

Open Loop GSHP Application at Dubuque County Courthouse

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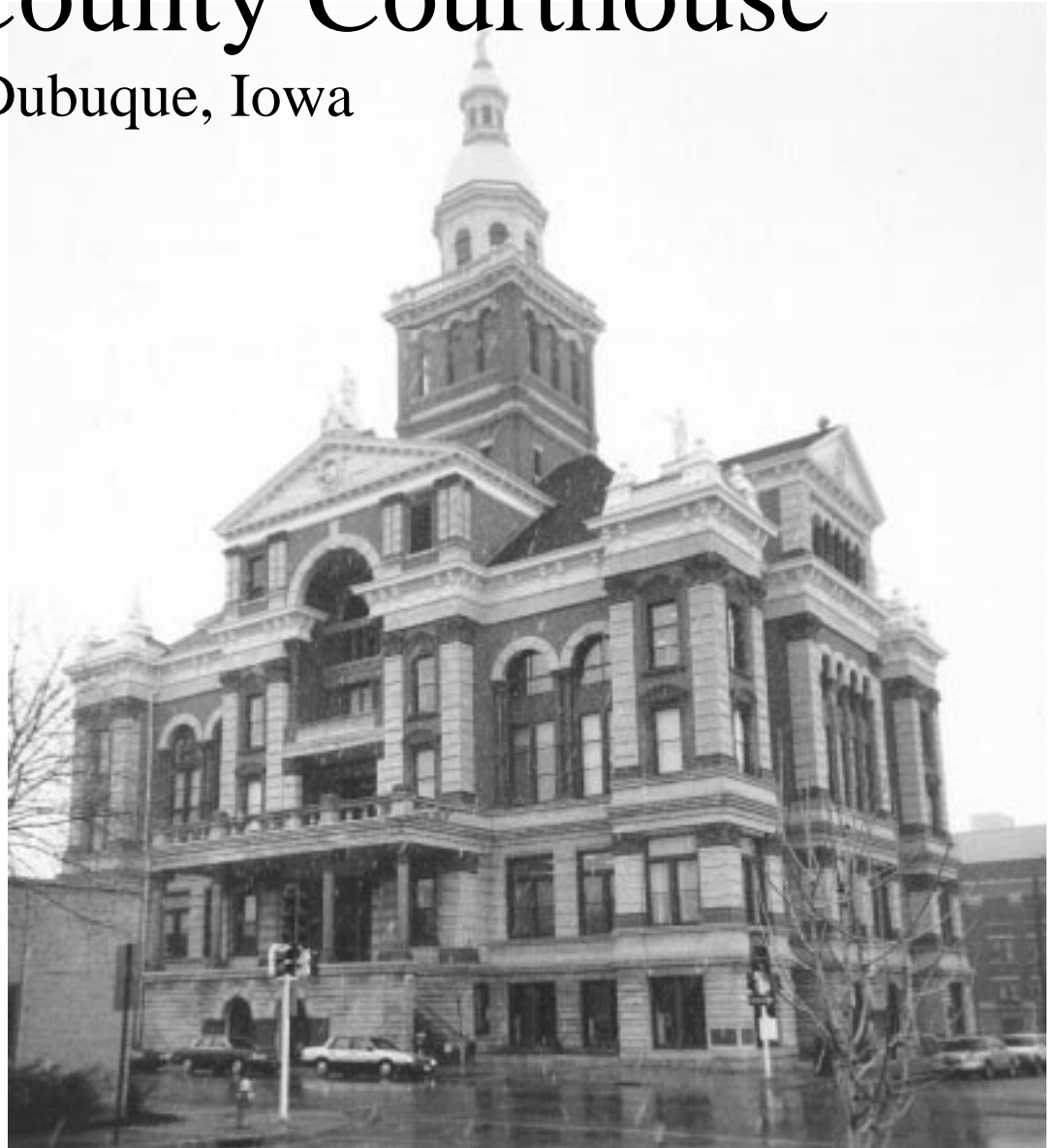


Iowa Energy Center - Energy Resource Station

Dubuque County Courthouse

Dubuque, Iowa

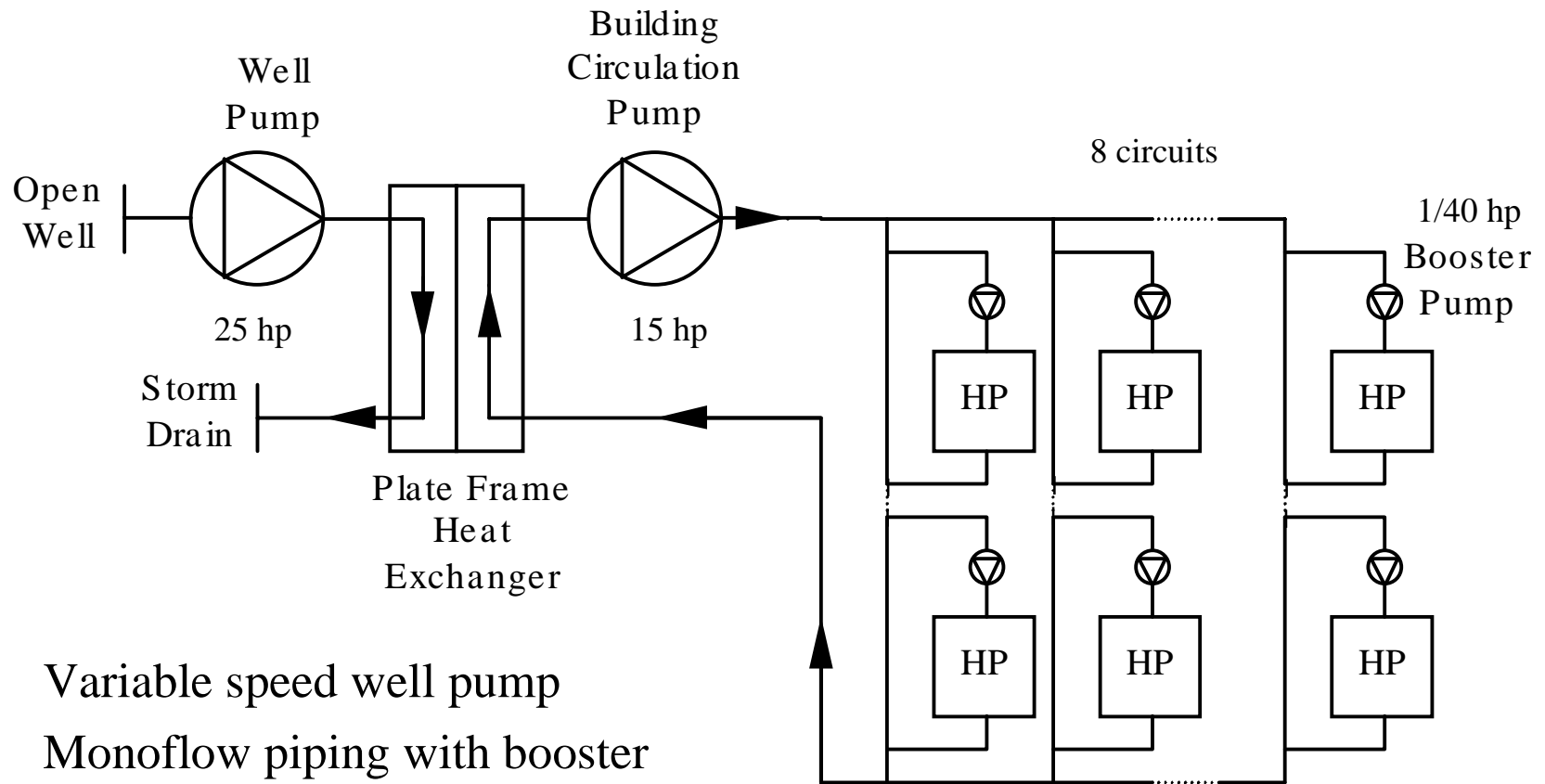
- 38,000 sq. ft.
- 100 years old
- Register of Historic Buildings
- Challenge to maintain character
- Chose open well system



