



INDIVIDUAL BATTERY HEALTH MONITORING SOLUTION

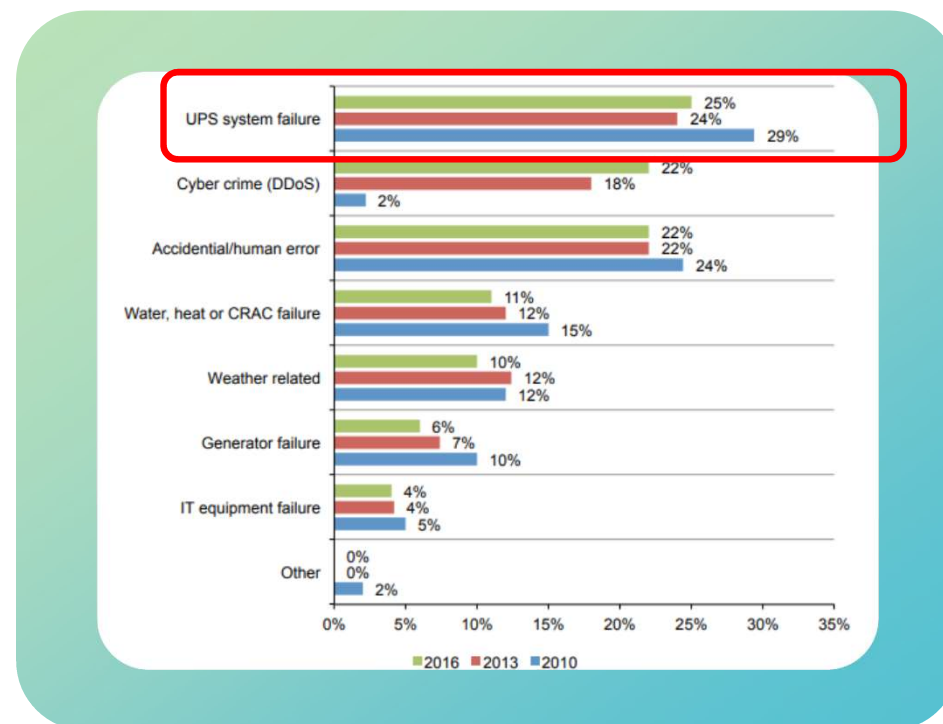
iBHMS Solution for VRLA batteries

▶ WHY MONITOR BATTERIES 24x7?

- Batteries form the backbone of backup power for every business-critical infrastructure¹
- Failure of batteries can lead to catastrophic infrastructure failure costing millions in losses²
- **65% of backup power failure are due to battery failure³**
- Batteries are black boxes and their health cannot be ascertained by looking at them or manually logging data
- Temperature raise in batteries can lead to explosions and fire
- Life of battery gets reduced if ambient temperature is not maintained at appropriate levels
- Batteries are connected in series and if one or two batteries degrade, it will affect the health of all other batteries if undetected

- ❖ [1] – [IJSR Research Paper](#)
- ❖ [2] – [Cost of Data Center Outages](#)
- ❖ [3] – [National Survey on Data Center Outages](#)

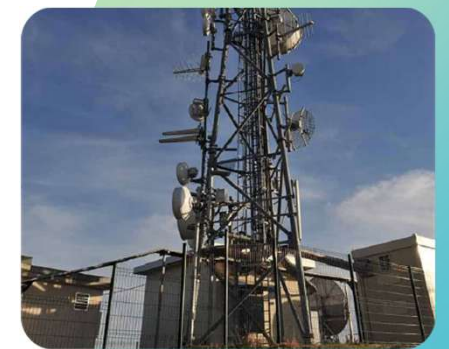
Root causes of unplanned outages



As detailed in the research report titled “[Cost of Data Center Outages](#)” by Ponemon Institute©

▶ POTENTIAL ROI

- VRLA batteries typically last for 5 to 10 years depending on its operating condition.
- However, in reality, companies tend to replace their VRLA batteries every 3 to 5 years as a standard practice.
 - This is because the state of battery health for individual battery blocks are unknown.
 - This approach increases the OPEX for the companies as they are replacing good batteries along with the few batteries that may be weak/bad.
- Sixth Energy's iBHMS solution can provide the health of individual batteries.
- This will enable the customer to replace only the bad/weak batteries as required.



▶ TENTATIVE ROI CALCULATION

- Consider a sample UPS system with 1 battery string having 12V 200Ah 40 VRLA batteries with standard wiring. Considering INR 18,000/- per battery, customer needs to spend **INR 7,20,000/- every 3 years.**

Total investment without monitoring solutions	
Initial batteries cost with 3years (Rs. 18,000 * 40 Batteries)	₹ 7,20,000.00
Replacement of batteries cost after warranty period for 3years (W/o inflation)	₹ 7,20,000.00
Total without Monitoring Solutions	₹ 14,40,000.00
Total investment with monitoring solutions	
Initial batteries cost with 3years (Rs. 18,000 * 40 Batteries)	₹ 7,20,000.00
Initial BHMS Cost	₹ 1,40,000.00
Batteries cost (20% extra for AMC/Maintenance) for 4th, 5th and 6th Year	₹ 1,44,000.00
BHMS AMC Renewal for next three years (4th, 5th and 6th Year)	₹ 63,000.00
Total with Monitoring Solutions	₹ 10,67,000.00
Saving - Return on Investment	₹ 3,73,000.00
Percentage - Return on Investment	26%

- During the warranty period, 6th Energy's Battery Health Monitoring Solutions provide customers with real-time visibility of battery health, along with proactive alerts and notifications to help reduce failures and prevent unforeseen incidents.
- With 6th Energy Battery Health Monitoring Solutions offerings, we have observed that the battery replacement was/is equal or less than 10%, however we have taken 20% in the above working. **@10%, the ROI will be 31%**

▶ WHY SIXTH ENERGY iBHMS?

