CSUDH

CALIFORNIA STATE UNIVERSITY, DOMINGUEZ HILLS

Central Plant Electrification and Campus Decarbonization Through CEOP

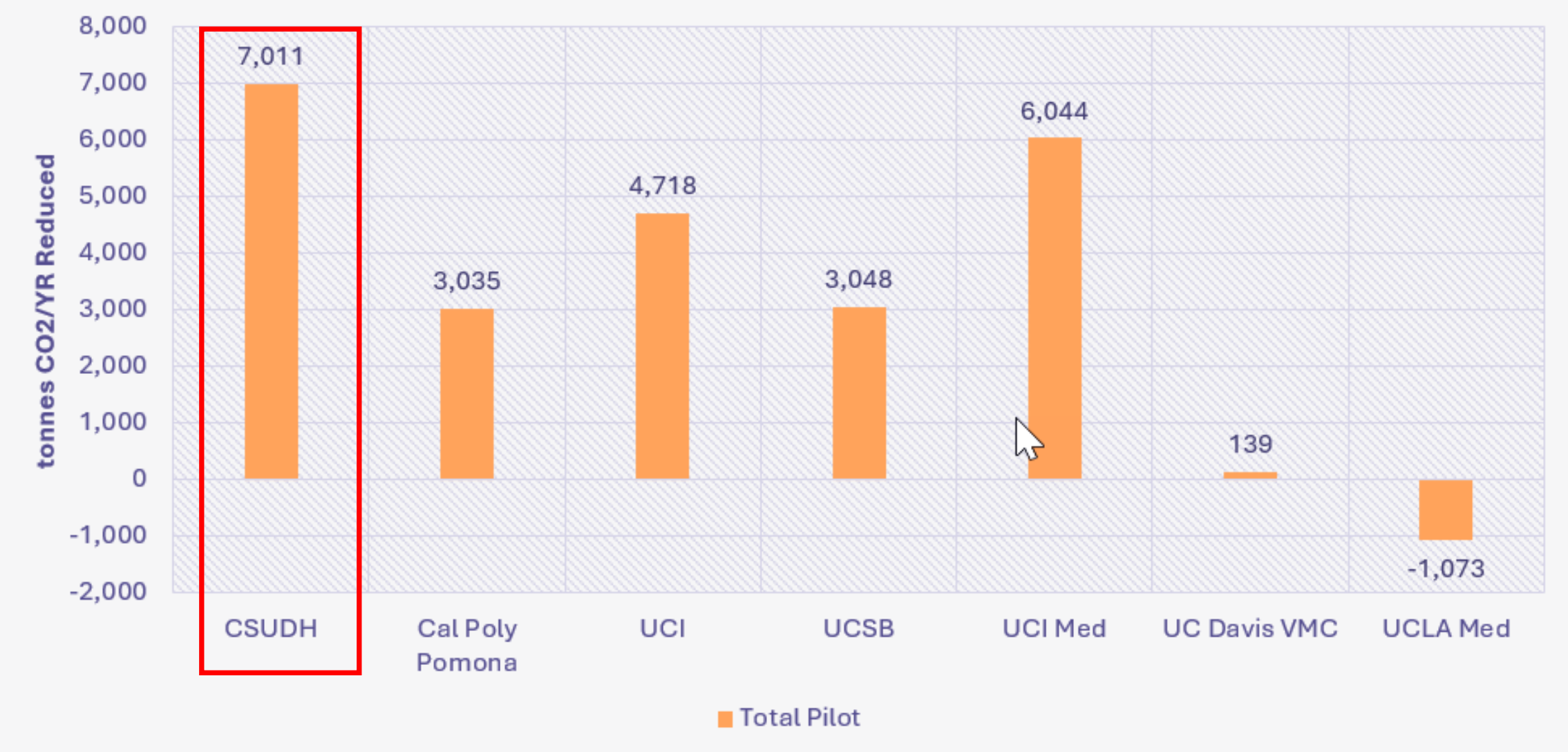
Kenny Seeton (Kenergy)

