Voltage Power Optimisation (VPO)®

CASE STUDY

Experian

- Riverleen House - North Wing & West wing
- Embankment House
- Lambert House

"We at Experian are committed to achieving continuous improvement in environmental performance. Our powerPerfector installations are helping us to minimise the environmental impacts of current activities and therefore fulfill our Environmental Policy. Furthermore, the units are paying for themselves quickly through the savings achieved and the guaranteed Return on Investment ensures that there was very little risk involved on our part."

Tom Farr
Group Building Services Manager
Experian

Experian
A world of insight

power Perfector
energy saving like no other

About Experian

Experian is the leading global information services company, providing data and analytical tools to clients in more than 90 countries. At the heart of Experian lies a vast store of information, around which unique analytical skills and highly advanced software tools have been developed. Together these enable Experian to deliver extraordinary insight into everyday decision-making on behalf of organisations and consumers. Whilst the storage of the information which drives Experian can be energy intensive, Experian have made the commitment in their Environmental Policy to "minimise the environmental impacts of current activities, products and services".

How powerPerfector was able to help Experian

After receiving the annual electricity consumption details for the Riverleen, Embankment and Lambert House sites it was possible to give a provisional quote for the four powerPerfector units (Riverleen House has multiple electrical supplies) and to outline the potential for energy savings. A voltage logger was then sent for a little more than a week, which recorded the voltage level at the site by connecting it to a regular mains socket. After a survey of the sites by a powerPerfector Approved Contractor, the installations took place. Analysis following the installations showed that there was an average reduction in kWh consumption of **12.1%** attributable to the powerPerfector installation, equating to annual carbon dioxide emissions saving of approximately **300,000 kg**[1] across the three sites.

Getting the source right

powerPerfector is the world's only Voltage Power Optimiser, giving energy, carbon and cost savings by efficiently optimising a site's supply voltage. By optimising the voltage, electrical equipment runs more efficiently and consumes less energy. The declared electricity supply in the United Kingdom is now, as a result of European Harmonisation, 230V with a tolerance of +10% to -10%. This means that effective voltage can be anywhere between 207V and 253V depending on local conditions. Most electrical equipment manufactured for Europe and the UK is rated at 220V and operates more efficiently at this level. Forcing appliances to operate at a higher voltage in the UK (242V is the average supply level) leads to significantly higher energy consumption, increased heat losses and a reduced life span. 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, extending its lifespan according to many of our clients.

[1] Based on the CO_2 conversion factor of 0.544kg CO_2/kWh

1-10 Praed Mews, London, W2 1QY
Tel: 0845 6014723 fax: 0845 6014724 Email: enquiries@powerperfector.com
www.powerperfector.com

Savings Summary across Riverleen, Embankment and Lambert House:

- Reduction in average kWh consumption: **12.1%**
- Projected annual carbon dioxide emissions savings: **301,000kg**
- Projected annual financial savings: **£39,000**

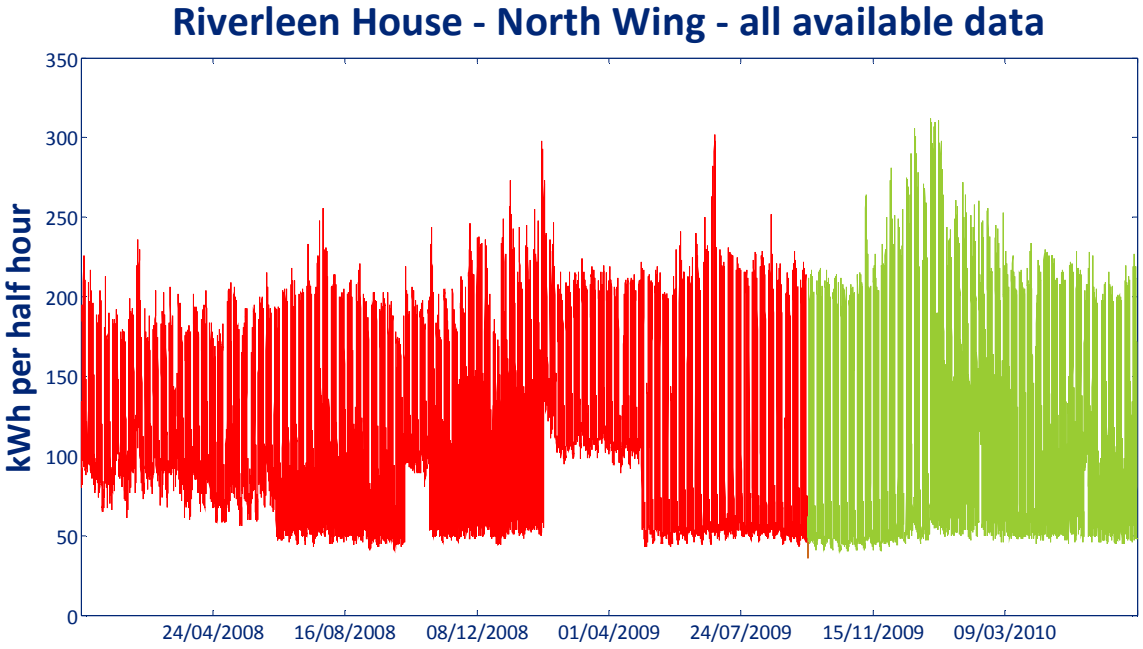
1-10 Praed Mews, London, W2 1QY
Tel: 0845 6014723 fax: 0845 6014724 Email: enquiries@powerperfector.com
www.powerperfector.com

