Energy Efficiency

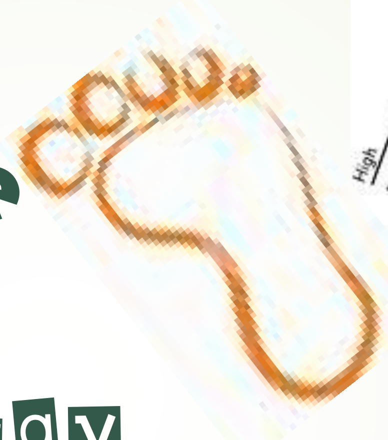
BIF, the baking industry forum

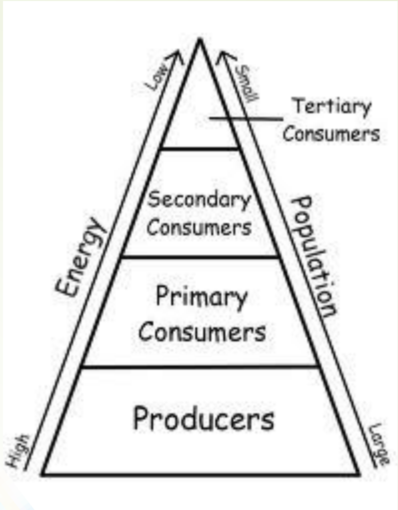
Why Energy?

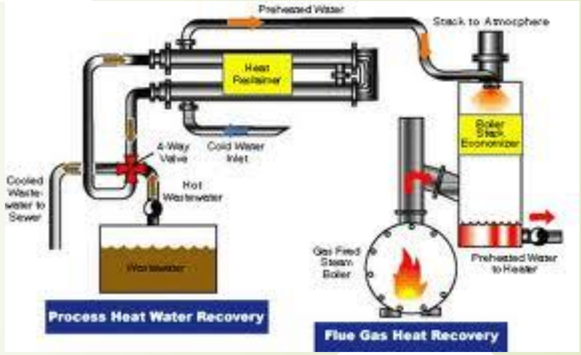
- Customer Demands
  - Walmart Sustainable Vendor Survey has a new question
- Dollars and Cents
  - Using less energy saves improves the bottom line
- Butterflies and Bunnies
  - Reduce our footprints

What is Green ?

Sustainable







Horsepower

Energy Initiative

HEAT RECOVERY

ENERGY CHALLENGE

energy

Bottom Line

IT AIN'T EASY BEING GREEN

Words you'll hear today

- Energy Efficiency
- Energy Star
- Energy Challenge
- Energy Initiative
- Footprint
- Heat Recovery
- Sustainability
- LEED Certification
- AND Green

What is Energy Efficiency?

- THE PERFECT RATIO BETWEEN THE USEFUL OUTPUT OF AN ENERGY CONVERSION MECHANISM AND THE INPUT OF RESOURCES - WEBSTER

1:1

What is Energy Star?

- Established in 1992
- Environmental Protection Agency (EPA)
- Voluntary Program

What is the Energy Challenge? Energy Initiative?

- Call-to-Action
- ABA partnership with EPA
- Goal = continual improvement
  - 10% (or more) improvement within 5 years

What is LEED Certification?

- The USGBC **(US Green Building Council)** will award LEED certification to a project if the design and construction process incorporates a sufficient number of strategies developed to provide beneficial environmental impacts and human benefits.

Leadership in Energy and Environmental Design

What is a Footprint?

- Carbon Footprint
  - Amount of Carbon Compounds emitted
  - Fossil Fuel usage
- Environmental Footprint
  - Clean air, water
  - No black plumes

What is sustainability?

- Any process involving methods that do not completely use up or destroy natural resources.
- Affordable.

Today's Topics

- JEFF TEASDALE – WILL PRESENT A SEGMENT ON COMPRESSED AIR MANAGEMENT. (LISA ARATO AND MIKE PIERCE)
- JEFF DEARDUFF – WILL PRESENT ON ENERGY EFFICIENT PLANTS. (CLAY MILLER)
- ROBERT BENTON – WILL PRESENT ON OVENS AND ENERGY EFFICIENCY. (MIKE DAY AND JIM WARREN)
- JACK LEWIS – WILL LEAD A TEAM RECAPPING THE FINDINGS AND PROVIDE RESOURCES FOR ADDITIONAL INFORMATION. (ELLINGTON)

Compressed Air Managment

Presented by: Jeff Teasdale

Compressed Air Management (Jeff T, Lisa, Mike P)

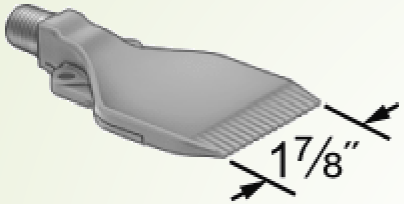
- 30% of plant electricity is used to Generate Compressed Air
  - 10-15% efficient (air motor vs. Compressor Energy)
- The Basics
  - Leaks, shut-offs
  - VFDs on Compressors
- Desired Outcomes of CA Management
  - Energy Bill Reduction
  - Waste Reduction
  - Cost Avoidance - Build up effect could allow avoidance of adding compressor(s) as a plant grows

Compressed Air Management Examples for Discussion

- Small Air Devices vs. Electric Alternatives
- Equipment Design Decisions – Bulk Handling System Study
  - Example 2 Line Bakery
- Plant Compressed Air System Design

Examples (assume 13.2* cents per kWh / 22.5 cents for 1000 cfm**)

