



Leveraging EnergyCAP for full lifecycle energy project management: from benchmarking to ROI



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IMEG

Agenda



1. Goals
2. Benchmarking multiple ways
3. Project selection
4. Initial results
5. Current results
6. Questions

Introduction



University of Nebraska Medical Center

- Researcher
- Research Building Owner's Rep; "translator"
- Sustainability Manager
 - Waste, Water, Transportation, Engagement
 - Energy & Emissions
 - Reduced Campus Energy by 25% in 5 years
 - Added 1 Million square feet during that time

Optimized Systems > IMEG

- Focus on energy/emission reductions, w/o compromising occupant comfort or safety
- Controls, HVAC equipment
- Not an ESCO
- Projects across the country
- Use EnergyCAP to track projects, make decisions, prove ROI

The Client

The University of Nebraska Medical Center

- Nebraska's premier academic health sciences institution, dedicated to education, research, patient care, and community health improvement. It trains more healthcare professionals than any other institution in the state.

Nebraska Medicine

- The clinical partner of UNMC and one of the Midwest's leading academic health systems, providing advanced patient care through hospitals, specialty centers, and outpatient clinics.

Together

- Nebraska's largest academic health sciences campus
- Home to world-class education, research, and patient care programs
- Nationally recognized centers for cancer care, transplantation, infectious diseases, and trauma care
 - Ebola, COVID-19 patients
- Main Omaha campus plus clinics, support spaces in Omaha and other towns
- Total portfolio has 126 buildings, plus additional sites

The Client - Sustainability

Combined, Stated Goals

- **Net zero building emissions**
- Net zero water
- Net zero waste
- 35% of employee commutes use active transportation
- Maintain baseline campus density at 73,000 square feet per acre
 - While maintaining quality green space
- Sustainability engagement score of 85

The Building

Medical Services Building

- Older building, 1977
 - 102,670 square feet
 - Mixed use, primarily offices, teaching auditorium
 - Chilled water, steam, electricity
 - EUI over 200
- Connected to multiple other building
 - Open and through hallways
 - Patient care spaces
 - Pressurized/constant airflow
 - Always simultaneously heating and cooling



Benchmarking

- Benchmarking
 - Benchmarked in EnergyCAP in multiple categories
 - State owned, Higher Education
 - Comingled with other University of Nebraska spaces
 - Hard to compare, so much mixed-use space
- Connected to Energy Star Portfolio Manager through EnergyCAP
 - EPA median site EUI for Medical Office Building = 51.2 kBtu/sf
 - MSB site EUI = 200.638 kBtu/sf

Benchmarking

- Compared to other buildings on campus using Building Use/Area Widget (bar rank) on dashboard
- Building #19 on campus for EUI, but...
- All building ranked ahead are inpatient care, operating rooms, research
- Median EUI
- Medical Office Building = 51.2 kBtu/sf
- Inpatient Hospital = 234.3 kBtu/sf
- Wet Bench Research = 200-400 kBtu/sf
- High-Intensity Research = 300-500 kBtu/sf
- MSB = 200.6 kBtu/sf

BCC - Fred & Pamela Buffet Cancer Center	275.918 Kbtu/ft ²
CKC - Clarkson College	259.545 Kbtu/ft ²
LTC - Lied Transplant Ctr -Unit 7	259.067 Kbtu/ft ²
ESH - Eppley Science Hall	241.589 Kbtu/ft ²
CDS - Clarkson Doctors South	240.611 Kbtu/ft ²
UT4 - University Tower 4	237.608 Kbtu/ft ²
DOC - Durham Outpatient Center Center-Unit 6	236.046 Kbtu/ft ²
NOR - Nebraska Organ Recovery	229.678 Kbtu/ft ²
CFM - Clarkson Family Medicine	215.245 Kbtu/ft ²
UT3 - University Tower 3	213.687 Kbtu/ft ²

The Project

- Needed updating across the board
 - Fixtures, amenities, etc.
 - Facilities made the argument to do more, as part of same project
- Replaced equipment
 - Air handlers, VAV boxes, piping, heat exchangers, exhaust system for underground parking
 - LED lighting retrofit
 - Updated controls
- Collaborated to:
 - Make process more efficient
 - Smoother project execution
 - Energy efficiency began immediately

The Project

Optimization

- Automation Design
 - Involved at beginning of project
 - Reduced installation costs
- Wrote new sequence of operations
 - Identified inefficiencies
 - LED lighting retrofit
 - Updated controls

Integration

- All components to single front end
- Integrated BMS to room scheduling software
 - Match occupancy*
 - Increase efficiencies

First Year Results

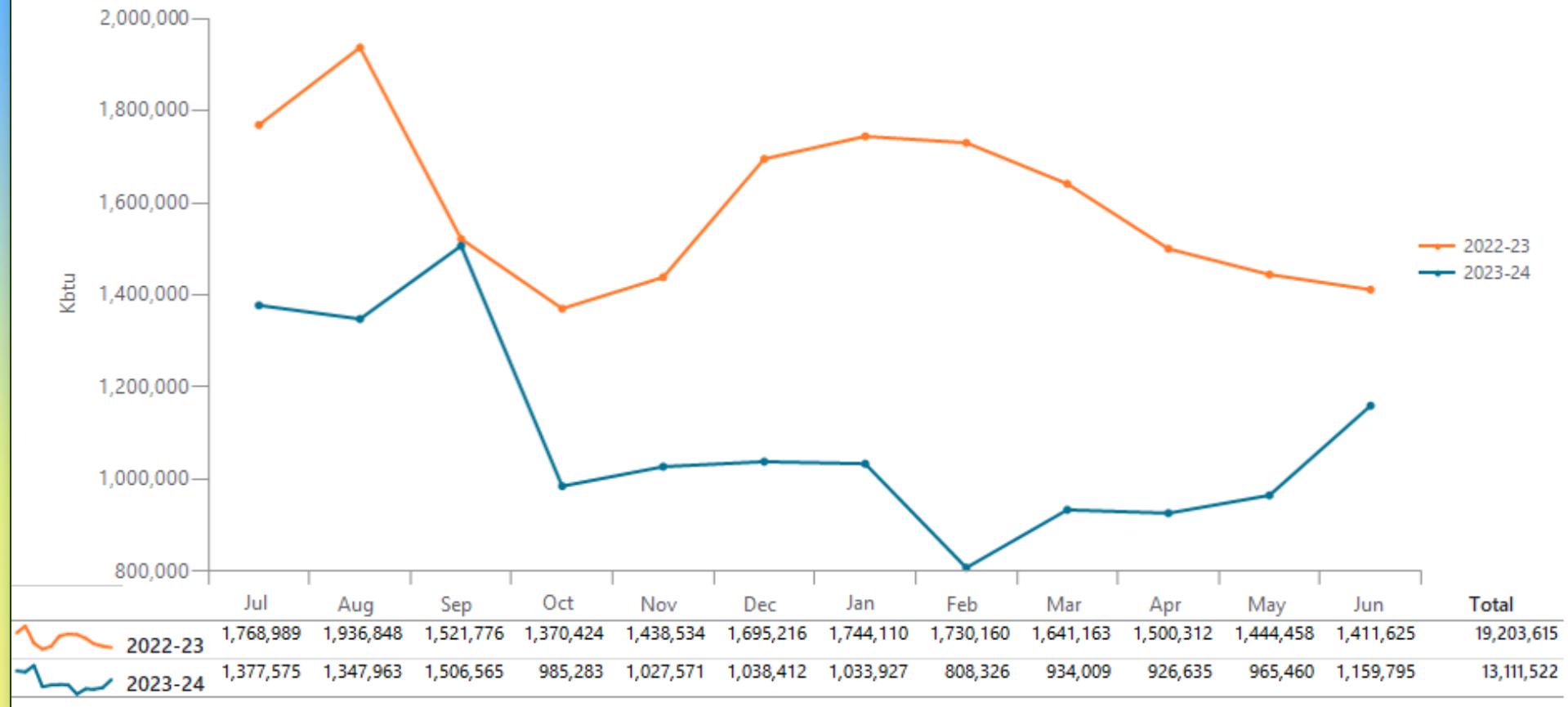
Overall energy: **Reduced by 6.1 million kBtus (31.72%)**

