I-Star Energy Solutions

Using Infrared Technology to Define Energy saving Opportunities

Course Number: CXENERGY1950

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Course Description

Using Infrared Technology to Define Energy saving Opportunities

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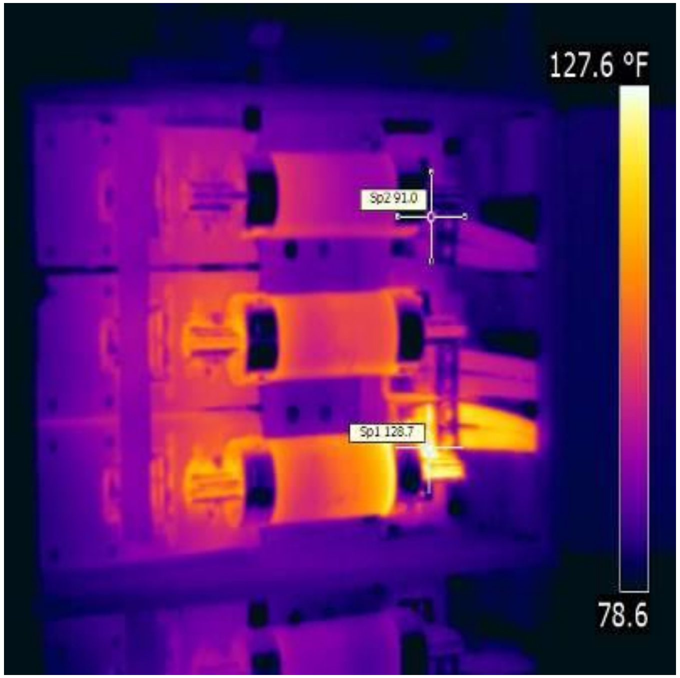
All facilities have tiny energy wasters so small and insignificant they are never seen. Some are obvious to the analyst but appear normal to the occupants and even the facility managers. Until a specialist does the analysis and attaches the monetary value nothing ever gets done. Even then, other things have priority. Many facilities pay good money for infrared cameras for a fun tool (even though they won't admit it), for real electrical purposes but often use it without proper training. Once they are trained and walk around they can find lots of other energy saving opportunities. Once they see the opportunities they might get the impression there might be value in the analysis. I hope this presentation will open eyes to the possibilities for infrared analysis in their facilities and open the eyes of commissioning agents to opportunities for increasing their value to clients.

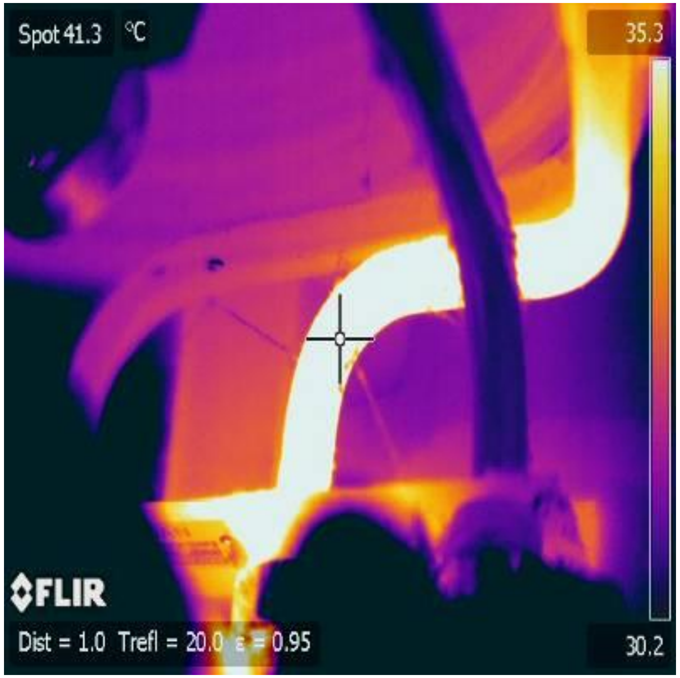
Learning Objectives

Attendees will learn:

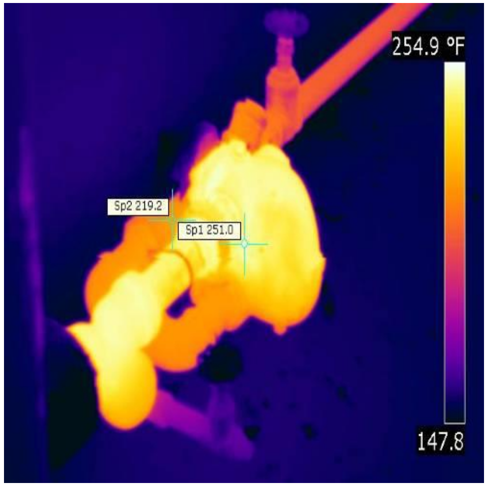
1. Learn what infrared measures and how to make use of the measurements
2. Learn the importance of infrared training to properly and effectively use the technology
3. How to find other uses for infrared analysis
4. Why infrared is an effective tool to find energy saving opportunities and how to act on them

Electrical surveys identify areas of concern like loose connections and overheated components due to increased resistance

