powerstar®

GLOBAL MARKET LEADER IN VOLTAGE OPTIMISATION

The Powerstar Range

www.powerstar.com

TRUSTED BY LANDMARK SITES

Powerstar has been installed into landmark sites including the Palace of Westminster, London City Hall, the Cabinet Office, the House of Keys and the Welsh Assembly.

The Cabinet Office - London

London City Hall - London

Our global client list includes

VOLTAGE OPTIMISATION

HOW IT WORKS

"Our unique, patented designed voltage optimisation system returns the excess voltage in terms of real negative power which is subtracted from the grid input power. 70-80% of the total savings come from the negative power feedback while 20-30% come from the improvement in the equipment efficiencies."

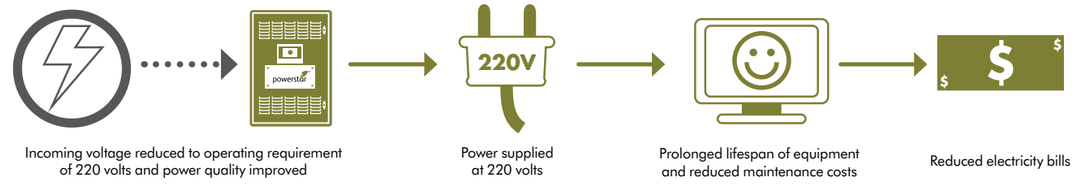
Dr Alex Mardapittas
INVENTOR OF POWERSTAR

A report from the University of Warwick showed: "Powerstar Voltage Optimisation can lead to energy savings. The overall power consumption is reduced because the negative power is induced as feedback power to the source. Virtually, this power can be considered as power "generated" from the load side."

Professor Jihong Wang
THE UNIVERSITY OF WARWICK

NORMAL ELECTRICITY CONSUMPTION

powerstar® CONTROLLED ELECTRICITY CONSUMPTION

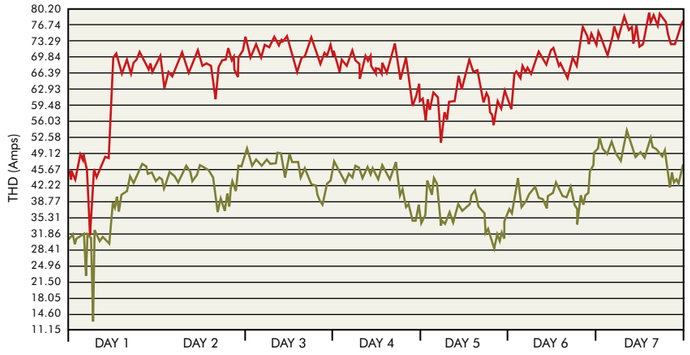


HOW YOU BENEFIT FROM POWERSTAR

VOLTAGE PROFILE BY STATE

STATE	POWER COMPANY	NOMINAL (VOLTS)	EQUIPMENT DESIGNED TO RUN AT	RANGE UPPER	RANGE LOWER
QUEENSLAND	ENERGEX ERGON ENERGY ESSENTIAL ENERGY	240	220V	+6%	-6%
NEW SOUTH WALES	ESSENTIAL ENERGY AUSGRID ENDEAVOUR ENERGY	230 240 230	220V	+10% +6% +10	-2% -6% -2%
AUSTRALIAN CAPITAL TERRITORY	ACTEWAGL	240	220V	+6%	-6%
VICTORIA	CITIPOWER | JEMENA POWERCOR | SPAUSNET	230	220V	+10%	-6%
TASMANIA	TASNETWORKS	230	220V	+10%	-6%
SOUTH AUSTRALIA	SAPN UTILITIES	230	220V	+10%	-6%
WESTERN AUSTRALIA	HORIZON POWER WESTERN POWER	240 230	220V	+6%	-6%
NORTHERN TERRITORY	POWERWATER	230	220V	+10%	-10%
NEW ZEALAND	ALL	230	220V	+6%	-6%

Reduces Harmonics

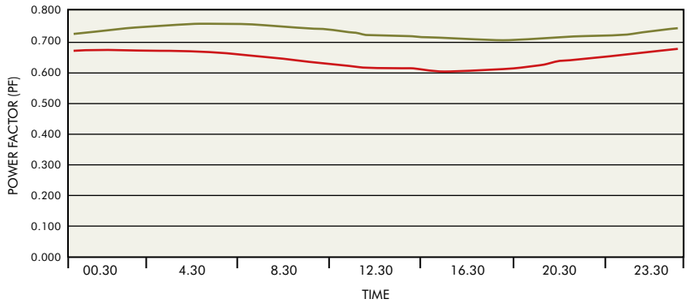


VOLTAGE OPTIMISATION REDUCES ELECTRICITY CONSUMPTION BY OPTIMISING INCOMING VOLTAGE TO MEET THE REQUIREMENTS ON ONSITE ELECTRICAL EQUIPMENT

