

Energy Assessment for Laguna Woods Village

UCI SMART IAC



**Industrial
Assessment
Center**
U.S. DEPARTMENT OF ENERGY

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Sustainable Manufacturing Alliance for Research and Training
Industrial Assessment Center



UCI SMART IAC Energy Assessments

- Tour facility, brainstorm ideas, collect data ☐ develop report
- Energy efficiency, waste reduction, and productivity enhancements
- Energy efficiency techniques: lighting, air compressors, motors, furnaces, ovens, boilers, HVAC, chillers, water treatment systems, renewables, and much more!

UCI SMART IAC Energy Assessment

Executive Summary

Report Number: CI0008

Assessment Date: February 13, 2023

S.I.C. Code: 8322

Annual Sales: N/A

Number of Recommendations: 7

Location: Laguna Woods, CA 92637

N.A.I.C.S. Code : 624120

Annual Production: N/A

Building Type: Community Center

Location	Operating Hours, hr	Plant Area, ft ²
Clubhouse 1	5,096	32,800
Clubhouse 3	2,080	17,400
Clubhouse 5	5,096	12,752
Clubhouse 7	5,096	26,407

Executive Summary

Report Number: CI00012

Assessment Date: March 16, 2023

S.I.C. Code: 8322

Annual Sales: \$100,000

Number of Recommendations: 8

Location: Laguna Woods, CA 92637

N.A.I.C.S. Code: 624120

Annual Production: N/A

Building Type: Community Center

Location	Operating Hours, hr	Plant Area, ft ²
Clubhouse 2	5,096	19,110
Clubhouse 4	2,834	8,590
Clubhouse 6	1,248	6,038
Community Center	3,900	32,292

