Using Post Occupancy Energy Monitoring to Resolve Issues

For

Lake|Flato Architects

January 2023

Overview

- Engineered Projects Consulting
- Post Occupancy Energy Monitoring
- Site Sage
- Lake|Flato Projects
- Lessons Learned
- Q&A

Engineered Projects Consulting

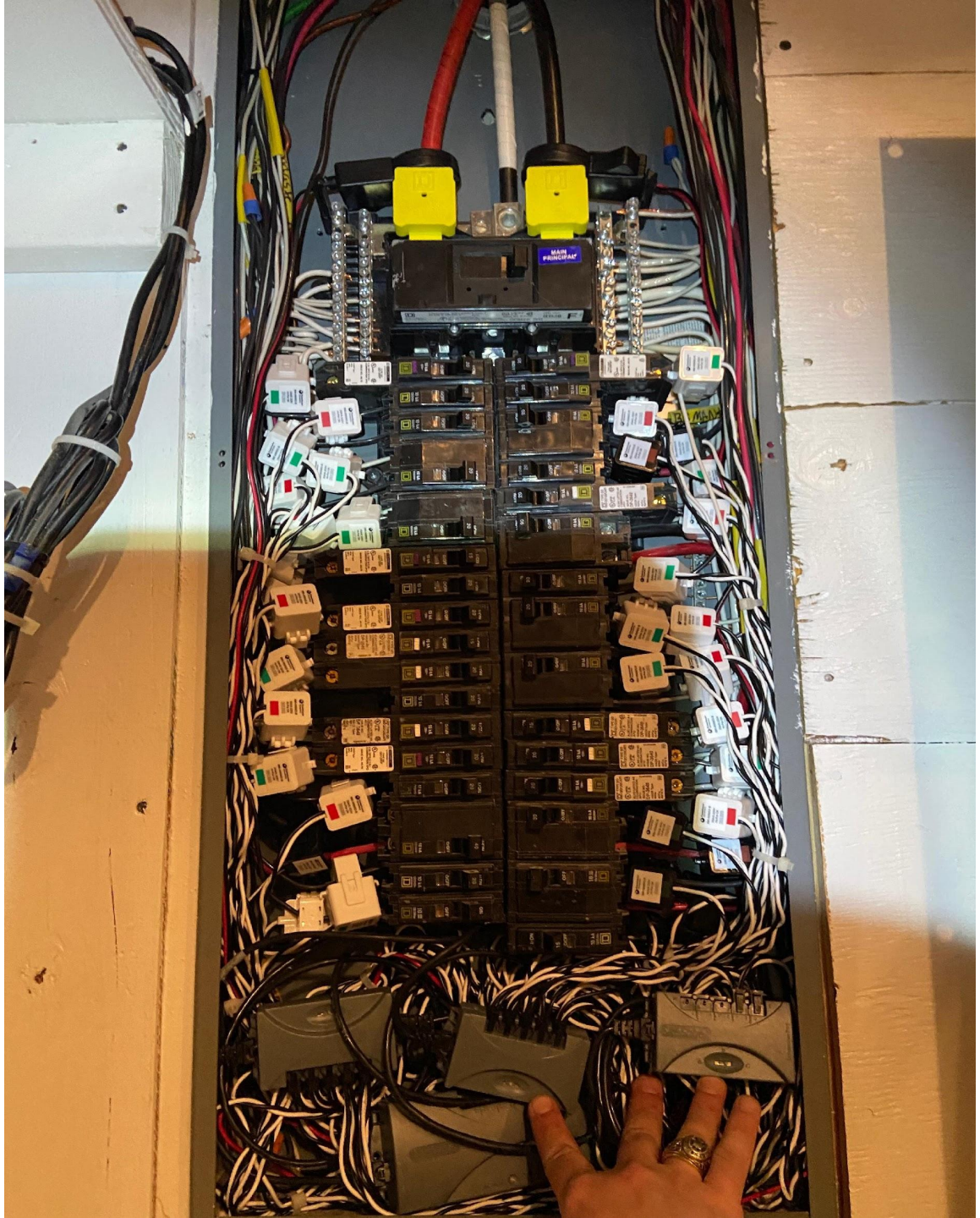
- Providing Consulting and Post Occupancy Commissioning services to Lake|Flato Architects
- Eight projects over the last two years
- Applying Building Science