▪ Latest in technology- Doing IT the 2025 way

- ✓ Latest IoT technology provides secure private cloud deployment with ability to access selective data by authorized users.

▪ User based data view

- ✓ Customers can provide selective access to information and data to their end user through APPs and web browsers (some users can access only some parameters)

▪ Apps & data on the move

- ✓ Integrates with digital life style, mute notifications selectively, Data at your finger tips

▪ Advanced data analytics

- ✓ Appliance server runs Enterprise class Linux with various advanced data analytics features

▪ Wireless sensors

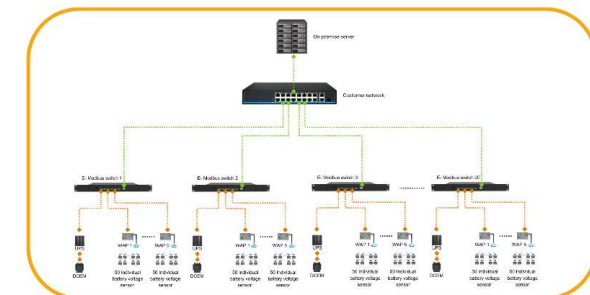
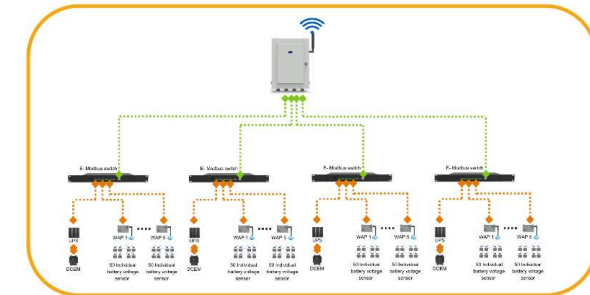
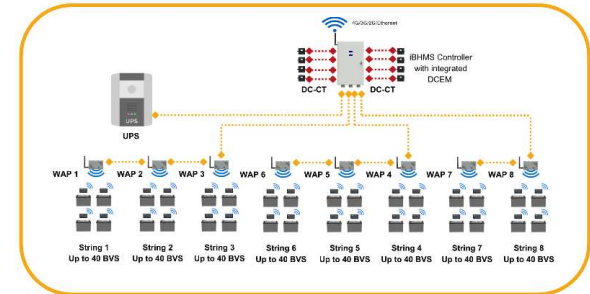
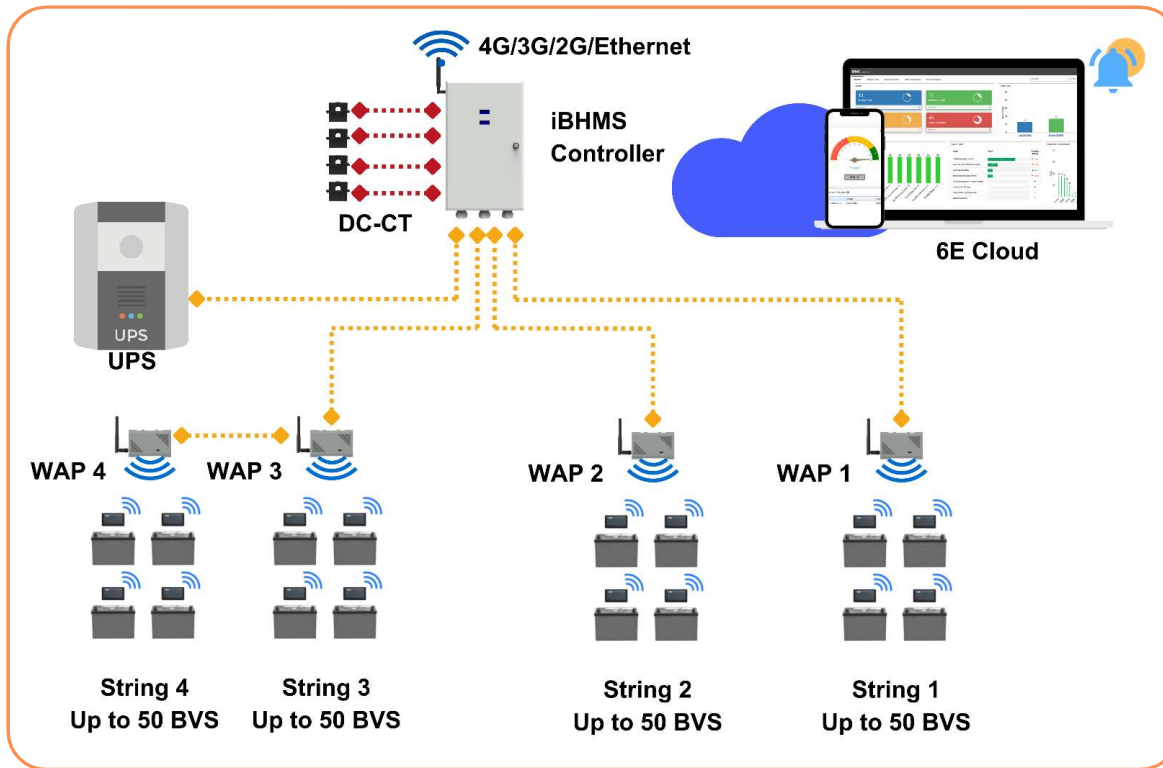
- ✓ Wireless sensors enable high reliability (no loose connections), enhanced electrical safety (high isolation) and nice aesthetics

