



HARC

Getting to Zero Forum, Oakland CA

The Road to Net Zero and Beyond

October 10, 2019

HARC Mission & Programs



HARC

Mission: To provide independent analysis on energy, air, and water issues to people seeking scientific answers and to operate as a research hub finding solutions for a sustainable future.

ENERGY



Accelerating clean, efficient and sustainable energy

AIR



Improving air quality through research

WATER



Protecting water resources and ecosystems

RESILIENCE



Providing science-based resilience solutions to communities

HARC's Headquarters

Certified **LEED Platinum** and **Energy Star 98/100**

- 18,601 SF office building
- 88.2 kW rooftop PV solar plant

Energy Star score of 98 → According to EPA, HARC's building is more efficient than 98 percent of comparable office buildings across the United States.

EPA's Energy Star scores in the Houston Area:

- 24 office buildings ≥ 95
- 14 office buildings ≥ 98
- 4 office buildings ≥ 99
- None of them certified Net Zero



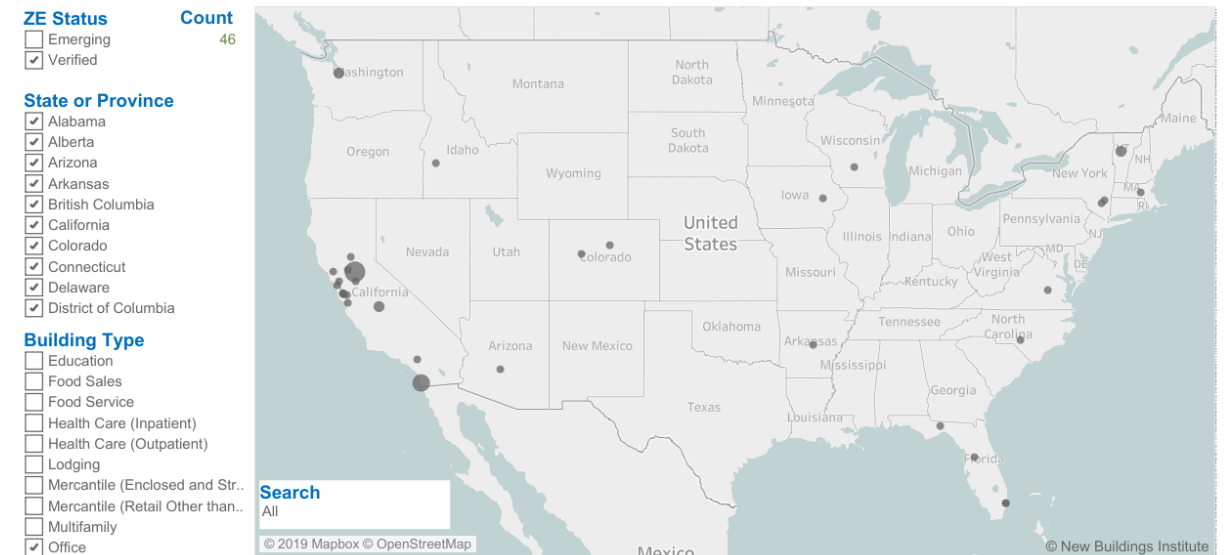
Net Zero Office Buildings

- 46 Verified Net Zero Office Buildings in the US according to NBI
- Aiming to be the 1st Net Zero office building in Texas
- HARC expecting to achieve that status in October 2019
- Certification process to be started in November 2019

NBI Getting to Zero Buildings Database

Use the filters on the left to filter projects in the map, and/or select a bubble on the map to filter the table below. Click on the **Analysis** tab above to see the big picture and create customized charts.

Reset Filters ↺



ZE Status	State or Province	Name	Certifications	City	Building Type	Size (sf)	Total Site EUI	Net Site EUI
Verified	AR	Entegity Headquarters	LEED, ILFI	Little Rock	Office	13,342	14	-1
Verified	AZ	DPR Construction Phoenix Net Zero Office	LEED, ILFI	Phoenix	Office	16,533	27	-3
Verified	CA	008 Energy Commission Building		Sacramento	Office	142,378	39	0
Verified	CA	010 Dept. of Rehabilitation		Sacramento	Office	163,350	49	0
Verified	CA	013 EDD Solar Building (incl. subterr.)		Sacramento	Office	272,546	38	0
Verified	CA	021 State Personnel Building		Sacramento	Office	84,400	47	0
Verified	CA	039 and 045 Office Building 8 and 9		Sacramento	Office	628,592	44	0
Verified	CA	049 Education Building		Sacramento	Office	562,582	41	0
Verified	CA	153 Cal Trans District Office 3		Marysville	Office	225,378	38	0
Verified	CA	330 California Towers (Riverside)		Riverside	Office	164,260	40	0

