Managing Energy Across Multiple Sites

May 19, 2004
About The Web Conferences

- Monthly
- Topics are structured on a strategic approach to energy management
- Help you continually improving energy performance
- Opportunity to share ideas with others
- Slides are a starting point for discussion
- Open & Interactive
Web Conference Tips

• Mute phone when listening! Improves sound quality for everyone.

• If slides are not advancing, hit refresh or close presentation window and press the re-launch button again.
Today’s Web Conference

- Overview of energy management across sites
- Toyota’s practices
- University of Michigan’s methods
- Motivating people
- Wrap-up
Guidelines for Energy Management

Learn more at www.energystar.gov
Key Management Steps:

- Energy Director
- Energy Team
- Energy Policy
Key Management Steps:

- Gather and track data; know how, when and where energy is used through tracking, benchmarking and assessments.
Key Management Steps:

- Energy Director and team establish goals to drive energy management across the organization
Key Management Steps:
- create a corporate action plan that spans the sites, defines steps and targets, and identifies responsible people
Key Management Steps:
- carry out actions; communication, raise awareness, motivate
Key Management Steps:
-measure and review plan
Key Management Steps:

- internal recognition
- external recognition
<table>
<thead>
<tr>
<th>ENERGY STAR® Guidelines to Energy Management Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Make Commitment to Continuous Improvement</strong></td>
</tr>
<tr>
<td><strong>Energy Director</strong></td>
</tr>
<tr>
<td>0 - Little or no evidence</td>
</tr>
<tr>
<td>1 - Some elements/degree</td>
</tr>
<tr>
<td>2 - Fully implemented</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Energy Team</strong></td>
</tr>
<tr>
<td>0 - Little or no evidence</td>
</tr>
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</tr>
<tr>
<td>2 - Fully implemented</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Assess Performance and Opportunities</strong></td>
</tr>
<tr>
<td><strong>Gather and Track Data</strong></td>
</tr>
<tr>
<td>0 - Little metering/no tracking</td>
</tr>
<tr>
<td>1 - Local or partial metering/tracking/reporting</td>
</tr>
<tr>
<td>2 - All facilities report for central consolidation/analysis</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Normalize</strong></td>
</tr>
<tr>
<td>0 - Not addressed</td>
</tr>
<tr>
<td>1 - Some unit measures or weather adjustments</td>
</tr>
<tr>
<td>2 - All meaningful adjustments for corporate analysis</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Establish baselines</strong></td>
</tr>
<tr>
<td>0 - No baselines</td>
</tr>
<tr>
<td>1 - Various facility-established</td>
</tr>
<tr>
<td>2 - Standardized corporate base year and metric established</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Benchmark</strong></td>
</tr>
<tr>
<td>0 - Not addressed or only same site historical comparisons</td>
</tr>
<tr>
<td>1 - Some internal comparisons among company sites</td>
</tr>
<tr>
<td>2 - Regular internal &amp; external comparisons &amp; analyses</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Analyze</strong></td>
</tr>
<tr>
<td>0 - Not addressed</td>
</tr>
<tr>
<td>1 - Some attempt to identify and correct spikes</td>
</tr>
<tr>
<td>2 - Profiles identifying trends, peaks, valleys &amp; causes</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Technical assessments and audits</strong></td>
</tr>
<tr>
<td>0 - Not addressed</td>
</tr>
<tr>
<td>1 - Internal facility reviews</td>
</tr>
<tr>
<td>2 - Reviews by multi-functional team of professionals</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Set Performance Goals</strong></td>
</tr>
<tr>
<td><strong>Determine scope</strong></td>
</tr>
<tr>
<td>0 - No quantifiable goals</td>
</tr>
<tr>
<td>1 - Short term facility goals or nominal corporate goals</td>
</tr>
<tr>
<td>2 - Short &amp; long term facility and corporate goals</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Estimate potential for improvement</strong></td>
</tr>
<tr>
<td>0 - No process in place</td>
</tr>
<tr>
<td>1 - Specific projects based on limited vendor projections</td>
</tr>
<tr>
<td>2 - Facility &amp; corporate defined based on experience</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Establish goals</strong></td>
</tr>
<tr>
<td>0 - Not addressed</td>
</tr>
<tr>
<td>1 - Loosely defined or sporadically applied</td>
</tr>
<tr>
<td>2 - Specific &amp; quantifiable at various organizational levels</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Create Action Plan</strong></td>
</tr>
<tr>
<td><strong>Define technical steps and targets</strong></td>
</tr>
<tr>
<td>0 - Not addressed</td>
</tr>
<tr>
<td>1 - Facility-level consideration as opportunities occur</td>
</tr>
<tr>
<td>2 - Detailed multi-level targets with timelines to close gaps</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Determine roles and resources</strong></td>
</tr>
<tr>
<td>0 - Not addressed</td>
</tr>
<tr>
<td>1 - Informal interested person competes for funding</td>
</tr>
<tr>
<td>2 - Internal/external roles defined &amp; funding identified</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Implement Action Plan</strong></td>
</tr>
<tr>
<td><strong>Create a communication plan</strong></td>
</tr>
<tr>
<td>0 - Not addressed</td>
</tr>
<tr>
<td>1 - Tools targeted for some groups used occasionally</td>
</tr>
<tr>
<td>2 - All stakeholders are addressed on regular basis</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Raise awareness</strong></td>
</tr>
<tr>
<td>0 - No overt effort made</td>
</tr>
<tr>
<td>1 - Periodic references to energy initiatives</td>
</tr>
<tr>
<td>2 - All levels of organization support energy goals</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Build capacity</strong></td>
</tr>
<tr>
<td>0 - Indirect training only</td>
</tr>
<tr>
<td>1 - Some training for key individuals</td>
</tr>
<tr>
<td>2 - Broad training/certification in technology &amp; best practices</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Motivate</strong></td>
</tr>
<tr>
<td>0 - Occasional mention</td>
</tr>
<tr>
<td>1 - Threats for non-performance or periodic reminders</td>
</tr>
<tr>
<td>2 - Recognition, financial &amp; performance incentives</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Track and monitor</strong></td>
</tr>
<tr>
<td>0 - No system for monitoring progress</td>
</tr>
<tr>
<td>1 - Annual reviews by facilities</td>
</tr>
<tr>
<td>2 - Regular reviews &amp; updates of centralized system</td>
</tr>
<tr>
<td><strong>Score</strong></td>
</tr>
<tr>
<td><strong>Evaluate Progress</strong></td>
</tr>
</tbody>
</table>

