CLOUD
Predictive Maintenance
Case Study

Cloud

EXECUTIVE SUMMARY

This case study examines the impact of **Mindsett PRISM®**, an advanced predictive maintenance and energy optimisation solution, within a commercial building for a Global FM player and a Global Technology Company. The study compares two operational periods, highlighting **significant energy savings and improved asset performance** through data-driven maintenance strategies.

KEY OUTCOMES

Energy Efficiency Gains:

- Mindsett PRISM® implementation led to a 13.5% **reduction in daily energy consumption**, including a 24.5% **reduction in lighting energy use** during operational hours and 14.3% **reduction out of hours**, resulting in projected **annual savings of** $41,554 **(49,868 kWh)**.

Predictive Maintenance Success:

- Using harmonic analysis, Mindsett PRISM® RAINBOW identified anomalies in **Fan Coil Units (FCUs)**, allowing pre-emptive maintenance actions. The result being no asset down time and a 10% saving on maintenance.

Fault Diagnosis & Correction:

- Anomalies in one Fan Coil Unit (FCU 1) were flagged, leading to a **successful AC capacitor replacement on 15th March 2025**. Post-maintenance data confirmed improved performance, including a 6% **increase in Power Factor (PF) and a decrease in current from 1.9A to** 1.66A.

Future Steps:

- **Enhancing Fault Prediction:** Mindsett will retrain its model to further refine anomaly detection and pre-emptive diagnostics.
- **Continued Monitoring:** Engineers will track the second Fan Coil Unit for potential capacitor deterioration, applying insights gained from FCU 1's maintenance cycle.

Reduction in Daily Energy Consumption of **13.5%** with Mindsett

PREDICTIVE MAINTENANCE

10% saving on Maintenance

Harmonics return to usual operating pattern

Asset down time prevented

Power Factor increased to 96%

Current reduced from 1.90A to 1.66A

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ENERGY Reduction in Daily Energy Consumption of 13.5% with Mindsett

Comparing the periods
11th Aug24 – 25th Sep24 and 29th Nov24 – 13th Jan25 (46 days).

With Mindsett, the daily energy consumption has reduced across all Asset Categories.

Lighting consumption has dropped by **24.5%** during operational hours and, even with the timer/sensor issues, out of hours has still reduced by 14.3%.
Highlighting the **success of the LED project.**

Based on your 2024 annualised baseline of $187,541, this equates to an estimated annual saving of $41,554 (49,868 kWh)

Overall Daily kWh

Asset Category	11/08 - 25/09	29/11 - 13/01	Movement	%
Internal Lighting	169.0	131.5	-37.5	-22.2%
Central Plant System	13.3	11.7	-1.6	-12.2%
Chilled Water	0.4	0.3	0.0	-7.5%
Power	107.3	100.6	-6.7	-6.2%
Alarm Panel	7.3	6.9	-0.4	-6.1%
IT Equipment	31.6	30.0	-1.6	-4.9%
Ring Main Circuit	33.0	32.0	-1.1	-3.2%
Intruder Alarm	1.1	1.1	0.0	-0.4%
Total	**362.9**	**314.1**	**-48.8**	**-13.5%**

Operational Hours

Asset Category	11/08 - 25/09	29/11 - 13/01	Movement	%
Internal Lighting	148.6	112.2	-36.4	-24.5%
Ring Main Circuit	21.9	19.0	-2.9	-13.1%
Power	62.9	56.0	-6.9	-11.0%
Chilled Water	0.2	0.2	0.0	-10.4%
Central Plant System	6.8	6.2	-0.6	-9.3%
Alarm Panel	3.6	3.4	-0.2	-6.6%
IT Equipment	15.8	15.0	-0.8	-5.2%
Intruder Alarm	0.6	0.6	0.0	-1.9%
Total	**260.4**	**212.5**	**-47.9**	**-18.4%**

Out of Hours

Asset Category	11/08 - 25/09	29/11 - 13/01	Movement	%
Internal Lighting	62.3	53.4	-8.9	-14.3%
Central Plant System	8.5	7.4	-1.0	-12.3%
Chilled Water	0.2	0.2	0.0	-4.7%
Alarm Panel	4.7	4.5	-0.2	-4.2%
IT Equipment	20.3	19.6	-0.6	-3.1%
Power	62.1	61.6	-0.5	-0.8%
Intruder Alarm	0.7	0.7	0.0	2.2%
Ring Main Circuit	17.3	18.7	1.4	8.1%
Total	**176.1**	**166.3**	**-9.9**	**-5.6%**

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RAINBOW

Our predictive maintenance solution is delivering great insight for a Global Technology Company at their HQ in APAC. Through our Mindsett, "PRISM", we are able to measure the electrical field harmonics on each and every asset in their building, to generate a unique "fingerprint" of asset performance, enabling us to predict failure before the event and centrally observe the effectiveness of maintenance tasks undertaken.

Here, we demonstrate the stages we are going through for the two FCUs with their Project team

01

STAGE 1

Mindsett analyses the Harmonic data for each FCU, creating a digital fingerprint of its performance.

02

STAGE 2

If the assets start to perform sub optimally an alert is raised.

Engineers attend to the asset, carry out an inspection and undertake any necessary maintenance.