- Chilled water consumption: **Reduced by 35%**
- Steam consumption: **Reduced by 48.5%**
- Electricity consumption: **Reduced by 20%**
- Cost “Savings” **\$80,600**
- Cost avoidance **\$107,000**

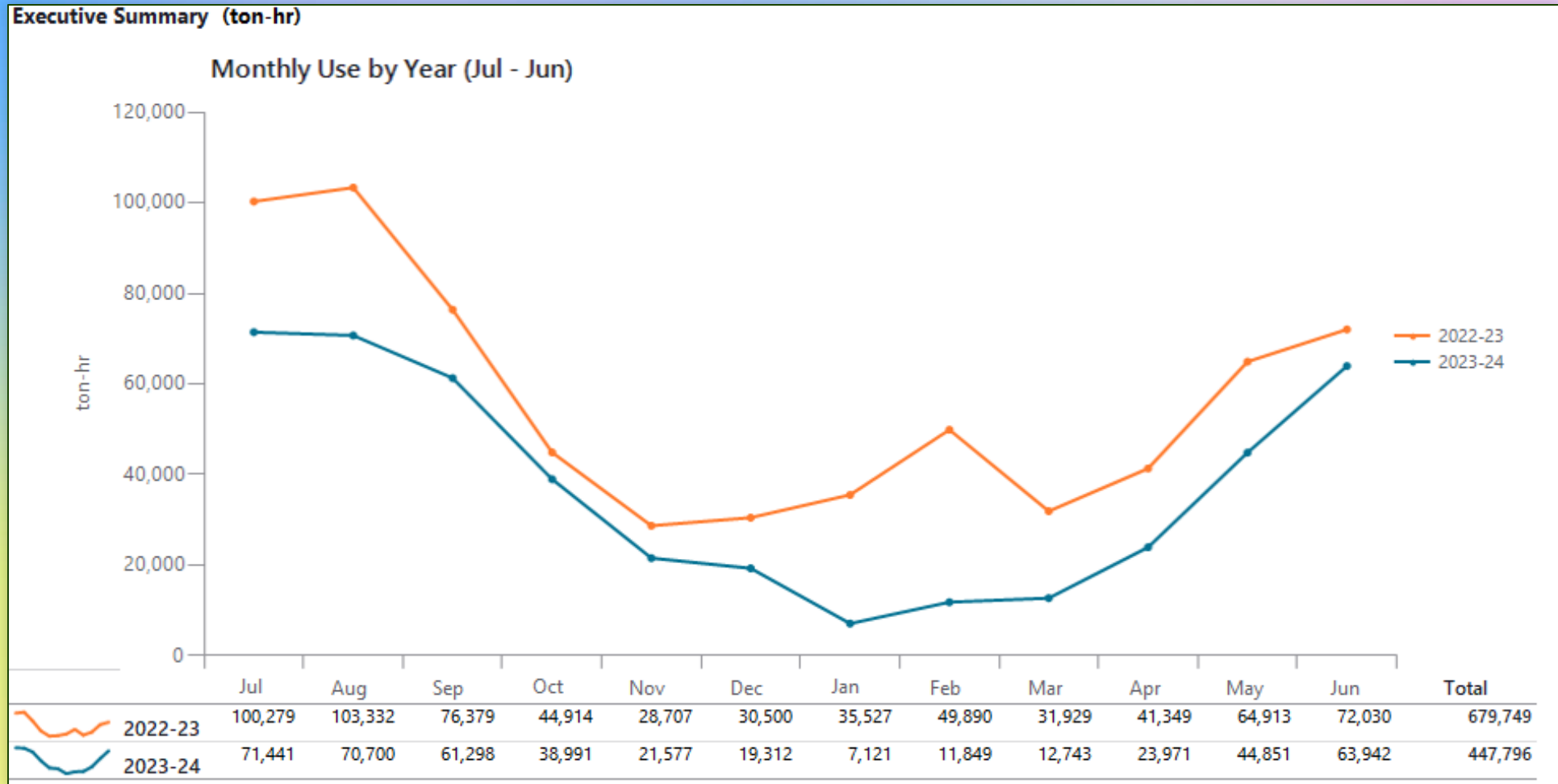
First Year Results

Executive Summary (Kbtu)

Monthly Use by Year (Jul - Jun)



