Energy Treasure Hunt
2017 ESI Members Meeting

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Agenda

- What is an Energy Treasure Hunt?
- What value do they bring?
- What are the results?
- Who are the ideal participants?
- How are they performed?
- Typical opportunities identified?
- Calculations
Activity Overview

A three day activity focused on:

- Low cost and no cost actions to reduce energy consumption
- Learning ways to continuously improve and reduce energy consumption
- Cross-functional teams brainstorm ways to reduce energy use
- Teams identify, analyze, and evaluate energy savings opportunities by observing daily operations
- Opportunities for reduction are quantified using a standard methodology and calculation
TE Connectivity is in Good Company
Key Elements

• Observing the idle facility – start on Sunday or periods of reduced production
• Facility employees conduct the Energy Treasure Hunts and have ownership of the ideas/opportunities
• Outside experts/participants are there to facilitate the process, generate discussion, and help quantify opportunities
• Local personnel have the most expertise on optimizing facility production and operational changes
What are the benefits?

- Enhanced employee engagement and awareness
- Reduced cost and improved efficiency
- Quick and actionable ideas to reduce energy usage
- Opportunities are not capital intensive
- Opportunities can be replicated across similar processes and business units
- Historically, more than 50% of opportunities are implemented
- Movement toward corporate sustainability goals
Energy Treasure Hunt vs Energy Assessment

**Treasure Hunt**
- Continuous process (repeat annually, quarterly, etc.)
- Internal resources
- Focus on operational opportunities

**Assessment**
- Standalone event (assess as needed)
- External resources
- Focus on system performance and technology
## What are we looking for?

<table>
<thead>
<tr>
<th>No Cost / Low Cost Energy Actions Items</th>
<th>$0 to &lt;$10K Usually an expense or operating cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Cost and High Return Energy Actions Items</td>
<td>$5K to &lt;$20K Capital less than 1 year simple pay back</td>
</tr>
<tr>
<td>Capital Investment Energy Actions Items</td>
<td>Capital greater than 1 year simple pay back</td>
</tr>
<tr>
<td>Productivity Actions Items</td>
<td>Added production capacity, scrap reduction, etc.</td>
</tr>
</tbody>
</table>
Energy Treasure Hunt Process Flow

TH Preparation

- Kick Off & Train
  - Intro to TH
  - Collect Preliminary Data
  - Finalize Agenda

- Create TH Teams (5-10 Members)
  - Maintenance T/M's
  - Production T/M's
  - Engineering T/M's

Day 1:

- Go & See:
  - ID Opportunities
  - Collect Data
  - Grasp Hurdles

- Create Detail Sheets:
  - Estimate Savings
  - Describe ideas

TH Outcomes

- Summarize
  - opportunities:
    - Individual Savings
    - Individual Payback
    - Totals

- Management
  - Presentation:
    - Highlight Top items
    - Implementation Support

- Implementation:
  - Measure Energy Before
  - Install
  - Measure Energy After
  - Finalize Detail Sheet

- Yokoten:
  - Share Company Wide
  - Energy Database
  - Keep All Ideas
Basic Daily Format

Sunday – 8AM – 4PM
• Introductions, background information
• Training on best practices identification
• Training on use of diagnostic equipment
• Observe idle facility, generate ideas
• Daily flip-chart notes – major opportunities

Monday – 7AM – 5PM
• Training on use of DOE software tools and calculation sheets
• Observe facility under operation
• Investigate ideas, gather information
• Identify and complete top 2 detail sheets
• Complete presentation slides for top 2 detail sheets

Tuesday – 7AM – 4PM
• Finalize / review all detail sheets
• Findings summary
• Dry run through presentation / format
• Present to management

Sunday is typically a non-production day for many facilities. The Energy Treasure Hunt agenda is adjusted appropriately for the plant hosting the event.
The Basic Mission

