P.0727.U – Bartillon Men's Homeless Shelter

100% DD ENERGY MODELING REPORT

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Figure 1 – Project visualization from September 26, 2023

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Bartillon Men's Shelter

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1.1 BUILDING DESCRIPTION

The proposed design is a 42,125 SF, 2-story building involving a publicly funded homeless shelter serving primarily men. As outlined in Dimension's Design Report and Drawings, the proposed building's design incorporates:

Occupancy: *Based on 22061 – 1904 Bartillon_Schematic Design Report_6.30.2023 and OPR (12.2022)*

- Shelter intended to support 254 beds
  - Sensitivity analysis to the number of guests could be analyzed in future iterations
- Operational 24/7 - 365
- Congregate Sleeping – lights out 8 PM-6 AM
- Kitchen
  - Breakfast – 6 AM-9 AM
  - Lunch – 11 AM-2 PM (pending programming)
  - Dinner 4 PM-7 PM

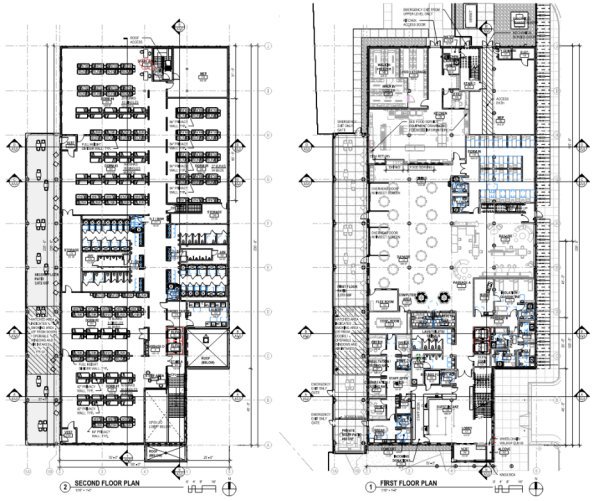


Figure 2 – First and Second Floor Overall Plan from the September 1, 2023, City of Madison –Dane County – Men's Homeless Shelter DD Draft

1.2 INTERNAL LOADS

Lighting: *Based on 30% reduction from ASHRAE 90.1-2013 Table 9.5.1 Values per OPR page 16*

- Sleeping Quarters: 0.171 W/SF
- Toilet / Shower: 0.171 W/SF
- Circulation / Stairs: 0.171 W/SF
- Office: 0.246 W/Sf
- Kitchen / Dining: 0.27 W/SF
- Day Use: 0.261 W/SF
- Nurse: 0.27 W/SF
- Outdoor Shelter: 0.063 W/Sf
- BOH: 0.171 W/SF

Plug Loads: *Based on ASHRAE 90.1 Users Manual Table G-C*

- Sleeping Quarters: 0.25 W/SF
- Office: 0.75 W/SF
- Dining: 0.10 W/SF
- Kitchen: 3.4 W/SF (Electricity) 13.3 W/SF (Gas)
- Day Use: 0.50 W/SF
- Nurse: 1.00 W/SF

1.3 ENVELOPE AND DHW SYSTEMS

Envelope:

- Infiltration @ 50Pa: 0.1 cfm/sf

Proposed Design Alt B: BASIS OF DESIGN *Based on Bartillon-Exterior wall/roof Assemblies Email 8/9/2023 from Dimension*

- Roof: R-50 (U-0.020)
- Wall: R-21 + R-10 c.i. (U-0.051) Table A3.3.3.1
- Fenestration: U-0.2; SHGC-0.27
- Slab: Fully insulated slab R-25 F-0.326 (perimeter - heated)

Water Heating:

- DHW ASHP Interior (4.1 COP; 14 EER)
- 1,095,000 gallons/year (based on 3,000/day email)
- Additional 8,197 gallons/year (Clothes washer)

