

Reinhold Environmental Ltd.



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Switch Mode Technology

Presented By

NWL

Joseph Manna



What is a Switch Mode Power Supply

- Three Phase
- High Frequency
- Spark Regulated
- DSP
- Power System



NWL/PowerPlus

Alstom/S.I.R.



What is a Switch Mode Power Supply

“IGBT”

Insulated Gate Bipolar Transistor



Comparison

PARAMETER	SMPS 70	CONVENTIONAL T/R SYSTEM
kVdc	70	60
mAdc	1000	1000
Output kW	70	60
% Ripple kV p-p	3 – 5	35-45
Peak kV (Open Circuit)	77 kV	100.8
Input Vac	480	480
Number of phases	3	1
I line (AAC)	94	186
Losses (kW)	3.6	3.3
Power Factor	.94	.63
Input kVA (Iff = 1.2)	78.3	89.3
Operating frequency	25 kHz	60 Hz
EMI filter	Yes	No
Arc shutdown time	30 usec	8.33 msec
Cooling	Forced Air (1/2 HP fan)	Natural Convection
Max. 24 hr. Ambient Temp. (deg C) (Max = 50 deg C for 4 hr.)	40	40
System Volume envelope (cubic feet)	24.8	65
System Plan envelope (square feet)	9.9	21
System Weight (lb.)	1000	3750
Gallons of fluid	29	125

