University of MN
Monthly Metrics
January 2024

Energy Management oversees the operation of mechanical, electrical, and civil utilities systems for the Twin Cities campus. This set of monthly metrics provides measurement of the group's three core principles:

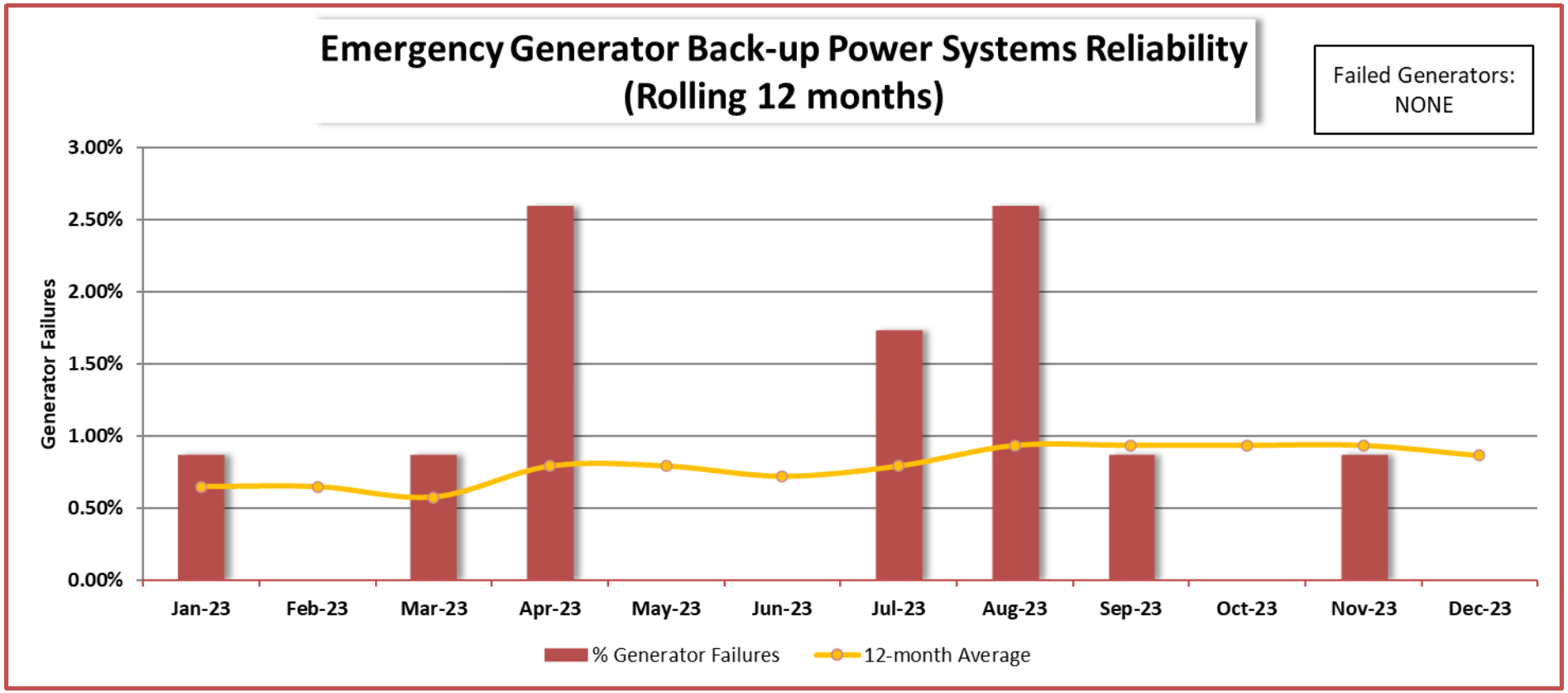
1) Reliability
2) Sustainability
3) Cost-effectiveness

Unplanned Service Loss Events

	FY18	FY19	FY20	FY21	FY22	FY23	FY24 @ 6 of 12	FY24 Target
CHILLED WATER								
Total	1	0	0	0	0	0	0	
Root-Caused to UMN	1	0	0	0	0	0	0	**2**
ELECTRIC								
Total	6	10	6	6	9	12	3	
Root-Caused to UMN	2	5	4	2	3	3	3	**3**
STEAM								
Total	3	6	2	3	1	0	0	
Root-Caused to UMN	2	1	2	3	0	0	0	**2**
WATER								
Total	1	1	1	1	1	0	0	
Root-Caused to UMN	0	0	1	1	0	0	0	**1**

This chart shows the number of unplanned utility outages on campus each year. Some outages are out of University control, such as actions of our utility provider or acts of nature. Energy Management sets targets each year for number of outages that are caused by our work.

RELIABILITY

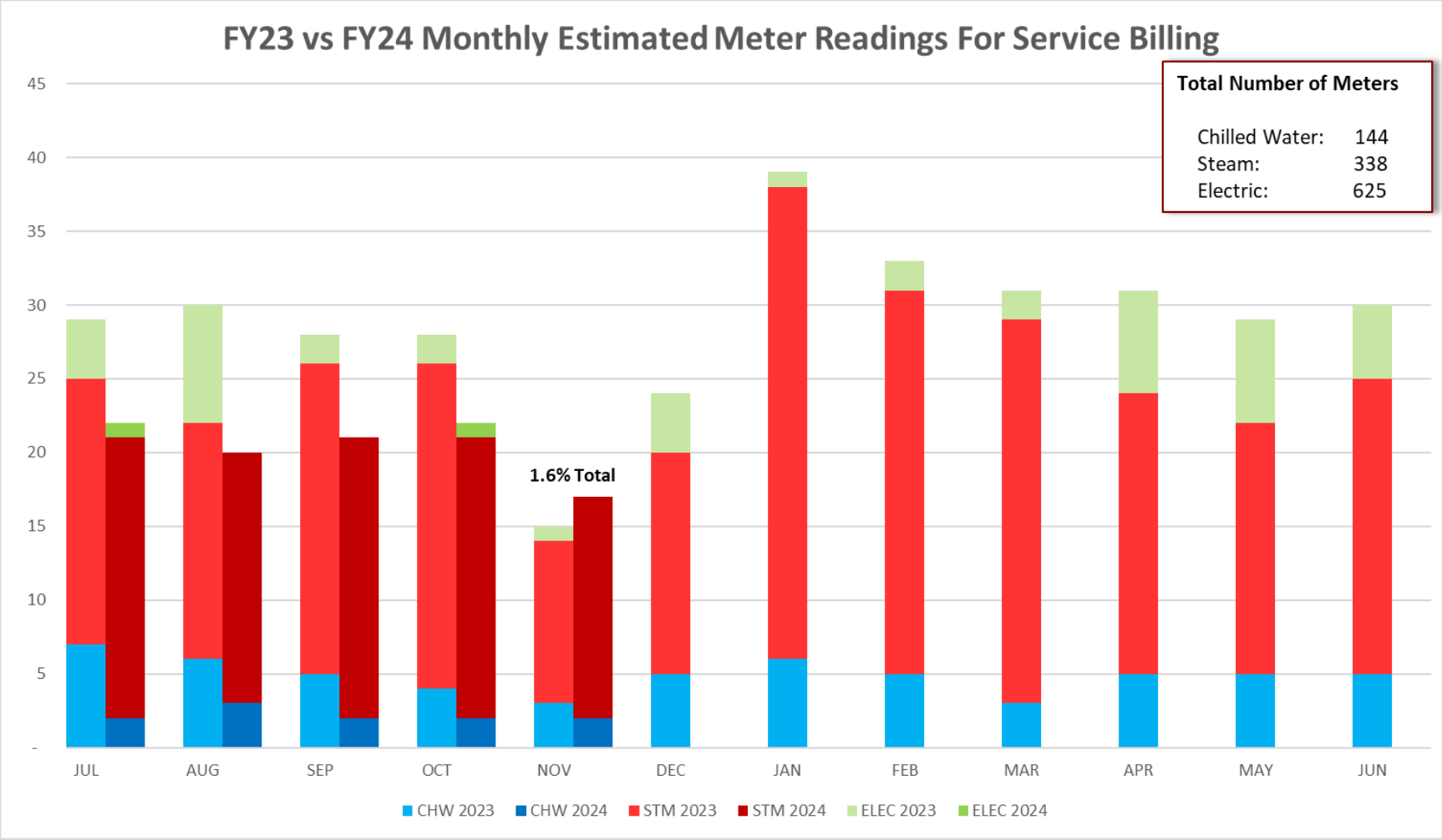


	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
Monthly Failures	0.86%	0.00%	0.86%	2.59%	0.00%	0.00%	1.72%	2.59%	0.86%	0.00%	0.86%	0.00%
12-month Average	0.65%	0.65%	0.57%	0.79%	0.79%	0.72%	0.79%	0.93%	0.93%	0.93%	0.93%	0.86%

In the event of a power outage, the campus has a number of emergency generators standing by to power essential systems. Energy Management tests them monthly to ensure they are properly maintained and ready for service.