1.4 MECHANICAL SYSTEM

- Setpoints: 68°F, 73°F

- ***L1 AHU***
  - Outdoor Air: Max 5,000, Min 2,500 CFM
  - Supply Air: Max 12,500 CFM
  - Demand Control Ventilation – 80% diversity
  - VAV with reheat (water)
  - Energy recovery wheel (65% effective)
  - Water-source
  - Discharge air temp 55°F
  - Fan Power at design conditions 1.5 W/cfm

- ***L2 AHU***
  - Outdoor Air: Max 3,750, Min 2,250 CFM
  - Supply Air: Max 10,000 CFM
  - Demand Control Ventilation – 80% diversity
  - VAV with reheat (water)
  - Energy recovery wheel (65%)
  - Water-source
  - Discharge air temp 55°F
  - Fan Power at design conditions 1.5 W/cfm

- ***Kitchen Exhaust and Makeup Air***
- 3 meals/day, running 3 hours/meal for a total of 9 hours/day
  - Makeup Air (MAU-1)
    - 4,800 CFM -100% VAV Outdoor Air
    - Fan Power at design conditions: 1.0 W/cfm
    - Discharge Air Temp: 64°F
    - Water-source
  - Kitchen Exhaust (KEF-1)
    - 4,800 CFM Kitchen Hood
    - Fan Power at design conditions: 1.0 W/cfm
  - Demand Control Kitchen Ventilation (DCKV)
    - Smart Control results in an average of 40% diversity

Other Equipment

- Radiant Floor Heating L1 & L2 Perimeter (water)
- Cabinet Unit Heater (electric)
  - Stairs B and C
  - 3 vestibules

1.5 MECHANICAL SYSTEM - GROUND LOOP PARAMETERS

The Water-Side HVAC includes a closed-loop vertical borefield with variable-speed pumps and properties outlined below. The ground loop parameters were provided by the design team or assumed based on location and common construction best practices. The pump power at design water flow conditions was modeled at CHW: 22 W/GPM, HW: 19 W/GPM, and Condenser: 19 W/GPM.

Vertical Borehole Parameters		Source
Depth	500 ft	M002
Diameter	5 in (SDR-11)	Typical
Spacing	20 ft	Typical
Geometry	Rectangular	M002
Thermal Resistance	0.4193 F/(Btu/h-ft)	Calculated
Tube Type	U-Tube	Typical

Ground Parameters		Source
Thermal Conductivity	1.92 Btu/h-ft-F	Soil
Heat Capacity	58.84 Btu/F-ft3	Heavy Soil (Saturated)
Average Ground Temp	52.16 F	Based on Location

Fluid Parameters		Source
Total Flow Rate	300 GPM	M601
Fluid Type	30% glycol	Email 7.24.23

Heat Pump Efficiency		Source
Cooling	15.92 EER	IBC 8.15.23 Email
Heating	3.11 COP	IBC 8.15.23 Email

1.6 INTERNAL LOADS – Kitchen Use

The Kitchen loads have been divided into three categories: refrigeration, electrical, and gas.