▪ Future proof

- ✓ Ability to upgrade to monitoring UPS, PAC, ACDB, Genset, ATS from and manufacturer at a future date using the same platform (monitor from both BMS and IoT at the same time)

SOLUTION ARCHITECTURE

Standard Deployment Architecture



Alternate Deployment Architectures

▶ KEY ALARMS & PARAMETERS MONITORED

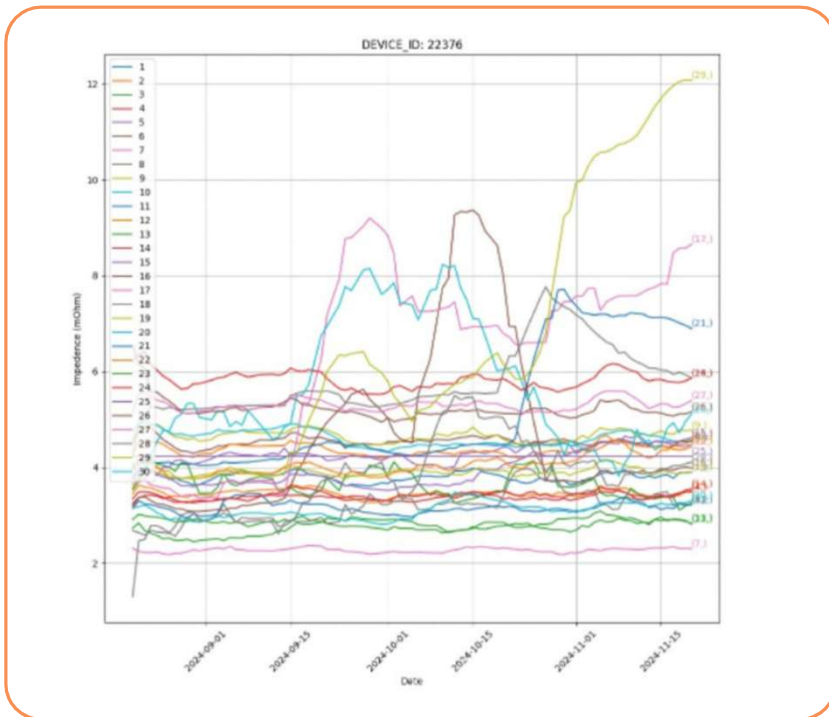


Parameters		
Battery	Cell	Voltage (V)
		Ripple Voltage (V)
		Temperature (°C)
		Impedance (milli-Ohms)
	String	Current (A)
		Ripple Current (A)
		Voltage (V)
		State (Float/Charge/Discharge)
		Charge Level (%)
UPS	Input	Voltage (R,Y,B)
		Current (R,Y,B)
		Frequency
	Output	Voltage (R,Y,B)
		Current (R,Y,B)
		Load (R,Y,B)
		Frequency
	Battery	Charge Level (%)
		Voltage (V)
		State (Float/Charge/Discharge)
Environment	Temperature (°C)	
	Humidity (%)	

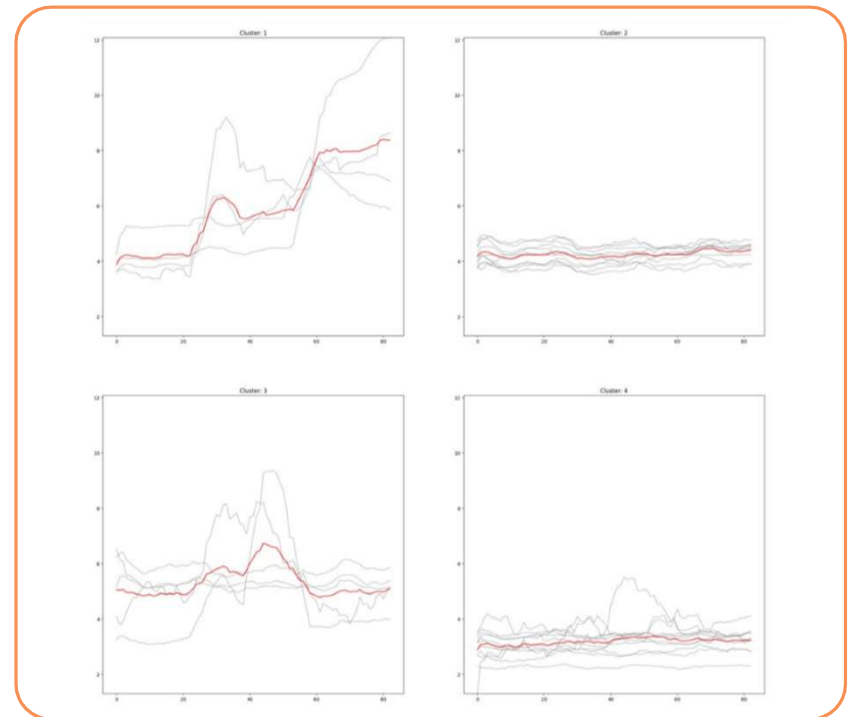
Battery Alarms		
Battery Cell	Sensor Communication Error	
	Block High Float Voltage	Major
	Block High Float Voltage	Critical
	Block Low Float Voltage	Major
	Block Low Float Voltage	Critical
	High Block Charging Voltage	Major
	High Block Charging Voltage	Critical
	Low Block Charging Voltage	Major
	Low Block Charging Voltage	Critical
	Low Block Discharge Voltage	Major
	Low Block Discharge Voltage	Critical
	High block impedance value	Major
	High block impedance value	Critical
	High block temperature	Major
	High block temperature	Critical
	Block High Ripple Voltage	Major
Block High Ripple Voltage	Critical	
Battery String	Sensor Communication Error	
	String High Ripple Current	Major
	String High Ripple Current	Critical
	String Discharge	Major