HARMONICS WITHOUT POWERSTAR

HARMONICS WITH POWERSTAR

Improves Power Factor



PF WITHOUT POWERSTAR

PF WITH POWERSTAR

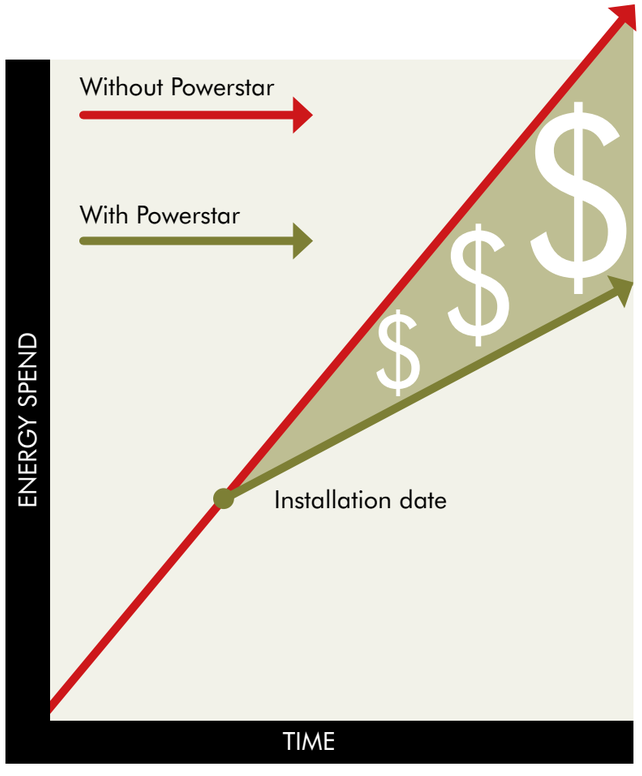
SAVE ELECTRICITY COSTS

PROTECT CORPORATE SOCIAL RESPONSIBILITY AND REPUTATION

REDUCE FINANCIAL RISK
INCREASE BOTTOM LINE AND CUT CAPITAL REPLACEMENT COSTS

CUT CARBON FOOTPRINT

AS ENERGY PRICES CONTINUE TO RISE EFFICIENCY SAVINGS FROM POWERSTAR WILL INCREASE OVER TIME



BT

"We have been very pleased with the quality and workmanship – the energy savings have been higher than forecast and we are expecting to run a phase 2. The Powerstar team have been very flexible in scoping, design and working around our operational units to ensure full services were maintained. I have no hesitation in recommending voltage optimisation (Powerstar) and we are pleased with the full service provided."

STUART HARRIS
HEAD OF ENERGY AND CARBON OPERATIONS
BT TECHNOLOGY, SERVICE & OPERATIONS

ASDA

"Powerstar voltage optimisation has been a major part of our comprehensive energy efficiency programme. It is perhaps the simplest and most effective way to instantly save energy and therefore we would highly recommend Powerstar systems."

MARK ORPIN
HEAD OF ENERGY MANAGEMENT
ASDA SUPERMARKETS

npower

"Powerstar's estimated savings were not only met but surpassed. We also measured the harmonics and power factor and again they surpassed expectations. We now have Powerstar installed across the majority of our larger office portfolio and are showing savings every day."

DAVE HORTON
SUSTAINABILITY AND CAPITAL INVESTMENTS MANAGER
RWE NPOWER

NEWBURGH PRECISION

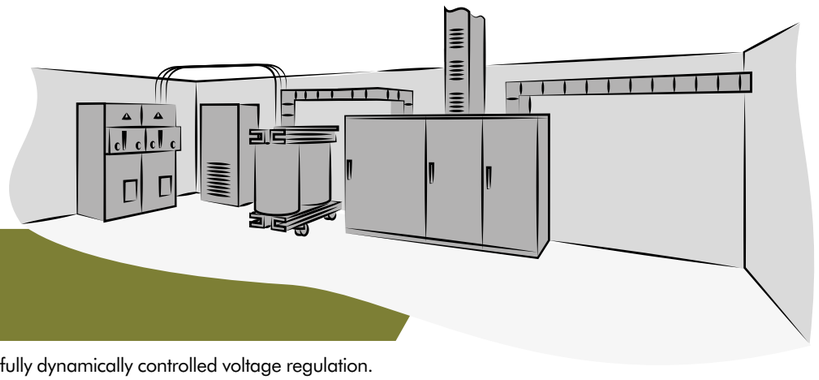
"Powerstar gave us an effective, guaranteed option to reduce our electricity consumption and carbon emissions. Along with the positive environmental impacts we have seen a reduction in motor drive failures, giving us greater efficiency and providing further savings on top of those promised."