Assemble your teams

Facilitator & Host

Team 1 Electric
Team 2 Comp. Air
Team 3 Nat. Gas

Facility walk through for each team to generate ideas

Assess idea feasibility, gather data, quantify

At the end of each day the teams brief each other on what they are pursuing.
Average Payback

**Identified Opportunity**

$0
$500,000
$1,000,000
$1,500,000
$2,000,000
$2,500,000
$3,000,000

**Implementation Cost**

**Payback**

- < 3 Yr
- < 2 Yr
- < 1 Yr

*Opportunities tend to be small, but economically competitive!!*
# Team Makeup

<table>
<thead>
<tr>
<th>Core Team</th>
<th>Internal Participants</th>
<th>External Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance (shift mechanic/electrician)</td>
<td>Administrative support</td>
<td>Consultants (compressed air, process heat, energy specialist)</td>
</tr>
<tr>
<td>Production (operators, supervisors, leads)</td>
<td>EH&amp;S</td>
<td>Previous hosts</td>
</tr>
<tr>
<td>Engineering (area engineer, process engineer)</td>
<td>Buyers, planners</td>
<td>Similar facilities, future hosts, other stewards</td>
</tr>
<tr>
<td>Subject Matter Expert (HVAC, compressed air, electrical, etc.)</td>
<td>Anyone enthusiastic to participate</td>
<td>Suppliers, vendors</td>
</tr>
</tbody>
</table>
Observe the Idle Facility

Most important day for generating ideas

Rarely is production activity 24 hrs / 7 days a week

- Take note of maintenance downtime / shift changes / off shifts

Use your eyes and ears to find wasted energy!
Typical Treasure Hunt Opportunities
Lighting

If sufficient day lighting is available, turn off excess lighting where possible:

- During a treasure hunt, experiment by turning off lights and then measuring the available lumens.

Evaluate areas that are infrequently occupied during the day or non-production hours:

- Implement shut down procedures or install occupancy sensors and calculate the savings.

Identify unnecessary lighting:

- Robots do not need light to work
- Infrequently accessed areas with large lights (400KW – 1000KW) such as tops of ovens, warehouse shelves, and storage areas

Retrofit lighting with more efficient technology

LED technology can save more on maintenance than energy in some applications
Steam & Compressed Air

Steam

- General steam leaks
- Condensate leaks
- Boiler efficiency
- Building heat with poor control:
  - If areas are excessively warm experiment with reducing steam heat.

Compressed Air

- Operate at the lowest practical pressure setpoint
- Replace pneumatic energy with electrical energy where practical
- Evaluate high efficiency nozzles
- Eliminate inappropriate end use applications
- Optimize control strategy
- Perform a leak survey
- Install solenoid valves on open blowing
Process Heat

- Combustion tuning
- Combustion efficiency – burner upgrades, recuperators
- Poor furnace insulation
- Furnace shut downs/non-production management
  - Temperature setpoints
  - Recirculation fans/blowers
  - Minimize ramp up time
  - Excessive soak time
Cooling/HVAC

Cooling Towers

- Match tower capacity with process requirements
  - Less active cooling may be needed during night, colder seasons, and non production
- Check for throttled pumps / opportunities for VFD

HVAC / Makeup Air / Comfort Cooling

- Use programmable thermostats to optimize cooling schedule:
  - Particularly in non-24/7 areas such as offices, warehouses, partial production areas
- Challenge temperature set points
- Less makeup air may be needed during non production, if possible, shut down a few units
Process Equipment

• Ensure auxiliary energy is minimized during non-production:
  ➢ Shut down lubrication pumps, valve off compressed air, consoles, lighting panels
• Production cells should have a shut down procedure during idle time
• Optimize throughput:
  ➢ parts washers,
  ➢ cooling tables / fans
  ➢ die heaters

• If the process is not a bottleneck in plant production, consider batch processing and avoid constant idle time waiting for product
TE Connectivity Treasure Hunt Opportunities
Thermalator Management (Molding)

- Molding houses 118 molding presses with approximately 40-45 down at any given time
- Each press uses two thermolators
- Estimations were made by turning half the thermolators off

