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**Pete Ielmini**, *Executive Director* 732-210-7084    **Gina Walsh**, *Deputy Director* 314-683-6136

The following pages will outline a case study, which shows the benefits in energy and cost savings of properly installed mechanical insulation.

Insulation is a proven means for conserving energy, reducing greenhouse gas emissions, increasing process productivity, providing a safer and more productive work environment, controlling condensation (which can lead to mold growth), supporting sustainable design technology and a host of other benefits.

Mechanical insulation does all of this, while providing a return on investment (ROI) rate, which is seldom rivaled. Despite the proven ROI, insulation is often overlooked and its benefits undervalued. Insulation is truly the lost or forgotten technology. Can you think of a more important time than now to think about how insulation can help you?

An insulation system is a technology, which needs to be engineered and maintained throughout the entire process. Several studies have estimated roughly 10 to 30 percent of all installed insulation is now missing or damaged.

The practice of not replacing or maintaining an insulation system in a timely and correct manner reduces the full benefits of insulation, and in return, decreases the ROI. In many cases, significant other issues - such as excessive energy loss, corrosion under insulation (CUI), mold development, increased cost of operations and reduced process productivity or efficiency - develop.

You can learn more on [www.MechanicalInsulatorsLMCT.com](http://www.MechanicalInsulatorsLMCT.com), where additional case studies can be viewed.

Please do not hesitate to contact me should you have any additional questions.  
Thank you,

Peter Ielimi

Executive Director  
Mechanical Insulators Labor Management Cooperative Trust



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# INSULATION ENERGY APPRAISAL FINAL REPORT

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For  
Bernice MacNaughton High School  
Moncton, New Brunswick



Presented by:  
Joshua Sherrard  
Heat & Frost Training Centre  
1041 Bayside Drive  
Saint John, NB  
E2J 4Y2

## **Executive Summary**

The insulation energy appraisal evaluated the performance of mechanical rooms at your facility. All piping is currently insulated with 1-inch thick fiberglass insulation. Based on the analysis findings, the appraiser calculated a) the cost of operating line with existing insulation; b) the cost to operate with 1 inch thick fiberglass vs 1 ½ thick fiberglass. He also calculated emission saving if each facility was properly insulated. These calculations are summarized below.

### **Energy Cost**

Heat loss at Bernice MacNaughton facility listed at 2,143,494 Kbtu per year

*An estimated 5 year saving of \$134,430.05, and a simple payback return on investment in 0.9 years*

### **Energy/Emissions Savings**

Co<sub>2</sub> reduction at Bernice MacNaughton facility 123.3 Mt per year

### **Insulation and Energy Efficiency**

Insulation systems improve the energy efficiency of a plant and reduce the level of emissions of greenhouse gases into the atmosphere. Systems that have an upgraded insulation system can achieve an even more dramatic increase in savings. A properly selected, installed and maintained insulation system can, in many cases, provide an excellent return on investment and quick payback through cost savings. When compared to other conservation measures, the payback is often very quick - usually less than six months. The savings are significant in terms of reduced energy use, increased efficiency, and reduced greenhouse gas emissions.

### **Conclusion**

The appraiser commends Bernice MacNaughton facility on upkeep and maintaining their insulation systems. The Bernice MacNaughton facility insulation system is very well maintained also, and the finding show a relatively positive energy efficiency. Our analysis show that though each facility is believed to be insulated with proper thicknesses. But due to facility maintenance, there are some areas that, if insulated to meet the rest of facility insulation standards, would be able to significantly reduce their energy loss and reduce the level of greenhouse gas emissions.

**Limitations:**

We have used information provided to us from various sources but information such as operational heating cycles and cooling cycles are based on conversations with maintenance personnel.

**Disclaimer:**

The results of the insulation energy audit are estimated based upon the data supplied or determined during the audit process and the 3E programs calculations. The results are not guaranteed nor warranted and may vary depending upon information provided and actual operating conditions. The results are intended to portray a reasonable estimate of potential energy savings and emissions reduction with the use of an upgraded and maintain insulation system.

Please contact the undersigned should you have questions about this report

Best regards,

Joshua Sherrard  
Energy Appraiser  
506 635 8609



# ENERGY AUDIT SCHOOL BERNICE MACNAUGHTON HIGH SCHOOL

Total Heat Loss  
5 year savings  
of  
\$134,430.05

CO<sub>2</sub> Reduction of  
123.3 MT/Year

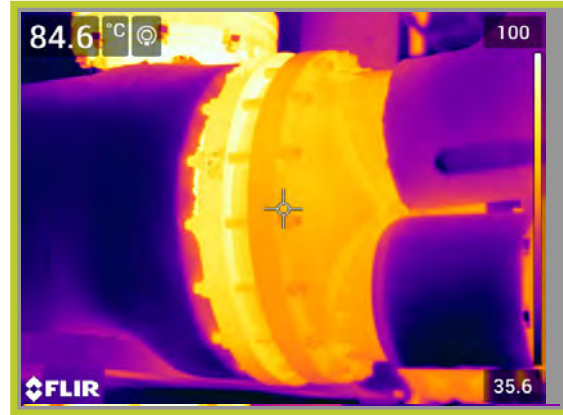


## Benefits:

- Simple payback period
- CO<sub>2</sub> Reduction
- Personnel safety

*Audit Done By:  
Joshua Sherrard  
Certified Thermographer  
Certified 3E Plus Auditor*

## Boiler Room



Operating Temperature,  
Ambient Temperature,  
Insulation selected

212°F  
71°F  
Fiberglass

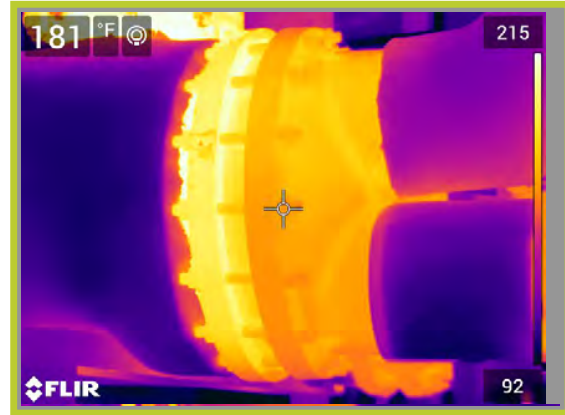
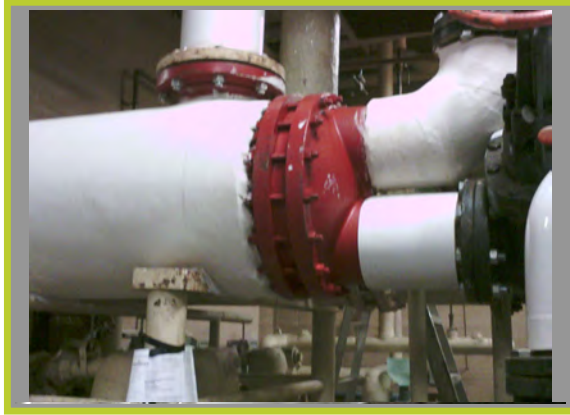
Emittance of Surface  
Expected Useful Life of Insulation System  
Operating hours per year  
Efficiency of fuel Conversion%

0.95  
20 yrs.  
8760  
85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	212F	41,220	\$578.58	\$578.58	\$2,892.90	2.73
1	92F	4,959	\$69.63	\$508.95	\$2,544.75	0.3
1.5	86F	3,483	\$48.90	\$529.68	\$2,648.40	0.21