DAVE BURROWS
PLANT PROVISION MANAGER
NEWBURGH PRECISION

OPTIMISE AT HV SIDE OR LV SIDE

Voltage optimisation is needed to correct the supply issues caused by the high voltage (HV) infrastructure.

If your company operates its own HV/LV (distribution) transformer then perhaps the most effective option is to install a Powerstar HV MAX system. This will produce savings on both the transformer side as well as the load side (depending on the voltage profile, business operation and type of equipment on site). If your company has a low voltage (LV) supply only, then the Powerstar or Powerstar MAX systems will be the most appropriate.



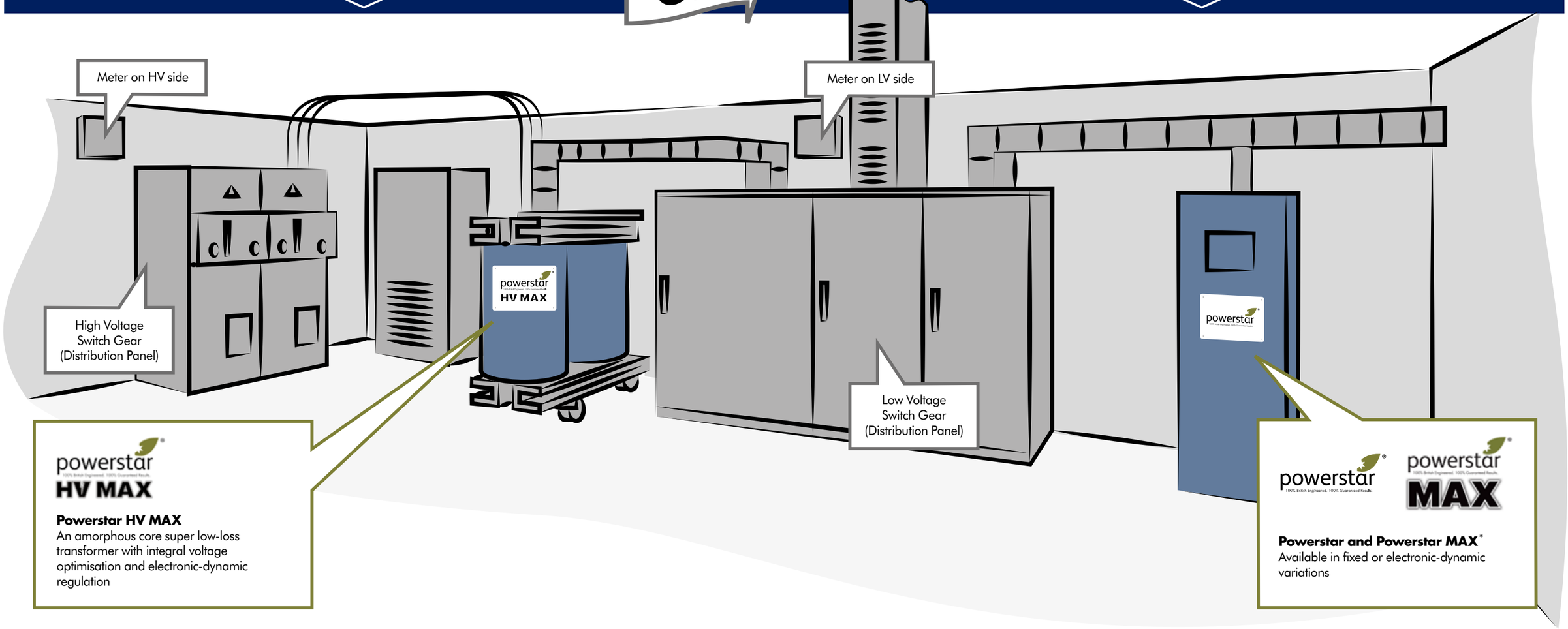
This diagram shows a typical plant room set up with **NO** voltage optimisation

*MAX – Indicates a solid state, fully dynamically controlled voltage regulation.
MAX is produced with both HV and LV systems and can provide additional security as the voltage to the site is fully regulated regardless of the voltage input provided by the electricity supplier.

HV SIDE

OR

LV SIDE



powerstar HV MAX

Powerstar HV MAX
An amorphous core super low-loss transformer with integral voltage optimisation and electronic-dynamic regulation

powerstar MAX

Powerstar and Powerstar MAX*
Available in fixed or electronic-dynamic variations

HV SYSTEMS

powerstar®

100% British Engineered. 100% Guaranteed Results.