Director of Central Plant Operations and Strategic Energy Projects

www.csudh.edu/sustainability

CALIFORNIA STATE UNIVERSITY, DOMINGUEZ HILLS

Final GHG Reduction in CEOP



OUR CSUDH Energy Journey- Projects

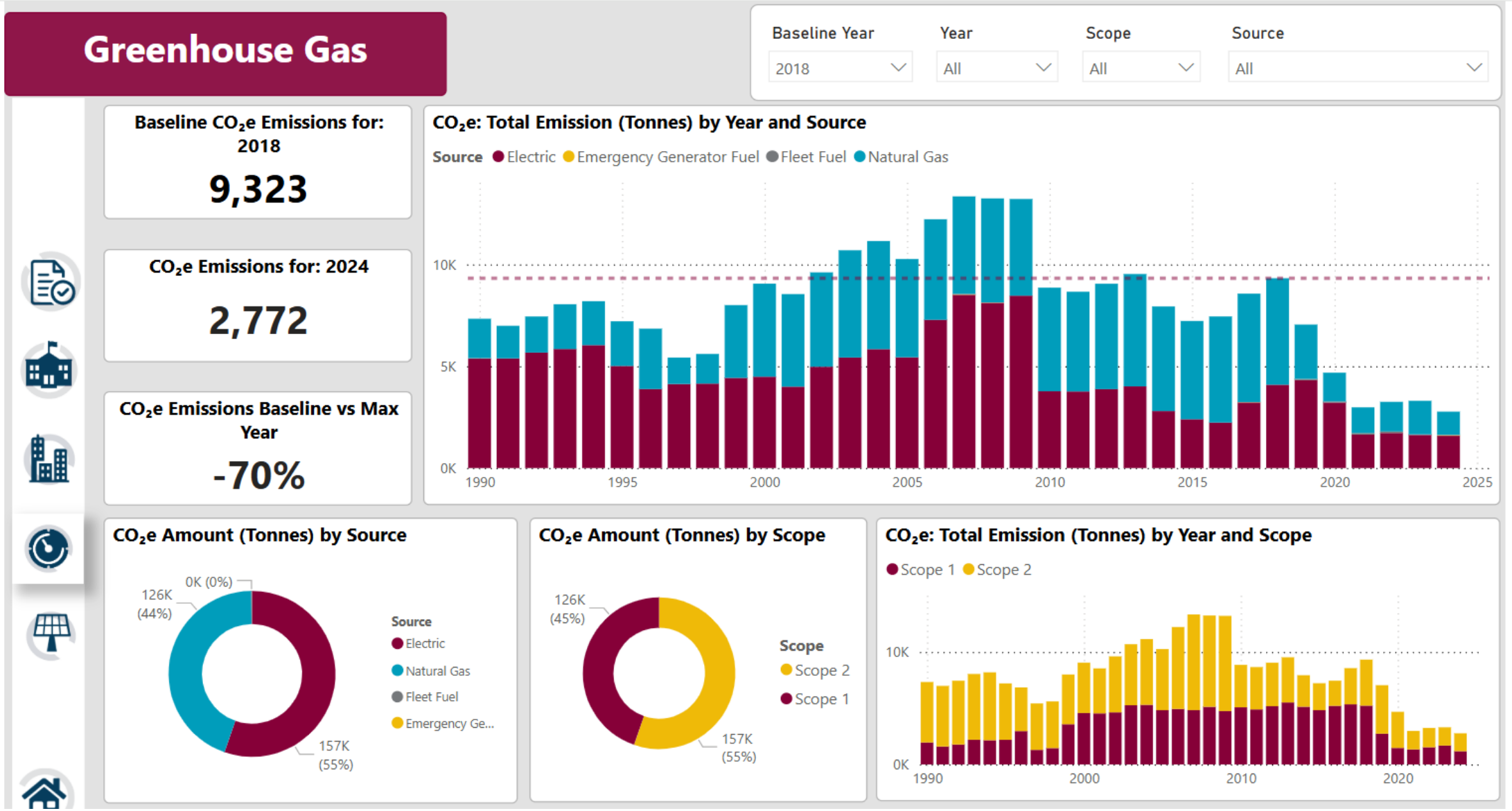
Project	Location	Date Completed
Switched from Gas Fired Absorption Chillers to Electric	Central Plant (CP)	2019 Q2
LED w Enlighted controls integrated into the BAS (Building Automation System)	Social Behavior Sciences (SBS) Welch Hall (WH) La Corte Hall (LCH)	2020 2021 2021
VAV dual duct Pneumatic to DDC	SBS	2020 Q2
Finish CHW, HW Belimo Smart Energy Valve upgrade	Campus wide	2020 Q4
964 kW roof top solar (WH,SCI, S Lib, SBS, Gym)	Campus wide	2022 Q1
800 exterior fixtures with LED & controls	Entire campus exterior	2022 Q2
Solar Thermal HW	CP Boiler roof	2022
70ton Trane (gas heating) to 25t & 12.5T heat pump	South Academic Complex #3 (SAC-3)	2023
Heat pumps 21-30t MultiStack units	Cental Plant (CP)	2024 Q3
facil.ai (Artificial Intelligence for Central Plant Optimization)	Central Plant (CP)	2023 Q4
LED Englighted/ BAS Integration- Pneumuatic to DDC	Student Health Center	2025 Q2 Planned
LED Enlighted	Physical Plant	2025 Q2 Planned
200 LV 2 EV Chargers	Lot 3	2026 Q3 Planned
More Solar 2 MW to 3 MW	Carport and Ground Mount	2025/2026 Planned

CSUDH
CALIFORNIA STATE UNIVERSITY, DOMINGUEZ HILLS

Decarbonization @ California State University, Dominguez Hills

- Campus has NetZero Vision
- 1 MW of Solar in Place
- 4 MWH of battery Storage in place
- 2,000 Tons of Gas Fired absorbers replaced with 3,000 Ton of York Centrifugal chillers
- Campuswide LED and Enlighted controls (smart fixture controls)
- Pneumatic to DDC
- Electrification of space heating
- AI Chiller Optimization