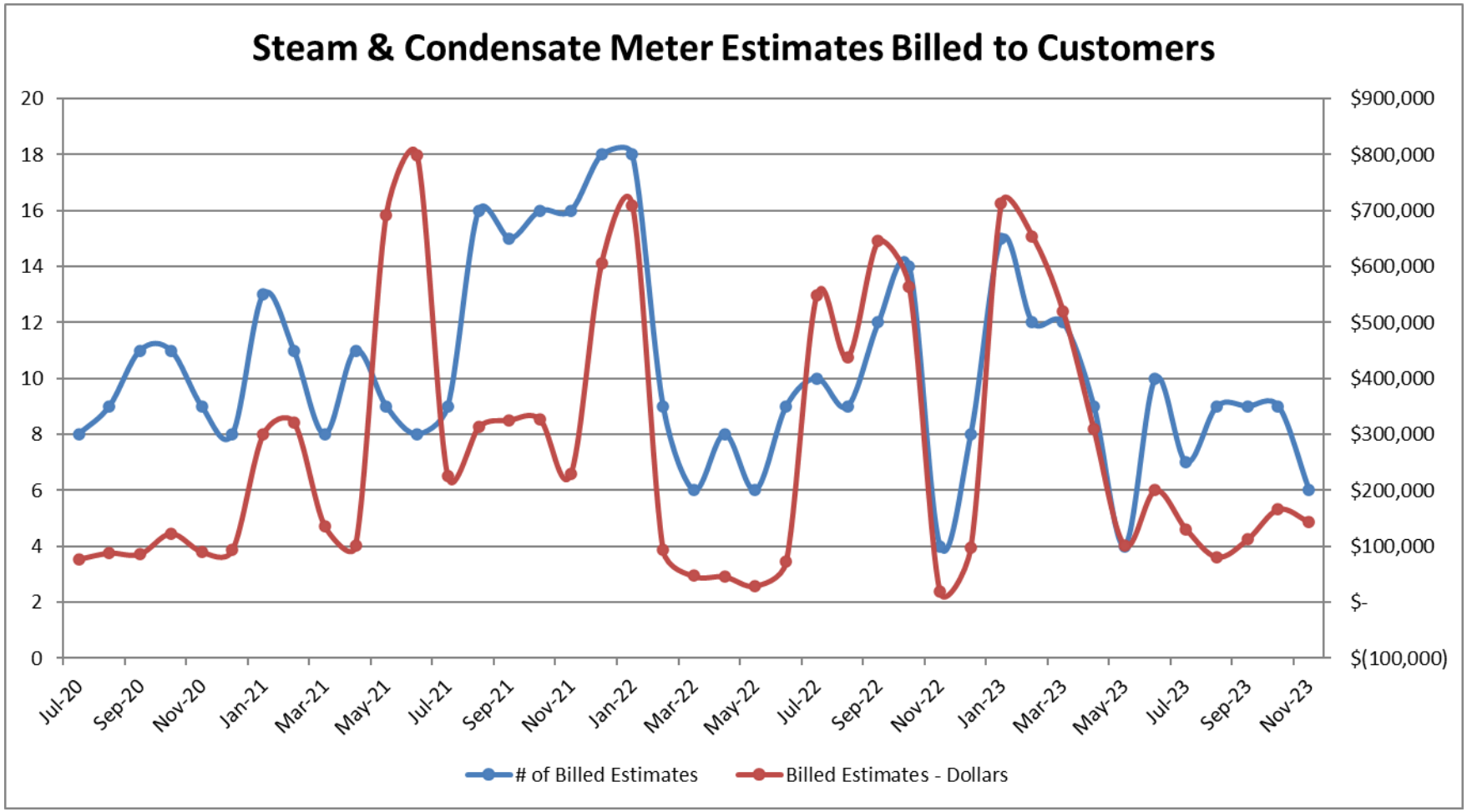
RELIABILITY

EM maintains nearly 1200 energy meters throughout campus, which are used to collect building energy consumption data. This measure of the metering system's health shows how many meters are malfunctioning compared to the previous year.



Period:	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24
Meter Read Inventory:	1466	1466	1466	1466	1466	1466	1466	1466	1466	1466	1466	1466
Estimated Readings:	25	23	23	23	18	0	0	0	0	0	0	0
% Monthly Estimates:	1.7%	1.6%	1.6%	1.6%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

RELIABILITY



Steam and condensate meters are more likely to malfunction than other types of utility meters, since they have mechanical parts and operate in extreme environments. Where possible, EM employs additional meters to achieve metering redundancy. This graph shows the percentage of buildings where there is no redundancy for a malfunctioning meter and we are forced to bill using estimated usage.

RELIABILITY

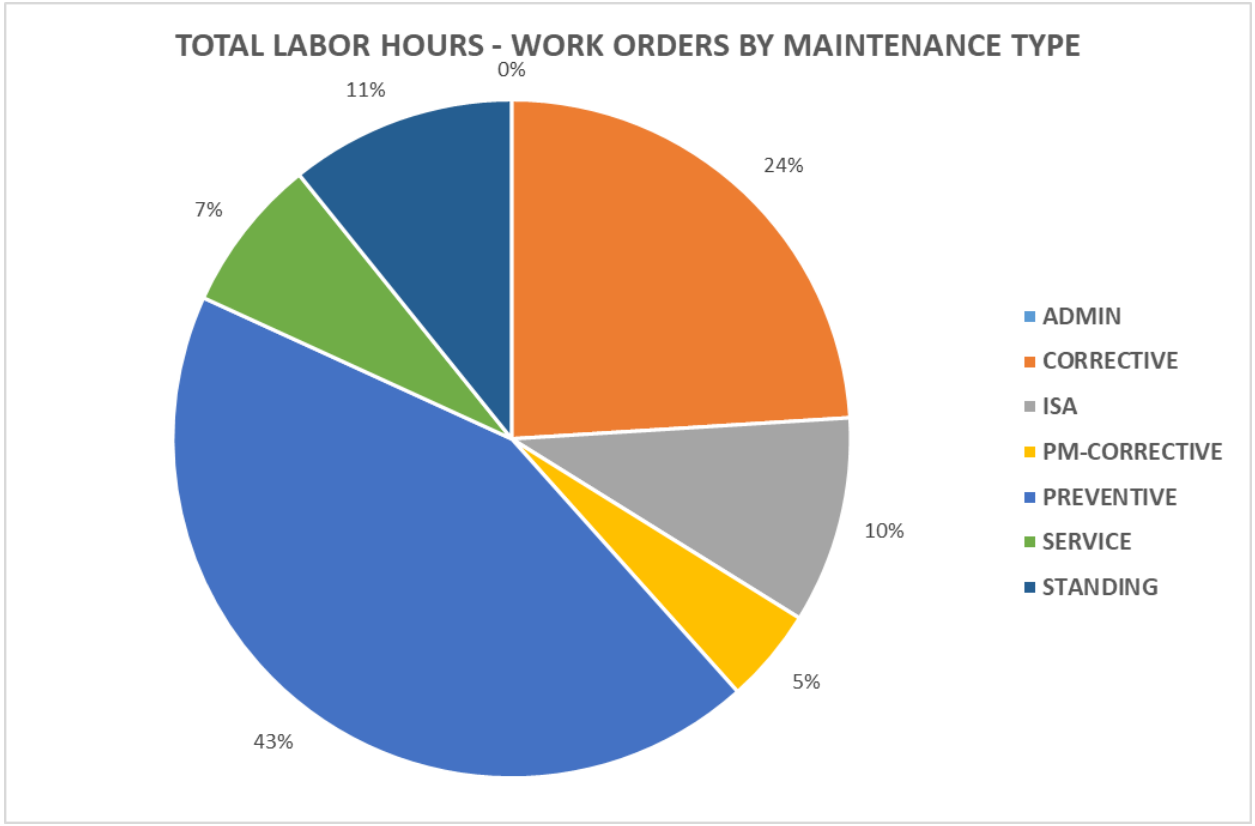
DECEMBER 2023

Energy Management crews play a number of different roles in the operation and maintenance of campus utility system.

These charts show the total labor hours worked by each crew for the month and which types of work they performed.

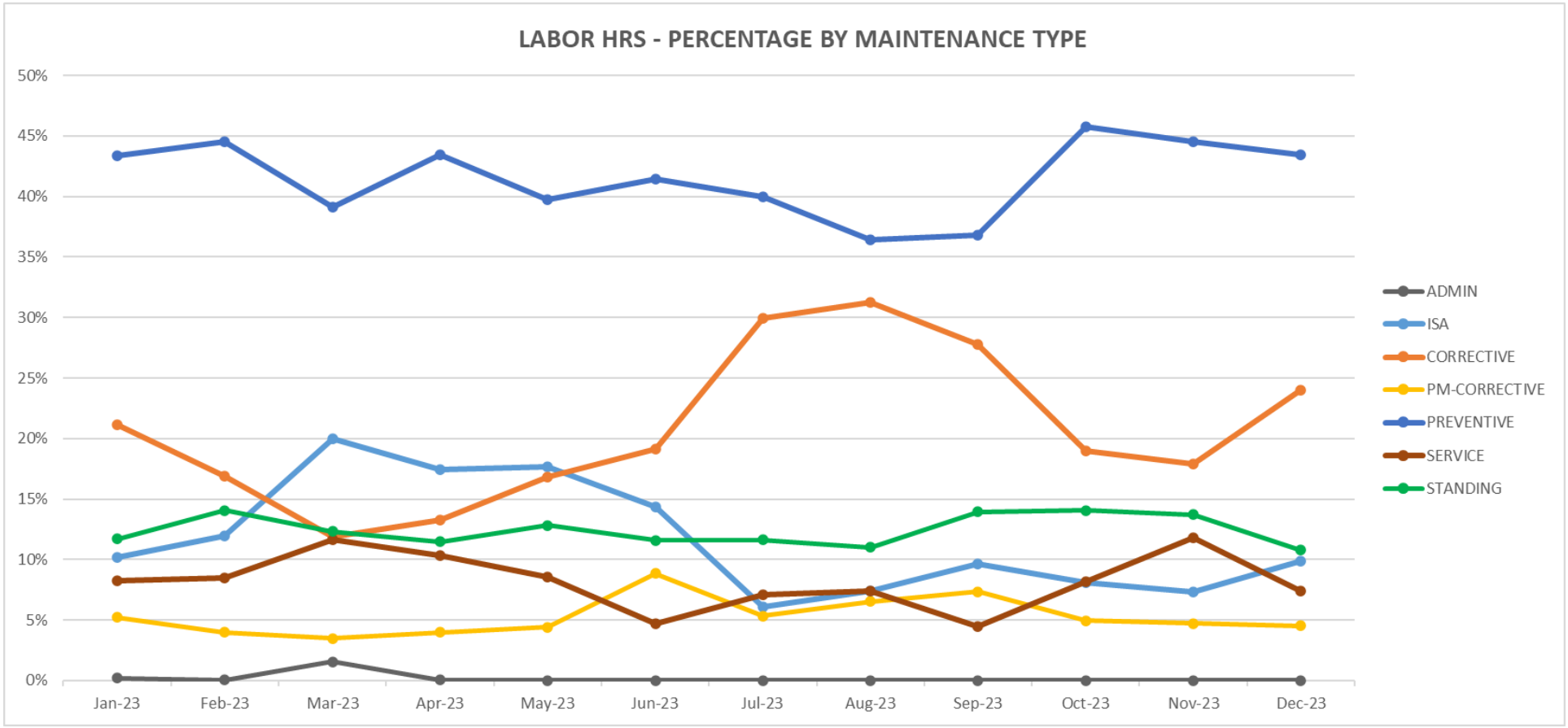
TOTAL MONTHLY LABOR HOURS BY CREW AND MAINTENANCE TYPE

	CHILLED WATER	ELECTRIC	EMELEC	EMTECH	STEAM	WATER & SEWER	TOTAL	TOTAL
ADMIN							0	0%
CORRECTIVE	207	843	105	36	1,148	94	2,432	24%
ISA	6	424	124	121	324		998	10%
PM-CORRECTIVE	213	127				119	458	5%
PREVENTIVE	929	1,282		22	1,935	232	4,399	43%
SERVICE	106	33	24	301	230	54	748	7%
STANDING		90		1,001	2		1,093	11%
TOTAL	1,460	2,798	253	1,480	3,639	498	10,128	100%