Recommendations

All Clubhouses

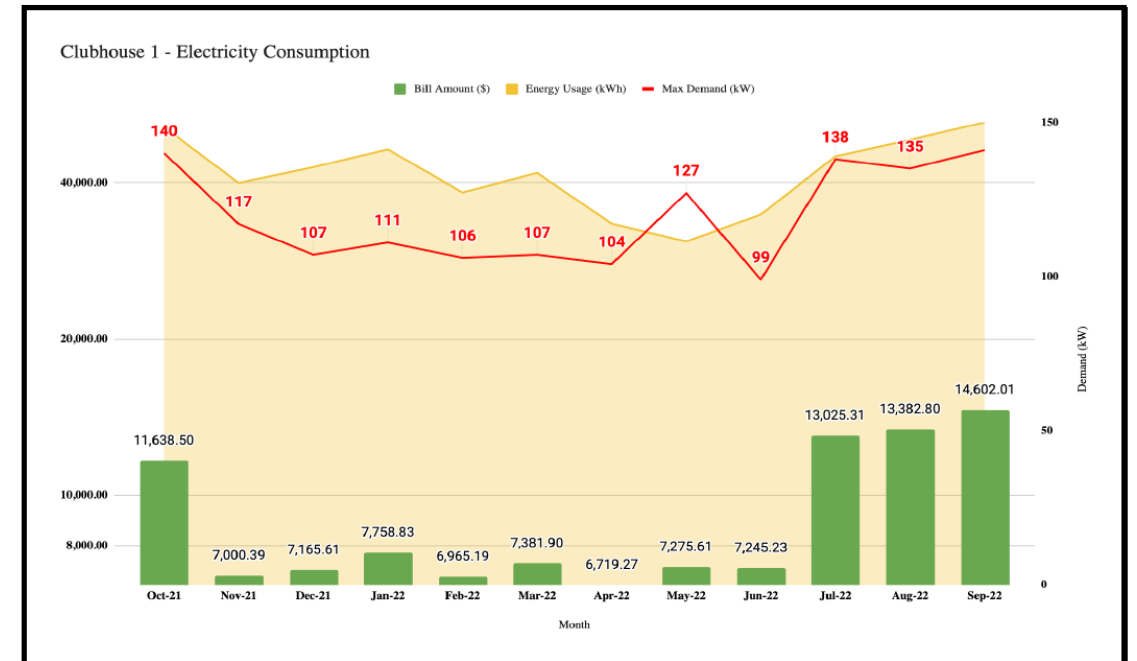
Summary of Assessment Recommendations

Assessment Recommendations		Energy Savings	TOTAL Cost Savings	Project Cost	Simple Payback
1	Replaced Current Lights with LEDs	613,946 kWh	\$151,993	\$140,699	0.93
2	Addition of Solar Energy Panels	463,639 kWh	\$114,566	\$701,185	6.12
3	Install VSD on Existing HVAC Equipment	258,626 kWh	\$64,346	\$55,450	0.86
4	Upgrading Existing HVAC Equipment	319,597 kWh	\$62,442	\$116,877	1.87
5	Install Occupancy Sensors	182,723 kWh	\$45,330	\$19,000	0.42
6	Installation and Maintenance of CO2 Sensors	130,140 kWh	\$32,167	\$16,000	0.50
7	Turn Off Pilot Lights	39,594 kWh	\$9,977	\$1,040	0.10
8	Replace Gas Water Heaters with Heat Pump Water Heaters	22,279 kWh	\$5,614	\$8,200	1.46
9	Install High Efficiency Pumps	4,629 kWh	\$1,166	\$2,400	2.06
10	Install Triple Glazed Windows	33,432 kWh	\$8,144	\$15,610	1.92
Total		2,068,605 kWh/yr	\$495,745/yr	\$1,076,461	2.17 years

Example Utility Analysis

[Clubhouse 1]

Month	Energy Usage	Max Demand	Bill Amount
	kWh	kW	\$
Oct-21	51,225	140	11,638.50
Nov-21	39,948	117	7,000.39
Dec-21	42,871	107	7,165.61
Jan-22	46,396	111	7,758.83
Feb-22	38,309	106	6,965.19
Mar-22	41,786	107	7,381.90
Apr-22	33,365	104	6,719.27
May-22	30,829	127	7,275.61
Jun-22	34,733	99	7,245.23
Jul-22	44,994	138	13,025.31
Aug-22	48,392	135	13,382.80
Sep-22	52,319	141	14,602.01



Utility Analysis

Energy Summary of Clubhouse 1,3,5,7			
Energy			
Month		kWh	Total\$
Oct-21	10	125314	30656.25
Nov-21	11	98597	20394.75
Dec-21	12	109050	20200.84
Jan-22	1	98442	18449.99
Feb-22	2	96489	18758.11
Mar-22	3	107284	20600.20
Apr-22	4	98221	21290.11
May-22	5	97129	22358.73
Jun-22	6	105753	23190.19
Jul-22	7	125931	40619.43
Aug-22	8	125770	39581.13
Sep-22	9	140560	47540.43
Total		1328540	323640.16

Effective Energy Cost (\$/kWh)

0.24361

Energy Summary of Clubhouse 2,4,6,CC			
Energy			
Month		kWh	Total\$
Oct-21	10	130945	32257.51
Nov-21	11	108443	22005.74
Dec-21	12	121358	22005.74
Jan-22	1	107823	19607.61
Feb-22	2	102151	20851.13
Mar-22	3	112233	23837.69
Apr-22	4	111965	26404.12
May-22	5	115765	27402.83
Jun-22	6	122042	30640.43
Jul-22	7	139570	46426.04
Aug-22	8	140299	47086.47
Sep-22	9	155860	49785.59
Total		1468454	370037.63

Effective Energy Cost (\$/kWh)