CEOP Journey – GHG Reduction



1st

CSUDH

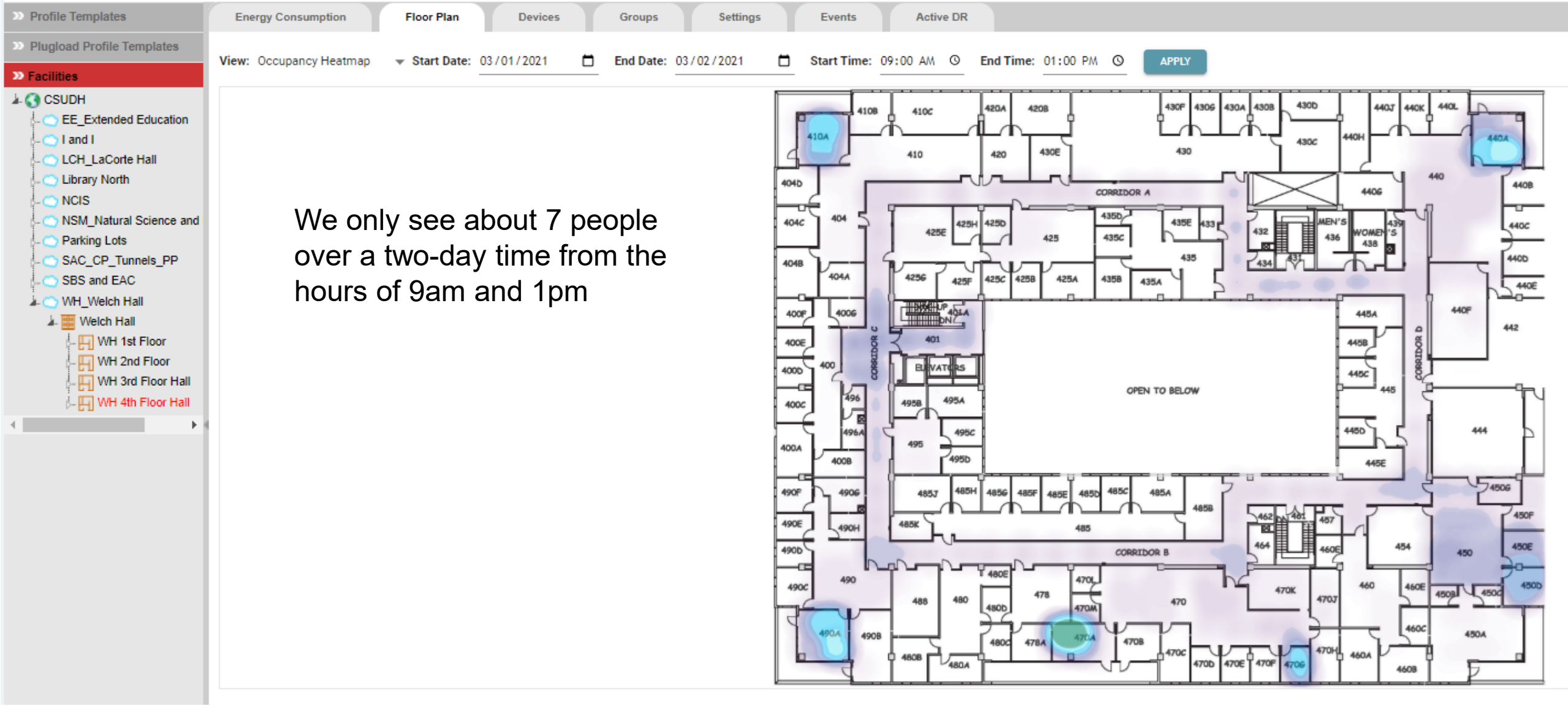
CALIFORNIA STATE UNIVERSITY, DOMINGUEZ HILLS

CSUDH

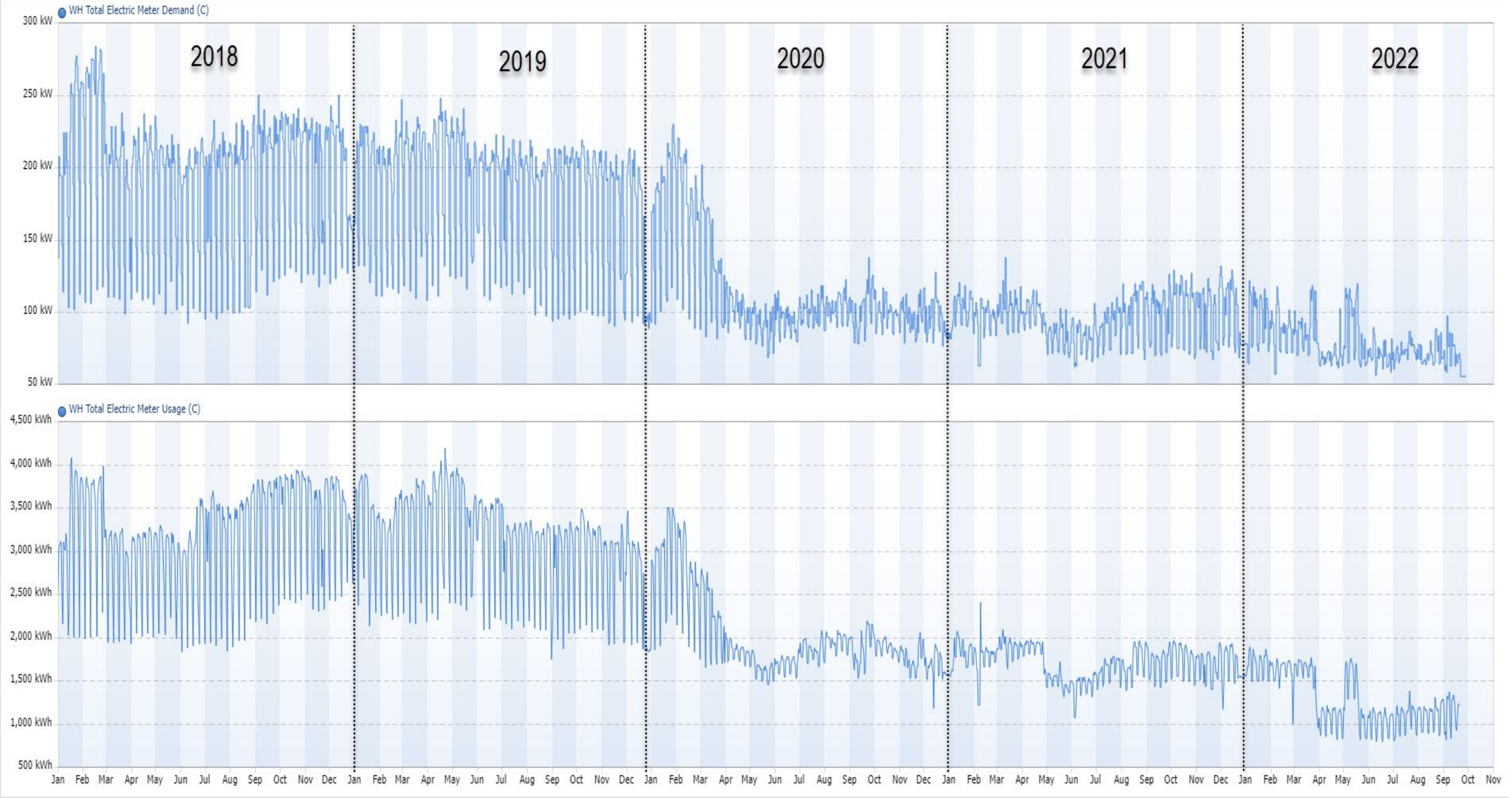
CALIFORNIA STATE UNIVERSITY, DOMINGUEZ HILLS

