

VAASCO energy efficiency solutions
Voltage as a Service (VAAS)TM

VAASCO Group

grid voltage control for commercial, industrial & government

20th May 2022

an effective step towards net zero energy

commercial and technical introduction



Voltage as a Service (VAAS)TM

an effective step towards net zero energy

Outcomes

- ✓ Secure facility's most valuable operating assets
- ✓ Generate higher savings
- ✓ Reduce CO2 footprint
- ✓ Transition towards **NET ZERO Energy**
- ✓ Future proof the facility fleet
- ✓ Control voltage and power for the first time
- ✓ Failsafe uninterrupted supply

Managed service solution

- ✓ Preserve capital (**ZERO** client investment required)
- ✓ Gain share performance based
- ✓ Real time monitoring (Class 1 revenue grade)
- ✓ Cloud based dashboard for fleet wide reporting
- ✓ One Master Service Agreement for global group deployment

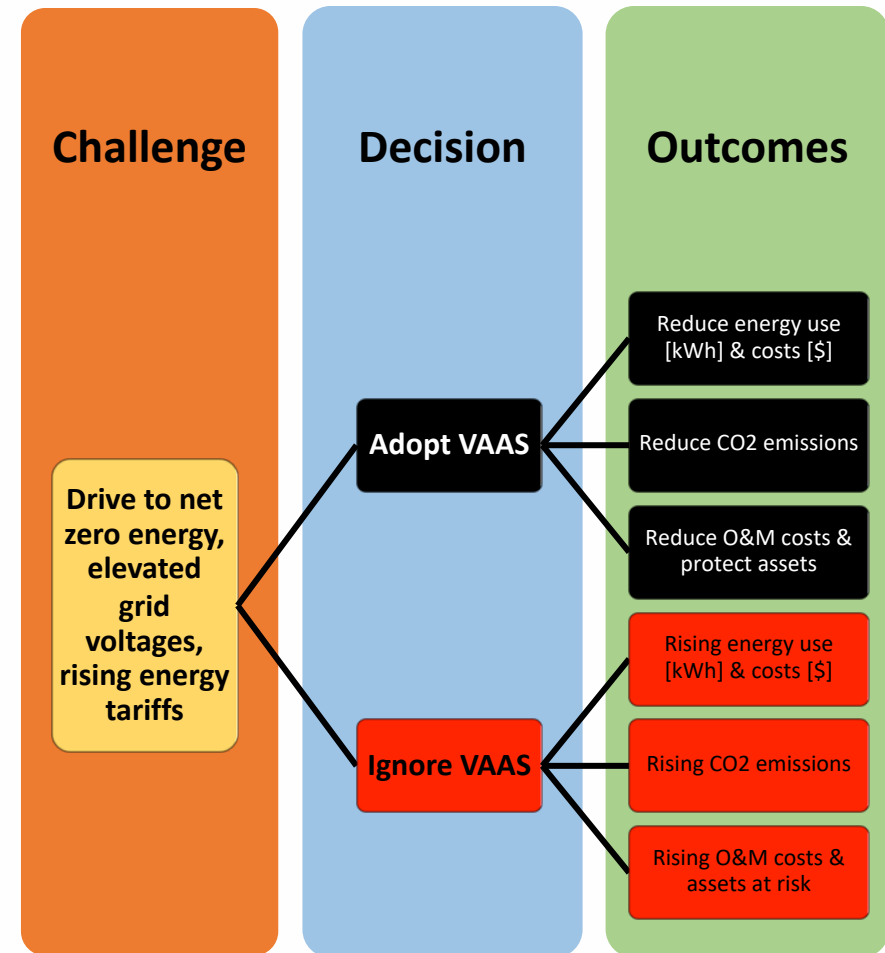
VAASCO Group provides total solution

- ✓ Fully managed and maintained by VAASCO Group, worldwide
- ✓ Site evaluation and engineering
- ✓ Solution supply, installed and commissioned by VAASCO specialists
- ✓ A partnership approach for your organization's global facility fleet

20 May 2022

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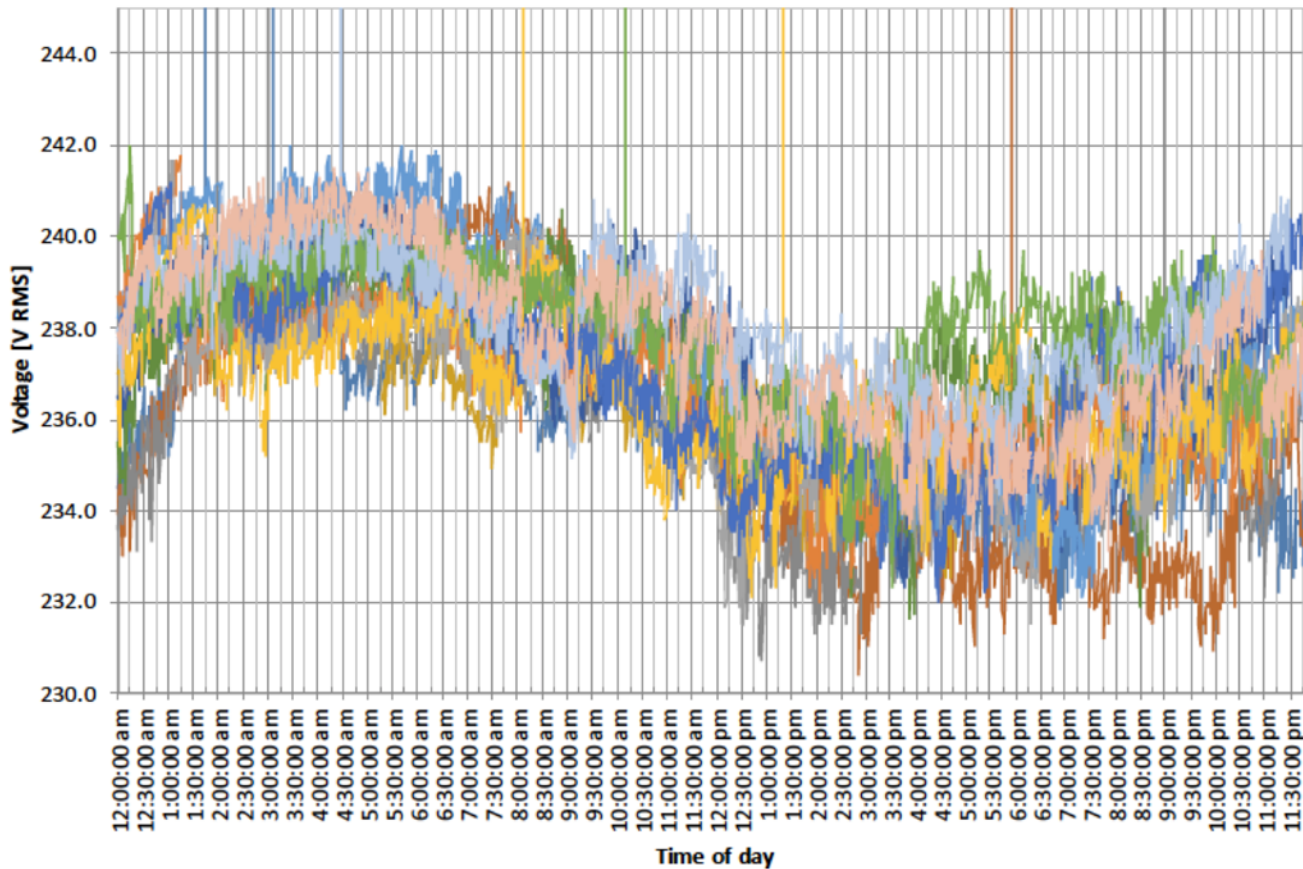


