How can predictive strategies contribute to better power control and reduced energy consumption ?

PLM and LTC Explained

Presented by: Rene Meuleman / Seetharaman J

EPower

a contribution to 

reduction

Environment Cartoons by: Chris Madden

Where do we need power control?

- Furnace boosting systems
- Throat boosting systems
- Electrical heated refiners
- Electrical heated forehearts
- Electrical heated bending lines
- Drain systems (protect against zircon cords)
- Bath roof heating systems (flat/float)
- Lehr heating systems (flat/float)
- Bushing control (fiber reinforcement/insulation)
- Poly silicon production

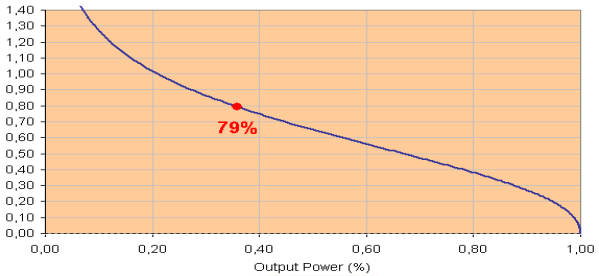
What Power Management Issues do we have?

Managing Poor Power Factor

Managing Peak Power Demands

Reduce harmonics

Improve the transformer design



Graph:Epower LTC simulator by Mikael Le Guern

Managing Poor Power Factor – What is the problem ?

Application

- Typically in many applications Thyristors (SCR's) are used in Phase Angle firing mode.
- This often generates reactive power and a high harmonic content in the output voltage and current waveform typically reaching a maximum when the delay angle is 90°

Problem

- This can create problems in harmonics and the creation of electrical noise.
- The creation of reactive power decreases the power factor

Managing Poor Power Factor

- *"Because of the costs of larger equipment and wasted energy, electrical utilities will usually charge a higher cost to industrial or commercial customers where there is a low power factor"**

€ $ £ Billed similarly to the demand charge, the power factor penalty increases the amount the utility charges for no other reason but a significant amount of reactive current was used over the course of the billing period. € $ £

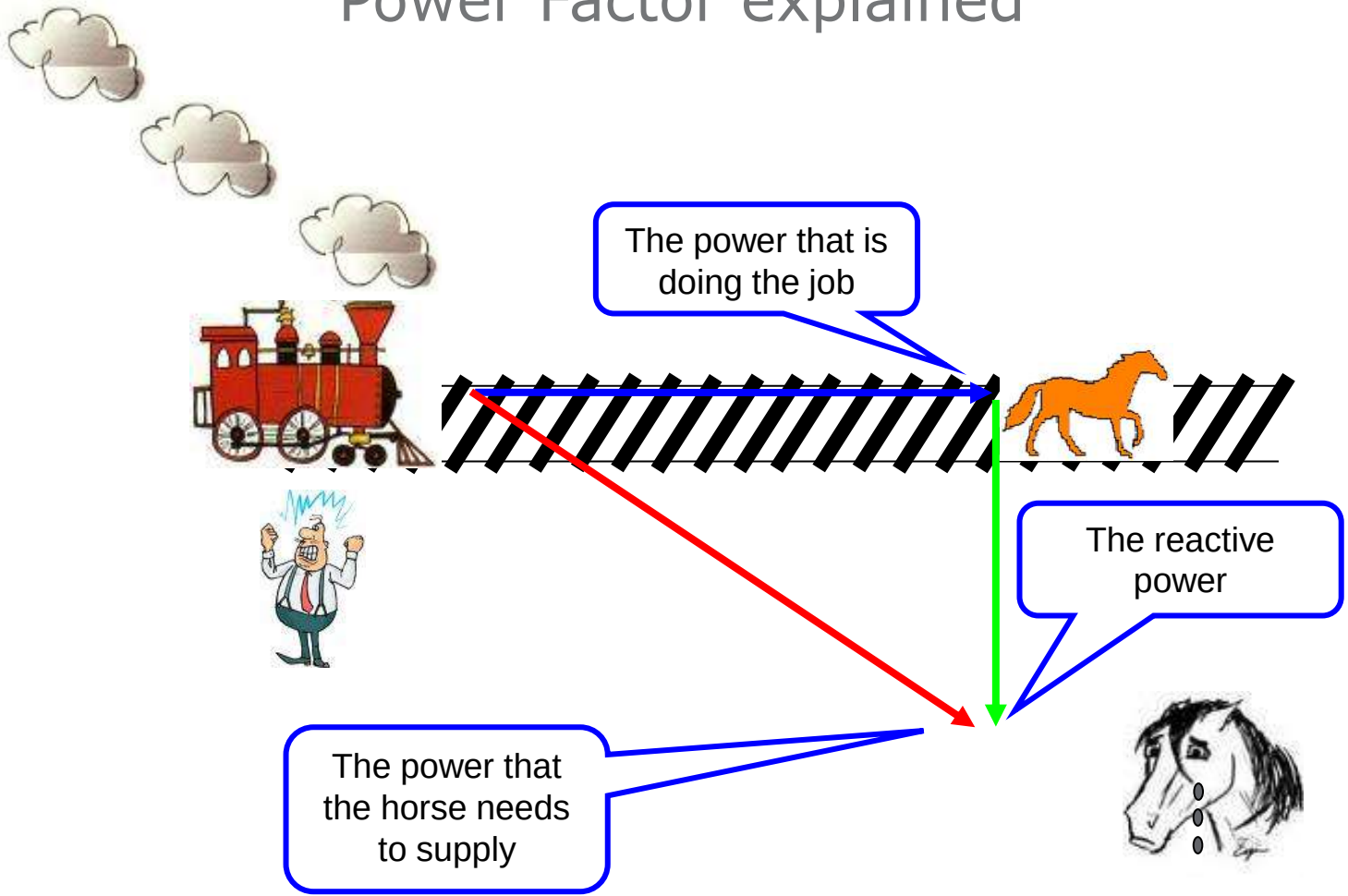
In Europe this limit is typically 0.9 to 0.95.

* Source - Wikipedia

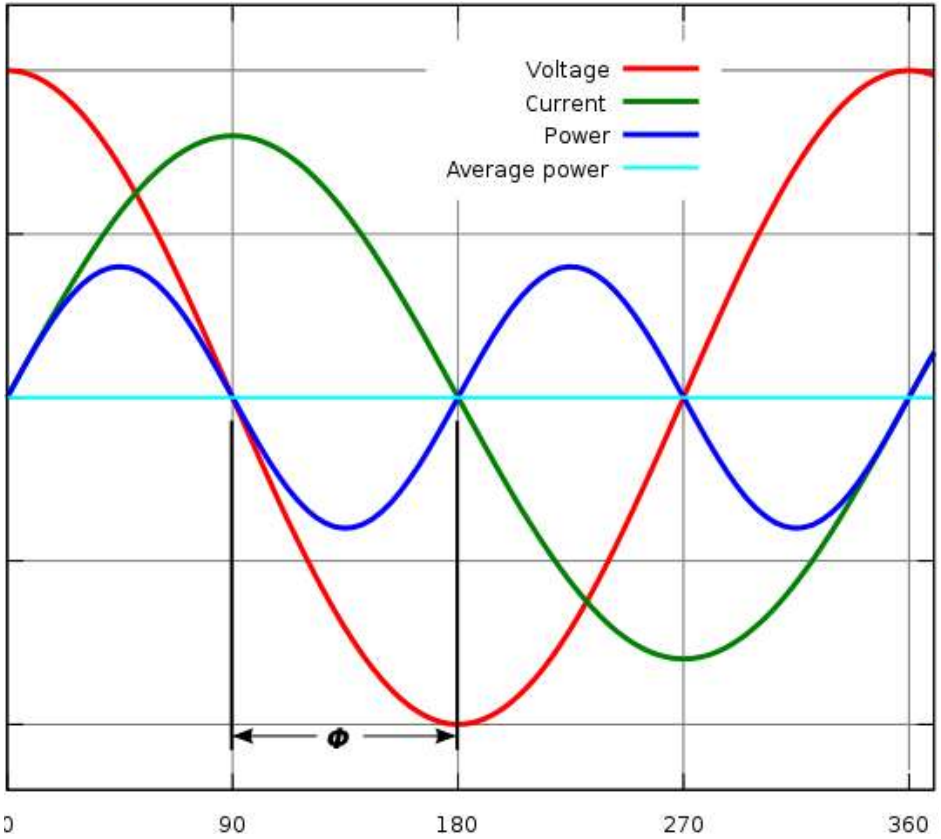
ENERGY COST SAVINGS

One of the most fundamental reasons a company should consider optimizing their power factor is to eliminate the power factor penalty component of their electrical power utility bill.