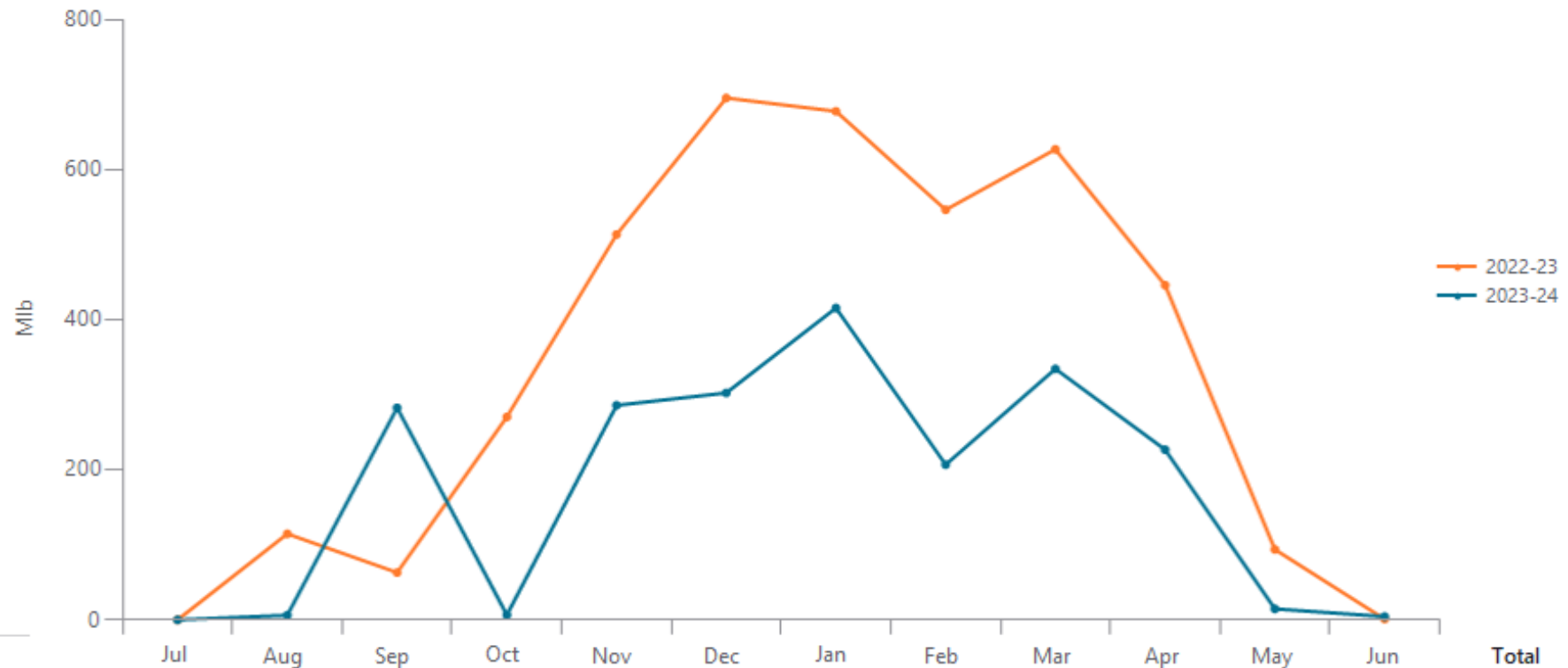
First Year Results



First Year Results

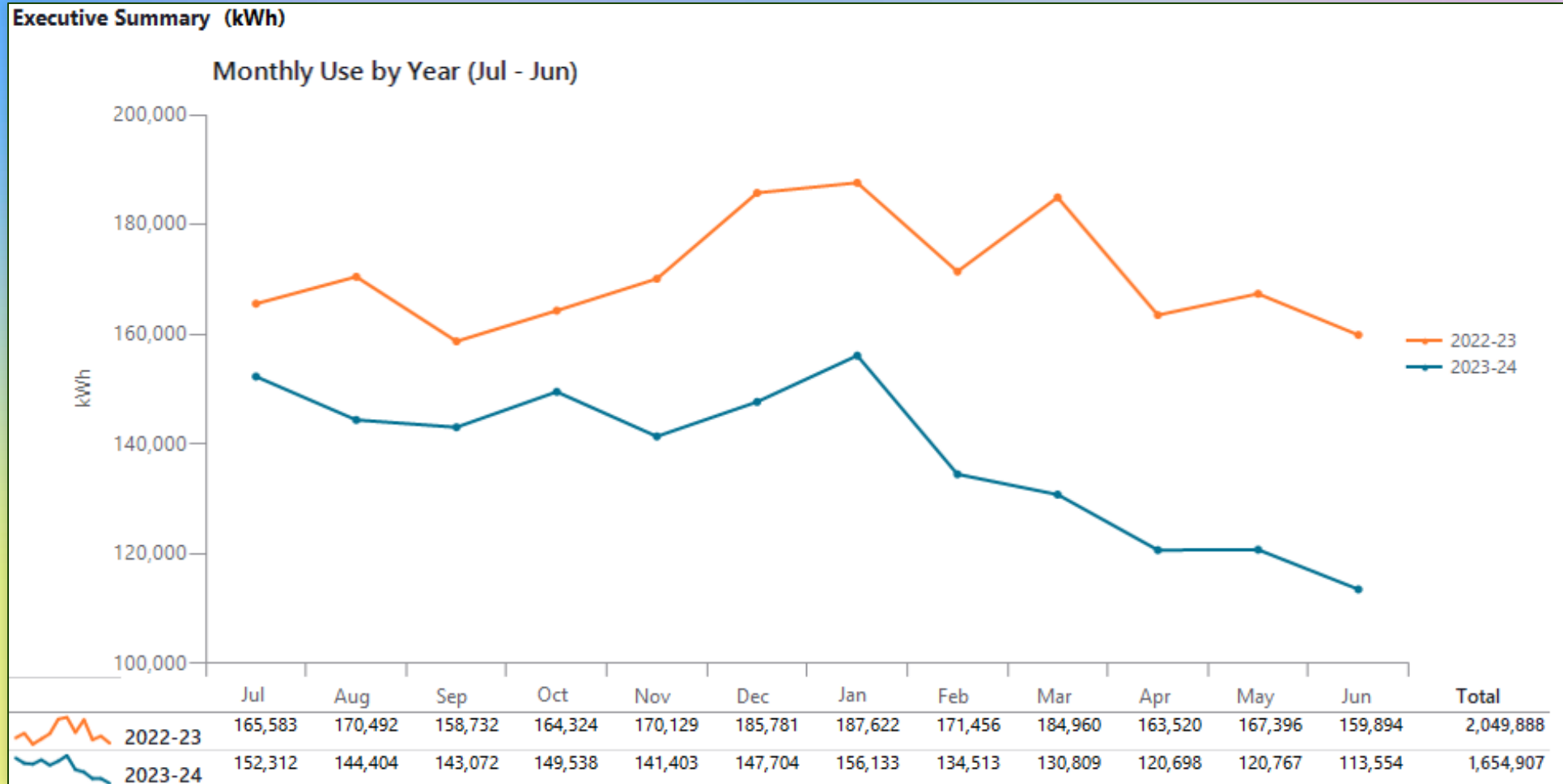
Executive Summary (Mlb)

Monthly Use by Year (Jul - Jun)



	2022-23	1	115	64	271	514	695	678	546	627	446	94	2	4,052
	2023-24	1	7	283	7	286	303	416	207	335	227	15	5	2,091

First Year Results



Continued Results

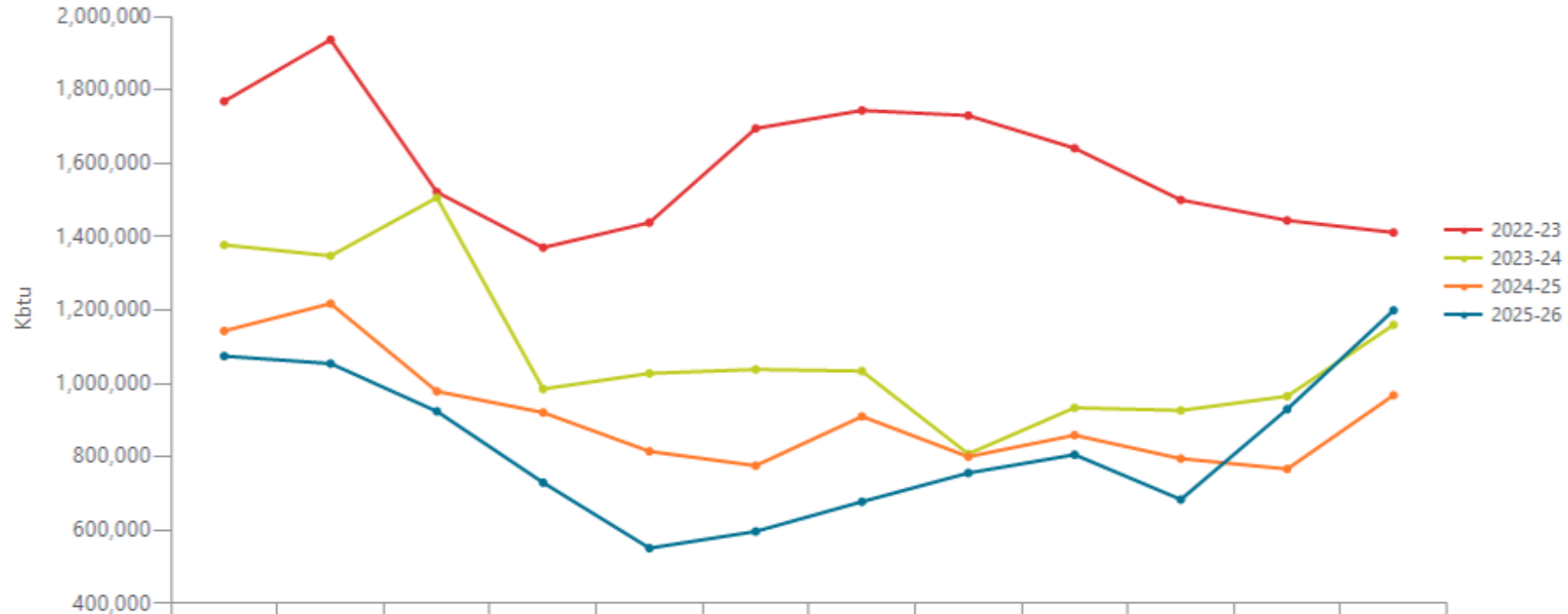
Overall energy: Reduced by 23,558,864 kBtus (48%)