Eliminate supply voltage variability

And, save kWh & \$\$\$ & CO2 tonnes

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Input Voltage : Time of Day : Average Voltage
Daily during period : 04 Jan 2022 to 14 Apr 2022



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Our Customers

Installed at more than...

- 300+ private companies, including:
 - Retail
 - Hospitality
 - Financial services
 - Manufacturing
 - Offices and data centres
 - Many others
- 178 councils
- 98 HE / FE facilities (all types)
- 28 government agencies

220 Case Studies

nationalgrid



ASDA



TESCO



TRELLEBORG



Waitrose



ofgem



Hilton

TATE



The co-operative

NHS



Experian



Warner Leisure Hotels

Historic Royal Palaces

VAASCO Group service commitment

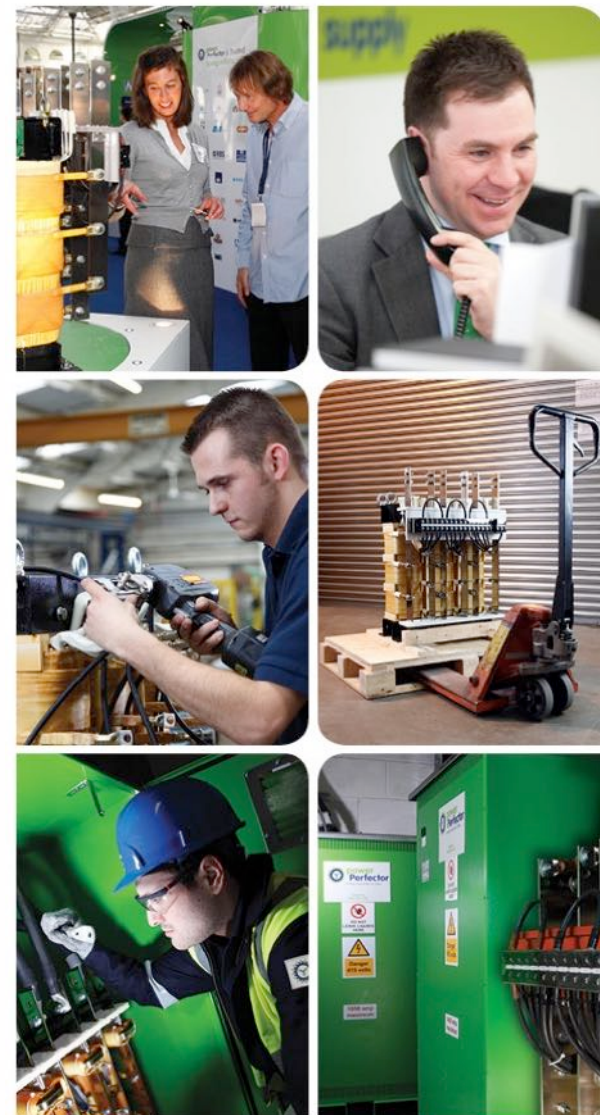
VAASCO Group offers the Voltage as a Service (VAAS)TM solution, which entails deploying well proven dynamic voltage optimisation solutions at every facility on an enterprise wide basis for commercial, industrial and government organisations. Our process is rigorous and includes:

- Enterprise familiarisation including site visit, and monitoring for development of site specific energy savings
- Procurement of of all VPO and balance of systems
- Supply, installation and commissioning of systems
- Coordination of protection upgrades and special requirements
- Measurement and verification to determine the magnitude of reduced electricity consumption over a period, post commissioning
- Provision of a report outlining reduction in electricity consumption including all supporting data
- All electricity network liaison and approvals
- Generation and submission of all documentation relating to relevant Energy Efficiency Certificates, as applicable
- Allowance for after-hours shutdown/installation

Training and service support are a feature of the offering. VAASCO GROUP commits to locally based factory trained field engineers that will be equipped to maintain the dynamic voltage optimisation solutions using field replaceable units, in order to maximise uptime, in the unlikely event of controller electronic defect. Even then the failsafe design ensures uninterrupted supply.

The project provisioning includes a spare controller inventory to ensure that a rapid 24 hour service resolution policy is maintained across our customer's national (and global) facility fleets.

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Dynamic voltage control history

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VAASCO Group Ltd

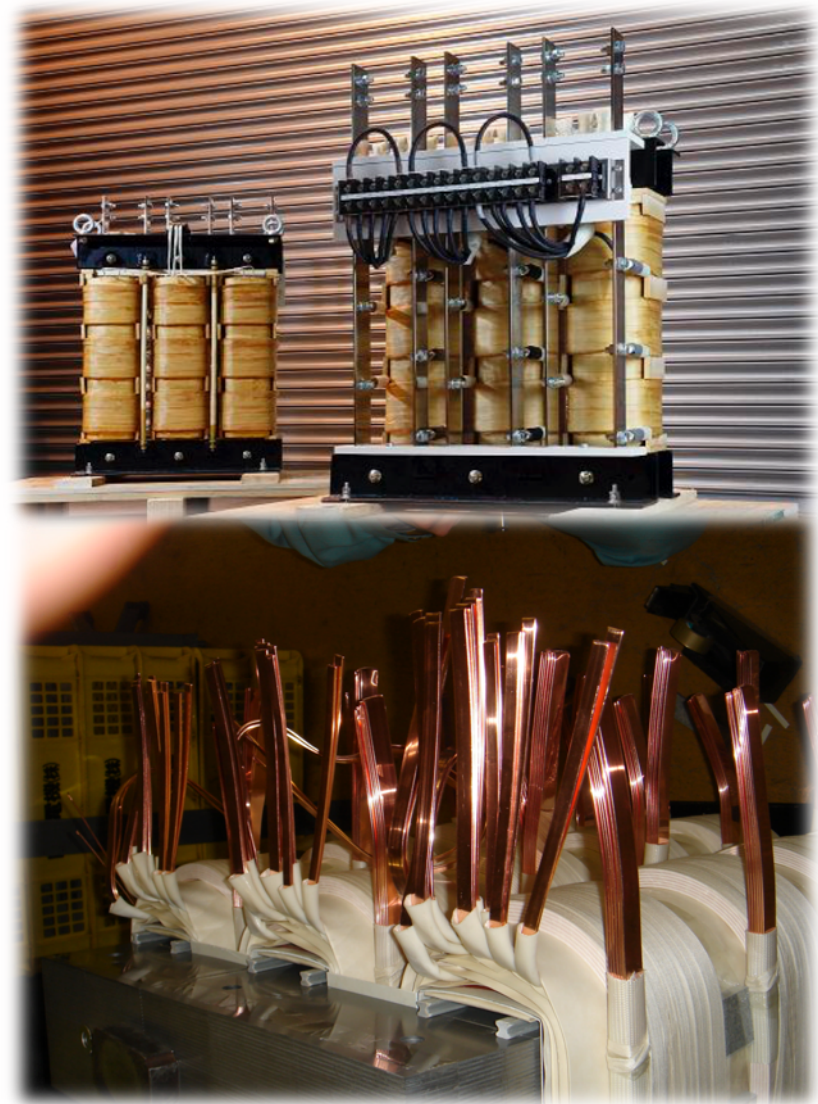
- ✓ Established 2021 to deliver Voltage as a Service (VAAS)™
- ✓ Unique service offering for Commercial, Industrial and Government customers worldwide
- ✓ Builds on more than 20 years' experience in manufacturing and installing dynamic voltage optimisation for the group, related companies and supply chain worldwide

