

Thermal Energy Efficiency Opportunities & Incentives



Steam & Energy Management Systems

Overview

Steam Systems & Energy Management Systems

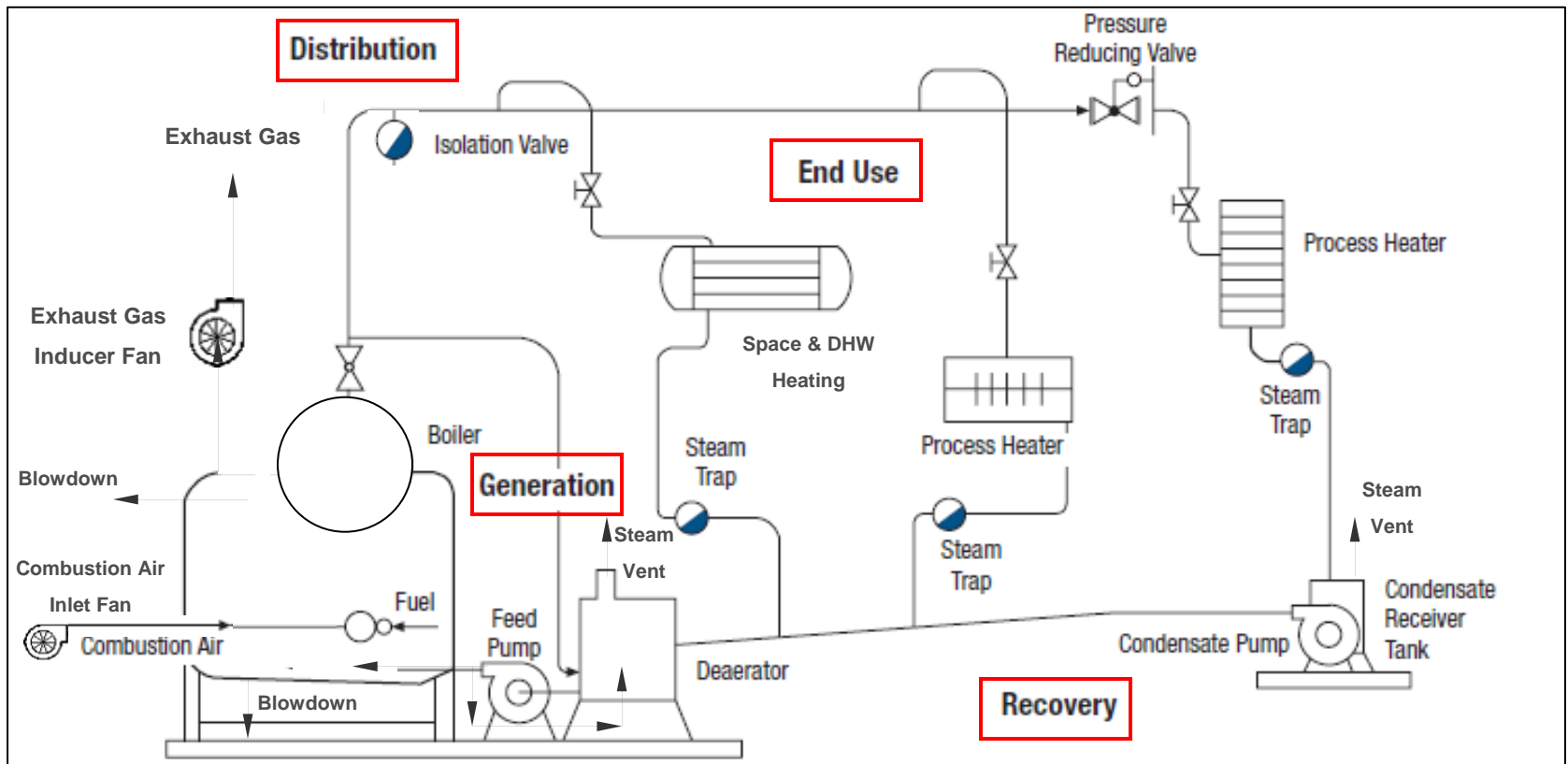
Thermal (Natural Gas) Energy Efficiency Opportunities

National Grid Incentives Overview

Energy Efficiency Measure Examples

Steam Systems

• Typical System



Steam Systems

System Incorrectly Operating

VS.

System Correctly Operating

Correct or Submit “As Is”?

