Deploying Idle Reduction Technology:
Using Telematics to Reduce Emissions and Operational Costs

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Disclosure

Overview

- Backgrounder: The Vehicle Idling Problem
- Why deploy Anti Idling Technology
- An Introduction to the GRIP Idle Management System
- How the GRIP System Works
- Customer Case Studies
- Available Support
- Questions?

Idling- The Science

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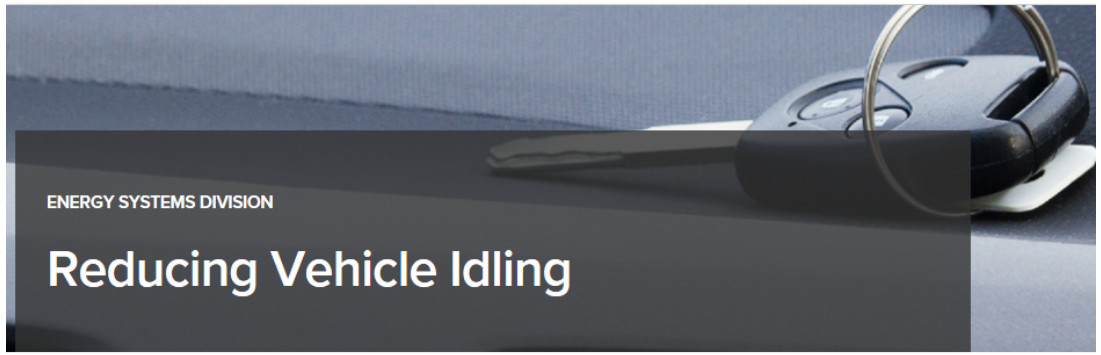
RESEARCH BUSII



Reducing the costs and hazards associating with running vehicles unnecessarily while stopped

What Is Idling?

When a vehicle's engine is on but the vehicle is not in motion, it is *idling*. Sitting at traffic lights, waiting in a running car to pick someone up, trucks idling while their drivers make deliveries or sleep during rest stops - these are all examples of idling.

Why Care About Idling?

Although many individual idling episodes are small, the cumulative impacts of idling are large! Consider that idling in the United States uses ***more than 6 billion gallons of fuel at a cost of more than $20 billion to consumers and businesses EACH year***. Other reasons to reduce idling include the fact that many states and municipalities are adopting stringent anti-idling laws and imposing large fines for those who violate the laws, and that the federal and some state governments offer incentives for those who adopt idling reduction measures.

Argonne Lab Resources

Idling- The Science

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How Can Idling Time be Reduced?

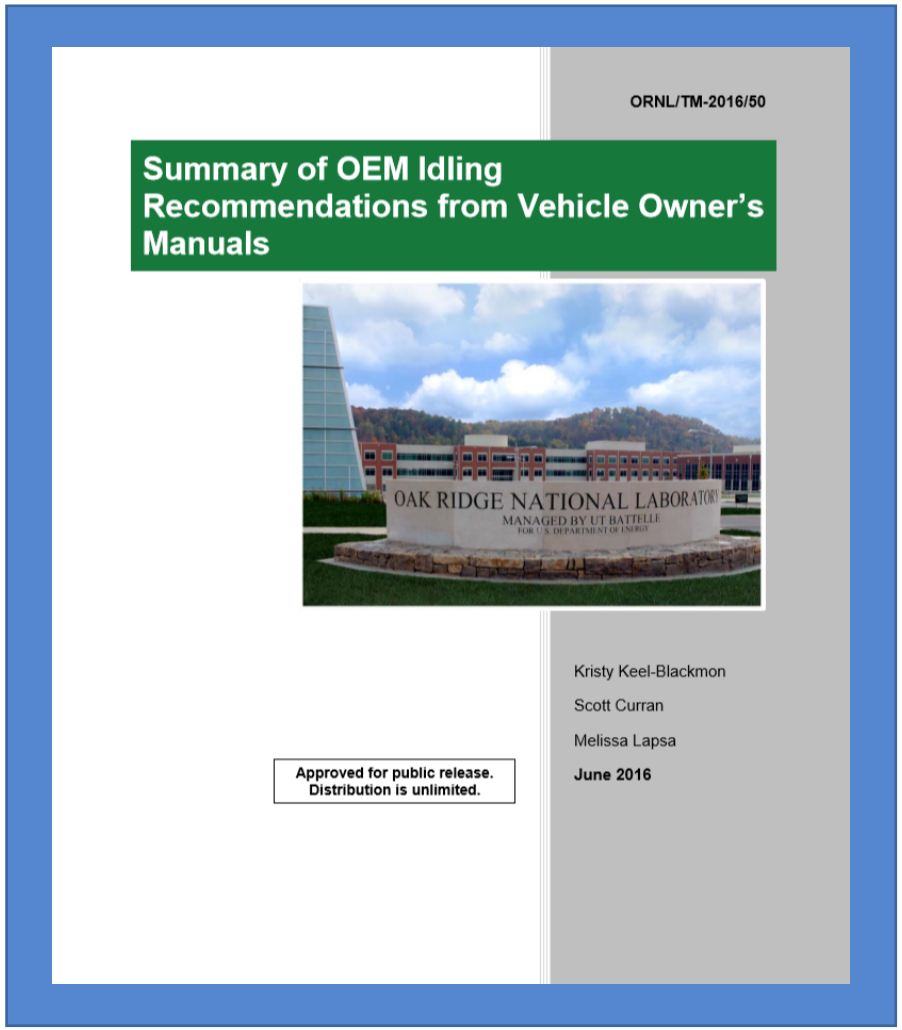
That depends on the type of vehicle and why it is idling. The good news is that reducing idling time need not compromise driver or passenger comfort.

For light-duty vehicles such as passenger cars, the answer is pretty simple; turn off the engine whenever running it is not truly necessary, such as while waiting to pick up children after school, waiting at long freight train crossings, or waiting for someone at the grocery store. For light-duty vehicles that require more extensive heating and power support, retrofits such as air heaters and auxiliary power systems can fill the gap.

For medium- and heavy-duty vehicles such as tractor-trailer trucks and locomotives, the answer depends a little more on why the vehicle is idling; there is no one-size-fits-all solution to idling. With support from the U.S. Department of Energy, Argonne National Laboratory has pioneered research into the science and economics of reducing idling, resulting in several landmark studies and tools to help drivers and organizations determine the best and most cost-effective ways to reduce the time they idle their vehicles.

Argonne Lab Resources

Idling- The Science



- From Oak Ridges National Test Laboratory

https://info.ornl.gov/sites/publications/files/Pub61263.pdf

- First extensive study in the US on the effects of Idling with key recommendations on Idle reduction

EXECUTIVE SUMMARY

The project upon which this report is based was conceived in 2012 during discussions between the East Tennessee Clean Fuels Coalition (ETCleanFuels) and Oak Ridge National Laboratory (ORNL) who both noted that a detailed summary of idling recommendations for a wide variety of engines and vehicles were not available in the literature. The two organizations agreed that ETCleanFuels would develop a first-of-its-kind collection of idling recommendations from the owner's manuals of modern production vehicles.

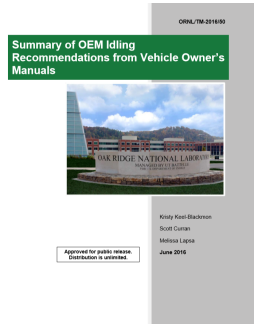
Vehicle engine idling, a subject that has long been debated, is largely shrouded in misinformation. The justifications for idling seem to be many: driver comfort, waiting in lines, and talking on cell phones to name a few. Assuredly, a great number of people idle because of the myths and misinformation surrounding this issue. This report addresses these myths by turning to statements taken directly from the automobile and engine manufacturers themselves.

Idling- The Science

None of the manufacturers mentioned in this report recommend extended idle time. In fact, the vast majority recommend that drivers avoid excessive idle time and idle only if necessary. Light-duty vehicles are ready to be driven at start up, and neither medium- nor heavy-duty vehicles need long warm up periods. According to many original equipment manufacturers (OEMs), idling can actually be damaging to an engine and vehicle components. This is because idling can produce sulfuric acid, which can eat away at the engine and other components. Additionally, idling results in lower in-cylinder temperatures combustion, which can produce additional soot, creates buildup in the engine, and causes unnecessary engine wear. Based on the potential for engine damage, drivers should avoid idling whenever possible

Common Myths About Idling

- Idling is more efficient and uses less fuel than turning the engine off and on again.
- Turning the engine off and on is hard on the starter.
- Idling is the best way to warm up the engine, especially in cold weather.
- Idling does not cause damage to a vehicle's engine.



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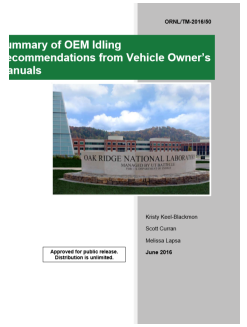
Idling- The Science

In addition to increased engine wear and tear, idling should be avoided for other important reasons. Vehicles get 0 MPG and fuel is unnecessarily wasted while idling. This wasted fuel can be costly over the course of a year, especially for fleets. The amount of fuel wasted will vary from vehicle to vehicle and depends on a number of conditions; however, a good rule of thumb to remember is that the larger the engine, the more fuel will be wasted while idling.[1] Many OEMs also state that engine oil can be affected by extended idling because the oil becomes contaminated, resulting in a decrease in oil life and thus the need for more frequent oil changes—another expense.



The harmful emissions that idling creates should also be considered. These emissions include nitrogen oxides, carbon monoxide, carbon dioxide, and particulate matter.[1] Some of these pollutants pose health threats on their own, and some will come into contact with heat and sunlight to form ground level ozone, a potent pollutant that can worsen asthma and other respiratory problems and cause reduced lung function. Ground level ozone is especially harmful to children, the elderly, people who work or exercise outside, and people with existing lung problems.[2]

As stated previously, idling is occasionally necessary, as is the case for some delivery trucks, instances of extreme weather, or waiting in a slow-moving line. However, most idling is unnecessary and can be eliminated through conscious effort. Some manufacturers do recommend a very short warmup or cooldown period, but only if a vehicle has been under high-power operation. Generally speaking, more than 5 minutes of idling is excessive and should be avoided.

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Idling- We we Idle

- The Vehicle Idles to maintain power to onboard systems
  - Policing- Computer, take down lights, air bags
  - Work Truck- power to PTO, other vehicle systems
- The Vehicle Idles to maintain occupant comfort
  - Cabin must be maintained for heat or cool, humidity issues
- Other considerations
  - Extreme Climates
    - Concerns over freezing
    - Filters & other Wear
  - Maintaining other engine dependent conditions
    - Air or Hydraulic pressure

Idling- The Impact on Engine Wear and Tear

- 1 hour of Idle is equal to 52 km or 32 miles of driving for engine wear and tear*
- Every 200 hours of Idling represents a 6,000 Mile/10,000km service
    - Impact on Maintenance frequency
        - Belts, Hoses, Pulleys, Fuel & Air Filter, Alternator, A/C Compressor, Timing Chain, Sparks/Ignition, Fuel Injector Cleaning, Oil Change and Coolant Change
- And for Diesel
    - DPF Fluid, Maintenance & Repair
    - Fuel contamination of Lube Oil is higher at Idle

*Source Ford Motor Company OEM data

Idling- The Impact on Fuel Consumption

- Ford 3.7L V6 Gasoline Engine (Police Interceptor) will Consume 0.7 Gallons or 2.6 Litres Per Hour when Idling (Loaded)
- Ford V8 Tahoe will consume 1 Gallon or 3.7 L/hr
- Class 8 Diesel Truck (37,000cwt Bucket Truck, no load) will consume 0.9 Gallons or 3.4 L/hr Idling
- John Deere Loader will consume 9 L/hr at Idle
- Cat D will consume 22 L/hr

As a reality check:

What is your fleet's Mpg?

Columbus PD has achieved 11.8mpg or 5.2 L/km, 17L/100km

Idling- The Impact on Emissions

- An gasoline engine produces 18.9 Pounds of CO_2 for every Gallon of fuel consumed or 2.26 Kg per Litre

- An diesel engine produces 18.9 Pounds of CO_2 for every Gallon of fuel consumed or 22.89 Kg per Litre

  - Depending on Climactic conditions, engine emissions may dwell in the vehicles immediate area posing H & S issues
  - Idling is directly correlated to fuel use and emissions
  - Idling may result in a 1-4% reduction in engine efficiency
  - A diesel engine produces higher emissions when idling

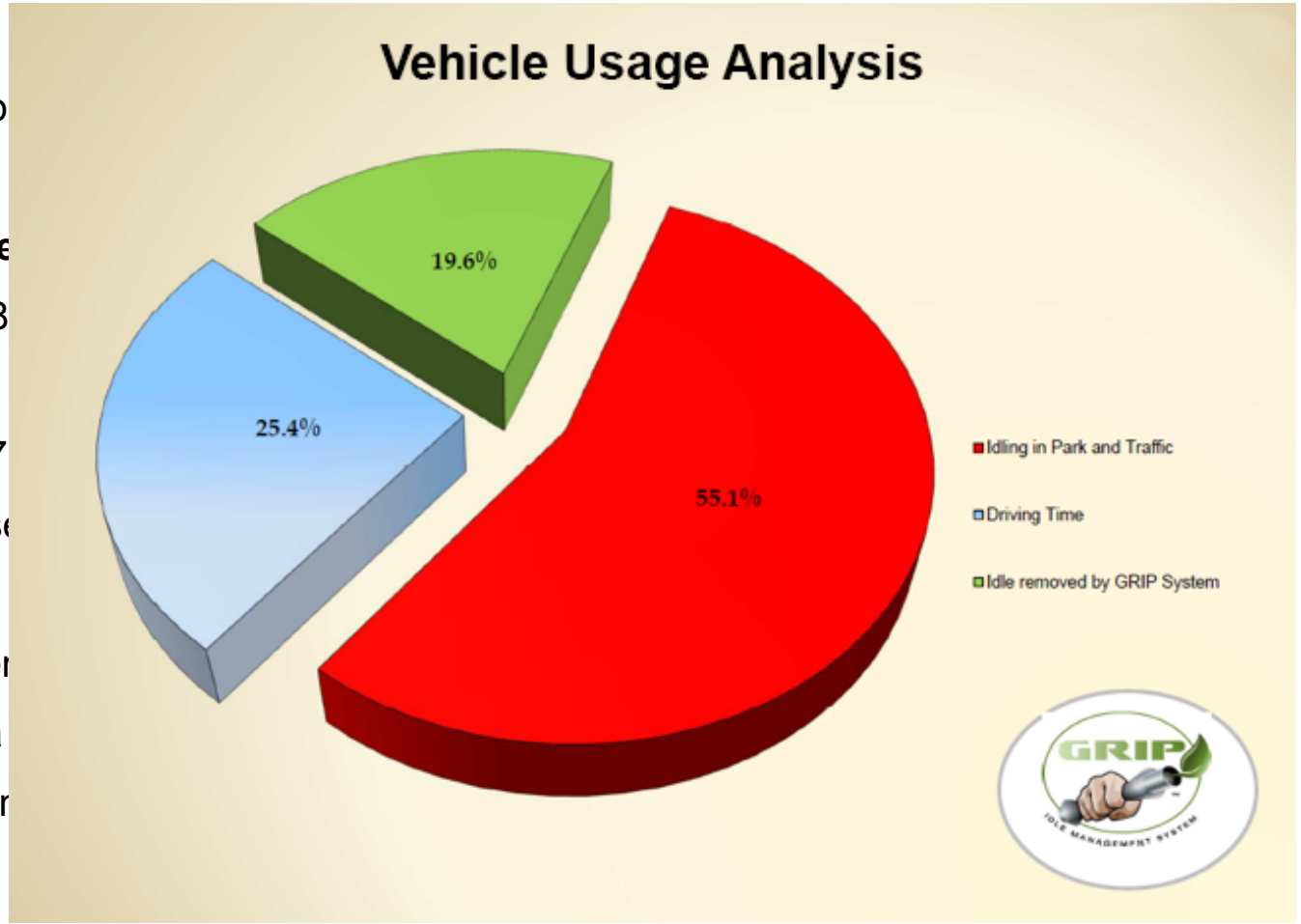
Idling- The Impact on Emissions

Why Deploy Anti Idling Technologies: Maintenance and Operational Cost Benefits - Policing

- **Direct Fuel Savings:** a typical police Fleet will Idle for 70% of the vehicles life
- Fuel economy impacted by poor combustion- 1-4%
- Reduced time and travel for re-fueling
- **Maintenance Savings:**
  - Less frequent service intervals, Engine life extended
  - In addition to shop time and materials, vehicle may have to be brought in with associated labour cost as well as being off the road
  - Fewer vehicles required when less shop time
- Reduced overtime due to emergency repairs/unscheduled activity
- Warranty impacts, OEM's checking for Engine hours
- Extended vehicle life or improved resale

Why Deploy Anti Idling Technologies: Operational Cost Policing Example

- **Fuel Savings:** a typ
- **A Conservative sce**
  - 12 hour shift (438
    consuming 6,832
    emissions of 15,7
  - $8,198 in fuel use
    - Achieving a
      $2,459/yr, er
    - Assuming a
    - Vehicle mair



Why Deploy Anti Idling Technologies: Operational Cost Policing Example

Slip-Seat Situation (Ford Interceptor)

- Assuming 90% vehicle availability annually and 70% idling
  - 5,518 hours of idling using 14,346 L of fuel and with equivalent road wear of 293,500 km per year and emissions of 32,996 Kg CO_2
  - $17,215 in fuel used when Idling, actual maintenance costs will vary by department
  - Achieving a 35% reduction in Idling would reduce fuel consumed by $6,025 L/ year, engine hours by 1,931 hours or equivalent road wear of 102,358 km
  - Assuming a 4 year vehicle life a total fuel savings of ~$24,100 is possible
  - Vehicle maintenance costs can vary significantly by Dept.
  - Time for refueling, vehicle delivery etc. are also not included

