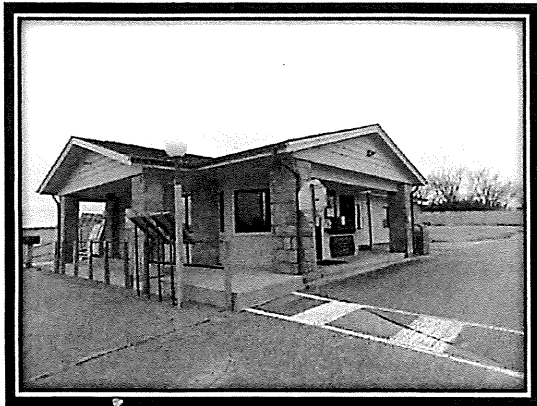
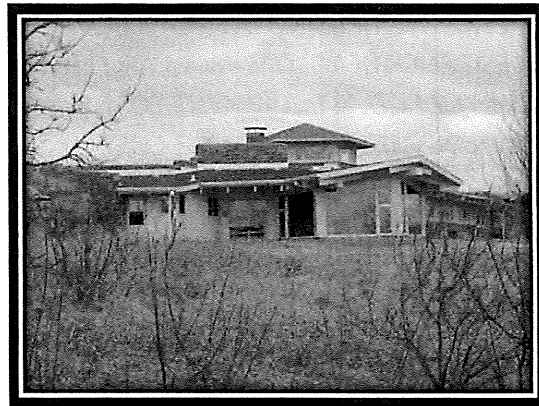


## BLUE MOUND STATE PARK

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**Contact Station**



**Interpretive Center**



**Ranger Residence**



**Repair Shop**

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## **SYSTEMS AUDITED**

### **CONTACT STATION**

Air Conditioner  
Building Envelope  
Domestic Water Heater  
Furnace  
Lighting  
Office Equipment

### **INTERPRETIVE CENTER**

Air Conditioner  
Building Envelope  
Dehumidifiers  
Domestic Water Heater  
Furnace  
Lighting

### **RANGER RESIDENCE**

Air Conditioner  
Building Envelope  
Domestic Water Heater  
Furnace  
Lighting

### **REPAIR SHOP**

Animal Water Heater  
Building Envelope  
Furnace  
Lighting  
On-Demand Water Heater  
Shop Equipment  
Well Pump  
Wood Burning Furnace

## CONTACT STATION SUMMARY OF RECOMMENDATIONS

RECOMMENDATIONS	PAGE NUMBER	EXISTING MMBTU USAGE	PROPOSED MMBTU USAGE	MMBTU SAVINGS	ENERGY SAVINGS BY GALLON OR KWH	DOLLAR SAVINGS	COST	PAYBACK IN YEARS
INSULATE THE ATTICS	Page 20 & 21	13.56	5.37	8.19	85	\$ 130.57	\$ 1,000.00	\$ 7.66
INSULATE DUCTWORK IN ATTIC	Page 20 & 21	5.33	1.67	3.67	38	\$ 71.91	\$ 300.00	\$ 4.17
REPLACE LIGHTING WITH LED	Page 20 & 21	10.12	4.77	5.35	1,574	\$ 188.93	\$ 1,500.00	\$ 7.94
INSTALL SEER 14 AC	Page 20 & 21	8.57	5.30	3.26	960	\$ 115.20	\$ 2,000.00	\$ 17.36
<b>TOTALS</b>		<b>37.58</b>	<b>17.10</b>	<b>20.48</b>	<b>2,658</b>	<b>\$ 506.61</b>	<b>\$ 4,800.00</b>	<b>\$ 9.47</b>
<b>SAVINGS PERCENT</b>	<b>54%</b>							

The attic needs additional insulation. I recommend blown cellulose fiber. Install 3" rigid insulation to attic hatch and weather-strip around the ledge.

The attic ductwork could have additional insulation added with boxing around existing insulation. The payback is higher because of the increased temperature difference from the ductwork air and the ambient air in the attic. I recommend 1 1/2" thermax with the joints and seams taped.

All lighting that is used during business hours should be changed with LED linear and LED bulb. The installation of a good quality motion sensor is very compatible the LEDs. This will reduce the air conditioning load, but add a small amount to the heating load. This will likely be offset by the attic insulation.

The existing air conditioner is a designed seasonal energy efficiency (SEER) of 10, but is likely running closer to SEER 9. A SEER 14 will improve efficiency 40 to 50 percent.

## INTERPRETIVE CENTER SUMMARY OF RECOMMENDATIONS

RECOMMENDATIONS	PAGE NUMBER	EXISTING MMBTU USAGE	PROPOSED MMBTU USAGE	MMBTU SAVINGS	ENERGY SAVINGS BY GALLON OR KWH	DOLLAR SAVINGS	COST	PAYBACK IN YEARS
CEILING LIGHTING	Page 22	1.47	0.67	0.80	234	\$ 28.08	\$ 360.00	12.82
AIR CONDITIONING	Page 22	4.49	2.24	2.24	660	\$ 79.20	\$ 2,000.00	12.11
DEHUMIDIFIERS	Page 22	5.46	2.48	2.98	876	\$ 105.12	\$ -	0
FURNACE FAN	Page 22	0.33	0.87	-0.54	(160)	\$ (19.20)	\$ -	0
<b>TOTALS</b>		11.74	6.27	5.47	1,610	\$ 193.20	\$ 2,360.00	\$ 12.22
<b>SAVINGS PERCENT</b>	47%							

Most of the lighting is reflector incandescent lighting which can easily be replaced with LED units with motion sensors where possible.

A large amount of dehumidifying is done by 2 dehumidifiers which run many hours during summer. I would recommend down sizing the 4 ton SEER 10 unit to a 2.5 ton modulating unit. This will run more but do a better job of dehumidifying the area.

Pull down solar shades will reduce heat gain during the summer months.