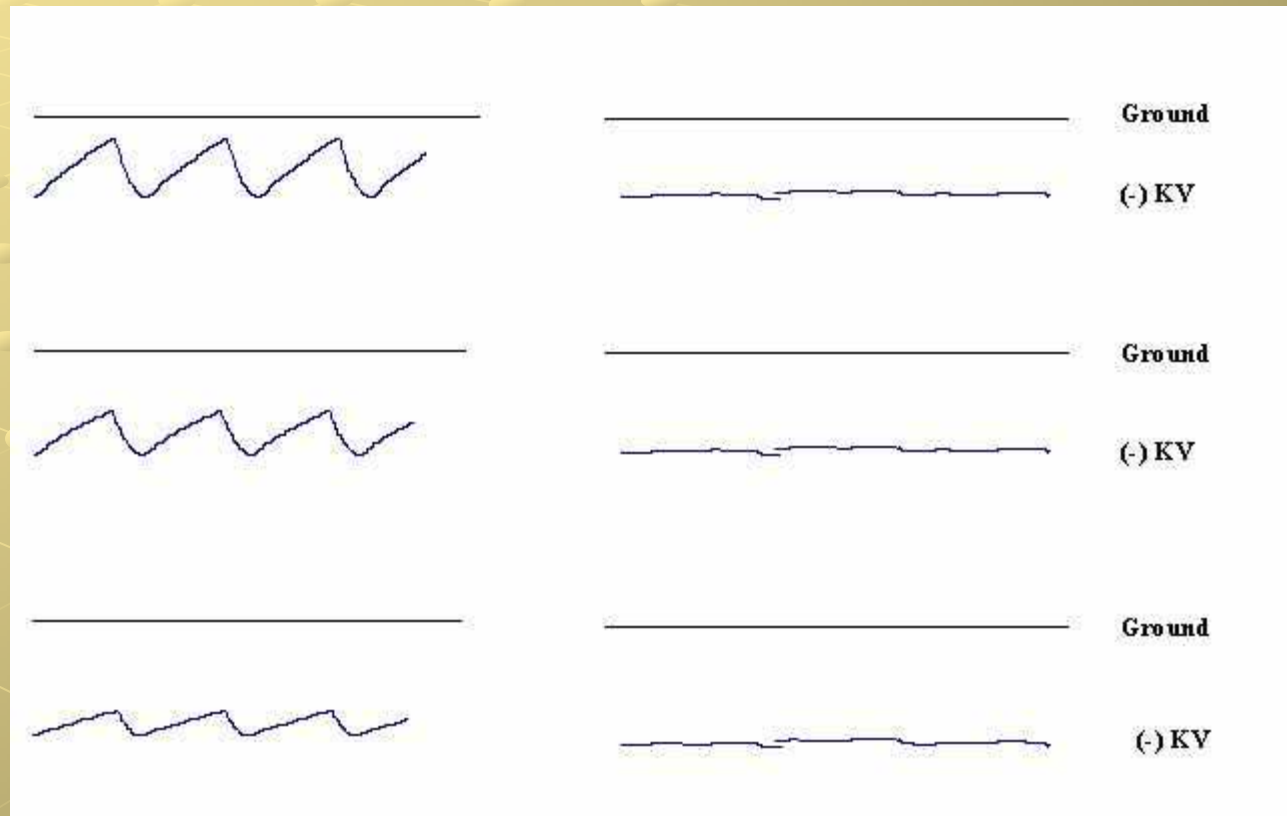


Comparison of kV Output Waveforms

Increasing
Output

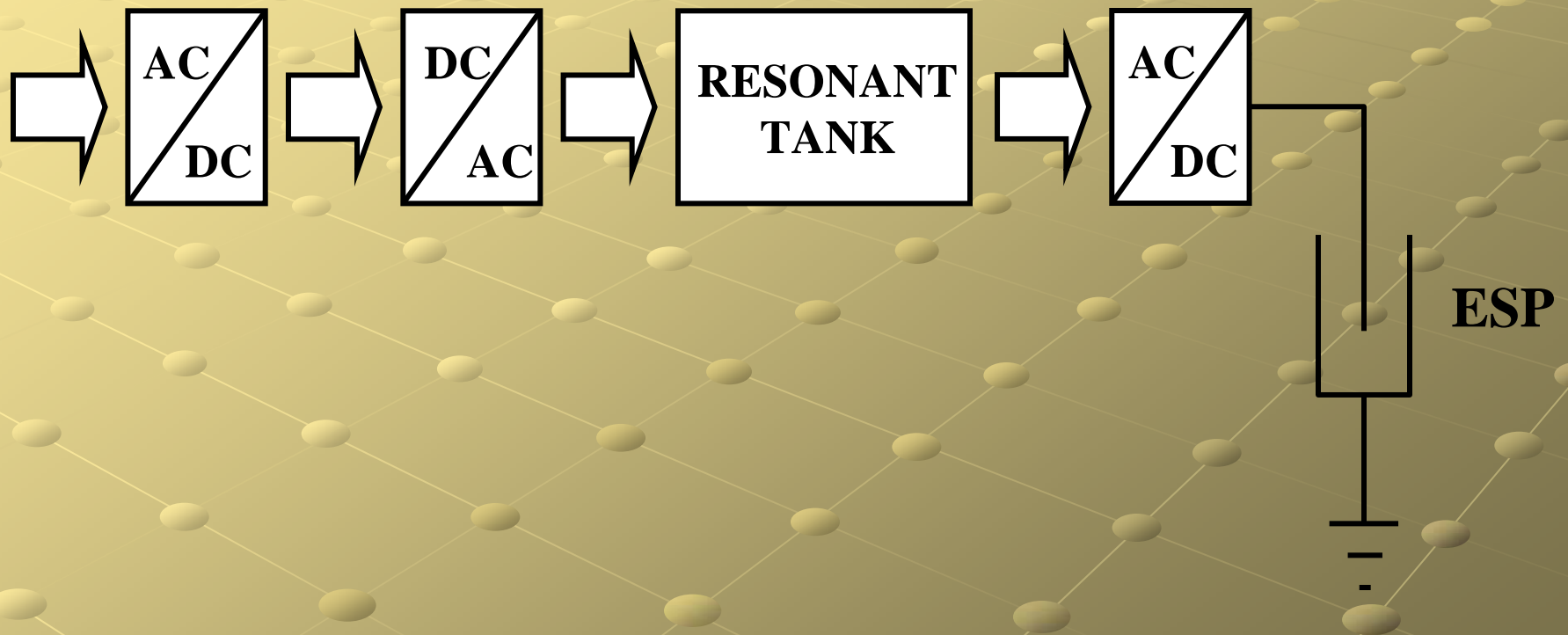
Conventional T/R

SMPS

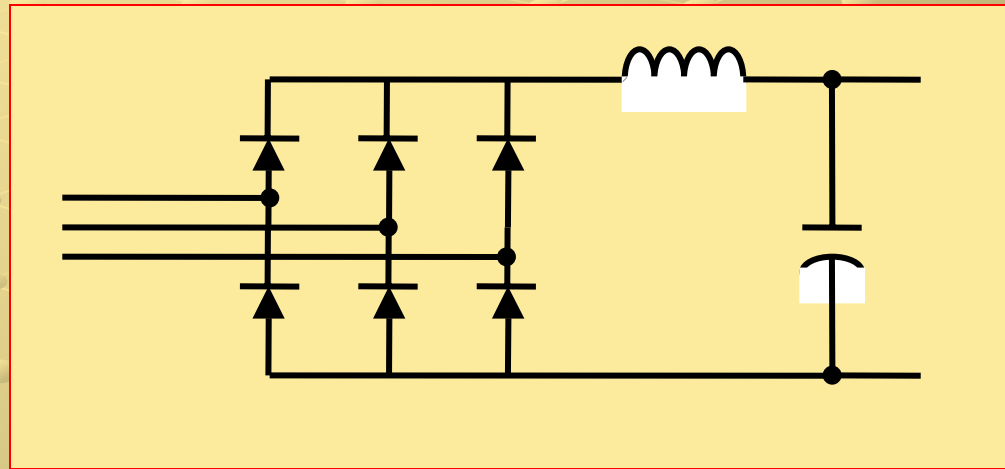


HOW DOES IT WORK

Block Diagram of Switchmode Resonant Power Supply