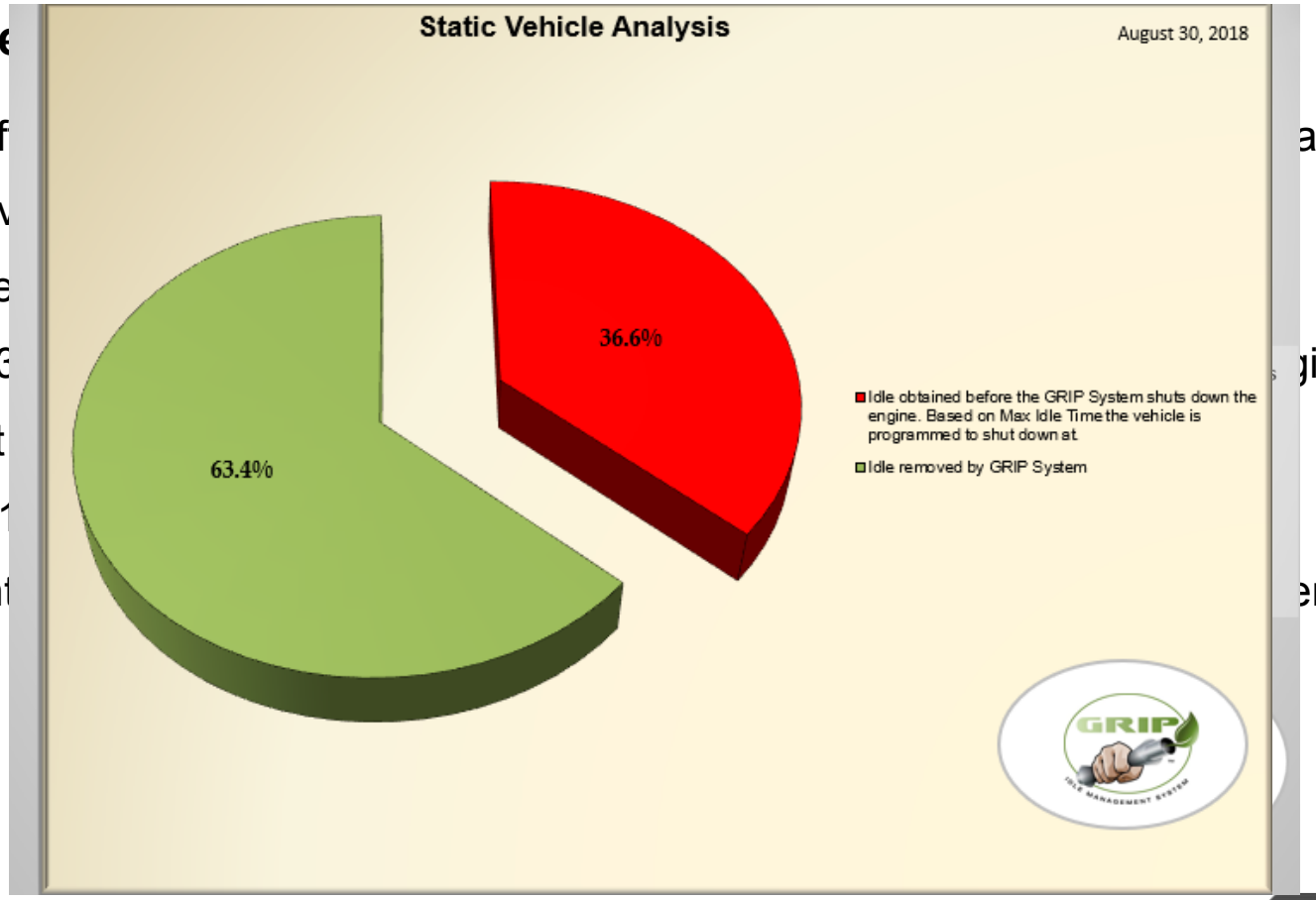
Why Deploy Anti Idling Technologies:
Maintenance and Operational Cost Benefits – Work Truck (Utility)

- **Direct Fuel Savings:** Work trucks will Idle from 20-70% of the vehicles life
- Fuel economy impacted by poor combustion- 1-4%
- Direct relationship between Fuel use and DPF materials and maintenance
- Reduced time and travel for re-fueling
- **Maintenance Savings:**
  - Less frequent service intervals, Engine life extended
  - In addition to shop time and materials, vehicle may have to be brought in with associated labour cost as well as being off the road
  - Fewer vehicles required when less shop time
- Reduced overtime due to emergency repairs/unscheduled activity
- Warranty impacts, OEM's checking for Engine hours
  - John Deere, 12 months unlimited hours, 24 months or 2000 hours
- Extended vehicle life or improved resale

Why Deploy Anti Idling Technologies:
Operational Cost Example – Work Truck (Utility)

Conservative Sce

- 8 hour weekly shif ar consuming 6,000 L of fuel and with equiv
- $8,198 in fuel use
  - Achieving a 3 gine hours by 800 hours or equivalent
  - Assuming a 1
  - Vehicle maint enance interval



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Why Deploy Anti Idling Technologies:
Other Operational Considerations

Fuel costs may not adequately reflect the real cost of poor mileage

- Bringing Fuel to remote communities has a significant cost
- Bringing Fuel 'In Theatre' can have significant logistical challenges
- Other maintenance related costs will vary by dept.

Meet Fleet Objectives for Green Initiatives

Idle reduction of 20% - 70% per vehicle is possible

Typical Anti Idling Applications

POLICING

EMS

ROAD CONSTRUCTION

UTILITIES

SCHOOL BUS & TRANSIT

HEAVY TRUCK

MINING

WORK TRUCK

YARD TRUCK

- Diverse Vehicle coverage.
- Fleet Standardization regardless of make and application.
- Customized features and functions for each application.
- Universal Hardware kits with vehicle specific components and options.

System Applications

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Examples of GRIP equipped Vehicles

Chevrolet Tahoe

Ford F550

Ford Interceptor

Bucket Truck

John Deere Loader

International 4300

Freightliner M2 106

Posi+

System Applications

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How Does the GRIP System Work?

Changes the key position to emulate operator control

- Key switch becomes an input to the GRIP controller
- GRIP Controller becomes the key switch
- No difference for the operator starting the vehicle
- Safety systems and other devices are always ‘on’ and available

System Features

How Does the GRIP System Work? Function

The GRIP works by controlling the vehicles ignition signal, which allows auxiliary equipment to remain working even when the GRIP shuts down the engine:

- Lighting, computers, and any other auxiliary equipment

The engine runs based on vehicle configuration/programming and the status of battery and climate conditions.

- Battery Monitoring – Voltage and Current sensing, manage multiple battery packs and voltages, shore power monitoring.

- Climate Monitoring – start the vehicle, operate auxiliary climate systems, option for automatically controlling the climate systems of the vehicle as well as managing two independent areas for climate.

System Features

How Does the GRIP System Work? Safety

- Vehicle must be in Park or Neutral for the system to activate.
  - 0 km/h speed, Hood is closed and RPM at idle
- System places the key in the run position to keep “AIR BAGS” operational.
  - Keeps windshield wipers, windows and lights operational
- Added safety
  - Operator Screen goes off in Drive for “Distraction Free” driving.
  - Hood Sensor installed for operator and technician safety.

Safety

System Features

How Does the GRIP System Work? Security

- Anti-Theft Feature – Secure the vehicle while unattended.
  - Stalls the engine if the key isn't present.
  - Can lock the shifter so it can't be pulled out of Park.
- Telematics System is on board – only connected when GSM is used.
  - GSM is hosted by private network.
  - Advanced security measures of network.
  - No GPS to pinpoint exact locations.
  - Not connected to the vehicle CAN to eliminate Vehicle Hacking concerns.

Security

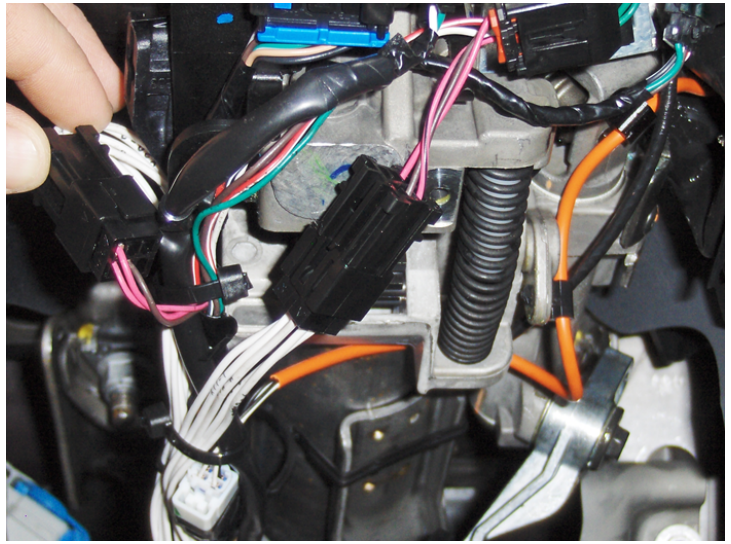
System Features

Easy to Install

System Installation

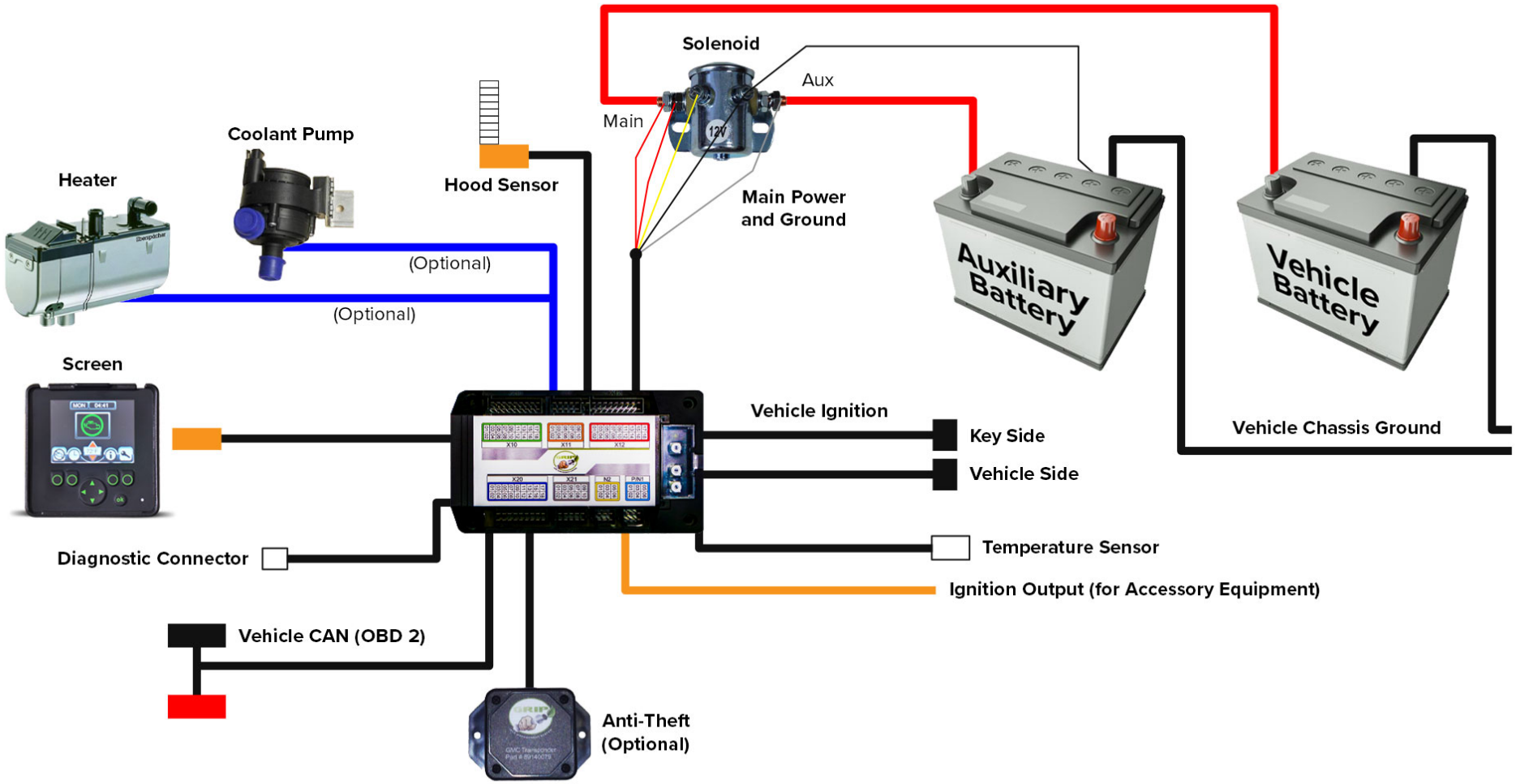
GRIP System Installation

- Ignition wires are the only invasive connection to the vehicle.
  - A connector is ‘Teed’ for easy removal/diagnostics.
  - Vehicle ignition details are provided through the GRIP Portal
- A CAN (J1939) connection to vehicle is a pass-through tee in connection that is easy to remove (OBD).
- All other components use plug and play connections
  - Connectors are keyed differently to avoid mating wrong connectors.
  - All harnesses are labeled and individual wires are printed for ease of troubleshooting.



System Installation

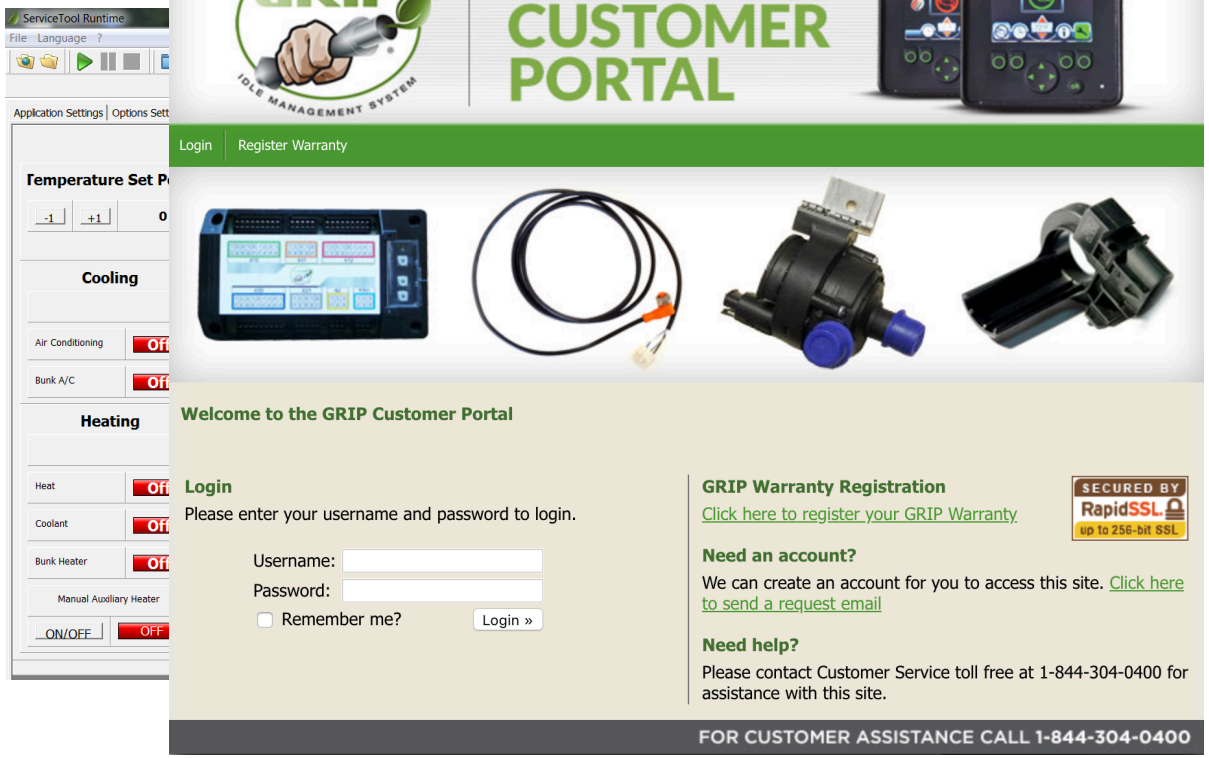
GRIP System Installation with Options



System Installation

Product Support

- GRIP System Service Tool
- Online Manuals
- Component Troubleshooting Guide
- Training Material
- www.gripidlemanagement.com
- Customer support line 1-844-304-0400
- Email: info@gripidlemanagement.com



Case Studies

GRIP 3.0 EMAT – London Hydro Case Study

London Hydro Rolled out the GRIP Idle Management System on 10 Vehicles 5 Ford F-550 Linemen trucks and 5 Ram 1500 Supervisor trucks in January 2018. The following slides highlight the results of the first 10 months

Data Population Selection			Life Hours			Vehicle Operation						Monitoring Vehicle Analysis											
Selected Unit	Selected Category	Selected Fuel Type	Selected Vehicles Total	Selected Vehicles Total	Selected Total Life Hours	Selected Vehicles Total	Selected Vehicles Total	Selected Vehicles Total	Selected Vehicles Total	Selected Vehicles Total	Selected Total Operation Hours	Selected Vehicles Total	Selected Vehicles Total	Selected Vehicles Total	Selected Vehicles Total	Selected Total Analysis Hours	Selected Vehicles Total	Selected Vehicles Total	Selected Vehicles Total	Selected Vehicles Total	Selected Vehicles Total	Selected Vehicles Total
All	Unit Selected	All	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
Unit Number	Category	Fuel Type	Life Hours	Shore Power Hours	Total Life Hours	Park and Neutral Hours	Idling in Drive Hours	Driving Hours	Monitoring Hours	Hood Open Hours	Total Vehicle Operation Hours	Air Conditioning Engine Off	Heating Engine Off	Monitoring Without Climate	Empty	Total Monitoring Vehicel Analysis	Engine Running For Heating	Engine Running For A/C	Engine Running for Humidity	Low Battery Charging Hours	PTO/Lights/Aux Hours	Low Coolant Temp Hours
132	RAM 1500	Gas	662.2	0.0	662.2	106.3	97.6	244.0	194.5	6.1	648.5	0.0	101.0	91.7	0.0	192.7	6.8	47.1	0.0	2.7	0.0	6.3
137	RAM 1500	Gas	736.0	0.0	736.0	107.0	102.2	237.3	260.9	2.3	709.7	0.0	90.2	169.5	0.0	259.7	7.8	40.8	0.0	0.4	0.0	5.9
135	RAM 1500	Gas	1192.6	0.0	1192.6	213.8	104.4	265.3	604.2	1.2	1188.9	0.0	344.0	258.1	0.0	602.1	56.5	72.6	0.0	0.6	0.0	19.1
133	RAM 1500	Gas	1034.4	0.0	1034.4	186.1	99.2	267.6	459.8	5.7	1018.4	0.0	326.5	132.5	0.0	459.0	40.6	47.7	0.0	17.2	0.0	13.9
103	Ford F-550	Diesel	987.8	0.0	987.8	476.7	54.7	156.8	229.0	3.0	920.2	0.0	57.9	170.0	0.0	227.9	11.8	48.5	0.0	341.0	0.0	34.8
136	RAM 1500	Gas	948.4	0.0	948.4	160.5	120.7	452.6	203.8	2.8	940.4	0.0	26.1	173.8	0.0	199.9	3.6	88.3	0.0	0.0	0.0	4.8
4	Ford F-550	Diesel	928.0	0.0	928.0	185.7	80.3	289.7	319.6	6.5	881.8	0.0	51.3	266.6	0.0	317.9	20.2	57.9	0.0	19.5	0.0	25.6
18	Ford F-550	Diesel	1081.2	0.0	1081.2	324.4	67.8	165.0	388.2	3.6	949.0	0.0	93.9	293.3	0.0	387.2	11.5	41.2	0.0	151.6	0.0	52.9
23	Ford F-550	Diesel	1491.0	0.0	1491.0	621.1	139.4	420.8	285.0	1.6	1467.9	0.0	139.1	145.9	0.0	285.0	28.3	3.5	0.0	466.2	0.0	43.4
118	Ford F-550	Diesel	1234.2	0.0	1234.2	263.3	101.4	414.4	424.3	16.2	1219.6	0.0	150.7	272.4	0.0	423.1	29.6	39.5	0.0	66.9	0.0	33.9