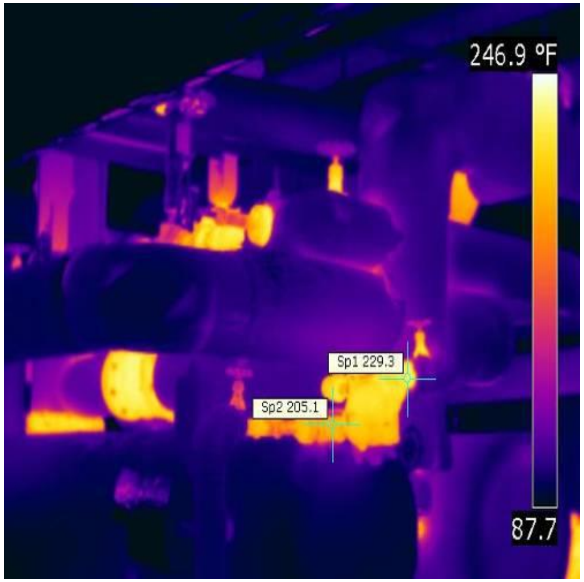




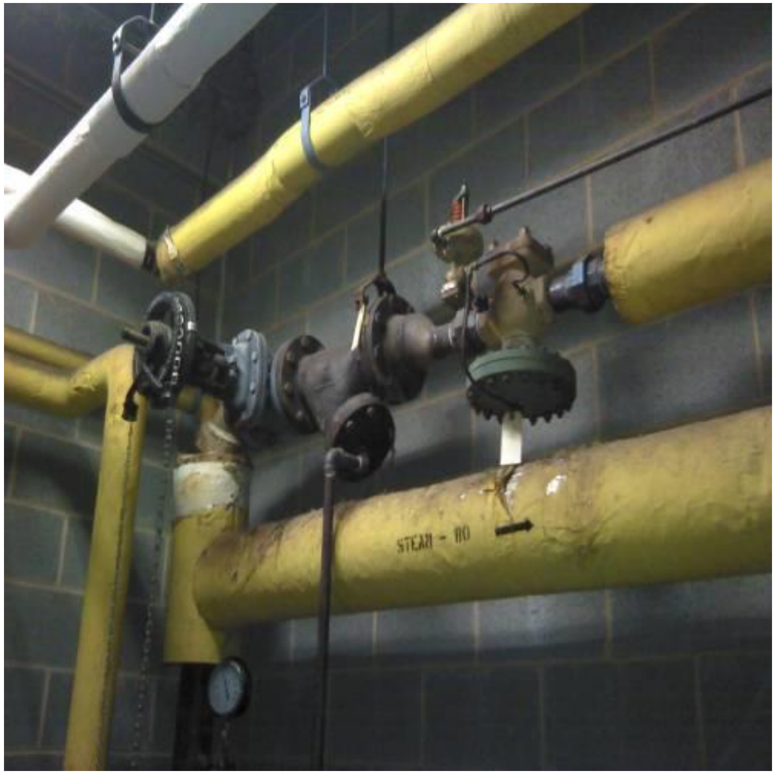
Steam trap assembly, close to the floor, in a dark area

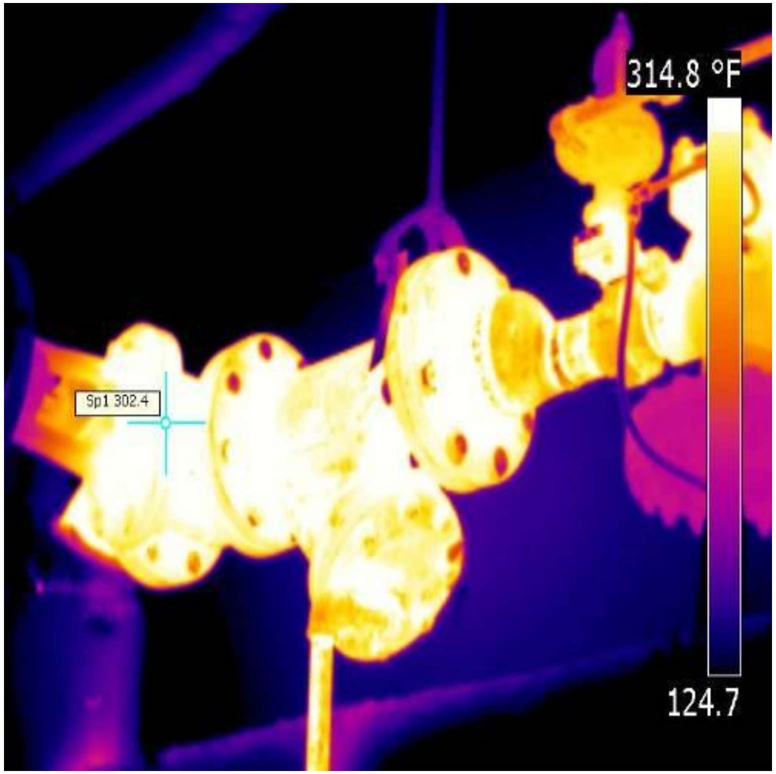


Out of sight out of mind.

