

## Measured Initial Performance Data for Madison Project, Troy, NY



Data loggers were installed by CDH Energy at the two apartments (1<sup>st</sup> floor, 2<sup>nd</sup> floor) at 111 Madison St in Troy to measure total apartment power and boiler operation on August 19, 2010. The battery-powered data loggers were setup to measure the parameters listed in Table 1. Data were recorded at hourly intervals. We retrieved data from the loggers on March 16, 2011 and also acquired copies of the utility bills. This report provides an initial analysis.

**Table 1. Monitored Points at the Site**

1	1 <sup>st</sup> Floor Hot Water Pump Runtime (hrs)	Veris Current Switch	Runtime
2	1 <sup>st</sup> Floor Domestic Hot Water Pump Runtime (hrs)	Veris Current Switch	Runtime
3	2 <sup>nd</sup> Floor Hot Water Pump Runtime (hrs)	Veris Current Switch	Runtime
4	2 <sup>nd</sup> Floor Domestic Hot Water Pump Runtime (hrs)	Veris Current Switch	Runtime
5	1 <sup>st</sup> Floor Total House Power (kWh)	Wattnode Power Mtr	Power
6	2 <sup>nd</sup> Floor Total House Power (kWh)	Wattnode Power Mtr	Power
7	1 <sup>st</sup> Floor Boiler Electric Power (kWh)	Wattnode Power Mtr	Power
8	2 <sup>nd</sup> Floor Boiler Electric Power (kWh)	Wattnode Power Mtr	Power

### Apartment 1 (downstairs)

The heating system is controlled by a setback thermostat (see the pattern in Figure 1). Apartment 1 used significantly more space heat than Apartment 2 (see Figure 5).

Measured gas use data implies the peak space heating load is about 15 MBtu/h input (Figure 7). When the space heating pump operates, the average boiler gas input for the boiler is 0.247 therms/h, or 24.7 MBtu/h (see Figure 8).

The status on the DHW pump did not work (see Figure 1). However we can infer from the boiler power data when the DHW pump and boiler operated (see Figure 12 and 13). There was almost no domestic hot water use; the only DHW pump operation was required to keep the tank warm.

The occupants were on vacation for about a week starting at Christmas (see Figure 1 and Figure 3).

### Apartment 2 (upstairs)

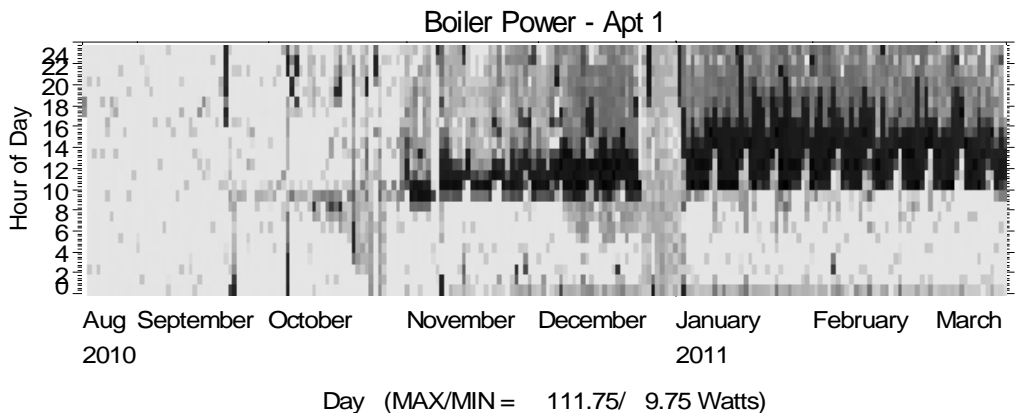
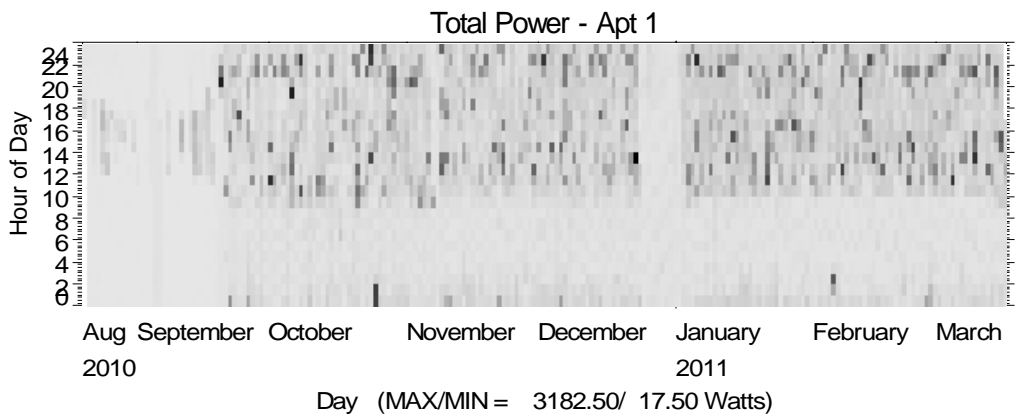
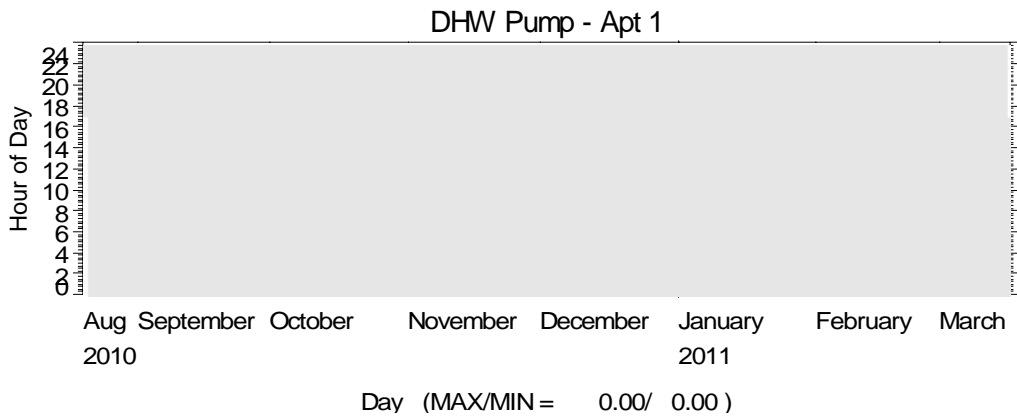
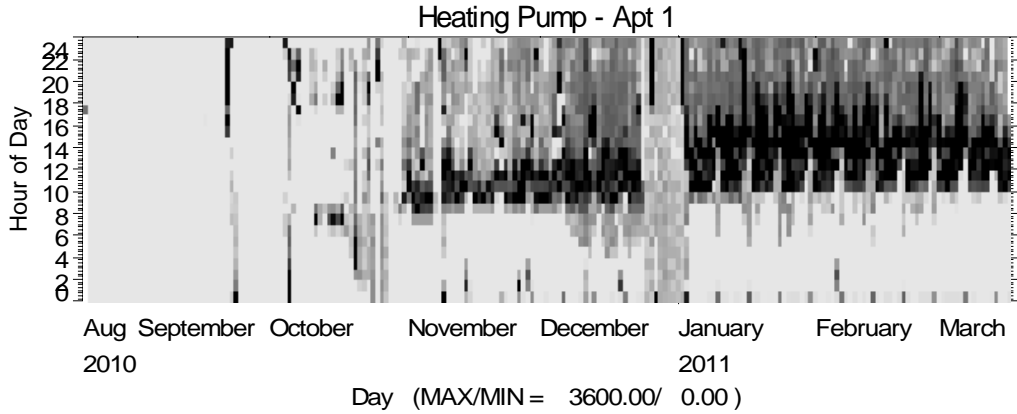
Apartment 2 had significantly more hot water use than Apartment 1, but almost no space heating (see Figure 2, Figure 4 and Figure 5, and Figure 9).

