



24 OCTOBER 2023

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# Qatar Foundation: Increasing Operational Visibility at Education City

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AVEVA



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# Qatar Foundation

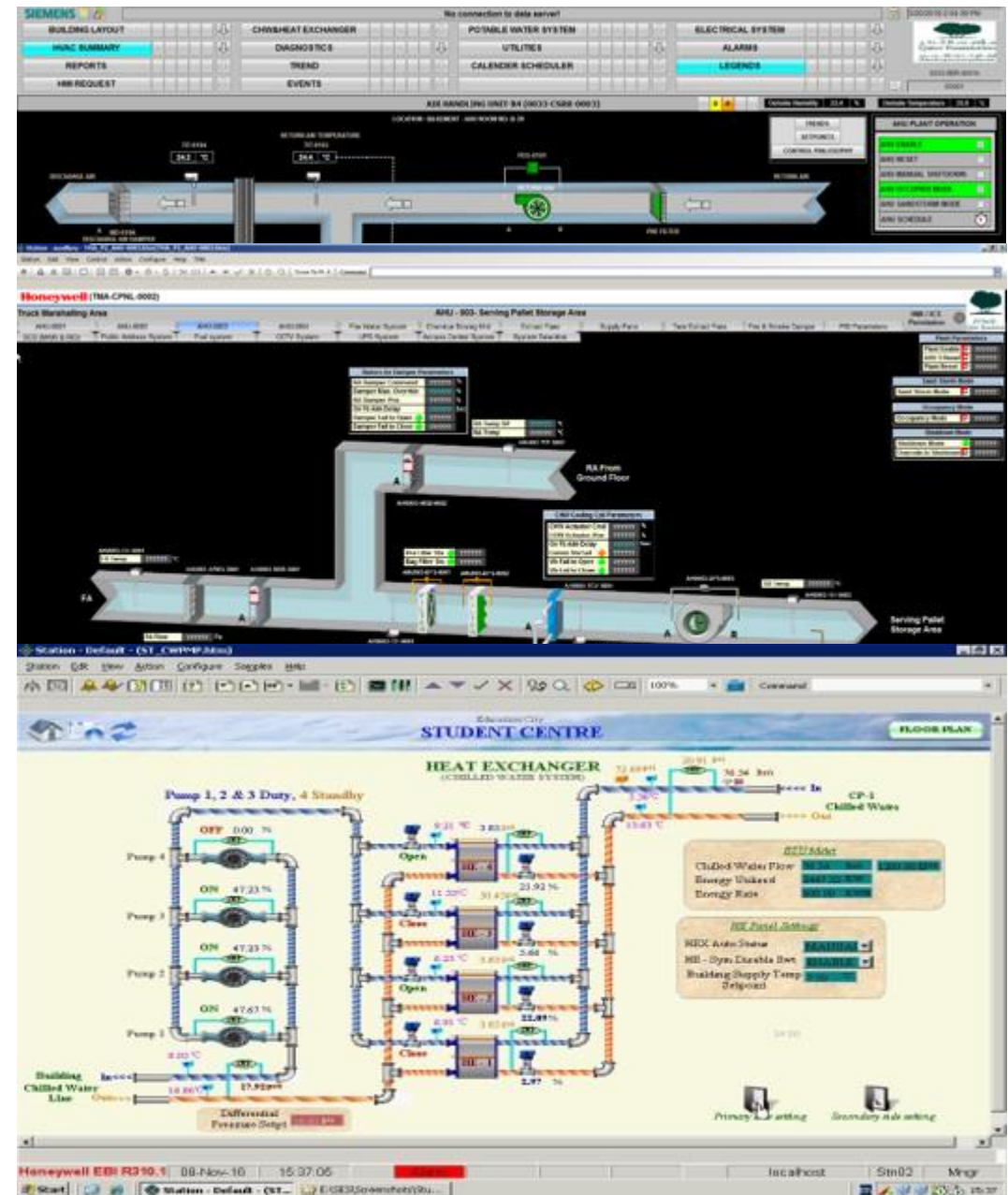
*Unlocking Human Potential*



- Qatar Foundation for Education, Science and Community Development (QF) was established in 1995 by:
  - His Highness, The Father Emir, Sheikh Hamad Bin Khalifa Al Thani
  - Her Highness, Sheikha Moza Bint Nasser Al Misnad (Chairperson)
- QF is a non-profit organization where centers and programs focused on education, research, innovation, and community development intertwine for the benefit of Qatar, and the world.

# The Challenge

- Many facilities have their local BMS from different manufacturers.
- An OWS from every facility is added in the 2 Central Control Rooms (CCR) of Education City.
- South Campus facilities were connected to CCR 1
- North Campus facilities were connected to CCR 2
- Individual OWS to monitor & control every facility in the CCR has made the CCR very cluttered.
- Manual energy recording and reporting followed
- Not able to determine cooling energy wastages due to improper scheduling and not having energy management in place.
- A lot of manpower were needed to locally monitor & control every facility.



## Various BMS at Education City Facilities

Facility Name	OEM	BMS
Central Plant 1	Schneider	Eco Struxure
Central Plant 1 Utility Tunnel		
North Utility Tunnel	Honeywell	EPKS
Central Plant 2	Honeywell	EBI
CP2 Utility Tunnel	Honeywell	EBI
TMA	Honeywell	EPKS
Central Plant 3	Honeywell	EPKS
Al Shaqab	Honeywell	EBI
CP4 utility tunnel	Honeywell	EBI
Central Plant 4	Honeywell	EBI
Central Plant 5	Siemens	WinCC
Central Plant 6	Honeywell	EPKS
South Utility Tunnel	Siemens	WinCC
Central Plant 7	Siemens	WinCC
Convention Centre (QNCC) & QNCC Extension	Honeywell	EBI
QNCC Carpark	Honeywell	EBI
QSTP - ITTC1	Honeywell	EBI
QSTP - ITTC2	Honeywell	EBI
College of Media and Communication (CMC)	Siemens	WinCC
School of Islamic Studies (QFIS)	Honeywell	EBI
Male Student Housing	Honeywell	EBI