Riverleen House

North Wing

A 560kVA powerPerfector unit was installed on one of the three electrical supplies, North Wing, at the Experian Riverleen House building on 20th September 2009. The following report is an analysis of the half-hourly kWh consumption data for the site using data up to 30th June 2010. It should be noted that the supply on which the powerPerfector has been installed, contributes 40% of the total kWh consumption at the half-hourly meter used in the following analysis.

The chart below shows kWh consumption data for the Riverleen House site, from 1st January 2008 to 30th June 2010. Data before installation is shown in red and after installation in green.



The consumption profile above shows that the kWh consumption of this site varies considerably. There is no consistent seasonal variation and baseload has gone through several step changes.

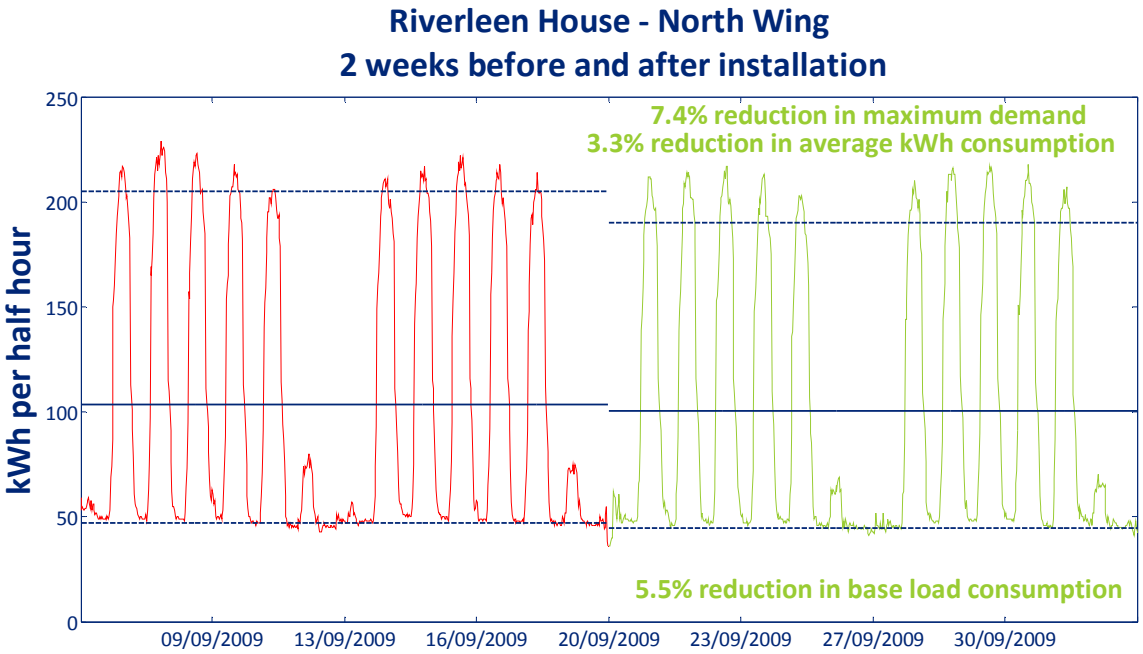
It is understood that there was an increase in building occupancy between January and April 2009, which may, in part, account for the increase in site baseload around that period. However, an increase in occupancy would usually be expected to have an effect on the maximum demand of the site rather than the baseload, suggesting that there are other influences on the kWh consumption of the site.

1-10 Praed Mews, London, W2 1QY
Tel: 0845 6014723 fax: 0845 6014724 Email: enquiries@powerperfector.com
www.powerperfector.com

Where there are multiple influences on kWh consumption which are not easily quantified, as in this case, it is not always possible to calculate how much energy the site would have used if the powerPerfector had not been installed. Therefore it is necessary to compare post-installation kWh consumption directly to that of the pre-install period.

The most accurate indication of the kWh savings currently available can be calculated by restricting the data used to represent typical kWh consumption immediately before and after installation. This minimises the effect of the unexplained variations in kWh consumption.

