

hurleypalmerflatt
building sustainability

Client:
RWE npower



RESEARCH REPORT

FOR THE

**VOLTAGE OPTIMISATION
HOME STUDY**

AT

RWE npower



unique voltage optimisation system

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1.0 EXECUTIVE SUMMARY

The installation of the domestic voltage optimisation unit over a 26 day test period has resulted in a 12% reduction in kWh electricity consumption. The reduction is attributed to lowering the consumption of the fridge-freezer motor, the washing machine and tumble dryer, and the 40W incandescent lamps throughout. The 12% reduction equates to an annual electricity saving of approximately 600kWh, resulting in a cost saving of £90 (inc. 5% VAT) per annum and a CO2 saving of 330kg per annum.

2.0 INTRODUCTION

Voltage optimisation is widely used on commercial properties to lower the incoming voltage on the electricity supply. In the UK mains electricity supply is typically 240V, whereas a number of appliances are designed to run at 220V.

Voltage optimisation is particularly beneficial for inductive electric loads and nonthermostatically controlled resistive loads.

Although a number of commercial premises have benefited from voltage optimisation, the technology has not been widely extended to the domestic sector in the UK. Other European countries are using domestic voltage optimisation but due to the varying weather conditions in these countries there are different electrical demands, such as the need for cooling in households in warmer climates. This study has been carried out to determine if it is beneficial to apply voltage optimisation to domestic properties within the UK.

3.0 METHODOLOGY

A typical five bedroom detached residential property was used to compare electricity consumption and voltage before and after optimisation. The home contains regular household appliances (see appendices) and appliance usage was consistent over the test period, with an exception being a one week period when the occupants went on holiday.

3.1 Installation

A data logger was installed at the property to record electricity consumption and voltage with no optimisation. The voltage optimisation equipment was installed next to the electricity unit two weeks later.

3.2 Test Period

The pre-test period ran for 13 days. The period after the voltage optimiser was installed was in total 23 days but the building was unoccupied for 7 days, the unoccupied period has been omitted from the study. The 13 occupied days after the optimiser was installed has been used, making the total test period 26 days. Please see Table 1 for details of test period timeline.

Table 1: Test Period Timeline

| Date | Action |
|---------------------------|-------------------------------------|
| 8 th May 2010 | First full day logger was installed |
| 21 st May | Voltage optimisation unit installed |
| 2010 29 th | Premises unoccupied |
| May 2010 5 th | Premises re-occupied |
| June 2010 9 th | End of test period |
| June 2010 | All equipment removed |

3.3 Monitoring

A single phase logger monitored the incoming supply for the following:

- Volts
- Current
- kVA
- kW
- kWh
- Power factor
- Total harmonics

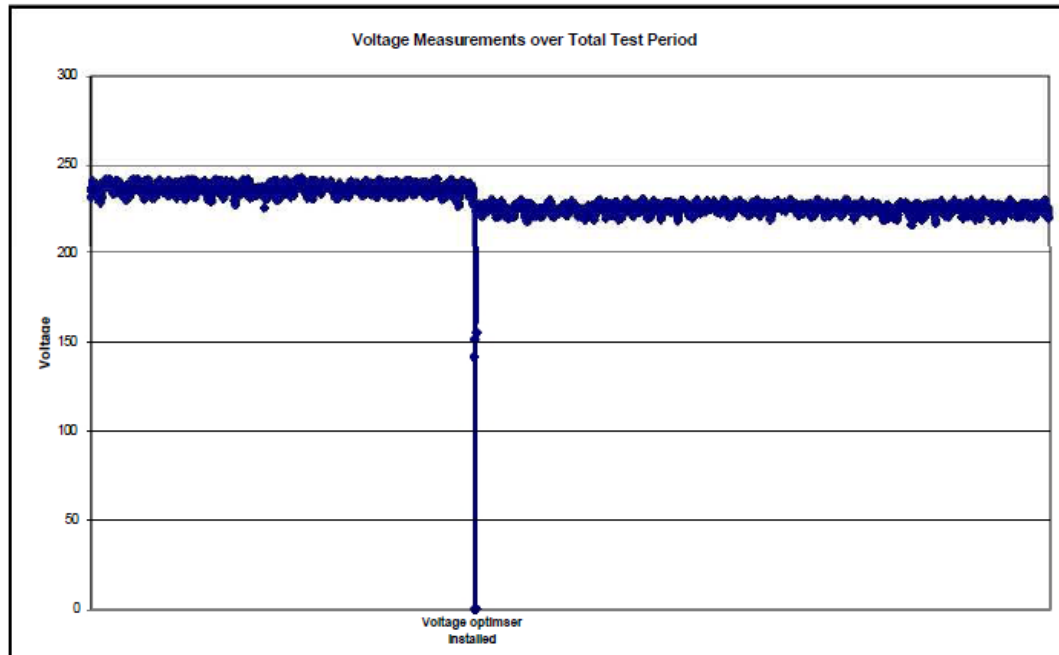
3.4 Carbon and Cost Calculations

The study has been limited to a month test period, which does not take into consideration the effect of seasonal variations on electricity consumption. In the winter months lighting and central heating pumps would run more often, while in the height of summer lighting and pump usage would be minimal. The annual electricity consumption for 2009 has been provided from actual meter readings and was 5108kWh.