Typical

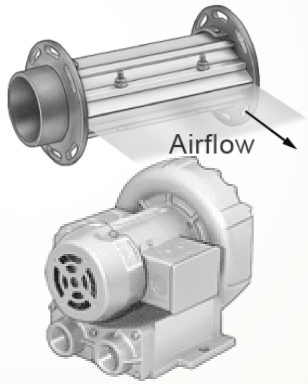


20 cfm

82 cfm for 24" Knife

20 cfm ~1,000 Btu

Alternative



$2,400 per year
VS.
$542 per year

77% less Cost

$9,670 per year
VS.
$6,960 per year

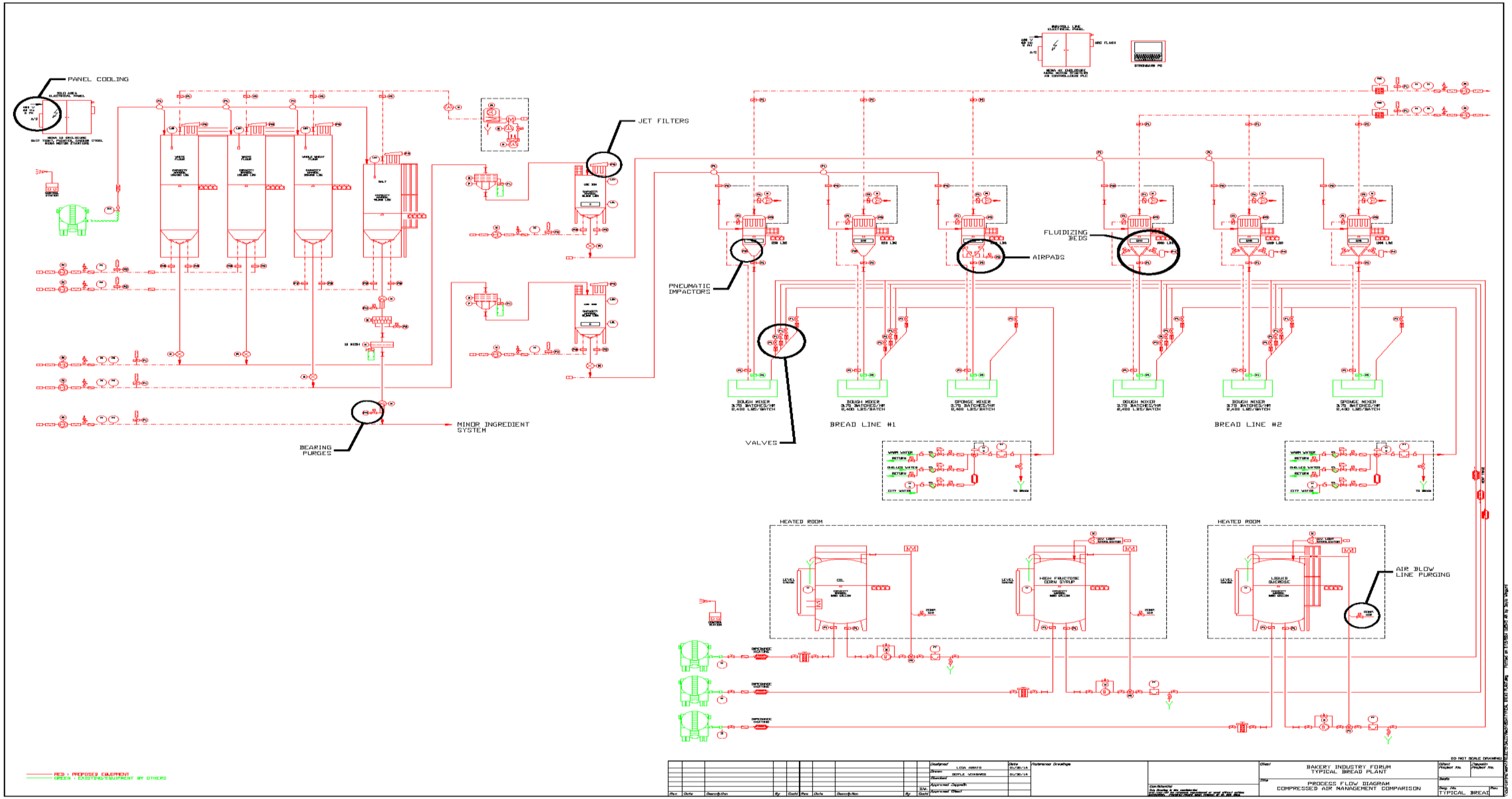
28% less Cost

$2,300 per year
VS.
$330 per year

85% less Cost

*Northeastern / Mid Atlantic AVG Industrial Rate **D.O.E – 15-30 cents per 1000 cfm is typical

Compressed Air Management
Bulk Material Handling Equipment



Compressed Air Management
in
Bulk Material Handling Equipment

Equipment Design and Set-up Decisions and Details

- Jet Filters – Pulse Programming, Electro-Mechanical Options
- Bearing Purges – Frequency and duration
- Pneumatic Vibrators or Impactors – Programming, Vibratory?
- Air Pads/Fluidizing Dischargers – Programming, Vibratory?
- Air Blow Line Cleaning - Sizing, Programming, Drains
- Valves – Assume Pneumatic

Compressed Air Management of Material Handling Equipment

Bulk Handling System Study Findings:

(2 Line bakery, 4 Silos, 2 Use bins, 6 Scale/Use Points)

Based on making the programming and equipment decisions,

In this case the annual savings would be **~$9,000 per year**

This does not account for:

- The difference in equipment cost - ~$7,500 - 10,000
- Installation cost difference
- Application specific reasons for selecting a method or device over another
- Leaks in pneumatics as they age (more upside for electro/mechanical)

Compressed Air – Plant System Design

- Provide lead compressor with VFD drive to save energy during compressed air load variations.
- Provide air receiver storage tank of 5 gallon per CFM of compressed air flow.
- Reduce demand spikes and pressure drops by installing additional receivers/storage tanks close to high-volume/ short duration point of use.
- Provide no-loss drains to allow only condensate to escape in lieu of timed drains that waste compressed air.
- Provide pressure flow control valve to minimize air leakage through piping and waste of compressed air at unregulated point of usage.
- Provide pressure gages at inlet and outlet of air filters to monitor pressure loss.
- Provide a Sequencer panel to control multiple compressors.

Compressed Air – Plant System Design

Provide a Sequencer panel to control multiple compressors.

Provide air receiver storage tank of 5 gallon per CFM of compressed air flow.

