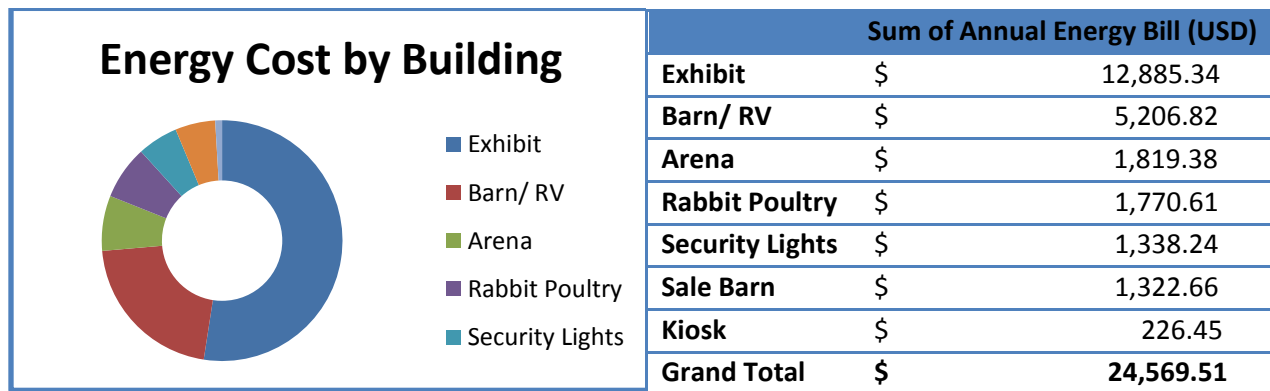


Fairgrounds Energy Audit Report

Summary:

In the next ten years, the fairgrounds will spend approximately **\$227,000** on electricity and **\$94,000** on natural gas to a **total of \$321,000** if no improvements are made. Almost half of these costs will come from the exhibit building, with an estimated energy cost of **\$167,000**. With the recommended remediation, it is estimated that the fairgrounds could be saving about **\$65,000** in the next ten years.

Energy Audits of the Fairground revealed certain hotspots of energy use that demanded deep energy improvements. The major energy sinks identified were the Exhibit building and the Barn/RV hookups.



Because of its abnormally high energy bill, this report has mainly focused on the exhibit hall for Energy Savings. Summary of the energy savings are below.

Summary of Energy Recommendations				
Description	Annual Savings	Cost	Rebate	Payback
Insulate Walls and Ceilings	\$4,660	TBD	--	TBD
Replace Furnaces	--	~\$3,500	\$660	--
Replace Weather stripping	--	~\$312	--	--
Cover swamp coolers	--	\$300	--	--
Replace thermostats	--	\$636	--	--
Replace Dining room lighting	\$259	\$1,218	\$330	3.43
Turn off Fridges	\$163	\$0	--	0
Add Insulation to water heaters	\$15	\$50	--	3.3
Total	\$5,097	TBD	\$990	TBD

This report was completed with the help and guidance of Jim Baerg, who dedicated several days to come to the fairgrounds and has offered his expertise in building science throughout the process.

Cost Outlook:

The below chart details the energy cost associated with the exhibit building over the next ten years factoring in the typical inflation of energy costs. The electricity rate was assumed to increase 5% per year while the gas was assumed to increase 4% per year. Electricity will cost roughly \$95,000, and gas about \$83,000 in the next decade. These could be reduced to \$91,000, and \$20,500 respectively, with a net savings of about \$65,000.

Year	Electric Rate	Gas Rate	Electricity Cost	Electricity Cost with Remediation	Net Savings Electric	Natural Gas Costs	Natural Gas Cost with Remediation	Net Savings Gas
0	100%	100%	\$6,708	\$6,434	\$274	\$6,177	\$1,517	\$4,660
1	105%	104%	\$7,044	\$6,756	\$288	\$6,424	\$1,578	\$4,846
2	110%	108%	\$7,396	\$7,094	\$302	\$6,681	\$1,641	\$5,040
3	116%	112%	\$7,766	\$7,449	\$317	\$6,948	\$1,706	\$5,242
4	122%	117%	\$8,154	\$7,821	\$333	\$7,226	\$1,775	\$5,452
5	128%	122%	\$8,562	\$8,212	\$350	\$7,515	\$1,846	\$5,670
6	134%	127%	\$8,990	\$8,623	\$367	\$7,816	\$1,919	\$5,896
7	141%	132%	\$9,439	\$9,054	\$386	\$8,128	\$1,996	\$6,132
8	148%	137%	\$9,911	\$9,507	\$405	\$8,454	\$2,076	\$6,378
9	155%	142%	\$10,407	\$9,982	\$425	\$8,792	\$2,159	\$6,633
10	163%	148%	\$10,927	\$10,481	\$446	\$9,143	\$2,245	\$6,898
		Total	\$95,305	\$91,412	\$3,893	\$83,304	\$20,458	\$62,846

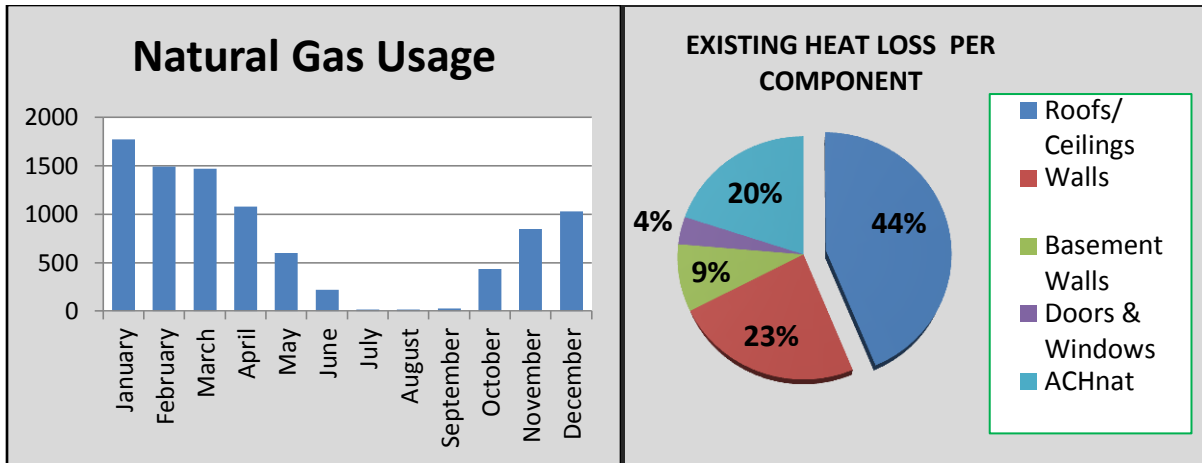
Exhibit Building:

Analysis of the energy bills for the exhibit building showed that it was costing the Fairgrounds **\$12,885 per year to operate.**

Source	Supply Charge	Demand Charge	Total Cost
Gas	\$ 6,176.93		\$ 6,176.93
Electric	\$ 3,304.93	\$ 3,403.49	\$ 6,708.42
Annual Total Cost	\$ 9,481.85	\$ 3,403.49	\$ 12,885.34

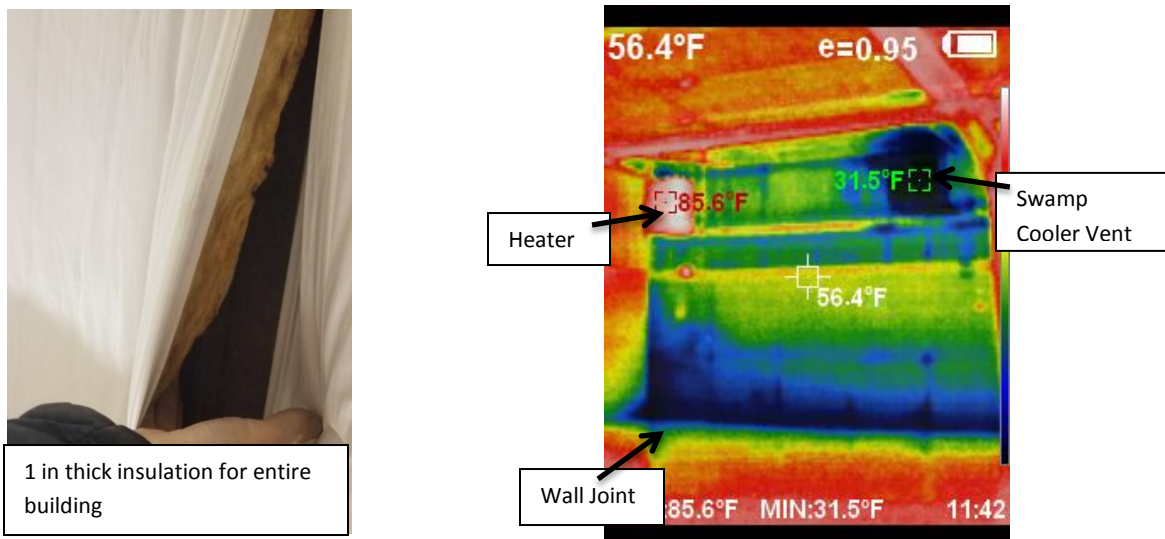
Natural Gas Heating:

Nearly all of the \$6176.23 spent on natural gas went towards heating the building. Analysis of the natural gas usage throughout the year, seen below, showed that usage increased in winter and dropped to nearly none in the summer. This confirmed that heating was likely the main use of natural gas. The current furnace operates at 70% efficiency, which is low for today's standards of nearly 95% efficiency.



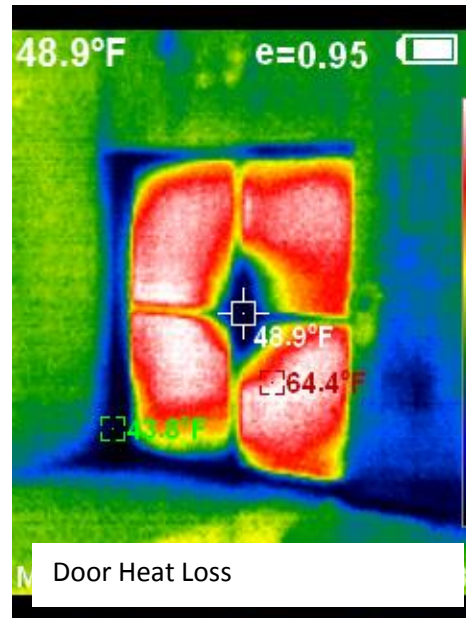
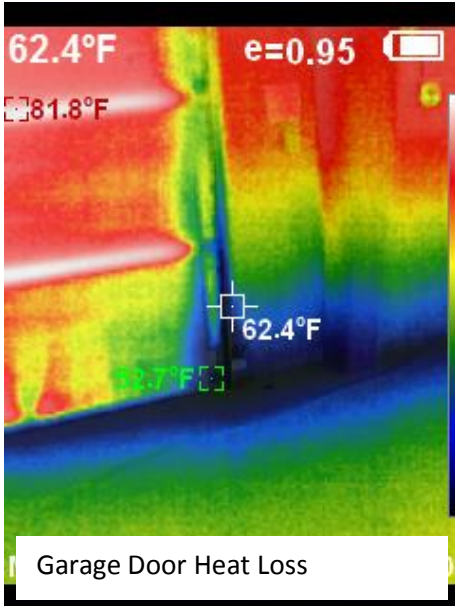
Analysis of the building envelope revealed that most of the heat was lost through the roof, walls, and air leakages (See above right chart). These are the main sources of heat loss the building should address. Additionally, it was found that the set point for the thermostat was 68 degrees Fahrenheit continuously 365 days a year. The building is **used only 30% of days** during the costly winter months. Reducing heated days would have immediate cost savings for the building.

In order to investigate heat loss, we employed a blower door in conjunction with a thermal imaging camera. The photograph to the below right labels three key items; **the furnace labeled at 85.6 F**, the **swamp cooler at 31.5 F**, and the wall **temperature at 56.4 F**. This highlights that the heat generated by

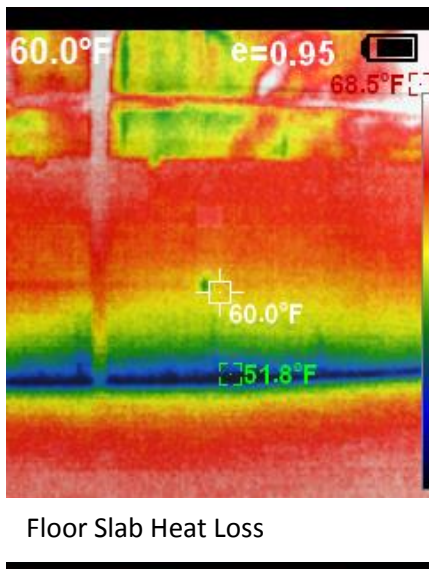


the furnace and surrounding air is being lost directly to heat leakages from the uncovered swamp coolers as well as the poorly insulated walls. The air temperature of the building when this photo was taken was measured at 62 F. There is nearly an 8 degree F temperature difference between the wall and the surrounding air. This is due to the poor 1-inch thick insulation in the walls pictured above.

There is also a need for general improvement of air leakages in the building. The swamp coolers let in significant air when the wind is strong. Wind could be felt through doors and the kitchen vent as well. These leakages can be seen in the thermal images below as the colder blue regions.



Additionally, there is significant heat loss from the foundation of the building. The building is constructed on a concrete slab in the ground. You can see in the image below that the base of the wall is nearly 8 degrees cooler than center point of the wall. This can be remediated by adding insulation to the exterior slab of the building.



Energy Reduction Recommendations:

Although the audit of this building revealed it was a horrendous waste of energy and money, the building construction is conducive to easy remediation. Below are the details to suggested remediation.

Insulating Walls, Slab, and Ceiling

Adding insulation to the building envelope could save approximately **\$4,660** annually. These calculations are based on building geometry, air leakage data, furnace efficiency, and weather patterns for Montana. These calculations are by no means perfect estimation of savings; however do represent a ballpark figure. As a point of reference, an audit performed by Northwestern Energy in 2010 estimated the savings from added R-28 ceiling insulation would be near \$2,195, while the savings estimated in this report for R-32 ceiling insulation is \$2366. Although the Northwestern Audit did not include wall or floor slab insulation, they are included in this report for thorough consideration of all modes of heat loss.

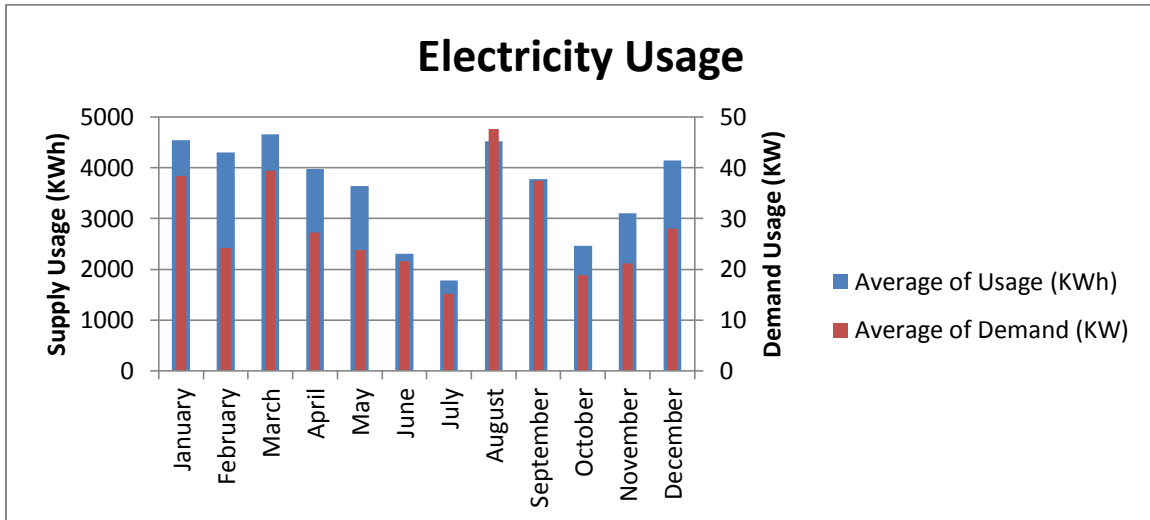
Existing State				Proposed Changes			Savings
	Exist. R-Value	% Heat Loss	Appx. Cost to Heat/ Yr.	Prop. R-Value	% Heat Loss	Appx. Cost to Heat/ Yr.	Savings/ Yr.
Ceiling	4	44%	\$2,704	32	22%	\$337.99	\$2,366
Walls	4	24%	\$1,460	32	12%	\$182.45	\$1,277
Floor	2.2	9%	\$551	8	10%	\$151.65	\$400
Doors & Windows	1	4%	\$227	2	8%	\$113.74	\$114
Air Leakage	0.42	20%	\$1,234	0.25	48%	\$730.07	\$504
		100%	\$6,176		100%	\$1,516	\$4,660

Other Recommendations

- Replace Furnaces using smaller, 95% efficient units after the insulation is complete.
- Re-do weather-stripping on all doors.
- Cover swamp coolers on external and internal facing faces to prevent air leakage
 - a. Cover internal vents: [\\$31 /vent](#)
 - b. Cover external cooler: [\\$56 /cooler with modifications](#)
- Seal garage door: [\\$42 from Home Depot](#)
- Purchase and utilize [NEST thermostats](#) to schedule heating on days of use, \$636

Electric:

The data from utility bills revealed high usage during the winter along with during the busiest summer months. The energy use is likely to come from a variety of sources; lighting, appliances, and AC.



