Work Truck Show 2016

“Fleet Data: What Can We Learn, How Can It Help” – Richard Domonkos & Etienne (Tino) Atisso

“Indiana LTAP: Green Fleet Technologies for the Municipal Market”
FLEET DATA
WHAT CAN WE LEARN
HOW CAN IT HELP

2016 WORK TRUCK SHOW

Richard Domonkos
Training Manager, Indiana LTAP

Etienne (Tino) Atisso
Indiana LTAP
National LTAP/TTAP Center Programs

Blue – D.O.T. Based  Red – Transportation Center  Green – University Based
LTAP/TTAP Centers 2014 Effort:

- 6128 training sessions
- 177,768 participants
- 1,022,584 participant hours
- Communicate with 185,000 local contacts; and
- Share more than 500,000 informational materials.
Indiana’s LTAP

Indiana LTAP

- Affiliated with Purdue University in West Lafayette
- Provides Indiana Counties, Cities, and Towns with:
  - Training Programs, Workshops, and Conferences
  - Information Clearinghouse
  - New and Existing Technology Updates
  - Newsletters, Directories, and Publications
102nd Annual Purdue Road School

- On Campus of Purdue University in West Lafayette, IN
- Over 150 sessions and approximately 250 speakers and moderators

2016 Purdue Road School
March 8-10, 2016
FLEET DATA
WHAT CAN WE LEARN AND HOW CAN IT HELP
NTEA 2016 – THE WORK TRUCK SHOW

• Introduction
• Types of Data
• How can Fleet data make a difference
• Where do I find the time and money for this
• How to get started
Fleet Data is the information that is continually generated by fleet operations. Weather you identify it or not it is still there.

Fleet management is the process of acquiring data, analyzing data and using that information to make decisions.
INTRODUCTION
WHAT IS FLEET DATA

We are already thinking about fleet data when we make daily decisions about our equipment.

The only difference is we may or may not be collecting it and reporting it.
INTRODUCTION

WHAT IS FLEET DATA

Would you agree or disagree with this data?

Your experience and gut tells you this is about right.

But good data can back it up!

This data came from a study on component replacement for the INDOT truck fleet

Battery
Number replaced = 751
Average Life = 8.5 years
Standard deviation = 3.5 years
OEM Manufacturer Warranty = 1 Year
New Replacement Warranty = 2.5 Year
Would you agree or disagree with this data?

Your experience and gut tells you that your drivers plow much faster then that!

But good data can tell the real story and allow for better decisions.

Fleet DNA: Commercial Fleet Vehicle Operating Data

FLEET DATA
WHAT CAN WE LEARN AND HOW CAN IT HELP
NTEA 2016 – THE WORK TRUCK SHOW

• Introduction
• Types of Data
• How can Fleet data make a difference
• Where do I find the time and money for this
• How to get started
TYPES OF DATA
WHERE DO I FIND MY FLEET DATA

- Equipment Performance Data
- Vehicle Location Data
- Environmental and Regulatory Compliance
- Maintenance & Operations Data
- Driver and Equipment Utilization
- Inventory Data
- Financial Management Lifecycle Analysis

Fleet Data
WHERE DO I FIND MY FLEET DATA

- Equipment Performance Data
- Vehicle Location Data
- Environmental and Regulatory Compliance
- Maintenance & Operations Data
- Driver and Equipment Utilization
- Financial Management Lifecycle Analysis

**Fleet Data**

**Inventory Data**
Fleet Inventory data could include:

- Primary and auxiliary equipment inventory
- Parts and supplies inventory
- Fuel inventory
- Tire inventory
- Annual bids
- Maintenance and construction supplies inventory
TYPES OF DATA
WHERE DO I FIND MY FLEET DATA

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- Vehicle Location Data
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Fleet Data
TYPES OF DATA
WHERE DO I FIND MY FLEET DATA

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Fleet Maintenance and Operations data could include:

- Equipment repair orders
- Preventive maintenance records
- Oil Sampling
- Equipment history records “repair history and parts history”
- Parts and supplies allocation “shop rate”
- Technician time allocation “hourly shop rate and recommended number of technicians”
TYPES OF DATA
WHERE DO I FIND MY FLEET DATA

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Fleet Data
Equipment performance data could include:

- Fleet overall performance or availability
- Equipment performance or “downtime”
- Component replacement data
- Stored engine or transmission ECM data
- External data loggers
- Run time information from AVL or GPS
TYPES OF DATA
WHERE DO I FIND MY FLEET DATA

- Equipment Performance Data
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- Driver and Equipment Utilization
- Financial Management Lifecycle Analysis
- Inventory Data

Fleet Data
TYPES OF DATA
WHERE DO I FIND MY FLEET DATA

- Equipment Location Data
- Environmental and Regulatory Compliance
- Driver and Equipment Utilization
- Financial Management Lifecycle Analysis
- Inventory Data
- Maintenance & Operations Data
- Fleet Data
- Vehicle Location Data

LTAP
LOCAL TECHNICAL ASSISTANCE PROGRAM
Vehicle location data could include:

- Location information from AVL or GPS
- Route history
- Route efficiency
- How long a unit is allocated to a task
- Equipment availability
- Vehicle performance information
- Driver records/safety
TYPES OF DATA
WHERE DO I FIND MY FLEET DATA

- Equipment Performance Data
- Vehicle Location Data
- Environmental and Regulatory Compliance
- Maintenance & Operations Data
- Driver and Equipment Utilization
- Inventory Data
- Financial Management Lifecycle Analysis
TYPES OF DATA
WHERE DO I FIND MY FLEET DATA

- Equipment Performance Data
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Fleet Data
Environmental and regulatory compliance data could include:

- MSDS/SDS safety information
- EPA/IDEM environmental reporting
- Overall carbon footprint
- Baseline – Energy Reduction Effort – Results
- Communication data, 2-way radio, FCC/FAA
TYPES OF DATA
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- Inventory Data
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TYPES OF DATA
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- Vehicle Location Data
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- Maintenance & Operations Data
- Driver and Equipment Utilization
- Inventory Data
- Financial Management Lifecycle Analysis
Driver and equipment utilization data could include:

- AVL/GPS equipment location
- Fleet size analysis
- Fleet type analysis
- Project performance/operator performance
- Route optimization
TYPES OF DATA
WHERE DO I FIND MY FLEET DATA

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- Vehicle Location Data
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TYPES OF DATA
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- Vehicle Location Data
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- Maintenance & Operations Data
- Driver and Equipment Utilization
- Inventory Data
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Fleet Data
Financial management lifecycle analysis data could include:

- Equipment per hour/per mile cost
- Equipment lease/purchase analysis
- Equipment depreciation – prime sell point or ROI
- Equipment total maintenance cost
- Identify proper level of preventive maintenance
- Identify candidates for mid-life overhaul
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EXAMPLE DATA

ANALYZING COMPONENT FAILURE

SPR – 3802 Development of Standardized Component Based Equipment Specifications and Transition Plan into a Predictive Maintenance Strategy

Results of study of INDOT repair data for the 1125 single and tandem axle fleet

Figure 2.2 – Relationship between hours and per year repair costs
## EXAMPLE DATA