Annual Savings: $56,461
Installation: $14,000
Payback period: 0.25 years

BONUS FACT: Based on data collection, a dual heater is more energy efficient than two single heaters on a press.
Sleep Mode Savings – Office Desktop/Laptops

By setting all office desktop and laptop monitors and displays to go into sleep mode after 10 minutes

Annual Savings: $5,539
Installation: $0
Payback period: 0.0 years
Partially De-lamp High Bay Fluorescent Lights

High bay fluorescent lights measure from 89 foot-candle to 95 foot-candle

- **Recommendation**: Remove 2 bulbs from each fixture

Current = $500 \times \frac{6 \text{ lamps}}{\text{fixture}} = 89 - 95 \text{ foot-candle}$

Projected = $500 \times \frac{4 \text{ lamps}}{\text{fixture}} = 75 - 80 \text{ foot-candle}$

**Total Energy Savings**: $19,290
Retro-Commissioning HVAC System

- Perform a recommissioning of the building’s systems operations to improve overall performance of the computerized maintenance management system
- Focus on HVAC, process cooling water, process chilled water
- 41 points on a chiller, 42 points on an air handler

Total Energy Savings: $20,729
Implementation Cost: $25,232
Simple Payback Period: 1.2 years
Raise Chilled Water Temperature

- System is set for historic process chilled water demand;
- Only process remaining on system is the laser welders;
- Welders are tolerant of much higher water temperatures;
- Chilled water temp can vary with air conditioning demand. The lower the HVAC requirement, the higher the chilled water temp can be.

Total Energy Savings: $7,100

Implementation Cost: $0

Simple Payback Period: 0.0 years
Compressed air pressure reduction

Reduce compressed air system pressure from 95psi to 75psi.

Cost to implement may include pressure boosters and/or small modifications to some of the existing equipment.

Total Energy Savings: $38,000/year
Implementation Cost: $28,000
Simple Payback Period: 0.63 years
Air knife blow off conversion

Before

Current usage: 278,865 kscf
Current Cost: $38,217

After

Future usage: 41,954 kscf
Future Cost: $5,622

Total Energy Savings: $32,595/year
Implementation Cost: $27,400
Simple Payback Period: 0.84 years

Additional Benefits:
- Noise reduction from 83 dBA to 69 dBA
- Standardized set-ups, less adjust time
Plating air reduction

Before

Current usage: 388,800 kWh
Current Cost: $27,216

No Air Reduction Nozzle
(10 Missing)

After

Future usage: 58,579.2 kWh
Current Cost: $4,100.54

Super Air Nozzle

Total Energy Savings: $22,124.79/year

Implementation Cost: $583.30 + 2 labor hours

Simple Payback Period: 0.02 years
What does this mean?

**Electric Expenditures**

10% Spending

Current $2,200,000 (Electricity)

Kaizen savings: $236,696

Implementation Cost

Treasure Hunt

Payback

- < 3 Yr
- < 2 Yr
- < 1 Yr

Implementation Cost

$160,061

$226,688

0

$ 50,000

$ 100,000

$ 150,000

$ 200,000

$ 250,000
Detail Sheets
Documentation and Calculations

• A “detail sheet” is the excel calculator we use to document and quantify an opportunity during an Energy Treasure Hunt

• To use the detail sheets you must quantify a “before” and “after” state for the equipment
  ➢ Consider equipment operating profiles
  ➢ Note nameplate energy consumption or take a measurement

• As a group we will create a “detail sheet” for **each** opportunity
### Plant Cost Information Tab

