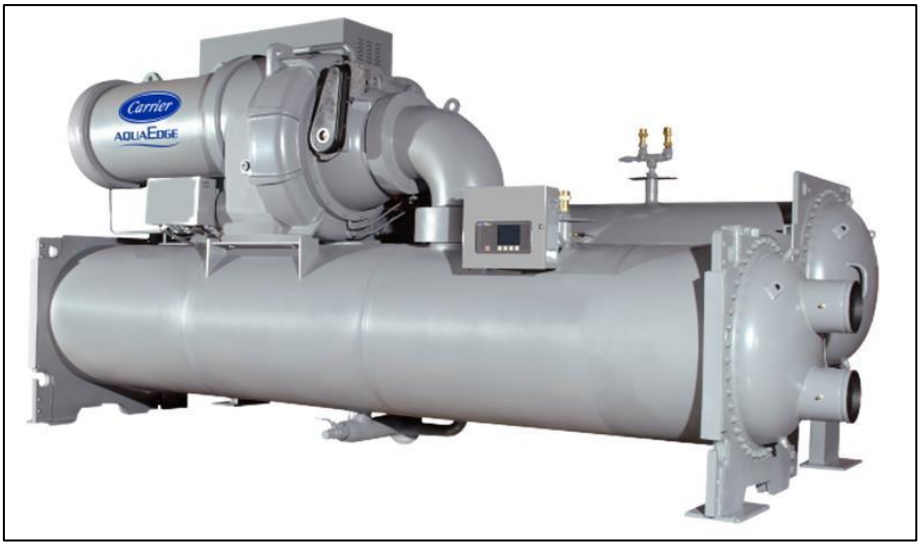
Chiller Retrofit Analytics Report



Chiller background

Chiller details	Information
Chiller Number	2301Q65746
Location	Fountain Valley Regional Hospital
City	Fountain Valley
Year of Manufacturing (Age)	2001 (23 Years)
Model Number	19XRV4747321CDH64
Chiller Run Hours	103,713
Report Duration	18-Nov-2022 to 03-Apr-2024
Chiller Capacity (RT)	323
Rated Chilled Power (kW)	
Design Leaving Chilled Water Temperature (°℉)	
Design Entering Condenser Water Temperature (°℉)	
Report Release Date	09-May-2024

Summary

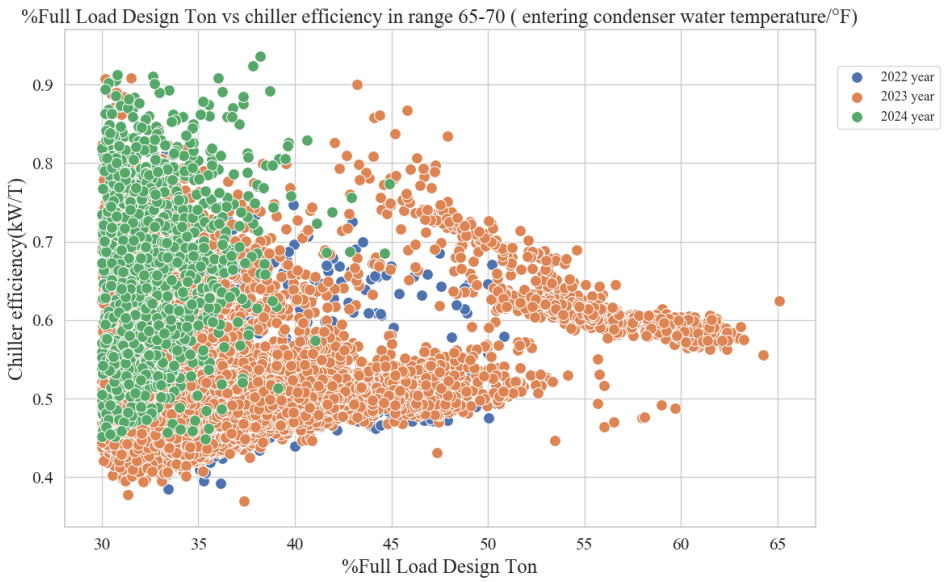
As part of Carrier's connected service program, our command center experts continuously monitor the performance and health of the chiller and its major components.

The chiller with serial number 2301Q65746 underwent a chiller retrofit analytics program considering its age and run hours exceeding 20 years and 70,000, respectively. Further analysis was conducted using real-time data from 18-Nov-2022 to 03-Apr-2024.

The chiller's designed leaving chilled water temperature is ℉ and the entering condenser water temperature is ℉ and the design full load efficiency is kW/RT, while the computed chiller leaving chilled water temperature is 43.0℉ and the entering condenser water temperature is 72.5℉ and the computed chiller efficiency is 0.59 kW/RT during this period.

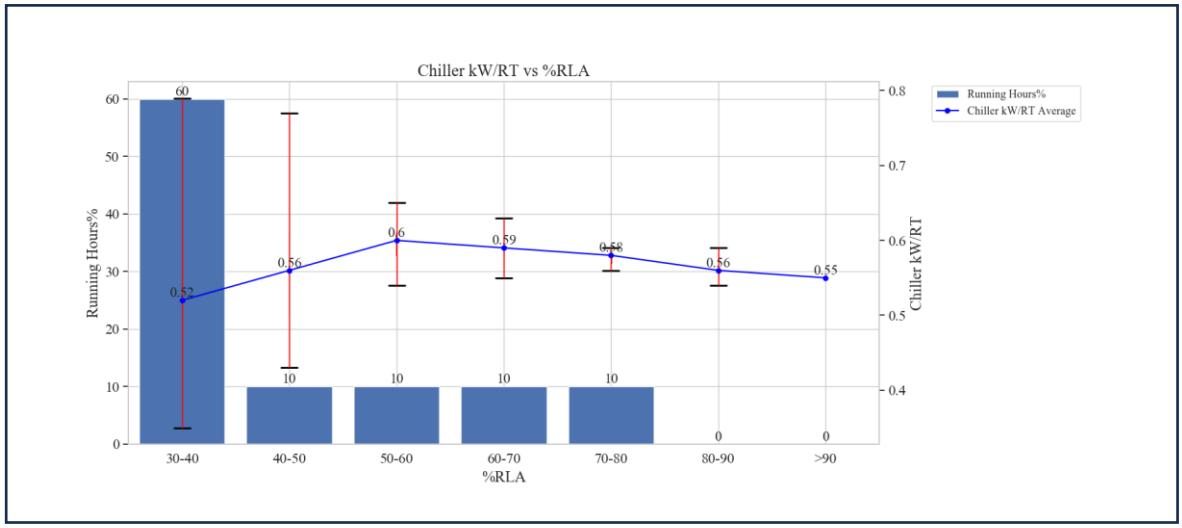
These are initial analytic and findings of a chiller performance from telemetry data within a specified period. Further investigation and energy assessment on chiller plant level are recommended to understand existing chiller plant baseline performance. Carrier offers in-house engineering tools to assist our customers in developing new solution with optimized configuration and operation.

