

Saving you up to 25% of your Total Electricity Bill



Interest Free Loans Could be
available for PowerStarTM

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Why is Voltage Reduction needed?

It is to the benefit of the Electricity Supplier to provide as high as possible voltage to companies as this will reduce the transmission I^2R losses. Under the G5/4, Electricity Suppliers must provide a Voltage which is 230V +10% or -6%, which is between 253V and 216V. The supplier will therefore start the supply of electricity from its distribution areas at a voltage of 253V. The voltage will change in accordance to the area demand and length of supply. However, on average, in the UK, a voltage of 242V is supplied which is 12V or 5.2% above the UK nominal voltage of 230V.

Does it matter that my Voltage is high?

Well yes it does.

The higher the voltage the higher the energy consumption. As a rule of thumb, reducing the voltage by 5% will result in savings of 10%. In addition, higher voltage tends to increase the heat generation in motors, reducing their life, and generally reduces the life expectancy of electrical equipment, including lighting bulbs.

As the majority of electrical equipment is designed to run at the 220V nominal which is in place in Europe, there should be no problem operating at the UK's 230V nominal level. All electrical equipment is designed using parameters such as Voltage, Frequency, Capacity, etc. Therefore, to ensure that these are operating at their optimum performance, they need to operate as close as possible to their design characteristics.

How does PowerStarTM work?

Energy Savings through Voltage Reduction of your total Incoming Power. Fixed reduction and Servo-Controlled systems available.

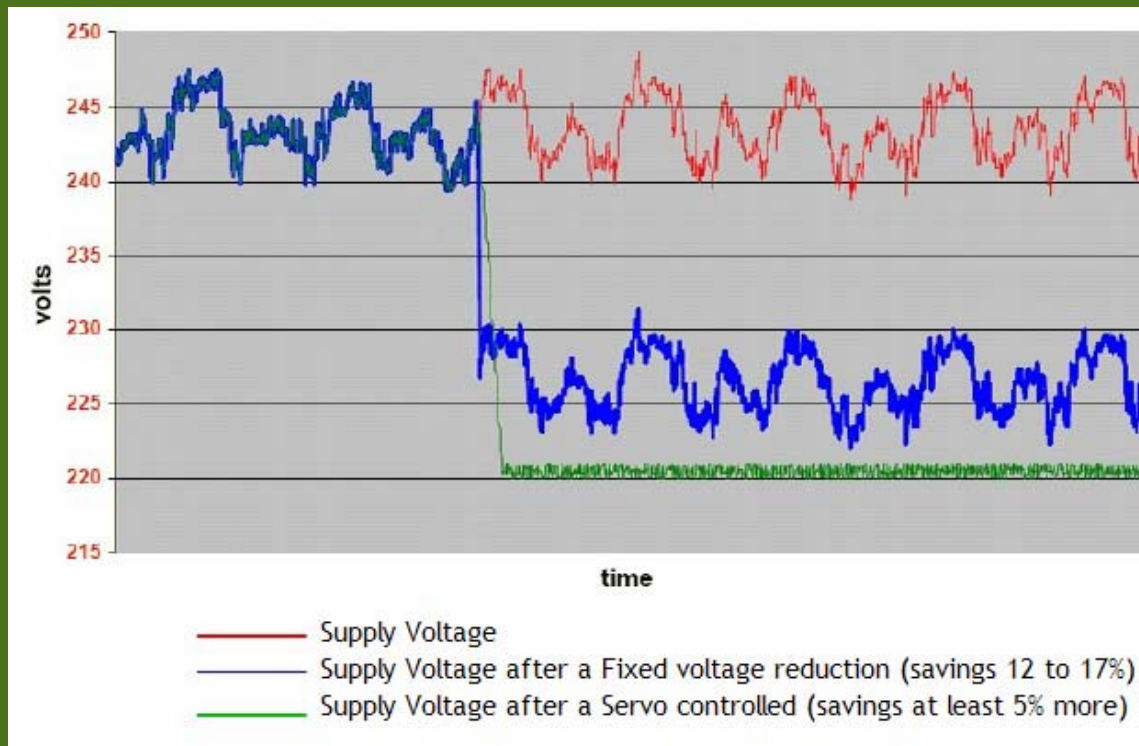
The PowerStarTM system will automatically adjust the incoming voltage to suit your requirements (Servo-Controlled only). The System will allow absolute controllability of the site voltage down to an accuracy of 0.1V. Therefore, a constant 225V will be provided if you wish to have a 225V. This is PLC controlled and can be adjusted if required.