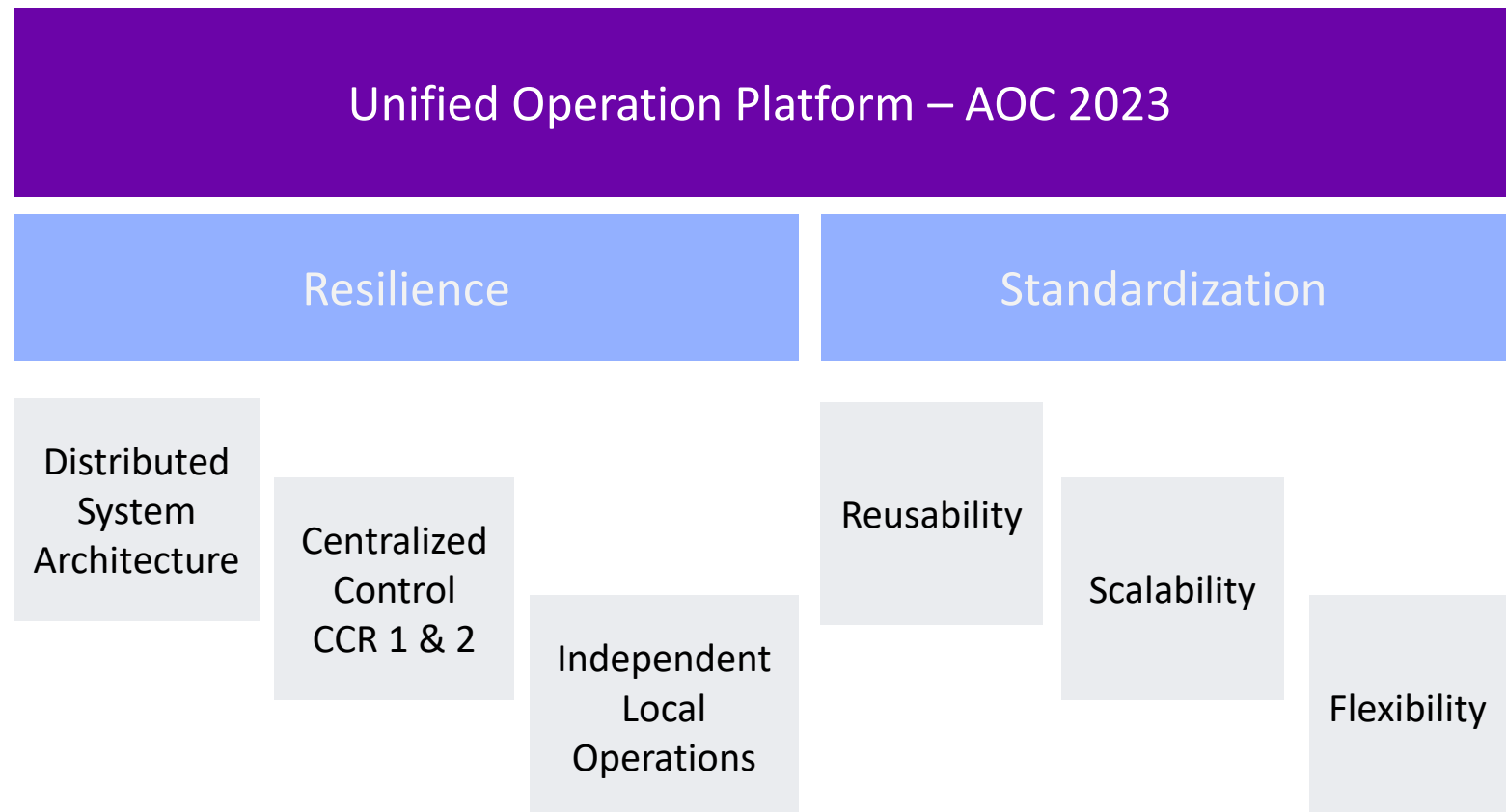
Facility Name	OEM	BMS
Female Student Housing	Honeywell	EBI
AWSAJ		
Strategic Studies Centre ( HQ -SSC)	Siemens	WinCC
QF Headquarters	Siemens	WinCC
Central Library/ QNL	Honeywell	EPKS
Student Centre	Honeywell	EBI
Oxygen Park Area	Siemens	WinCC
NEUCP	Siemens	WinCC
TAMU	Honeywell	EBI
Tech 4	Honeywell	EBI
Research & Development Complex	Siemens	WinCC
VCU	Honeywell	EBI
Western Green Spine	Schneider	Citec SCADA
West Car Park	Siemens	WinCC
Carousel	Schneider	Wonderware
School of Foreign Service (GU)	Siemens	Desigo
Aljazeera Children	Schneider	Eco Struxure
College of Liberal Arts & Science (LAS)	Schneider	Eco Struxure
Ceremonial Court - Trend	Schneider	Eco Struxure
College of Medicine (WCMC)	Schneider	Eco Struxure
Carnegie Mellon University	Honeywell	EBI

# Design Guidelines & Principles

The Master Solution incorporates existing guidelines and standards from industry best practices, AVEVA Software development practices, and Qatar Foundation Standards to deliver the SCADA system.

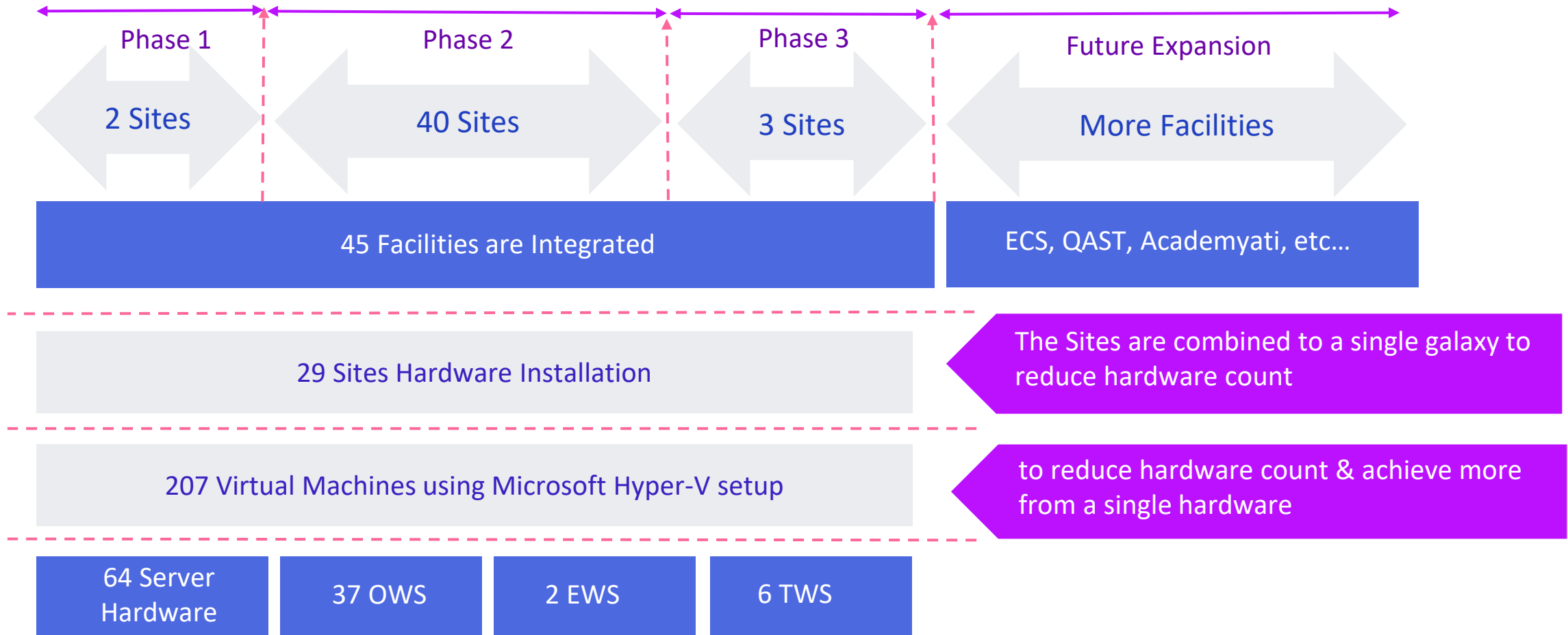
## Design Guidelines & Principles

- Centralized Control & Independent local operations
- Simplify and streamline
- Accessible by operators from remote
- High Availability
- Redundant solution
- Standardizing operations
- Minimizing energy usage through scheduling
- Scalable for future expansion



# Project Overview

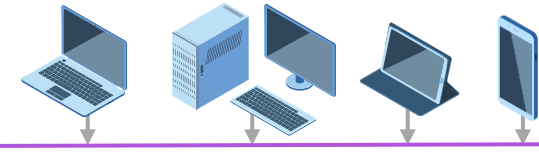
45 facilities are Integrated to SCADA with independent local control & Centralized control from CCR



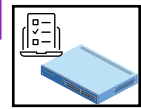
# Overall System Architecture



Remote users ( using Intouch Anywhere Access )