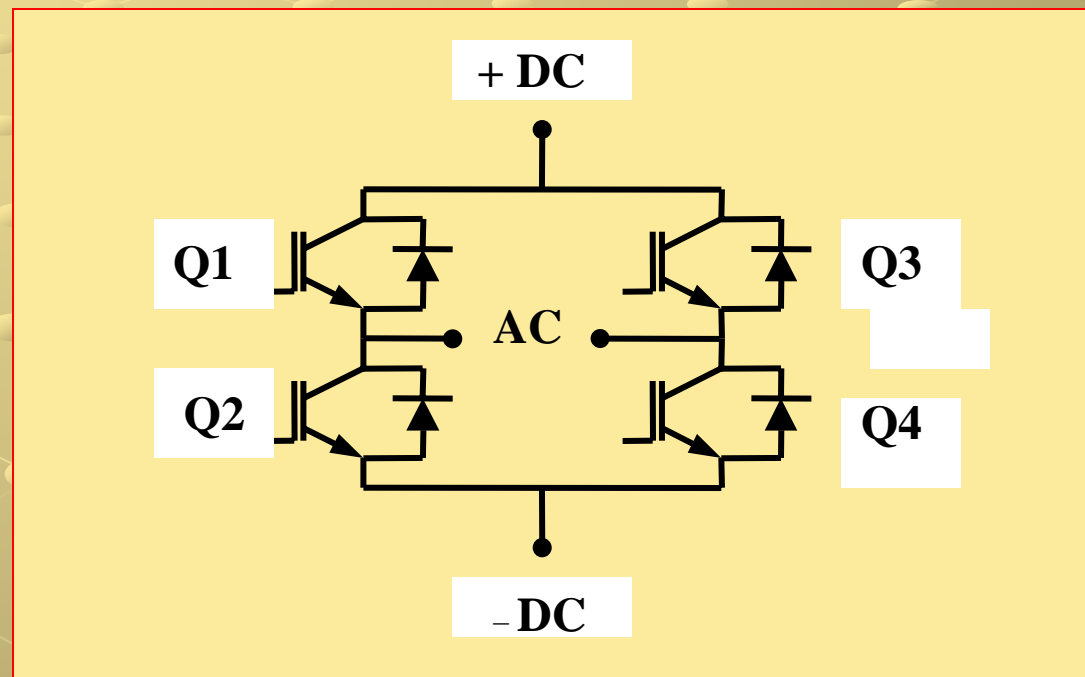
Low Voltage AC/DC Block



Three Phase Rectifier Bridge and Filter



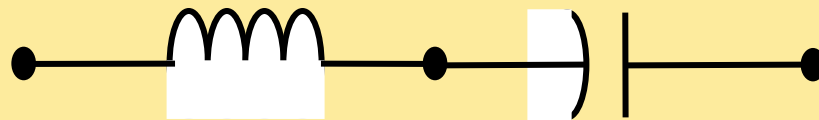
High Frequency DC/AC Block



IGBT Full Bridge



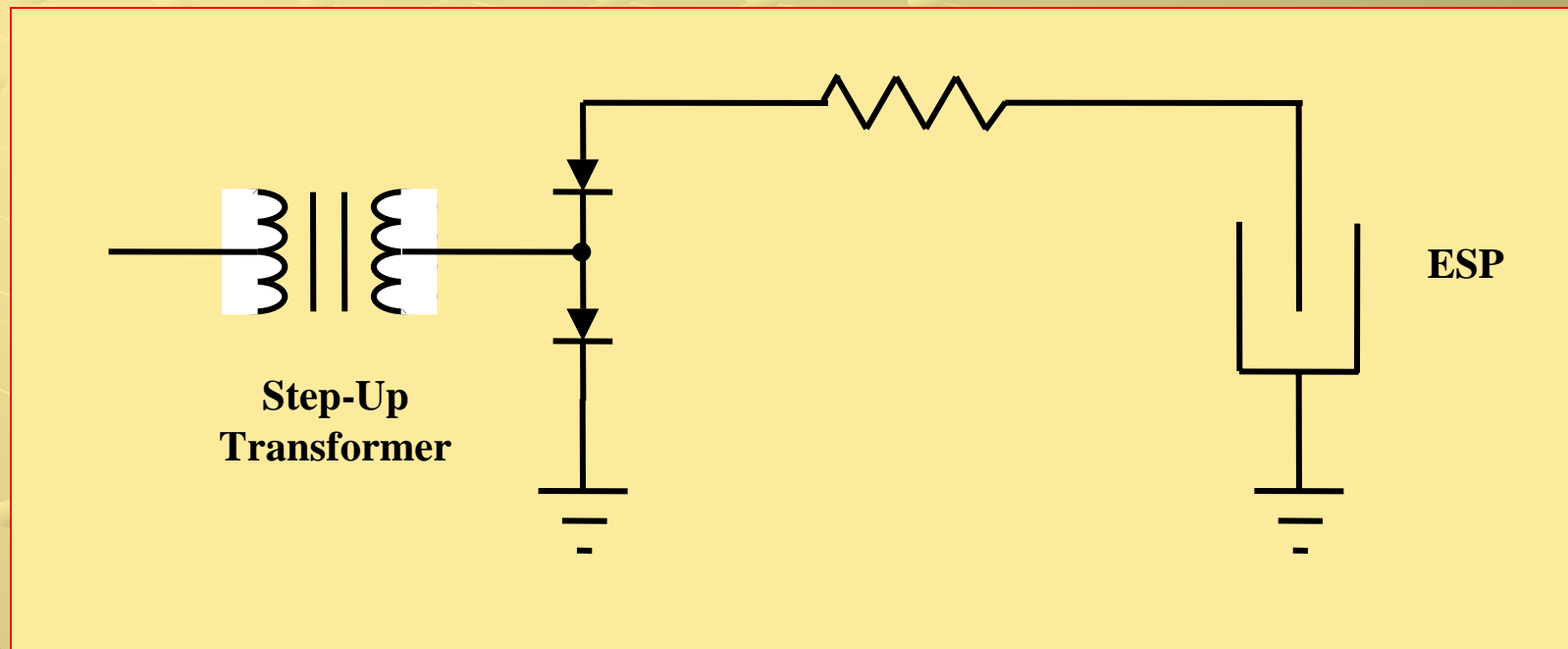
Series Resonant Tank Block



LC Resonant Circuit



High Voltage AC/DC Block



HOW DOES IT DIFFER

- High Frequency
- Smaller Transformer
- Less Cooling Fluid
- Integrated Package
- Faster Response Time
- New Control Algorithms