Types of PowerStarTM

PowerStarTM comes in two versions.

- 1. Fixed Voltage reduction.** This version will provide a fixed reduction. The reduction is chosen specific for each company as to ensure that the company's voltage is optimised.
- 2. Servo-Controlled reduction.** This version provides an accurate output voltage based on the company's requirements. This will provide a voltage output which is $\pm 0.1V$ from the chosen voltage.

Fixed vs Servo Systems

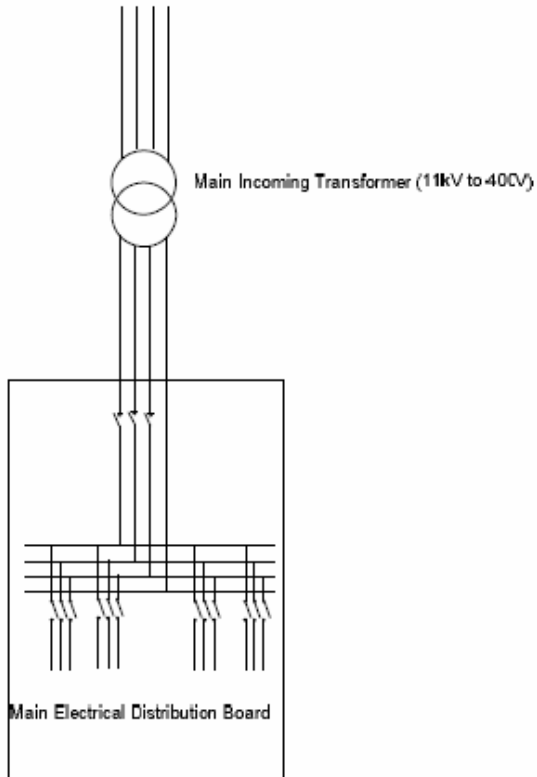


The graph shows how the incoming voltage is controlled by a fixed and a servo voltage control system. The servo controlled PowerStarTM unit achieves on average 5% more savings than the Fixed Voltage reduction system. In some cases the additional savings can be 10% more than the Fixed voltage reduction unit.

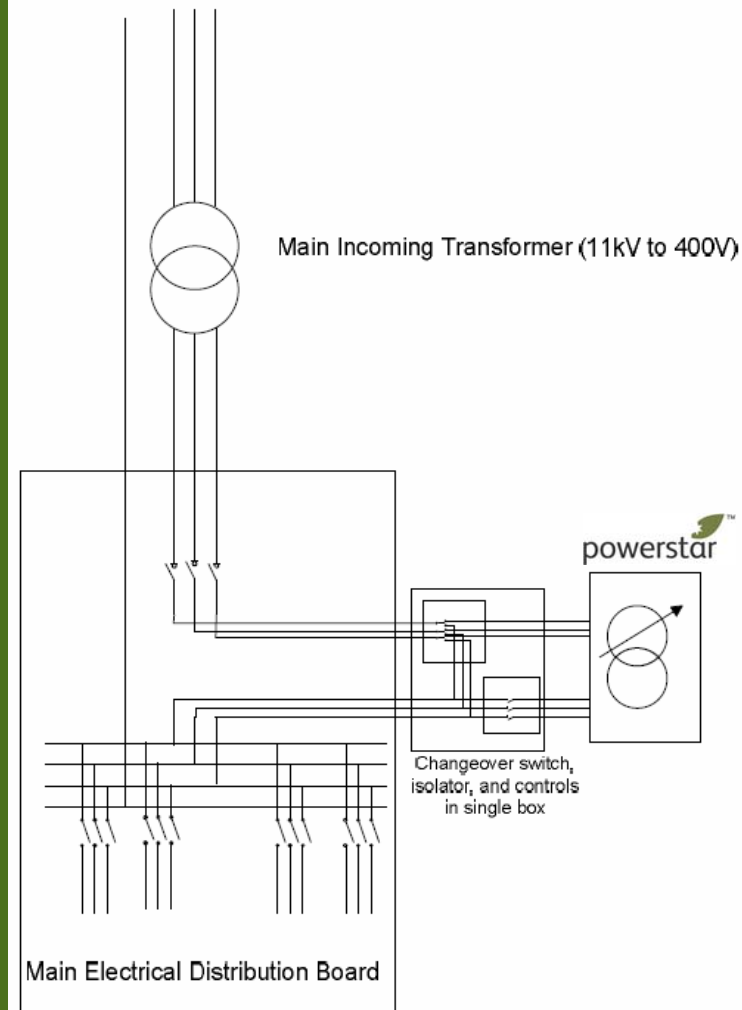
An additional advantage is simply that regardless of the incoming voltage, the PowerStarTM Servo unit will maintain voltage at the pre-programmed level. The voltage level can be changed at any time by authorised personnel and therefore further savings can be obtained by fine tuning the system after its installation

