

## Voltage Power Optimisation (VPO)<sup>®</sup>

### CASE STUDY

#### The Good News Press

#### Essex

Installed September 8th, 2007

Report January, 2008



## About The Good News Press

The Good News Press is based in Essex and is a high quality digital printing press. They run some unique machinery and are well established in the industry.

The Good News Press are environmentally minded; they offset all the carbon they are responsible for through “Carbon Care” and subscribe to ISO14001, FSC and PEFC. They saw the fitting of a powerPerfector unit as a further commitment to the environment and sustainability, whilst benefiting from their decision through achieving **15.1%** savings on their electricity consumption.

## powerPerfector unit details

A 150KVA/220A unit was installed on 8th September 2007 with a –9% Optimisation setting. Through installation the following results were achieved:

- **18.5% reduction in daily average consumption**
- **£5,439 per year**
- **7,628kg CO2 per year**

## Electrical load

The office electrical load includes lighting circuits, heating and ventilation systems, as well as switch mode power supply devices, whilst the press itself operates a number of induction motors.

## FULL REPORT

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### Introduction

powerPerfector optimises the voltage and improves the power quality for a whole site more efficiently than any other technology available. Optimising the supply voltage allows equipment to use only the energy it requires to operate efficiently.

For example, providing a motor with its optimum voltage prevents excess heat and vibration, while delivering the required torque and speed. When these effects are aggregated across a whole site, substantial energy savings are delivered. The Maximum Demand of the site is also reduced — typically by as much as 10% — which will help keep the site within its Agreed Service Capacity and may reduce penalty charges.

Installing a powerPerfector improves power quality on a site considerably. The reactance of some electrical equipment is reduced when voltage is optimised, so there is an overall improvement in power factor. Equipment is protected as the powerPerfector eliminates transients up to 25,000V and harmonics are filtered from the mains, while the balancing of phase voltages maximises the efficiency of three-phase equipment. By optimising the power supply at source, the powerPerfector is able to extend the lifetime of all the electrical equipment on a site, substantially reducing maintenance overheads in addition to the energy savings.

## Overview

Following a process of evaluation to confirm the level of Optimisation and suitability of the Good News Press site for a powerPerfector unit, a pP150kVA / 220A unit was installed on the 8<sup>th</sup> September 2007.

A scheduled shut down of the site was required, with the work carried out over a weekend.

Following installation all electrical equipment has operated normally and there have been no reports of any problems. With further observation over time, our clients tell us that equipment life can be noticeably extended.

## THE SAVINGS REPORT

### Savings summary

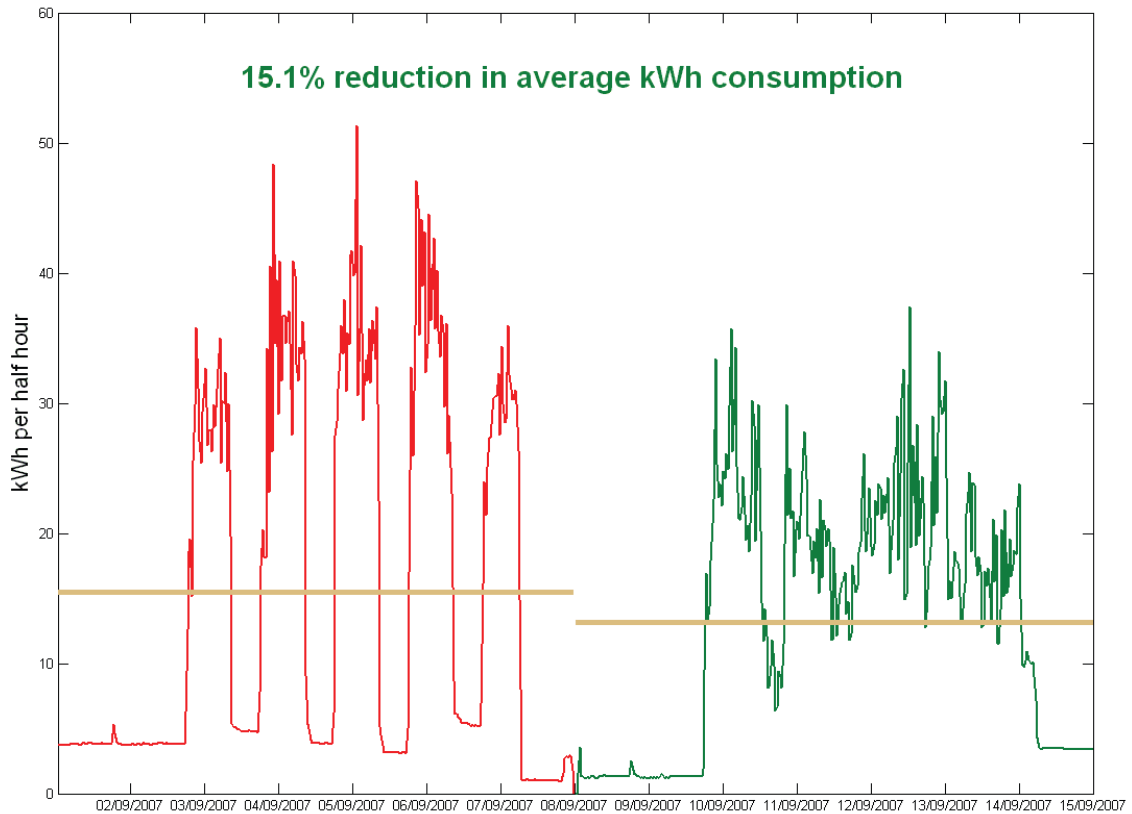
Reduction in daily average consumption	<b>18.5%</b>	<b>£14.88 per day</b> <b>£5,439 annually</b>
Projected annual carbon savings	<b>7,862kg</b>	
Immediate consumption reduction	<b>15.1%</b>	
Effective base load reduction	<b>20.2%</b>	
Reduction in daily average maximum demand	<b>16.8%</b>	