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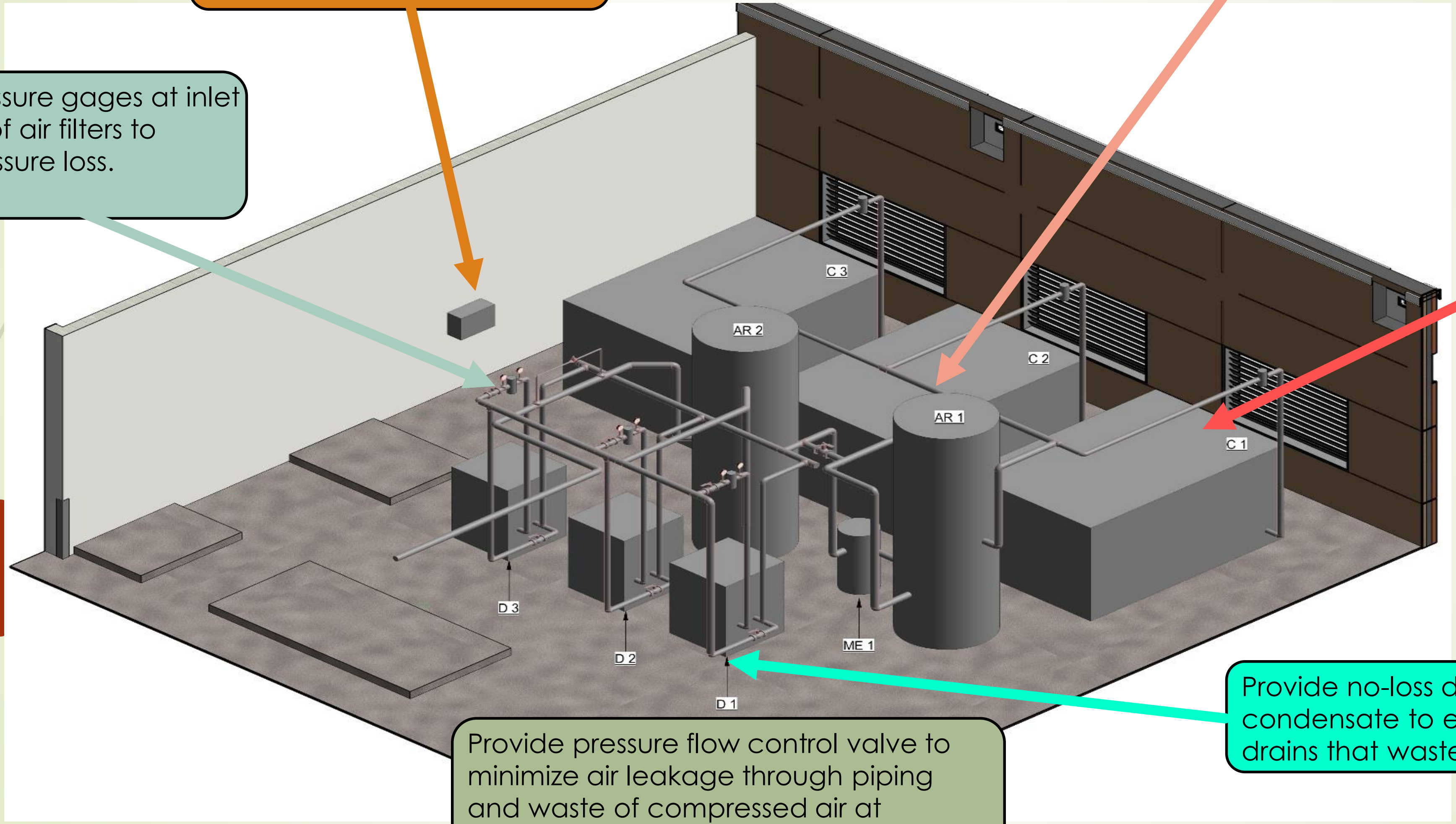
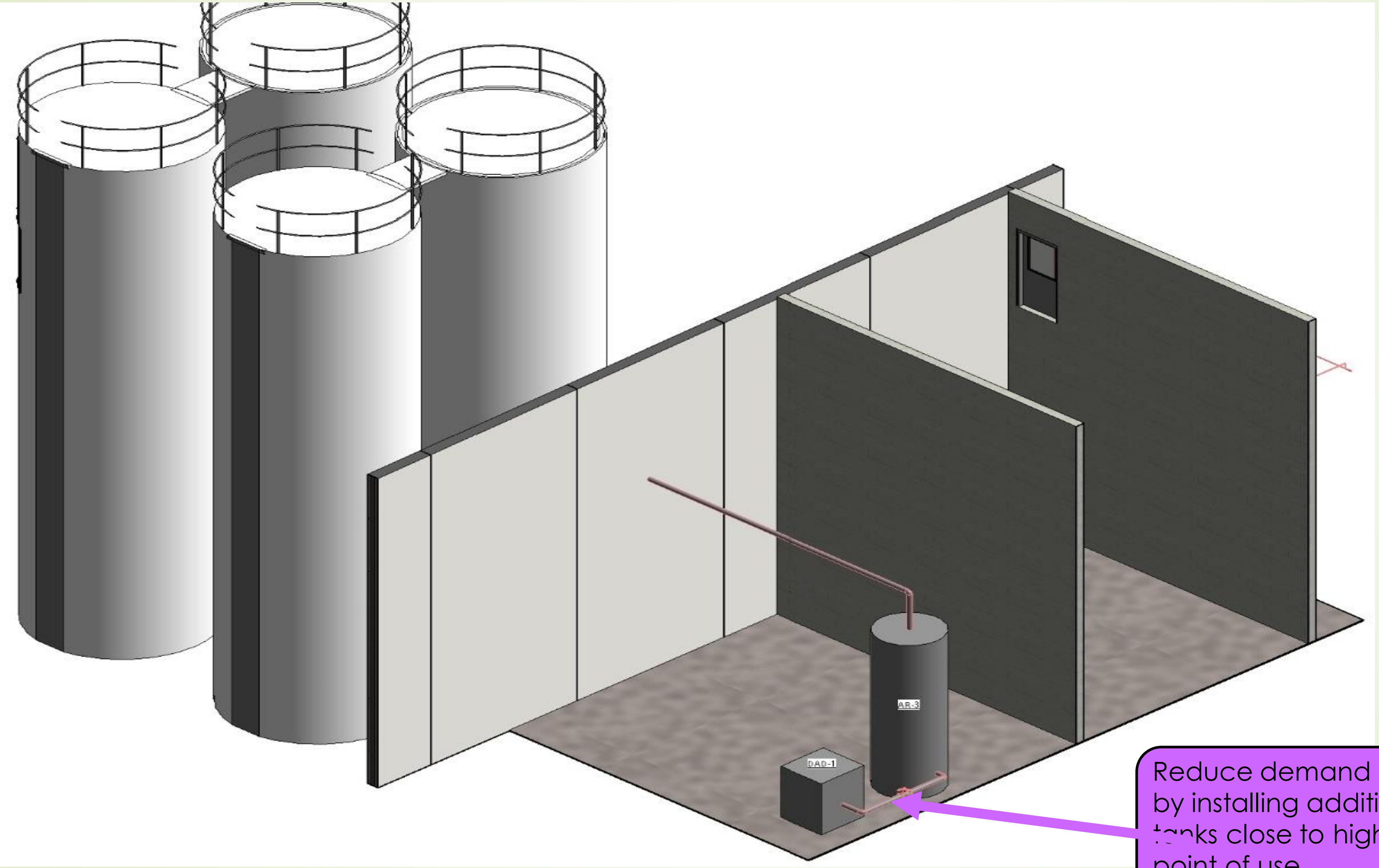


