Better Buildings®  
U.S. DEPARTMENT OF ENERGY

JUNE 8–11

2020 SUMMIT
A Virtual Leadership Symposium

Learn more: betterbuildingssolutioncenter.energy.gov/summit
Best of the Betters: 2020 Better Project and Better Practice Presentations

Wednesday, June 10
11:00 am-12:30 pm ET
Bruce Lung
Better Plants Program
Welcome Remarks from Valri Lightner, Deputy Director, Advanced Manufacturing Office

1. Mike Brown and Daniel Lefebvre (Better Project – Electrolux)
2. Amy Costello (Better Practice – Armstrong Flooring)
3. Jeff White (Better Project – Ford Motor Company)
4. David Reid (Better Practice – Celanese Corporation)
5. Alexander Zhang (Better Project – Lineage Logistics)
6. Kate Peterson (Better Practice – General Motors)
7. Nathan Onchuck (Better Project – Ozinga Brothers)
8. Robin Davis (Better Practice – Imerys Carbonates North America)
9. Michael Waitek (Better Project – PepsiCo)
11. Daniel Downen and John Keller (Better Project – ThyssenKrupp Elevator)
12. Marco Gonzalez (Better Project – Waupaca Foundry)

Q&A Session
Please go to www.slido.com using your mobile device or web browser

Enter Event Code

#bbsummit

…and then select the room “Best of the Betters”
Follow along with Better Buildings, Better Plants

#BBSummit2020

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CONGRATULATIONS!
2020 Better Practice and Project Award Winners

Valri Lightner, Deputy Director, Advanced Manufacturing Office
Better Buildings, Better Plants Summit
June 10, 2020
Better Plants Partners Help Achieve AMO Goals

AMO works to increase energy and material efficiency in manufacturing to drive energy productivity and economic growth.

**MANUFACTURING**

- Uses roughly 25% of the nation’s primary energy
- Represents nearly 80% of energy use in energy-intensive sectors
- Generates 11% of the U.S. GDP and 13 million jobs
- Incurs $200 billion in energy costs annually

**AMO GOALS**

- Improve the **productivity, competitiveness, energy efficiency, and security** of U.S. manufacturing
- Reduce the **life cycle energy and resource impacts** of manufactured goods
- Leverage diverse **domestic energy resources and materials** in U.S. manufacturing, while strengthening environmental stewardship
- Transition DOE-supported innovative technologies and practices into **U.S. manufacturing capabilities**
- Strengthen and advance the **U.S. manufacturing workforce**
AMO and our partners are involved a range of rapid response efforts associated with COVID-19, including:

• Participating in the DOE taskforce’s subcommittee on manufacturing, led by the Office of Science

• Supporting production scale-up of masks, ventilators, and consumables (i.e. test kits and swabs)

• Providing technical assistance to industry partners through the National Laboratories
Additive Manufacturing

FLEXIBLE MANUFACTURING TECHNOLOGIES
• The Manufacturing Demonstration Facility (MDF) and the Institute for Advanced Composites Manufacturing Innovation (IACMI) maintain robust knowledge, tools, expertise, and supply chain connections.
• Rapid production of 3D-printed tooling for injection molding enables industrial partners to scale production quickly for needed materials.

COLLECTION TUBES FOR TEST KITS
• Use metal additive manufacturing to make injection molding tooling for collection tubes
• Identify and test soda bottle preforms to enable rapid production of COVID-19 swab-holding test kits

PARTNER: COCA-COLA CONSOLIDATED

SUPPORTED BY: DEPARTMENT OF DEFENSE
DEPARTMENT OF HEALTH AND HUMAN SERVICES
ADVANCED EQUIPMENT AND EXPERTISE

• AMO’s support for the CFTF created conditions for the team to react nimbly to develop new, scalable methods to meet demand for N95 filter material.

• Experts de-risked a specific and reproducible set of parameters, making them adoptable by the manufacturing industry.

AGILE RESPONSE TO N95 DEMAND

• Work with N95 inventor Dr. Peter Tsai to tackle real-time challenges with conversion

• Partner with engine, filtration, and power generation manufacturer Cummins to convert their commercial melt blowing lines to potentially produce millions of pounds of N95 material

• Open source the process parameters for industry, enabling textile and filter manufacturers with melt blown machines to start making N95 filters
AMO’s Role in DOE Grand Challenges

AMO provides manufacturing expertise and helps shape the direction of DOE Grand Challenges.

ENERGY STORAGE GRAND CHALLENGE
A strong, diverse domestic manufacturing base with integrated supply chains to support U.S. energy storage leadership

STAY TUNED: Engage in the Battery Manufacturing Lab Call

PLASTICS INNOVATION CHALLENGE
U.S. global leadership in advanced plastics recycling and new plastics manufacturing

WATCH FOR: Opportunities to join the BOTTLE Consortium

WATER SECURITY GRAND CHALLENGE
Transformational technology and innovation to meet the global need for safe, secure, and affordable water

COMING SOON: Water security-specific FOA
High Performance Computing (HPC)

HPC tools can improve energy and material productivity – boosting manufacturing efficiency and competitiveness.