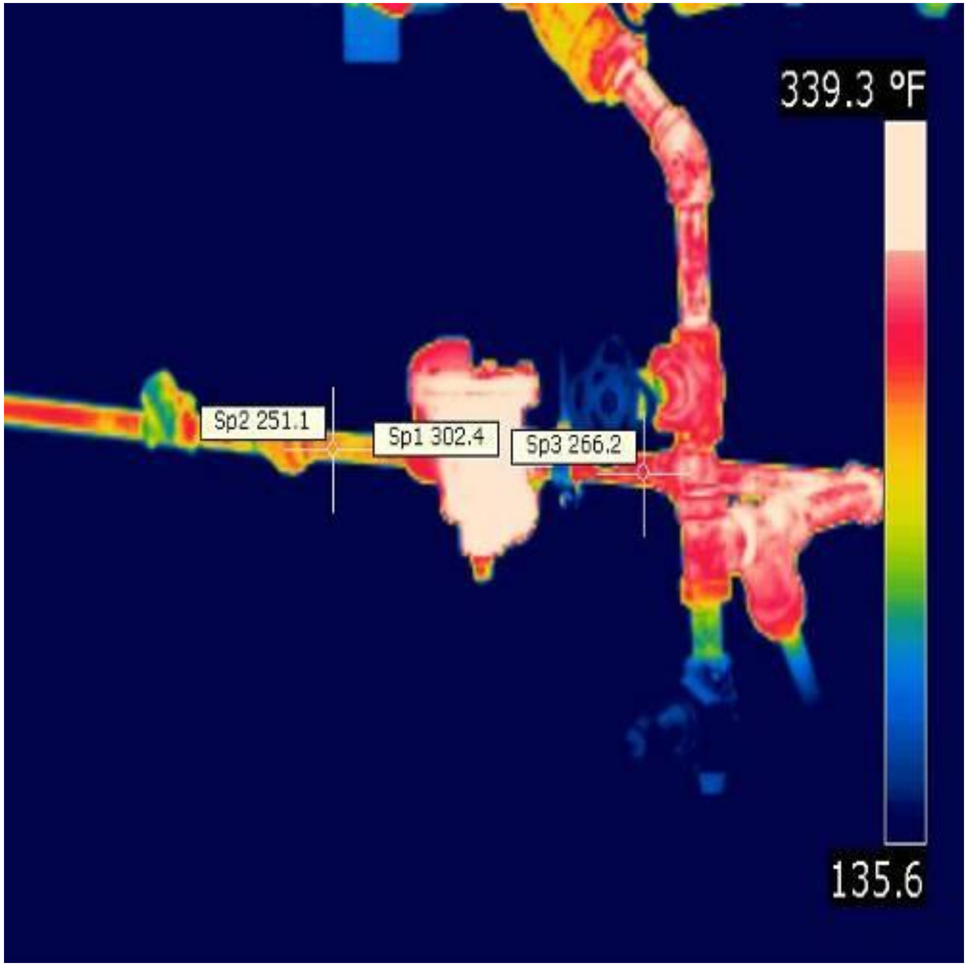


Typical Valve/Strainer assemblies The addition of Any Insulation will result in a quick payback