Opportunity

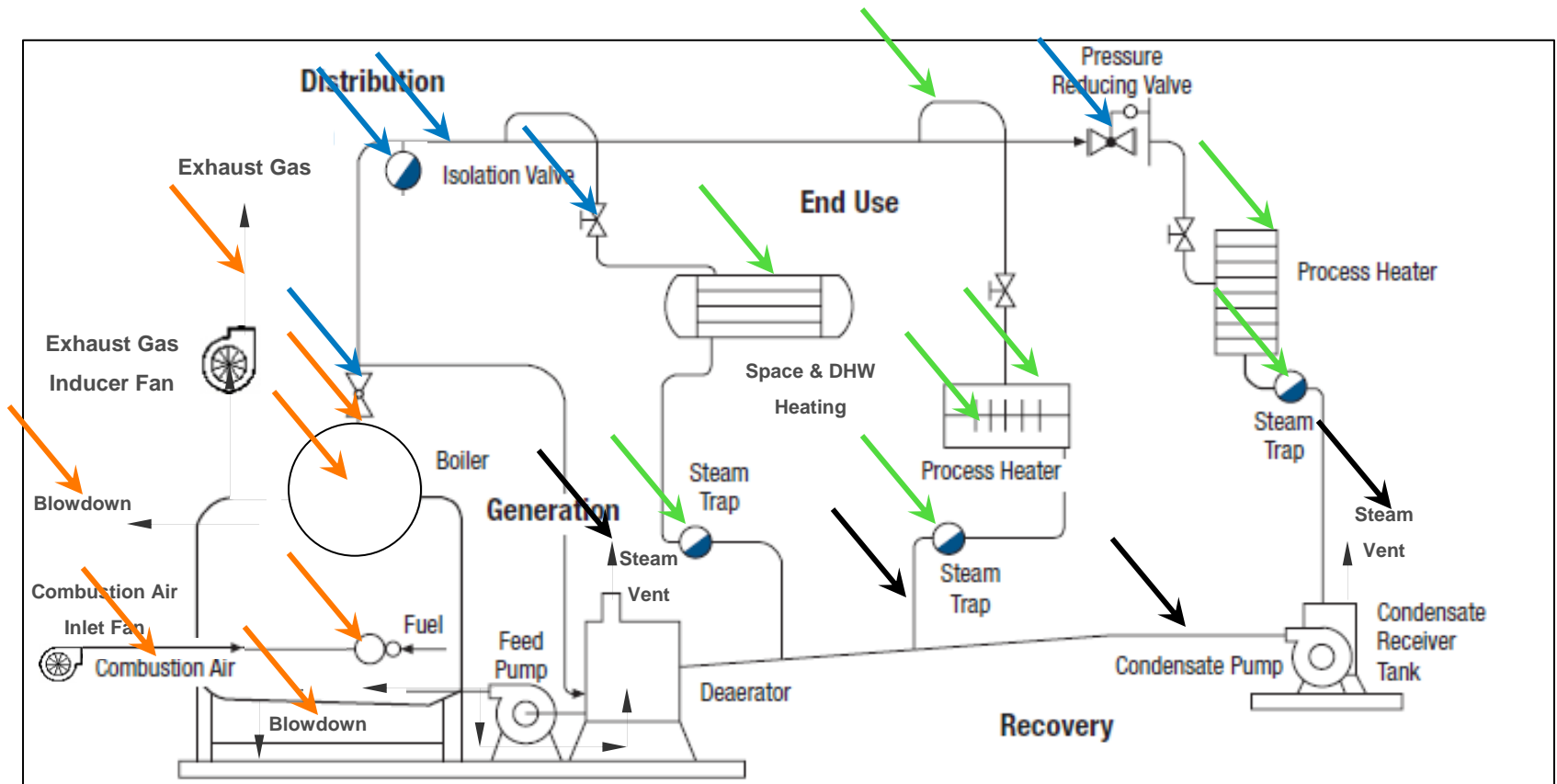
VS.

Incentive Eligible EEM

Boiler Door Gaskets, Pipe Leaks, etc.

