Energy Efficiency Services
Northeast Indiana Lean
Fort Wayne, Indiana
September 16th, 2008
Agenda

• Understanding the jargon
• Identifying and justifying energy savings
• Getting more out of what you got
• Developing a “Green Workforce”
• Overview of Purdue Energy Efficiency Services
What is Green? What is Green Manufacturing?

Also called:

• Low-Impact Manufacturing
• Sustainable Manufacturing

• A multidisciplinary approaches aimed at reducing the energy- and material-intensiveness of manufacturing processes
Green Manufacturing

- Green manufacturing and environmental sustainability are the current terms being used to explain an effort aimed at producing products with a manageable product life cycle and a relatively benign effect on the environment and human health.
Components of Green Manufacturing

- Environmental compliance
- Lean manufacturing
- Energy Efficiency
- Low Carbon-Footprint
- Renewable Energy
- Green design (LEED)
- Zero Landfill
- Industrial Symbiosis
• **Environmental Compliance**
  – Operating within permits
  – Safe work environment

• **Energy Efficiency**
  – Employing industry best practices in energy intensive systems
  – Investing in best available technologies

• **Lean Manufacturing**
  – Continuous improvement
Energy Efficiency – Low Cost & No Cost

Most facilities can save up to 15% of energy use by implementing low cost / no cost energy saving measures such as…

– Lighting Improvements
– Combustion Efficiency Improvements
– Compressed air system optimization
– Motor Efficiency Improvements
– Boiler Optimization
Defining Clean

Clean is:

A systematic approach to eliminating waste by optimizing use and selection of resources and technologies while lessening the impact on the environment.
Defining Lean

Lean is:

“A systematic approach to identifying and eliminating waste (non-value added activities) through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection”

—The MEP Lean Network
What is “Carbon Footprint”? 

• A carbon footprint is the total cumulative greenhouse gas emissions (often only CO2 is considered) that result from your existence.

• A business carbon footprint could include contributions from all energy consumed including, energy expended for acquisition, transportation and processing of all materials, energy used for transportation of employees, building heating & cooling and construction.
Renewable and Alternative Energy

• Renewable
  – Wind, solar, geothermal, solar-thermal, tidal
  – Biofuels

• Alternative
  – Co-generation
  – Distributed generation
Green Design

• The LEED (Leadership in Energy and Environmental Design) Green Building Rating System is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings.

• Green Building Council website
  www.usgbc.org/leed
• LEED Design:
• An additional upfront investment of 2% of project cost will, on average, result in life cycle cost savings of 20% of constructions costs in today’s dollars. For example, investing an additional $100,000 in the design phase of a $5,000,000 will result in $1,000,000 of savings over the life of the building.
Zero Landfill

- SIA (Subaru) plant in Lafayette, IN
- 99% Recycled; 1% Incinerated with waste heat recovery
- “Dumpster diving”
- Empowerment of all employees
What Is Waste?

Waste is “anything other than the minimum amount of equipment, materials, parts, space, and worker’s time which are absolutely necessary to add value to the product.”

- Shoichiro Toyoda, President, Toyota
Product Lifecycle Management

Old Thinking: “Cradle to Grave”

- **Cradle** – Hazardous Waste Generator
- **To** – Transporter
- **Grave** – Treatment, Storage, and Disposal Facilities

NEW: “Cradle to Cradle”

- All material inputs and outputs are seen either as technical or biological nutrients
- Technical nutrients must be recycled or reused with no loss of quality and biological nutrients composted or consumed
Industrial Symbiosis

• Engages traditionally separate industries in a collective approach to competitive advantage involving physical exchange of materials, energy, water, and/or by-products.

• The keys are collaboration and the synergistic possibilities offered by geographical proximity (Chertow 2000)
Figure 2  Industrial symbiosis at Kalundborg.
Waste Exchanges & Transfers

http://www.recycle.net/exchange/
http://www.grn.com/grn/
Identifying Opportunities

• Energy Efficiency
• Waste Minimization
• Health & Safety
• Environmental
  – Air
  – Water
  – Hazardous
Learn to “See” Environmental Wastes

Overview of Organizational Strategies

1. Add environmental metrics to Lean metrics
2. Show management commitment and support
3. Include environmental wastes in Lean training efforts
4. Make environmental wastes visible and simple to eliminate
5. Recognize and reward success
Applying Lean Concepts to Green Manufacturing

– What things could you do to include environmental wastes in your company’s Lean implementation efforts?

– How could you involve employees at all levels of your company in efforts to identify and eliminate environmental wastes?

– What environmental goals and targets does your organization have?
The Link to Lean’s Seven Deadly Wastes

• Many environmental wastes are, embedded in, or related to, the seven deadly wastes

Lean’s “Deadly Wastes”

1. Overproduction
2. Inventory
3. Transportation
4. Motion
5. Defects
6. Over Processing
7. Waiting

Where are environmental wastes?

