



TITLE OF PROPOSAL: MAIN LIBRARY STEAM REDUCTION PROJECT

Organization Name:
Facilities and Services

Date of Submission:
March 14, 2012



PROJECT DESCRIPTION

This project will reduce the need for burning coal to fulfill the campus steam energy demand, by reducing the steam load at the Main Library. The Library's annual utility expense is almost \$1.3 million with steam accounting for \$775,000 of it. Much of the steam distribution equipment is original and in need of replacement. Specifically, this project will address Pressure Reducing Valves, Steam Traps, and Control Valve needs at the Main Library as follows:

Pressure Reducing Valve stations (PRV):

- There are seventeen main PRV stations in the building. The age of the stations vary, with the majority of them being forty plus years old. The building was designed for 2lbs of steam for perimeter radiation and 5lbs for air handler reheats. Several PRV stations are leaking through or are fixed in position and will not adjust with steam pressures ranging from 7 lbs to 13 lbs.
 - Mechanical room 2:
 - PRV1: AHU10, 11 and 12 reheat coils
 - PRV2: Radiation for center wing, and east entry
 - PRV3: Heat exchanger 1, 2(Radiation) and 3(Reheats). Move HX3 to PRV1 and combine PR2 and PRV3 together and install an automated control valve to turn on/off radiation with outside air conditions.
 - Mechanical room 444A:
 - PRV12: Serves heat exchanger 8 that serves reheats for AHU18-20, and the two rare book units.
 - 1st Stack Addition Attic:
 - PRV13: South Half of 1st thru 5th stack's radiation
 - PRV14: North Half of 1st thru 5th stack radiation

*Removal of asbestos from the piping will be required for installation of new PRV stations.

Steam Traps:

- The building steam traps have not been replaced for years and several of them are blowing through. There are approximately 800 traps in the building. With the steam pressure through the PRV station being much higher than the design value, the traps may have been damaged and are need of repair/replacement. This work needs to be done in conjunction or after PRV replacement.

Valve replacement:

- There is a broad style of control valves located in the building with many of these being original equipment and leaking through.
 - Replace the steam radiation valves in the 2nd, 3rd, and 7th additions of the main library. These valves were recently inspected by retrocommissioning and the valves leaking through had maintenance work orders entered to repair or replace them. There are still numerous radiation valves that are of original installation.
 - Install new thermostats and radiation zone control valves, in the 1st through 5th stack additions. The radiators on these zone valves are equipped with manual valves. The majority of these manual valves have been recently replaced. There are still manual valves that leak through and cause overheating of the stacks area. There are approximately 68 of zone valves. The steam supply to these zone valves is from two separate PRV stations, PRV13 and 14. There are isolation control valves on these two steam feeds that are currently under DDC control that



BUDGET, FUNDRAISING, AND TIMELINE

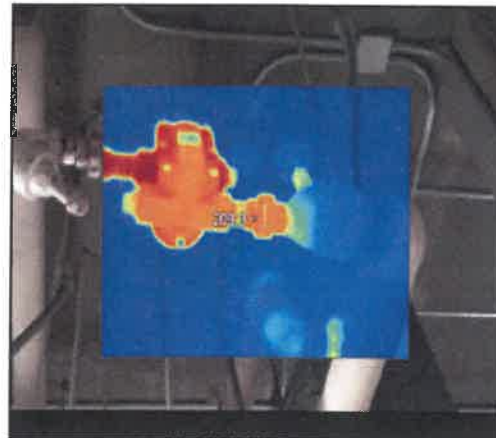
I. Detailed Budget

1. Provide a detailed budget of the full project costs: initial costs, life-cycle operation, maintenance costs, and an analysis of the project's rate of return

Repairing steam traps and broken control valves is one of the most cost effective things that we can do. The Vet Med ESCO project with guaranteed savings projected a payback of 1.5 years on this type of work at that location.



Existing Steam Trap



Thermal Image of Same Trap (Operable)

2. Detail both the specific budget items and the total funding amount being requested

Pressure Reducing Valve stations (PRV):

The cost to replace the PRV stations is approximately \$75,000.

Steam Traps:

Based on an average cost of \$250 per trap, the cost to repair the steam traps is approximately \$200,000. In our letter of inquiry, we had assumed there were about 640 steam traps, based on some old building records, but now we have an estimate of approximately 800. This is still an unknown quantity, and it will be clarified once the project has been approved with funding.

Valve replacement:

- There are still numerous radiation valves that are of original installation. Updating the remaining control valves would approximately be \$25,000.
- The estimated cost to replace the zone valves and thermostats would be around \$95,000.
- Five control valves will need to be installed on the radiation steam mains and controlled through the DDC system. The estimated cost would be: \$35,000.

Total Project Cost:

The total cost for this project is \$430,000, and we are seeking a grant from SSC for half that amount: \$215,000.

Funding Requested from SSC: \$215,000.

3. Provide supporting documentation (such as quotes from F&S or outside contractors) for project components, if obtained before proposal is due.

See attached Project Scope Statement



1. The amount of energy and money the project will save on an annual basis and for the lifetime of the project

Because this is the first steam project to be completed as a full-on comprehensive project, rather than through individual ad hoc maintenance work-orders, we do not yet have specific energy savings projections for this campus or this specific building. We do have a reasonable payback estimate provided by the contractor on the ESCO at Vet Med, which indicates a 1.5 year payback for steam traps (see attached). The ESCO estimate shows a cost of \$260.78 per trap, and associated savings of \$176.04 per trap. The Vet Med ESCO calculations used the FY10 variable savings rate for steam, which was \$10.4730/1,000 pounds of steam. Therefore, the anticipated energy savings is 16.81 klb per steam trap (= \$176.04/10.473). With 800 steam traps, the energy savings should be approximately 13,447 klbs per year. The current energy savings rate for steam on campus is \$19.17 per klb, so this project is projected to save about \$257,778.99 per year. The additional savings from PRV replacements and Valve replacements are not currently quantifiable.

2. Any significant energy inputs required to complete and maintain the project.
This project does not need energy inputs.

3. Net amount of energy saved by the project.

Projected savings: 13,447 klbs of steam per year
There is not a lifetime limit on these savings.

**For all estimates, please provide a yearly estimate and an estimate for the lifetime of the project. Please also provide supporting information regarding your estimates.*

III. All Projects

Greenhouse Gas Impact

Effect on greenhouse gases (if applicable): Detail your project's reduction of greenhouse gases by the offset use of fossil fuel energy sources normally used by the university. Unless you have data more relevant to your project, please visit the University of Illinois Urbana-Champaign Energy Management website (http://www.energymanagement.illinois.edu/energy_data.cfm) to determine the cost of energy on campus (provide estimates using both the fixed and variable cost rates).

GHG Emissions

Electricity: 1.672 CO₂lb/kWh
Steam: 244.9 CO₂lb/klb
Chilled Water: 144.6 CO₂lb/mmbtu

Diesel: 22.2 pounds CO₂/gallon
Gasoline: 19.4 pounds CO₂/gallon

3,293,170.3 CO₂ lb savings
from the 13,447 klb of savings per year

Other Environmental Impact and Metrics

Detail other environmental benefits of your project, and quantify them if possible. Even if benefits do not directly translate into cost savings, please list them and provide metrics for assessment. Examples may include: Educational benefits, storm-water benefits, waste reduction, food production, habitat preservation, etc. In addition, please list significant positive and negative environmental impacts, using quantifiable metrics if possible.

Project Scope Statement #2

Building Name / Number:	Main Library, 41
Project Name:	Steam Savings-PRV, steam traps, and valve replacements
Internal WO:	
Date Issued / Revised:	Jan 2, 2012

Project Scope Statement

The Library's annual utility expense is almost \$1.3 million with steam accounting for \$775,000 of it. Much of the steam distribution equipment is original and in need of replacement. Below are some of the recommendations for steam energy saving items listed in order of priority.

Pressure Reducing Valve stations(PRV):

There are seventeen main PRV stations in the building. The age of the stations vary, with the majority of them being forty plus years old. The building was designed for 2lbs of steam for perimeter radiation and 5lbs for air handler reheats. The following PRV stations are leaking through or are fixed in position and will not adjust with steam pressures ranging from 7 lbs to 13 lbs. Below are the PRV stations that are not operating correctly and are in need of repair or replace. The cost to replace the PRV stations would approximately be \$75,000.

Mechanical room 2:

PRV1: AHU10, 11 and 12 reheat coils

PRV2: Radiation for center wing, and east entry

PRV3: Heat exchanger 1, 2(Radiation) and 3(Reheats). Move HX3 to PRV1 and combine PR2 and PRV3 together and install an automated control valve to turn on/off radiation with outside air conditions.

Mechanical room 444A:

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**Removal of asbestos from the piping will be required for installation of new PRV stations.*

Steam Traps:

The building steam traps have not been replaced for years and several of them are blowing through. There are approximately 800 traps in the building. With the steam pressure through the PRV station being much higher than the design value, the traps may have been damaged and are need of repair/replacement. This work needs to be done in conjunction or after PRV replacement.

Valve replacement:

There is a broad style of control valves located in the building with many of these being original equipment and leaking through.

- It would be recommended to replace the steam radiation valves in the 2nd, 3rd, and 7th additions of the main library. These valves were recently inspected by retro commissioning and the valves leaking through had maintenance work orders entered to repair or replace them. There are still numerous radiation valves that are of original installation. Updating the remaining control valves would approximately be \$25,000.

ECM 6 – Steam Traps

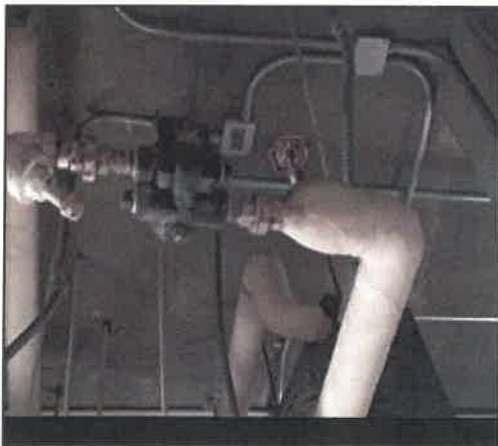
Existing Conditions

Steam is the primary source of heating for the BSB, LAC, SAC and SOL. Steam is produced at a central plant and delivered to each of the buildings. The steam pressure is then reduced and distributed to coils, heat exchangers and process loads. The steam system utilizes steam traps to return condensate to the boiler plant.

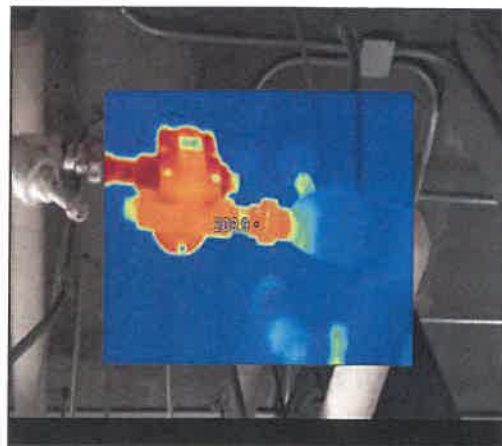
Currently there is no steam trap maintenance program at the Veterinary Medicine Complex. Steam traps are typically replaced when a problem is detected. The building utilizes bucket-type and float-and-thermostatic traps.

Recommendations

When steam traps fail, steam is wasted thereby reducing overall efficiencies, increasing operating costs, and chemical treatment costs. ESG performed a steam trap survey and tested all accessible traps. Methods of testing included ultrasonic testing and/or IR thermal scans. Many traps were not activated during the testing because the steam to them was valved out. Since these traps have been valved out, no savings can be attributed to them. By testing each trap ESG was able to determine the exact quantity of failed traps and potential energy savings. ESG recommends replacing the failed traps at the buildings.



Existing Steam Trap



Thermal Image of Same Trap (Operable)