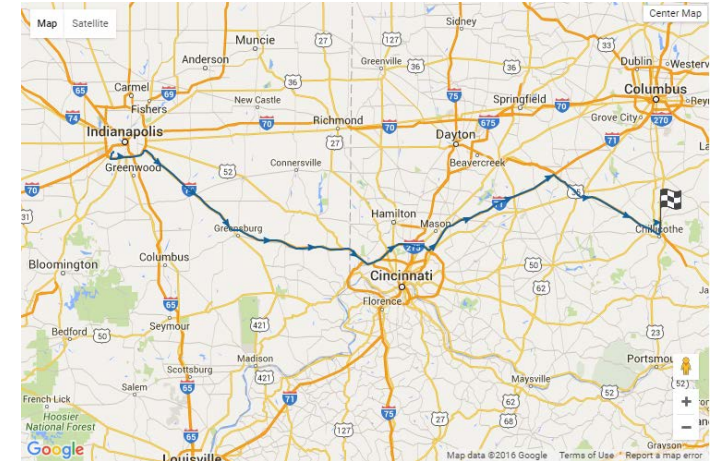
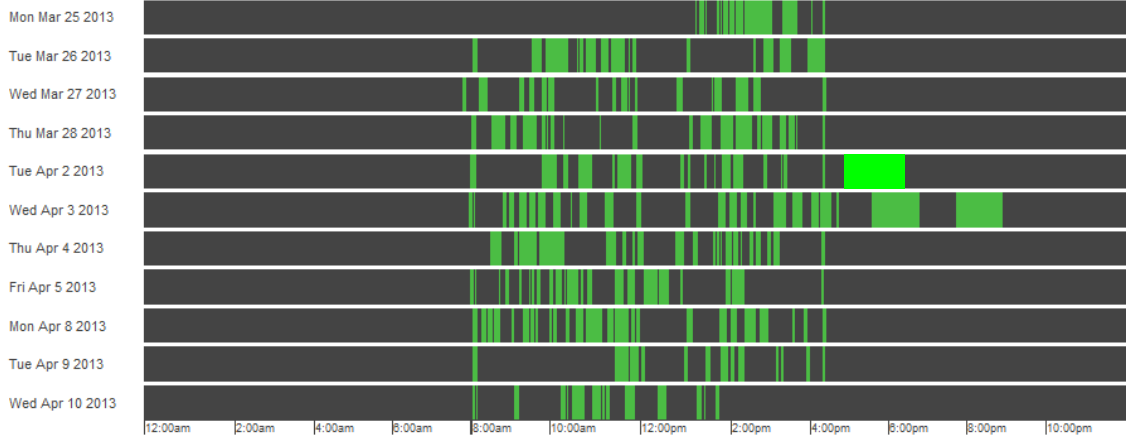


2010 Ford Fusion

Fleet:
 Depot:
 Vehicle: 2010 Ford Fusion
 Unit Id: 1442
 Description:
 Log Dates: March 25 - April 10 2013
 Logtime: 16 Days, 0 Hours
 Operation Hours: 27.5 (1.7 h/operating days)
 Time Idling: 318.8 min (19.3%)
 Total Distance Travelled: 632 mi
 Longest Single Day: 194 mi

Consumption: 21 MPG
 1,572 Wh/mi
 Carbon Emissions: 1.20 lb/mi

Daily Utilization



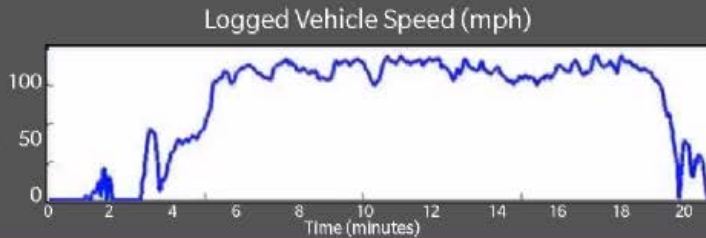
| Date | Duration | Trip Distance (mi) | Fuel Consumed (gal) | Fuel Consumption (MPG) | Ambient Temperature (°F) | Average Speed (MPH) | Eco Driving Score | % Hard Acceleration | % Hard Braking | % Time Idle | Number of Idle Events | Idle Fuel Use (gal) |
|---------------------------|----------|--------------------|---------------------|------------------------|--------------------------|---------------------|-------------------|---------------------|----------------|-------------|-----------------------|---------------------|
| April 13 2016 08:19:35 PM | 01:19:00 | 63.48 | 8.2 | 7.78 | 53.5 | 48.21 | 100 | 0 | 0 | 18 % | 2 | 0.17 |
| April 13 2016 05:14:32 PM | 02:29:13 | 148.59 | 18.7 | 7.94 | 59.7 | 59.74 | 100 | 0 | 0 | 3 % | 4 | 0.05 |
| April 13 2016 12:17:08 PM | 04:00:59 | 211.94 | 29.9 | 7.09 | 58 | 52.77 | 100 | 0 | 0 | 17 % | 5 | 0.08 |