CAFM Integration



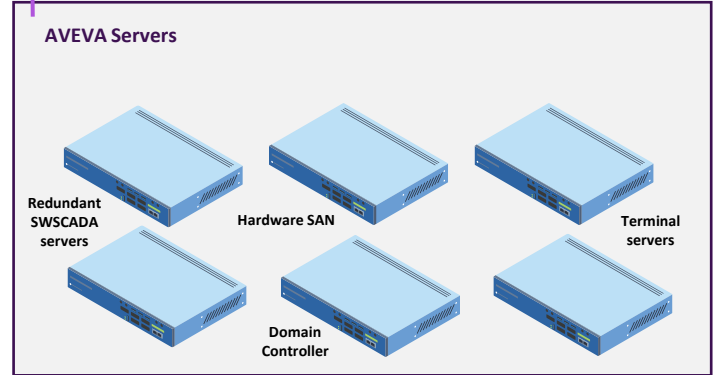
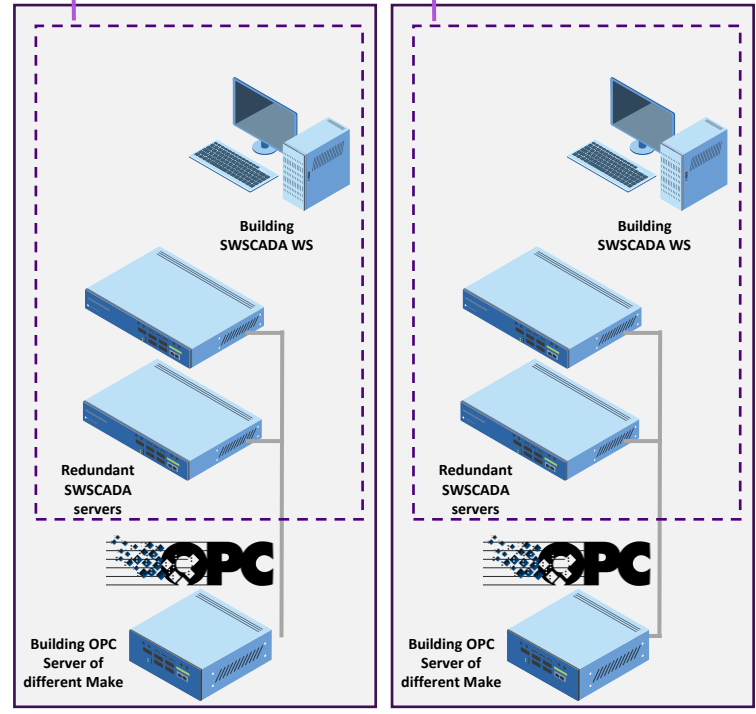
Router & Firewall

IT Hub Room ( CCR 1 & CCR 2 )

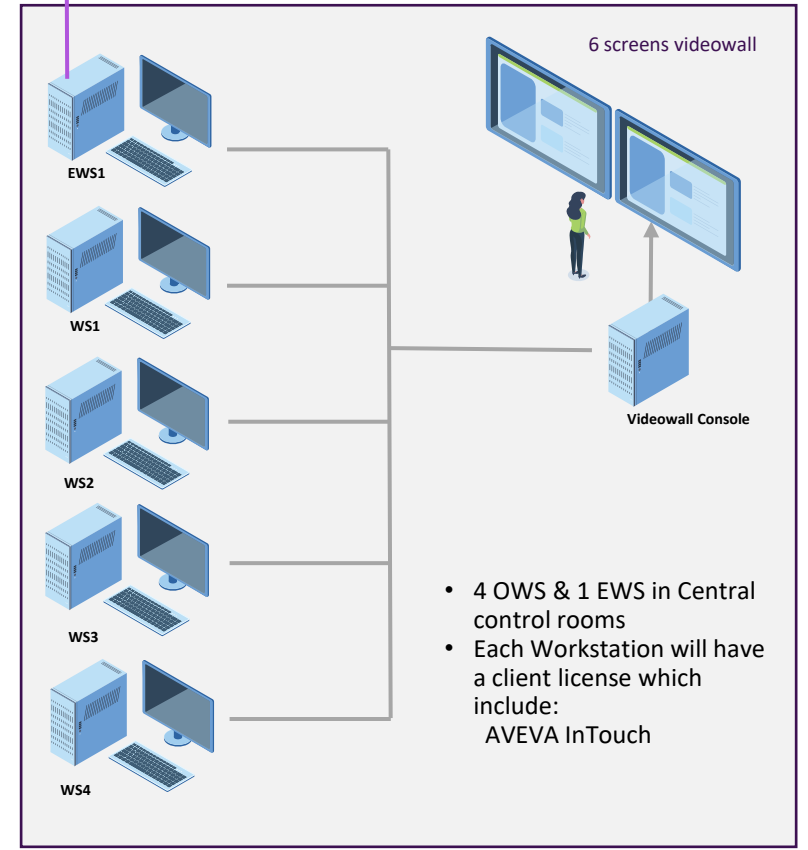
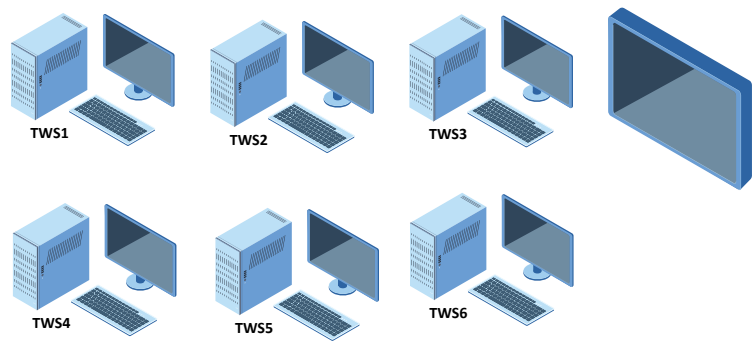
Command Center Room ( CCR 1 & 2 )

Facilities\Buildings

QF OT Network



Training Room ( CCR 2 )



- 4 OWS & 1 EWS in Central control rooms
- Each Workstation will have a client license which include: AVEVA InTouch

• 316,000 Data Points.

• Upgraded to 500,000 data points in total for future expansions.





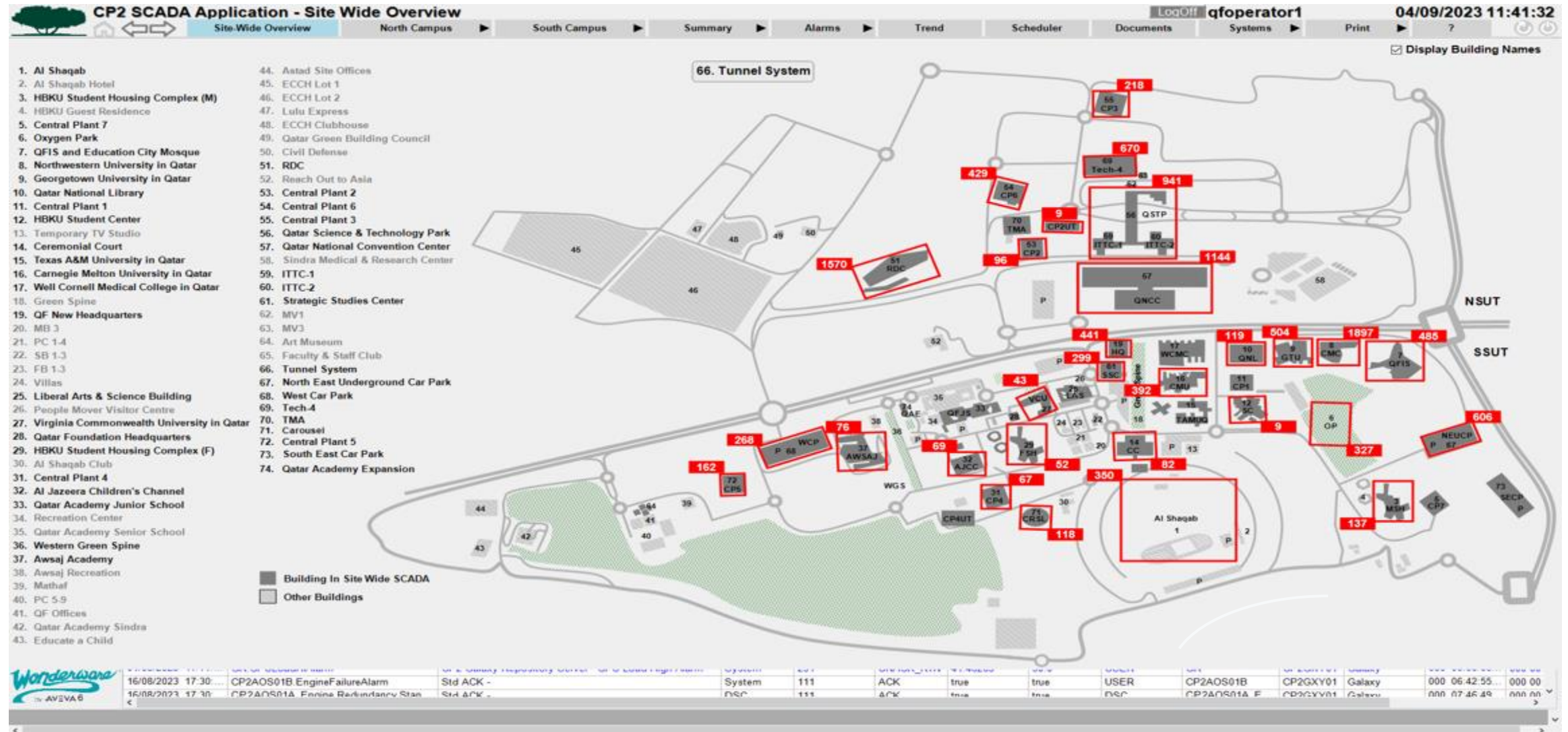
# Application Structure Overview



The following table lists the Hierarchy of the SCADA application.

