

Voltage Power Optimisation (VPO)[®]

CASE STUDY

Warner Hotels, Bourne Leisure Littlecote House Hotel

Installation 18th July 2008
Report September 2008



"The powerPerfector units we have installed are playing a pivotal role in our objective of reducing energy consumption at our hotels and early indications are that we will achieve a 2 year payback. I have been most impressed with the level of service provided by the team at powerPerfector, from initial data logging and appraisal to installation through to post installation review, it really has been hassle free."

Darren Scutter, Strategic Projects Manager Warner Leisure Hotels

Warner Leisure Hotels



About Littlecote House Hotel

Littlecote House Hotel is located in Hungerford, Berkshire and is one of many hotels belonging to Warner Leisure Hotels.

powerPerfactor unit details

A pP420kVA/600A unit with a 9% optimisation was installed at the Littlecote House Hotel on 18th July 2008. Through installation the following results were achieved:

- **11.5% reduction in daily average consumption**
- **£20,694 average savings per year**
- **61,700kg CO2 per year**

Electrical load

It features 193 rooms and facilities include a restaurant, spa, gym, pool, sauna and beauty rooms. The load is largely air-conditioning and lighting.

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 Littlecote House Hotel site for a powerPerfector unit, a pP420kVA / 600A unit was installed on 18th July 2008.

A scheduled shut down of the site was required, with the work carried out over the 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 average consumption	11.5%
Projected annual carbon savings	61,700kg
Average savings per day	£56
Average savings per year	£20,694

Overall savings

A 420kVA powerPerfector with a -9% optimisation setting was installed at Littlecote House Hotel on 18th July 2008. The following is an analysis of the half-hourly electricity consumption data for the site up to 25th September 2008. As shown in the charts below, the average consumption for that period since the powerPerfector was installed has been reduced by at least 11.5%. The method of analysis is outlined in the following report.

Littlecote House Hotel - all available data - period from 01/01/2004 to 25/09/2008

