

# UC Davis Path to Carbon Neutrality Using the OSIsoft PI System

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**UCDAVIS**  
Utilities

# Sustainability at UC Davis

## Achievements

- 90% renewable or carbon neutral electricity in 2019
- >\$13M energy savings since 2009
- >36% reduction in population-weighted water use

## How we use data

- Optimization
- Capacity planning
- User engagement
- Operator feedback
- Scheduling and dispatch of equipment
- Reporting, verification of savings
- Research and instruction

## Key concepts

- Value of a single data infrastructure
- Power of data in the hands of domain experts
- Real time data is an integral part of our business
- Real time data enables campus as a living lab

# UC Davis Overview


- 35k Students
- 23k Faculty & Staff
- 1000+ Buildings, 180 over 10,000 SF
- 11.3M SF total; 5,300 acres Land
- Founded 1905, Average Building Age: 41 years



# Carbon Neutrality Initiative

UNIVERSITY  
OF  
CALIFORNIA

Office  
of the  
President



Jobs People

HOME ABOUT ORGANIZATION INITIATIVES

Carbon Neutrality Initiative

CARBON NEUTRALITY INITIATIVE

OVERVIEW ORGANIZATION STUDENT INVOLVEMENT REPORTS RESOURCES

UC, a national leader in sustainability, has pledged to become carbon neutral by 2025, becoming the first major university to accomplish this achievement.


Global climate disruption is impacting the planet in ways never experienced in human history. Warmer temperatures are contributing to changing weather patterns that cause more intense storms and heavier rainfall in some places, while elsewhere drought is parching the land. Glaciers are melting at an accelerated rate and oceans are rising.

The overwhelming scientific consensus is that climate change is being driven by the release of carbon dioxide into the atmosphere, primarily from the burning of fossil fuels.

The University of California has responded to this growing environmental crisis with direct action aimed at ending its reliance on fossil fuels.

In November 2013, [President Janet Napolitano announced the Carbon Neutrality Initiative](#), which commits UC to emitting net zero greenhouse gases from its buildings and vehicle fleet by 2025, something no other major university system has done.

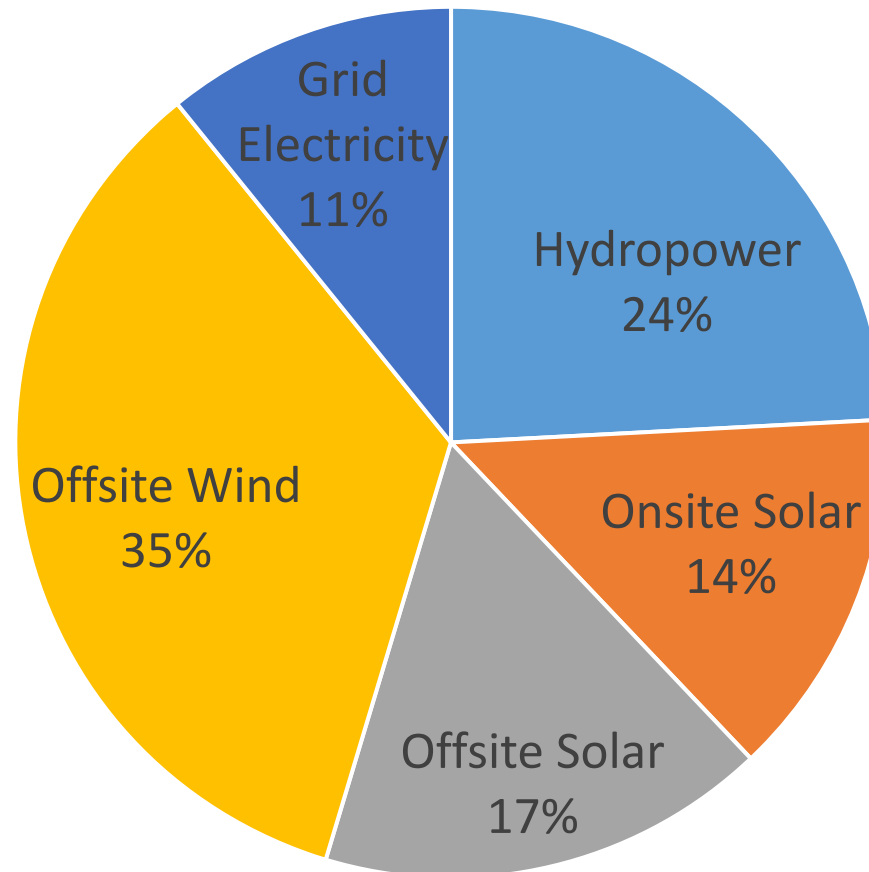
The initiative builds on UC's pioneering work on climate research and furthers its leadership on sustainable business practices. UC is improving its energy efficiency, developing new sources of renewable energy and enacting a range of related strategies to cut carbon emissions.