0.251991

Utility Analysis

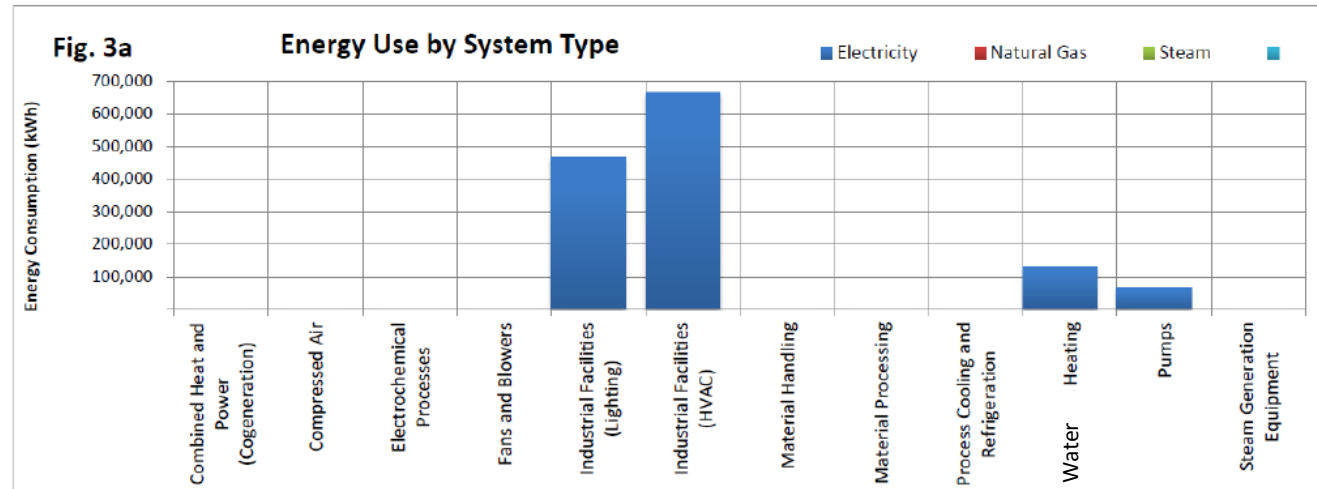
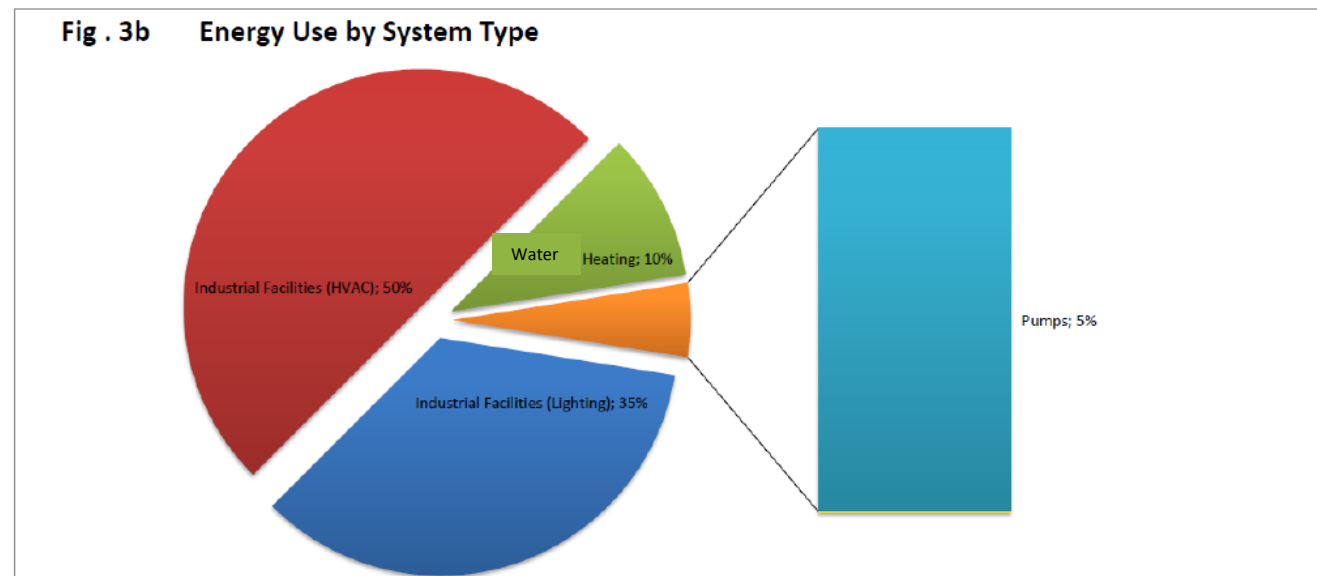
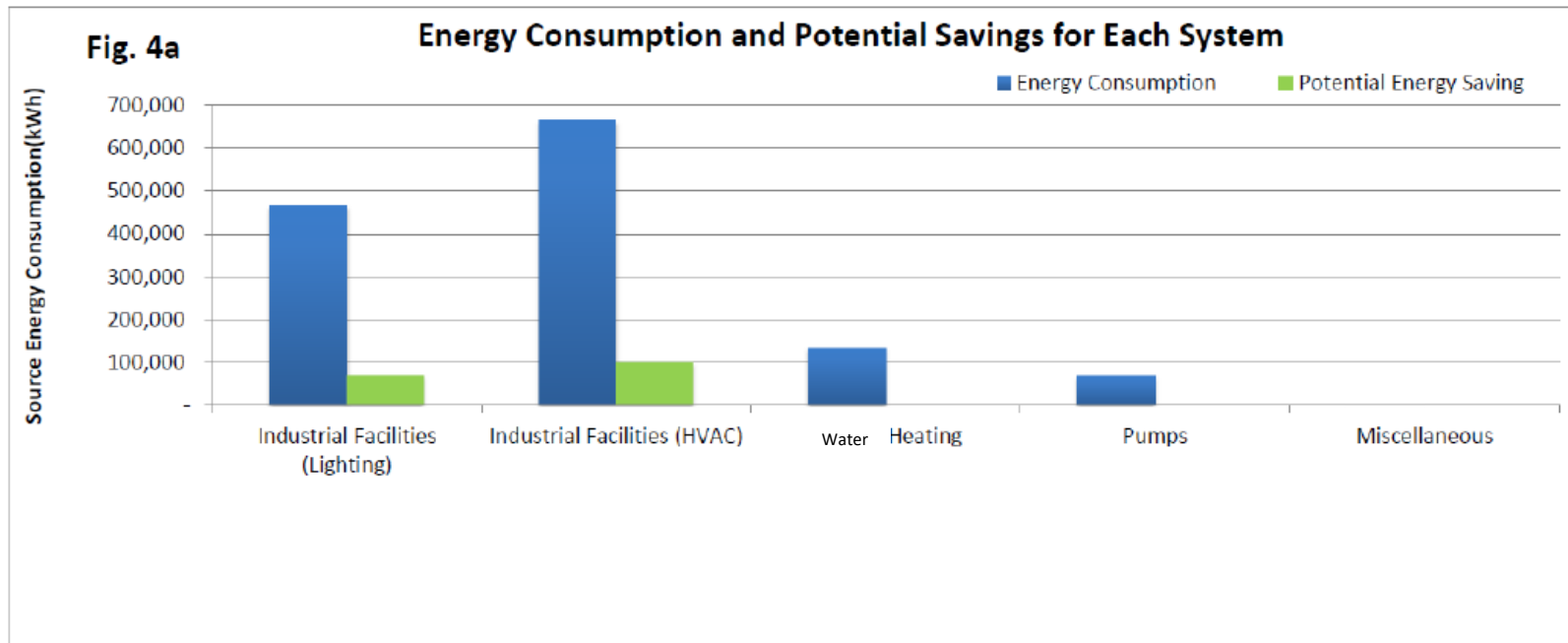


