The Future is Now: Emerging Technologies in Manufacturing

Thursday, August 23rd
2:00 – 3:30pm
Panelists:
- Fernando Reyes-González, Johnson Controls
- Logan Olds, VVWRA
- Steve Schultz, 3M
The Future is Now – Emerging Manufacturing Technologies

Steve Schultz
3M
The Future is Now – Emerging Manufacturing Technologies

- Steve Schultz, Corporate Energy Manager
- 3M Energy Management
3M at a glance

- Sales in ~200 countries
- $32 billion in sales
- Five business groups
- 90,000 3Mers globally
- 113,000 patents
- 101 straight years of dividends
- One of 30 companies on the Dow Jones Industrial Index
3M’s fundamental strengths

Technology
Ability to share and combine elements of 3M’s broad technology portfolio to produce unique, differentiated products, translating to premium margins

Manufacturing
Utilization of 3M manufacturing footprint and technology, including process trade secrets, leading to higher-performing products and lower unit costs

Global capabilities
Subsidiary front- and back-office footprint that allows for the effective development, adaptation and commercialization of products

Brand
Brand equity in the 3M brand and in strategic brands that are shared across business groups
Work
(Rate of energy consumption, BTU/hr, KW)

Production Rate
(Rate in yds per hour, lbs per hour...)

Energy Consumption

Waste Energy

Export to excel for analysis

Why energy sub-metering?

Make energy visible
Decision tree for project engineers

START (AFE in draft)

Is the investment location a manufacturing facility?

- Yes
  - Is the project category CP, CR, FE, FN, ME, MN, NP, ST?
    - Yes
      - Does the project work breakdown include energy consuming equipment, energy distribution equipment, utility generation equipment, or controls upgrade to existing equipment?
        - Yes
          - Do equipment design/nameplate utility rating(s) exceed threshold criteria?
            - Yes
              - Meter(s) required.
                Contact Facilities Engineering or PI&CS to select appropriate meter and implement meter installation.
            - No
              - Meter(s) not required.
        - No
    - No
  - No
- No

Utility | Threshold Criteria
---|---
Chilled Water | > 50 TONS
Compressed Air | > 75 SCFM
Natural Gas / LP | > 400 MBtu / hr
Electrical | > 35 KW
Steam | > 900 lbs / hr
Treasure Hunts/Assessments

- Go and See

Facilitator & Host

Team 1: Power/Facilities
- Lighting, motors, compressed air, steam, water, chilled water, HVACs, office area, thermal oxidizer

Team 2: Area 1
- Compressed air, water, motors, gas, electricity, steam, chilled water

Team 3: Area 2
- Lighting, motors, compressed air, steam, water, conveyors, chilled water

Team 4: Area 3
- Lighting, motors, compressed air, steam, water, conveyors, chilled water

Team 5: Area 4
- Lighting, motors, compressed air, steam, water, conveyors, chilled water

Capital Projects: Small
- Operations Day to Day: Low or No Cost

Capital Projects: Large
- Improved Procurement

Energy Treasure Hunt Focus
Treasure Hunts/Assessments

- Barriers to project identification
  - End users not engaged, unfamiliar with energy terms and concepts

- Barriers to project follow-up and implementation
  - Understanding the magnitude of the savings potential
  - Assigning resources for further study and investigation
  - End users not engaged in idea generation
  - Everyone is already busy, this isn't their regular job, they are not Energy Experts, ...
### Treasure Hunts/Assessments

Quick Analysis Tool

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**Energy Management**

<table>
<thead>
<tr>
<th>Site Name</th>
<th>3M Energy Quick Analysis</th>
<th>Instructions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangor</td>
<td>Total 2017 Cost $1,264,895</td>
<td>1) Select site name</td>
</tr>
<tr>
<td></td>
<td>2017 Electric Cost / MMbtu $35.38</td>
<td>2) Enter Project Title</td>
</tr>
<tr>
<td></td>
<td>2017 Electric Cost / KW $0.12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2017 Natural Gas Cost / MMBtu $11.78</td>
<td>3) Click on the HDD or CDD link to get annual data for your area, then enter data using 65 degrees as balance point</td>
</tr>
</tbody>
</table>

**Project Title**

<table>
<thead>
<tr>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDD</td>
</tr>
<tr>
<td>6902</td>
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</tbody>
</table>

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### Treasure Hunts/Assessments

#### Quick Analysis Tool

<table>
<thead>
<tr>
<th>Component</th>
<th>Motor HP Savings</th>
<th>MMbtu Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter HP</td>
<td>Hours of Reduction/week</td>
<td># of weeks per year</td>
</tr>
<tr>
<td>Steam Load</td>
<td>Hours of Reduction/week</td>
<td># of weeks per year</td>
</tr>
<tr>
<td>Compressed Air</td>
<td>Hours of Reduction/week</td>
<td># of weeks per year</td>
</tr>
<tr>
<td>Lighting-Electrical</td>
<td>Hours of Reduction/week</td>
<td># of weeks per year</td>
</tr>
<tr>
<td>Gas Heat Only</td>
<td>Hours of Reduction/week</td>
<td># of weeks per year</td>
</tr>
<tr>
<td>Chilled Water Reduction</td>
<td>Hours of Reduction/week</td>
<td># of weeks per year</td>
</tr>
<tr>
<td>Conditioned Exhaust Air Reduction</td>
<td>Hours of Reduction/week</td>
<td># of weeks per year</td>
</tr>
<tr>
<td>Non-Conditioned Exhaust Air Reduction</td>
<td>Hours of Reduction/week</td>
<td># of weeks per year</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Estimated Cost to Implement</th>
<th>Payback in Years</th>
<th>Total Project Savings</th>
<th>Total MMbtu Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0</td>
<td>0.0</td>
<td>$0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

### Additional Resources:

- VFD Calculator
- Steam Calculator
- Insulation Calculator
- Compressed Air Calculator
# Treasure Hunts/Assessments

<table>
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</tr>
</tbody>
</table>

### Project Title

**Description:** Air to feeder system doesn’t stop when process stops. The program could be changed to only run air when the machine needed the parts. This opportunity was seen on multiple machines.

### Motor HP Savings

<table>
<thead>
<tr>
<th>Enter HP</th>
<th>Hours of Reduction/week</th>
<th># of weeks per year</th>
<th>Motor Savings/Yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td>$0</td>
</tr>
</tbody>
</table>

### Steam Load

<table>
<thead>
<tr>
<th>Enter lbs/hr</th>
<th>Hours of Reduction/week</th>
<th># of weeks per year</th>
<th>Annual Steam Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>$0</td>
</tr>
</tbody>
</table>

### Compressed Air

<table>
<thead>
<tr>
<th>Enter CFM</th>
<th>Hours of Reduction/week</th>
<th># of weeks per year</th>
<th>Annual Compressed Air Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>360</td>
<td></td>
<td>100</td>
<td>$42,147</td>
</tr>
</tbody>
</table>

Three inputs
Treasure Hunts/Assessments

- Training activity to learn Treasure Hunt culture
- Need senior management support
- Engage all employees in energy activities
- Always ask questions (continuous improvement)

- Best ideas are still ideas unless implemented
- Share best practices
- Make part of day to day activities
- Continue internal Treasure Hunts
Treasure Hunts/Assessments

- Training activity to learn Treasure Hunt culture
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Remember: Everything can always be improved!
Lighting

- Technology keeps improving
  - Higher and higher lumen per watt ratios

Don’t wait: retrofit projects installed one or two years ago can justify replacement yet again

Quick Analysis tool for lighting projects
Lighting

Quick Analysis Tool - Lighting

Please take a moment to fill in the requested information in the white boxes. With this information, estimations on how much your facility could save this year with the easy installation of energy efficient lighting will be provided.

1. Select your facility name in the drop down list.
   - Bangor

2. List the estimated number of T8 bulbs currently utilized at your facility.
   - 200

3. What is the existing wattage of these light bulbs?
   - 32

4. How many hours does your lighting operate in a given year?
   - 6,240

5. What would be the estimated labor costs to install new bulbs at your facility?
   - $3,750

**Relevant Variables:**

- Replacement Bulb Wattage: 18
- Current electrical Cost / Kw: $0.14
- Cost of New T8 bulb: $3.50

**Potential Savings:**

- Estimated Potential Electrical Savings: $2,472
- Simple Payback in Years (without Utility Rebates or Incentives): 1.8
Permanent Magnet Motors

SyMAX® Performance Data

SyMAX® Motor Energy Payback Calculator

Graphs and data courtesy of Marathon Motors

Graphic courtesy of newenergyandfuel.com
**Benefits**

- Significant Energy Savings
  - Motor + VFD
- Variable frequency drive with direct mechanical drive can eliminate additional losses in belts, sheaves, gearboxes and external flow control devices.
- Longer bearing and winding life
- Higher power to size ratio
- Less waste heat and reduced cooling requirements

**Drawbacks**

- Need variable frequency drive with PMAC compatibility
- Availability in larger sizes
3M’s Approach to Improving Energy Productivity

**New Product Development**
- Design new manufacturing processes to maximize energy
- Develop products that promote principles of Sustainability

**New Capital Projects**
- Incorporate energy efficiency into new project design
- Develop internal engineering expertise in areas related to energy

**Existing Operations**
- Energy Champions leading Energy Teams at 3M facilities globally
- Corporate Energy Management providing guidance, resources and accountability
Conclusion

• Technology keeps improving, don’t wait for the ultimate solution
• Use technology to make it easier
• Engage as many people as possible
Emerging Technologies in Wastewater

Logan Olds
Victor Valley Wastewater Reclamation Authority
Emerging Technologies in Wastewater

Logan Olds
GM - VVWRA
VVWRA
Victorville, CA
446 acres
Subregional Treatment Approach

Victorville

Apple Valley

Hesperia
What do we manufacture?

Recycled water

Biogas
Energy Consumption

[Graph showing energy consumption data with points labeled OB1, OB2, etc., and categories such as AS, Biological Aerated Filter, AS, Carbonaceous, etc.]

VVWRA 40 Years
Energy Production

- Natural gas consumption reduced by 94%
- Grid consumed power reduced by 76%
- Net Annual Savings $885,620
Managing our do do
What we are doing about...

- Solids control
- Ammonia based DO control in air bays
- Increasing Digester Gas Production
- Renewable Energy Credits
Energy Production and Management

2G Generators
800 kWh each

Microgrid & Battery Storage
Energy Production and Management

Net Energy Metering

AV Subregional

Hesperia Subregional
Logan Olds
General Manager, VVWRA
lolds@VVWRA.com
Emerging Technologies in Manufacturing: Advanced Energy Metering

Fernando Reyes-González
Johnson Controls
Emerging Technologies in Manufacturing: Advanced Energy Metering

Fernando Reyes-Gonzalez
Manager, Global Environmental Sustainability
Leading Markets

**Buildings**
Leading provider of building technology, products and solutions—controls, equipment and services for HVAC, security, fire and refrigeration.

**Power Solutions**
Global leader and largest manufacturer of automotive batteries, powering nearly every type of vehicle.
Global Sustainability Strategy

Solutions

Improve the sustainability of our high impact products and services

People

Foster a culture of sustainability that engages, attracts and retains people who want to make a difference

Partnerships

Lead in global partnerships that significantly increase the scale of our sustainability impact

Performance

Performance measures identified to meet stakeholder needs and track progress towards our sustainability vision and goals

Governance

Formalize a sustainability governance process that drives accountability and achieves objectives
Our US Manufacturing Energy Intensity Performance

**Goal:** Reduce energy intensity of our US manufacturing operations by 25%, 2009-2019

- Achieved our energy intensity goal in 2016, 3 years early
Johnson Controls Manufacturing System (JCMS)
Environment & Sustainability
We promote the safe, efficient, and responsible use of global resources and our employees actively support their communities.

Objectives
- Risk assessment
- Air, water, waste management
- Emergency preparedness
- Community engagement
- Energy & sustainability

Maturity Model

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1)</td>
<td>Energy Champion &amp; Training</td>
</tr>
<tr>
<td>2)</td>
<td>Energy Plan</td>
</tr>
<tr>
<td>3)</td>
<td>Energy Hunt</td>
</tr>
<tr>
<td>4)</td>
<td>Energy Metering System</td>
</tr>
<tr>
<td>5)</td>
<td>ISO50001</td>
</tr>
</tbody>
</table>
Metering System Architecture:
Johnson Controls Enterprise Management System (JEMS)
Data Visualization & Reporting
Example – Detection of Faulty Free Cooling Logic

- 12,500 €/a in wasted energy for the past 1, 2, 5...10 years?

82% of the year can be cooled by free cooling with outside air.
Example – Detection of Air Handling Unit Malfunction

- Consumption values over a day indicate a defect in the heat-recovery system and that the air handling unit starts too early in the morning.
- The saving potential is around 35% of the consumption.
More than 700 projects implemented in Europe from 2008 through 2016
Results from implementing energy metering & ISO50001

28% reduction in energy intensity from implementation of ISO50001 and energy metering
Questions
Thank you!

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www.johnsoncontrols.com

@johnsoncontrols
Questions?

- Fernando Reyes-González, JCI (fernando.reyes@jci.com)
- Logan Olds, VVWRA (lolds@vvwra.com)
- Steve Schultz, 3M (scschultz@mmm.com)
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