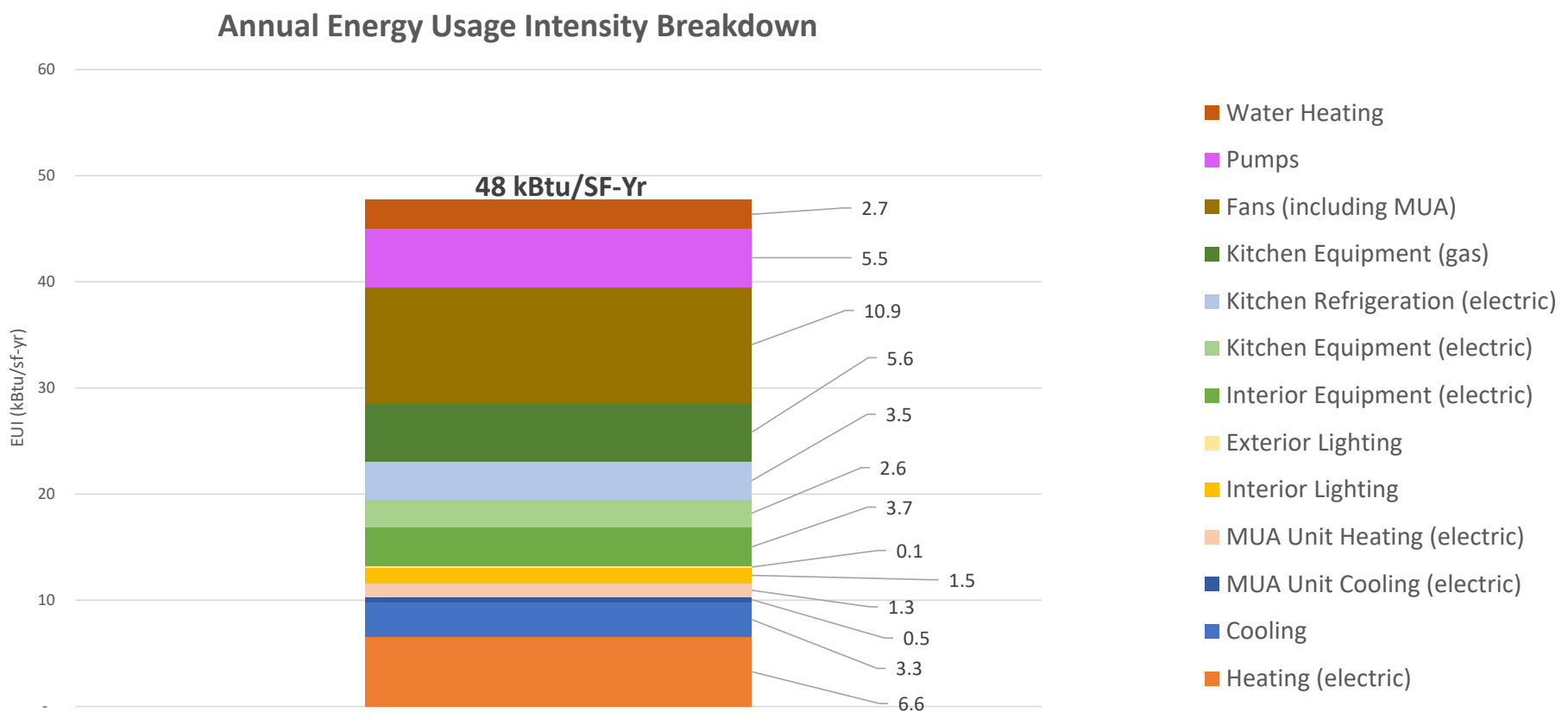
Kitchen – Refrigeration			
Walk-in Freezer	On 24x7	375 sf	12,916 Btu/h
Walk-in Cooler	On 24x7	300 sf	4,305 Btu/h
Total (Btu/h)			17,221
Total (W/sf)			4.12

Kitchen – Gas					
Equipment	2013 ASHRAE Handbook of Fundamentals Appliance	Stand By Energy Rate (Btu/h)	Rate of Heat Gain (Btu/h)	Usage Factor Fu	Radiation Factor Fr
Range with Oven	Range Top: 3 burners on/oven on				
Total (Btu/h)		67,500	9,100	0.80	0.39
Total (W/sf)		7.3	0.98		