ANALYZING COMPONENT FAILURE - INDOT INVENTORY DATA

<table>
<thead>
<tr>
<th>MAKE</th>
<th>TOTAL UNITS</th>
<th>PERCENT OF FLEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORD</td>
<td>132</td>
<td>12%</td>
</tr>
<tr>
<td>FREIGHTLINER</td>
<td>99</td>
<td>9%</td>
</tr>
<tr>
<td>INTERNATIONAL</td>
<td>272</td>
<td>24%</td>
</tr>
<tr>
<td>KENWORTH</td>
<td>47</td>
<td>4%</td>
</tr>
<tr>
<td>OSHKOSH</td>
<td>6</td>
<td>1%</td>
</tr>
<tr>
<td>STERLING</td>
<td>569</td>
<td>51%</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>1125</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>YEAR</th>
<th>COMPONENT REPLACE</th>
<th>TOTAL UNITS</th>
<th>PERCENT OF FLEET</th>
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<tbody>
<tr>
<td>1990</td>
<td>0.03%</td>
<td>2</td>
<td>0.18%</td>
</tr>
<tr>
<td>1994</td>
<td>0.07%</td>
<td>1</td>
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<tr>
<td>1995</td>
<td>0.17%</td>
<td>3</td>
<td>0.27%</td>
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<tr>
<td>1996</td>
<td>0.50%</td>
<td>14</td>
<td>1.24%</td>
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<tr>
<td>1997</td>
<td>3.71%</td>
<td>44</td>
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<tr>
<td>1998</td>
<td>7.89%</td>
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<tr>
<td>1999</td>
<td>4.92%</td>
<td>43</td>
<td>3.82%</td>
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<tr>
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<td>8.21%</td>
<td>67</td>
<td>5.96%</td>
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<td>2001</td>
<td>12.59%</td>
<td>103</td>
<td>9.16%</td>
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<td>2002</td>
<td>10.92%</td>
<td>75</td>
<td>6.67%</td>
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<tr>
<td>2004</td>
<td>9.44%</td>
<td>86</td>
<td>7.64%</td>
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<td>2005</td>
<td>8.46%</td>
<td>80</td>
<td>7.11%</td>
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<tr>
<td>2006</td>
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<td>2007</td>
<td>10.47%</td>
<td>160</td>
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<td>4.46%</td>
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<td>6.40%</td>
</tr>
<tr>
<td>2009</td>
<td>1.31%</td>
<td>30</td>
<td>2.67%</td>
</tr>
<tr>
<td>2011</td>
<td>1.62%</td>
<td>75</td>
<td>6.67%</td>
</tr>
<tr>
<td>2012</td>
<td>0.25%</td>
<td>29</td>
<td>2.58%</td>
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<tr>
<td>2013</td>
<td>0.43%</td>
<td>42</td>
<td>3.73%</td>
</tr>
<tr>
<td>2014</td>
<td>0.08%</td>
<td>9</td>
<td>0.80%</td>
</tr>
<tr>
<td>(blank)</td>
<td>0.00%</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>100.00%</strong></td>
<td><strong>1125</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>
### Component Data

<table>
<thead>
<tr>
<th>Component Type</th>
<th>Average Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternators</td>
<td>9</td>
</tr>
<tr>
<td>Starters</td>
<td>7.5</td>
</tr>
<tr>
<td>Turbochargers</td>
<td>8.5</td>
</tr>
<tr>
<td>Injectors</td>
<td>8</td>
</tr>
<tr>
<td>Radiators</td>
<td>9</td>
</tr>
<tr>
<td>Water pumps</td>
<td>8.67</td>
</tr>
<tr>
<td>Tires</td>
<td>7.75</td>
</tr>
<tr>
<td>Oil Pans</td>
<td>6.5</td>
</tr>
<tr>
<td>Air Dryer</td>
<td>10</td>
</tr>
</tbody>
</table>

### Minor Component Data

<table>
<thead>
<tr>
<th>Minor Component Type</th>
<th>Average Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery</td>
<td>8.6</td>
</tr>
<tr>
<td>Air Compressor</td>
<td>9.7</td>
</tr>
<tr>
<td>Rear Brake Shoes</td>
<td>9.5</td>
</tr>
<tr>
<td>Front Brake Shoes</td>
<td>9.5</td>
</tr>
<tr>
<td>Clutch</td>
<td>9.5</td>
</tr>
<tr>
<td>Fan Clutch</td>
<td>8</td>
</tr>
<tr>
<td>Brake Chamber</td>
<td>8</td>
</tr>
<tr>
<td>Front Leaf Springs</td>
<td>9</td>
</tr>
<tr>
<td>Rear Leaf Springs</td>
<td>10</td>
</tr>
<tr>
<td>Oil Cooler</td>
<td>8.5</td>
</tr>
<tr>
<td>Slack Adjustors</td>
<td>9</td>
</tr>
<tr>
<td>Conveyor Motor</td>
<td>8.5</td>
</tr>
<tr>
<td>Spinner Motor</td>
<td>6.5</td>
</tr>
<tr>
<td>Hydraulic Pump</td>
<td>9</td>
</tr>
<tr>
<td>Power Steering Gear box</td>
<td>8</td>
</tr>
<tr>
<td>Power Steering pump</td>
<td>8</td>
</tr>
<tr>
<td>Transmission Cooler</td>
<td>10</td>
</tr>
</tbody>
</table>
From 2008-2014, 1191 alternators were replaced. From the data average component life was calculated and a distribution of the average life and years in service is shown below.