Connectivity

Typical wiring prior to installation



Typical PowerStar Installation

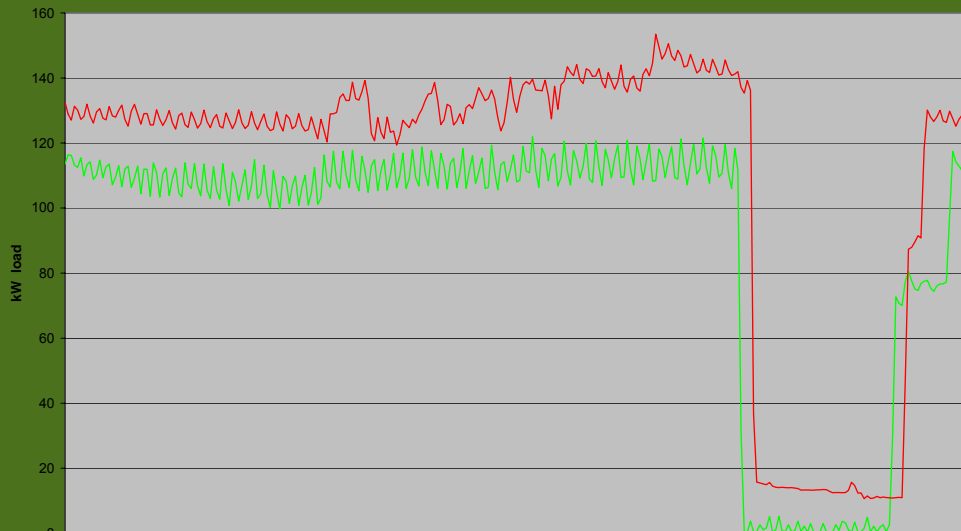


Benefits of PowerStar™

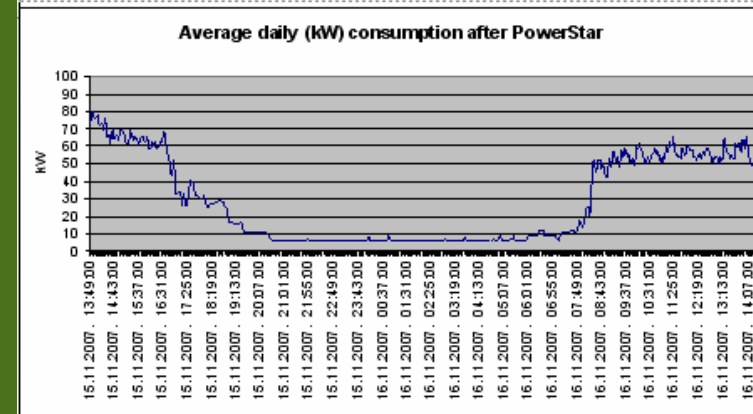
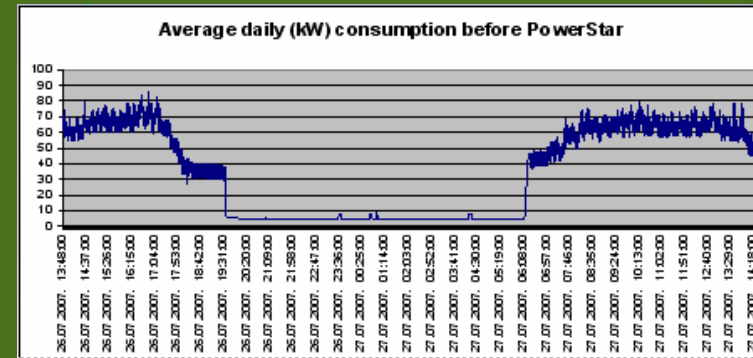
The advantages are many, including significant energy savings, reduced current and voltage harmonic distortions, improved power factor and also reduced maintenance costs with extended equipment life due to reduced operating temperatures and operating close to their design characteristics.