• Excess materials use
• Pollution/emissions
• Scrap & non-product output
• Hazardous wastes
Identifying Opportunities

Energy Use Mapping

• Identify the opportunity to save energy

<table>
<thead>
<tr>
<th>Melting</th>
<th>Forming</th>
<th>Reheat</th>
<th>Rolling</th>
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<tbody>
<tr>
<td>15 tph</td>
<td>10 tph</td>
<td>8 ton/hr</td>
<td>11 ton/hr</td>
</tr>
<tr>
<td>1700° F</td>
<td>1400° F</td>
<td>1200° F</td>
<td>1200 °F</td>
</tr>
<tr>
<td>95% Eff.</td>
<td>80% Eff.</td>
<td>80% Eff.</td>
<td>85% Eff.</td>
</tr>
<tr>
<td>Electric</td>
<td>Nat Gas</td>
<td>Nat Gas</td>
<td>Electric</td>
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</table>
Getting More out of What You Got!

- Water reuse
- Energy Efficiency
- Material Exchange
- Recycling
- Waste Heat Recovery
Reduction (conservation)
Recovery (divert, don’t discharge)
Recycling (reuse directly or treat)

Wastewater can be treated to different qualities for industry, aquifer recharge, irrigation, and even to drinking water quality (psychological issues).

Why do we use potable (drinking quality) water to flush toilets?
Reuse water from Reverse Osmosis units
Getting More Energy Efficiency

Compressed Air
- 100 hp Compressor (93% efficient)
- 8000 hrs/yr
- 110 psi reduce to 90 psi
- 2 psi reduction = 1% reduction in hp
- 8 kW peak reduction
- $3,840/year savings
Energy Efficiency

Boiler & Steam Systems

- A single steam trap has failed and is blowing through.
- 1/8” orifice flows 51 lbs/hr of 100 psi steam according to manufacturer
- $1.00/therm natural gas
- 8000 hours/year operation
- $4,675/year cost of leak
Getting More

Waste Exchanges

• Most often focused at the end-of-life stage of a product or process

• Waste exchanges databases to advertise their waste.

• The scale of trades can be local, regional, national, or global.

• [http://www.in.gov/recycle/2450.htm](http://www.in.gov/recycle/2450.htm)
IDEM Recycling Promotion & Assistance Fund

- Zero-Interest Loans: $500,000 – to install equipment to recycle waste materials
- Pollution Prevention Grants (P2): $10,000 - $100,000 individually
- 3Rs Grants: Grants up to $6,000 will be made available to successful applicants to perform facility assessments
- Innovations Grants: $100,000 to develop new recycled content products
- Recycle Business Startup Grants: $50,000
- Recycled Product Marketing Grant: $30,000
- Waste Tire Fund

http://www.in.gov/recycle/2716.htm
Waste Heat Recovery

- A manufacturing facility is considering a heat recovery system to supplement a new make-up air handler.
- It has been estimated that 30,000 cfm of outdoor air is needed to satisfy heating and IAQ requirements in the building.
- Air being exhausted from the building at 68 deg °F is used for heat recovery.
- A Heat Exchanger costs $45,000 to purchase and $15,000 to install
- Payback at $1/therm is 2 years
Developing a Green Workforce

- Knowledge
- Skill
- Culture
- Training
- Empowerment
- Reward
Greenworker Certification Program

• Training focused on:
  – Materials
  – Water
  – Energy

• Learning how to:
  – Reduce
  – Reuse
  – Recycle
Greenworker Certification Program

Two levels of certification

• Generalist
  – 1/2 – 1 day

• Specialist
  – 3 or more days
  – To be endorsed by Society of Manufacturing Engineers (SME)
Greenworker Generalist Training

• Waste stream management
  – Zero-Landfill
  – Waste Exchange
  – Waste Transfer

• Regulations and the Green Connection
  – Reducing regulatory burden through Green

• Energy
  – Energy Savings Assessments
  – Alternative Energy Sources
Greenworker Specialist Training

• **Green Tools**
  – Applying Lean to Green
  – Characterization of Waste Streams
  – Project Life Management

• **Environmental Management Systems**
  – ISO 14001
  – Interface with ISO 9001 and ISO 18001

• **Financials**
  – Green Supply Chain
  – Green Marketing
  – Engineering Economics
  – Justifying Solutions

• **Green Survey**
  – Pollution Prevention
  – Health and Safety
Purdue TAP Energy Efficiency Services

- Energy Efficiency Practitioner worker certification program
- DOE BestPractices workshops
- Energy Assessments
Practitioner worker certification program

– Portable, industry recognized certification from Purdue Technical Assistance Program (TAP)

– Cost of training can be off set by Indiana Department of Workforce Development (DWD) Skills Enhancement Funds (SEF) or Training Acceleration Grant (TAG) financial assistance programs

– Consortium approach enables costs to be shared by multiple companies
Best Practices Workshops

- Boilers & steam systems
- Compressed Air
- Pumping systems
- Fans & Blowers
- Chillers & Cooling Towers
- Process Heating
- HVAC
- Lighting
- EPAct 2005 tax incentives
- Incorporating E² best practices into financial decision making
Energy Assessments

- Plant Surveys
- Plant Energy Profiles
- Plant Wide Assessments
- Energy Savings Assessments
- Custom
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