1.6 INTERNAL LOADS – Kitchen Use (continued)

Equipment	2013 ASHRAE Handbook of Fundamentals Appliance	Stand By Energy Rate (Btu/h)	Sensible Rad. Rate of Heat Gain (Btu/h)	Sensible Conv. Rate of Heat Gain (Btu/h)	Total Rate of Heat (Btu/h)	Usage Factor (FU)	Radiation Factor (FR)
Tilting Braising Pan	Tilting skillet/braising pan (hooded)	5,300	0			0.16	0.00
Kettle	Steam Kettle; Large 60 gal (hooded)	2,600	100			0.02	0.04
Convection Oven	Oven: convection full-size	6,700	1,500			0.16	0.22
Dishwasher	Dishwasher Conveyor type hot	5,700	0	4,750	21,720		
Cold Roll-Thru	Refrigerated Prep Table	900	600	300	900	0.45	0.67
Hot Roll-Thru	Hot-food case (dry holding)	2,500	900	1,600	2,500	0.08	0.36
Mixer	H roller	2,400	900	1,500	2,400	0.71	0.38
Cold Serving	Refrigerated Prep Table	900	600	300	900	0.45	0.67
Hot Serving	Hot-Food Case (moist holding)	3,300	900	1,800	3,300	0.11	0.27
Milk Fridge	Reach in Refrigerator	1,200	300	900	1,200	0.25	0.25
Total	**(Btu/h)**	**31,500**	**5,800**	**11,150**	**32,920**		
Total	**(W/SF)**	**3.4**	**0.6**	**1.2**	**3.5**		

2.1 BUILDING ANNUAL ENERGY END-USE BREAKDOWN



2 – Energy Model Utility Results

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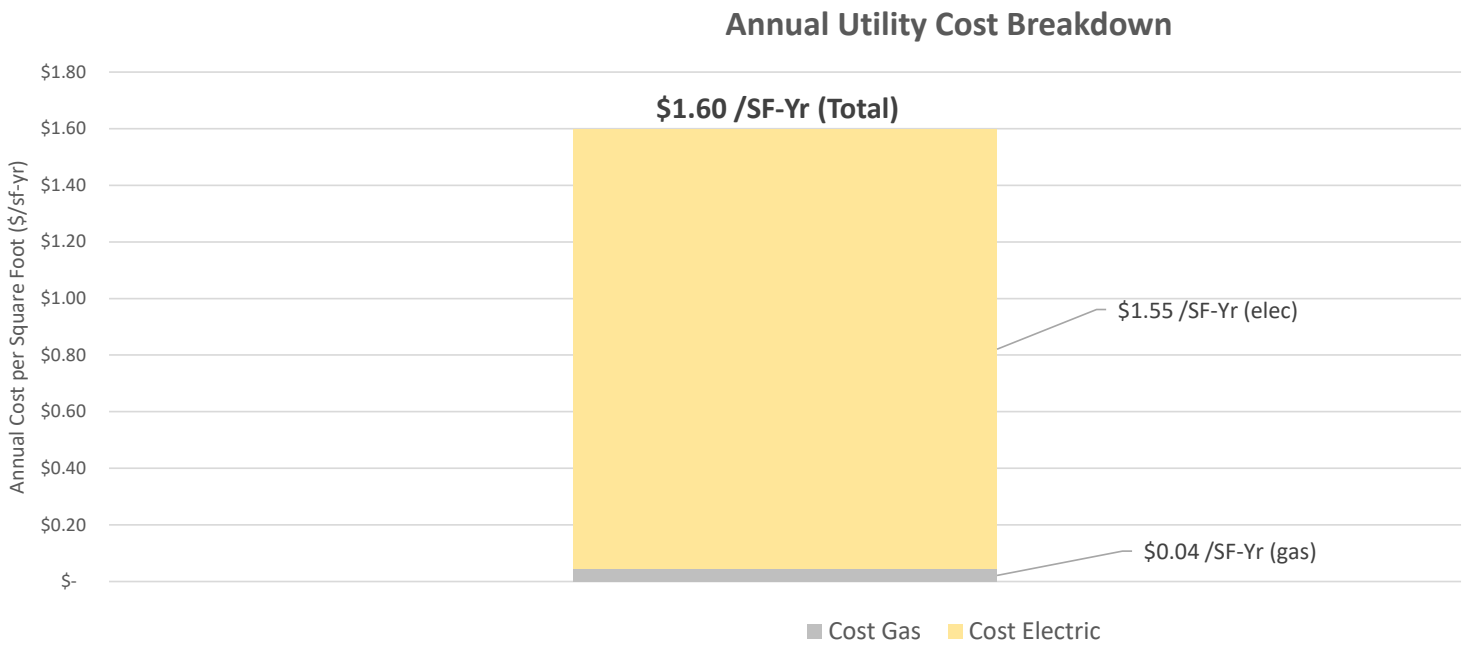
2.2 BUILDING ANNUAL ENERGY COST BREAKDOWN