When the DHW pump operates in Apartment 2, the boiler uses about 0.49 therms/h, or 49 MBtu/h (see Figure 10). This implies the boiler operates at nearly full capacity when meeting the DHW load (the boiler is rated at 60 MBtu/h).

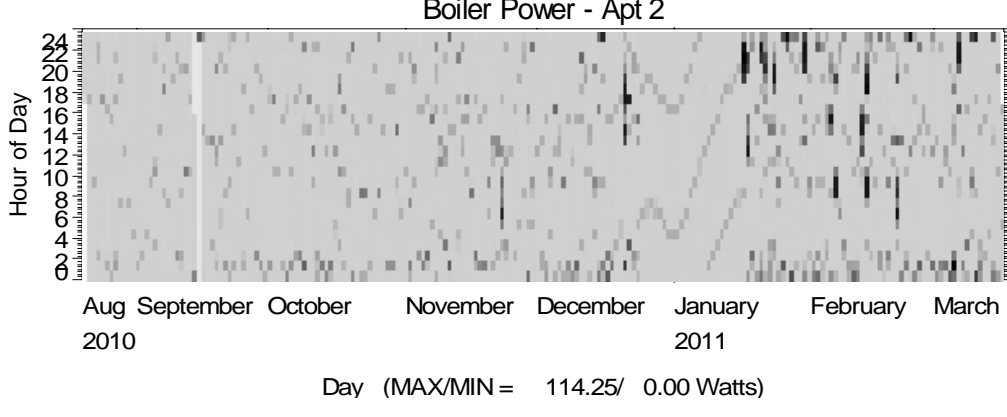
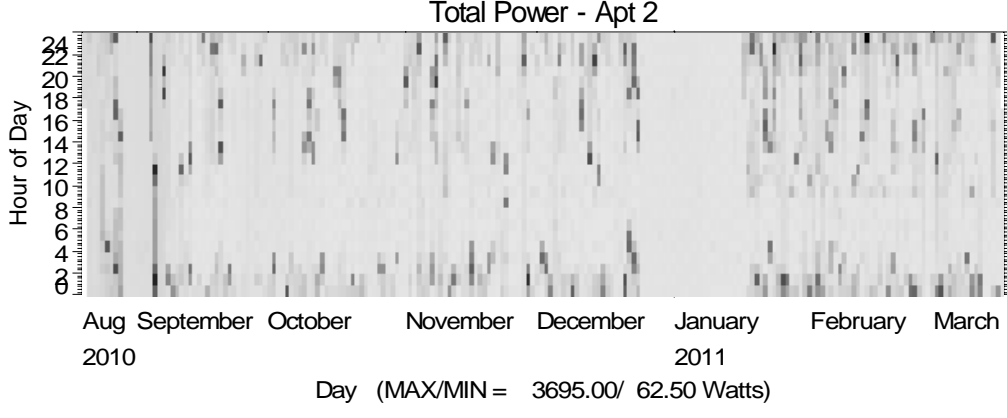
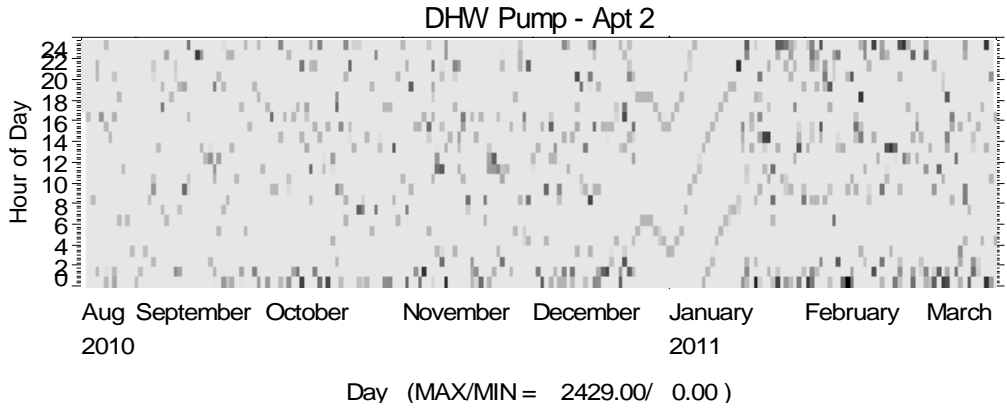
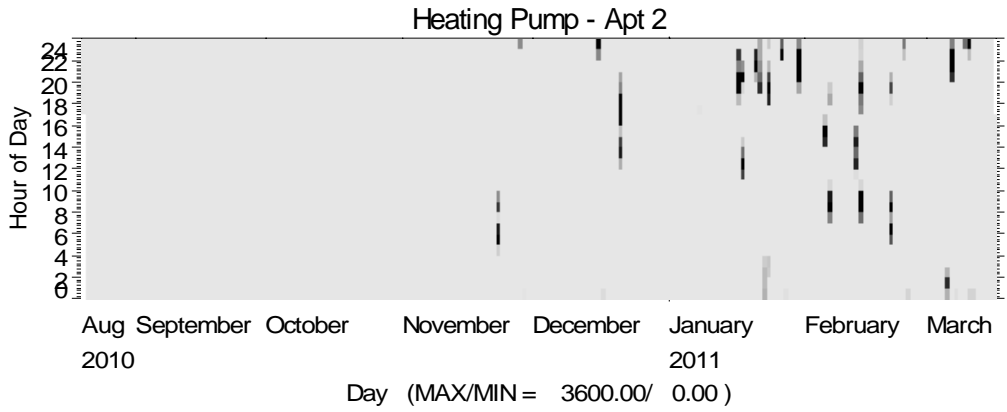
The occupants in Apartment 2 were on vacation for a week starting August 28 and about 2 weeks starting at Christmas (see Figure 2 and Figure 4). The difference in pump runtime for the Winter and Summer vacation periods is due to the different heat loss rates for the tank in the two seasons. Figure 11 shows that the pump runtime to maintain the DHW tank without any usage was about 8 minutes per day in August and 17 minutes per day at Christmas time (when the apartment was presumably colder).