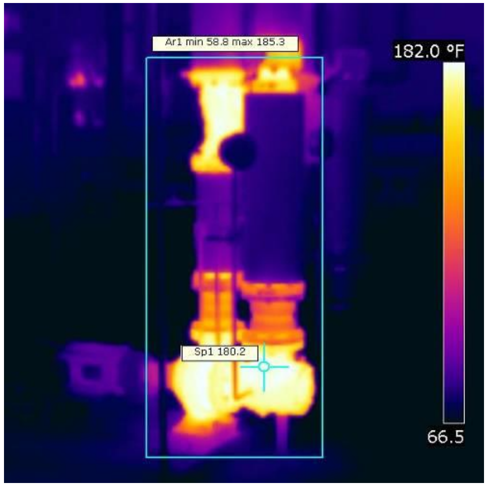




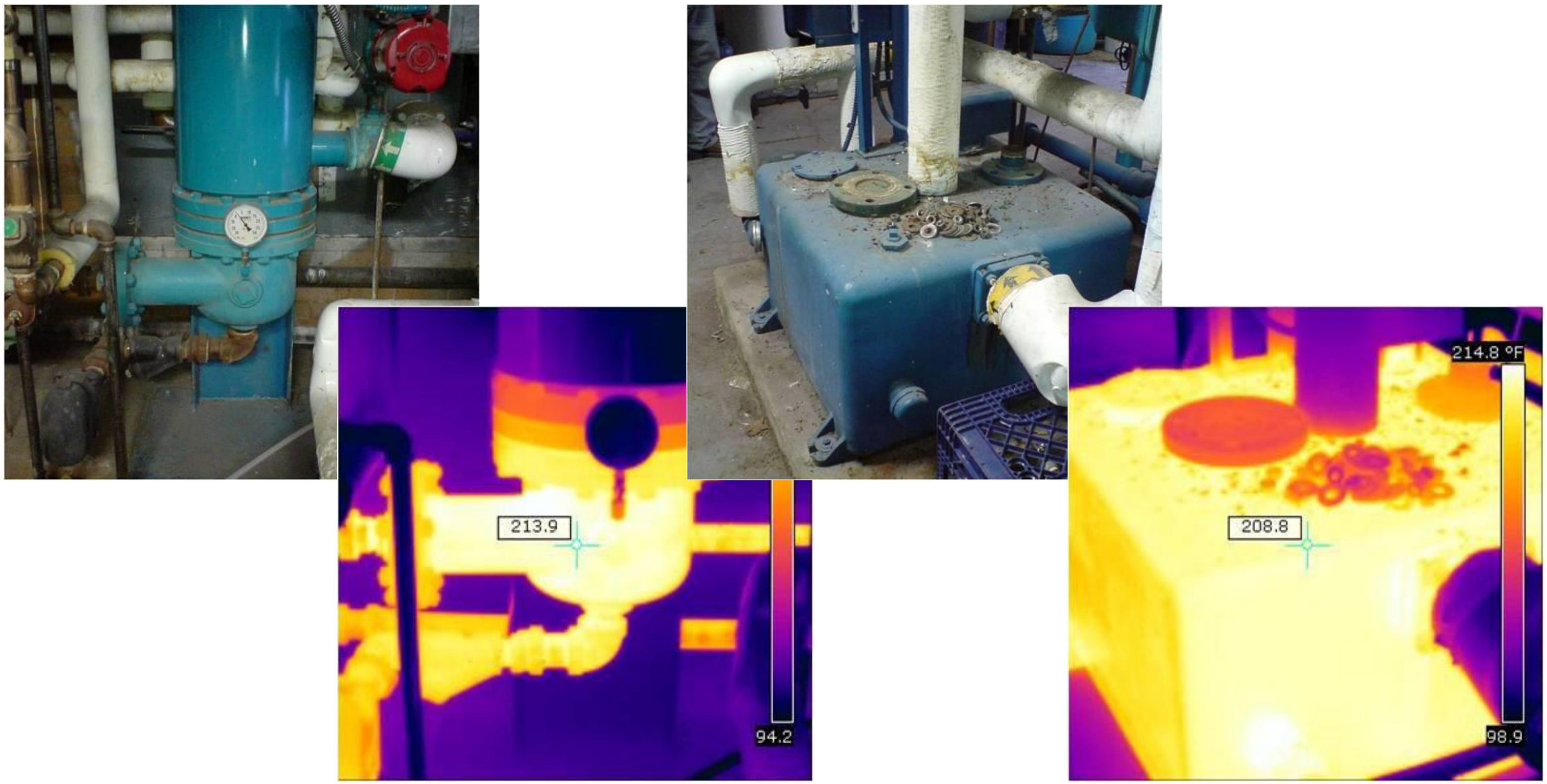
FAILED STEAM TRAP



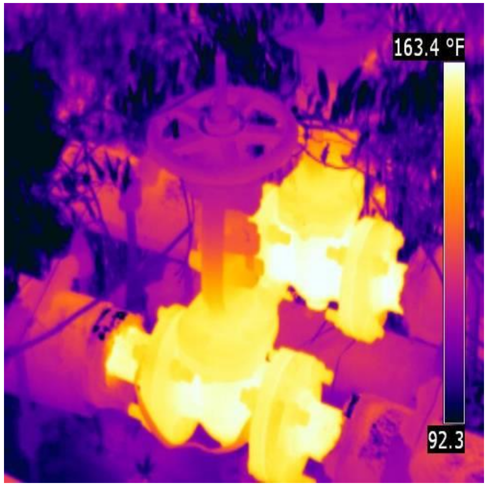
HYDRONIC HEATING PUMPS



The condensate receiver tanks and condensate pre-heaters



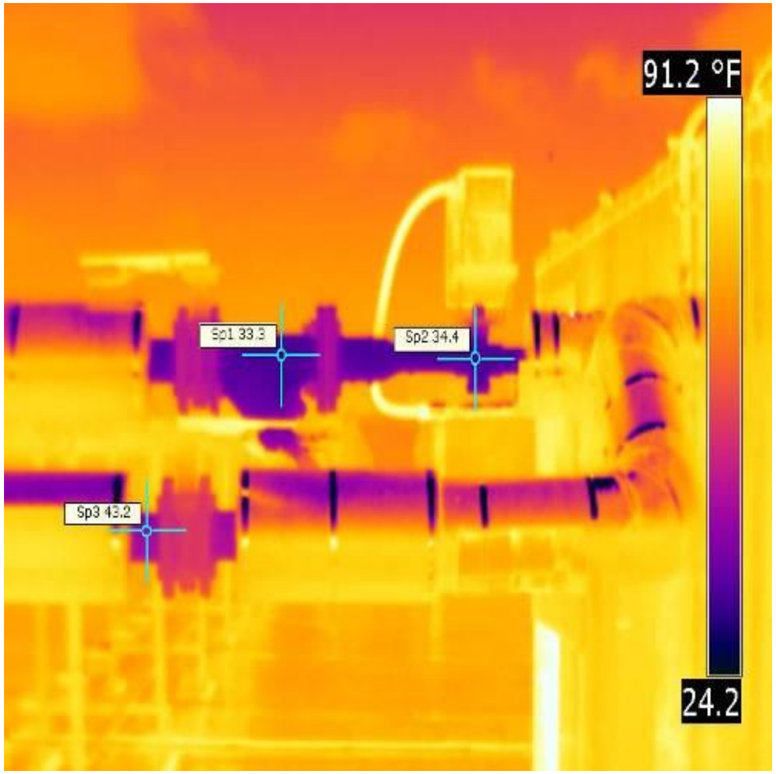
Exterior piping and valves are often neglected