UPS Alarms (as per protocol availability)	
Load Not Protected	Major
UPS Operation Mode - Battery	Minor
Emergency stop	Major
Input Bypass Due to Internal Fault	Major
UPS Overload	Major
Fan Fault	Critical
Manual Bypass Switch	Critical
Rectifier Internal Failure / Major Rectifier-Charger Fault	Critical
Protection Lost In Parallel Installation	Critical
Battery Circuit Breaker	Critical
Input Fuse Fault	Major
Bypass Overload	Major
Load Short Circuit	Critical
Battery Low Warning	Minor
Temperature Out of Range	Minor
Communication Fault	Major
Output Switch	Critical
Chopper Major Fault	Major
Inverter Major Fault	Major
Inverter Overload	Major
Inverter Thermal Overload	Major
Inverter Limitation	Major
Ups Fuse Fault	Major
Inverter Stack Overload	Major
Inverter Output Current Limiting	Minor
Battery Ventilation Fault	Major
Output Thermal Overload	Major
Charger General Fault	Major

▶ AI/ML ANALYTICS



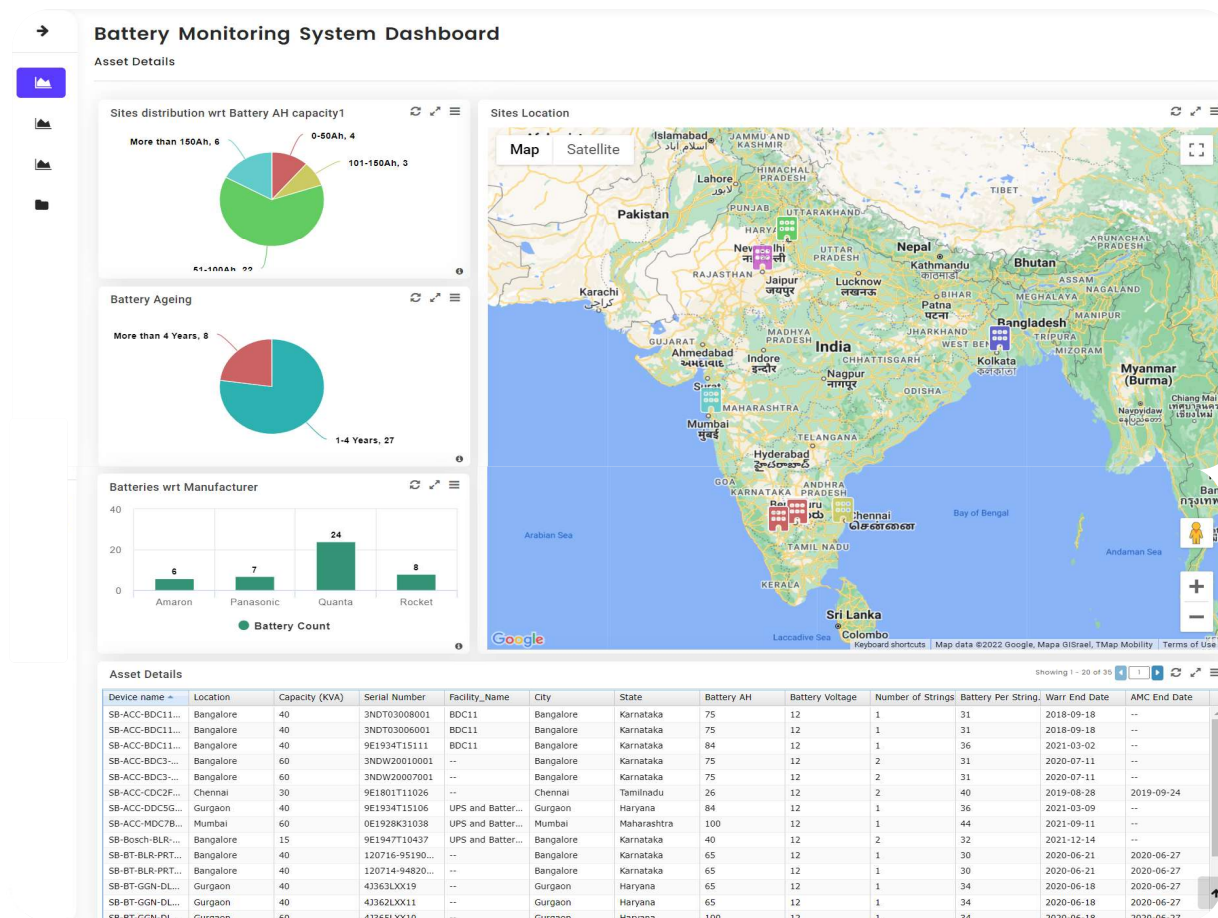
Impedance data gathered from different battery blocks