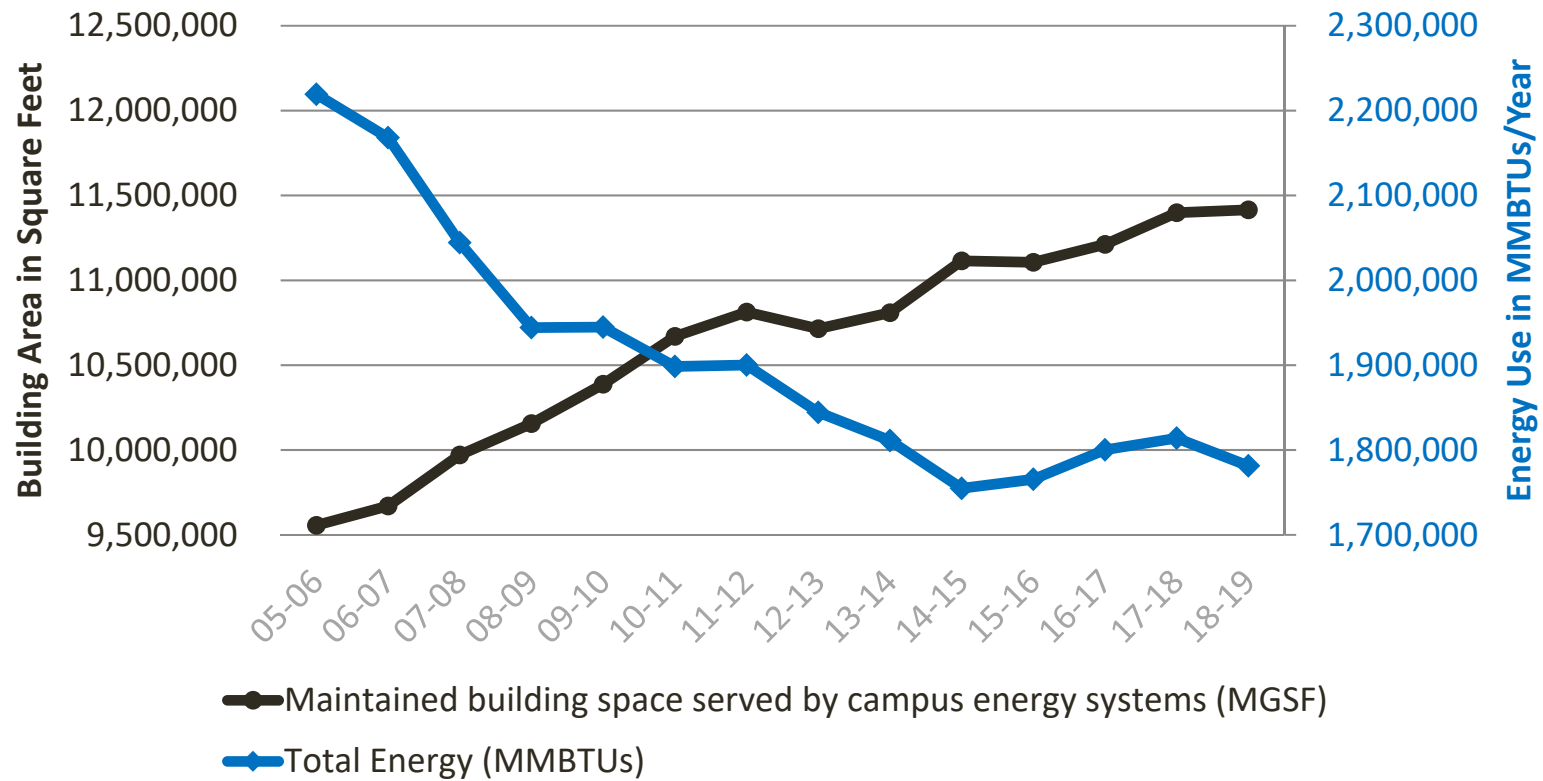
*"We are the University of California, and there is no reason that UC can't lead the world in this quest, as it has in so many others."*