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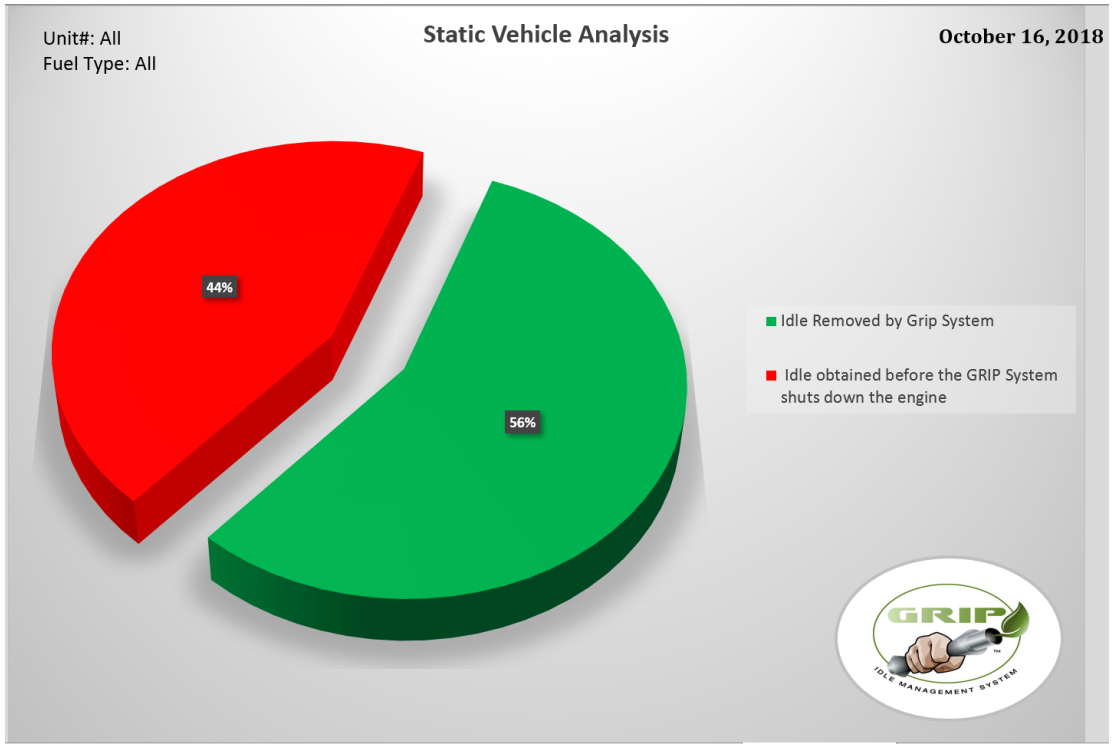
Static Vehicle Analysis

- Comparison of the actual idle versus the monitoring time while the vehicle is in Park or Neutral.
- 56% of Idle time removed by the GRIP System



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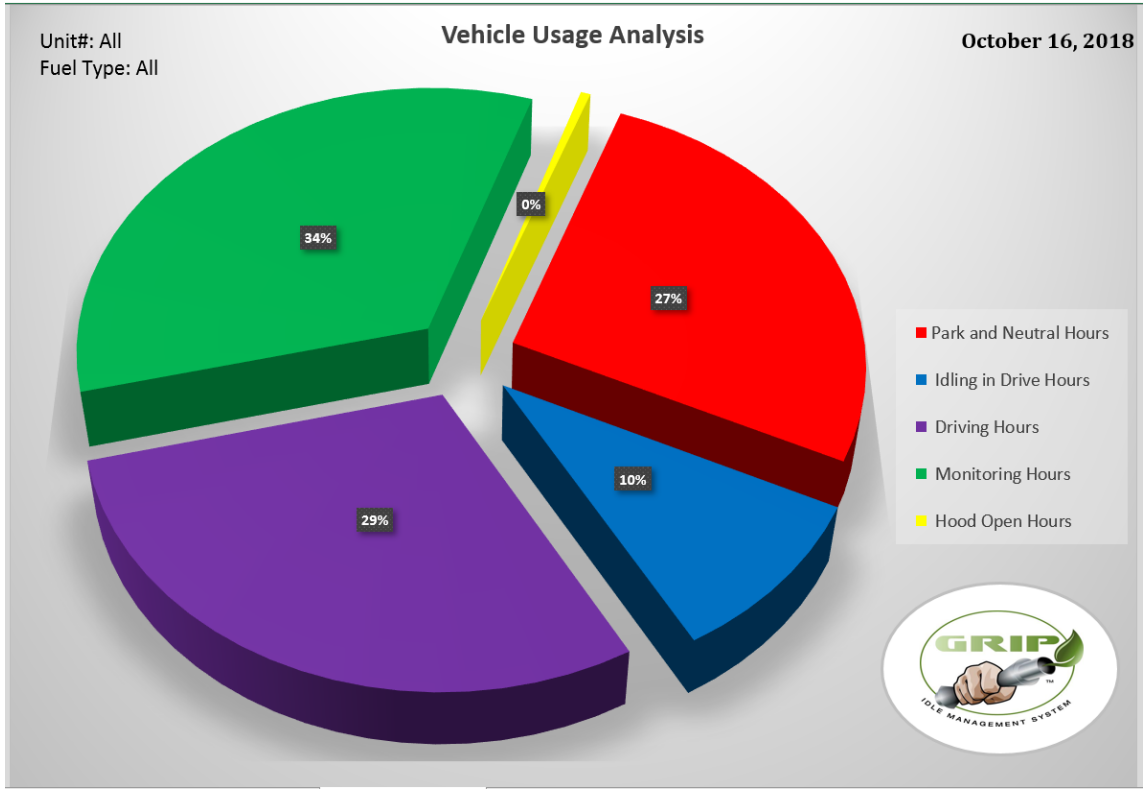
Vehicle Usage Analysis

- Comparison of a vehicles overall usage
- It measures the hours in: park and neutral, idling in drive, Driving, monitoring (idle removed by GRIP) and hood open.
- 34% Monitoring Hours
- 27% Park & Neutral Hours
- 29% Driving hours



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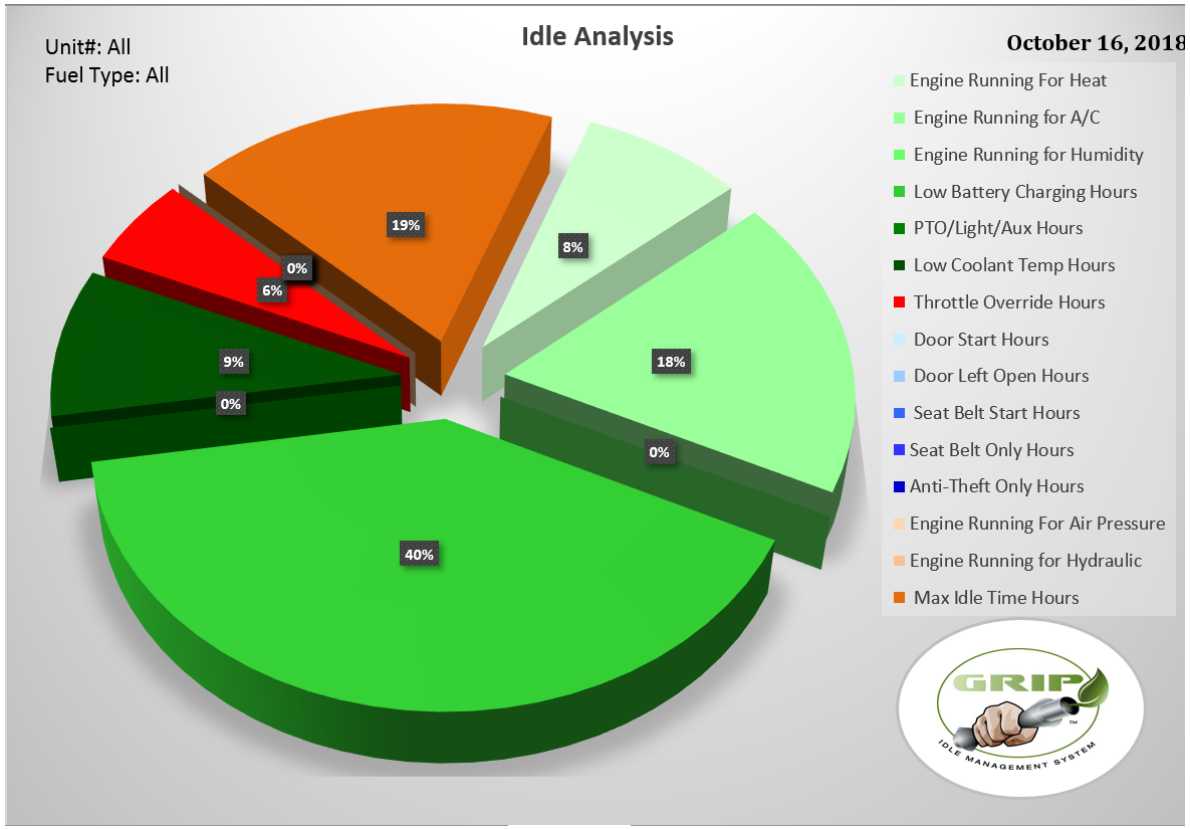
Idling Analysis

- Comparison of a vehicles overall usage

- 40% Engine Running for Battery Charge
- 19% Engine Running for Max Idle Time
- 18% Engine Running for A/C
- 9% Engine Running for low coolant temp



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Idle Time Comparison (Hrs)

- Compares the Actual idling hours with the idle removed by the GRIP System, as well as what the idling would have been if the GRIP had not been installed.

- 3369.33 Hrs Idle Time Removed
- 2644.96 Hrs Actual Time spent at Idle
- 6014.29 Hrs Idle Time without GRIP System

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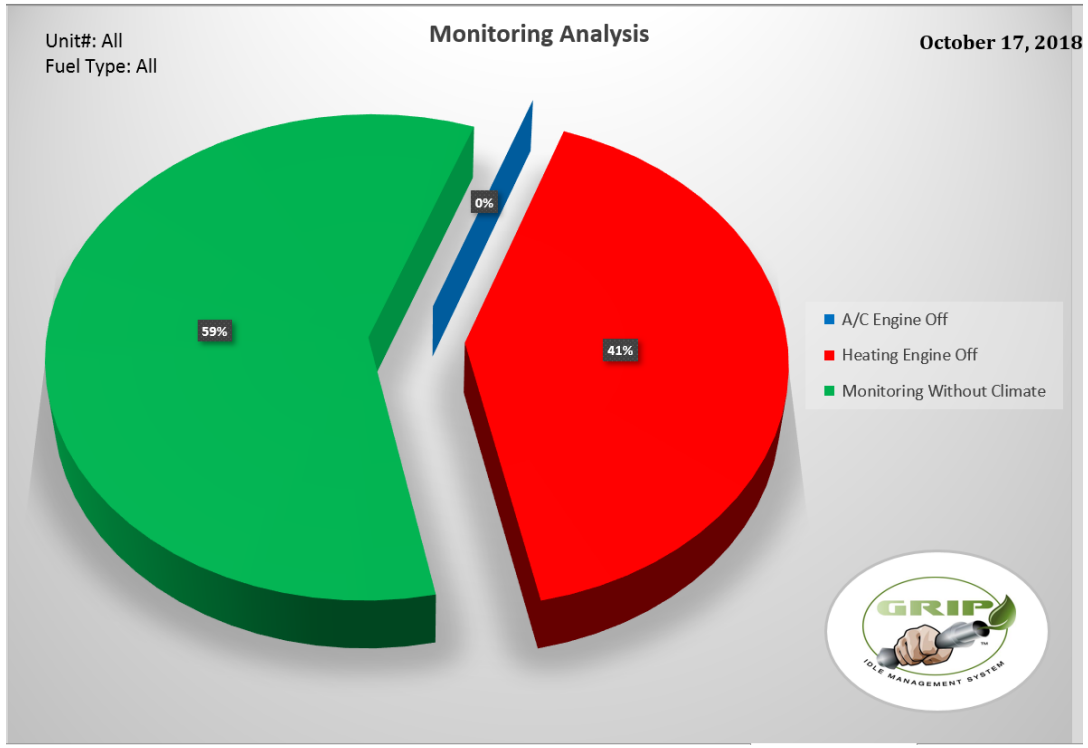
Monitoring Analysis

- Compares the amount of time the vehicle was off, while running for: A/C, Heating, and time spent in monitoring mode

- 59% Monitoring Without Climate
- 41% Heating Engine Off
- 0% A/C Engine Off (No DC A/C option)



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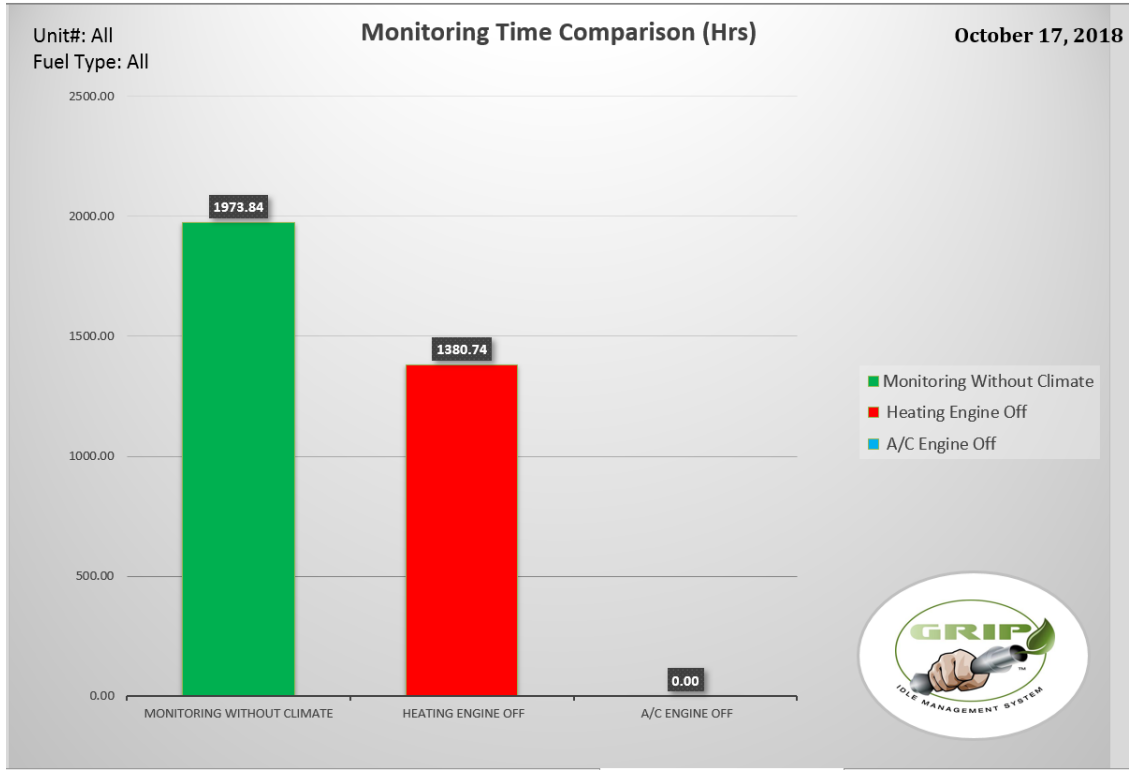
Monitoring Time Comparison

- Compares the amount of time the vehicle was off, while running for: A/C, Heating, and time spent in monitoring mode

- 1973.84 Monitoring without Climate
- 1380.74 Heating Engine Off



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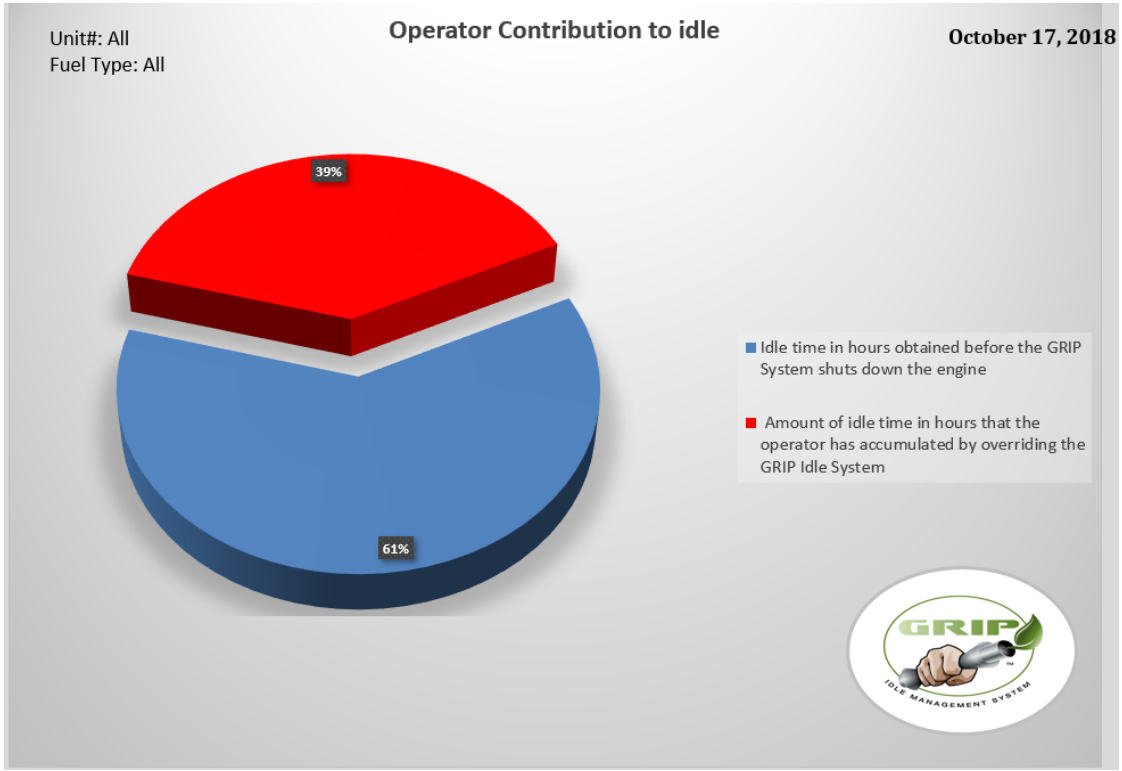
Operator Contribution to Idle

