Explaining
Distortion Power Factor (DPF)

The proliferation of electronic ballasts into our local market has been met with both awe and confusion. Yes, a good electronic ballast will bestow marvellous advantages over their electromagnetic rivals but how does one quantify the weird mains current waveforms? Whereas the power factor measurement for electromagnetic ballasts is simply a measure of displacement between the voltage and current fundamentals (both sinusoids) the effect of the transient current pulse of electronic ballasts requires further understanding from both Eskom (electricity provider) and end user perspectives. This article will deal with the effects of a simple, non power factor corrected, low power, CFL electronic ballast on:

- Building wiring
- Overall power factor
- Eskom reticulation

Now it so happens that the analysis of the waveforms for electronic ballasts is nothing new: Its full wave rectifier front end has been used for decades in most power supplies. What is new is the sheer quantity of these things connected to our mains, especially with the new drive to eradicate incandescent lamps around the home.

What is power factor? Displacement power factor, distortion power factor..

Distortion Power Factor (DPF) .. as opposed to Displacement Power Factor, also called DPF.

Figure 1shows the measured voltage and current waveforms for a typical off-the-mains full wave rectifier. The lower trace (current) is a current transient to top up the smoothing capacitor and typically leads the voltage slightly (by about 10^0). The pulse width is typically around 1 to 2 ms. The displacement power factor of this waveform is approximately 0.98 because the current is almost in phase with the voltage.

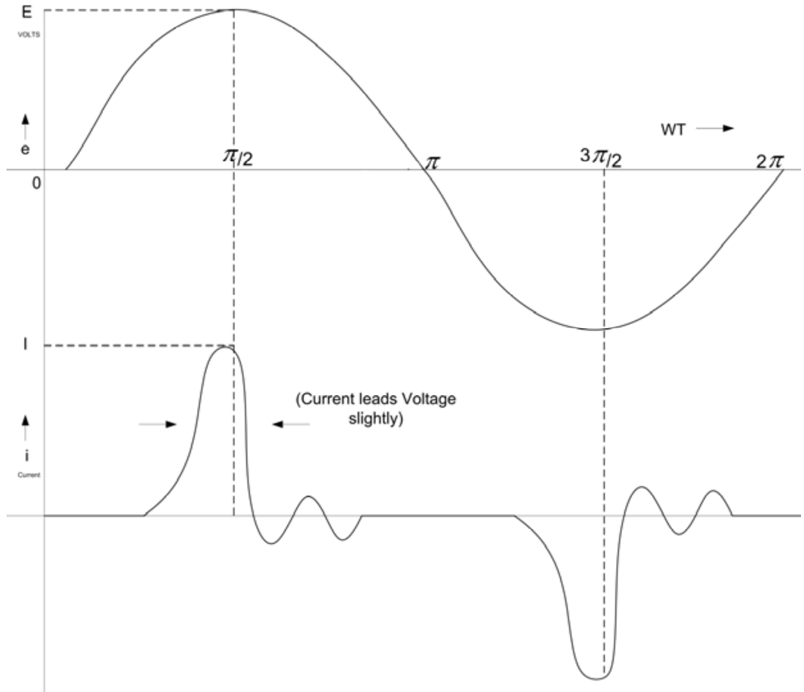
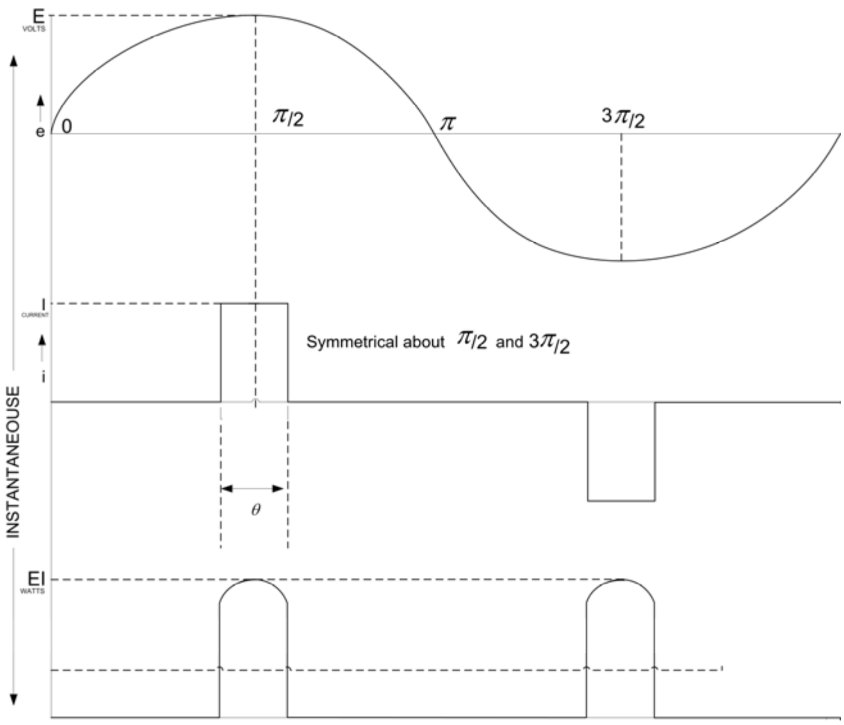
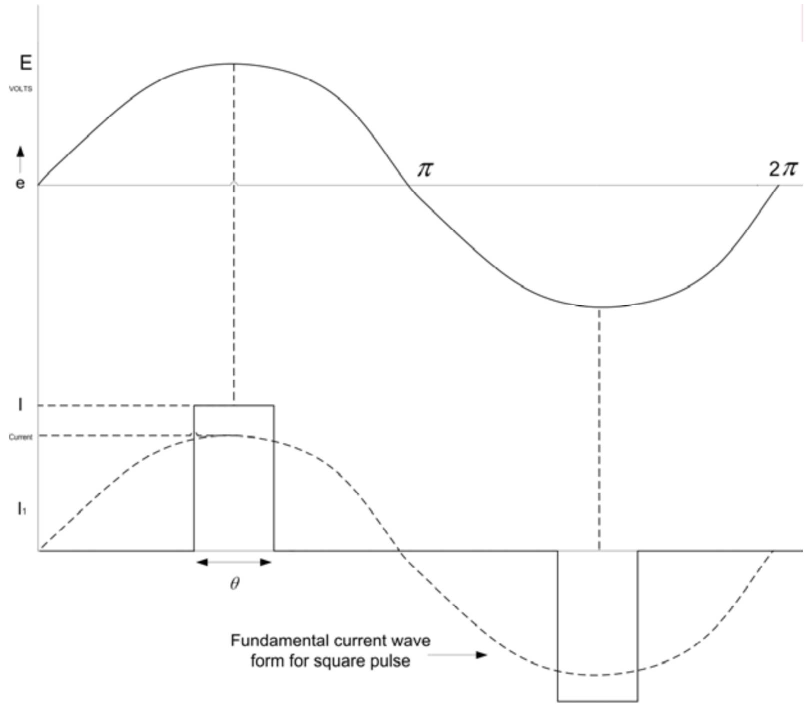

E
VOLTS
e
0
$\pi/2$
π
$3\pi/2$
2π
WT
I
i
Current
(Current leads Voltage
slightly)

Figure 1


E
VOLTS
e
0
$\pi/2$
π
$3\pi/2$
I
CURRENT
i
Symmetrical about $\pi/2$ and $3\pi/2$
θ
EI
WATTS
INSTANTANEOUSE


E
VOLTS
e
π
2π
I
Current
I1
θ
Fundamental current wave
form for square pulse