General Session

Energy Saving Ideas for Your Box Plant

Moderator:
Jeff Pallini
Fosber America, Inc.
**Program Overview:**

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<th>Immediate Ideas:</th>
<th>Jim Simko of Simtek Systems, Inc.</th>
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<td>Mid-Term Ideas:</td>
<td>John Donahue of Donahue &amp; Associates &amp; Bud Stickle of Stickle Specialties Company</td>
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<td>Future Energy</td>
<td>Professor Art J. Ragauskas, School of Chemistry &amp; Biochemistry Institute of Paper Science &amp; Technology at Georgia Institute of Technology</td>
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<td>Q &amp; A Session:</td>
<td>Moderated by Pete Snyder of Harper/Love Adhesive Corporation</td>
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Energy Saving Ideas for Your Box Plant

Presented By:
Jim Simko
Simtek Systems Inc.
Benefits of Saving Energy

• Lower cost more money to your bottom line
• Beneficial to our environment, smaller carbon footprint
• Prolong the life of fossil fuels
• Make alternative energy sources more realistic
Office Lighting

- Change incandescent light bulbs to compact fluorescent lamps
- A 14 watt compact fluorescent will replace a 60 watt incandescent
- Replace or upgrade existing T-12 fluorescent fixtures with T-8 fixtures with electronic ballasts
Office Lighting

• Automatically control light fixtures
• Install occupancy sensors especially in restrooms and conference rooms that are not always occupied
• Install ambient light sensors with dimming ballasts
• Add additional switching for large office areas
Plant Lighting

• Replace 400 watt metal halide fixtures with T-5HO fluorescent fixtures.

• T-5HO fixtures will cut your energy consumption for your plant lighting by more than half

• Install occupancy sensors in areas of your facility where traffic is light especially in off shifts

• Replace existing incandescent exit signs with LED exit signs
Plant Lighting

• Check with your local utility for rebates or incentives for installing the F-Bay fixtures
• Review EPACT 2005 tax incentives to see if your lighting project qualifies for the tax rebate
Estimated Savings

• Example
• If you currently have 300 metal halide 400 watt fixtures installed in your facility and you replace them with 300, 4 lamp, T-5HO fixtures, you would save the following:
  • Assuming your lights are on 136 hours per week or 7072 hours per year
  • Also assume $.06 per Kwh
Savings Estimate

- 300 fixtures X 460 watts per fixture = 138,000 watts or 138 KW
- 300 new fixtures X 216 Watts per fixture = 64,800 watts or 64.8 KW
- Savings = 73.2 KW
- 73.2 KW X 7072 hr = 517,670 KWh
- 517,670 KWh X $.06 = $31,060.00 per year
- @ $0.10 per KWh = $51,767.00 per year
Compressed Air System

- Repair air leaks
- Have a company that performs ultrasound testing for leaks perform an audit at your facility
Approximate Costs of Air Leaks

- 1/64” = $66.00 per year
- 1/16” = $1,051.00 per year
- 1/8” = $4,202.00 per year
- 1/4” = $16,744.00 per year

These costs are for each air leak of the given size
Operations

- Automatically control scrap blowers
- They should turn off when not in use
- They should be controlled so as not to allow starting of more than one fan at a time
- This will reduce your demand charge from your power company
Operations

• Feed vacuum blowers and vacuum transfer blowers should be automatically controlled so they will turn off when not in use

• Install AC drives or inverters on vacuum blowers
Operations

• Train front line supervisors to recognize energy wasted at work station.
• Water hoses left running down the sewer, dedicated lighting for machines left on when not in use, limit the use of air motors where possible, turn off air lines with leaks until maintenance can repair them, turn down discharge temperatures in air make up units
• In the office, turn down the thermostat in the winter and up in the summer
Conclusion

- Higher energy costs are here to stay
- Fossil fuels have a limited availability, we will run out
- Saving energy now makes the possibility and use of alternative energy sources in the future more realistic
- Saving energy means more money to your bottom line
- Thank you
Energy Saving Ideas for Your Box Plant

Presented By:
John Donahue
Donahue & Associates
Heat Balance Study of a Corrugated Box Plant

ENERGY IN = ENERGY OUT

- Boiler Stack Loss
- Scrap System & Ventilation
- Steam Showers & Leaks
- Product
- Boiler Fuel In
- City Make-Up Water In
- Boiler Blowdown
- Flash Loss from Condensate
A LOOK AT THE TOTAL PLANT SYSTEM

HEAT BALANCE

A. Defines the areas of loss – **REDUCE THEM**.

B. Design from the total plant heat balance system – as a system – **A TOTAL SYSTEM**.

C. Invent other systems for your needs.
   1. Surge requirements.
   2. Superheated steam from a paper mill.
   3. Waste steam from a paper mill.
   4. Steam from a power plant.
   5. New steam shower design.
BOILER ENERGY HEAT BALANCE