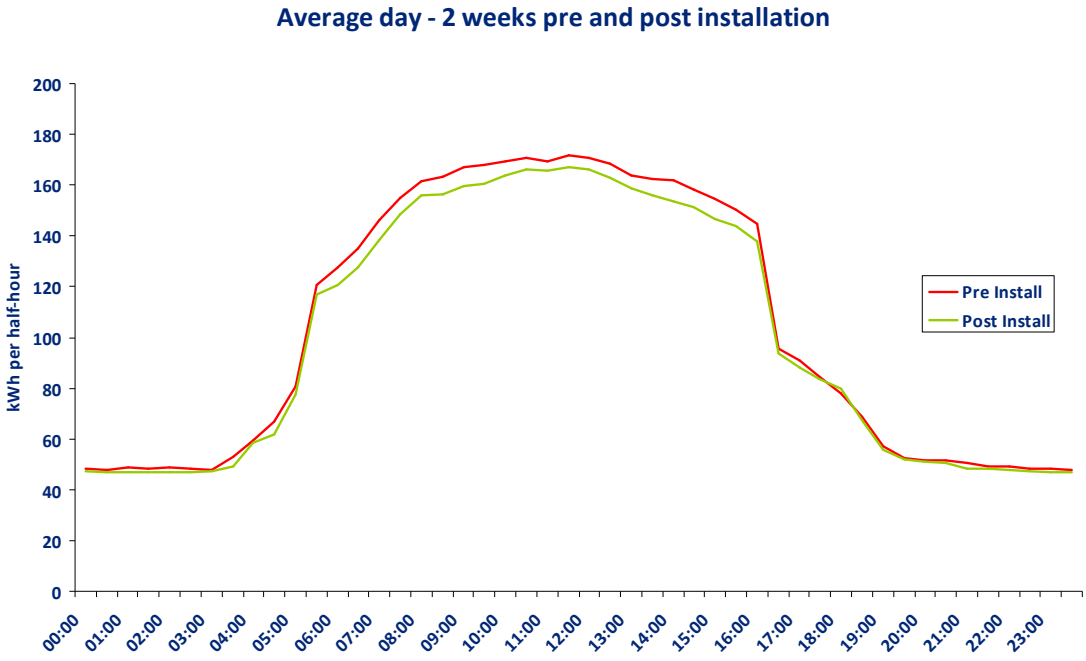
The following graph shows the kWh consumption data restricted to the 2 weeks before and after installation.



The graph above indicates that the average kWh consumption was reduced by 3.3% during the 2 weeks after installation compared to the 2 weeks before. Furthermore, both maximum demand and baseload were significantly reduced. Recall that the electrical supply on which the powerPerfector has been installed makes up around 40% of the kWh consumption recorded by this meter. Assuming the 60% of the load which is not behind the recently installed powerPerfector has remained relatively consistent; a 3.3% reduction in the total kWh consumption indicates that there has been a reduction of 8.3% in the kWh consumption at the supply on which the powerPerfector was installed.

The following graph shows data from the same period as above in the form of an average day.

1-10 Praed Mews, London, W2 1QY
Tel: 0845 6014723 fax: 0845 6014724 Email: enquiries@powerperfector.com
www.powerperfector.com



The previous graph shows that the majority of the savings are being achieved during business hours (from around 06:00 – 17:00) which indicates that the benefit on equipment in use during the day has been greater than the benefit on equipment which remains operational overnight.

As previously discussed, the powerPerfector was installed on 40% of the site load, a 3.3% reduction indicates that there has been an **8.3%** in kWh consumption at the supply in question. An **8.3%** reduction in kWh consumption at the North supply equates to a projected annual carbon dioxide emissions saving of approximately **46,400 kg**[2] and an annual financial saving of **£7,200.**

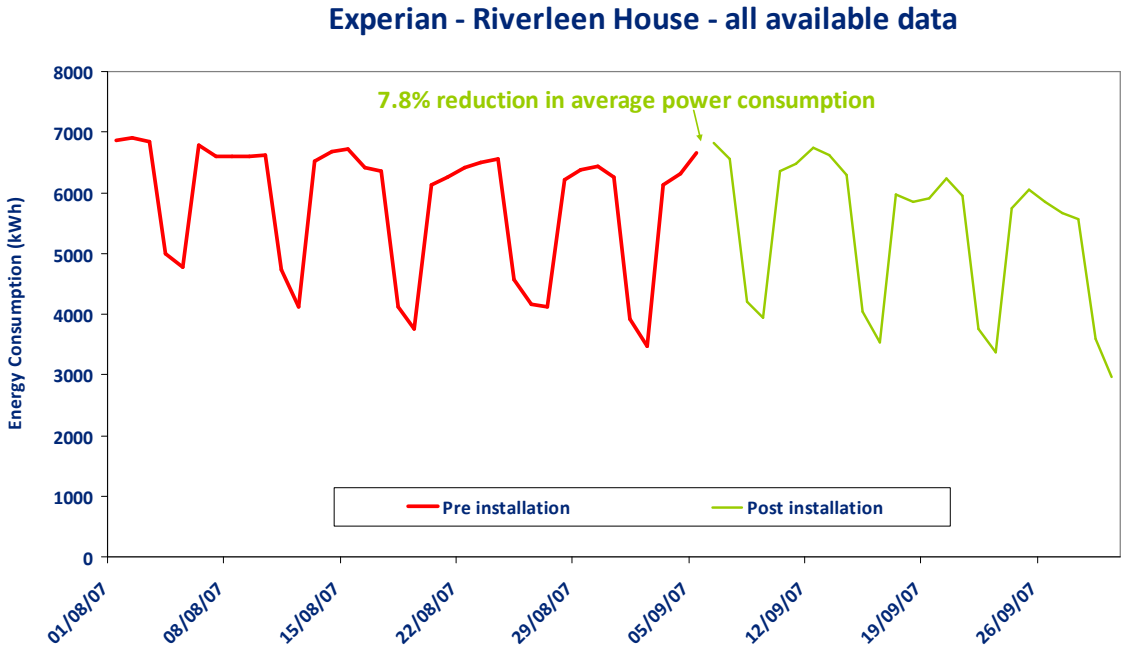
[2] Based on the CO_2 conversion factor of 0.544kg CO_2/kWh