AI/ML engine clusters & groups batteries based on their health

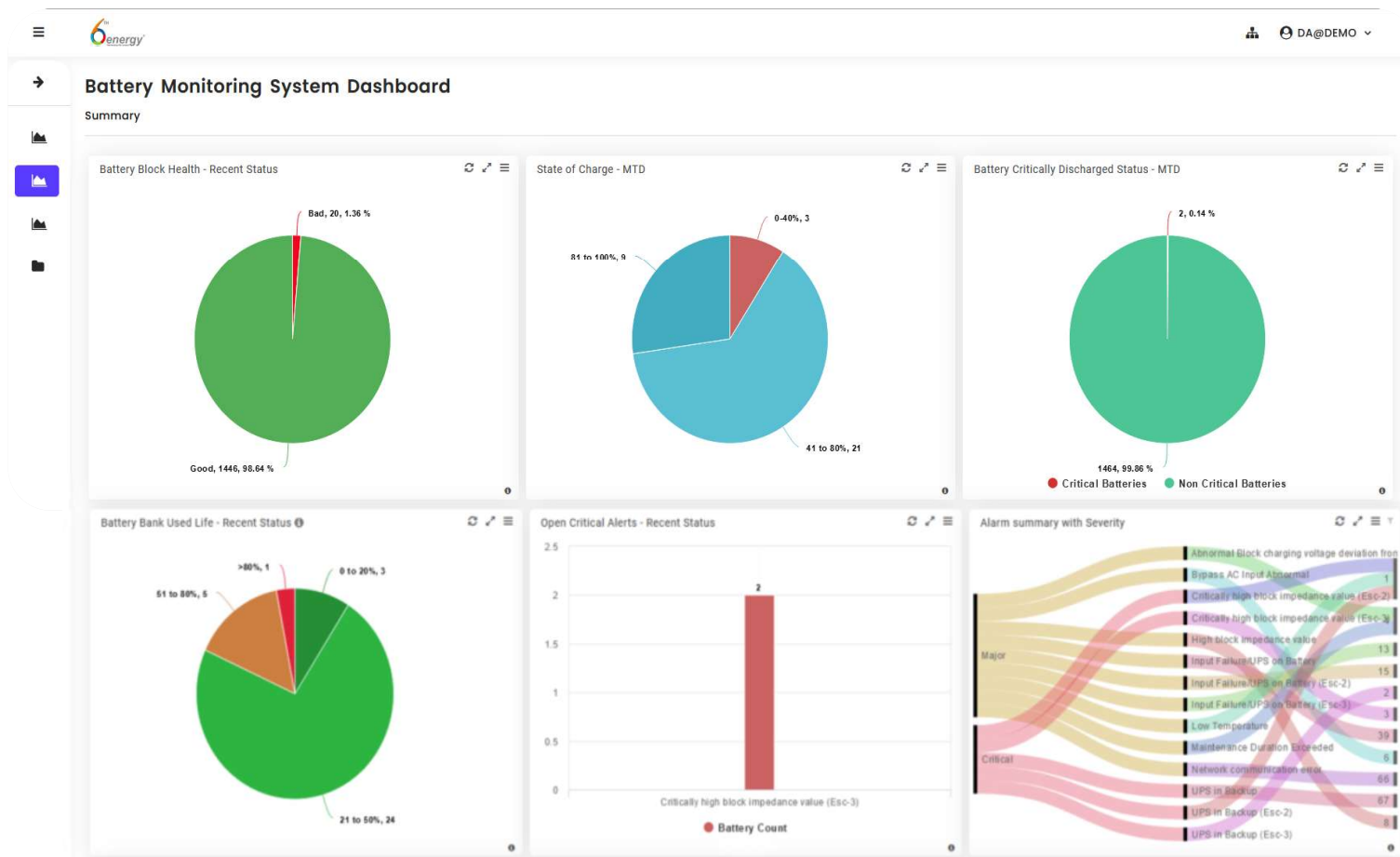
SAMPLE DASHBOARD – SITE SUMMARY

- Overview of all batteries
- Alarm view
- Asset view
- Health view



▶ SAMPLE DASHBOARD – BATTERY STATUS

- Alarm analysis
- State of charge summary
- Critical discharge summary
- Utilized life summary