Power Factor explained

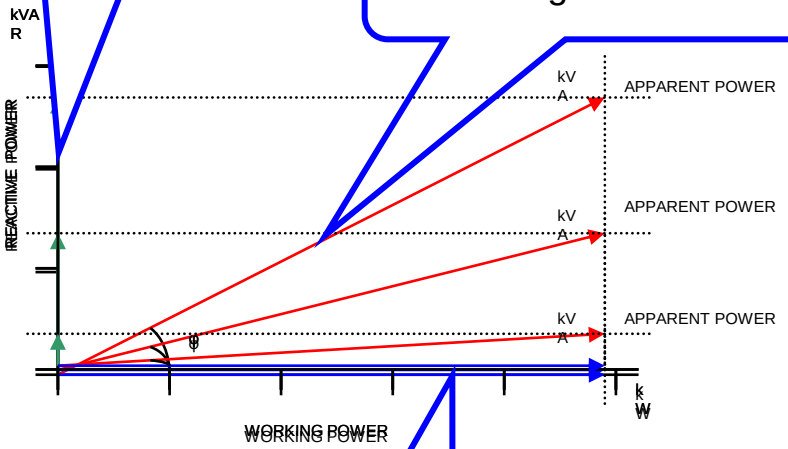


Power Factor explained



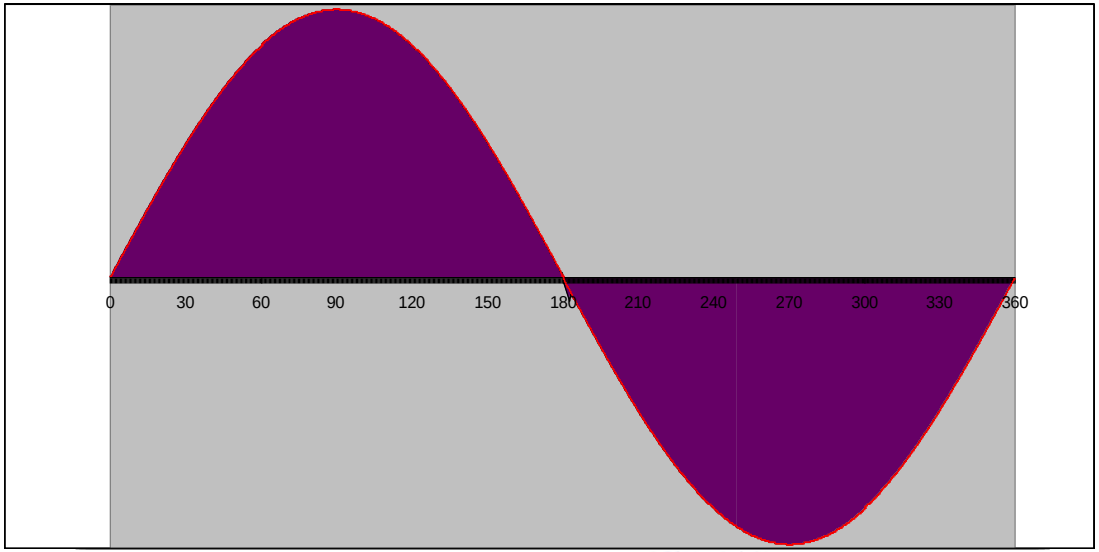
The power that is lost

The power that needs to be generated

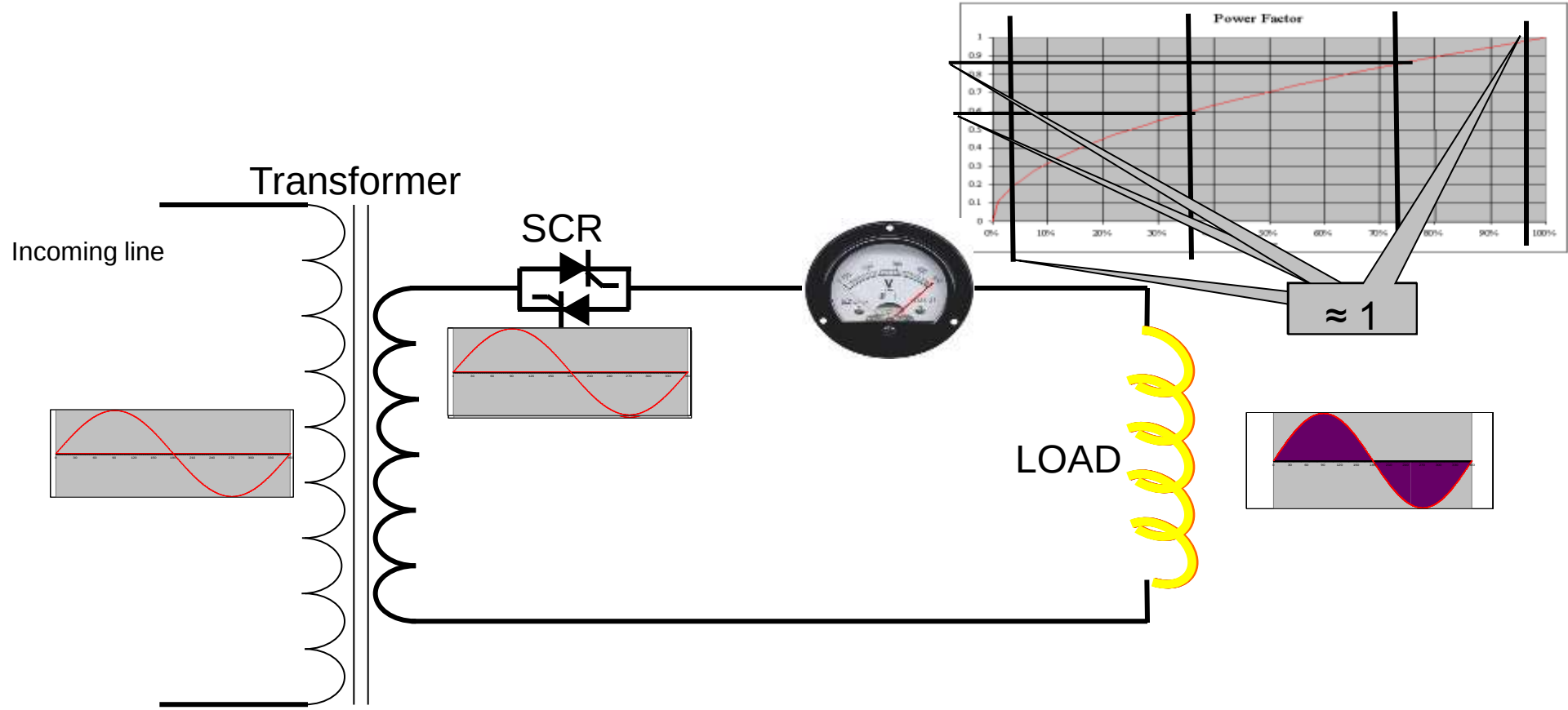


The power that is doing the job

Phase angle firing explained



Power factor in phase angle mode



Conclusion

Phase angle firing is a simple and smooth way to control power demands with SCR’s.