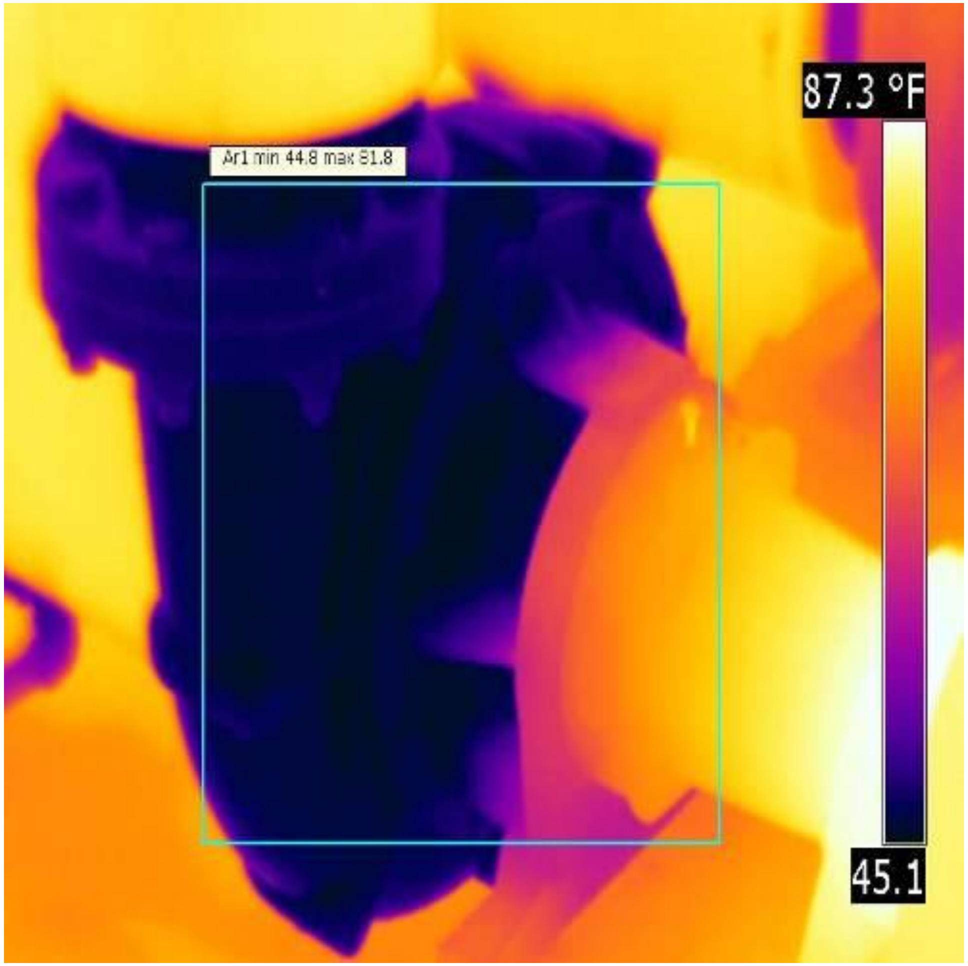
Damaged insulation from leak repair never fixed

