# CARBON BITES

From the CIBSE ENERGY PERFORMANCE GROUP

## Voltage Optimization

**What is voltage optimization?**

It is sold as a technique for saving energy on the basis that a lower voltage should mean a lower current and therefore less power consumption. This concept is superficially correct and generally produces savings, but take care; the payback may be longer and the hassle greater than you expect!

A number of approaches are possible – depending on what you mean by "voltage optimisation"...

- Tap down an existing transformer to the correct voltage
- Add a secondary transformer to step down to the correct voltage
- Add automatic voltage regulation to maintain the correct voltage

The difference in cost between these options is considerable and to make a choice you will have to understand your electrical distribution. Consider the key issues set out below – then investigate further on the web sites listed.

There is considerable debate about how effective these devices can be – both for energy saving and for other claims on harmonics and phase balancing - the web sites listed have more detail.

You should also consider whether proper consideration of each energy consuming system (particularly lighting) might be more productive – the "site wide quick fix" is attractive – but a step-by-step approach is likely to be better overall.

**Key issues**

- What is the size of your demand – is your existing transformer right ?
  *(Losses on older transformers can be 8% of rating -and do not reduce with lower loads – get this right before moving on)*
- What is the nature of your load – reactive or inductive ?
  *(Lighting is reactive and may reduce as planned – motors are inductive and may not)*
- What voltage is your equipment designed for – is the current sale pitch assumption of 240/440v supplied and 220/400v optimum correct for you ?
  *(Older motors and control gear may require 440v – equipment is most efficient at its design voltage – whatever that is)*
- What voltage drops do you experience – would your longer runs drop too far ?
  *(inductive loads will draw more current, under sized cables will run hotter, motor losses will increase and switch mode power supplies may start to give trouble)*
- What load fluctuations do you experience – is a general reduction suitable or do you need voltage regulation ?
  *(watch out for summer / winter variation – winter may place a higher load on a reduced grid voltage)*
- Do you have UPS or standby generation; will they need re-commissioning ?
  *(controls and fault protection will need to be re-set – expect problems)*
- Should you optimise the whole installation – is lighting your real target ?
  *(up to 30% for discharge and switch start fluorescent – 5% for high frequency - nil for LED)*
- Can you afford the downtime ? A distributed approach is less intrusive.
  *(Major surgery on your LV incomer and a single point of failure – against a distributed risk on less vital circuits with cheaper equipment)*

**Web links**

- General introduction (http://en.wikipedia.org/wiki/Voltage_optimisation)
- The IET forums (http://www.theiet.org/forums) - a very informative discussion of the subject
- Power Save (http://www.powersavetechnology.co.uk) - Voltage regulation/reduction (VR) manufacturer
- Power Efficient Systems (http://www.pesgroupltd.co.uk) - VR manufacturer covers lighting installations
- DEFRA case study (http://www.sd-commission.org.uk)

Tony Johnstone, 11 February 2011