- Manufacturers are paired with National Laboratory experts
- DOE encourages partnerships with universities and nonprofits in federally designated Opportunity Zones and/or Historically Black Colleges and Universities
- Two calls per year, released in the fall and the spring
- Up to $300,000 per award with at least 20% cost-share

REAL-TIME PROCESS CONTROL FOR GLASS MANUFACTURING

- Develop a machine-learning algorithm that can be run off of a desktop computer to replace the computational fluid dynamics model
- Make real-time, online adjustments by leveraging the new fast-running prediction tool
- Increase productivity in other industries using similar tools

Learn more: hpc4energyinnovation.llnl.gov
Thank you!

For additional information and to subscribe for updates: energy.gov/eere/amo/advanced-manufacturing-office
Mike Brown and Daniel Lefebvre
Electrolux

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Electrolux Green Spirit Program
Electrolux 2030 Sustainability Strategy

For the Better 2030
- towards carbon neutrality & circularity

- Better Solutions
  - Lead in energy- and resource-efficient solutions
  - Offer circular solutions and business models
  - Eliminate harmful materials

- Better Company
  - Be climate neutral and drive clean, resource-efficient operations
  - Act ethically, lead in diversity and respect human rights
  - Drive supply chain sustainability

- Better Living
  - Make sustainable eating the preferred choice
  - Make clothes last twice as long with half of the environmental impact
  - Make homes healthier and more sustainable through smart solutions for air, water and floors

Supporting the UN Sustainable Development Goals and Climate targets

- Each of the Strategy Focus Area includes three Electrolux Promises.

- The Green Spirit program leads: “Be climate neutral and drive clean, resource efficient operations” for water, energy and CO₂ emissions.

- The Green Sprit program supports: “Eliminate harmful materials” in our production and building systems.
Sphagnum Moss Treatment Solution
Electrolux Kinston Plant Case Study

Kinston Team
Mike Brown, Jason Chavous, Earl Hill, Alex Rouse, Selby Harrell

Sphagnum Moss solution replaces hazardous phosphorous-based chemicals in cooling towers.

✓ Water Savings: 3,881 M³ per yr. (measured).
✓ Energy Savings: 2.5-3.0% savings from better heat exchanger performance (estimation).

Other Benefits
✓ Improved water quality realized in cooling towers, chiller loops, and quench tanks.
✓ Lower odor and skin irritation risk to personnel.
✓ Less maintenance needs and waste products.
✓ Moss can be reused as mulch or as oil absorbent.
### Sphagnum Moss Treatment Solution

**Electrolux Kinston Plant Case Study**

#### Before Moss Implementation

**Inside Plastics Tower**

#### Analytical Results: Nov. 2016

- **Plastics Molding Loop**
  - Molybdenum ppm: 81
  - Iron, ppm: 1974
  - Conductivity: 661
  - Microbio, ATP tot.: 998

### After Moss Implementation

**Inside Plastics Tower**

#### Analytical Results: Apr 2017

- **Plastics Molding Loop**
  - Molybdenum ppm: 41
  - Iron, ppm: 0.224
  - Conductivity: 336
  - Microbio, ATP tot.: 41

### Present

**Inside Plastics Tower**

#### Analytical Results: May 2020

- **Plastics Molding Loop**
  - Molybdenum ppm: NA
  - Iron, ppm: 0.120
  - Conductivity: 191
  - Microbio, ATP tot.: 6
Sphagnum Moss Treatment Solution
Electrolux Kinston Plant Case Study

Exceeded Green Spirit Water Reduction Targets due to Moss Implementation

5.6% YOY Reduction!
Amy Costello
Armstrong Flooring

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Zero-Kilowatt Challenge

Goal: Reduce energy by updating shutdown procedures (Benchmark)

What: Update planned shutdown procedures
Identify systematically opportunities to reduce energy
Chart and review progress

Metric: Kilowatts use during plant shutdown (11 p.m. on Saturday)

Outcome: >50% kW reduction during planned shutdown

Lessons Learned: Establish and review shutdown procedures at least annually
Regularly monitor, track and share energy use during shutdown
Understand energy use data as a diagnostic & procurement tool
Jeff White
Ford Motor Company

Submit Questions
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Ford & DTE’s Central Energy Plant

A Private CHP Facility with Local Utility Participation

Jeff White, Energy Manager, Ford
Outline

Who  What  Where  When  WHY  HOW
Who

Ford Motor Company

DTE Energy Services

DTE Electric

Walbridge, PEC, MEP, Solar, Siemens, Rentech, Trane, WadeTrim, John E Green, Motor City Electric, CBI, Commonwealth, Black & Veatch, PIC, etc.
Dearborn Campus

- Modern campus in Dearborn, MI
- Collocate 30,000 employees
- Improve overall efficiency
- Improve reliability
What

Utilities Upgrades:

- New 200 PSI NG Supply
- Consolidate Electric Supply
Where

Ford Dearborn REC

DTE Dearborn CHP
What

Project Goals

Retiring Elm Street Steam Plant

New 40,000 ton-hr thermal energy storage tank

New CHP with up to 225 k-lb/hr steam

New 16,000 ton chilled water

and 34 MW electricity production

New 156 MMBtu/hr hot water
Ford Energy Master Planning January 2016

2016

RFP Process for CEP May 2016

2017

DTE Selected January 2017

Construction Begins April 2018

2018

Project Documents Executed October 2017

2019

Commissioning of CHP Facility July 2019

Commercial Operation Date 12/31/19

2020
Why

Ensure N+1 reliability for Utilities Supply:

• Improve energy supply resilience
• Dual fuel generation to serve the campus (NG and diesel)
• Improve campus energy efficiency and carbon footprint (70,000 tons of annual carbon emissions reduction)

Use co-design process to ensure risk mitigation and cost control

• Joint review of capital equipment selections and overall design
• Outsourced operations to single purpose entity is built in
• State of the art facility (generation, renewable energy, integrated controls, N+1/islanding)
How

...did the final solution materialize?