Background

- ✓ Invented in Japan in 1993
- ✓ EU Manufactured since 2012
- ✓ FT.com: “The Green Holy Grail”
- ✓ Green Business Awards

Proven

- ✓ 100% safety and reliability record
- ✓ Over 10,000 units installed in UK
- ✓ 50 year lifecycle
- ✓ Failsafe uninterrupted supply
- ✓ Full dynamic buck and boost capabilities
- ✓ Average energy usage savings (8 - 20 per cent) varies according to
 - Grid supply conditions
 - Load types



VAAS unique technical characteristics

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Dynamic voltage control

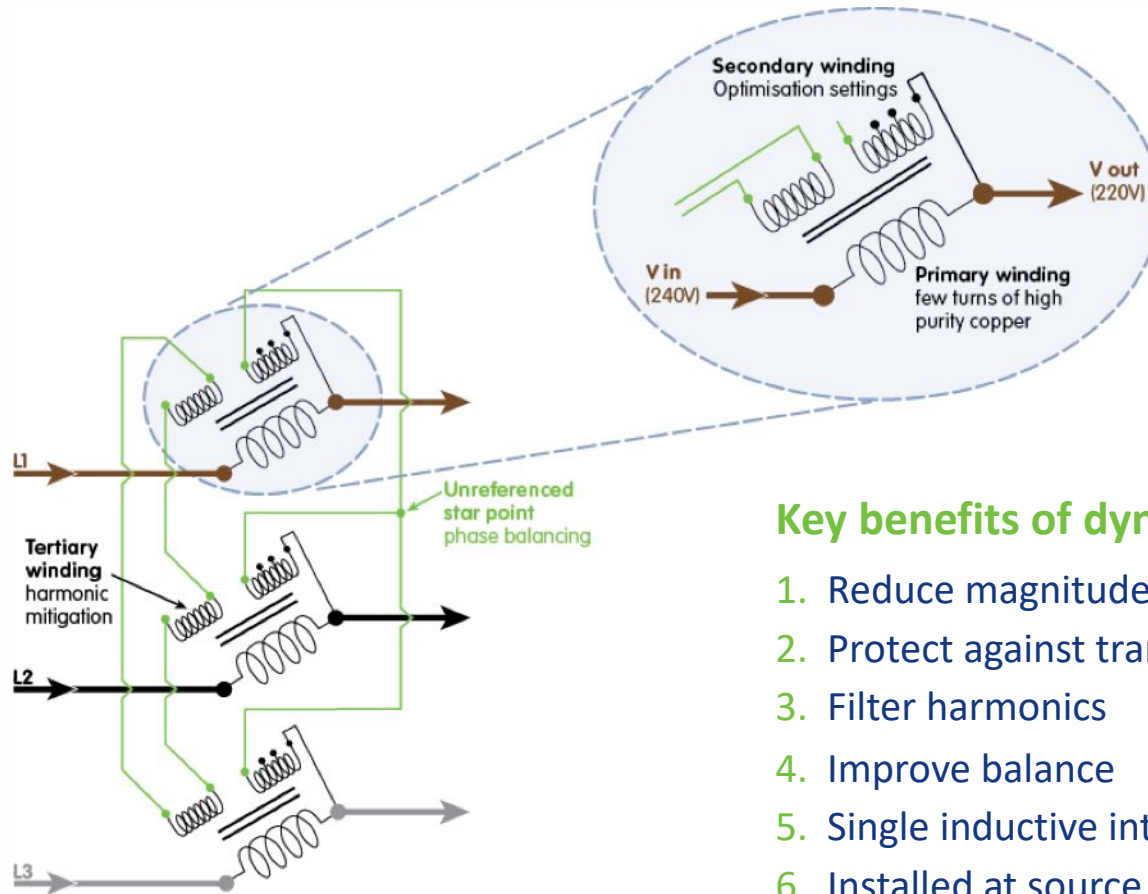
- Responsive Power Optimisation – **Stable Output** $\pm 0.5V$
- Active 3 Phase balancing – **Balances 3 phases** within $\pm 0.5V$
- Super Fast Response – **0.25 seconds**
- Intelligent Voltage Control – **0.1V Incremental Control**
- Voltage Recovery – **Buck or Boost** voltage by 11% - 15%
- Wi-Fi/LAN remote monitoring & control
- Cloud based dashboard, with Class 1 (revenue grade) monitoring



Core TX

- Primary winding connected in series with on-site load
- Primary winding carries 100% of load current - **Failure Proof**
- Very few turns on the primary winding, turns ratio ($N1 / N2 < 1$)
- Very low impedance, negligible impact on existing circuits – **Risk mitigation**
- Industry leading 99.94% efficiency at peak load – **Highest energy savings**
- High efficiency and minimal heat output
- Neutral connection not required due to internal floating Neutral





