Energy Efficiency at Koppers

May 21, 2015
Distillation and Railroad Tie Treatment

Coal → Coke Ovens → Coke Tar → Distillation Tower → Creosote → Treated Railroad Crossties and Utility Poles

- Coke
- Chemical Oils/Naphthalene
- Carbon Pitch
- Carbon Black
- Phthalic Anhydride
Global Locations

Facilities are well-positioned to capture worldwide growth in demand

North America
19 facilities

Europe
4 facilities

China
3 facilities

Australasia
9 facilities

2013 Point of Sale

- North America, 60%
- Europe, 14%
- Australia, 11%
- Emerging Markets, 15%

(1) Toll producing facilities

- Carbon Materials and Chemicals
- Railroad and Utility Products and Services
- Performance Chemicals
2014 Energy Use by Type

Koppers’ 2014 Global Energy Usage – 6.2 Million GJ (excludes Performance Chemicals group)

- Diesel: 860,540 GJ
- Fuel Oil #6: 114,511 GJ
- Solvent: 366,350 GJ
- Coke Oven Gas: 249,459 GJ
- Natural Gas: 2,765,726 GJ
- Electricity: 674,474 GJ
- Wood Chips (45% Moisture): 689,550 GJ
- Steam (if purchased from another entity): 415,438 GJ
Energy Assessments

• Koppers had 14 energy assessments completed by Universities funded by DOE and consultants funded by local utilities

• WVU performed four assessments for Koppers
  • Follansbee, WV (Distillation)
  • Clairton, PA (Distillation)
  • Green Spring, WV (Wood Treating)
  • Huntington, WV (Rail Joints)

• These energy assessments are logged into a shared drive and are the foundation for projects to reduce usage
Energy Assessment Spreadsheet

- Core information from assessment
  - Project title
  - Annual energy savings
  - Cost to implement
  - Annual cost savings
  - Payback
- If project considered, detailed analysis is performed.
- Depending on funding, projects can be split into multiple projects
Energy Assessment Spreadsheet (2)

- Used as a working document, also includes:
  - Date
  - Status
  - Rate – projects can rise to top if rates increase
  - Usage
  - % energy savings
  - Plant Manager’s Comments
- Look for good paybacks and large % energy savings
### Sample of energy assessment spreadsheet

#### Date

**6/21/2012**

#### Status

- **Complete Date:** 6/21/2012
- **Responsibility:** Air-Permitting issues have stalled project
- **Usage:** 23,000
- **Cost:** $100,000
- **Energy Savings:** $143,060
- **Comments:** Contractor scheduled for next week to adjust controls. Costs $5,000

#### Usage

<table>
<thead>
<tr>
<th>Project Title</th>
<th>Status</th>
<th>Responsibility</th>
<th>Annual Electricity Savings</th>
<th>Annual Natural Gas Savings</th>
<th>Cost to Implement</th>
<th>Annual Cost Savings</th>
<th>Simple Payback</th>
<th>Energy Savings</th>
<th>Plant Manager Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjust Air-Fuel Ratio for Natural Gas Heaters</td>
<td>Complete</td>
<td></td>
<td></td>
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<tr>
<td>Rework Piping for Heaters to optimize Air-Fuel ratio</td>
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<tr>
<td>Preheat Combustion Air for Natural Gas Heaters Using Stack Gases</td>
<td>Air-Permitting issues have stalled project</td>
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<tr>
<td>Install a Nitrogen Generator to Clean Storage Tanks and Utilize Produced Oxygen Enriched Air to Feed Natural Gas Heaters</td>
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<tr>
<td>Install Variable Speed Drives on the Two 250-Hp Water Pumps</td>
<td>Installing</td>
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<tr>
<td>Install Timers to Switch-off Outside Light</td>
<td>Ongoing</td>
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<tr>
<td>Perform Vibration Analysis on Equipment</td>
<td>Ongoing</td>
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<tr>
<td>Preheat Oxidizer Combustion Air Using Stack Gases</td>
<td>1,511</td>
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<tr>
<td>Replace T12 with T8 Acrobats and Update Lighting</td>
<td>Ongoing</td>
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<tr>
<td>±offset Motor Management System</td>
<td>Complete</td>
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<tr>
<td>Replace 45 ton Air Conditioner with 25 ton Unit</td>
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<td>Use Outside Air for 150-hp Air Compressor Intake</td>
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<tr>
<td>Incorporate VFD with new 2T-1 Bottoms Pumps</td>
<td>Proceeding</td>
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</tbody>
</table>

#### % Usage Savings

- **Energy Savings:** 5.5%
- **Comments:** Exploring costs now, have included it as a project in Capex program sent to Greg Tracezek for next year at around $40k

#### Adjust Pricing Regularly

- **Comments:** Rebate of $34,722.48 expected
- **Energy Savings:** 8.3%
- **Cost:** $1,210
- **Energy Savings:** $3,360
- **Cost:** $1,210
- **Energy Savings:** $2,740
- **Comments:** Cooling tower in old unit needs to be repaired at a cost of $25k. New unit has no cooling tower.
- **Comments:** Exploring costs now, should be done as plant expenses if less than $10,000
- **Comments:** CapEx approved on 10/19/2012
Save Energy Now at Follansbee

• Change in Management focus over past year
  • Personnel
  • Priorities
• Overhaul of steam traps
• Repair steam leaks
• Re-evaluate boiler piping
• Implementing more changes that were initially identified in the SEN assessment
Projects Completed from Energy Assessments

• Installed Variable Speed Drives (VSD)
• Added air receiver to compressed air system
• Implemented a motor management system
• Reduced air compressor set-point
• Changed to use outside air for air compressors
• Upgraded light bulbs and fixtures
• Replaced drive belts
• Performed vibration analysis
• Replaced steam traps and repaired steam leaks
Clairton 250 HP VSD Project

- Originally, we had two, single speed 250 HP cooling tower water pumps with variable flow requirements controlled by a bypass, recirculation valve.

- Energy Savings identified by WVU by using VSD’s on 250 HP cooling tower water pumps during the May 2012 energy assessment.
  - Annual Savings: $36,459
  - Energy Saved: 578,708 kWh or 5.2% Electricity usage
  - Cost to complete: $46,822
  - Original payback of 1.3 years
Clairton 250 HP VSD Project (2)

- Explored possibility of a rebate for this energy efficient project
- Energy rebate from local utility based on WVU’s write-up
  - Amount of rebate: $34,725 or 74% of project cost
  - Actual 250 HP VSD project payback: 0.3 years or 4 months
- Justified to management by using WVU write-up
Clairton 250 HP VSD Project (3)

- In process of installing VSD’s on cooling tower pumps in other locations.
- Using VSD’s in other applications as well
  - Cooling Tower Fans
  - Process Pumps
  - Potentially Air Compressors
- Due to successful project, wider implementation at Koppers
Energy Intensity

- Began measuring in 2013
- Measure total energy at plant
- Divide by total raw materials (distillation) or cubic feet of wood treated (railroad)
- Compare Energy Intensity worldwide
- Note differences based on plant capabilities
Energy Intensity Metric

Energy Intensity (GJ/MT)

- 2010
- 2011
- 2012
- 2013

Clairton, Follansbee, Stickney Tar, Stickney PA
Reverse Osmosis System

• Blowdown for our steam system is based on conductivity, which represents impurities.
• The RO system reduced the impurities by 90%.
• With less blowdown, less water is needed in the boiler, which means that less natural gas is needed to heat the water.
• Savings on natural gas, water and water treatment chemicals.
• Rebates from utility for this.
Reverse Osmosis System (2)

Potential 17,000 MMBtu/yr. in Natural Gas Savings
Reverse Osmosis (3)

- RO System operational in April 2015
- Capital intensive project ($500,000+)
- Determining actual savings
- Expect significant energy, water and chemical savings ($200,000+)
- Expect Rebate for natural gas savings (Over $150,000)
- If successful, may roll out to other plants as we have done with the cooling tower water pump VSDs
Conclusion

- Increasing focus on energy intensity
- Actively honing the way that we measure energy and normalizing it for production
- Implementing energy efficiency projects due to past successes
- Increasing activity/behavioral based initiatives
- Next focus is operational monitoring of energy usage
- Determining meters needed for this and appropriate metrics
Thank You!

• Koppers thanks the US Department of Energy, WVU and other Universities that have performed energy assessments at our facilities

• Special thanks to the State of West Virginia for providing energy efficiency programs

• We look forward to working with energy efficiency programs in the future