### Overall savings

A 150kVA powerPerfactor Voltage Power Optimiser with a 9% optimisation setting was installed at The Good News Press, Essex, on 8th September 2007. The following is an analysis of the half-hourly electricity consumption data for the site. Optimising voltage by 9% ordinarily yields a 14.5% reduction in average electricity consumption. As shown in the charts below, in this case average consumption for the period since the powerPerfactor was installed has been reduced immediately by **15.1%** (see **figure 1**), with savings of **18.5%** evident from a longer-term analysis.

To assess the immediate effect of the powerPerfactor, we plot the chart below, showing the kWh consumption 1 week before and after installation. Average half-hourly consumption has been reduced from **15.5kWh** during the week before installation to **13.1kWh** the following week – a saving of **15.1%**. There has been an immediate improvement in the electrical efficiency of the site, as electrical equipment is supplied with an optimised voltage.

### The Good News Press - 1 week before and after installation



**Figure 1**

Taking a longer-term view of the site's electrical energy consumption, we plot **figure 2** overleaf. This shows average half-hourly kWh consumption since June 2004. The reduction in consumption levels following the powerPerfactor installation is visually apparent. From June 2004 to September 2007, an average **17.8kWh** per half-hour was being consumed, which has been reduced to **14.5kWh** since installation. This is a saving of **18.5%**.