03

STAGE 3

The RAINBOW can then be used to confirm if maintenance has been completed successfully.

04

STAGE 4

Using CAFM, maintenance history and engineer feedback the fault is tagged and added to the fault library, helping engineers diagnose future issues and arrive on site prepared.

05

STAGE 5

Mindsett learns from past faults and failures and can supply diagnostic information before jobs are booked and engineers dispatched.

CURRENT STATUS

Anomaly has proven that maintenance is required! Maintenance undertaken and proven successful post AC capacitor replacement!

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Identifying the Assets: 'P28 Power Outlet'

Two confirmed assets and their operating hours:

- Fan Coil Unit 1 (FCU 1): 4pm to 8am.
- Fan Coil Unit 2 (FCU 2): 8am to 4pm.

Events:

- PPM Event took place on 9th November 2024.
- Maintenance review on 9th March 2025.
- Reactive maintenance undertaken on 15th March 2025.

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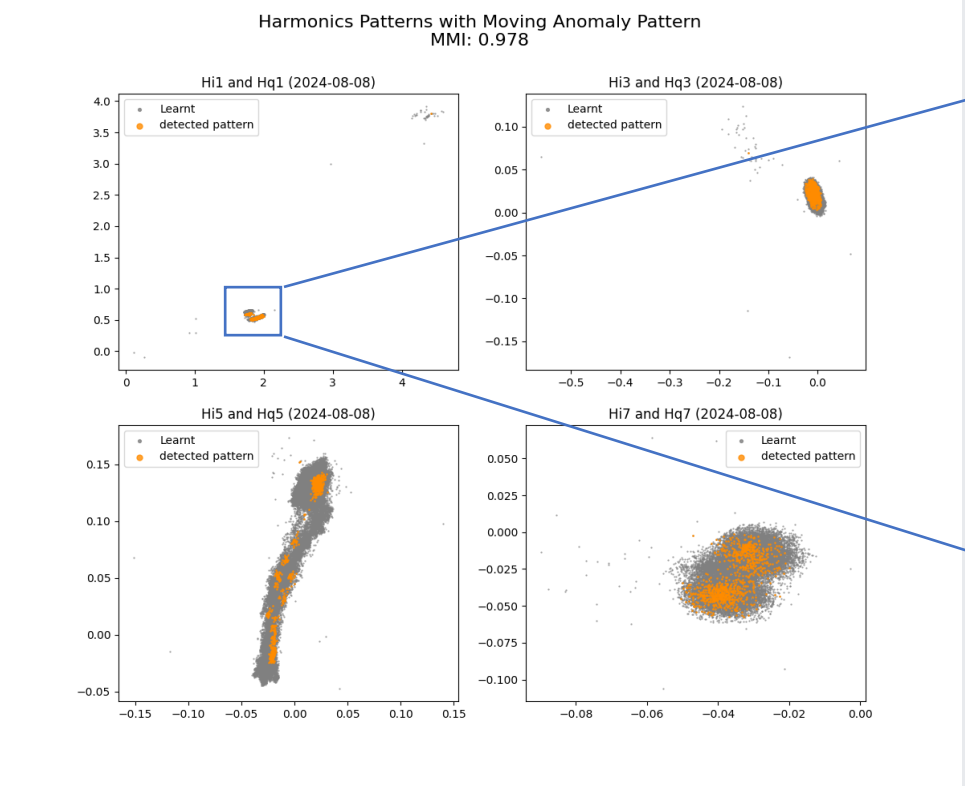
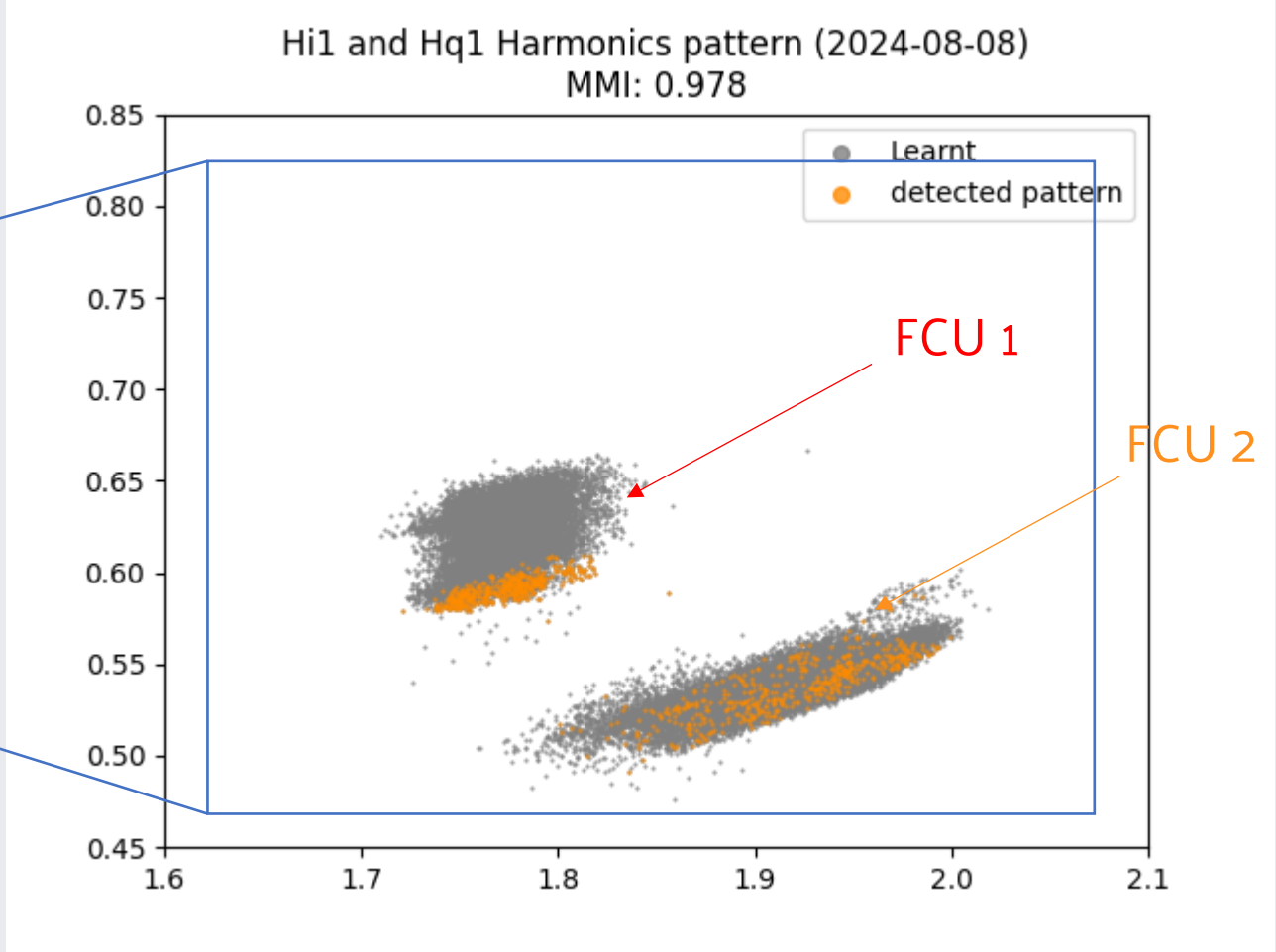


