Addressing the Challenge of Rising Energy Costs Through an Effective Energy Management System

A Look at the Best Practices of Subaru of Indiana Automotive
The Industry Leader in Energy Management

Presented by:

Tom Easterday
Executive Vice President
The only auto assembly plant in the U.S. to build vehicles for two of the top 5 brands on Consumer Reports’ 2014 Automaker Report Cards.
Elwood Haynes in his first car in 1894

Photo courtesy of the Elwood Haynes Museum Archives, for "Elwood Haynes," an Indiana Local Legacies project
Since 2008, over 250,000 electric cars have been sold in the United States (Source: Hybridcars.com); and cumulative sales of all plug-in vehicles are projected to reach one million by 2018.
(Source: Pike Research)

Tesla Model S

Nissan Leaf

Chevrolet Volt
Lifecycle of the Automobile

1. Production
2. Use
3. Disposal
# Recycling A Subaru

<table>
<thead>
<tr>
<th>STEEL</th>
<th>Aluminum</th>
<th>Plastics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel from cars is recycled to make new automotive parts, construction materials and consumer products.</td>
<td>Aluminum from cars is recycled to make new items including car parts and consumer goods.</td>
<td>Many new plastic car parts are made from plastics recycled from vehicles as well as from other sources, and can be recycled again.</td>
</tr>
</tbody>
</table>

### Engine
- Steel and aluminum are recycled from engine and driveline components, recycled plastic and nylon fibers are used to make new engine components.

### Copper
- Electrical wiring is made using recycled content and can be reused to make new wire.

### Bumper Cover
- Recycled polymers are used and can be recycled again to make containers and outdoor furniture.

### Tires
- Rubber from tires is recycled to make playground surfaces, garden mulch and new tires.

### Battery
- Resold or recycled materials are used to make new batteries.

### Carpet Padding
- Sound deadening materials are made from recycled clothing, scrap fabric and carpeting.

### Fluids
- Antifreeze, gasoline, oil and brake fluids are recycled and reused.

### Catalytic Converter
- Precious metals, such as platinum, are recycled to make jewelry and new automotive parts.

### Polymer (Acrylic) Tail Lamp Lens
- Plastic polymers recycled from vehicle lamp assemblies are reused to make new parts.

### Glass
- Windshields and glass are recycled to make new windows for cars, homes and buildings, as well as glass containers and other household products.
Recycling A Subaru

Reuse of Auto Parts

Body panels, doors, engines, drivetrain components, electronics and interior items are removed at automotive dismantlers to be resold as used.

**Steering Wheel**
The steering wheel column can be dismantled and sold as used.

**Seats**
The seats can be dismantled and sold as used.

**Gas Tank**
The gas tank can be dismantled and sold as used.

**Fluids**
Antifreeze, gas, oil and brake fluid can be recycled and reused.

**Fenders & Doors**
Fenders and doors can be dismantled and sold as used.

**Stereo**
The stereo can be dismantled and sold as used.

**Battery**
The battery can be sold as used or recycled.

**Engine & Transmission**
The engine and transmission can be dismantled, reconditioned and sold as used.

**Tires**
Tires can be reused. Worn tires can be shredded, cleaned and recycled into playground surfaces and road surfacing material.

**Starters**
The starter can be dismantled, reconditioned and sold as used.

**Windshield Wiper Fluid**
Windshield wiper fluid can be drained for reuse.

**Metals/Steel**
Magnets are used to separate the ferrous (e.g., iron and steel) from non-ferrous (e.g., aluminum) metals. The recovered ferrous metals can be recycled to produce new steel. More than 14 million tons of steel from end-of-life vehicles is recycled each year.
Modern Manufacturing: High Use of Electricity
### Average Retail Price of Electricity
**Industrial; March 2015**