The Good News Press - all available data - period from 08/06/2004 to 30/11/2007

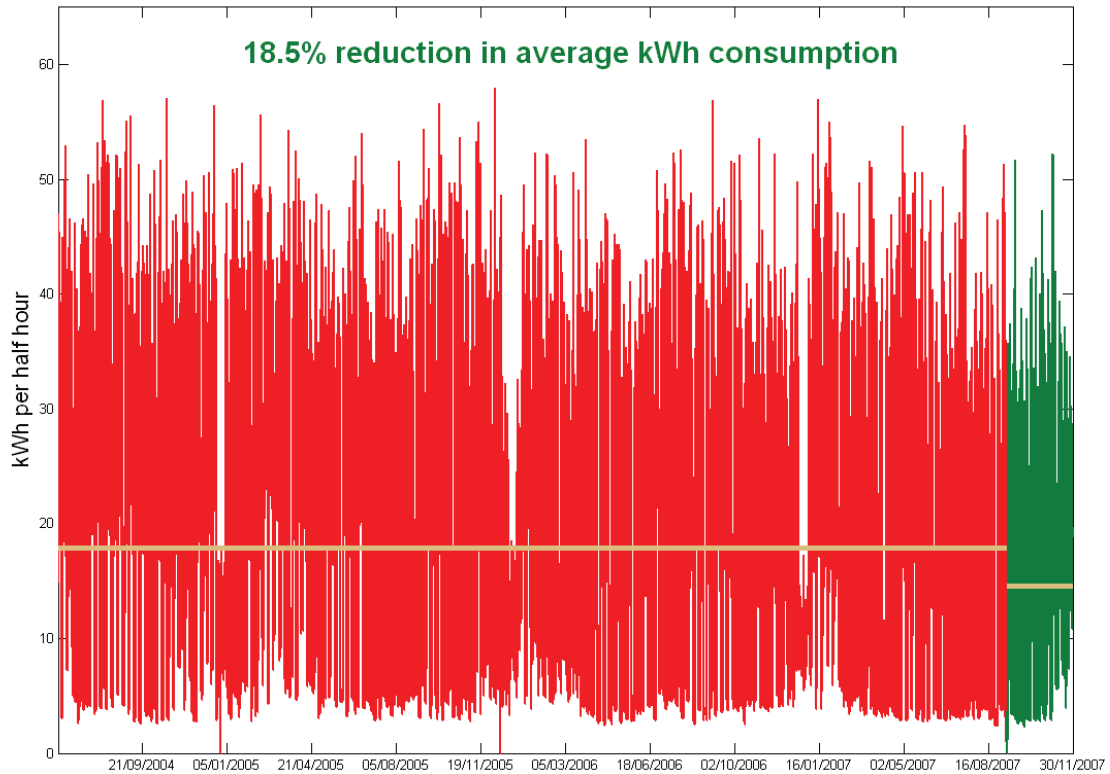
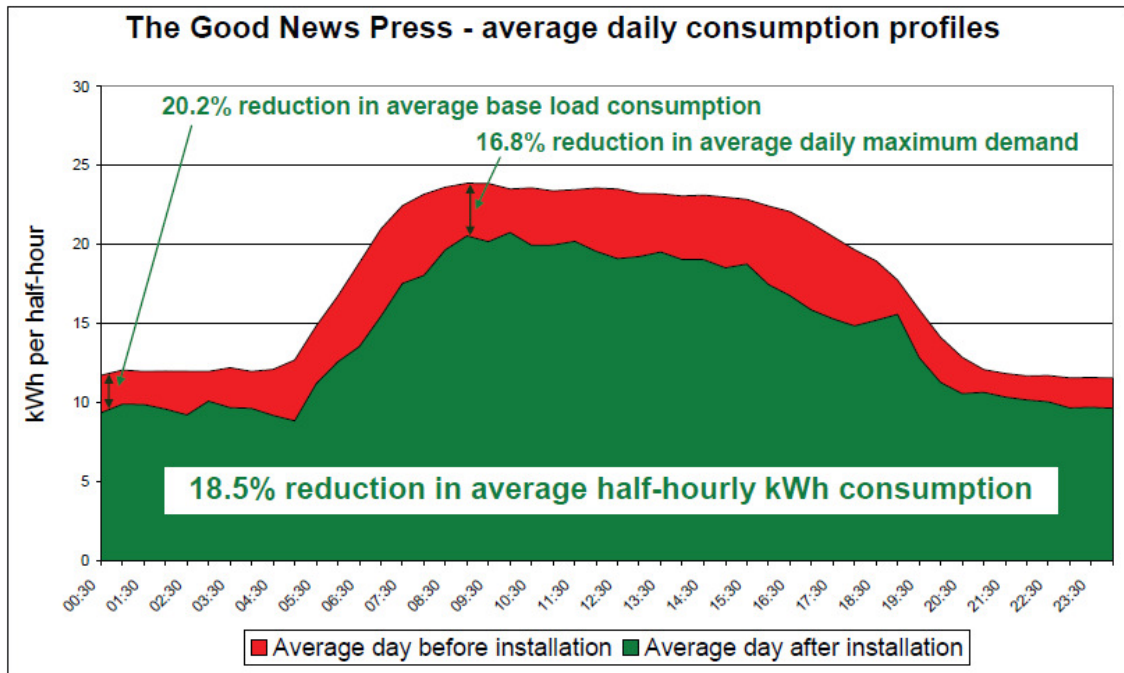


Figure 2

The effect of this saving on an average day's electrical usage on the site is shown in **figure 3** overleaf, with the red area representing an average day before installation, and the green area an average day afterwards. There has been a reduction in the energy used throughout the day, including at peak operating time (around 08:30) and overnight when the site is running at base load.



