Resolving Operational Downtime at a Major Industrial Site

How Power Quality logging and first-principles nodal analysis identified critical equipment placement and configuration errors that standard commissioning missed.

The Challenge: Unexplained System Failures

An Australian building contractor contacted GreenVolt Power Quality Solutions regarding recurring electrical disruptions at a critical industrial site. Despite having Power Quality mitigation and monitoring hardware on site, the facility was experiencing:

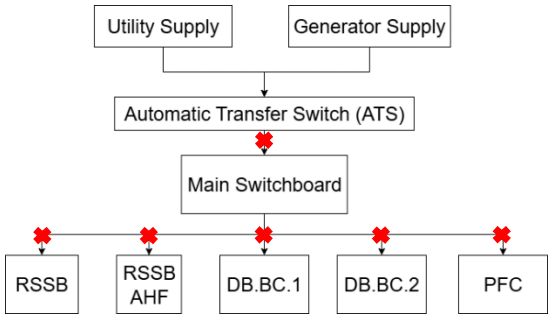
- **Operational Disruptions:** Security gates were failing to open, alarms triggering randomly and flickering office lighting.
- **IT Instability:** Frequent headaches for the client's IT department due to the Power Quality problems sending alerts.
- **Escalating Call-out Costs:** The problems were sporadic and had no pattern, causing site technicians and contractor electricians to find no faults when they investigated.

The Investigation: Applications of Electrical Principles

Existing hardware at the site included an Active Harmonic Filter (AHF) and a Power Factor Correction (PFC) unit. The site had refrigeration equipment, compressors, VSDs, EV charging units and office and warehouse loads.

Power Quality Logging:

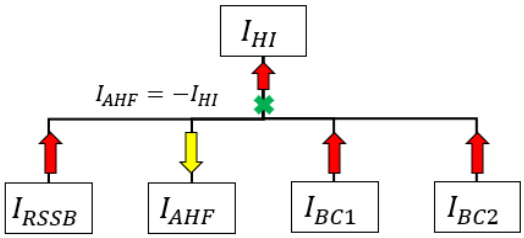
- We installed Power Quality loggers (**marked in red**) to capture a full load profile over a fortnight.
- Rather than logging every downstream load; five (5) major loads were selected based on the Single Line Diagram (SLD).



- In addition to logging downstream loads, the incomer was also logged for compliance purposes and to serve as a point of reference.

Nodal Analysis:

- By applying Kirchoff's laws, nodal analysis and calculating system impedance, we were able to build an accurate circuit model of the client's system.
- Traditional electrical commissioning usually misses Power Quality requirements such as harmonic voltage compliance at the Point of Common Coupling (PCC).



Importance of Configuration:

- AHFs are usually sized based on the total RMS harmonic current. This may not account for the cases where individual harmonics are dominant.
- We frequently find that at many sites, that while AHFs may have adequate mitigation capacity, the configuration is not optimised to mitigate site-specific harmonics.

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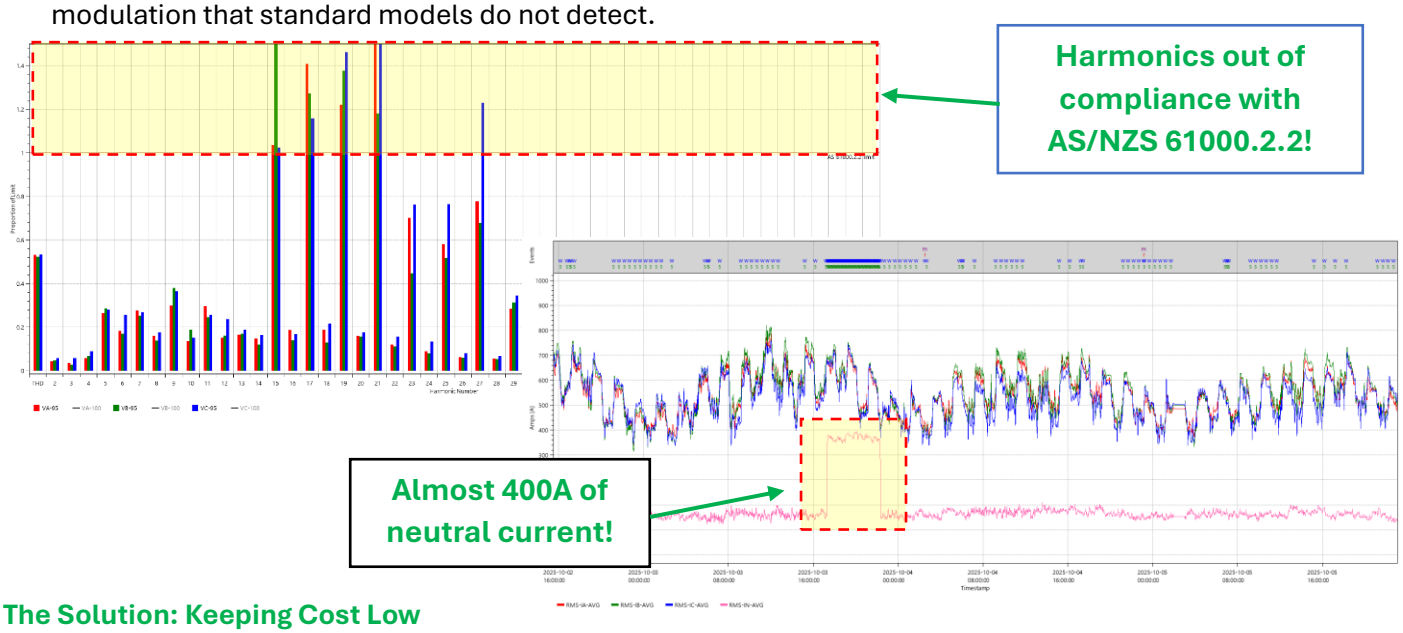
The Discovery: Configuration vs Reality

Through our analysis of the collected data, we proved the following:

- The AHF current sensors were installed at the wrong location for the AHF configuration.
- The AHF was not configured appropriately for the harmonics on the network, leading to non-compliant voltage harmonics.
- We also identified a non-triplen harmonic summing in the neutral, a sign of electronic phase modulation that standard models do not detect.



The Solution: Keeping Cost Low

Our goal was to deliver a low-cost, low-interference solution that did not disrupt ongoing operation by:

- Reconfiguration of the AHF harmonic mitigation profile to match site harmonics.
- Increased capacity of the AHF to account for site-wide harmonics.
- Post-solution logging and audit to ensure compliances are being met.

Table 2: Configuration (Before)

Harmonic (N)	Weighting (%)
3	100
5	100
7	100
11	100
13	50

Table 1: Compliant Configuration (After)

Harmonic (N)	Weighting (%)
3	50
5	100
7	70
11	40
13	70
15	20
17	15
19	10
21	10

Results: Mitigation of Issue

Operational failures were minimised, harmonic compliances restored at the (PCC), the client had greater visibility and understanding of their industrial site; avoiding additional call-out costs.

Unexplained power issue at your site?
Equipment malfunctioning?
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