Fig 3b. shows the percentage energy consumption per system.



Utility Analysis

System Name	Site Energy Consumption (kWh)	Cost per System(\$)	% Energy Consumption by system	Potential Energy Savings by System (%)	Potential Site Energy Savings(kWh)	Potential Cost Saving(\$)
Industrial Facilities (Lighting)	464,989	\$113,274	35.0%	15%	69,748	\$16,991
Industrial Facilities (HVAC)	664,270	\$161,820	50.0%	15%	99,641	\$24,273
Water Heating	132,854	\$32,364	10.0%	#N/A	#N/A	#N/A
Pumps	66,427	\$16,182	5.0%	-	-	
Miscellaneous	-					
Total	1,328,540	\$323,640	100%		#N/A	#N/A



Best Practices

- Outside lighting upgraded to LEDs
- Training in energy efficiency for staff
- Electric golf carts and cars
- White ceiling
 - Outside lighting on timers
 - High efficiency motors

Recommendation – Upgrade Lighting to LEDs

- Upgrade existing T8 fluorescent, incandescent, and halogen lamps to LED lamps
- Benefits: lower energy usage, longer bulb lifetime, less frequent bulb purchases, less labor to change bulbs, less waste

	Type	Rate/ Demand Watt	Output Brightness Lumen	Lifetime Hr
	T8 Fluorescent	32	2,675	31,000
Current Light	Incandescent	53	890	985.5
	Halogen	80	1,600	1,095
	LED 1	18.5	2,600	50,000
Proposed Light	LED 2	40	8,000	50,000
	LED 3	25	1,800	50,000

Recommendation – Solar

- Use solar to offset some of your electrical energy usage
- Example: Clubhouse 5

Proposed System

The addition of solar energy cells has the following characteristics:

- Number of cells to be utilized **95 units**, energy output of each unit **33 kW/hr**.
- Estimated to run **1,906 hours** per year.
- Connections to the facility.
- Structure and foundation mountings.