## Boiler Room

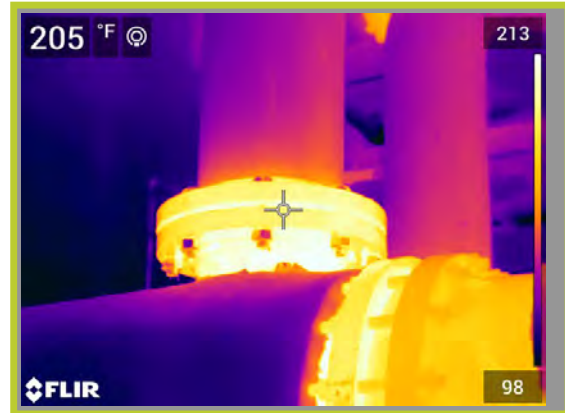


Operating Temperature,	210°F	Emittance of Surface	0.95
Ambient Temperature,	71°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	210F	29,163	\$409.32	\$409.32	\$2,046.6	1.92
1	92F	3,324	\$46.65	\$362.67	\$1,813.35	.021
1.5	86F	2,352	\$33.00	\$376.32	1,881.60	0.15



## Boiler Room



Operating Temperature,	185°F	Emittance of Surface	0.95
Ambient Temperature,	71°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	185F	23268	\$326.56	\$326.56	\$1,632.80	1.84
1	88F	2768	\$38.84	\$287.72	\$1438.60	0.24
1.5	82F	1852	\$25.96	\$300.60	\$1,503	0.16

## Boiler Room



Operating Temperature,  
Ambient Temperature,  
Insulation selected

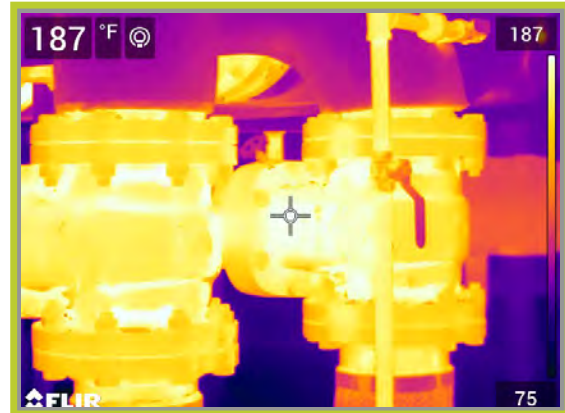
180°F  
71°F  
Fiberglass

Emittance of Surface  
Expected Useful Life of Insulation System  
Operating hours per year  
Efficiency of fuel Conversion%

0.95  
20 yrs.  
8760  
85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	180F	27,656	\$388.16	\$388.16	1,940.80	1.84
1	86F	3,432	\$48.16	\$340	\$1,700	0.24
1.5	82F	2,496	\$34.96	\$353.20	\$1,766	0.16

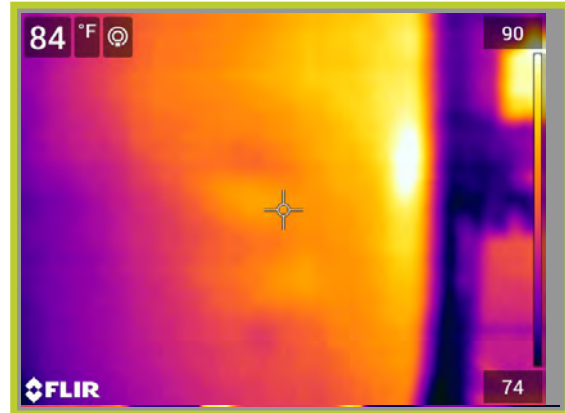
## Boiler Room



Operating Temperature,	210°F	Emittance of Surface	0.95
Ambient Temperature,	71°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	210F	35,472	\$497.76	\$497.76	\$2488.80	2.4
1	86F	4,800	\$67.20	\$430.56	\$2,152.80	0.24
1.5	81F	3,792	\$32.25	\$465.51	\$2,327.55	0.24

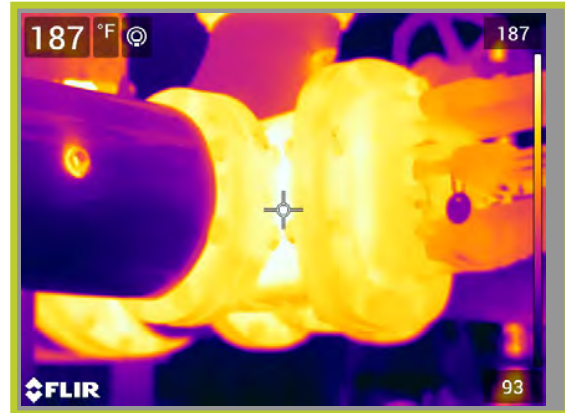
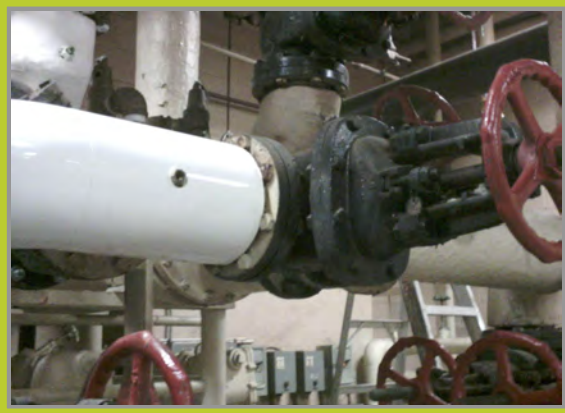
## Boiler Room



Operating Temperature,	210°F	Emittance of Surface	0.95
Ambient Temperature,	71°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	210F	15,900	\$223.20	\$223.20	\$1,116	1.05
1	84F	2,295	\$32.25	\$190.95	\$954.75	0.15
1.5	80F	1,875	\$26.40	\$196.80	\$984	0.15

## Boiler Room



Operating Temperature,	190°F	Emittance of Surface	0.95
Ambient Temperature,	71°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	190F	22,230	\$312.00	\$312.00	\$1560	1.5
1	84F	2,940	\$41.25	\$270.75	\$1353.75	0.15
1.5	80F	2,280	\$31.95	\$280.05	\$1400.25	0.15

## Boiler Room

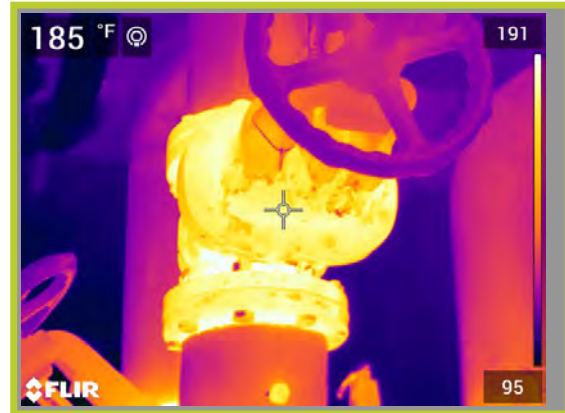


Operating Temperature,	130°F	Emittance of Surface	0.95
Ambient Temperature,	71°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%
		Selected fuel	Natural Gas

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	130F	6,699	\$94.08	\$94.08	\$470.40	0.42
1	77F	1,260	\$17.64	\$76.44	\$382.20	0
1.5	76F	1,029	\$14.49	\$79.59	\$397.95	0