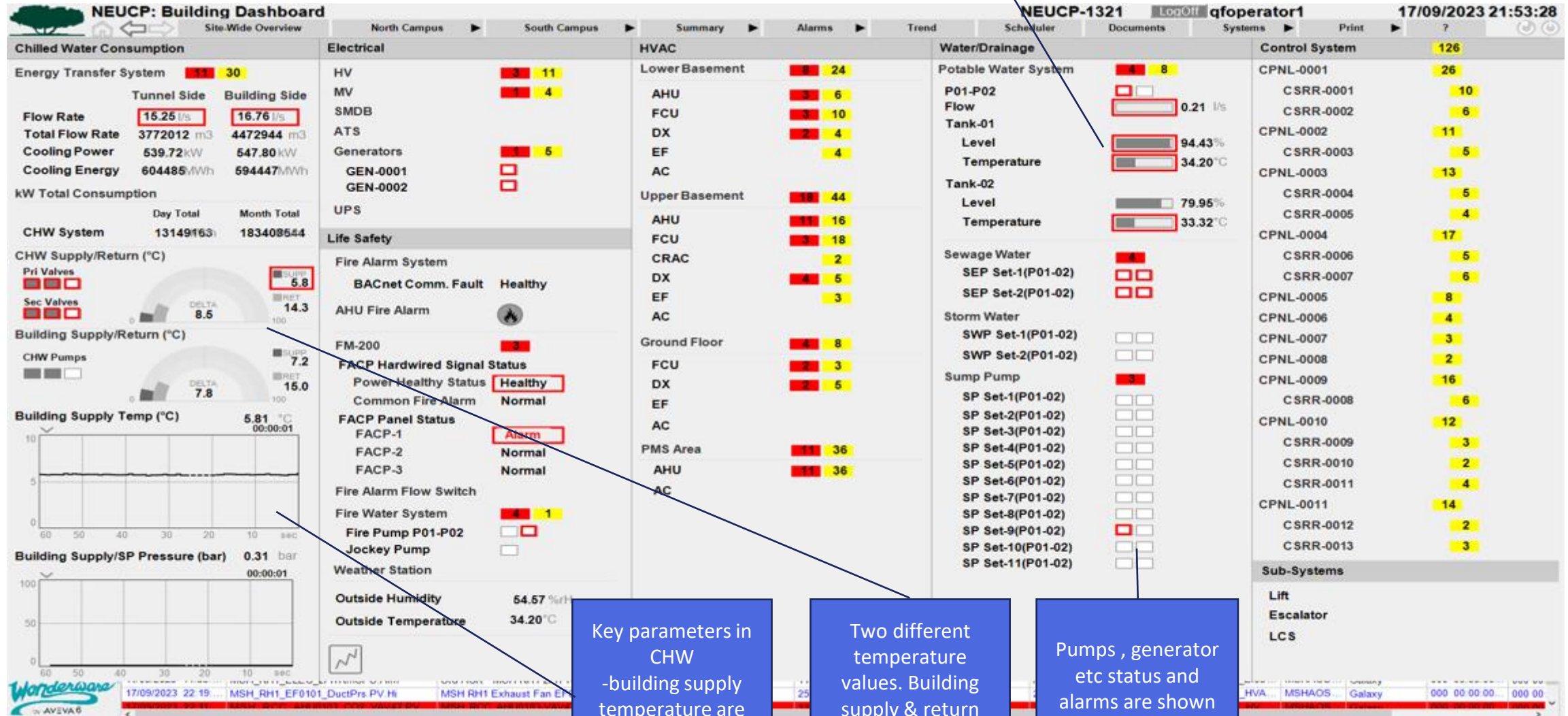
Style	Level	Description
Overview Map	0	Level 0 screen shows The Site Wide Overview gives a bird's eye view on Education City Masterplan where the facilities are mimicked as well as the total number of alarms associated with each facility.
Facility Dashboard	1	Level 1 Building Dashboard shows KPIs for the entire facility , sub sections includes CHW , HVAC , Electrical , Life safety etc...
Equipment Dashboard	2	Level 2 screens contain objects depicting KPIs for equipment in each facility / floor.
Process Graphics	3	Level 3 screens typically provide detail on a specific piece of equipment, process, or area.
Faceplate	4	Level 4 screens are pop-up style screens that are displayed when the user clicks on a component.