But it has two major disadvantages:

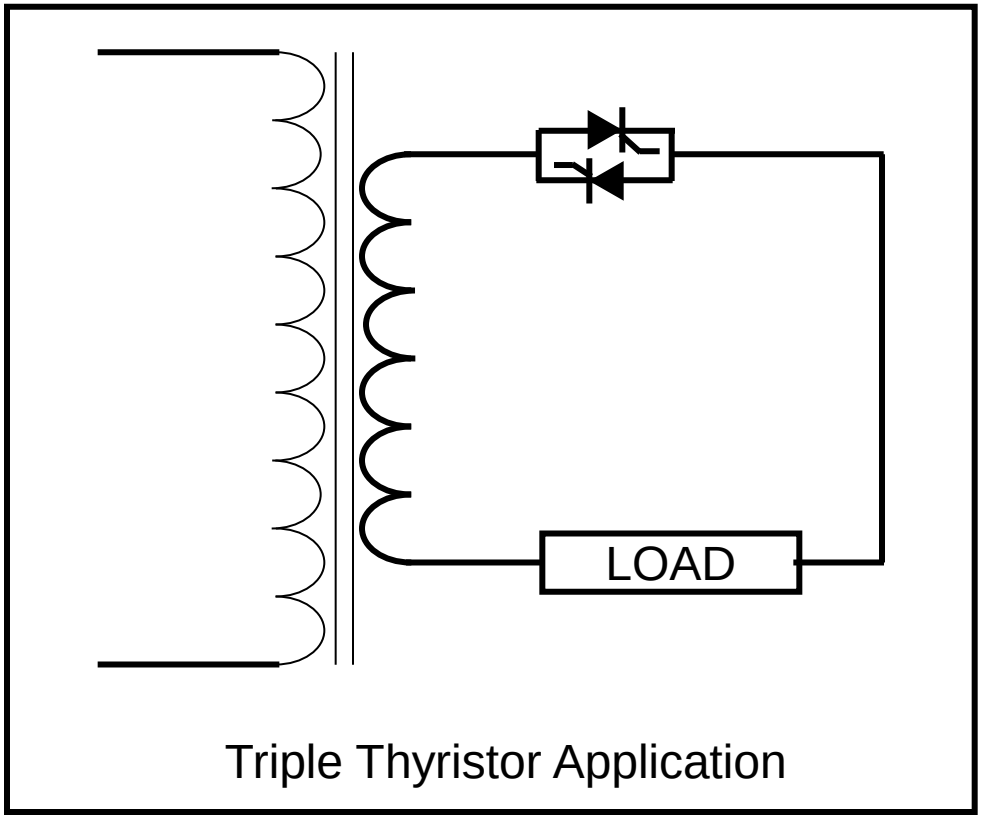
- Poor power factor
- Harmonic distortion

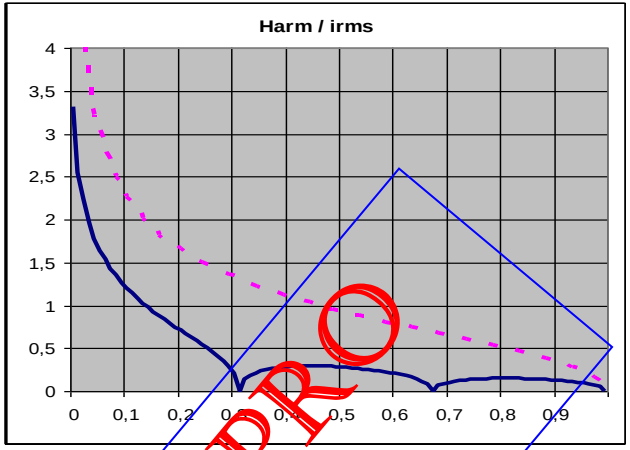
Power factor improvement

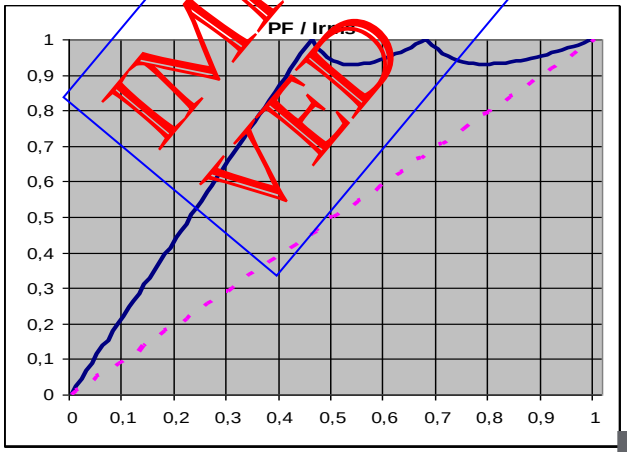
There are two effective methods to improve power factor in SCR driven power control systems.