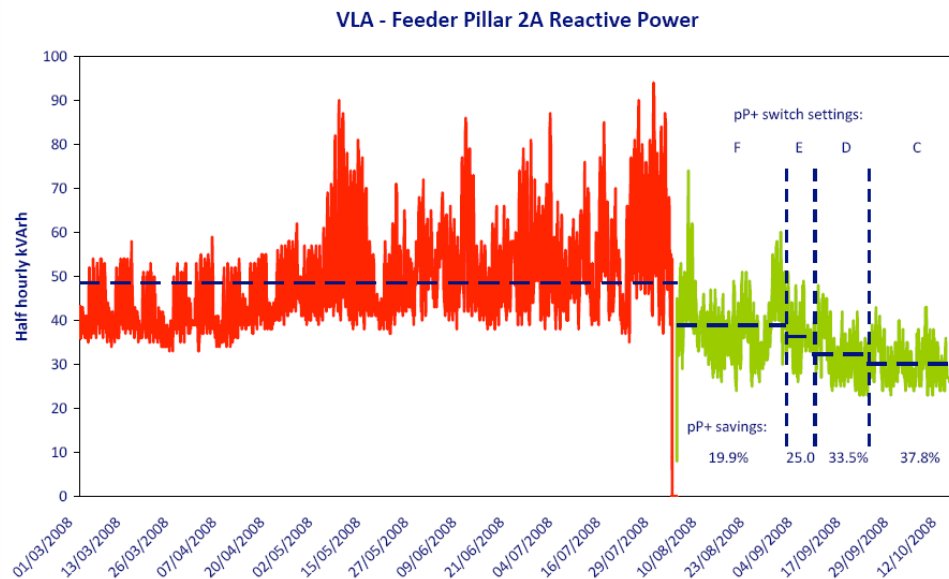
Key benefits of dynamic voltage optimisation

1. Reduce magnitude to optimum level
2. Protect against transients
3. Filter harmonics
4. Improve balance
5. Single inductive interaction
6. Installed at source
7. No need for continuous monitoring
8. No maintenance

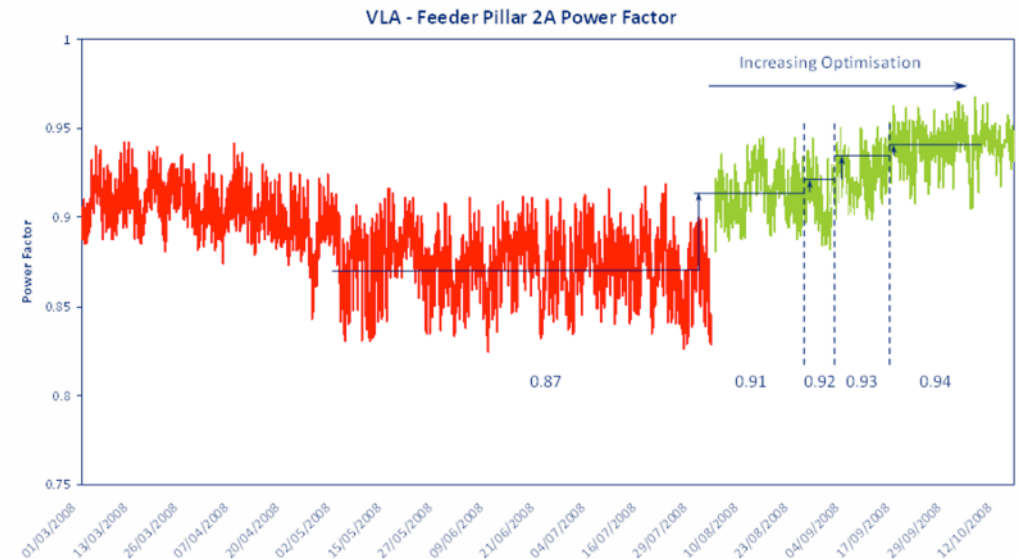
Enhance power quality

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Reactive power reduction of 25% - 50%



Harmonic distortion reduced by 10% - 20%

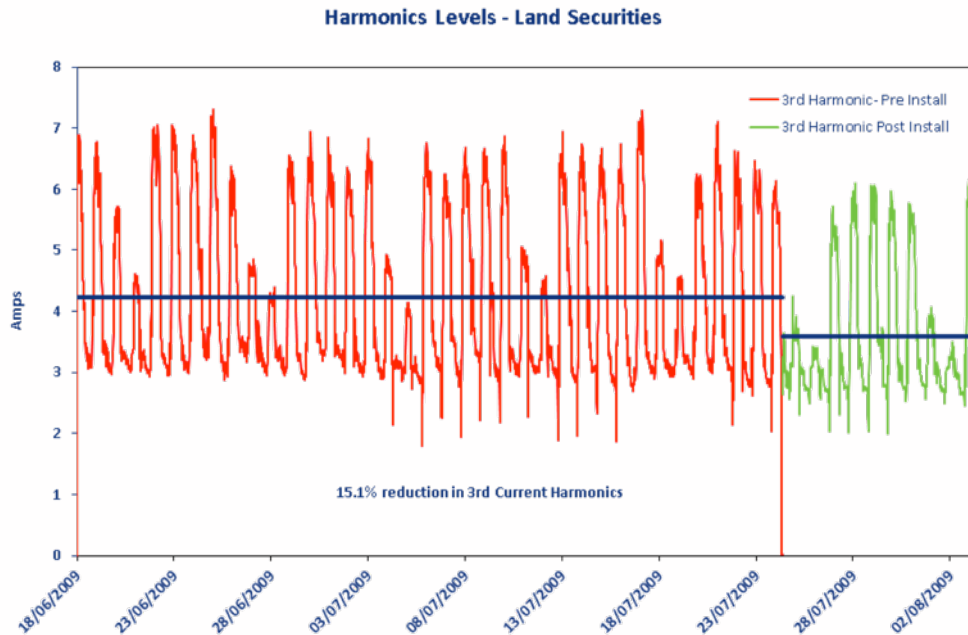


- Improved Power Factor – reduces KVA charges
- Increases the amount of available power to run equipment
- Results in more efficient use of power and increases room on your breaker

Enhance power quality

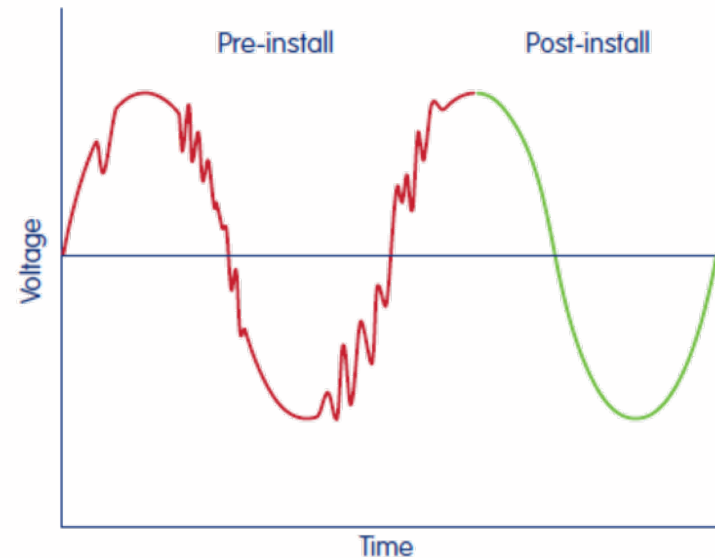
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Harmonic Distortion reduced by 10% - 20%