# Level 0 – Site Wide Overview



# Level 1 – Building Dashboard

Water tank level, pressure is displayed using this bar indicator

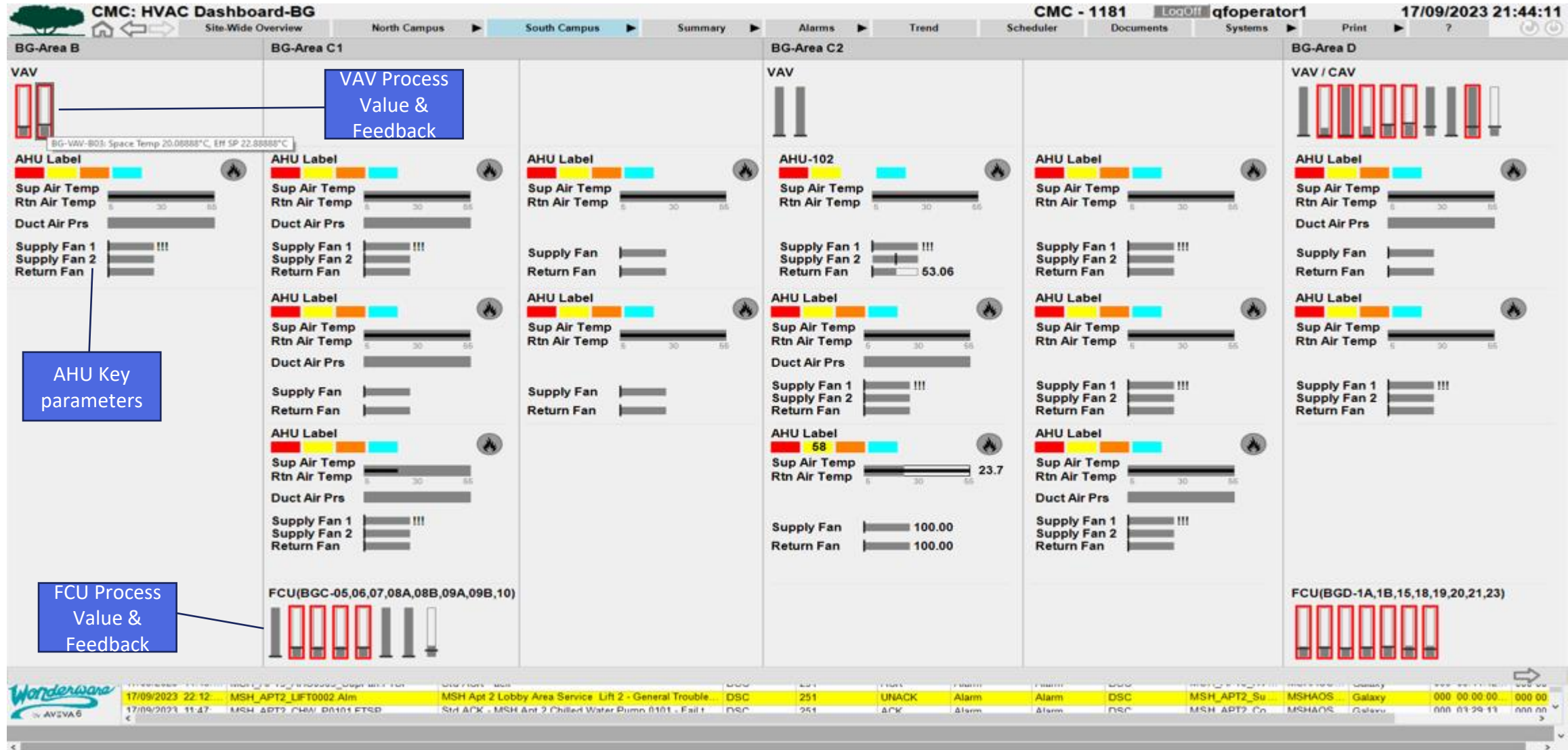


Key parameters in CHW -building supply temperature are displayed in the form of trend.

Two different temperature values. Building supply & return and its difference (delta) is displayed.

Pumps, generator etc status and alarms are shown using this symbol

# Level 2 – Equipment Dashboard



# Level 3 – Process Graphics

Star Navigation

If any alarm is active in the equipment, then a red border appears

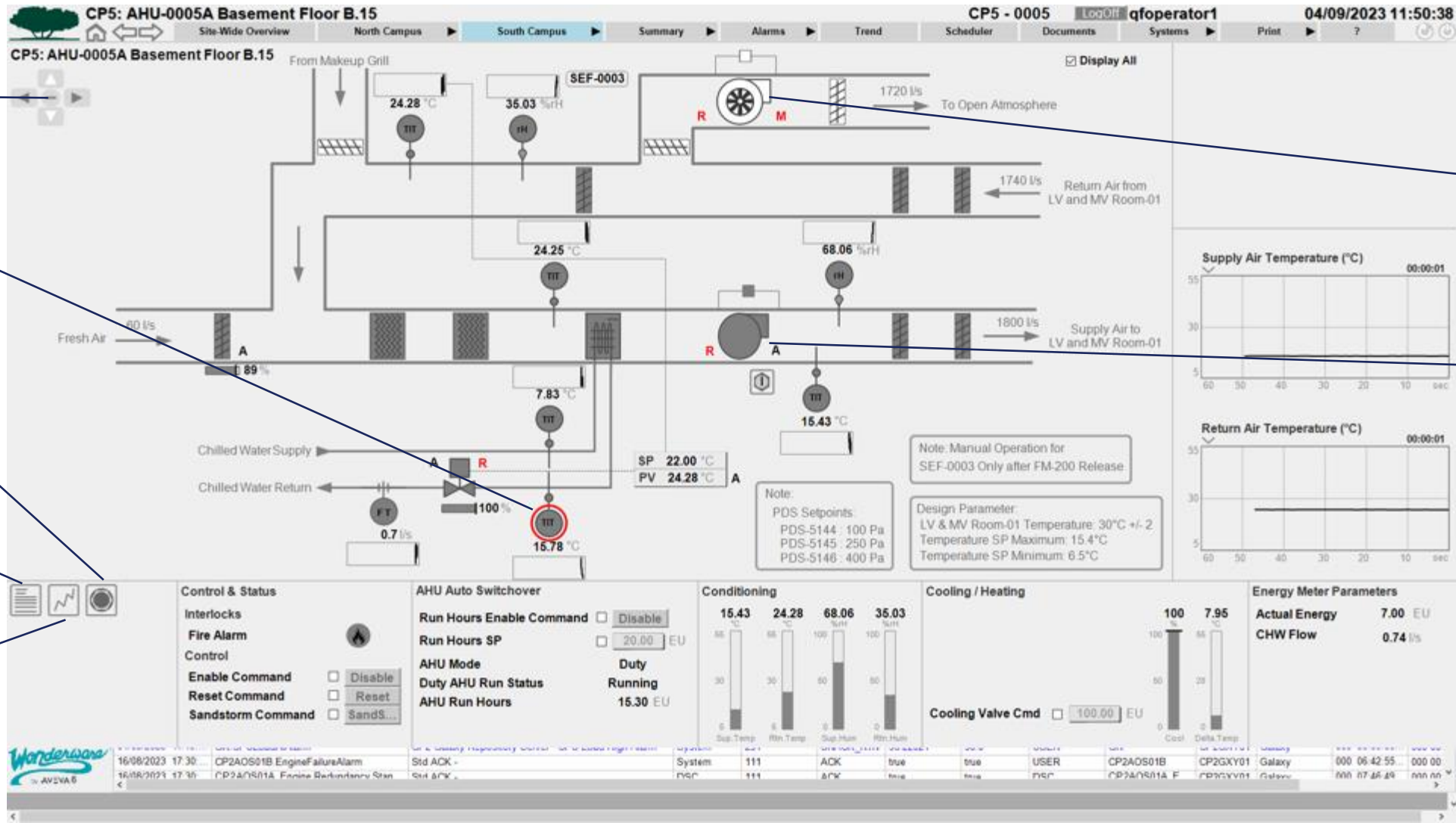
Control Faceplate

Document Viewer

Page Trend

White color displays the equipment is not running

Grey color shows the equipment is running

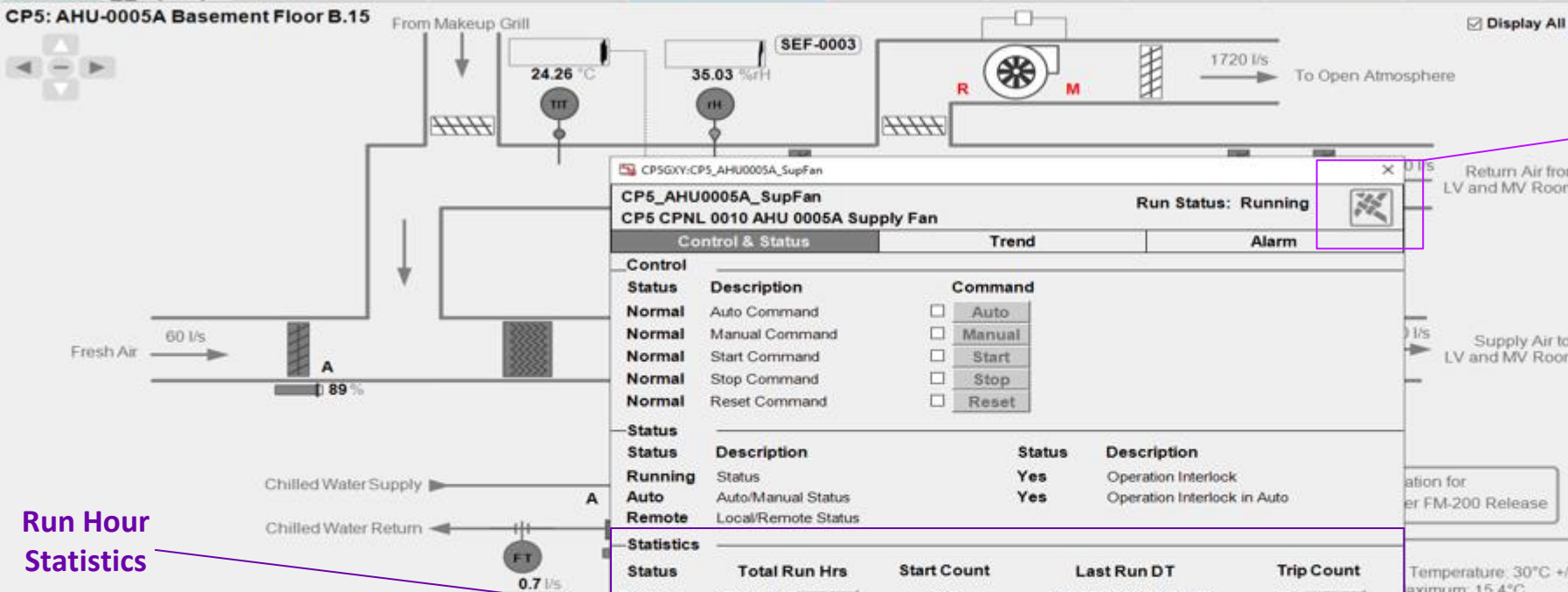


# Level 4 – Faceplate

CP5: AHU-0005A Basement Floor B.15 CP5 - 0005 LogOff! qfoperator1 04/09/2023 11:51:13

Site-Wide Overview North Campus South Campus Summary Alarms Trend Scheduler Documents Systems Print ?