Steam Systems

• Natural Gas Savings Opportunities

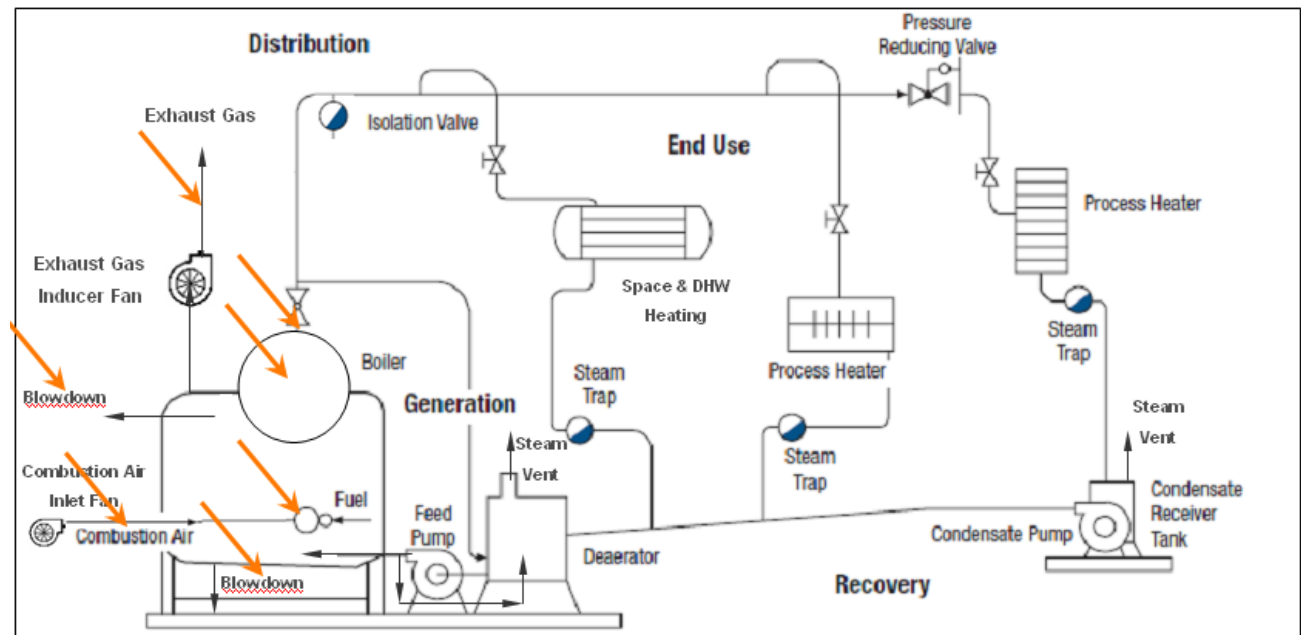


Steam Systems

• Natural Gas Savings Opportunities

■ Generation

- High-Efficiency Boiler
- Shell Insulation
- Pre-Heat Combustion Air
- Pre-Heat Feedwater
- Decrease Pressure
- Automate Blowdown
- Blowdown Heat Recovery
- Excess O₂ Trim



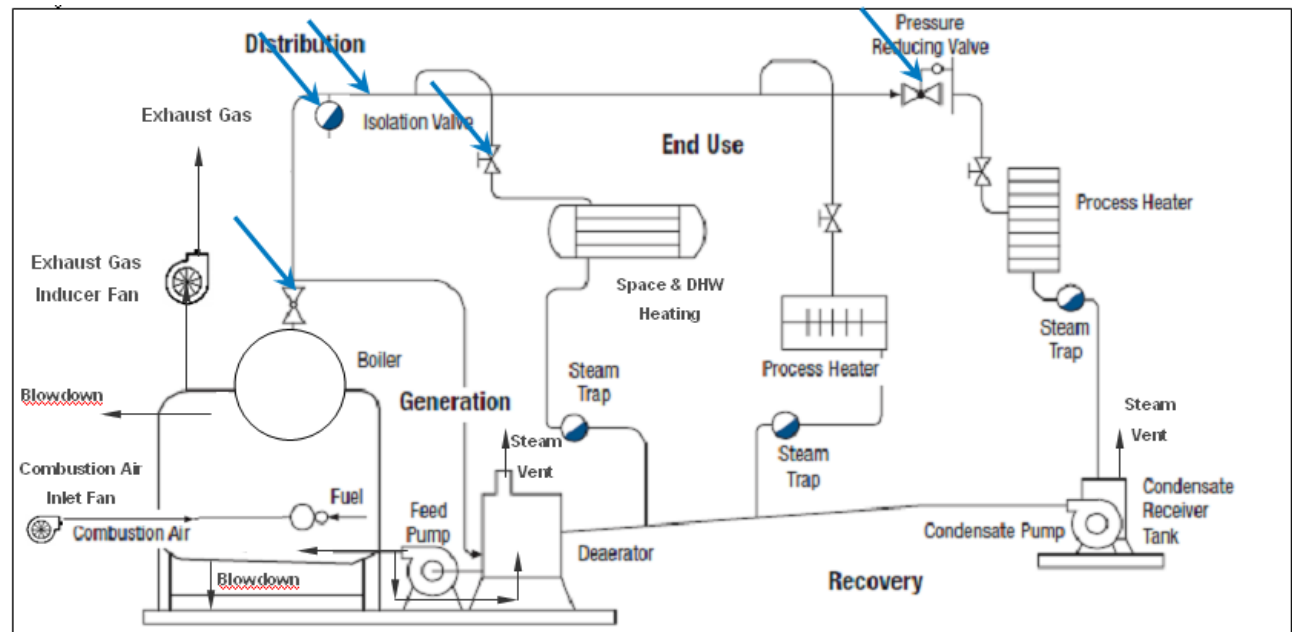
USDOE - Industrial Technologies Program - Improving Steam System Performance

Steam Systems

• Natural Gas Savings Opportunities

■ Distribution

- Steam Pipe Insulation
- Turbine vs. PRVs
- Control & Isolation Valve Insulation
- Steam Traps