- Load tap changing
- Full cycle firing

PF improvement for Phase angle firing by Load Tap Changing





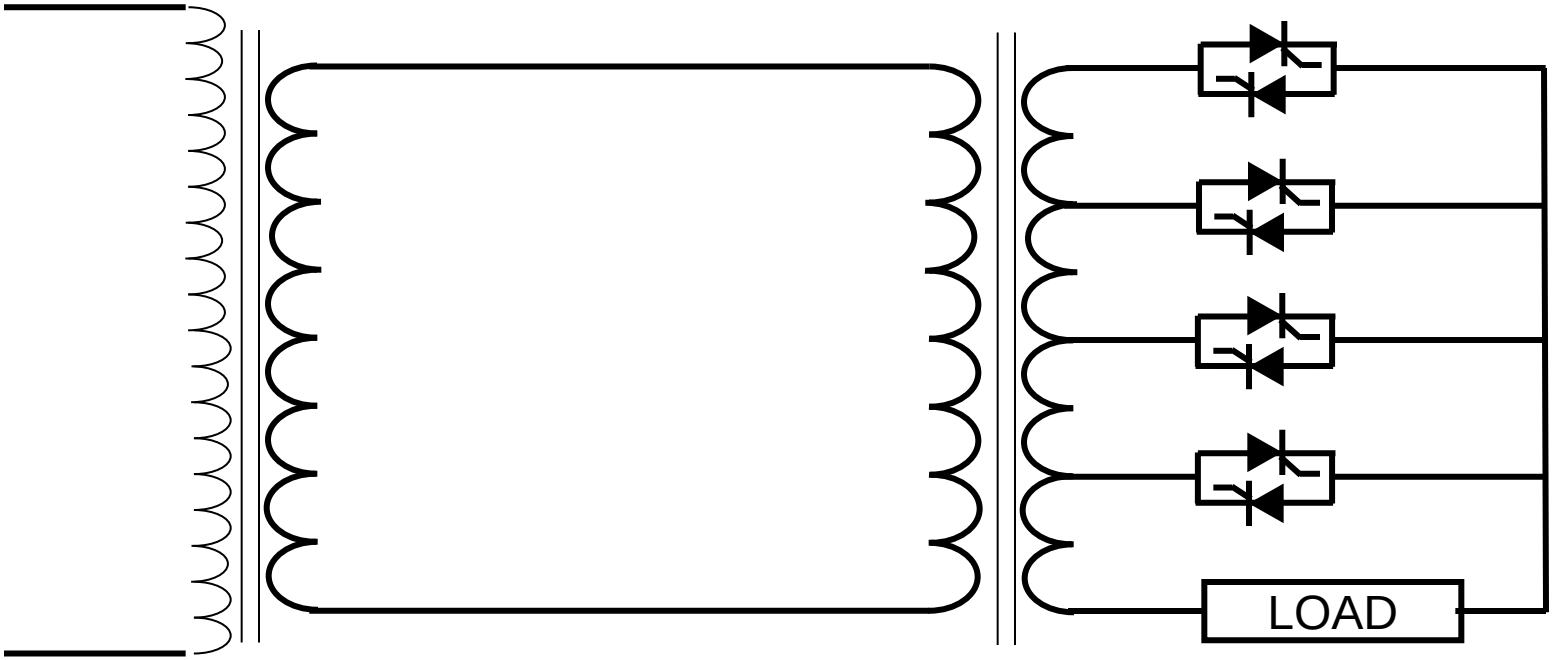


IMPROVED

STEP DOWN TRANSFORMER

WC TRANSFORMER

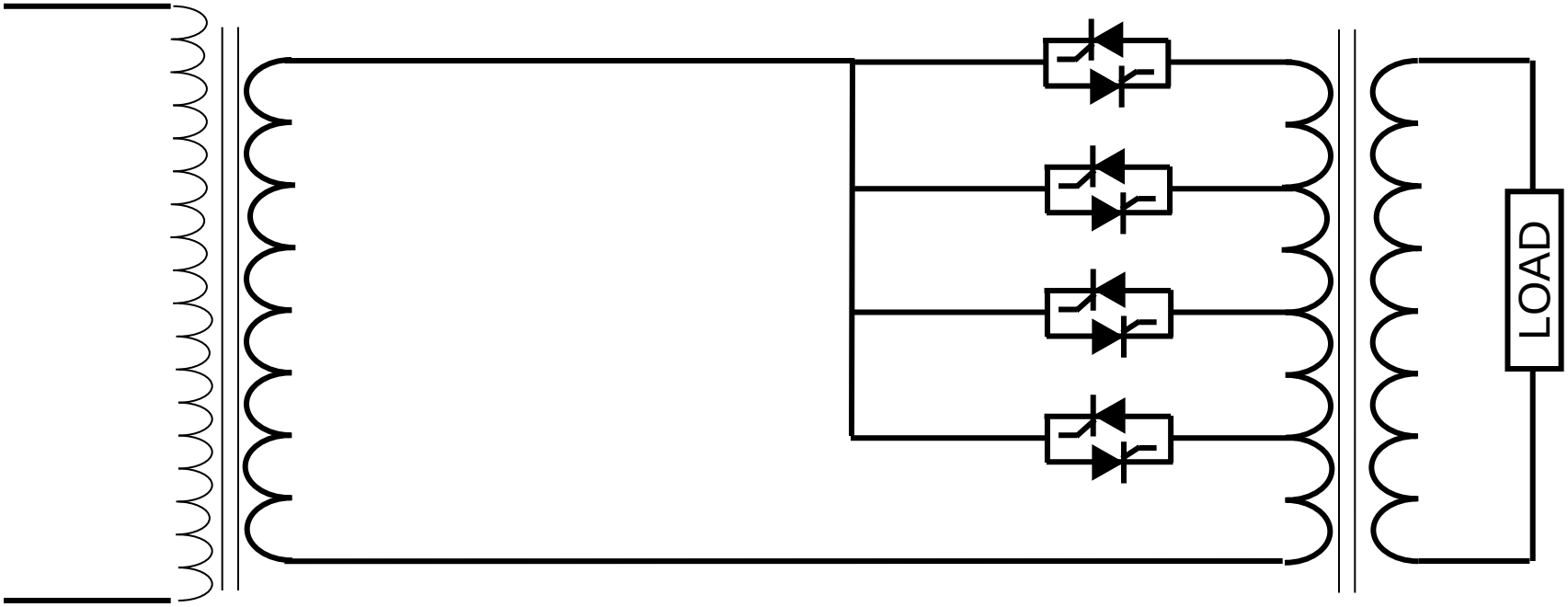
EUROTHERM SYSTEM



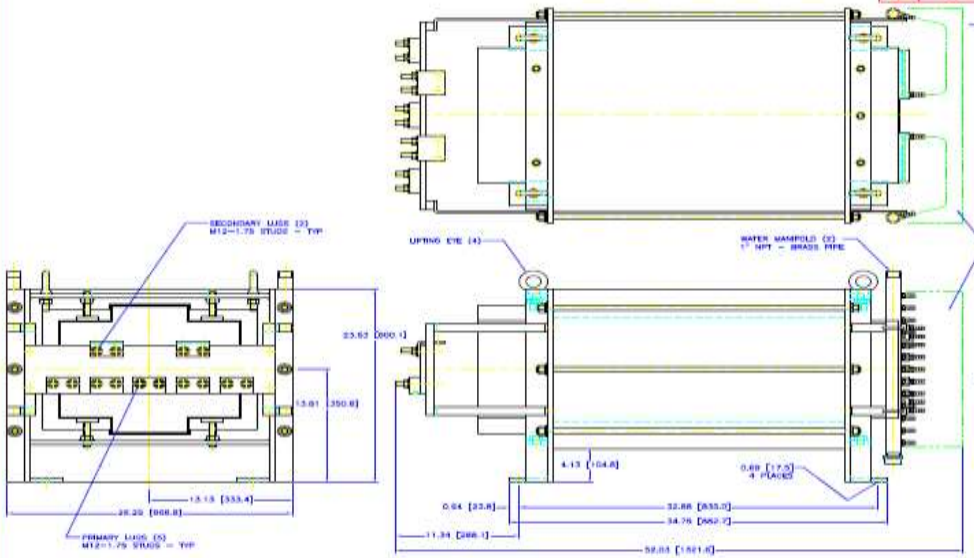
STEP DOWN TRANSFORMER

EUROTHERM SYSTEM

WC TRANSFORMER



TAP	PRIMARY TURNS	SECONDARY TURNS	SECONDARY VOLTAGE	PRIMARY CURRENT	SECONDARY CURRENT	KVA PRIMARY	KVA SECONDARY
1	33	7	212	949	4000	949	949
2	33	10	303	1212	4000	1212	1212
3	33	14	424	1198	2824	1198	1198
4	33	20	606	1212	2000	1212	1212



WATER REQUIREMENTS

6 GPM @ MAXIMUM INLET TEMPERATURE OF 30°C
(DOES NOT INCLUDE 4 EXTRA PORTS FOR CUSTOMER USE)

CONCEPT DRAWING
NOTE:
THIS IS A CONCEPT DRAWING ONLY.
DIMENSIONS ARE APPROXIMATE. FINAL
DESIGN MAY CHANGE AS PROJECT PROGRESSES.

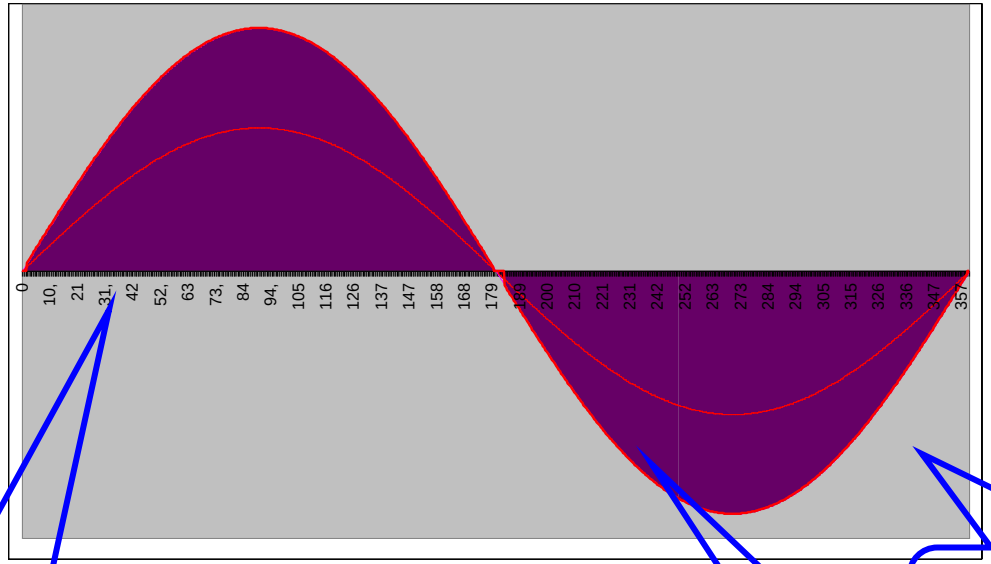
NOTE:
DIMENSIONS = INCH [MM]

