

***Custom, creative ideas for  
energy savings and make-up air  
management***

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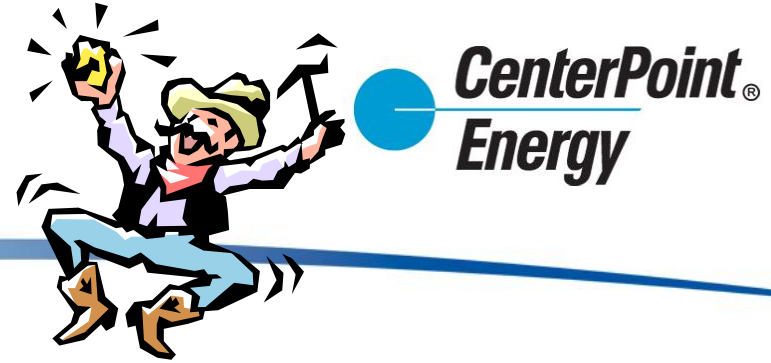
## What is the custom rebate program?

The custom rebate program is designed to provide rebate opportunities to natural gas saving technologies not covered in our Prescriptive rebate offerings. **Projects are reviewed and approved on a “case-by-case” basis.**

## For a project to be approved for a custom rebate:

- Contact us early on in the idea or proposal stage to review the project.
- Preapproval is required before you purchase equipment
- Provide project scope, energy savings calculations and project costs (new custom rebate application available soon).
- If the project qualifies for a rebate CNP will return a “pre-approval”
- Upon receipt of pre-approval, begin purchase

# Heat Recovery



## Prospecting: What are you cooling & heating?

- List all thermal processes
- Cooling tower plume is indicative of waste heat
  - Work backwards from cooling tower to product
- Get down to the product/water/air heating level
- Review for potential heat exchange
  - Water to water; product or air
  - Air to product; water; or air
  - Product to product; water; or air

# Heat Recovery

- Ensure proper design
  - Cross contamination
  - Pressure losses
  - Engineering Assistance
- Avoid corrosion
  - Use premium materials
- Consider Cleaning
- CIP rebate - Quick Payback
  - Cover greater distance between source & sink
  - Cover more heat exchange surface area
  - Cover better materials
  - Cover insulation
  - Cover controls

## Not just for home ventilation!

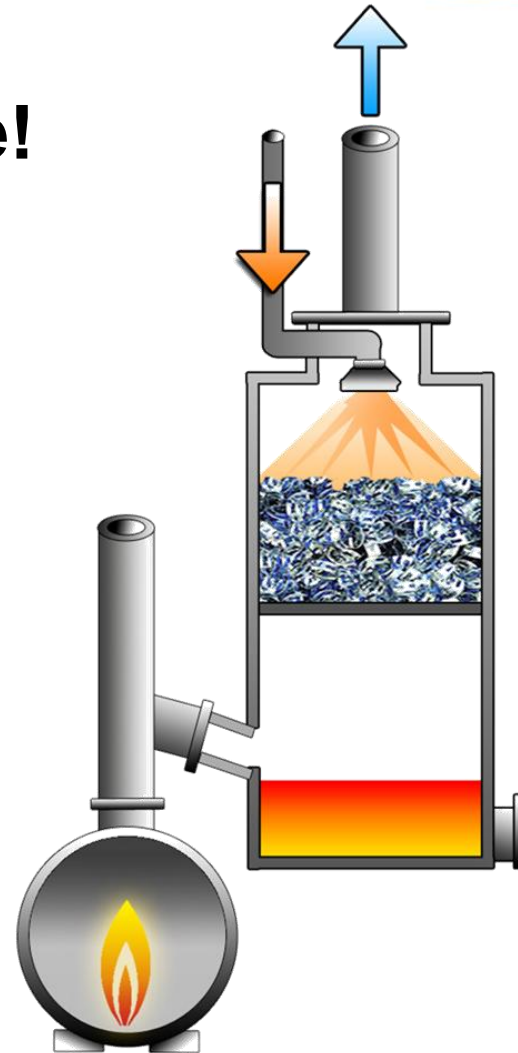
- Up to 90% of energy is recoverable!
  - Plate
  - Heat Wheel
  - Run around loop
  - Heat pipes
- Add on to your HVAC/MAU systems!
- Process Dryers
- Oven
- Kilns
- Furnace
- Thermal Oxidizer



# Economizers

## Not just for boilers anymore!

- Thermal Oxidizer
- Oven
- Dryer
- Kiln
- Engines
- Cogeneration



# Make Up Air Heating

- First use waste heat!
- Indirect or steam fired  $\approx 80\%$
- Direct Fired  $\approx 92\%$
- Savings 15%



# Roof Top Units

## Simple units designed to heat/cool & ventilate

- Supply fresh air & exhaust stale air
- Economizer/OA Damper
  - Schedule control
  - CO<sub>2</sub> demand control
- Heat Exchanger



# Condensing Water Heater

- First use waste heat!
- Heating process or wash water with steam is  $\approx 80\%$
- Condensing water heaters are up to  $\approx 99\%$  efficient
- $\approx 23\%$  savings!
- Capable of heated water meeting food grade quality standards
- Water quality unchanged



Illustration courtesy of Armstrong  
<http://www.armstronginternational.com/flo-direct>

# Insulation

## Not just for ceilings, walls & pipes!

- Steam Fittings
- Boilers
- Ovens
- Kilns
- Pumps
- Savings, Rebates, Safety, & Comfort
- What have you got that's hot?