2nd

Heat Map



We only see about 7 people over a two-day time from the hours of 9am and 1pm


WH Total Electric Meter Demand (C)
300 kW
250 kW
200 kW
150 kW
100 kW
50 kW
2018
2019
2020
2021
2022
WH Total Electric Meter Usage (C)
4,500 kWh
4,000 kWh
3,500 kWh
3,000 kWh
2,500 kWh
2,000 kWh
1,500 kWh
1,000 kWh
500 kWh
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov

CSUDH

CALIFORNIA STATE UNIVERSITY, DOMINGUEZ HILLS

3rd

CSUDH

CALIFORNIA STATE UNIVERSITY, DOMINGUEZ HILLS


CSUDH
CALIFORNIA STATE UNIVERSITY, DOMINGUEZ HILLS

CSUDH

CAMPUS | HOME | OA-T

HEAT PUMP SETPOINTS

HP-CHWDP-SP		5.8 psi
HP-HWDP-SP		6.8 psi
COOL_UPPER_SETP...	HP-3	54.0
COOL_LOWER_SET...		44.0
HEAT_UPPER_SETP...		125.0
HEAT_LOWER_SETP...		115.0
COOL_LOAD_LIMIT		11.0
HEAT_LOAD_LIMIT		0.0
COOL_UPPER_SETP...	HP-2	54.0
COOL_LOWER_SET...		44.0
HEAT_UPPER_SETP...		125.0
HEAT_LOWER_SETP...		115.0
COOL_LOAD_LIMIT		100.0
HEAT_LOAD_LIMIT		100.0
COOL_UPPER_SETP...	HP-1	54.0
COOL_LOWER_SET...		44.0
HEAT_UPPER_SETP...		125.0
HEAT_LOWER_SETP...		115.0
COOL_LOAD_LIMIT		100.0
HEAT_LOAD_LIMIT		100.0

HEAT PUMP PARAMETERS

SYSTEM-EN	Shutdown
SYS-RESET	Reset
HP-ROTATE	False
HP1-COOLING-EN	On
HP1-HEATING-EN	On
HP2-COOLING-EN	On
HP2-HEATING-EN	On
HP3-COOLING-EN	Off
HP3-HEATING-EN	Off
EMERGENCY SHUT...	Enable

BYPASS VALVES

La Corte Hall Tunnel

CLG BYPASS-O 0.0 %

HTG BYPASS-O 0.0 %

C.P. Tunnel

CLG BYPASS-O 0.0 %

C.P. Yard

HTG BYPASS-O 0.0 %

CHILLED WATER SYSTEM

P3-C	P2-C	P1-C
Off	On	Off
CHW P3-O 0.0 %	CHW P2-O 77.2 %	CHW P1-O 0.0 %

CHW Plant Ret. Press.	61.7 psi
CHW Plant D.P.	12.4 psi

HP-HWS-T 123.8 deg F

HP-HWR-T 115.7 deg F

HP-CHWS-T 49.2 deg F

HP-CHWR-T 55.0 deg F

Pump #1	Pump #1	Pump #2	Pump #2	Pump #3	Pump #3
Command On	Command On	Command On	Command On	Command Off	Command Off
Status On	Status On	Status On	Status On	Status Off	Status Off
Output 56.5	Output 55.6 %	Output 58.3 %	Output 55.7 %	Output 0.0 %	Output 0.0 %
Frequency 34.0 Hz	Frequency 33.4 Hz	Frequency 34.6 Hz	Frequency 32.9 Hz	Frequency 0.0 Hz	Frequency 0.0 Hz
Fault Ok	Fault Ok	Fault Ok	Fault Ok	Fault Ok	Fault Ok