4.0 RESULTS

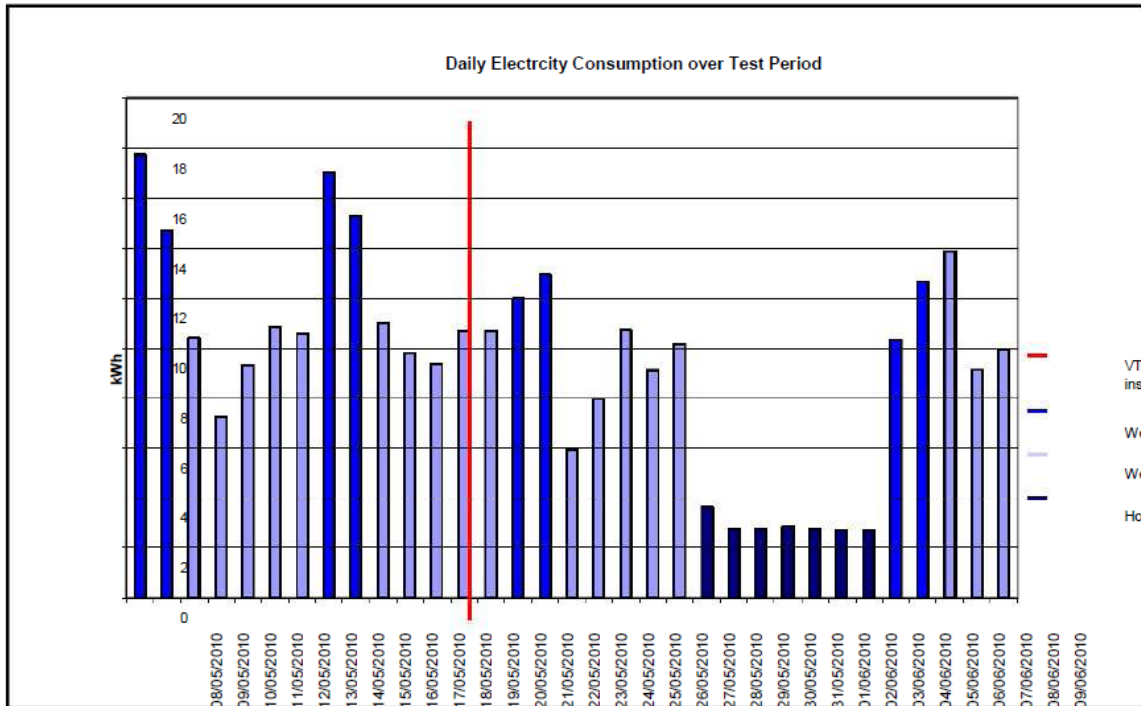
4.1 Voltage

The graph in Figure 2 shows the voltage throughout the test period, with a clear drop in voltage after the 21st May when the voltage optimisation unit was installed.