Provide no-loss drains to allow only condensate to escape in lieu of timed drains that waste compressed air.

Provide pressure flow control valve to minimize air leakage through piping and waste of compressed air at unregulated point of usage.

Compressed Air – Plant System Design - at point of use



Reduce demand spikes and pressure drops by installing additional receivers/storage tanks close to high-volume/ short duration point of use.

Energy Saving Building

Presented by: Jeff Dearduff

Green Plant Design – Case Study

Jeff Dearduff, Clay Miller

A NEW BUILD

- It all starts with the LEED Checklist
- **<u>Bakers:</u>** Make your decision up front as to whether you will design to LEED standards for energy efficiency.
- **<u>Suppliers:</u>** Know what is in the LEED checklist and be ready to provide solutions to the customer that help them make their goal.
- There is a capital cost to "Going Green", but also an ROI to that spend.
- It is imperative that you understand how to calculate the two.
- Poor calculations will lead to poor decisions in a new build.

LEED 2009 for New Construction and Major Renovations

Project Checklist

Project Name

Date

Sustainable Sites	Possible Points: 26
Construction Activity Pollution Prevention	
Site Selection	1
Development Density and Community Connectivity	5
Brownfield Redevelopment	1
Alternative Transportation—Public Transportation Access	6
Alternative Transportation—Bicycle Storage and Changing Rooms	1
Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
Alternative Transportation—Parking Capacity	2
Site Development—Protect or Restore Habitat	1
Site Development—Maximize Open Space	1
Stormwater Design—Quantity Control	1
Stormwater Design—Quality Control	1
Heat Island Effect—Non-roof	1
Heat Island Effect—Roof	1
Light Pollution Reduction	1

Water Efficiency	Possible Points: 10
Water Use Reduction—20% Reduction	
Water Efficient Landscaping	2 to 4
Innovative Wastewater Technologies	2
Water Use Reduction	2 to 4

Energy and Atmosphere	Possible Points: 35
Fundamental Commissioning of Building Energy Systems	
Minimum Energy Performance	
Fundamental Refrigerant Management	
Optimize Energy Performance	1 to 19
On-Site Renewable Energy	1 to 7
Enhanced Commissioning	2
Enhanced Refrigerant Management	2
Measurement and Verification	3
Green Power	2

Materials and Resources	Possible Points: 14
Storage and Collection of Recyclables	
Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
Construction Waste Management	1 to 2
Materials Reuse	1 to 2

Materials and Resources, Continued	
Recycled Content	1 to 2
Regional Materials	1 to 2
Rapidly Renewable Materials	1
Certified Wood	1

Indoor Environmental Quality	Possible Points: 15
Minimum Indoor Air Quality Performance	
Environmental Tobacco Smoke (ETS) Control	
Outdoor Air Delivery Monitoring	1
Increased Ventilation	1
Construction IAQ Management Plan—During Construction	1
Construction IAQ Management Plan—Before Occupancy	1
Low-Emitting Materials—Adhesives and Sealants	1
Low-Emitting Materials—Paints and Coatings	1
Low-Emitting Materials—Flooring Systems	1
Low-Emitting Materials—Composite Wood and Agrifiber Products	1
Indoor Chemical and Pollutant Source Control	1
Controllability of Systems—Lighting	1
Controllability of Systems—Thermal Comfort	1
Thermal Comfort—Design	1
Thermal Comfort—Verification	1
Daylight and Views—Daylight	1
Daylight and Views—Views	1

Innovation and Design Process	Possible Points: 6
Innovation in Design: Specific Title	1
Innovation in Design: Specific Title	1
Innovation in Design: Specific Title	1
Innovation in Design: Specific Title	1
Innovation in Design: Specific Title	1
LEED Accredited Professional	1

Regional Priority Credits	Possible Points: 4
Regional Priority: Specific Credit	1
Regional Priority: Specific Credit	1
Regional Priority: Specific Credit	1
Regional Priority: Specific Credit	1

Total	Possible Points: 110

Energy Saving Design

A NEW BUILD

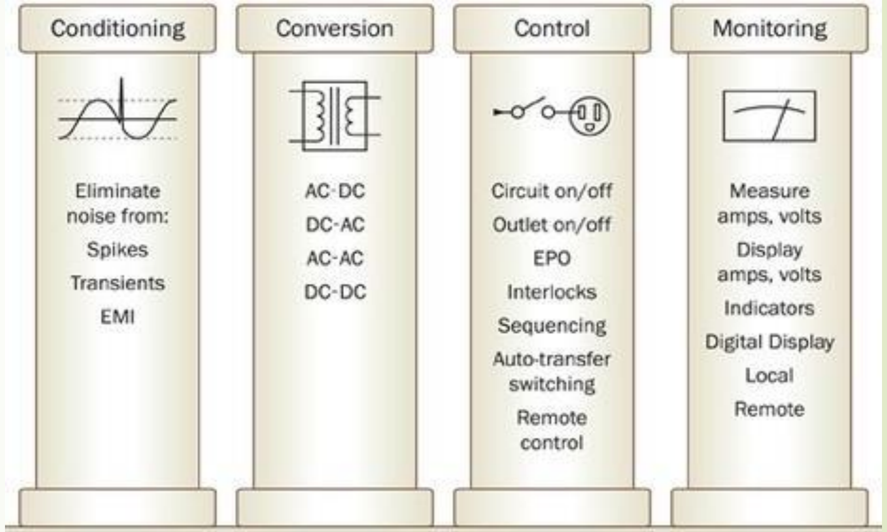
When we set out to build a new bakery;