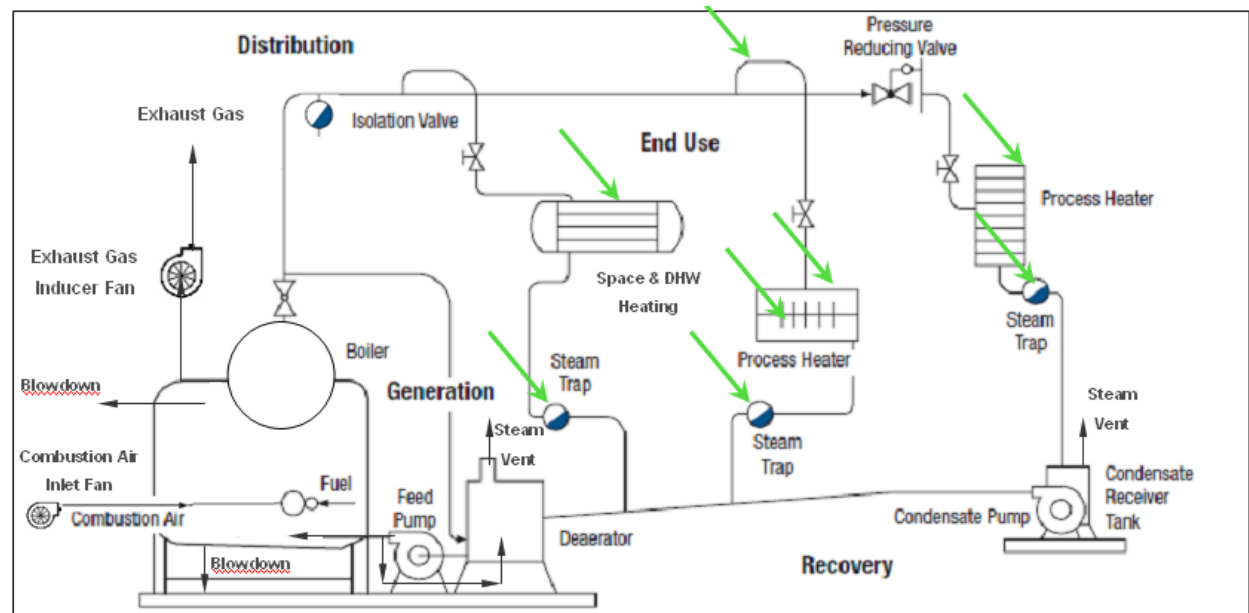
USDOE - Industrial Technologies Program - Improving Steam System Performance

Steam Systems

• Natural Gas Savings Opportunities

■ End-Use

- Heat Exchanger Insulation
- Steam Traps
- Steam Pipe Insulation
- Process Equipment (i.e., steam vats)
- Pre-Heat Incoming Water/Fluid



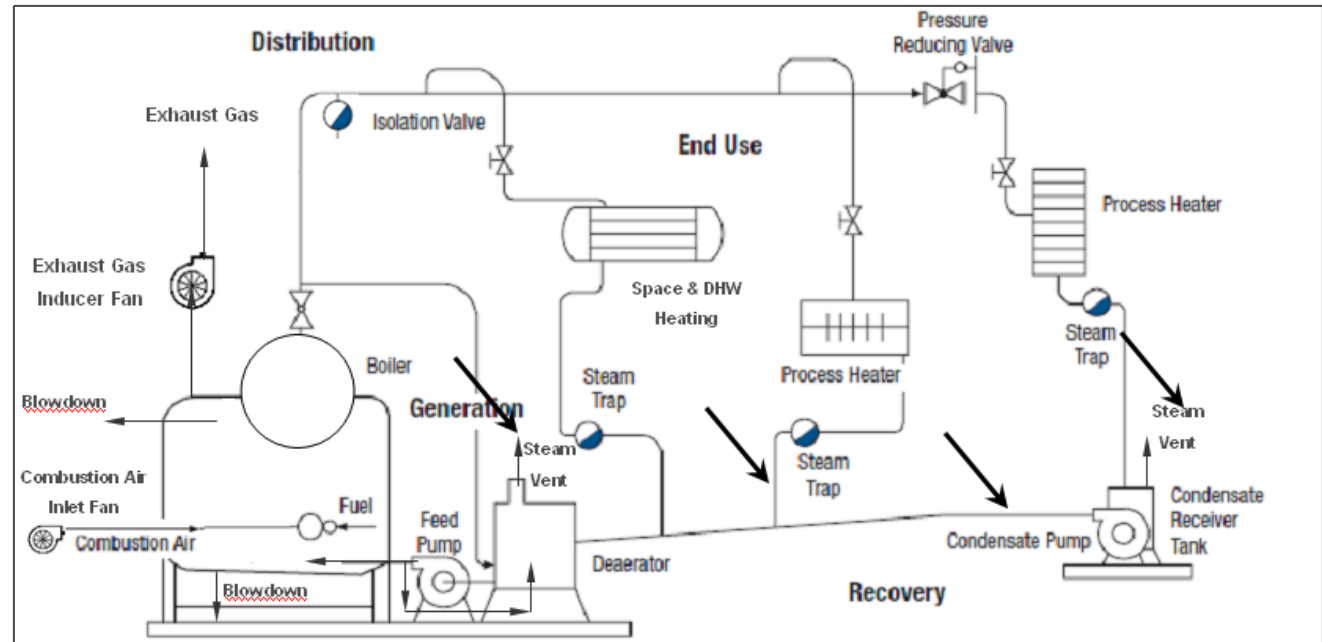
USDOE - Industrial Technologies Program - Improving Steam System Performance

Steam Systems

• Natural Gas Savings Opportunities

■ Recovery

- High-Pressure Condensate Flash Steam Re-Use
- Condensate Pipe Insulation
- Vent Steam Reduction & Heat Recovery
- Steam Traps
- Condensate & Deaerator Tanks Insulation



USDOE - Industrial Technologies Program - Improving Steam System Performance

Steam Systems

• Natural Gas Incentives

■ Generation

- High-Efficiency Boiler
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■ Distribution

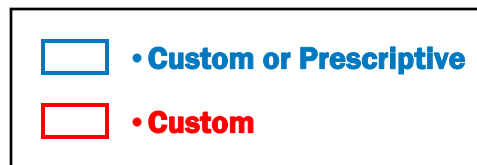
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■ End-Use

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Steam Systems

• Natural Gas Incentives Overview - *Prescriptive*



mass save
Savings through energy efficiency

High-Efficiency Commercial Natural Gas Equipment Rebates



Save energy with high-efficiency equipment. Rebates are provided to reduce the cost difference between standard efficiency and high-efficiency equipment.