...did the participants realize value?

...is the project structured?
How did the final solution materialize?

Project activities

- Develop Energy master plan
- Load Analyses: Current loads – future loads
- Preliminary technical solution: (Early engagement of engineering – PEC, MEP)
- RFP for third party DBOOM structure
- Selection of DTEES as successful Bidder drove incremental value engineering

**Behind-the-meter**

- CHP Facility
- Utility Meter

**In-front-of-the-meter**

- Utility Meter
- CHP Facility
How was the final solution structured?

The transaction involved collaboration between Ford, DTEE, and DTEES

* While DTEE was directly involved in the three-way agreements, DTE Gas also supported the project by investing in a new gas main line and infrastructure to serve the CEP and the Dearborn campus.
Plant Features

- Combined Heat and Power (DTE – funded)
- Cooling Towers (DTEES – capital lease)
- Chiller Plant (DTEES – capital lease)
- Thermal Storage Tanks (DTEES – capital lease)
Plant Features

Solar Titan 130 Gas Turbine
Can produce ~70,000 lbs/hr of steam when running exhaust gases through the HRSG.
Plant Features

While STG is dispatched the condensing unit can utilize heating hot water return from the Ford campus to generate free hot water.
Plant Features

Steam can be sent to the following:

- FORD CAMPUS - UP TO 225,000 LBS/HR
- STG - UP TO 90,000 LBS/HR
- STEAM TO HOT WATER HEAT EXCHANGERS
Plant Features

Chilled water distribution through 42” supply and return lines
Plant Features

~220 PSI TO 400 PSI

ONE GAS COMPRESSOR FOR EACH TURBINE

Vilter Gas Compressors
Plant Features

TES TANK

- Holds 5,300,000 gallons of water
- Diameter: 64' tall x 120' wide
- Tank was erected in 5 weeks
- Tank is designed for peak shaving (11:00 AM – 7:00 PM), and can supply 5,000 tons/hr of chilled water for 8 hours
- Cost of the tank is $3,250,000
- ROI for the tank is less than 3 years
R-1233zd EcoWise Refrigerant with Ozone Depletion Potential (ODP) of Zero and Global Warming Potential (GWP) of 1.
Plant Features

If Ford heating load is below the required cooling load of the STG, excess heat can be rejected to the Cooling Towers via this heat exchanger.
Plant Features

Piping for chilled and hot water
Preparation for Future Geothermal Pumps: Header Piping and Valves installed to allow for future geothermal connection while CEP is in operation.
Digital Twin implementation was engineered and incorporated in this project.
Plant Features

System Rendering for Future Operation
Open for business in December 2019

“Plant at Dusk”
Other Highlights

- Invaluable Lessons learned
  - Construction-driven innovations – 3D design, 3D Construction and 3D validation tools, tip-up panels, modular/skidded equipment, etc.
- Non-CHP features – TES (5 million gallon CW storage (40k ton-hours)), steam to HW heat exchangers, geothermal-ready
  - Operational-driven innovations – GT gantry crane pedestals, ice-melt system
- Digital Twin Operations
  - LEED Gold/Platinum – many things make this plant unique

Many things make this plant unique
Thank You!

Jeff White
Energy Manager
313-549-6132
jwhite11@ford.com
David Reid
Celanese Corporation

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Celanese - Energy Sparks

U.S. Department of Energy - Better Plant Program
2020 Better Practice Award
David Reid CEM, P.Eng. – Sr. Manager Energy and Productivity
Background, Goal and Challenge

► Sometimes even the best energy projects and equipment can underperform
  – Mis-operation
  – Knowledge gaps
  – Lack of know-how

► Energy systems are sometimes operated with:
  – Incorrect setpoints,
  – Inefficient equipment lineup
  – Manual mode, bypassing automated optimization

► Personnel do not realize the cost magnitude of seemingly insignificant energy inefficiencies.
Approach, Implementation and Execution:

- Engaging Operations teams in energy
  - “Sparks” engagement, discussion and action

- Informative manufacturing related energy facts for:
  - Relevant to Operations teams
  - Toolbox meetings and bulletin boards
  - “Did You Know” format using DOE Energy Tips
  - Two minute conversation starters
  - Keeps energy in conversation and mindset of the 24/7 teams
Outcomes & Measuring Success

► Changed the mindset of shift operators
► Initiated conversation and action at the shift team level
► Steam Trap Case Study
  - Energy Spark - how steam traps work and how to inspect and detect a failed trap.
  - Operations teams took it on themselves to conduct further inspections
  - Post External Inspection trap failure finding saved $7000

DOE Better Practice Award
Currently 16 Energy Sparks available in English and Spanish

Goal is to translate them to German, Chinese and Dutch.

Can be adapted to other subjects in the sustainability space

Carries over to home and community life, engaging the next generations in energy efficiency.
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Alexander Zhang
Lineage Logistics

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WHAT IS LINEAGE?
BLAST FREEZING

101 °F

Blast Cell
T = -20 °F

0 °F

Lineage Logistics | 62
BLAST FREEZER
WHAT MAKES A GOOD BLAST CELL?