HV MAX

Powerstar HV MAX provides a combined solution to two common problems, combining a super low-loss amorphous core HV/LV transformer with integrated electronic-dynamic voltage optimisation technology, allowing for 11,000V input (other inputs available) and regulated 380V or user defined output.

Replacing HV/LV transformer

The reason you need to optimise voltage is to correct problems caused by the HV infrastructure.

Unless your HV/LV transformer is brand new, it is more efficient to correct the issues at source. This can be achieved by optimising the voltage at the HV supply by simply replacing the inefficient HV/LV transformer with the Powerstar HV MAX super low-loss amorphous core.

Powerstar HV MAX Savings

Most of the savings continue to come from the negative power feedback (Powerstar design). Therefore, in the Powerstar HV MAX system 60-70% of the total savings come from the unique Powerstar design, 10% from the transformer efficiency and improvements of 20-30% from equipment efficiencies.

Installing an amorphous core transformer

- The Powerstar HV MAX transformer uses amorphous alloy with superior magnetic characteristics
- It is a non-crystalline structure with atoms randomly arranged and easy magnetisation
- Quick magnetisation, significantly reduces losses
- Amorphous metal uses thin ribbons of metal at 0.0025mm thickness

The chart (right) shows that for a 1,000kVA system at 75% load typical annual consumption savings are 52,867kWh, with financial savings of £6,344 and a reduction in carbon emissions of 29.3 tCO_2.

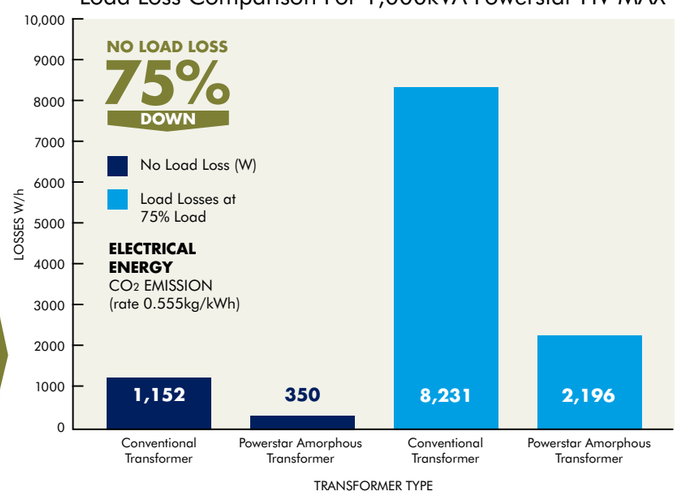
Over 15 years (the warranty period of the system), typical financial saving are therefore £95,160 with carbon reductions of 439.5 tCO_2. These are savings from reduced transformer losses alone.

Savings figures show typical estimation. Financial figures based on 12p/kWh. CO_2 figures based on 0.000555t CO_2/kWh

Replacing the existing transformer with the super low loss amorphous core HV Powerstar Max transformer can yield significant savings depending on the age and type of transformer installed.

YEAR	ANTICIPATED SAVINGS
1950	5.5%
1955	4.5%
1960	4%
1965	4%
1970	4%
1975	3.5%
1980	3.5%
1985	3.5%
1990	3.5%
1995	3%
2000	2.5%
2005	2.5%
2010	2%
2013	1%