The energy audit revealed that the biggest room for improvement was in lighting replacement and appliance adjustments.

Energy Reduction Recommendations:

Replace CFL lighting to LED in the dining room

Replace the CFL lighting in the dining room with LED bulbs. This will cost roughly \$1048 in materials and \$170 in labor, but includes a rebate from Northwestern Energy of \$330. The net payback will be in 3.43 years.

Location	Existing Fixtures	Qty
Dining Room	4 lamp 32W T8	18
	2 lamp 34W T12	2
Kitchen Closet	2 lamp 95W F96 T12 HO w/1 E.S.	1
Womens BR	1 lamp 26W CFL	1

Energy Rate	\$	0.0765
Demand Rate	\$	9.9285
Annual Bill Savings	\$	259
Estimated Bulb Cost +Shipping	\$	1,048
Estimated Labor for Direct Wire	\$	170
Estimated Rebate	\$	330
Estimated Net Cost	\$	888
Simple Payback		3.43

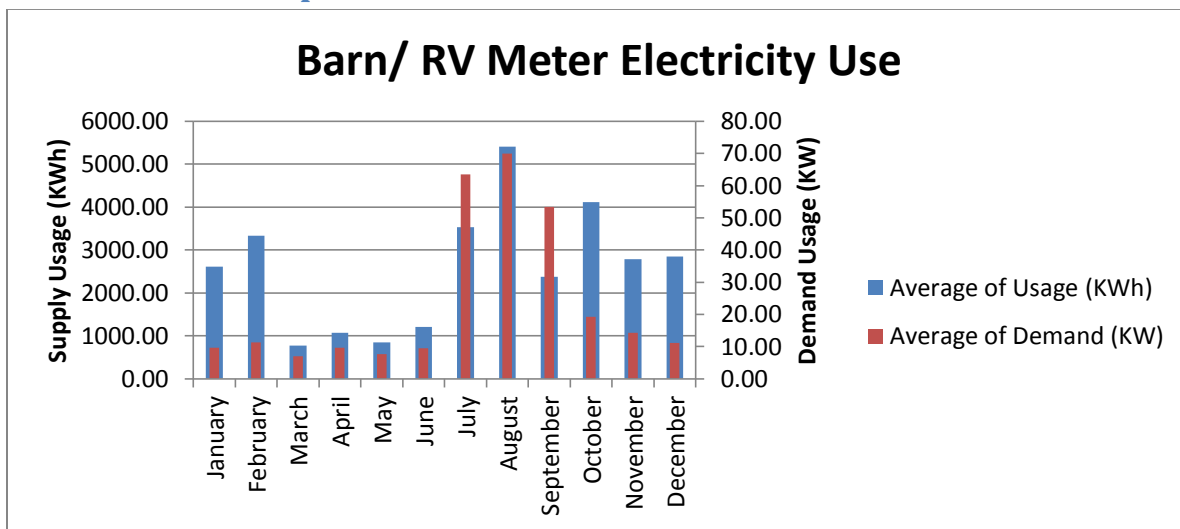
Turn off 5 out of the 6 fridges during most of the year.

	Current Usage	Reduction Proposed	Estimated Savings
Usage / day (KWh)	7.8	1.3	--
Days in Use	365	30	--
Annual Usage (KWh)	2847	708.5	2138.50
Annual Cost	\$ 217.80	\$ 54.20	\$ 163.60

Other Recommendations:

- Insulate hot water heater.
- Timer for water heaters.

Barn and RV Hook-up Meter:



	Supply Charge	Demand Charge	Total Cost
Annual Total Cost	\$ 2,365.88	\$ 2,840.94	\$ 5,206.82

The barn and RV hook-up meter usage was also high, but significant savings were not found. The usage graph shows that the demand charge and usage is high during the summer, likely due to the high usage during the rodeo and county fair. Investigation found no opportunities to reduce the bill. Further investigation is necessary.