- Reduces risk of harmonic damage to sensitive electronic equipment and computer chips
- Extends the life of all electrically powered equipment and their control systems

Suppress common transients from renewables (including from solar PV inverters)



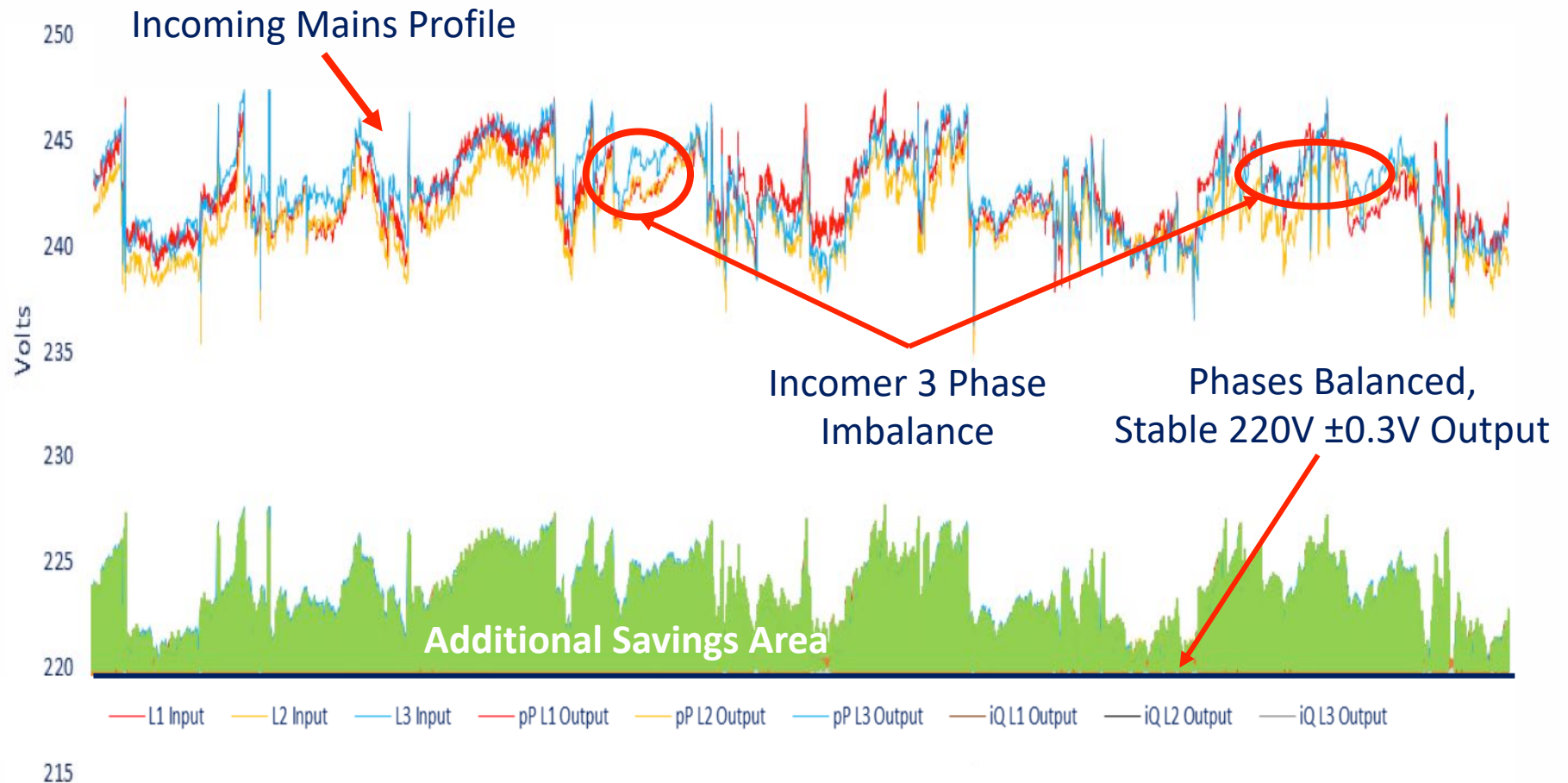
- Transients damage and disrupt calibration of electronic controls and automated systems

“We were suffering from voltage spikes (transients) which on numerous occasions damaged the lift controls causing them to stop operating. In the 1.5 years following the voltage optimisation installation there has been no repeat of the issue.” Kim Pivett, Ofgem