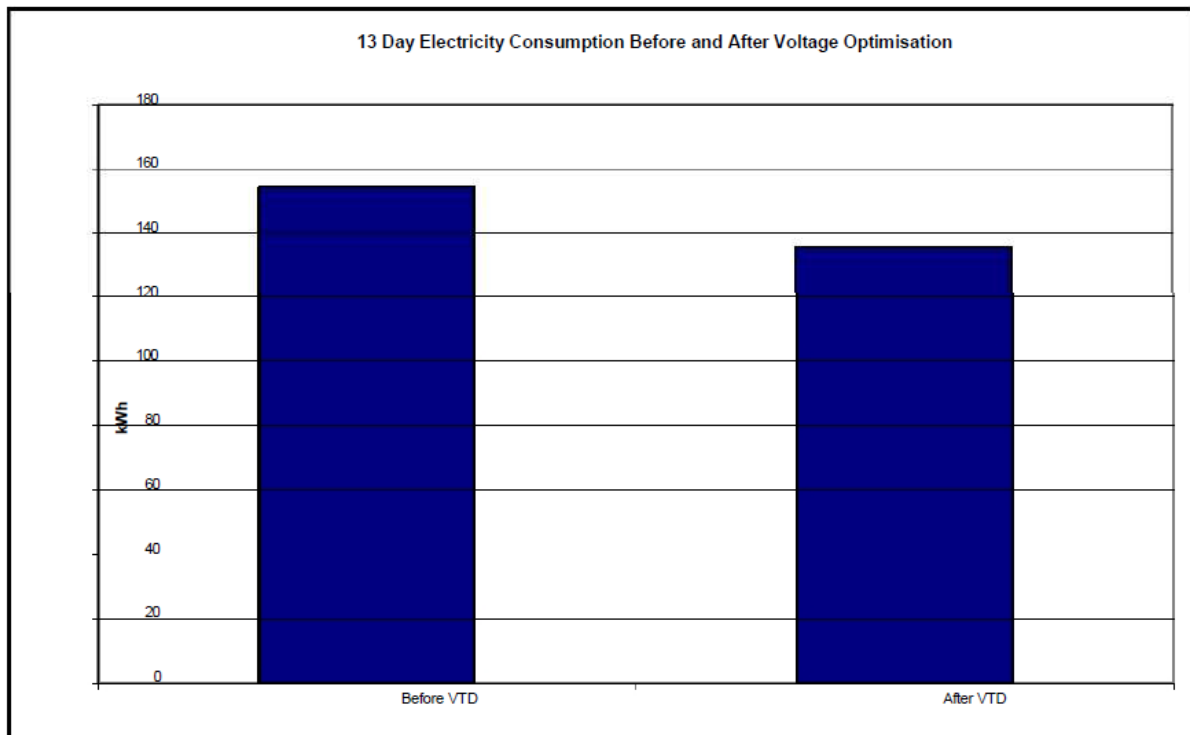


4.2 Electricity Consumption

Figure 3 shows electricity consumption over the same period. The weekend and weekday loads are different, and it is the weekend loads that are more reduced after the voltage turn down. The base load is highlighted during the period when the premises were unoccupied, this load will be made up of the refrigerator and any appliances left on standby. The weekday load actually peaks after the voltage turn down, this could be due to the return of the occupants from holiday doing extra loads of washing.



The chart in Figure 4 highlights the reduction in energy consumption from the 13 day period before voltage optimisation and 13 days after optimisation (excluding when the premises was unoccupied). There is a 12% reduction in consumption after installation of the voltage turn down kit.



4.3 Observations

During the test, all aspects of the individual domestic appliances were recorded. There was no deterioration of any of the capabilities of the electric appliances.

4.4 Carbon and Cost Savings

The total annual electricity consumption for 2009 was 5108kWh, at an electricity unit cost of 13.98p/kWh, this equates to an annual electricity cost of £750 (inc. 5% VAT). Reducing consumption by 12% results in a kWh saving of 613kWh, resulting in a cost saving of £90 per annum and a CO2 saving of 330kg per annum. This is approximately the amount of CO2 emitted during a 1500 mile car journey (dependent on type of car).

5.0 CONCLUSIONS

The 12% reduction in electricity consumption after installing the voltage optimisation unit is attributed to reducing lighting, TV, and other IT related consumption(kWh). The savings also arise from the fridge-freezer motor, which operates on a 24/7 duty cycle, and the washing machine and tumble dryer motors as well as extraction fans in bathrooms, kitchen, etc. Furthermore, the energy used for the gas central heating pump would also be reduced but full central heating was not used during the test period.

A further point to be made is that the original voltage at the home was low (232V) in relation to the average UK voltage of 242V, hence the percentage savings in some homes could be significantly higher.

This study has shown reduced electricity consumption, and a payback under 4 years, which is impressive, however, the benefits will vary according to the type of appliances, running hours and electricity tariffs at individual properties. As the cost of the system is the same for all homes, the payback will improve for larger properties (3 bedrooms and above) and at properties with a higher initial voltage.

With the pressing need to cut our carbon emissions and reduce energy consumption, a 12% electricity reduction from domestic properties would go a long way to attaining this.

APPENDIX A
APPLIANCE INVENTORY

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| Appliance | Number | Apprx Wattage | Total Wattage |
|----------------------|--------|---------------|---------------|
| Fridge Freezer | 1 | 500 | 500 |
| Electric Double Oven | 1 | 2000 | 2000 |
| Kettle | 1 | 2000 | 2000 |
| Toaster | 1 | 1000 | 1000 |
| Monitor | 1 | 30 | 30 |
| Laptop | 1 | 50 | 50 |
| Dishwasher | 1 | 1300 | 1300 |
| Tumble Dryer | 1 | 2000 | 2000 |
| Microwave | 1 | 1000 | 1000 |
| Iron | 2 | 1200 | 2400 |
| Washing Machine | 1 | 1500 | 1500 |
| 42" Plasma TV | 4 | 300 | 1200 |
| Incandescent Lamps | 10 | 40 | 400 |
| Halogen Spot Lights | 3 | 50 | 150 |