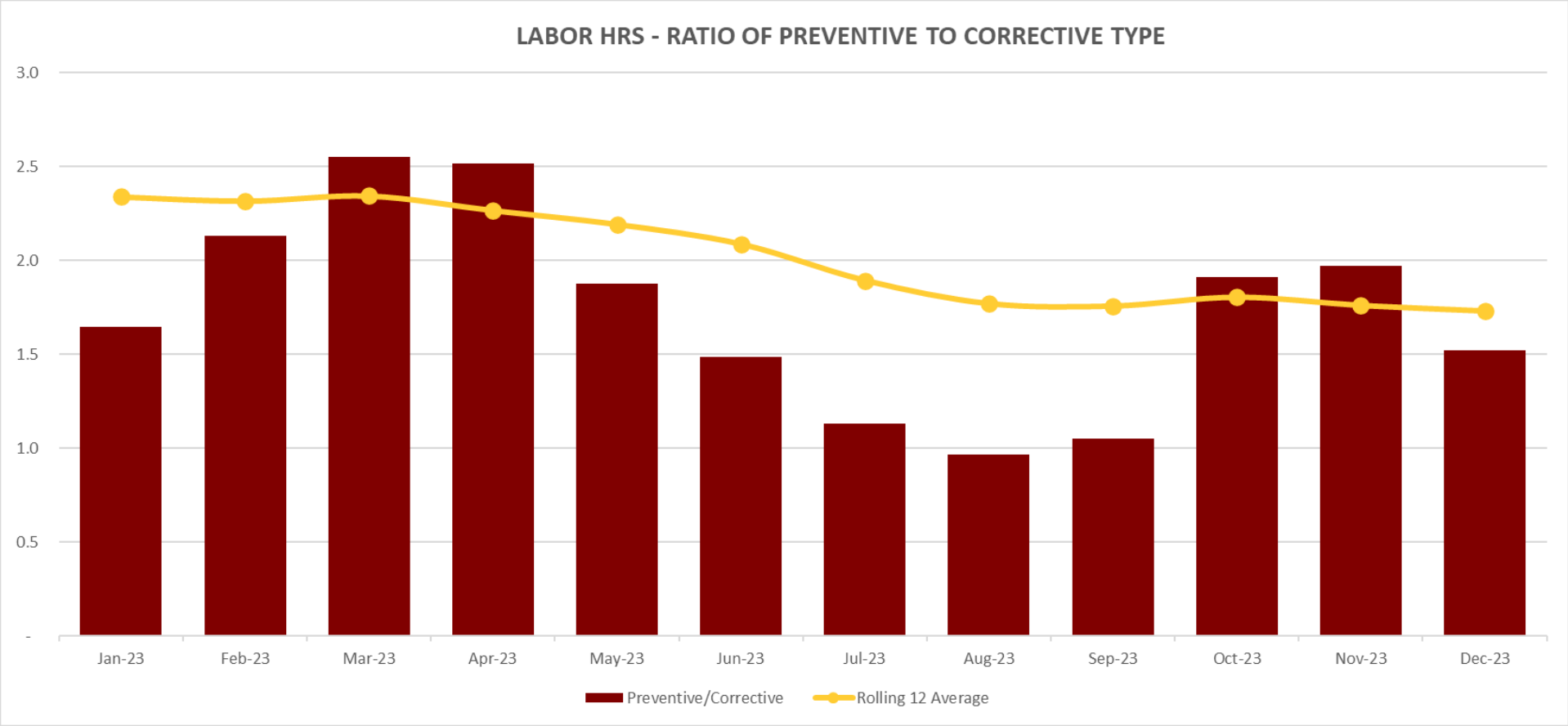
RELIABILITY

Different work happens at different times of the year. This graph shows the ebb and flow of work devoted to each maintenance type over the most recent 12-month period.



RELIABILITY

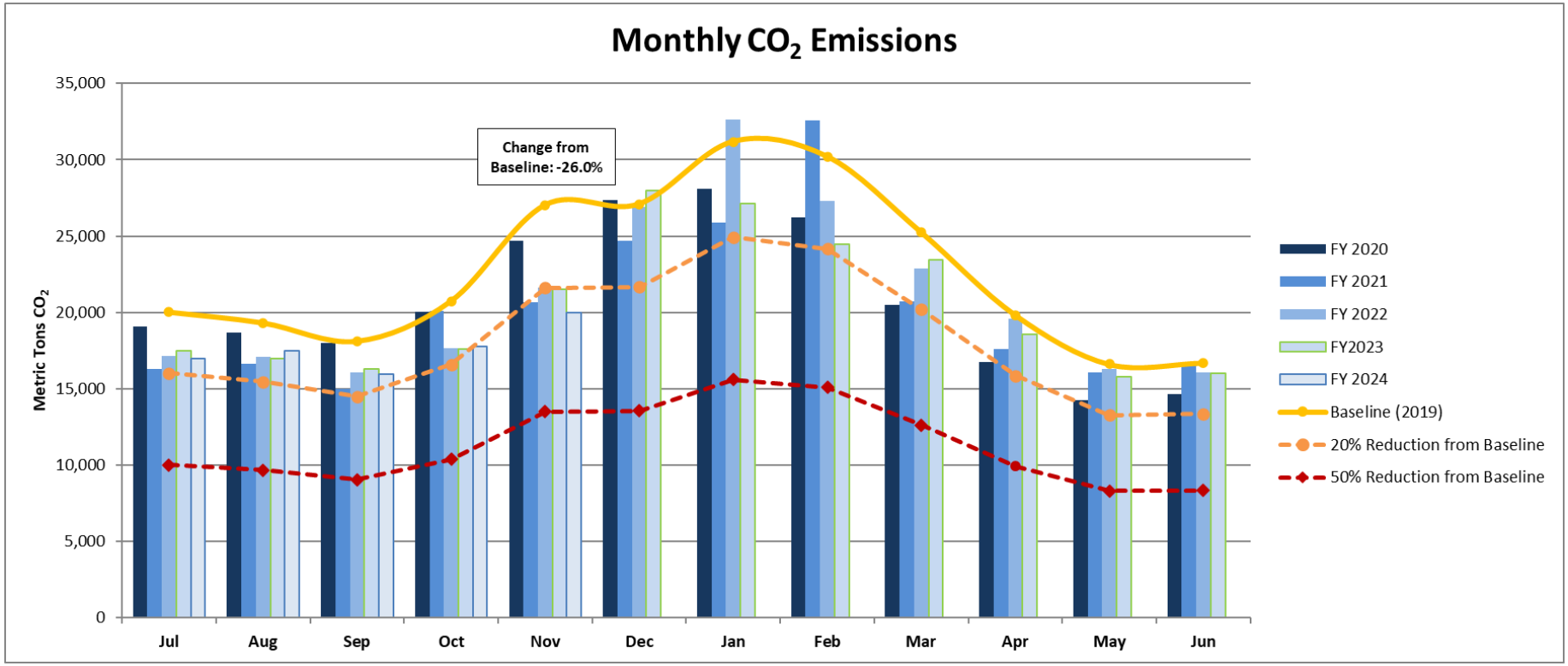
When operating and maintaining equipment, a good rule of thumb is to have a ratio of preventive labor hours to corrective maintenance hours equal to 2. This indicates that you are taking care of your equipment in a robust way, catching small problems during maintenance before they become big ones that cost more time and money to resolve.



LABOR HRS - CORRECTIVE vs PREVENTIVE

	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
Preventive/Corrective	1.6	2.1	2.5	2.5	1.9	1.5	1.1	1.0	1.0	1.9	2.0	1.5
Rolling 12 Average	2.3	2.3	2.3	2.3	2.2	2.1	1.9	1.8	1.8	1.8	1.8	1.7

SUSTAINABILITY



Monthly Emissions (Metric Tons CO_2):

FY	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Baseline	20,028	19,326	18,127	20,743	27,030	27,098	31,182	30,204	25,248	19,833	16,610	16,701
2020	19,093	18,688	18,009	20,029	24,667	27,357	28,101	26,235	20,485	16,771	14,262	14,630
2021	16,282	16,618	14,999	20,092	20,668	24,682	25,878	32,580	20,714	17,573	16,089	16,639
2022	17,170	17,077	16,062	17,635	21,622	26,930	32,618	27,321	22,880	19,566	16,286	16,091
2023	17,482	16,953	16,321	17,586	21,521	27,986	27,113	24,473	23,433	18,551	15,811	15,988
2024	17,003	17,484	15,955	17,797	20,005							

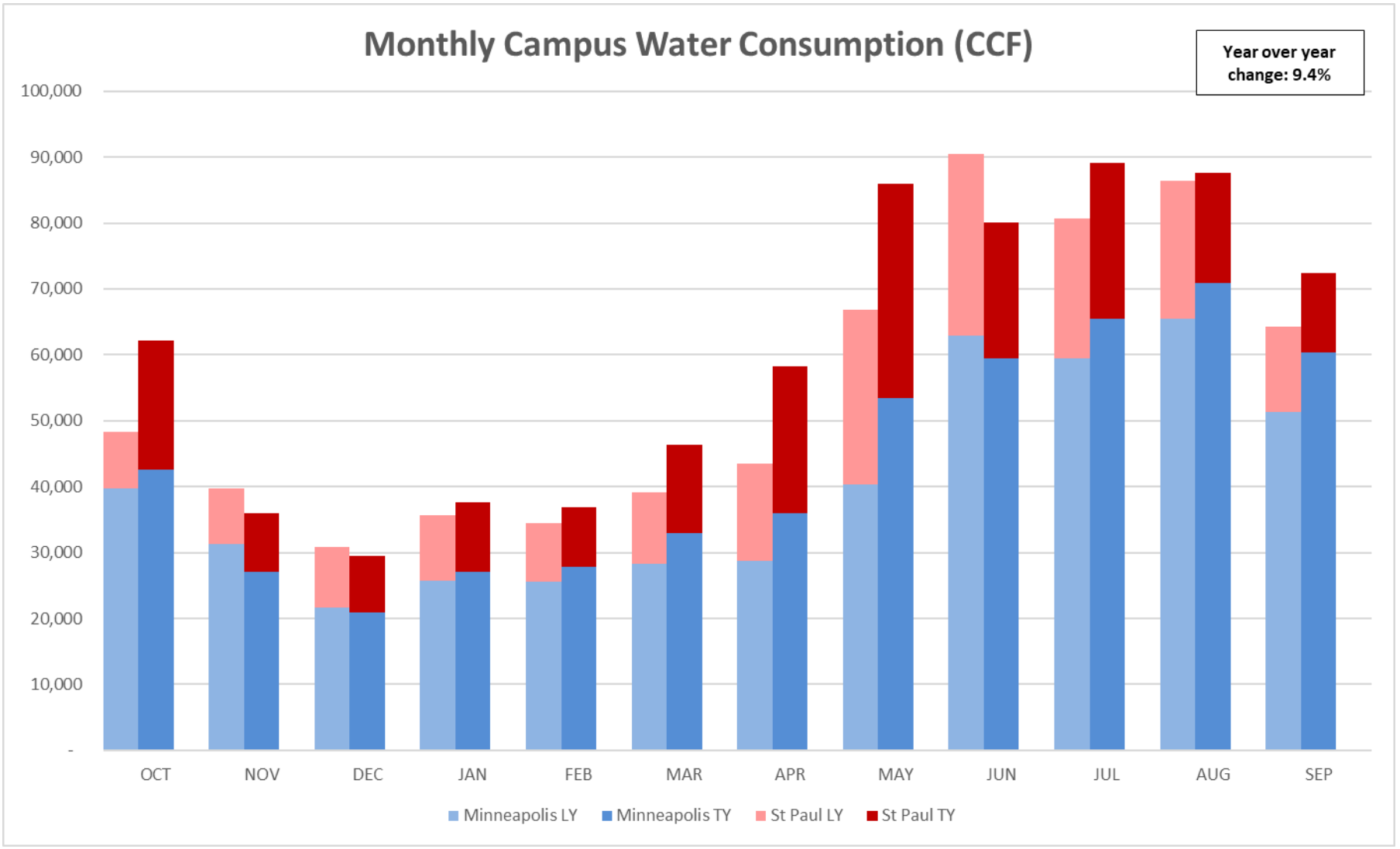
Change from Baseline:

FY	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
2020	-4.67%	-3.30%	-0.65%	-3.44%	-8.74%	0.95%	-9.88%	-13.14%	-18.86%	-15.44%	-14.14%	-12.40%
2021	-18.70%	-14.01%	-17.26%	-3.14%	-23.54%	-8.92%	-17.01%	7.87%	-17.96%	-11.39%	-3.14%	-0.37%
2022	-14.27%	-11.63%	-11.39%	-14.98%	-20.01%	-0.62%	4.61%	-9.55%	-9.38%	-1.35%	-1.95%	-3.65%
2023	-12.71%	-12.28%	-9.96%	-15.22%	-20.38%	3.27%	-13.05%	-18.97%	-7.19%	-6.46%	-4.81%	-4.26%
2024	-15.10%	-9.53%	-11.98%	-14.20%	-25.99%							

EM actively works to reduce emissions and meet University targets for carbon reduction. This chart shows monthly carbon emissions and how they have changed since the baseline year of 2019.

SUSTAINABILITY

We seek to be good stewards of our natural resources and use them wisely. This shows monthly water consumption for the Minneapolis and St Paul campuses vs the previous year.



Change from LY:

	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
Minneapolis	7.19%	-13.44%	-3.21%	5.16%	8.87%	16.16%	24.96%	32.18%	-5.49%	10.19%	8.43%	17.65%
St Paul	129.34%	4.78%	-7.37%	5.57%	1.71%	25.13%	51.90%	23.30%	-24.83%	11.06%	-20.12%	-6.57%
Total	**28.85%**	**-9.57%**	**-4.45%**	**5.28%**	**7.02%**	**18.63%**	**34.10%**	**28.67%**	**-11.38%**	**10.42%**	**1.52%**	**12.75%**

SUSTAINABILITY

This shows total campus energy usage, separated by utility type, compared to the baseline year of 2009. It is weather-normalized to remove variations due to weather fluctuations.

All Organizations / Higher Ed

University of Minnesota - Twin Cities

26,951,196 gross bldg sf

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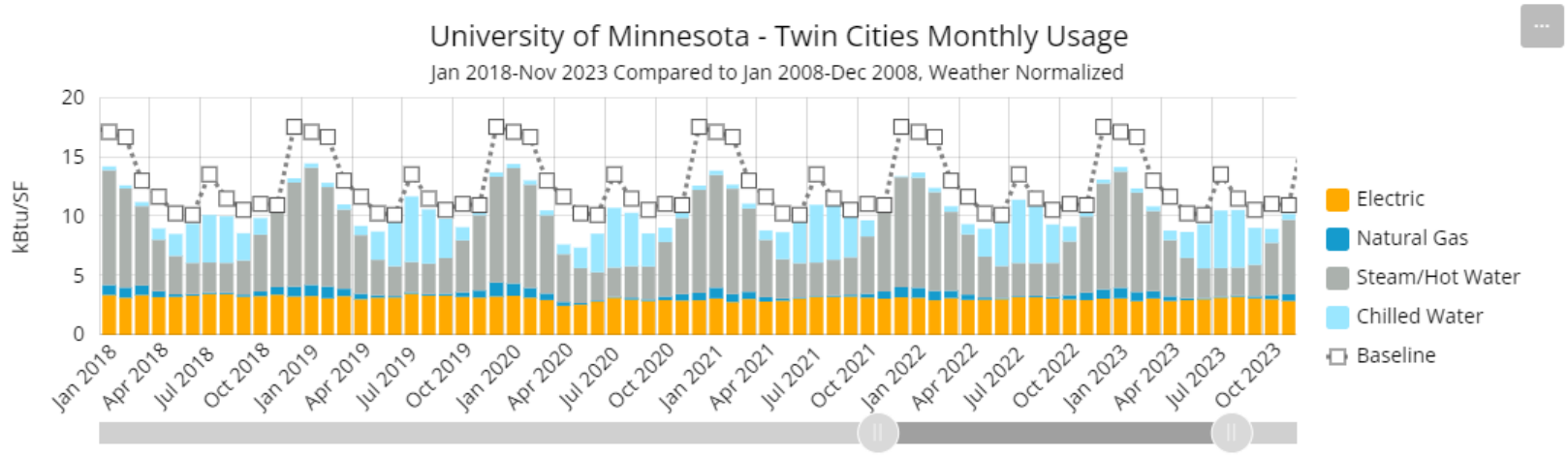
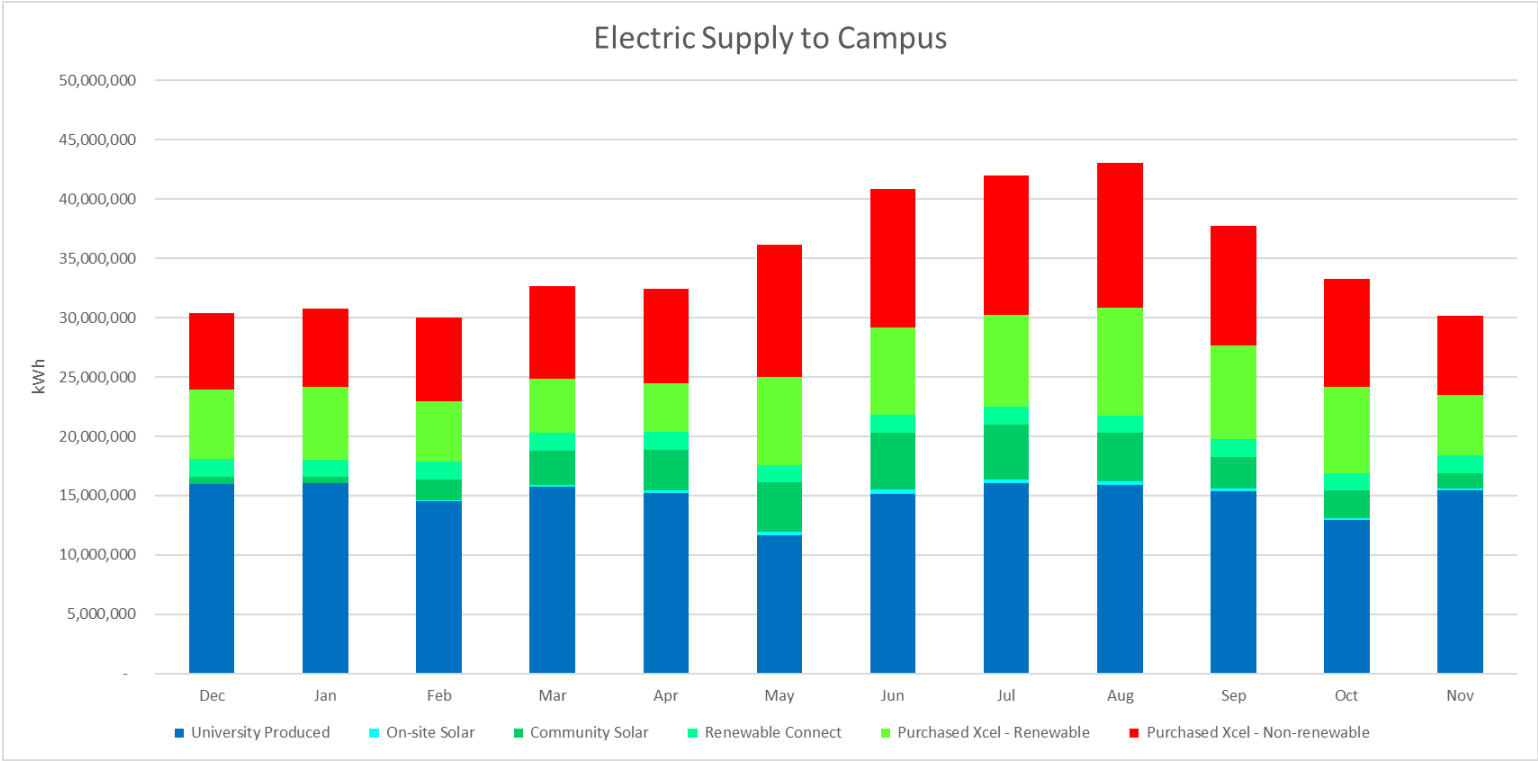