APPROVED BY: _____

DATE: _____

REV	DESCRIPTION	DATE

TRANSFORMER
PROPOSAL DRAWING
SA-1389



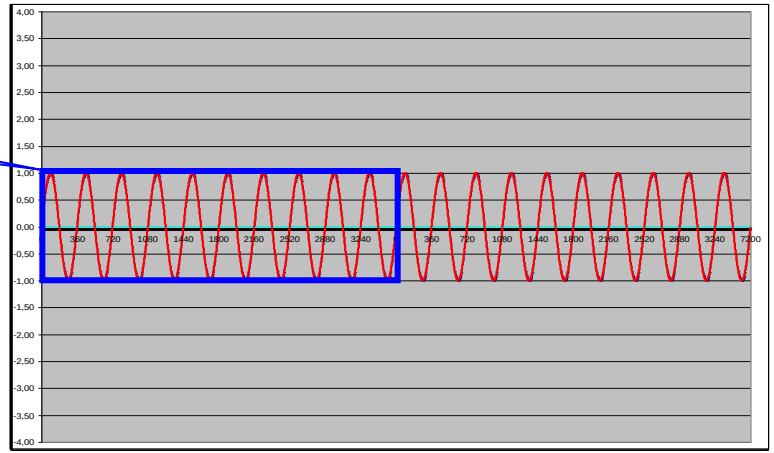
Load Tap Changing
gives us a more complete
energy sine wave