Chiller Performance Analysis



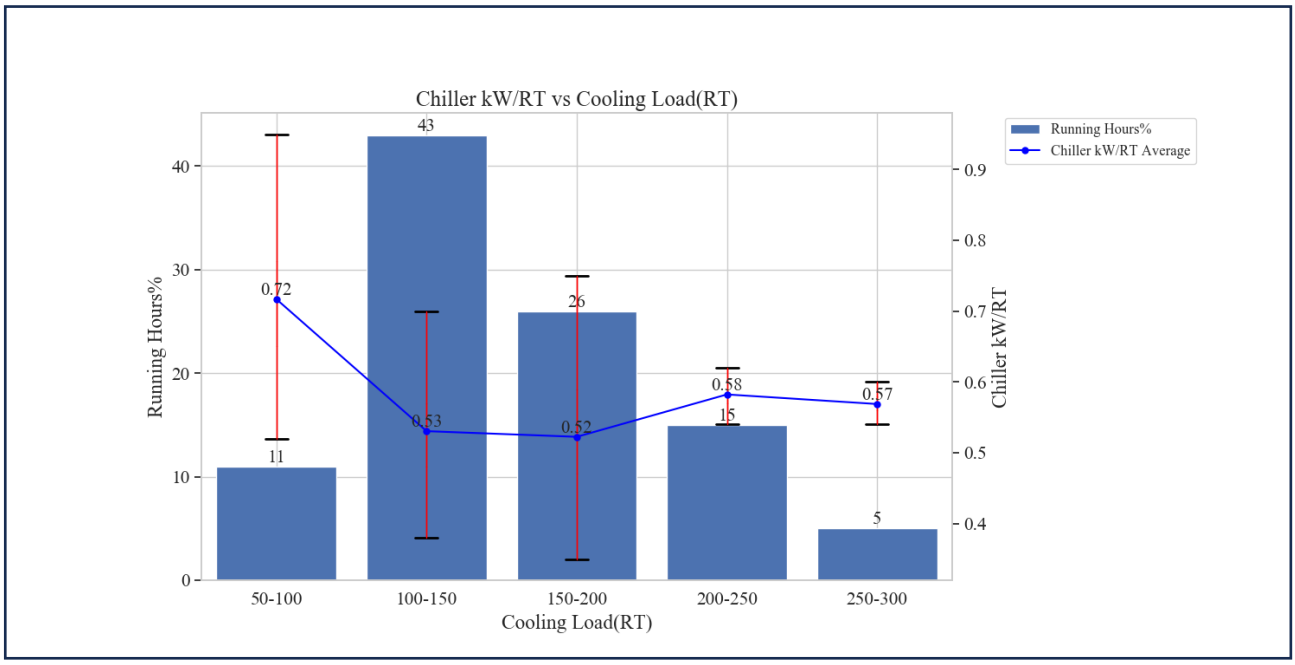
Comments

- The chiller kW/RT is steadily rising compared to the previous year, indicating an increase in energy consumption per unit of cooling output.
- This trend indicates a potential decline in efficiency, emphasizing the need for further investigation to address and rectify underlying issues.



Comments

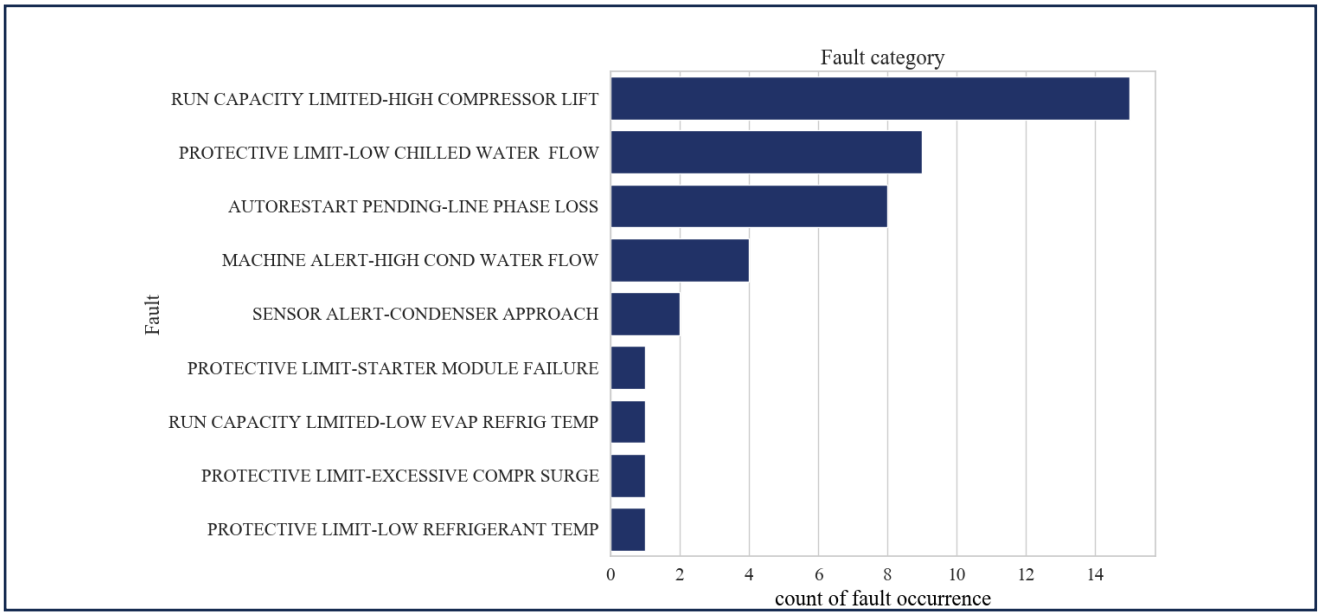
- This plot illustrates various part-load efficiencies based on specific criteria:
  - The chiller operates at full load for more than 80% of the time: **No**
  - The chiller frequently operates at less than 60% of its RLA for most of the time (more than 80% of the time): **No**
  - The chiller is installed with VFD: **Yes**