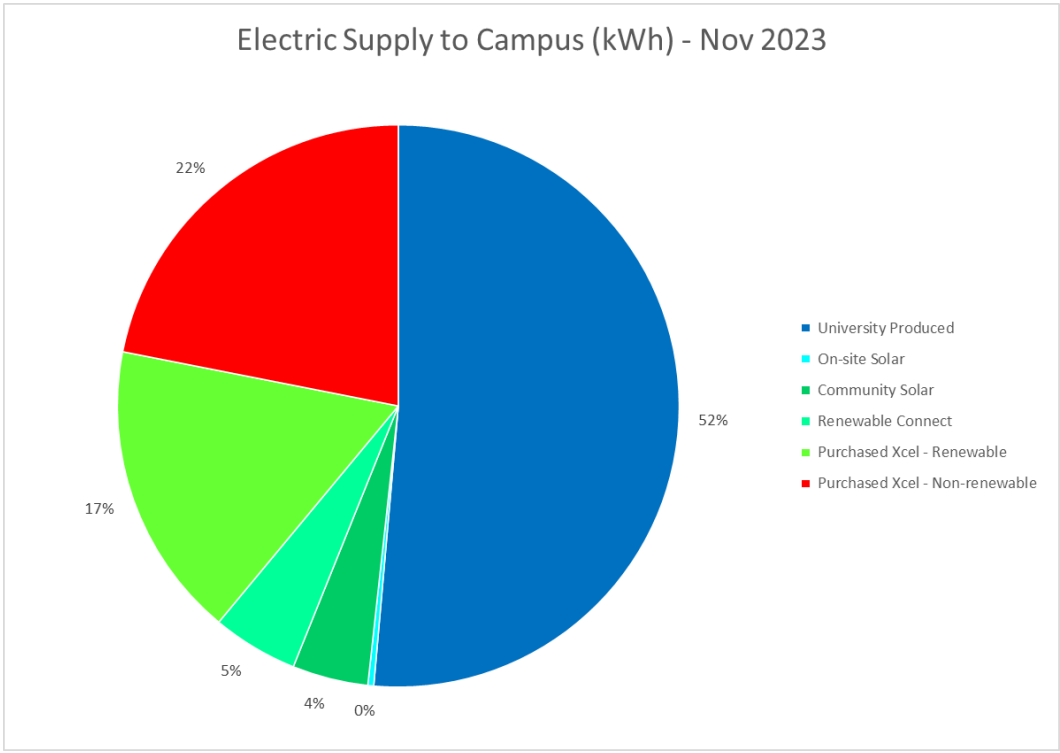
Annual Summary

Period	Days	% Complete	SF	*Actual (kBtu/SF)	*Baseline (kBtu/SF)	Change	% Change
Jan 2018-Dec 2018	365	99.2%	26,548,086	128.08	154.47	-26.38	-17.08%
Jan 2019-Dec 2019	365	99.8%	26,761,275	131.50	154.47	-22.97	-14.87%
Jan 2020-Dec 2020	366	100%	26,879,883	123.40	154.47	-31.07	-20.11%
Jan 2021-Dec 2021	365	100%	26,958,123	131.05	154.47	-23.42	-15.16%
Jan 2022-Dec 2022	365	100%	26,951,196	129.97	154.47	-24.50	-15.86%
Jan 2023-Nov 2023	334	99.8%	26,951,196	113.77	136.87	-23.09	-16.87%

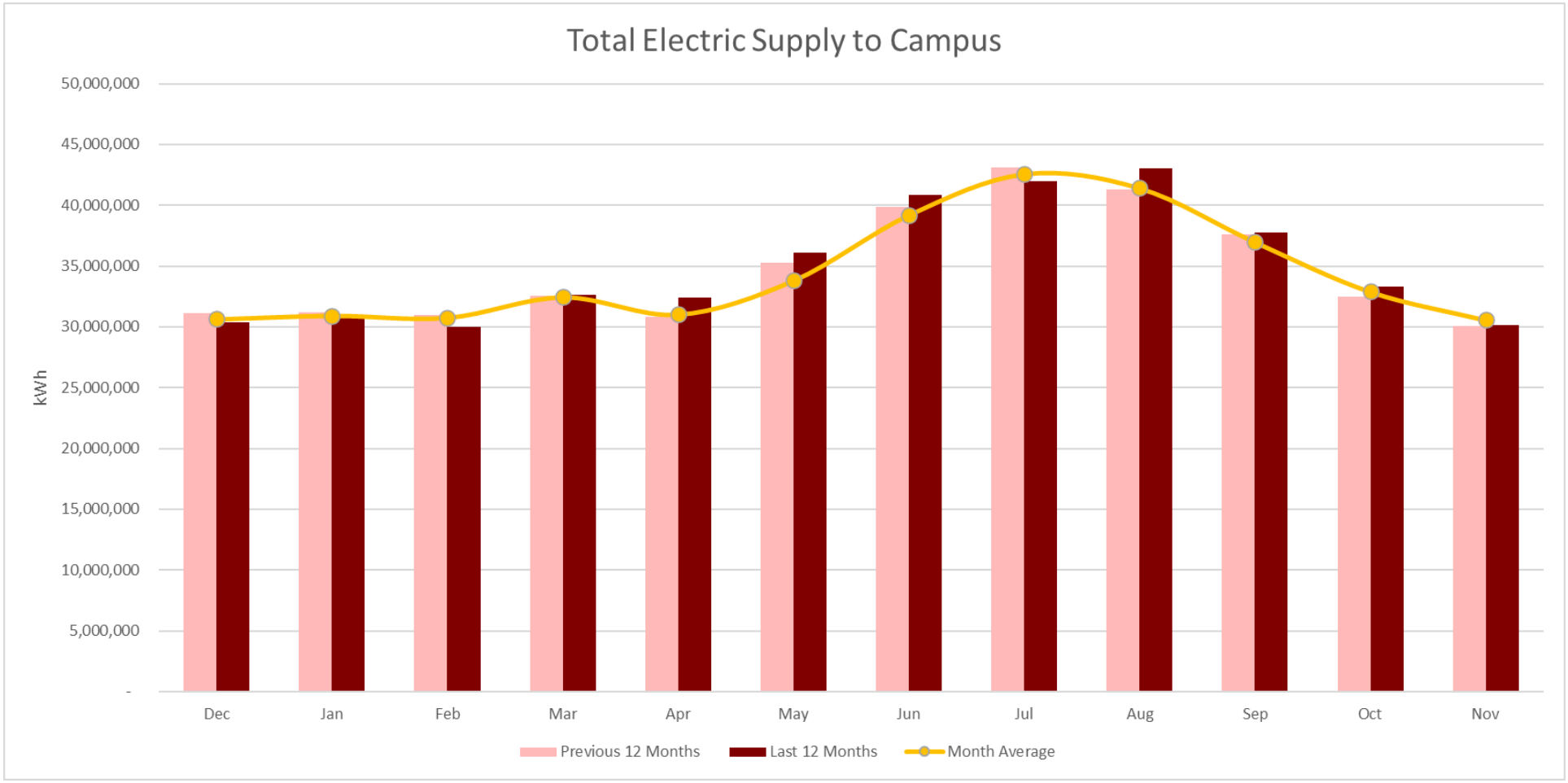
SUSTAINABILITY



The University continually explores new ways to provide energy using sustainable methods. These charts show monthly electricity supplied to campus, broken out by its manner of production.



COST EFFECTIVENESS



The cheapest and most sustainable energy is that which isn't used! This chart shows the total amount of electricity supplied to campus over the past 12 months, compared to the previous year.

COST EFFECTIVENESS

Chilled Water Production Utilities by Fiscal Year

	FY18	FY19	FY20	FY21	FY22	FY23	FY24 @5 of 12
CHW PRODUCTION (TON-HRS)	**53,674,555**	**50,462,692**	**53,449,008**	**60,759,336**	**62,643,652**	**63,124,518**	**38,504,787**
ELECTRIC (KWH)	**32,227,851**	**30,366,204**	**29,371,048**	**32,606,006**	**36,581,795**	**36,126,272**	**22,381,625**
ELECTRIC (kW/Ton)	0.600	0.602	0.550	0.537	0.584	0.572	0.581
STEAM (KLB)	**88,632**	**67,873**	**78,530**	**93,967**	**85,629**	**85,503**	**72,038,996**
STEAM (kLb/Ton)	0.0017	0.0013	0.0015	0.0015	0.0014	0.0014	1.8709
WATER (CCF)	**111,443**	**113,830**	**103,774**	**95,975**	**128,293**	**122,790**	**107,919**
WATER (CCF/Ton)	0.00208	0.00226	0.00194	0.00158	0.00205	0.00195	0.00280
CHW CONSUMPTION (TON-HRS)	**47,050,240**	**45,653,168**	**46,478,654**	**49,132,181**	**55,760,246**	**56,130,182**	**34,390,016**
% Billed Through	**87.7%**	**90.5%**	**87.0%**	**80.9%**	**89.0%**	**88.9%**	**89.3%**

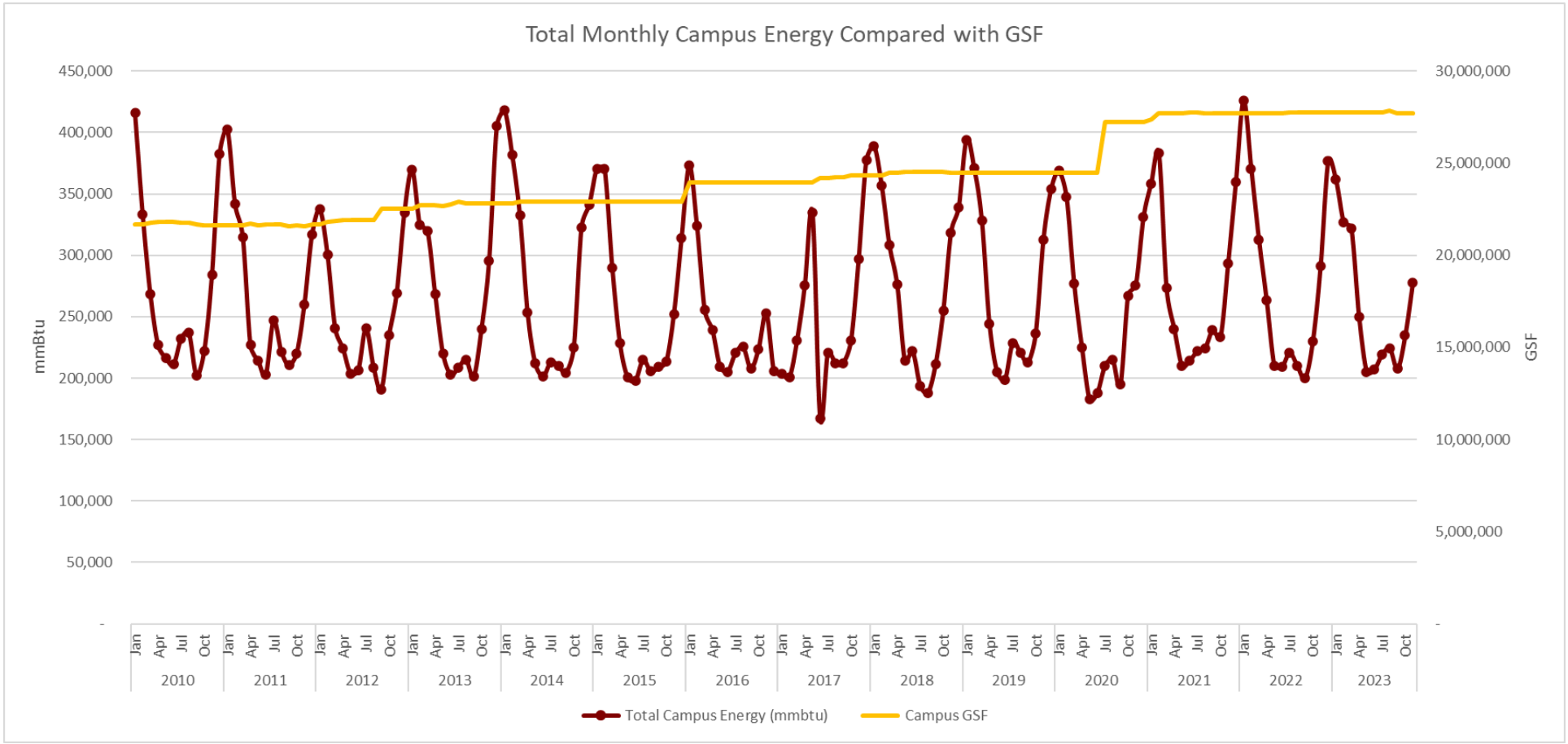
Twin Cities Utility Plant Production by Fiscal Year