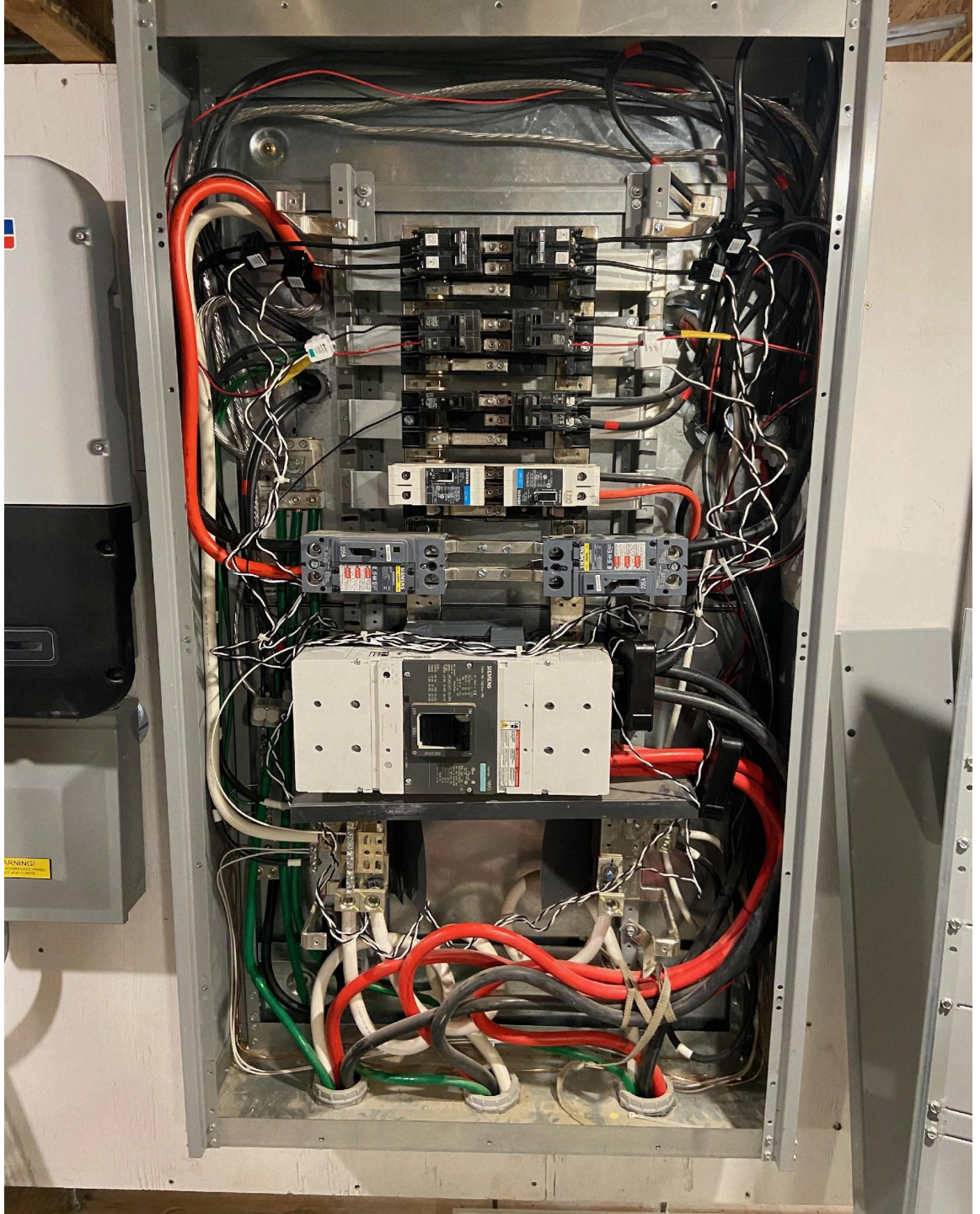
Post Occupancy Energy Monitoring

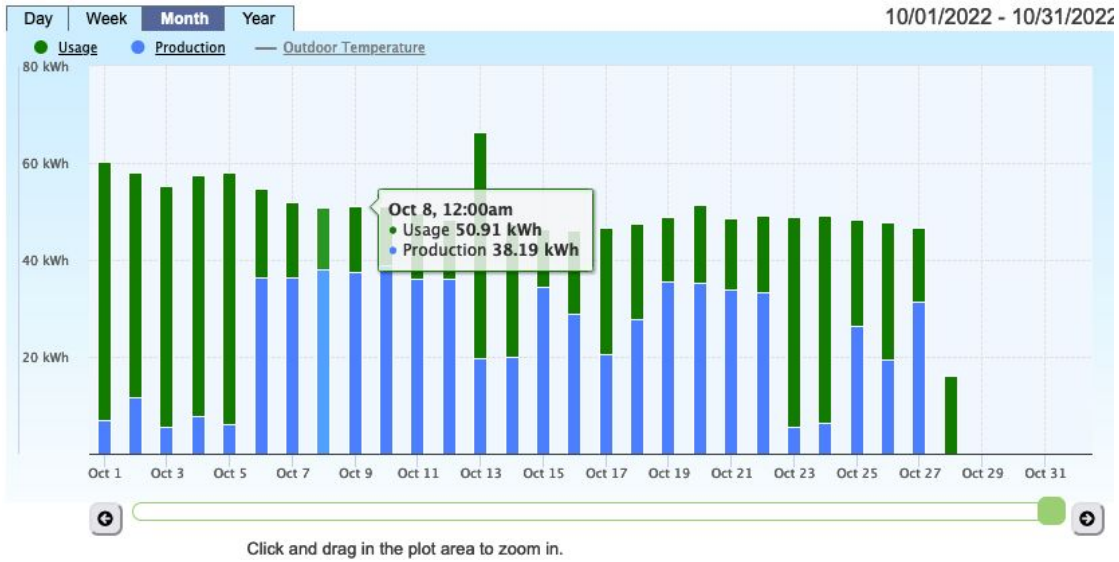
- Using energy use data to determine if the building is performing as expected
- Very useful for Net Zero projects
- Check actual use vs model predicted use