1. **Blast Temperature and Refrigeration**
   - Cells need appropriate refrigeration capacity to remove product heat load

2. **Blast Airflow**
   - Cells need appropriate structural design for consistent, evenly-distributed airflow to cool all product within a cell
PROBLEM ASSESSMENT

AIR FLOW
- Fast
- Slow

PRODUCT TEMP
- Hot
- Cold
“TUNNEL CELL” R&D
BLAST CELL CONCEPT W/GUIDED AIRFLOW
TEMPERATURE COMPARISON

Standard Backthrow Blast Cell

Guided Airflow Blast Cell
AIRFLOW COMPARISON

Standard Backthrow Blast Cell

Guided Airflow Blast Cell
ZFD Blast Tests

Average Freeze Time is 35.22 Hours
## Table 1 Time and Energy Savings of ZFD Design

<table>
<thead>
<tr>
<th>Annual Projection</th>
<th>Standard Blast</th>
<th>ZFD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blast Runtime, hours</td>
<td>7,514</td>
<td>3,653</td>
</tr>
<tr>
<td># of Blast Cells</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Product Blasted, lbs.</td>
<td>56,356,802</td>
<td>56,356,802</td>
</tr>
<tr>
<td>Total Power Consumption, kWh</td>
<td>3,844,273</td>
<td>3,215,860</td>
</tr>
<tr>
<td>Energy Efficiency, kWh/pallet</td>
<td>122.8</td>
<td>102.7</td>
</tr>
</tbody>
</table>
FUTURE IMPROVEMENTS
This specification relates to technology for efficiently cooling physical items in a blast cell.

Convective air blast freezing is a process by which freezing of items like foodstuffs is facilitated by flowing very cold air over the items via mechanical force, typically in very large volumes of goods (e.g., many pallets) and airflow (e.g., thousands of cubic feet per minute (CFM)). Blast freezing is typically used on perishable foods (e.g., fruits and meats) geographically near their point of initial food processing. Such goods may then be stored for a short or long period in frozen warehouse, and then shipped to a point close to their use (e.g., to a grocery store or a warehouse operated by a particular grocer).
BLAST CELL COOLING WITH GUIDED AIRFLOW

TECHNICAL FIELD

[0001] This specification relates to technology for efficiently cooling physical items in a blast cell.

BACKGROUND

[0002] Convective air blast freezing is a process by which freezing of items like foodstuffs is facilitated by flowing very cold air over the items via mechanical force. Such air blast freezing can be typically used for very large volumes of goods that are carried on pallets. Airflow of thousands of cubic feet per minute (CFM) can be used for freezing. Blast freezing is typically used on perishable foods (e.g., fruits and meats) geographically near their point of initial food processing. Such goods may then be stored for a short or long period in frozen warehouse, and then shipped to a point close to their use, such as to a grocery store or a warehouse operated by a particular grocer.

[0003] Such food decays largely because it includes water, which when not frozen, is a hospitable environment for bacteria and other pathogens. Blast freezing can prevent this process and thus is employed broadly in the food distribution industry. Blast freezing can be a large and
Thank You!
Kate Peterson
General Motors

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Finding Energy Treasure with General Motors Project Roadmap

GM Sustainable Workplaces

Kate Peterson, Energy/Carbon Optimization Engineer
GM Sustainability Goals

- Reduce 2010 carbon emissions by 31% by 2030
  - Achievable with energy efficiency projects and RE-100

- Energy efficiency projects identified by third parties, plant, & Energy Treasure Hunts (ETH)

- GM’s history of hundreds of ETH and efficiency projects provided large database of conservation measures
Previous project tracking methods did not encourage collaboration

- Pursued projects tracked as a part of the plant’s energy performance measures
- Suggested projects remained in ETH files
- Completed projects were not compiled for other plants
- Project information generally delivered “through the grapevine”
Need for a tool that improves communication between plants

- **Track** past and current plant projects
- **“Live”** capability to show current plant project information
- **Share** past and current plant project info across all plants
- Include **granular** details – cost to implement & savings
- **Easy** to use (Excel and Power BI)
- **Showcase** project information in visuals
Project Roadmap improves collaboration

- Project Implementation and Identification Roadmap
  - Treasure Hunt findings
  - 2020 project info for plant records
  - PIIR PBI component stores live project info in visuals

The Result

Filtering allows plants to find specific opportunities in their area of concern
Project Roadmap serves as a project tracking tool

- Projects are tracked from ideas, to projects under implementation, to completed projects

1. Opportunities/suggestions
2. Developed, cost, implementation, and energy savings updated
3. Installed, real time cost and energy information

Project info is detailed
- Allows for project duplication, benchmarking
- Improves future estimations
Project Roadmap continuous improvement

- Plant collaboration and project tracking improved
- Use feedback to improve Roadmap process
- Expand globally to all GM manufacturing sites
- Collaboration with industry partners
Nathan Onchuck
Ozinga Brothers

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Potential SEU’s

- Air Compressors
- Conveyors
- Central Mixers
- Dust Collection
- Variety of small HP pumps/blowers
Accurate, reliable measurements of operating data is a critical part of energy efficiency at both the equipment and system level. But plant personnel do not always have access to the necessary instruments, may not know the right tool to use, or lack sufficient justification to purchase one. The Field Validation and Diagnostic Equipment Program helps Better Plants partners address these issues. The program provides partners with access to various instruments to measure their energy consumption. Historically, this equipment was used by Experts for In-Plant Training. Now, partners can directly access equipment free of charge.