<table>
<thead>
<tr>
<th>Mid-West States</th>
<th>Price per kwh</th>
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<tbody>
<tr>
<td>Illinois</td>
<td>6.97</td>
</tr>
<tr>
<td>Indiana</td>
<td>6.78</td>
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<tr>
<td>Michigan</td>
<td>7.12</td>
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<tr>
<td>Ohio</td>
<td>6.89</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>7.61</td>
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<table>
<thead>
<tr>
<th>Southern States</th>
<th>Price per kwh</th>
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<tbody>
<tr>
<td>Alabama</td>
<td>5.65</td>
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<tr>
<td>Kentucky</td>
<td>5.20</td>
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<tr>
<td>Mississippi</td>
<td>6.45</td>
</tr>
<tr>
<td>Tennessee</td>
<td>5.82</td>
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</table>
“EPA clean air regulations on coal-fired power plants have hit many states hard. The Associated Press reports more than 32 mostly coal-fired power plants will close and another 36 plants could also be forced to shut down as a result of new EPA rules regulating air pollution. Together, these power plants produce enough electricity for more than 22 million households.”

renewableenergyworld.com, 5/5/14

“This rule (the Obama Administration Clean Power Plan) could cost Hoosier manufacturers about $600 million per year in higher electric bills, which represents a 20-percent increase.”

Pat Kiely, President
Indiana Manufacturers Association
Decline in Electricity Production

- Electricity production in the United States has declined since 2007, when it hit its all-time high. *(Source: Energy Information Administration)*

- The U.S. population has risen by over 14 million since 2007. *(Source: U.S. Census Bureau)*

- Per capita electricity generation has gone from .013799 in 2007 to .012895 in 2012, a 6.6% decline in five years.
Between 2007 and 2014, the nation's annual coal-fired electricity generation declined by about 21 percent, or 430,759 million KWh. The combined 390,381 million KWh increase in electricity generation from natural gas, wind and solar did not cover the 430,759 million KWh decline in the electricity generated by coal.

Source: Energy Information Administration
Coal was not the only form of generation that produced less electricity in 2014 than in 2007.

- Electricity from nuclear power plants dropped from 806,425 million KWh in 2007 to 797,067 million KWh in 2014—a decline of 9,358 million KWh or 1.1 percent.

- Electricity generated from petroleum sources dropped from 65,739 million KWh in 2007 to 30,489 million KWh in 2014—a decline of 35,250 million KWh or about 54 percent.

- Conventional hydroelectric means of generating electricity hit their peak in 1997 producing 385,946 million KWh of electricity through conventional hydroelectric power that year. By 2014, that had dropped to 258,749 million KWh, a decline of 127,197 million KWh or 33 percent in 17 years.

Source: Energy Information Administration
“The polar vortexes that blasted the Northeast and Mid-Atlantic with sustained periods of brutal cold during the 2013-2014 winter led to a spike in the price generators paid for natural gas. The increase was largely due to inadequate pipeline capacity. Gas-fired power generators, forced to buy gas from the spot market to deal with shortages, paid prices that were in some cases 878% higher than the 12-month average…. Last winter’s cold also challenged the reliability of the electric grid, prompting PJM Interconnection to issue several warnings and requests for curtailment in January. Consumers were asked to conserve electricity and real-time power prices skyrocketed to $1,800/MWh during certain hours, a 2,798% increase above the $64.33/MWh 12-month average.”

platts.com, 7/22/14
“We are now in an era of rising electricity prices. If you take enough supply out of the system, the price is going to increase.”

*Phillip Moeller, Member Federal Energy Regulatory Commission*

“Everywhere you turn, there are proposals and regulations to make prices go higher. The trend line is up up up.”

*Daniel Kish, SVP – Institute for Energy Research*
SIA’s Average Cost Per KWh

<table>
<thead>
<tr>
<th>Year</th>
<th>kWhr/Cost</th>
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<tr>
<td>2000</td>
<td>0.0351</td>
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<tr>
<td>2001</td>
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<td>2002</td>
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<td>2007</td>
<td>0.0500</td>
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<td>2009</td>
<td>0.0623</td>
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<tr>
<td>2010</td>
<td>0.0628</td>
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<td>Jan-15</td>
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<td>Mar-15</td>
<td>0.0794</td>
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<tr>
<td>Apr-15</td>
<td>0.0743</td>
</tr>
<tr>
<td>May-15</td>
<td>0.0774</td>
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</table>

SIA: Average Kwhr Cost by year

Monthly thru May 2015
Energy is typically the third-largest expense for businesses (after employees and real estate), representing an average of 19% of total expenses and accounts for 75% of a company's carbon footprint. Implementing ISO 50001 will establish a framework for organizations to manage energy, and could influence 60% of the world's energy use, according to the International Organization for Standardization (ISO).
Effective energy management is a priority focus because of the significant potential to save energy and reduce greenhouse gas (GHG) emissions worldwide.

