EEEN313/ECEN405

Understanding PF and THD

1

Understanding PF and THD

- THD should be kept as low as possible
- AS/NZS (IEC) 61000-3-2 sets limits on harmonic currents for power equipment.

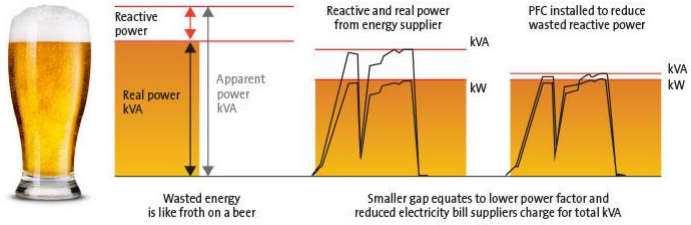
CAPITAL THINKING.
GLOBALLY MINDED.
MAI I TE IHO KI TE PAE

VICTORIA UNIVERSITY OF WELLINGTON
TE HERENGA WAKA

2

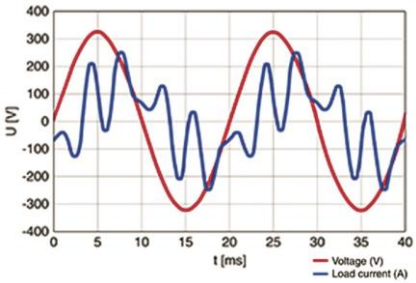
How to Solve these?

- Place L or C in the circuits – placing a component with opposite reactance to counteract
- Use Power Factor Correcting Circuits (Later in the course)

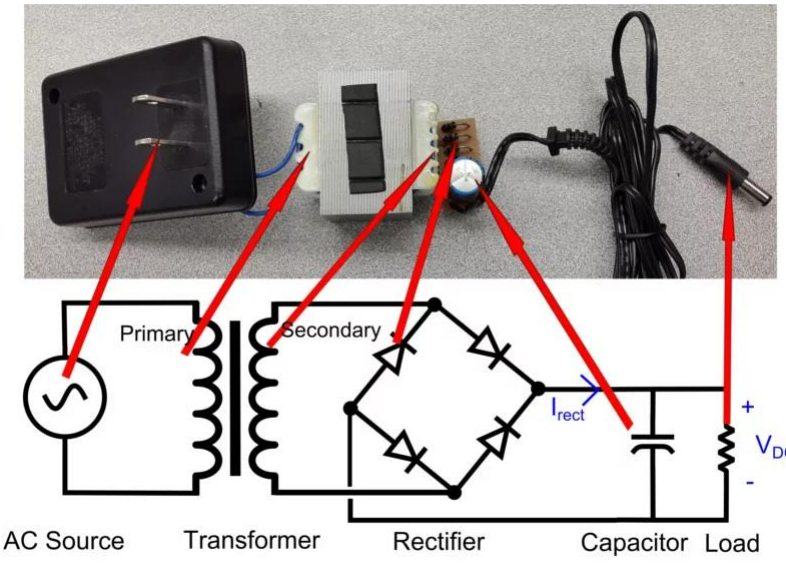


Solved?

- NOPE!
- We develop switch-based power converters – power to non-linear loads
- Hence currents are 'bursty'