## RANGER RESIDENCESUMMARY OF RECOMMENDATIONS

RECOMMENDATIONS	PAGE NUMBER	EXISTING MMBTU USAGE	PROPOSED MMBTU USAGE	MMBTU SAVINGS	ENERGY SAVINGS BY GALLON OR KWH	DOLLAR SAVINGS	COST	PAYBACK IN YEARS
INSULATE ATTICS	Page 23 & 24	23.29	6.00	17.29	180	\$ 269.44	\$ 1,000.00	\$ 3.71
PERIMETER WALLS	Page 23 & 24	43.05	19.87	23.18	241	\$ 398.50	\$ 1,800.00	\$ 4.52
FOUNDATION	Page 23 & 24	24.03	0.56	23.46	244	\$ 289.11	\$ 1,400.00	\$ 4.84
LIGHTING MAIN	Page 23 & 24	4.90	0.33	4.56	1,342	\$ 174.46	\$ 360.00	\$ 2.06
LIGHTING BASEMENT	Page 23 & 24	2.39	1.09	1.31	384	\$ 46.08	\$ 400.00	\$ 8.68
WATER HEATER	Page 23 & 24	15.30	13.77	1.53	450	\$ 54.00	\$ 30.00	\$ 0.56
REDUCE AIR INFILTRATIONS	Page 23 & 24	101.00	79.00	22.15	231	\$ 380.78	\$ 1,000.00	\$ 2.63
<b>TOTALS</b>		<b>213.95</b>	<b>120.62</b>	<b>93.49</b>	<b>3,073</b>	<b>\$ 1,612.38</b>	<b>\$ 5,990.00</b>	<b>\$ 3.72</b>
<b>SAVINGS PERCENT</b>	<b>44%</b>							

Attic insulation should be blown cellulose fiber which will reduce air flow through attic bypasses. The attic hatch should be insulated with 3" rigid foam and weather-stripped around the ledge of hatch.

Walls should be dense packed with blown cellulose fiber. The existing insulation is 1" balsa wool. This will be in reducing the air flow in the house.

Reducing the air infiltration is done by dense packing the walls, possible replacing the windows. Sometimes the windows can be caulked but I believe that these windows are beyond caulking. Sealing the attic bypasses is also important. The rim joists are still leaking air with fiberglass installed and foam insulation is recommended in the rim joist areas.

## REPAIR SHOP SUMMARY OF RECOMMENDATIONS

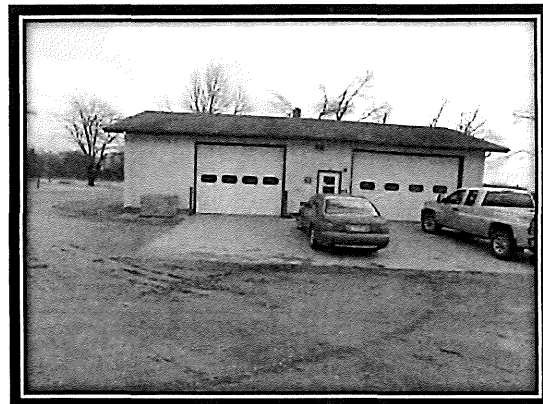
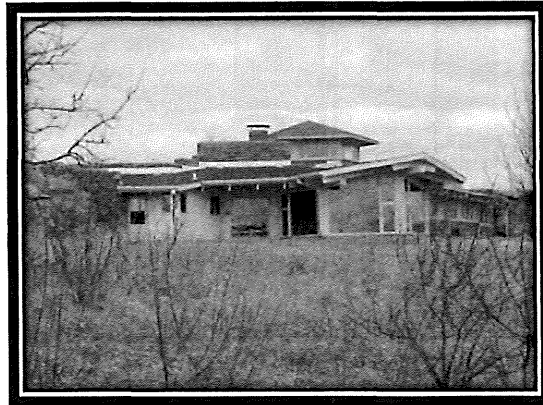
RECOMMENDATIONS	PAGE NUMBER	EXISTING MMBTU USAGE	PROPOSED MMBTU USAGE	MMBTU SAVINGS	ENERGY SAVINGS BY GALLON OR KWH	DOLLAR SAVINGS	COST	PAYBACK IN YEARS
REPLACE LIGHTING WITH LED	Page 26	596.00	126.00	470.00	470	\$ 56.40	\$ 450.00	\$ 7.98
<b>TOTALS</b>		596.00	126.00	470.00	470	\$ 56.40	\$ 450.00	\$ 7.98
<b>SAVINGS PERCENT</b>	79%							

LED lighting will create better lighting in the shop area. Install motion sensors where possible.

Existing walk doors and overhead doors could use a tune up. Seal around the windows with caulking.

Bringing a controlled source of fresh combustion air will improve the performance of the wood burner by not pulling out heated air. This should be done with an air trap to ensure that air is not "free flowing" into the shop when it is not needed.

## BUILDING ENVELOPES



The contact station is located on the northwest area of the park. The building is 1,366 sq ft. The blower door reading is 1,275 cfm @ 50 pa. This could be safely reduced to 800 cfm with typical occupancy & without an air exchanger. The foundation is slab on grade and the walls are 2x4 construction with newer windows and doors. The attic has approximately 8" blown fiberglass insulation, so additional attic insulation is recommended.

The interpretive center was built in the late 1950's and is located on the southern edge of the park. The building is 3,225 sq ft. The construction is slab on grade and built into the side of a granite hill. The design of the building has some good and negative energy aspects. During the winter, there is significant solar gain from the large area of south glass and there is also some geothermal heating that occurs from the exposed stone. During the summer, the solar gain is a negative as well as the higher natural humidity created by the stone exposure.

The ranger residence was built in the mid 1950's and is located on the northwest area of the park, south of the contact station. The building is 1348 sq ft. The blower door reading 1,870 @ 50 pa which would be high considering the square footage. It consists of a full basement which is 2x4 construction. The wall cavities are partially insulated, along with some of the foundation walls. The occupant says the basement stays cold. The attic needs additional insulation.