The average life is 9 years with a standard deviation of 3 years.
From 2008-2014, 1348 starters were replaced. From the data average component life was calculated and a distribution of the average life and years in service is shown below.

The average life is 7.5 years with a standard deviation of 3.5 years.
EXAMPLE DATA
ANALYZING COMPONENT FAILURE – TURBOCHARGER DATA

From 2008-2014, 364 turbochargers were replaced. From the data average component life was calculated and a distribution of the average life and years in service is shown below.

The average life is 8.5 years with a standard deviation of 3 years.
### Analyzing Component Failure – INDOT Component Data

#### Turbocharger

<table>
<thead>
<tr>
<th>Sum of Quantity</th>
<th>Column Labels</th>
<th># of Trucks</th>
<th>2 year</th>
<th>3 year</th>
<th>4 year</th>
<th>5 year</th>
<th>6 year</th>
<th>7 year</th>
<th>8 year</th>
<th>9 year</th>
<th>10 year</th>
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<tbody>
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<td>1995</td>
<td>1</td>
<td>1</td>
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<td>3</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td>1</td>
<td></td>
<td></td>
<td>44</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>3</td>
<td>2</td>
<td>14</td>
<td>5</td>
<td>2</td>
<td>30</td>
<td>72</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>6</td>
<td>2</td>
<td>18</td>
<td>43</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>5</td>
<td>4</td>
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<td>8</td>
<td>6</td>
<td>5</td>
<td>34</td>
<td>67</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>2</td>
<td>3</td>
<td>12</td>
<td>9</td>
<td>13</td>
<td>5</td>
<td>2</td>
<td>46</td>
<td>103</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>7</td>
<td>2</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>35</td>
<td>75</td>
<td></td>
<td></td>
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<tr>
<td>2003</td>
<td>4</td>
<td>2</td>
<td>7</td>
<td>12</td>
<td>5</td>
<td>7</td>
<td>3</td>
<td>40</td>
<td>104</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>3</td>
<td>1</td>
<td>7</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>26</td>
<td>86</td>
<td></td>
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</tr>
<tr>
<td>2005</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>8</td>
<td>9</td>
<td>1</td>
<td>32</td>
<td>80</td>
<td></td>
<td></td>
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<td>2006</td>
<td>1</td>
<td>2</td>
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<td>2</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>14</td>
<td>0%</td>
<td>7%</td>
<td>0%</td>
</tr>
<tr>
<td>2007</td>
<td>1</td>
<td>8</td>
<td>26</td>
<td>40</td>
<td>6</td>
<td>81</td>
<td>160</td>
<td>0%</td>
<td>1%</td>
<td>5%</td>
<td>16%</td>
</tr>
<tr>
<td>2008</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td></td>
<td>72</td>
<td>0%</td>
<td>0%</td>
<td>3%</td>
<td>6%</td>
<td>3%</td>
</tr>
<tr>
<td>2009</td>
<td>3</td>
<td>1</td>
<td></td>
<td>4</td>
<td></td>
<td>30</td>
<td>0%</td>
<td>0%</td>
<td>10%</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>75</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td>26</td>
<td>20</td>
<td>57</td>
<td>71</td>
<td>85</td>
<td>90</td>
<td>20</td>
<td>369</td>
<td>1042</td>
<td>1%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Percent replace accumulative: 2% 6% 13% 22% 28% 37% 42% 48%

Turbocharger Replacement trucks 1995 or newer

Recommend replace at 10 year point at 48% failure rate.
EXAMPLE DATA

HOW MUCH HORSEPOWER DO I NEED

What factors do you consider when specifying engine torque/horsepower?

• Vehicle weight
• Load demands
• Performance of existing equipment

Do you have any data to back up your decision?

• Data logging to identify horsepower/torque demands
• Types of repairs to existing equipment – engine overhauls
• Oil sampling data
• Route demands and operator input
EXAMPLE DATA
HOW MUCH HORSEPOWER DO I NEED

Work done by Bob Johnson with the NTEA and noted in the May 2014 issues of Fleet Affiliation. Vehicle engine torque and horsepower requirements are driven by two sets of criteria that can, with some degree of accuracy, be quantified. The first set of criteria includes the following vehicle performance parameters:

- Design cruising speed
- Reserve gradeability
- Starting gradeability

The second set of criteria factors in the weight of the vehicle, as well as impacts to a vehicle’s energy demands:

- Pavement type and condition when operating at design speed
- Type of tires to be used
- Vehicle weight (loaded to include trailer weight if towing is required)
- Number of axles
- Vehicle frontal cross section
- Vehicle design coefficient of drag
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TIME AND MONEY

WHY INVEST IN THIS – WHAT IS THE PAYOFF

With sound information what can be the positive effect?