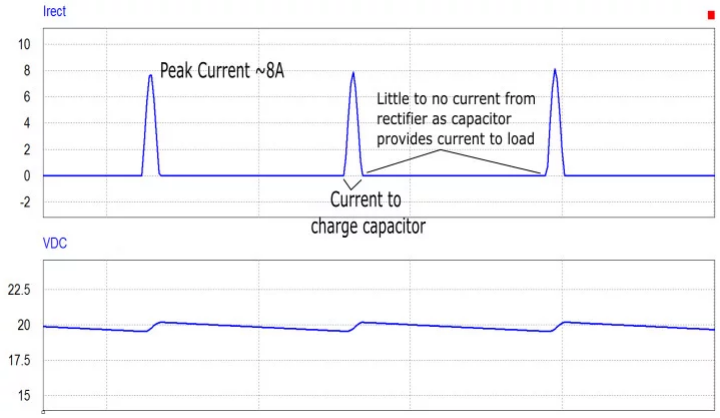


An example



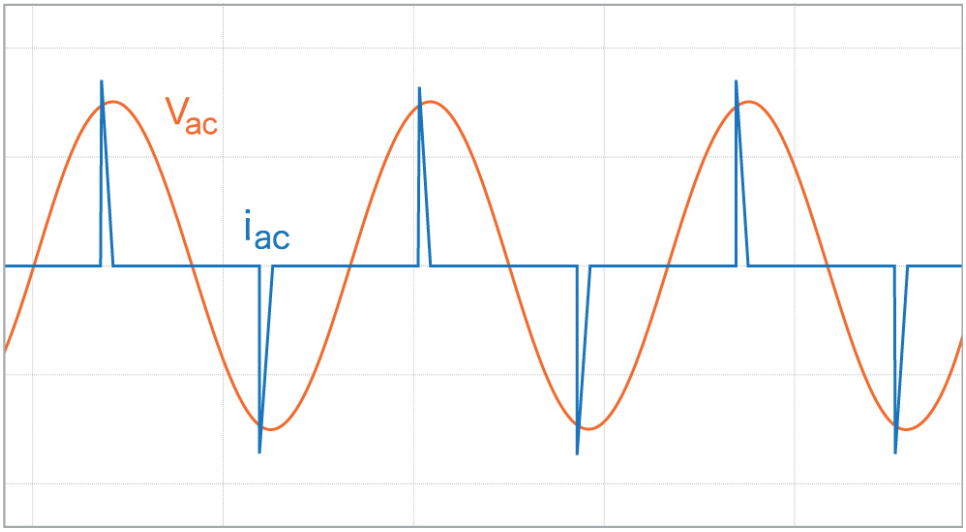
8

The output



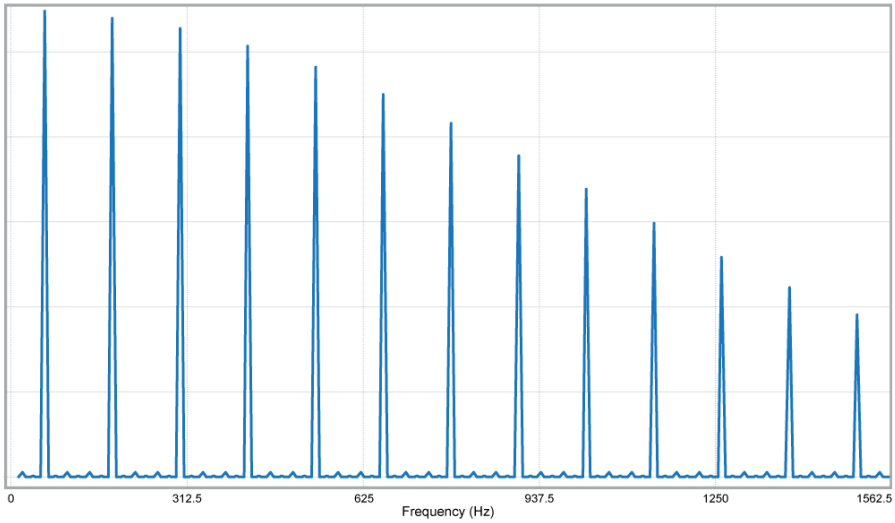
9

The input



10

So the Harmonics



11

So the PF?

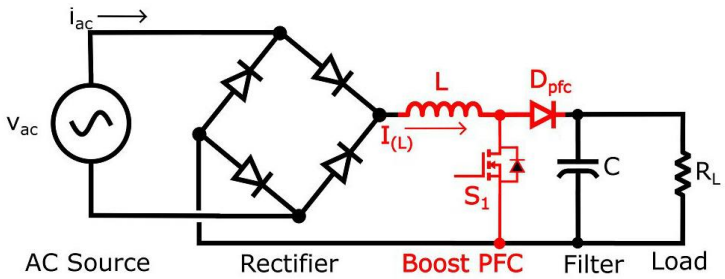
- First the THD – 2.8 (that's 280%)
- Phase shift between V and I waveforms - 10°

$$PowerFactor = cos(10^\circ) \times \sqrt{\frac{1}{1+(2.8)^2}} = (0.985)(0.336) = 0.331$$

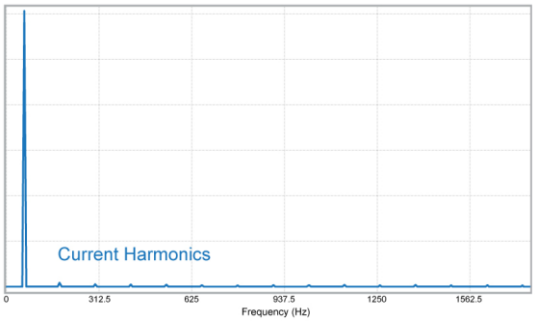
- Just imagine thousands of these connected in a power system.

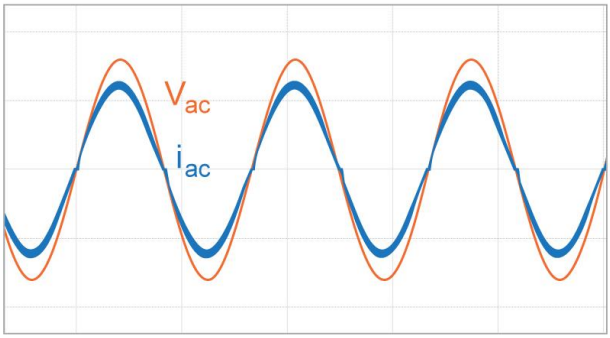
So the solution?

- We created the problem – So we solve it (More money ☺)
- Make the Current track the voltage as closely as possible



The output?





$$PowerFactor = cos(3^{\circ}) \times \sqrt{\frac{1}{1+(0.2)^2}} = (0.999)(0.98) = 0.979$$