- ▶ High-Efficiency Heating Equipment
- ▶ High-Efficiency Water Heating Equipment
- ▶ After Market Boiler

STEAM TRAPS \$25/ea.

Electric Program Administrators				
Cape Light Energy P.O. Box 1001 Barnstable, MA 02536 Tel: 508-767-1400 www.capeenergy.com info@capeenergy.com	National Grid 60 Newell Road Waltham, MA 02457-1200 Tel: 781-882-7700 www.nationalgrid.com/ma info@nationalgrid.com	NSTAR One 855 Main Street Newburyport, MA 02459 Tel: 781-881-4400 www.nstar.com info@nstar.com	Unitil 2000 North Main Street Rochester, MA 02475 Tel: 781-882-7700 www.unitil.com info@unitil.com	Western Massachusetts Electric The Boston Edison System 200 Main Street West Springfield, MA 01103-2070 Tel: 413-863-3000 www.wme.com info@wme.com
Gas Program Administrators				
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nationalgrid
THE POWER OF ACTION
Tel: 1-877-882-3700
www.powerofaction.com/ri

Rhode Island High-Efficiency Commercial Gas Equipment Incentives

STEAM TRAPS** \$75/ea.



Save energy with high-efficiency equipment. Incentives are provided to reduce the cost difference between standard efficiency and high-efficiency equipment.

New Traps & Repair Kits

Steam Traps (limit 100)

- High-Efficiency Heating Equipment
- High-Efficiency Water Heating Equipment
- After Market Boiler Reset Controls
- Programmable Thermostats
- Steam Traps

**** Not to exceed cost of equipment**

Steam Systems

• Steam & Condensate Pipe Insulation



Pipe Insulation		
Summary	Heating	Process
Capital Cost	\$15,000	\$15,000
Annual Savings	\$6,728	\$35,924
Payback (Years)	2.2	0.4
Incentive	Heating	Process
Up to 50% of Capital Cost	\$7,500	N/A
Up to \$1.50/Therm (MA)	\$13,456	N/A
Up to \$3.00/Therm (RI)	\$26,913	N/A
Down to 1.0 Years SPB	\$8,272	N/A
Savings	Heating	Process
Unit Loss (Btu/H-Ft)	396	881
Hours/Year	3,500	8,400
K Lbs./Year (500 Ft.)	714	3,815
Therms/Year (500 Ft.)	8,971	47,899
Dollars/Year	\$6,728	\$35,924

Heat Loss Per Hour Report

Item Description: **Steam Pipe**

Geometry Description: **Steel Pipe - Horizontal**

Bare Surface Emittance: **0.8** Nominal Pipe Size: **4 in.**

Process Temp: **250 °F** Ave. Ambient Temp: **100**

Relative Humidity: **N/A** Dew Point: **N/A**

Condensation Control Thickness: **N/A**

Outer Jacket Material: **All Service Jacket**

Insulation Layer 1: **Cellular Glass, Type II, PIPE and Tube**

Append To Audit

Variable Insulation Thickness	Surface Temp (°F)	Heat Loss (BTU/hr/ft)
Bare	249.8	445.60
Layer 1	113.2	49.05

System Units: **ASTM C585**

Heat Loss Per Hour Report

Item Description: **Steam Pipe**

Geometry Description: **Steel Pipe - Horizontal**

Bare Surface Emittance: **0.8** Nominal Pipe Size: **4 in.**

Process Temp: **366 °F** Ave. Ambient Temp: **100 F** Ave. Wind Speed: **0 mph**

Relative Humidity: **N/A** Dew Point: **N/A**

Condensation Control Thickness: **N/A**

Outer Jacket Material: **All Service Jacket** Outer Surface Emittance: **0.9**

Insulation Layer 1: **Cellular Glass, Type II, PIPE and Tube.** Thickness: **2.045 in.**

Append To Audit

Browse...