- The amount of hours that the operator has increased the idling by overriding the shutdown vs the amount of normal operation idle hours
- 39% Idle Time Contribution by Operator Override



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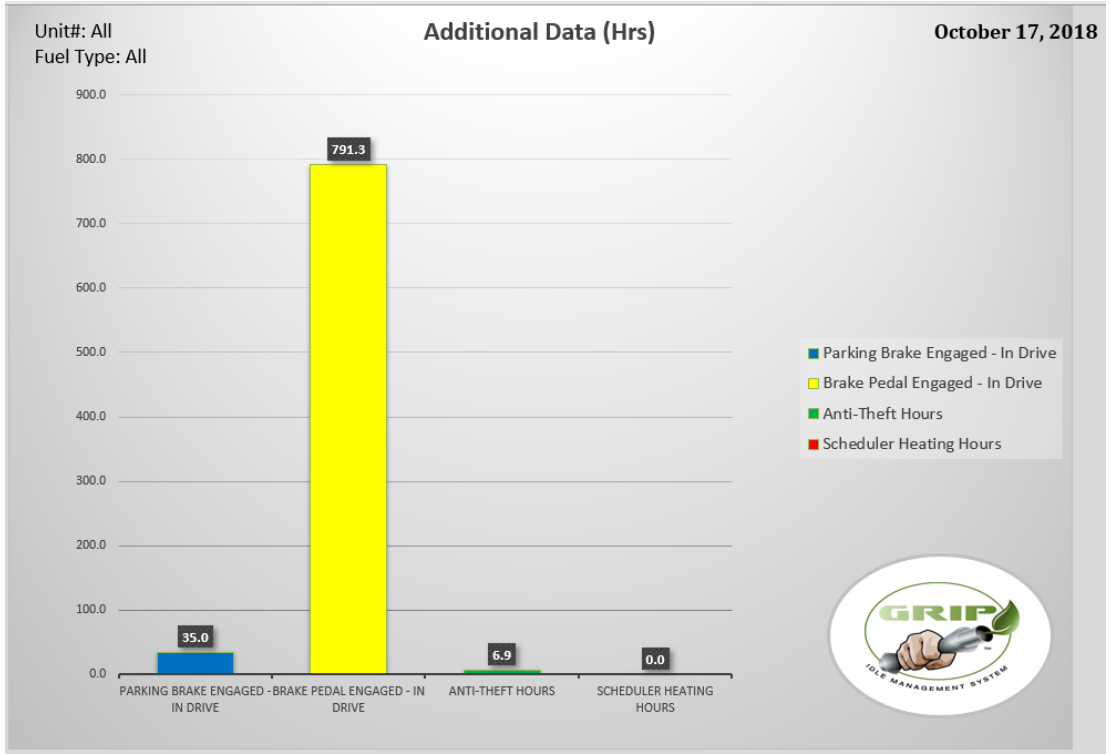
Additional Data

- The amount of hours that the operator has the brake pedal or parking brake engaged in drive
- The amount of time the Grip has run in Anti-theft or for scheduler heating.
- 791.3 hrs Brake Pedal Engaged – In Drive
- 35 hrs Parking Brake Engaged – In Drive
- 6.9 hrs Anti-Theft Engaged



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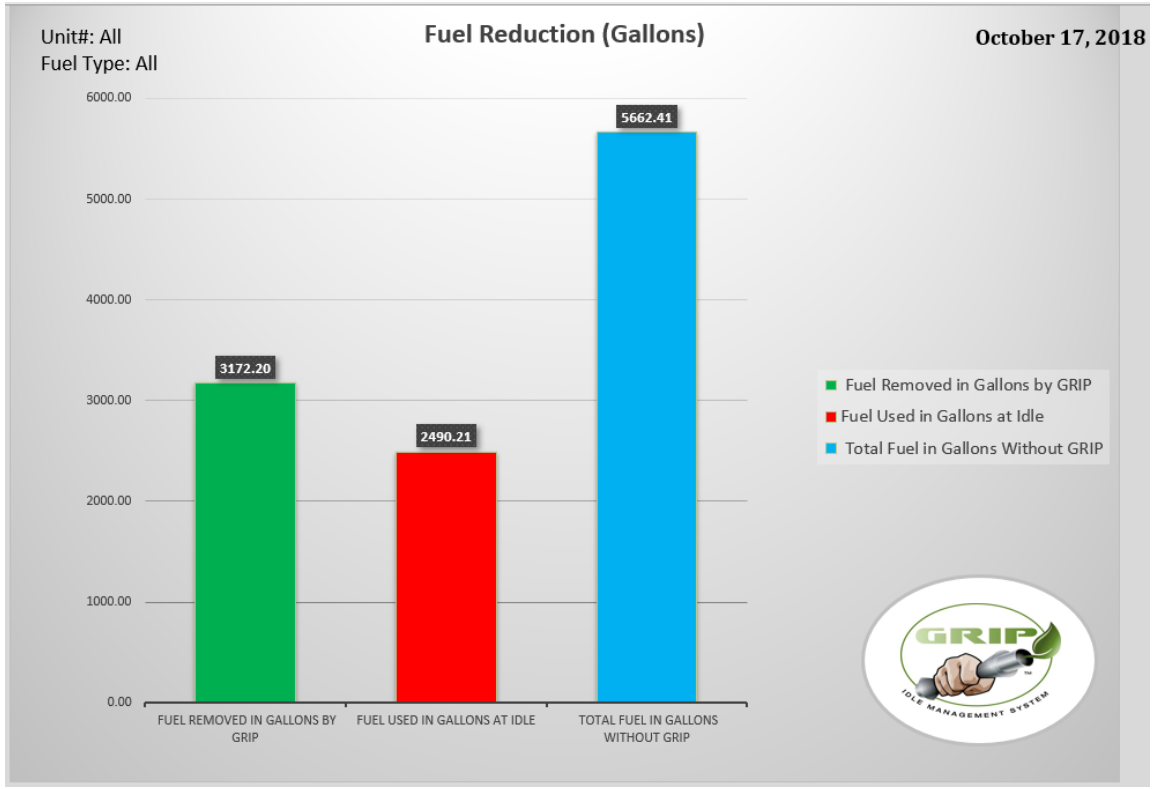
GRIP 3.0 EMAT – London Hydro Case Study

Fuel Reduction (Gallons)

- Compares the gallons of fuel saved by the GRIP vs the fuel used, as well as the total number of gallons if the GRIP had not been installed.

- 3172.20 Gallons of Fuel Saved
- 2490.21 Gallons of Fuel Spent at Idle



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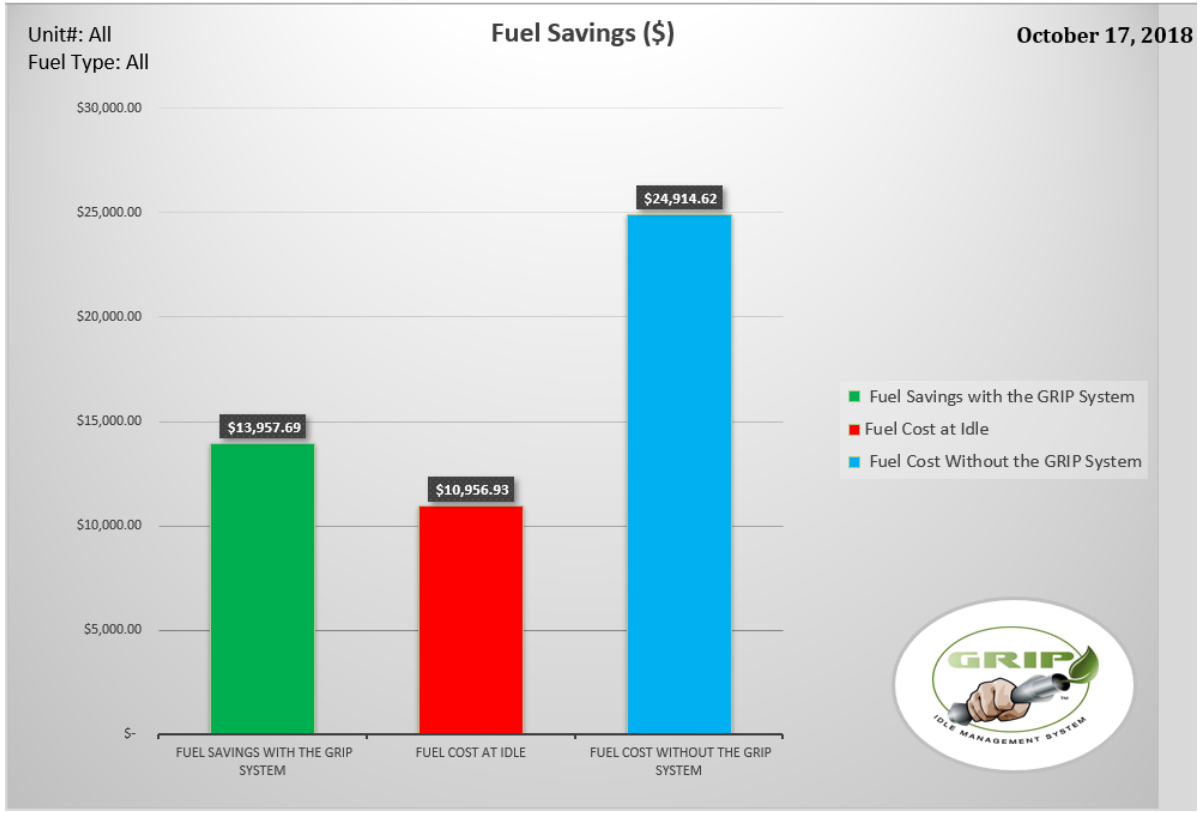
GRIP 3.0 EMAT – London Hydro Case Study

Fuel Savings ($)

- Compares the fuel cost saved by the GRIP vs. the fuel cost used, as well as the total cost of fuel if the GRIP had not been installed.
- Fuel price must be entered into the ‘Category Manager’ tab for each fuel type
- $13,957.69 CDN Fuel Savings
- $10,956.93 CDN Fuel Cost at Idle



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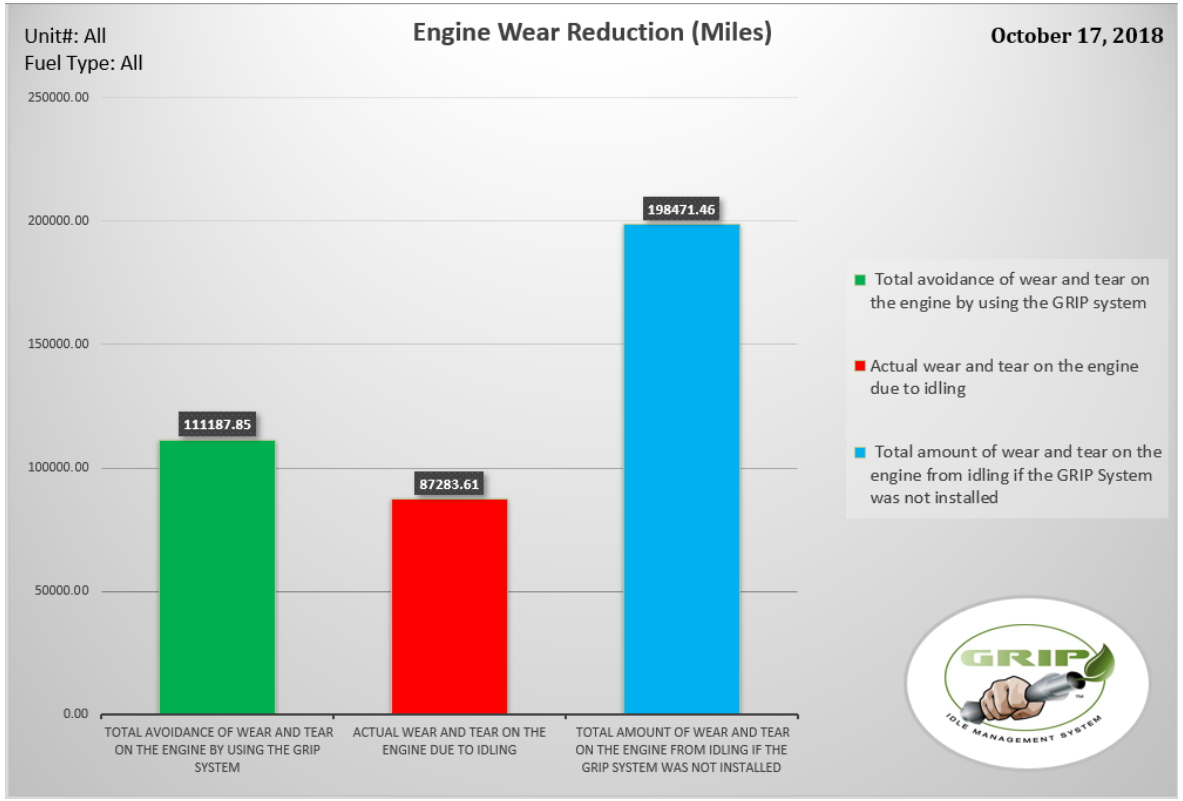
GRIP 3.0 EMAT – London Hydro Case Study

Engine Wear Reduction

- Statistic measure of the equivalent wear and tear reduction on the engine based on the reduced operation at idle. 1 hour of idle equals 52 km of driving wear and tear on the engine

- 111,187.85 Mile of Wear Removed from Engine
- 87,283.61 Actual Engine Wear due to Idling



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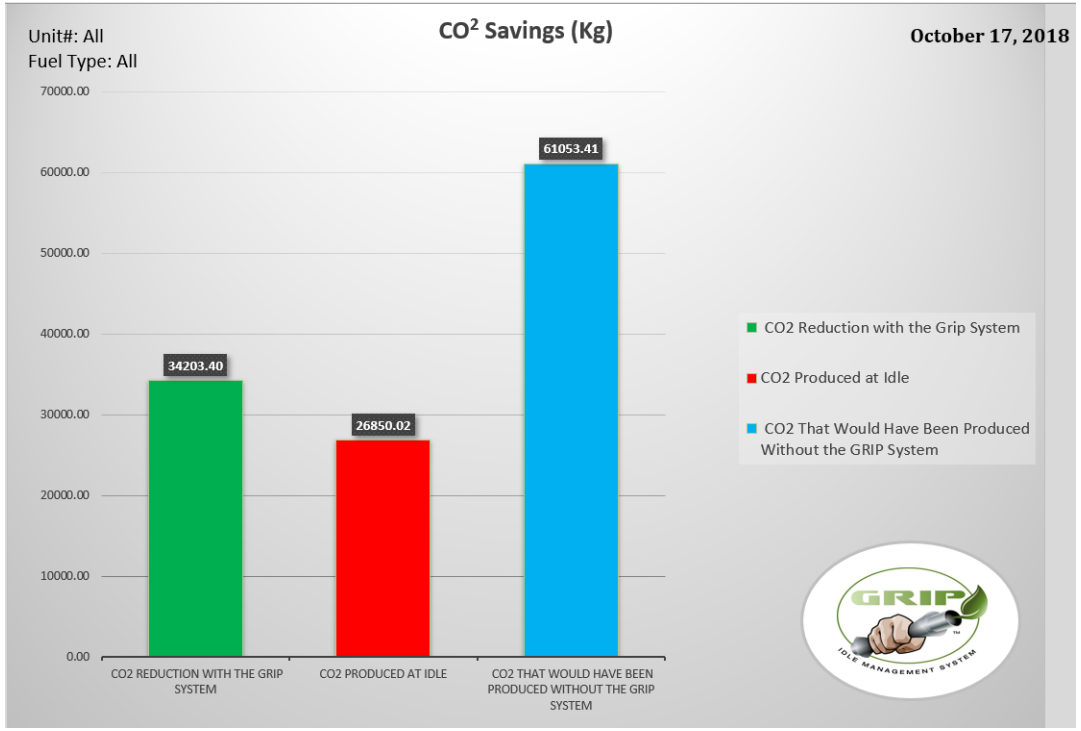
GRIP 3.0 EMAT – London Hydro Case Study

CO^2 Savings

- Comparison of all the vehicle categories (Zones); fuel consumption and average fuel consumption level. One liter of gasoline burnt produces 2.3 kg of CO2, One liter of Diesel burnt produces 2.64 kg of CO2

- 34,203.40 KG of CO2 Avoided
- 26,850.02 KG of CO2 produced at Idle



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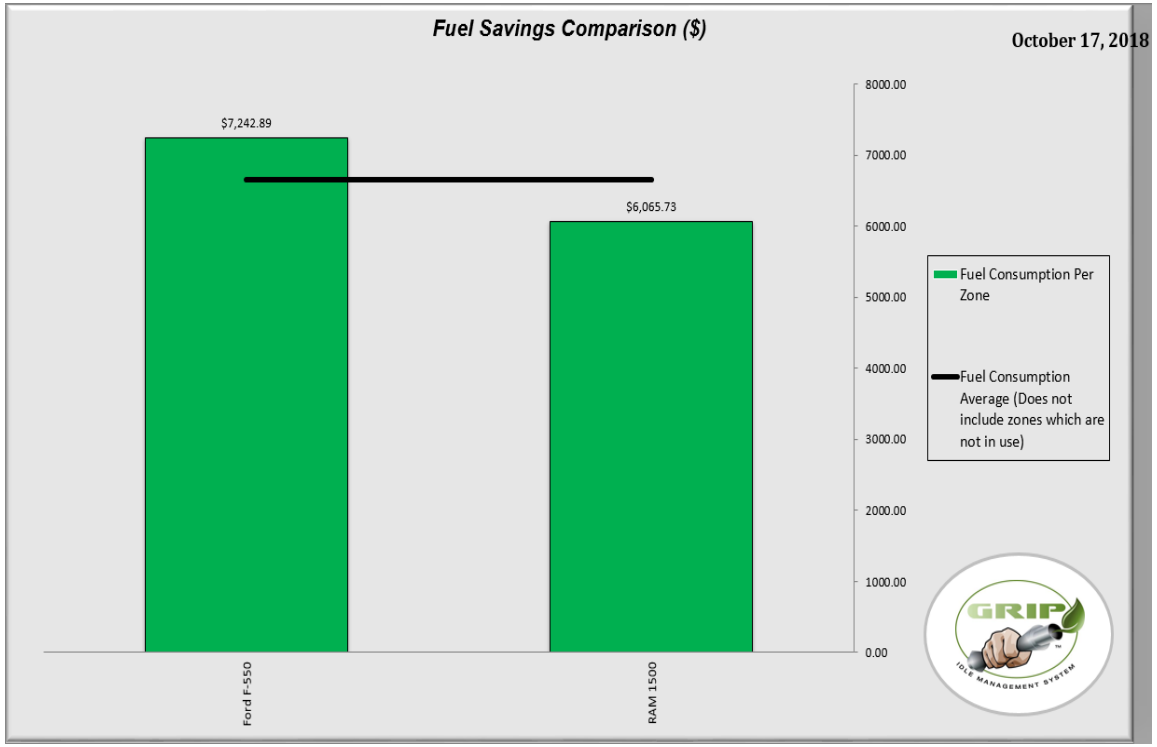
GRIP 3.0 EMAT – London Hydro Case Study

Fuel Savings Comparison

- Comparison of all the vehicle categories (Zones); fuel cost and average fuel cost level.

