Commercial Boiler Webinar
January 26, 2011

Brought to you by CenterPoint Energy
Speakers

Jon Williams
Manager Energy Sales
CenterPoint Energy

Lance Orton
Energy Efficiency Consultant
CenterPoint Energy

Eric Burgis
Dir. Res & Com Markets
Energy Solutions Center

Rich Biljetina
Dir. Energy Technologies
Energy Solutions Center
What we will cover today?

- Boiler Market Statistics and Drivers
- Boiler and Steam System Solutions
- Rebate Programs and Services
U.S. Commercial Boilers – Energy Consumption (2005): ~ 1.6 Qbtu / yr or nearly 30% of all energy in commercial facilities

CO2 Emissions - Commercial Boilers: ~ 120+ MtCO₂ / yr
U.S. CO2 Emissions:

U.S. CO2 Emissions (MMtCO₂) – 1980 - 2006:
Global agreements target reductions below 1990 emissions (reductions of over 1 Billion mtCO₂/yr)

CO₂ Equivalents (lbs / MMBtu)
- Natural Gas – 117 lbs
- Propane – 139 lbs
- Distillate Fuels – 162 lbs
- Residual Fuels – 174 lbs
- Coal (BC) – 205 lbs
- Coal (AC) – 227 lbs
Rated in Horsepower (hp):

- One boiler horsepower equals 33,475 Btu per hour
- Energy rate required to evaporate 34.5 lb (15.65 kg) of water at 212°F (100°C) in an hour

See http://en.wikipedia.org/wiki/Horsepower
Firetube vs Watertube Designs

Firetube Design
Series of straight tubes in a water-filled outer shell. Combustion gases flow through the tubes and heat water in outer shell.

Watertube Design
Combustion gases circulate around water-filled tubes. Pressure confined inside of the tubes. Common in large power plants, available as packaged systems or can be field erected.
Small Commercial Boilers

Sectional Boilers
- Assembled using a number of cast sections
- Unit sizing up to 150 hp
- Efficiency ranges from 80%-96%

Copper Fin Tube Boilers
- Water tube design – flows through pipe fitted with fins
- Increased heat transfer surface /Compact design
- Sized from 45,000 -2,065,000 Btu/Hr
- Efficiency ranged from 82%-97%
Time to Change Out That Boiler?

U.S. C&I Boiler Inventory

47% are 40 plus yrs old
76% are 30 plus yrs old
Advancements in Boiler Technologies

• Modular Boilers
• High Efficiency Boilers
• Linkage-Less Controls
Making the Case for Modular Boiler Systems

- Fuel-to-Steam vs. In-Service Efficiency
- Understanding operating efficiency = tracking energy losses
Modular Compact Boiler Systems

Low NOx Burner

Miura Design

Clayton Design

Low-Water Inventory Principle Contributes to High ‘In-Service Efficiency’
Several steam or hot water modular boilers replace one large boiler that operates much of the time at low efficiencies.

High fuel-to-steam/hot water efficiencies are maintained over wide variations of load.

Added benefits:
- Low space and weight requirements
- Rapid start-up
- Rapid response to changes in steam demand
- High steam quality
- Reduced emissions
- Reduced blow-down

Save $$ by Improving Your In-Service Efficiency
Compact Boiler Save Space and Provide Flexibility
“If building loads are highly variable, as is common in commercial buildings, designers should consider installing multiple small (modular) boilers.”

“Modular systems are more efficient because they allow each boiler to operate at or close to full rated load most of the time, with reduced standby losses.”
High Efficiency and Condensing Boilers Systems
Why Bother with High Efficiency?