## Boiler Room



Operating Temperature,  
Ambient Temperature,  
Insulation selected

130°F  
73°F  
Fiberglass

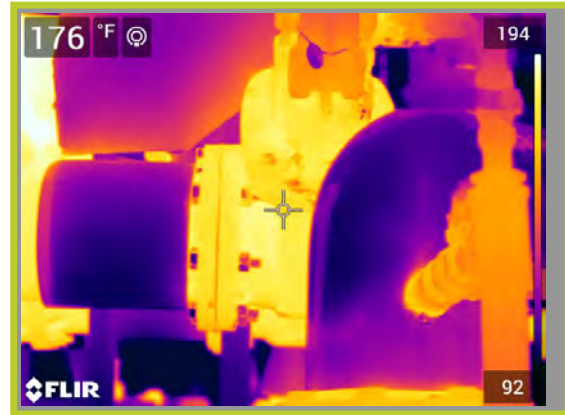
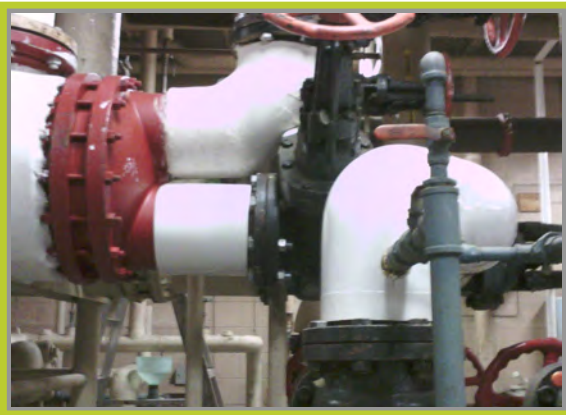
Emittance of Surface  
Expected Useful Life of Insulation System  
Operating hours per year  
Efficiency of fuel Conversion%

0.95  
20 yrs.  
8760  
85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	130F	13,398	\$188.16	\$188.16	\$940.80	0.84
1	77F	2,520	\$35.28	\$152.88	\$764.40	0
1.5	76F	2,058	\$28.98	\$159.18	\$795.90	0



## Boiler Room



Operating Temperature,  
Ambient Temperature,  
Insulation selected

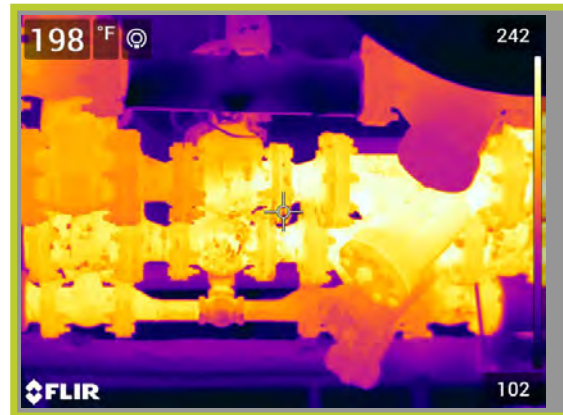
180°F  
71°F  
Fiberglass

Emittance of Surface  
Expected Useful Life of Insulation System  
Operating hours per year  
Efficiency of fuel Conversion%

0.95  
20 yrs.  
8760  
85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	180F	358,500	\$5,031.90	\$5,031.90	\$25,159.50	20.4
1	88F	41,880	\$588.00	\$4,443.90	\$22,219.50	2.7
1.5	83F	29,340	\$411.60	\$4,620.30	\$23,101.50	1.8

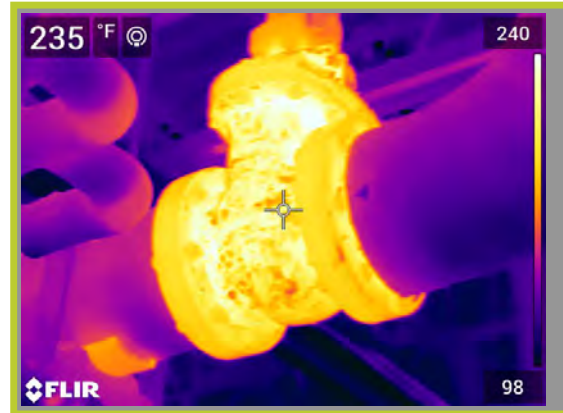
## Boiler Room



Operating Temperature,	225°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	225F	74,508	\$1,045.80	\$1045.80	\$5229.00	4.92
1	92F	8,604	\$120.84	\$924.96	\$4,624.80	0.6
1.5	86F	6,012	\$84.36	\$961.44	\$4,807.20	0.48

## Boiler Room



Operating Temperature,	225°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	225F	83,832	\$1,176.60	\$1,176.60	\$5,883.00	5.52
1	92F	9,108	\$127.92	\$1,048.68	\$5,243.40	0.6
1.5	86F	6,660	\$93.48	\$1083.12	\$5,415.6	0.48

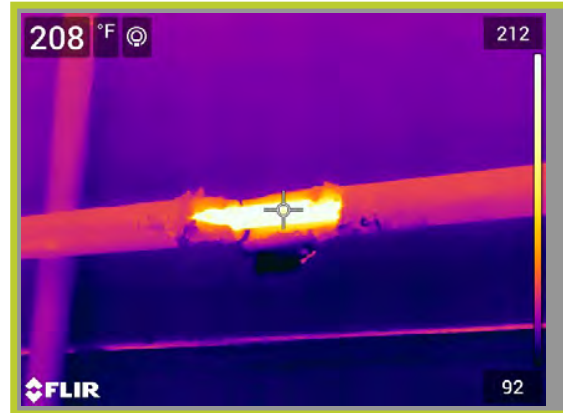
## Boiler Room



Operating Temperature,	200°F	Emittance of Surface	0.95
Ambient Temperature,	71°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	200F	84,984	\$1,192.80	\$1,192.80	\$5,964.00	5.64
1	87F	10,104	\$141.72	\$1,051.08	\$5,255.40	0.72
1.5	83F	7,152	\$100.44	\$1,092.36	\$5,461.80	0.48

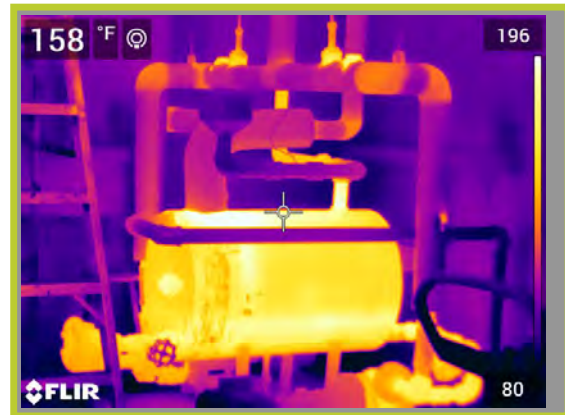
## Boiler Room



Operating Temperature,	225°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	225F	40,720	\$571.28	\$571.28	\$2,856.40	2.68
1	91F	4,140	\$58.12	\$513.16	\$2,565.80	0.28
1.5	86F	3,032	\$42.56	\$528.72	\$2,643.60	0.2

## Boiler Room

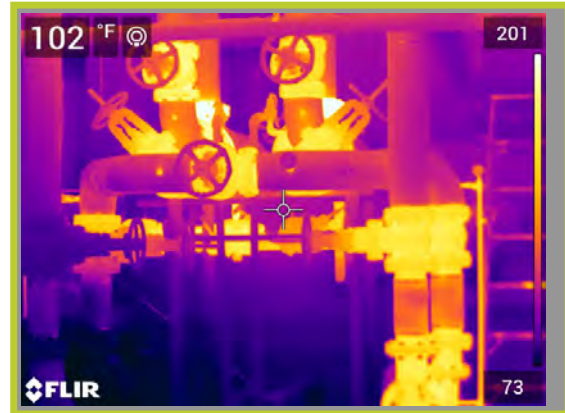


Operating Temperature,	230°F	Emittance of Surface	0.95
Ambient Temperature,	71°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	230F	94,500	\$1,326.12	\$1,326.12	\$6,630.60	6.24
1	94F	10,446	\$146.58	\$1,179.54	\$5,897.70	0.72
1.5	88F	7,320	\$102.78	\$1,223.34	\$6,116.70	0.48