ENERGY IN = ENERGY OUT

THE CONVENTIONAL CORRUGATOR HEAT SYSTEM

BOILER STACK LOSS
2.9 MMBTU/HR

SCRAP SYSTEM & VENTILATION
6.35 MMBTU/HR

STEAM & LEAKS SHOWER
2.21 MMBTU/HR

PRODUCT
1.24 MMBTU/HR

FLASH LOSS
FROM CONDENSATE
1.8 MMBTU/HR

FUEL IN
14.5 MMBTU/HR

WATER IN
.138 MMBTU/HR

BOILER

4 PASS BOILER
At 210# (391°F)

STEAM TO CORRUGATOR
12.98 MMBTU/HR.

CORRUGATOR

BOILER STACK LOSS
2.9 MMBTU/HR

BOILER

SCREW SYSTEM & VENTILATION
6.35 MMBTU/HR

STEAM & LEAKS SHOWER
2.21 MMBTU/HR

PRODUCT
1.24 MMBTU/HR

FLASH LOSS
FROM CONDENSATE
1.8 MMBTU/HR

CONTRACTS RETURN
1.38 MMBTU/HR

BOILER BLOWDOWN
.138 MMBTU/HR

THE CONVENTIONAL CORRUGATOR HEAT SYSTEM
COST PER HOUR FOR THE CONVENTIONAL STEAM SYSTEM

BASED ON NATURAL GAS COST OF $15.20/MCF

(1 MCF = 1,000,000 BTU)

- BOILER STACK LOSS: $44.08/HR
- FUEL IN: $220.40/HR
- WATER IN: $2.10/HR
- BOILER BLOWDOWN: $2.10/HR

- STEAM TO CORRUGATOR: $197.30/HR
- 4 PASS BOILER At 210# (391F)

- SCRAP SYSTEM & VENTILATION: $96.52/HR
- CORRUGATOR: 110"

- CONDENSATE RETURN: $20.98/HR
- FLASH LOSSES FROM CONDENSATE: $27.36/HR
- PRODUCT: $18.85/HR
- STEAM SHOWER & LEAKS: $33.59/HR
A RE-DESIGNED CORRUGATOR HEAT SYSTEM

BOILER STACK LOSS
1.8 MMBTU/HR

FUEL IN
9.00 MMBTU/HR

WATER IN
.079 MMBTU/HR

BOILER BLOWDOWN
.079 MMBTU/HR

4 PASS BOILER
At 210# (391F)

STEAM TO CORRUGATOR
7.447 MMBTU/HR.

CONDENSATE RETURN
.247 MMBTU/HR

BOILER

SCRAP SYSTEM & VENTILATION
5.79 MMBTU/HR

STEAM SHOWER & LEAKS
.18 MMBTU/HR

PRODUCT
1.12 MMBTU/HR

CORRUGATOR

FLASH LOSS
FROM CONDENSATE
.11 MMBTU/HR

A RE-DESIGNED CORRUGATOR HEAT SYSTEM

ENERGY IN = ENERGY OUT
COST PER HOUR FOR THE RE-DESIGNED STEAM SYSTEM

BASED ON NATURAL GAS COST OF $15.20/MCF
(1 MCF = 1,000,000 BTU)

- **BOILER STACK LOSS**: $27.36/HR
- **SCRAP SYSTEM & VENTILATION**: $88.00/HR
- **STEAM SHOWER & LEAKS**: $2.74/HR
- **CONDENSATE RETURN**: $3.76/HR
- **FLASH LOSSES FROM CONDENSATE**: $1.67/HR
- **PRODUCT**: $17.03/HR
- **FUEL IN**: $136.80/HR
- **WATER IN**: $1.20/HR
- **BOILER BLOWDOWN**: $1.20/HR
- **BOILER**: $113.19/HR
- **CORRUGATOR**: $1.20/HR
- **BOILER TO CORRUGATOR**: $113.19/HR
SUMMARY

THE COST SAVINGS REALIZED WITH THE INSTALLATION OF THE RE-DESIGNED STEAM SYSTEM

<table>
<thead>
<tr>
<th>Energy Into the Plant</th>
<th>Conventional Steam System Dollars/Hour</th>
<th>Redesigned Steam System Dollars/Hour</th>
<th>Cost Savings Dollars/Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Boiler Fuel</td>
<td>$220.40</td>
<td>$136.80</td>
<td>$83.60</td>
</tr>
<tr>
<td>2-Water Energy</td>
<td>$2.10</td>
<td>$1.20</td>
<td>$.90</td>
</tr>
<tr>
<td>Total</td>
<td>$222.50</td>
<td>$138.00</td>
<td>$84.50</td>
</tr>
</tbody>
</table>