SAMPLE DASHBOARD – DISCHARGE ANALYSIS

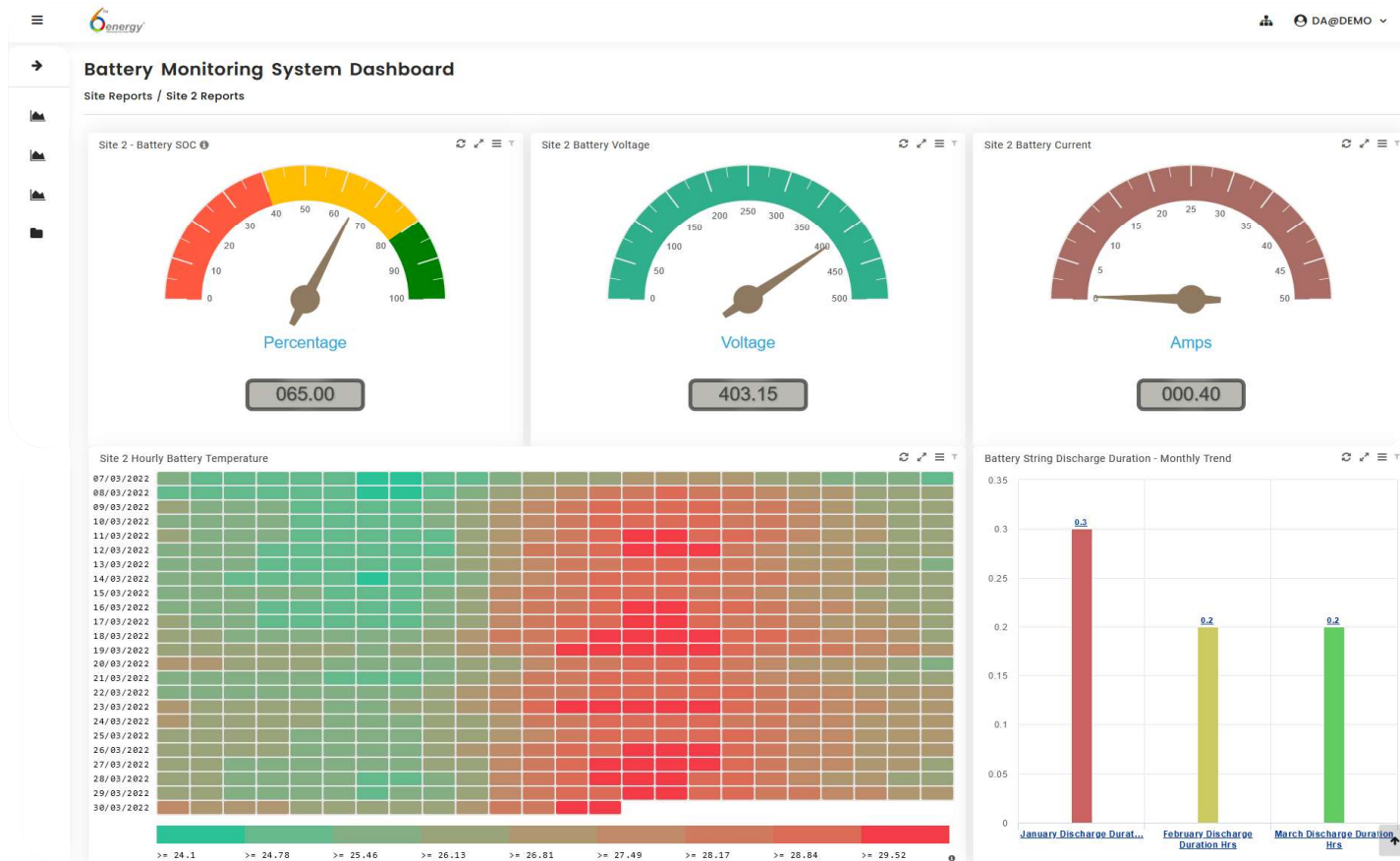


BHMS Dashboard

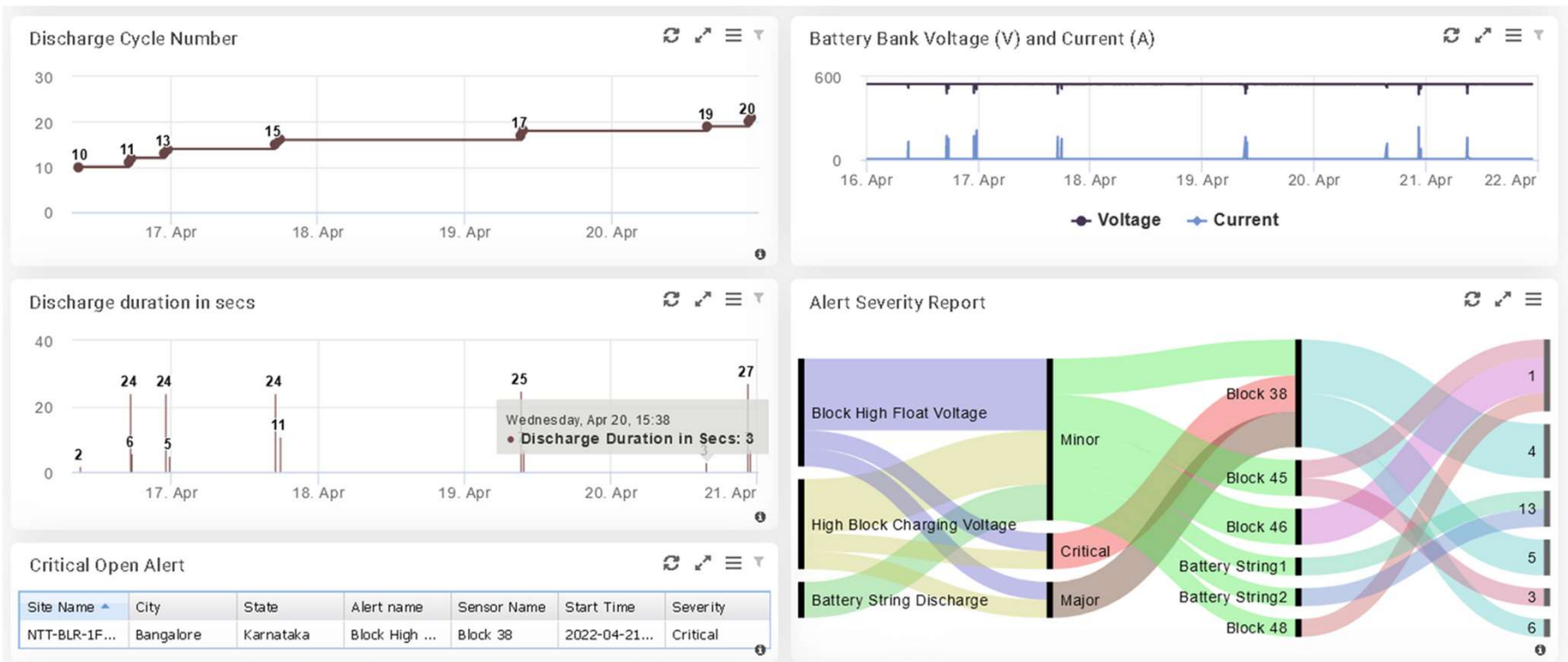
Discharge Activity Report

Site Name	String Name	Discharge Cycle Number	Discharge Start Time	Discharge End Time	Discharge Average Current	Charge Start Time	Charge End Time	Charge Duration
UPS05	Battery String 1	49	2023-01-03 12:11:00	2023-01-03 12:14:00	80.2	2023-01-03 12:14:00	2023-01-03 12:28:00	84.3
UPS07	Battery String 1	49	2023-01-03 12:11:00	2023-01-03 12:15:00	75	2023-01-03 12:15:00	2023-01-03 12:28:00	731
UPS08	Battery String 1	35	2023-01-03 12:11:00	2023-01-03 12:13:00	76.9	2023-01-03 12:13:00	2023-01-03 12:27:00	842
UPS06	Battery String 1	45	2023-01-03 12:11:00	2023-01-03 12:13:00	80.1	2023-01-03 12:13:00	2023-01-03 12:28:00	882
UPS04	Battery String 1	34	2023-01-03 12:28:00	2023-01-03 12:29:00	99.3	2023-01-03 12:29:00	2023-01-03 13:20:00	3058
UPS05	Battery String 1	50	2023-01-03 12:28:00	2023-01-03 12:32:00	64.3	2023-01-03 12:32:00	2023-01-03 12:45:00	819
UPS15	Battery String 1	50	2023-01-03 12:28:00	2023-01-03 12:28:00	31	2023-01-03 12:28:00	2023-01-03 12:43:00	897
UPS16	Battery String 1	45	2023-01-03 12:28:00	2023-01-03 12:31:00	26.1	2023-01-03 12:31:00	2023-01-03 13:31:00	3828
UP022	Battery String 1	31	2023-01-03 12:28:00	2023-01-03 12:28:00	33.1	2023-01-03 12:28:00	2023-01-03 12:30:00	97
UPS10	Battery String 1	35	2023-01-03 12:28:00	2023-01-03 12:29:00	87	2023-01-03 12:29:00	2023-01-03 12:41:00	758
UPS18	Battery String 1	52	2023-01-03 12:28:00	2023-01-03 12:28:00	26.7	2023-01-03 12:28:00	2023-01-03 13:31:00	3765