## Boiler Room



Operating Temperature,  
Ambient Temperature,  
Insulation selected

185°F  
71°F  
Fiberglass

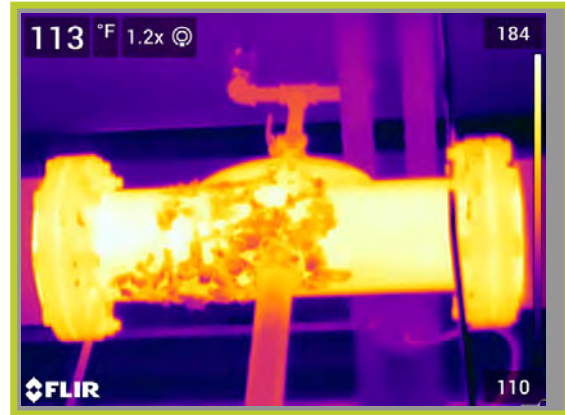
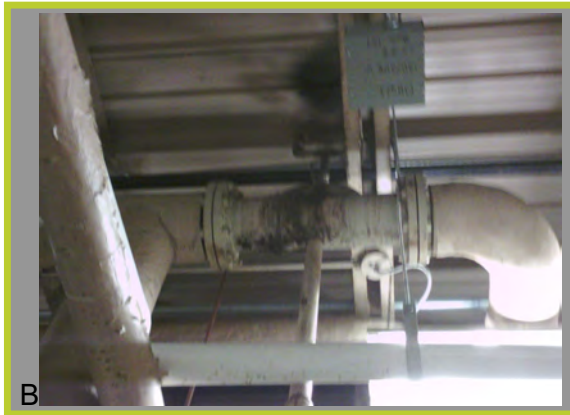
Emittance of Surface  
Expected Useful Life of Insulation System  
Operating hours per year  
Efficiency of fuel Conversion%

0.95  
20 yrs.  
8760  
85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	185F	127,476	\$1,789.20	\$1,789.20	\$8,946.00	8.46
1	87F	15,156	\$212.58	\$1,576.62	\$7,883.10	1.08
1.5	83F	10,728	\$150.66	\$1638.54	\$8,192.70	0.72



## Boiler Room



Operating Temperature,	237°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	237F	157,200	\$2,206.80	\$2,206.80	\$11,034.00	10.4
1	93F	17,210	\$241.50	\$1,965.30	\$9,826.50	1.1
1.5	89F	12,090	\$169.60	\$2,037.20	\$10,186.00	0.8

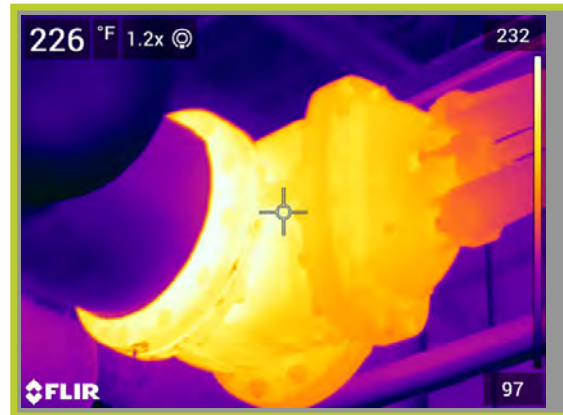
Boiler Room



Operating Temperature,	237°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	237F	67,500	\$947.76	\$947.76	\$4,738.80	4.44
1	93F	6,780	\$95.16	\$852.60	\$4,263.00	0.42
1.5	87F	4,962	\$69.66	\$878.10	\$4,390.50	0.3

## Boiler Room



Operating Temperature,	160°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	160F	6,144	\$81.18	\$81.18	\$405.90	0.36
1	81F	852	\$11.28	\$69.90	\$349.50	0.06
1.5	78F	660	\$8.70	\$72.48	\$362.40	0.06

## Boiler Room



Operating Temperature,	160°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	160F	10,989	\$145.17	\$145.17	\$725.85	0.72
1	82F	1,467	\$19.44	\$125.73	\$628.65	0.09
1.5	77F	1,017	\$13.41	\$131.76	\$658.80	0.09

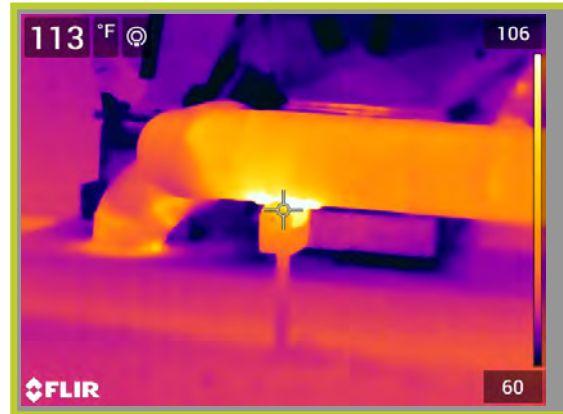
## Boiler Room



Operating Temperature,	235°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	235F	13,530	\$178.74	\$178.74	\$893.70	0.84
1	89F	1,698	\$22.44	\$156.30	\$781.50	0.12
1.5	83F	1,314	\$17.34	\$161.40	\$807.00	0.06

## Upstairs Mechanical Room



Operating Temperature,	230°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	230F	65,619	\$866.79	\$866.79	\$4333.95	4.05
1	92F	7,092	\$93.69	\$773.10	\$3865.50	0.45
1.5	86F	5,184	\$68.49	\$798.30		0.36



## Upstairs Mechanical Room

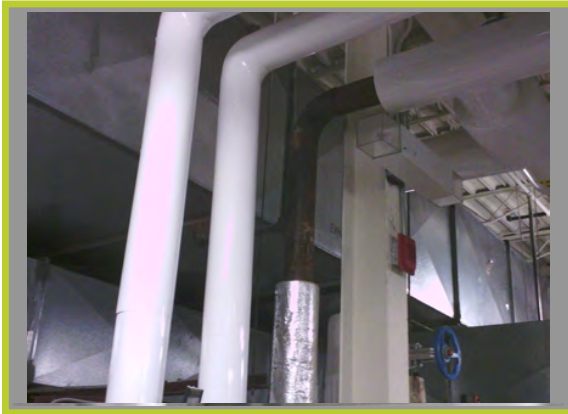


Operating Temperature,	104°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	104F	7,092	\$93.69	\$93.69	\$468.45	0.45
1	77F	1,062	\$14.04	\$79.65	\$398.25	0.09
1.5	75F	774	\$10.29	\$83.40	\$417.00	0.09



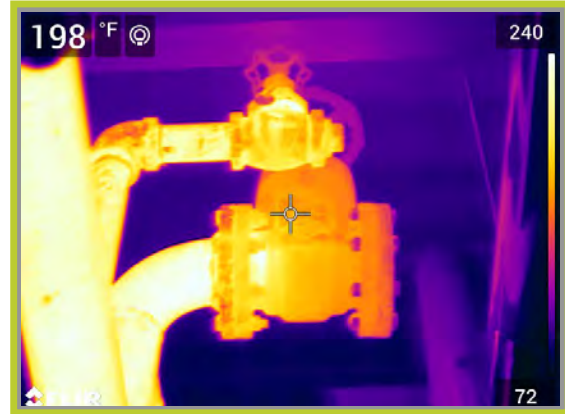
## Upstairs Mechanical Room



Operating Temperature,	110°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	110F	2,226	\$29.40	\$29.40	\$147.00	0.12
1	76F	354	\$4.62	\$24.78	\$123.90	0
1.5	75F	276	\$3.60	\$25.80	\$129.00	0