Load Loss Comparison For 1,000kVA Powerstar HV MAX



A COMBINED SOLUTION

TO TWO COMMON PROBLEMS

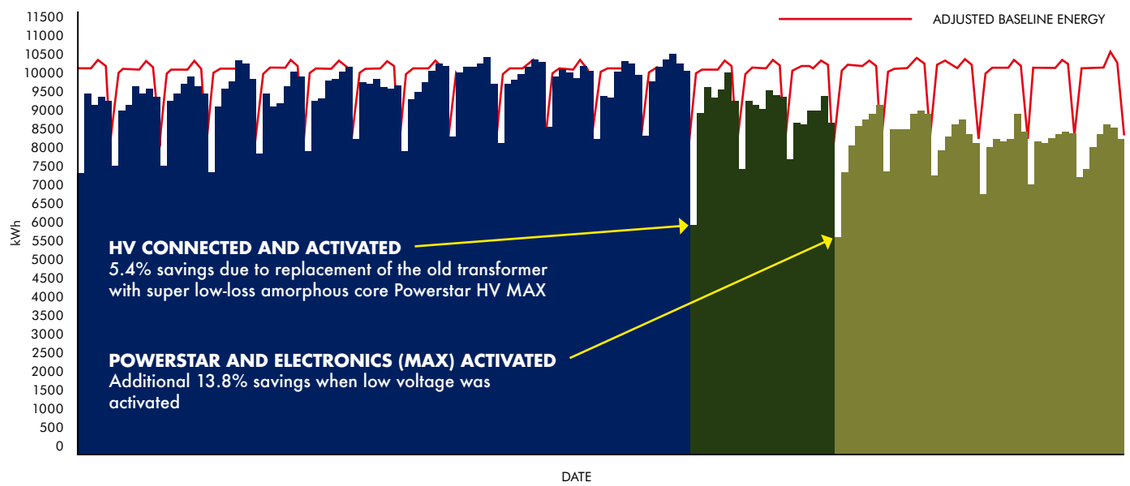
1st SOLUTION OF ITS KIND

PATENTED BRITISH DESIGNED AND MANUFACTURED SOLUTION, LAUNCHED IN 2012

Features and benefits of Powerstar HV MAX

- The super low-loss amorphous core is 99% efficient, therefore will provide upto an additional 5% savings on total electricity consumption than traditional HV transformers
- The integrated electronic-dynamic voltage optimisation technology may offer a further 12%-15% saving
- **Typical savings of 17% off annual electricity consumption can be expected**
- Environmentally friendly with low greenhouse emissions
- Guaranteed safety, security and reliability
- Reduced temperature rise of the core and reduced magnetising current
- Provides voltage stabilisation and protection against spikes and surges
- Output accuracy of +/-1.25V single phase LV output
- Capacity 315kVA to 2500kVA

Example of savings achieved at ASDA part of the WAL•MART family Project Tracking: Daily Date: Actual vs Forecast



powerstar

LV SYSTEMS

powerstar®

powerstar®
100% British Engineered. 100% Guaranteed Results.
MAX

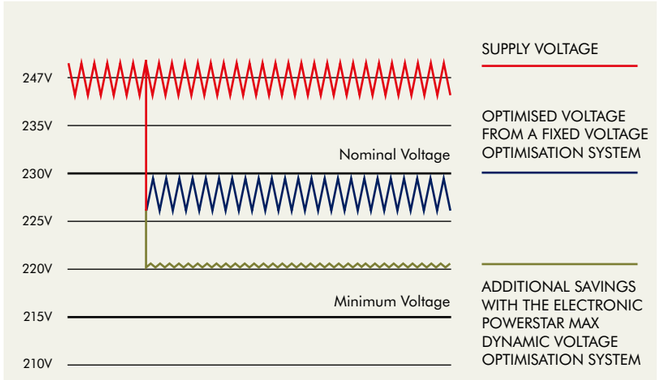
Powerstar voltage optimisation systems are available in electronic-dynamic (Powerstar MAX) and fixed (Powerstar) variations each offering ideal energy saving solutions for the correct application.

Powerstar MAX

An intelligent, electronic-dynamic voltage optimisation system which provides a stable voltage output by automatically adjusting and maintaining voltage at the optimum level. Powerstar MAX is ideal for sites with fluctuating voltage, high night loading or critical equipment requiring additional security.

Powerstar

Optimises the incoming voltage by a set amount and matches the incoming voltage profile albeit dropped by a set amount. Powerstar is ideal for sites with stable, yet high levels of incoming voltage.



Powerstar v Powerstar MAX comparison

Powerstar and Powerstar MAX both offer high levels of savings and efficiency afforded by the patented Powerstar design and the quality of manufacture. The electronic-dynamic technology offers additional savings potential for certain sites with a high fluctuating voltage profile.

	powerstar	powerstar MAX
Patented Design	✔	✔
Achieves 12% Average Savings	✔	✔
Additional Savings Opportunities		✔
Reduces Harmonic Distortions	✔	✔
Improves Power Factor	✔	✔
Improves Phase Balancing	✔	✔
Increases Lifespan of Equipment	✔	✔
Intelligent Real-Time Interface (HMI)	✔ Option	✔
No Moving Parts	✔	✔
Guaranteed Savings	✔	✔
Manufactured in UK	✔	✔
Electronic-Dynamic (Variable) Optimisation		✔
Incorporates Modern Technology to Regulate Voltage Output		✔
Suitable for Sites with Fluctuating Voltage		✔