HOT WATER SYSTEM

HW P1-C Off

HW P1-O 0.0 Hz

HW P2-C On

HW P2-O 17.9 Hz

HW Plant Suct. Press.	45.92 psi
HW Plant D.P.	6.6 psi

HEAT PUMP FLOW

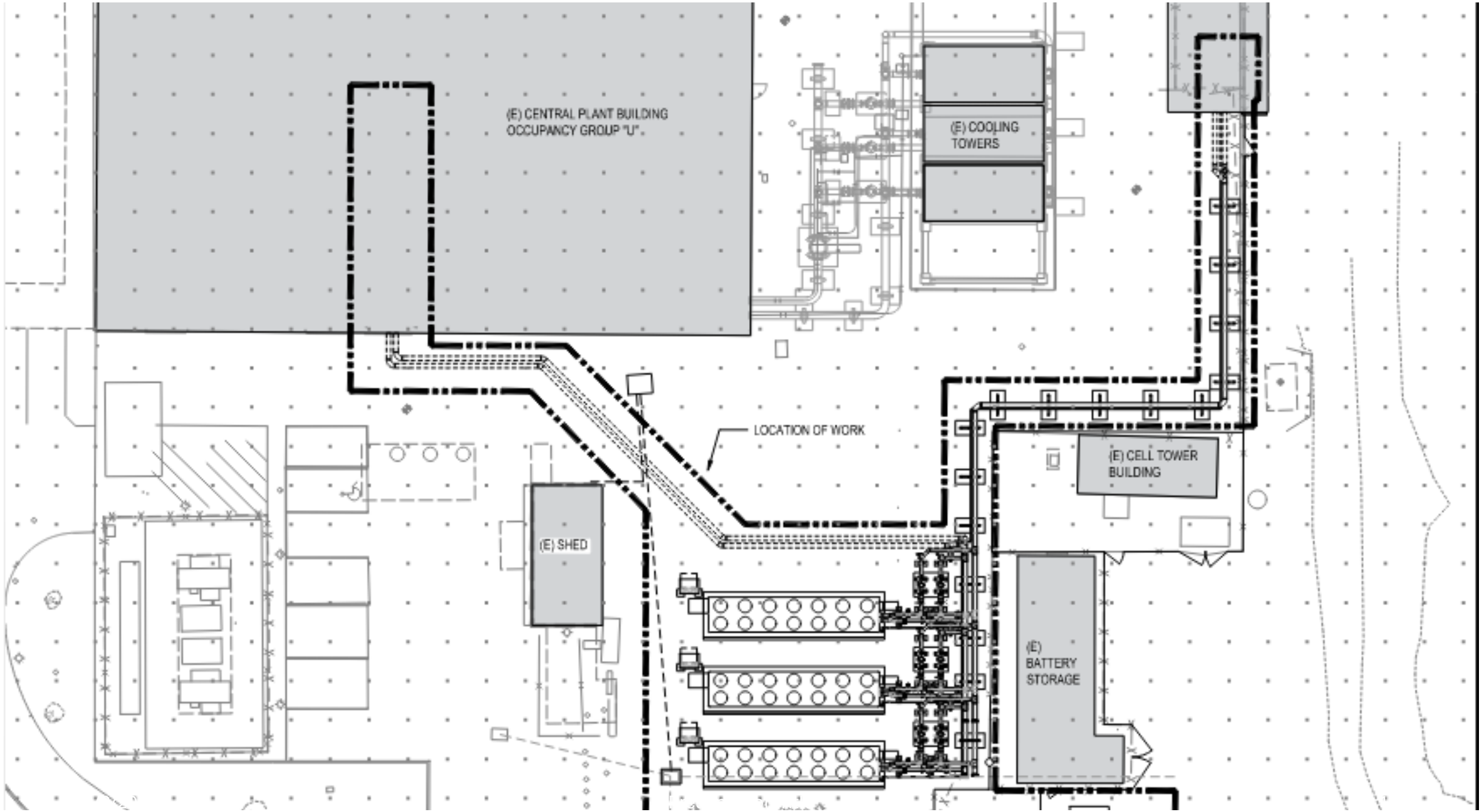
	HW	CHW
H.P. 3 Flow	-0.5 gpm	-0.5 gpm
H.P. 2 Flow	237.6 gpm	230.9 gpm
H.P. 1 Flow	234.2 gpm	223.1 gpm