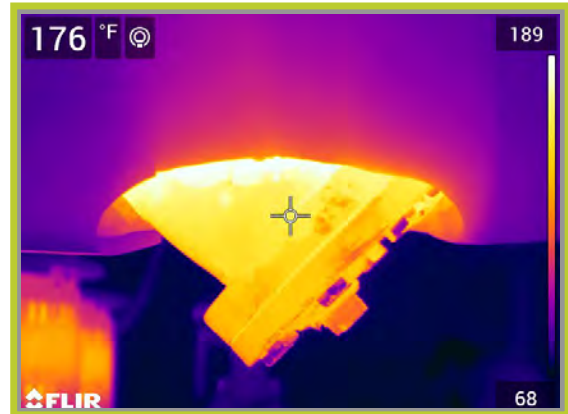
## Upstairs Mechanical Room



Operating Temperature,	240°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	240F	179,004	\$2,364.60	\$2,364.60	\$11,823.00	11.34
1	92F	20,076	\$265.02	\$2,099.58	\$10,497.90	1.26
1.5	86F	15,162	\$199.92	\$2,164.68	\$10,823.40	0.84

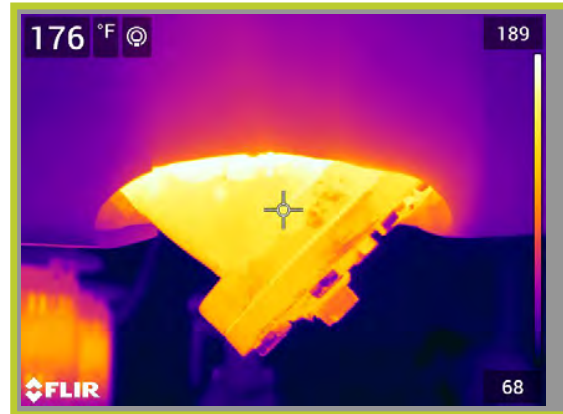
## Upstairs Mechanical Room



Operating Temperature,	240°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	240F	28,176	\$372.12	\$372.12	\$1860.60	1.8
1	90F	3,516	\$46.44	\$325.68	\$1628.40	0.24
1.5	84F	2,712	\$35.88	\$336.24	\$1681.20	0.12

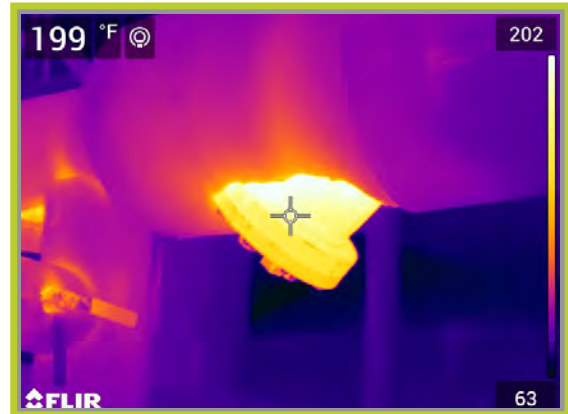
## Upstairs Mechanical Room



Operating Temperature,	235°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	235F	7,746	\$102.33	\$102.33	\$511.65	0.48
1	89F	942	\$12.45	\$89.88	\$449.40	0.06
1.5	82F	648	\$8.58	\$93.75	\$468.75	0.03

## Upstairs Mechanical Room



Operating Temperature,	200°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	200F	24,568	\$324.52	\$324.52	\$1622.60	1.52
1	89F	2,732	\$36.08	\$288.44	\$1442.20	0.16
1.5	84F	1,992	\$26.32	\$298.20	\$1491.00	0.12

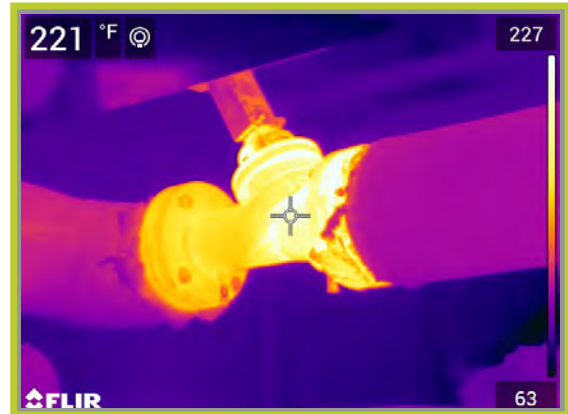
## Upstairs Mechanical Room



Operating Temperature,	115°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	115	2,085	\$27.54	\$27.54	\$137.70	0.12
1	76	255	\$3.36	\$24.18	\$120.90	0.03
1.5	75	204	\$2.70	\$24.84	\$124.20	0

## Upstairs Mechanical Room

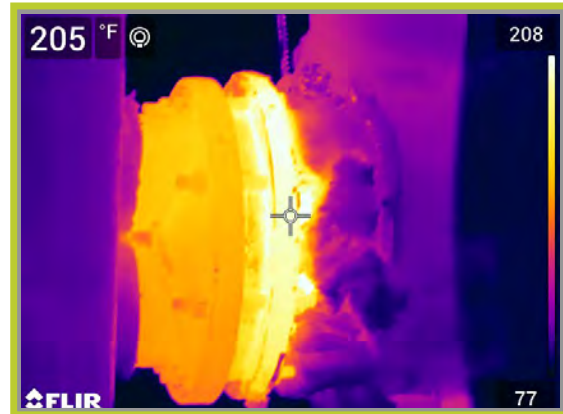
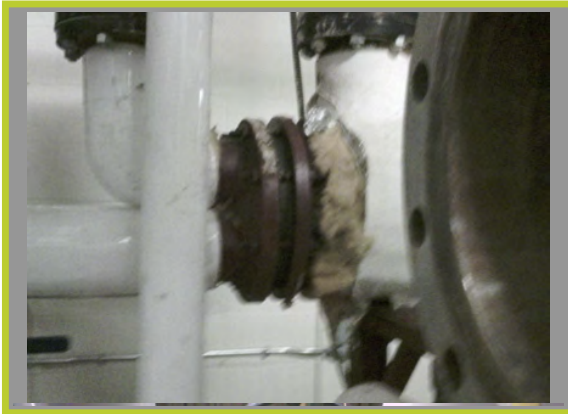


Operating Temperature,	180°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	180F	20,742	\$273.96	\$273.96	\$1369.80	1.26
1	86F	2,574	\$33.96	\$240.00	\$1200.00	0.18
1.5	82F	1,872	\$24.72	\$249.24	\$1246.20	0.12



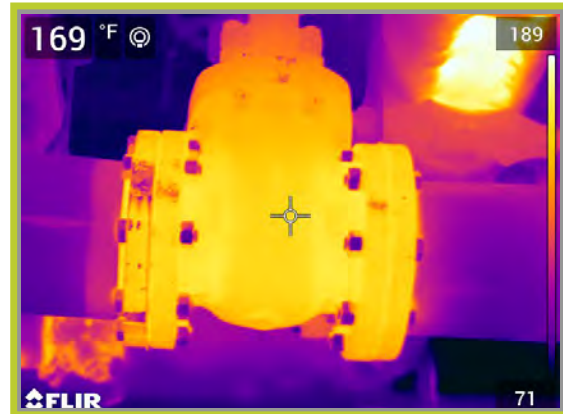
## Upstairs Mechanical Room



Operating Temperature,	205°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	205F	23,248	\$307.08	\$307.08	\$1535.40	1.44
1	89F	2,588	\$34.20	\$272.88	\$1364.40	0.16
1.5	84F	1,896	\$25.00	\$282.08	\$1410.40	0.12