Building Envelope

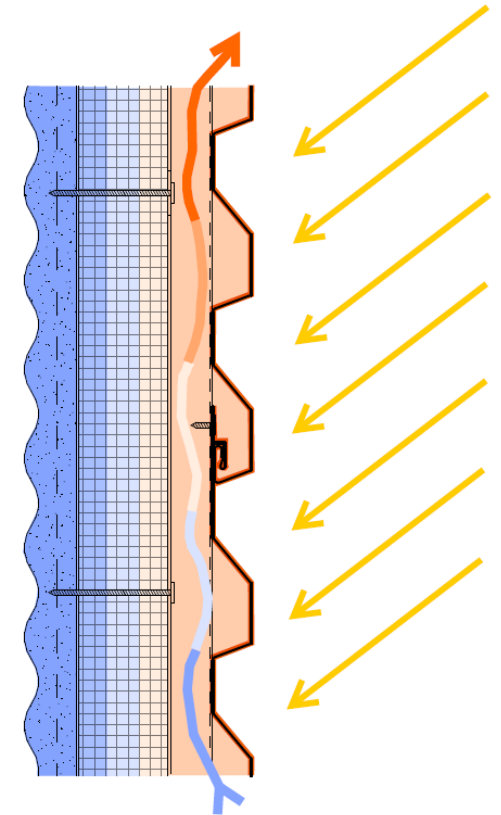
- **High performance building envelope**

- Uses Dow Thermax insulation system and thermal venting
- Heat from exterior metal panels transfers to air (rather than enclosure) and vents upwards
- Reduces amount of heat hitting the insulation
- Effectively brings enclosure to R50 value
- Cladding protects the slab from direct sunlight and eliminating the slab as an external heat sink



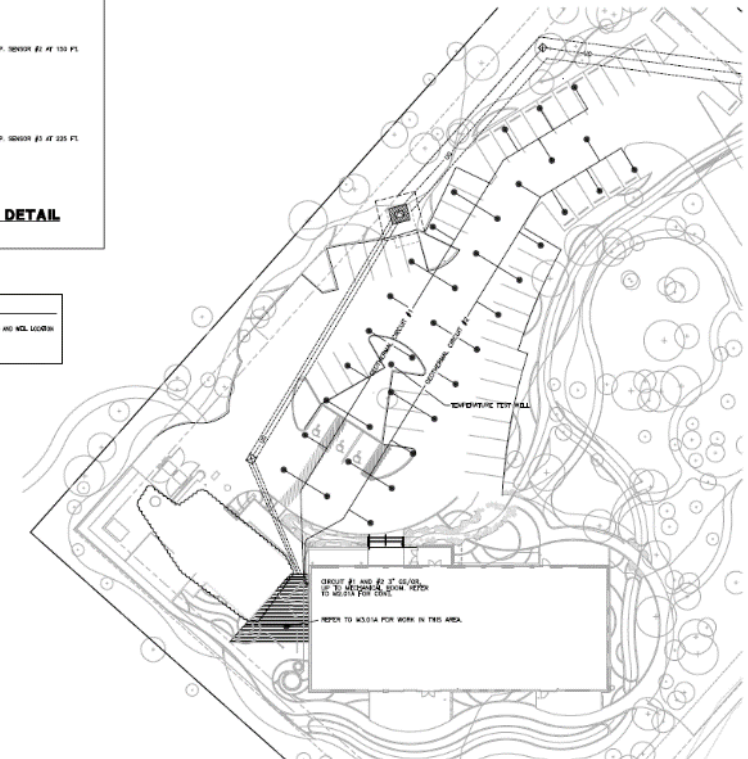
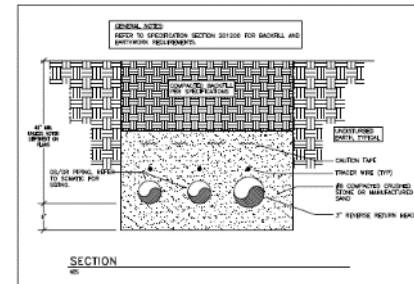
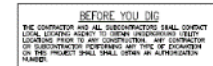
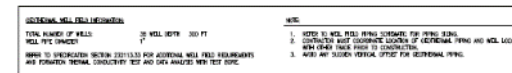
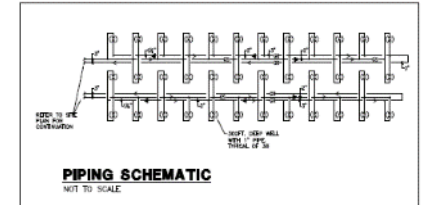
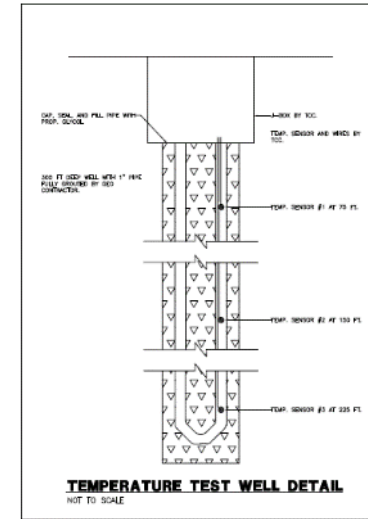
Dow
Thermax
Insulation