CP5: AHU-0005A Basement Floor B.15



Display All

CAFM Button

CP5GXY:CP5\_AHU0005A\_SupFan

CP5\_AHU0005A\_SupFan Run Status: Running

CP5 CPNL 0010 AHU 0005A Supply Fan

Control & Status		Trend	Alarm
<b>Control</b>			
Status	Description	Command	
Normal	Auto Command	<input type="checkbox"/> Auto	
Normal	Manual Command	<input type="checkbox"/> Manual	
Normal	Start Command	<input type="checkbox"/> Start	
Normal	Stop Command	<input type="checkbox"/> Stop	
Normal	Reset Command	<input type="checkbox"/> Reset	
<b>Status</b>			
Status	Description	Status	Description
Running	Status	Yes	Operation Interlock
Auto	Auto/Manual Status	Yes	Operation Interlock in Auto
Remote	Local/Remote Status		
<b>Statistics</b>			
Status	Total Run Hrs	Start Count	Last Run DT
Running	250 04:10 <a href="#">Reset</a>	211	03/09/2023 20:30:28
			Trip Count
			15 <a href="#">Reset</a>

Run Hour Statistics

Supply Air Temperature (°C) 00:00:01

Return Air Temperature (°C) 00:00:01

Energy Meter Parameters

Actual Energy 6.89 EU

CHW Flow 0.73 l/s

Control & Status

Interlocks

Fire Alarm

Control

Enable Command  Disable

Reset Command  Reset

Sandstorm Command  SandS...

AHU Run Hours Enable Command  20.00 EU

AHU Mode Duty Running

Duty AHU Run Status Running

AHU Run Hours 15.31 EU

Cooling Valve Cmd  100.00 EU

Sup. Temp 30.00 °C Rtn. Temp 30.00 °C Sup. Hum 50.00 % Rtn. Hum 50.00 %

Time	Event	System	Priority	ACK	Clear	Done	User	Device	Location	Start	End	
16/08/2023 17:30	CP2AOS01B EngineFailureAlarm	System	111	ACK	true	true	USER	CP2AOS01B	CP2GXY01	Galaxy	000 06:42:55	000 00
16/08/2023 17:30	CP2AOS01A EngineRedundancyStat	DSC	111	ACK	true	true	DSC	CP2AOS01A	CP2GXY01	Galaxy	nnn 07:46:49	nnn nn

# Better Visibility – Equipment Availability & Reliability

CP1 SCADA Application: Equipment Availability & Reliability LogOff QOperator1 27/09/2023 18:47:50

Site-Wide Overview North Campus South Campus Summary Alarms Trend Scheduler Documents Systems Print ?

Building	Description	Total Scheduled PM (hrs.)	Total Unscheduled Outage (hrs.)	Availability (%)	Reliability (%)	Accept Update	Last Update Date/Time	User
CP4-0004	CP4 Condenser Water System Cooling Tower 01	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Condenser Water System Cooling Tower 02	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Condenser Water System Cooling Tower 03	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Condenser Water System Cooling Tower 04	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Condenser Water System Cooling Tower 05	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Condenser Water System Cooling Tower 06	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Condenser Water System Cooling Tower 07	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Condenser Water System Cooling Tower 08	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Condenser Water System Cooling Tower 09	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Condenser Water System Cooling Tower 10	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Condenser Water System Cooling Tower 11	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Condenser Water System Cooling Tower 12	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Condenser Pump 01	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Condenser Pump 02	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Condenser Pump 03	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Condenser Pump 04	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Condenser Pump 05	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Condenser Pump 06	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Condenser Pump 07	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Condenser Pump 08	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Condenser Pump 09	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Condenser Pump 10	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Condenser Pump 11	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Condenser Pump 12	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Chiller 02	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Chiller 03	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Chiller 04	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Chiller 05	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Chiller 06	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		
CP4-0004	CP4 Chilled Water System Chiller 07	0.00	0.00	100.00	100.00	<input checked="" type="checkbox"/>		

Expand All Collapse All

Reset Select All Clear All Sep 2023 Update Page 1 of 3

27/09/2023 19:07:...	MSH_APT2_LIFT0002.Alm	MSH Apt 2 Lobby Area Service Lift 2 - General Trouble...	DSC	251	UNACK_RTN	Normal	Alarm	DSC	MSH_APT2_Su...	MSHAOS...	Galaxy	000 00:00:00...	000 00:00:00...
27/09/2023 10:21:...	MSH_APT2_CHW_P0101.ETSP	Std ACK - MSH Apt 2 Chilled Water Pump 0101 - Fail t...	DSC	251	ACK	Alarm	Alarm	DSC	MSH_APT2_Co...	MSHAOS...	Galaxy	000 02:02:09...	000 02:02:09...

# Better Visibility – Equipment Summary

CP1 SCADA Application: AHU Summary LogOff QOperator1 27/09/2023 18:49:53

Site-Wide Overview North Campus South Campus Summary Alarms Trend Scheduler Documents Systems Print

Building	Floor/Location	ID	Sup. Air Temp (°C)	Ret./Exh Air Temp (°C)	Supply Humidity (%Rh)	Supply Fan Status	Return Fan Status	Cooling Valve Feedback (%)	Supply Duct Pressure (psi)	Sup. Fan Filter Status	Exh. Fan Filter Status	Sup. Air Setpoint (°C)
CP6-0006	BF-P1-B25	AHU-0001	11.07	27.64	---	Running	---	100.00	---	Normal	---	---
CP6-0006	BF-P2-B15	AHU-0002	25.38	25.97	---	Running	---	0.00	---	Normal	---	---
CP6-0006	BF-P1-B8	AHU-0003	12.19	26.28	---	Running	---	100.00	---	Normal	---	---
CP6-0006	BF-P2-B32	AHU-0004	12.20	28.00	---	Running	---	100.00	---	Normal	---	---
CP6-0006	BF-P2-B15	AHU-0005A	15.35	23.92	---	Running	---	48.00	---	Normal	---	---
CP6-0006	BF-P2-B15	AHU-0005B	16.77	19.19	---	Stopped	---	0.00	---	Normal	---	---
CP6-0006	BF-P2-B32	AHU-0006A	21.22	25.70	---	Stopped	---	0.00	---	Normal	---	---
CP6-0006	BF-P2-B32	AHU-0006B	19.07	25.92	---	Running	---	16.00	---	Normal	---	---
CP6-0006	BF-P1-B30A	AHU-0009	13.23	26.27	---	Running	---	100.00	---	Normal	---	---
CP6-0006	GF-P4-G19	AHU-0007A	20.45	24.50	---	Stopped	---	0.00	---	Normal	---	---
CP6-0006	GF-P4-G19	AHU-0007B	20.15	25.62	---	Running	---	0.00	---	Normal	---	---
CP6-0006	GF-P3-G20	AHU-0008A	23.95	19.96	---	Stopped	---	0.00	---	Normal	---	---
CP6-0006	GF-P3-G20	AHU-0008B	23.26	26.18	---	Running	---	10.00	---	Normal	---	---
CP6-0006	GF-P4-G19	OAHU-0001	14.07	---	---	Running	---	29.00	---	Normal	---	14.00 °C
CP6-0006	LRF	AHU-0010B	18.88	19.97	---	Running	---	13.00	---	Normal	---	---
CP6-0006	LRF	AHU-0011	17.76	22.00	---	Running	---	17.00	---	Normal	---	---
CP6-0006	LRF	AHU-0012	14.49	22.03	---	Running	---	22.00	---	Normal	---	---
CP6-0006	LRF	AHU-0013	15.72	22.04	---	Running	---	29.00	---	Normal	---	---

Expand All Collapse All

Wonderware by AVEVA 6

27/09/2023 19:11:... MSH\_APT2\_LIFT0002 Alm MSH Apt 2 Lobby Area Service Lift 2 - General Trouble... DSC 251 UNACK\_RTN Normal Alarm DSC MSH\_APT2\_Su... MSHAOS... Galaxy 000 00:00:00... 000 00:00:00...