Comments

- This plot illustrates various part-load efficiencies at different Cooling Loads:
    - Most of the time (43%) chiller operates from 100-150 RT.

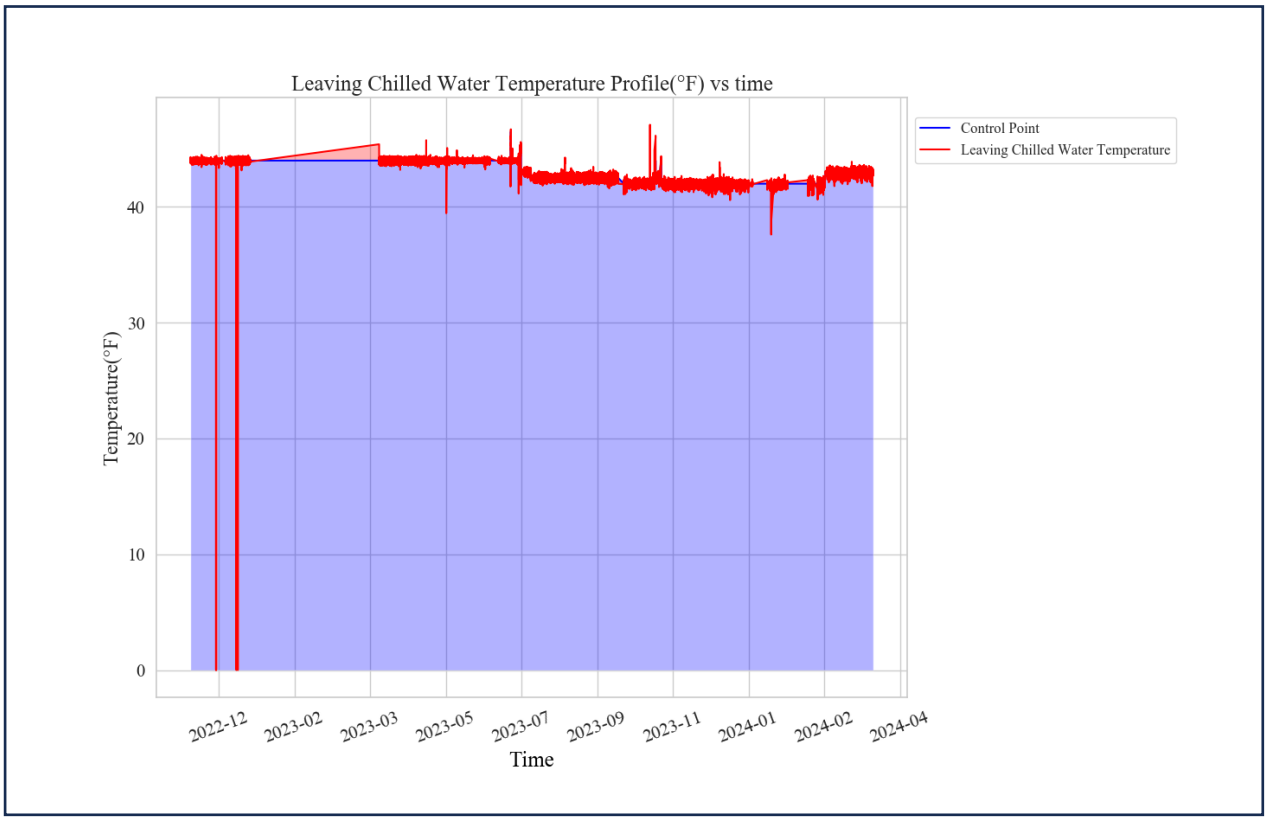
Chiller Alarm Analysis



Comments

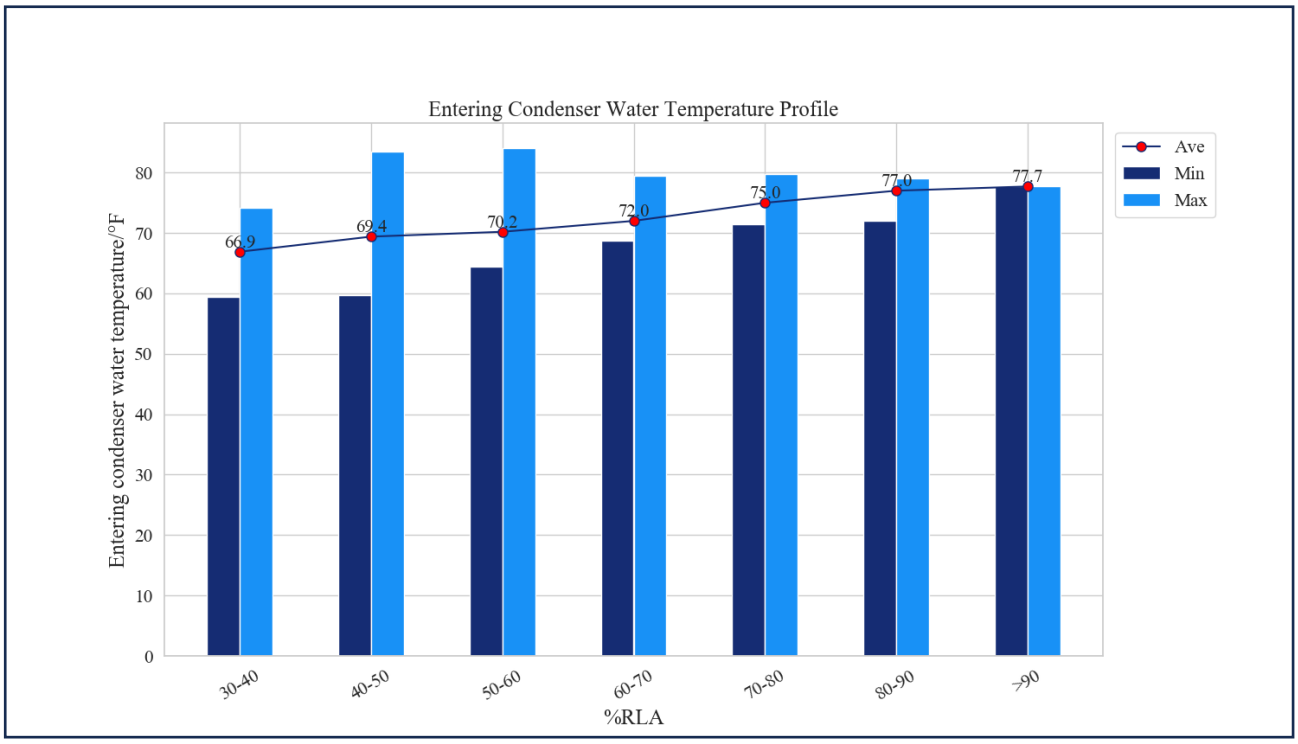
- The chiller device has total of 42 alarms during this analysis timeframe.
- There have been no instances of chiller device alarms exceeding 15 in the last 2 months.

Chiller Water Temperature Analysis



Comments

- The leaving chilled water temperature meets **100%**, the set point.