**Figure 3**

It is also useful to compare the period since installation with the same period from previous years, as shown in **figure 4**. Readings are available for this site going back to 2004, so it is possible to show the same period for each of the last four years. Consumption for 2007 is markedly lower, with daily kWh consumption reduced by **18.5%** from the average for 2004-06.

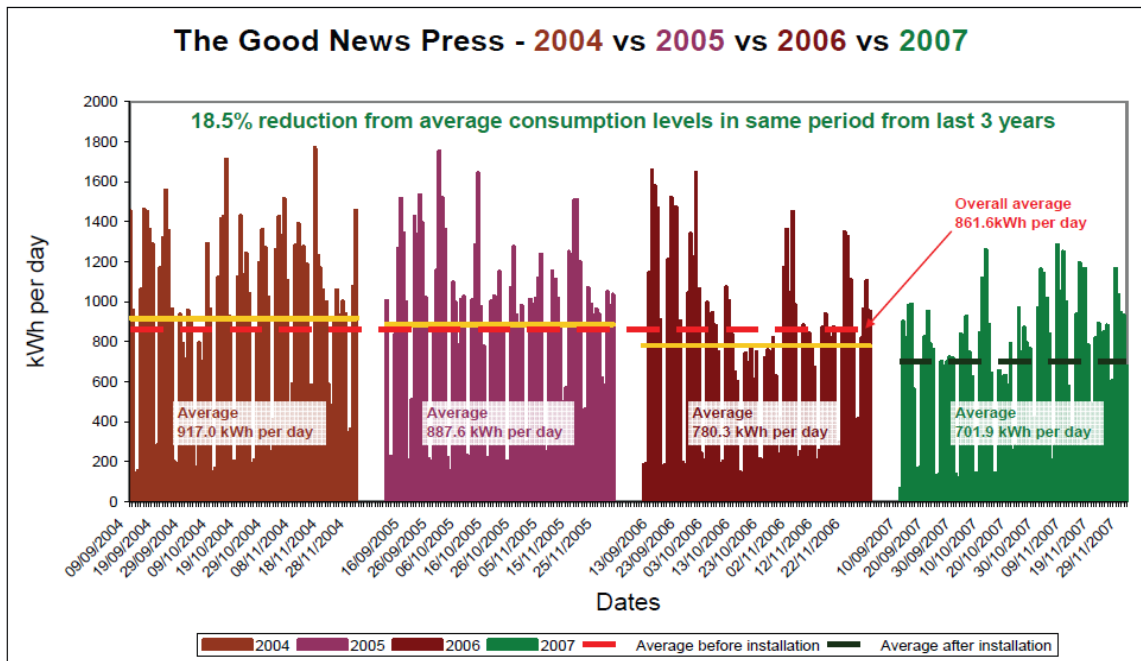


Figure 4

## Conclusion

In conclusion, analysis of the electricity consumption since the installation of the **powerPerfactor** indicates that savings, which have exceeded predictions, are being made relative to previous consumption levels going back to 2004. The **powerPerfactor** is ensuring that the site operates with a high level of efficiency, as well as benefiting from improved power quality and protection against transients of up to 25kV.

Additionally, the site's equipment is being driven more efficiently by the **powerPerfactor's** higher quality power output, with improved phase balancing, reduced harmonics and optimised voltage. Equipment lifetimes will be extended as a result, giving further savings going forward that are not included in this analysis.

It should be noted that there were no reported problems upon switch over from normal supply to **powerPerfactor** and there is no requirement for ongoing maintenance, beyond the standard 5 yearly electrical checks required for all electrical equipment.



## Voltage Power Optimisation Additional Benefits

The ability of VPO<sup>®</sup> technology to reduce energy (kWh) consumption on a site is well documented, but the technology also provides a range of other benefits. These all contribute to creating a more efficient, robust and reliable electrical supply for your site, and provide further financial benefits on top of the reduced energy costs.