The shop is located south of the contact station. The shop is 1,508 sq ft built in the 1970s. There are 2 south overhead doors. The ceiling height is 11'4" and has 8" of blown insulation. The foundation is exposed block. The primary heat source is wood with a propane furnace as a backup.



### CONTACT STATION HEATING LOSS CALCULATIONS

LOCATION	SAVINGS IN HEATING BY MMBTU	SAVINGS IN COOLING BY MMBTU	HEATING COST IN SAVINGS	COOLING COST IN SAVINGS
MAIN ATTIC	6.81	0.54	\$ 117.06	\$ 18.90
MAIN ATTIC DUCT WORK	0.79	0.06	\$ 13.51	\$ 2.18
INSULATION	3.40	0.27	\$ 58.41	\$ 9.43
<b>TOTAL</b>	<b>10.99</b>	<b>0.87</b>	<b>\$ 188.97</b>	<b>\$ 30.51</b>

### RANGER RESIDENCE HEAT LOSS CALCULATIONS

LOCATION	SAVINGS IN HEATING BY MMBTU	SAVINGS IN COOLING BY MMBTU	HEATING COST SAVINGS	COOLING COST SAVINGS
ATTIC	14.72	1.54	\$ 253.08	\$ 54.13
ENTRANCE ATTIC	0.95	0.07	\$ 16.36	\$ 2.61
PERIMETER WALLS	23.18	1.81	\$ 398.50	\$ 63.59
FOUNDATION	16.82	1.31	\$ 289.11	\$ 46.13
<b>TOTAL</b>	<b>55.68</b>	<b>4.73</b>	<b>\$ 957.06</b>	<b>\$ 166.47</b>

## RANGER RESIDENCE HEAT LOSS FROM AIR FLOW

ACPH EXISTING	ACPH PROPOSED	BUILDING COEFFICIENT	HOURS PER DAY	HEATING DEGREE DAYS	COST PER UNIT OF FUEL	HEAT SYSTEM EFFICIENCY	GALLONS SAVINGS PER YEAR	EXISTING MMBTU	PROPOSED MMBTU	MMBTU SAVINGS PER YEAR	DOLLARS PER YEAR SAVED
0.286166	0.229545	0.018	24	8680	\$ 1.65	0.92	230.78	101.00	79.00	22.15	\$ 380.78

Volume of building Cubic Feet

BLOWER DOOR @ 50pa

Air changes per hour @ 50

Air changes per hour natural

Reduced by

EXISTING	PROPOSED	REDUCTION
19604		
1870	1500	
5.72	4.59	1.13
0.29	0.23	0.06
21%		

## ELECTRIC & FUEL USAGE PER MMBTU

CONTACT STATION	MMBTU	PERCENT	USAGE EQUIPMENT
Electrical Usage	36.14	39%	Air Conditioning, Lighting, Furnace Fan & Office Equipment
Gas Usage	56.32	61%	Furnace
<b>TOTAL</b>	<b>92.46</b>	<b>100%</b>	

INTERPRETIVE CENTER	MMBTU	PERCENT	USAGE EQUIPMENT
Electrical Usage	1.14	100%	Air Conditioner, Dehumidifiers, & Lighting
Gas Usage	NA	NA	Presently Non-Applicable
<b>TOTAL</b>	<b>1.14</b>	<b>100%</b>	

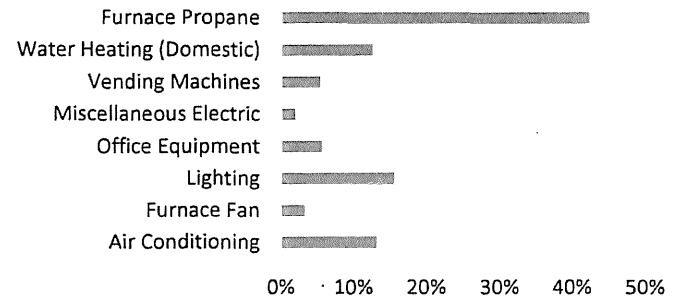
RANGER STATION	MMBTU	PERCENT	USAGE EQUIPMENT
Electrical Usage	63.75	39%	Domestic Water Heater, Kitchen Appliances, Lighting, Furnace Fan, Miscellaneous.
Gas Usage	100.32	61%	Furnace
<b>TOTAL</b>	<b>164.07</b>	<b>100%</b>	

REPAIR SHOP	MMBTU	PERCENT	USAGE EQUIPMENT
Electrical Usage	41.53	32%	Lighting, furnace fan & Well Pump
Wood (Biomass)	60.00	46%	Wood Burner
Gas Usage	28.15	22%	Furnace
<b>TOTAL</b>	<b>129.68</b>	<b>100%</b>	

## BREAKDOWN OF FUEL & EQUIPMENT COST

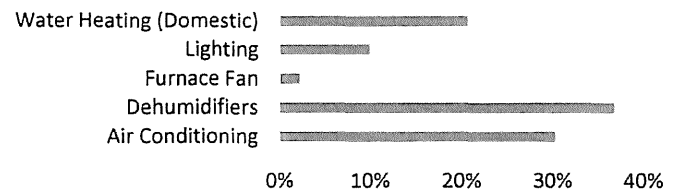
CONTACT STATION	ESTIMATED COST	PERCENT OF COST
Air Conditioning	\$ 302.40	13%
Furnace Fan	\$ 75.60	3%
Lighting	\$ 357.12	16%
Office Equipment	\$ 129.60	6%
Miscellaneous Electric	\$ 43.20	2%
Vending Machines	\$ 122.88	5%
Water Heating (Domestic)	\$ 288.00	13%
Furnace Propane	\$ 968.01	42%
<b>TOTAL</b>	<b>\$ 2,286.81</b>	<b>100%</b>