1-10 Praed Mews, London, W2 1QY
Tel: 0845 6014723 fax: 0845 6014724 Email: enquiries@powerperfector.com
www.powerperfector.com

West Supply

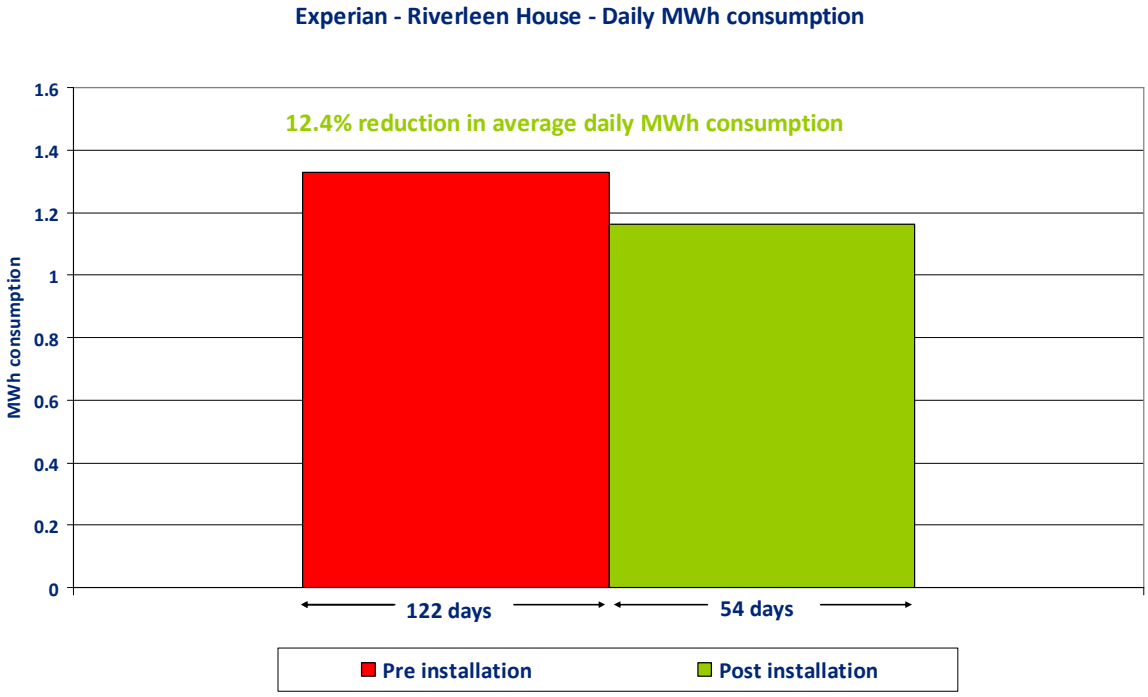
A 280kVA powerPerfector with a 9% optimisation setting was installed at Riverleen House on the West supply on 6th September 2007. The following is an analysis of the half-hourly electricity consumption data and meter readings for the site up to 16th October 2007. As shown in the charts below, in this case average consumption for the period since the powerPerfector was installed has been reduced by 7.8%, but it must also be noted that the West supply accounts for only around one third of the kWh consumption represented by the half-hourly data. Additionally, readings from the meter in Riverleen House indicated that average daily consumption after installation is **12.4%** lower than before installation. The method of analysis is outlined in the following report.

In order to assess the changes in kWh consumption over time, we plot the chart below. This shows the full daily electricity consumption profile before and after installation. The electricity consumption before installation of the powerPerfector is shown in red and the consumption after installation is shown in green. We observe a reduction in average kWh consumption of 7.8%. This level of savings reflects the fact that Riverleen House accounts for approximately one third the electricity consumption detailed in the half-hourly data.