Instruments Available to Borrow:

- Anemometer
- Combustion Analyzer
- Digital Manometer
- Infrared Camera
- Power Logger
- Strobe Tachometer
- Ultrasonic Leak Detector
- And Many More!

In Picture: Workers using infrared camera at the Charter Steel, Saukville Plant.
Compressor Controls: Load/Idle/Stop

Before:

After:

Changes:
- Low pressure set point reduced by 15 PSI
- Compressor control mode changed from Load/Unload to Load/Unload/Stop

Results:
- 68% reduction in compressor run time
- 65% reduction in compressor energy intensity
Air Usage Modeling

- Estimate CFM output by tracking compressor run time
- Datalogging shows compressor is undersized for plant
- Compressor will be moved to smaller plant with failing compressor and replaced with properly sized machine
## Conveyor Utilization

<table>
<thead>
<tr>
<th>Unloaded Time</th>
<th>Loaded Time</th>
<th>Motor Starts</th>
<th>Utilization Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.88</td>
<td>0.35</td>
<td>13</td>
<td>16%</td>
</tr>
<tr>
<td>1.93</td>
<td>0.24</td>
<td>17</td>
<td>11%</td>
</tr>
<tr>
<td>2.41</td>
<td>0.28</td>
<td>19</td>
<td>10%</td>
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<tr>
<td>1.55</td>
<td>0.27</td>
<td>8</td>
<td>15%</td>
</tr>
<tr>
<td>1.23</td>
<td>0.19</td>
<td>10</td>
<td>13%</td>
</tr>
<tr>
<td>1.67</td>
<td>0.79</td>
<td>9</td>
<td>32%</td>
</tr>
<tr>
<td>0.50</td>
<td>0.68</td>
<td>9</td>
<td>58%</td>
</tr>
<tr>
<td>0.01</td>
<td>0.23</td>
<td>3</td>
<td>94%</td>
</tr>
<tr>
<td>0.17</td>
<td>0.25</td>
<td>6</td>
<td>60%</td>
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<tr>
<td>0.85</td>
<td>0.13</td>
<td>5</td>
<td>13%</td>
</tr>
<tr>
<td>0.55</td>
<td>0.07</td>
<td>5</td>
<td>12%</td>
</tr>
<tr>
<td>1.78</td>
<td>0.20</td>
<td>11</td>
<td>10%</td>
</tr>
<tr>
<td>2.18</td>
<td>0.25</td>
<td>11</td>
<td>10%</td>
</tr>
<tr>
<td>0.23</td>
<td>0.01</td>
<td>0</td>
<td>4%</td>
</tr>
<tr>
<td><strong>16.94</strong></td>
<td><strong>3.92</strong></td>
<td><strong>0</strong></td>
<td><strong>26%</strong></td>
</tr>
</tbody>
</table>

- Conveyor is on manual switch, left on if plant is busy
- Average conveyor utilization is 26%
- Will install soft starter and program conveyor controls into plant’s batching sequence
Next Steps

- Air Compressors
- Conveyors
- Central Mixers
- Dust Collection
- Variety of small HP pumps/blowers
Robin Davis
Imerys Carbonates North America

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Dust Collector Best Practice
Imerys Industrial Support Team
Robin Davis, Energy Engineer
Introduction to Imerys

A world leader in mineral-based specialties, offering high value-added solutions to many different industries, ranging from process manufacturing to consumer goods.


We succeed through:

- Best-in-class operations, delivering commercial excellence and market-driven innovation
- A strong business model and value proposition
- Unrivalled technological and industrial processes, solutions and leading positions in most of our markets
- Understanding our customers’ applications
- Meeting ambitious targets for being a responsible business
Compressed air is known to be the least efficient utility in industrial plants.

Dust collectors are the main consumer of compressed air within the Imerys industrial facilities.
  - Most collectors in operation for environmental compliance.

Imerys recognized dust collectors opportunities to improvement performance, efficiency and to reduce environmental impact.
  - Aligns with corporate sustainability and energy goals
  - Joint project developed with the Asset Management and Global Energy Management Teams to develop the internal best practice for dust collector operation and maintenance.
Dust Collector Best Practice Document

- Identified Best Practices across NA plants
  - 40 Plants across North America
  - Over 500 Dust Collectors in North America
  - Numerous sites had ongoing improvement initiatives
  - Included equipment, operations and maintenance protocols

- Reviewed Industry Standards & Supplier Guidance

- Developed Best Practices Document

- Includes recommendations that impact EHS, Energy, Production, Maintenance, and Quality

- Released to IMERYS Performance Minerals - North America on March 18th
New Technologies and Standardization

- **Lower Plant Air Pressure**
  - Reduction in energy spend

- **New Pulse Valves (MAC Valves)**
  - Reduced Air Consumption

- **New Water Separators/Filter (Tsunami)**
  - Increased reliability

- **Differential Pressure Monitors**
  - EHS Compliance
  - Troubleshooting

- **Pulse On Demand**
  - Reduced Air Consumption
  - Increase Bag Life

MAC Valves Installed @ Sandersville Calcine Plant

Time collector pulsed in past 24 hrs captured for Improvement Tracking

Differential Pressure Displayed and Captured in Historian
**Impact**

- **Pilot Site: Sandersville GA, Calcine Plant**
  - Reducing the plant air pressure from 100 PSIG to 85 PSIG allowed us to shut down our first compressor. (75 connected HP)
  - Implementation of pulse-on-demand for 4 collectors showed a pulse reduction of over 40% in 1 collector and over 70% in other.
  - MAC Valves are presenting about 20% air consumption reduction the collector they have been installed.
    - Developing capital project to replace all pulse valves in plant with MAC Valves
  - Currently averaging 2 compressors shut down (125 connected HP)
  - First Phase financial impact: $68K