FIXED AND ELECTRONIC

DYNAMIC (VARIABLE) SOLUTIONS WITH A PATENTED DESIGN

100%

100% RELIABILITY

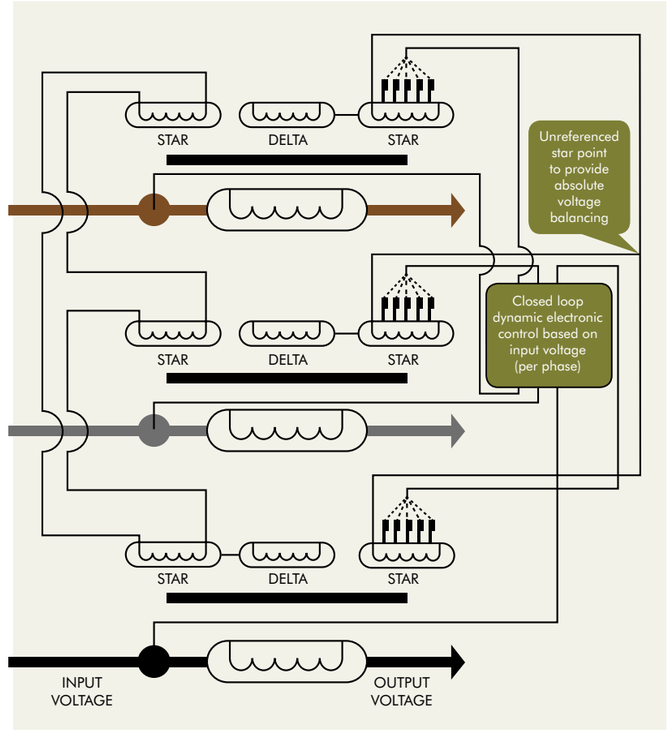
POWERSTAR HAS ONE HUNDRED PERCENT RELIABILITY, WITH NO RECORDED FAILURES IN OVER 13 YEARS OF INSTALLATIONS

Patented technology

Powerstar is the only voltage optimisation system in the world to be granted a patent on its design, testament to the uniquely designed triple-wound transformer that affords clients additional energy savings and efficiency potential coupled with unrivalled suppression of harmonics.

Schematic

The diagram shows the basic schematic for the Powerstar MAX system, highlighting how the solution works to reduce energy consumption through optimising on site voltage.



The configurations

Star configuration
To eliminate harmonics

Delta Configuration
To further suppress any remaining harmonics

Star Configuration
To control voltage

UK MANUFACTURING

EACH OF THE POWERSTAR VOLTAGE OPTIMISATION SYSTEMS IS FULLY DESIGNED AND MANUFACTURED BY EMSC (UK) LTD IN BRITAIN.

Whilst Japanese and Chinese electronic and engineered solutions continue to be prevalent in the market, EMSc (UK) Ltd is proud to be able to say that its research, development, sourcing and manufacturing is all done in the UK. EMSc (UK) Ltd is extremely proud of its British roots and refuses to compromise on product quality during the manufacture of Powerstar.

Real time monitoring

The Powerstar HMI (Human Machine Interface) can be viewed online and/or through an internal network and is IP addressable.

In addition the system stores the following information every 10 minutes and has a huge storage capability:

- Display of energy savings
- Current per phase
- kVA per phase
- Total kVA
- kWh per phase
- Total kWh
- Voltage per phase
- kVAr per phase
- Power factor per phase
- Harmonics (both voltage and current)

TESTIMONIALS

We found Powerstar to be both professional and proactive in their awareness of the installation requirements during business operational hours, which ensured minimum disturbance for our guests.
We have now installed more than 400 Powerstar systems in our estates and the carbon savings are fantastic.
It is the equivalent of removing the emissions of 24,000 UK households from the National Grid. A great result for our company, and the environment.

Chris George
Head of Energy and Environment
Whitbread Hotels & Restaurants

We would highly recommend Powerstar voltage optimisation systems. Powerstar voltage optimisation has shown that significant savings can be achieved without compromising the operations of the hospital.

Mark O'Grady
Managing Director
Mitie Engineering (North) Ltd

We are absolutely delighted with the Powerstar system which has reduced our direct electricity and carbon emissions by 16%. I have no hesitation to recommend Powerstar to others.

Stephen Ward
Senior Electrical And Mechanical Engineer
Sheffield Hallam University

After looking around the market for voltage optimisation units, we found that Powerstar provided the best overall evaluation of our site and most realistic cost savings. After a seamless installation, it has certainly delivered what was forecast in the way of cost savings for our business.

Matthew Sykes
Maintenance Leader & EHS Coordinator
Metaldyne International

From the outset, the Powerstar team was pro-active, commercially aware and able to demonstrate a high level of competence in both analysing our technical & subsequent installation requirements within a live hotel requirement. They promised technical support, professionalism and minimum fuss and that was precisely what they delivered!
So far the Powerstar installations in our hotels have achieved as much as an amazing 26.1% saving in total energy consumption at our Thistle Hyde Park hotel, and elsewhere, never less than an 11.5% saving. Thats what I call a result!