Four quadratic harmonic views in 2D, representing the Mindsett digital '**fingerprint**' of the assets.



The first quadratic harmonic view enhanced in 2D.
The orange patterns demonstrate anomaly behaviour for FCU 1 moving away from the training pattern.

Key: *Grey: Training period (August 2024)*
Orange: detected patterns (September 2024 to March 2025)

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MINDSETT
Click Logo for Filters...

All Anomalies

Severity: All

Date: Last 30 Days

Total Anomalies	Assets with Anomalies	Total Low Priority Anomalies	Total Moderate Priority Anomalies	Total High Priority Anomalies	Low Anomalies by Day	Moderate Anomalies by Day	High Anomalies by Day
168	1	138	7	23	4.60	0.23	0.77

Asset Name	Severity	Anomaly ID	Date	# Anomalies	Space	Asset Category	Asset Type
P28 Power Outlet	Low			138	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	Moderate			7	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 01200	20/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 01123	19/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 01099	18/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 01091	17/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 01064	16/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 01032	15/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 00988	14/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 00949	13/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 00915	12/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 00904	11/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 00817	09/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 00761	08/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 00720	07/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 00686	06/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 00671	04/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 00664	03/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 00656	02/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 00647	01/01/2025	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit
P28 Power Outlet	High	CBRE - 00632	30/12/2024	1	L41 FCU 1 & 2 DB Room	Central Plant System	Fan Coil Unit

Mindsett RAINBOW Dashboard:

- Anomaly detection information, designating if the anomaly observed is ‘Low’, ‘Moderate’ or ‘High’.
- Anomaly severity increasing over time for the P28 Power Outlet (the two FCUs) from ‘Low’ to ‘High’.

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Evidence of maintenance

ENERGY

HARMONICS

RAINBOW Score

- The PPM Event on 9th November 2024 is from 10:07 to 10:52 (Singapore time).
- Mindsett RAINBOW score dropped and recovered immediately after the event.
- This is usual for a PPM event. Instead, we are focussing on the impact of the PPM and the long period of asset behaviour/feature trend.