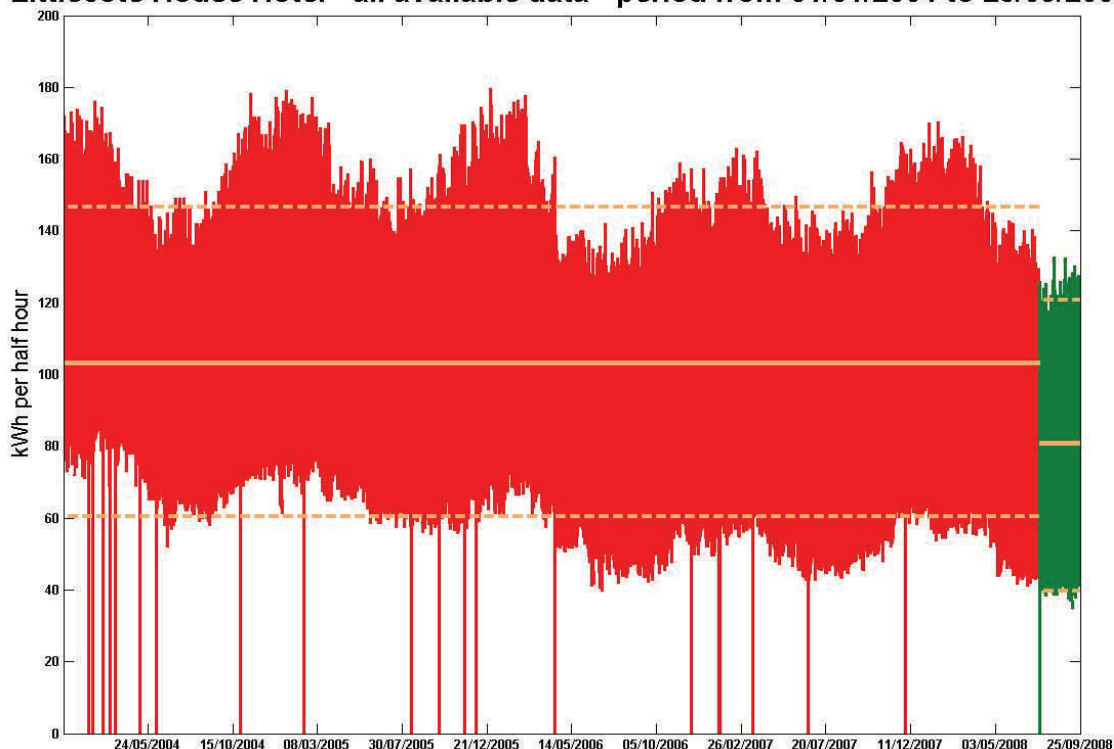
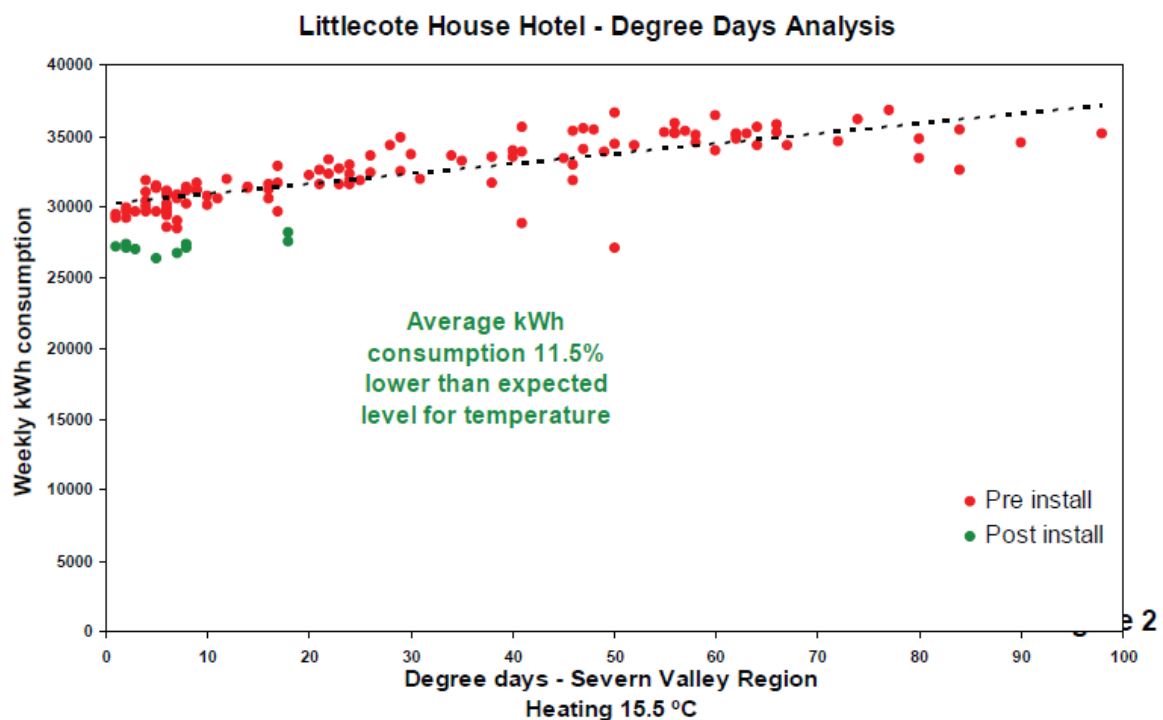


Figure 1

Figure 1 shows a significant variation in kWh consumption over time, in particular a seasonal variation such that the highest consumption occurs during the winter months and an apparent decrease in consumption from around May 2006.

An established method of quantifying energy savings in the context of seasonal changes is a “degree days” analysis. Degree days are based on Met Office temperature data and give a measure of how hard heating or cooling equipment has to work in order to compensate for the effects of the external temperature. Further details on how degree days may be calculated and used are available on the Carbon Trust website. In the following graph, degree days for the Severn Valley region for heating to 15.5 °C have been plotted against weekly kWh consumption totals. Only data going back to May 2006 has been included because of the apparent drop in consumption around this time.