Graphs showing Energy before and after PowerStar™

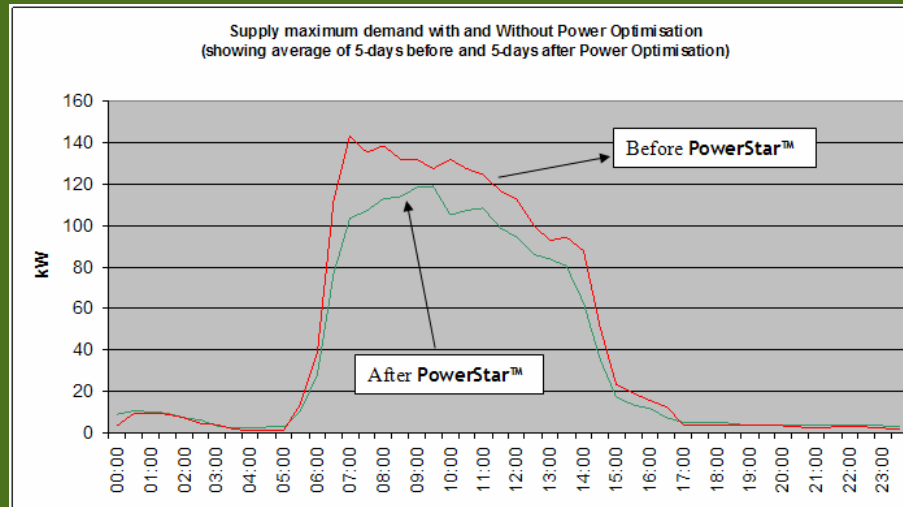
Green - With PowerStar; Red - Without PowerStar



The graph above demonstrates the energy savings achieved using PowerStar™ at a refrigerated storage depot. The results shown are over a 24hour period (one day without PowerStar™ and one day with PowerStar™). A total of 12% savings were achieved. Such savings are typical in heavy engineering, where motors are the major electricity consumption units

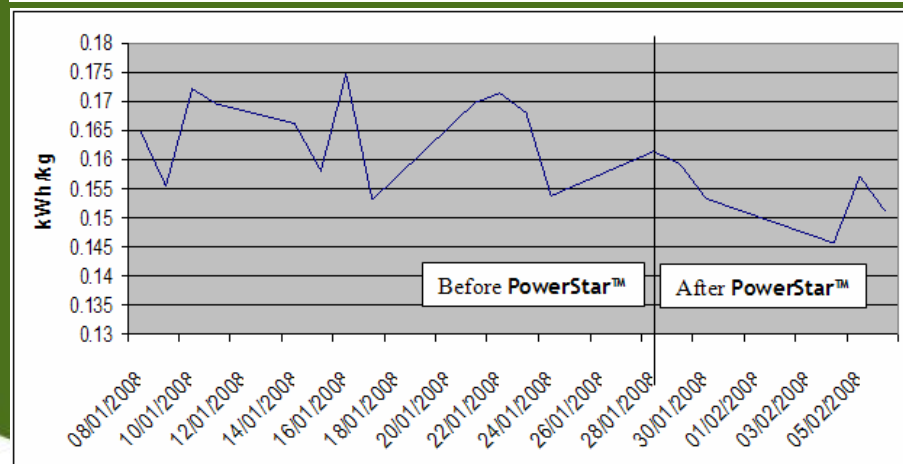


The graph above shows the energy savings achieved using PowerStar™ at a small manufacturing company. The results shown are over a 24hour period (one day without PowerStar™ and one day with PowerStar™). A total of 18% savings were achieved. Such savings are typical in Light Industries, Hotels, Office Blocks, and any other industry, where Lighting, IT and small motors are the major electricity consumers.