Project Background

- Original project to expand 5th floor
- Retrofit first four floors with GSHP
- Used existing one-pipe system (monoflow)
- Minimize disruption of occupants / walls
- Found haphazard wiring - computers, lights, heat pumps on same circuits (208 / 110)

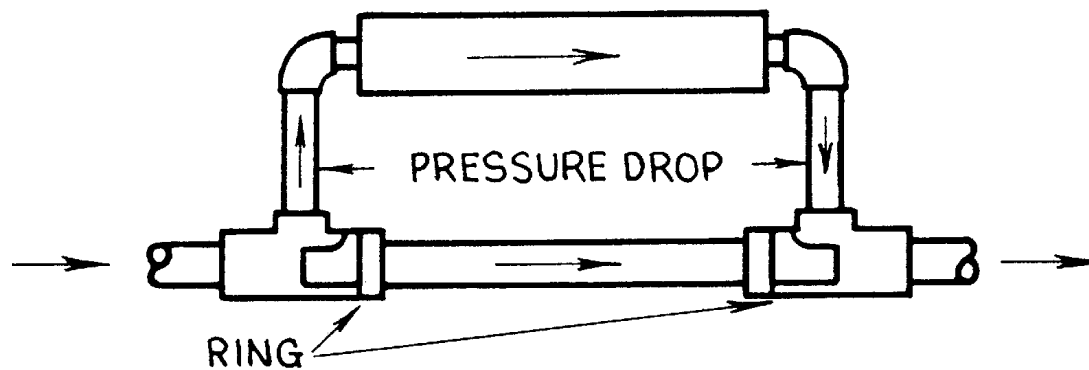
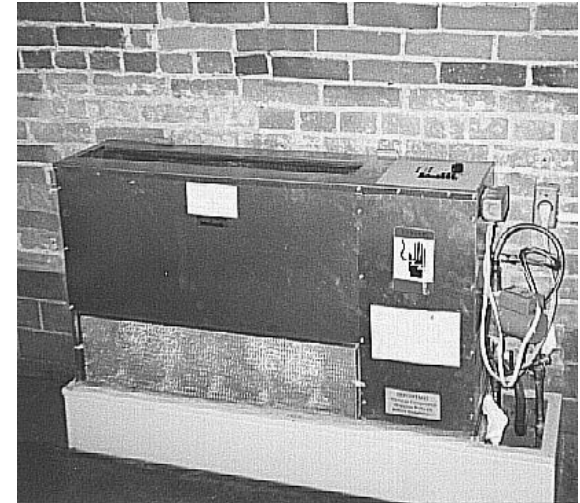
System



- Variable speed well pump
- Monoflow piping with booster pumps

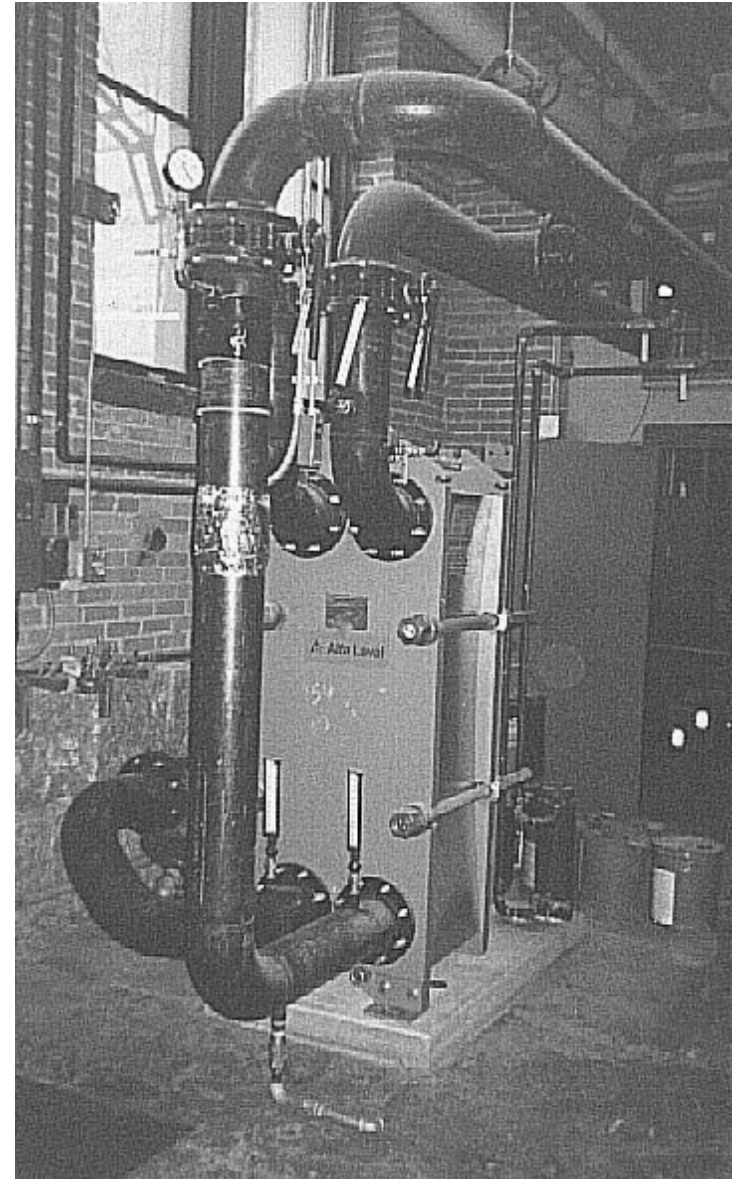
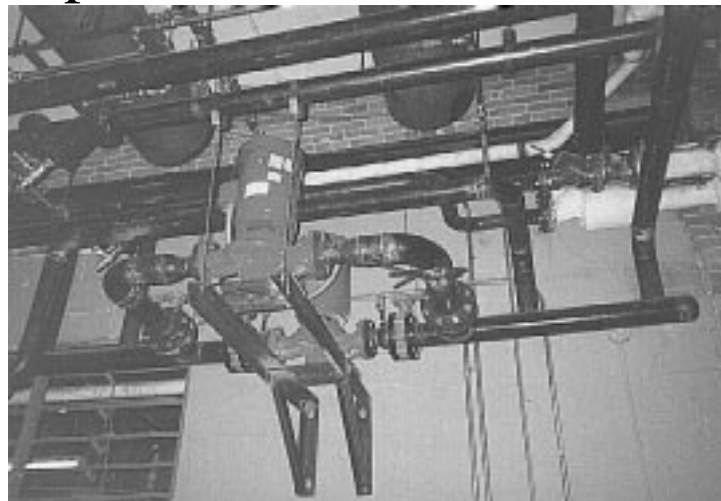
Heat Pumps