100% DD LEED Performance:

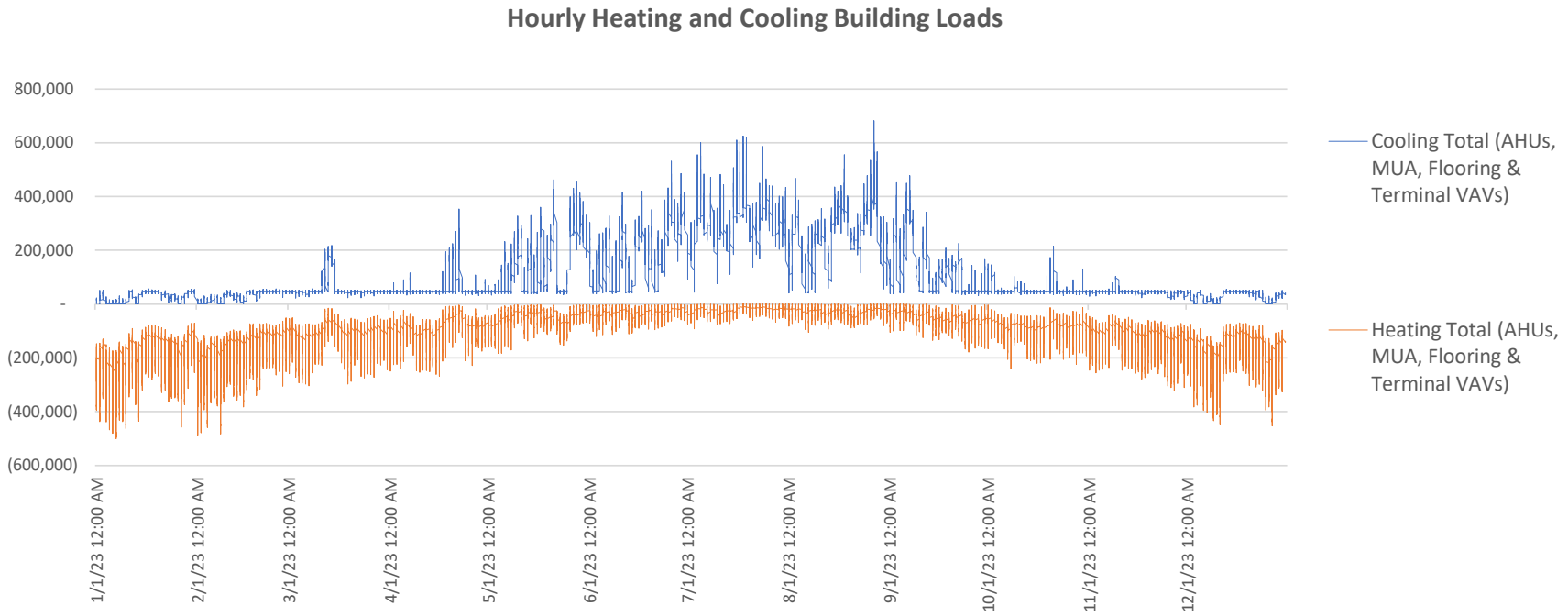
Annual Utility Cost Reduction vs ASHRAE 90.1-2010 Appendix G Baseline: **24%**

LEED v4 BD+C (NC) EA Credit Optimize Energy Performance Points: **10**

Proposed & & Baseline will be updated throughout CD. LEED Design-phase submission documentation will be based on 100% CD drawings and specifications.