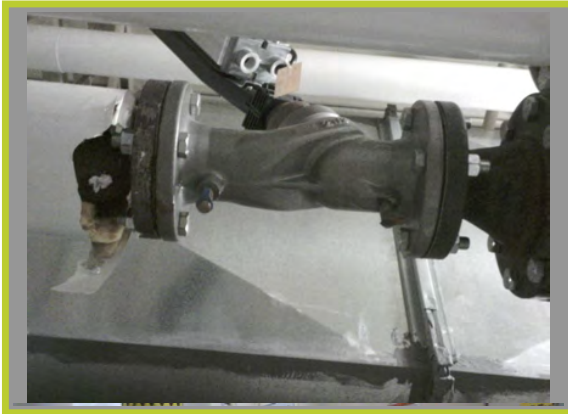
## Upstairs Mechanical Room



Operating Temperature,	110°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	110F	654	\$8.64	\$8.64	\$43.20	0.03
1	76F	117	\$1.53	\$7.11	\$35.55	0
1.5	74F	96	\$1.26	\$7.38	\$36.90	0

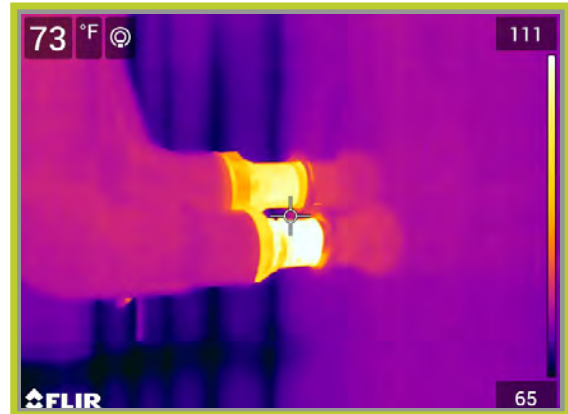
## Upstairs Mechanical Room



Operating Temperature,	108°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	108	4,473	\$59.13	\$59.13	\$295.65	0.27
1	76	675	\$8.91	\$50.22	\$251.10	0
1.5	75	513	\$6.75	\$52.38	\$261.90	0

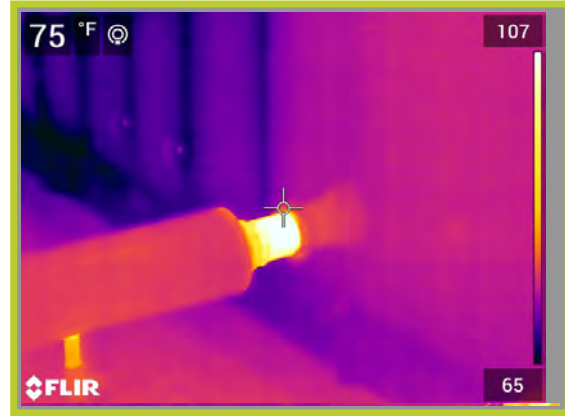
## Gym Mechanical Room



Operating Temperature,	208°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	208F	34,852	\$460.36	\$460.36	\$2301.80	2.16
1	89F	3,620	\$47.80	\$412.56	\$2062.80	0.24
1.5	84F	2,652	\$35.00	\$425.36	\$2126.80	0.16

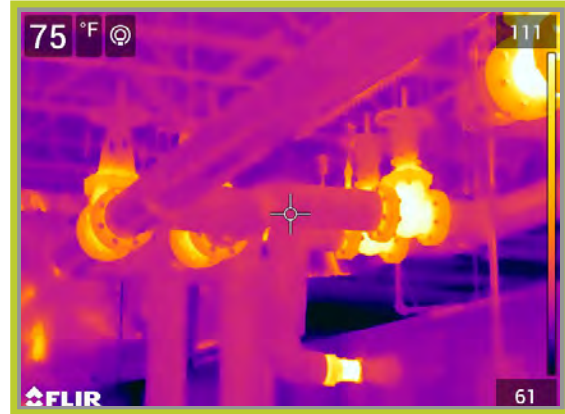
## Gym Mechanical Room



Operating Temperature,	205°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	205F	52,308	\$690.93	\$690.93	\$3454.65	3.24
1	89F	5,823	\$76.95	\$613.98	\$3069.90	0.36
1.5	84F	4,266	\$56.25	\$634.68	\$3173.40	0.27

## Gym Mechanical Room

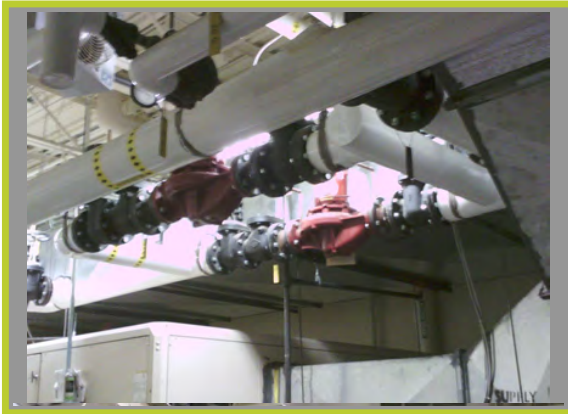


Operating Temperature,	167°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	167F	34,011	\$449.28	\$449.28	\$2246.40	2.16
1	84F	4,005	\$52.92	\$396.36	\$1981.80	0.27
1.5	81F	2,934	\$38.79	\$410.49	\$2052.45	0.18



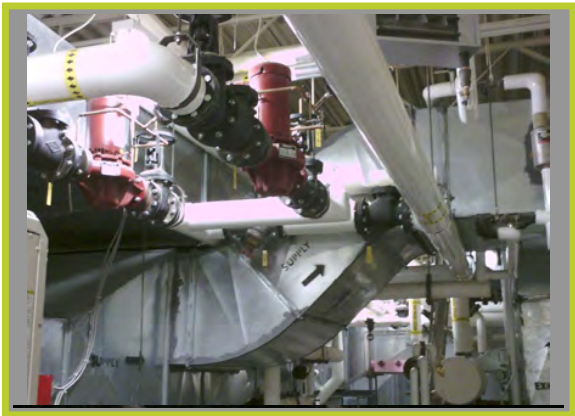
## Gym Mechanical Room



Operating Temperature,	160°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	160	18,318	\$241.98	\$241.98	\$1209.90	1.14
1	84	2,322	\$30.66	\$211.32	\$1056.60	0.12
1.5	80	1,626	\$21.48	\$220.50	\$1102.50	0.12

Gym Mechanical Room



Operating Temperature,	160°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	160F	9,159	\$120.99	\$120.99	\$604.95	0.57
1	84F	1,161	\$15.33	\$105.66	\$528.30	0.06
1.5	80F	813	\$10.74	\$110.25	\$551.25	0.06