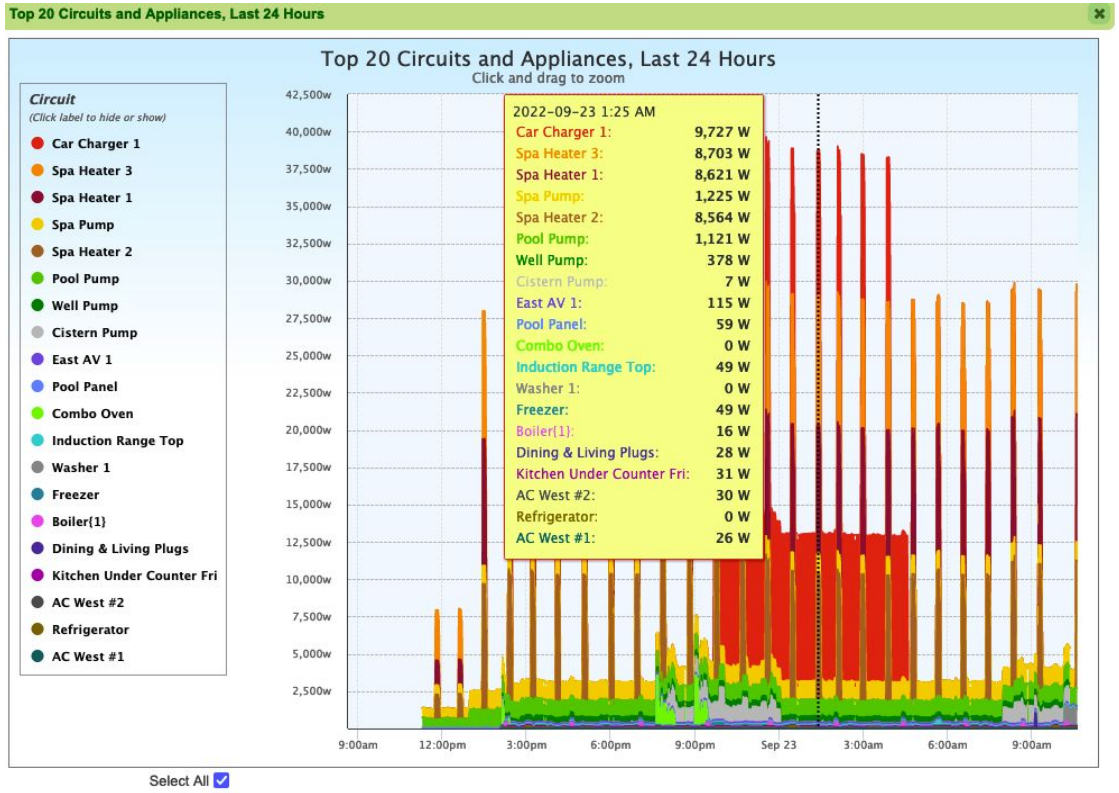
Site Sage

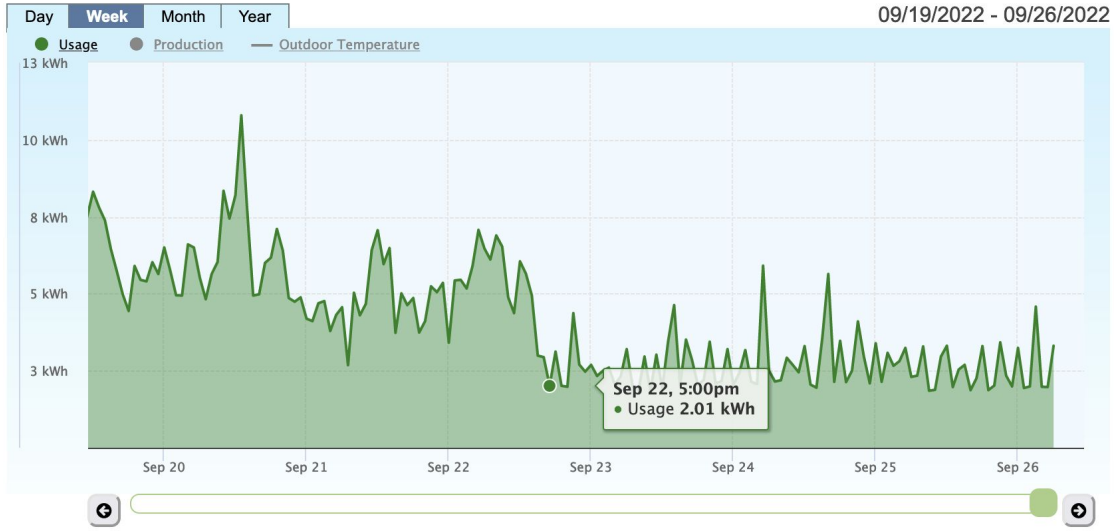
- Monitor energy use on a circuit level
- Sends data in real time to web based interface
- Provides multiple ways to see and evaluate energy use data
- Client accessible
- Shows solar production vs consumption