EV Modelling & Simulation Demonstration Video

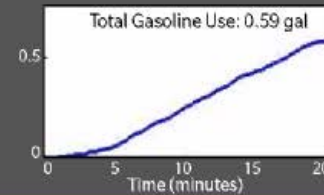


Electric Vehicle Modelling and Simulation

Logged Vehicle

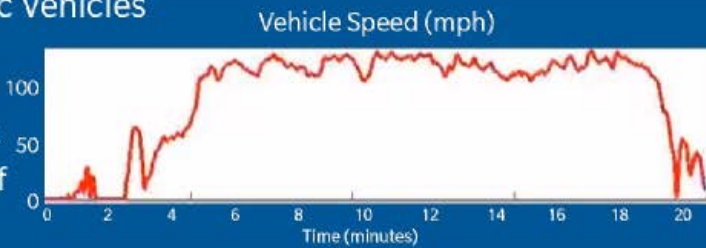


Logged Gasoline Use



| Trip Metrics | |
|---------------|-------------|
| Distance: | 18.01 miles |
| Fuel Economy: | 30.37 MPG |

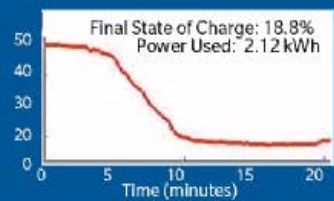
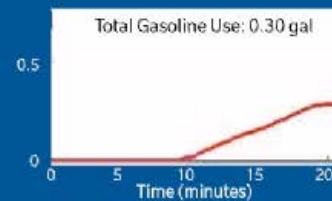
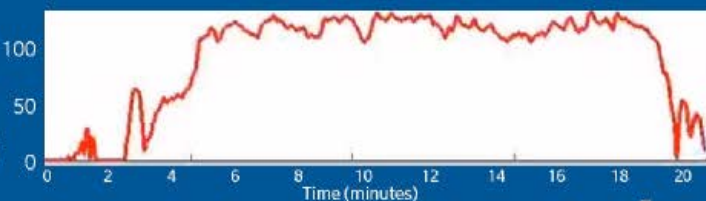
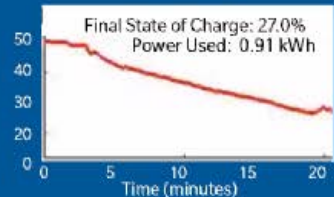
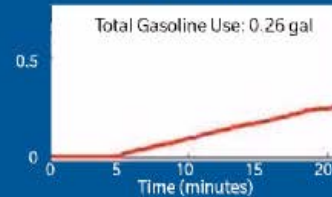
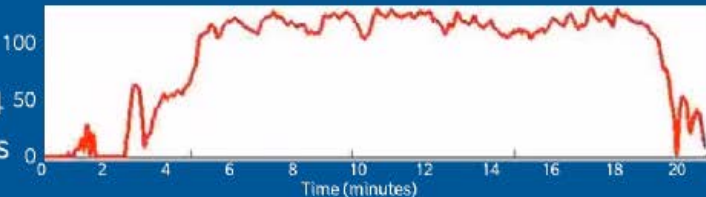
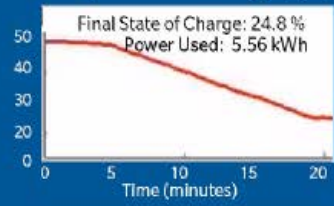
Simulated Electric Vehicles



Simulated Gasoline Use (gal)