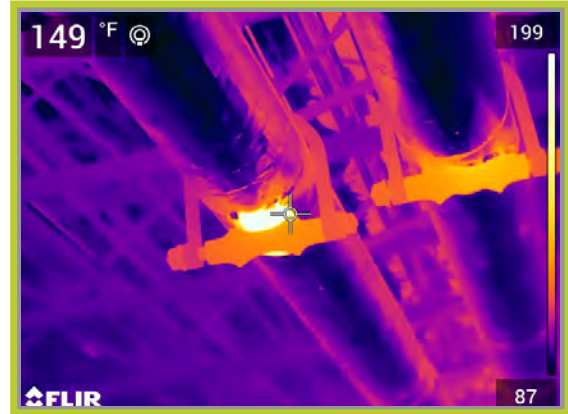
## Gym Mechanical Room



Operating Temperature,	115°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	115	17,232	\$227.52	\$227.52	\$1137.60	0.96
1	78	2,304	\$30.48	\$197.04	\$985.20	0.24
1.5	76	1,680	\$22.32	\$205.20	\$1026.00	0

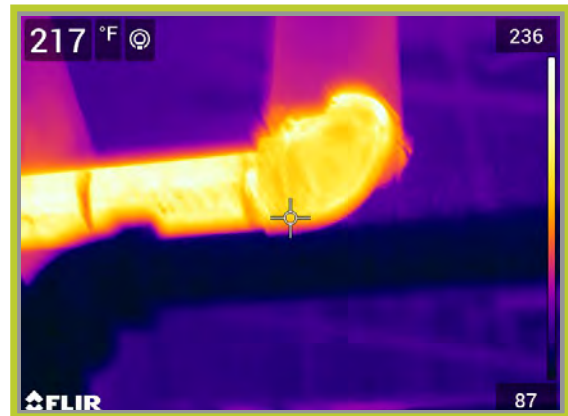
## Gym Mechanical Room



Operating Temperature,	108°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	108F	7,614	\$100.53	\$100.53	\$502.65	0.45
1	77F	981	\$12.87	\$87.66	\$438.30	0.09
1.5	75F	720	\$9.54	\$90.99	\$454.95	0

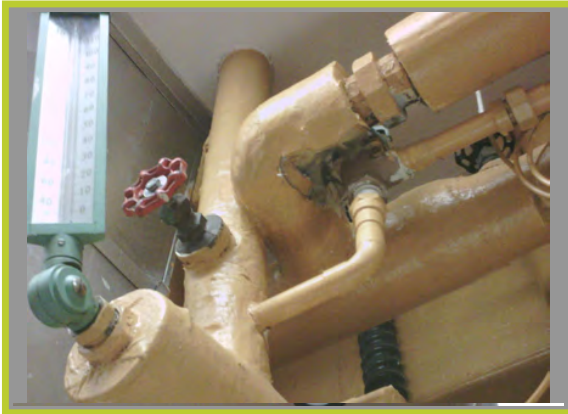
## Gym Mechanical Room



Operating Temperature,	115°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	115F	921	\$12.15	\$12.15	\$60.75	0.06
1	77F	135	\$1.80	\$10.35	\$51.75	0
1.5	75F	102	\$1.35	\$10.80	\$54.00	0

## Kitchen

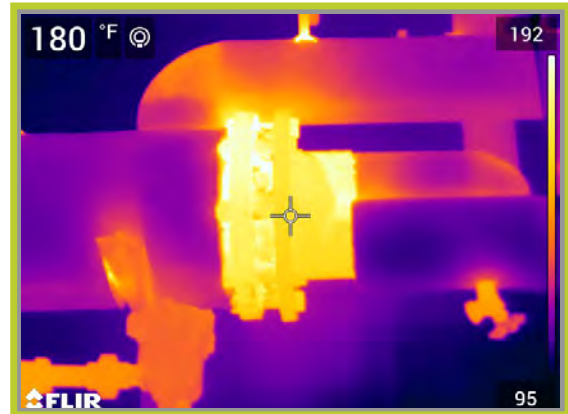
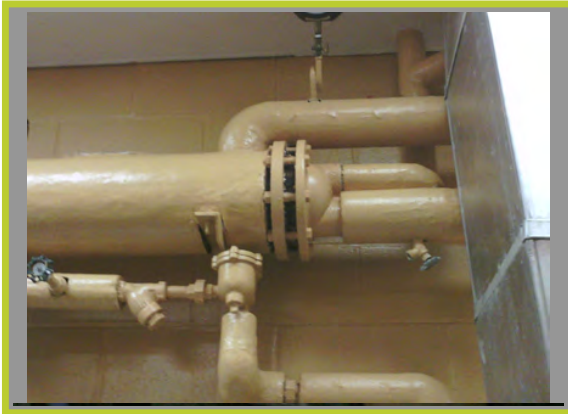


Operating Temperature,	180°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	180F	21,960	\$290.08	\$290.08	\$1450.40	1.36
1	87F	2,632	\$34.76	\$255.32	\$1276.60	0.16
1.5	82F	1,760	\$23.24	\$266.84	\$1334.20	0.12



## Kitchen



Operating Temperature,	150°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	150F	2,160	\$28.53	\$28.53	\$142.65	0.12
1	80F	321	\$4.23	\$24.30	\$121.50	0.03
1.5	77F	255	\$3.36	\$25.17	\$125.85	0.03

## Hall Above Ceiling



Operating Temperature,	151°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	151F	42,336	\$559.20	\$559.20	\$2796.00	2.4
1	80F	6,000	\$79.20	\$480.00	\$2400.00	0.48
1.5	76F	4,656	\$61.44	\$497.76	\$2488.80	0.48

## Hall Above Ceiling



Operating Temperature,	174°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	174F	37,023	\$489.09	\$489.09	\$2445.45	2.31
1	84F	4,767	\$63.00	\$426.09	\$2130.45	0.21
1.5	80F	3,591	\$47.46	\$441.63	\$2208.15	0.21

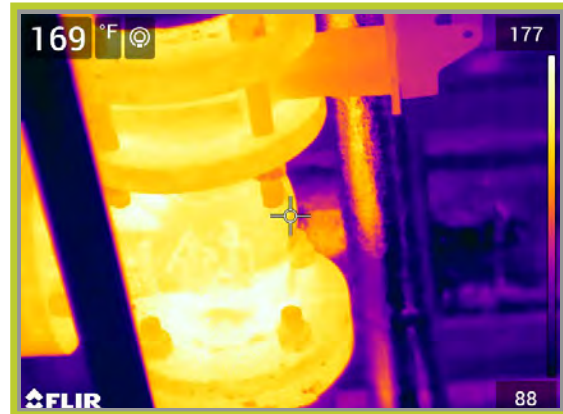
## Hall Above Ceiling



Operating Temperature,	174°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	174F	14,700	\$194.20	\$194.20	\$971.00	0.92
1	86F	1,820	\$24.04	\$170.16	\$850.80	0.12
1.5	81F	1,272	\$16.80	\$177.40	\$887.00	0.08

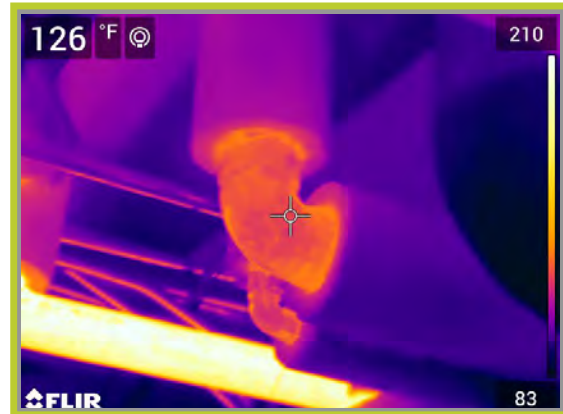
## Hall Above Ceiling



Operating Temperature,	230°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	230F	65,142	\$860.37	\$860.37	\$4301.85	3.99
1	90F	7,812	\$103.11	\$757.26	\$3786.30	0.42
1.5	84F	5,859	\$77.28	\$783.09	\$3915.45	0.42