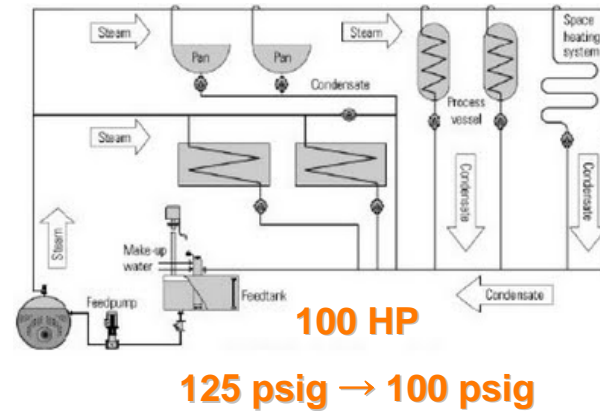
Variable Insulation Thickness	Surface Temp (°F)	Heat Loss (BTU/hr/ft)	Efficiency (%)
Bare	365.5	981.70	
Layer 1	124.6	99.50	89.86



Steam Systems

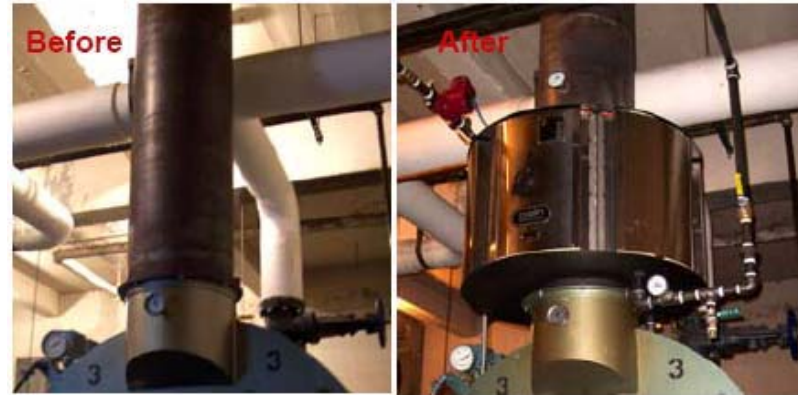
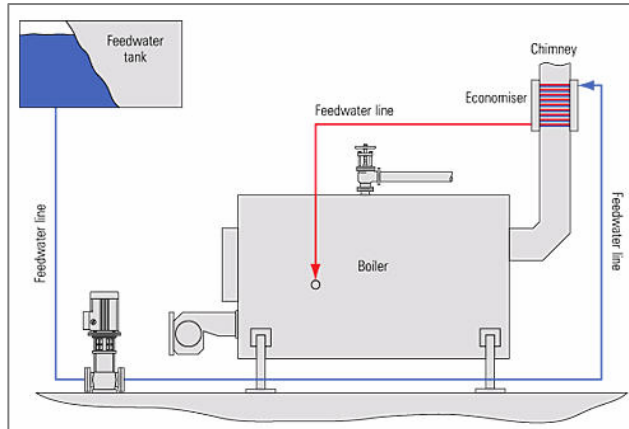
• Steam Pressure Reduction

Steam Pressure Reduction		
Summary	Heating	Process
Capital Cost	N/A	\$20,000
Annual Savings	N/A	\$4,224
Payback (Years)	N/A	4.7
Incentive	Heating	Process
Up to 50% of Capital Cost	N/A	\$10,000
Up to \$1.50/Therm (MA)	N/A	\$8,449
Up to \$3.00/Therm (RI)	N/A	\$16,898
Down to 1.0 Years SPB	N/A	\$15,776
Savings	Heating	Process
Unit Loss (Btu/H-HP)	N/A	518
Hours/Year	N/A	8,400
K Lbs./Year	N/A	449
Therms/Year	N/A	5,633
Dollars/Year	N/A	\$4,224



Steam Systems

• Pre-Heat Boiler Feedwater



200 HP
100% Firing Rate
~14 gpm
225 °F → 250 °F
~166,000 Btu/H



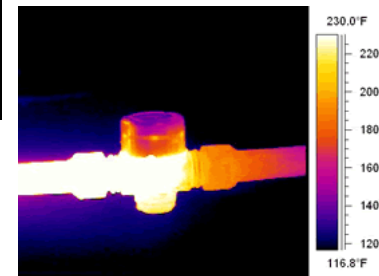
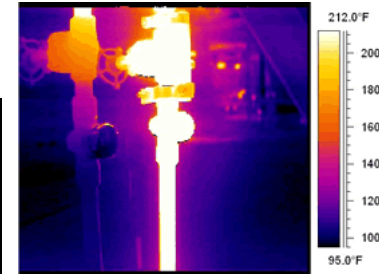
Pre-Heat Boiler Feedwater		
Summary	Heating	Process
Capital Cost	N/A	\$25,000
Annual Savings	N/A	\$9,786
Payback (Years)	N/A	2.6
Incentive	Heating	Process
Up to 50% of Capital Cost	N/A	\$12,500
Up to \$1.50/Therm (MA)	N/A	\$19,573
Up to \$3.00/Therm (RI)	N/A	\$39,146
Down to 1.0 Years SPB	N/A	\$15,214
Savings	Heating	Process
Unit Heat Recovery (Btu/H)	N/A	120,000
Hours/Year	N/A	8,400
K Lbs./Year	N/A	1,039
Therms/Year	N/A	13,049
Dollars/Year	N/A	\$9,786