Stabilisation and Balancing

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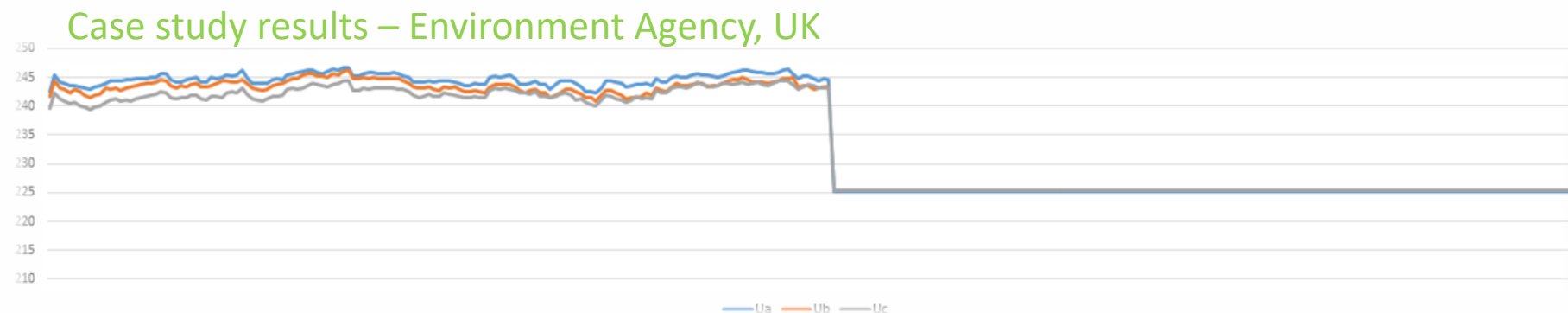
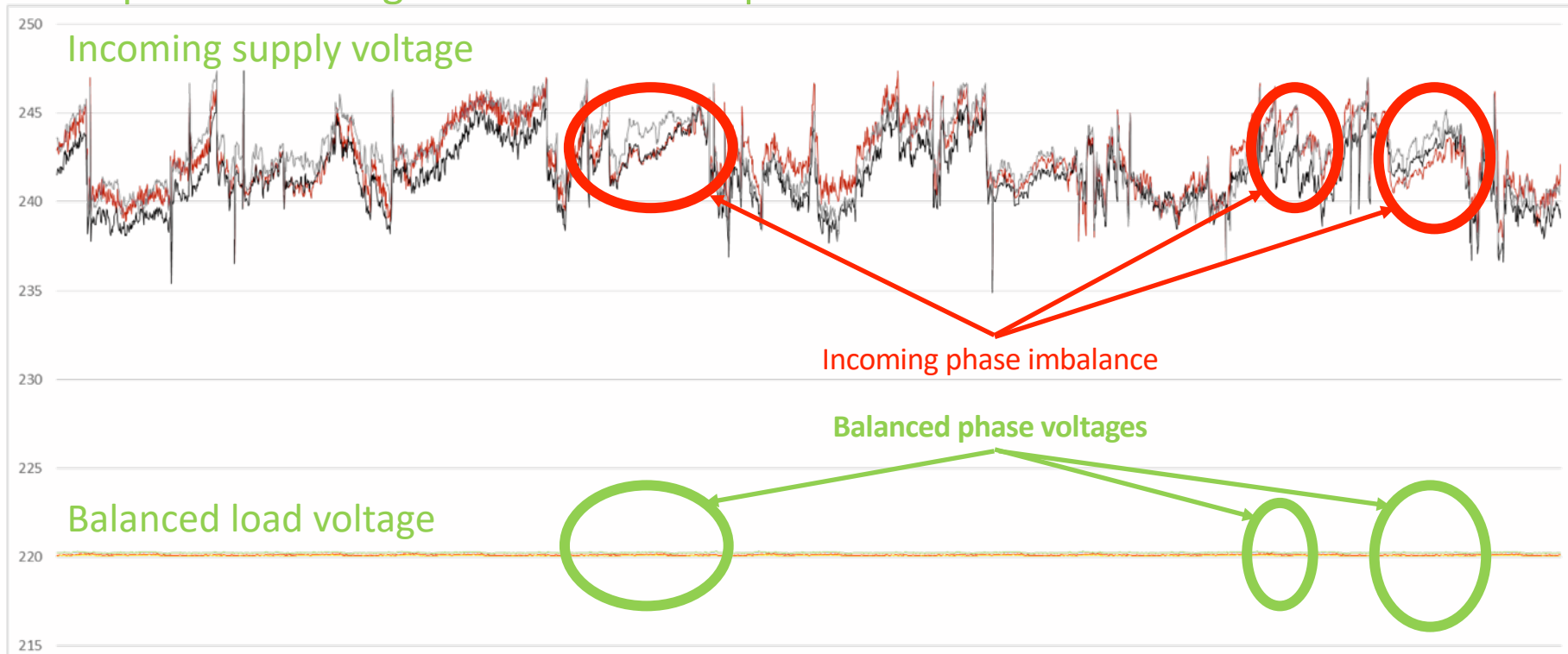
Responsive Power Optimisation through accurate and precise voltage control ensures the site supply remains optimised irrespective of what happens to the incoming supply voltage



Phase balancing

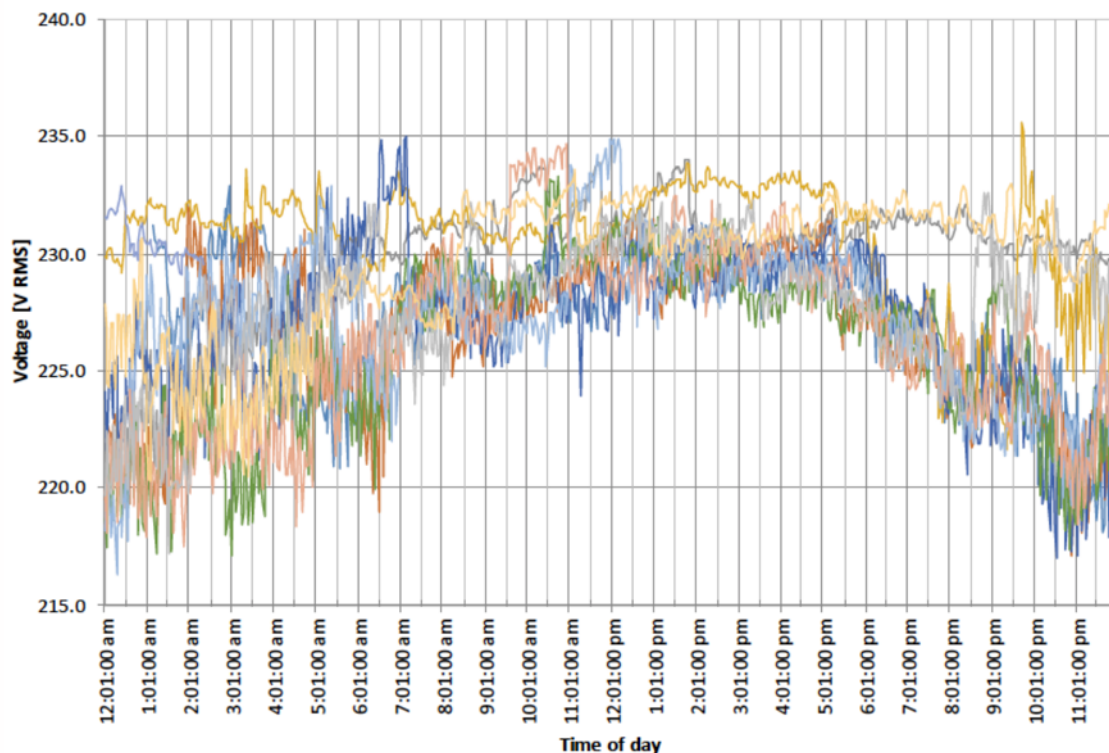
independent voltage control for each phase

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Buck and Boost solution

And, save kWh & \$\$\$ & CO2 tonnes



- ✓ VAAS is the approach to deliver voltage boost in cases where voltage sag events occur.
- ✓ VAASCO Group can deliver fully dynamic voltage management solutions that provide stable voltage, as well as reducing kWh usage, energy costs and will also reduce the carbon footprint.