- Chilled water consumption:
 - Reduced by 795,782 ton-hr (41.8%)
- Steam consumption:
 - Reduced by 7,179Mlb (71%)
- Electricity consumption:
 - Reduced by 20%2,001,782kWh (42.1%)
- Cost avoidance \$458,934

Continued results

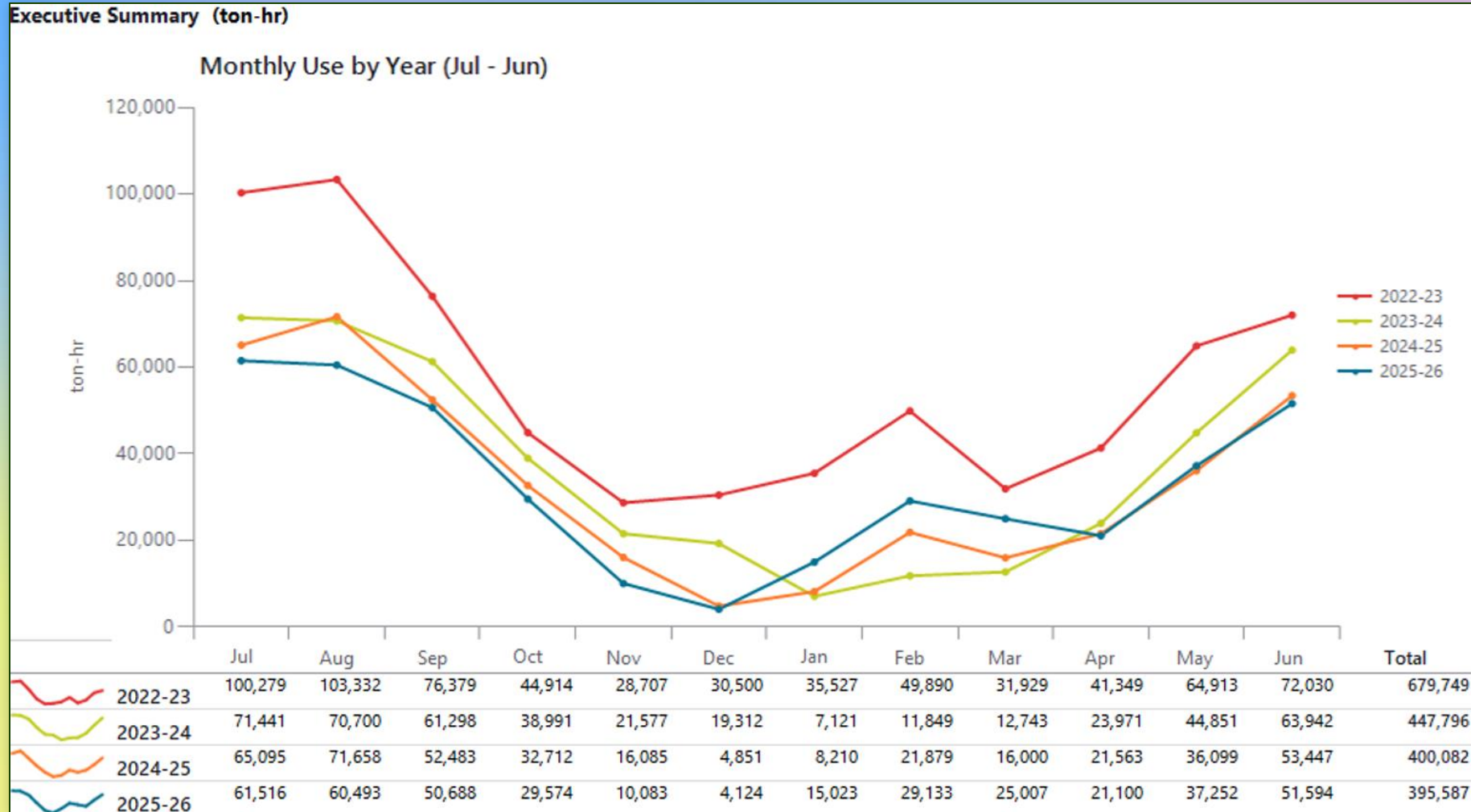
Executive Summary (Kbtu)

Monthly Use by Year (Jul - Jun)



	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
2022-23	1,768,989	1,936,848	1,521,776	1,370,424	1,438,534	1,695,216	1,744,110	1,730,160	1,641,163	1,500,312	1,444,458	1,411,625	19,203,615
2023-24	1,377,575	1,347,963	1,506,565	985,283	1,027,571	1,038,412	1,033,927	808,326	934,009	926,635	965,460	1,159,795	13,111,522
2024-25	1,143,346	1,217,972	978,735	921,051	815,357	776,242	910,441	800,684	859,377	795,402	767,095	968,277	10,953,977
2025-26	1,074,697	1,054,453	924,203	730,043	551,621	597,048	678,037	756,261	806,312	684,150	930,073	1,199,583	9,986,481

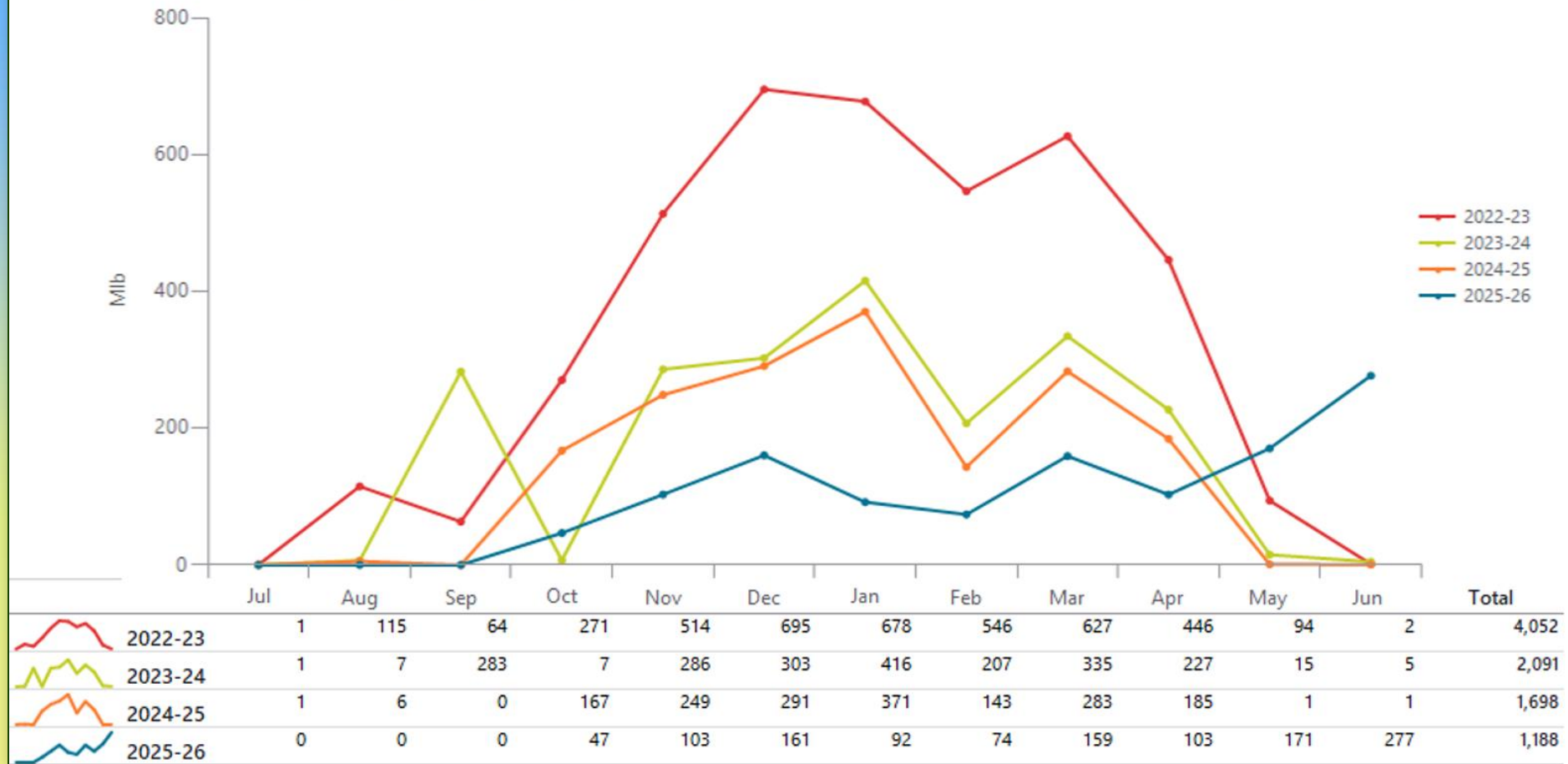
Continued results



Continued results

Executive Summary (Mlb)

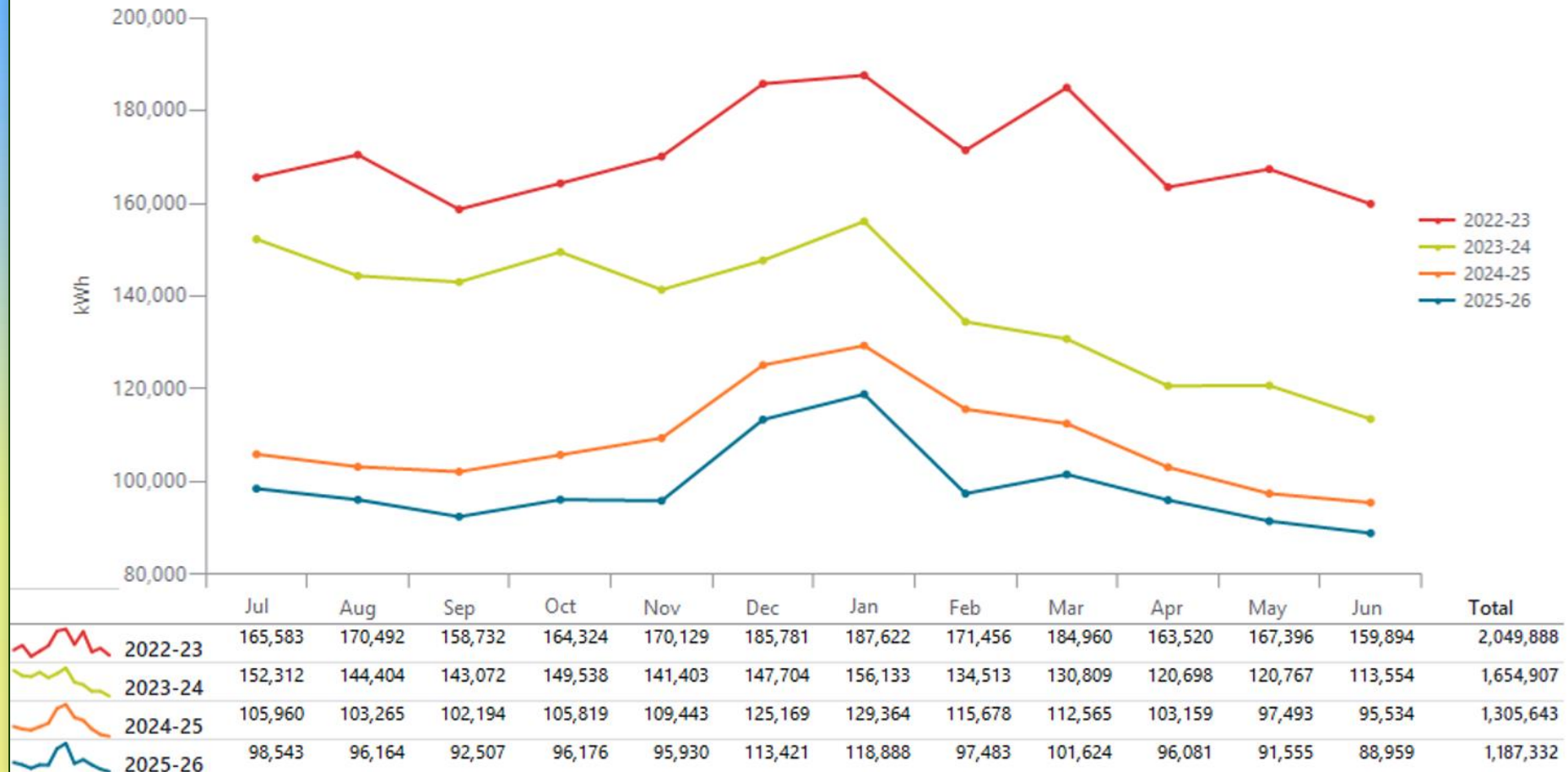
Monthly Use by Year (Jul - Jun)



Continued results

Executive Summary (kWh)

Monthly Use by Year (Jul - Jun)

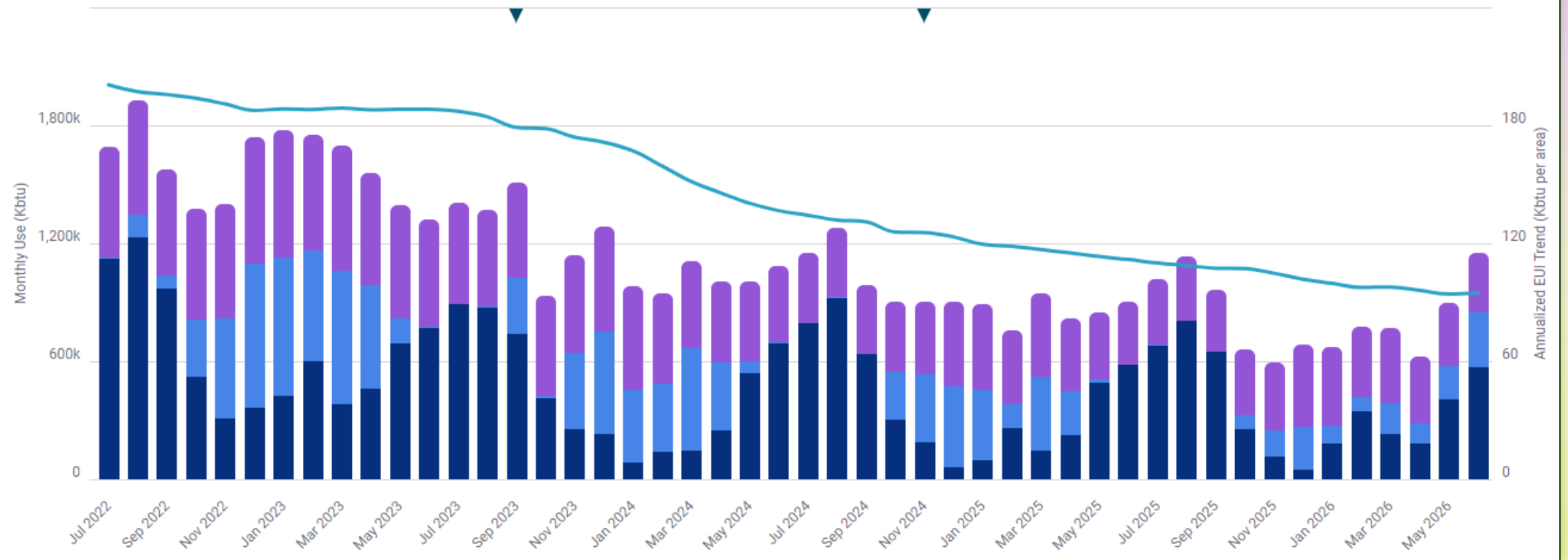


EUI Trend

Energy Trend (EUI)



Click and drag on the chart to zoom

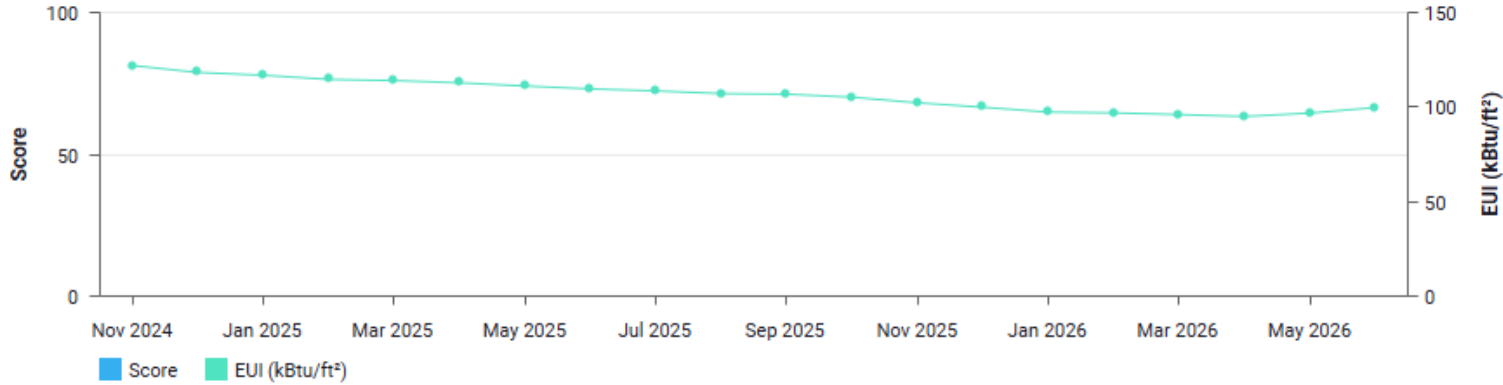


ENERGY STAR Reporting

ENERGY STAR Scores and Metrics

99.7

Latest EUI (kBtu/ft²)



Month	ENERGY STAR Score	ENERGY STAR EUI (kBtu/ft²)	12-Month Site Energy Use (kBtu)	National Median Score	National Median EUI (kBtu/ft²)	Diff. from National Median EUI(%)
Jun 2026	99.7	99.7	10,237,742.4	50		
May 2026	96.8	96.8	9,937,411.4	50		
Apr 2026	95.0	95.0	9,750,563.4	50		
Mar 2026	96.0	96.0	9,853,531.4	50		
Feb 2026	96.9	96.9	9,944,614.8	50		
Jan 2026	97.3	97.3	9,988,798.4	50		

Retro-commissioning

Organ donation facility, new construction

- Operating rooms
- Cold storage
- Offices
- 22,000 sq ft
- Occupied early 2020

- Not meeting energy projections
- Comfort complaints, operational issues

- Tested mechanical components
- Deficiencies found and resolved
- Some sequences modified

- EUI ~380kBtu/sq ft

Retro-commissioning

Types of issues

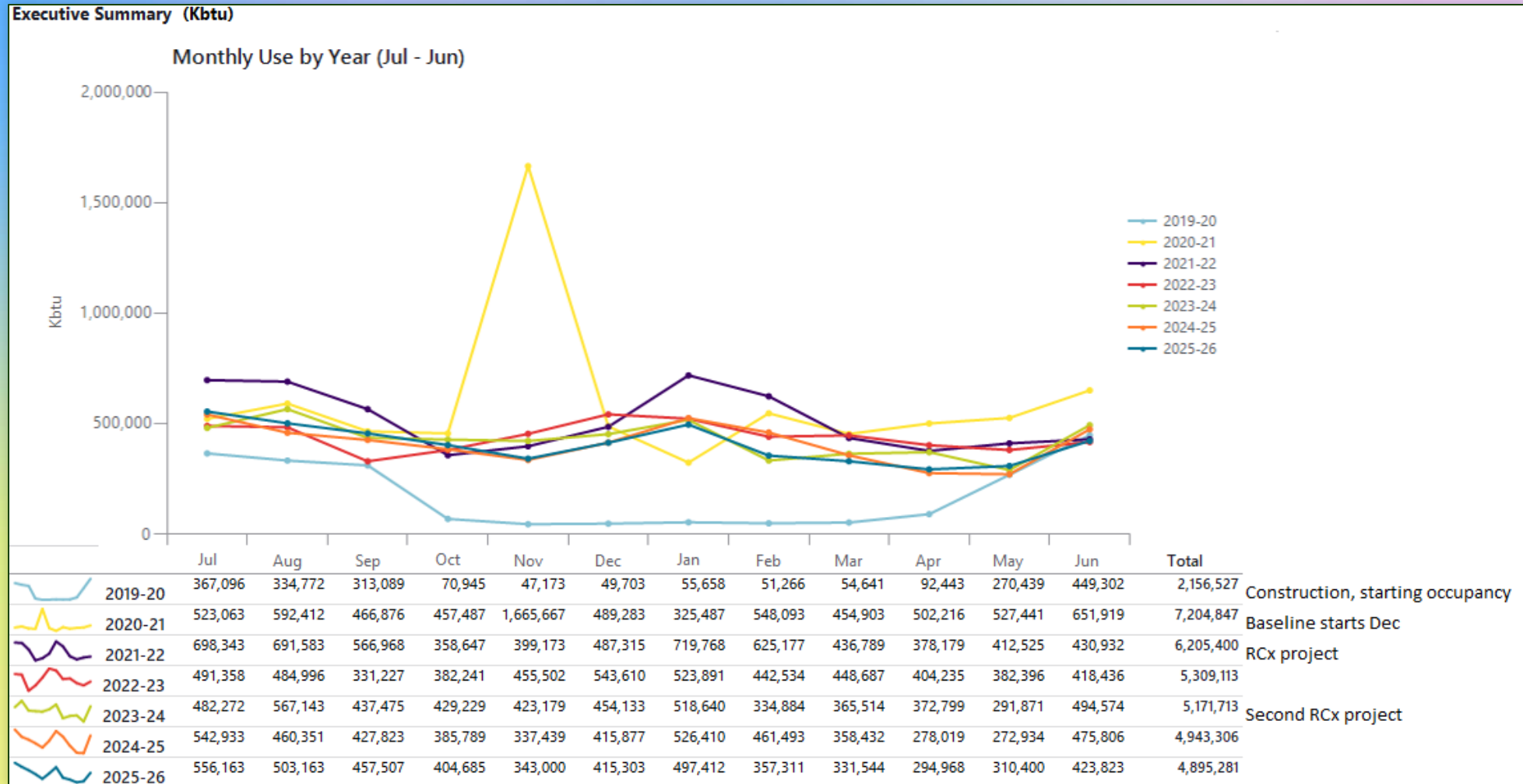
- Lots of debris on outside air dampers
- Re-heat valves not hitting discharge temp
- Exhaust fans relay outlets not set up correctly
- Supply air CFM not set to design
- Exhaust air CFM not set to design
- Night setbacks not set evenly
- Equipment labeled in space differently than on graphics, which impacted programming
- Disconnected actuators
- Hot water valve not opening when commanded
- Return sensor installed in the mixed air chamber
- Temperature sensors reading incorrectly
- Damper linkage bars bent
- Steam valve isolated prior to humidifier valve
- Max heating flow set at 3-5x design
- Air damper not closing completely
- Miscellaneous safety issues

Continued Results

Overall energy: Reduced by 19.7% from baseline

- Chilled water consumption: 21.2%
- Steam consumption: 21.8%
- Cost avoidance \$75,858

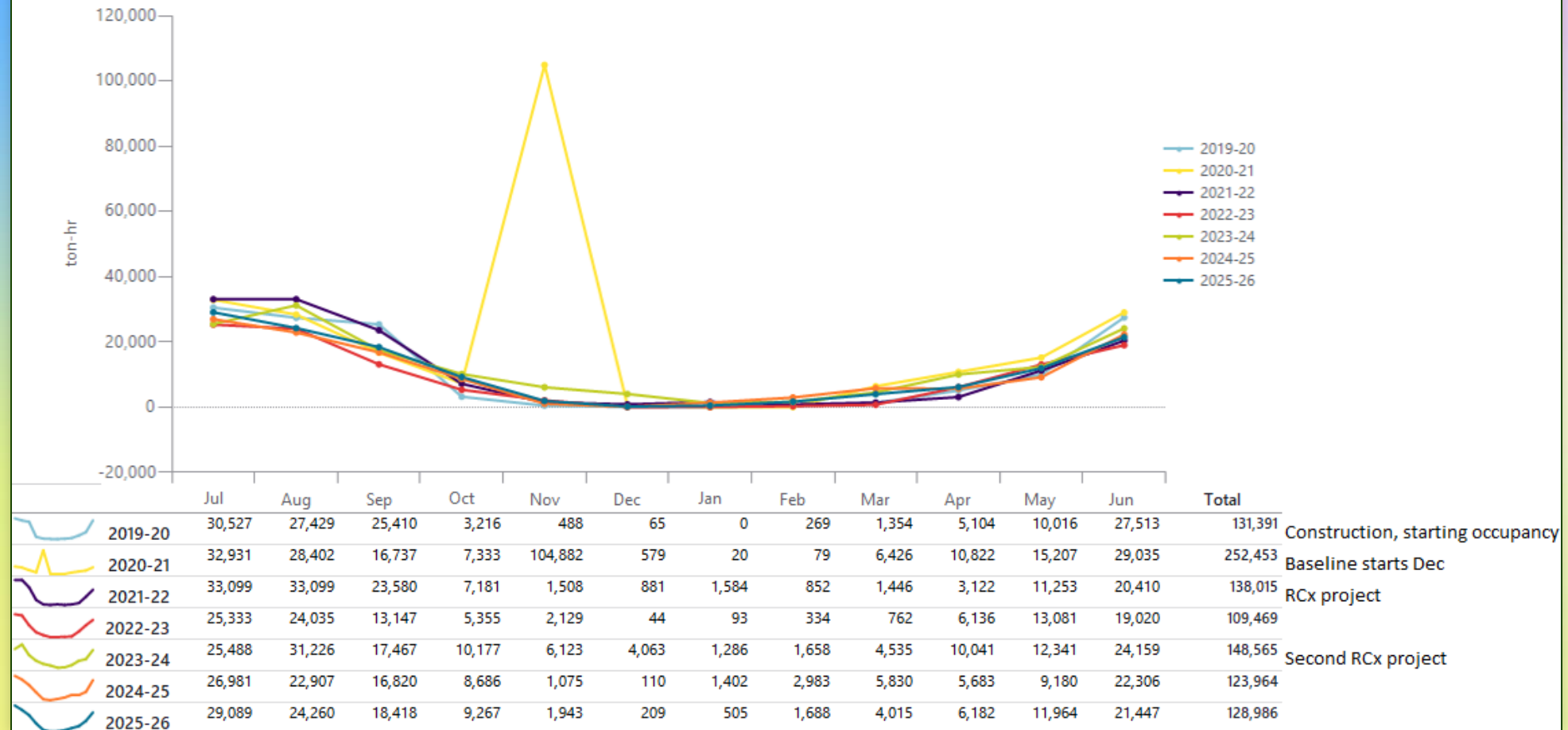
Continued results



Continued results

Executive Summary (ton-hr)

Monthly Use by Year (Jul - Jun)