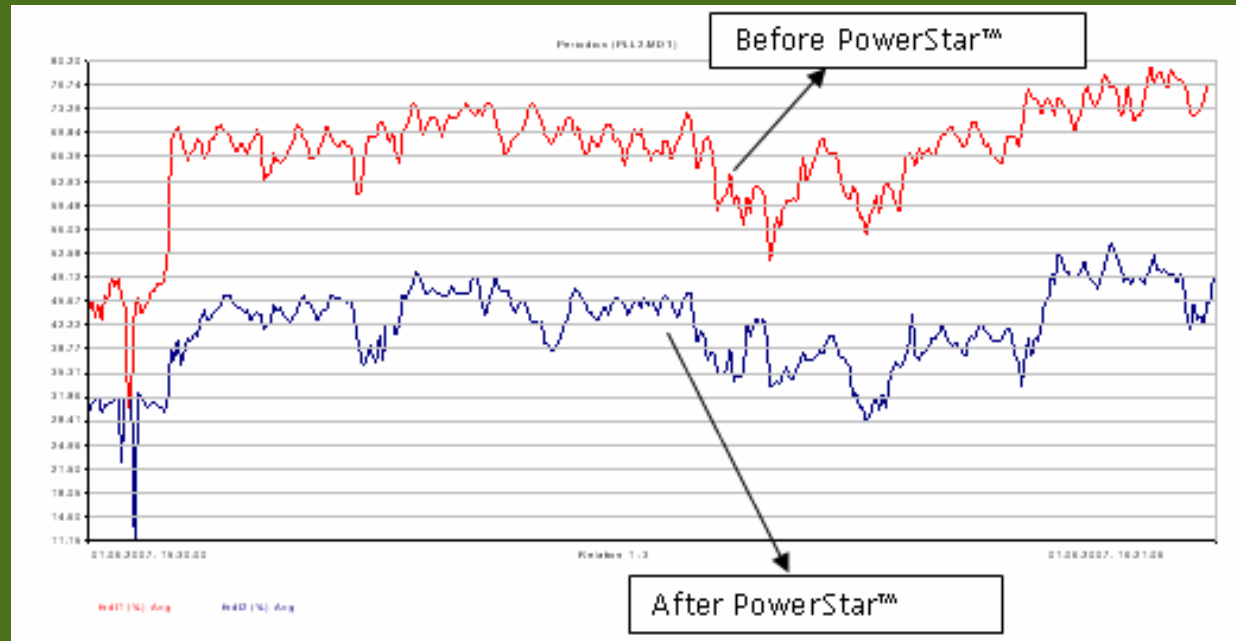
Graph shows the average daily consumption before and after the installation of the PowerStarTM system.

The average percentage electricity kWh reduction is 16.3% (Average data over 10 working days).



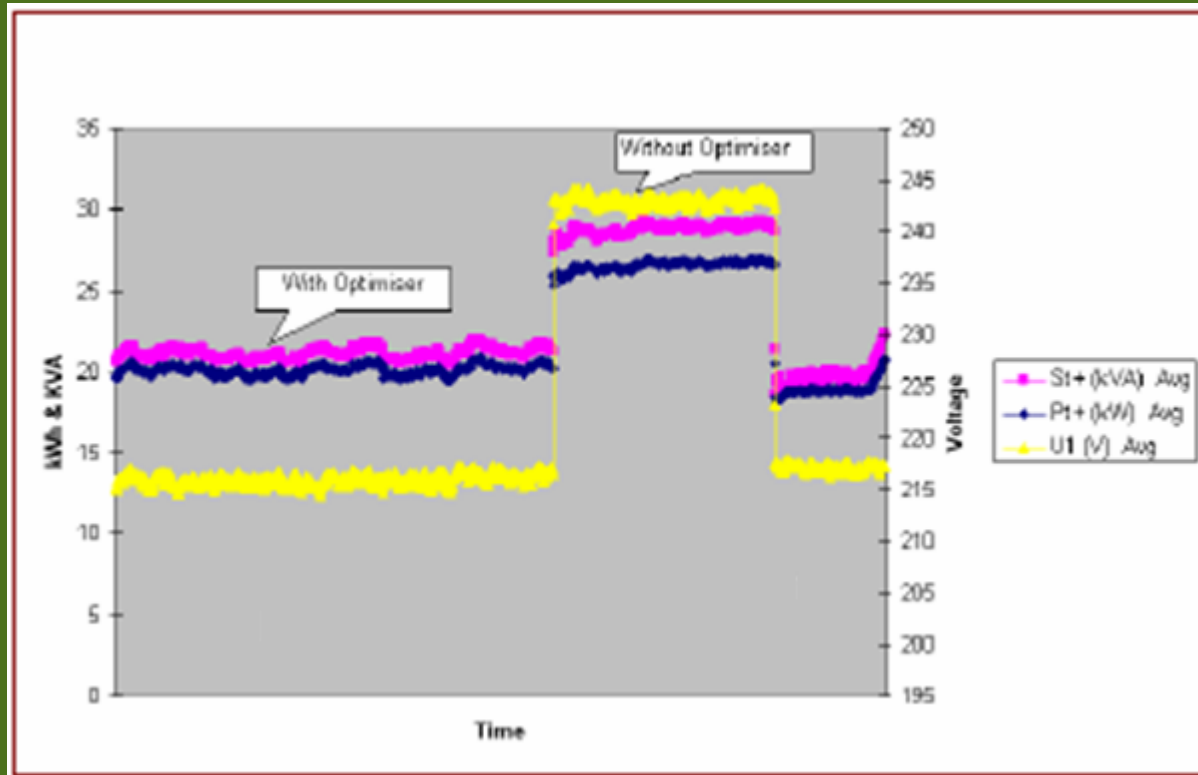
Graph shows the Specific Energy Consumption (SEC) at the company, showing that the PowerStarTM installation reduced the SEC by 11.2%, thus helping James Dyson to meet the CCL targets.