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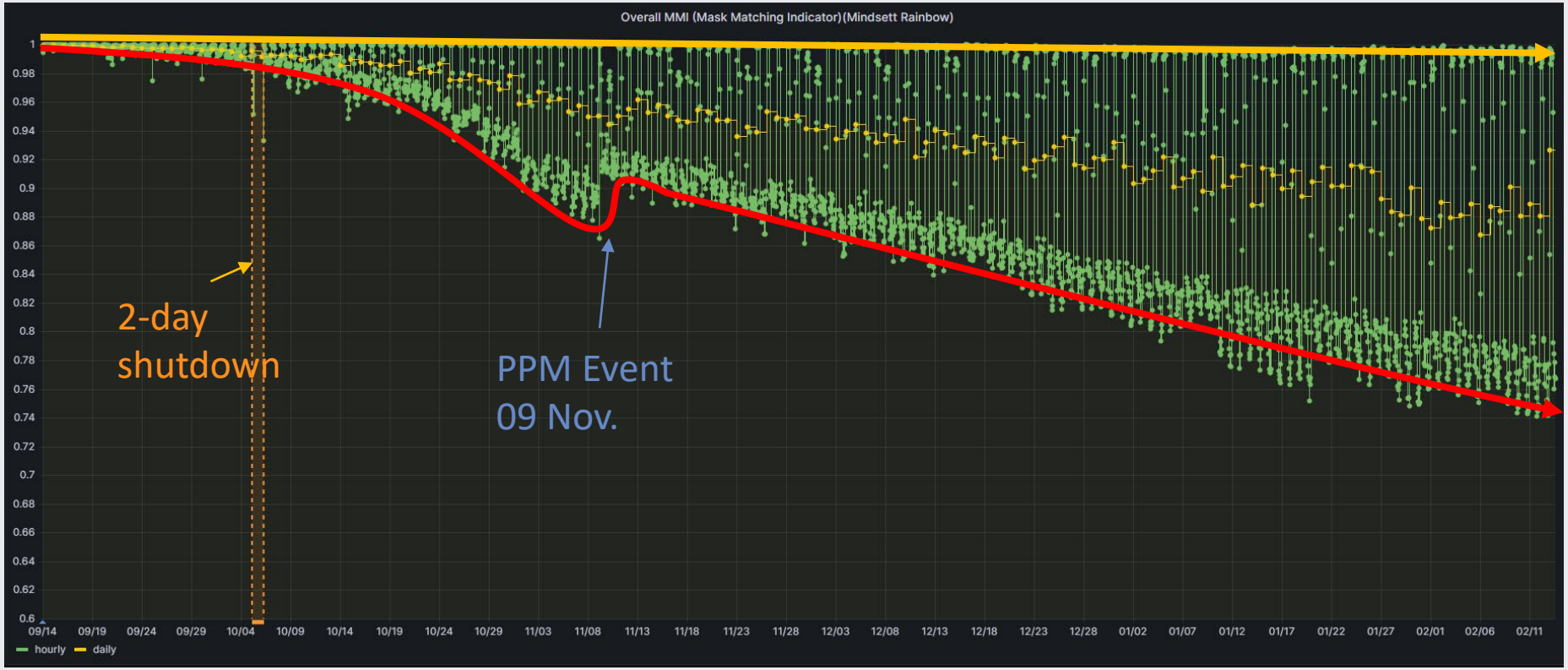
Evidence of maintenance



FCU 2

FCU 1

- Both asset started with high Mindsett RAINBOW score > 0.98.
- FCU 2 RAINBOW score remains high > 0.98.
- FCU 1 RAINBOW score drops significantly < 0.8 to February 2025.
- The PPM event improved the RAINBOW score a little bit, but didn't change the trend of the score decreasing.

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Maintenance review:
9th March 2025

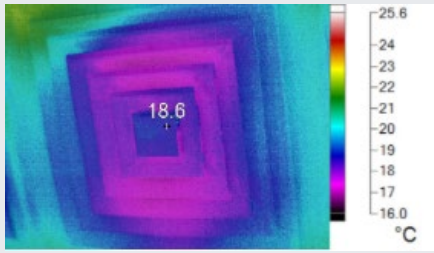
P28 Power Outlet

Thorough check carried out by Global FM's approved engineers on both FCUs on 9th March 2025. Their findings:

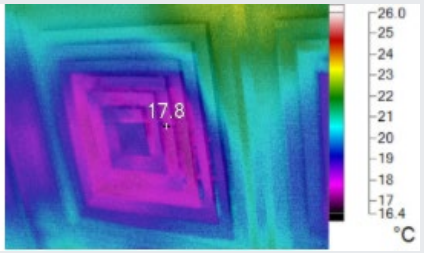
- FCU 1 , AC Capacitor rated (5 uf) has "**sign**" of deterioration which the capacitance dropped to 3.04uf.
- FCU-2, AC Capacitor capacitance at 4.24uF.
- Air Diffuser no. 1 & no. 2, temperature range between 16 to 18 Deg C.
- FCU-1 Duty, Anemometer Air Flow , air diffuser no.1: 2.6mtr/s ; air diffuser no.2: 3.05mtr/s.
- FCU-2 Duty, Anemometer Air Flow, air diffuser no.1: 2.5mtr/s ; air diffuser no.2: 3.3mtr/s.
- Both FCU-1 & 2 motors temperature range (22- 37 Deg C), no anomaly detected.
- FCU-1 Duty, the reading on the Thermometers, CHWS: 7 Deg C , CHWR: 9 Deg C . CHWS Pressure: 75psi, CHWR Pressure: 72psi.
- FCU-2 Duty, the reading on the Thermometers, CHWS: 7 Deg C , CHWR: 12 Deg C . CHWS Pressure: 80psi, CHWR Pressure: 73psi.

Temperature Range

FCU 1



FCU 2



"Cloud recommend to replace the AC Capacitor for the FCU-1 blower motor."