- Ford $7,242.89
- Ram $6,065.73



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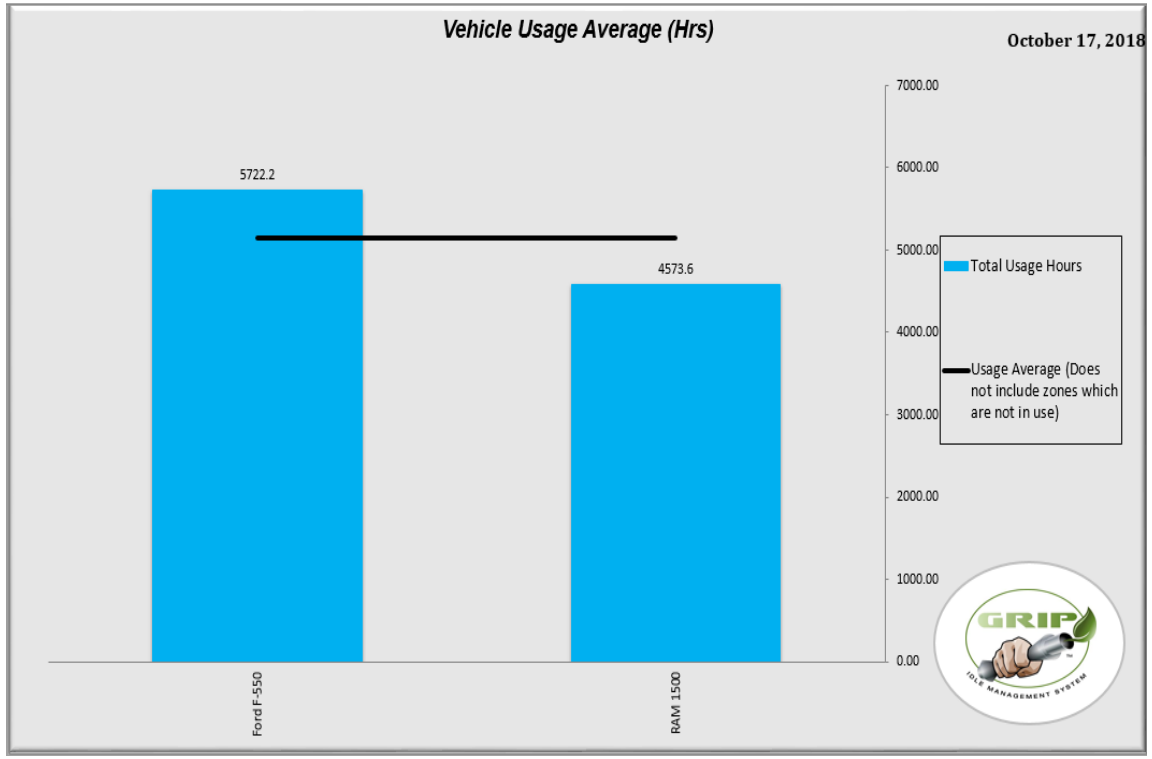
GRIP 3.0 EMAT – London Hydro Case Study

Vehicle Usage Average

- Comparison of all the vehicle categories (Zones); total usage and average usage level.

- Ford 5,722.2 hrs Total Usage
- Ram 4,573.6 hrs Total Usage



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Case Study
Columbus Police Dept.

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GRIP 3.0 EMAT

City of Columbus Police Dept. Case Study

THE CITY OF COLUMBUS DIVISION OF POLICE
ANDREW J. GINTHER, MAYOR

Established in 1816, The City of Columbus Division of Police has more than 1,800 officers and 300 civilian employees covering 20 precincts across the Greater Columbus Metropolitan Area serving nearly 800,000 residents. The division prides itself on providing excellent public service, and the division's fleet also takes pride in being one that reduces its fuel consumption, vehicle emissions, and petroleum usage through the use of extensive anti-idling and efficiency technologies. The City currently "hot-seats" its police cruisers – with each marked patrol unit operating continuously 24 hours-a-day with a rotating slate of officers. By deploying GRIP idle reduction technologies, the City has been able to provide constant in-cab power for equipment and climate control without the need for engines to run for 24 hours-a-day – allowing the City's Division of Police to nearly reduce 33% of its fuel use from idling or 152,262 gallons per year.

In recognition of these efforts, Clean Fuels Ohio is pleased to certify The Columbus Division of Police as a One-Star Ohio Green Fleet.

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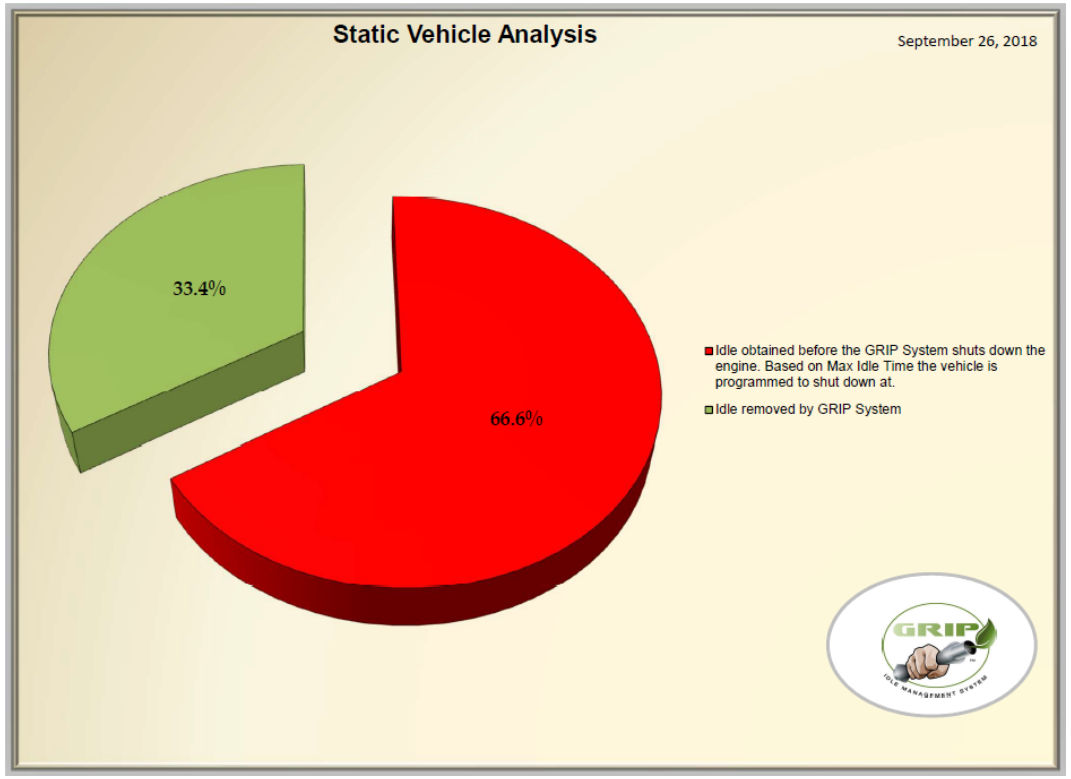
GRIP 3.0 EMAT

City of Columbus Police Dept. Case Study

Static Vehicle Analysis: Columbus

- Comparison of the actual idle versus the monitoring time while the vehicle is in Park or Neutral.
- 33.4% of Idle time removed by the GRIP System



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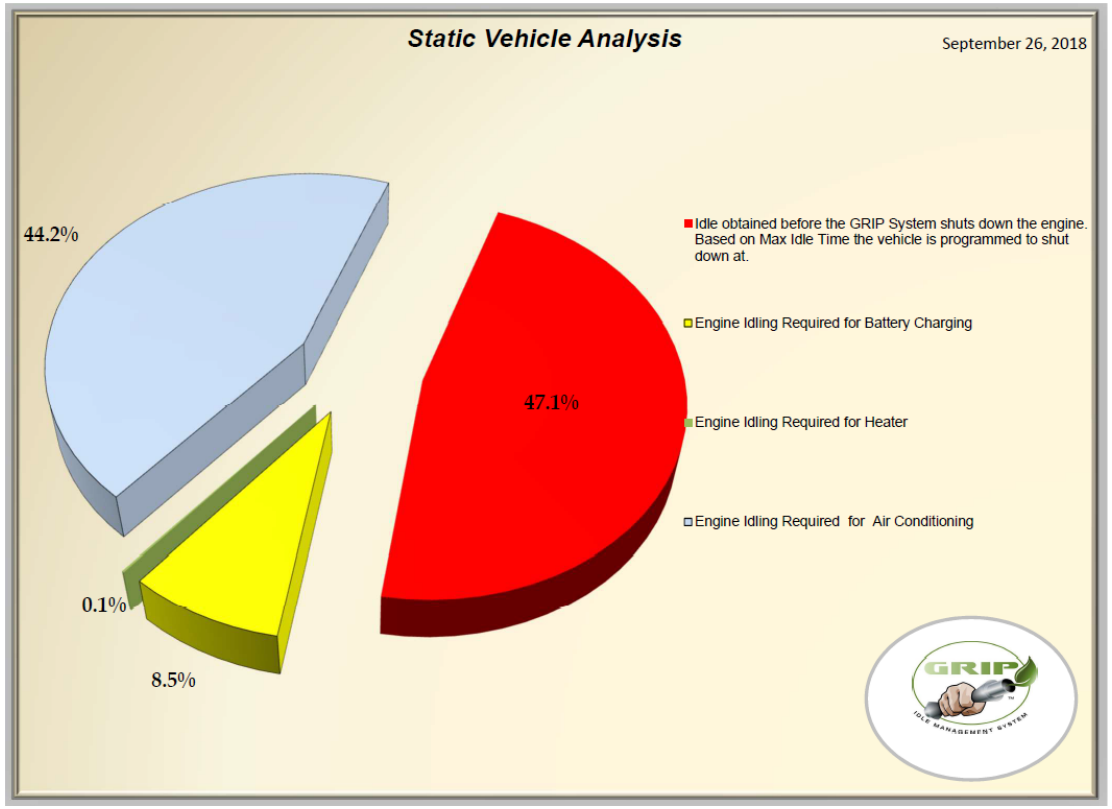
GRIP 3.0 EMAT

City of Columbus Police Dept. Case Study

Vehicle Idle Analysis: Columbus

- Comparison of a vehicles Idle time
- It measures the reasons for Idle
- 47% Max (Programmed) Idle Time
- 8.5% Battery Charging
- 44% Air Conditioning



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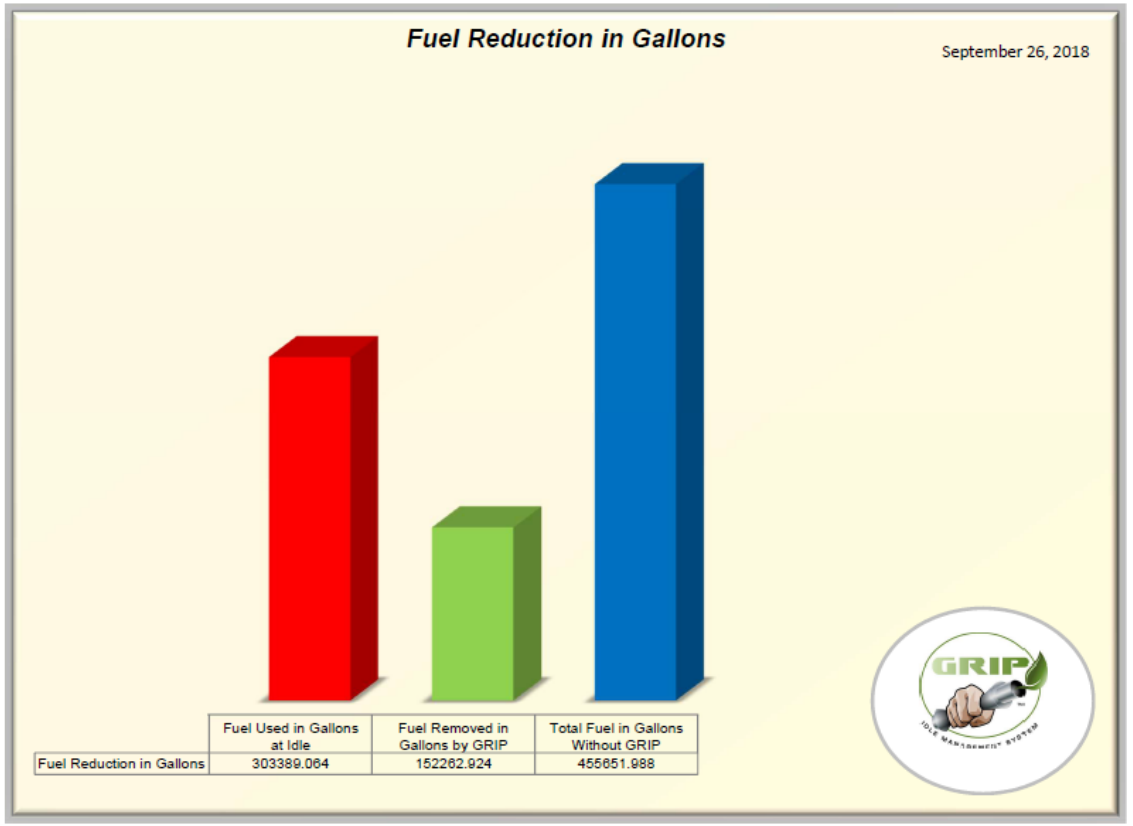
GRIP 3.0 EMAT

City of Columbus Police Dept. Case Study

Fuel Reduction (Gallons): Columbus

- Compares the gallons of fuel saved by the GRIP vs the fuel used, as well as the total number of gallons if the GRIP had not been installed.

- 152,262 Gallons of Fuel Saved
- 303,389 Gallons of Fuel Spent at Idle



	Fuel Used in Gallons at Idle	Fuel Removed in Gallons by GRIP	Total Fuel in Gallons Without GRIP
Fuel Reduction in Gallons	303389.064	152262.924	455651.988

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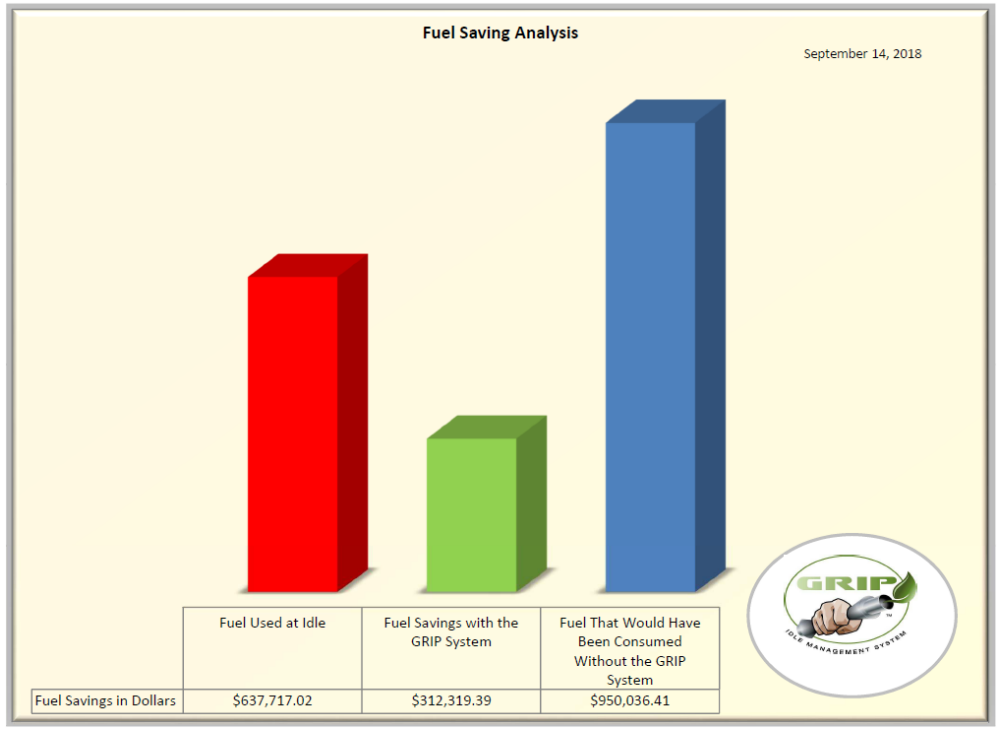
GRIP 3.0 EMAT