— UC President Janet Napolitano

## Renewable Electricity (CY 2019)

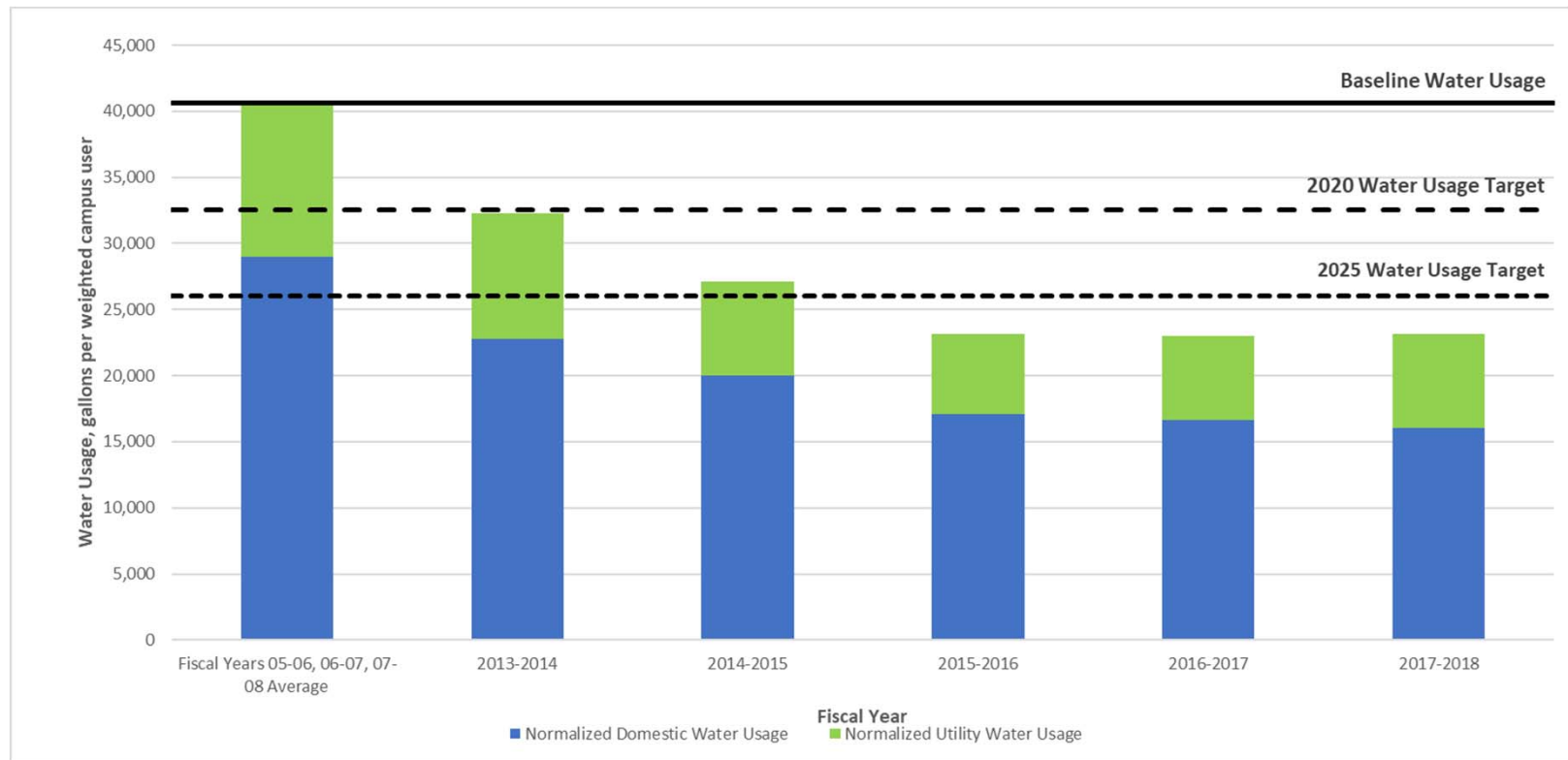


# Energy Savings

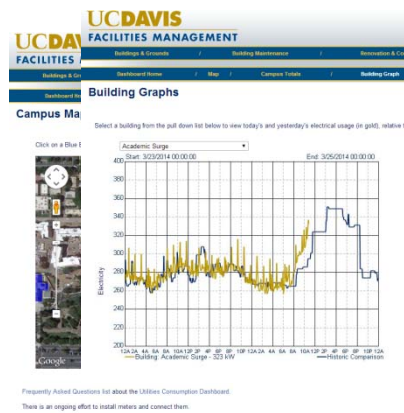




# Water savings results



# Early progress



## Building Metering Dashboard

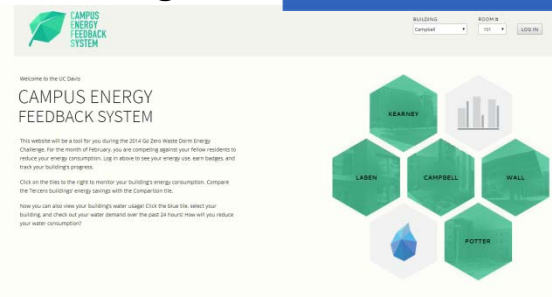
## Plant Operating Screens



## Campus Energy Feedback System

### Dorm Energy Challenge

### Campus Energy Dashboard



2007

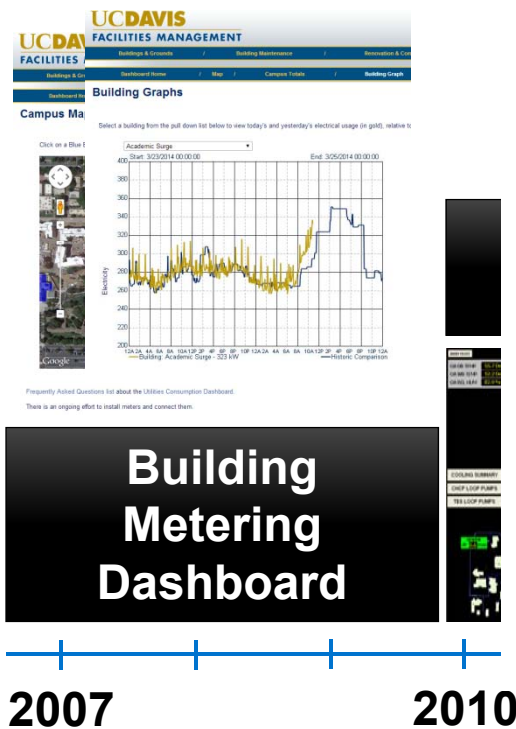
2010

2012

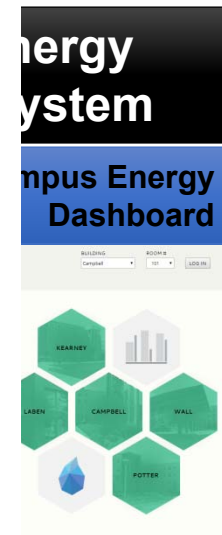
2014



## Early progress



- Monitoring, tracking project outcomes, trending
- Early user engagement
- Plant operational and performance metrics



2014

## Early progress

- Plant retrofits
- Large building retrofits





# Onsite Renewable Electricity



13.7 MWAC behind the meter solar farm; ~15% of total electricity

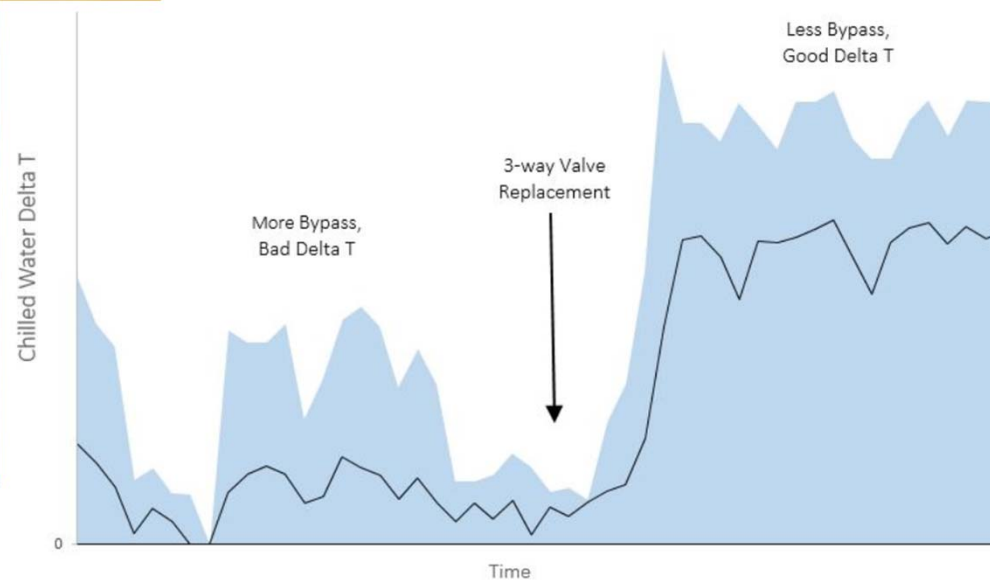
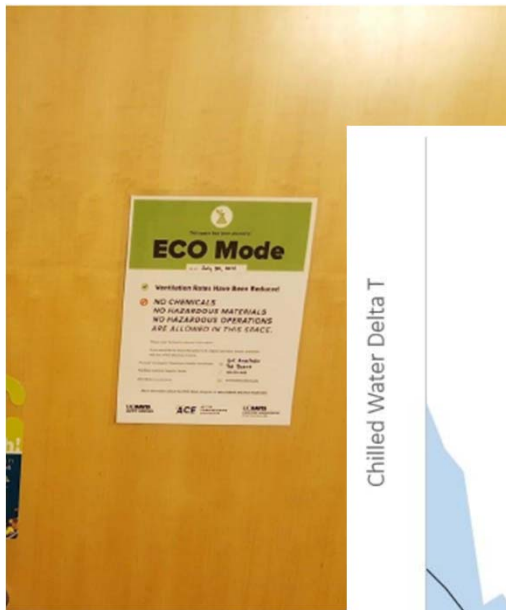
# Offsite Renewable Electricity