A series of meter readings have also been taken from Riverleen House at varying time intervals and used to calculate the average daily electricity consumption before and after installation. The average daily post installation electricity consumption is found to be **12.4%** lower than the average pre installation consumption.

1-10 Praed Mews, London, W2 1QY
Tel: 0845 6014723 fax: 0845 6014724 Email: enquiries@powerperfector.com
www.powerperfector.com



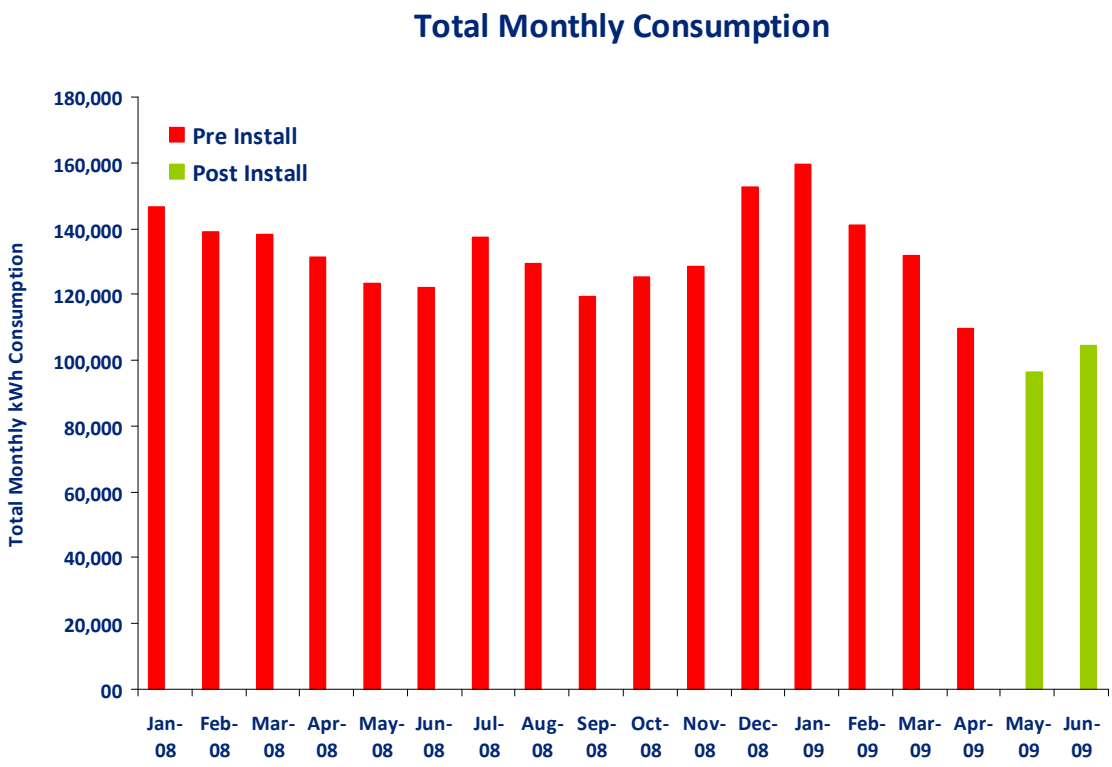
In conclusion, analysis of the electricity consumption since the installation of the powerPerfector indicates that savings, which are broadly in line with predictions, are being made. A **12.4%** reduction in kWh consumption equates to a projected annual carbon dioxide emissions saving of approximately **34,600 kg**[3] and an annual financial saving of **£3,700.**

[3] Based on the CO_2 conversion factor of 0.544kg CO_2/kWh

Embankment House:

A 560kVA powerPerfector unit with a 9% optimisation setting was installed at Embankment House on 3rd May 2009. The following report is an analysis of the monthly kWh consumption data for the site using data up to 30th June 2009. Whilst the certainty of the analysis is limited by the resolution of the data, our analysis indicates that electricity consumption has been reduced by **18.2%** since the powerPerfector was installed. This equates to a projected annual carbon dioxide emissions saving of approximately **153,000 kg**[4] and an annual financial saving of £19,000.