## Hall Above Ceiling

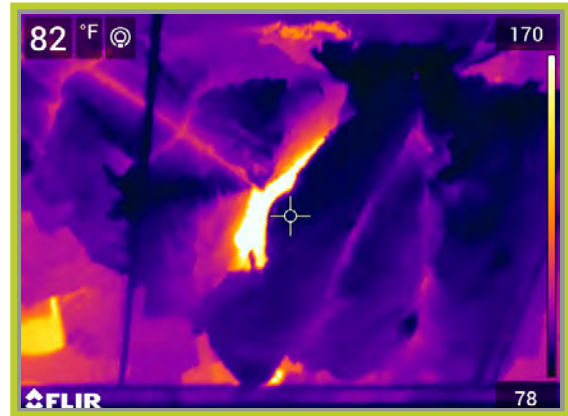


Operating Temperature,	228°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	228F	23,562	\$311.28	\$311.28	\$1556.40	1.44
1	90F	2,670	\$35.22	\$276.06	\$1380.30	0.18
1.5	85F	2,016	\$26.64	\$284.64	\$1423.20	0.12



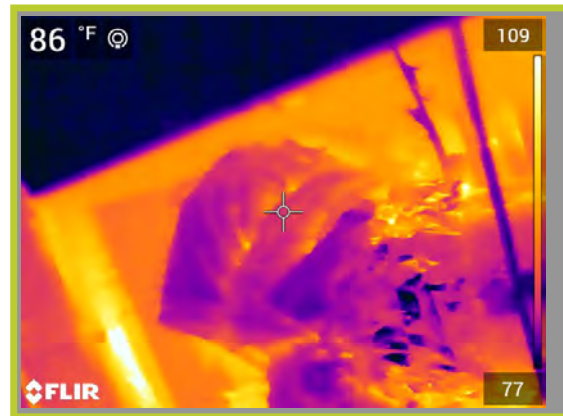
## Hall Above Ceiling



Operating Temperature,	100°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	100F	3,390	\$44.70	\$44.70	\$223.50	0.15
1	75F	645	\$8.40	\$36.30	\$181.50	0
1.5	74F	495	\$6.60	\$38.10	\$190.50	0

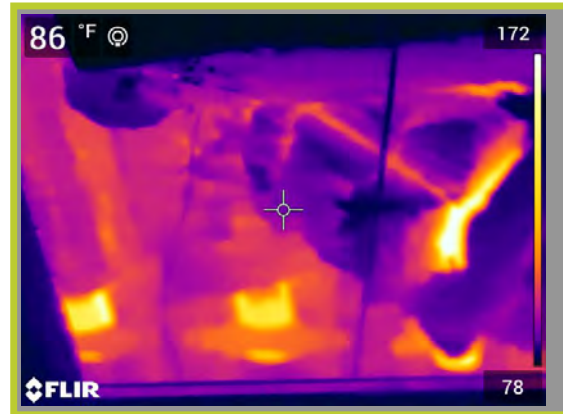
## Hall Above Ceiling



Operating Temperature,	126°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	126F	879	\$11.58	\$11.58	\$57.90	0.06
1	77F	168	\$2.19	\$9.39	\$46.95	0
1.5	75F	135	\$1.80	\$9.78	\$48.90	0

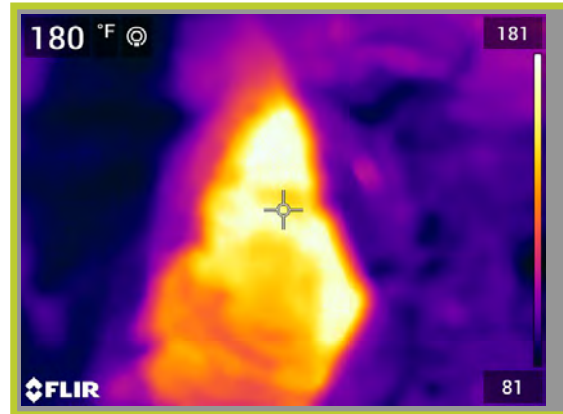
## Hall Above Ceiling



Operating Temperature,	126°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	126F	2,109	\$27.87	\$27.87	\$139.35	0.12
1	78F	345	\$4.56	\$23.31	\$116.55	0.03
1.5	76F	261	\$3.42	\$24.45	\$122.25	0.03

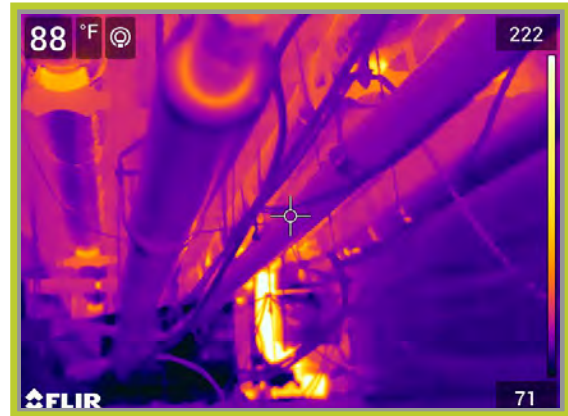
## Hall Above Ceiling



Operating Temperature,	174°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	174F	28,935	\$382.23	\$382.23	\$1911.15	1.8
1	86F	3,618	\$47.88	\$334.35	\$1671.75	0.27
1.5	81F	2,637	\$34.83	\$347.40	\$1737.00	0.18

## Hall Above Ceiling



Operating Temperature,	180°F	Emittance of Surface	0.95
Ambient Temperature,	73°F	Expected Useful Life of Insulation System	20 yrs.
Insulation selected	Fiberglass	Operating hours per year	8760
		Efficiency of fuel Conversion%	85%

THICKNESS	TEMPERATURE	HEAT LOSS	FUEL COST \$/yr	1styr SAVINGS.	5yr. SAVINGS	CO2 EMMISSIONS
0	180F	26,361	\$348.21	\$348.21	1,741.05	1.62
1	86F	3,249	\$42.93	\$305.28	1,526.40	0.18
1.5	81F	2,403	\$31.68	\$316.53	1,582.65	0.18

### Results

Simple Payback Period, yrs	0.9
Internal Rate of Return (IRR or ROI)	108.8%
Net Present Value,	\$513,009

### Calculations

Year	Investment	Annual Savings	Annual Cash Flow	Cumulative Cash Flow
0	\$-24,711	\$0	\$-24,711	\$-24,711
1	\$0	\$26,886	\$26,886	\$2,175
2	\$0	\$26,886	\$26,886	\$29,061
3	\$0	\$26,886	\$26,886	\$55,947
4	\$0	\$26,886	\$26,886	\$82,833
5	\$0	\$26,886	\$26,886	\$109,719
6	\$0	\$26,886	\$26,886	\$136,605
7	\$0	\$26,886	\$26,886	\$163,491
8	\$0	\$26,886	\$26,886	\$190,377
9	\$0	\$26,886	\$26,886	\$217,263
10	\$0	\$26,886	\$26,886	\$244,149
11	\$0	\$26,886	\$26,886	\$271,035
12	\$0	\$26,886	\$26,886	\$297,921
13	\$0	\$26,886	\$26,886	\$324,807
14	\$0	\$26,886	\$26,886	\$351,693
15	\$0	\$26,886	\$26,886	\$378,579
16	\$0	\$26,886	\$26,886	\$405,465
17	\$0	\$26,886	\$26,886	\$432,351
18	\$0	\$26,886	\$26,886	\$459,237
19	\$0	\$26,886	\$26,886	\$486,123
20	\$0	\$26,886	\$26,886	\$513,009