The estimated energy output is determined from x panels at 345 Watts each, with an estimated overall system efficiency of 70%. This is a conservative estimation.

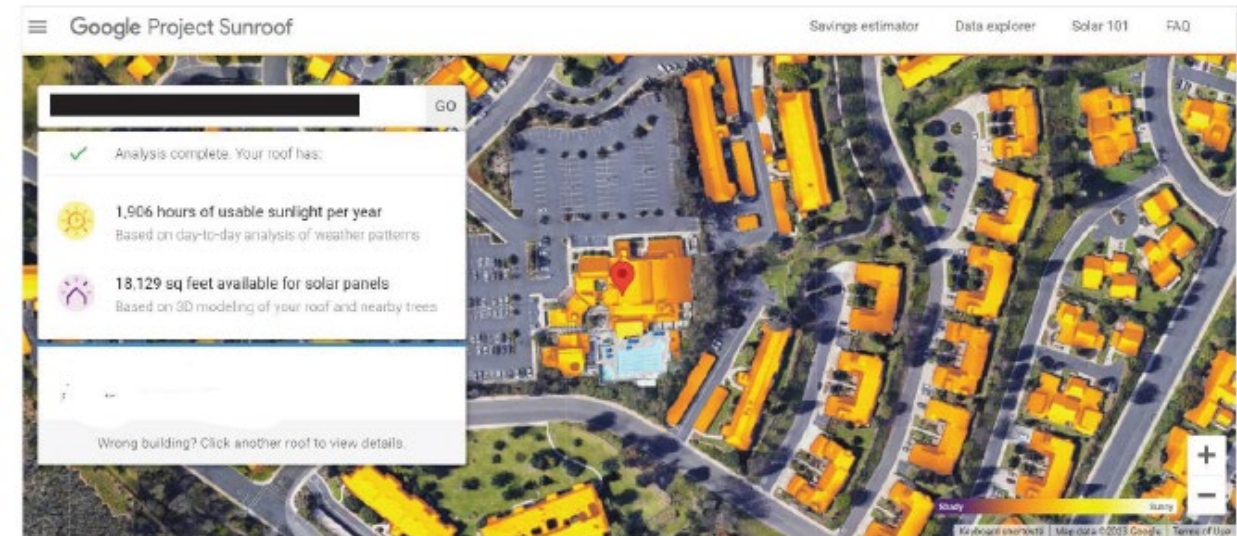


Figure 1. Google Project Sunroof, there are 1,906 hours of usable sun.

As indicated by Figure 1, according to Google Project Sunroof, there are 1,906 hours of usable sun light per year for this specific location. This facility operates 7 days per week.