- 100 console units (106 tons)
- 3/4 to 4 tons
- State of monoflow valves required booster pumps
- Main circulation pump and boosters run continuously



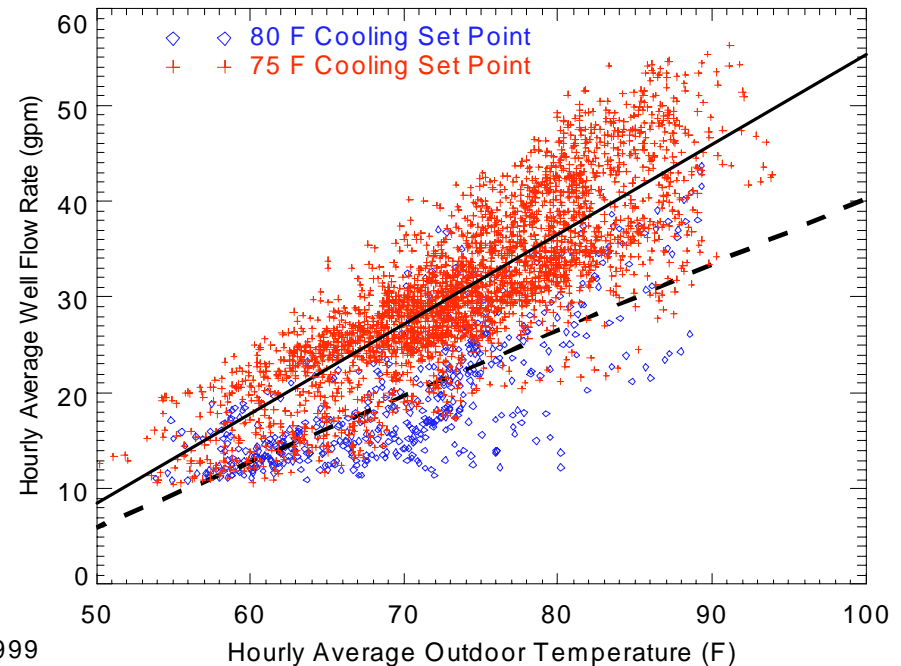
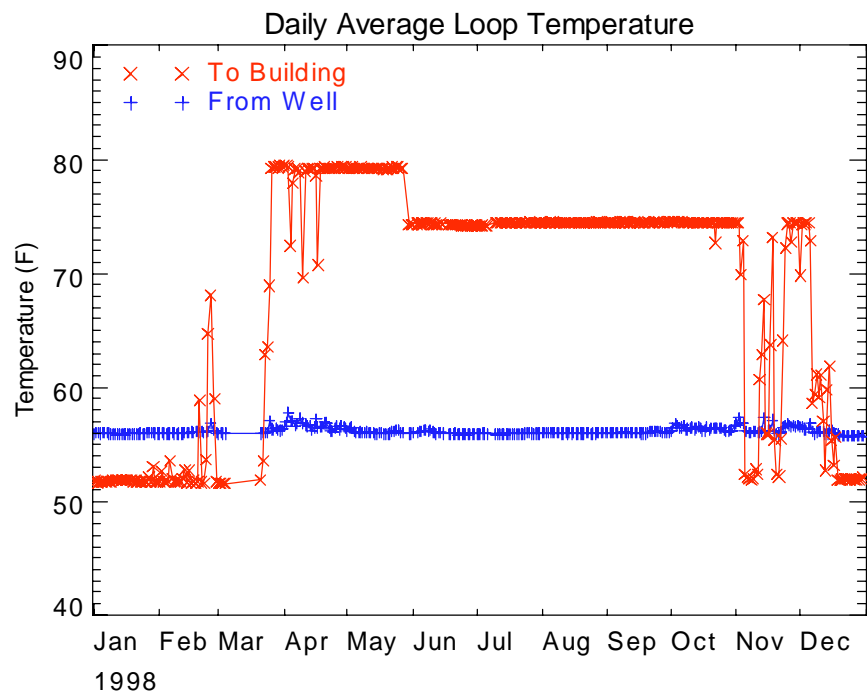
Mechanical Room & Well

- 94 ft well, 10 inch diameter
- Cased to 76 feet
- 23 ft static water level
- 10 ft draw down at 400 gpm
- Tower space now used for license plate storage, boiler space for workshop