### Reduced maintenance burden

- Optimising voltage with powerPerfector brings your supply voltage to the “higher efficiency” operating range of your equipment. Without this, the ‘raw’ supply voltage to your site is likely to be at the top end of the range of voltages your electrical equipment can tolerate. As well as reducing energy consumption, this reduces the **strain** on your equipment, and many of our clients tell us that this increases its lifespan.
- For example, a lightly-loaded **induction motor** operating at an optimum 380V instead of a ‘raw’ 415V experiences less heating and vibration, reducing wear on bearings and prolonging its life.
- The life of **incandescent light bulbs** is almost doubled by optimising their supply voltage.
- Most equipment benefits from the lower ‘**pressure**’ when voltages are optimised. Other examples include Variable Speed Drives – which are particularly sensitive to over-voltage – and the capacitor banks in Power Factor Correction systems.
- When these effects are **aggregated**, the benefit to your site of extended equipment lifetimes and reduced replacement costs will be substantial. The exact saving is difficult for powerPerfector to quantify, but we estimate it to give you a 10%+ reduction of your maintenance and capital replacement costs.

### Improved power factor

- Optimising supply voltages reduces the **reactance** of electrical equipment, as it prevents over-excitation of magnetic components. The effect of this is to reduce the level of wasteful **reactive power** in the electrical system. Reducing reactive power improves **power factor**, and the powerPerfector typically improves power factor by 3-10%.
- The **maximum demand** of a site is expressed in kVA (incorporating both real and reactive power). So reducing reactive power reduces the maximum demand of a site, which will lead to reduced kVA demand charges, Agreed Service Capacity (ASC), and increase spare capacity for further growth. (8% optimisation = 6%-10% reduction in MD normally)

- Power factor **penalty charges** – which are now uncapped in the UK – can be avoided if your power factor is above 0.95. These may appear on your bill as ‘reactive power charge’, ‘kVAr charge’, ‘use of system charge’ or ‘availability charge’. If your power factor is at around 0.9 at the moment, the powerPerfactor could remove your exposure to these charges.
- In general, the strain on your electrical infrastructure is reduced if power factor is good. If your system is carrying a high proportion of reactive power, impedances and voltage-drop will be excessive, and overall **efficiency** will be low. The powerPerfactor improves the electrical efficiency of your site.
- The powerPerfactor yields many of the same benefits as **Power Factor Correction**, but does not use capacitors, which can be prone to failure. Instead, it helps correct the underlying cause of poor power factor, while saving energy.

#### **Lower harmonic distortion**

- The powerPerfactor is able to **filter harmonics** on the mains incomer. Harmonic distortion is on the increase, leading to apparently random failures of electronic equipment.
- As the site is protected from mains-borne harmonics, disruptions to the operation of sensitive **electronic equipment** that could otherwise result from intolerance to harmonic distortion are minimised.
- By preventing harmonics from entering the secondary side of the **HV supply transformer**, the powerPerfactor is able to improve the transformer’s efficiency and increase its effective capacity. Customers whose utility meter is on the HV side of their transformer will see higher savings as a result.
- The threat from damaging **resonance** effects is reduced as harmonic distortion is lower, as is the risk of failure of Power Factor Correction capacitors.
- The **efficiency** of any equipment containing magnetic components is improved – contributing to energy savings – as the heating effect of harmonics is reduced. This in turn extends operating life by postponing the breakdown of insulating materials.

#### **Reduced neutral currents**

- As well as providing general harmonic filtration, the powerPerfactor helps to reduce the level of **triplen harmonics** on a site, by balancing the three phase voltages.

- In addition to the benefits listed above, this leads to reduced **neutral currents** and temperatures – even though the neutral cable does not pass through the powerPerfector – as triplen harmonics accumulate on the neutral. Lower neutral currents are always desirable, and with an increasing proportion of non-linear loads generating more harmonics than ever before, undersized neutrals are a potential risk on many sites.

#### **Improved phase voltage balance**

- The operation of **three-phase equipment** – particularly induction motors – is much more efficient if the phase voltages are closely balanced. For large industrial sites that are heavily dependent upon such loads, balancing phase voltages at an optimum level with powerPerfector can yield energy savings of over 20% in motors.

#### **Protection**

- A powerPerfector makes an electrical supply more robust, and your site better protected. **Transients** – which are very brief surges in voltage from the grid – are eliminated by the powerPerfector, provided they are less than 25,000V.
- This level of protection is able to prevent transients from causing catastrophic damage to equipment, but it also prevents smaller, more common transient events that act to degrade equipment over time. This prolongs the expected life of electronic equipment.