1" air gap &
metal panels



Geothermal Heat Exchange

- Closed loop geothermal heat exchange system
- 36 wells + 1 test well w/ sensors
- Wells 300' deep
- Constant temp ~70 degrees F
- 15 high efficiency heat pumps throughout building



Solar Array



- 252 solar panels
- 88 kW of power generation (DC)
- 5 DC to AC Inverters



HARC's Internal Dashboard

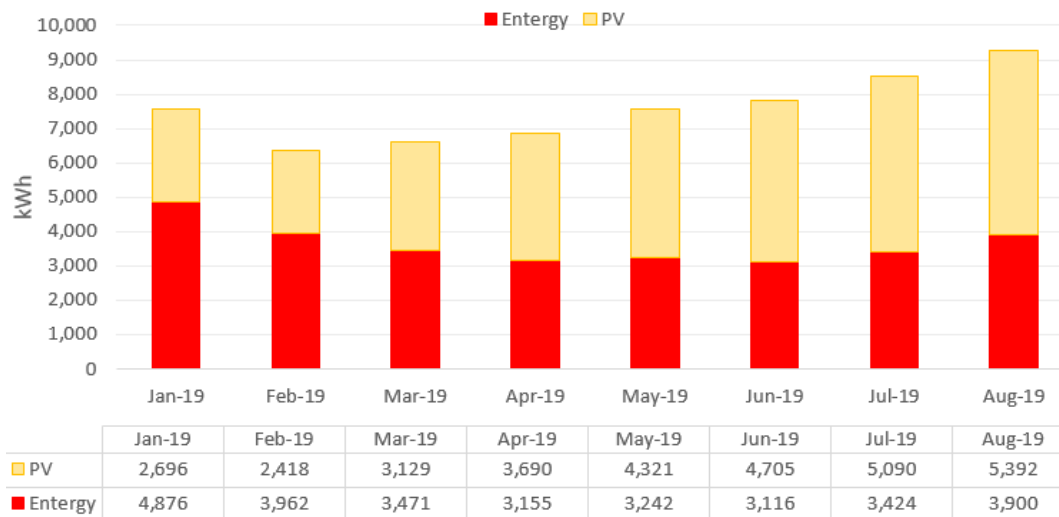


Energy Supply Analysis

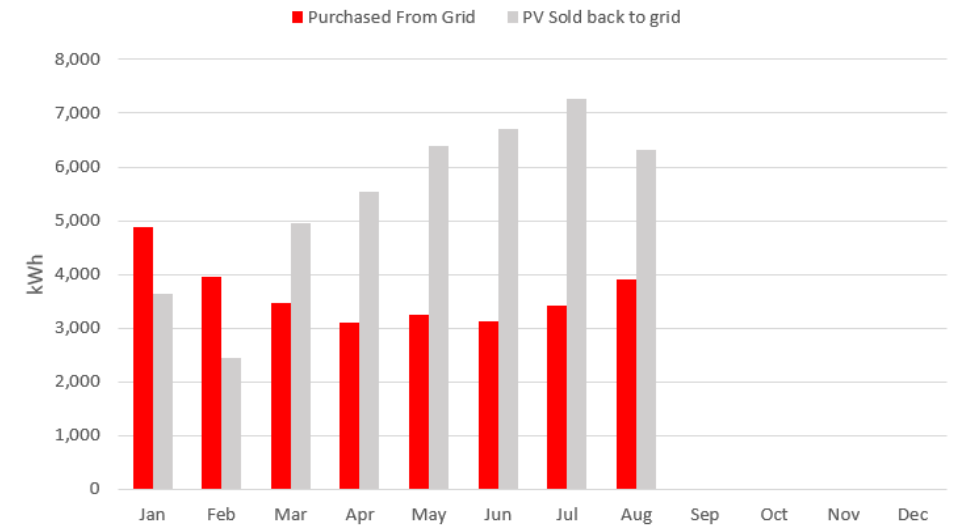
60,826 kWh consumed as of August 31st 2019:

- 31,735 kWh from our solar plant
- 29,091 kWh from Entergy (our local utility)
- 43,274 kWh of excess power sold back to Entergy