Energy Losses From the Plant

<table>
<thead>
<tr>
<th>Loss Type</th>
<th>Conventional Steam System Dollars/Hour</th>
<th>Redesigned Steam System Dollars/Hour</th>
<th>Cost Savings Dollars/Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Boiler Stack Loss</td>
<td>$44.08</td>
<td>$27.36</td>
<td>$16.72</td>
</tr>
<tr>
<td>2-The Scrap System &amp; Ventilation Losses</td>
<td>$96.52</td>
<td>$88.00</td>
<td>$8.52</td>
</tr>
<tr>
<td>3-Steam Shower and Steam Leak Loss</td>
<td>$33.59</td>
<td>$2.74</td>
<td>$30.85</td>
</tr>
<tr>
<td>4-Energy Lost with Product</td>
<td>$18.85</td>
<td>$17.03</td>
<td>$1.82</td>
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<tr>
<td>5-Condensate Flash Loss</td>
<td>$27.36</td>
<td>$1.67</td>
<td>$25.69</td>
</tr>
<tr>
<td>6-Loss with Boiler Blowdown</td>
<td>$2.10</td>
<td>$1.20</td>
<td>$.90</td>
</tr>
<tr>
<td>Total</td>
<td>$222.50</td>
<td>$138.00</td>
<td>$84.50</td>
</tr>
</tbody>
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You may realize a less than one year payback based on fuel savings alone.
### COSTS OF STEAM LEAKS

Cost of various sized steam leaks at 100psi

(Assuming steam costs of $15 per 1000 lbs.)

<table>
<thead>
<tr>
<th>Orifice size (inches)</th>
<th>Steam wasted (lbs per month)</th>
<th>Total cost/month</th>
<th>Total cost/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>835,000</td>
<td>$12,525</td>
<td>$150,300</td>
</tr>
<tr>
<td>7/16</td>
<td>637,000</td>
<td>$9,555</td>
<td>$114,660</td>
</tr>
<tr>
<td>3/8</td>
<td>470,000</td>
<td>$7,050</td>
<td>$84,600</td>
</tr>
<tr>
<td>5/16</td>
<td>325,000</td>
<td>$4,875</td>
<td>$58,500</td>
</tr>
<tr>
<td>1/4</td>
<td>210,000</td>
<td>$3,150</td>
<td>$37,800</td>
</tr>
<tr>
<td>3/16</td>
<td>117,000</td>
<td>$1,755</td>
<td>$21,060</td>
</tr>
<tr>
<td>1/8</td>
<td>52,500</td>
<td>$787.50</td>
<td>$9,450</td>
</tr>
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NOTE: The steam-loss values assume clean, dry steam flowing through a sharp-edged orifice to atmospheric pressure with no condensate present. Condensate would normally reduce these losses because of the flashing effect that occurs when a pressure drop is experienced.
Energy Saving Ideas
for Your Box Plant

Thanks to
John Kohler
Harper/Love
Tom Evans
CSI

Presented By:
Bud Stickle
Stickle Steam Specialties Co., Inc.
Cost of Steam

For this discussion it cost $20.00 to produce 1,000 lbs of steam

• We are saying 1.2 million BTU’s/1,000 lbs
• Cost include fuel, water, electricity & water chemistry
Eliminating Steam Leaks

• The equivalent of 3/16” leak equals 180 lbs/hr
• $3.60/hr
Traps and By-Pass Valves

• One trap blowing thru w/5/32” orifice equals 160 lb/hr
  • $3.20/hr
• One ¾” failed by pass valve equals 1,100 lb/hr
  • $22.00/hr
Un-insulated Pipe Radiation Loss

- Example: 2” pipe 200 ft long @360 (F)
- Radiation loss 61bls/hr
- $1.23/hr
Boilers and Burners

• A boiler is just a heat exchanger and it is the burner that counts.
• A high efficiency burner reduces excess air and will give you a higher turn down ratio
• A major integrated has installed high efficient Weishaupt burners and reduce gas usage 13.5%
High Pressure Condensate Return

- Return High Temp. effluent directly to the boiler with HP Return System
- Condensate @ 360 (F) verses 250 (F) deaerator
- Savings achieved 18-20%
- $40.00/hr
Efficient Utilization of Energy

- Speed Up
- 675 fpm 10,951 lbs/hr 36-23-36 .27 lbs/ft
- 908 fpm 12,100 lbs/hr 36-23-36 .22 lbs/ft

lbs of steam per linear Ft of board
Cooler Corrugator

- Running Hot Plates “Backwards”
- Achieve better heat transfer and higher energy efficiency
- Potential of .305 therms/msf
Future Energy Opportunities

Presented By:
Dr. Art J. Ragauskas,
School of Chemistry & Biochemistry
Institute of Paper Science & Technology at
Georgia Institute of Technology
Questions & Answers
Thank You For Attending!