- Power Conditioning on Incoming Source
- Sub Metering on all key systems; such as Ovens, Boilers, Mixers, Spirals, Freezers, Refer systems
- Best in class Lighting Choices with motion sensors
- Variable Frequency Drives on all 50+ HP applications
- Heat Recovery systems
- Start up procedures

Power Conditioning

A NEW BUILD

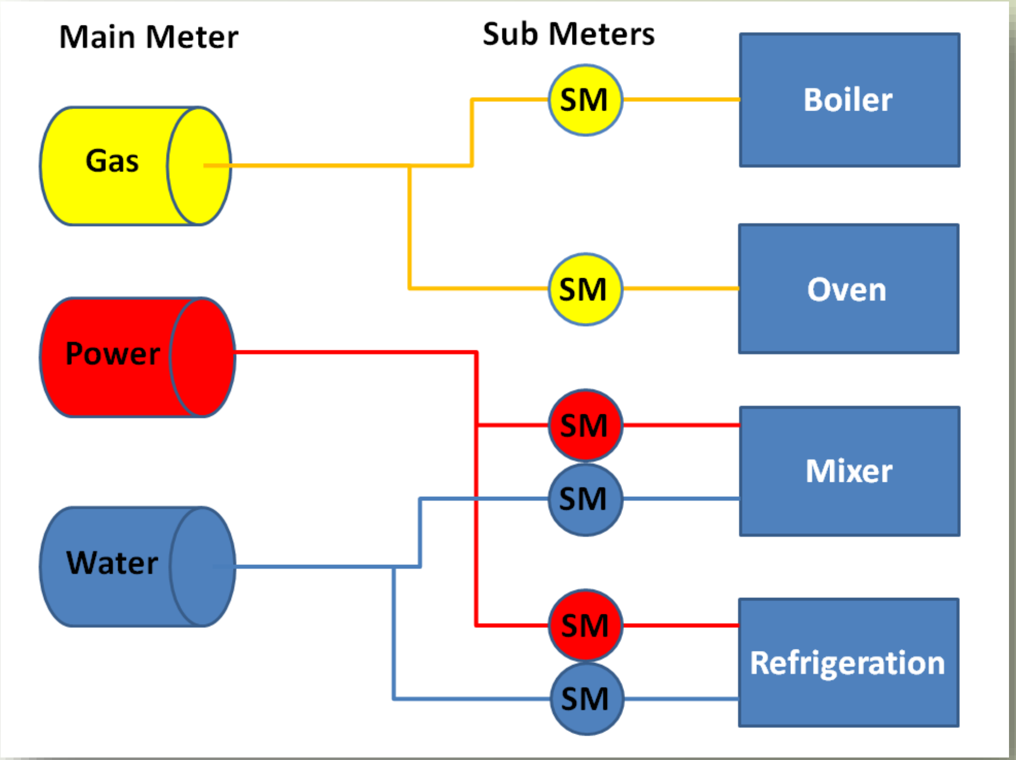
- Energy Saving Design starts with good quality power.
- Power supplies from the grid come with all levels of imbalance.
- Power Conditioning equipment can be installed that will balance the incoming supply which eliminates noise and spikes.
- Equipment down the line will operate more efficiently and have a longer service life when provided a balance power stream.
- Power conditioning allows for better conversions when going through transformers and control devices.
- Always set up to monitor and correct.



Sub-Metering Utilities

A NEW BUILD

- For long term control of power, fuel and water usage, sub-metering is installed from day 1.
- Not every source requires sub-metering to every usage point.
- Decide which utilities need to be sub-metered for best results and control.
- Sub-metering DOES NOT save energy by itself, it is simply the tool by which to measure usage.
- Measurement leads to improvement.



Lighting Design

A NEW BUILD

- The choices for efficient lighting continue to expand.
- T5 Tube Lighting is most common.
- LED is "all the rage" right now.
- Induction lighting is on the rise.
- Lighting layouts, elevations and types chosen for different areas of a bakery will drive efficiency.
- No matter what, fewer lights means fewer kilowatts.

Must Have VFD's

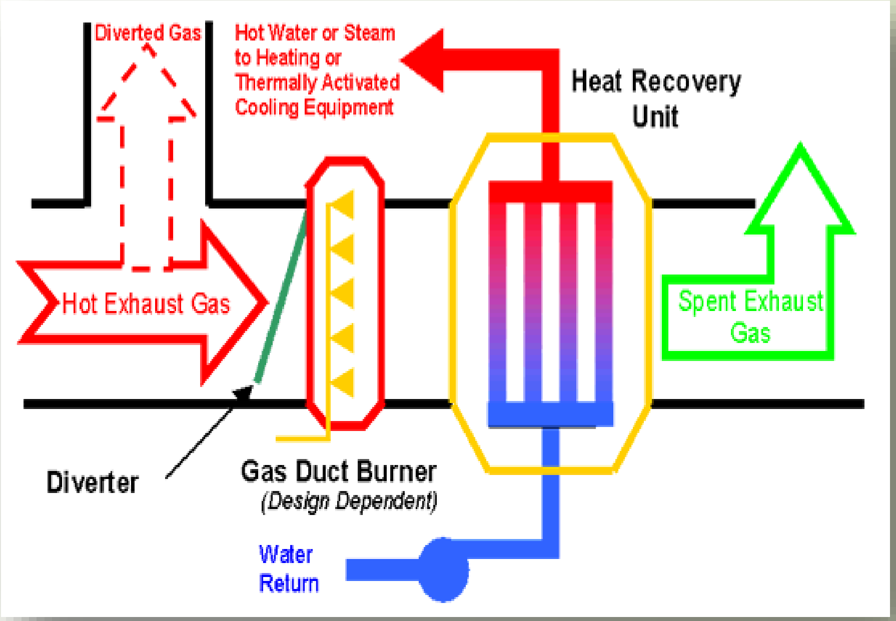
A NEW BUILD

- Variable Frequency Drives are nothing new, but their contribution to energy savings is catching on.
- This is a must have on every motor over 50HP.
- VFD's should be standard, **not options** from the manufacturer. Options make it too easy for buyers to overlook.
- Better to have as standard and to let someone ask for it to be pulled out if it is not desired.