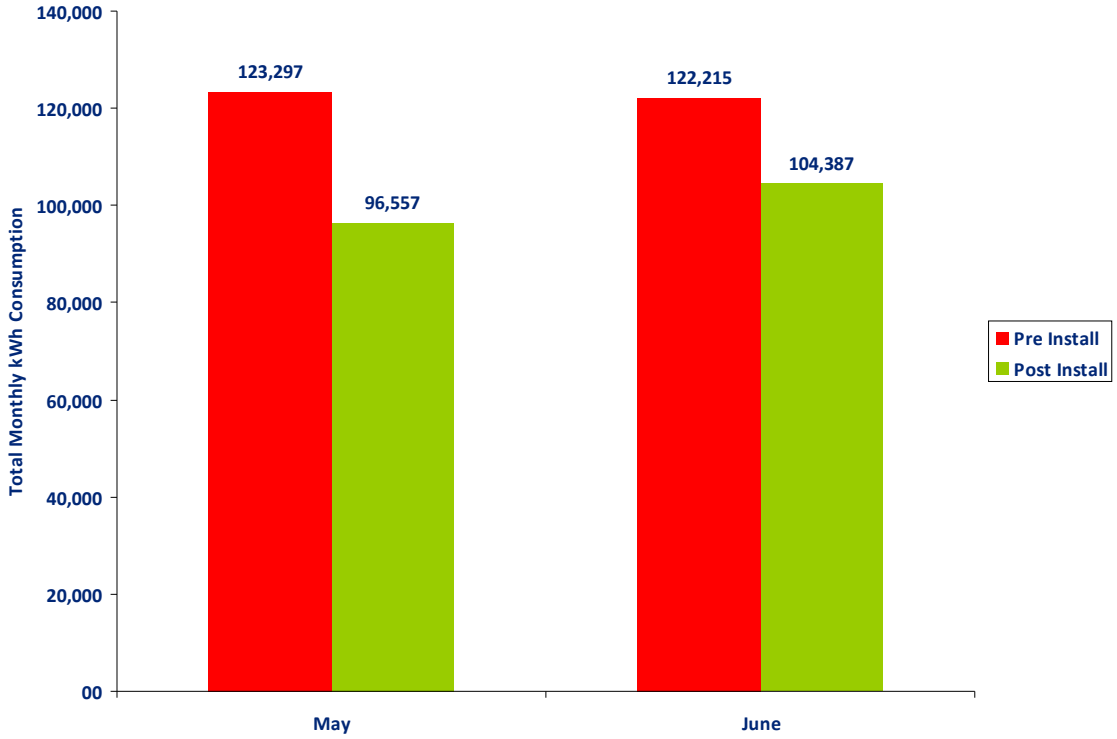
The following chart shows all of the available monthly totals for the site from January 2008 to June 2009 (below). The data before installation is shown in red and after installation in green.



It is apparent from the previous chart that seasonal variation has a significant effect in the consumption of the Embankment site. Energy consumption is generally higher in winter months so we would expect the consumption to reduce between April and May. An appropriate comparison is therefore of consumption in May and June 2008 (when the powerPerfector was not in place) with consumption in May and June 2009.

[4] Based on the CO_2 conversion factor of 0.544kg CO_2/kWh

1-10 Praed Mews, London, W2 1QY
Tel: 0845 6014723 fax: 0845 6014724 Email: enquiries@powerperfector.com
www.powerperfector.com



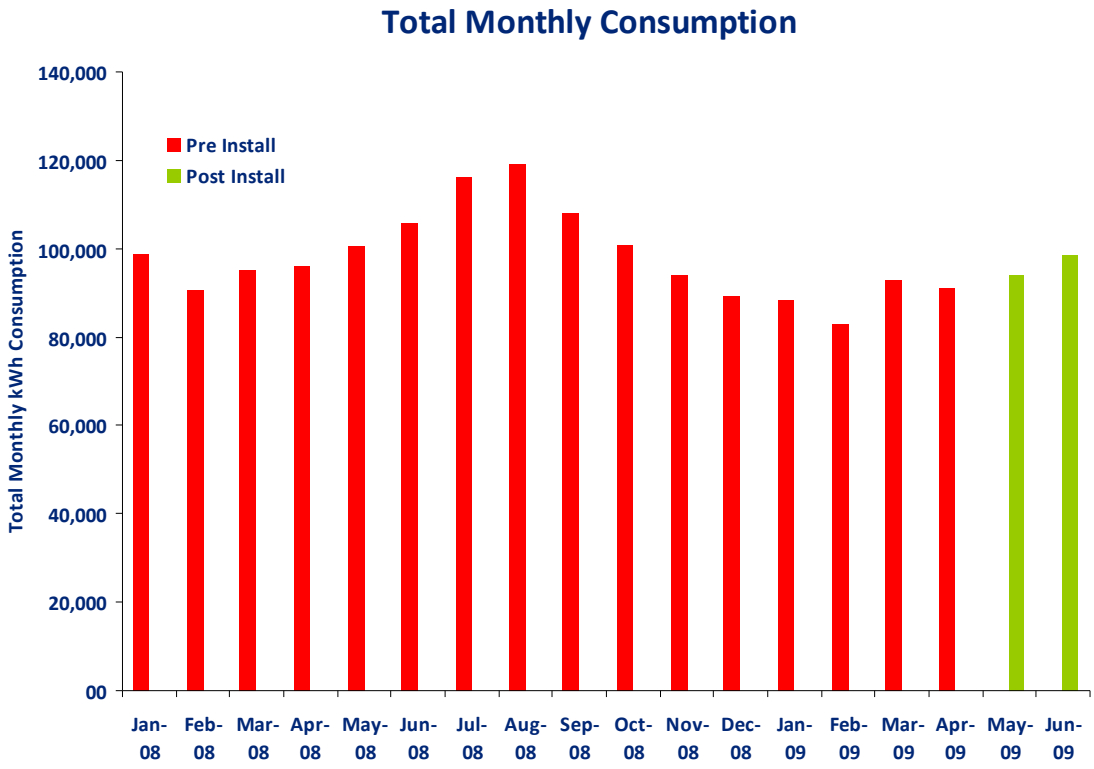
Taking the average of the difference in consumption between May and June 2008 to May and June 2009 (21.7% from May and 14.6% from June) Embankment House has seen a saving of 18.2% in its kWh consumption.