Steam Systems

• Steam Traps



Steam Traps			Steam Traps		
Summary	Heating	Process	Summary	Heating	Process
Capital Cost	\$170	\$518	Capital Cost	\$170	\$518
Annual Savings	\$112	\$1,495	Annual Savings	\$112	\$1,495
Payback (Years)	1.5	0.3	Payback (Years)	1.5	0.3
Incentive	Heating	Process	Incentive	Heating	Process
Up to 50% of Capital Cost	N/A	N/A	Up to 50% of Capital Cost	N/A	N/A
Up to \$1.50/Therm (MA)	N/A	N/A	Up to \$1.50/Therm (MA)	N/A	N/A
Up to \$3.00/Therm (RI)	N/A	N/A	Up to \$3.00/Therm (RI)	N/A	N/A
Down to 1.0 Years SPB	N/A	N/A	Down to 1.0 Years SPB	N/A	N/A
Savings	Heating	Process	Savings	Heating	Process
Unit Loss (Lbs./H)	3.4	18.9	Unit Loss (Lbs./H)	3.4	18.9
Hours/Year	3,500	8,400	Hours/Year	3,500	8,400
K Lbs./Year	12	159	K Lbs./Year	12	159
Therms/Year	149	1,993	Therms/Year	149	1,993
Dollars/Year	\$112	\$1,495	Dollars/Year	\$112	\$1,495



Trap Orifice Diameter (inches)	Steam Loss (lbs/hr)			
	Steam Pressure (psig)			
	15	100	150	300
1/32	0.85	3.3	4.8	–
1/16	3.4	13.2	18.9	36.2
1/8	13.7	52.8	75.8	145
3/16	30.7	119	170	326
1/4	54.7	211	303	579
3/8	123	475	682	1,303

From the Boiler Efficiency Institute. Steam is discharging to atmospheric pressure.

Prescriptive

MA - \$25/Trap

RI – Up to \$75/Trap

(RI – 100 Trap Max.)

Custom

Survey - 100% by NGrid

Repairs – 50% by Ngrid

(RI – \$10,000 Max./Y)

Steam Systems

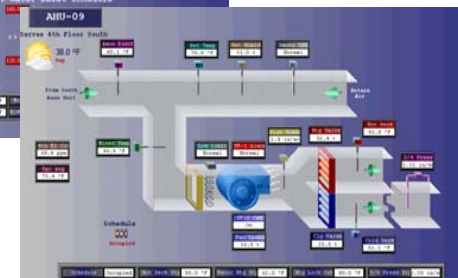
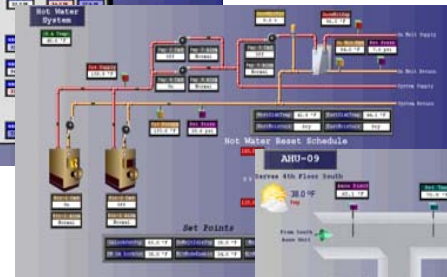
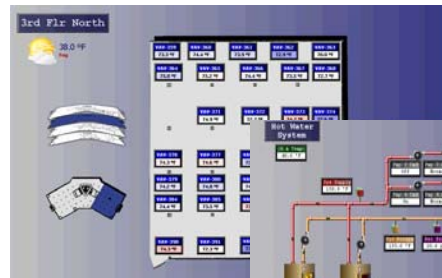


EMSs

• Natural Gas Savings Opportunities

■ AHU, RTU, Boiler, Pump, etc.

- Start/Stop
 - Schedules (Master, Zones, Equipment, etc.)
 - Occupancy
 - Optimal
- Reset
 - Hot Water
 - Discharge Air Temperature
- Setback
 - Unoccupied
 - Standby
- Demand Control Ventilation
- Boiler Staging & Loading
- Warm Weather Shutdown/Lockout
- Prevent Simultaneous Heating & Cooling



Steam Systems

• Natural Gas Incentives Overview - Custom

Notable Differences between MA's & RI's NG Programs...

- Program Names

- ≥ 300 kW

-\$1.50/Therm vs. \$3.00/Therm

- Dual-Fuel EEM Incentive

Incentive Programs Overview

National Grid's electric and natural gas incentive programs for medium and large business customers are fully integrated and consolidated into two (2) programs for 2011. They are the...

- Commercial New Construction Program; and the
- Large Commercial Retrofit Program.

Both programs consist of Prescriptive and Custom incentive classifications for projects saving either electricity or natural gas, but not both energy sources. Prescriptive incentives are typically for common, individual pieces of equipment and are assigned pre-determined incentive values based on their type, size and certified efficiency rating. All Prescriptive incentives are located on www.powerofaction.com under the "What can you do?" and "Energy Efficiency" menus. Custom incentives apply to complete energy systems, less common individual pieces of equipment and anything not eligible for a Prescriptive incentive. Projects simultaneously saving electricity and natural gas are classified as Custom and are specially addressed at the end of this section.

The Commercial New Construction Program (CNC) is designed for new buildings and additions to and major renovations in existing buildings. The CNC also applies to spaces changing function within existing buildings, failed equipment or equipment age exceeding 75% of their useful lifetimes. Incremental Energy Savings and Incremental Capital Costs are defined as the difference between the Rhode Island Energy Code's requirements and the proposed energy project. The CNC also applies to a Benefit-to-Cost Ratio (BCR) for a Natural Gas (NG) project. The CNC program classification must pass, an individual electric or natural gas project to the lesser of the below, respective amounts.