**Table 2. Summary of Monthly Utility Bills**

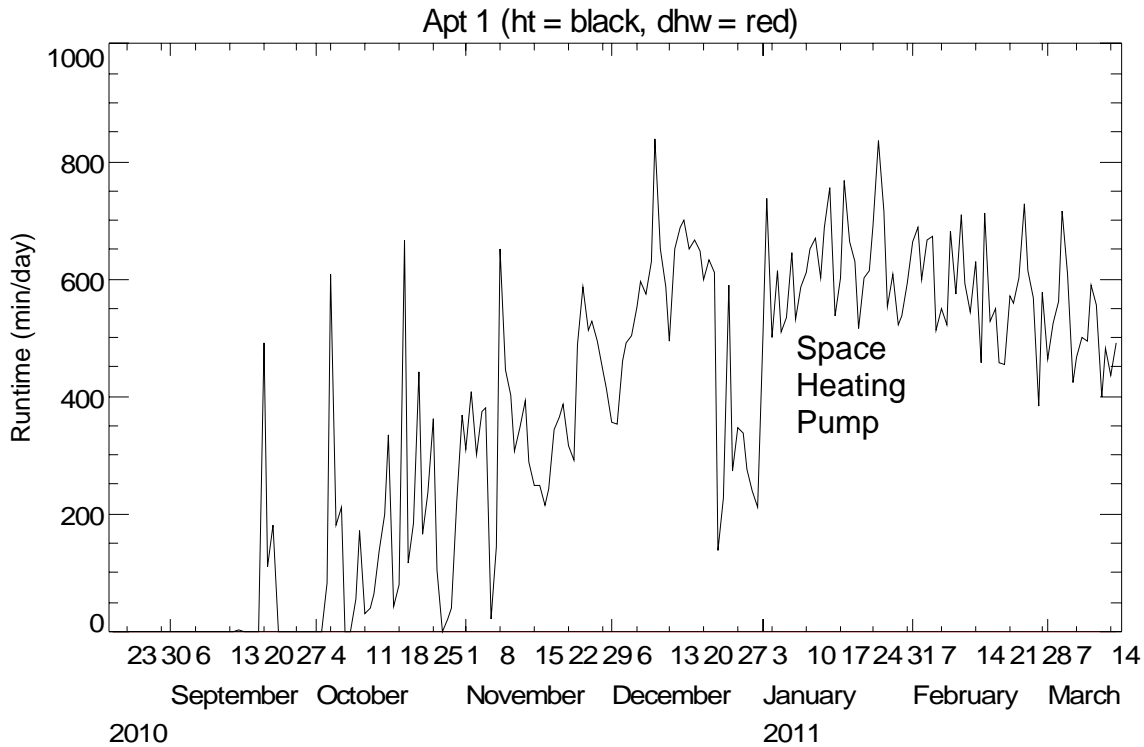
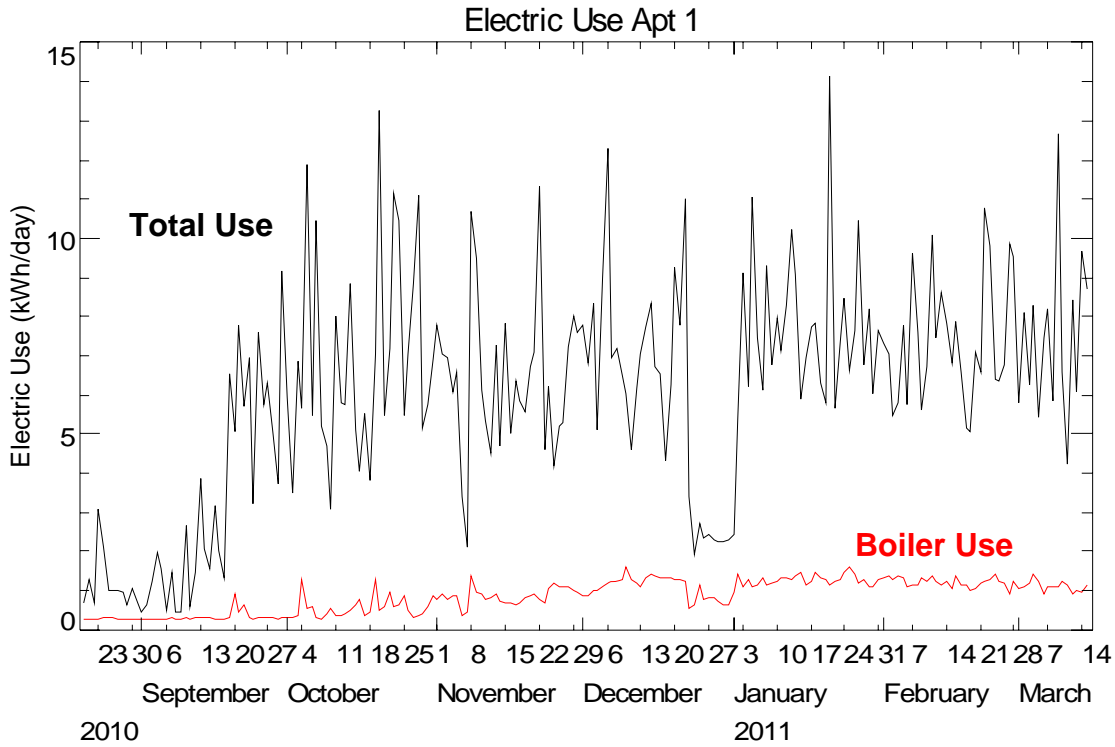
Month	Apartment 1 (1st Floor)		Apartment 2 (2nd Floor)		Outdoor Temp
	kWh	therms	kWh	therms	F
5/25/2010			64	3	
6/25/2010			244	7	
7/25/2010			476	6	
8/25/2010			334	4	72.4
9/25/2010		1	224	5	66.0
10/25/2010	37	21	175	7	53.1
11/25/2010	210	33	179	10	44.1
12/25/2010	195	68	195	11	28.0
1/25/2011	211	77	161	11	22.5
2/23/2011	218	68	214	17	23.7