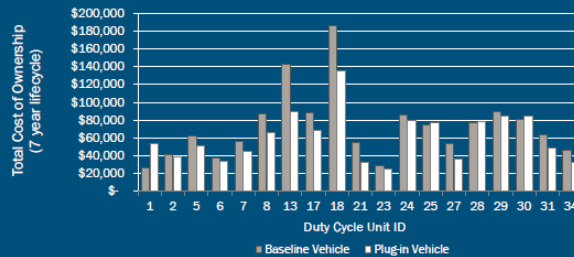
Battery State of Charge (%)



Present & Deliver Final Report to the Fleet and Stakeholders

ELECTRIC VEHICLE SUITABILITY ASSESSMENT

JANUARY 2015 - FINAL REPORT



Of 18 duty cycles assessed, 14 of them would reduce their TCO with the recommended plug-in vehicle. If all 14 of the baseline vehicles are replaced with the recommended plug-in vehicle the fleet will see the following savings over a 7 year service life.

Fleet Savings (17%)
\$152,952

If recommended vehicles are replaced with the best fit plug-in vehicle the fleet will save \$152,952 over a 7 year service life. The recommended fleet vehicles save 17% of the fleet budget.

Emission Reductions (61%)
↓418 tons

If recommended vehicles are replaced with the best fit plug-in vehicle, the fleet can realize an emission reduction of 418 tonnes over a 7 year service life, representing a 61% reduction in CO₂ emissions.

Fuel Reduction (77%)
↓171,913 gal

If recommended vehicles are replaced with the best fit plug-in vehicle, the fleet will reduce gasoline consumption by 171,913 gallons over a 7 year service life, representing a 77% reduction in fuel.