Partnership with UC System; UCD receives 24% of output



# Active Commissioning Enterprise

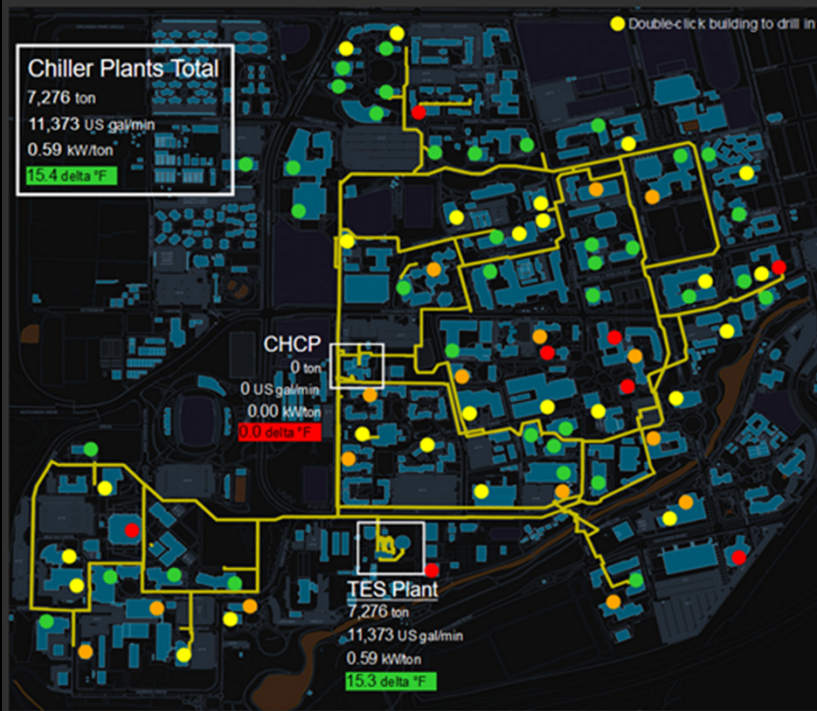


- Initial seed funding from campus
- Ultimately self-funding from savings: expected in FY19-20
- Green revolving fund – mechanism to reinvest savings

# Building CHW Utilization

## Chilled Water Utilization

10/18/2019 2:39:30 PM



Chilled Water Utilization	Heat (tons)	Heat (% of Total)	Flow (gpm)	Flow (% of Total)
$\Delta T < 5^\circ F$	10	0 %	420	4 %
$\Delta T = 5 - 10^\circ F$	815	11 %	2,548	22 %
$\Delta T = 10 - 15^\circ F$	1,318	18 %	2,520	22 %
$\Delta T > 15^\circ F$	2,752	38 %	2,911	26 %
$\Delta T$ unknown	2,287	29 %	2,809	22 %