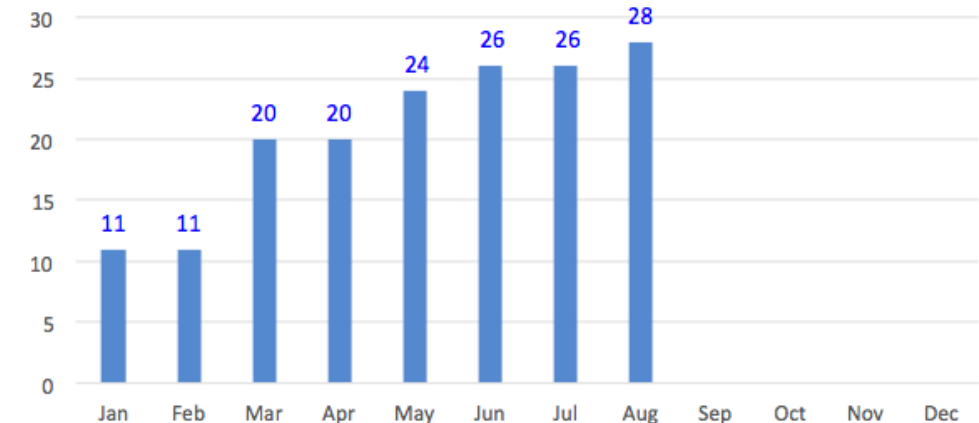
Building's Consumption per Source



Energy Exchanged with the Power Grid

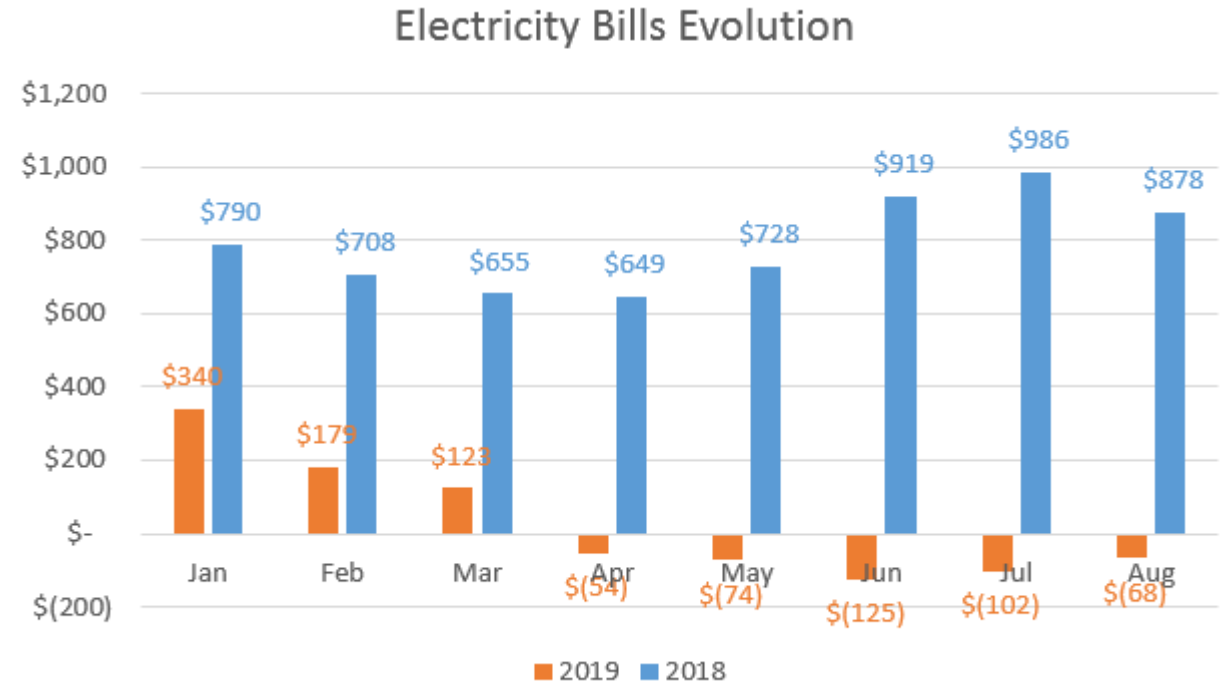


Net Zero Days per Month