City of Columbus Police Dept. Case Study

Fuel Savings (USD): Columbus

- $312,919 USD of Fuel Saved
- $637,717 USD of Fuel Spent at Idle



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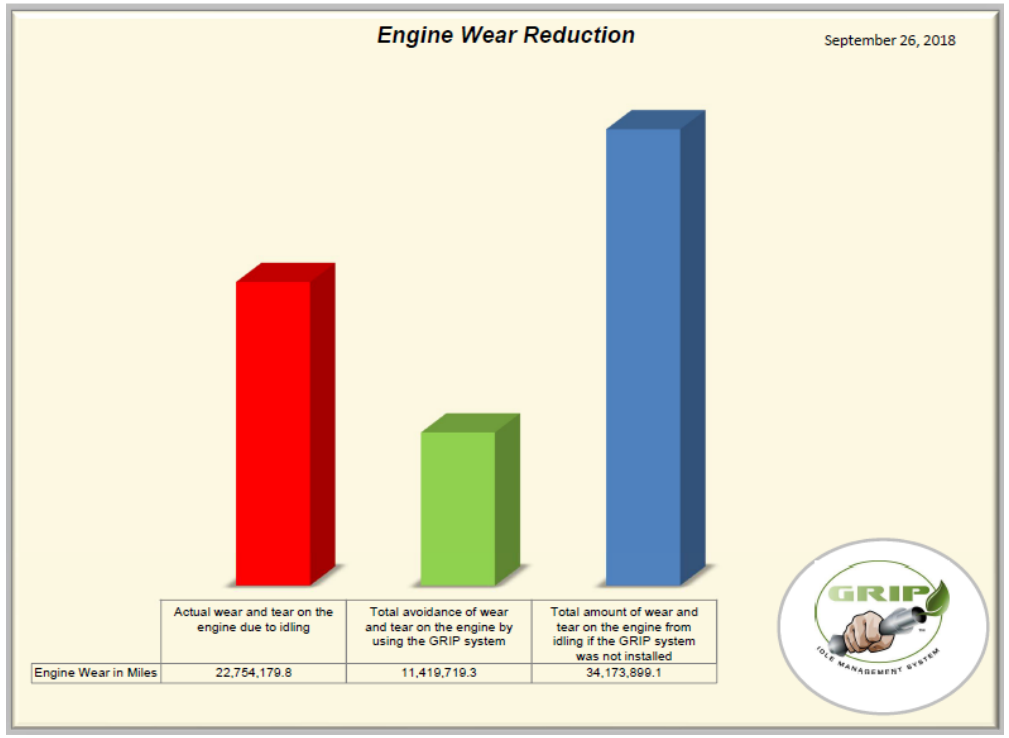
GRIP 3.0 EMAT

City of Columbus Police Dept. Case Study

Engine Wear Reduction

- Statistic measure of the equivalent wear and tear reduction on the engine based on the reduced operation at idle. 1 hour of idle equals 52 km of driving wear and tear on the engine

- 11,419,719 Mile of Wear Removed from Engine
- 22,754,179 Actual Engine Wear due to Idling



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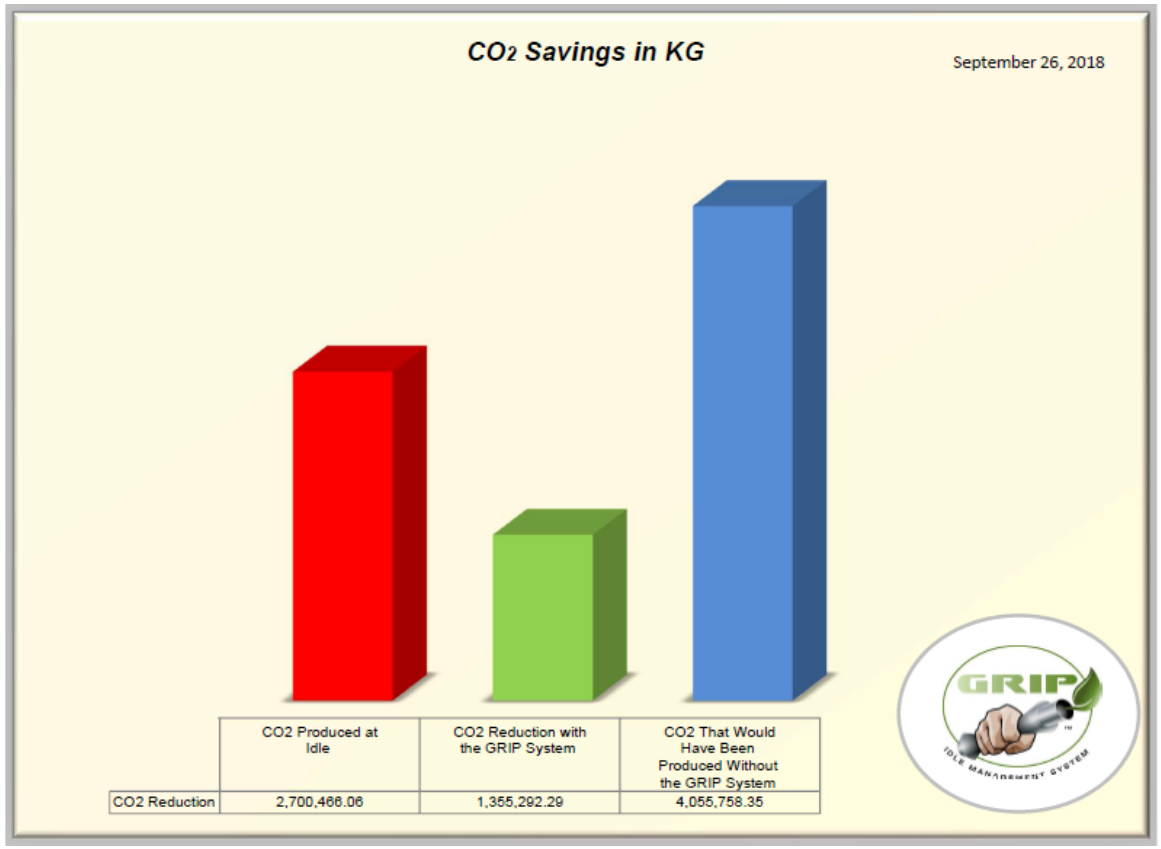
GRIP 3.0 EMAT

City of Columbus Police Dept. Case Study

CO2 Reduction

- 1,335,292 Kg of CO2 removed
- 2,700,466 Kg of CO2 produced



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Case Study
Toronto Hydro

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GRIP 3.0 EMAT
Toronto Hydro Case Study

Anti-Idling Technologies

The installation of Governor to Reduce Idle and Pollution (GRIP) technology on 24 of Toronto Hydro's cube vans (starting in late 2014), has led to a 27% decrease in average annual idling hours in its GRIP-equipped vehicles (compared to non-GRIP equipped cube vans).

In November 2015, Toronto Hydro began GRIP trials in four of its new heavy duty bucket trucks, which has resulted in a 26% decrease in idling amongst those trucks (compared to non-GRIP equipped trucks). In July 2016, the Company trialed the GRIP units in five of its highest idling pick-up trucks.

Since installing the GRIP system in pick-up vehicles , Toronto Hydro has realized a 22% reduction in idling hours across this pool of vehicles compared to the same period, in 2015 (July-November, inclusive).

The GRIP system has delivered proven idling reductions and, as such, is currently Toronto Hydro's preferred anti-idling technology. GRIP functions by shutting the engine off after 1 minute of idling and deferring to the auxiliary battery power source requiring long-lasting batteries in order to fully optimize the GRIP system's use. In 2016, Toronto Hydro's Fleet department explored various means of extending auxiliary battery longevity. Solutions currently being trialed are: (1) decreasing load on the auxiliary battery by swapping out the existing inverter for a high-efficiency generator; (2) swapping existing auxiliary battery for a high-efficiency lithium ion battery; (3) reactive reporting on vehicles not plugged into shore power nightly. Preliminary results on the expected benefits of these solutions are anticipated by end of the second quarter of 2017.

As a result of the idling reduction initiatives, in 2016, Toronto Hydro saw a 23% reduction in fuel consumption amongst cube vans - a 6% reduction in fuel consumption amongst bucket trucks - and a 13% reduction in fuel consumption amongst pickup trucks. This led to fuel savings of 16,331 L and reduction in GHGs of 45 tCO_2e, in 2016 relative to 2015.

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GRIP 3.0 EMAT

Toronto Hydro Case Study

- We continued to use and install the Governor to Reduce Idle and Pollution (GRIP) technology on our vehicles, and downsized our fleet by 12 vehicles. We also implemented a pilot project in collaboration with Centennial College and eCamion to test the effectiveness of lithium ion batteries in vehicles, and trialed the use of electric power take-off for our bucket trucks. The cumulative 2017 savings, relative to 2013, associated with our fleet-related initiatives are: 36% reduction in total fuel consumed; 35% reduction in GHG emissions; 0.4% reduction in kilometres travelled; and 43% reduction in total non-PTO idling hours**

2017 ANNUAL REPORT **TORONTO HYDRO CORPORATION**

GRIP 3.0 EMAT

Toronto Hydro Case Study

August 30, 2018

Fleet EMAT Tool
(Electronic Management Analysis Tool)

Steps to take to use this tool

1. Fill in the Vehicle Categories for your fleet - this will populate in the dropdown list in the same order as they were entered
   IF CHANGED PLEASE CHANGE ALL IN THAT CATEGORY
2. Input your data
3. Once the data is inputted chose the category you wish to populate in the charts from the drop down list you populated in Step #1
4. Once the category is chosen click on every sheet to populate your data

NOTE : To change the price of fuel please input fuel price beside appropriate category

Choose Vehicle Types for Selection	Vehicle Category to Populate in Charts
All	All
Isuzu Trucks	
Ford Truck	
Bucket Truck	
SWAT Van	

PRICE OF FUEL	
1.1	Gas
1.25	Diesel

TOTAL CULMATIVE DATA FOR VEHICLE CATEGORY SELECTED

Total Idling	Total P/N	Total Run	Total Battery	Total Heater	Total A/C	Total Monitor	Total Life	Total
34,629.20	19,522.20	15,918.50	4,679.20	100.60	5,679.70	33,771.30	99,485.20	1

VIN Number	Unit Number	Asset Number	Category	Max Idle Time	Fuel Costs	Fuel Type	Liters/Hour	Idling	P/N	Run	Battery	Heater	A/C	Monitor	Life	Ov
				Max Idle Time	Fuel cost per Liter	Gas or Diesel	Fuel Consumed at Idle	Total Time Idling	Total Time in Park	Total Driving Time	Total Time Vehicle Idled to Charge the Battery	Total Time Vehicle has Started to Provide Heat	Total Time Vehicle has Started to Provide A/C	Total Idle Avoidance	Total Hours of the Vehicle	Number o Shutdow Avoided by
	348	348	Isuzu Trucks	1	1.25	Diesel	2	913.5	541.1	440.7	92.8	0	257	1282.3	2802	
	349	349	Isuzu Trucks	1	1.25	Diesel	2	1387.9	839.9	493.9	275	0	363.6	1851.6	4160.8	
	350	350	Isuzu Trucks	1	1.25	Diesel	2	1119.9	609.8	561.3	9.6	0	331.9	867.1	3261.7	
	351	351	Isuzu Trucks	1	1.25	Diesel	2	1566.4	846	597.1	334.6	0	29.6	1241.6	4039.8	1
	352	352	Isuzu Trucks	1	1.25	Diesel	2	2066.4	1276.9	831.5	327.1	0	451.9	2237.5	5322.7	1
	353	353	Isuzu Trucks	1	1.25	Diesel	2	1576.4	949.7	599.5	110.9	0	369.5	1105.7	3908.7	5
	354	354	Isuzu Trucks	2	1.25	Diesel	2	2216	1338.1	874	438.5	0	240	2034.9	5834.8	1
	355	355	Isuzu Trucks	1	1.25	Diesel	2	1249.8	693.3	504.8	258.7	0	220.5	1837.5	3995	2

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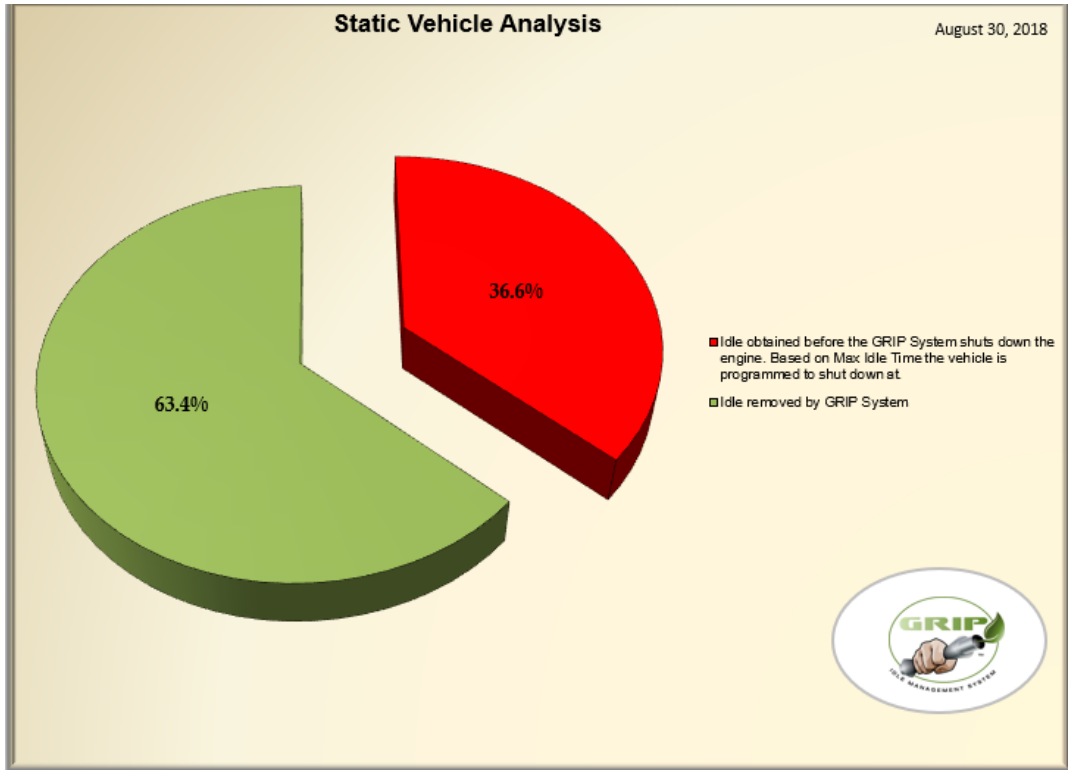
GRIP 3.0 EMAT
Toronto Hydro Case Study

Static Vehicle Analysis: Toronto Hydro

- Comparison of the actual idle versus the monitoring time while the vehicle is in Park or Neutral.
- 63.4% of Idle time removed by the GRIP System



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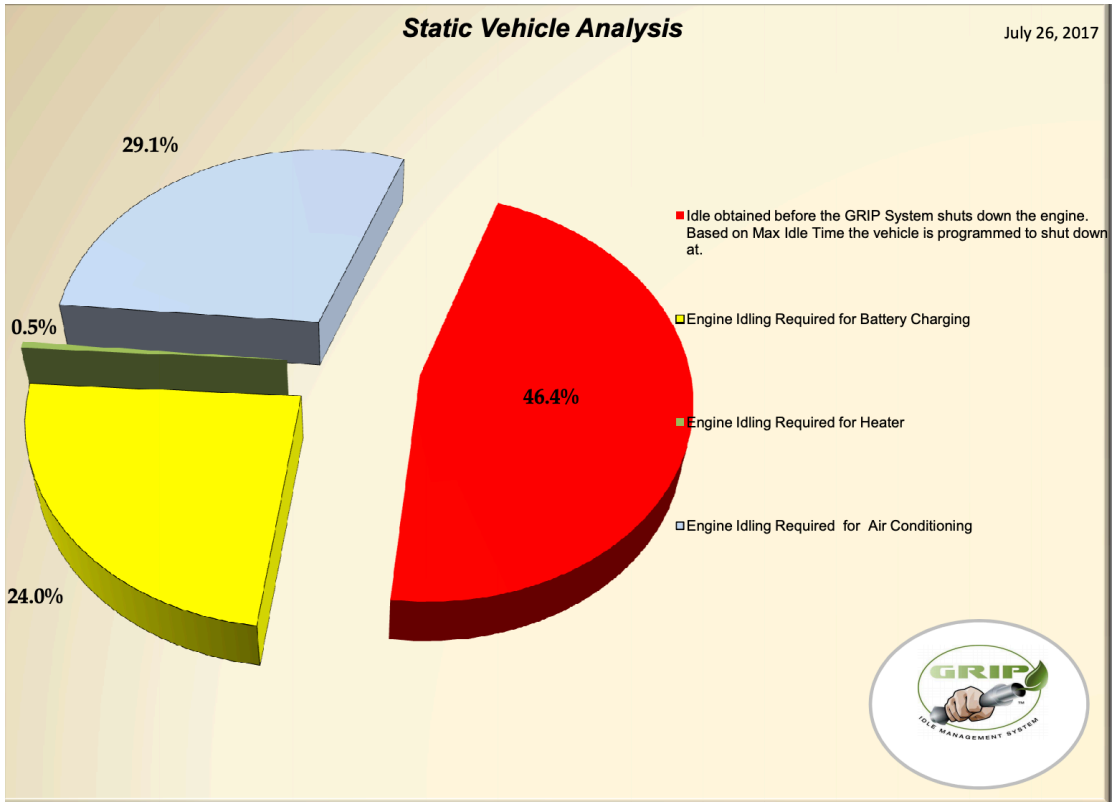
GRIP 3.0 EMAT
Toronto Hydro Case Study

Vehicle Idle Analysis: Toronto Hydro

- Comparison of a vehicles Idle time
- It measures the reasons for Idle
- 46.4% Max (Programmed) Idle Time
- 24% Battery Charging
- 29% Air Conditioning



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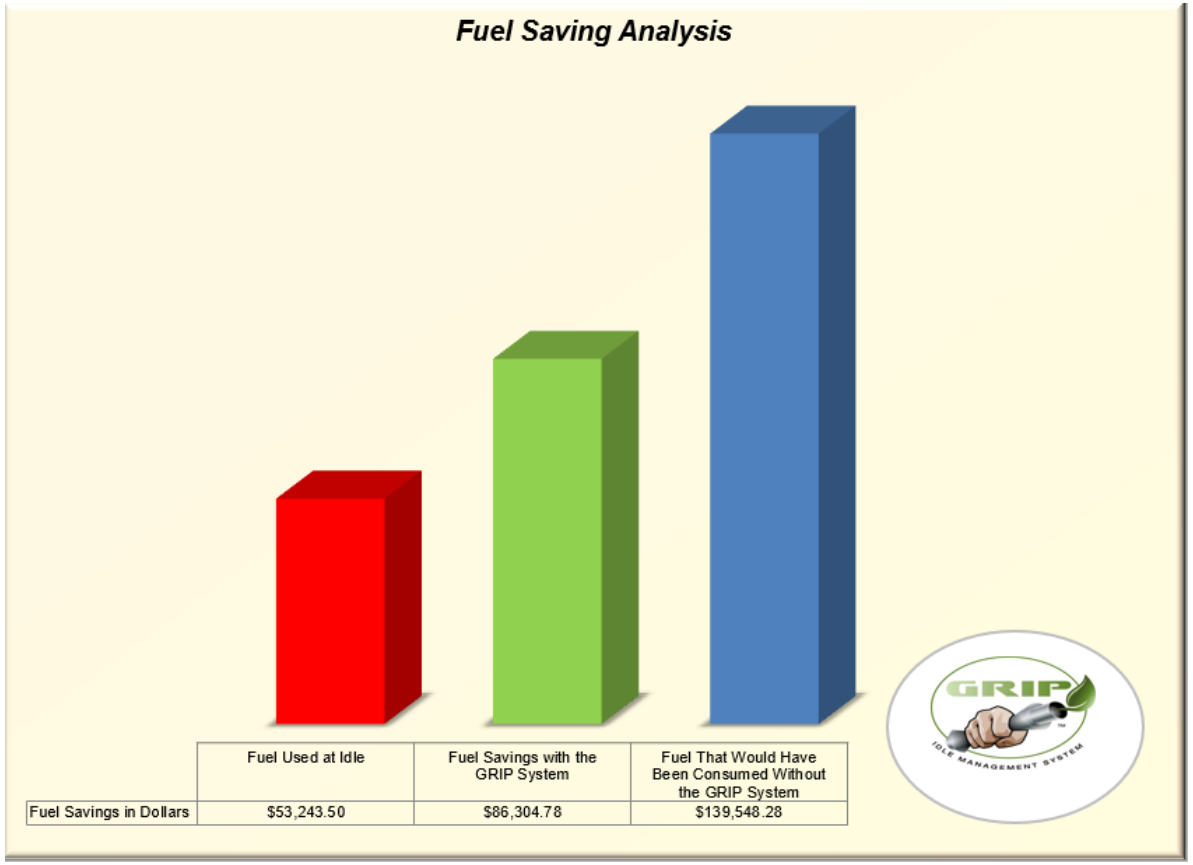
GRIP 3.0 EMAT
Toronto Hydro Case Study