Pictures courtesy of Blanket Insulation  
[www.blanket-insulation.com](http://www.blanket-insulation.com)

# Prospecting Deeper!



- What can apply to your facility or process?
- Centrifuge – more efficient to spin water out than to dry thermally
- Evaporator – add effects – use evaporate for heat
- Production Improvement – Fermentation Tank
- Food processor – upgrade oven from burner to infrared
- Thermal Oxidizer – RTO – 90% heat recovery

# Air Compressor Heat Recovery



- 80-93% of electricity is converted to heat
- 50-90% of that heat is “recoverable”
- Usable for process heating; water heating; space heating; makeup air heating; combustion air heating; desiccant regeneration; and industrial drying
- $\approx 50,000$  Btu/hr available per 100 cfm full load capacity

## Air Cooled Systems are best used to heat air

- 30-40<sup>0</sup>F Temp increase typical
- Packaged compressors “amenable” to heat recovery
- Already have a cabinet designed to cool air & oil
- Simply need duct work, fan (possibly filter) & controls
  - combustion air heating; drying; desiccant regeneration; and makeup air heating
- Simple hinged vent can divert unnecessary heat
- Hot water can be produced by the oil cooler with a heat exchanger
- Ensure proper design –CNP Engineering Assistance program.

# Energy Savings Calculations



- Savings = Compressor bhp x 2,545 Btu/bhp-hour x hours x recovery efficiency ÷ heating system efficiency. (2,545 is a simplified conversion factor)
- Ex: 100 hp x 2,545 Btu/bhp-hour x 6,000 hours/year x 80% recovery efficiency ÷ 80% efficient boiler x 1MMBtu/1,000,000 Btu = 1,527 MMBtu/year
- 1,527 MMBtu/year x \$5.00/MMBtu = \$7,635/year.
- Potential CIP rebate of \$5,000.
- Cost of operating an additional fan for duct loading has not been included

# Refrigeration Heat Recovery

## Maximum potential Heat Recovery:

- $(12,000 \text{ Btu/ton} + (\text{heat of compression})) \div \text{efficiency} = \text{Max Potential}$
- $\text{Heat of compression} = (12,000 \div \text{COP})$
- Ex:  $\text{COP} = 3$        $12,000 \div 3 = 4,000 \text{ Btu/Ton}$
- $12,000 \text{ Btu/ton} + 4,000 \text{ Btu/ton} = 16,000 \text{ Btu/ton}$
- $16,000 \text{ Btu/ton} \div 80\% = 20,000 \text{ Btu/ton}, .02 \text{ MMBtu/ton}$
- $500 \text{ ton} \times .02 \text{ MMBtu/ton} = 10 \text{ MMBtu/hr}$

**Tremendous potential!**

# How much can you actually recover?



## Dependent upon

- Quality: source (refrigeration) and sink temperatures &  $\Delta t$
- Quantity: Heat sink quantity & availability:
- Coincidental Demand: Source and sink timing daily through annually
- Physical locations

# Heat Sources

## High Stage Discharge Gas Steam

- External oil cooled best – HSDGS  $\approx 185^{\circ}\text{f}$
- Liquid Injected 2<sup>nd</sup> choice – HSDGS  $\approx 130^{\circ}\text{f}$

## Oil Cooling (external oil cooled screw compressors)

# Heat Sinks

- Ideal: heat sink with a large Delta T and needs matches heat source capacity & timing
- Prefer annual over seasonal sinks
- Proximity
- Cold water
- Cold product
- Desiccant regeneration
- Combustion air; dryer air; oven air; etc.
- Make-up air

# Complications to overcome



- Properly engineer the system
  - Added head pressure to refrigeration system and sink system
  - Ensure product safety
- CNP Engineering Assistance Program
  - Up to \$2,500 to review project
  - Additional \$2,500 for projects qualifying for a CIP rebate!
- Operating & Maintenance
  - Leverage savings

# Energy Savings Calculations



- 500 Tons x 50% recovery x .02 MMBtu/ton x 8,000 hours/year = 40,000 MMBtu/year
- 40,000 MMBtu/year x \$5.00/MMBtu = \$200,000/year gas savings
- \$500,000 capital expenditure
- CIP Rebate potential: up to \$120,000
- Is this worth investigating?

# Take care of yourself

## Leverage

- You're shorthanded
- Projects require extra effort initially & ongoing
- Leverage energy savings to get the personnel you need
- Outsource the additional O&M.
- Apply for Engineering Assistance
- CenterPoint Energy is here to help you through the process



# Questions?

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