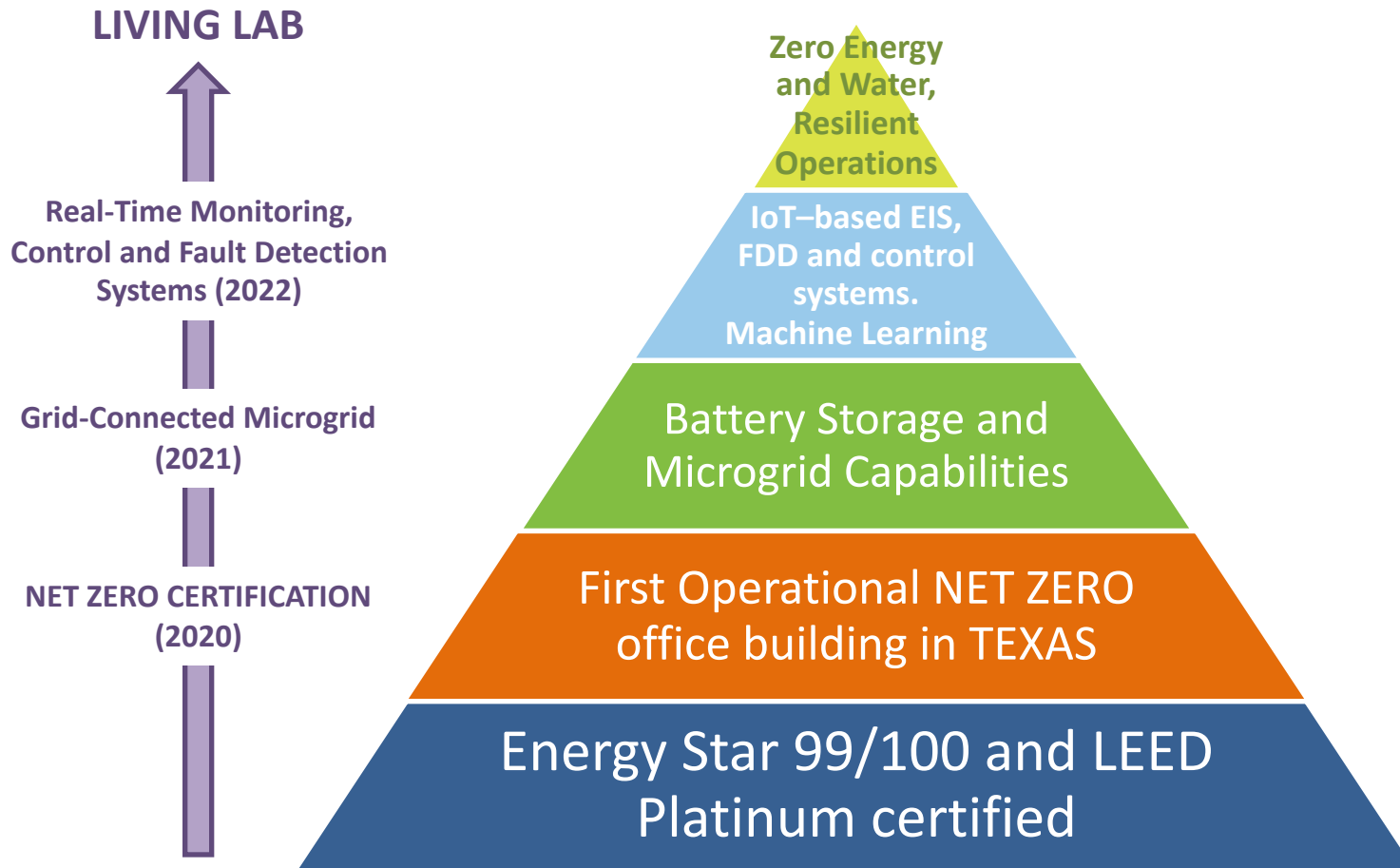


Energy Costs

- Energy Bills
 - \$9,747 in 2018
 - **\$287 in 2019 as of August 14th**
 - 91.25% lower costs than in the 1st half of 2018