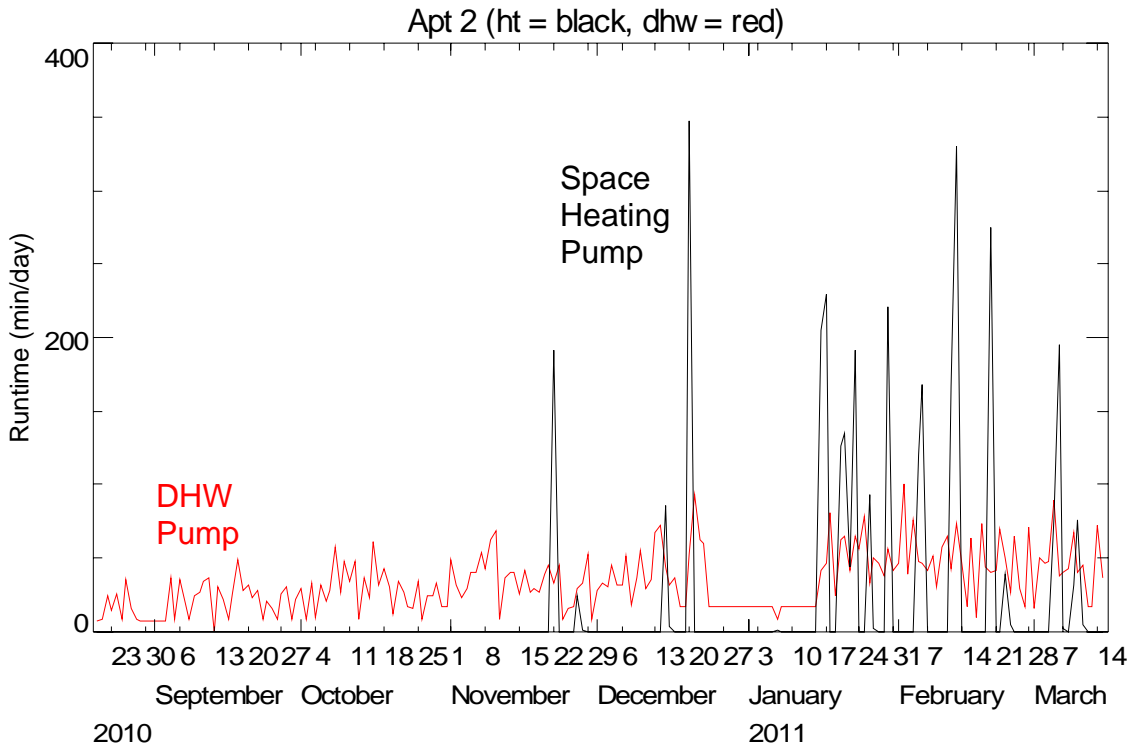
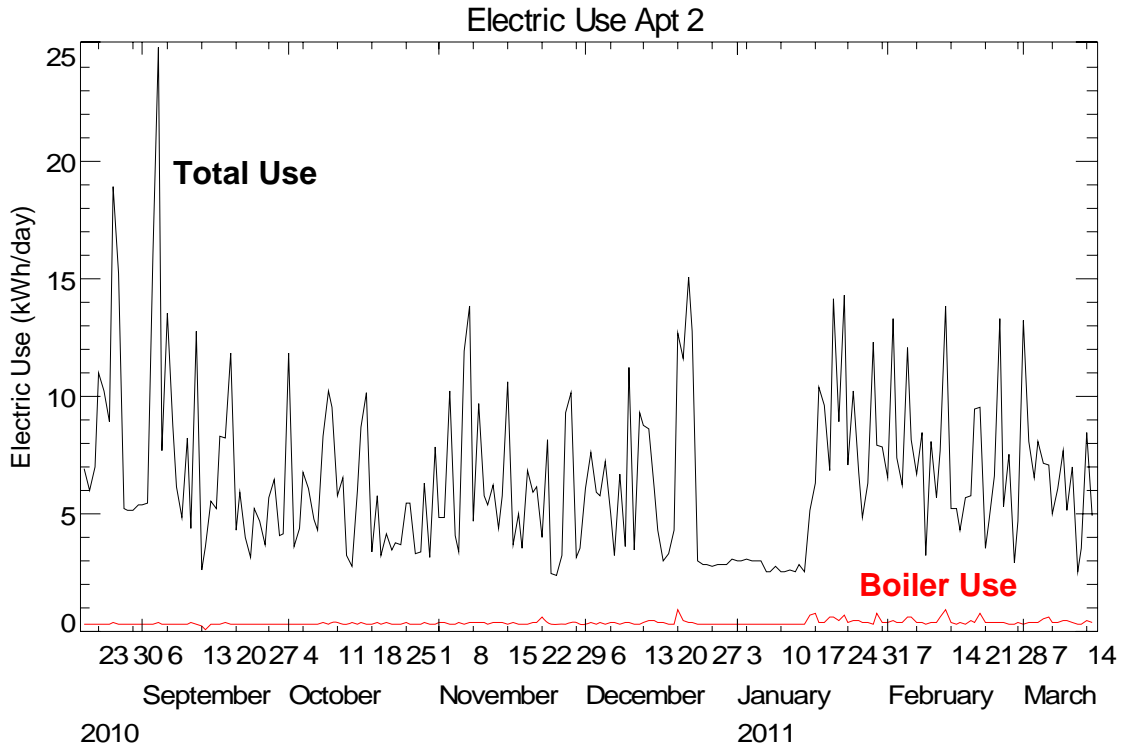
**Figure 1. Shade Plots of Pump Runtime and Power – Apartment 1**