• Having the parts you need during a winter storm
• Knowing where you trucks are
• Truck tires on hand when you need them
• Better preventive maintenance means fewer breakdowns
• We now change more oil and fewer main bearings
• I know how much it cost us to plow a subdivision
• My techs now have the fleet history at their fingertips
• We cut fuel usage by simply adjusting transmission shift points and checking tire pressures
• After identifying our shop rate, we now out source oil changes and brake work on sedans and light trucks and save money
TIME AND MONEY

WHY INVEST TIME IN THIS – WHAT IS THE PAYOFF

Fuel costs are down but they won’t stay down forever.
Now is the time to invest.

Gasoline & No 2 Diesel Retail Prices
(Dollars per Gallon)

Price Per Gal

0 0.5 1 1.5 2 2.5 3 3.5 4 4.5

Jan-2010 Apr-2010 Jul-2010 Oct-2010
Jan-2012 Apr-2012 Jul-2012 Oct-2012
Jan-2013 Apr-2013 Jul-2013 Oct-2013
Jan-2016

NO2 Diesel
Gasoline
TIME AND MONEY

WHERE WILL I FIND THE MONEY AND TIME FOR THIS EFFORT.

Lower fuel prices in 2015 and 2016
You may bid fuel on a 5 year average price per gallon
• 5 year average for Diesel U.S. = $3.50
• In 2015 the average price per gallon on diesel U.S. = $2.71
• You saved $0.79 per gallon
If you bid 30,000 gallons you have $20,000 left in your budget

Smart money would invest those savings to prepare for tomorrow
TIME AND MONEY
WHERE WILL I FIND THE MONEY AND TIME FOR THIS EFFORT.

Lower fuel prices in 2015 and 2016
You may bid fuel on a 5 year average price per gallon
- 5 year average for Diesel U.S. = $3.50
- In 2015 the average price per gallon on diesel U.S. = $2.71
- You saved $0.79 per gallon
If you bid 30,000 gallons you have $20,000 left in your budget

Smart money would invest those savings to prepare for tomorrow
FLEET DATA
WHAT CAN WE LEARN AND HOW CAN IT HELP
NTEA 2016 – THE WORK TRUCK SHOW

• Introduction
• Types of Data
• How can Fleet data make a difference
• Where do I find the time and money for this
• How to get started
GETTING STARTED

FLEET DATA ASSESSMENT

Implement the 5-S’s method from the lean manufacturing process
GETTING STARTED

FLEET DATA ASSESSMENT

Is this your parts room?
GETTING STARTED
FLEET DATA ASSESSMENT

Turn it into this!
GETTING STARTED

FLEET DATA ASSESSMENT

Is this your file system?
GETTING STARTED
FLEET DATA ASSESSMENT

Or this?
GETTING STARTED
FLEET DATA ASSESSMENT

Turn it into this?
GETTING STARTED

FLEET DATA ASSESSMENT

Or maybe this?
GETTING STARTED

FLEET DATA ASSESSMENT

Or with the technology available today put all of your files on this?
GETTING STARTED

FLEET DATA ASSESSMENT

Is the timing right? Is technology at a point that we can get started and make this sustainable?

Fleet Asset Management software
GETTING STARTED

FLEET DATA ASSESSMENT

Is the timing right? Is technology at a point that we can get started and make this sustainable?

Fleet Telematics
GETTING STARTED

FLEET DATA ASSESSMENT

Is the timing right? Is technology at a point that we can get started and make this sustainable?

Fleet Telematics
GETTING STARTED

FLEET DATA ASSESSMENT

Is the timing right? Is technology at a point that we can get started and make this sustainable?

Fleet Data Logging
GETTING STARTED

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Fleet Data Logging
GETTING STARTED

FLEET ASSESSMENT

Your shop may be an amazing asset to your operation – well run with competent technicians that care!

