

## **CASE STUDY**

### **Voltage Optimisation**

#### **The Balmoral Hotel, Edinburgh**

##### Introduction

A study of the mains voltage profile at the hotel identified that the site was being supplied with excess voltage. Calculations based on the type and number of electrical loads at the Hotel, together with an understanding of the existing voltage profile, revealed that the site would benefit significantly from Voltage Optimisation.

A Voltage Optimiser system was installed at the hotel in November.

This report contains an analysis of the savings which have been achieved as a result of the installation.

It is worth noting that we are using August as our base period, of which we are comparing against, simply because the half hourly data is not available 12 months previously.

##### Analysis Method

It is often difficult to quantify the actual energy savings achieved through the use of 'Voltage Optimisation' from simple analysis of monthly electricity usage. Many factors can influence the amount of electricity a particular site uses and often the magnitude of these variations in demand can overshadow the comparatively minor change in consumption brought about through Voltage Optimisation.

In the case of a hotel, the single largest variation in electrical demand stems from varying guest numbers. There may also be other variations in demand caused by irregular activities e.g. building works, periodic carpet and upholstery cleaning etc.

It is not possible to fully account for all energy usage retrospectively and one has to assume that on average each guest uses a similar amount of electricity.

To improve the accuracy of the comparison account has been taken of variations in guest numbers for the sample periods. Unfortunately the limited information available does not allow account to be made for any other influences on electricity demand which may or may not have been present during either sample period.

The analysis assumes the Hotel base-load accounts for 75% of the total consumption. This is the energy the Hotel would consume assuming the hypothetical case of zero guests. The remaining 25% accounts for guest related.

**Comparative analysis**

October Year 1 Consumption

From the half hourly data HHD supplied for October (1<sup>st</sup>-24<sup>th</sup>) the actual consumption was 319,709 kWh. A total month's kWh would have been 430,912 kWh. Occupancy rates were 79.9%.

Based on our assumptions, the consumption breakdown was as follows:

Fixed base-load (75%)	323,184
Remainder (Guest Related)	107,728
<b>Total</b>	<b>430,912</b>

November Year 1 Consumption

For the 21 days since installation the hotel consumed 267,354 kWh. Averaged out across the month the hotels consumption for November would have been 381,934 kWh. Occupancy rates were 70.64%.

When comparing the same period's consumption for October pre installation to November post installation there is a difference of 48,978 kWh. This equates to a saving of over 11.4% on kWh consumption.

However, this does not take into account the differences in guest numbers between the two periods. These differences can be accounted for by applying appropriate scaling factors to the previous year's October consumption breakdown and then comparing the modified total with the actual total for November Year 1.

	October 2012 Consumption	Correction Factor	Predicted Consumption for November Year 1
Fixed base-load	323,184	No change	323,184
Remainder	107,728	(70.64/79.9%)	95,243
		<b>Total</b>	<b>418,427</b>

When factors are applied to the October Year 1 consumption to account for these variations the actual consumption for the previous year November without 'Voltage Optimisation' would have been 418,427kWh.

Comparing this figure with the actual consumption for November (381,934kWh) shows a net savings of 36,493kWh which is equivalent to approximately **9.5%**.

**December Year 1 Consumption**

For the month of December the hotel consumed 381,662 kWh. Occupancy rates were 60.6%.

When comparing the same period’s consumption for October to December there is a difference of 49,250kWh. This equates to a saving of over 12.9% on kWh consumption.

However, this does not take into account the differences in guest numbers between the two periods. These differences can be accounted for by applying appropriate scaling factors to the October consumption breakdown and then comparing the modified total with the actual total for December.

	October Consumption	Correction Factor	Predicted Consumption for December
Fixed base-load	323,184	No change	323,184
Remainder	107,728	(60.6/79.9)	81,706
		<b>Total</b>	<b>404,890</b>

When factors are applied to the October consumption to account for these variations the actual consumption for December without ‘Voltage Optimisation’ would have been 404,890kWh.

Comparing this figure with the actual consumption for December (381,662kWh) shows a net savings of 23,228kWh which is equivalent to approximately **6.1%**.

**January Consumption**

For the month of January the hotel consumed 354,562 kWh. Occupancy rates were 48.7%.

When comparing the same period’s consumption for October to January there is a difference of 76,350kWh. This equates to a saving of over 17.8% on kWh consumption.

However, this does not take into account the differences in guest numbers between the two periods. These differences can be accounted for by applying appropriate scaling factors to the October consumption breakdown and then comparing the modified total with the actual total for January.

	October Consumption	Correction Factor	Predicted Consumption for January
Fixed base-load	323,184	No change	323,184
Remainder	107,728	(48.7/79.9)	65,662
		<b>Total</b>	<b>388,846</b>

When factors are applied to the October consumption to account for these variations the actual consumption for January without 'Voltage Optimisation' would have been 388,846kWh.

Comparing this figure with the actual consumption for January (354,562kWh) shows a net savings of 34,284kWh which is equivalent to approximately **9.7%**.

### February Consumption

For the month of February the hotel consumed 365,608 kWh (corrected to 31 days). Occupancy rates were 52.2%.

When comparing the same period's consumption for October to February there is a difference of 65,304 kWh. This equates to a saving of over 17.9% on kWh consumption.

However, this does not take into account the differences in guest numbers between the two periods. These differences can be accounted for by applying appropriate scaling factors to the October consumption breakdown and then comparing the modified total with the actual total for February.

	October Consumption	Correction Factor	Predicted Consumption for February
Fixed base-load	323,184	No change	323,184
Remainder	107,728	(52.2/79.9)	70,380
		<b>Total</b>	<b>395,564</b>

When factors are applied to the October consumption to account for these variations the actual consumption for February without 'Voltage Optimisation' would have been 393,564kWh.

Comparing this figure with the actual corrected consumption for February (365,608kWh) shows a net savings of 27,956 kWh which is equivalent to approximately **7.7%**.

### March Consumption

For the month of March the hotel consumed 364,336 kWh. Occupancy rates were 51.9%.

When comparing the same period's consumption for October to March there is a difference of 66,576 kWh. This equates to a saving of over 18.3% on kWh consumption.

However, this does not take into account the differences in guest numbers between the two periods. These differences can be accounted for by applying appropriate scaling factors to the October consumption breakdown and then comparing the modified total with the actual total for March.

	October Consumption	Correction Factor	Predicted Consumption for March
Fixed base-load	323,184	No change	323,184
Remainder	107,728	(51.9/79.9)	69,976
		<b>Total</b>	<b>393,160</b>

When factors are applied to the October consumption to account for these variations the actual consumption for March without 'Voltage Optimisation' would have been 393,160kWh.

Comparing this figure with the actual consumption for March (364,336 kWh) shows a net savings of 28,824 kWh which is equivalent to approximately **9.6%**.

### Conclusion

This analysis highlights the common pitfall of trying to compare electricity consumption before and after fitting an energy saving device without taking into account significant variations in demand created by external influences.

By performing a more scientific analysis it is clear that Voltage Optimisation is providing a worthwhile net reduction in electricity consumption at the Balmoral Hotel.

**Actual kWh savings over the last 5 months are 306,458kwh.**

**kWh. Averaged over 5 months at 15.7% reduction in kWh.**

**Factored average saving over 5 months at 8.52%.**