**Figure 2. Shade Plots of Pump Runtime and Power – Apartment 2**



**Figure 3. Plots of Daily Pump Runtime and Power Use – Apartment 1**



**Figure 4. Plots of Daily Pump Runtime and Power Use – Apartment 2**

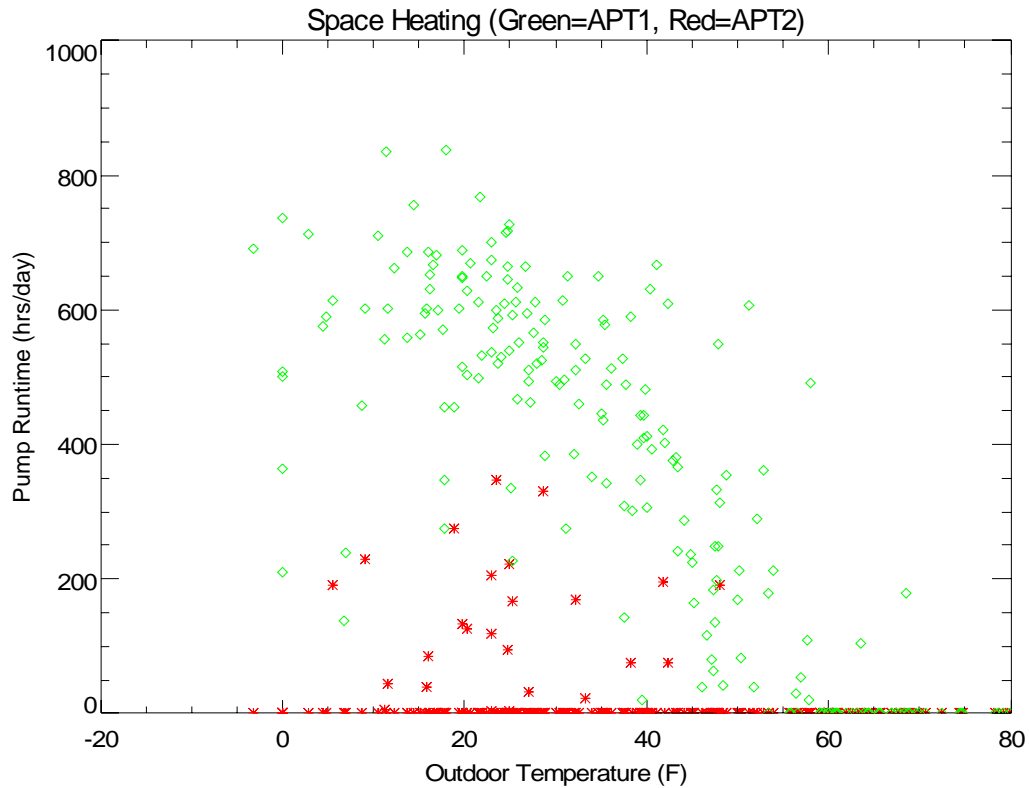


Figure 5. Comparing Runtime of the Space Heating Pump to Outdoor Temperature