UPS12	Battery String 1	51	2023-01-03 12:28:00	2023-01-03 12:29:00	33.1	2023-01-03 12:29:00	2023-01-03 12:43:00	847
UPS13	Battery String 1	52	2023-01-03 12:28:00	2023-01-03 12:29:00	30.3	2023-01-03 12:29:00	2023-01-03 13:31:00	3734
UPS02	Battery String 1	48	2023-01-03 12:28:00	2023-01-03 12:30:00	107.2	2023-01-03 12:30:00	2023-01-03 12:40:00	601
UPS07	Battery String 1	50	2023-01-03 12:28:00	2023-01-03 12:29:00	50.1	2023-01-03 12:29:00	2023-01-03 12:45:00	955
UPS17	Battery String 1	45	2023-01-03 12:28:00	2023-01-03 12:29:00	29.9	2023-01-03 12:29:00	2023-01-03 13:31:00	3708
UPS01	Battery String 1	44	2023-01-03 12:28:00	2023-01-03 12:30:00	113.6	2023-01-03 12:30:00	2023-01-03 12:40:00	574
UPS14	Battery String 1	55	2023-01-03 12:28:00	2023-01-03 12:30:00	28.1	2023-01-03 12:30:00	2023-01-03 12:43:00	810
UPS03	Battery String 1	49	2023-01-03 12:28:00	2023-01-03 12:31:00	108.3	2023-01-03 12:31:00	2023-01-03 12:39:00	449
UPS19	Battery String 1	56	2023-01-03 12:28:00	2023-01-03 12:30:00	12.4	2023-01-03 12:30:00	2023-01-03 12:30:00	0
UPS06	Battery String 1	46	2023-01-03 12:28:00	2023-01-03 12:30:00	71.1	2023-01-03 12:30:00	2023-01-03 12:43:00	754
UPS20	Battery String 1	39	2023-01-03 12:28:00	2023-01-03 12:29:00	21	2023-01-03 12:29:00	2023-01-03 14:28:00	7110
UPS08	Battery String 1	36	2023-01-03 12:28:00	2023-01-03 12:32:00	81.2	2023-01-03 12:32:00	2023-01-03 12:45:00	792
UPS22	Battery String 1	32	2023-01-03 12:32:00	2023-01-03 12:33:00	36.2	2023-01-03 12:33:00	2023-01-03 15:06:00	9132
UPS01	Battery String 1	45	2023-01-03 12:40:00	2023-01-03 12:41:00	107.3	2023-01-03 12:41:00	2023-01-03 13:31:00	3017

