Steam Best Practices: Reduce Your Overall Steam Consumption & On-peak Demand

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STEAM Conservation Tips

S Shield Pipes and Valves from Heat Loss

T Thermal Energy Recovery from Condensate

E Ensure Vacuum at All Times, If Intended

A Apply Outdoor Temperature Reset

M Maintain Steam Traps & Repair Leaks
Shield Pipes and Valves from Heat Loss (Insulate)

• Avoid excessive heat loss and condensate build-up
• Valves and fittings have large surface areas from which heat escapes
• Removable insulation jackets around valves and other components
## Cost of Losses Due to Lack of Insulation

### Annual Cost Savings *Per Valve* from Installing 1” Removable Valve Insulating Pads

<table>
<thead>
<tr>
<th>Valve Size</th>
<th>3”</th>
<th>4”</th>
<th>6”</th>
<th>8”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Heat Saved with 1” Insulation (BTU/hr)</td>
<td>2,300</td>
<td>2,900</td>
<td>4,600</td>
<td>6,600</td>
</tr>
<tr>
<td>$ Saved Per Year Per Valve</td>
<td>$450</td>
<td>$550</td>
<td>$900</td>
<td>$1,300</td>
</tr>
</tbody>
</table>

### Annual Losses Per 100 Feet of Un-insulated Steam Pipe (15 PSIG)

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>1”</th>
<th>2”</th>
<th>4”</th>
<th>8”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat Lost (MMBTU/Yr)</td>
<td>140</td>
<td>235</td>
<td>415</td>
<td>740</td>
</tr>
<tr>
<td>$ Wasted Per Year</td>
<td>$3,200</td>
<td>$5,400</td>
<td>$9,500</td>
<td>$17,000</td>
</tr>
</tbody>
</table>
Thermal Energy Recovery from Condensate

- Maximize heat recovery from condensate using a 2 stage approach:
  1. Outdoor air preheating OR recovering condensate heat for secondary water loops
  2. Recovering condensate heat to preheat domestic water

- This reduces steam consumption and also amount of city water required to dilute condensate before discharging it

- Many Con Edison steam customers already recover heat (but not all)

- Depending on site conditions, paybacks may be 3 years or less
Other Ways to Reuse Condensate

• Include cooling tower make-up, washing sidewalks, and watering plants

• Condensate heat recovery and reuse guidance sketches are available at www.coned.com/steam

• Why reuse condensate?
  ▪ Steam and water savings
  ▪ The DEP charges for discharge into sewers. If you reuse condensate, you can apply to the DEP for a discount
  ▪ Resulting water savings may help gain points if your building is looking for LEED certification
Ensure Vacuum at All Times, If Intended

• If your steam system is designed to operate under vacuum, maintaining vacuum will ensure optimal operation

• Loss of vacuum may occur if:
  ▪ Steam traps are not maintained
  ▪ Leaks in piping are present
  ▪ Vacuum pumps are not working properly
Apply Outdoor Temperature Reset

• Reduce circulating hot water temperatures on milder days and increase them on colder days

• If you already reset water temperatures, consider shifting the reset schedule down (i.e. instead of having water at 160°F when it is 20°F outside, set water to 150°F)
Maintain Steam Traps & Repair Leaks

- Maintaining steam traps will not only save steam, but will help ensure safe operation.
- Visually inspect steam systems for leaks.
- Ensure that relief valves are not leaking.
<table>
<thead>
<tr>
<th>STEAM PRESSURE</th>
<th>TRAP SIZE</th>
<th>STEAM FLOW</th>
<th>LOSSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>(150 psig)</td>
<td>INCH</td>
<td>Hourly</td>
<td>DAILY</td>
</tr>
<tr>
<td>150</td>
<td>½</td>
<td>105</td>
<td>2.5M# / (lbs)</td>
</tr>
<tr>
<td>150</td>
<td>¾</td>
<td>152</td>
<td>3.6M# / (lbs)</td>
</tr>
<tr>
<td>150</td>
<td>1&quot;</td>
<td>230</td>
<td>5.5M# / (lbs)</td>
</tr>
</tbody>
</table>

Cost of Losses Due to Leaking Steam Traps
Improving Summer Steam Efficiency

• Install a plate frame heat exchanger connected to your cooling towers for “free” cooling during mild days

• Open fresh air dampers for night or early morning pre-cooling

• Shut down chillers earlier than normal but prolong chilled water circulation. It may take some time for chilled water to warm up
Ways to Reduce On-Peak Demand
(6 a.m. – 11 a.m., weekdays; 4 months)

• Storage of Thermal Energy in Existing Mechanical systems (STEEMs)
• Start up some of the fans earlier
• Stagger fan start-ups if starting up after 6 a.m.
• Do not raise circulating water temperatures during the on-peak period
• Reduce space air temperature set points
Storage of Thermal Energy in Existing Mechanical systems (STEEMs)

- Con Edison developed STEEMs in conjunction with Goldman Copeland Associates
- Tested at 2 customer buildings
- No effect on comfort conditions & no increase in overall steam consumption
- Good candidate buildings have
  - Induction, fan coil, or other terminal units with local thermostats
  - Circulating hot water
  - A programmable building management system
STEEMs at One Penn Plaza

• Between 33rd & 34th Street and 7th & 8th Avenue
• 2.6 million square feet
• 57 stories
• Completed in 1970
• Interior fans w/steam heating coils
• Perimeter fans w/steam heating coils serving induction units
• All fans have returns
• STEEMs testing performed during last 2 winters
STEEMs - Operating Steps by the BMS

1. Thermal Charging
   • Prior to 6 a.m. slowly (over a 2 hour period) ramp up temperatures in all the circulating hot water loops to a design maximum temperature (no greater than 190°F)

2. Automatically calculate steam flow rate set point using outdoor air temperature, at 5:30 a.m.

3. Starting at 6 a.m. modulate all the hot water temperature control valves in unison to maintain the steam flow set point
   • Once water temperature reaches the minimum temperature limit in any loop, disengage that loop from STEEMs operation
   • If water temperature reaches the maximum temperature limit in any loop, shut the valves in that loop until a minimum temperature is reached, then disengage that loop from STEEMs operation
STEEMs Result at One Penn Plaza

Demand Reduction
= 6,500 lbs/hr

Demand Charge
Savings:
$5,900/month

26°F Morning

ON PEAK PERIOD

STEEMs Activated

01/18/2007  On-Peak
Demand= 22,234 lbs/hr

02/18/2005  On-Peak
Demand= 28,718 lbs/hr
STEEMs - How Can the BMS Predict the Flow Set Point for a Given Morning?

![Graph showing the relationship between outdoor air temperature and average steam flow from 6AM to 10AM on Non-Monday Weekdays.](image)
STEEMs - How Can the BMS Predict the Flow Set Point for a Given Morning?

\[ y = -523.92x + 37572 \]

![Graph showing the relationship between outdoor air temperature and average steam flow.](image)
STEEMs - How Can the BMS Predict the Flow Set Point for a Given Morning?

Average Steam Flow, lbs/hr (6AM-10AM)

Outdoor Air Temperature at 5:30 AM

- Monday: $y = -523.92x + 37572$
- Non-Monday: $y = -849.47x + 49708$

- Mondays
- Non-Monday Weekdays
- Linear (Non-Monday Weekdays)
- Linear (Mondays)
STEEMs - How Can the BMS Predict the Flow Set Point for a Given Morning?

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Operator Specified Offset

y = -523.92x + 37572

y = -849.47x + 49708

y = -521.92x + 37572

25,000
STEEMs: Advantages and Challenges

**Advantages:**

• Automated operation

• No effect on comfort conditions

**Challenges:**

• Tuning the valves correctly to maintain steady steam flow rate is critical
Starting Up Fans Earlier

• At an earlier hour, start up only those fans that serve the coldest spaces to ensure that increase in electric costs is not higher than steam demand savings

• To heat up spaces as fast as possible before 6 a.m., set the discharge air set point to maximum and, if the building is unoccupied, close fresh air dampers

• After 6 a.m., reduce the discharge air set point to normal
Result of Starting Fans Earlier (Midtown Office Building)

Normal Operating Day 02/06/07
Occurrence Day 01/26/07

Reduced Demand by 7,000 lbs/hr

11°F morning

ON PEAK PERIOD
Conclusion

• Follow STEAM Conservation tips
• Identify ways to reduce your on-peak demand
• Share your ideas with us!
  ▪ Call the Steam Business Development Group at 212-460-2011 to let us know how what you did to reduce your demand