27/09/2023 10:21:... MSH\_APT2\_CHW\_P0101 FTSP Strd ACK - MSH Apt 2 Chilled Water Pump 0101 - Fail t DSC 251 ACK Alarm Alarm DSC MSH\_APT2\_Co... MSHAOS... Galaxy 000 02:02:09 000 02:02:09

Page 1 of 1



# Water Meter Management

## SWSCADA Flow Meter Report(Daily) - ALSQB

Report Period : 25/08/2023 12:59 PM To 26/08/2023 01:00 PM



DAILY FLOW (l/s)

Item Name	Min	Max	Average
SSUT_ALSQB_FM1_FR.PV	0.93	17.86	6.51
SSUT_ALSQB_FM2_FR.PV	-0.95	91.23	26.57

DAILY TOTAL (m3)

Item Name	Total
SSUT_ALSQB_FM1_FR.Tot	733.47
SSUT_ALSQB_FM2_FR.Tot	2287.72

HOURLY TOTAL (m3)

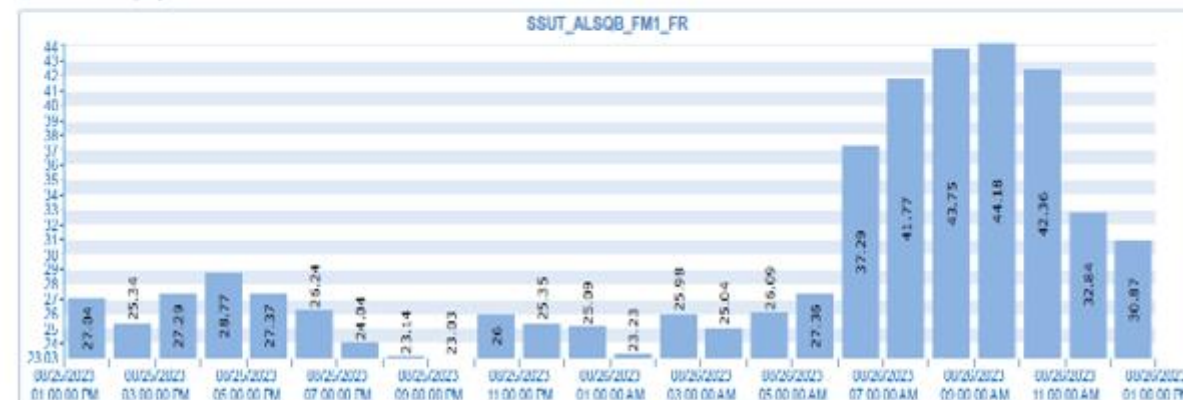
Time	SSUT_ALSQB_FM1	SSUT_ALSQB_FM2	SysMin	SysHour
25/08/2023 14:00:00	27.04	5.10	0.00	0.00
25/08/2023 15:00:00	26.43	32.02	0.00	1.00
25/08/2023 16:00:00	28.34	53.34	0.00	1.00
25/08/2023 17:00:00	29.79	143.23	0.00	1.00
25/08/2023 18:00:00	28.38	118.51	0.00	1.00
25/08/2023 19:00:00	27.32	101.45	0.00	1.00
25/08/2023 20:00:00	25.04	76.25	0.00	1.00
25/08/2023 21:00:00	24.21	122.38	0.00	1.00
25/08/2023 22:00:00	24.09	20.57	0.00	1.00
25/08/2023 23:00:00	27.06	71.06	0.00	1.00
26/08/2023 00:00:00	26.37	114.31	0.00	1.00
26/08/2023 01:00:00	26.12	68.85	0.00	0.00
26/08/2023 02:00:00	24.31	162.63	0.00	1.00
26/08/2023 03:00:00	27.04	171.20	0.00	1.00
26/08/2023 04:00:00	26.07	204.32	0.00	1.00
26/08/2023 05:00:00	27.10	257.80	0.00	1.00
26/08/2023 06:00:00	28.41	146.33	0.00	1.00
26/08/2023 07:00:00	38.29	76.33	0.00	1.00
26/08/2023 08:00:00	42.80	100.47	0.00	0.00
26/08/2023 09:00:00	44.81	161.97	0.00	0.00
26/08/2023 10:00:00	45.25	44.89	0.00	0.00
26/08/2023 11:00:00	43.38	11.29	0.00	0.00
26/08/2023 12:00:00	33.93	13.23	0.00	0.00
26/08/2023 13:00:00	31.93	10.19	0.00	0.00

## SWSCADA Flow Meter Report(Daily) - ALSQB

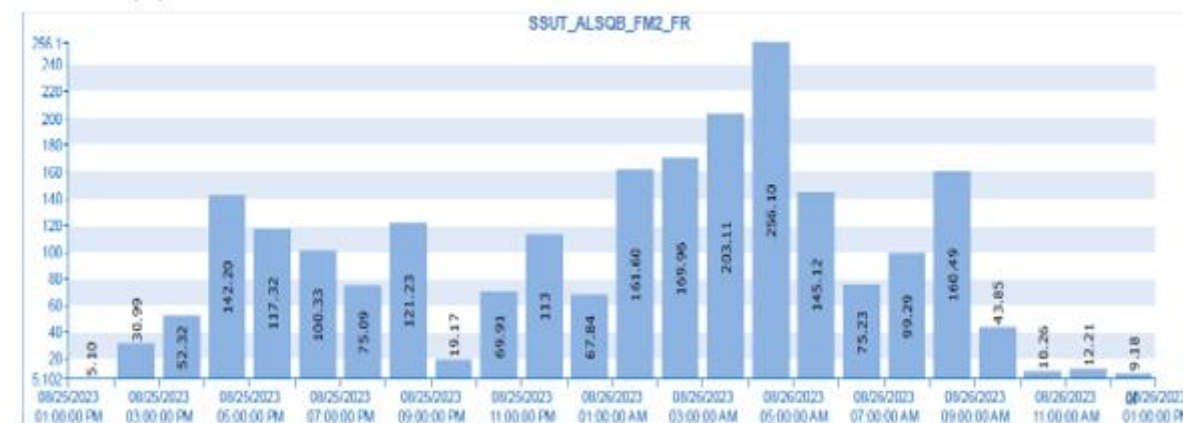
Report Period : 25/08/2023 12:59 PM To 26/08/2023 01:00 PM



HOURLY TOTAL (m3)



HOURLY TOTAL (m3)