That is why
Load Tap Changing
Improves
Power Factor

And reduces harmonic
distortion

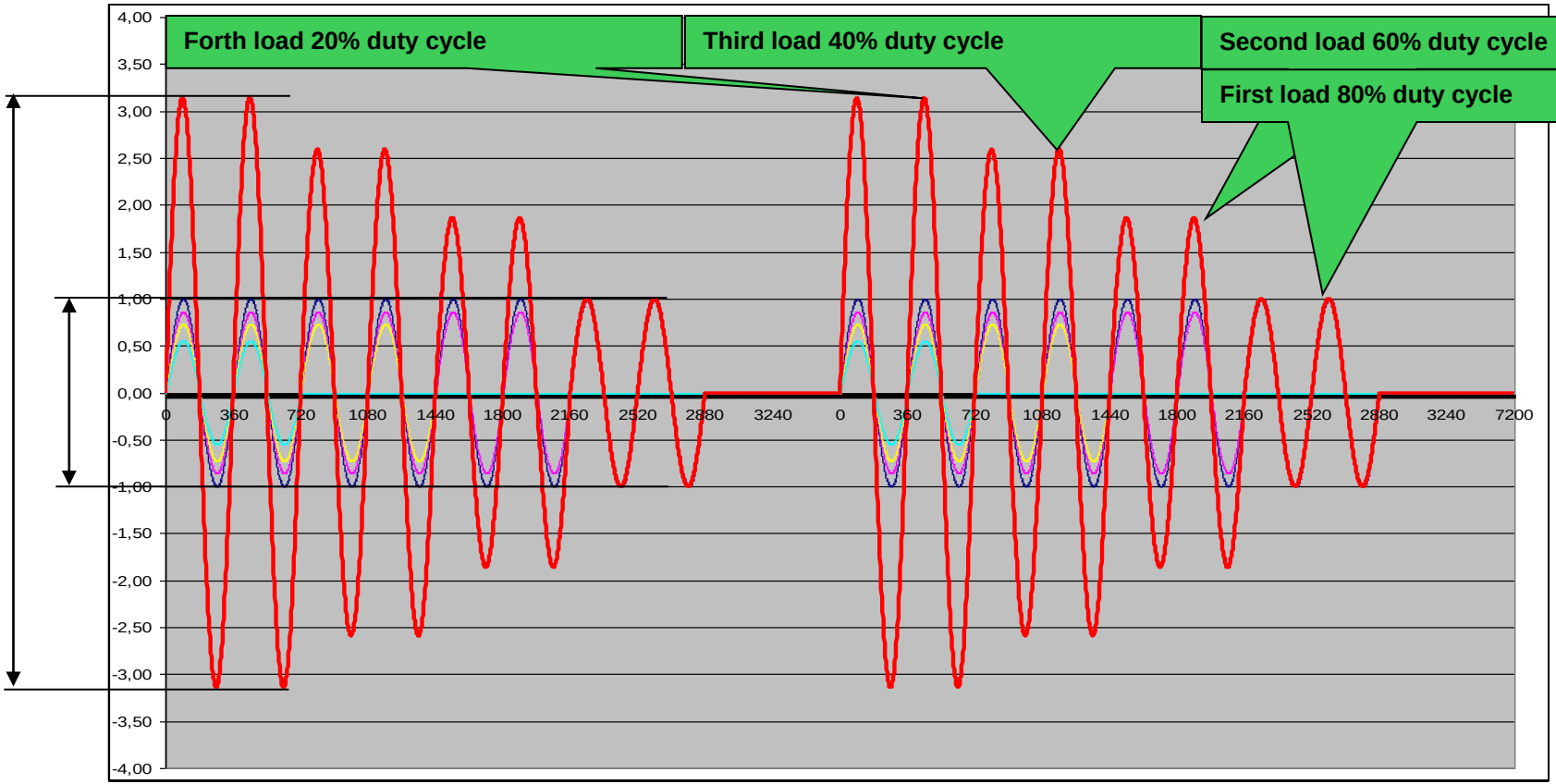
Full cycle firing

DUTY CYCLE



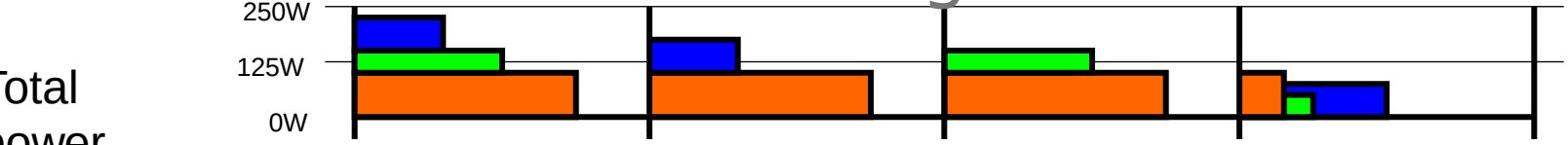
AVERAGE POWER
DURING DUTY CYCLE

Peak power demand in a full cycle multiple load situation

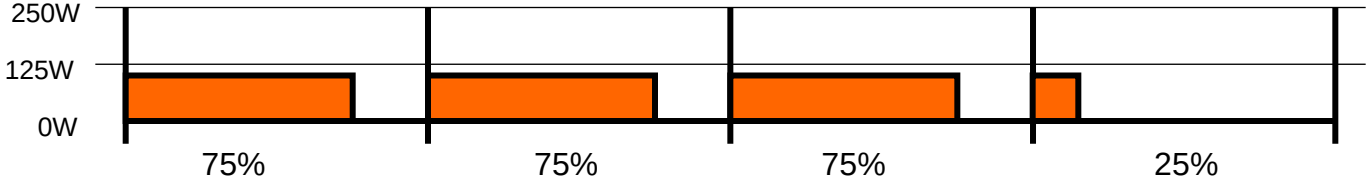


Without Predictive Load Management

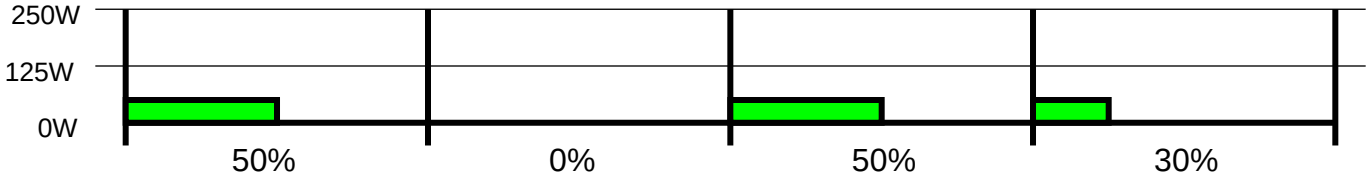
Total power



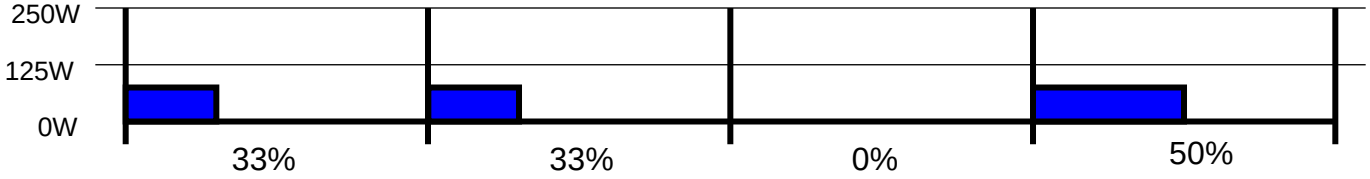
100 W



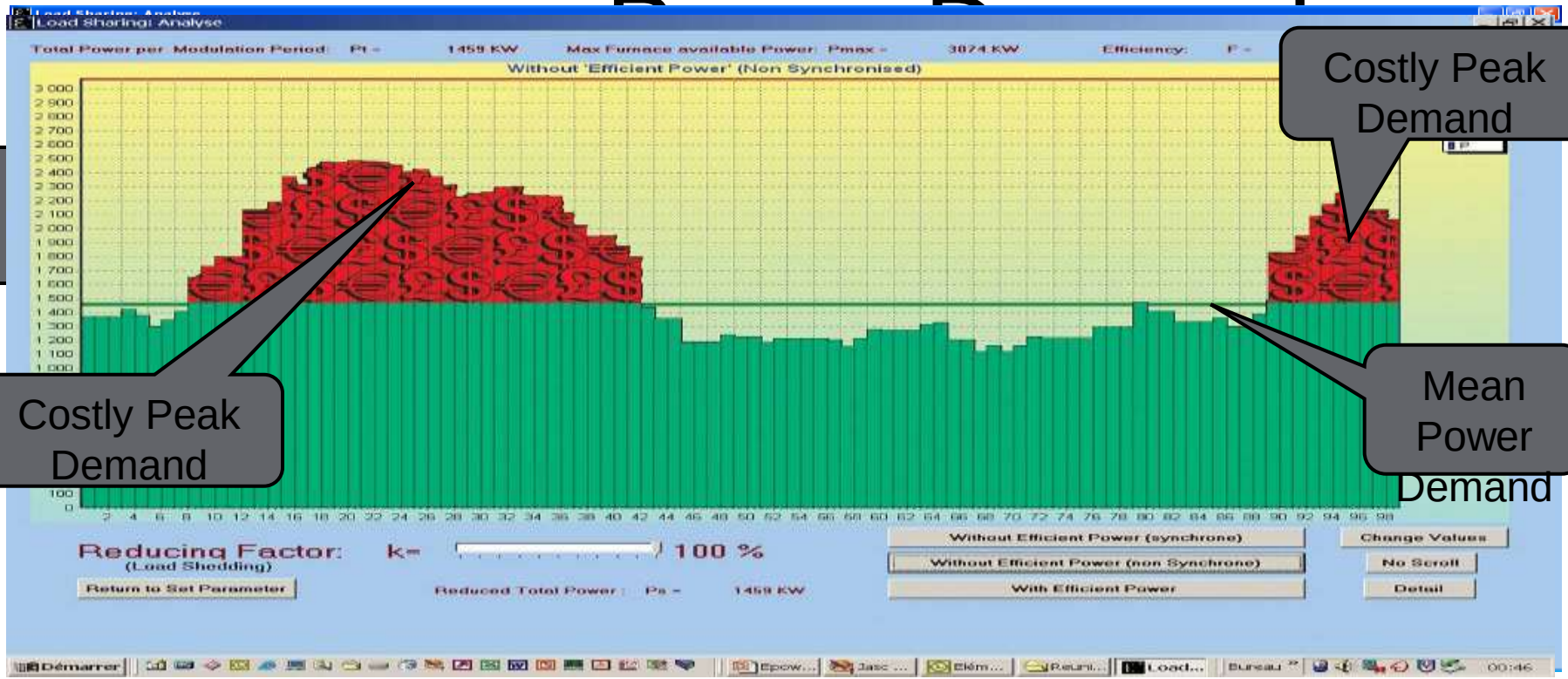