Fuel Savings (CAD): Toronto Hydro

- $86,304 of Fuel Saved
- $53,245 of Fuel Spent at Idle



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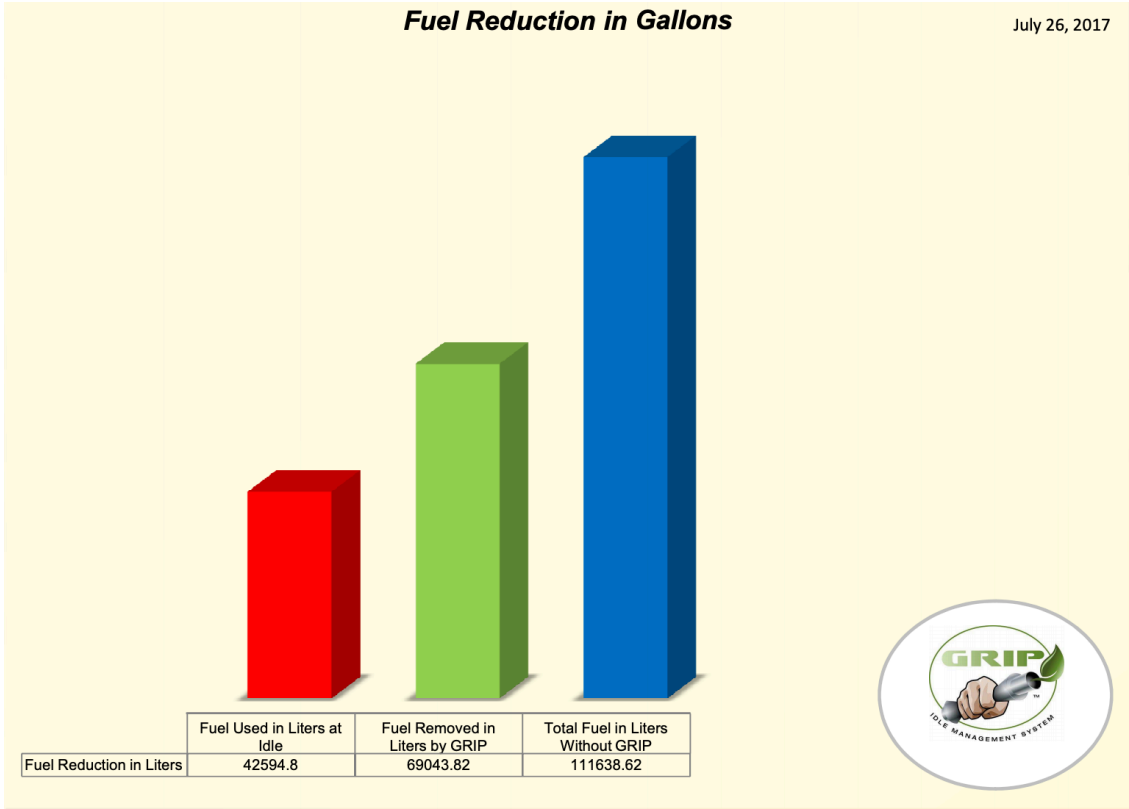
GRIP 3.0 EMAT
Toronto Hydro Case Study

Fuel Reduction (Litres): Toronto Hydro

- Compares the litres of fuel saved by the GRIP vs the fuel used, as well as the total number of litres if the GRIP had not been installed.

- 69,043 Litres of Fuel Saved
- 42,595 Litres of Fuel Spent at Idle



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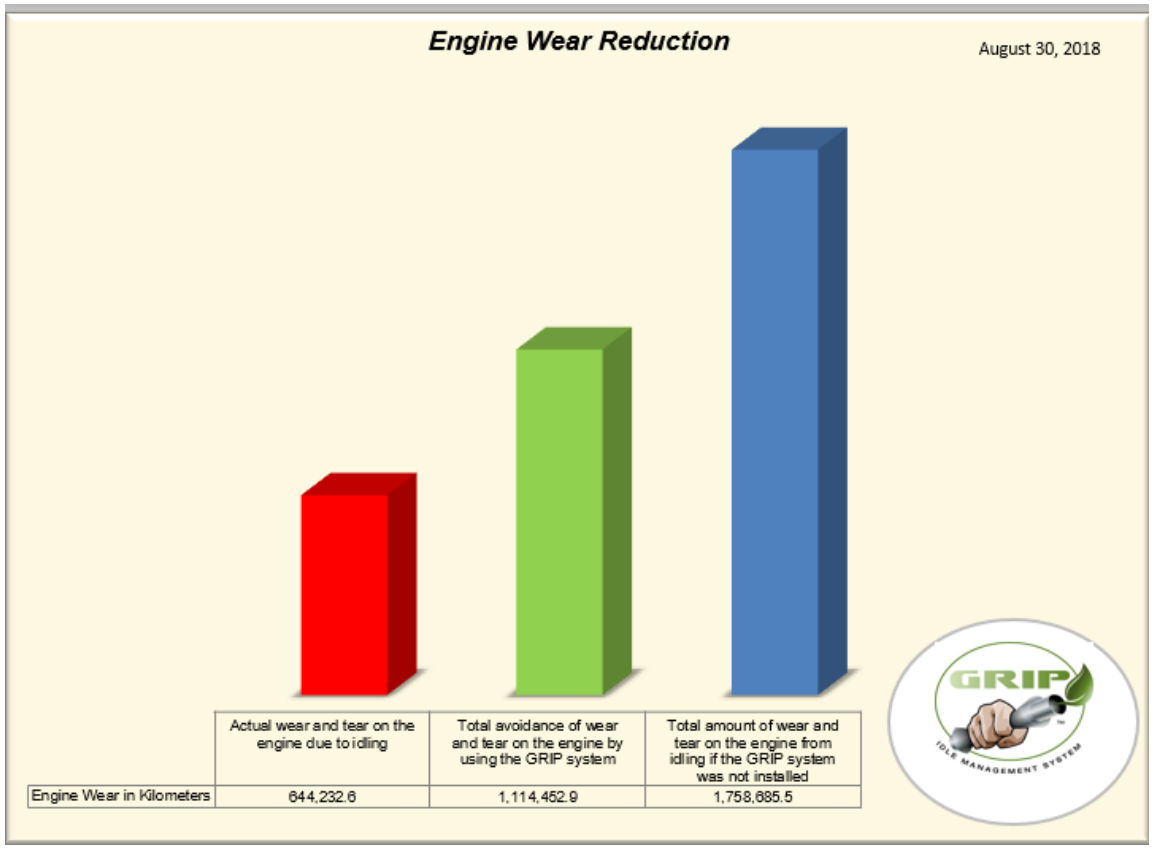
GRIP 3.0 EMAT

Toronto Hydro Case Study

Engine Wear Reduction

- Statistic measure of the equivalent wear and tear reduction on the engine based on the reduced operation at idle. 1 hour of idle equals 52 km of driving wear and tear on the engine

- 1,114,452 Mile of Wear Removed from Engine
- 644,232 Actual Engine Wear due to Idling



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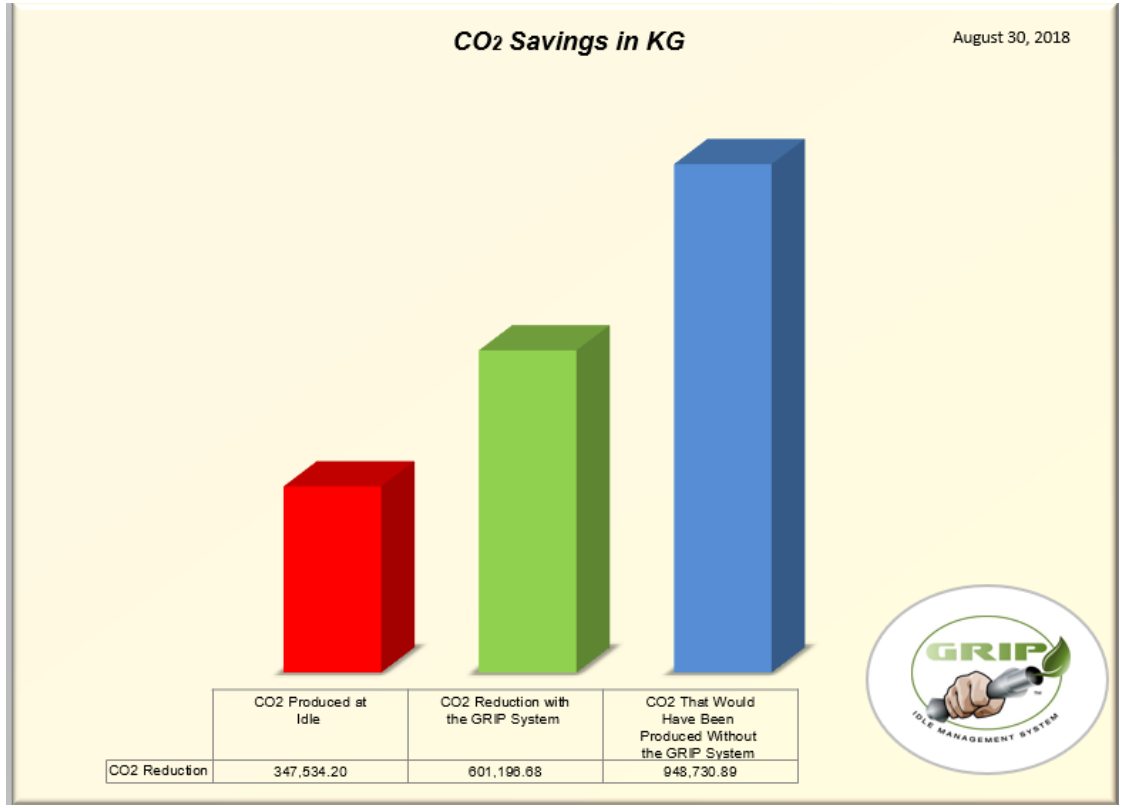
GRIP 3.0 EMAT
Toronto Hydro Case Study

CO2 Reduction

- 601,197 Kg of CO2 Removed
- 347,534 Kg of CO2 produced



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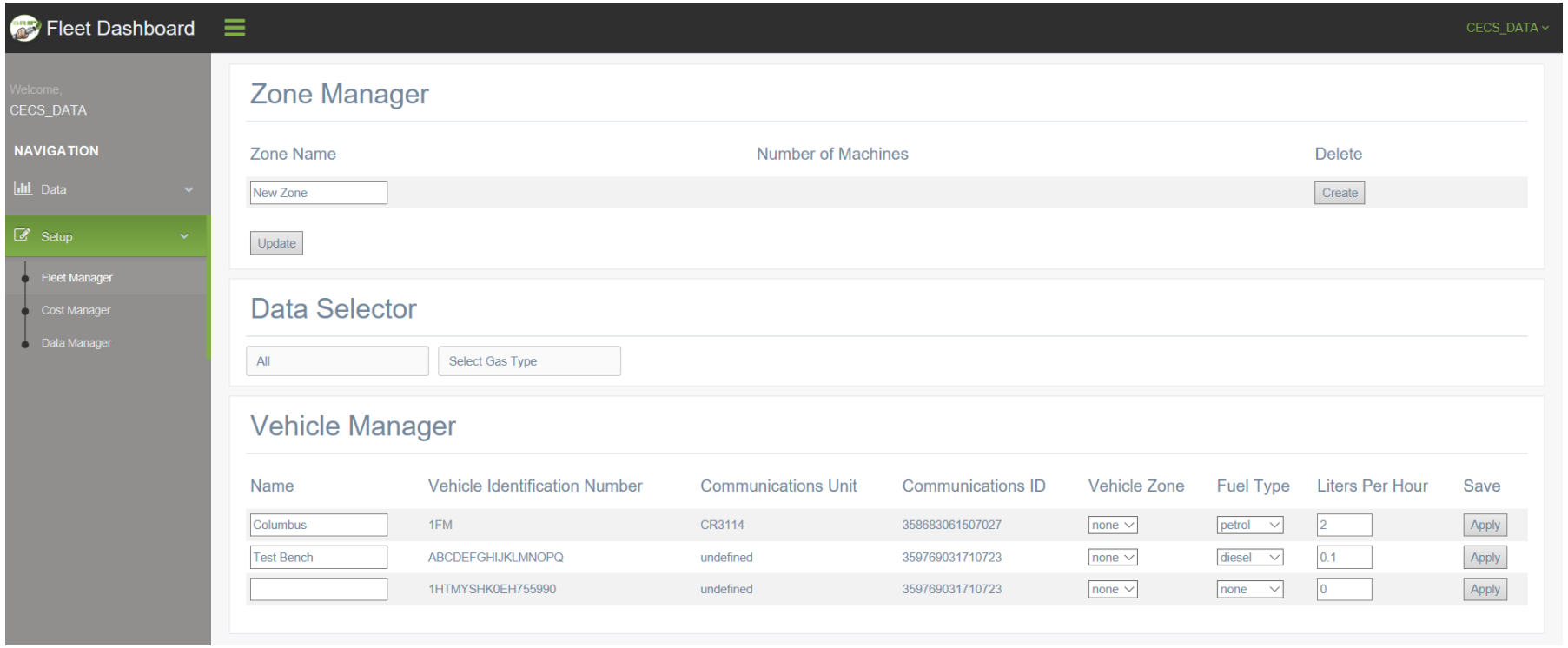
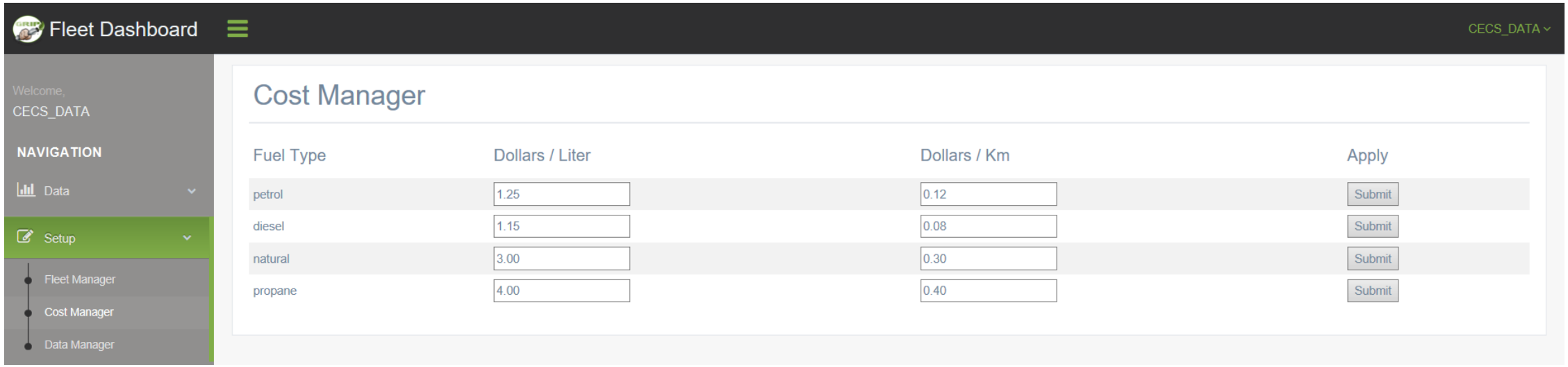
Data Portal