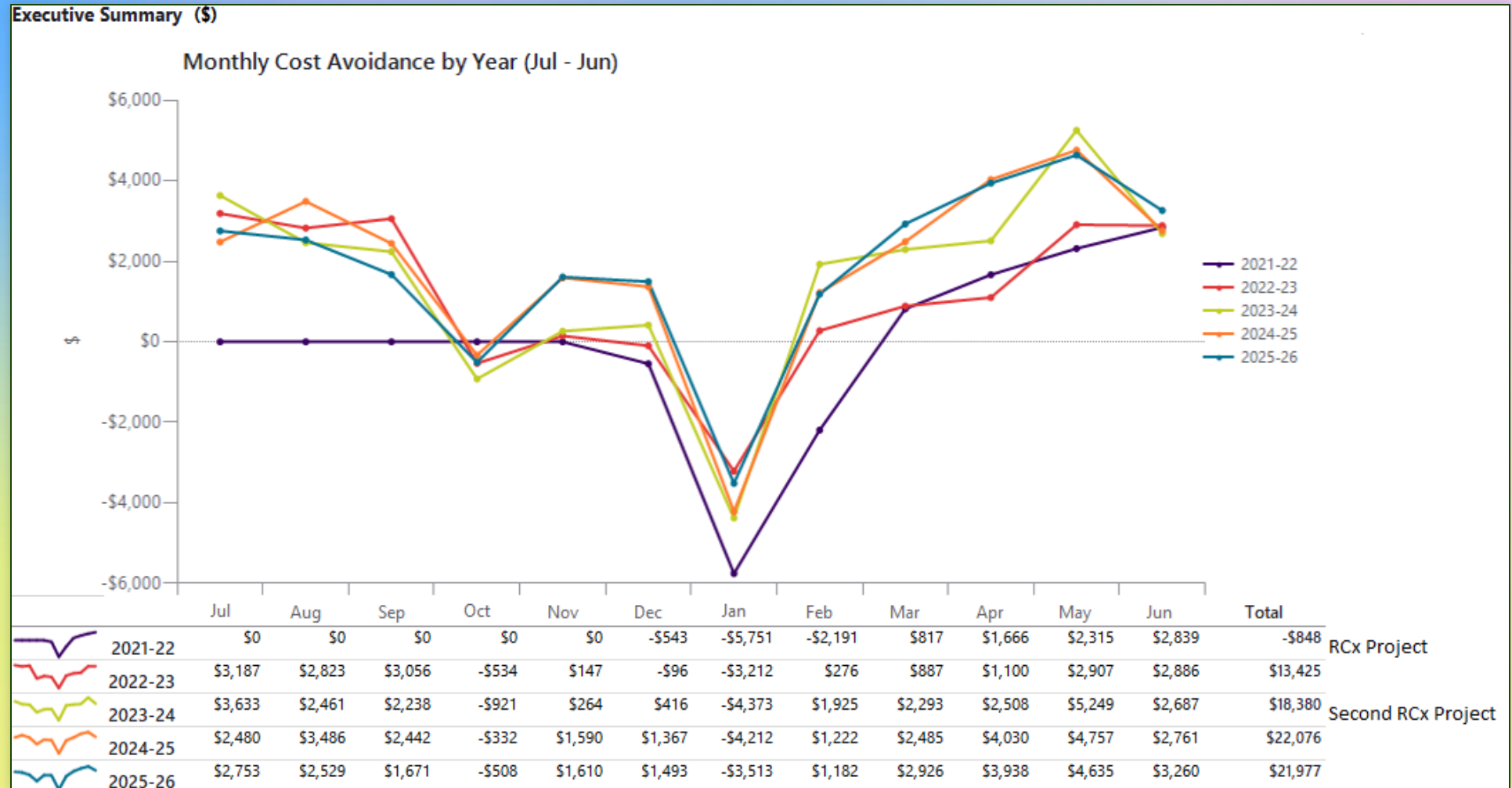
Continued results

Executive Summary (Mlb)

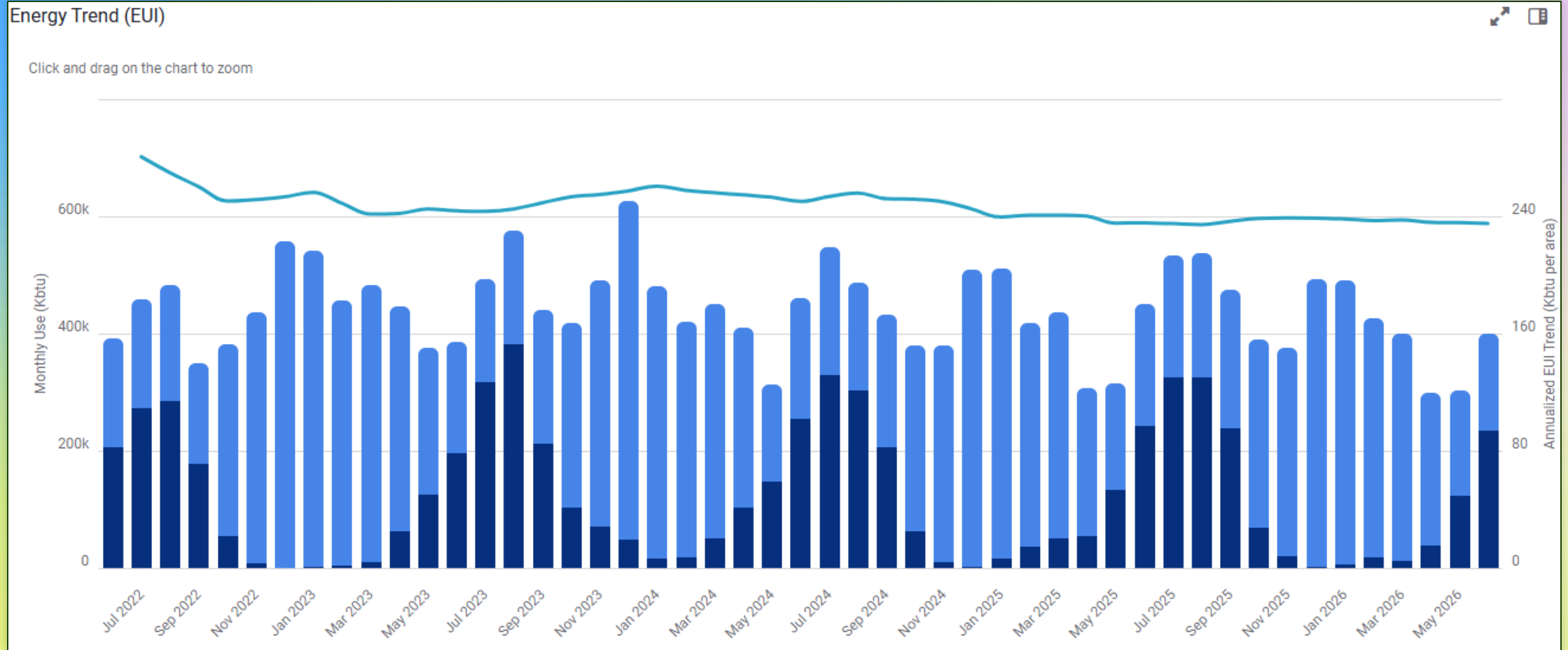
Monthly Use by Year (Jul - Jun)



Continued results



EUI Trend





Questions? Comments?

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