

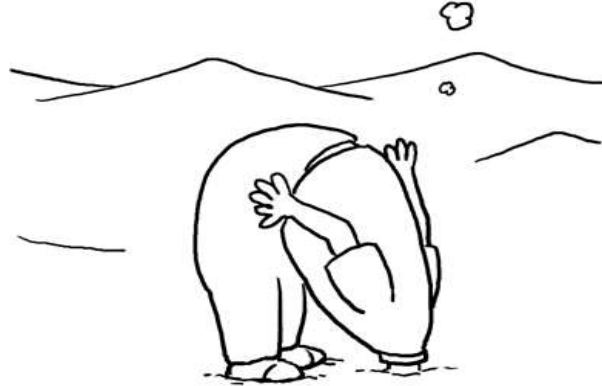
How can predictive strategies contribute to better power control and reduced energy consumption ?

PLM and LTC Explained

Presented by: Rene Meuleman / Seetharaman J

EPower

BURYING MY HEAD IN THE SAND
OVER CLIMATE CHANGE IS MUCH EASIER
NOW THAT HALF THE WORLD'S
TURNED TO DESERT!



a contribution to  reduction

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?

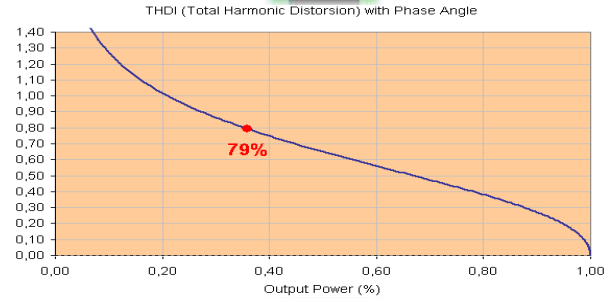
Managing Poor Power Factor



Managing Peak Power Demands



Reduce harmonics



Improve the transformer design



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.

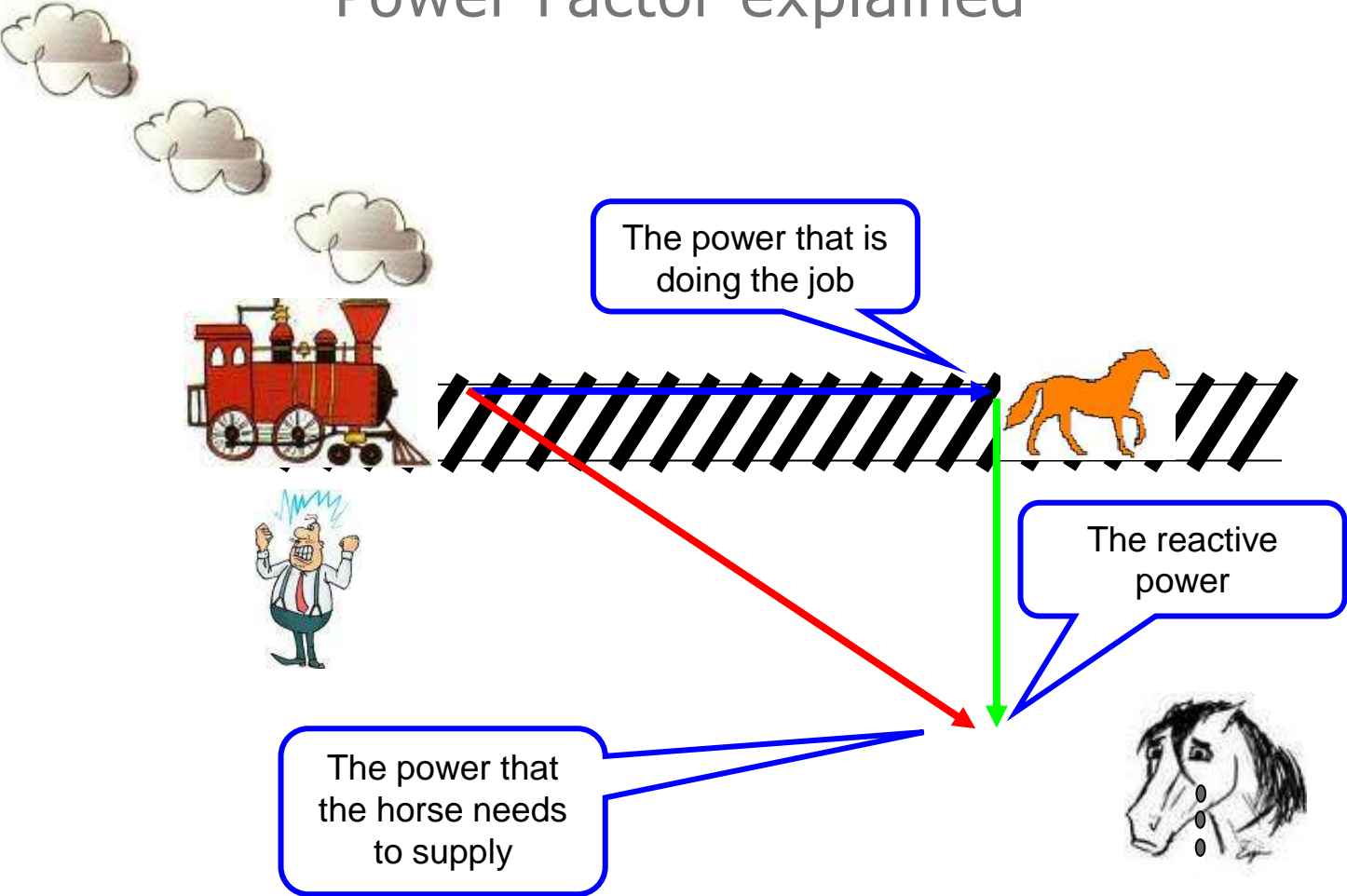
In Europe this limit is typically 0.9 to 0.95.

* Source - Wikipedia

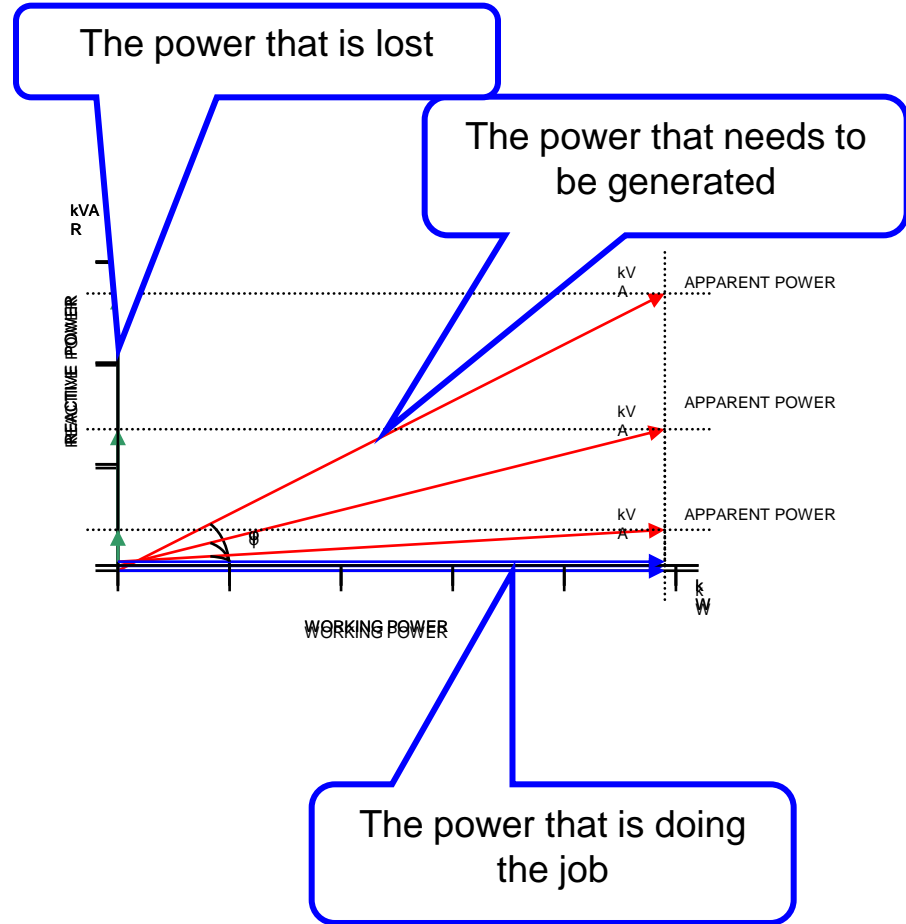
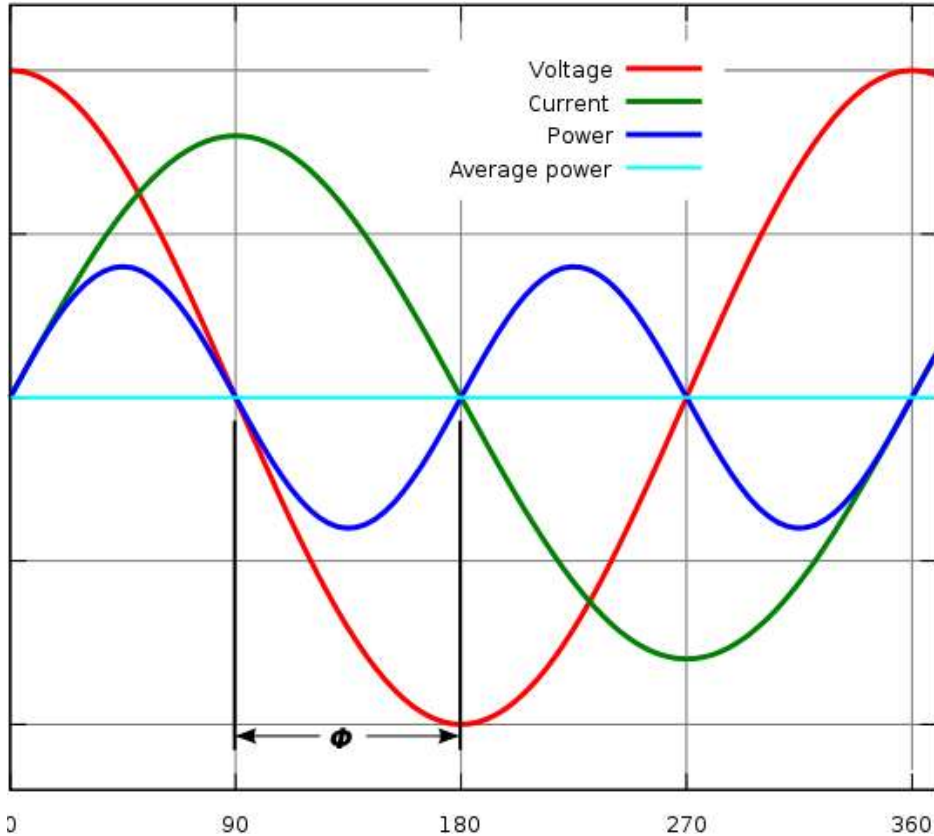
ENERGY COST SAVINGS

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.

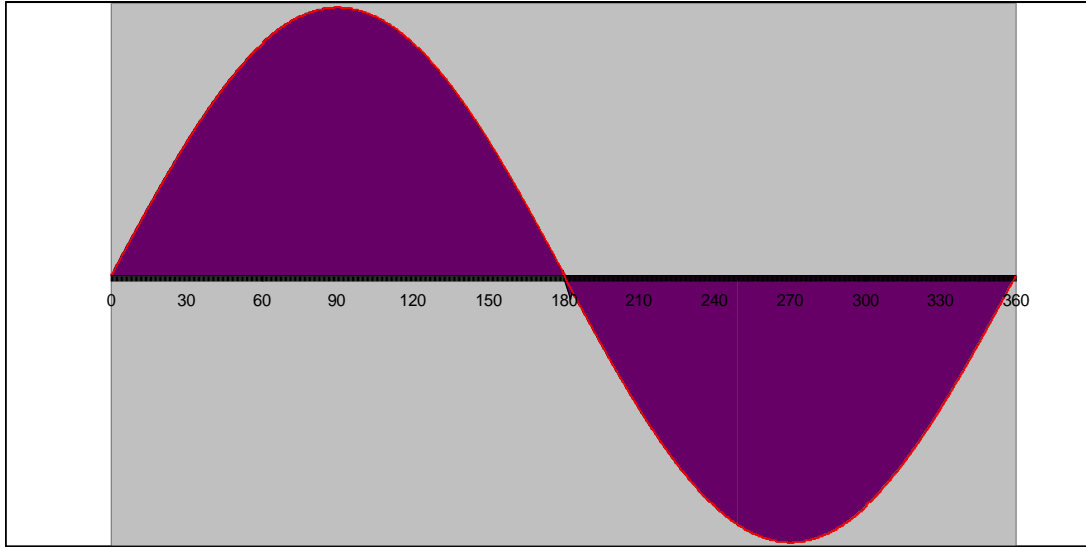
Power Factor explained



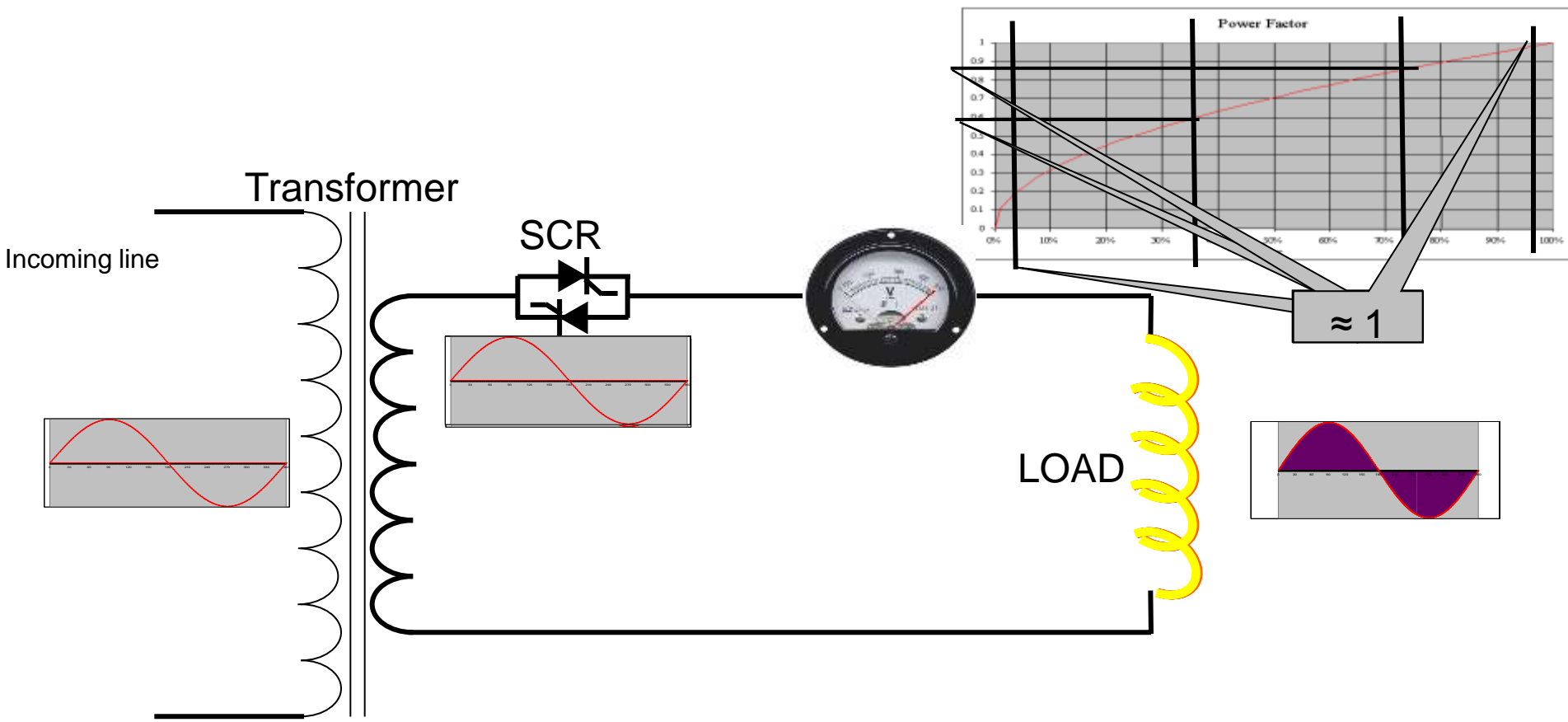
Power Factor explained



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:

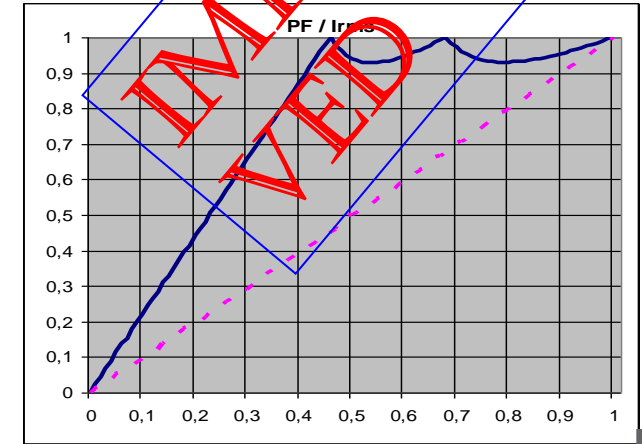
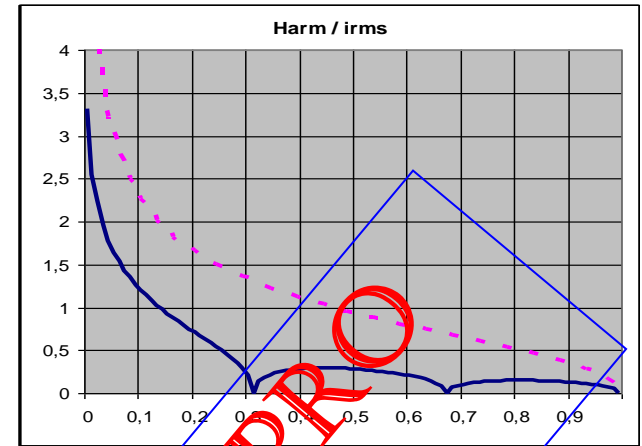
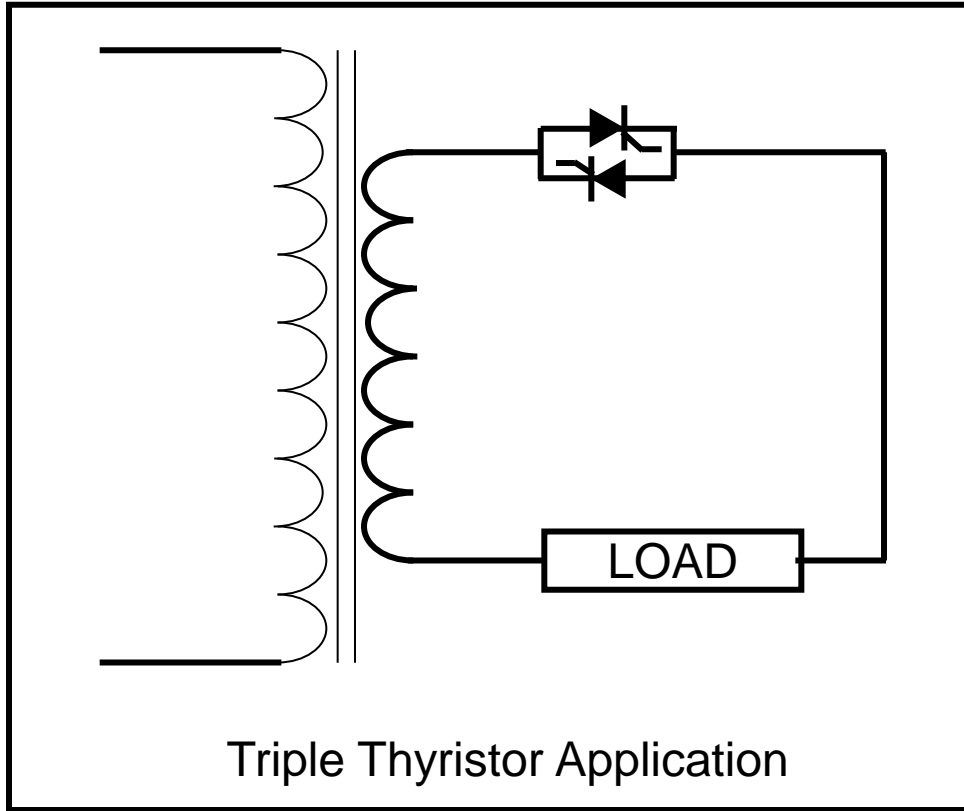
- Poor power factor
- Harmonic distortion

Power factor improvement

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

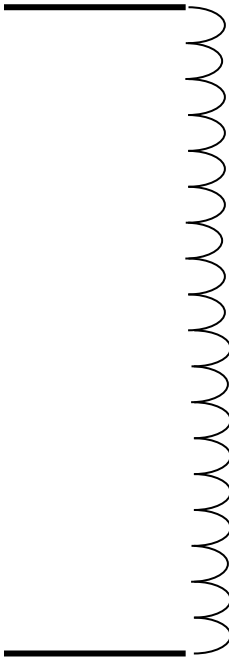
- Load tap changing
- Full cycle firing

PF improvement for Phase angle firing by Load Tap Changing

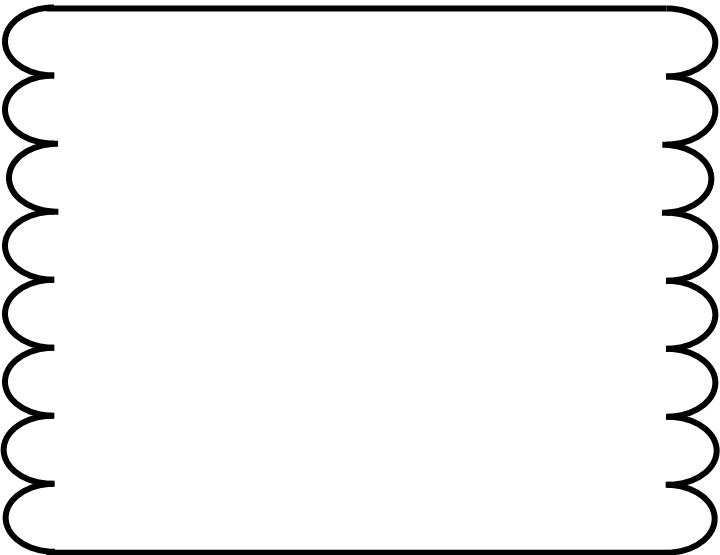


IMPROVED

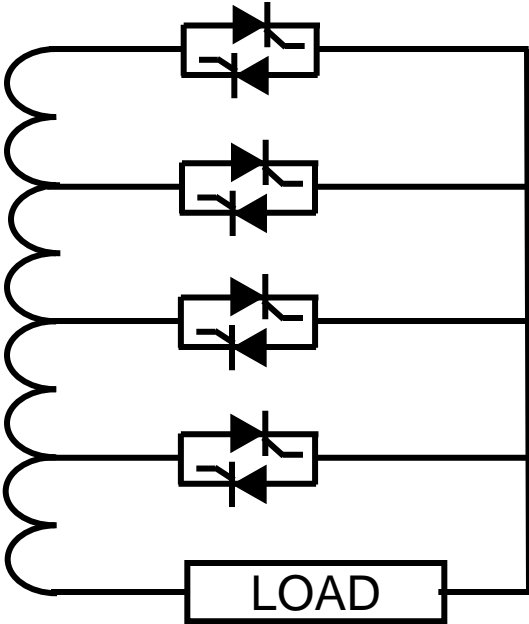
STEP DOWN TRANSFORMER



WC TRANSFORMER



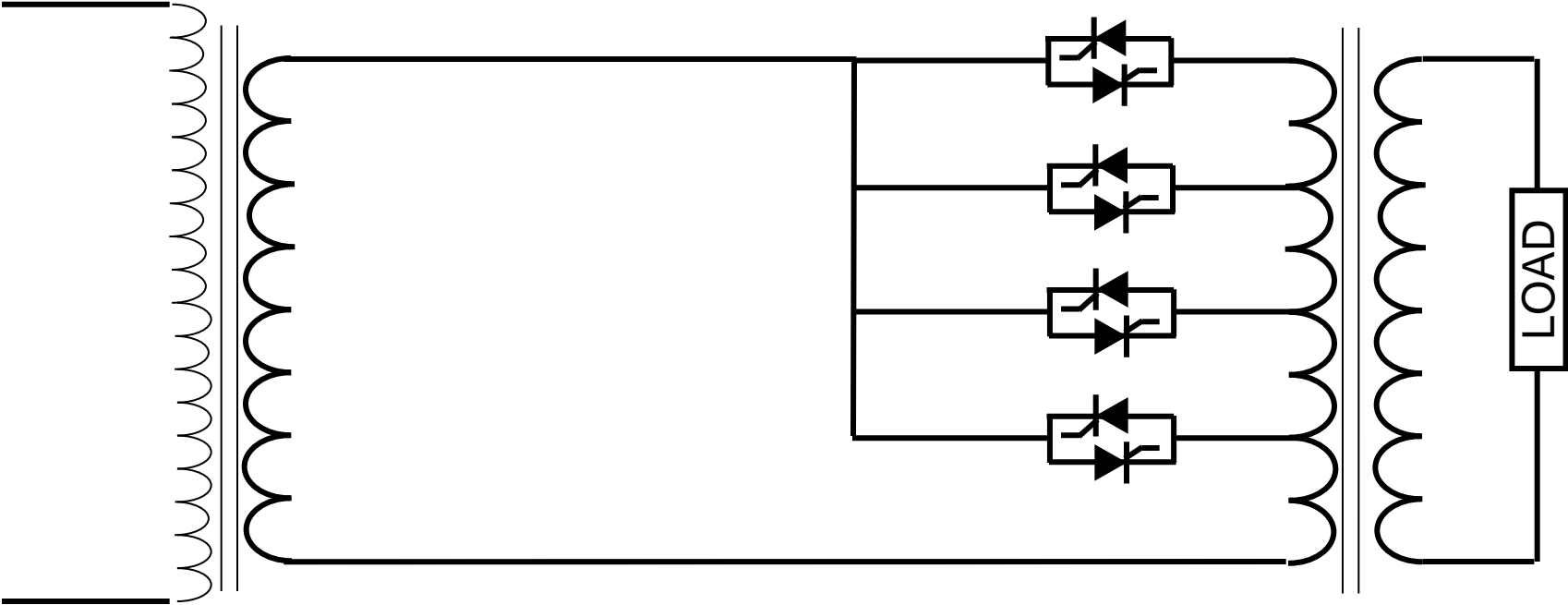
EUROTHERM SYSTEM



STEP DOWN TRANSFORMER

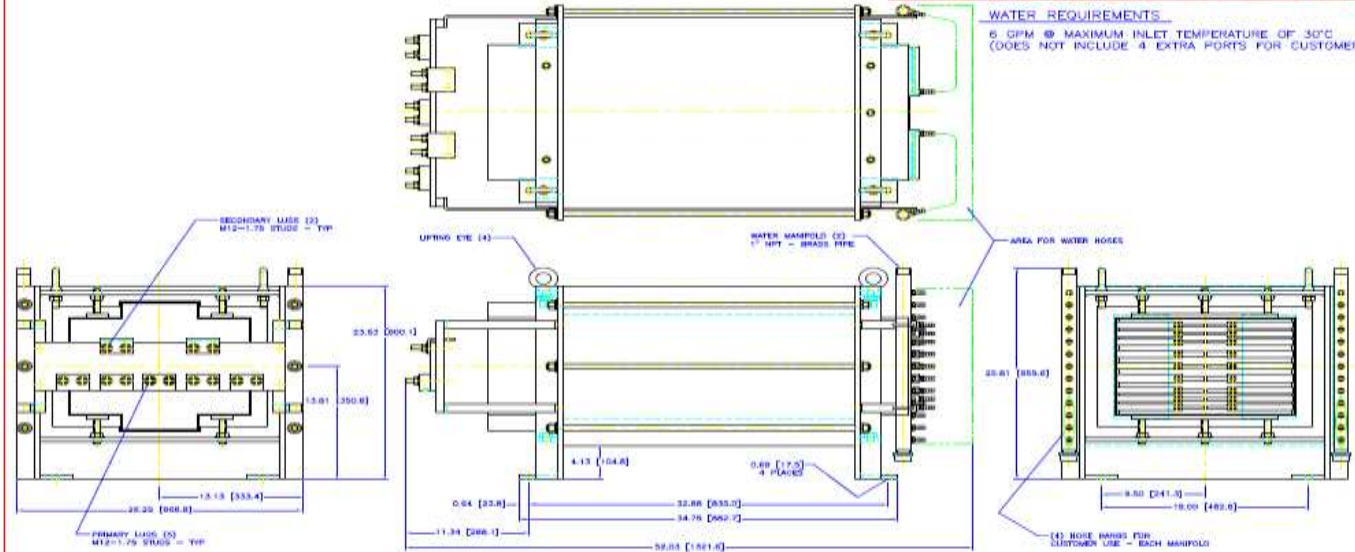
EUROTHERM SYSTEM

WC TRANSFORMER



| TAP | PRIMARY TURNS | SECONDARY TURNS | SECONDARY VOLTAGE | PRIMARY CURRENT | SECONDARY CURRENT | KVA PRIMARY | KVA SECONDARY |
|-----|---------------|-----------------|-------------------|-----------------|-------------------|-------------|---------------|
| 1 | 33 | 7 | 312 | 848 | 4000 | 848 | 848 |
| 2 | 33 | 10 | 303 | 1212 | 4000 | 1212 | 1212 |
| 3 | 33 | 14 | 294 | 1188 | 2824 | 1188 | 1188 |
| 4 | 33 | 20 | 266 | 1212 | 2000 | 1212 | 1212 |

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

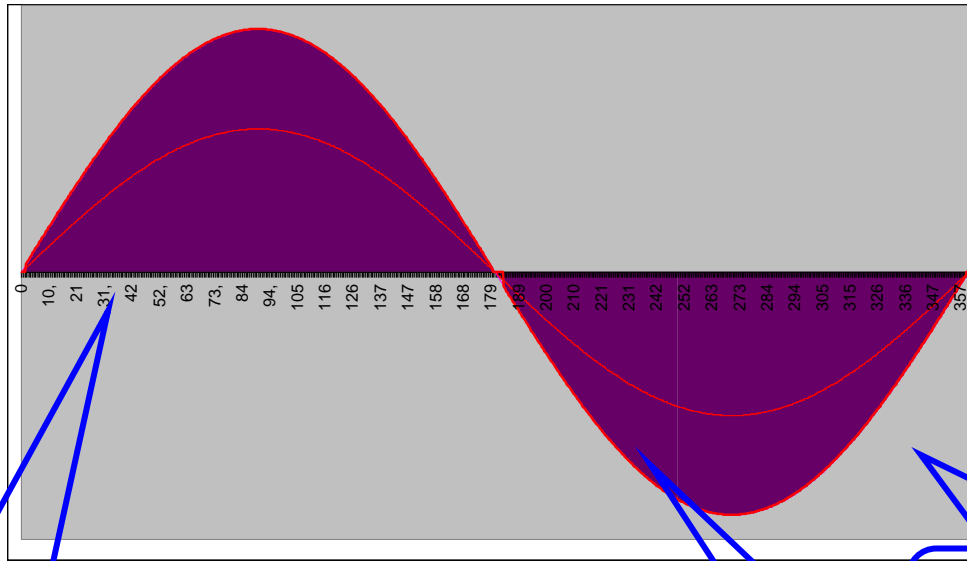


CONCEPT DRAWING
 NOTE:
 THIS IS A CONCEPT DRAWING ONLY.
 DIMENSIONS ARE APPROXIMATE. FINAL
 DESIGN MAY CHANGE AS PROJECT PROGRESSES.

NOTE:
 DIMENSIONS = INCH [MM]

APPROVED BY: _____
 DATE: _____

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Load Tap Changing gives us a more complete energy sine wave

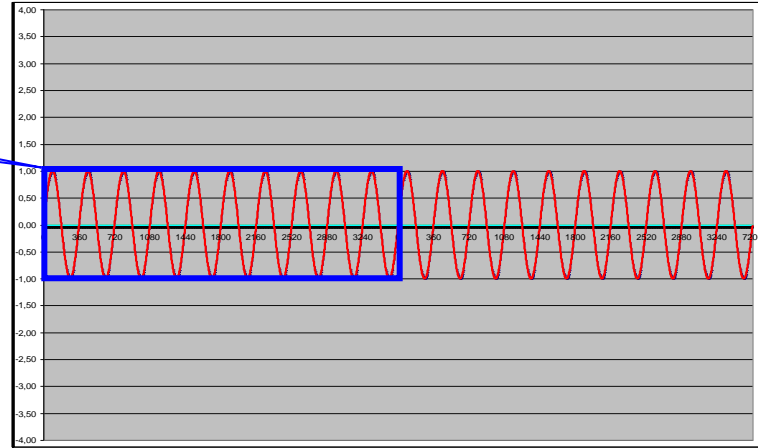


And reduces harmonic distortion

That is why Load Tap Changing Improves Power Factor

Full cycle firing

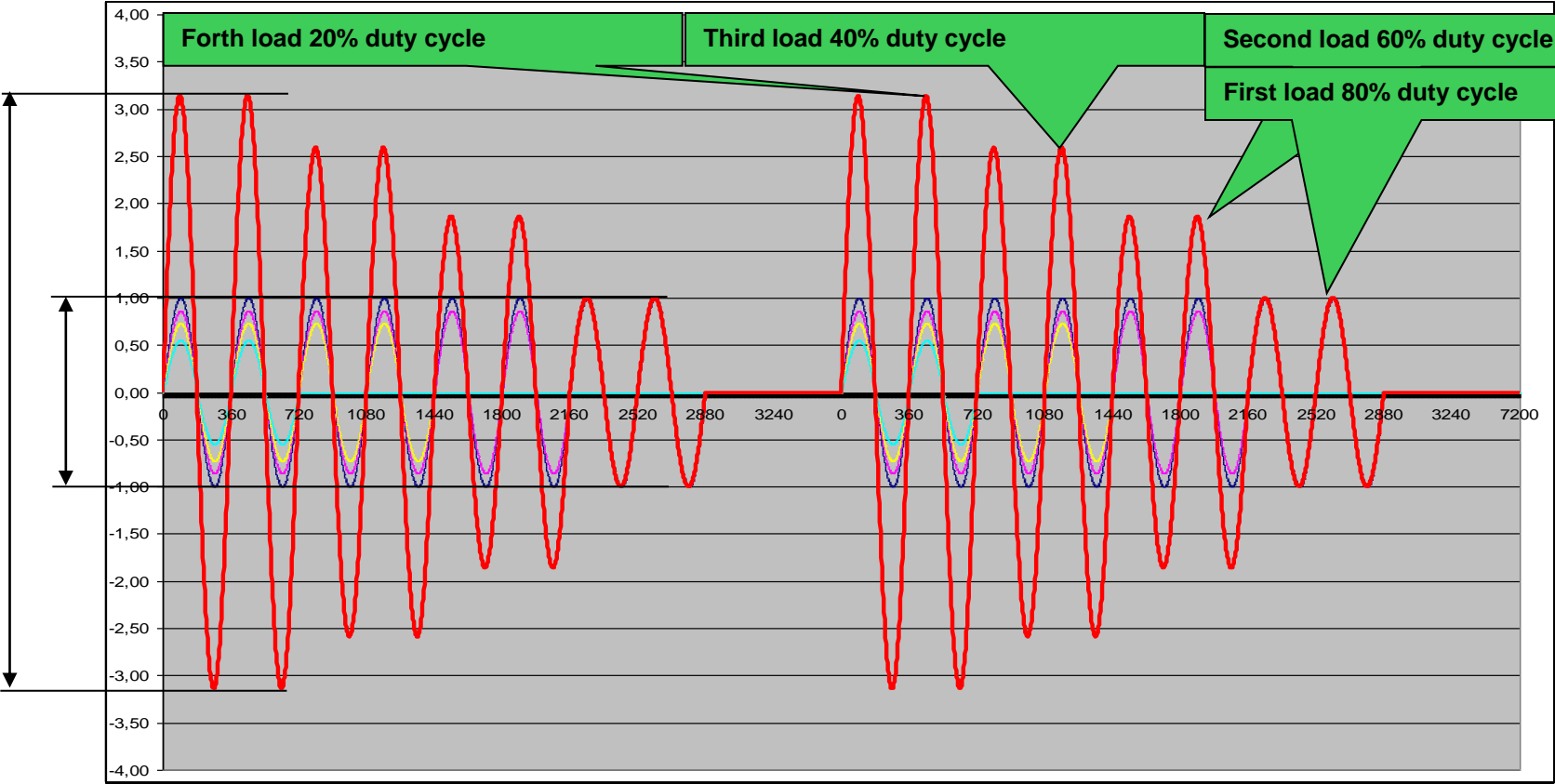
DUTY CYCLE



AVERAGE POWER
DURING DUTY CYCLE

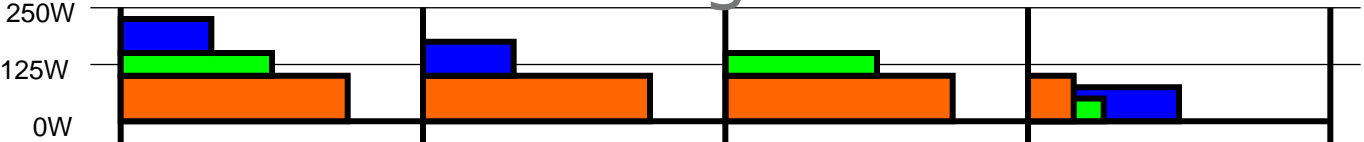


Peak power demand in a full cycle multiple load situation

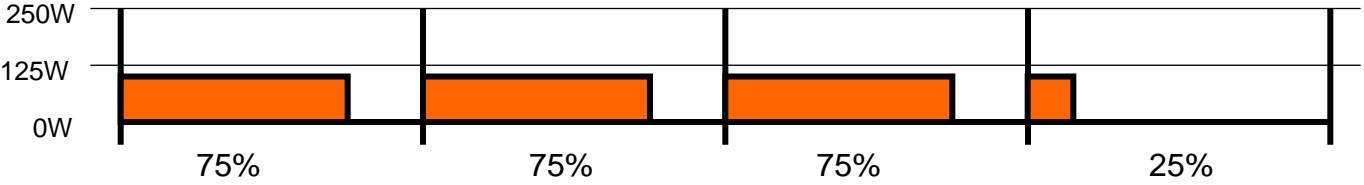


Without Predictive Load Management

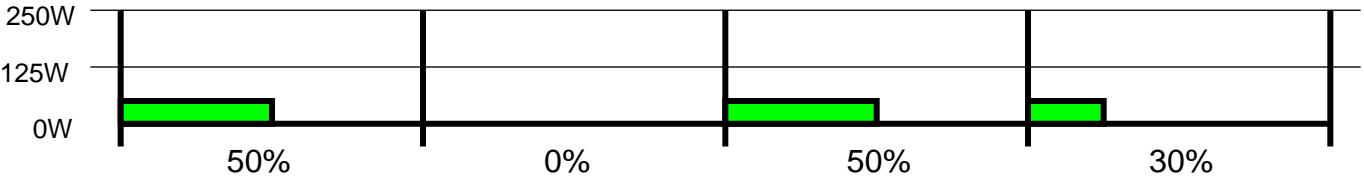
Total power



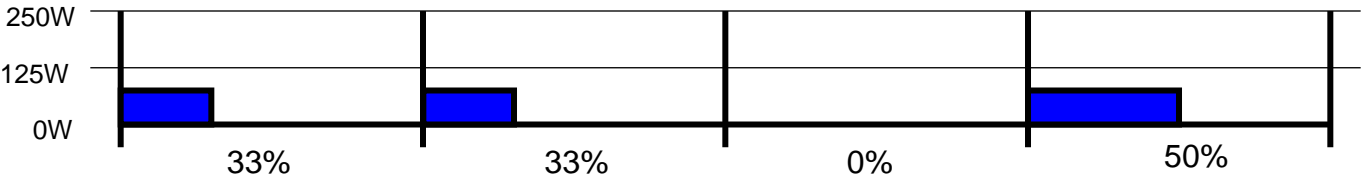
100 W



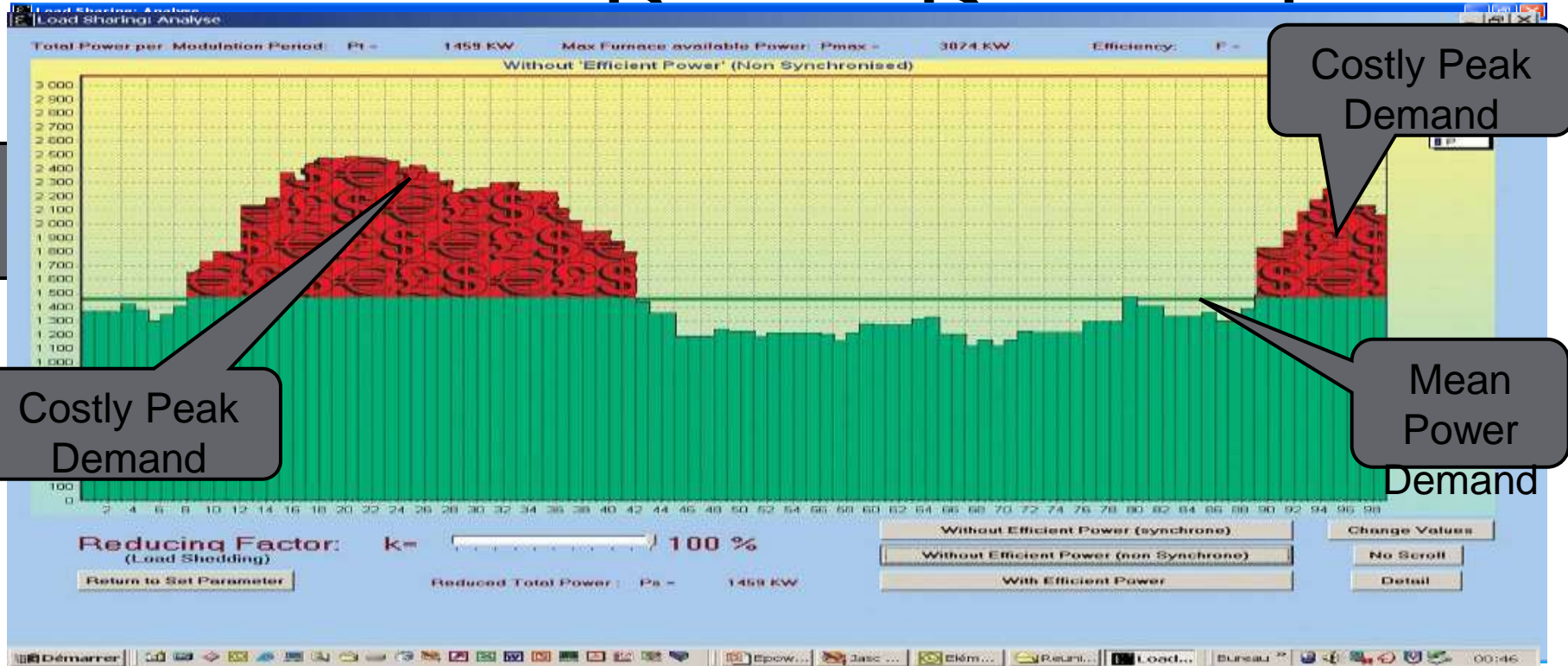
50 W



75 W

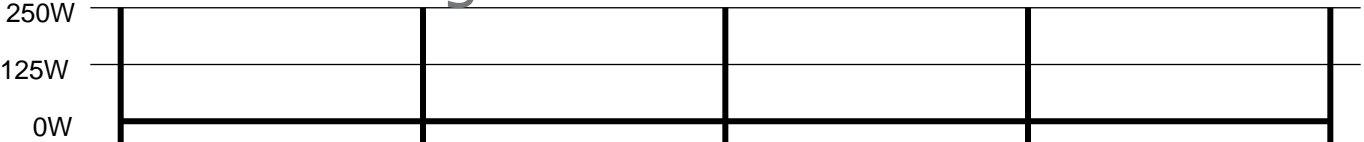


Managing Peak

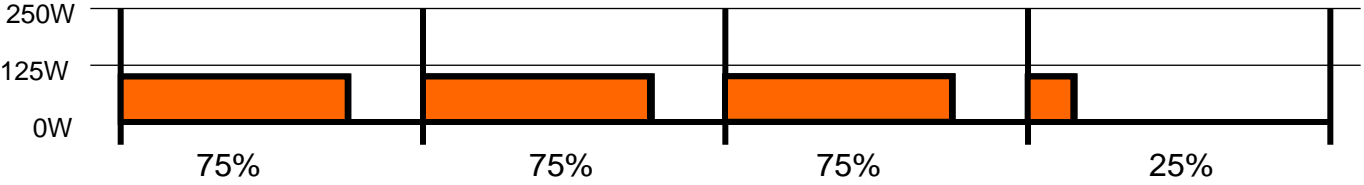


With Predictive Load Management

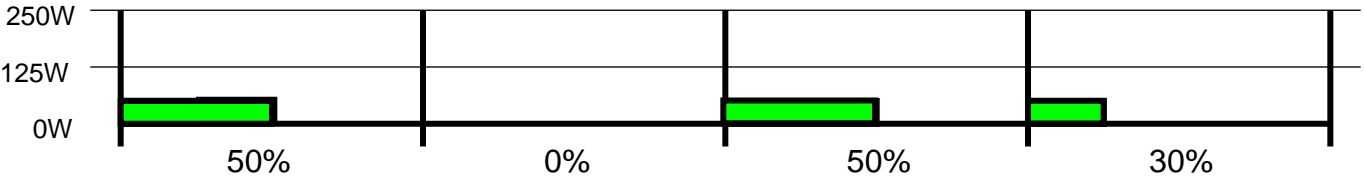
Total power



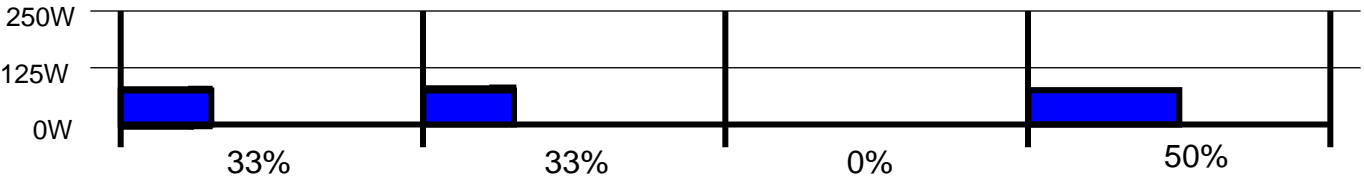
100 W



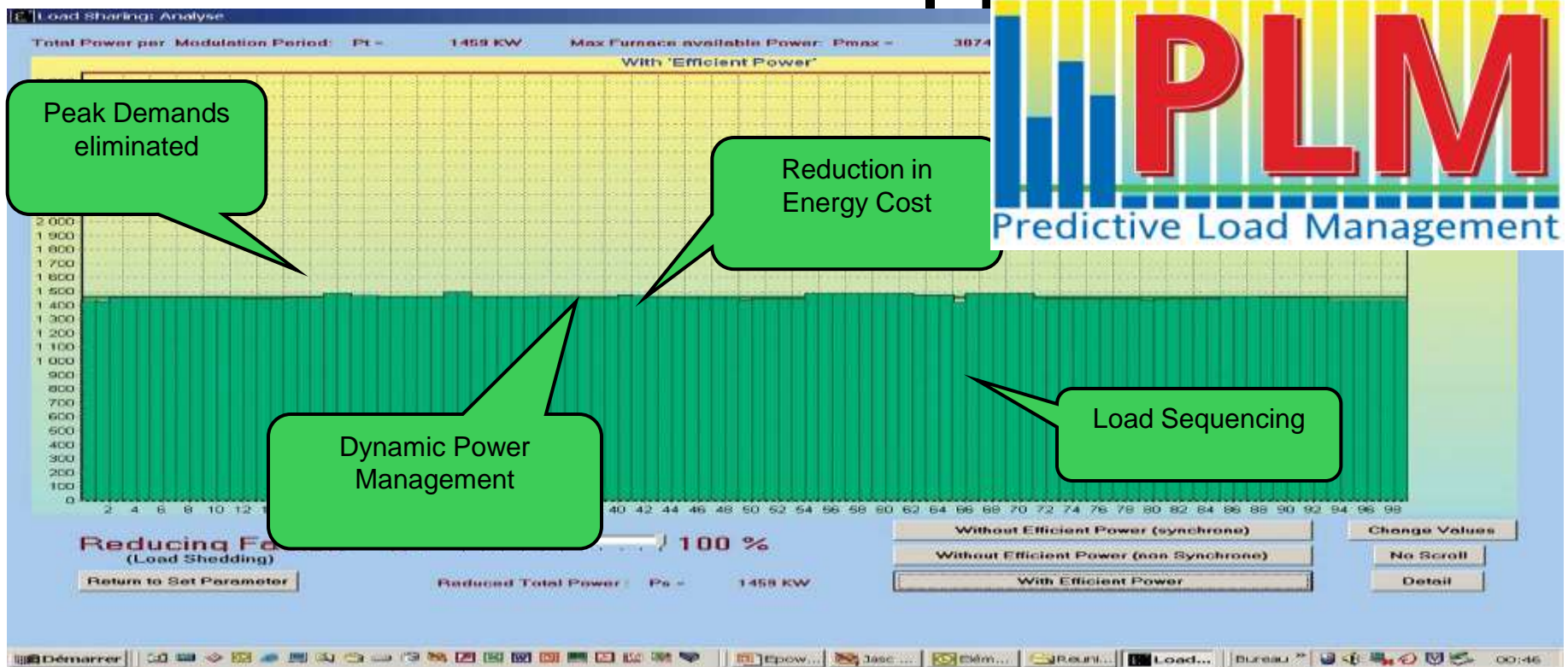
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The efficient solution



...and load shedding

Total power



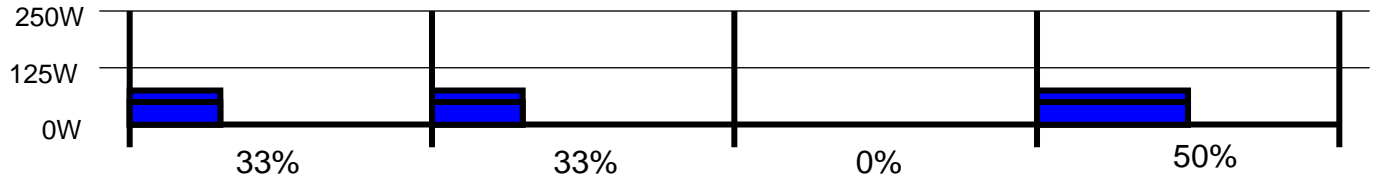
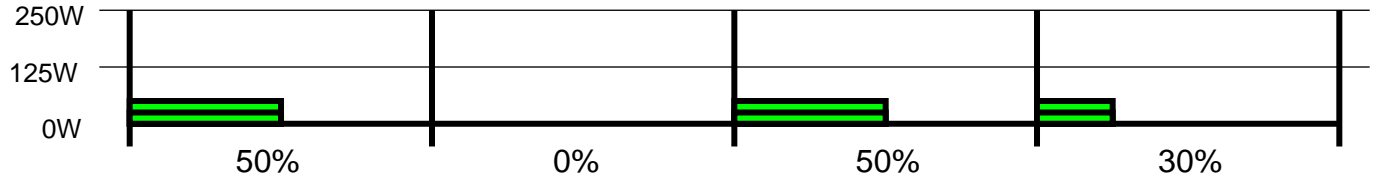
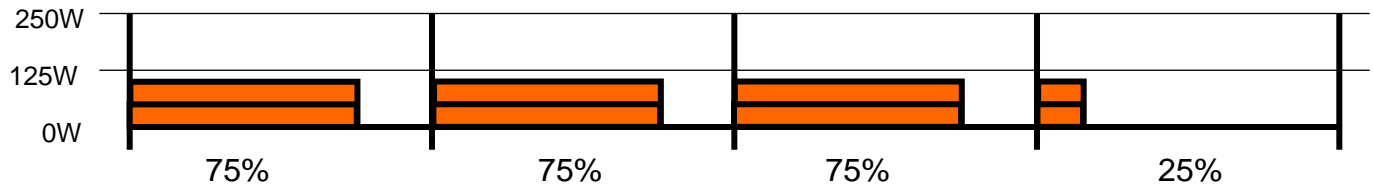
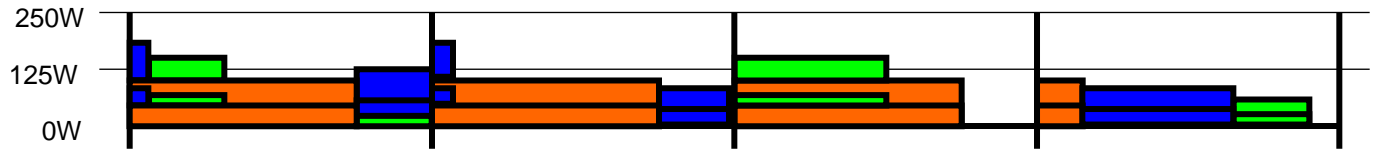
100 W