Heat Recovery

A NEW BUILD

- This is one of the best uses of waste that can be designed into a bakery.
- Heat from ovens, boilers, air compressors and refrigeration systems can yield huge BTU's.
- This captured waste can be used to heat water, glycol and air which reduces energy consumption.



Start Up Procedures

- Energy conservation starts with gear, but ends with people.
- Starting up a line that has energy saving design features can cost you money if not managed correctly.
- Fire an oven too early and you waste gas!
- Fire up a large conveyor systems too early and you waste electricity!
- PEOPLE and PROCEDURE make the difference.

ROI of GREEN Design

- Power Conditioning Savings;
  - Balanced power, more efficient at the motor.
  - Reduced or eliminated penalties at PEAK times.
- Sub-Metering Savings;
  - Measurement x Control = Results
- Lighting Design Savings;
  - Reduced electricity demand
- VFD's Savings;
  - Reduced electricity demand
  - Less wear and tear on equipment and controls
- Heat Recovery Savings;
  - Elimination or reduction of energy inputs
- Start Up Procedures;
  - Reduction in total energy demand

Bakery Oven – A Necessary Cost & Source of Savings

Presented by: Robert Benton

Bakery Oven – Necessary Cost

Oven

- What are the **Operating Costs**?
- How do we **Offset** these **Costs**?
- Discuss **Results** and **Savings**

Operating Costs

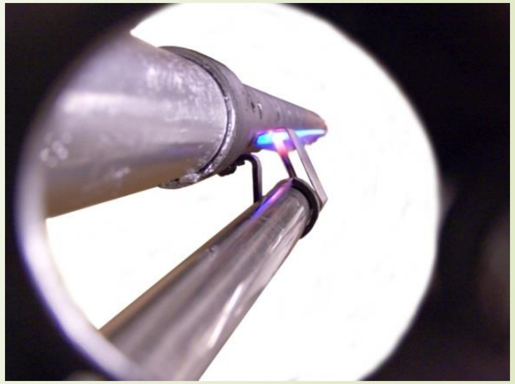
- Fuel
  - Natural Gas
- Electrical
- Maintenance

Ways to Improve Oven Efficiency

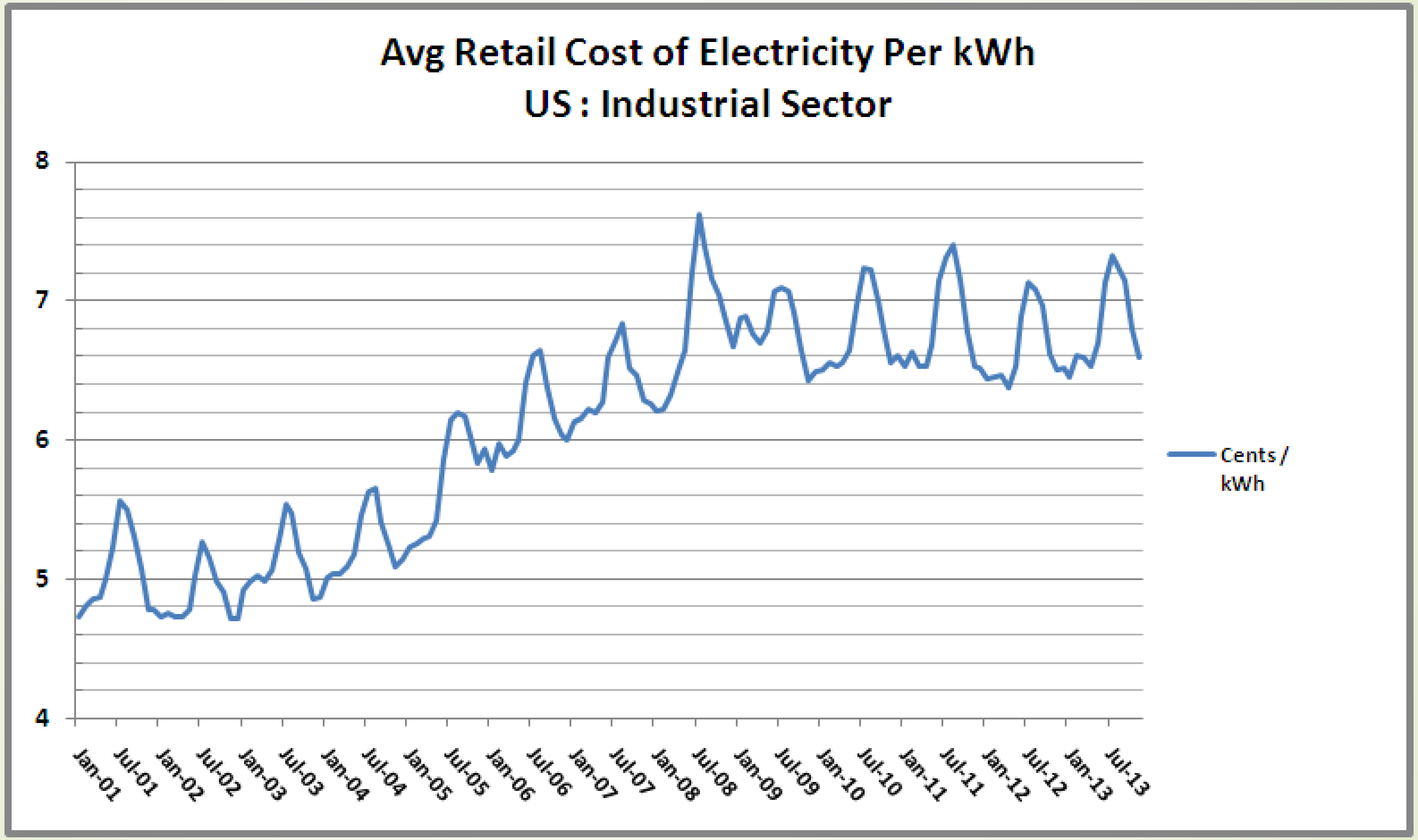
- Methods of Reducing Costs
  - Direct Spark Ignition – (DSI)
  - Exhaust Stack Heat Recovery