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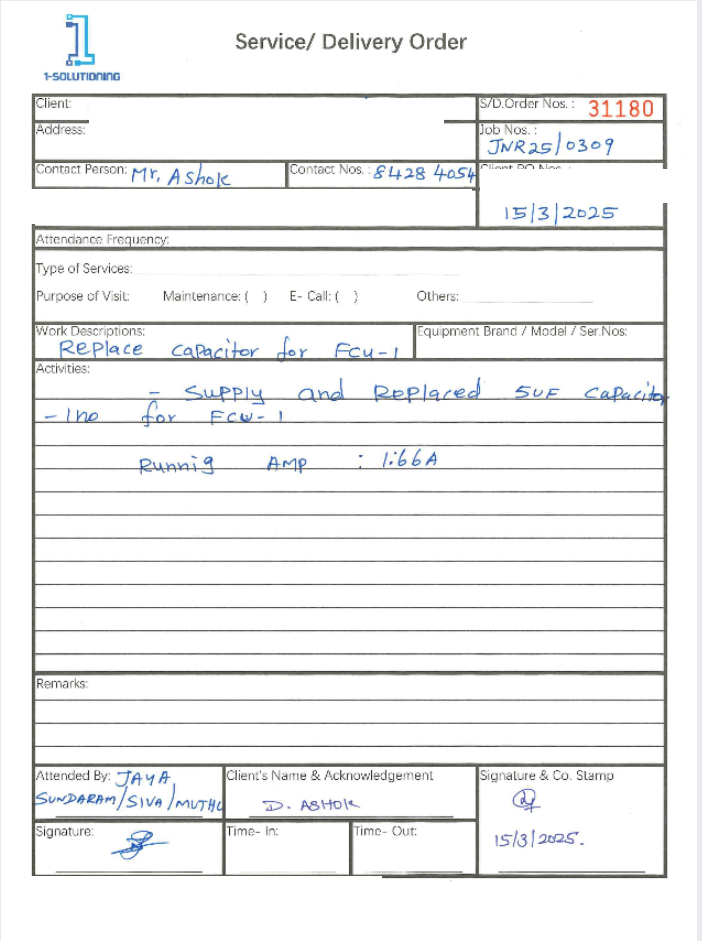
Maintenance undertaken:
15th March 2025

AC Capacitor for FCU 1 Blower Replaced

Reactive maintenance carried out by the Global FM Company's approved engineers on FCU 1, on 15th March 2025 to replace AC Capacitor for the blower. Our findings:

- Mindsett RAINBOW anomalies are **no longer** registering as 'High".
- The first quadratic harmonic is **performing closer** the the 'learnt pattern'.
  - Not exactly to the 'learnt pattern' which, could indicate the AC Capacitor had minor deterioration during the training period.
- Current has **improved** from 1.9A to **1.66A.**
- Power Factor has **improved** from 90% to **96%.**

There has been no change or inference on FCU 2 however, regarding the same harmonic, the cluster is moving away from it's 'learnt pattern'. This could indicate that FCU 2 may face a similar problem over time.



1-SOLUTIONING

Service/ Delivery Order

Client:
S/D.Order Nos.: 31180
Address:
Job Nos.: JNR25/0309
Contact Person: Mr. Ashok
Contact Nos.: 8428 4054
15/3/2025
Attendance Frequency:
Type of Services:
Purpose of Visit: Maintenance: ( ) E- Call: ( ) Others:
Work Descriptions: Replace capacitor for Fcu-1
Equipment Brand / Model / Ser.Nos:
Activities:
- Supply and Replaced 5uF capacitor - 1no for Fcu-1
Runnig Amp : 1.66A
Remarks:
Attended By: JAYA SUNDARAM/SIVA/MUTHU
Client's Name & Acknowledgement: D. ASHOK
Signature & Co. Stamp
Signature:
Time- In:
Time- Out:
15/3/2025.