www.fleetcarma.com | support@fleetcarma.com | phone: 800.975.2434



FLEET-WIDE RESULTS



www.fleetcarma.com | support@fleetcarma.com | phone: 800.975.2434

EV Monitoring Features

Maintenance Data



Automated
odometer
notifications



DTC and 12v
battery issue
notifications

Battery Data



EV range
management
real-time SOC



Battery
health
monitoring

Charging Data



EV charging
data & TOU
load profile



Plug-in
compliance
reporting

Driving Data



GPS location
for trips and
charge events



Eco-driving &
safe driver
scorecards

Client Support



Dedicated
technical
support



EV fleet
consulting
services

PHEV Dashboard

🚗 Vehicle Overview



1501
2011 Chevrolet Volt
F4059C


72,691
mi

Measured Odometer


1,207
mi

Distance Logged


31
Percent

Idle Fraction


19
gal

Fuel Consumed


64
MPG

Fuel Consumption


0
gal

Idle Fuel Consumption


0
gal

Idle Event Fuel Consumption


81
Rating (out of 100)

Driver Score


0
lb/mi

Total CO2 Emissions


140
kWh

Electricity Consumed


72
Wh/mi

Electricity Consumption


27
kWh

Charger Loss


100
Percent

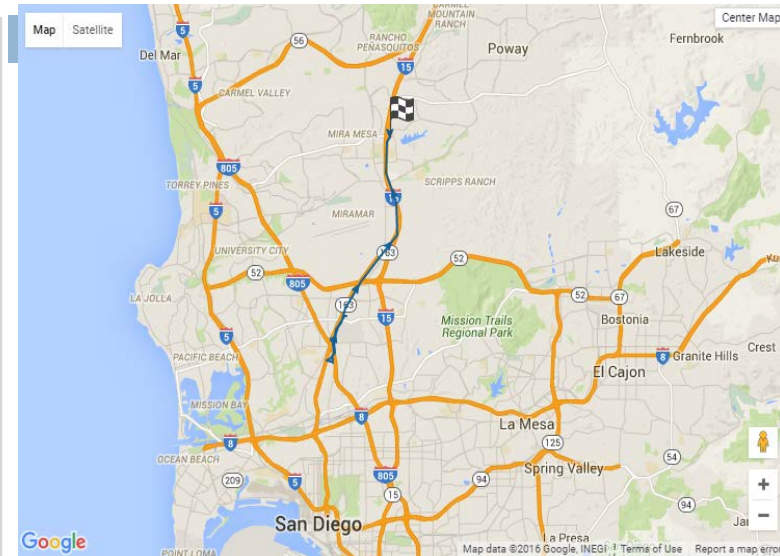
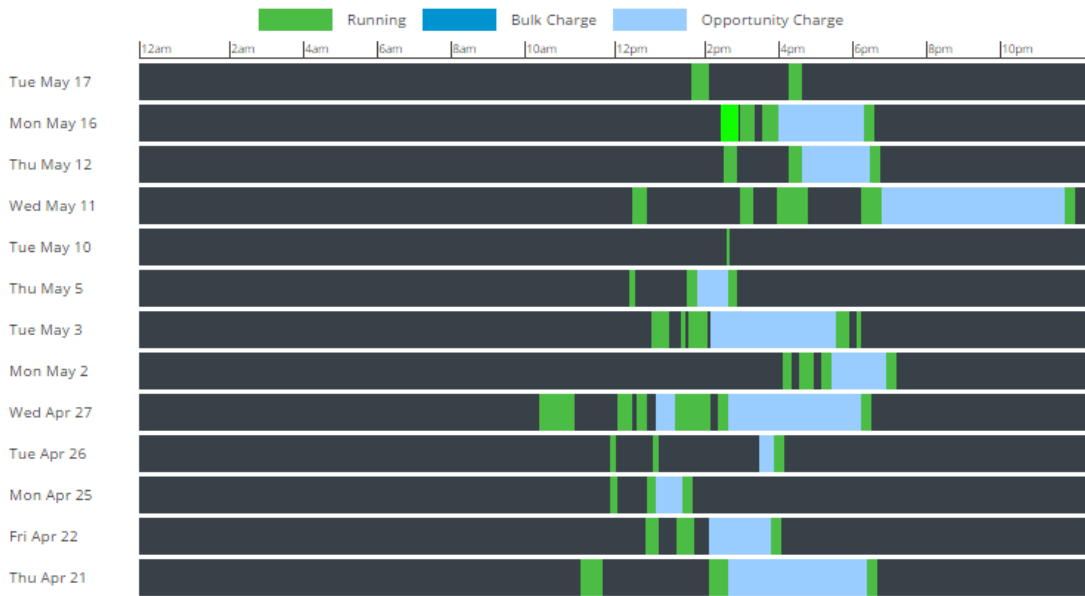
Battery Health