Chilled Water
Repair

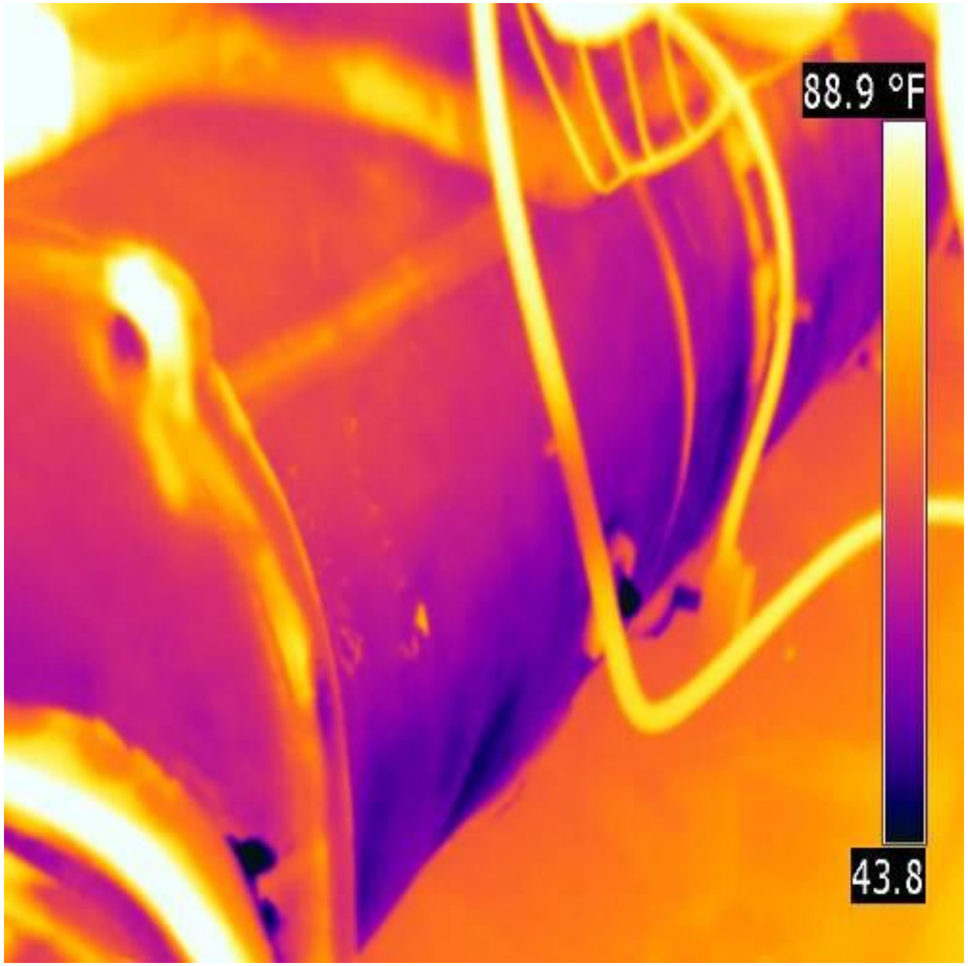
Chilled piping on the roof



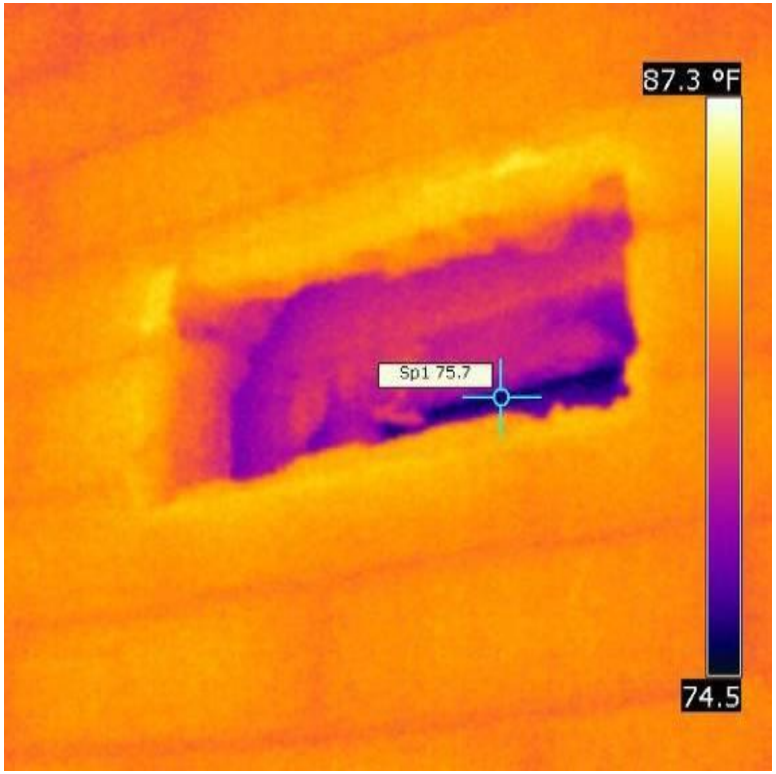
Chilled Pumps

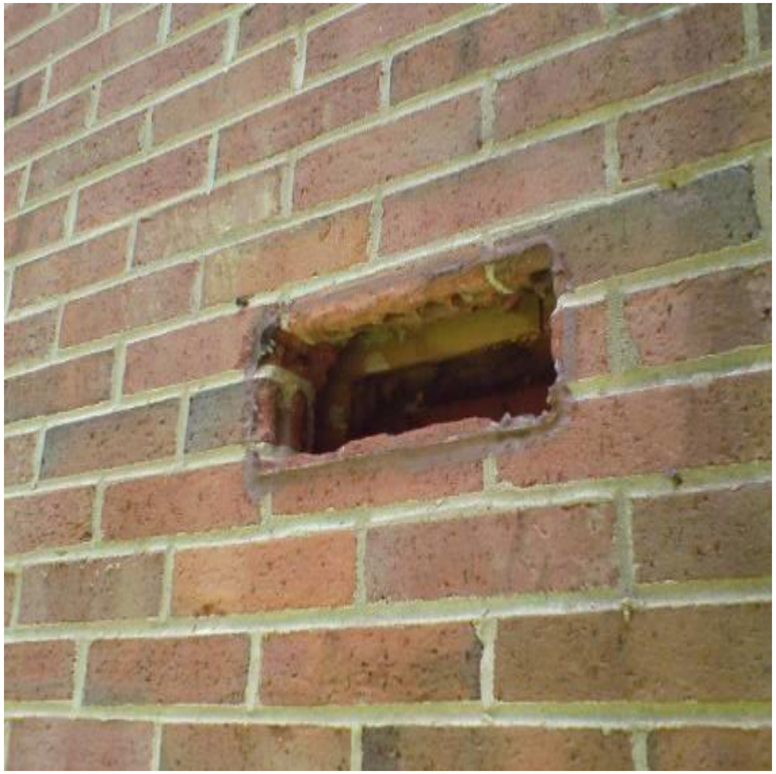


Water Saturated Insulation



Openings in the Building's Envelope

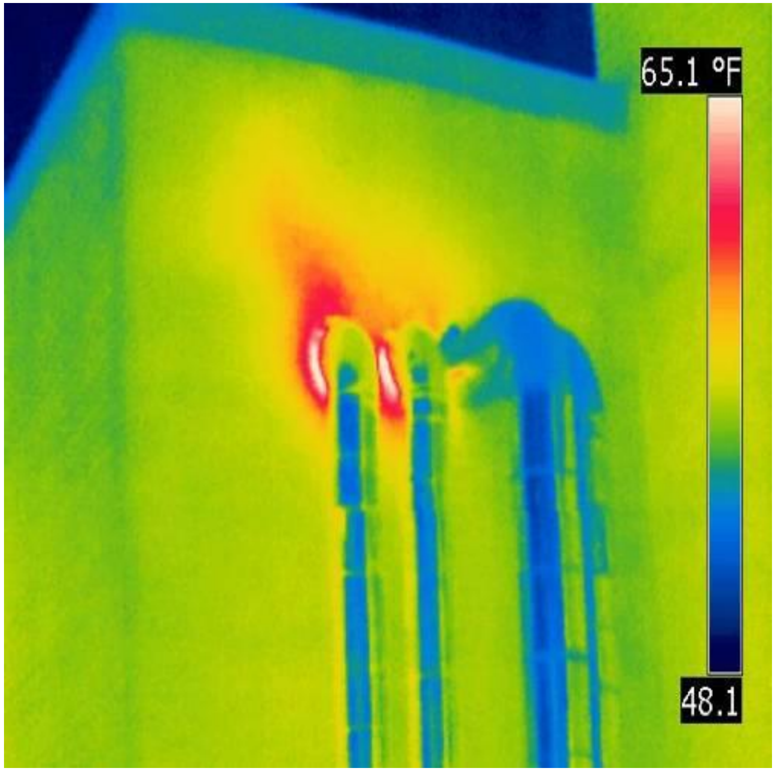