Direct Spark Ignition (DSI)

- A Platform for Oven Automation
- Transition from Constant Spark Ignition to Direct Spark Ignition (DSI)
  - Creates electrical energy and natural gas savings
  - Reduces maintenance hours required to maintain burner reliability
  - Provides burner ignition system reliability
- Automation
  - Provides expanded oven control
  - Enables effective burner staging
  - Improves zone heat input and turn down ability
  - Maintains burner lateral heat definition
  - Significantly improves burner ignition reliability



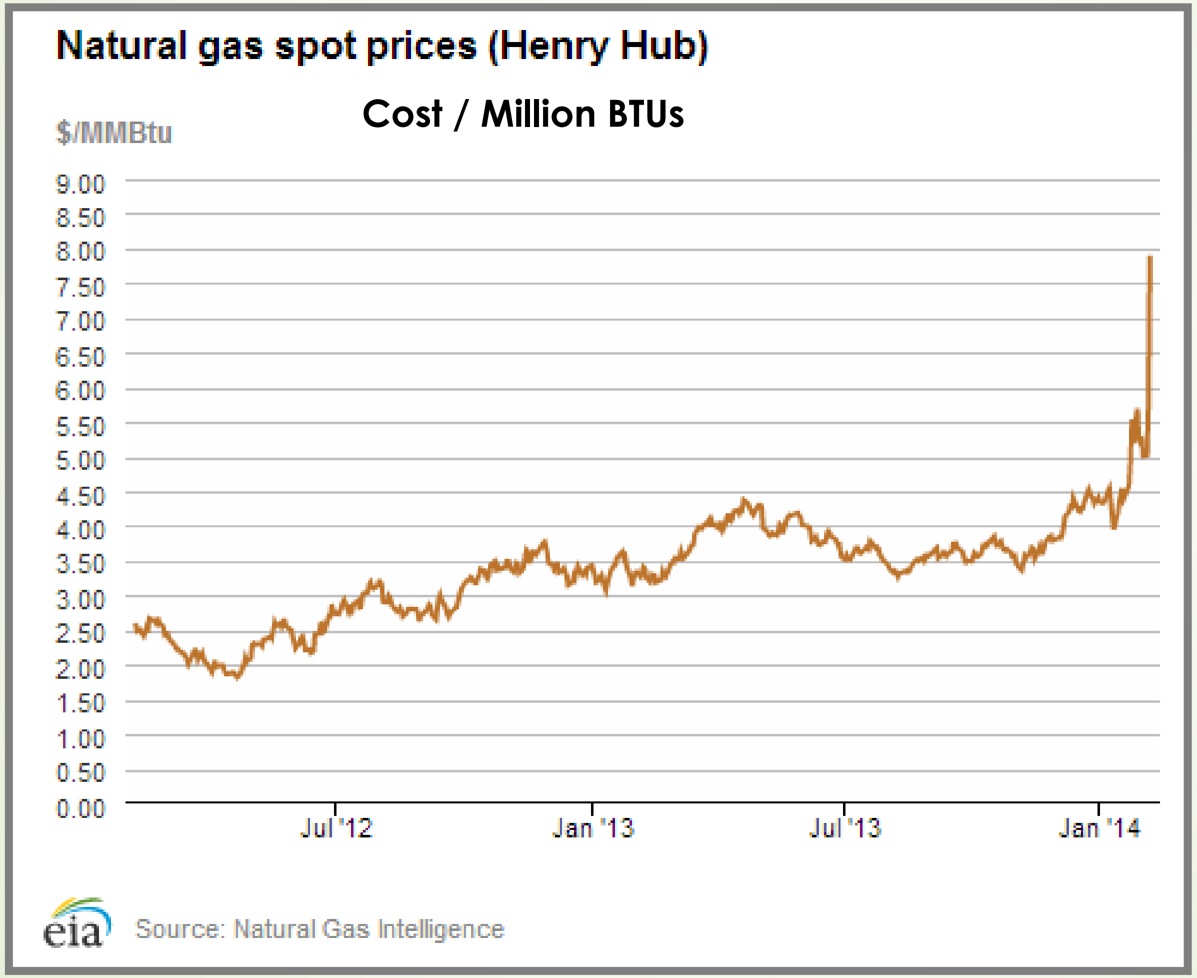
Cost Saving Opportunities



DSI Electrical Savings

- Creates instant electrical savings
  - Constant spark ignition transformers no longer energized continuously.
  - Saving of ≈100 Watts per burner
- DSI Electrical Savings example:
  - Typical 108 burner direct fired Tray Oven
  - .1 KWH per burner X 108 burners = 10.8 KW
  - 10.8 KW X 24 hrs = 259.2 KWH per day
  - 259.2 KWH per day X 6 days per week X 50 wks per year = 77,760 KWH per year
  - 77,760 KWH per year X .08 per KWH = **$6,221.00 Annual Electrical Savings**

Cost Saving Opportunities



DSI Natural Gas Savings

- DSI Creates instant natural gas savings
  - Failed burners no longer allowed to vent unburned natural gas into bake chamber and exhausted out the oven exhaust stack.
  - Direct Spark Ignition (DSI) system shuts off natural gas supply to failed burners.
  - Natural Gas Savings example for a 108 Burner direct fired Tray oven:
    - Assuming a conservative estimate of 10% of burner failure in a 108 burner oven using a constant spark ignition system
    - Assuming a typical burner firing rate capacity of 60,000 BTU/Hr
    - 108 @ 10% failed = 11 failed burners
    - 11 burners X 60,000 BTU/Hr X 67% average firing rate = 442,200 BTU/Hr wasted
    - 442,200 BTU/Hr / 1000 BTU/CF natural gas = 442.2 CFH wasted
    - 442.2 CFH X 24 Hrs per day X 6 days per wk X 50 wks per yr = 3,182,400 CF per yr
    - 3,182,400 CF per year = 3,182.4 MCF wasted per year
    - 3,182.4 MCF per yr X $5.50 per MCF = **$27,687 Annual Natural Gas Savings**