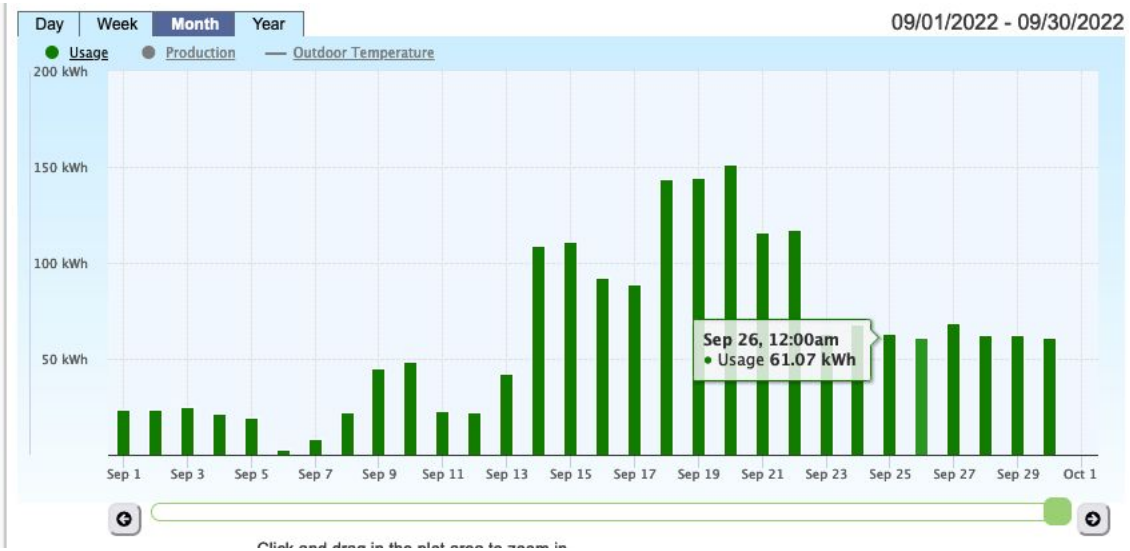

MAIN
PRINCIPAL

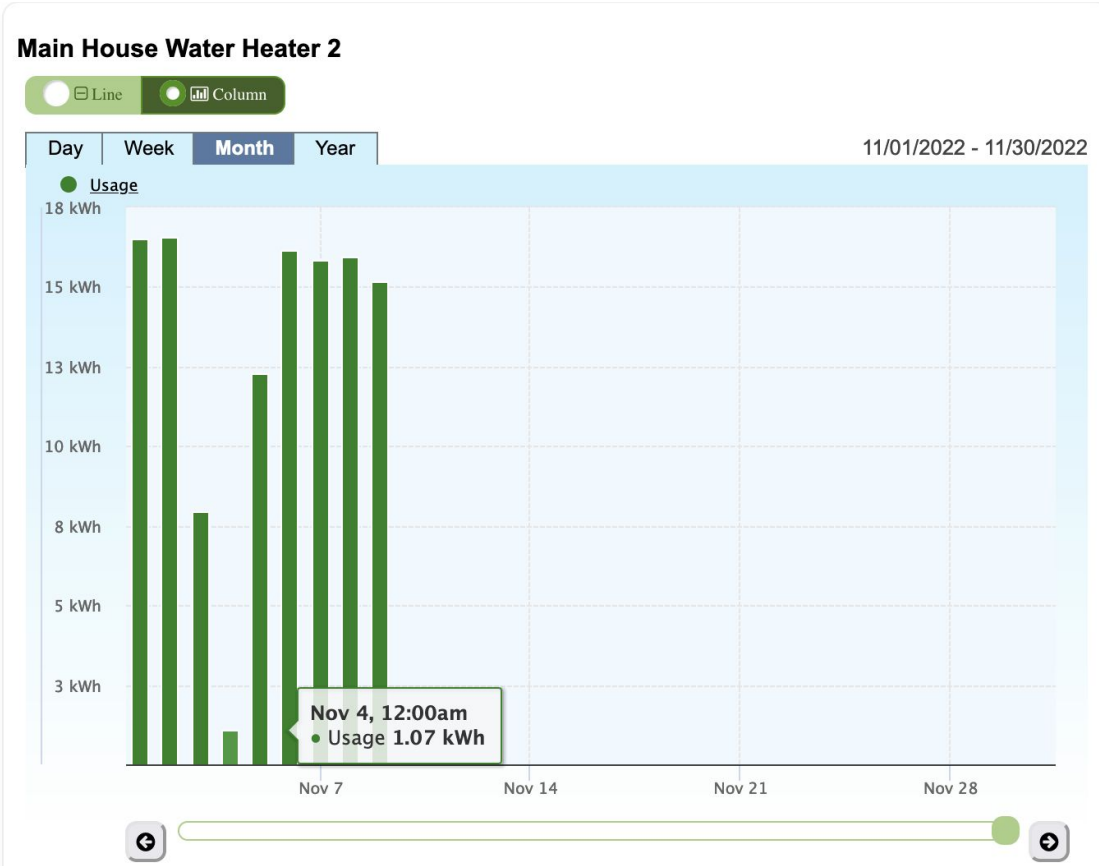

SIEMENS


Day
Week
Month
Year
10/01/2022 - 10/31/2022
Usage
Production
Outdoor Temperature
80 kWh
60 kWh
40 kWh
20 kWh
Oct 8, 12:00am
Usage 50.91 kWh
Production 38.19 kWh
Oct 1
Oct 3
Oct 5
Oct 7
Oct 9
Oct 11
Oct 13
Oct 15
Oct 17
Oct 19
Oct 21
Oct 23
Oct 25
Oct 27
Oct 29
Oct 31
Click and drag in the plot area to zoom in.