	FY18	FY19	FY20	FY21	FY22	FY23	FY24 @5 of 12
FUEL (mmBtu)	3,423,722	3,412,151	3,125,091	3,401,086	3,525,578	3,409,177	1,170,360
STEAM OUTPUT (kLbs)	1,852,760	1,844,541	1,785,216	1,837,425	1,903,993	1,781,511	569,035
METERED CONSUMPTION (kLbs)	1,708,061	1,723,162	1,626,020	1,736,174	1,806,859	1,739,295	519,213
% BILLED THROUGH	**92.2%**	**93.4%**	**91.1%**	**94.5%**	**94.9%**	**97.6%**	**91.2%**
COGEN GROSS (mWh)	172,417	165,435	135,566	173,988	180,902	184,007	75,765

EM produces all of the chilled water for cooling and steam for heating the campus, as well as a sizeable portion of the electricity used. These tables show the utilities used to do this, as well as measures of the efficiency of the systems.

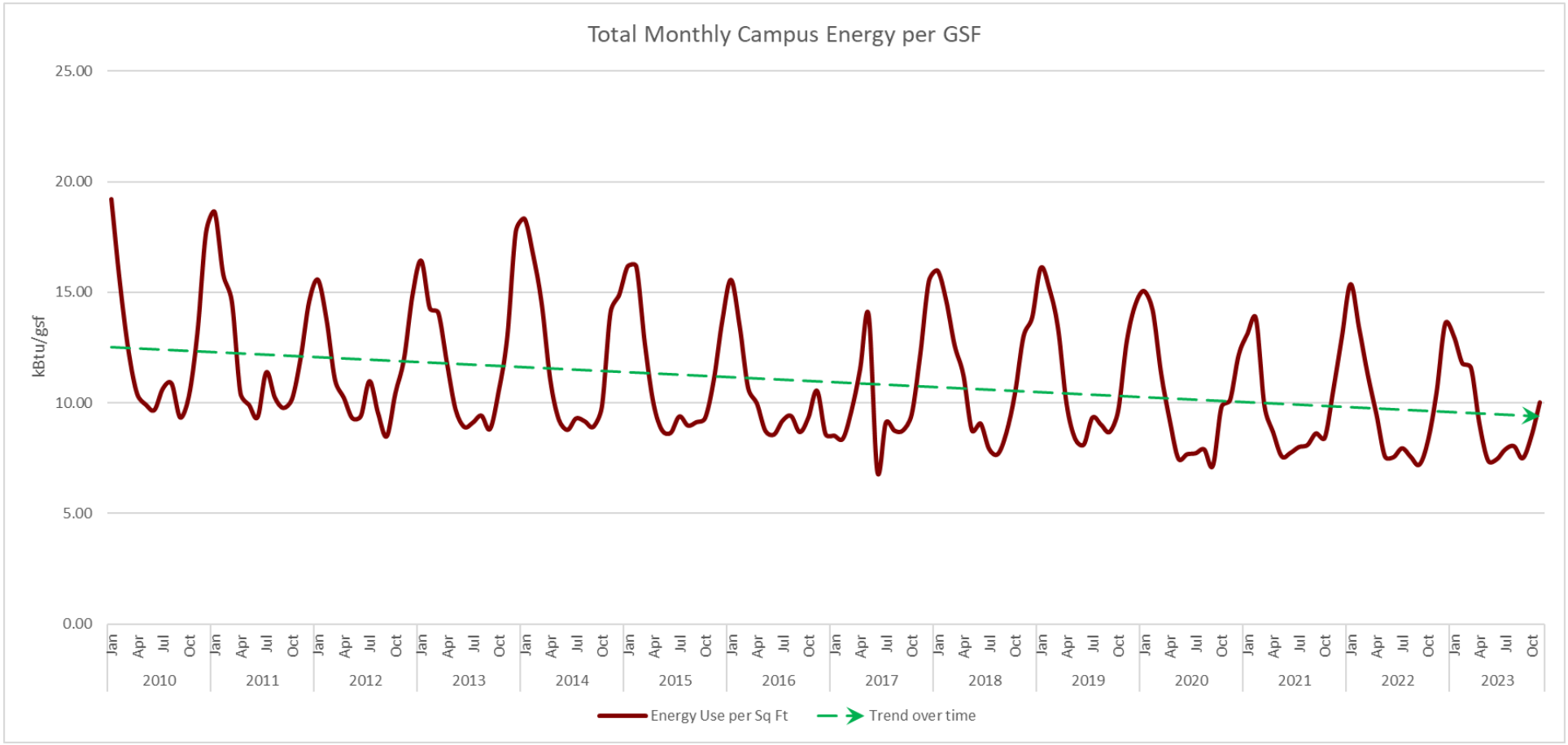
COST EFFECTIVENESS

Energy Management's efforts to conserve energy are complicated by the continued growth of the University. With new buildings being erected and old ones experiencing extensive renovation, it is useful to see the trend in energy usage in concert with the increasing square footage of campus.



COST EFFECTIVENESS

This similar chart shows the ratio of campus energy usage to square footage. It shows clearly that, even though the campus is growing, Energy Management continues to find ways to reduce energy consumption.



COST EFFECTIVENESS

Rolling 12 Month Energy Use Intensity (EUI) - Top and Bottom Performing Outliers per District

District	Bldg #	Building	GSF	Actual EUI (kbtu/ft2/yr)	Expected EUI (kbtu/ft2/yr)	Actual as a Percent of Expected	Code EUI (kbtu/ft2/yr)	Actual as a Percent of Code
East Bank	191	MAST Laboratory	9,537	115	369	31%	63	184%
	125	Shepherd Laboratories	98,540	210	438	48%	118	178%
	046	Morrill Hall	80,353	41	85	48%	67	62%
	197	Wallin Medical Biosciences	119,872	367	304	121%	230	159%
	149	Microbiology Research Facility	89,936	271	203	133%	886	31%
	049	Tate Laboratory Of Physics	260,608	168	116	144%	196	86%
Health Sciences	115	Children's Rehabilitation Center	70,851	94	196	48%	105	89%
	193	717 Delaware St SE	201,333	134	231	58%	159	84%
	143	Dwan Variety / Masonic Cancer Research Centers	190,038	255	403	63%	238	107%
	032	Jackson Hall	150,394	279	291	96%	214	131%
	147	Weaver-Densford Hall	195,438	222	229	97%	186	119%
	144	Phillips-Wangensteen Building	580,141	272	237	115%	152	179%
HRA	169	Recreation and Wellness Center	307,048	45	118	38%	122	37%
	181	Ridder Arena/Baseline Tennis	367,813	43	106	40%	98	44%
	067	Field House	89,186	30	73	41%	72	42%
	182	McNamara	175,611	81	69	117%	59	136%
	098	University Stores South	55,183	110	85	130%	215	51%
	126	Keeler Apartments	98,900	26	18	147%	95	27%
St Paul	463	Poultry Teaching and Research	27,648	76	332	23%	212	36%
	415	Plant Growth Facilities-West (415)	13,092	204	614	33%	172	118%
	432	Plant Growth Facilities-West (432)	9,244	126	330	38%	566	22%
	392	Sheep Research	8,165	40	26	154%	11	361%
	455	Swine Research Facility	10,559	348	85	408%	31	1,120%
	409	Veterinary Isolation Facility	31,843	380	63	601%	270	141%
West Bank	207	Willey Hall	120,464	42	132	32%	116	36%
	209	Rarig Center	173,139	82	193	43%	92	90%
	241	Regis Center for Art - East	102,035	118	260	45%	242	49%
	058	St Anthony Falls Laboratory	65,342	168	160	105%	295	57%
	201	Heller Hall	103,926	81	74	109%	84	96%
	135	Urban Research & Outreach Center	22,528	72	28	259%	100	72%