*Note: The table above outlines the energy management matrix by identifying the levels of evidence and guidelines for various aspects of energy management, including commitment, assessment, setting goals, creating action plans, implementing actions, and evaluating progress.*
Establishing Network Identity

- Use a Logo.
- Use a Network Stationery LOOK
- Create a Council of Site Energy Leaders. (4-6 people)
- Create a Website.
- Have a Senior Manager adopt the Network as Champion.
Communicate with the Network

- Share Identified Technology.
- Quarterly Status Reports.
- Annual Report of Network Activities- Status, Results and Upcoming Events.
- Conduct Annual Energy Summit.
Conduct Site Assessments

• At One Volunteer Site.
• Invite the Entire Network to Participate.
• Find Opportunities, Come Along Side of Facility Efforts, Find Best Practices- No Fault-Finding.
• Invite Process Participation.
Provide Added-value Tools

• Posters, Energy Awareness.
• CEM Certification.
• Share Expensive Diagnostic Tools Across Network.
• Identify Funding Opportunities for Projects.
• Technology Transfer from Other Companies.
Communicate Outside Network

- Celebrate Site Success Stories with Senior Management.
- Share Results Across All Business Units and Non-Energy Supporters. (PR, EHS, Procurement, GR, Maintenance, Engineering).
- Offer Champion to Accept Outside Recognition and Awards.
- Sell Accomplishments with Facts to Publications, internal and external.
Managing Energy Across Multiple Sites.

Toyota Motor Manufacturing North America

ENERGY STAR Webcast, May 19, 2004
Bruce Bremer-Manager Facility Engineering
Historical Background

Toyota Motor Manufacturing North America-TMMNA

- 6 Assembly plants-NAMCs
- 3 Engine Plants
- 4 Unit plants (Casting, wheels, etc)
- Production > 1M vehicles/year
TMMNA Conception

• 1997
  – Established Toyota North America Corporate Headquarters
  – Established Company Energy Key Performance Indicators
TMMNA Facilities Engineering Responsibilities

- Energy Consumption Forecasts
- Energy Reduction Activities/Projects
- Energy Action Plan Targets
- Natural Gas strategy

- Energy Risk Management Program
- Facilities System & Equipment standards
- New Plant Site selection and Utility Infrastructure coordination
- Energy Design Feedback-Process and Utilities
TMMNA Energy Program Summary

• 1) Energy Management Organization
• 2) Energy Measuring Systems
• 3) Energy Target Setting
• 4) Implementation – How to Reach Targets
  – a) Kaizen database
  – b) Pilot Kaizens
  – c) Design feedback
• 5) Energy Visualization Target Tracking/Reporting
1) Energy Management Organization

- NAMC President
  - Environmental Steering Committee
    - Facility Manager
      - EMO Leader
        - Paint Shop Captain
        - Plastics Shop Captain
        - Weld Shop Captain
        - Facilities Shop Captain
        - Press Shop Captain
        - Assembly Shop Captain
2) Energy Measurement System

Purpose

1. Promote energy management by Plant management
2. Promote energy reduction by shop management
3. Establish energy/unit as a KPI

- **UTILITY Co.**
  - 1. Received Volume
  - Energy efficiency as a whole plant

- **FACILITIES**
  - 2. Produced & supply volume
  - Conversion efficiency at utility

- **PRODUCTION SHOP**
  - 3. Production Energy Consumption
  - Energy efficiency in process

Index of evaluation

Measurement division

Primary energy

Site Utilities

Production area
2) Energy Measurement System

- All primary energy-elect, gas, water, steam, air, chilled water-sources are metered to the plant level.
- All energy sources are metered to the production shop level
- Consumption and cost are fed back to TMMNA monthly via Environmental Performance Indicator system.
3) Energy Target Setting: Energy Action Plans

- Part of Company’s Environmental Targets
- Roadmap to Energy Reduction
  - Established yearly energy targets/unit of production
  - Major kaizen activities planned to achieve targets
  - Established funding and manpower
- Subject to Revision
  - Greater challenges not lesser
3) Energy Target Setting

2006 Energy Action Plan

Purpose:

Current Situation

Energy Usage

Non-Production Time Energy Usage

Key Activities:

1) Focus on paint shop energy reductions
2) Optimize Non-production energy

Project Payback = $2,220,000

Yearly Energy Targets

Additional Plan

New Annual Reduction Targets

Total Reduction required to achieve target (FY02 - FY06)
4) Implementation – How to Reach our Targets

• Energy Kaizen Database – Tool
  – Kaizen ideas
  – Implementation details

• Information Source
  – All team members can view on Intranet
  – Only authorized team members can modify details
4a) Database Home Page
4a) Database Kaizens
29 Discrete Categories,
16,000 Ideas
### 4a) Data Base Reports

#### Standard Kaizen Reports

<table>
<thead>
<tr>
<th>Report</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaizen Status</td>
<td>Provides the current status of all active kaizens for the selected NAMC. Complete and Not Applicable Kaizens are not active.</td>
</tr>
<tr>
<td>Kaizen History</td>
<td>Lists every Kaizen for the selected NAMC.</td>
</tr>
<tr>
<td>Shop Kaizen Yoken</td>
<td>Reports all Kaizens that are Yoken Kaizens for the selected Shop.</td>
</tr>
<tr>
<td>Pie Chart Status</td>
<td>Generates pie charts of Kaizen activity specific to the selected shops at each NAMC. Incluides only those reports that are applicable to the selected shop.</td>
</tr>
<tr>
<td>Progress/Savings Status</td>
<td>Generates a report that includes the kaizen ID, the kaizen description, its process, any comments, its progress, KGAL saved, KWH saved, and MMBTU saved.</td>
</tr>
<tr>
<td>Treasure Hunt Status</td>
<td></td>
</tr>
<tr>
<td>Savings Report</td>
<td>Shows the Savings Report for each NAMC and also has total savings numbers.</td>
</tr>
<tr>
<td>Master Kaizen &amp; NAMC Table</td>
<td>Dumps all of the data in both the Master and NAMC databases.</td>
</tr>
<tr>
<td>Recently Completed Kaizens</td>
<td>Returns the information of Kaizens where the M1Progress field equals 1 (???)</td>
</tr>
<tr>
<td>Orphaned Kaizens</td>
<td>Produces a report containing Kaizens yotoktened to NAMCs, but don't appear in the Master database.</td>
</tr>
<tr>
<td>Yotokten Kaizens</td>
<td>Selects Master Kaizens where the Yotokten box is checked, but the Kaizen is not yotoktened to any NAMC.</td>
</tr>
</tbody>
</table>
4b) Pilot Kaizens

- Pilot Kaizens are Designed and Implemented to Prove Concept.
  - Sourcing may be NA, NAMC external-ENERGY STAR/benchmarking.
  - Labor is often split between NA and NAMC.
  - Data collection is strictly enforced.
  - Results are shared with all NAMCs
  - Successful pilots are yokotened to other NAMCs
4c) Design Feedback

• Establish Energy Ideas into New Plant Construction.

• Sources:
  – Kaizen database
  – New technology
  – Benchmarking

• Cost Justification is Required.
5) Visual Target Tracking

- Monthly/Quarterly/Yearly NAMC energy comparison reports to all Management
  - Plant
  - Shop
  - Consumption
  - Cost
  - Previous Year
  - Non-production/weekend
Non-Production Energy Report

Weekend Non-Production Energy Graphs

- **Paint**
  - Non-Prod/Prod
  - Tahara = 13%

- **Plastics**
  - Non-Prod/Prod
  - Tahara = 13%

- **Weld**
  - Non-Prod/Prod
  - Tahara = 15%

Between Shift Non-Production Energy Graphs

- **Paint**
  - NAMC WE/P% TMC WE P%
  - Tahoe = 13%

- **Plastics**
  - NAMC BS/P% TMC BS/P%
  - Tahoe = 28%

- **Weld**
  - NAMC BS/P% TMC BS/P%
  - Tahoe = 29%
Benefits

- Lower Operating Costs
- Lower Capital Costs
- Reduce Environmental Impact
  Internal and External
  - Lower emissions
  - Lower consumption
Future

• Continue to Set Aggressive Energy Reduction Targets
• Continue to Implement Best Practice Sharing
• Continue to Enhance Toyota as an Environmental Leader
EPA ENERGY STAR Webcast Presentation

Bill Verge, P.E.
Plant Operations Associate Director for Utilities & Plant Engineering
The University of Michigan
Ann Arbor, Michigan

May 19, 2004
The University:

- A World Class University
- Energy Accounting
- Energy Management in the Past
- The ENERGY STAR Program
- Program Successes
- Future Program
The University:

- Supports 19 schools and colleges – decentralized administration
- There are 35 centers and 18 institutes of related research and education
- Offers 600 degree programs
- And an extensive medical center
- With a daytime population of 70,000 including 36,000 students

The University of Michigan
• UM has a budget of $3.6 billion a year
• That includes a research budget of $656 million
• There are over 315 major buildings from offices to very energy intensive research facilities
• Annual energy costs of $71 million
• The UM consumes 5.05E12 btu of energy per year in over 28,000,000 sq ft of space
• Enough to supply the City of Ann Arbor with over 125,000 people in 46,000 households
Utilities Accounting

Variable fuel rate plus an administrative and maintenance surcharge for each utility.

Fixed fuel rates based on total enterprise costs.

The University of Michigan
Energy Conservation before 1997

• Dispersed commitment to energy conservation existed prior to the ENERGY STAR program.
  – Funding was available for ECMs
  – Energy conservation engineers on staff
  – Maintenance engineers on staff
  – Steam trap program in place
  – Lighting program getting started
  – Building automation systems growing rapidly

• But no campus wide energy conservation initiative
Energy Management Vision

• Focus and Organization of Existing Energy Management Activities and Resources
• Fair Allocation of UM Energy Conservation Accounts to General Fund Units
• Services More Conspicuous to UM Community
• Vehicle for Communicating with UM Units
• Valuable Service Provided at a Time When Utility Costs are Shifting to Departmental Budgets
• Opportunity to Implement a Program with Strong Student Support
The Plan – Campus-Wide Adoption of the ENERGY STAR Program

• Detailed proposal was submitted to upper management recommending implementation of the ENERGY STAR program and laying out costs and benefits.

• Primarily based on reorganizing existing resources, rather than adding new resources.

• Extensive data was provided supporting expected costs and savings.

• Beginnings of campus wide “selling” of the program.

• Memorandum Of Understanding was signed with E.P.A on June 19, 1997 for 14 million gsf in seven years.

The University of Michigan
Energy Star Program Implementation

Energy Management Division Team (Administration)
- Energy Engineering
- BAS System Management

ENERGY STAR Implementation Team (Operation)
- Energy Engineering
- Maintenance Services Engineering
- A/C Shops
- Zone Maintenance
- BAS System

Energy Conservation Committee (Energy Project Funding)
- Plant Engineering (2)
- Facilities Planning & Design
- Faculty Representative

Tune-up Crews
- Student Interns
- Contract Engineers

The University of Michigan
Costs

- Lighting Retrofit Projects: $1.9 million/year
- Energy Conservation Projects: $1.1 million/year
- Tune-Up Personnel: $0.6 million/year
- Tune-Up Materials: $0.4 million/year
- Engineering Staff: $0.4 million/year
- Total: $4.4 million/year
Cost Reductions

- Added Each Year of Program:
  - Lighting Retrofits $0.42 million/year
  - Mechanical Systems Tune-ups $0.38 million/year
  - Energy Conservation Measures $0.22 million/year
  - Total $1.02 million/year

- Estimated Cost Reduction
  Achieved At End of Program $5.7 million/year

- Savings Now Projected to Reach $9.7 million/year

The University of Michigan
Intangible Benefits of the Program

• **ENERGY STAR Building Reference Manual**
  – Building Floor Plans Showing HVAC Zones
  – Schedules of Mechanical Equipment
  – HVAC Control Diagrams
  – BAS Point Log Software Listings
  – BAS Log of Building Complaints
  – Energy Consumption Data and Trends for Seven Years
  – List of Maintenance Work Orders Issued During the Last Two Years

• **ENERGY STAR Tune-Up Data Book**
  – Equipment Surveys and Inspection Reports
  – Steam Trap Surveys and Reports

*The University of Michigan*
Biggest Reason for Success of the Program: Improved Communications

- Annual Utility Report
- Annual ENERGY STAR Status Report
- Facilities Users Network
- UM ENERGY STAR web site
- Energy Fest each September
- ENERGY STAR Progress Posters
Communications

• ENERGY STAR Certificates of Completion
• Presentations to the Board of Regents
• Celebration and Appreciation Luncheons
• Press Releases and Articles to student, internal, and local media.
• Publication of Brochures
• Energy Conservation Posters, light switch covers, pocket thermometers
• ENERGY STAR Award for Excellence in Energy Management

The University of Michigan
ENERGY STAR - The Next Steps

The Energy Conservation & Outreach Program

• New Energy Conservation Liaison Position

• Work with University departments to recruit and train “building energy proctors”

• Educate and Promote responsible energy conservation practices

• Advocate Energy Standards and Policies

• Re-commission all HVAC systems on a six year cycle.

The University of Michigan
Questions & Discussion
Upcoming Web Conferences

June 23* – ENERGY STAR Leaders

July 21 – From 40 to 75: How did you do it?

August 18 – Avoid the O & M Rollercoaster

www.energystar.gov/networking
Thank You!