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Responsive Power Optimisation

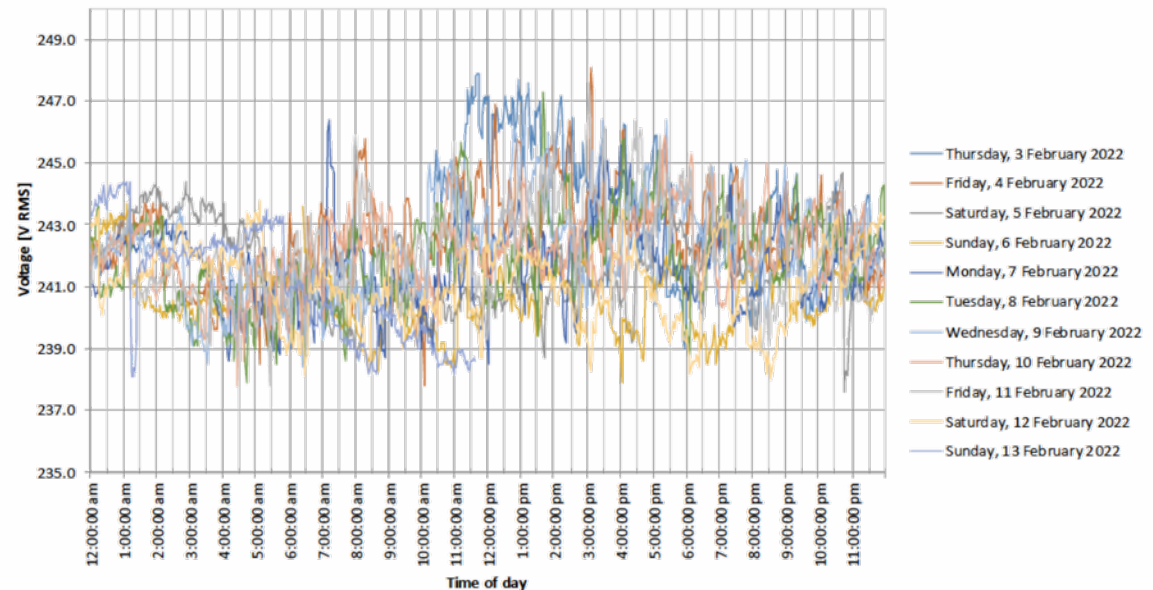
delivered as a managed service

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Grid supply voltage levels are rising, and becoming more variable due to increased renewables deployment

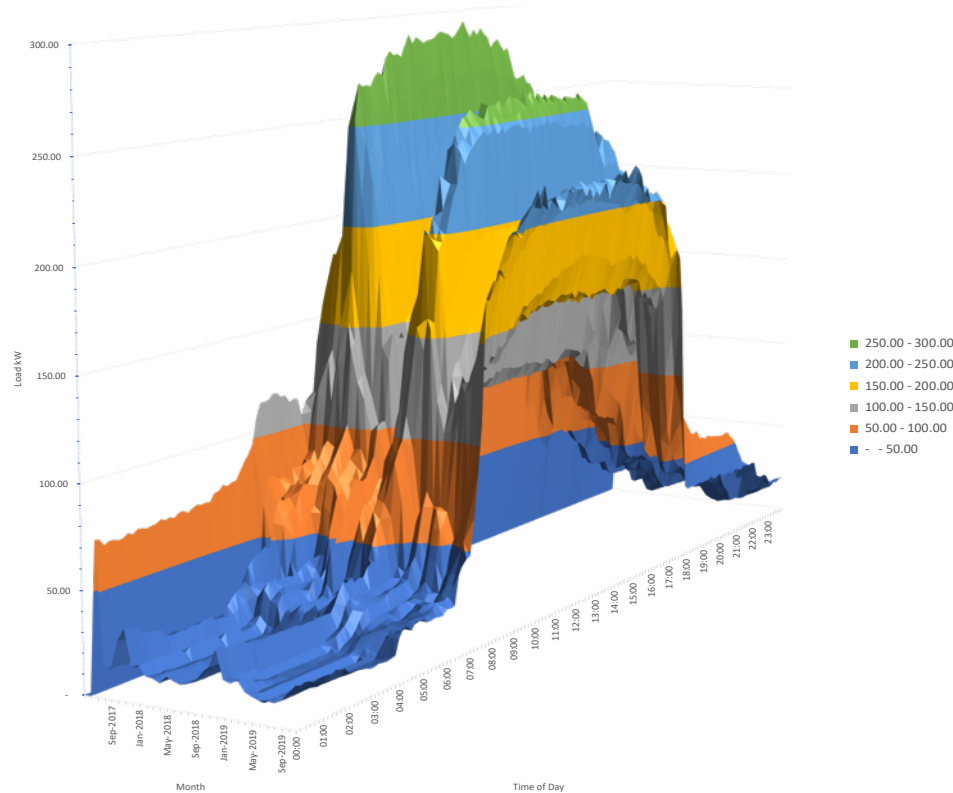
Input Voltage : Time of Day : Average Voltage
Daily during period : 03 Feb 2022 to 13 Feb 2022



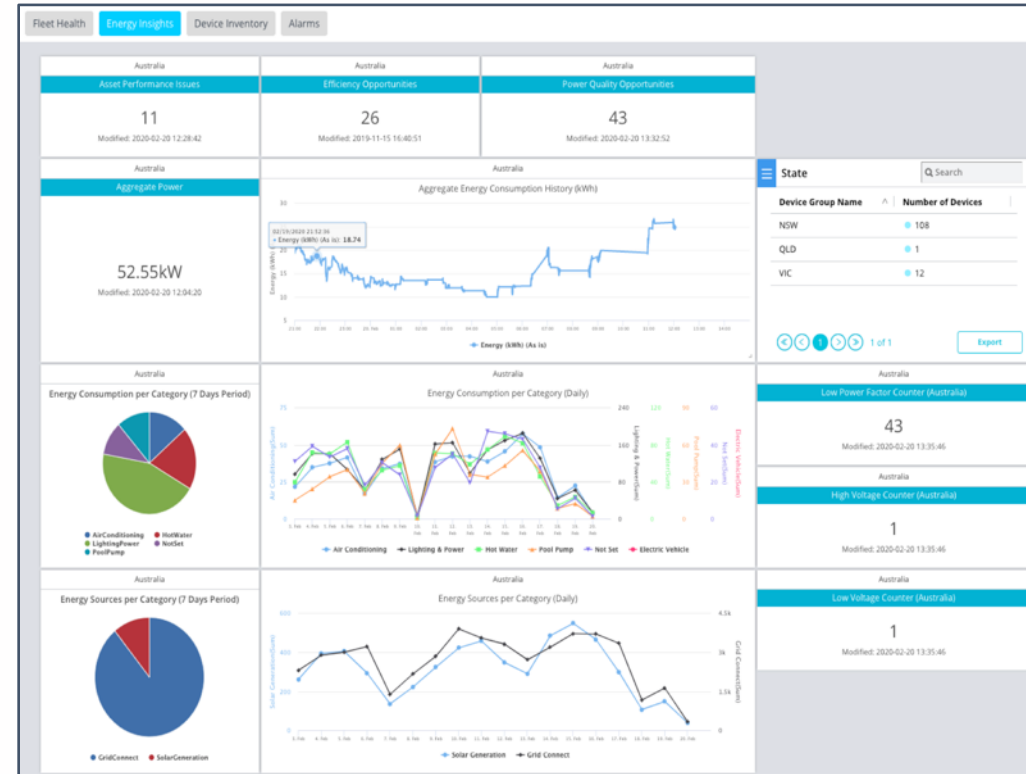
- ✓ Protects from fluctuating voltage, diminishing power quality and common transients
- ✓ Protects sites from common brownouts (Voltage Sags) during grid energy gaps
- ✓ Provides clean power for greatest operational efficiency - future proof
- ✓ Provides security and control of your electricity supply for the first time
- ✓ Highest possible energy saving due to balanced and precise voltage output
- ✓ Extends the life of all electrical equipment as it operates at optimal efficiency
- ✓ Reduces the maintenance time and replacement costs of electrical assets
- ✓ Future revenue potential from Demand and Frequency Response