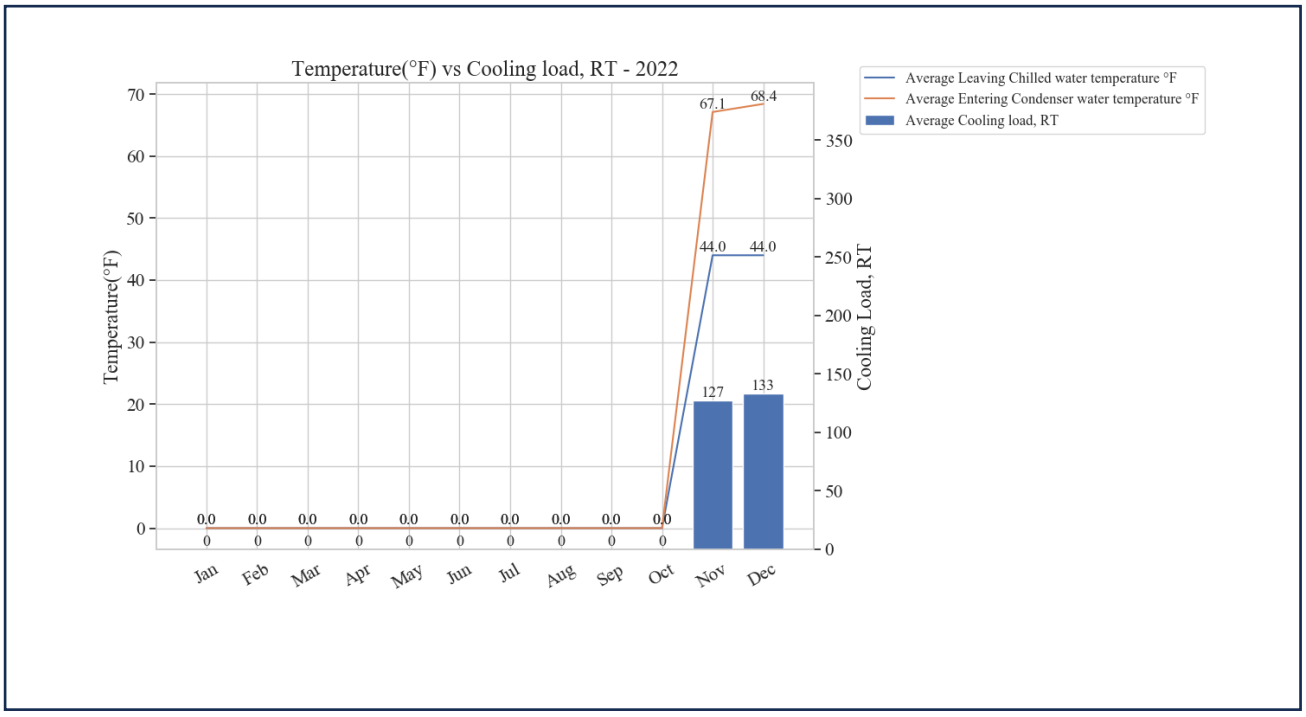


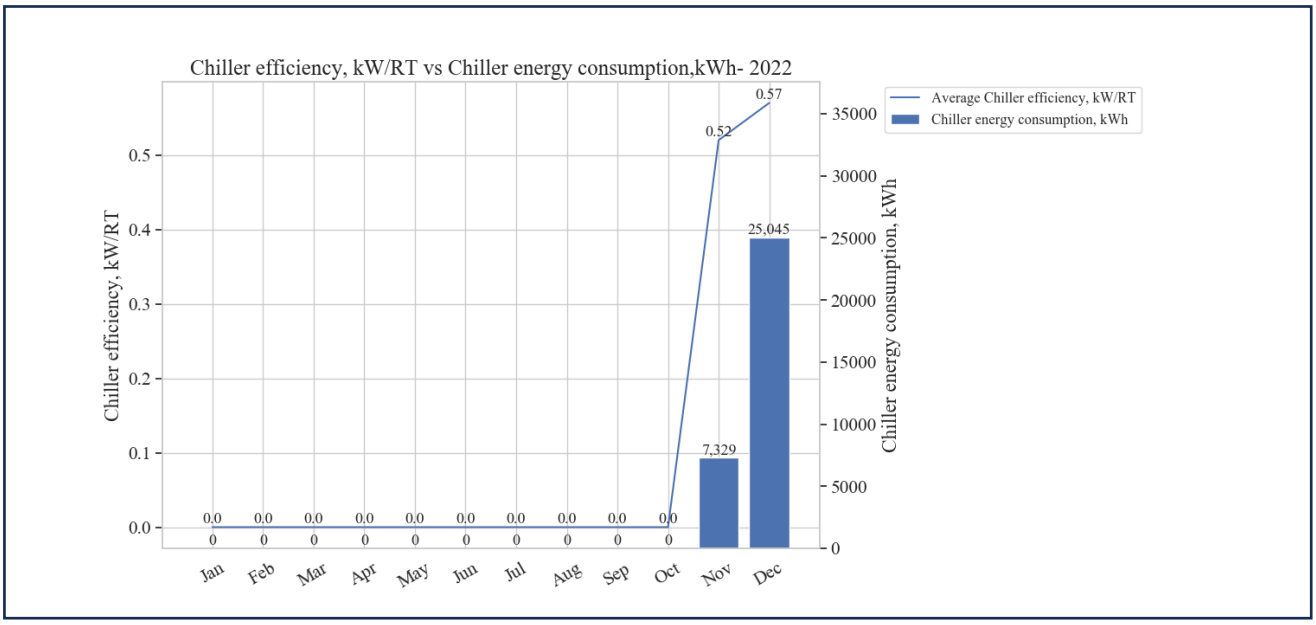
Comments

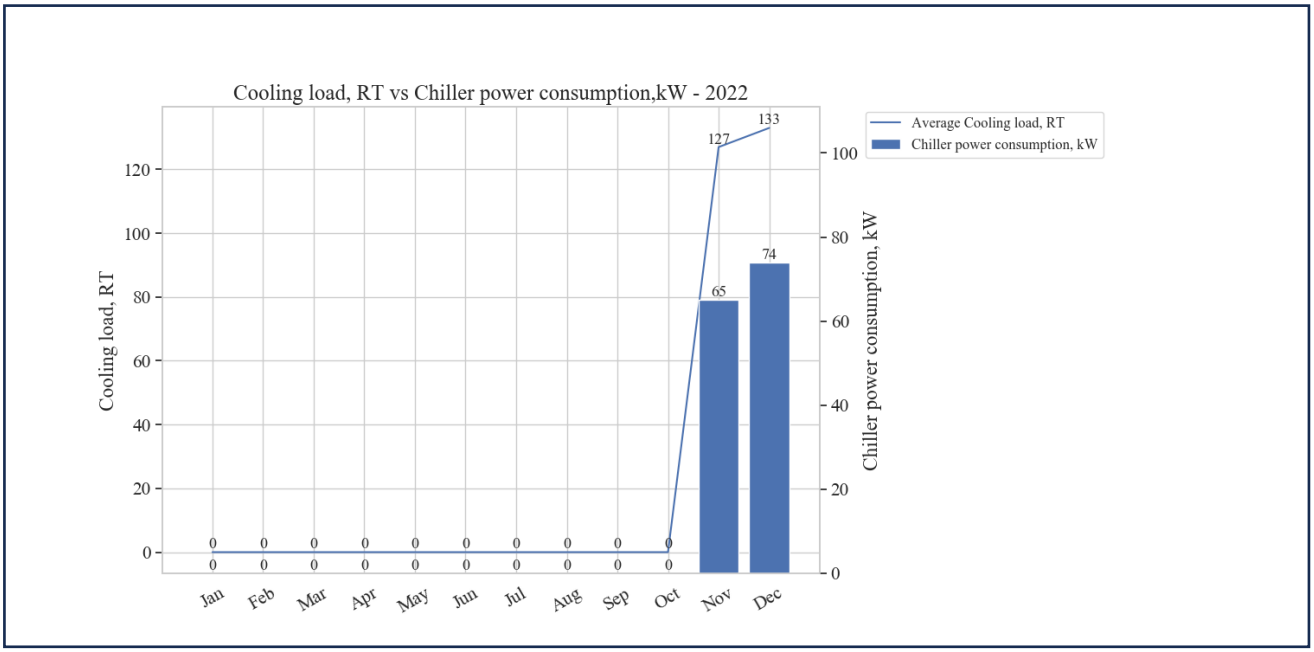
- The average entering condenser water temperature falls within the range of 66.9℉ to 77.7℉.

Chiller Data 2022 (Average)

Year 2022	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Leaving Chilled water temperature, °F	-	-	-	-	-	-	-	-	-	-	44.0	44.0
Chiller power consumption, kW	-	-	-	-	-	-	-	-	-	-	65	74
Chiller efficiency, kW/RT	-	-	-	-	-	-	-	-	-	-	0.52	0.57
Cooling load, RT	-	-	-	-	-	-	-	-	-	-	127	133
Entering Condenser water temperature °F	-	-	-	-	-	-	-	-	-	-	67.1	68.4
Chiller energy consumption, kWh	-	-	-	-	-	-	-	-	-	-	7,329	25,045