50 W

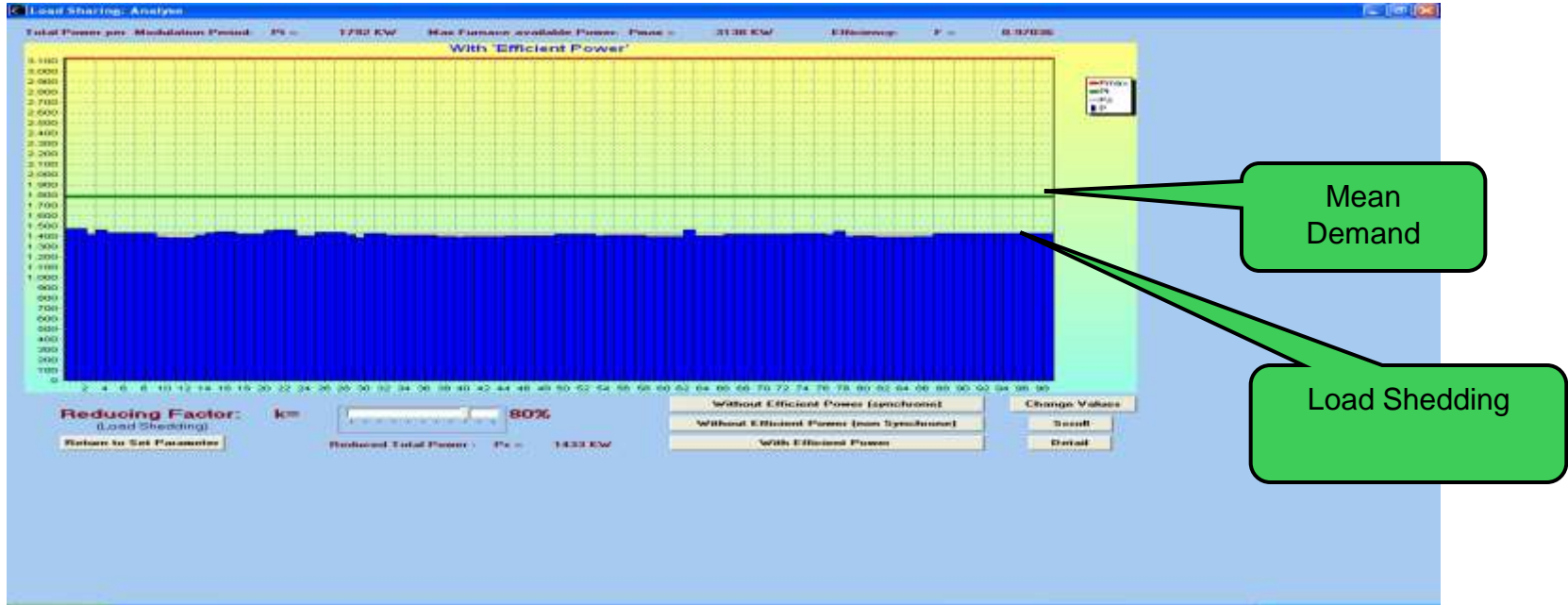


75 W

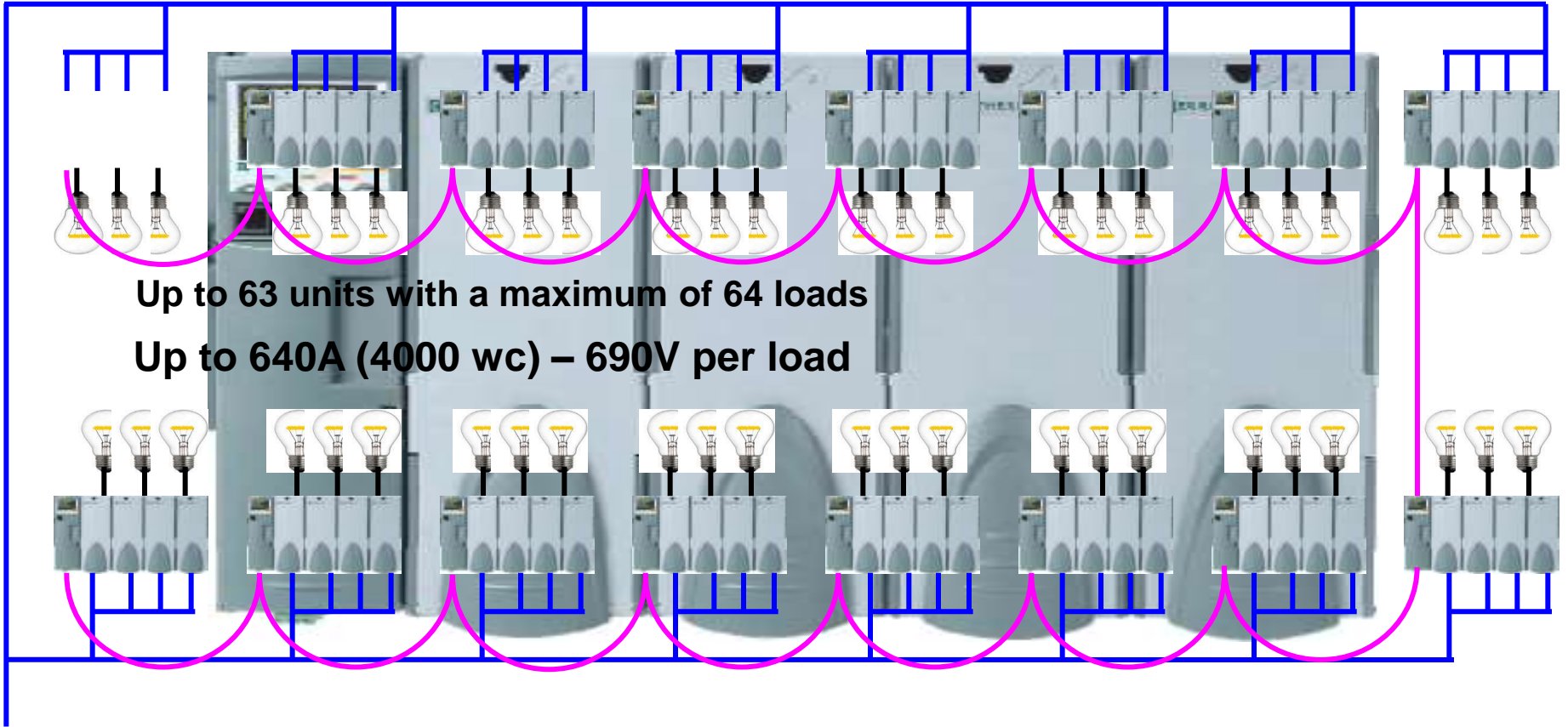


Additional Benefit...

- 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 CO₂ emissions
 - ✓ Possible ROI <12 months





Questions?

A man with glasses on his head, wearing a light purple shirt, is smiling and looking towards the left. He is sitting at a desk with a laptop in front of him. In the background, there is a blue file cabinet and some office supplies. The text "THANK YOU." is overlaid in the center of the image.

THANK YOU.

Life Is On

Schneider
Electric