<table>
<thead>
<tr>
<th>Electric</th>
<th>CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg Electric Cost [$/kWh]</td>
<td>$ 0.054 /kWh</td>
</tr>
<tr>
<td>CO₂ Rate [lb/kWh]</td>
<td>1.000 lb/kWh</td>
</tr>
<tr>
<td>NG CO₂ Emission Rate [lb/MMBtu]</td>
<td>114.2 lb/MMBtu</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Misc</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Cost [$/MMBtu]</td>
<td>$ 2.89 /MMBtu</td>
</tr>
<tr>
<td>Compressed Air Cost [$/kcf]</td>
<td>Water Cost [$/kGal]</td>
</tr>
<tr>
<td>Steam Cost [$/klb]</td>
<td>CHW Cost [$/kTon]</td>
</tr>
<tr>
<td>Altitude (Above MSL) [ft]</td>
<td>WWT Cost [$/kGal]</td>
</tr>
<tr>
<td>POTW Cost [$/kGal]</td>
<td></td>
</tr>
</tbody>
</table>

### Sub Resources

<table>
<thead>
<tr>
<th>Type</th>
<th>Compressed Air (kscf)</th>
<th>Steam (klb)</th>
<th>Chilled Water (kTon)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity [kWh/unit]</td>
<td>2.73 kWh/kscf</td>
<td></td>
<td>0.25 kWh/kTon</td>
</tr>
<tr>
<td>Gas [MMBtu/unit]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water [kGal/unit]</td>
<td></td>
<td>1.000 kGal/klb</td>
<td>0.01 kGal/kTon</td>
</tr>
<tr>
<td>Other [$/unit]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use regional CO₂ rate, default value if CO₂ value is desired or zero (optional)

Use ONLY if these are purchased and not generated on site (seldom the case)

These are system capabilities
If compressed air, chilled water and steam are generated on site (usually this is the case)
The “Detail Sheet”

**Only complete pertinent orange cells**

Title is important for summary

Before and after completed even if no change.

These will be completed by excel but do a “sanity check”

If there is a cost to complete estimate here
# Example

**Kaizen Title:** Injection Molding Press and Auxiliary shutdown  
**Plant:** Lisle HOME  
**Department:** Appliance  
**Manager:** Jamie Setto

**Description:** Shutdown of Press and Auxiliary when not in operation. Based on the calculation of each individual piece of Auxiliary equipment and the press, using the amperage each pulls while running versus powered down. We can deduce that one press could provide $553.04 a year reduction. Including the average press utilization, we could potentially create a savings of $33,222 across the course of a year.

### Current Situation (Before Kaizen) vs. Projected Situation (After Kaizen)

<table>
<thead>
<tr>
<th>Energy Use Before Kaizen (Energy Unit)</th>
<th>Energy Use After Kaizen (Energy Unit)</th>
<th>Energy Savings (Energy Unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity [kW]</td>
<td>247,957.2</td>
<td>247,957.2</td>
</tr>
<tr>
<td>Gas [MMBtu]</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Compressed Air [KSCF]</td>
<td>17,445.5</td>
<td>17,445.5</td>
</tr>
<tr>
<td>Compressed Air Leak [KSCF]</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Steam [KLB]</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Chilled Water [kTon]</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Water [L/Gal]</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>WWTP [kGal]</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>POTW [kGal]</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other: Explain</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2 [metric tons]</td>
<td>112.5</td>
<td>112.5</td>
</tr>
</tbody>
</table>

**Implementation Cost**

<table>
<thead>
<tr>
<th>Cost/Category</th>
<th>Total Units</th>
<th>Individual Unit</th>
<th>Cost</th>
<th>Projected Annual Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Service</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$2.75</td>
<td>$16,613.13</td>
</tr>
<tr>
<td>Material</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.15</td>
<td>-</td>
</tr>
<tr>
<td>Labor Contract</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$3.28</td>
<td>-</td>
</tr>
<tr>
<td>Labor: In House</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>-</td>
</tr>
<tr>
<td>Other</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>-</td>
</tr>
<tr>
<td>Other</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
<td>-</td>
</tr>
<tr>
<td>Est. Int Labor (Hrs):</td>
<td>40.0</td>
<td>6.7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>$0.00</td>
<td>$0.00</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Simple Payback Period (yrs):** 0.00
Questions / Comments?