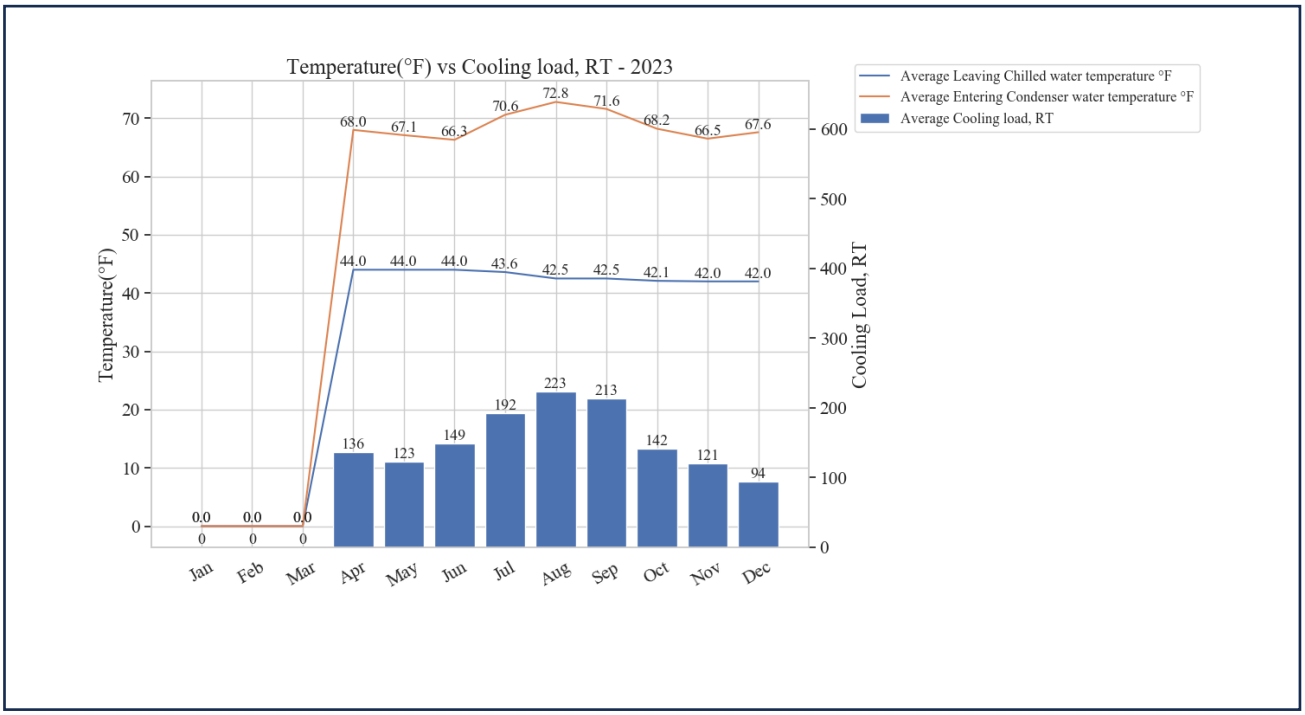


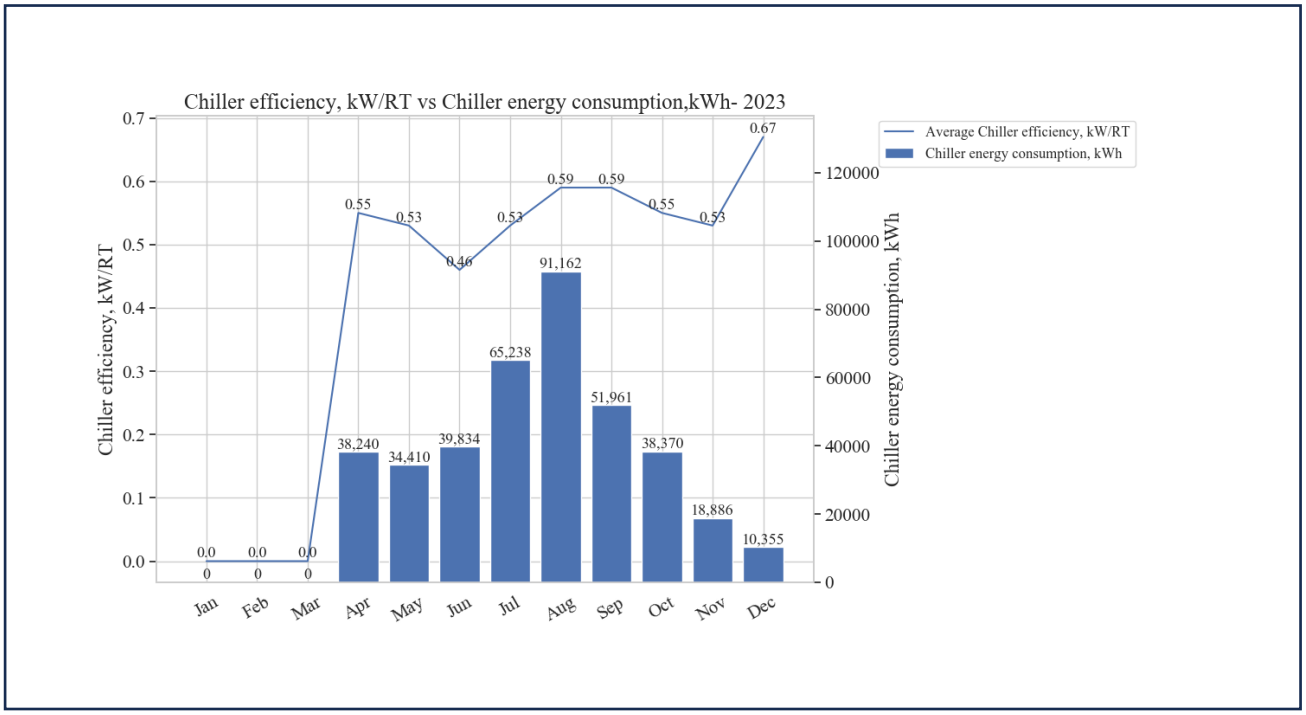

Chiller efficiency, kW/RT vs Chiller energy consumption,kWh- 2022
Average Chiller efficiency, kW/RT
Chiller energy consumption, kWh
Chiller efficiency, kW/RT
Chiller energy consumption, kWh
0.57
0.52
25,045
7,329
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