COMPARISON CHART



INTERPRETIVE CENTER	ESTIMATED COST	PERCENT OF COST
Air Conditioning	\$ 158.40	30%
Dehumidifiers	\$ 192.72	37%
Furnace Fan	\$ 11.52	2%
Lighting	\$ 51.84	10%
Water Heating (Domestic)	\$ 108.00	21%
<b>TOTAL</b>	<b>\$ 522.48</b>	<b>100%</b>

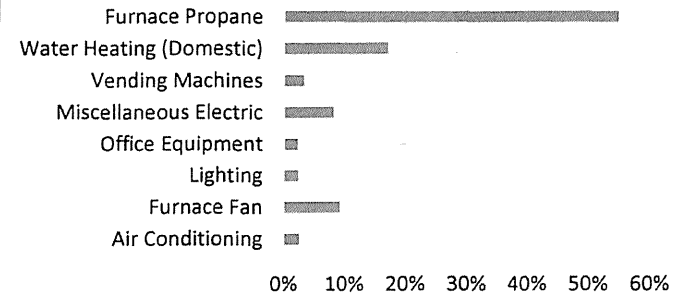
COMPARISON CHART



## BREAKDOWN OF FUEL & EQUIPMENT COST

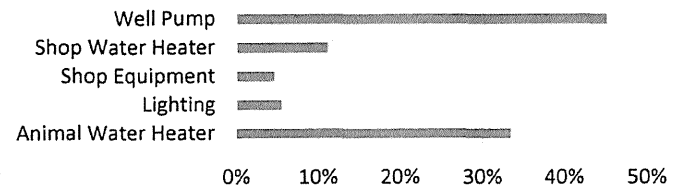
RANGER RESIDENCE	ESTIMATED COST	PERCENT OF COST
Air Conditioning	\$ 79.20	3%
Furnace Fan	\$ 290.40	9%
Lighting	\$ 76.80	2%
Office Equipment	\$ 72.00	2%
Miscellaneous Electric	\$ 257.28	8%
Vending Machines	\$ 105.12	3%
Water Heating (Domestic)	\$ 540.00	17%
Furnace Propane	\$ 1,724.25	55%
<b>TOTAL</b>	<b>\$ 3,145.05</b>	<b>100%</b>

COMPARISON CHART



REPAIR SHOP	ESTIMATED COST	PERCENT OF COST
Animal Water Heater	\$ 432.00	34%
Lighting	\$ 71.52	6%
Shop Equipment	\$ 60.00	5%
Shop Water Heater	\$ 144.00	11%
Well Pump	\$ 581.88	45%
<b>TOTAL</b>	<b>\$ 1,289.40</b>	<b>100%</b>

COMPARISON CHART



# CONTACT STATION LIGHTING AND EQUIPMENT USAGE SCHEDULE

EXISTING						PROPOSED					
LOCATION	LAMP	QUANT	EXIST KW	HRS PER YEAR	ANNUAL TOTAL KWH EXISTING	RETRO FIT TYPE	MOTION SENSOR	TOTAL KWH PROPOSED	HOURS PER YEAR PROPOSED	ANNUAL TOTAL KWH PROPOSED	ANNUAL SAVINGS KWH
BATHROOM	2X4' T8	2	0.064	400	51	LED	YES	0.032	200	13	38
BATHROOM	2X2' T8	2	0.032	400	26	LED	YES	0.016	200	6	19
FRONT	2X4' T8	6	0.064	2,200	845	LED	NO	0.032	2,200	422	422
OFFICES	3X4' T8	8	0.096	1,800	1,382	LED	YES	0.048	1,500	576	806
EXTERIOR	100 W HPS3	3	0.07	3,200	672	LED	NO	0.04	3,200	384	288
COMPUTERS		3	0.2	1,800	1,080		NO	0.2	1,800	1,080	0
POP & ICE MACHINE		2	0.32	1,600	1,024		NO	0.32	1,600	1,024	0
AIR CONDITIONER		1	4.2	600	2,520	SEER 14	NO	2.6	600	1,560	960
FURNACE FAN		1	0.35	1,800	630		NO	0.35	1,800	630	0
WATER HEATER		1	3	800	2,400			3	800	2,400	0
MISC		1	0.2	1,800	360		NO	0.2	1,800	360	0
<b>TOTAL</b>			<b>8.596</b>		<b>10,990</b>			<b>6.838</b>		<b>8,456</b>	<b>2,534</b>

# **INTERPRETIVE CENTER LIGHTING AND EQUIPMENT USAGE SCHEDULE**

EXISTING					PROPOSED						
LOCATION	LAMP	QUANT	EXIST KW	HRS PER YEAR	ANNUAL TOTAL KWH EXISTING	RETRO FIT TYPE	MOTION SENSOR	TOTAL KWH PROPOSED	HOURS PER YEAR PROPOSED	ANNUAL TOTAL KWH PROPOSED	ANNUAL SAVINGS KWH
CEILING LIGHTING	24 W CFL	18	0.024	1,000	432	LED	NO	0.011	1,000	198	234
AIR											
CONDITIONING	SEER 10 4 TON	1	4.4	300	1,320	SEER 14 -2 TON	NO	2.2	1,000	660	660
DOMESTIC											
WATER HEATER		1	4.5	200	900		NO	4.5	200	900	0
DEHUMIDIFIERS		2	0.365	2,200	1,606		NO	0.365	1,000	730	876
FURNACE FAN		1	0.32	300	96		NO	0.32	800	256	-160
<b>TOTAL</b>			<b>9.609</b>		<b>4,354</b>			<b>7.396</b>		<b>2,744</b>	<b>1,610</b>