- Total potential Imerys North America Impact in excess of: **14 GWh reduced** and **6700 Metric Tons CO2 eliminated**
Michael Waitek
PepsiCo

Submit Questions
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Indianapolis
Gatorade Cogen - Combined Heat and Power System

Project Designed to lower electricity costs and reduce greenhouse gas emissions – part of PepsiCo’s Winning with Purpose initiative


Project Team consisting of PepsiCo corporate sustainability engineering, plant support, contractors

$6M Capital Project for Generators, Heat Recovery and Installation

$1.45MM Annual Utility Savings

$1.0MM Net Savings w/Maintenance Contract

35% Reduction in Greenhouse Gas Emissions – 6% of PepsiCo’s 2030 Goal

Project Startup – January 2019

Project Overview

- Three 1700hp natural gas engines turning 1.2MW electric generators – 3.6MW total output
  - Provides ~90% of plants electricity usage
  - Reduces peak demand

World Class Efficiency by Utilizing Heat Recovery

- Heat generated by engines (cooling and exhaust) utilized for Gatorade processing
  - Reduces load on natural gas boilers
  - Reduces overall utility costs
- System Efficiency to Approach 85%
  - Electrical Utility Efficiency ~35%
Project Details

Generators utilize a control system to produce electricity based on plant load.

Generators can efficiently run from 600kW to 1200kW.

Gatorade is thermally processed – provides large heat sink for engine cooling.

Engine cooling is mainly provided by transferring heat to Gatorade.

Gatorade can gain up to 40F by utilizing the heat from the engines.

Engine Exhaust at ~700F is used to make steam with a converted boiler for additional heat needed for processing.
Bert Hill
Volvo Group North America

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Landfill Free Directive and Certification Process

Bert Hill
2020 Better Buildings Better Plants Summit
We employ some 100,000 PEOPLE, have production facilities in 18 COUNTRIES and sell our products in more than 190 MARKETS.
Driving prosperity through transport solutions

Modern logistics is a prerequisite for our economic welfare: transport helps combat poverty. Transport is not an end in itself, but rather a means allowing people to access what they need, economically and socially.
The Waste Hierarchy
Waste Prevention and Reduction Initiatives

• Studies to determine the amount and types of packaging delivered with major components to identify reduction opportunities;
• Returnable/Reusable Volvo Emballage
• Plant-level initiatives focused on recycling/composting infrastructure, signage, employee training, technical support and waste audits to facilitate waste reduction, reuse and recycling;
• Benchmarking with peer companies in the manufacturing industry to identify best practices in corporate waste management, with a particular focus on reducing long-term liability;
• Creation of a national account with a single waste vendor to reduce the number of different facilities that receive the final waste fraction that cannot be re-used or recycled;
Landfill free certification process

- **Landfill Free Footprint** – Documentation and mapping of all waste types.

- **Active Waste Reduction, Reuse and Recycling Program** – Program implemented and maintained, using the waste management hierarchy as a basis for decision-making.

- **Sustained Landfill Free Program** – Volvo Landfill Free definition has been met for a minimum of 12 months. Landfill alternatives include source reduction, reuse, recycling, energy recovery, incineration and fuel blending.

- **Reuse and Recycling Assurance** - Where waste is provided to a business to be reused or recycled off-site, any residue or waste fraction that cannot be reused or recycled and must be landfilled must not exceed 1%. 
Results

- Four manufacturing plants in the U.S. have achieved Landfill Free Certification: New River Valley, Middletown, Lehigh Valley Operations, Volvo CE Shippensburg
- Three additional U.S. manufacturing/distribution facilities are within the 12-month evaluation period for certification.
- In 2019, only 6% of the waste from Volvo Group North America facilities was landfilled; 78% of operational waste was recycled.
- Middletown/Charlotte Remanufacturing and DEX Heavy Duty Parts complete the circle in the Circular Economy.
Thank You!
Daniel Downen and John Keller
ThyssenKrupp Elevator

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Better Project Presentation: Structural Oven Energy Reductions

DANIEL DOWNEN AND JOHN KELLER

THYSSENKRUPP ELEVATOR
MIDDLETON, TENNESSEE

BETTER BUILDINGS SUMMIT 2020
JUNE 10, 2020
ThyssenKrupp Elevator
Middleton Plant

• Middleton TN plant, only plant in U.S. for TKE

• Established in 1969
  • 700,000 sq ft (about 70% manufacturing, rest is offices)
  • Approximately 1,100 employees

• Production of new elevators, elevator modernization, and parts (cabs, doors, safeties, governors, controllers, etc.)