1-10 Praed Mews, London, W2 1QY
Tel: 0845 6014723 fax: 0845 6014724 Email: enquiries@powerperfector.com
www.powerperfector.com

Lambert House:

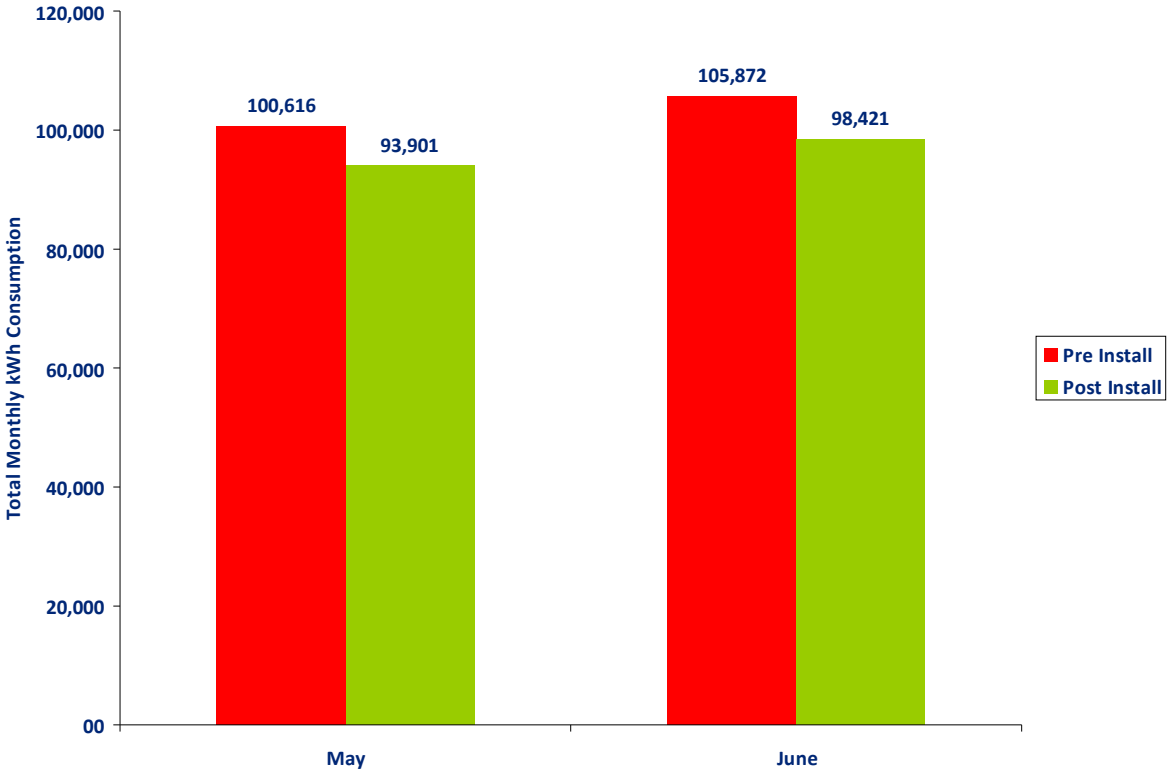
A 350kVA powerPerfector unit with a 10% optimisation setting was installed at Experian, Lambert House on 19th April 2009. Our analysis indicates that electricity consumption has been reduced by 10.2% since the powerPerfector was installed. This equates to a projected annual carbon dioxide emissions saving of approximately **67,800 kg**[5] and an annual financial saving of **£9,100**.

Comparing the kWh consumption of the Lambert site, before and after installation of the powerPerfector, it is clear that energy consumption has actually increased. However, it is also clear that at the Lambert site, in contrast with the Embankment site, consumption is generally higher in summer months; hence an increase in consumption would have been expected between April and June.



As with the Embankment House site, it would be useful to see how the two months (May and June) of consumption data after installation compare to those months in 2008.