# **RANGER RESIDENCE LIGHTING AND EQUIPMENT USAGE SCHEDULE**

<b>EXISTING</b>						<b>PROPOSED</b>					
<b>LOCATION</b>	<b>LAMP</b>	<b>QUANT</b>	<b>EXIST KW</b>	<b>HRS PER YEAR</b>	<b>ANNUAL TOTAL KWH</b>	<b>RETRO FIT TYPE</b>	<b>MOTION SENSOR</b>	<b>TOTAL KWH PROPOSED</b>	<b>HOURS PER YEAR</b>	<b>ANNUAL TOTAL KWH</b>	<b>ANNUAL SAVINGS</b>
LIGHTING MAIN LIGHTING	60 W INC	12	0.06	2,000	1,440	LED	YES	0.01	1,000	98	1,342
BASEMENT REFRIGERATOR	4'-T12	10	0.04	1,600	704	LED	YES	0.03	1,000	320	384
		1	0.42	1,000	420		NO	0.42	1,000	420	0
APPLIANCES	STOVE, WASHER & DRYER	2	1.00	1,000	2,000		NO	1.00	1,000	2,000	0
WATER HEATER	MARATHON	1	4.50	1,000	4,500	SHOWER HEAD	NO	4.50	900	4,050	450
FURNACE FAN	LENNOX	1	0.32	2,000	640		NO	0.32	2,000	640	0
AIR CONDITIONING	SEER 10	1	2.20	300	660		NO	2.20	300	660	0
MISC ELECTRONIC	COMPUTERS & TELEVISIONS	3	0.20	1,000	600		NO	0.20	1,000	600	0
RADON MITIGATION		1	0.10	8,760	876		NO	0.10	8,760	876	0
<b>TOTAL</b>			<b>8.84</b>		<b>11,840</b>			<b>8.78</b>		<b>9,664</b>	<b>2,176</b>



## REPAIR SHOP LIGHTING AND EQUIPMENT USAGE SCHEDULE

EXISTING			PROPOSED								
LOCATION	LAMP	QUANT	EXIST KW	HRS PER YEAR	ANNUAL TOTAL KWH EXISTING	RETRO FIT TYPE	MOTION SENSOR	TOTAL KWH PROPOSED	HOURS PER YEAR PROPOSED	ANNUAL TOTAL KWH PROPOSED	ANNUAL SAVINGS KWH
INTERIOR LIGHTING	24 W CFLS	7	0.024	2,000	336	LED	YES	0.014	1000	98	238
EXTERIOR LIGHTING	65 W INCANDESCENT	2	0.065	2,000	260	LED	YES	0.014	1000	28	232
SHOP WATER HEATER	BOSCH 2.5 GALLONS	1	1.5	800	1,200		NO			0	
SHOP EQUIPMENT	MISC POWER TOOLS	1	1	500	500		NO			0	
WELL PUMP	300 FT WELL	1	0.746	6,500	4,849		NO			0	
ANIMAL WATER HEATER		1	1	3,600	3,600		NO			0	
<b>TOTAL</b>			<b>4.335</b>		<b>10,745</b>			<b>0.028</b>		<b>126</b>	<b>470</b>

# CONTACT STATION USAGE DATA FOR 2013 & 2014

2013	HDD (MNLU)	CDD (MNLU)	KWH	ENERGY COST	PROPANE GALLONS	PROPANE COST
January	1,522	0	495	\$ 96.48	49	\$ 85.35
February	1,283	0	159	\$ 75.83	44	\$ 77.09
March	1,213	0	689	\$ 17.40	49	\$ 85.35
April	854	0	676	\$ (116.90)	47	\$ 82.60
May	319	28	1,013	\$ (58.40)	49	\$ 85.35
June	70	128	1,523	\$ 63.90	47	\$ 82.60
July	22	227	1,820	\$ 69.16	49	\$ 85.35
August	13	183	1,409	\$ 55.65	49	\$ 85.35
September	81	109	945	\$ 44.83	47	\$ 82.60
October	566	2	623	\$ 25.27	49	\$ 85.35
November	1,032	0	598	\$ 30.08	47	\$ 82.60
December	1,705	0	642	\$ 42.28	58	\$ 93.69
<b>2013 TOTALS</b>	<b>8,680</b>	<b>677</b>	<b>10,591</b>	<b>\$ 345.60</b>	<b>587</b>	<b>\$ 1,013.30</b>

2014	HDD (MNLU)	CDD (MNLU)	KWH	ENERGY COST	PROPANE GALLONS	PROPANE COST
January	1,678	0	540	\$ 19.91	49	\$ 95.29
February	1,557	0	365	\$ 4.53	44	\$ 86.07
March	1,194	0	-347	\$ (10.42)	49	\$ 95.29
April	652	0	-1,451	\$ (4.35)	47	\$ 92.22
May	295	56	-326	\$ 43.46	49	\$ 95.29
June	43	110	112	\$ 55.00	47	\$ 92.22
July	25	130	140	\$ 52.79	49	\$ 95.29
August	8	145	10	\$ 67.74	49	\$ 95.29
September	167	40	-82	\$ 39.82	47	\$ 92.22
October	467	0	-309	\$ 23.40	49	\$ 3.07
November	1,217	0	-251	\$ 12.07	47	\$ -
December	1,277	0	-143	\$ 1.66	58	\$ -
<b>2014 TOTALS</b>	<b>8,580</b>	<b>481</b>	<b>-1,741</b>	<b>\$ 305.61</b>	<b>587</b>	<b>\$ 842.28</b>