‘Typically, a boiler will consume its initial capital expenditure in fuel usage within its first year (based on 24/7 operation); therefore, increases in a boiler’s efficiency by just a few percentage points can amount to substantial cost savings’

Quote from Today’s Boiler, Fall 2009

Author: Steve Connor, Director of Marketing Services, Cleaver Brooks
High Efficiency Boilers: An Example

ClearFire Hot Water Boiler by Cleaver-Brooks

- Hinged Premix Burner with Metal Fiber Head
- Full Modulation (5:1 Turndown)
- Efficiencies up to 98%
- Single Pass - Down Fired Design
- Fully Condensing Design
- No minimum flow requirements.
- No minimum return water temperatures

ClearFire Steam Boilers: 10 – 60 HP
High Efficiency Boilers: An Example

Vantage Hydronic Boiler by Fulton

- Linkageless Modulation
- Efficiencies up to 99%
- Fully Condensing Design
- Dual Fuel Capabilities.
- Low Emissions Option Available
  < 9vppm NOx

Vantage available in 2,3,& 4 Million But/Hr Input
Consider Adding a Condensing Economizer

Water in products of combustion is vaporized due to heat of combustion
17% of the energy from natural gas combustion is recoverable water vapor.
Normally energy is lost to atmosphere with exhaust gases leaving the stack
Heat of vaporization can be recovered if flue gases are cooled below water dew point
When water vapor condenses, it releases heat of vaporization
Condensing economizers recover both the heat of condensation (latent heat) and sensible heat

You must have a heat sink for the recovered heat!.... paybacks are very low!!!
The Case for Condensing Economizers

A CASE HISTORY
Heinz Inc - Stockton, CA

- Patented Combustion and Energy Systems *ConDex* Cylindrical In-Stack Condensing Economizer.
- Installed on a 350 HP boiler.
- Recovers 1,264,000 Btu/ hr.
- Yearly savings $105,900.00
- Annual CO2 Emissions reduction: 732 Tons/ year
- Annual Water Recovery: 544,530 Gallons per year
Boiler MFGs working with ESC to Promote Energy Efficiency

Clayton Industries
www.ClaytonIndustries.com

Cleaver Brooks
www.Cleaver-Brooks.com

Combustion and Energy Systems
www.CombustionandEnergy.com

Fulton
www.Fulton.com

Miura
www.MiuraBoiler.com

Hurst Boilers
www.HurstBoiler.com
Linkage-Less Boiler Controls:

SAVE ENERGY & $$

CONSIDER A RETROFIT
Why Migrate Toward Linkage-Less Boiler Controls?

The Problem
Jackshaft/Linkages
- Slop/wear
- Hysteresis losses
The Solution: Linkage-Less Controls

The Benefits

- Safe and reliable operation
- Repeatability and less maintenance
- Emissions reduction
- Increased boiler efficiency
- Energy savings $$$

- Fuel/Air ratio control
- Burner safety control
- UV or IR flame safeguard
- Gas Valve Proving
- FGR Management
- Precise target setpoint control (PID)
- Lead lag control for both steam and hot water (I.B.S.)
- 3 Parameter Trim, $O_2$, $CO_2$ & CO
### Case Study: INTEL (New Mexico)

**Five Boilers**

**Annual Reductions**

- **592 lbs NOX (30%)**
- **5,731 lbs CO (93%)**

**Electricity Saved:** $35,000

**Maint. Savings:** $40,000

**NG Savings:** $170,000

<table>
<thead>
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<th>Lever Position</th>
<th>NOx ppm Before</th>
<th>NOx ppm After</th>
<th>CO ppm Before</th>
<th>CO ppm After</th>
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<tbody>
<tr>
<td>Low Fire</td>
<td>23.0</td>
<td>27.2</td>
<td>263.0</td>
<td>2.8</td>
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<td>2</td>
<td>23.0</td>
<td>20.3</td>
<td>71.0</td>
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<td>24.0</td>
<td>20.2</td>
<td>55.0</td>
<td>0.0</td>
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<tr>
<td>4</td>
<td>26.0</td>
<td>22.0</td>
<td>10.0</td>
<td>0.0</td>
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<td>5</td>
<td>26.0</td>
<td>21.9</td>
<td>1.0</td>
<td>0.0</td>
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<td>6</td>
<td>25.0</td>
<td>24.2</td>
<td>0.0</td>
<td>0.1</td>
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<td>7</td>
<td>27.0</td>
<td>21.6</td>
<td>0.0</td>
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<tr>
<td>8</td>
<td>27.0</td>
<td>24.7</td>
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<td>0.7</td>
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<tr>
<td>9</td>
<td>28.0</td>
<td>24.8</td>
<td>1.0</td>
<td>1.6</td>
</tr>
<tr>
<td>High Fire</td>
<td><strong>29.0</strong></td>
<td><strong>21.8</strong></td>
<td><strong>1.0</strong></td>
<td><strong>0.6</strong></td>
</tr>
</tbody>
</table>

**Case Study – Courtesy Autoflame**
Resources for Linkage-Less Controls –
presented at June 2010 ESC Panel Session

Autoflame
www.autoflame.com

Fireye
www.fireye.com

Honeywell
- Industrial/Process Control Group
http:hpsweb.honeywell.com/cultures/en-us/default.htm
The Cost of Steam Trap Failure!

Steam Pressure (orifice Size in)

- 15 psi (5/32") $210
- 50 psi (5/32") $457
- 125 psi (1/8") $632
- 200 psi (7/64") $743
- 400 psi (5/64") $733
- 600 psi (3/32") $1,086

US Dollars

Dollar Loss in 1 month @ $15/1000 lbs

Source: Armstrong International
Identify that malfunctioning steam trap!

Courtesy FLIR
Is Your Insulation Telling a Story?

Applications for IR Thermography

Steam Systems

- Wet Insulation - Blanket is saturated with water due to leak in steam tracing.

Another Example where your eye can be deceived.
These Companies Can Help You:

**FLIR Systems**

**Fluke Corporation**
http://us.fluke.com/usen/products/CategoryTI/
New Innovative Ways to Monitor Your Steam System

SteamEye®
Best Practice Steam Trap Monitoring

and a sustained (24/7) monitoring process.

SteamStar™
Best Practice Steam System Measurement

Company wide awareness and measurement of steam trap performance for ROI decision making.

Armstrong
What is SteamStar™?

Web-based steam trap management platform

Helps customer’s efforts toward proactive trap management

Used to monitor, measure, and manage steam trap data
Radio Frequency 24/7 steam trap monitoring system (902-928 MHz)

Tests for a failed open or failed closed trap

The trap population can be viewed from any computer in the company network

2-3 psig to 600 psig steam pressure
An Answer to Those Difficult/Dangerous to Access Locations
Components of SteamEye® 4000 Series

Monitors:
- Ultrasonic & Conductivity
- Repeaters
- Gateway
Additional Steam System Resources:

**Armstrong**
https://www.armstronginternational.com/steam-system

**Spirax Sarco**
http://www.spiraxsarco.com/

**Yarway**
http://www.yarway.com/steam_traps.asp
DOE Resources for Energy Savings

- Energy analysis software tools
- Case studies/tip sheets/manuals
- Energy efficiency training for plant staff
- Qualified software specialists
- DOE-supported energy assessments
- Plant information package & CD

Info Center: 877-337-3463
Website: www.eere.energy.gov/industry/saveenergynow
Boiler House Improvements!

Boilers
Burners
Controls

Brought to you by ESC’ Boiler Consortium

www.CleanBoiler.org
Tankless Water Heaters
Tankless Water Heaters

Have no storage tank
Heat water on demand
Higher first cost but they last three times longer
No standby-losses from the tank provide energy savings
High efficiency: 97+%  

Customers like both the ‘look’ and the space-saving features!
What Makes Tankless Water Heaters Green?*

They reduce energy consumption by up to 40% because you heat water only on demand.

They can save water by heating water quicker and because they can be placed close to fixtures, reducing time for hot water to arrive.

They can reduce your carbon footprint with better energy efficiency and lower gas emissions.

They reduce waste and material usage by being much smaller than traditional hot water tanks and they last 3 times longer.

They have many recyclable parts, including copper and steel core components.

*http://tanklesswaterheating.net
Tankless Water Heaters: Lots of Choices!

- AO Smith
- American Water Heater Co.
- Bosh
- Navien America
- Noritz
- Rheem
- Rinnai
- RUUD
- State Water Heaters
- Takagi
Commercial Boiler Webinar

Rebate Programs and Services
Minnesota Commercial Rebate Programs and Services

Overview of 2011 programs & services

• Boiler and boiler system component rebates
• Other heating system rebates
• Water heater rebates
• Foodservice equipment rebates
• Custom rebates

Programs valid January 1 – December 15, 2011
Boiler and Boiler System Component Rebates

- High efficiency hot water boilers
- Low-pressure steam boilers
- High-pressure steam boilers
- Turbulators
- Burners
- Stack dampers
- Steam trap repair/replacement
- Boiler tune-ups
- Reset and cutout controls
Boiler System Rebate Example

Hot Water Boiler

2,000,000 BTUH Input = 2 MMBtuh Input

87% Designed/Installed Efficiency Rating

High-efficiency hot water boilers
Up to 12.5 MMBtu

85% - 87.9%

$1,700/MMBtuh input +
[$200/MMBtuh input x (New efficiency rating - 85)]

(87 - 85) = 2 x $200/MMBtuh Input = $400/MMBtuh Input + $1,700/MMBtuh Input = $2,100/MMBtuh Input

First Calculate Efficiency Bonus

Add Base Rebate

Incentive per Input Rating

Rebate = 2 MMBtuh x $2,100/MMBtuh Input = $4,200
Other rebates available

Other heating system rebates:
- Forced-air furnaces
- Unit heaters
- Infrared heaters

Water heater rebates
For more information in Minnesota

• Visit: CenterPointEnergy.com/businessrebates

• Contact your account manager or 612-321-4330

• Call our Business Customer Hotline at 612-321-4939 (1-877-809-3803)
<table>
<thead>
<tr>
<th>Equipment</th>
<th>Unit size in Btu/hr input</th>
<th>Efficiency * Requirement</th>
<th>Rebate Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-efficiency boiler</td>
<td>Minimum 100,000</td>
<td>85% to 91.9%</td>
<td>$1,400 per MMBtuh Input - up to 25% of equipment cost</td>
</tr>
<tr>
<td>High-efficiency boiler</td>
<td>Minimum 100,000</td>
<td>92% or greater</td>
<td>$2,000 per MMBtuh Input - up to 25% of equipment cost</td>
</tr>
</tbody>
</table>
### Arkansas 2011 Boiler Rebate Program

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Rebate Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully Modulating or 6 step Modulation Boiler Burner</td>
<td>$1,000 per MMBtuh input - not to exceed 25% of equipment costs</td>
</tr>
<tr>
<td>Vent Damper</td>
<td>Up to $250 per boiler - not to exceed 25% of equipment costs</td>
</tr>
<tr>
<td>Boiler Reset Control</td>
<td>Up to $150/control system - not to exceed equipment cost</td>
</tr>
<tr>
<td>Boiler Cut-out Control</td>
<td>Up to $150/control system - not to exceed equipment cost</td>
</tr>
<tr>
<td>BTUH Input</td>
<td>Efficiency Rating</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>900,000</td>
<td>94%</td>
</tr>
<tr>
<td>2,500,000</td>
<td>95%</td>
</tr>
<tr>
<td>31,383,000</td>
<td>87%</td>
</tr>
</tbody>
</table>
Other Arkansas 2011 Rebate Programs

- Natural Gas Energy Audit Program
- Food Service Equipment Rebates
- Heating System Rebates
- Water Heater Rebates
Contact Information for Arkansas

Website: CenterPointEnergy.com/arkansasrebates

Toll Free Number: 888-498-0409

Email: ArkansasEfficiency@CenterPointEnergy.com
Minnesota
Jon Williams
(612)321-4390
jon.williams@centerpointenergy.com

Arkansas
Lance Orton
(501)-377-4548
lance.orton@centerpointenergy.com

Texas, Oklahoma, Mississippi and Louisiana
Steve Landrum
(877)-OPT-4GAS
steve.landrum@CenterPointEnergy.com

Thanks for Joining us Today!