47
Percent

Electric Fraction



Vehicle Trip Reports



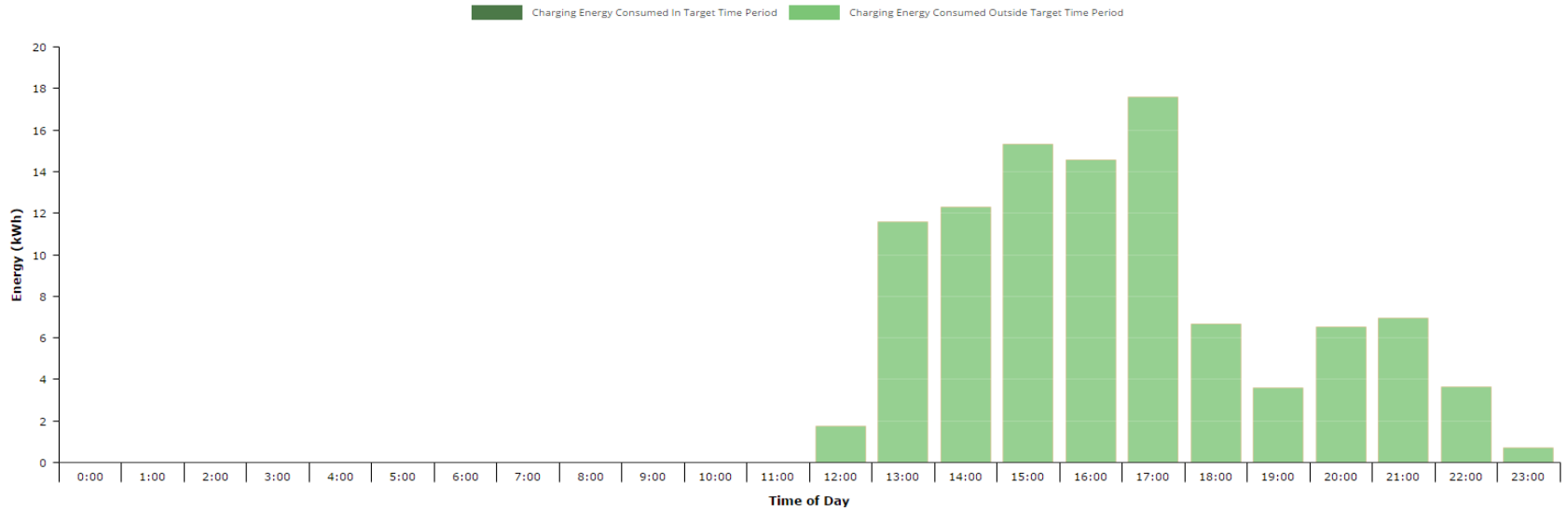
Trip Log Charge Log Alerts

Tools

| Date | Duration | Trip Distance (mi) | Electricity Consumed (kWh) | Total Energy Consumption (Wh/mi) | Start SOC | End SOC | Ambient Temperature (°F) | Average Speed (MPH) | Eco Driving Score | % Hard Acceleration | % Hard Braking | % Time Idle | Number of Idle Events |
|-------------------------|----------|--------------------|----------------------------|----------------------------------|-----------|---------|--------------------------|---------------------|-------------------|---------------------|----------------|-------------|-----------------------|
| May 16 2016 02:35:26 PM | 00:28:36 | 11.68 | 3.03 | 259 | 99.4 | 77.4 | 64.7 | 24.5 | 57 | 0 | 0 | 34 % | 7 |
| May 12 2016 06:22:22 PM | 00:15:05 | 0 | -0.04 | - | 99.5 | 99.5 | 32 | 0 | 100 | - | - | 100 % | 1 |
| May 12 2016 04:19:36 PM | 00:17:58 | 10.92 | 3.03 | 278 | 86.2 | 59.3 | 71.8 | 36.46 | 76 | 0 | 0 | 19 % | 2 |
| May 12 2016 02:40:25 PM | 00:19:56 | 8.98 | 1.96 | 218 | 100 | 86.3 | 70.9 | 27.02 | 73 | 0 | 0 | 29 % | 6 |
| May 11 2016 11:14:59 PM | 00:15:19 | 0 | -0.04 | - | 100 | 100 | 32 | 0 | 100 | - | - | 100 % | 1 |
| May 11 2016 06:08:15 PM | 00:31:14 | 20.22 | 5.8 | 287 | 39.8 | 10.2 | 71.8 | 38.85 | 81 | 0 | 0 | 18 % | 4 |

Time-of-Use Charging Profile and Energy Demand

⚡ Charging by Time of Day



📍 Charging by Geofence

Tools ▾ Search...

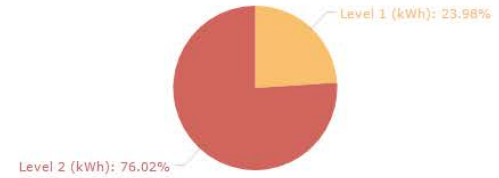
| Geofence | Charging (kWh) |
|-------------------|----------------|
| Other Charging | 157 |
| AlcoPark | 40 |
| 7th and Jefferson | 0 |
| Amador Garage | 0 |

Showing 1 to 4 of 4 entries

Show
5

< 1 >

🔌 Charging by Level





- This CNG Garbage Truck displaces 95,414 gallons of petroleum over 10 years
- Reduces Green House Gas(GHG) tailpipe emissions by 148 Short Tons over 10 years
- Saving taxpayers \$12K per year
- Projected total savings of \$116K over life of the vehicle





- This CNG Sweeper Truck displaces 24,890 gallons of petroleum over 10 years
- Reduces Green House Gas(GHG) tailpipe emissions by 39 Short Tons over 10 years
- Saving taxpayers \$3K per year
- Projected total savings of \$30K over life of the vehicle



- This CNG Asphalt Truck displaces 26,620 gallons of petroleum over 10 years
- Reduces Green House Gas(GHG) tailpipe emissions by 41 Short Tons over 10 years
- Saving taxpayers \$3K per year
- Projected total savings of \$32K over life of the vehicle



Department of Waste Management & Recycling
OUR GREEN CLEAN!
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SACRAMENTO COUNTY
CA 55755

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7445

704149

704147

1457952

Smile Keepers
The Tooth Fairy
Smile Keepers

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