CENTRAL PLANT FLOW

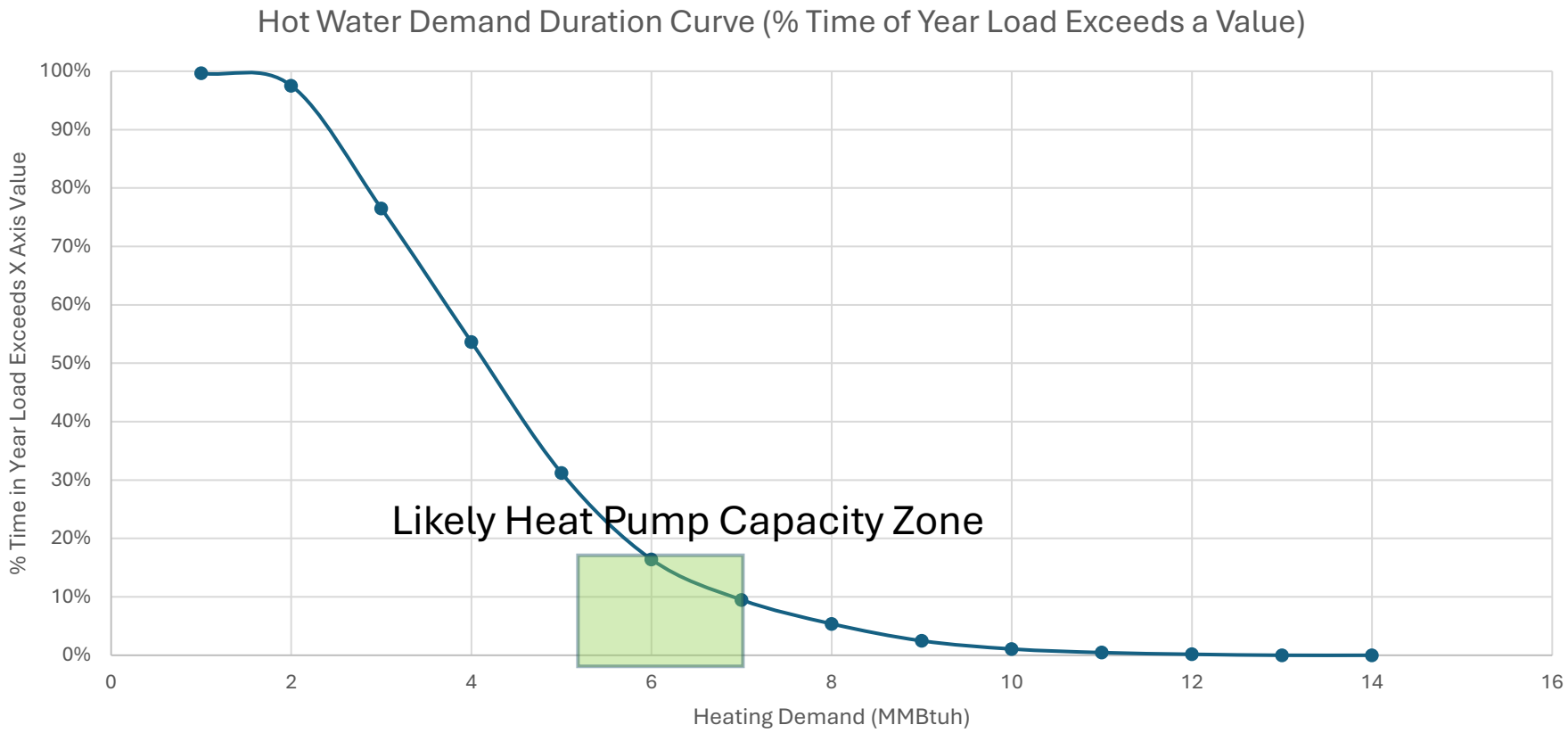
C.P. Total CHW Flow	2,298 gpm	
C.P. Total HW Flow	491 gpm	
H.P. Total CHW Flow	453.5	gpm
H.P. Total HW Flow	471.3	gpm

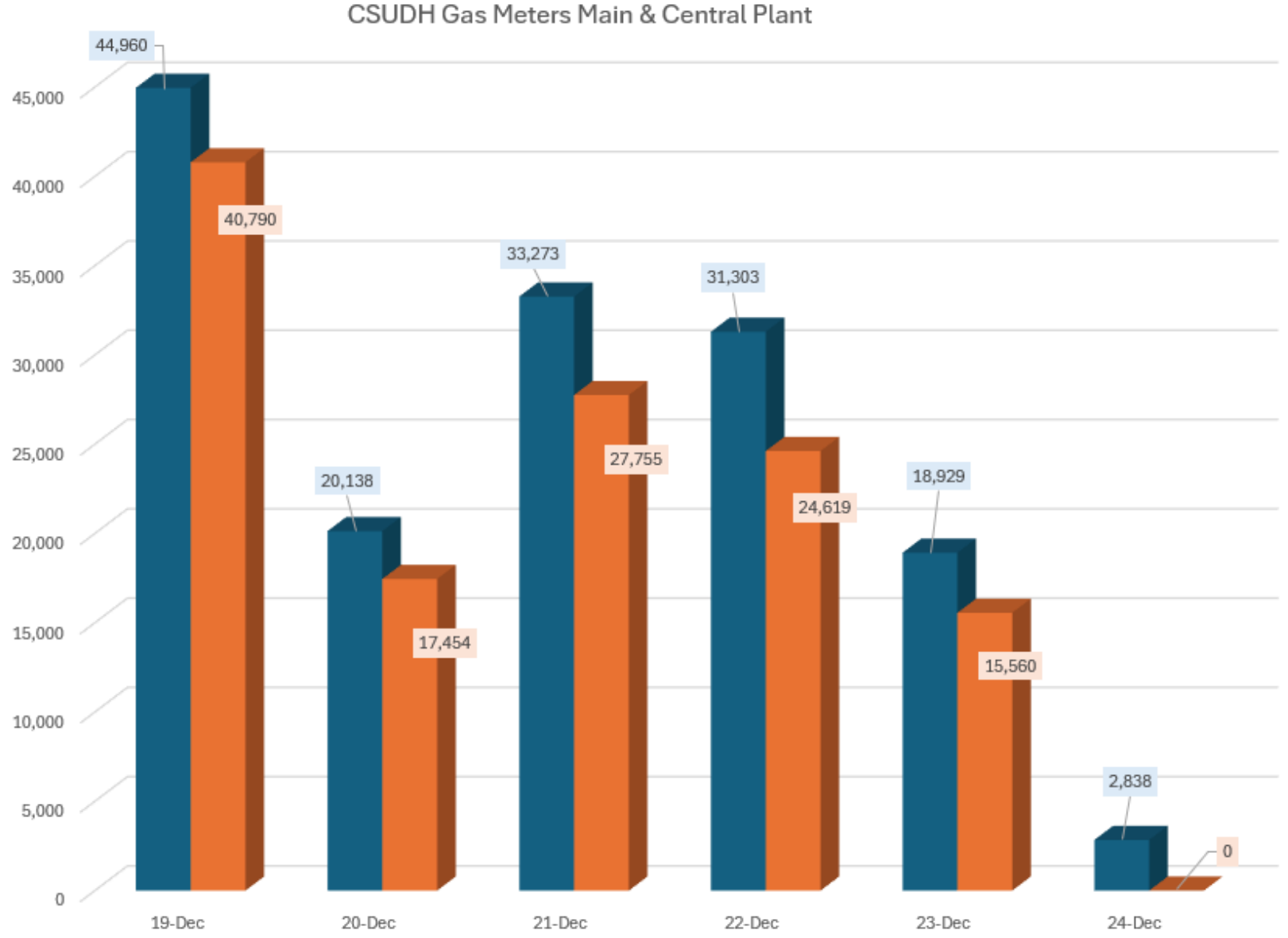
Summary of Major Equipment

- 21, 30-Ton Multi-stack Modules packaged into 7-skids
- 3, 10 HP Chilled water pumps, 500 GPM each
- 3, 10 HP Hot water Pumps, 500 GPM each
- Net Electrical Installed Load Addition: 1.35 MVA
- 12 KV/480 V 1.5 MVA Transformer
- 2500 Amp, 480 V Switchboard


(E) CENTRAL PLANT BUILDING
OCCUPANCY GROUP "U"
(E) COOLING TOWERS
LOCATION OF WORK
(E) CELL TOWER BUILDING
(E) SHED
(E) BATTERY STORAGE

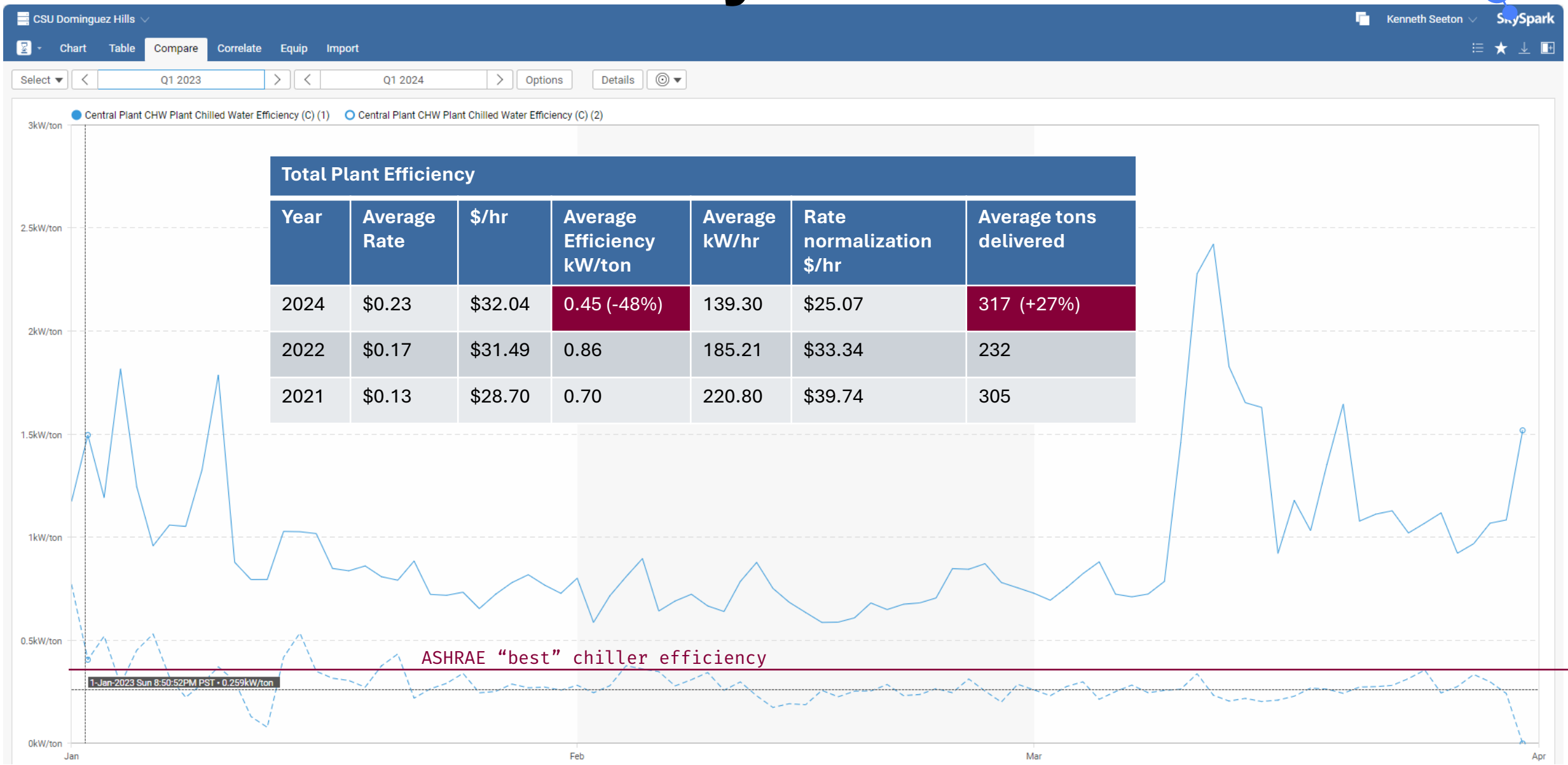
Heating Demand Time Duration Curve





	19-Dec	20-Dec	21-Dec	22-Dec	23-Dec	24-Dec
Main Gas Meter	44,960	20,138	33,273	31,303	18,929	2,838
Central Plant Gas Meter	40,790	17,454	27,755	24,619	15,560	0
CP GHG Usage (MT)	**216**	**82.3**	**147**	**130**	**82.3**	**0**