If you have a good operation in the maintenance side this is a low risk investment to improve performance of your entire operation.

Invest in fleet maintenance and everything works better. Projects get done on time. Overall moral improves. The equipment is safer and more reliable.

and

Drivers have one less thing to complain about!
Gregg Popovich San Antonio Spurs Coach and 1966 Merrillville High School graduate in an interview with ESPN

Q- When you bring someone into the Spurs organization, what do you look for?

A- We need people who can handle information and not take it personally because in most of these organizations, there’s a big divide. All of the sudden, the wall goes up between management and coaching, and everybody is ready to blame back and forth. And that’s the rule, rather than the exception. It just happens, but that’s about people. It’s about finding people who have all those kinds of qualities, so we do our best to look for that, and when somebody comes, they figure it out pretty quick.
I hope that with the resources available with the NTEA and LTAP, a local agency in Indiana make this statement one day- "

“We choose not to purchase this item from the lowest bidder because it is sub-par and we have the data to back that up”!

Or

“We recommend that the council award the bid to vendor#1 based on our data that suggests that this item has the best return on investment for the community"
QUESTIONS?
Indiana LTAP
Green Fleet Technologies for the Municipal Market
About NTEA

More than 1,750 companies

- Truck equipment distributors
- Truck equipment manufacturers
- Truck dealers and fleets, chassis OEMs, and leasing companies

Founded in 1964

Office locations

- Farmington Hills, Michigan (administrative headquarters)
- Washington, DC (government relations office)
- Ottawa, Ontario, Canada (government relations office)
Solutions provided by NTEA

NTEA is your source for work truck industry experts, services, programs and resources.

Engineering and technical assistance

Regulatory and legislative support

Finding the right business partners

The Work Truck Show®

Powerful online information and resources
Sustainable Technologies

• Sustainable technologies are defined as one which reduces the use of limited resources

• Most common limited resource is fuel

• Effective sustainable technologies are directly related to vehicle drive and duty cycles
Why do we use Alternative Vehicle Technologies?

- Reduced operating costs
- Regulatory compliance
- Organizational image
- Social responsibility
Alternative Fuels

• What is an alternative fuel?
  – Any fuel regardless of base, other than gasoline or diesel
  – May be hydrocarbon based as long as it has a lower specific carbon content or a reduced CO2 / criteria emissions level

• Why do we use them?
  – Reduced emissions
  – Lower cost per unit of energy
  – Energy security
    • United States / Canadian sourced
Alternative Fuels

- Natural gas (CNG/LNG)
- Propane Autogas
- Ethanol
- BioDiesel

\[
\begin{align*}
\text{Ethanol:} & \quad \text{H–C–C–H} \\
\text{BioDiesel:} & \quad \text{H–C–C–O–H}
\end{align*}
\]
Types of AFV’s

- **Dedicated**: These vehicles are designed to run on one fuel type.
- **Bi-fuel**: Vehicles designed to have two separate fuel systems that enable them to run on conventional fuel or alternative fuel.
- **Dual-fuel**: Limited to heavy duty, runs on alternative fuel, but uses diesel fuel for ignition assistance.
Natural Gas

- Low cost fuel
- Fully developed distribution infrastructure
  - Limited, but improving public fueling infrastructure
- Very low emissions
  - Leakage issues
- Performance is similar to gasoline or diesel vehicles with regard to power, acceleration, and cruising speed
- Tank weight and space penalties
Propane (Autogas)

- Domestically produced gaseous fuel
- Relatively low cost
- Fully developed distribution infrastructure
- Very low fueling infrastructure cost
- Moderately low emissions
- Is not a greenhouse gas
- Performance is similar to gasoline with regard to power, acceleration, and cruising speed
- Liquefies at a low pressure (150 psi) – good energy density
Biodiesel Blends

- Produced from vegetable oils, animal fats, recycled restaurant grease
- Physical properties are similar to petroleum diesel, but it a clean burning alternative
- Can be used in any application where conventional diesel fuel is being used
- Biodiesel can be blended and used in many concentrations
  - B100 (pure biodiesel)
  - B20 (20% biodiesel, 80% petroleum diesel)
  - B5 (5% biodiesel, 95% petroleum diesel)
- Many diesel engines currently being manufactured are rated for biodiesel blends up to B20
- Crucial that product meets ASTM D6751
- Cold weather issues
Ethanol