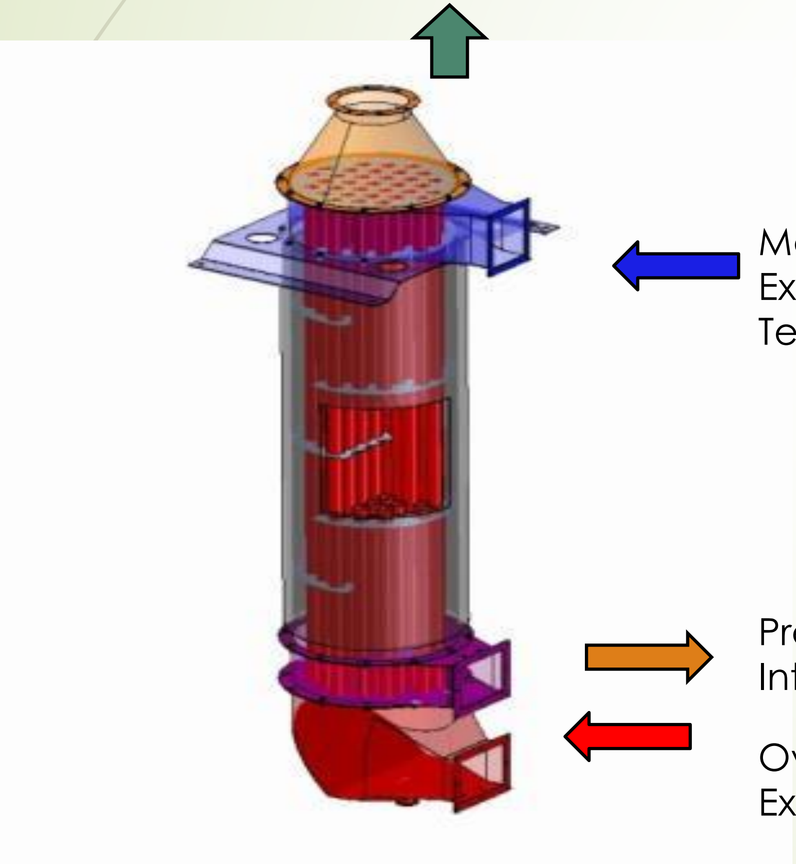
DSI Additional Savings

- Scrap Reduction and Improved Response Time
  - Better and more precise zone temperature control
  - Eliminate flash pans & flash heat related scrap
  - Minimize changeover time - As little as a one zone gap required
  - Enhances product quality and improves consistency

Exhaust Stack Heat Recovery

- Concept

Oven Exhaust Air after Heat Exchanger (125-150°C)



Make-Up Air Into Heat Exchanger at Room Temperature (30-40°C)

Pre-heated Make-Up Air Into Oven (100-150°C)

Oven Exhaust Air into Heat Exchanger(175-200°C)

Oven Exhaust Heat Recovery

- Recover heat from the ovens exhaust stream
  - Can be done with or without the use of oxidation equipment
    - The use of oxidation equipment consumes more energy but also provides a greater potential for recovery
  - Captured heat can be transferred into a water/glycol solution and redistributed through the plant with pumping systems made into steam, or in some cases, directly to air

Oven Exhaust Heat Recovery End Uses

- Process
  - Proofers (dry/wet heat)
  - Fermentation Rooms
  - Process & Domestic Water Heating
  - Boiler Feedwater
  - Cooling Retarders
  - Product Cooling Systems
  - Tray/Pan Washers
  - Preheating Combustion Air

Environmental Factors

- Environmental Impact
  - Greenhouse Gas Reductions
    - 2-Line Plant >600-Tons
    - 3-Line Plant >1,000-Tons
- Demonstrates responsibility to the environment
- Reduces air quality permitting levels where existing heating equipment can be eliminated or reduced in size
- Decreases boiler chemical use
- Can impact food safety issues – Not using raw steam

In Recap…
Cost Saving Opportunities

- Capital Cost Avoidance
  - No boiler room $100 Ft2 (Greenfield)
  - No steam boiler in many cases (feedwater, deaerator, piping, venting, etc.)
  - Code requirements reduced (combustion air, emergency shut-off, fire, etc.)
  - Same initial cost as steam system (traditional)
- Maintenance Cost Avoidance
  - No steam boiler maintenance (traps, chemicals, water softening, etc.)
  - No chemicals wet heat (Food Safety)-Not using raw steam
  - Low operation cost
- Energy Cost Savings
  - Immediate positive cash flow Greenfield plants
  - Existing plants ROI <10-Years
  - Thermal and electrical opportunities
- Environmental Savings
  - Reduce emissions exposure by more than 600-tons per year

Resources & Recap

Presented by: Jack Lewis, III

Summary

- Today the BIF panel presented multiple strategies bakeries are using to become sustainable through energy efficiency.
- Together we covered some of primary areas of energy use in plant and ideas on how to make them more efficient
  - Compressed Air Management – in equipment design and Plant system design
  - Energy Saving Design – lighting, facility layout, sub metering, power conditioning, and drives/motors.
  - Ovens - Direct Spark Design and Heat Exhaust recovery.

Sustainable, Cost Effective, and Green

- Each study today followed one or more of the 3 Rs of Sustainability:
  - Reduce,
  - Reuse,
  - Recycle
  - 4th R - Rethink
- Each provided a measurable saving in dollars and emissions.
- Most importantly they are doing the right thing and making their customers happy!

Further Information, Resources, and Help.

- www.bema.org/resources

- Includes links to all the resources in this presentation
- Includes links to useful Sustainability regarding Disclosing Emissions and Footprints

Energy Efficiency Q&A

BIF, the baking industry forum