Data points prior to the powerPerfector installation are shown in red with the black dotted line representing the expected level of consumption based on this data. The green points show the consumption after installation and all fall below the expected line. The average difference between the post installation post and the pre installation trend line indicates a reduction in energy consumption of 11.5%.



The data shown in the **Figure 2** can also be represented as a function of time, as in the graph below (Figure 3). Here, the grey bars show the expected consumption, calculated from the trend line in the previous chart, while the green bars show the actual kWh readings.

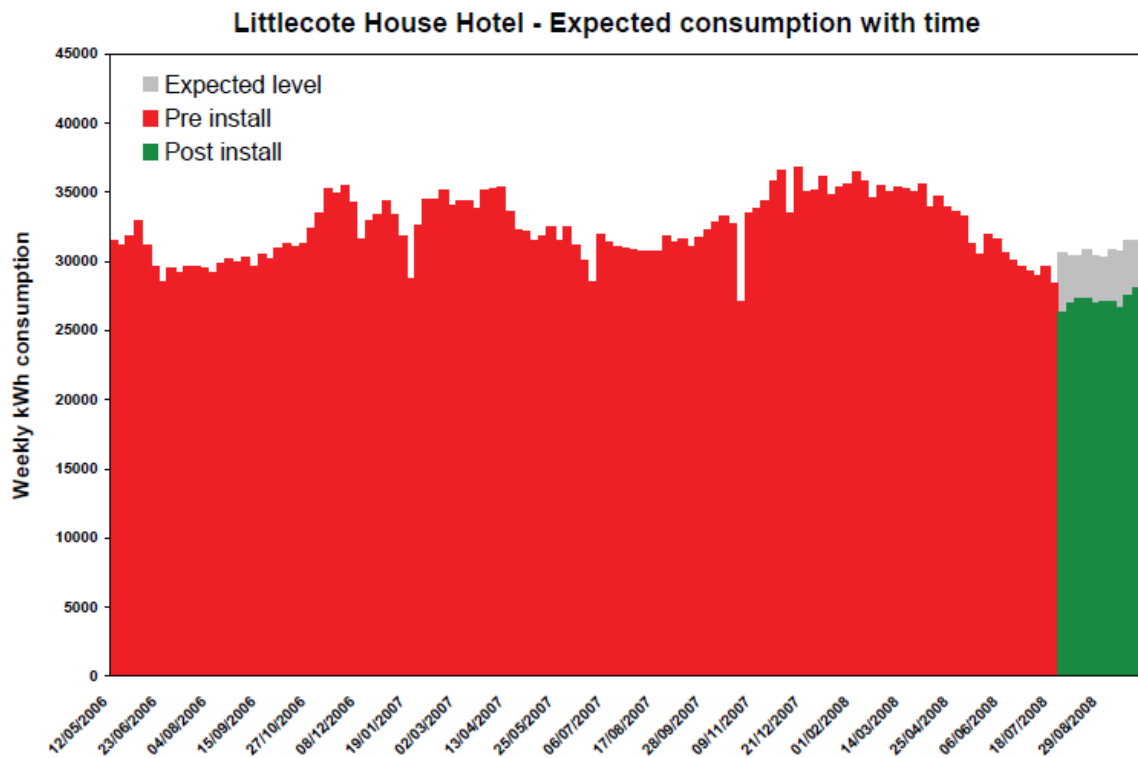


Figure 3

Conclusion

In conclusion, analysis of the electricity consumption since the installation of the **powerPerfactor** indicates that average consumption is **11.5%** lower than the expected level for temperature based on a degree day analysis. This equates to a projected annual saving of approximately **61,700 kg** of carbon dioxide emissions.

Additionally, the site's equipment is being driven more efficiently by the **powerPerfactor's** higherquality 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. The only maintenance that is required is external cleaning of the unit and 5 yearly routine wiring checks. No other maintenance is necessary.

Voltage Power Optimisation Additional Benefits

The ability of VPO[®] 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.