SMPS in IE Mode

3-7 SMPS

IE Mode

1ms On

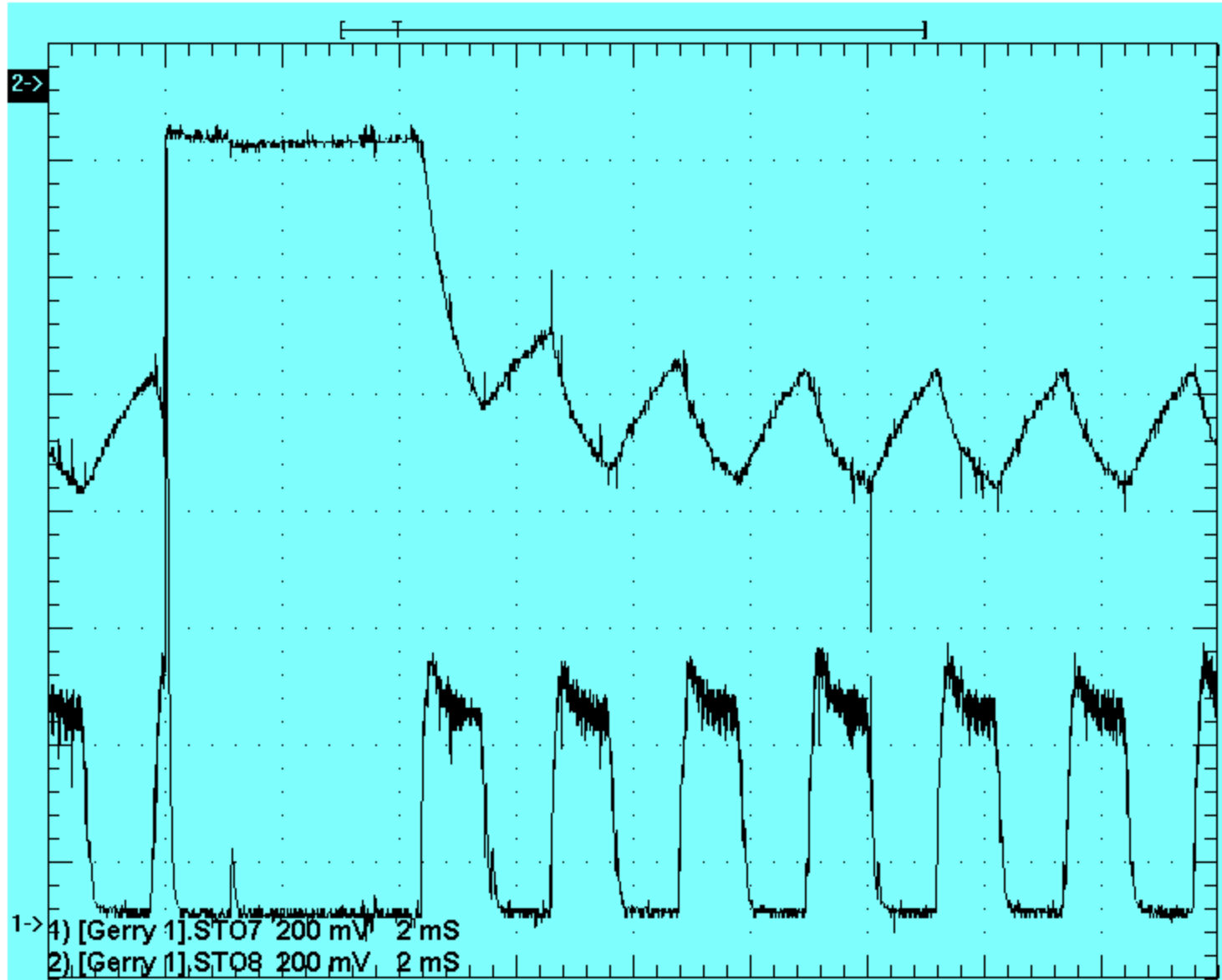
Time / 0.2ms

Off Time

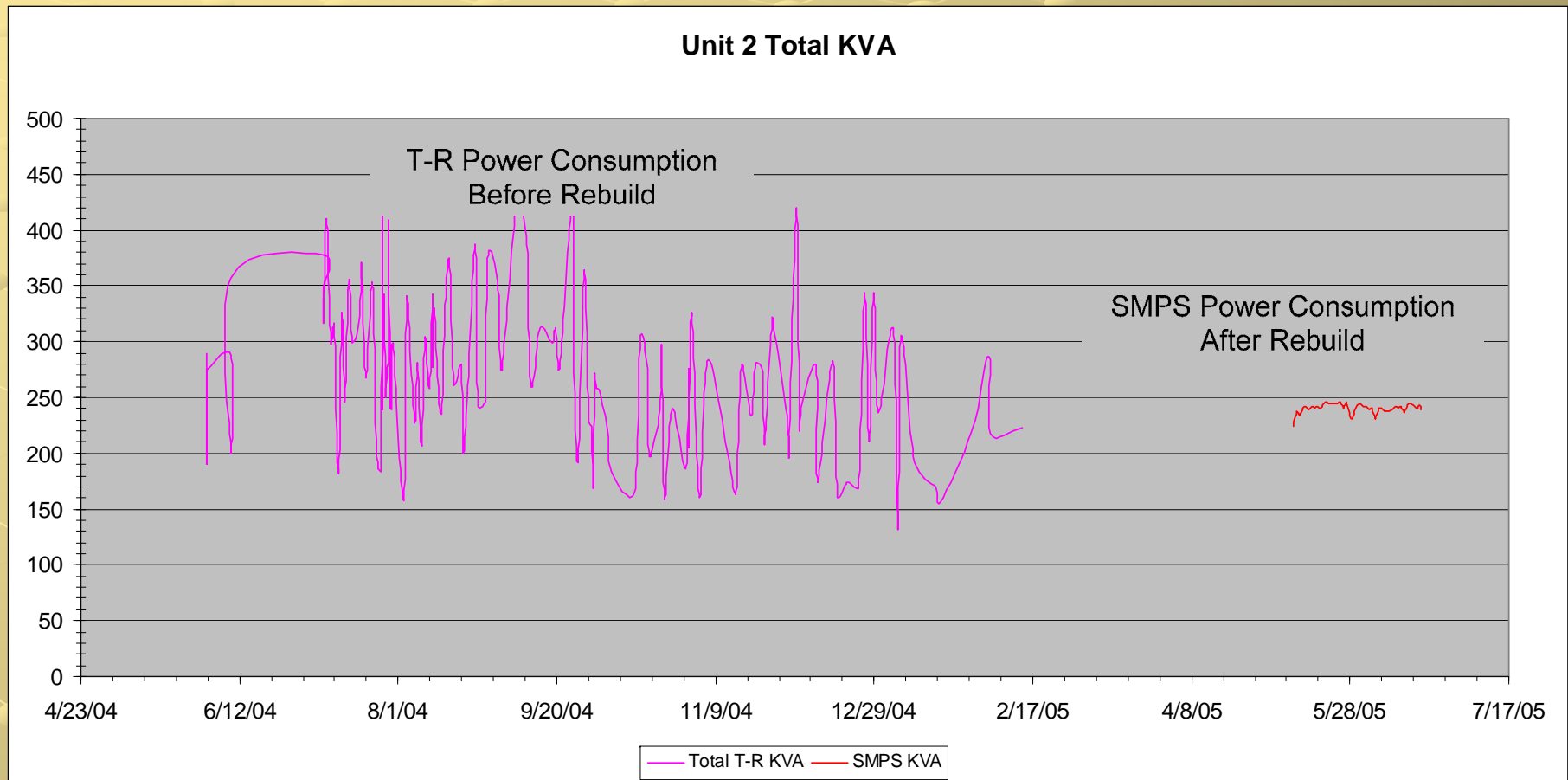
/ 4ms

Quench

With Spark



Gulf Power Plant Lansing Smith Before and After SMPS'



Operational Benefits

- 1. Improved peak to average output ratio. thereby supplying more power into the ESP.**
- 2. Flexibility of output voltage waveform, fast arc sensing and recovery, arc shutdown.**
- 3. Higher power factor.**
- 4. Improved Intermittent Energization**



ADVANTAGES

- Reduced Ripple
- Higher Power Factor
- Integrated Package
- Faster Control Response
- Standard Designs
- Easier to Service
- Lower Installation Cost
- Cleaner, Neater, Installation



Considerations

- Field Wiring
- Current Output
- Expensive as an Add On



RELIABILITY

- Site Specific Problems
- MTBF 16-17 Years



WHO'S ON BOARD

- Power Plants
- Pulp & Paper
- WESP'S
- CEMENT
- INDUSTRIAL



WHY CONSIDER SWITCH MODE TECHNOLOGY

- Marginal Precips
- Rebuilds
- New Precips
- Resistivity Range



IF YOU ARE CONSIDERING MAKING THE SWITCH

Consider an “Independent” Consultant



Summary

- **In DC mode, the SMPS units have the best power factor and put the most kW into the ESP.**
- **New insights were gained when in the IE mode while in high frequency operation. Under specific settings, higher peak spark over voltages were achieved.**



Conclusion

Improves the peak to average output ratio, thereby supplying more power into the ESP.

Better power factor. (.94 vs. .63)

Requires less input KVA to get the same output power.

Provides faster arc shutdown - 30 μ sec

Intermittent Energization can be set in shorter & more precise increments than with conventional T/R solution

May bring marginal precipitators back into compliance



NWL

THANKS YOU