Note 1 - Actual based on DEC 22 - NOV 23 meter readings

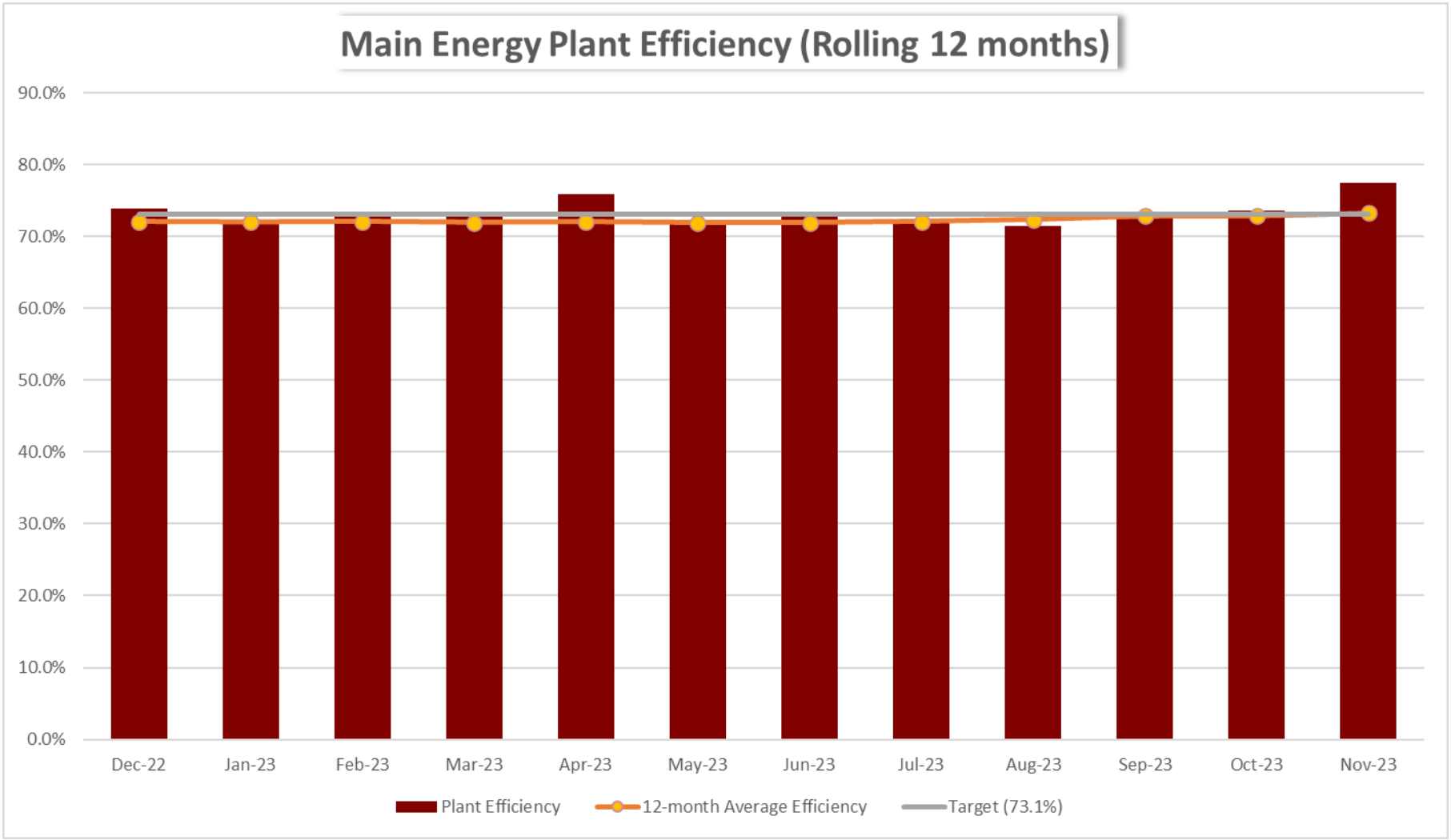
Note 2 - Expected based on JAN 09 - DEC 09 weather and energy data

Note 3 - Code based on current State Energy Code

<95%	<95%
96-110%	96-110%
>110%	>110%

Each building has challenges to conserving energy and using our resources effectively. This table shows how much energy an individual building uses, how much we expect it to use based on the type of building it is, and how much it should use, were it built to current energy standards. We showcase six buildings per District, three that perform well, given what we expect, and three that do not.

COST EFFECTIVENESS

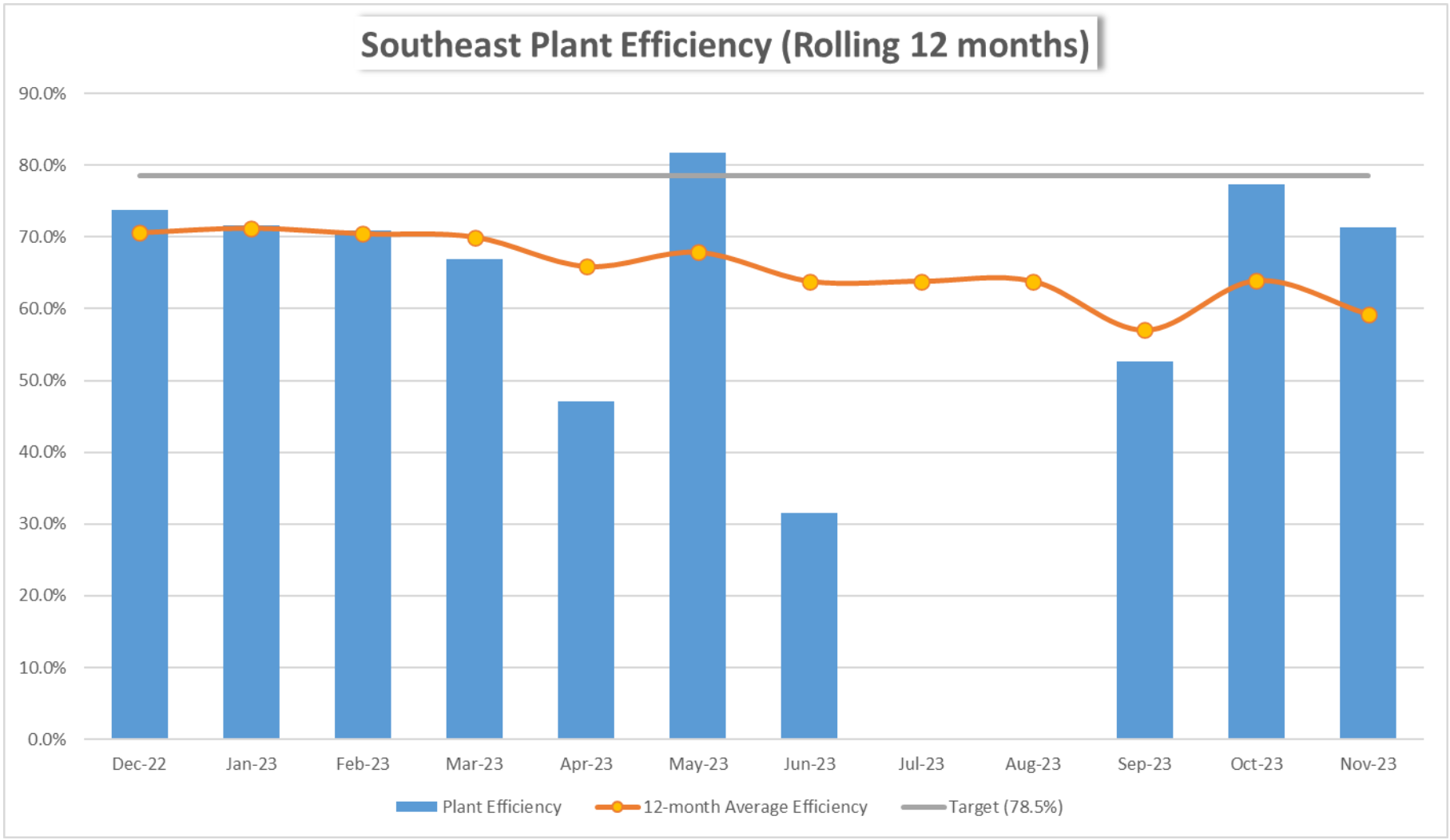


MAIN ENERGY PLANT EFFICIENCY

	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23
Plant Efficiency	73.8%	72.4%	72.9%	72.9%	75.8%	71.7%	72.7%	72.2%	71.5%	74.0%	73.6%	77.4%
Rolling 12 Average	72.0%	72.0%	72.1%	71.9%	72.0%	71.9%	71.9%	72.1%	72.4%	73.0%	72.9%	73.3%

It is important to run our utility plants as efficiently as possible. This chart measures how much energy on a monthly basis was brought into the Main Energy Plant, and how much flowed out, expressed as a percentage.

COST EFFECTIVENESS

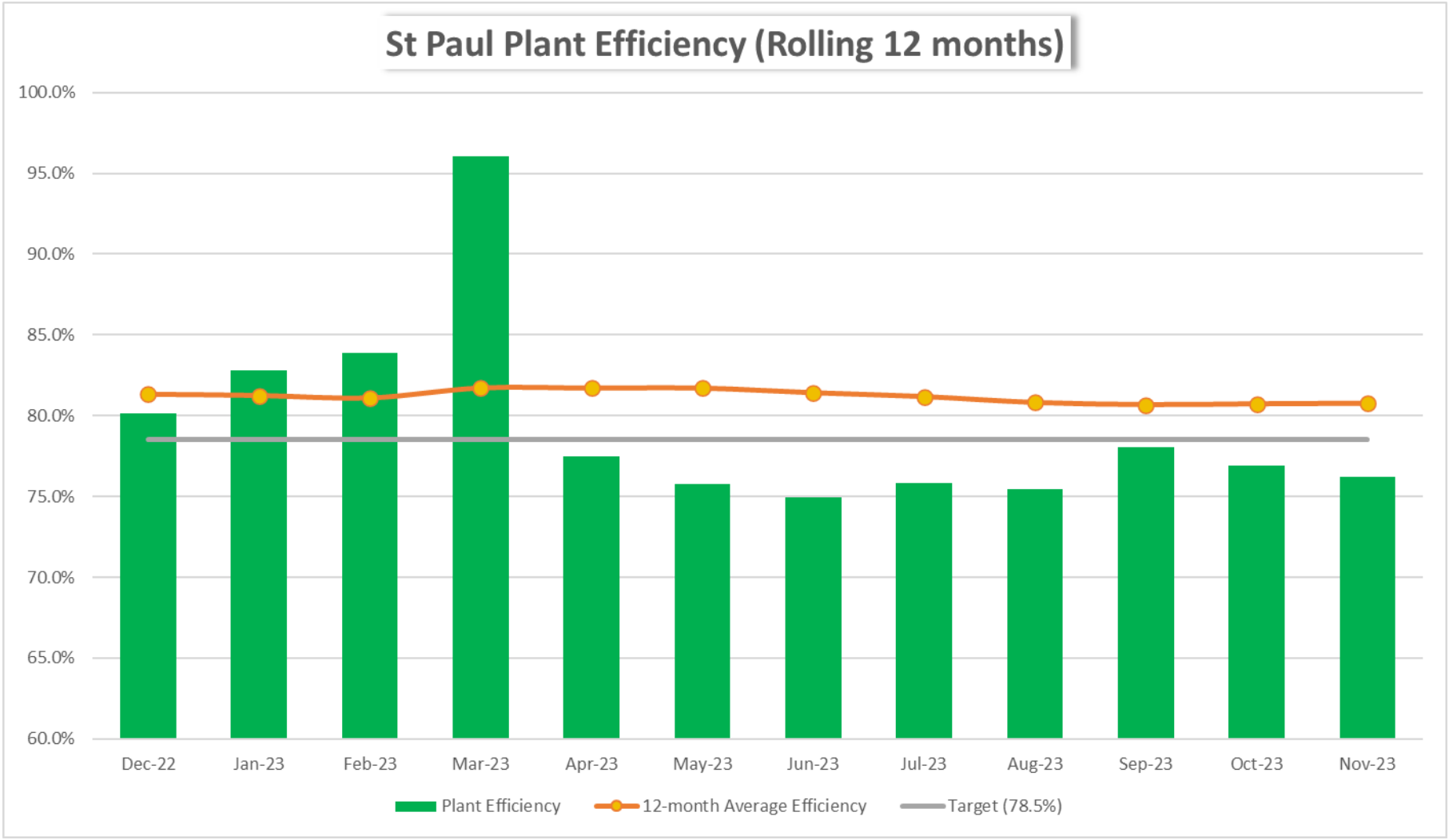


SOUTHEAST PLANT EFFICIENCY

	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23
Plant Efficiency	73.7%	71.6%	71.0%	66.8%	47.1%	81.7%	31.6%	0.0%	0.0%	52.7%	77.3%	71.4%
Rolling 12 Average	70.6%	71.2%	70.4%	70.0%	65.9%	67.8%	63.8%	63.8%	63.8%	57.0%	63.6%	59.2%

It is important to run our utility plants as efficiently as possible. This chart measures how much energy on a monthly basis was brought into the Southeast Steam Plant, and how much flowed out, expressed as a percentage.