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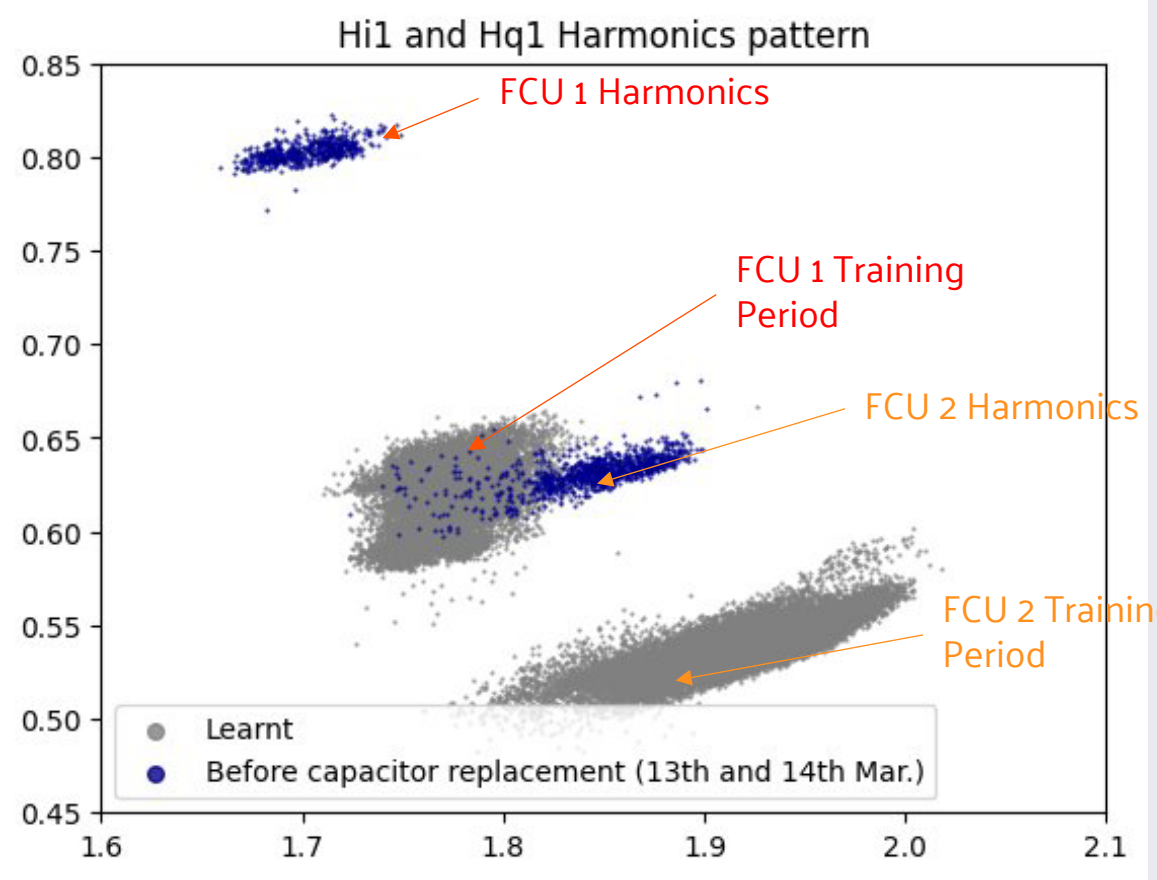
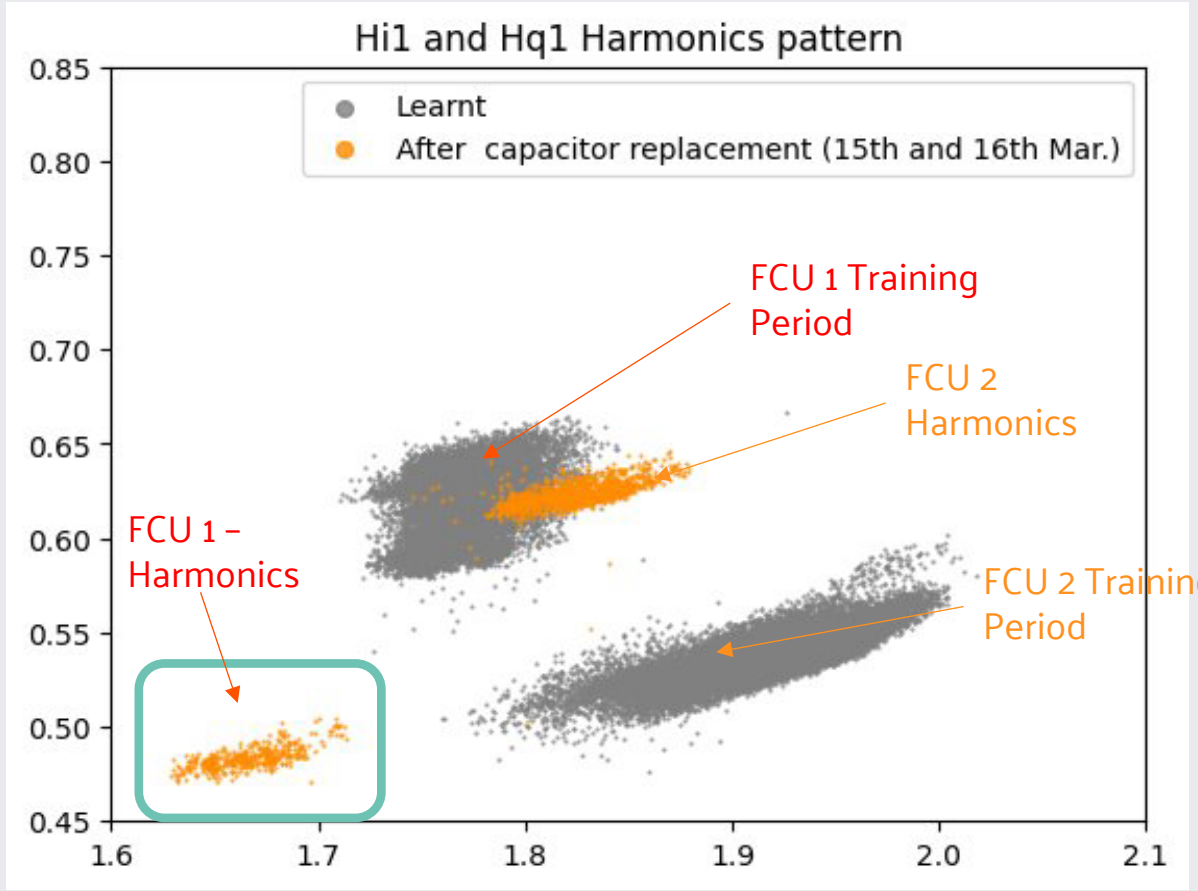
Evidence of maintenance



First Harmonic pattern pre-AC Capacitor replacement on FCU 1.