Recommendation – Solar

- Example: Clubhouse 5

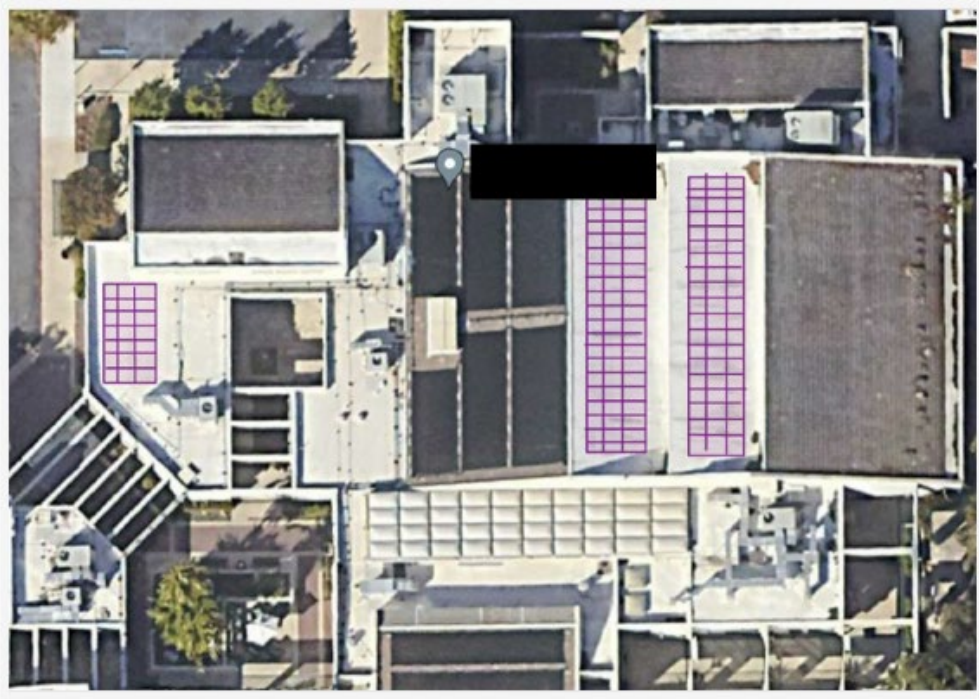


Figure 2. Proposed system design mounted in the roof

ARC: 2.9114	Estimated Annual Savings			Simple Payback
	Electric Energy Savings	Total Cost Savings	Estimated Implementation Cost	
Total	44,029 kWh/yr (150.6 MMBtu/yr)	\$10,726 /yr	\$58,817	5.48 years

Recommendation – HVAC Upgrades

- Installing variable speed drive to existing HVAC equipment
 - Installing VSDs on air handling units and air-cooling condensing units
 - Annual energy consumption savings of up to 30%
- Upgrade existing units to high-efficiency units – rooftop units
 - New units are variable speed compatible, have a higher SEER rating, and have communication technology to connect to other pieces of equipment



Recommendation – Occupancy Sensors

- Lighting can be eliminated during unoccupied periods by installing occupancy sensors into the lighting circuits
- This is especially useful for areas such as the bathrooms, lounge, gym, offices, dining rooms, kitchens, music room, billiard room, classrooms, and other activity rooms where people come and go
- Energy savings will result from reduced electrical usage for lighting
- Lights will automatically go on and off depending on occupancy, so no user interaction is needed