Madison Gas and Electric Utility Rates C&I Time of Use Service Cg-4: $0.09006/kWh base and distribution + 6.3109/day + peak charges vary
Madison Gas and Electric Utility Rates: GSD-1 FS-1: $0.5436/Therm + $0.80/day charge

3.1 Heating And Cooling Loads

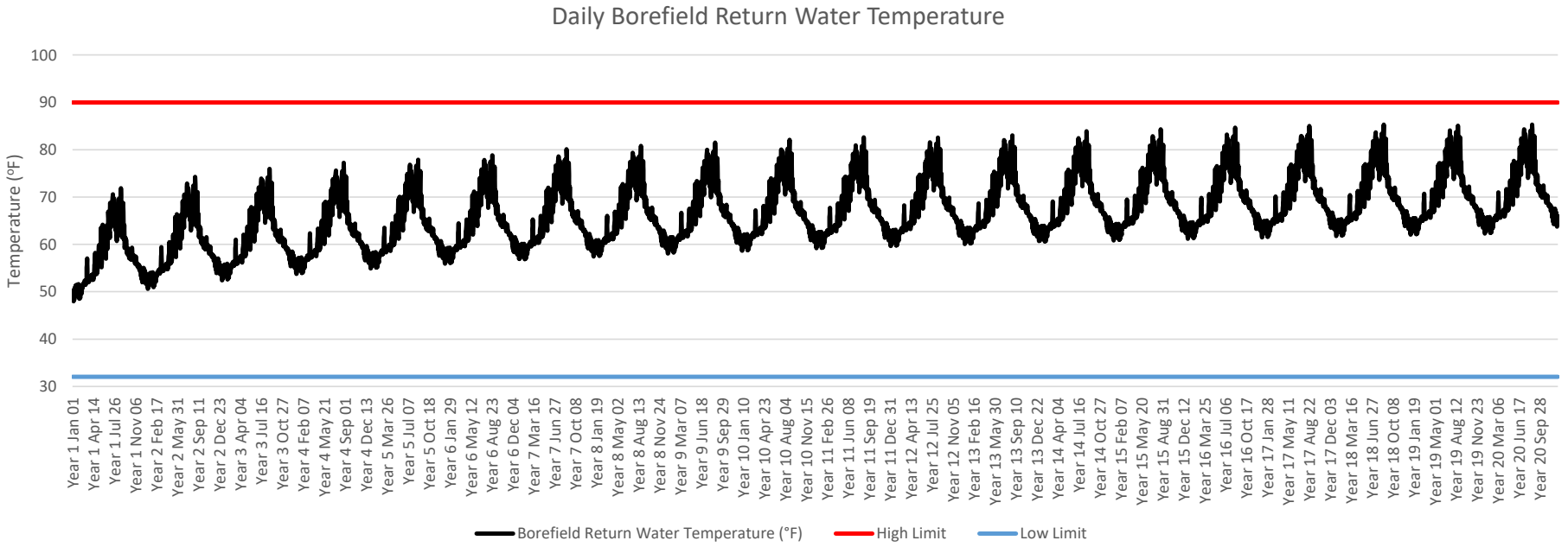


	Heating	Cooling
Total Annual Demand (kBtu)	869,137	997,934
Peak Load (MBH)	500	681

3.2 Ground Temperatures – 48 Bores

This slide shows the borefield return water temperature over the course of 20 years for a **48-well configuration**. The return water temperature remains within the 90°F high and 32°F low limits. This implies that more than fewer than 48 wells may provide an acceptable 20-year borefield return water temperature.

20-Year Maximum Return Water Temperature: 85.3°F



3 – Energy Model Results

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