First Harmonic pattern post-AC Capacitor replacement on FCU 1, suggesting the new 'baseline'.

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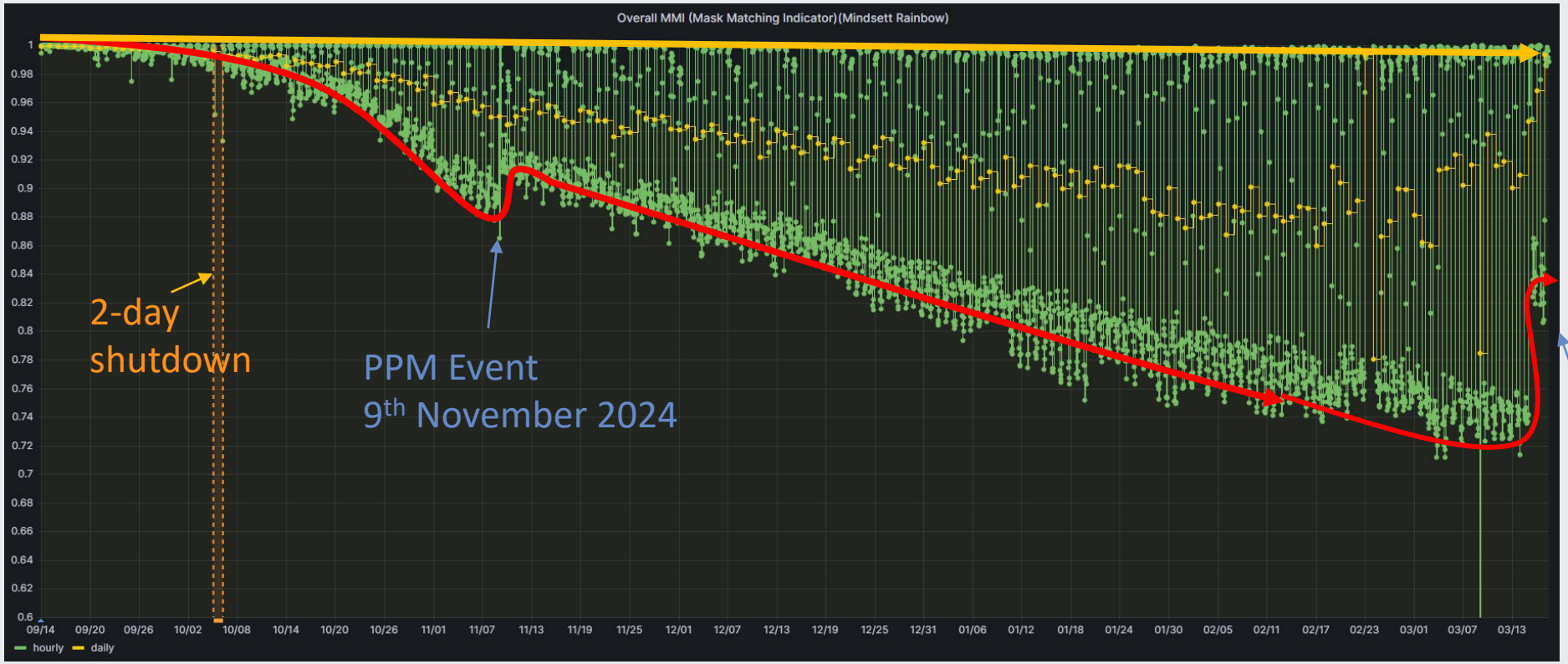
RAINBOW

Evidence of maintenance



FCU 2

FCU 1

Suggesting that this is the new 'baseline'

AC Capacitor replaced 15th March 2025

- Both asset started with high score > 0.98.
- FCU 2 RAINBOW score remains high > 0.98.
- **FCU 1** RAINBOW score drop < **0.8 and then had a significant increase after AC capacitor replacement.**
- The PPM event improved the RAINBOW score a little bit, but didn't change the trend of the score decreasing.

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RAINBOW

Evidence of maintenance

- Both asset Power Factor (PF) dropping over 200 days.
- FCU 2 PF drops slowly by 1% (from 96% to 95%).
- **FCU 1** PF drops noticeably by **5%** (from 95% to 90%).
- **FCU 1 PF increased to 96% after capacitor replacement.**