The ISO 50001 standard provides SIA with a recognized framework for integrating energy efficiency into our daily management practices by:

- making better use of our existing energy-consuming assets
- providing guidance on benchmarking, measuring, documenting, and reporting energy intensity improvements and their projected impact on reductions in greenhouse emissions
- creating transparency and facilitating communication on the management of energy resources
- promoting energy management best practices and reinforcing good energy management behaviors
- evaluating and prioritizing the implementation of new energy-efficient technologies
- providing a framework for promoting energy efficiency throughout the supply chain
- facilitating energy management improvements
CONSERVE ENERGY

Use Energy at the Right Place, Right Time, and in the Right Amount

Energy sources such as electricity, gas, compressed air, gasoline, etc. are essential resources used in our business operations. The use of a large amount of energy in our manufacturing process has an impact on the environment and our operational costs. Implementation of the ISO 50001 Energy Management System (EnMS) enables SIA to improve our overall energy performance by establishing specific objectives and targets to realize consumption of appropriate amounts of energy, and to make further contributions to society by helping protect our environment and preserving natural resources.

SIA understands its commitment to the global environment, society at large, our customers, and our Associates. As we conduct our business operations we are committed to continual improvement in energy performance, complying with all applicable legal and other requirements related to energy use and consumption, providing information and necessary resources to achieve energy objectives and targets, promoting the purchase of energy-efficient products and services, and supporting the design for energy performance improvement.

SIA is committed to being a world-class leader in energy performance. This policy is communicated to all SIA Associates and on-site contract personnel, and is available to the general public.
On May 28, 2012, SIA was awarded ISO 50001 Certification, making SIA the first car manufacturing plant in the U.S. to achieve this accreditation. Launched in 2011, ISO 50001 outlines the internationally recognized requirements for energy management systems. The standard provides organizations with management strategies to increase energy efficiency, reduce costs and improve energy performance.
ENERGY MANAGEMENT TEAM
ORGANIZATION STRUCTURE

Tom Easterday
EVP
Energy Management Representative

Ann Piechota
Energy Manager/Specialist

Team roles & responsibilities are defined on the P502 Energy Management Team Roles & Responsibilities document

PURCHASING
- Tim DeLong
  Sr. Manager

MFG. ENGINEERING
- Doug Russell
  Sr. Manager
  - Tim Winicker
    Manager
  - Greg Downham
    Manager
  - Clay Huenemann
    Specialist

MANUFACTURING
- Scott Brand
  Vice President
- Tom Boston
  Manager Stamping
- Mike Perkins
  Manager Body
- Mike Harmon
  Manager Paint
- Tom Devaney
  Manager Engine
- Jeff McTaggert
  Manager T/F

MAINTENANCE
- Chico Marks
  Manager

FINANCE
- David Toles
  Manager
- Bob Wu
  Vice President

INFORMATION SYS.
- Brent Lank
  EnMS Administrator

GOVR. AFFAIRS

SAFETY & ENVIRON.
Energy Management Team Meetings

- Meets quarterly
- Entire energy management team
- Reports on plant and section energy performance
- Reports on audit results
- Reports on energy efficiency activities (Kaizen)
Every week top management goes to a different section and reviews that section’s plan and progress towards achieving safety, environmental and energy goals.