Envisioning the Next Steps for Our Facility





Thank You!



RESEARCH. PEOPLE. NATURE
HARC

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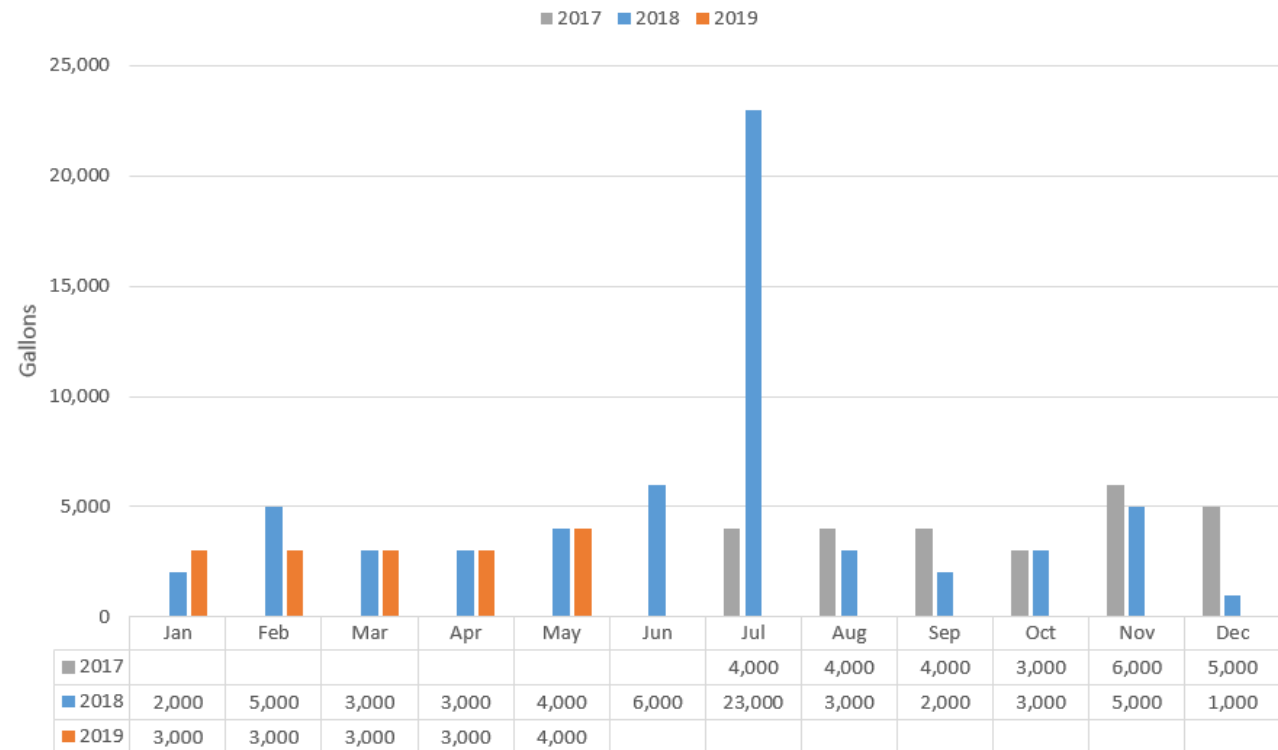
HARC