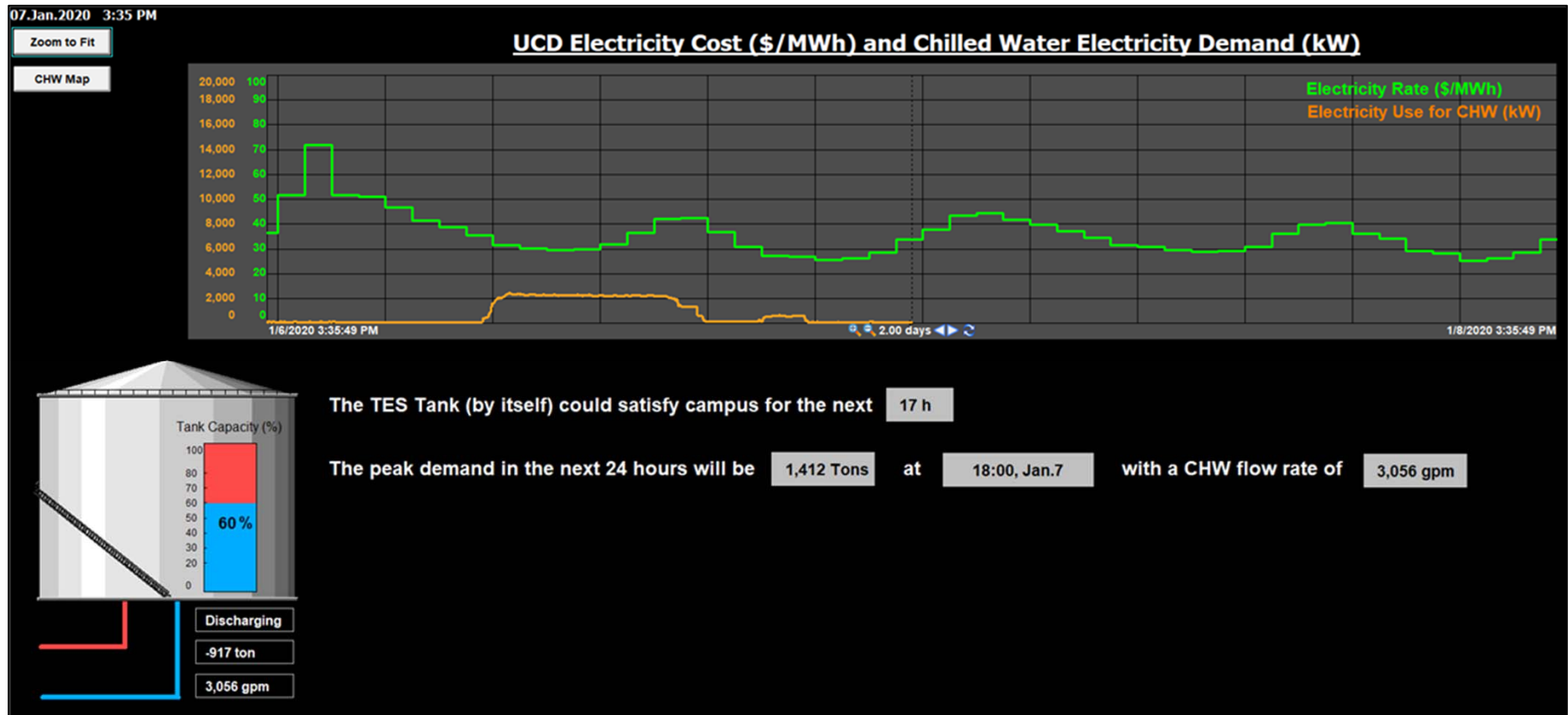
## Building Performance

Double-click building name to drill in

Academic_Surge_Building	24.4 delta °F	97 ton	93 US gal/min
Activities_and_Recreation_Center	23.7 delta °F	232 ton	234 US gal/min
Ann_E_Pitzer_Center	16.7 delta °F	8 ton	12 US gal/min
Art_Music_&_Wright	10.4 delta °F	2 ton	4 US gal/min
Asmundson_Hall	14.3 delta °F	32 ton	53 US gal/min
Balmer_Hall	12.9 delta °F	16 ton	30 US gal/min
Briggs_Hall	9.8 delta °F	88 ton	217 US gal/min
California_Hall	11.1 delta °F	3 ton	7 US gal/min
Center_for_Companion_Animal_Health	11.7 delta °F	88 ton	180 US gal/min
Central_Cage_Wash	17.0 delta °F	22 ton	30 US gal/min
CFA_Administration_Building	10.1 delta °F	11 ton	27 US gal/min
CFA_Mondavi	7.7 delta °F	131 ton	403 US gal/min
Chemistry	3.2 delta °F	0 ton	0 US gal/min
Chemistry_Annex	5.4 delta °F	36 ton	161 US gal/min
Cole_B	2.9 delta °F	0 ton	0 US gal/min
Crues Hall	22.0 delta °F	20 ton	22 US gal/min
Dutton_Hall	33.1 delta °F	41 ton	25 US gal/min
Earth_and_Physical_Sciences_Building	17.7 delta °F	131 ton	180 US gal/min
Genome_&_Biomedical_Sciences	11.5 delta °F	89 ton	186 US gal/min