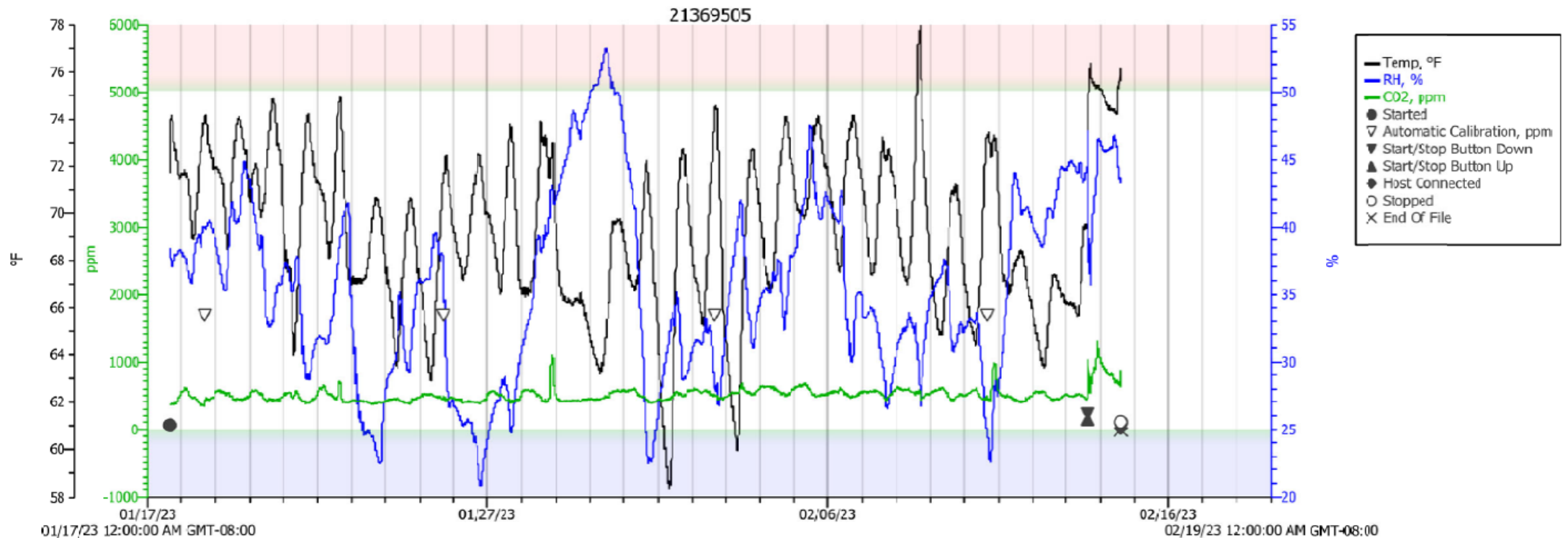
Recommendation – CO2 Sensors



- Install and maintain CO2 sensors that control the outside air dampers on the HVAC units
- If CO2 sensors are installed, the energy code allows for diversity of patrons in spaces
- By installing CO2 sensors, the outside air load can be reduced during hours when patron traffic is at a minimum, leading to energy savings

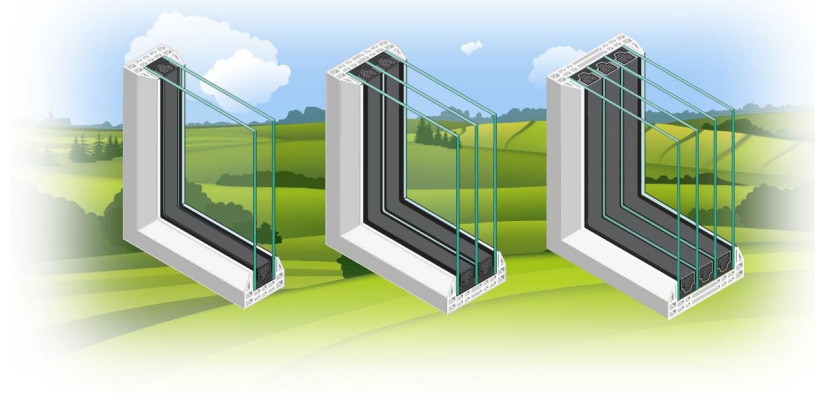
Recommendation – CO2 Sensors

- Datalogger: Clubhouse 3
- Measured temperature, relative humidity, CO2 levels
- Green line = CO2 levels – pretty consistently below 800 ppm



Recommendation – Triple Glazed Windows

- Replace all windows with high-efficiency, triple glazed windows
- Energy efficiency windows are an important consideration in heating and cooling costs
- Using more efficient windows can reduce heat gain and heat loss through windows, therefore less heating and cooling energy is needed
- Estimated that 25-30% of heating and cooling costs can be reduced
- Implementation cost (materials and installation) can get expensive



Recommendation – Turn Off Pilot Lights

- It is recommended to shut off the pilot lights for stoves in kitchens during times when they are not in use
- Currently, the pilot lights remain lit year round, while the stoves are only used for approximately 8 hours per week, or a total of 416 hours per year.
- Training employees on safely turning the pilot lights on and off will be important



Recommendation – Heat Pump Water Heater

- It is recommended to replace current water heaters with heat pump water heaters
- The operating cost and energy use can be estimated to be cut by 67% by replacing with a heat pump water heater due to increased efficiency
- Modern heat pump water heaters can be programmed to heat water during off-peak night hours, that would provide additional savings using off-peak rates



Recommendation – High Efficiency Pump Motors



- Many pools ☐ many pool pump motors
- Installing high efficiency pump motors will save energy consumption
- These motors can be replaced only as existing motors wear out (i.e. only on a replacement basis) to help spread out implementation cost

Additional Ideas

- Using active cooling for solar systems
 - Water is pumped over the solar cells to increase the efficiency of the system
- Replace natural gas boilers with electric boilers
 - Reduce greenhouse gas emissions and lower carbon footprint
 - Electric boilers are between 95-100% efficient, while natural gas are only around 80% efficient
- HVAC maintenance
 - Schedule maintenance for all air conditioning units in the spring (prior to the hottest season) and maintenance for heat pumps in the fall (prior to the coldest season)
 - This type of maintenance helps to maintain your HVAC equipment's performance and ensure the longevity of your units