Graphs showing Harmonics before and after PowerStarTM



The effect of reduced harmonic distortion is shown below at a printing machine electrical supply, where the two traces are measured concurrently either side of the PowerStarTM unit. **Total current harmonic distortions were significantly reduced by almost 50%. Also on the same trial, Voltage Harmonics were shown to have been reduced by 10%.**

Improving Power factor



Graph showing Improvement in PF with PoweStar

Can we help you?

Yes, we can.

- We can save you up to 20% of your total electricity consumption.

How can I find out if PowerStarTM can benefit my company?

- Call us on +44 (0)1709 836200 or email us on PowerStar@ems-uk.org
- Simply we can provide you with either voltage recorders or 3-Phase analysers to ensure that PowerStarTM will indeed benefit you. A report is then prepared which will show if PowerStarTM will indeed save you energy and money and how much. If appropriate a full proposal with financing facilities (if required is provided). Everything is extremely transparent, and the service is Free to you.

PowerStarTM Savings Explained

Power Consumption of Electrical Equipment (P_c) = Voltage (V) * Current (I) * $\sqrt{3}$
(three phase supply) * $\sin\Phi$ (inefficiencies of supply and equipment)

In addition to the above formula, Ohm's Law specifies that Voltage (V) = Current(I) * Load (R)

Therefore, the two formulae to consider are:

$$P_c = V * I * \sqrt{3} * \sin\Phi$$

And

$$V = I * R$$

Therefore, as the load (R) of a particular building is constant, regardless of the voltage supplied, a 5% reduction in voltage will result in a 5% reduction in current. This is absolutely true in a purely resistive load. However, companies have a combination of resistive, capacitive and inductive loads and in such circumstances the actual savings will be higher than the savings on a purely resistive system.

Therefore after reducing the voltage by 5% the New Power Consumption (P_{nc}) of a factory, building, etc will be: $P_{nc} = 0.95 V * 0.95 I * \sqrt{3} * \sin\theta$ (inefficiencies will be improve as the Voltage – Current Vector is reduced, however, these additional savings are not taken into consideration as are difficult to accurately measure).

$P_{nc} = 0.9025 * P_c$. Therefore the New Power consumption (P_{nc}) will be 9.75% lower than the Old Power Consumption (P_c).

PowerStarTM Savings Explained

Hence, as a rule of thumb a 5% reduction in voltage will result into a 10% reduction in Power Consumption.

Voltage reduction technology is not a new think. The Glass Industry has been using Voltage Reduction for controlling the flow of current in the glass furnaces since 1906 (earliest Reference found).

Intel Corporation carried out perhaps the most extensive study on voltage reduction in the mid 1990's and in order to compensate with increasing power consumption due to the increasing complexity of their micro-processors, they applied voltage reduction technology.

They found that an 8.9% reduction in voltage achieved a 20% reduction in power. The full Intel report can be provided if required. A microprocessor has all three type of loads, resistive, capacitive and inductive and our experience with voltage reduction varies but is in the same order as Intel's experience, i.e. for every 1% reduction in voltage you get 2% reduction on power.