# Advanced Operator Feedback/Optimization

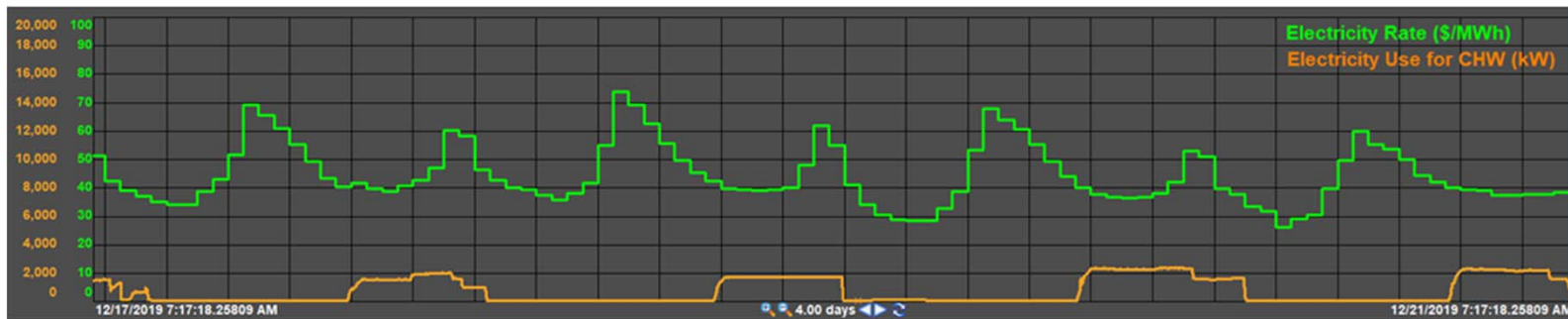


# Preliminary Optimization Results

## Prior to Training



## Post Training



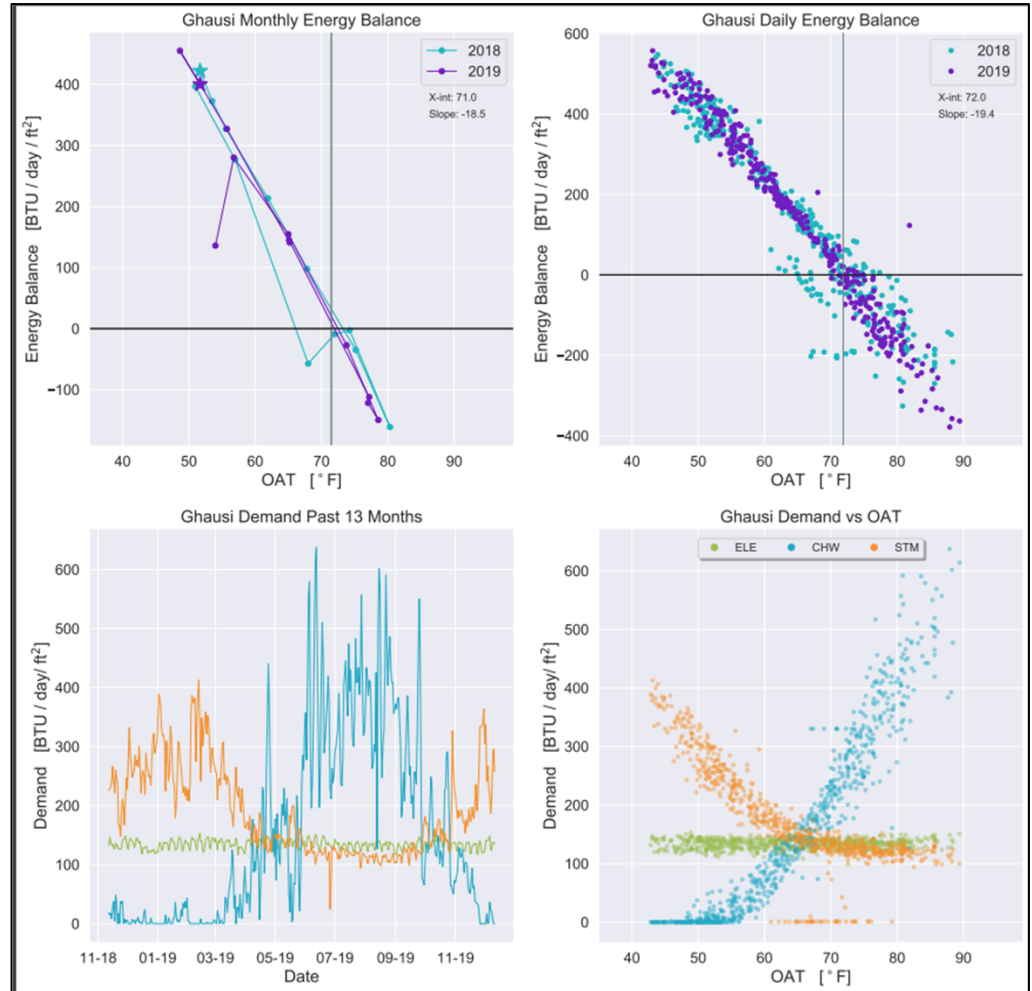
**Savings to Date: ~\$15,000**

**Expected Annual Savings: ~\$150,000**

# Verifying Savings Meter Quality

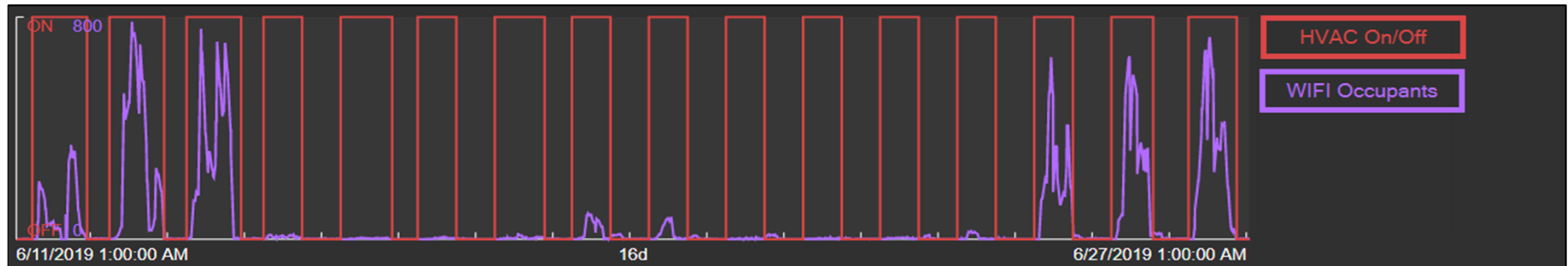
- **Energy Balance:**  
Electricity + Steam - CHW = 0

Utility Issues		
All Issues		
STATUS	Commodity	Building
Investigation		Count 12
1 Primate CCM Steam	Steam/Condensate	Center for Comparative Medicin
5 RMI North South Sensory steam baseload high	Steam/Condensate	RMI North
3 SCC Student Community Center Condensate Increase	Steam/Condensate	Student Community Center
4 Sprocket high condensate baseload	Steam/Condensate	Sprocket Building
5 Bainer Condensate intermittent issues	Steam/Condensate	Bainer Hall
6 CCAH electricity	Electricity	Center for Companion Animal H
7 Dutton condensate	Steam/Condensate	Dutton Hall
8 Gourley condensate low	Steam/Condensate	Gourley Clinical Teaching Cente
9 Hunt condensate low	Steam/Condensate	Hunt Hall
10 Segundo Regan	Steam/Condensate	Regan
11 Sproul condensate	Steam/Condensate	Sproul
12 Cole B	Steam/Condensate	Cole B