[5] Based on the CO_2 conversion factor of 0.544kg CO_2/kWh

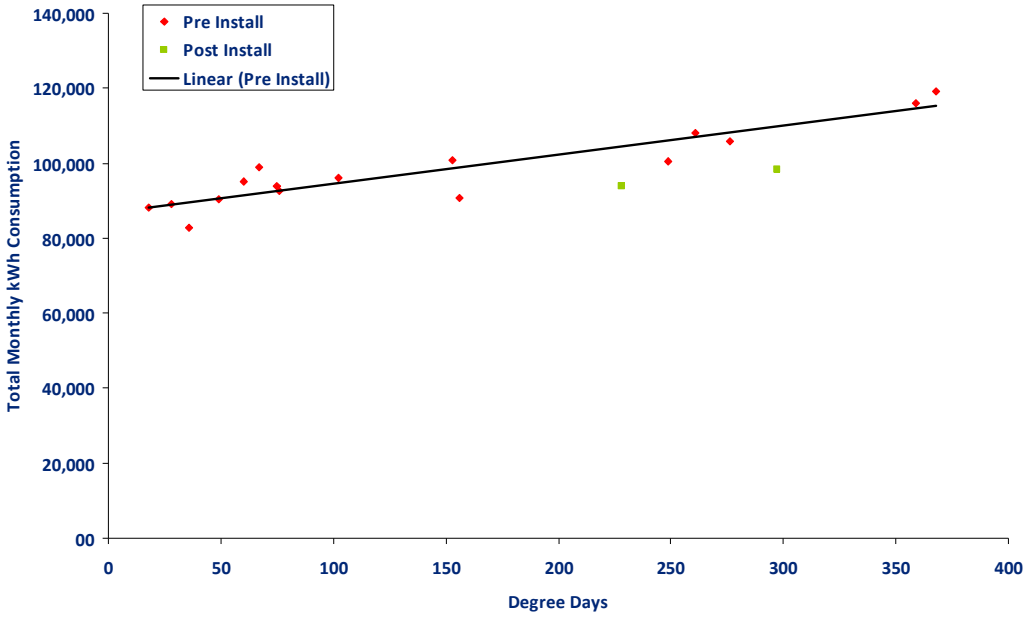


The above analysis shows a 6.9% reduction in energy consumption at the Lambert site, comparing the period post installation to the same period in 2008.

An established method of quantifying energy savings in the context of seasonal variations is known as a “degree days” analysis. Degree days are calculated from Met Office temperature data and give an indication of how hard heating or cooling equipment would be expected to work in order to compensate for changes in external temperature. This method of analysis is appropriate if a plot of consumption against degree days shows an approximately linear positive relationship. The energy consumption of the Lambert site is clearly greater during the summer months, suggesting a large proportion of the energy used at the site is powering cooling equipment. Thus, we have used cooling degree days, with a baseline temperature of 5 degrees. Below the degree day data for each month (from January 2008 to June 2009) is plotted against the total energy consumption for those months.

1-10 Praed Mews, London, W2 1QY
Tel: 0845 6014723 fax: 0845 6014724 Email: enquiries@powerperfector.com
www.powerperfector.com

Degree Day Analysis



The graph above shows that the correlation between degree day data and energy consumption before the installation of the powerPerfector is strong (the R^2 value for the regression line of the pre install data is 0.85). The energy consumption for the 2 months after the powerPerfector was installed (the green points) is clearly below what would have been expected in the same conditions without the powerPerfector (the expected values being shown by the regression line in the graph). On the basis of the degree day analysis the energy consumption at the Lambert site has been **10.2%** lower than the historical data suggests it would have been without the powerPerfector**.**

Note that Degree day data could have been used to analyse the Embankment House site, however, the correlation between the energy consumption and degree days at the Embankment House site was not strong enough to draw reasonable conclusions (with an R^2 value of only 0.48).

In conclusion, whilst the certainty of this savings assessment is limited by the resolution of the available data, there is very good evidence to demonstrate that energy efficiency has been improved at both sites.

The powerPerfector are also ensuring that the site operates at a higher level of efficiency, as well as benefiting from improved power quality and protection from transients of up to 25,000V. Further details about the benefits of voltage power optimisation are appended to this report.

1-10 Praed Mews, London, W2 1QY
Tel: 0845 6014723 fax: 0845 6014724 Email: enquiries@powerperfector.com
www.powerperfector.com

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)

1-10 Praed Mews, London, W2 1QY
Tel: 0845 6014723 fax: 0845 6014724 Email: enquiries@powerperfector.com
www.powerperfector.com

- 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 powerPerfector 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 powerPerfector improves the electrical efficiency of your site.

- The powerPerfector 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 powerPerfector 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 powerPerfector 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 powerPerfector helps to reduce the level of **triplen harmonics** on a site, by balancing the three phase voltages.

1-10 Praed Mews, London, W2 1QY
Tel: 0845 6014723 fax: 0845 6014724 Email: enquiries@powerperfector.com
www.powerperfector.com

- 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.

1-10 Praed Mews, London, W2 1QY
Tel: 0845 6014723 fax: 0845 6014724 Email: enquiries@powerperfector.com
www.powerperfector.com