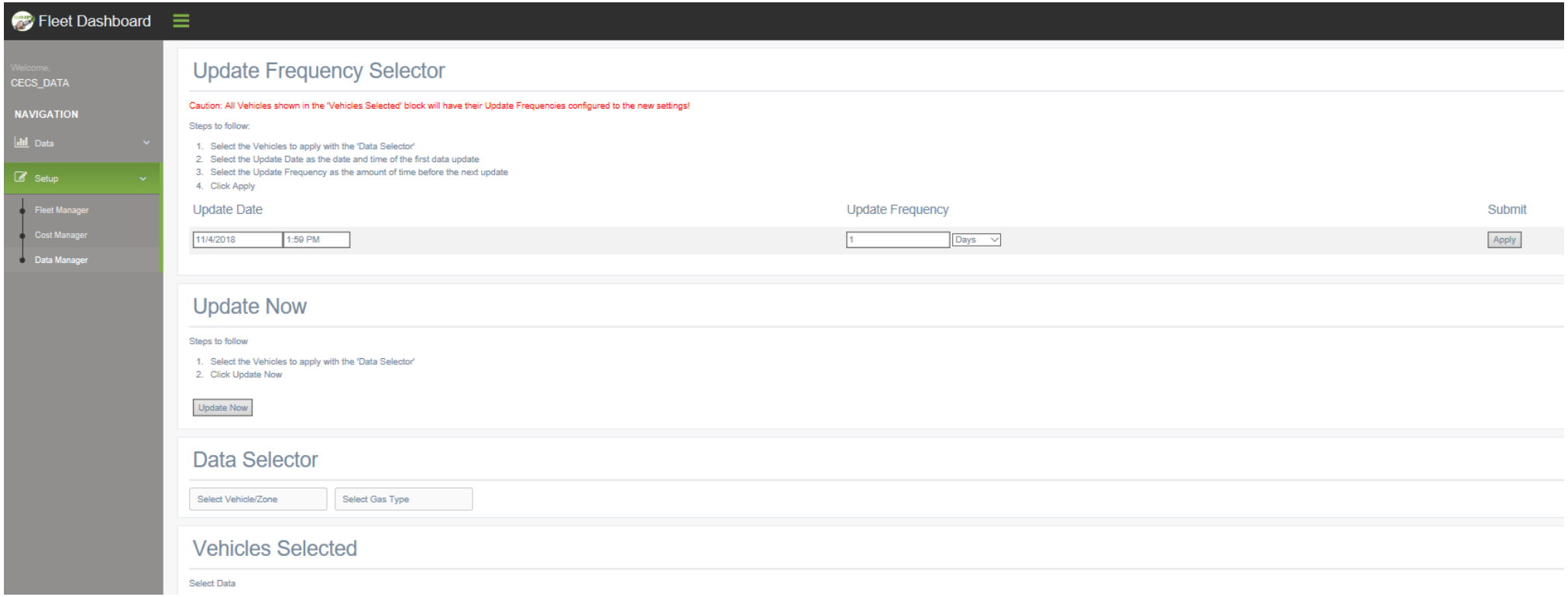
Data Portal
Setup: Fleet Manager



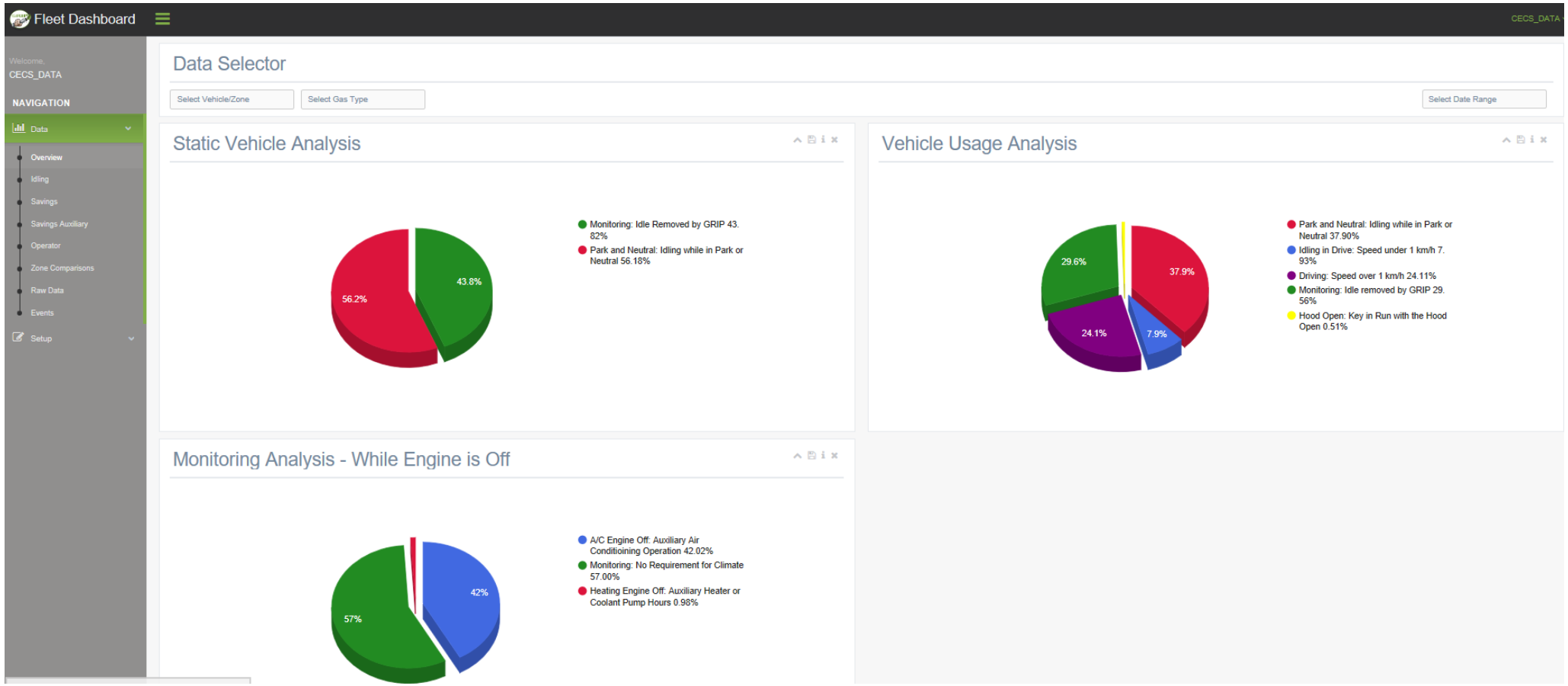
Data Portal
Setup: Cost Manager



Data Portal
Setup: Data Manager

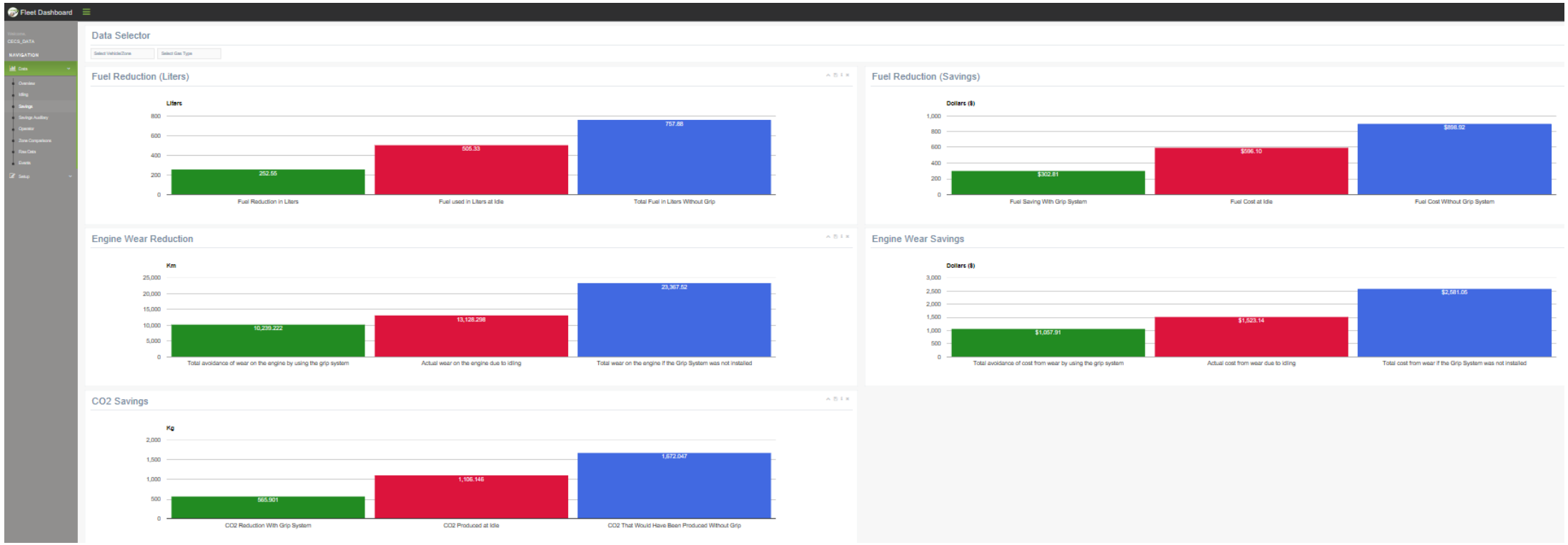


Data Portal
Data Analysis



Data Portal

Data Analysis



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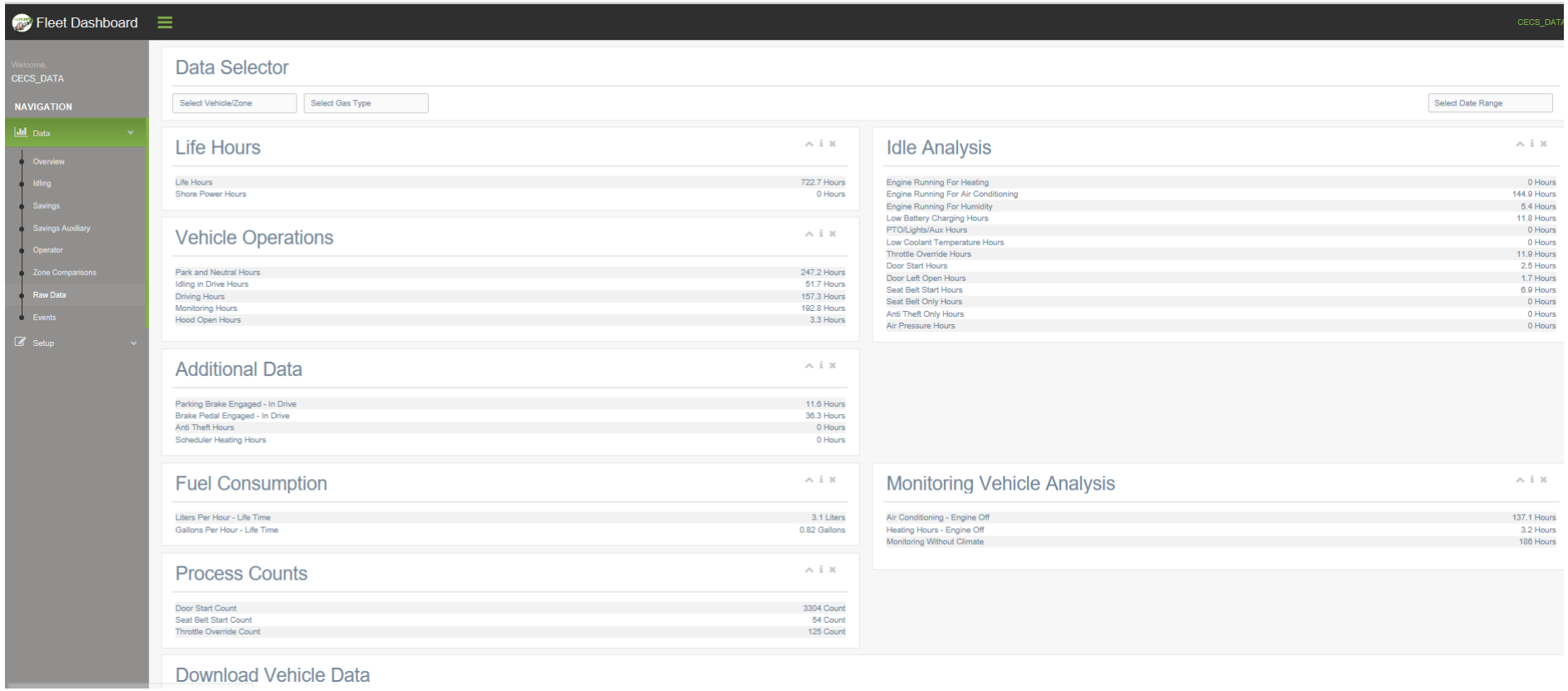
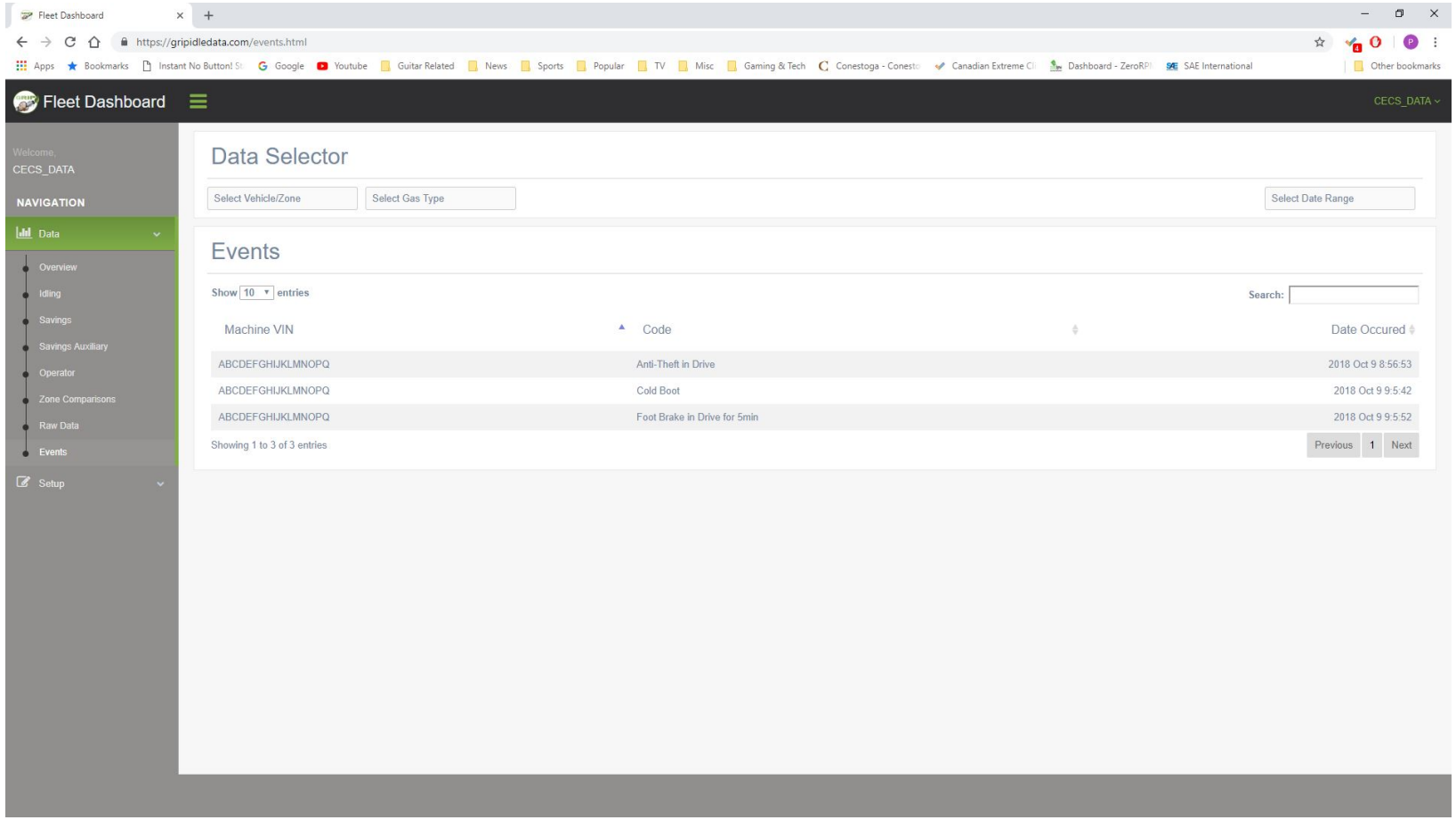
Data Portal
Raw Data



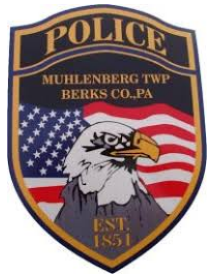
Data Portal

Data Events



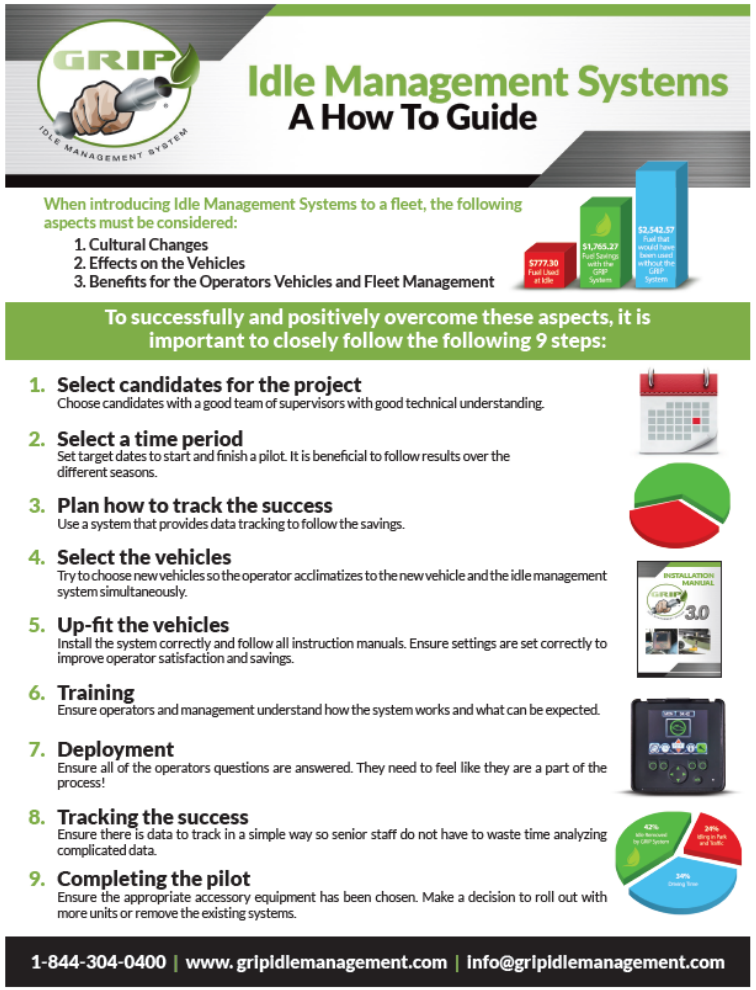
GRIP
IDLE MANAGEMENT SYSTEM

Proudly Supported by



How to Move Forward: Pilot Program

- At GRIP we have a proven methodology for Anti Idling needs analysis
- We also have a proven system for Piloting and deploying our Anti Idling technology based on 1000's of systems and years of customer experience



Pilot Program

How to Move Forward: Pilot Program

1. **Select candidates for the project**
   Choose candidates with a good team of supervisors with good technical understanding.

2. **Select a time period**
   Set target dates to start and finish a pilot. It is beneficial to follow results over the different seasons.

3. **Plan how to track the success**
   Use a system that provides data tracking to follow the savings.
4. **Select the vehicles**
   Try to choose new vehicles so the operator acclimatizes to the new vehicle and the idle management system simultaneously.

5. **Up-fit the vehicles**
   Install the system correctly and follow all instruction manuals. Ensure settings are set correctly to improve operator satisfaction and savings.
6. **Training**
   Ensure operators and management understand how the system works and what can be expected.

7. **Deployment**
   Ensure all of the operators questions are answered. They need to feel like they are a part of the process!
8. **Tracking the success**
   Ensure there is data to track in a simple way so senior staff do not have to waste time analyzing complicated data.

9. **Completing the pilot**
   Ensure the appropriate accessory equipment has been chosen. Make a decision to roll out with more units or remove the existing systems.

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Thank You

www.gripidlemanagement.com

Get a GRIP on Fleet Performance