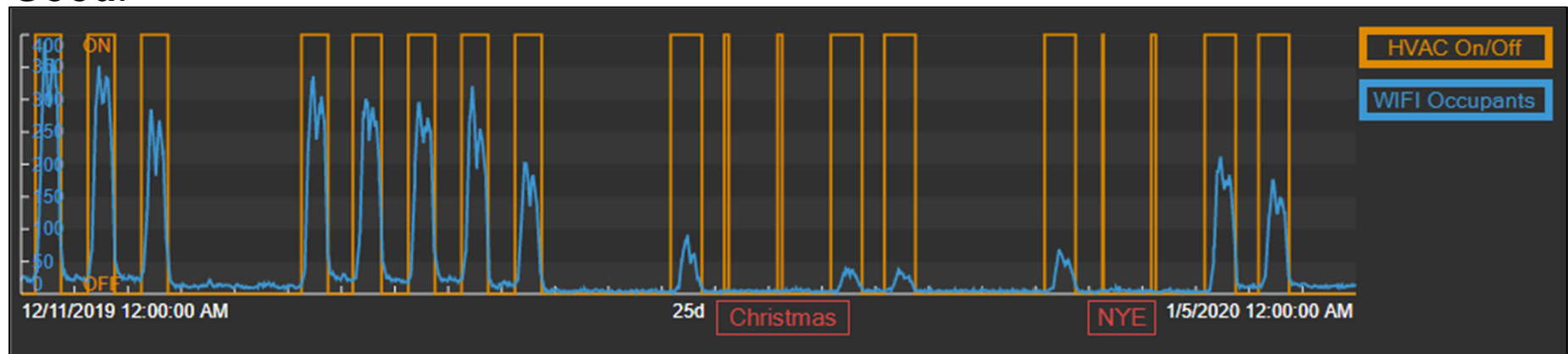


# WiFi/Schedule Alerting

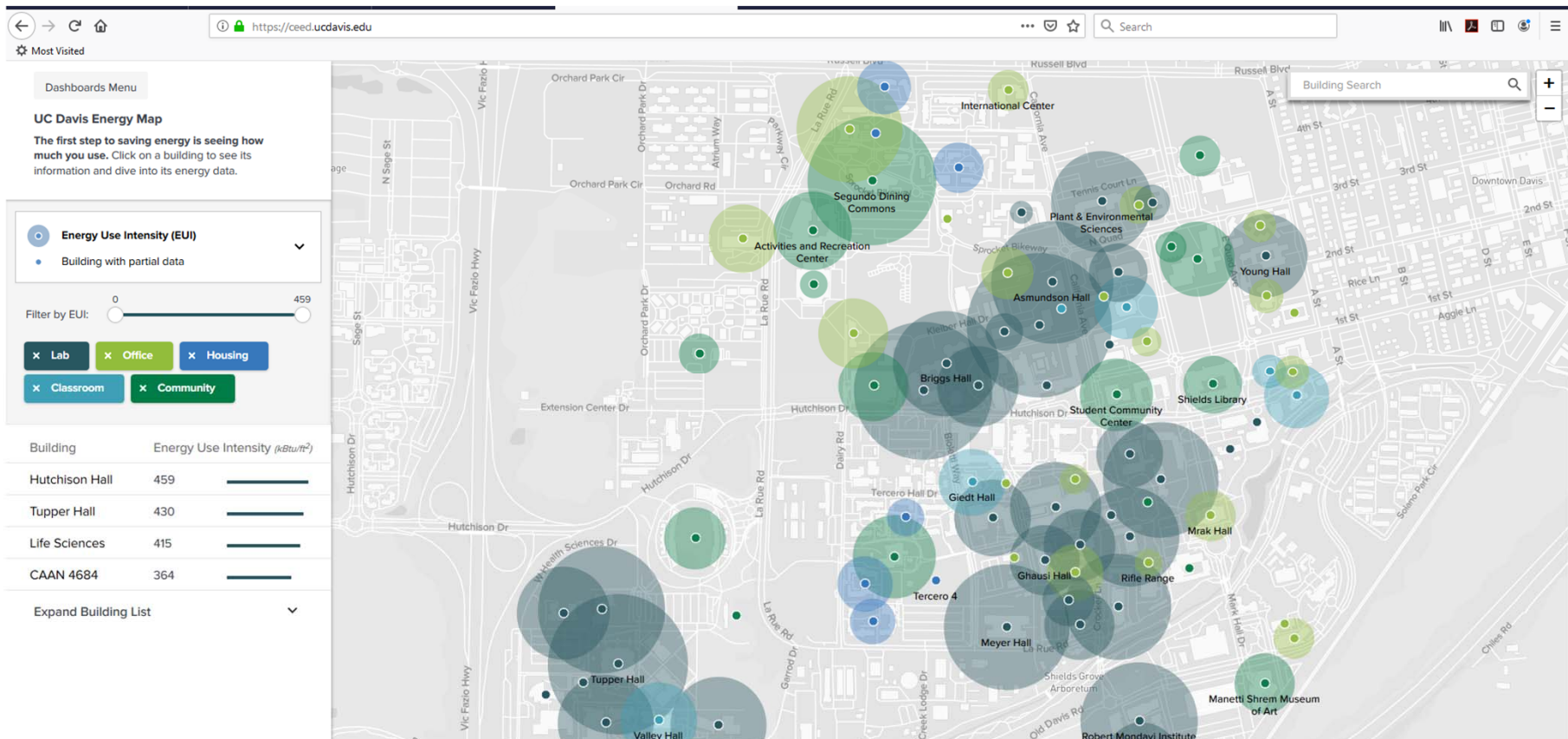
**Bad:**



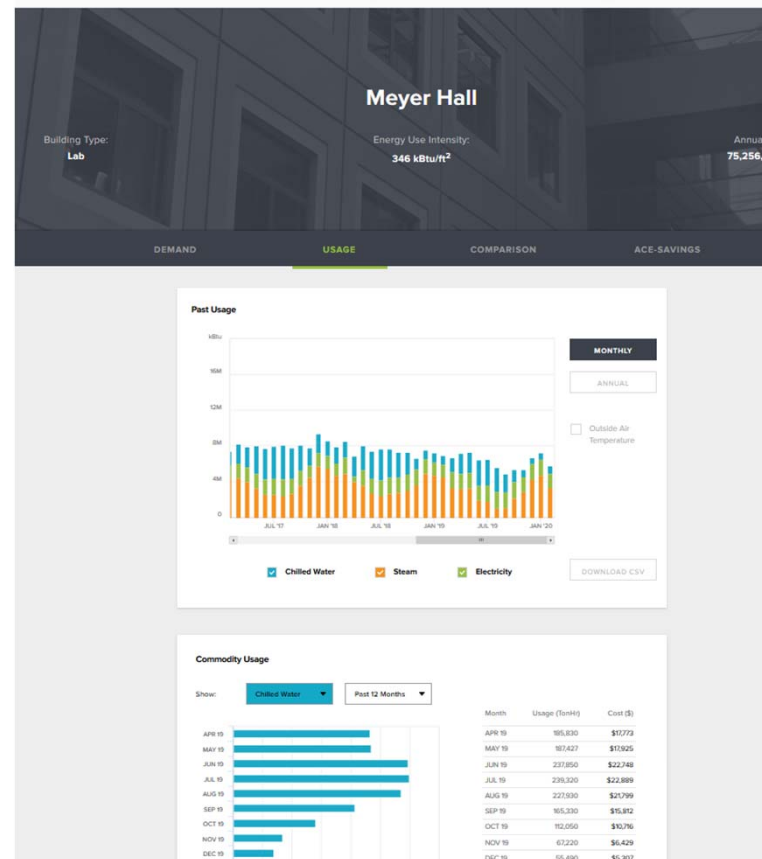
**Good:**



# Energy Feedback: [ceed.ucdavis.edu](https://ceed.ucdavis.edu)

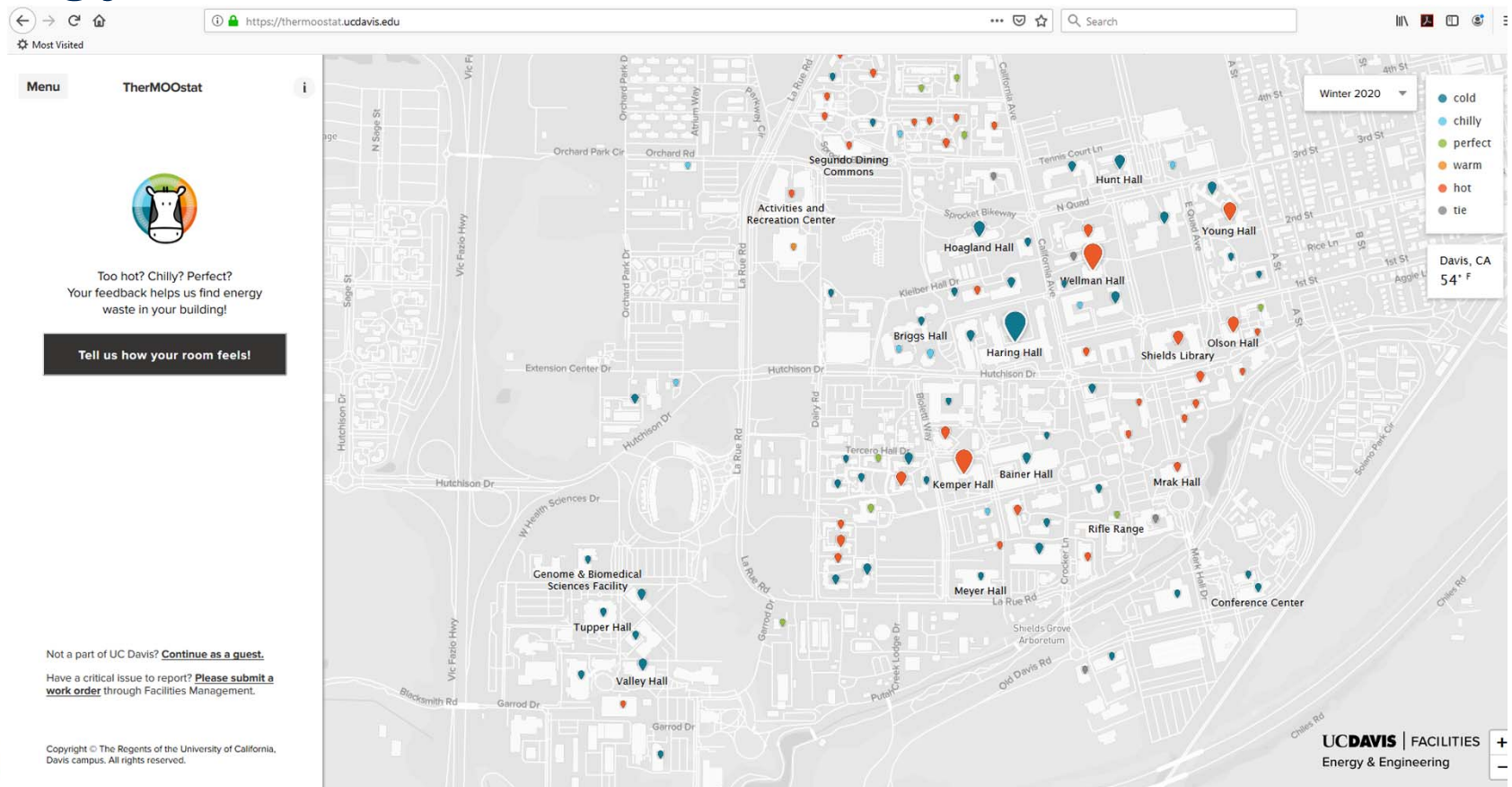


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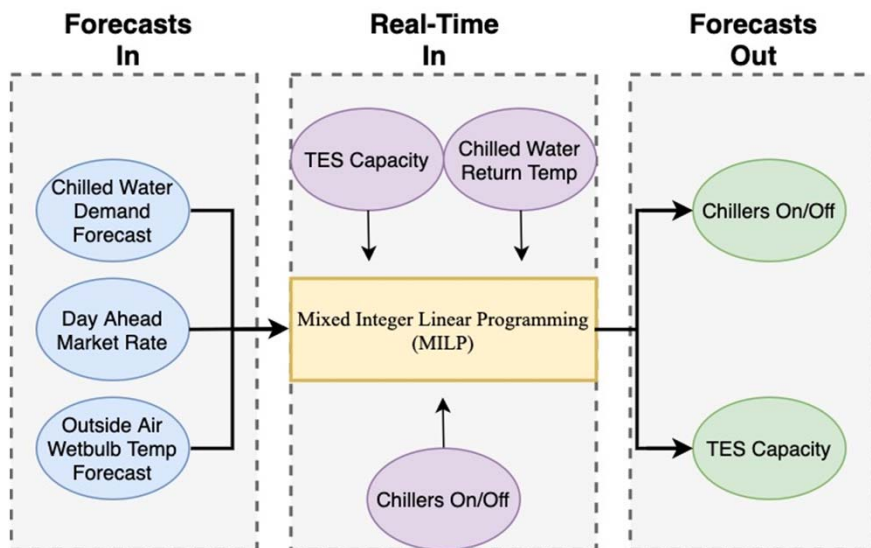




# Energy Feedback: [thermoostat.ucdavis.edu](https://thermoostat.ucdavis.edu)

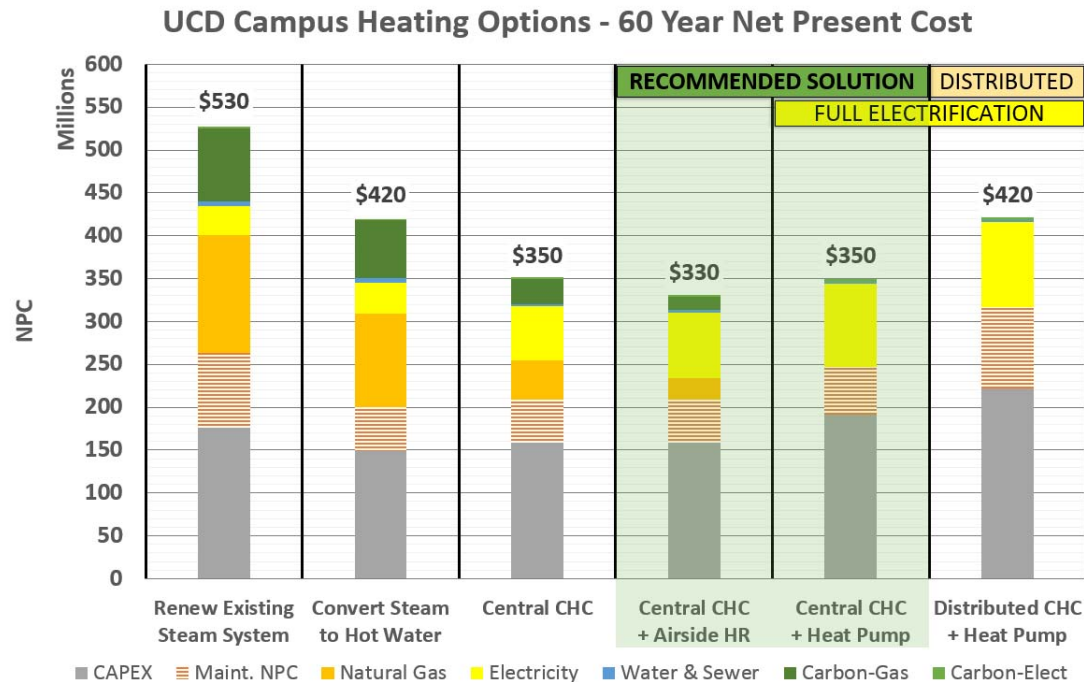


# Collaboration with Research and Instruction



- Providing data for courses and projects
- Using campus infrastructure for student projects and research studies
- Helping train students through internships

## Next steps: Steam to Hot Water Conversion



- Used PI System data for improved capacity planning
- 62% reduction in campus gas use, 10% increase in campus electricity use

## Next Steps

- Additional renewables investment to cover electricity emissions
- Deep energy efficiency
- Expanded user engagement, better communication initiatives

# Questions?

Please wait for  
the **microphone**

State your  
**name & company**



# Save the Date...



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