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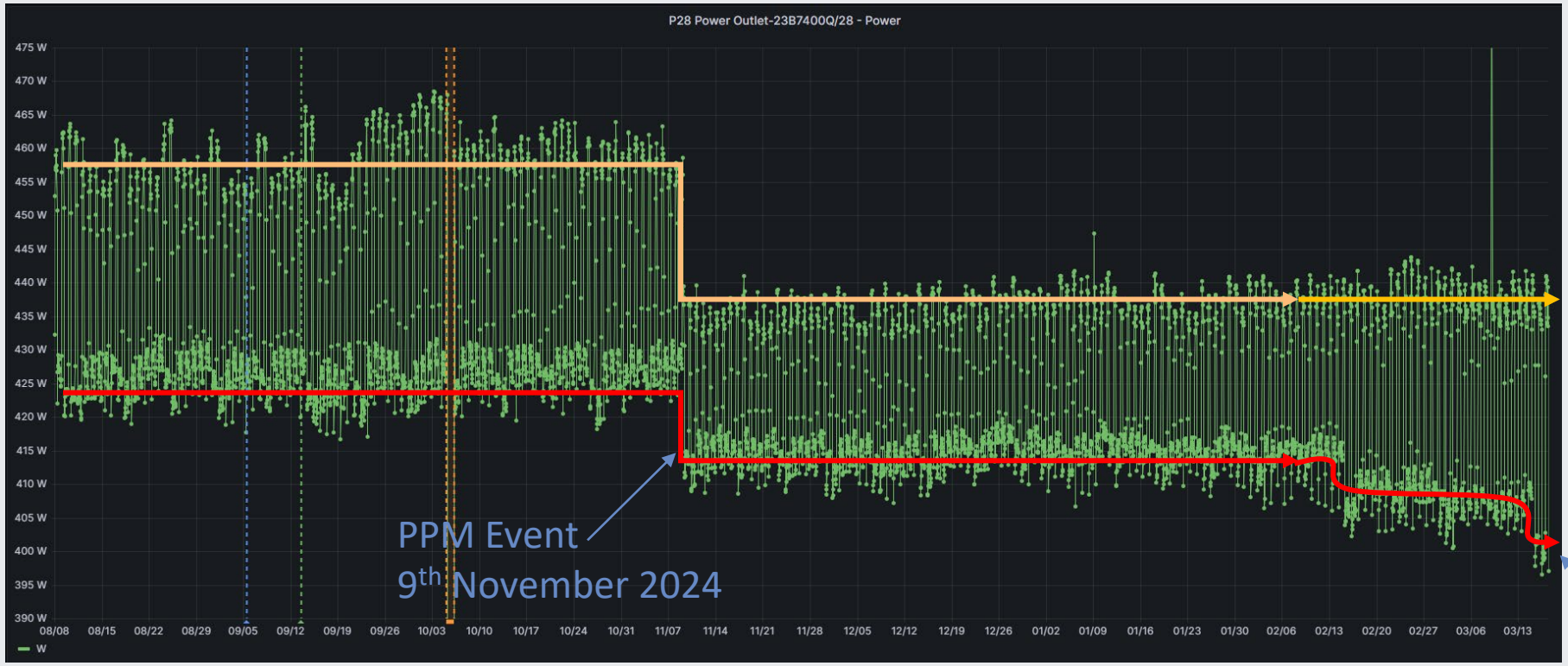
Evidence of maintenance



- There is a noticeable trend on the Real Power for both FCUs.
- FCU 2 consumes slightly more power by about 7%.
- The PPM on 9th November 2024 has assisted in the reduction of the power consumption by about 4%.
- FCU1 power slightly decreased after capacitor replacement on 15th March 2025.

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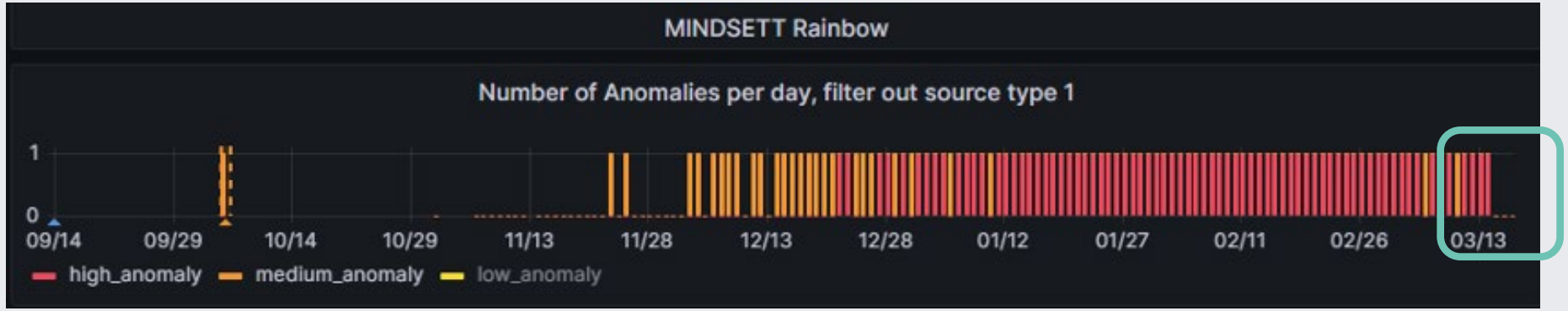
Evidence of maintenance

FCU 2

FCU 1

- There is a noticeable decrease in current from 1.9A to 1.66A post the AC Capacitor replacement on 15th March 2025.



- Mindsett RAINBOW anomalies have decreased in number and severity since the AC Capacitor replacement on 15th March 2025.

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Next Steps:

04

STAGE 4

Using this maintenance history and engineer feedback the fault is tagged and added to the fault library, helping engineers diagnose future issues and arrive on site prepared.

A close watch will be put on FCU 2 to see if this anomaly repeats itself on this asset.

05

STAGE 5

Mindsett will retrain RAINBOW for FCU 1, learn from this fault and can apply diagnostic information before jobs are booked and engineers are dispatched.

Thank you.

Contact Details

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