Two key parts of each week’s tour are having the Section Managers explain their targets/results and the Team Leaders explain their teams’ kaizen activities.
Motivate Management Through Measurement

- Develop a system to measure the energy being used
  - Make sure it is accurate
- Level the playing field
  - Normalize data for weather impact
- Make managers accountable
  - Reporting at quarterly EnMS Team meetings
  - Weekly top management tours
- Provide further motivational tools
  - Incorporate energy performance targets into bonus system
Completed Participation target for year 388/315 concerns

Air Emissions Kaizens: 9/9
Water Kaizens: 6/6
Green Supply Chain: 61%/85%
Travel Efficiency: 106.50/106.52 m/v/d
Compliance: 100%/100%
Biodiversity Kaizens: 28/18
Energy Kaizens: 160/147
Electricity: 8,679,733 KWH/3,150,060 KWH

YTD Plant Sustainability Impact Score: 96.67%

Target: 213.86
YTD: 219.94

Target: 0.0513
YTD: 0.0143
One of the best ways to reduce CO2 emissions is to reduce your use of energy. This also results in a cost savings and could result in quality and efficiency improvement. These additional benefits from an environmental kaizen are known as “green dividends.”

Reduction in CO2 per Unit: 33.83%

Reduction in Electricity per Unit: 31.31%

Reduction in Natural Gas per Unit: 39.61%
Kaizen (or continuous improvement) activities are an integral part of the development and implementation of lean ideas, processes and practices.
Generating Innovative Green Dividends Through Energy Kaizens

Reduced Excess Lighting

Added More Light Switches

Changed to Electronic Light Ballast

Reduced Excess Lighting
Energy Kaizens Can Be Easy and Effective

- Lower Oven Doors Between Shifts to Maintain Oven Temperature
- Daily Inspections of Air Lines to Reduce Air Leaks
Lighting Reduction Project

Identified the need to replace T-12 fixtures with more efficient T-8 fixtures.

BEFORE:

Identified the need to replace T-12 fixtures with more efficient T-8 fixtures.
Lighting Reduction Project

AFTER:
- Reduction in kwh usage
- Reduction in CO2 emissions
- Cost savings
- Better illumination

Return on Investment = Less than 1 year
# SIA Spray Booth Energy Reduction Project

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
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<tbody>
<tr>
<td>Calender Year</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Surfacer Booth</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>T/C C Booth</td>
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<td></td>
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<tr>
<td>T/C A Booth</td>
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<tr>
<td>Engineering</td>
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<tr>
<td>Procurement</td>
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<tr>
<td>Pre-work Construction</td>
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<tr>
<td>Installation &amp; SOP</td>
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<tr>
<td>T/C B Booth</td>
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</table>
Project Explanation

1.) Installation of VFD’s on Fan Motors (supply/exhaust)

2.) Reset Zone Down Drafts to Optimal Values

3.) Installed New High Efficiency Pre-Heat Burners in all three Air Supply Houses

4.) Installed low energy “Clean Mode” option
Electric / Gas Idle Mode Savings

Electricity - Idle Mode Chart

- Electricity - Idle Mode Savings 43.9%

Gas - Idle Mode Chart

- Gas - Idle Mode Savings 10.4%
Electric / Gas Charts
50 Degree F days (Before and After)

Electric Results

- Natural Gas Usages for Daily Production
- Daily Average: 339,552 → 282,890
- Range: 16.7%

Gas Results

- Energy (Kilowatts) Usage for Daily Production
- Daily Average: 30,478 → 21,464
- Range: 20 – 30 % Savings

Natural Gas Reduction

- Daily Average: 16.7%
- Range: 9 – 20 % Savings
# SIA Spray Booth Energy Reduction Project

Total Investment Surfacer, Topcoat C, Topcoat A = $1,955,035.00
Total Savings including Rebates = $897,162.00
ROI = 2.18

<table>
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<tr>
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<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calender Year</td>
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<tr>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
<td></td>
<td></td>
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<tr>
<td>Surfacer Booth</td>
<td>Completed in August of 2012 (2013 Budget)</td>
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<td></td>
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<tr>
<td>T/C C Booth</td>
<td>Completed in January of 2013 (2013 Budget)</td>
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<td>T/C A Booth</td>
<td>Gas Usage Reading</td>
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<td>Engineering</td>
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<td>T/C B Booth</td>
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Future Idle Mode Opportunities (Yokaten)

Electricity - Idle Mode Chart

Future Idle Mode opportunities (breaks, lunch, between shifts)
1) Bumper A
2) PVC A
3) PVC B
4) Black & Wax