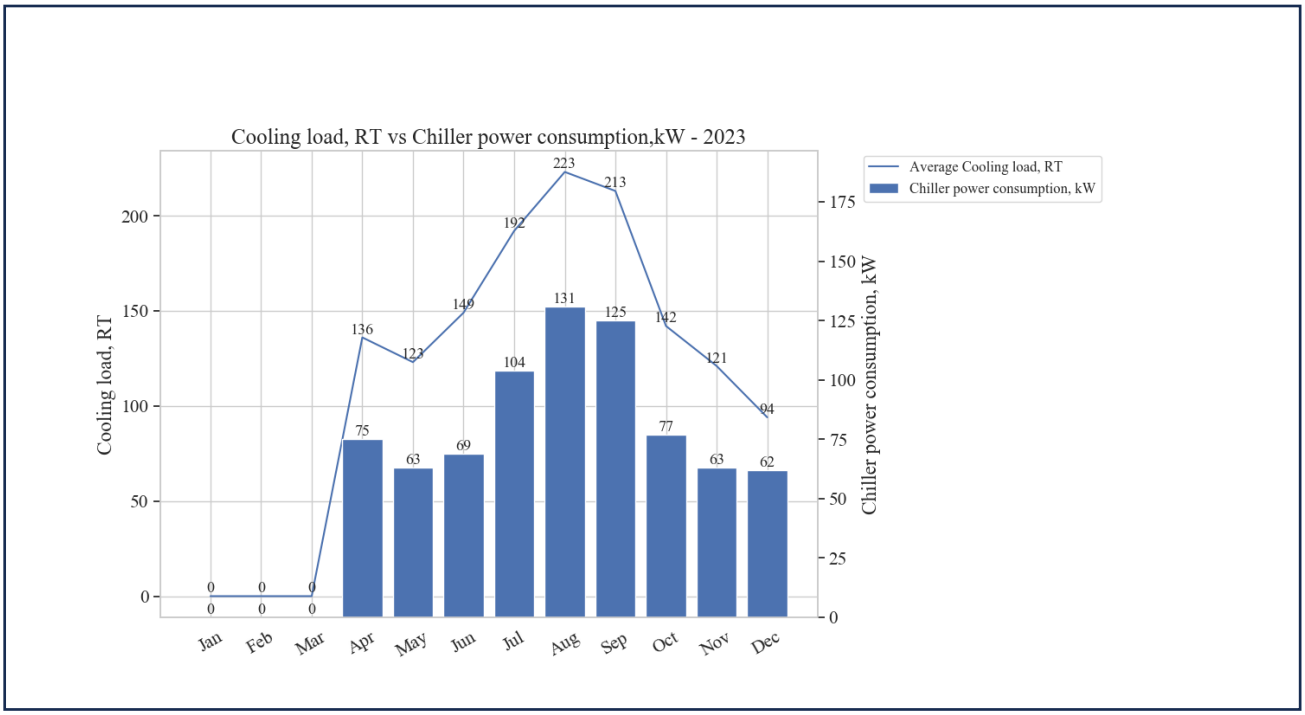

Cooling load, RT vs Chiller power consumption,kW - 2022
Average Cooling load, RT
Chiller power consumption, kW
Cooling load, RT
Chiller power consumption, kW
133
127
74
65
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Chiller Data 2023 (Average)

Year 2023	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Leaving Chilled water temperature, °F	-	-	-	44.0	44.0	44.0	43.6	42.5	42.5	42.1	42.0	42.0
Chiller power consumption, kW	-	-	-	75	63	69	104	131	125	77	63	62
Chiller efficiency, kW/RT	-	-	-	0.55	0.53	0.46	0.53	0.59	0.59	0.55	0.53	0.67
Cooling load, RT	-	-	-	136	123	149	192	223	213	142	121	94
Entering Condenser water temperature °F	-	-	-	68.0	67.1	66.3	70.6	72.8	71.6	68.2	66.5	67.6
Chiller energy consumption, kWh	-	-	-	38,240	34,410	39,834	65,238	91,162	51,961	38,370	18,886	10,355