Some are Obvious

SOME NOT SO OBVIOUS

Note: Only one is showing Energy Loss



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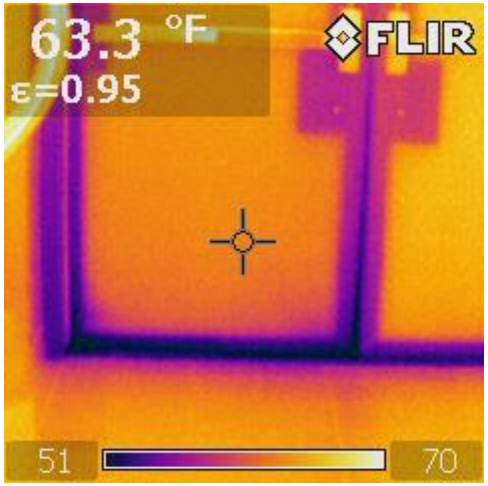
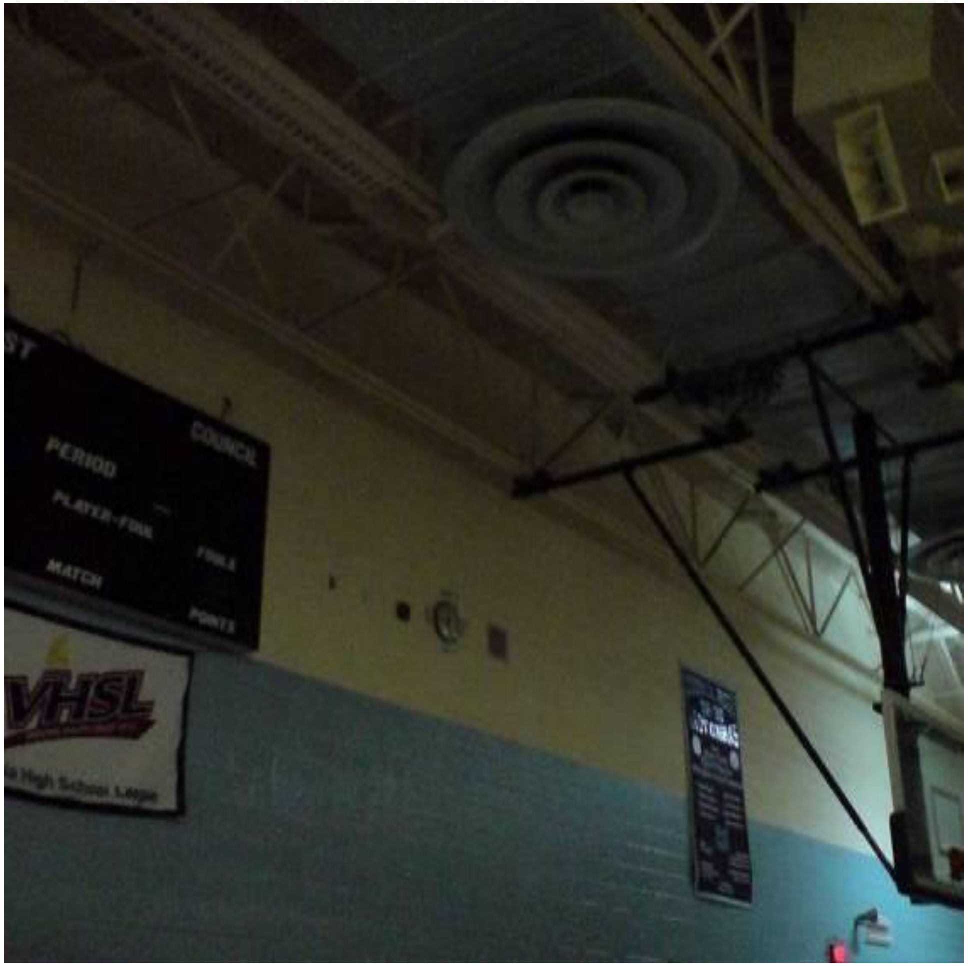
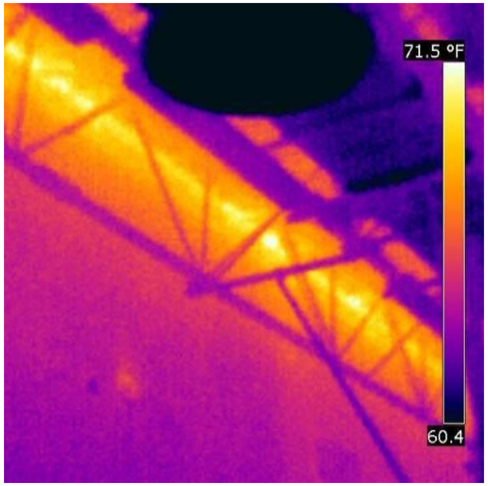
Infiltration around a door



Infiltration at the head of a wall





Gather Data Necessary to Perform Accurate Calculations

Temperature Which Heating Begins	70	°F
Temperature Which Cooling Begins	72	°F
Day Operation Begins (Sunday is Day 1)	2	Monday
Day Operation Ends (Sunday is Day 1)	6	Friday
Hour Operation Begins (Hour 1 is Midnight to 1 AM)	6	Hour
Hour Operation Ends (Hour 1 is Midnight to 1 AM)	18	Hour
Directional Wind Infiltration/Exfiltration	70%	per cent
Occupied Cooling Temperature Setpoint	72	°F
Occupied Heating Temperature Setpoint	70	°F
Unoccupied Cooling Indoor Temperature Setpoint	85	°F
Unoccupied Heating Indoor Temperature Setpoint	65	°F
Cooling Plant Efficiency	1.3	kW/ton
Heating Plant Efficiency	65%	per cent
Energy Cost $/kWh	$ 0.09000	per kWh
Fuel Energy Cost $/MMBtu	$ 23.91000	per MMBtu
# of Floors in Building	3	
Local Shelter Class (see Table 5 below)	3	Typical shelter used by othe
A_r = Effective Air Leakage Area from Survey, ft^2	6.57	ft^2

BE Calculations are based on ASHRAE 90.1 a Universally Recognized Standard

These calculations are based on ASHRAE Fundamentals 2009, chapter 16, page 16.23, formula number 48 as shown below.

Basic Model. The following calculations are based on the Sherman and Grimsrud (1980) model, which uses the effective air leakage area at 0.016 in. of water. This leakage area can be obtained from a whole-building pressurization test. Using effective air leakage area, the airflow rate from infiltration is calculated according to

$$Q = A_L\sqrt{C_s\Delta t + C_w U^2} \qquad (48)$$

where

- Q = airflow rate, cfm
- A_L = effective air leakage area, in^2
- C_s = stack coefficient, cfm^2/(in$^4\cdot$°F)
- Δt = average indoor-outdoor temperature difference for time interval of calculation, °F
- C_w = wind coefficient, cfm^2/(in$^4\cdot$mph^2)
- U = average wind speed measured at local weather station for time interval of calculation, mph

Table 4 presents values of C_s for one-, two-, and three-story houses. The value of wind coefficient C_w depends on the local shelter class of the building (described in Table 5) and the building height. Table 6 presents values of C_w for one-, two-, and three-story houses in shelter classes 1 through 5. In calculating values in Tables 4 and 6, the following assumptions were made regarding input to the basic model:

MI Calculations are performed by 3E Plus a DOE Recognized Standard

Energy Savings ($):	**31,856**
Energy Reduction (Btus):	**2.059E+09**
CO2 Reduction (lbs):	**422,952**
NOx Reduction (lbs):	**848**
Carbon Equivalent Reduction (lbs):	**115,245**
Simple Payback (yrs):	**2.39**
Internal Rate of Return (%)	**41.85**
Net Present Value ($):	**219,182**

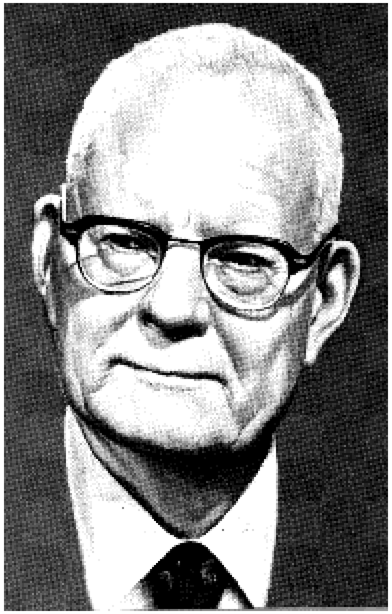
Paybacks, Environmental Reductions and ROI

Nothing gets done without Performing the Calculations

Data is Necessary for Financing

"If something can be calculated it can be approved".

W. Edwards Deming



Anything Less is…

Thank You

This concludes The American Institute of Architects Continuing Education Systems Course

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