SAMPLE DASHBOARD – SITE REPORT



▶ SAMPLE DASHBOARD – SYSTEM LEVEL



SAMPLE REPORT



6energy
DA@DEMO

Battery Monitoring System Dashboard

Battery Report

Battery Bank Health Report Showing 1 - 20 of 325

Site	Location	Number of Strings	Banks identified as check required	Banks identified as Weak	Banks identified as Bad	Utilized life at Start (%)	Utilized life at End (%)	Total Utilized life during selected pe
1		1	0	0	0	36.9	37.8	0.9
2		2	0	0	0	47.7	48.6	0.9
2		2	0	0	0	46.3	47.2	0.9
2		2	0	0	0	17.4	19.1	1.7
2		2	0	0	0	49.7	50.7	1
2		2	0	0	0	50.4	51.2	0.8
2		2	0	0	0	50.4	51.3	0.9
1		1	0	0	0	25.5	26.3	0.8
1		1	0	0	0	23.8	24.7	0.9
1		1	0	0	0	21.1	21.9	0.8

Battery Cyclic Discharge - Charge Report Showing 1 - 20 of 70

Site	String	Cycle	Cycle Start Time	Cycle End Time	Discharge Duration (min)	Charge Duration (mins)	Float Duration (mins)	AhIn	AhOut	Bank Utilized Life	Peak Charge Current	Average Discharge Curr
1	909	909	2022-03-29 14:57	2022-03-29 15:01	0:04:17	2:13:37	8:20:01	4.7	0.1	29	12	2.7
1	908	908	2022-03-29 14:54	2022-03-29 14:56	0:01:29	0:01:06	0:00:00	0	0	29	3	2.4
1	907	907	2022-03-28 10:29	2022-03-28 10:33	0:04:30	2:23:52	25:27:47	4.7	0.1	29	12.4	2.8
1	906	906	2022-03-28 9:16	2022-03-28 9:18	0:02:00	1:03:21	0:00:00	2.2	0	28.9	4.6	2.5
1	905	905	2022-03-27 16:47	2022-03-27 16:56	0:09:15	2:30:52	12:55:46	5	0.3	28.9	12.4	2.7
1	904	904	2022-03-27 10:21	2022-03-27 10:57	0:36:14	2:19:27	2:37:00	6.7	1.8	28.8	12.4	2.8
1	903	903	2022-03-27 10:06	2022-03-27 10:08	0:01:21	0:08:51	0:00:00	0.1	0	28.8	2.8	2.5
1	902	902	2022-03-27 5:10	2022-03-27 5:16	0:06:10	2:21:28	1:36:40	4.6	0.1	28.8	12	3.2
1	901	901	2022-03-26 16:08	2022-03-26 16:14	0:05:48	2:32:40	9:50:14	5.5	0.1	28.7	12	2.6
1	900	900	2022-03-25 6:31	2022-03-25 6:38	0:06:49	2:44:07	29:58:17	6.1	0.2	28.7	12.8	2.6

DOD Summary - Sitewise Showing 1 - 20 of 292

Site	0 to 0_5 %	0_5 to 2%	2 to 5%	5 to 10%	10 to 20%	great 20%	Average Battery DOD %	TotalDisch
100	0	0	0	0	0	0	0	3
100	0	0	0	0	0	0	0	4
100	0	0	0	0	0	0	0	14

► SUMMARY

Why Monitor Batteries?

Increases Battery Life & Performance
 Proactive maintenance
 Enhanced Business Continuity
 Real-time visibility with historic insights
 Transparency of actual status

Solution

Monitor batteries 24*7 at block level
 Monitor Health in Float, Charge & Discharge condition
 Using wireless sensors and cellular wireless gateways
 advance Health detection using automated cloud algorithms and analytics Alert proactively in real-time using SMS/EMAIL/APP notifications Access real-time and historical data through APPS/WEB Monitor associated equipment like UPS, PAC, HVAC and Gen set etc.

Why ?

Cloud Based

More visibility. More pairs of eyes looking

Wireless

Enhanced electrical safety, Increased communication reliability, Enhanced aesthetics with no cables, Ease of maintenance & Latest technology

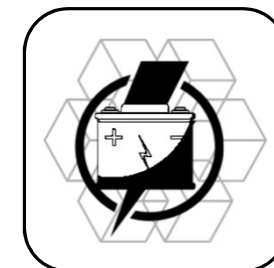
Apps

Integrates with digital life style, Mute notifications selectively, Data at your finger tips

Key Alarms

High Internal Impedance
 Battery Bad, Weak, Check Required
 High String Voltage/ Current
 High block float voltage
 High block Temperature

High Discharge current
 Low Battery Voltage
 Low State of charge
 High Charge Voltage
 High Cycle Count





Thank You.

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