# **INTERPRETIVE CENTER DATA USAGE FOR 2013 & 2014**

<b>2013</b>	<b>HDD (MNLU)</b>	<b>CDD (MNLU)</b>	<b>KWH</b>	<b>ENERGY COST</b>	<b>PROPANE GALLONS</b>	<b>PROPANE COST</b>
January	1,522	0	5	\$ 37.00	0	\$ -
February	1,283	0	5	\$ 35.19	0	\$ -
March	1,213	0	9	\$ 46.65	0	\$ -
April	854	0	23	\$ 63.82	0	\$ -
May	319	28	270	\$ 86.89	0	\$ -
June	70	128	741	\$ 135.11	0	\$ -
July	22	227	872	\$ 173.47	0	\$ -
August	13	183	839	\$ 146.97	0	\$ -
September	81	109	534	\$ 101.69	0	\$ -
October	566	2	53	\$ 57.66	0	\$ -
November	1,032	0	0	\$ 41.39	0	\$ -
December	1,705	0	0	\$ 37.19	0	\$ -
<b>2013 TOTALS</b>	<b>8,680</b>	<b>677</b>	<b>3,351</b>	<b>\$ 963.03</b>	<b>0</b>	<b>\$ -</b>

<b>2014</b>	<b>HDD (MNLU)</b>	<b>CDD (MNLU)</b>	<b>KWH</b>	<b>ENERGY COST</b>	<b>PROPANE GALLONS</b>	<b>PROPANE COST</b>
January	1,678	0	0	\$ 21.00	0	\$ -
February	1,557	0	0	\$ 24.36	0	\$ -
March	1,194	0	0	\$ 44.46	0	\$ -
April	652	0	52	\$ 45.00	0	\$ -
May	295	56	376	\$ 72.85	0	\$ -
June	43	110	716	\$ 114.35	0	\$ -
July	25	130	1,753	\$ 128.52	0	\$ -
August	8	145	1,354	\$ 125.31	0	\$ -
September	167	40	223	\$ 95.19	0	\$ -
October	467	0	8	\$ 49.61	0	\$ -
November	1,217	0	6	\$ 45.50	0	\$ -
December	1,277	0	3	\$ 46.53	0	\$ -
<b>2014 TOTALS</b>	<b>8,580</b>	<b>481</b>	<b>4,490</b>	<b>\$ 812.68</b>	<b>0</b>	<b>\$ -</b>

# **RANGER RESIDENCE USAGE DATA FOR 2013 & 2014**

<b>2013</b>	<b>HDD (MNLU)</b>	<b>CDD (MNLU)</b>	<b>KWH</b>	<b>ENERGY COST</b>	<b>PROPANE GALLONS</b>	<b>PROPANE COST</b>
January	1,522	0	NA	NA	NA	NA
February	1,283	0	NA	NA	NA	NA
March	1,213	0	NA	NA	NA	NA
April	854	0	NA	NA	NA	NA
May	319	28	NA	NA	NA	NA
June	70	128	NA	NA	NA	NA
July	22	227	NA	NA	NA	NA
August	13	183	NA	NA	NA	NA
September	81	109	NA	NA	NA	NA
October	566	2	NA	NA	NA	NA
November	1,032	0	NA	NA	NA	NA
December	1,705	0	NA	NA	NA	NA
<b>2013 TOTALS</b>	<b>8,680</b>	<b>677</b>	<b>0</b>	<b>\$ -</b>	<b>0</b>	<b>\$ -</b>

<b>2014</b>	<b>HDD (MNLU)</b>	<b>CDD (MNLU)</b>	<b>KWH</b>	<b>ENERGY COST</b>	<b>PROPANE GALLONS</b>	<b>PROPANE COST</b>
January	1,678	0	1,675	\$ 201.00	335	\$ 510.00
February	1,557	0	1,558	\$ 187.00		
March	1,194	0	1,508	\$ 181.00		
April	652	0	1,367	\$ 164.00	341	\$ 518.00
May	295	56	1,475	\$ 177.00		
June	43	110	1,475	\$ 177.00		
July	25	130	1,567	\$ 188.00		
August	8	145	1,767	\$ 212.00		
September	167	40	1,942	\$ 233.00		
October	467	0	1,633	\$ 196.00	132	\$ 209.00
November	1,217	0	1,275	\$ 153.00		
December	1,277	0	1,442	\$ 173.00	237	\$ 406.00
<b>2014 TOTALS</b>	<b>8,580</b>	<b>481</b>	<b>18,683</b>	<b>\$ 2,242.00</b>	<b>1,045</b>	<b>\$ 1,643.00</b>

# REPAIR SHOP DATE USAGE FOR 2013 & 2014

2013	HDD (MNLU)	CDD (MNLU)	KWH	ENERGY COST	PROPANE GALLONS	PROPANE COST
January	1,522	0	1,709	\$ 157.16	26	\$ 52.57
February	1,283	0	1,501	\$ 145.41	24	\$ 47.49
March	1,213	0	1,043	\$ 131.49	26	\$ 52.57
April	854	0	731	\$ 110.51	25	\$ 50.88
May	319	28	761	\$ 130.58	26	\$ 52.57
June	70	128	882	\$ 126.48	25	\$ 50.88
July	22	227	884	\$ 135.26	26	\$ 52.57
August	13	183	812	\$ 131.23	26	\$ 52.57
September	81	109	737	\$ 116.71	25	\$ 50.88
October	566	2	703	\$ 115.96	26	\$ 52.57
November	1,032	0	871	\$ 86.14	25	\$ 50.88
December	1,705	0	1,538	\$ 77.31	10	\$ 20.35
<b>2013 TOTALS</b>	<b>8,680</b>	<b>677</b>	<b>12,173</b>	<b>\$ 1,464.26</b>	<b>293</b>	<b>\$ 586.78</b>

2014	HDD (MNLU)	CDD (MNLU)	KWH	ENERGY COST	PROPANE GALLONS	PROPANE COST
January	1,678	0	1,901	\$ 202.16	0	\$0.00
February	1,557	0	1,656	\$ 179.29	0	\$0.00
March	1,194	0	1,228	\$ 145.10	0	\$0.00
April	652	0	1,169	\$ 116.10	0	\$0.00
May	295	56	391	\$ 123.99	0	\$0.00
June	43	110	431	\$ 133.01	0	\$0.00
July	25	130	603	\$ 135.41	0	\$0.00
August	8	145	615	\$ 127.70	0	\$0.00
September	167	40	576	\$ 118.76	0	\$0.00
October	467	0	702	\$ 117.73	0	\$0.00
November	1,217	0	1,109	\$ 132.88	0	\$0.00
December	1,277	0	1,470	\$ 196.34	0	\$0.00
<b>2014 TOTALS</b>	<b>8,580</b>	<b>481</b>	<b>11,850</b>	<b>\$ 1,728.47</b>	<b>0</b>	<b>\$ -</b>