• Energy management practices encouraged by parent company

• Accreditations
  • ISO 50001 in 2019
  • Also LEED Gold in 2015, and ISO 9001 and 14001
TKE Structural Oven

Two ovens used to cure coatings on elevator parts
  ◦ Older oven for structural elevator parts
  ◦ Newer oven for architectural parts

Structural oven identified as an SEU
  ◦ Part of ISO 50001 process
  ◦ May use 35% of plant natural gas

Structural oven designed decades ago
  ◦ Limited data on oven specifications
  ◦ Heavily used 20+ hours continuous use each day
  ◦ Quality of powder coat finish is critical
  ◦ Concern over making changes, conservative approach

Parts entering structural oven
Opportunities for Reduction in Oven Heat Losses

In 2018, we requested an assessment from the University of Memphis Industrial Assessment Center

- Looked at all areas of plant, but did spend time on oven
- Verified that oven insulation was a project opportunity
- We later confirmed the savings and arranged insulation to be installed

After IAC, still had sense that further reductions were available, and worked with TAM during visit in 2019 to focus on oven

- Logged key data and developed oven energy balance using MEASUR
- Refined energy use data, oven using 25 percent of plant gas use, lower but still significant
- Indicated high share of exhaust heat, pointed to potential heat recovery opportunity

After reviewing analysis, and minimum exhaust flow rates, we shut down one exhaust to reduce heat loss

Also built enclosure in rear of oven to further reduce losses
Developing Oven Energy Balance

- During the TAM visit, we observed the 4am oven startup to log initial firing rates, and kept recording these throughout the day to baseline the full production cycle fuel rate.

- We also documented data on oven dimensions, temperatures, exhaust rates, and other important parameters, to construct a baseline model of mass and energy balances, using the DOE MEASUR tool.

- We then documented the impact of the improvements, after insulation was installed and exhaust gas flow rate reduced.

- The data was input into the MEASUR tool and compared with the baseline data collected earlier.

- These operating values also will serve as a revised baseline, for Phase 2 improvements.
Impact of Improvements

- Firing rate dropped from 5.2 MMBTU/hr to 4.2 MMBTU/hr, a 19 percent reduction.
- Startup procedure was reduced from 2 hours to 60 minutes, and production time also cut by an hour.
- This reduced the oven shift hours from 20 hours per day to 17 hours, a decrease of 15 percent.
- Collectively, this represents a 34 percent reduction in fuel use.
Confirming Oven Curing Time

- Powder coating requires 25-30 minutes, maintained at approximately 350 F

- Developed an approach to testing the oven, to ensure that the energy reductions did not adversely impact production or product quality.
  - Part assembly that has imbedded thermocouples
  - Employ the parts handling system to route the assembly through the oven, while held at production firing rates, and record the temperature profile as it passed throughout the oven zones
  - Test results (see figure on right) can be compared with prior results to ensure that the cure time and temperature requirements are maintained.
  - Energy Team conducted this test after each improvement was implemented, to confirm that the oven controls were able to maintain oven parameters

Thermal profile of parts moving through structural oven
Sustained Impact

- Monthly reporting metric indicates project-specific natural gas savings, based on production rates and change in oven firing rates.
- Results indicate a 35% reduction in oven gas consumption, corresponding to the 34 percent reduction in firing rate and oven hours, yielding a six month bill reduction of $15,694.
- Full year savings of $31,000, a payback period of 3 months.

<table>
<thead>
<tr>
<th>Natural Gas, North MMBTU</th>
<th>19-Oct</th>
<th>19-Nov</th>
<th>19-Dec</th>
<th>20-Jan</th>
<th>20-Feb</th>
<th>20-Mar</th>
<th>Total, Year</th>
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<tbody>
<tr>
<td>FY2020</td>
<td>2,990</td>
<td>3,569</td>
<td>2,971</td>
<td>4,346</td>
<td>4,336</td>
<td>2,943</td>
<td>21,155</td>
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<tr>
<td>FY2019</td>
<td>2,327</td>
<td>4,133</td>
<td>4,339</td>
<td>5,388</td>
<td>4,125</td>
<td>3,407</td>
<td>23,718</td>
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<tr>
<td>YOY Savings %</td>
<td>-28%</td>
<td>14%</td>
<td>32%</td>
<td>19%</td>
<td>-5%</td>
<td>14%</td>
<td>11%</td>
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<tr>
<td>2019-2020 Reduction MMBTU</td>
<td>(663)</td>
<td>564</td>
<td>1,367</td>
<td>1,042</td>
<td>(211)</td>
<td>464</td>
<td>2,563</td>
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<tr>
<td>Bill Savings ($)</td>
<td>(3,983)</td>
<td>3,489</td>
<td>8,229</td>
<td>6,491</td>
<td>(1,291)</td>
<td>2,850</td>
<td>15,694</td>
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Compare Metered Reductions with Project Savings

<table>
<thead>
<tr>
<th>Metered Use, North MMBTU</th>
<th>2,990</th>
<th>3,569</th>
<th>2,971</th>
<th>4,346</th>
<th>4,336</th>
<th>2,943</th>
<th>21,155</th>
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<td>1,042</td>
<td>(211)</td>
<td>464</td>
<td>2,563</td>
</tr>
<tr>
<td>Percent Reduction</td>
<td>-22%</td>
<td>16%</td>
<td>46%</td>
<td>24%</td>
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<td>Total Oven Use Est. MMBTU</td>
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<td>1,765</td>
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<td>Project Savings Est. MMBTU</td>
<td>585</td>
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<td>374</td>
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<td>Percent Savings</td>
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<td>29%</td>
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HDD55

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<td>265</td>
<td>312</td>
<td>407</td>
<td>200</td>
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YOY Increase %

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<tr>
<th>2020FY</th>
<th>33%</th>
<th>3%</th>
<th>-13%</th>
<th>-25%</th>
<th>49%</th>
<th>-72%</th>
<th>-72%</th>
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<tr>
<td>2019FY</td>
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<td></td>
<td></td>
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Production