David Hannah
Head of Property
Guoman-Thistle Hotel Management (UK) Ltd

Due to Polyflor's manufacturing commitments, the Powerstar had to be installed during a planned shutdown and timing was critical. The Powerstar team completed the task without any problems. The Powerstar unit is in daily use and a comparison of electricity usage before and after installation shows a significant saving as predicted. I am happy to recommend Powerstar to anyone seeking similar objectives to ourselves.

N Holden
Senior Project Engineer
Polyflor

ACCREDITATIONS

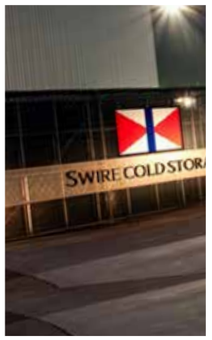
Powerstar has been granted with a number of accreditations in relation to the product and the manufacturing, installation, project management processes, procedures, systems and supply chains used by EMSc (UK) Ltd, who have been manufacturing Powerstar systems for over 13 years. Key accreditations include:

CASE STUDIES

Carlsberg is committed to ensure that its business is conducted according to rigorous ethical, professional and legal standards. The Group formulated an environmental policy to make every effort required to improve or safeguard the environment and act in an environmentally responsible manner in regards to operations, products and services.

SAVINGS

The site recorded savings of **17%** with a payback period of just 12 months. The Powerstar 250 kVA unit which was installed optimised voltage and helped machines and equipment at the factory to operate more efficiently reducing carbon emissions by **21 tonnes** per annum.



Over the last fifty years Swire Cold Storage (SCS) has been involved in every aspect of the Cold Chain. The Victorian facility located in the Laverton industrial district, west of Melbourne is a new facility which opened in March 2008 and handles a variety of frozen foods including vegetables and seafood.

SAVINGS

The installation of Powerstar resulted in annual electricity consumption savings of **13%-14%** per year with reductions in carbon emissions of **490 tonnes** per annum.

The Palais is a newly renovated family hotel offering some of the most stylish and modern facilities along the Adelaide coastline. The hotel has over 100 staff with a turnover of $7.5 million and was looking to reduce its electricity costs and lessen its impact on the environment.

SAVINGS

Powerstar has allowed Palais to reduce its electrical consumption by **10.5%**, saving **$13,500** each year and with installation times met it allowed for seamless transition which didn't affect customers or operations.

Principal Hayley is a hotel and conference centre venue operator with sites across the UK and Europe. The company has significantly lowered its carbon footprint and overall impact on the environment.

SAVINGS

Following installation of Powerstar at the Palace Hotel in Manchester, the hotel benefitted from annual energy consumption savings of **18%**, with a payback period of just **1.4 years**.

BIS identified that not only was the incoming voltage high, but that the sites were also suffering from poor power quality. A solution was required that would not only drop the incoming voltage levels but also significantly improve power quality.

SAVINGS

Across the five Powerstar systems that were installed into the BIS buildings an average of **12.8%** savings were made, reducing electricity costs by **$57,042** per year. The unique triple wound design of the Powerstar system enabled high levels of harmonics (electrical noise) to be removed which improved the power quality.

Derby City Council is aiming to reduce its carbon emissions by 25% as part of its Climate Change Strategy. The challenge to Powerstar was to demonstrate that it is the most efficient and cost effective system capable of delivering the savings expected by the Council.

SAVINGS

The system installed at the Eagle Centre market is saving **128,972kWh** annually, which equates to **14.6%** in electricity consumption. Powerstar is also helping the Council lower its carbon emissions by **69.2 tonnes** per annum.

Whitbread is the power behind some of the UK's most successful, much-loved hospitality brands including Premier Inn, Beefeater Grill, Brewers Fayre, Table Table, Taybarns and Costa Coffee.

The company employs over 40,000 people worldwide and serves more than 10 million customers every month in the UK.

SAVINGS

Over 400 Powerstar systems have been installed throughout the group, with each installation carried out with the requirements of each sites business demand in mind, to ensure no disruption to operations or negative impact on guest experience. Results from installations into the Whitbread chain of facilities has proven successful with a number of installations outperforming the guaranteed minimum levels of cost savings, average savings over the 400 sites is **12.35%**.

Trelleborg was looking to further reduce it's carbon emissions and overall energy consumption.

The site had already installed other energy savings solutions such as high efficiency T5 fluorescent lighting and large inverter drives and were looking at voltage optimisation to create further energy savings and supply the correct, regulated voltage for its plant equipment.

SAVINGS

Powerstar presented its findings to Trelleborg, which even after various other energy saving solutions had been installed, Powerstar would still give guaranteed savings of 7.7%.

A Powerstar MAX was installed on site and the guaranteed savings were surpassed by 3.5% at **11.2%**, with the incoming voltage now correct for plant equipment after installation.

CASE STUDIES

NHS Ashworth Hospital

Ashworth hospital is a high-security psychiatric hospital managed by Mersey Care NHS Trust, it currently provides care for more than 220 patients. Four Powerstar systems were installed within the hospital grounds.

SAVINGS

The installations provided savings of **12%** on annual electricity consumption and reduced maintenance costs of lighting, plant and IT equipment in the hospital.

SKI DUBAI

Ski Dubai is an indoor ski resort with 22,500 metres of indoor ski area, it is part of Mall of the Emirates, one of the largest shopping centres in the world. The facility needs to maintain a daytime temperature of -1 °C (30° F) and a temperature of -6 °C (21° F) at night when the snow is produced.

SAVINGS

Powerstar is providing **9.7%** savings on annual electricity consumption and a **79 tonne** reduction in CO_2 emissions.

The installation of Powerstar was completed without any negative effects to the delicate business operations on site and without impacting on business operation and guest experience.

pwc

PWC is a multinational professional services network that actively sought a transparent technology that would effectively reduce their carbon footprint, reduce their electricity costs and would do so in an effective secure and reliable way.

SAVINGS

A 575kVA Powerstar system was installed at the PWC office which reduced the overall energy consumption on the site by **8.1%** with 34.7% saved in maximum kWh demand. CO_2 emissions were reduced per annum by **66.4 tonnes** following installation.

Sheffield Hallam University

Sheffield Hallam University has implemented a number of projects – including energy efficiency initiatives – to reduce its impact on the environment. One area targeted by the university was the student union building, where energy consumption was high and where light tube failure occurred regularly.

SAVINGS

The installation was completed without disruption and the university has since seen a reduction of **16%** in kWh consumption and **19%** in the maximum demand. The failure of the light tubes was also monitored for 18 months before and 18 months after the installation of Powerstar.
A **75% reduction** in light tube failure was achieved. Combined results led to a payback of just over **1 year**.

LEASING

Leasing packages are available for clients looking for alternative ways of funding an installation.

OPERATING LEASE

Available over a five year fixed term with low monthly payments and no upfront costs. At the end of the operating lease, the Powerstar unit will have a 20% residual balance. There are three options the customer can take at this point which are:

1. Purchase at the residual value
2. Return the unit
3. Refinance the outstanding balance

FINANCE LEASE

The term of the lease is flexible and at the end of the agreement, the customer owns the unit. Payments are monthly, with no upfront costs. The client can choose a payment plan to suit their business cash flow requirements.

15* YEAR WARRANTY | **50** YEAR LIFESPAN

powerstar 100% SAVINGS GUARANTEE

Savings from all Powerstar systems are 100% guaranteed, analysis is based upon IPMVP and is carried out via the steps below.

- **Step 1** - Compares 28 days pre install kWh data against 28 days post install kWh data
- **Step 2** - Compares 28 days post install kWh data against the same dates a year previously (pre install)
- **Step 3** - Compares 84 days (12 weeks) post install kWh data against the same dates a year previous (pre install)
- **Step 4** - This involves a regression analysis. An accurate model is created based upon pre install kWh consumption data and variables such a temperature
- Following the analysis, if savings achieved are less than stated in the proposal, the shortfall in terms of $ based on c/kWh used in the proposal will be calculated
- This figure is multiplied by the payback period as stated in the proposal and issued as a one-off payment

EXAMPLE

Proposal states 10% saving worth $15,000 per annum giving a payback of 2.8 years

Actual energy savings achieved = 8% worth $12,000

Shortfall = $3,000

We issue a one-off payment to the client of $3,000 x 2.8 = $8,400 so the return on investment is guaranteed

WARRANTY & GUARANTEE

*15 years warranty in the UK, Australia and Cyprus, in all other countries a 10 year warranty applies. Warranty includes parts and labour but excludes damage due to overloading of the system.

THE POWERSTAR EXPERIENCE

To use the 3D model codes download the 'Junaio' AR App at **www.junaio.com/download**, IOS or Android app stores and scan the QR code. Hover over the logo of the system you wish to view on the brochure for the Powerstar experience.

junaio | Available on the App Store | App Store

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HV MAX

LV SYSTEMS

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MAX

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Powerstar is designed, manufactured and engineered by EMSc (UK) Ltd at the UK based head office in Sheffield

UK manufactured Powerstar systems are exported overseas to more than 15 countries

www.twitter.com/powerstarvo

www.linkedin.com/company/powerstar

www.youtube.com/emspowerstar

powerstar®

THE POWERSTAR RANGE

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ems ENERGY MANAGEMENT SYSTEMS