## CONTACT STATION PHOTOGRAPHS



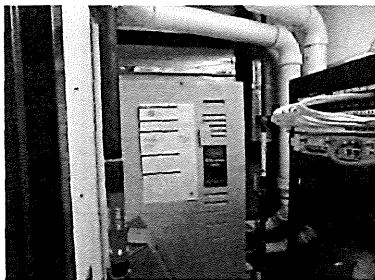
Front entry of contact station with view. The ceiling is vaulted in this area. According to the employees, this area is drafty in the winter.



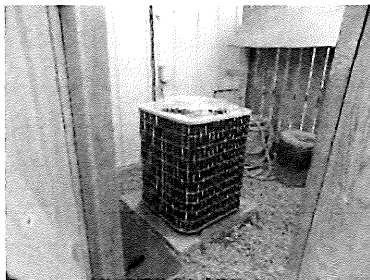
This is the attic area above the front entry. The insulation is deficient above the vaulted ceiling where the previous roof is exposed in the attic.



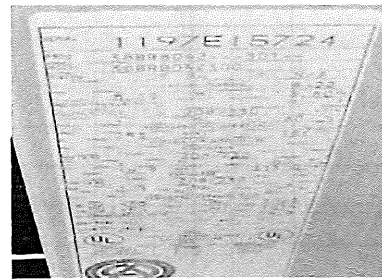
The duct work insulation is opening and should be repaired. Duct work should have additional insulation as possible.



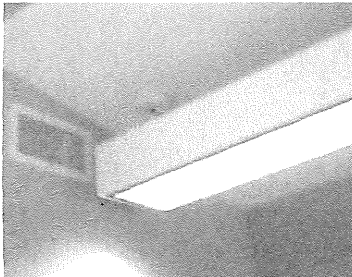
The furnace is a 1997 weather maker brand 92% efficient unit.



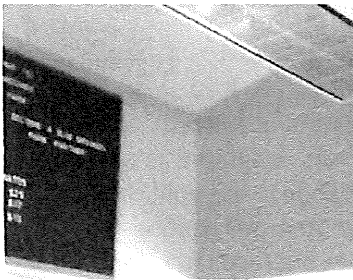
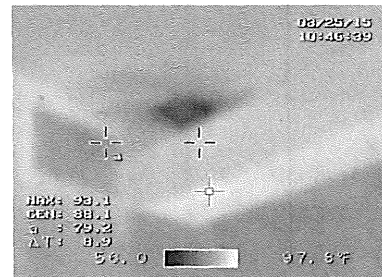
The air conditioner is a 3.5 ton, designed seer of 10, built in 1997. A seer of 14 or 15 will result in a 30 to 40 percent in air conditioning costs. Note that the unit is over sized by about 1 ton. Oversizing results in less run time which reduces dehumidification.



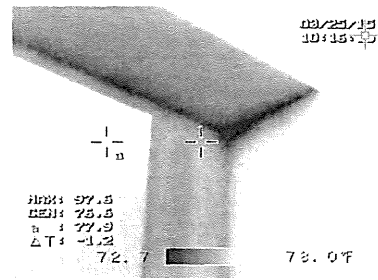
## CONTACT STATION INFRARED PHOTOGRAPHS



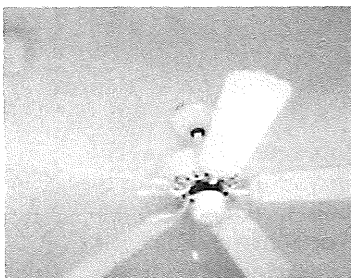
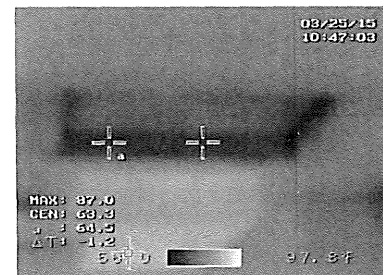
Front entry infrared photos indicate ceiling bypasses where electrical boxes are located in the attic.



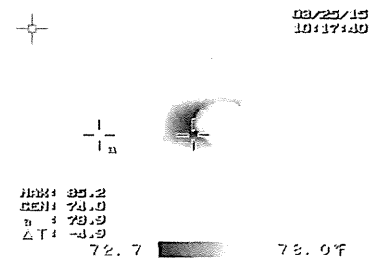
Infrared photos show typical cold corners where insulation is deficient and access to these areas is difficult.



Attic hatch should be insulated with 3" foam insulation board and be weather-stripped around the ledge, along with caulk between the stop and frame.



The ceiling bypasses can be caulked if fixture is removed.





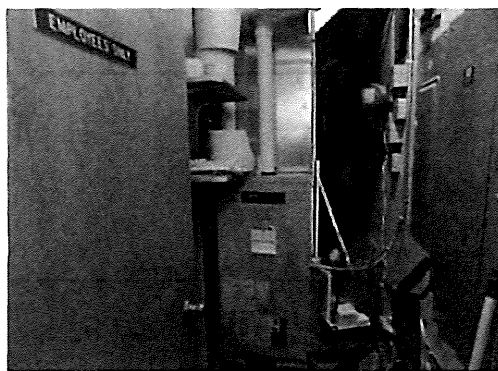
## INTERPRETIVE CENTER PHOTOS



The lookout tower should be sealed off during the winter to avoid air flow into this area.