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<tr>
<th>2020FY</th>
<th>560</th>
<th>797</th>
<th>12653</th>
<th>1037</th>
<th>9366</th>
<th>11237</th>
<th>1019</th>
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<td>2019FY</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NA</td>
</tr>
</tbody>
</table>

YOY Increase %

Project level results, comparing with metered reductions and also weather patterns.
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Cupola Blast Air Dehumidification System

Marco Gonzalez, CEM
Waupaca Foundry, Inc.
Corporate Energy Manager
Who we are

Waupaca Foundry, a Hitachi Metals Group company, produces best-in-class gray iron, ductile iron, austempered ductile iron and compacted graphite iron castings at seven, strategically located state-of-the-art foundries in North America.

Automotive

Commercial Trucks

Off Highway Vehicles

Industrial Applications
Waupaca Foundry, Inc. – Sustainability Goals 2020

- Reduce energy intensity by 25%
- Reduce spent foundry sand generation by 30%
- Reduce Water use consumption by 80%
- Maintain cutting edge air pollution control technologies
Tell City, IN – Plant 5

- Footprint: 560,000 square feet
- Employees: 956
- Melting Capacity: 160 tons per hour
  (at two cupolas 80 tons/hr each)
- Casting capacity: 450,000 tons annually

**Portfolio, Gray & Ductile Iron:**
Brake rotors and drums, brake calipers, crankshafts, differential carriers, differential cases, and flywheel housings

DH Project implemented in Cupola 5.1 Gray Iron
Waupaca Foundry, Inc. – Melting Facts

- Waupaca Foundry, Inc. melts over **10,000 tons per day** at seven locations. 80% is melted using Cupolas.

- A **Cupola Furnace** consists of a vertical steel shell, lined with a refractory brick. The charge consists of alternate layers of scrap metal, coke as an **additive and fuel**, and limestone flux.

- The coke is consumed in air which is introduced by the blast air blowers and oxygen injection through the tuyeres.

- The hot gases generated in the melt zone ascend and preheat the descending charge. A recuperative design allows waste heat recovery from the cupola for other applications.

- At Cupola plants, melt equipment represents ~70% of the total energy consumption of the plant.

- Coke supplies 50% of the energy consumed at Waupaca Foundry, Inc.

- Waupaca Foundry, Inc. is continuously implementing actions to improve the melting efficiency at its plants.
Humidity Impact on Cupola Blast Air

High humidity in cupola blast air has **detrimental effects** on cupola efficiency,

- Increased coke rate per unit of iron melted.
- Reduced combustion temperatures.
- Reduced carbon pickup (coke also provides C to the iron)
- Elevated thermal oil heat loads increasing exhaust volume to the emission control system.

When water vapor is “burned” in the cupola combustion zone at 4,000°F, the water is dissociated into elemental Hydrogen and Oxygen. The strong reducing effect of the hydrogen causes the oxygen to react with Coke in a reduction process, consuming coke and generating carbon monoxide.

CO and H levels in the cupola gas become elevated causing a highly endothermic reaction that consumes heat and decreases the efficiency of the coke combustion.

This drop in efficiency increases the overall coke demand while reducing the cupola melt rate.
SOLUTION: Installing a Cupola Blast Air Dehumidification System

Project developed in partnership with cupola manufacturer and dehumidifier manufacturer.
Project Timeline: 14 months. Payback 3.8 years

1. **The Dehumidifier Unit**: A rotating desiccant wheel divided into two sections with a seal between these two sections. On one side, the ambient process blast air to be dehumidified is drawn through the desiccant wheel, and the moisture in the air is absorbed by the desiccant wheel. On the other side, the absorbed moisture in the wheel is removed with heated regenerative air section.

2. **Thermal Oil Heating System**, from the cupola waste heat recovery system, provides the heat required to reactivate the desiccant wheel.

3. **Water Cooling System**, using cupola process cooling water, reduces the blast air temp before the blower.
Benefits

\[ 126,757 \text{ gallons of Water removed from blast air} = 8,178 \text{ Kegs of Beer} = 21x \]

\[ 1 \text{ Keg} = 15.5 \text{ Gallons} \]

\[ 1,804 \text{ t-CO}_2 \text{ AVOIDED} \quad -1\% \text{ PLANT'S GHG} \]

\[ 16,728 \text{ MMBTU ENERGY SAVINGS} \quad 1\% \text{ PLANT'S ENERGY USAGE} \]

\[ $335,000 \text{ ENERGY COST SAVINGS} \]

Project Timeline: 14 months
Payback 3.8 years

\[ +3\% \text{ CUPOLA MELTING EFFICIENCY} \]

\[ -2.5\% \text{ COKE REDUCTION 656 Tons} \]
thank you

Marco Gonzalez
Corporate Energy Manager
Waupaca Foundry, Inc.
Marco.Gonzalez@waupacafoundry.com
Q & A

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BEST PRACTICES FOR INTEGRATING DERS INTO COMMERCIAL BUILDINGS
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MAXIMIZING ENERGY SAVINGS AND ENVIRONMENTAL IMPACTS
July 16

EVERYONE HAS A DATA CENTER:
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July 28

PROGRAM DESIGN WITH EVERYONE IN MIND:
LOW-INCOME SOLAR PROGRAM STRATEGIES
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