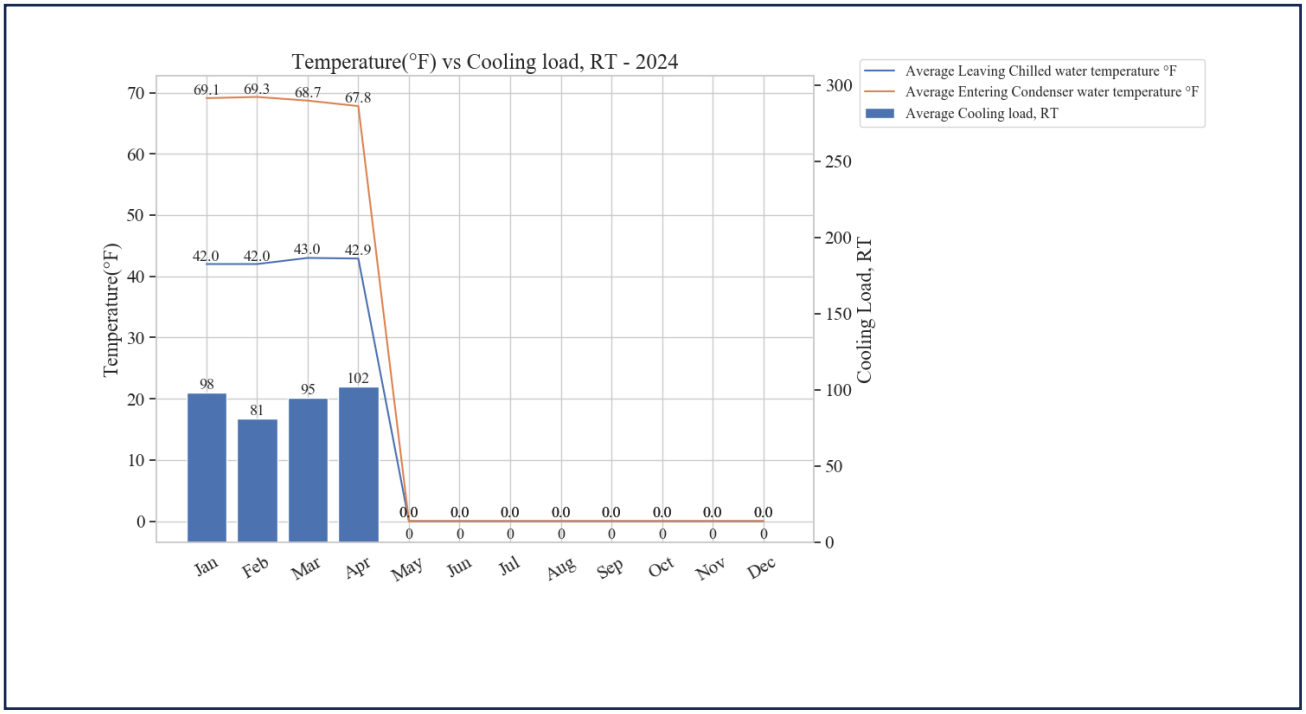


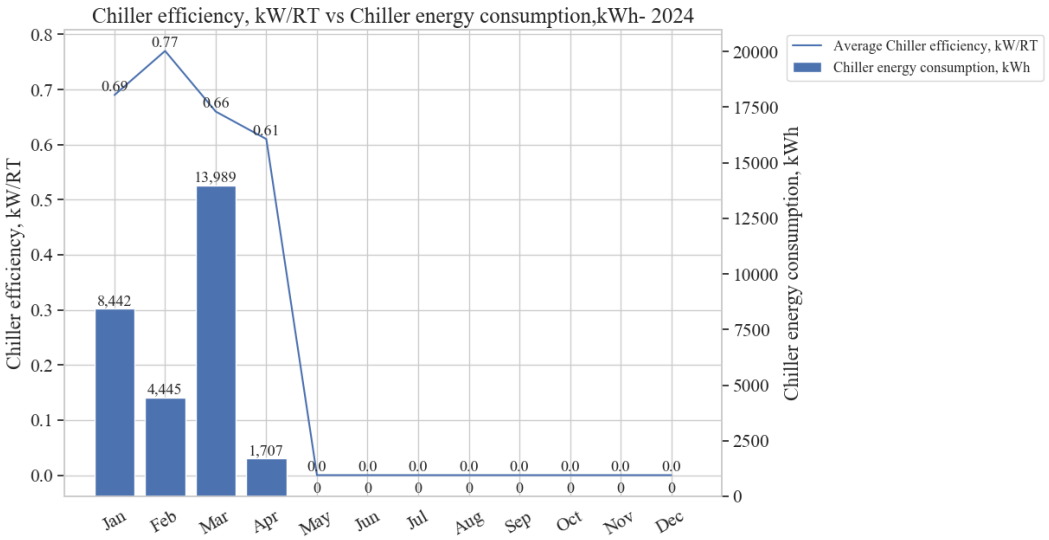

Chiller efficiency, kW/RT vs Chiller energy consumption,kWh- 2023
Average Chiller efficiency, kW/RT
Chiller energy consumption, kWh
Chiller efficiency, kW/RT
Chiller energy consumption, kWh
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
120000
100000
80000
60000
40000
20000
0
0.0 0.0 0.0 0.55 0.53 0.46 0.53 0.59 0.59 0.55 0.53 0.67
0 0 0 38,240 34,410 39,834 65,238 91,162 51,961 38,370 18,886 10,355
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

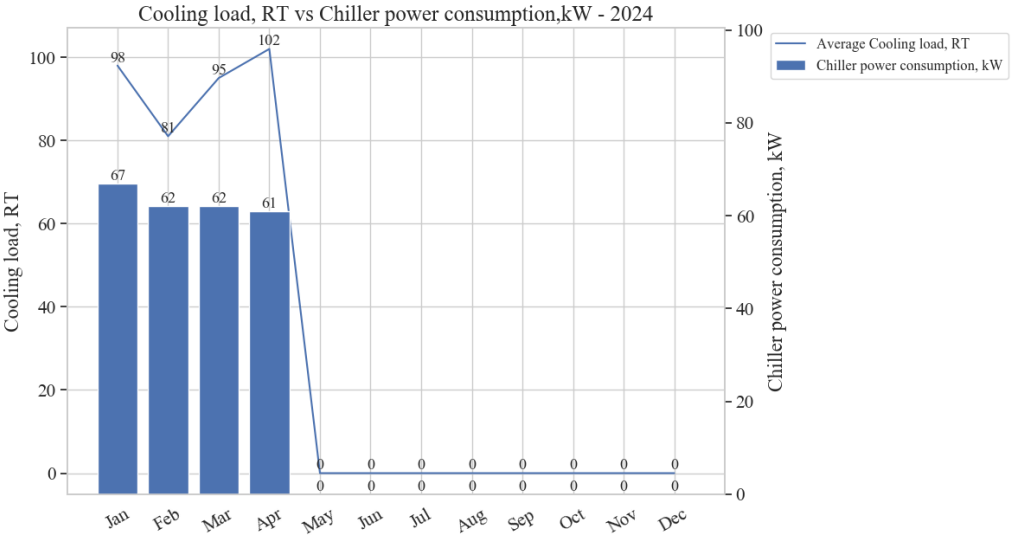

Cooling load, RT vs Chiller power consumption,kW - 2023
Average Cooling load, RT
Chiller power consumption, kW
Cooling load, RT
Chiller power consumption, kW
200
150
100
50
0
175
150
125
100
75
50
25
0
0 0 0 136 123 149 192 223 213 142 121 94
0 0 0 75 63 69 104 131 125 77 63 62
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Chiller Data 2024 (Average)

Year 2024	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Leaving Chilled water temperature, °F	42.0	42.0	43.0	42.9	-	-	-	-	-	-	-	-
Chiller power consumption, kW	67	62	62	61	-	-	-	-	-	-	-	-
Chiller efficiency, kW/RT	0.69	0.77	0.66	0.61	-	-	-	-	-	-	-	-
Cooling load, RT	98	81	95	102	-	-	-	-	-	-	-	-
Entering Condenser water temperature °F	69.1	69.3	68.7	67.8	-	-	-	-	-	-	-	-
Chiller energy consumption, kWh	8,442	4,445	13,989	1,707	-	-	-	-	-	-	-	-




Chiller efficiency, kW/RT vs Chiller energy consumption,kWh- 2024
Chiller efficiency, kW/RT
Chiller energy consumption, kWh
Average Chiller efficiency, kW/RT
Chiller energy consumption, kWh
0.69
0.77
0.66
0.61
0.0
8,442
4,445
13,989
1,707
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Cooling load, RT vs Chiller power consumption,kW - 2024
Cooling load, RT
Chiller power consumption, kW
Average Cooling load, RT
Chiller power consumption, kW
98
81
95
102
67
62
62
61
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec