A Practical Approach to Plant-Wide Energy Management at a Large Petrochemical Manufacturing Facility

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Cedar Bayou Plant
Agenda

- Cedar Bayou Plant Overview
- Plant-wide Energy Team Formation
- Awareness Training
- Audit Process
- Execution Plans
- Success to date
Cedar Bayou Plant Background

- Located 28 miles east of downtown Houston on Interstate Highway 10
- The plant has been in operation since 1963.
- 6+ Billion Lbs/Yr produced for 8 product lines:
  - Olefins: Ethylene, Propylene, Heavy Olefins.
  - Polyethylene: LDPE, LLDPE, HDPE.
  - AO: NAO, PAO
- OSHA VPP Star Site since 1997
- EPA Achievement Track Status in 2002
Team Formation

• Drivers for plant-wide energy initiative
  – Energy cost were over $\frac{1}{2}$ of facility’s budget
  – Need to reduce costs to stay competitive
  – Benchmarking studies indicated room for improvement

• Team formed 1Q 2004 to improve individual unit energy performance and coordinate plant-wide energy issues
  – Team composed of management sponsor, team leader, engineering, plant operations, electrical department, and automated systems
Initial Team Strategy

• Draft Charter
  – Established team mission statement
    • Focus on usage not pricing
    • Weigh energy performance with other profitability factors
  – State current energy management situation
  – Review existing energy initiatives and programs
  – Develop team boundaries
  – Establish team’s near- and long-term goals
  – Create team’s deliverables for first year
Energy Awareness Training

- Shift by shift meeting with the operators, “the 24-hour energy managers”
- Describe drivers for initiating a plant-wide effort
- Increase awareness of each unit’s current energy performance and energy gaps
- Explained what percentage of total operating cost is energy
- Included breakdown of total energy cost by utility
Energy Awareness Training (cont’d.)

• Created awareness of what typical costs were for everyday operation
  – Gave examples of annual costs for items such as a typical leaking steam trap, cost for a ¾” air bleed valve left open, the cost of a 50 hp motor

• Developed awareness of necessity to look at energy as an entire plant rather than just individual units
  – Established initial plant-wide team focus
  – Explained roles and responsibilities of each job function

• Described operator duties in energy management
Energy Assessment Process

- Audit teams formed for each operating area – operations, engineering, I&E, automated systems
- Evaluated each area using set of tools devised by plant energy team coordinator
  - Sources included DOE tools, CPC-internally-developed tools and checklists
Energy Assessment Process
(cont’d)

- Energy Metrics and Benchmarking Review
- Documented efforts of existing teams looking at energy
  - Avoid rework
  - Determine if there is overlap or gaps in efforts
  - Help assign roles and responsibilities
Energy Assessment Process
(Monitoring Status Tool)

- Brainstormed list of everything that a unit should monitor on a regular basis
- Created comparison of current monitoring practices vs. what SHOULD be occurring
- Developed action items to close gaps between current and future state
Other Assessment Topics

• Use of unit utility balances
  – Some had not been developed
  – No one clearly had the responsibility to review the balances and take action when they didn’t reasonably close

• Utilization of advanced control
  – Explored possibilities for new advanced control
  – Reviewed process for validating advanced control models; make energy part of optimization

• Reviewed recommendation from previous DOE and vendor plant audits; drive implementation of recommendations not implemented
Other Assessment Topics (cont’d)

- Developed a list of unit wastes & made recommendations
  - External utility leaks (steam, air, N2, etc.)
  - Status of unit’s steam trap monitoring process
  - Unnecessary 24-7 use of certain electrical equipment
  - Excess utility flows for certain process equipment (flares, flare purges, N2 blanketing blowthrough, etc.)
Other Assessment Topics (cont’d)

- Recommended action on several operating practices
  - Energy review of Standard Operating Procedures
  - Evaluation of energy savings from seasonal operation (cooling tower, steam tracing optimization)

- Equipment-specific assessment
  - Evaluation of energy best practices for various types of process equipment (boilers, furnaces, heat exchangers, pumps/compressors, instrumentation, etc.)
  - Recommended possible design and/or operational changes based on this review
Prioritization and Execution

• Energy action items compete for human resources in a large manufacturing facility
• Developed process for prioritizing energy projects along with safety, environmental, production projects
  – Recognized that not all operating units had the same energy gaps
  – Need to appropriately assign resources to energy projects
• Prioritization process similar to PHA ranking matrix
  – Ranking considers both benefit and ease of implementation
  – Low hanging fruit rises to the top!
• Continuous improvement teams execute projects based on overall ranking
Energy Successes

Energy Intensity Index has improved overtime!

![Graph showing energy intensity index over time.](image)
Energy Successes
(cont’d)

• A Cedar Bayou Polyethylene unit saved ~$150,000 per year in steam usage by repairing external steam leaks
• An Alpha Olefins unit is saving over $160,000 per year by changing its reactor wash procedure
• The Materials Handling area is saving $30,000 per year by better utilizing its blenders and transfer blowers
• The utilities area has documented over $200,000 in savings per year by more closely monitoring steam letdown valves vs. electrical motor usage
Challenges Facing the Plant-wide Effort

• Working issues within existing expense and capital budgets
• Competing for human resources with other facility issues and company growth
• Institutionalizing change poses challenges; the effort must be continuous.
Continuing Roles of Energy Team

- Resource for execution of energy projects and action items
- Body that serves to share best practices across the units at the plant
- Group to address plant-wide issues
- Group to serve as auditors of certain energy practices to help maintain efforts