50 W



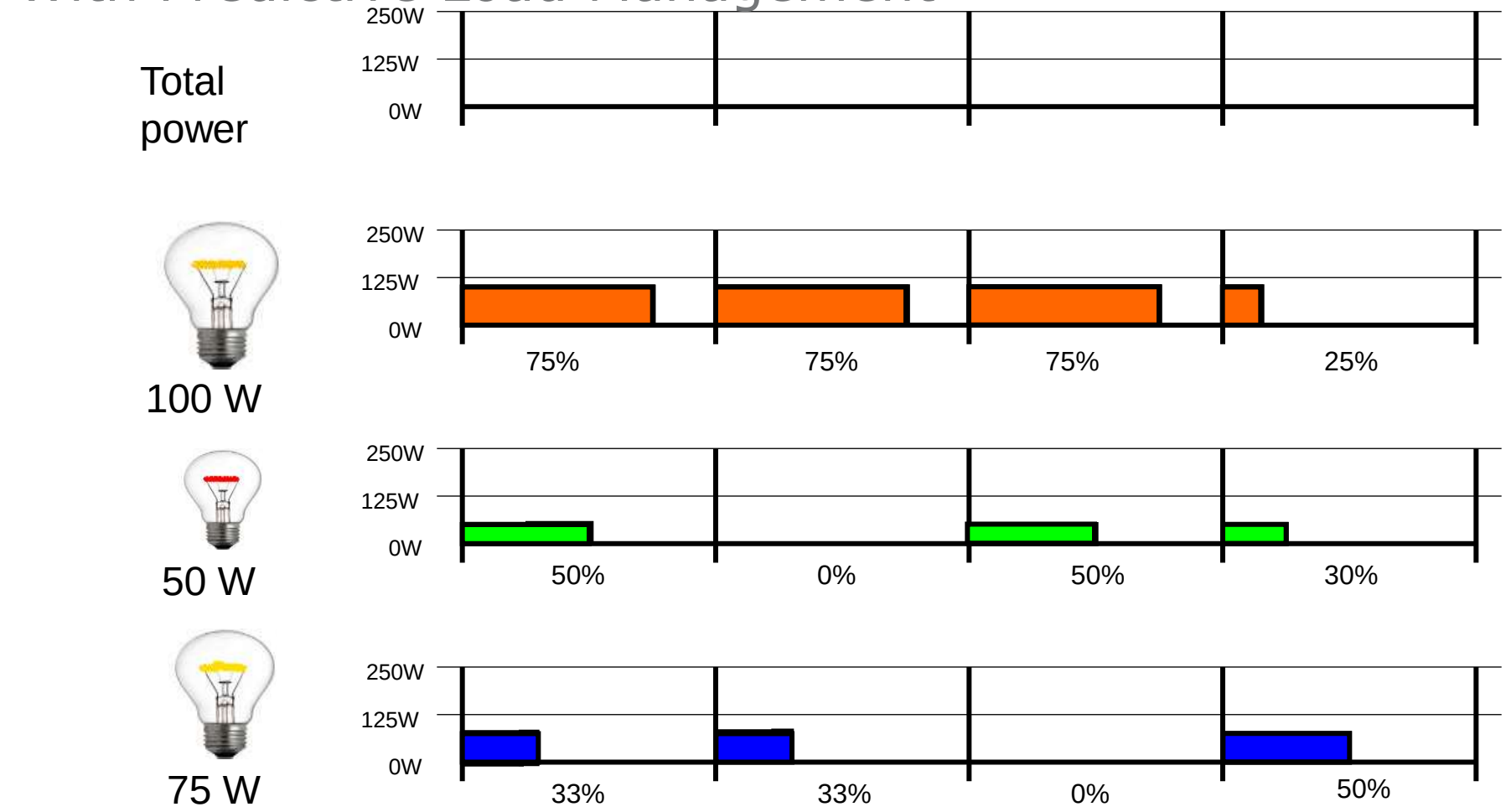
75 W



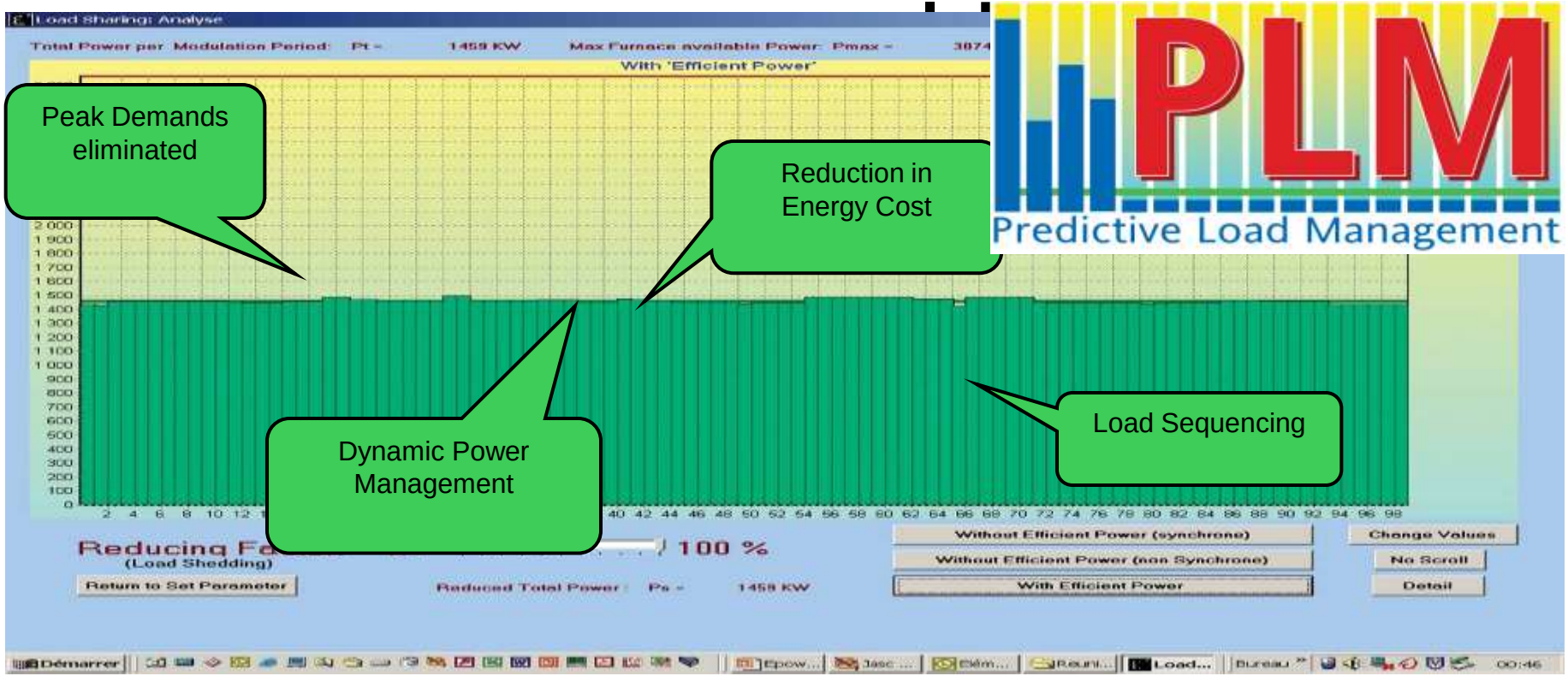
Managing Peak



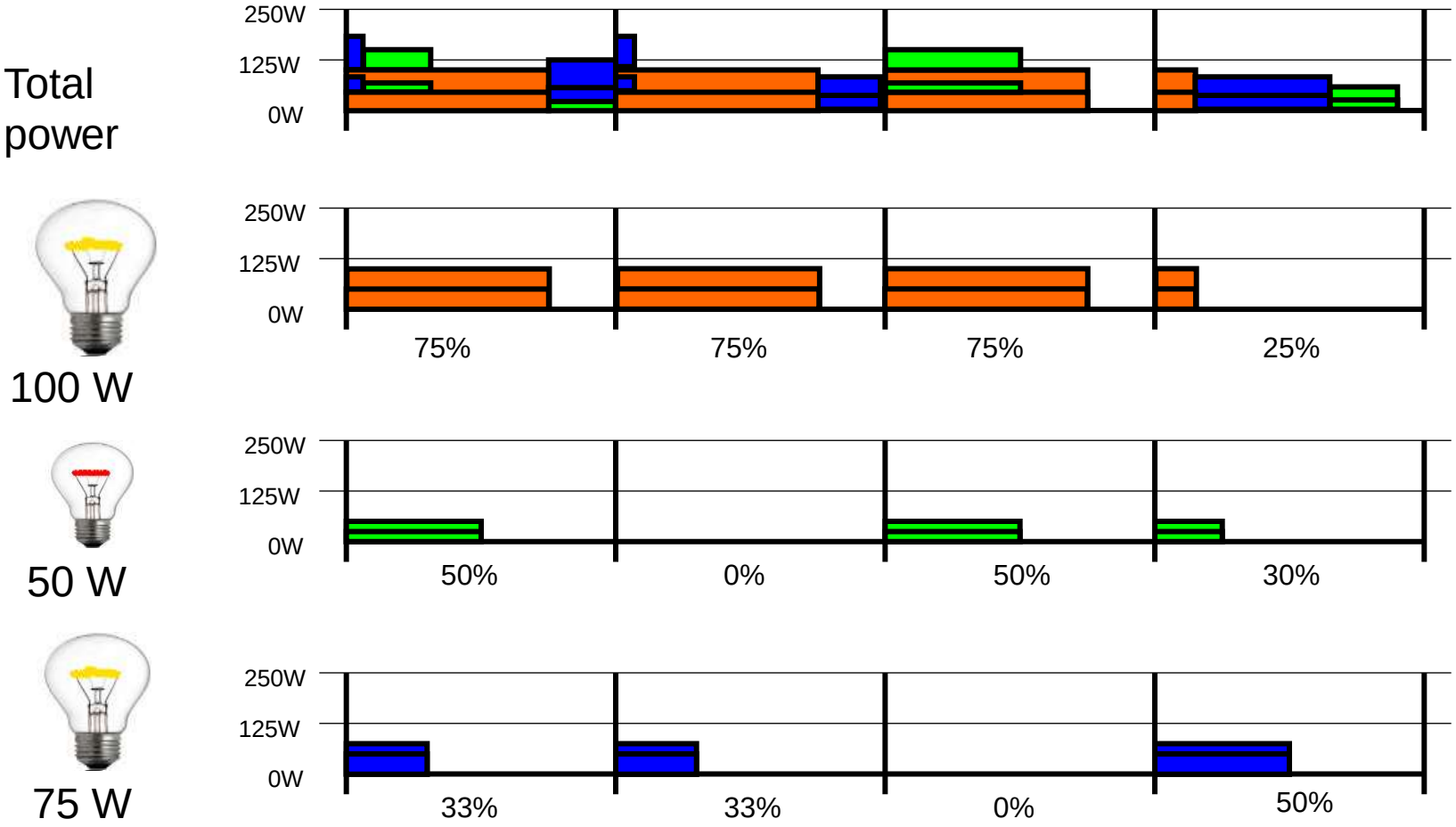
With Predictive Load Management



The efficient solution

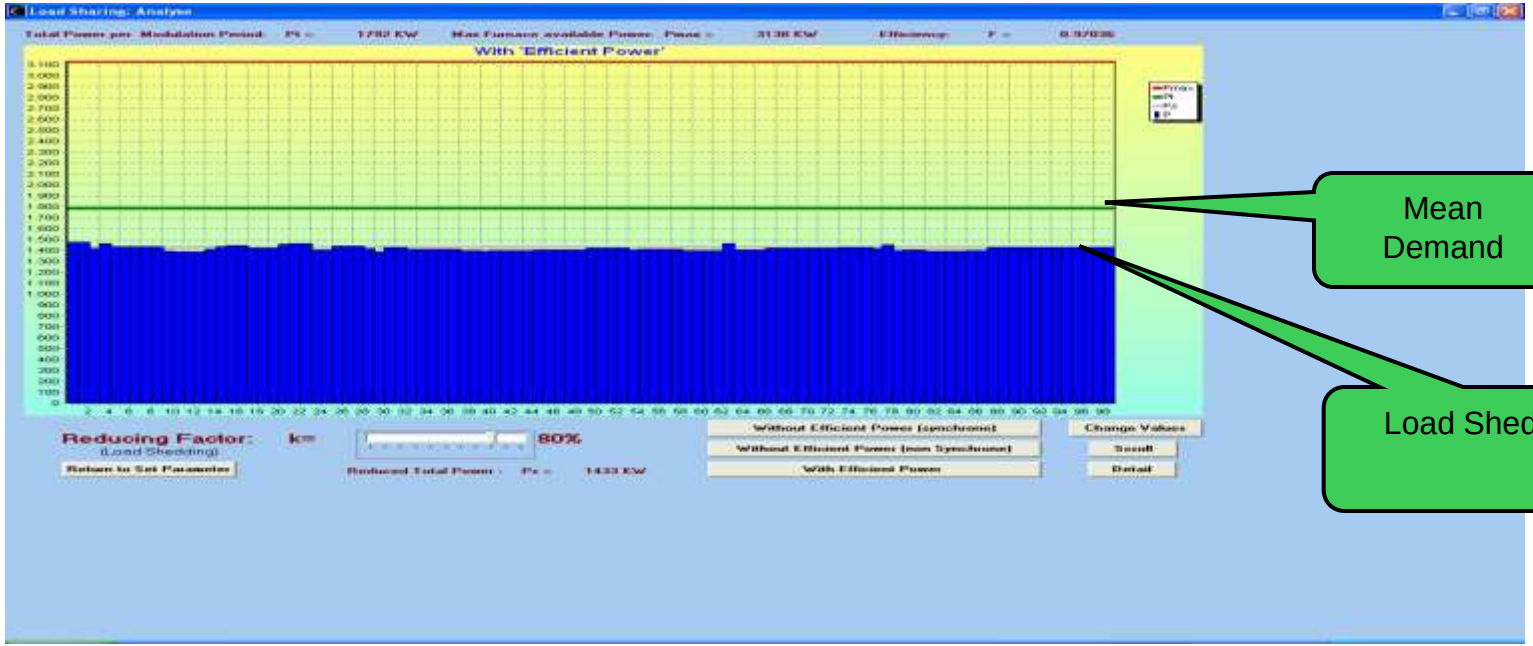


…and load shedding

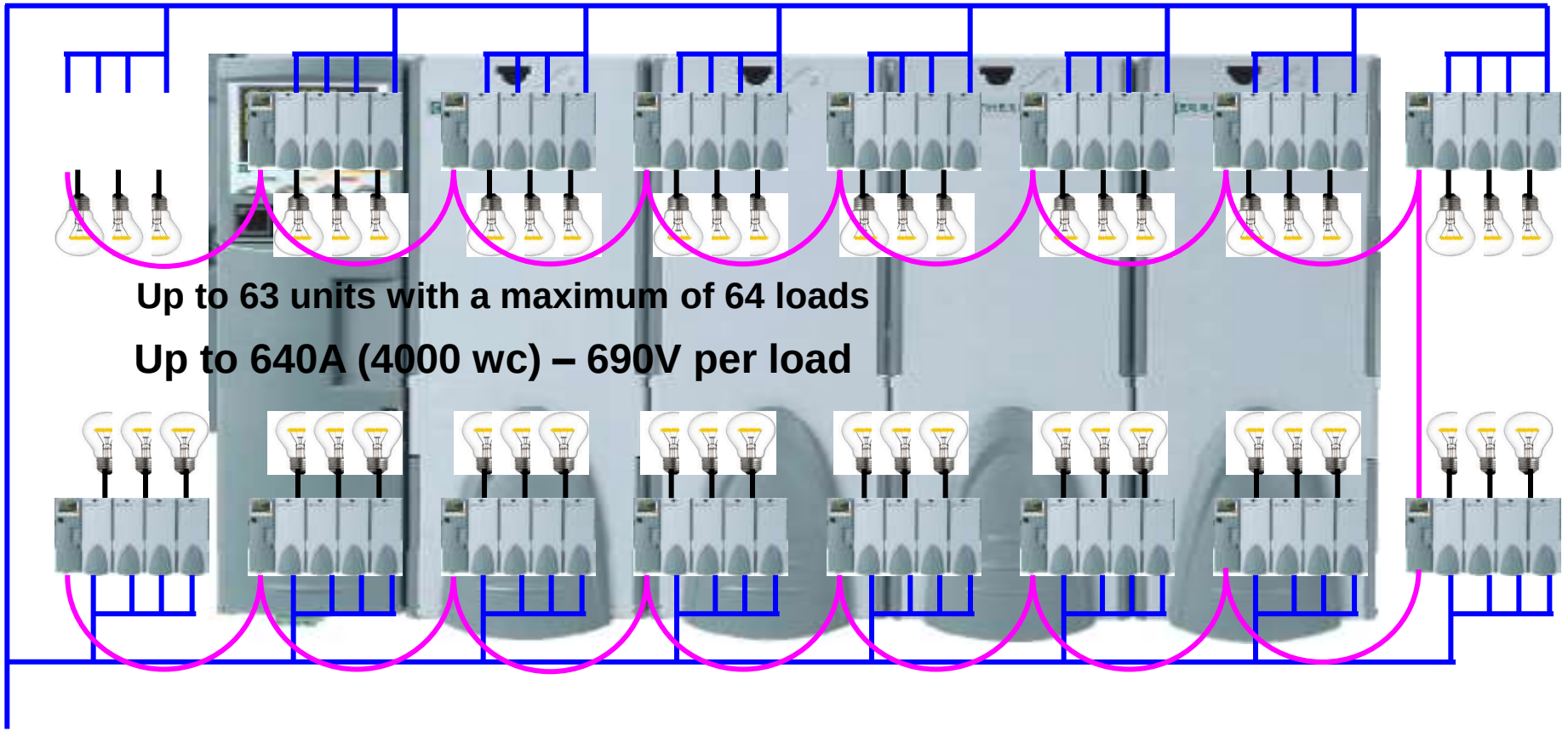


Additional Benefit…

- Additional Standard Feature allows Load Shedding – providing even more cost savings in reducing electrical energy costs



EPower Controller



Conclusion

- Improving the power factor, controlling the demand charge and reducing peak consumption during ON peak times can result in substantial savings:

✓ Reducing initial capital investment
✓ Improving quality of main power supply, peak demands eliminated minimizing incursions into more costly energy tariffs
✓ Making efficient use of the available power
✓ Reducing CO_2 emissions
✓ Possible ROI <12 months

Questions?

Environment Cartoons by: Chris Madden

Life Is On | Schneider Electric