Additional Ideas

- Smart building energy management scheduling and control system that ties in both HVAC and lighting systems
- Photosensors in gym/dining rooms and other areas with great natural light
- Replace diesel generator with fuel cell or natural gas/hydrogen blend
- Carports with solar and EV charging
- Automatic switches to turn off gym equipment when not in use
- Door sensors

Cybersecurity

- The IAC Cybersecurity Assessment Tool includes 20 simple questions to help identify risks and provides action items to help make your facility more secure
- Example of the screening tool:

Industrial Control Systems Cybersecurity Assessment Tool				
People				
1	Does your plant or facility provide basic cybersecurity awareness training to all employees?	Regular training of employees in proper conduct on company equipment can help prevent accidental downloads of viruses and other system vulnerabilities.	Medium Risk	
	Yes			
2	Are staff assigned and trained to take appropriate measures during a cybersecurity incident?	If a cybersecurity event were to occur, there could be issues with a safe and damage-free shutdown. Additionally, if roles are not properly articulated and no one knows who to contact regarding potential fixes for the system, the shutdown could be prolonged.		
	No			
Process				
7	Have you identified and inventoried critical equipment, data, or software in your plant or facility that would cause disruption to your operations if they were compromised?	Maintaining a list of your critical equipment, data, or software can help you prioritize actions during emergency shutdowns and other unplanned activities.		High Risk
	No			
8	Does a plan exist to identify and isolate impacted assets, or shut down equipment as necessary in the event of a cybersecurity incident?	Without a plan to review IT and ICS assets, external consultants or IT staff may have difficulty working and may prolong the plant outage. Additionally, without an emergency shutdown plan, equipment could be accidentally damaged or destroyed.		
	No			
Technology				
14	Which of the following best describes the industrial controls in your plant or facility?	Manually operated machinery presents little risk in a cybersecurity environment due to its lack of connection with business systems and the broader internet.	Low Risk	
	Mainly using manual controls such as mechanical levers, pneumatic or electrical switches			
15	Are indicators or alerts set up on critical equipment to indicate unusual changes to operating parameters, multiple login attempts, or detect other anomalies in use?	These alarms will notify you if unauthorized users are changing equipment operating parameters or may be close to damaging equipment.		
	Yes			
People: Medium Risk		Overall Risk: Medium		
Process: High Risk				
Technology: Low Risk				

Additional Resources

Additional Resources

- [Office of Manufacturing and Energy Supply Chains](#)
 - Technical resources
 - Financial assistance – implementation grant program
- [Better Plants Program](#)
 - Technical assistance for energy goals
- Energy Management
 - [CalPlug](#) – Plug Load Management
 - Strategic Energy Management
 - ISO 50001
- [DOE AMO Software Tools](#)
 - Energy & Water Management
 - Systems & Equipment Management
 - Decarbonization
- [Cybersecurity](#)
 - IAC Cybersecurity Assessment Tool
- [California Manufacturing Technology Consulting \(CMTc\)](#)
 - A non-profit organization that provides support resources to manufacturers on various ways to grow business, sales, improve quality, reduce sales and more
 - Offers more specific manufacturing programs, guidance on energy efficiency, and potential available incentives

U.S. DEPARTMENT OF
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OFFICE OF MANUFACTURING AND ENERGY SUPPLY CHAINS



- Rebates & Incentive Programs
 - Utility rebates
 - Subsidies
 - [Database of State Incentives for Renewables and Efficiency \(DSIRE\)](#)
 - Provides policies and incentives varying from city to city as well as the state as a whole
- [California Energy Commission](#)
 - Offers various programs and resources to help businesses reduce energy consumption and improve energy efficiency
 - Provides funding opportunities, financial awards, funding resources and workshops
- [California Public Utilities Commission](#)
 - Provides electrical energy financial assistance and other types of programs for residents and ratepayers.
 - Offers resources to understanding electricity rates and energy efficiency
- [California Alternative Energy and Advanced Transportation Financing Authority \(CAEATFA\)](#)
 - Administers various incentive programs, including financing options and incentives for energy efficiency projects
 - Offers multiple financial savings programs
 - Provides updated news regarding various programs throughout the energy industry

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Questions?