Chiller Plant Efficiency (2024 to Previous Years)



Total Plant Efficiency

Year	Average Rate	$/hr	Average Efficiency kW/ton	Average kW/hr	Rate normalization $/hr	Average tons delivered
2024	$0.23	$32.04	0.45 (-48%)	139.30	$25.07	317 (+27%)
2022	$0.17	$31.49	0.86	185.21	$33.34	232
2021	$0.13	$28.70	0.70	220.80	$39.74	305

Central Plant Utility Cost Trend

Year	Total kWh (Chillers + Heat Pumps)	Total Gas Therms	kWh Cost @ $0.27	Therm Cost @ $1.11	Annual CUP Cost
2020	2,060,032	208,693	$ 556,209	$ 231,650	$ 787,858
2021	2,237,098	169,369	$ 604,016	$ 188,000	$ 792,016
2022	2,849,753	178,851	$ 769,433	$ 198,524	$ 967,958
2023	1,979,124	212,813	$ 534,364	$ 236,223	$ 770,586
2024	2,008,706	116,022	$ 542,351	$ 128,784	$ 671,135
2025	2,608,103	6,584	$ 704,188	$ 7,308	$ 711,496

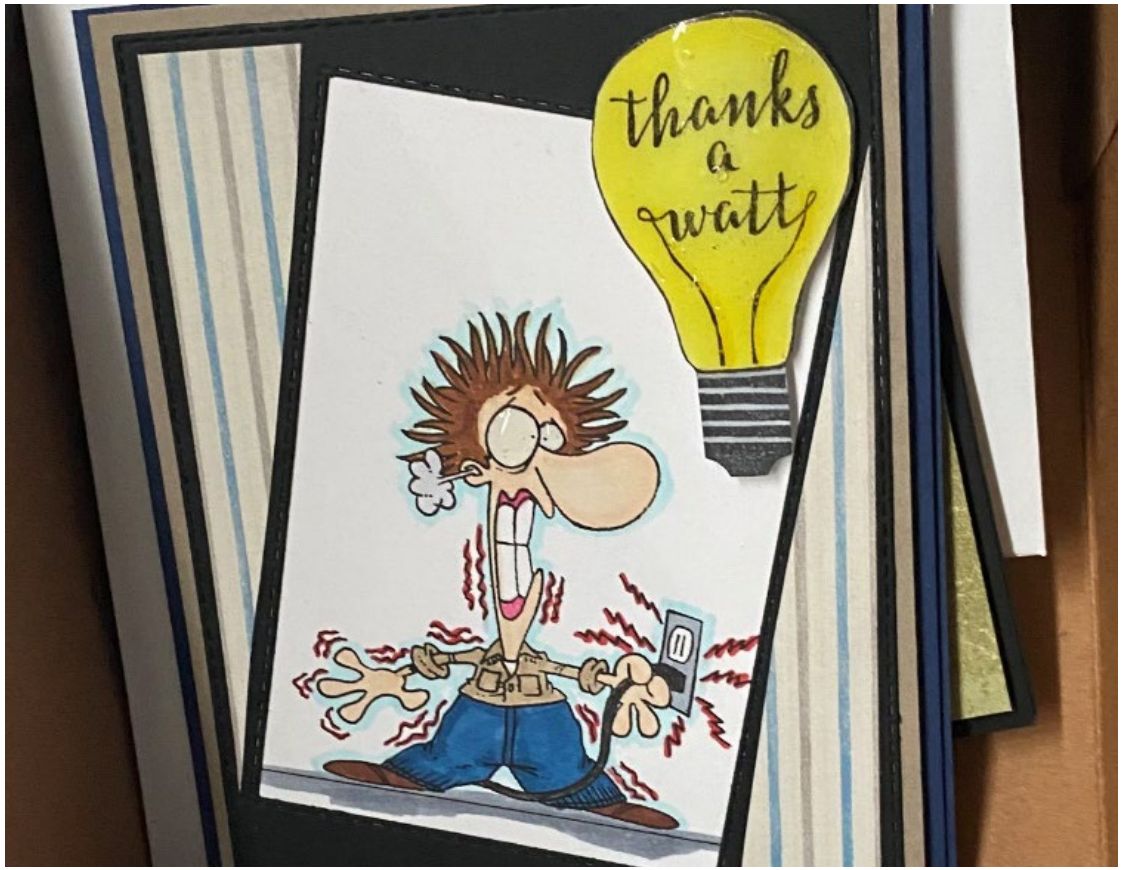
GSF

1.3 mil (2019)

1.4 mil (2020)

1.6 mil (2021)

- 2020 was COVID with much less people. It has been increasing every year since
- AI experimentation mid 2023. Perfected late 2024
- 21qty 30ton (**630tons**)Heat Pumps implemented mid 2024
- **Utility bill actually dropped by pairing AI with Heat Pumps**



If Better is Possible,
Good is not Enough

We're just getting started

Kenny Seeton (Kenergy)
Director of Central Plant Operations and Strategic Energy Projects
kseeton@csudh.edu

Q&A/Discussion

CSUDH
CALIFORNIA STATE UNIVERSITY, DOMINGUEZ HILLS