North wall consists of native red quartzite which was integrated as part of the structure when it was built. This provides some geothermal heating and cooling properties but tends to increase humidity levels in summer.



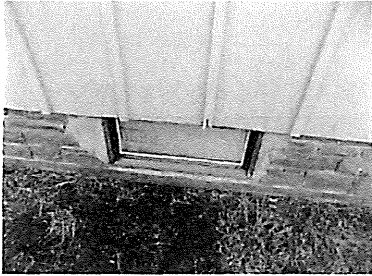
A Lennox 92% efficient propane furnace is the heating source for the building. The ductwork is located in the ceiling area.



A Lennox 3 1/2 ton, seer 10 air conditioner is the cooling source for the building. A modulating air conditioner with a seer of 14 or above could result in 30 to 40 percent savings in cooling costs.



## RANGER RESIDENCE PHOTOGRAPHS



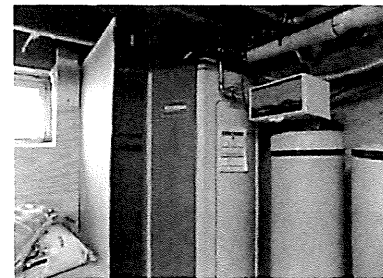
The residence foundation windows are in poor condition and leaking air.



The siding is board and batten and perimeter windows are single pane with storms.



The residence heat source is a 75,000 btu Lennox 92% efficient furnace that is located in the basement.



The domestic water heating is an electric Marathon water heater located in the basement.

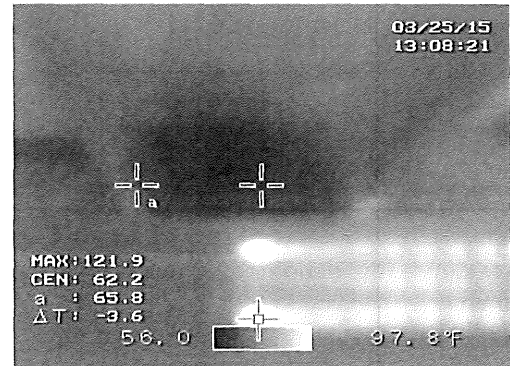
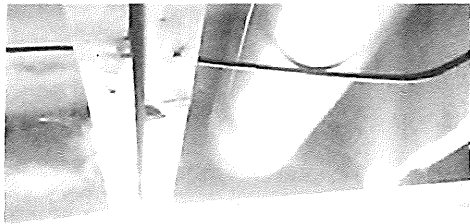


The attic hatch is located in closed storage. This should be insulated with 3" foam and weather-stripped around the frame.

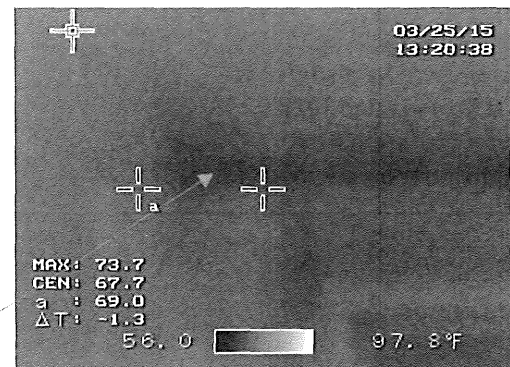


The attic has some blown cellulose fiber insulation. An additional 10" of blown cellulose should be added to the attic.

## RANGER RESIDENCE INFRARED PHOTOGRAPHS

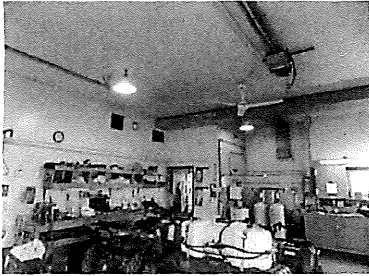


The rim joists are insulated with fiberglass, but the infrared showed that they are leaking air during the blower door test.

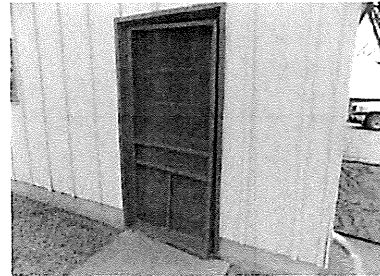


Infrared photos show cold corner and wall which is likely caused by some air infiltration into the wall from the attic.

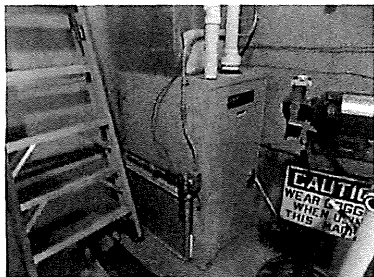
## REPAIR SHOP PHOTOGRAPHS



The shop lighting could be more effective with linear LED lamps positioned where tasks and work is performed.



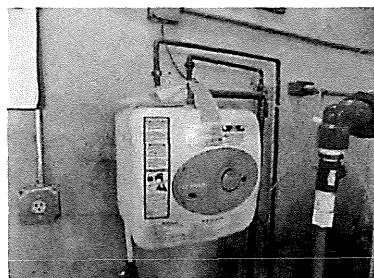
Original wood door could be replaced with a steel insulated unit which would provide additional security. Original windows should be replaced with double pane units.



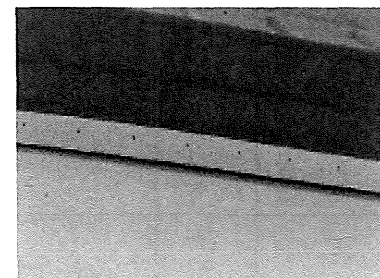
The gas forced air furnace was not used much in 2014.



The primary heating source is a burner which makes use of locally cut wood.



The hot & cold pipes should be insulated on this 3 gallon electric water heater for the shop.



Move the top weather-strip to the door on the overhead doors would be efficient.