Cloud based dashboard

Real time monitoring



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Every supply has a unique signature

The cloud based monitoring solution is 4G based, and does not engage with existing facility networking infrastructure. Real and reactive power, energy, min and max voltage, current, frequency are reported by default every 30 seconds, configurable between 5 to 150 seconds.

Aggregated monitoring across a group of facilities

Technical benefits of VAAS

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Risk from Grid supply	VAAS function	Technical benefits of VAAS
Increasing volatility of supply from Multiple renewable energy feeds into the HV Grid	Dynamic Voltage Control	Eliminates input voltage instability electronically by controlling VPO output voltage at a constant pre-determined voltage level (+/- 0.5V or 99.998% accuracy). Ensures that a site's equipment receives a highly stable voltage at a pre-set level.
Local brownouts result in the site's supply being too low for equipment to operate due to grid supply & demand constraints	Boost incoming supply voltage by 15%+ below set point	Protects the site against network voltage sags due to diminishing power quality and from rapid longer term voltage reduction (brownouts) caused by grid overloading. If input voltages sag to 185V will boost the voltage back to the set voltage point. Boosting lower voltage sags increases site resilience.
Incoming supply voltage fluctuates rapidly or becomes erratic due to grid issues from variable renewable generation	Ultra Fast Response	Autonomous very fast response time of <0.25secs - qualifying it for enhanced frequency response and demand response for an unlimited amount of time and does not impact site operation/equipment usage.
Unbalanced three phase supply due to Grid issues or single phase overloads reducing 3 phase equipment efficiency, operation and lifespan	Actively controlled 3 phase voltage balancing to within 0.1%	Actively corrects phase to phase voltage imbalance by correcting phase voltages to within 99.9% of each other, improving equipment operational efficiency and life span. Reducing kWh consumption.
Increased transients and harmonics from degraded power quality due to multi-directional Grid and uncontrolled renewable feed into the Grid	Standard Voltage Power Optimiser function	Suppresses harmonics and common transients. Reduces KVAR (c.40%) and improves power Factor (8-20%)

Key benefits summary

Item	Summary
Agreement	Single Master Service Agreement: covers the entire facility fleet
Energy usage and bill savings	Fleet wide basis, maximized as all sites included
CO2 footprint reduction	Fleet wide basis, maximized as all sites included
Energy security & asset protection	Fleet wide basis, maximized as all sites included
Fleet wide support, monitoring and reporting	Fleet wide basis, maximized as all sites included
Zero CAPEX and Zero OPEX	Fleet wide basis
Off balance sheet	Fleet wide basis
Gain share model for service delivery	Fleet wide basis, performance based
All maintenance, support and reporting	Fleet wide basis
Rapid fleet wide mobilisation	Fleet wide basis
Energy usage and bill savings	Fleet wide basis
Cloud dashboard	Fleet wide basis, each site, real time Class 1 metering
VPO technical solution	• Proven technology and solution • 3 phase solution – wide range voltage buck & boost • VPO will both increase or reduce voltage, suitable for all facility sites • Voltage resolution 1 V rms, ensuring maximum voltage adjustment is achieved • Time response 100 milliseconds, enabling fast tracking of grid supply changes • Efficiency VPO machine is 99.94% • Independent phase voltage balancing (providing potentially another 1.5% energy savings at sites with significant out of balance phase voltages)

Indicative key offer terms

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Item	Stage A (HQ fleet)	Stage B (ROW fleet)
Customer	Corporate or Government	Corporate or Government
# sites	To be assessed	To be assessed
Location	All sites in HQ country	Rest of world facility fleet
Coverage	All sites	All sites
Solution	Dynamic Voltage Optimisation (wide range buck & boost)	Dynamic Voltage Optimisation (wide range buck & boost)
Structure	VAAS Managed Service	VAAS Managed Service
Term	10 years, automatically renewed +5	10 years, automatically renewed +5
CO2 reduction	All sites	All sites
Energy usage reduction	All sites	All sites
Energy bill reduction	All sites	All sites
Monitoring – real time cloud dashboard	All sites, Class 1 metering	All sites, Class 1 metering
Capital cost	NIL	NIL
OPEX (maintenance, etc)	All sites	All sites
Existing PPIQ installs	Purchased by VAASCO	Purchased by VAASCO
Service fee	Gain share	Gain share
Billing	Monthly direct debit	Monthly direct debit
Security bond	To be assessed	To be assessed
Agent	Local subsidiary or agent	Local subsidiary or agent

Assessment process underpins the offer

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Item	Stage A (HQ fleet)	Stage B (ROW fleet)
Energy usage [kWh pa]	To be assessed by VAASCO	To be assessed by VAASCO
Energy usage [US\$ pa]	To be assessed by VAASCO	To be assessed by VAASCO
Energy tariff assumed [US\$ / kWh], fleet average	To be assessed by VAASCO	To be assessed by VAASCO
Energy savings [%], fleet average	To be assessed by VAASCO	To be assessed by VAASCO
Energy savings [kWh pa]	To be assessed by VAASCO	To be assessed by VAASCO
Energy savings (GROSS) [US\$ pa]	To be assessed by VAASCO	To be assessed by VAASCO
Energy savings (NET) [US\$ pa]	To be assessed by VAASCO	To be assessed by VAASCO
Engineering survey and design	Included	Included
Supply	Included	Included
Installation	Included	Included
Commissioning	Included	Included
Maintenance, 24 hour response	Included	Included
Cloud reporting, real time	Included	Included
Minimum energy usage [kWh pa]	80% Fleet aggregate	80% Fleet aggregate
Minimum effective tariff [US\$ / kWh]	80% Fleet average	80% Fleet average
Carbon credits	Included in gain share	Included in gain share
CO2 conversion factor (kg CO2e / kWh)	To be assessed by VAASCO	To be assessed by VAASCO
Carbon reduction tonnes [CO2 pa]	To be assessed by VAASCO	To be assessed by VAASCO

★ Where we currently do business

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