COST EFFECTIVENESS

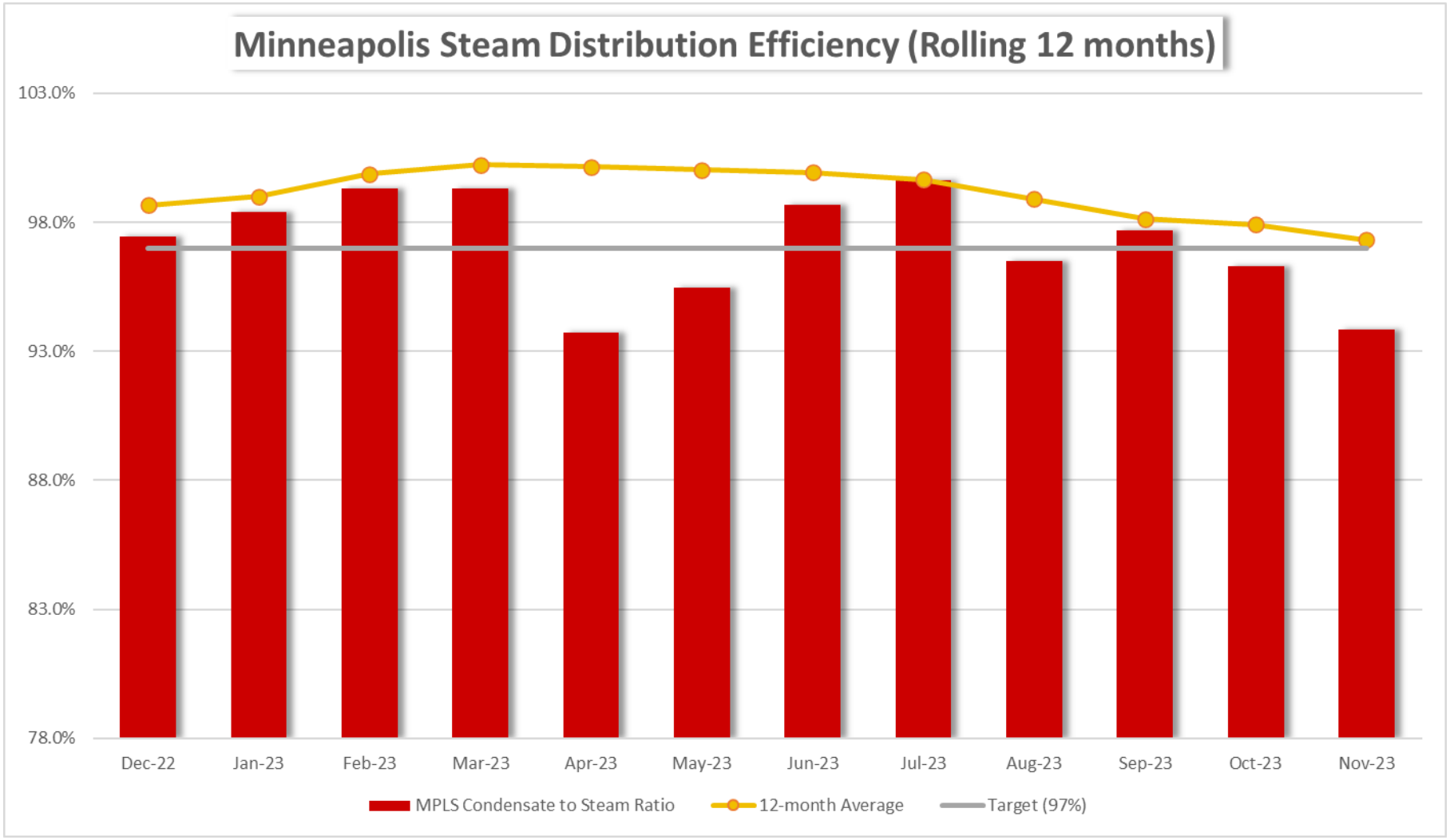


ST PAUL PLANT EFFICIENCY

	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23
Plant Efficiency	80.1%	82.8%	83.9%	96.1%	77.5%	75.8%	74.9%	75.9%	75.4%	78.0%	76.9%	76.2%
Rolling 12 Average	81.3%	81.2%	81.1%	81.7%	81.7%	81.7%	81.4%	81.2%	80.8%	80.7%	80.7%	80.8%

It is important to run our utility plants as efficiently as possible. This chart measures how much energy on a monthly basis was brought into the St Paul Steam Plant, and how much flowed out, expressed as a percentage.

COST EFFECTIVENESS

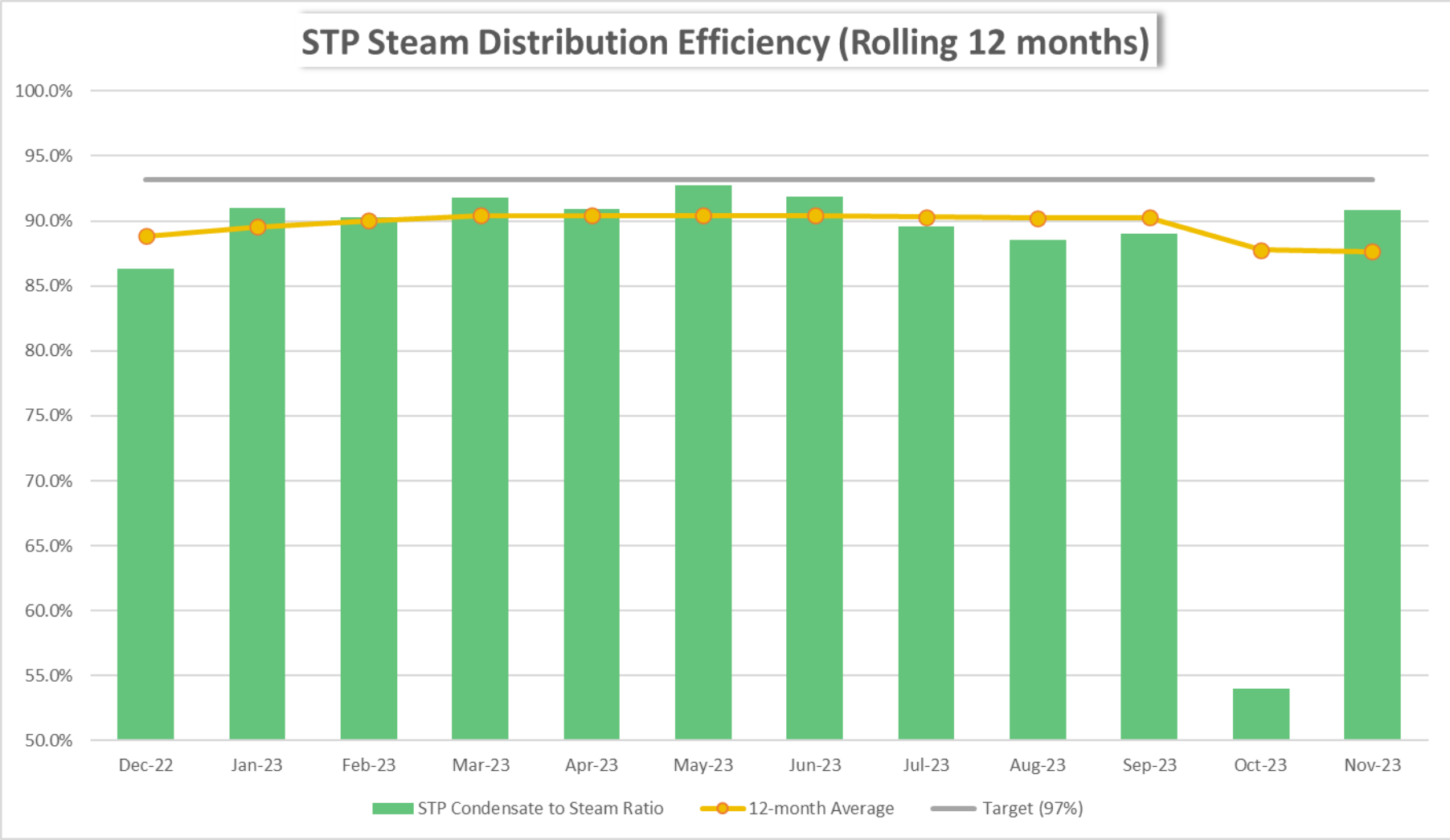


MINNEAPOLIS STEAM DISTRIBUTION EFFICIENCY

	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23
COND to STM Ratio	97.5%	98.4%	99.3%	99.3%	93.7%	95.5%	98.7%	99.6%	96.5%	97.7%	96.3%	93.8%
Rolling 12 Average	98.7%	99.0%	99.9%	100.2%	100.2%	100.0%	99.9%	99.7%	98.9%	98.1%	97.9%	97.3%

It is important to run our distribution systems as efficiently as possible. This chart measures how much condensate was returned vs how much steam left the Minneapolis energy plants.

COST EFFECTIVENESS



ST PAUL STEAM DISTRIBUTION EFFICIENCY

	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23
COND to STM Ratio	86.3%	91.0%	90.3%	91.8%	90.9%	92.8%	91.9%	89.6%	88.5%	89.0%	54.0%	90.8%
Rolling 12 Average	88.8%	89.6%	90.0%	90.4%	90.4%	90.4%	90.4%	90.3%	90.2%	90.3%	87.8%	87.7%

It is important to run our distribution systems as efficiently as possible. This chart measures how much condensate was returned vs how much steam left the St Paul energy plant.