- Renewable, domestically produced
- Classified as an alternative fuel when used as E85
- Gasoline-ethanol blend can 51% - 83% ethanol depending on geographic location and season
- E85 can have approximately 27% less energy per gallon than gasoline
- Hydroscopic – will absorb moisture out of the atmosphere
- Application limited to light duty vehicles due to engine / fuel system availability
- Fuel sourcing can be geographic dependent
Hybrids

• When speaking of motor vehicles the common usage of the term “Hybrid” refers to a vehicle which utilizes two or more power sources
• Electric Hybrid
• Work Site Hybrids
  – If a vehicle uses a secondary power source to power on board systems and/or to provide power export independent of the primary vehicle power source it is commonly referred to as a work site hybrid
  – Typically used when the non-propulsion power requirements are intermittent and/or significantly less than the output of the primary power source
    • Auto engine start – stop capabilities
Idle Management

- By definition idling is wasted energy
- Idling can be managed through active or passive management
  - Active: Auto Start/Stop, idle shut down timers, and hybrid systems
  - Passive: Driver behavior modification

Power export system designs

- Convenient manual start / stop systems
- Demand start / stop systems
- Auxiliary Power Units (APU’s)
- Work site hybrid systems
Discover Telematics

• **Telematics** -- The integrated use of telecommunications and informatics for application in vehicles and with control of vehicles on the move

• **Telematics** started as an enhanced GPS functionality and today provides features such as:
  – Vehicle locating and dispatching
  – Routing & traffic avoidance

• **Beyond GPS:**
  – Vehicle maintenance scheduling
  – Driver behavior monitoring and real-time feedback
  – Fuel monitoring
Historical fuel costs

Weekly Retail Gasoline and Diesel Prices

Source: U.S. Energy Information Administration
Opportunity to rewind

- Future fuel costs
- Energy security
- Current funding
- Opportunities to invest now
Historical fuel costs

Weekly Retail Gasoline and Diesel Prices

Source: U.S. Energy Information Administration
Is there still savings?

- Tier 4 diesel engine costs
- Fuel, Fluids, Filters
- Drive and duty cycle
Complex Engines

- Ease of ownership
- Diesel Exhaust Fluid
- Emissions maintenance and costs
Infrastructure

- Public infrastructure is expanding
- [http://www.afdc.energy.gov/locator/stations/](http://www.afdc.energy.gov/locator/stations/)
Using data

• What are the best green technologies for my fleet?
• It depends
• Analyze your data
What can be done now

- Direct drop in fuel replacement – Biodiesel

![Graph showing emissions impact of biodiesel for heavy-duty highway engines.](image-url)

- NOx
- PM
- CO
- HC

Percent Change in Emissions vs. Percent Biodiesel
What can be done now

- Proper vehicle design
- Driver behavior modification
- Idle Management
- Remember the basics
  - Maintain proper tire inflation
  - Reduce unnecessary weight
  - Maintain vehicles properly
What can be done now

• Proper vehicle design

• Drivetrain management
  – New automatic transmissions can be optimized to your drive / duty cycle

• Driver behavior modification

• Idle Management

• Remember the basics
  – Maintain proper tire inflation
  – Reduce unnecessary weight
  – Maintain vehicles properly
What can be done now

- Develop your fleet of tomorrow
- Define and analyze your energy needs
- Take advantage of opportunities and connections
Behind the scenes

- Look at your maintenance practices
- Recycled or re-refined lubricants
- Water based cleaners instead of high VOC solvents
- Waste stream, what’s leaving your facility?
Where to begin

• Begin with your data

• Organizational goals

• Vehicle design and constraints

• Infrastructure
  – What’s available
  – ROI
Resources

- Clean Cities Coalitions
- Green Truck Association
- Work Truck Show
- LTAP
Looking forward

- Manage your energy budget
- Analyze drive and duty cycles
- Implement telematics
- Evaluate energy options
- Take control of tomorrow
Available funding

• Where to find current incentives?

• WWW.AFDC.ENERGY.GOV

• Clean Cities Coalitions
SAVE THE DATE

March 14-17, 2017

Educational sessions begin March 14

Indianapolis, IN