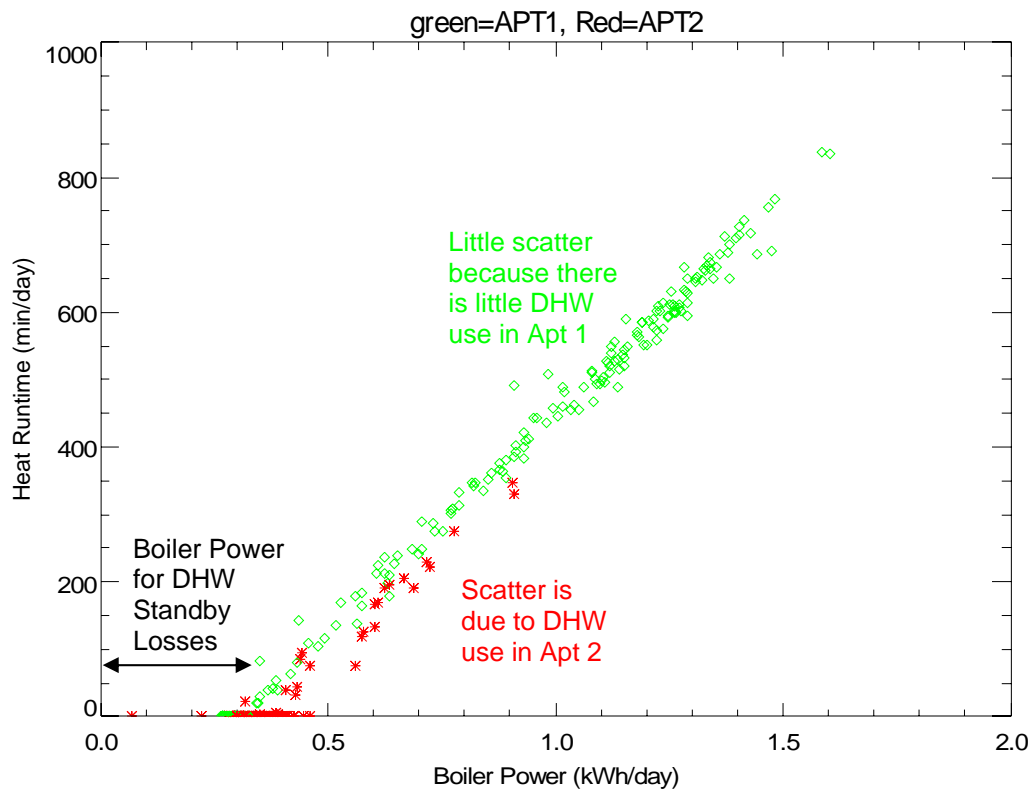


Figure 6. Comparing Runtime of the Space Heating Pump to Power Use

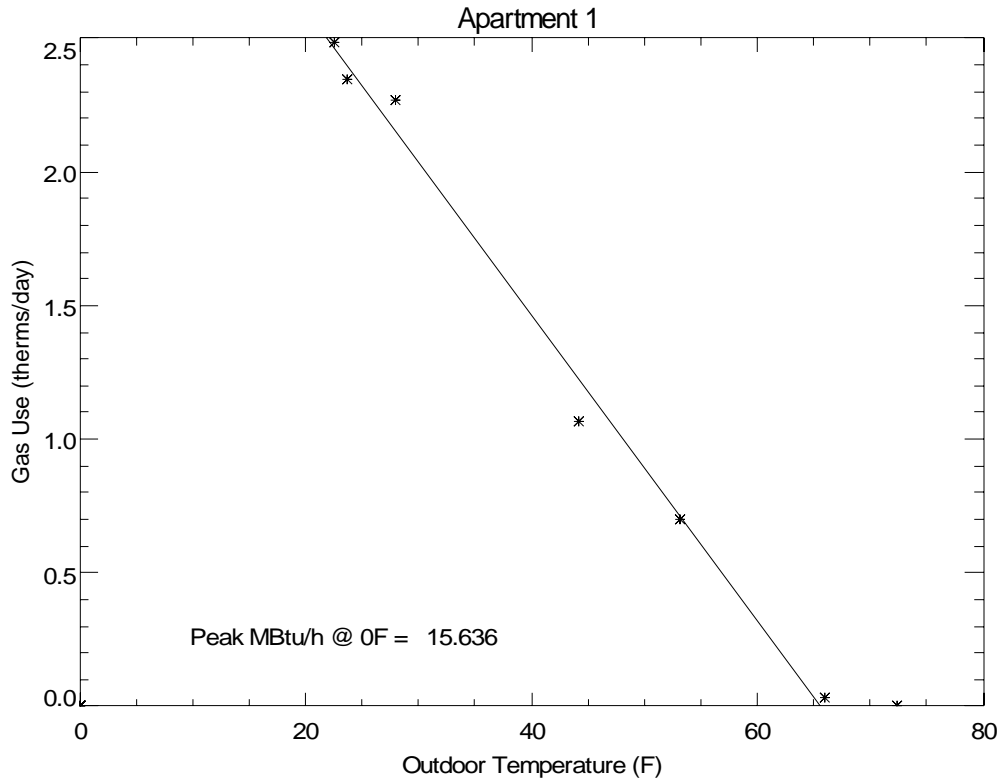


Figure 7. Monthly Gas Use vs. Outdoor Air Temperature, Apartment 1

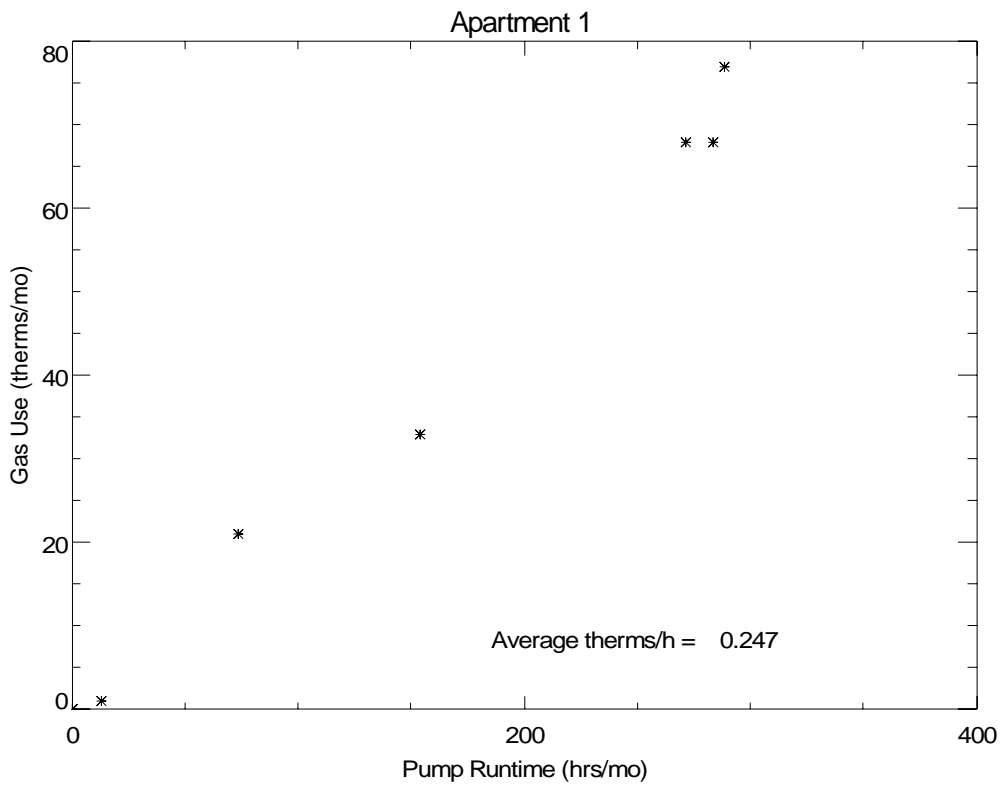


Figure 8. Comparing Monthly Runtime of the Space Heating Pump to Gas Use, Apartment 1