Additional Information

Water Consumption

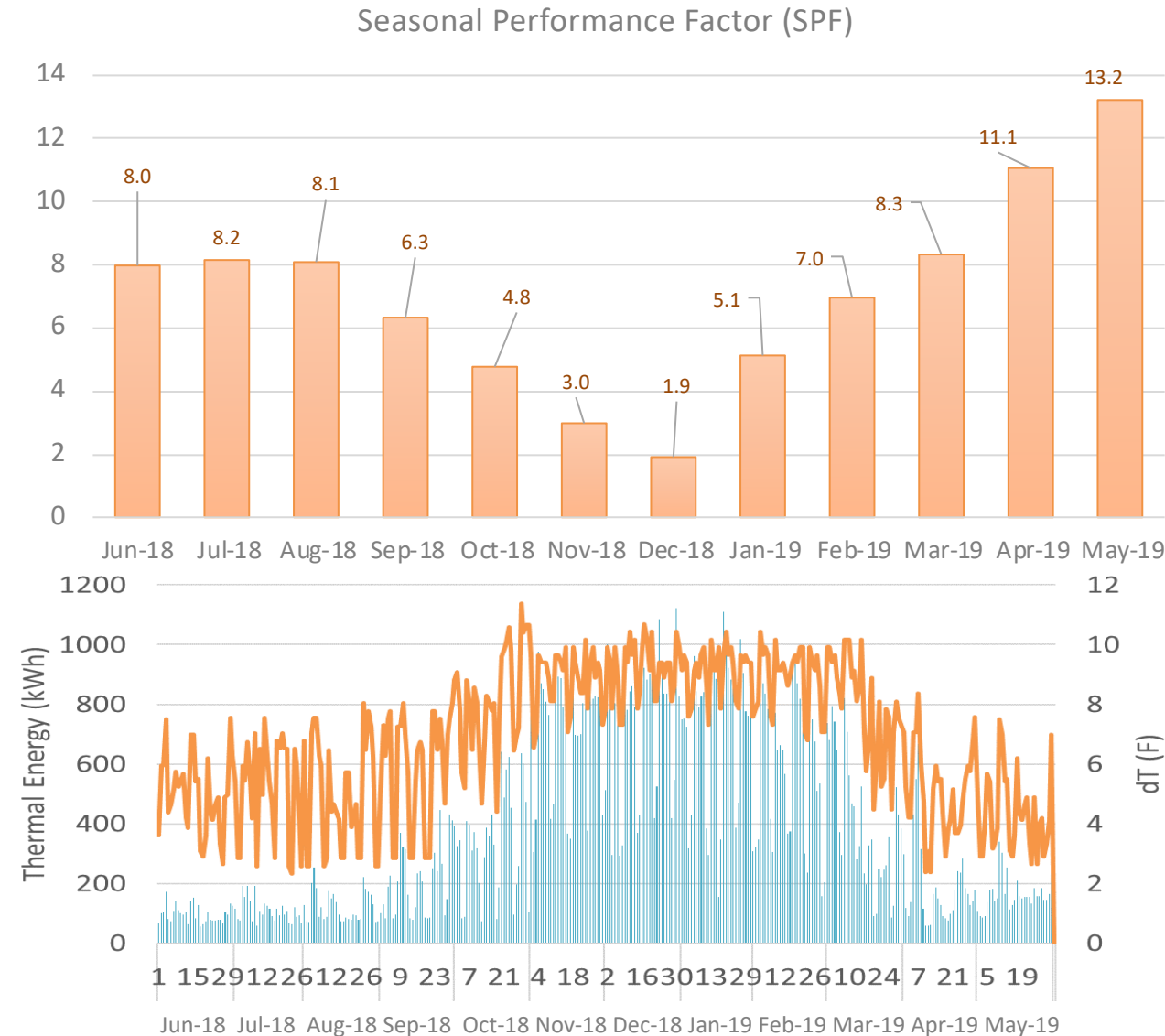
Water consumption

- 79% less water consumption than average office building in 2012
- Last 12 months: 59,000 gallons.
- 3.17 gallons per sf.
- Lack of detail in water bills data



Geothermal Heat Pump Performance

- Seasonal Performance Factor (SPF) from June 2018 to May 2019:
 - Maximum on 13.2
 - Average of 8.94
- Delta T values up to 11 F:
 - Low thermal saturation levels in the geothermal field



ECM1. PV Panels Cleaning



ECM 3. Occupancy-based HVAC Management Strategies

Occupancy-based Outside Air Management (Energy Recovery Unit, ERU)

- Occupancy before 8 AM ranges from 18 to 34% of the daily occupation
- Starting the ERU at 8 AM seems like an appropriate practice
- A deeper analysis based on Indoor Air Quality indicators is recommended to define when the ERU must be ON or OFF
- IAQ indicators such as humidity, temperature and VOCs will be considered

Average Staff Members IN per Hour and Month