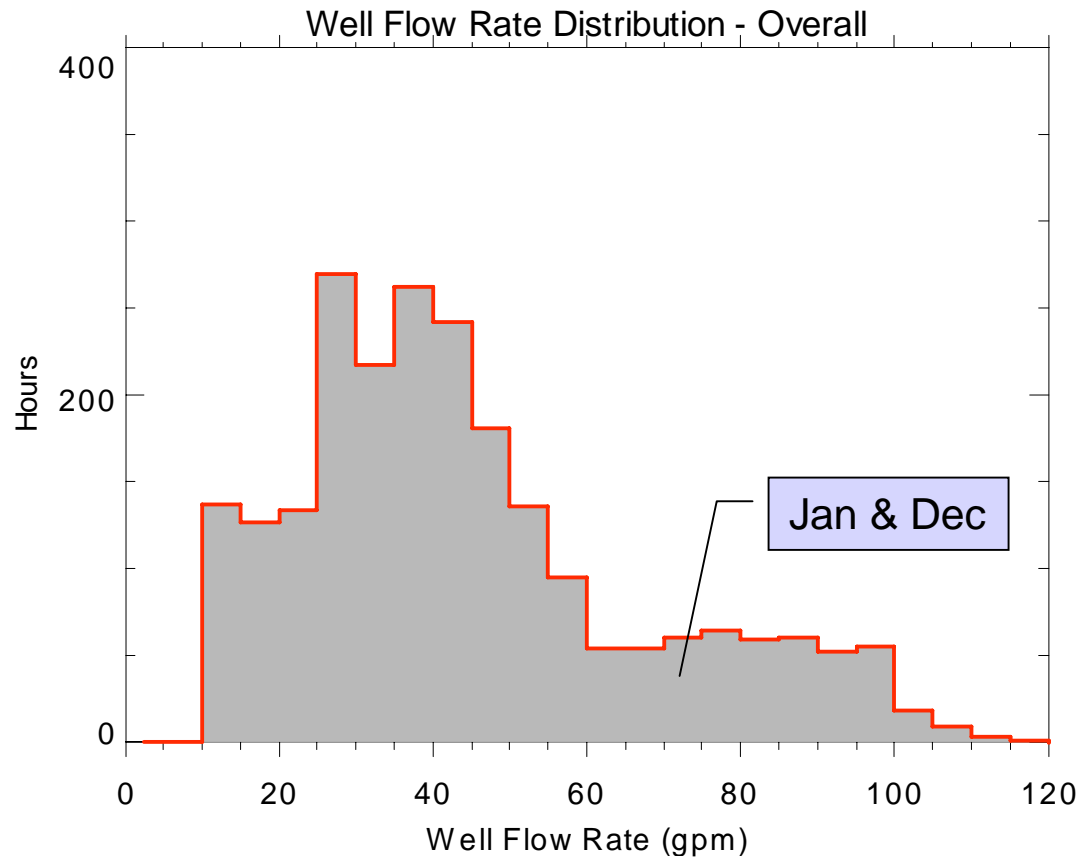
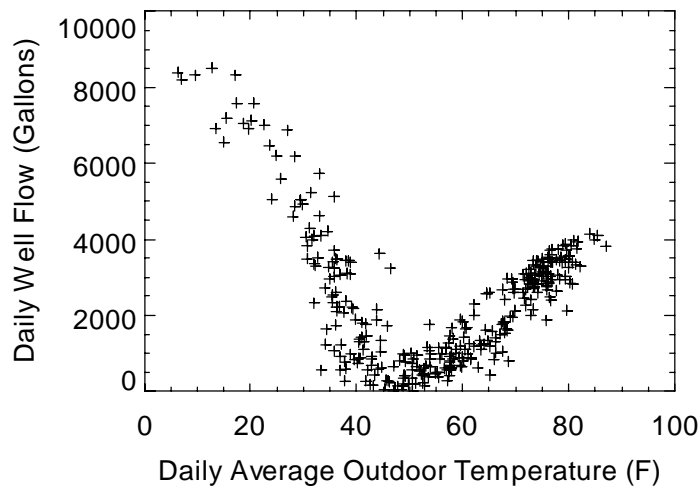
Water Pumping

- Variable speed well pump - 50F/80F control
- Changed set point to 75F
 - Nearly doubled well water flow rate (37% energy increase)
 - Improved heat pump efficiency (5.6% energy decrease)
 - Reduced system energy use by 4.5%

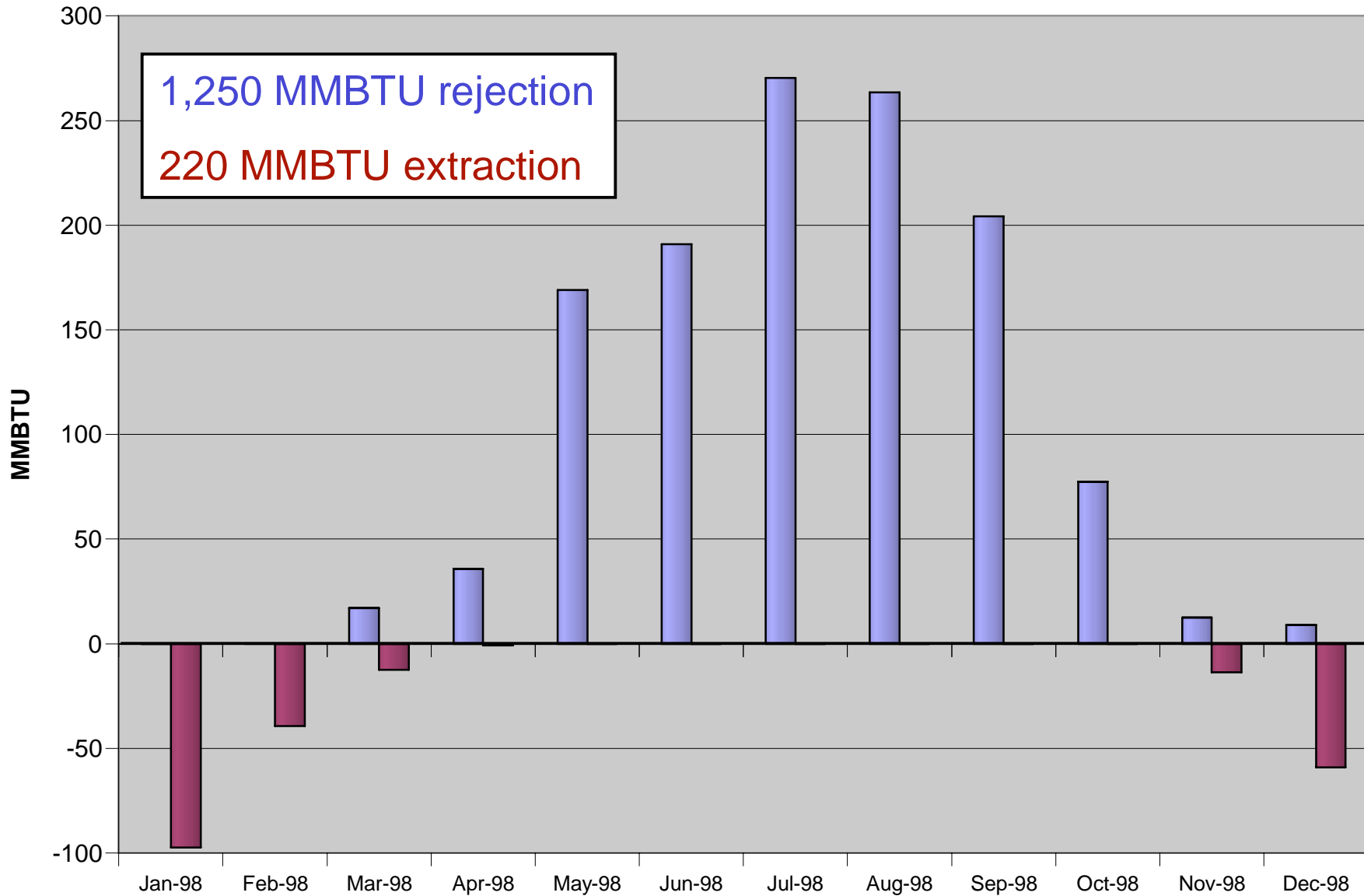


Well Water Flow

- 15:1 turn-down from 350 gpm capacity
- Highest flows in winter months

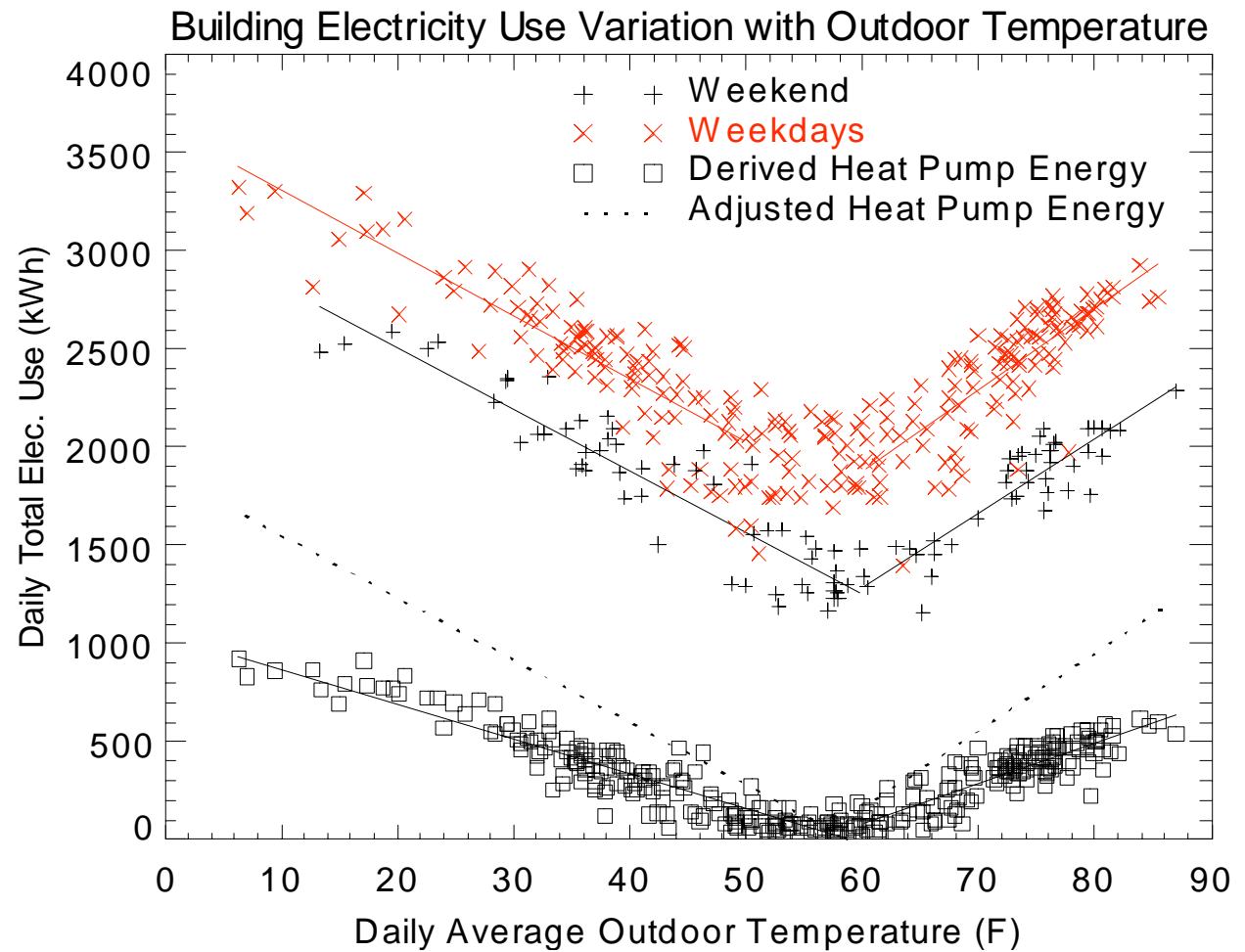


Monthly Loop Loading

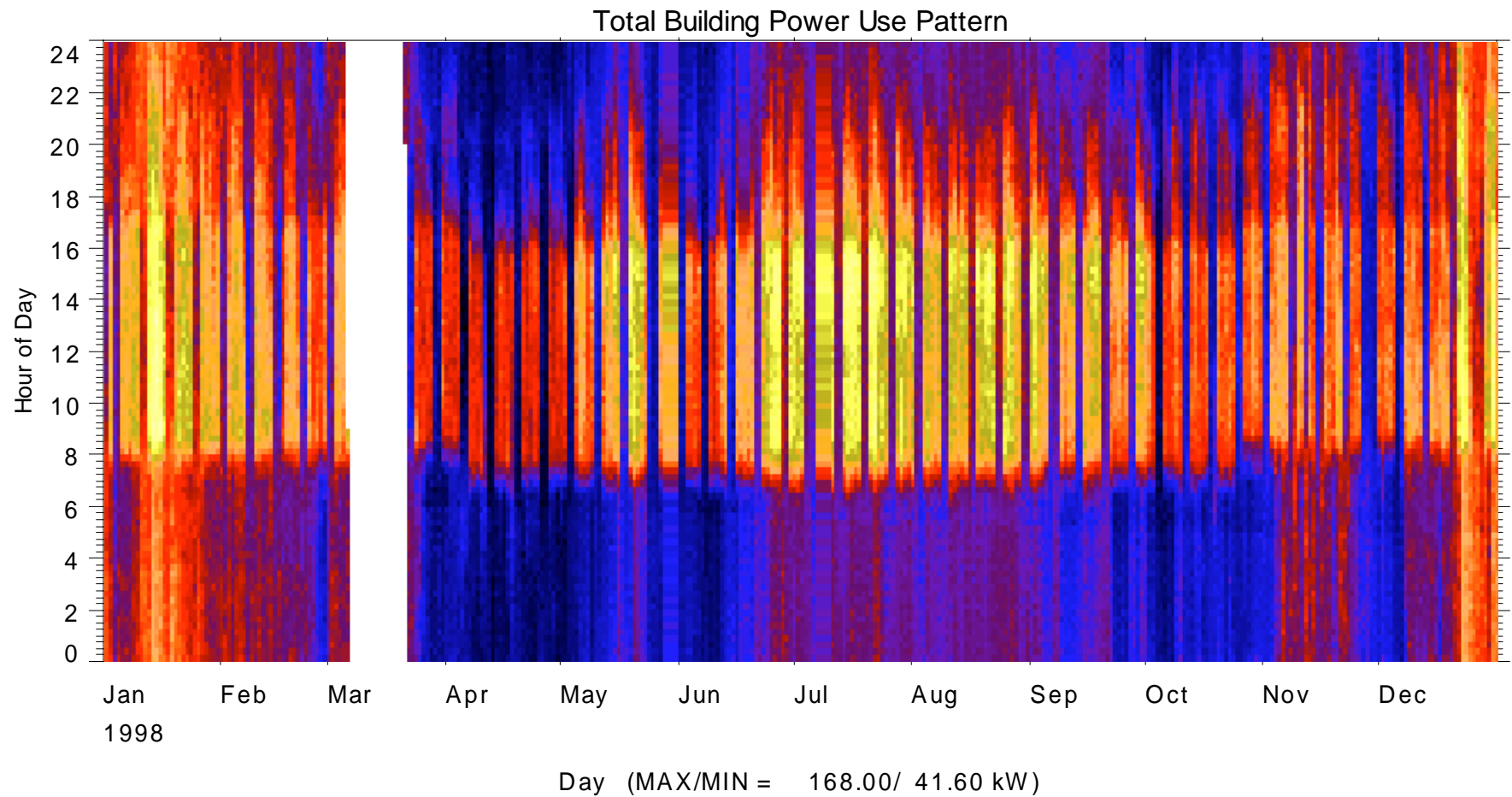


Heat Pump Energy

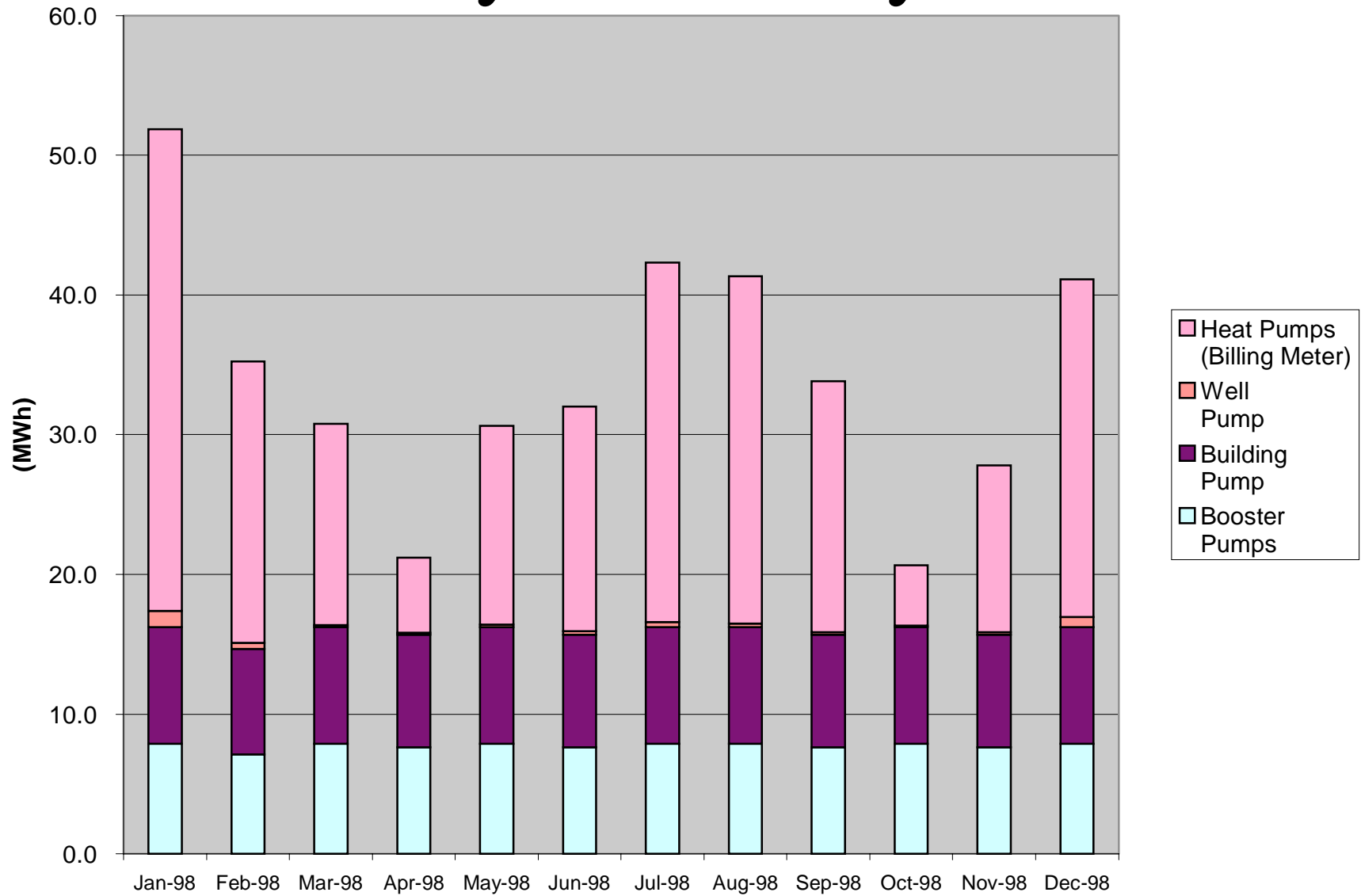
- Slope of total building electricity use gives estimate of heat pump electricity use
- Net loop load also gives estimate



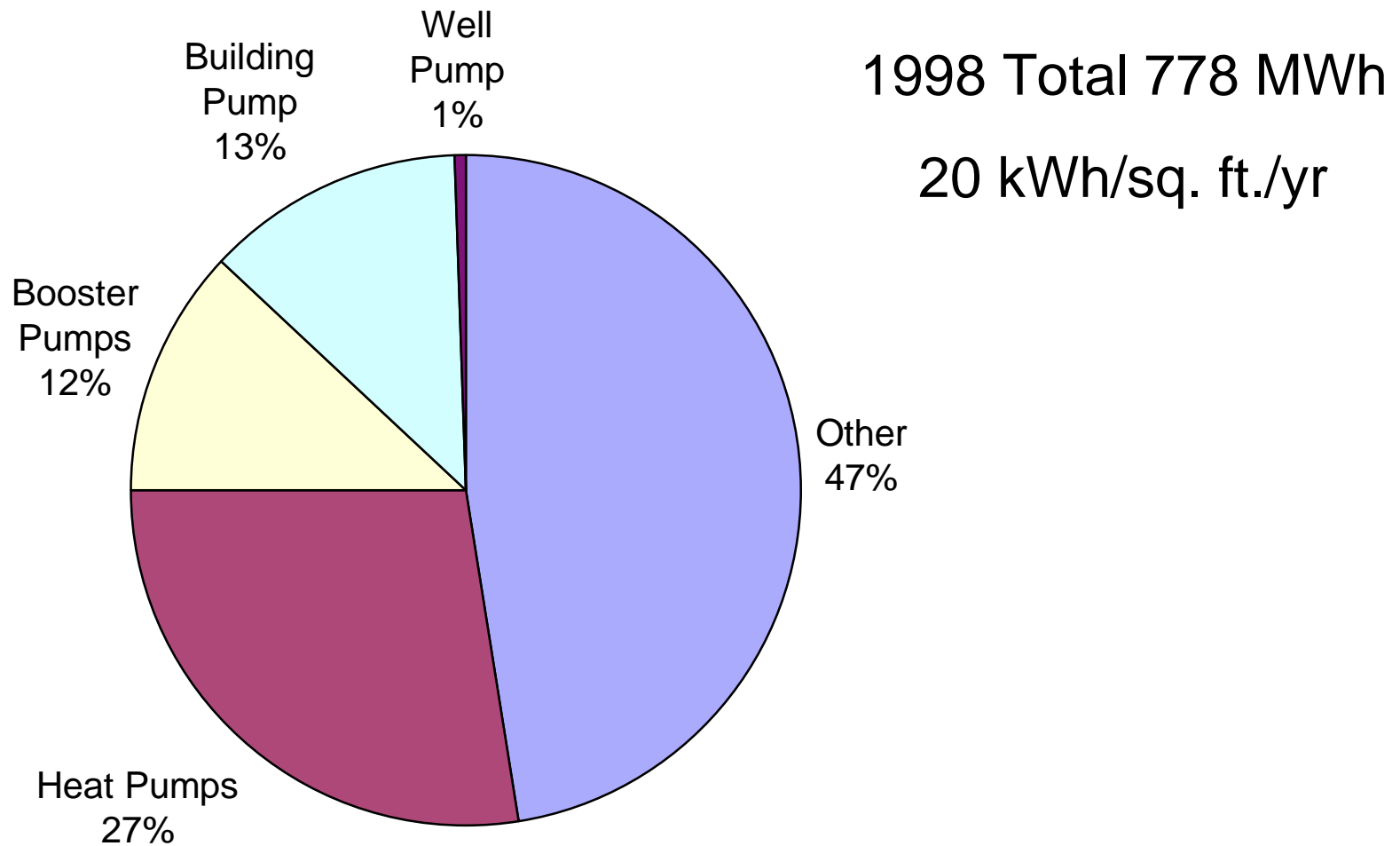
Total Building Power



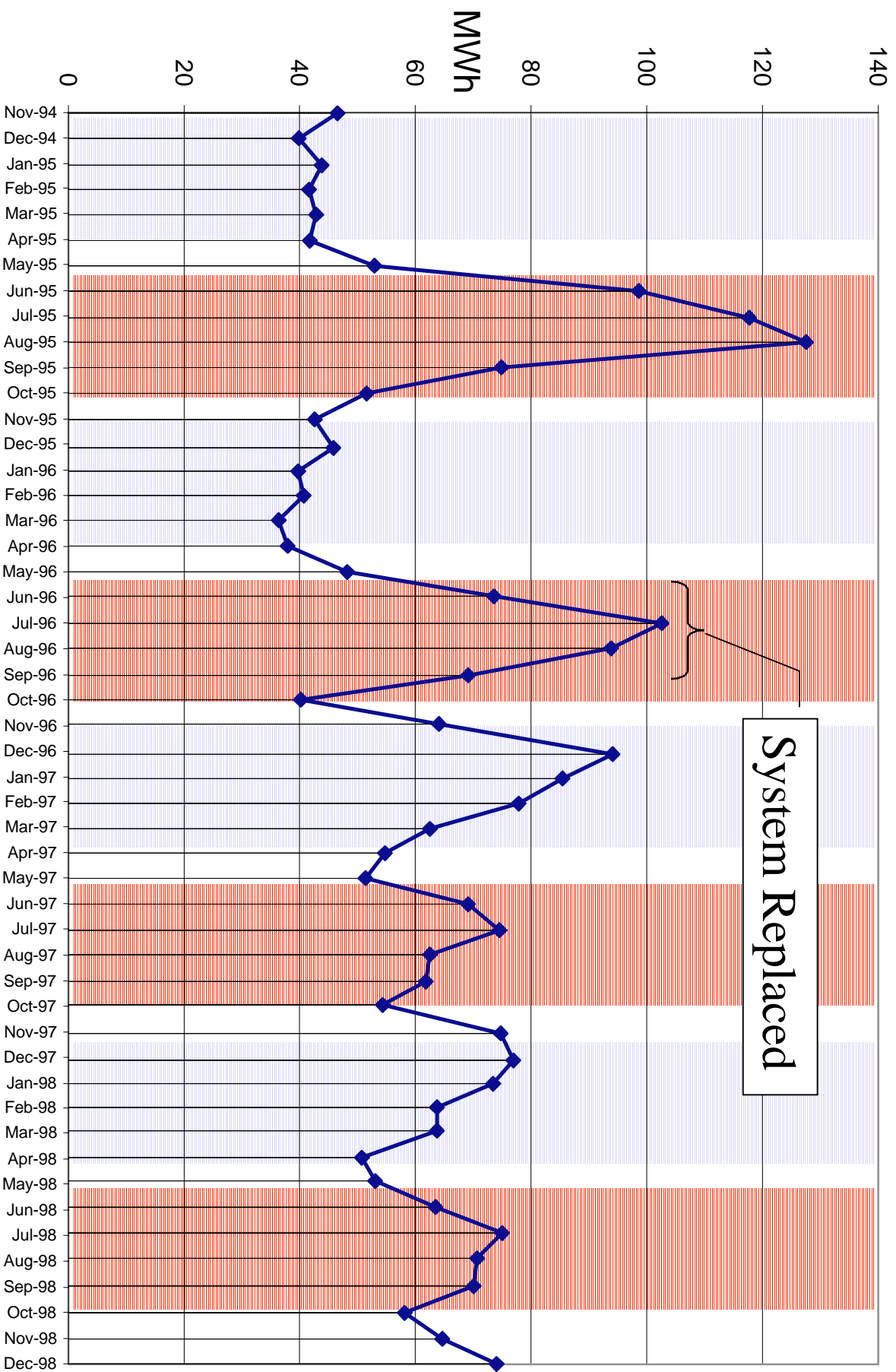
Monthly Electricity Use



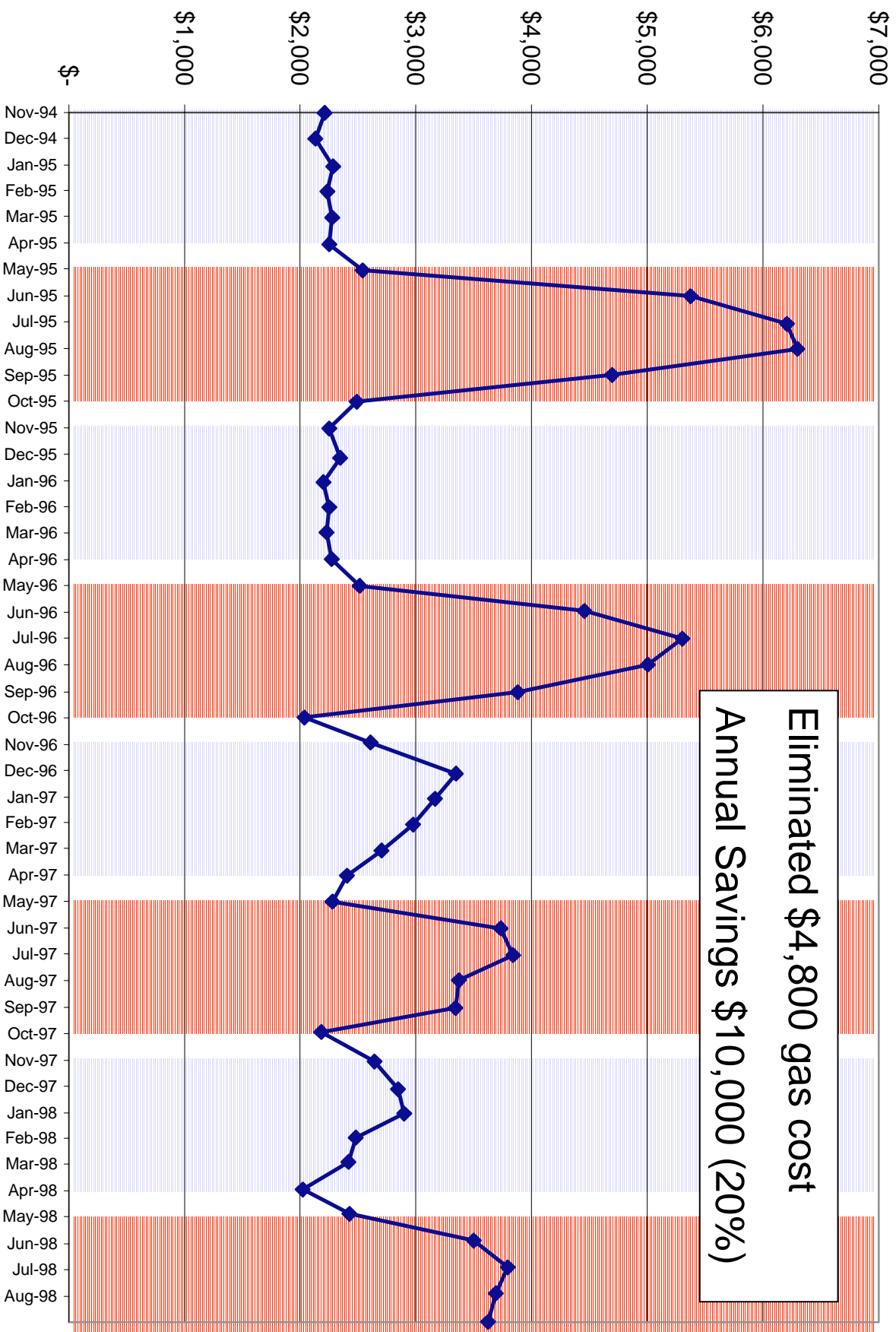
Annual Electricity Use



Monthly Electricity Use



Monthly Electricity Cost





Summary



- GSHP under constraints of historic site
- Replaced boiler/tower and console heat pumps
- Booster pumps
- Variable speed well pump
- Increased space
- Less time on maintenance
- Loop temperature set point analysis
- Total energy bill reduced 20% (\$10,000)