New Construction

Incentive Determinant	Electric Incentive	NG Incentive
Incremental Capital Cost	Up to 75%	Up to 75%
Incremental Energy Savings	Up to \$0.25/kWh-Y	Up to \$3.00/Therm-Y
Incremental Payback Buy-Down	Down to 1.0 Year	Down to 1.0 Year

The Large Commercial Retrofit Program (LCR) is designed for existing buildings with an average, monthly demand of 200 kW or greater. The proposed project's Total Energy Savings is based on the difference between the existing, operating equipment/system relative to the proposed equipment/system. Total Capital Cost is defined as all line item costs including, but not necessarily limited to permitting, design, major equipment, installation labor and miscellaneous materials, start-up, testing, commissioning and close-out. Like the CNC, a project falling under the LCR must pass its incentive eligibility in the LCR. In most cases, an eligible project receives an incentive equal to the lesser amount of the below.

Retrofit

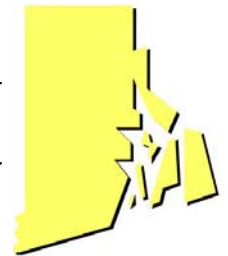
Incentive Determinant	Electric Incentive	NG Incentive
Total Capital Cost	Up to 50%	Up to 50%
Total Energy Savings	Up to \$0.19/kWh-Y	Up to \$3.00/Therm-Y
Total Payback Buy-Down	Down to 1.0 Year	Down to 1.0 Year

For a proposed project falling under either the CNC or LCR and saving both electricity and NG, a unique BCR process determines incentive eligibility. In general, an eligible project receives an incentive equal to the larger of the individually calculated electric and NG program incentives. The electric and NG contributions to the incentive are based on the lifetime, societal benefit each energy source contributes to the proposed project.

Eligibility Pre-Requisites in both MA & RI...

-SPB < Equip. Lifetime

- BCR > 1.0



Incentive Eligibility ROT

~80% Lifetime > EEM's SPB > 1.0 Y

• Natural Gas Incentives Overview - *Prescriptive*



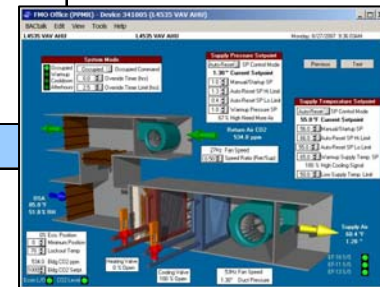
Measure Description	Maximum Unit Incentive for Eligible Points	Maximum Number of Points
Energy Management Systems Conditioned space controlled (See Req. 1,2,3 above)		
5,000 – 40,000 Sq. Feet		(up to 20 points)
Total Sq. Feet		16 Electric 4 Gas
		Total # of Points
40,001 - 80,000 Sq. Feet		(up to 60 points)
Total Sq. Feet		48 Electric 12 Gas
		Total # of Points
80,001 Sq. Ft. to < 200,000 Sq. Ft.		(up to 160 points)
Total Sq. Feet		128 Electric 32 Gas
		Total # of Points

\$3,600 (up to 20 points) \$900
\$225/pt \$10,800 (up to 60 points) \$2,700
\$28,800 (up to 160 points) \$7,200

EMSs

• Demand Control Ventilation

Energy Efficiency Measure Snapshot			
<ul style="list-style-type: none"> ○ Demand Control Ventilation ○ Air Handling Units, Roof-Top Units & Make-Up Air Units, Unit Ventilators ○ Reduces the amount of outside air to be conditioned. ○ Tracks space occupancy through CO2 sensors and adjusts outside/return air dampers. ○ Energy Savings - Percentage the AHU's outside airflow can be reduced. ~50% 			
Favorable System/Equipment Characteristics			
<ul style="list-style-type: none"> » Dampers with fixed position dampers set for maximum space occupancy. » Good - Space Heating or Cooling. » Best - Both Space Heating & Cooling. » Minimum Supply Fan rating of ~5,000 cfm and centralized returns. » Variable Hourly and/or Daily Occupancy. 			
Financial Summary			
Equipment Size:	1 x AHU (Supply Fan ~9,000 cfm)		
Capital Cost:	\$4,667	Monetary Savings:	\$1,650
Incentive - Electric:	\$667	Simple Payback:	2.8
Incentive - NG:	\$2,350	Simple Payback:	1.0
Incentive Program & Eligibility			
<p>Large Commercial Retrofit or Commercial New Construction Program Natural Gas Incentive - Custom Application Up to 75% of Incremental Cost or Up to \$1.50/Therm-Y (MA)/\$3.00/Therm (RI) or Down to 1.0 Y SPB. Up to 50% of Total Cost or Up to \$1.50/Therm-Y (MA)/\$3.00/Therm (RI) or Down to 1.0 Y SPB.</p> <p>Electric Incentive - Custom Application Up to 75% of Incremental Cost or ~\$.25/kWh-Y (RI) or Down to 1.0 Year Simple Payback. Up to 50% of Total or ~\$.19/kWh-Y (RI) or Down to 1.0 Year Simple Payback.</p>			



EMS Systems