Top 20 Circuits and Appliances, Last 24 Hours
Top 20 Circuits and Appliances, Last 24 Hours
Click and drag to zoom
Circuit
(Click label to hide or show)
Car Charger 1
Spa Heater 3
Spa Heater 1
Spa Pump
Spa Heater 2
Pool Pump
Well Pump
Cistern Pump
East AV 1
Pool Panel
Combo Oven
Induction Range Top
Washer 1
Freezer
Boiler{1}
Dining & Living Plugs
Kitchen Under Counter Fri
AC West #2
Refrigerator
AC West #1
42,500w
40,000w
37,500w
35,000w
32,500w
30,000w
27,500w
25,000w
22,500w
20,000w
17,500w
15,000w
12,500w
10,000w
7,500w
5,000w
2,500w
2022-09-23 1:25 AM
Car Charger 1: 9,727 W
Spa Heater 3: 8,703 W
Spa Heater 1: 8,621 W
Spa Pump: 1,225 W
Spa Heater 2: 8,564 W
Pool Pump: 1,121 W
Well Pump: 378 W
Cistern Pump: 7 W
East AV 1: 115 W
Pool Panel: 59 W
Combo Oven: 0 W
Induction Range Top: 49 W
Washer 1: 0 W
Freezer: 49 W
Boiler{1}: 16 W
Dining & Living Plugs: 28 W
Kitchen Under Counter Fri: 31 W
AC West #2: 30 W
Refrigerator: 0 W
AC West #1: 26 W
9:00am
12:00pm
3:00pm
6:00pm
9:00pm
Sep 23
3:00am
6:00am
9:00am
Select All


Day
Week
Month
Year
09/19/2022 - 09/26/2022
Usage
Production
Outdoor Temperature
13 kWh
10 kWh
8 kWh
5 kWh
3 kWh
Sep 22, 5:00pm
Usage 2.01 kWh
Sep 20
Sep 21
Sep 22
Sep 23
Sep 24
Sep 25
Sep 26


Day
Week
Month
Year
09/01/2022 - 09/30/2022
Usage
Production
Outdoor Temperature
200 kWh
150 kWh
100 kWh
50 kWh
Sep 26, 12:00am
Usage 61.07 kWh
Sep 1
Sep 3
Sep 5
Sep 7
Sep 9
Sep 11
Sep 13
Sep 15
Sep 17
Sep 19
Sep 21
Sep 23
Sep 25
Sep 27
Sep 29
Oct 1


Main House Water Heater 2
Line
Column
Day
Week
Month
Year
11/01/2022 - 11/30/2022
Usage
18 kWh
15 kWh
13 kWh
10 kWh
8 kWh
5 kWh
3 kWh
Nov 4, 12:00am
Usage 1.07 kWh
Nov 7
Nov 14
Nov 21
Nov 28

Verde Creek Ranch

- 9 kW Solar System with Tesla Wall
- High electric bills. Multiple users on same meter
- Battery Back-up did not perform as expected during winter storm
- Domestic hot water recirculation pump
  - Reduced total energy consumption by 25%
- Original energy model did not reflect actual use

North Fork Residence

- 16 kW Solar System
- Hydronic heating/cooling with Messana
- High electric bills with low occupancy
- HVAC performance
- Ventilation/Dehumidification strategy was inefficient
- High energy use related to domestic hot water system

Front Range Retreat

- 34 kW Solar System
- Electric resistance heat for spa
- Pool and Car Charger were 75% of total use
- Solar system is producing enough to cover 76% of base load

Total Use	6488.678	$1,025
Solar Production	-1235.594	-$195
Pool Energy Use	4172.801	$659
Car Charger	688.065	$109

Lessons Learned

- Design review to prevent issues we have identified in post occupancy
  - Pebble Beach – simplify design and decouple forced air and radiant system
- Great tool for net zero projects
  - How is home actually going to be used vs model predicted use
  - Monitor actual production vs consumption in real time
  - Quickly identify energy waste
  - Conflicting client priorities
- Avoid unnecessary complications that lead to issues and client dissatisfaction
  - Counter intuitive systems
- Make sure HVAC design is appropriate for client use, climate, etc.
  - Installation and maintenance resources
  - Redundancy – good and bad
  - Over designed systems lead to issues and inefficiencies

Questions?

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