# Water Meter Management

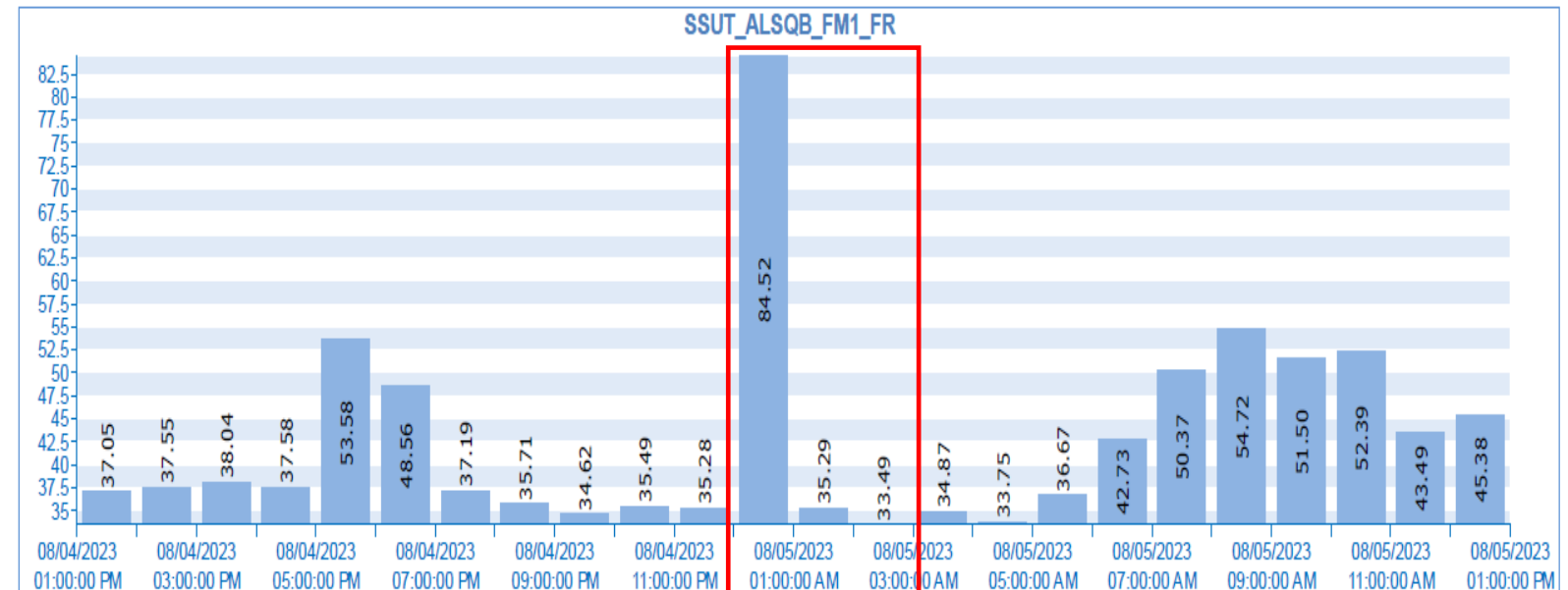
QF were able to identify a leakage in one of the sub header lines on the 5<sup>th</sup> of August 2023 utilizing the High Alarm set for Al Shaqab Flow meter

- Facilities water usage at night is less compared morning due to unoccupancy.
- Average water usage at Al Shaqab facility is around 35 m<sup>3</sup>/Hr at night.
- On the 5<sup>th</sup> August 2023 at night water usage peaked to 84 m<sup>3</sup>/hr due to a leakage in the sub header.
- High flow alerted the remote operator on his cell phone, and local operators were able to bypass the line and avoid huge wastage and cooling water.

## SWSCADA Flow Meter Report(Daily) - ALSQB

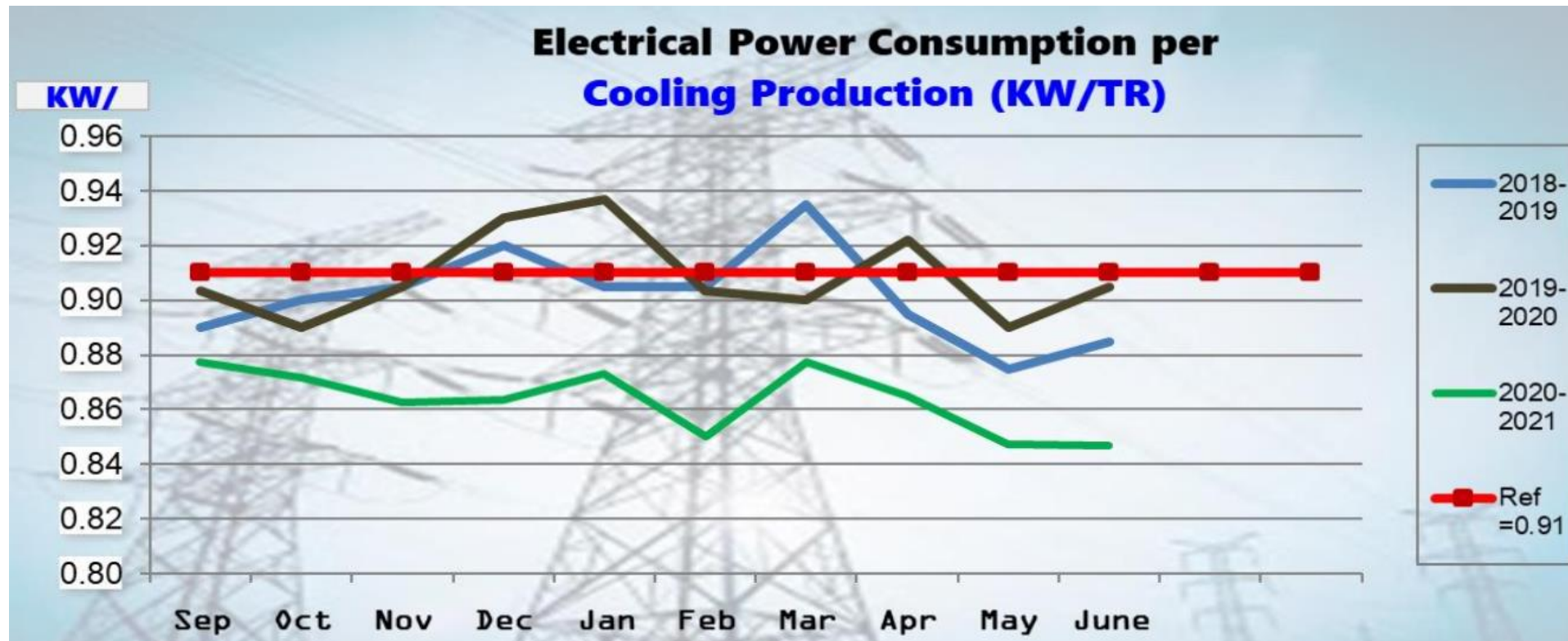
Report Period : 04/08/2023 12:59 PM To 05/08/2023 01:00 PM

HOURLY TOTAL (m3)



# Optimum Energy Utilization

Electrical Consumption is considerably reduced and Chiller Plant efficiency has improved from previous years average from 0.91 kW/TR down to 0.86 KW/TR leading to 5.5 % cost reduction to QF



- Performance of the District Cooling Plants and Energy Transfer Stations are continuously monitored 24/7.
- Real time diagnostics of all operating systems and equipment for higher reliability and lower operating costs.

# Reduction of Education City carbon footprint through optimum energy consumption

## Smart Cities & Infrastructure | Education City

### Challenge

- 12 sq km campus with 45+ buildings including educational, hospital, recreational, industrial, and sports facilities.
- Diverse makes and models of existing controls across facilities with inconsistency visualization, trending, and reporting interfaces.
- Difficulty to control and monitor all operations from centralized control rooms.

### Solution

- Deployed AVEVA Operations Control to streamline process visibility and centralized control. Utilizing a high availability architecture design enabling operation from two command centers interconnected throughout all facilities.

### Results

- Centralized control and independent monitoring & Control for over 45+ facilities
- Better visibility to information has led to 5.5 % reduction in energy consumption, optimum energy utilization, and enabled more reliable operations performance
- Corner stone for smart city transformation at Education City through a unified operation platform
- Streamlined operator training due to standardized design and function



“

AVEVA Operations Platform aligns Education City with our leadership's vision to transform it into a Digital Smart City, controlled from a centralized command center to attain optimum operability and to provide necessary information for decision making for our prestigious facilities to reduce their carbon footprint and O&M costs.”

*Georgios Sichanis, SPM, ASTAD*

# Team Members Acknowledgment

Distinctive Appreciation goes to the professional AVEVA team members who have successfully delivered the EPC of SCADA System for Qatar Foundation at Education City.



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  - Sanjiva Reddy
  - Sai Teja

# Questions?

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