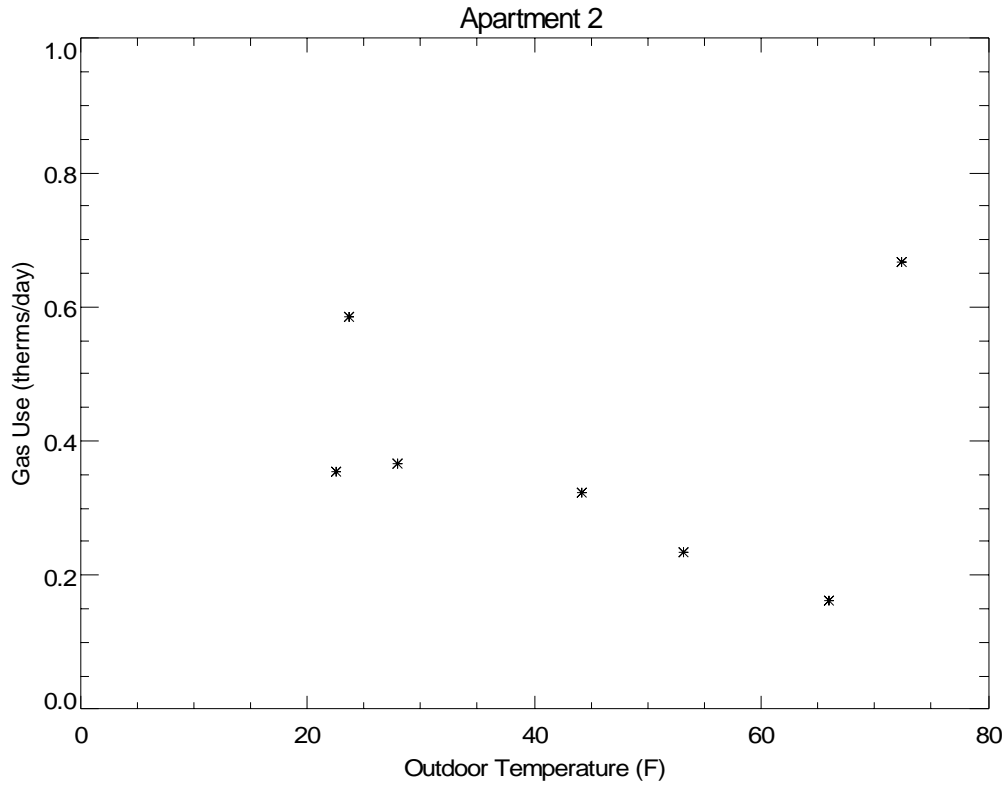


Figure 9. Monthly Gas Use vs. Outdoor Air Temperature, Apartment 2

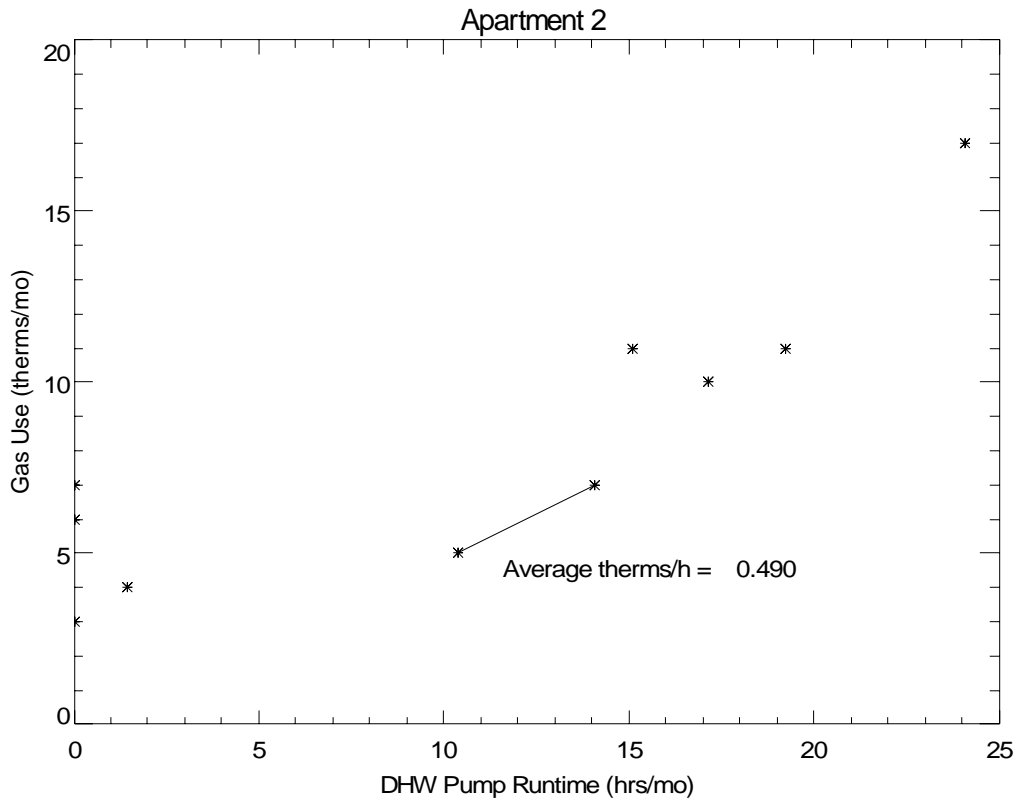
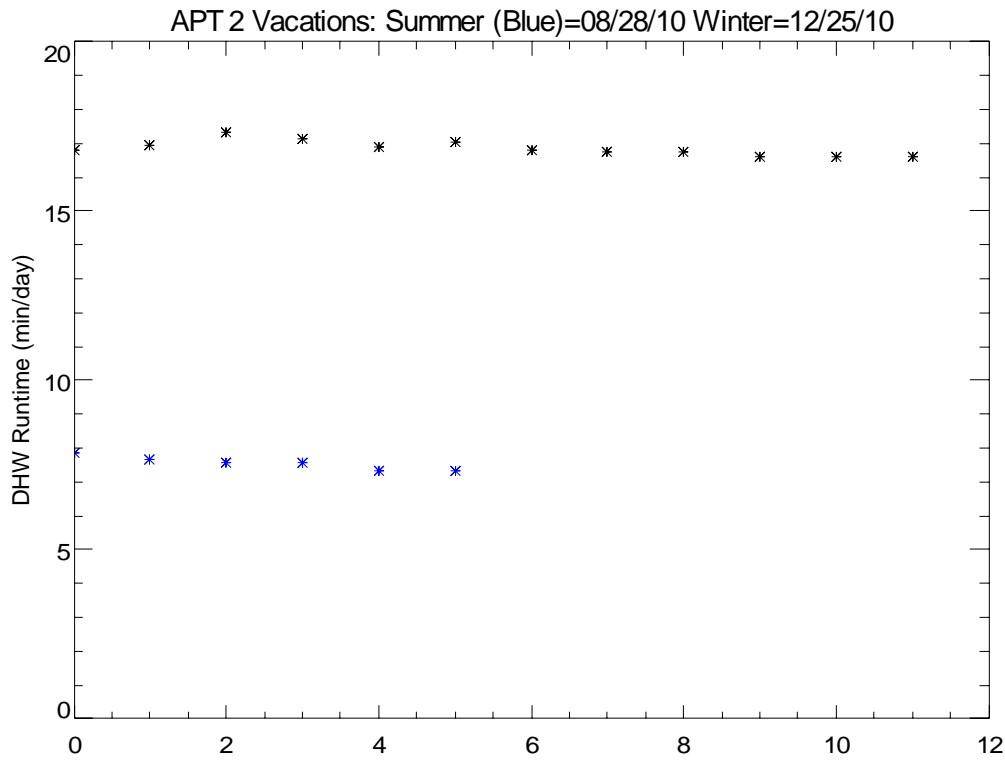


Figure 10. Comparing Monthly Runtime of the DHW Pump to Gas Use, Apartment 2



**Figure 11. Daily DHW Pump Runtime for Two Vacation Periods Without Hot Water Use**

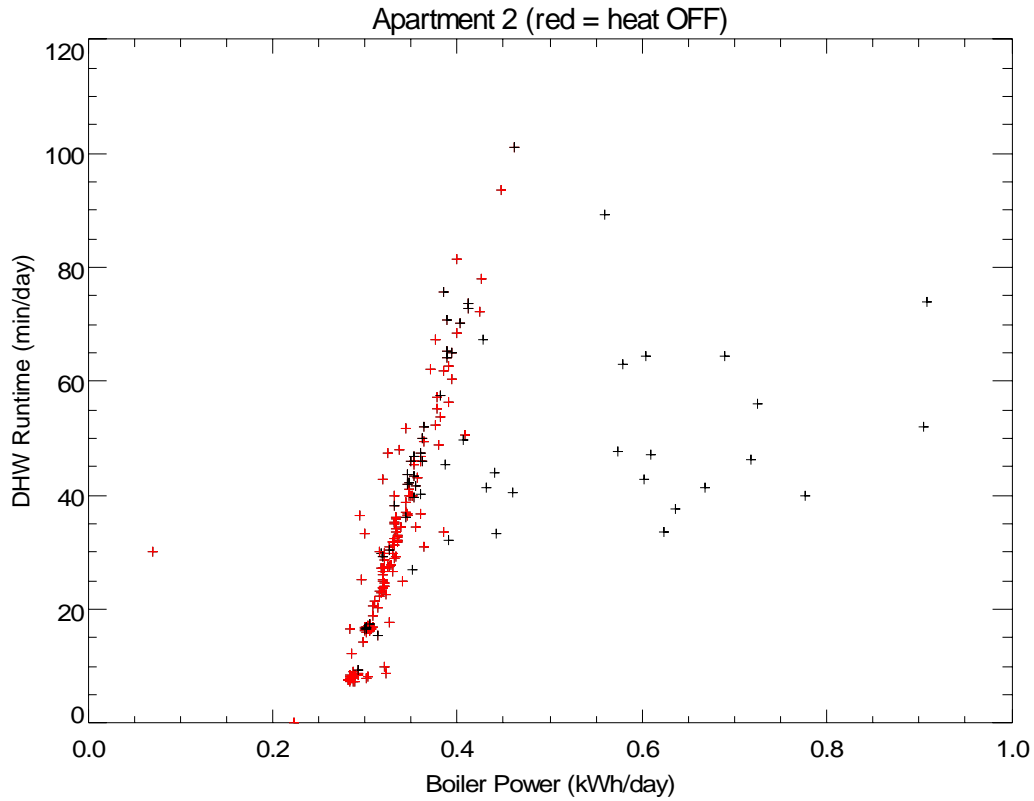


Figure 12. Comparing Daily DHW Pump Runtime to Boiler Power (red with space heat off)

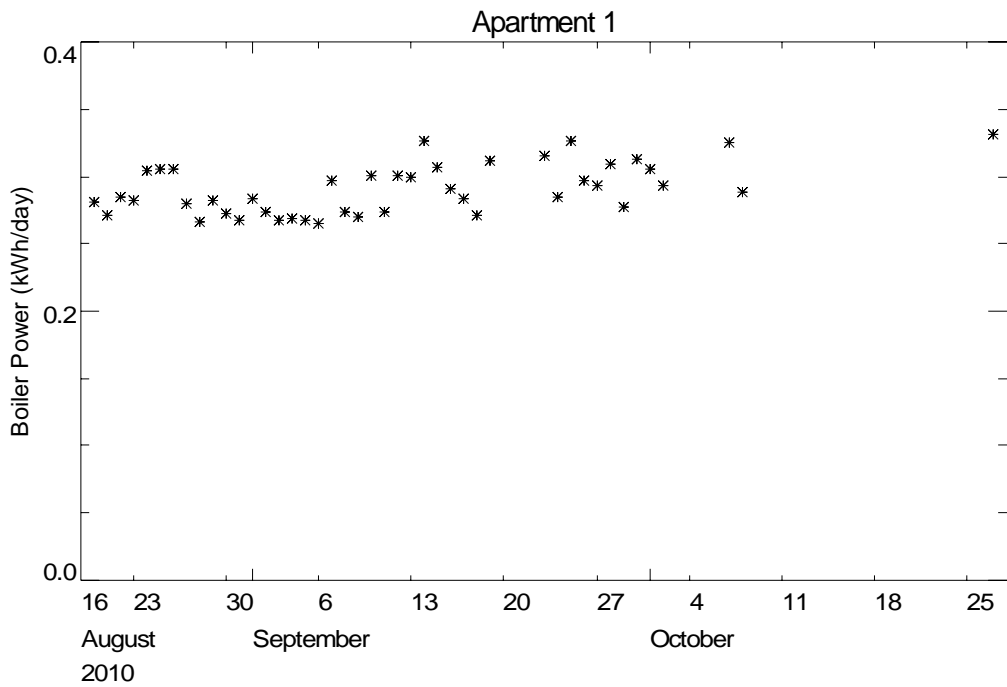


Figure 13. Daily Boiler Power for Apartment 1 (when space heating was off)