PPST SOLUTIONS

APPLICATION NOTE

Regenerative DC Load Cost Savings for DC Power Product Test and Burn-in

1.0 Introduction

Loads are generally required to develop and test any power supply to ensure its ability to deliver full power under all kinds of load conditions. For small power supplies, the amount of energy spent to test using any type of load is relatively small so energy costs are minimal. However, for high power products, the amount of energy used to develop and test power supplies can be significant.

When using passive loads or conventional electronic loads for this purpose, the amount of energy consumed can quickly add up as all of it is converted to heat and exhausted into the environment. This often requires larger HVAC systems to handle this excess heat driving up utility bills even further. With some utilities charging as much as $0.50 per kWh, these and the associated HVAC cooling costs can add up quickly.

2.0 Energy Recycling

To overcome these inefficient and environmentally unfriendly conditions, manufacturers of electronic loads like Cinergia and Adaptive Power Systems have developed AC and DC loads that return this test energy back to the grid, thus greatly reducing the amount of energy consumed. These grid-tied loads operate in a similar manner to PV solar inverters used to generate power by taking the energy from the unit under test and recycling this energy back on the power grid. Since the same grid connection is typically used to power the same equipment being tested, the net power draw from the utility is reduced to less than 20% of what otherwise would be required.

Not only does this save on utility bills, it also allows much larger power supply systems to be tested with only a small size grid power feed than would otherwise be possible. For example, testing a 100kW UPS powered from a 480Vac 3-phase grid connection would require a 120A grid service. Using a regenerative AC load would reduce this requirement to only a 25A grid service which is far less costly to install. Conversely, the same test lab that is already in existence can be used to test power equipment that is 5 to 7 times larger than what the lab was originally designed to support. We'll explore this later in section 4.0.

This energy-recycling concept is illustrated in Figure 1.

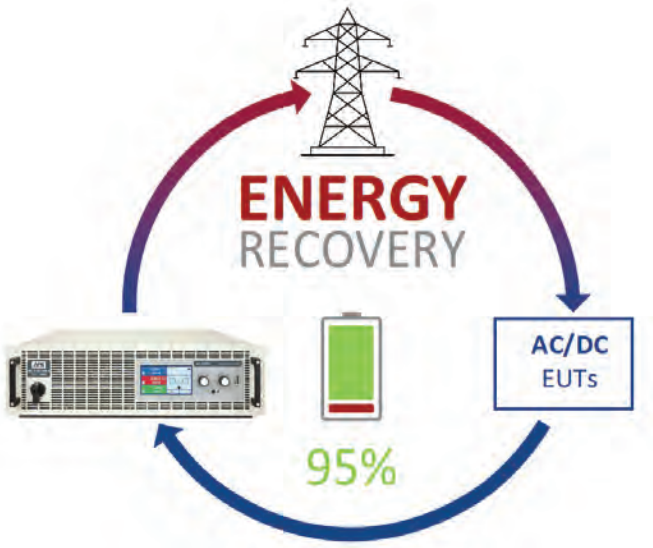

Figure 1: Energy Recovery back to Grid

3.0 DC Power Supply Burn-in Case Study

Let us look at an example where a number of AC/DC Telecom supplies are burned in for a 24-hour period. Each day, a new group of 10 supplies are put on burn-in. Each supply is 15kW so 10 units x 15kW x 24 hours = 3600 kWh per day of energy is required. At a conservative utility rate of $ 0.25 / kWh, the utility bill would be $900 a day.

For a five-day workweek, this amounts to $ 4500 a week in energy costs. On an annual basis, energy cost will be 52 x $ 4500 = $ 234,000.

Assuming an EUT is 90% efficient and a regenerative load is 92.5% efficient, then net overall system efficiency calculates to 83.3% of the rating of the EUT. If the ten existing passive loads are replaced with APS 6RL regenerative DC Loads (see Figure 2), energy cost would be reduced by 85.5% or an annual savings of $ 194,805. This would cover the capital cost of the ten electronic DC loads in less than one year at which point annual cost savings of $ 194,705 are realized.

See the worksheet below (Table 1) for reference. Alternate values for local electricity rates and EUT related can be entered easily in a spreadsheet (Table 1) to calculate each end user's cost savings. Note that the data highlighted in green must be provided by the end-user based on their specific test application.

To request a copy of the Excel worksheet (Table 1), contact PPST Solutions using info@ppstsolutions.com or call toll free: +1 888.239.1619.

Category	Amount/Qty	Units
Burn in Power/unit	15	kW
No. of Units	10	
Total Power	150	kW
Total Hours burn/unit	24	hr
kWh use /day	3600	kWh
Energy Cost ($/kWh)	$0.25	
Energy Cost per day	$900.00	
Energy cost per week	$4,500.00	
Energy cost per year	$234,000.00	
Efficiency EUT	90.0%	
Efficiency 6RL Regen DC Load	92.5%	
Overall Efficiency	83.3%	
Net Energy Cost/Year	$194,805.00	

Table 1: Cost savings worksheet

Note that this analysis does not include additional potential cost savings on HVAC operation, as the burn-in room will require far less air-conditioned cooling.

4.0 Energy Losses and Gains

While the regenerative DC loads used in this case study greatly reduce the amount of wasted energy, some energy is still being consumed by both the equipment under test (EUT) as well as the DC Load itself. Either piece of equipment would have to be 100% efficient to avoid this which is of course impossible.

This is illustrated in Figure 2 below. It shows the AC input power drawn by the equipment under test from the grid. Some of this energy is lost in the form of radiated heat (represented by the red squiggly arrows).

The rest is converted to the intended DC output power. Assuming the EUT is 90% efficient - which is quite realistic for a modern AC/DC power supply design - the remaining power to the DC load input is 90% of power drawn from the grid.

The DC load will consume some energy of its own to support its internal control circuits and DC/AC grid inverter that connects to the same grid as the EUT. Assuming a typical 92.5% overall efficiency of the 6RL Load, about 83.3% of power provided by the grid will be returned (regenerated). This means only 16.7% of rated power of the EUT (equals 2.5kW) is used to perform full power burn in.

This compares favorably to the 15kW + equipment losses that would be needed to run a conventional resistive load based burn-in system.

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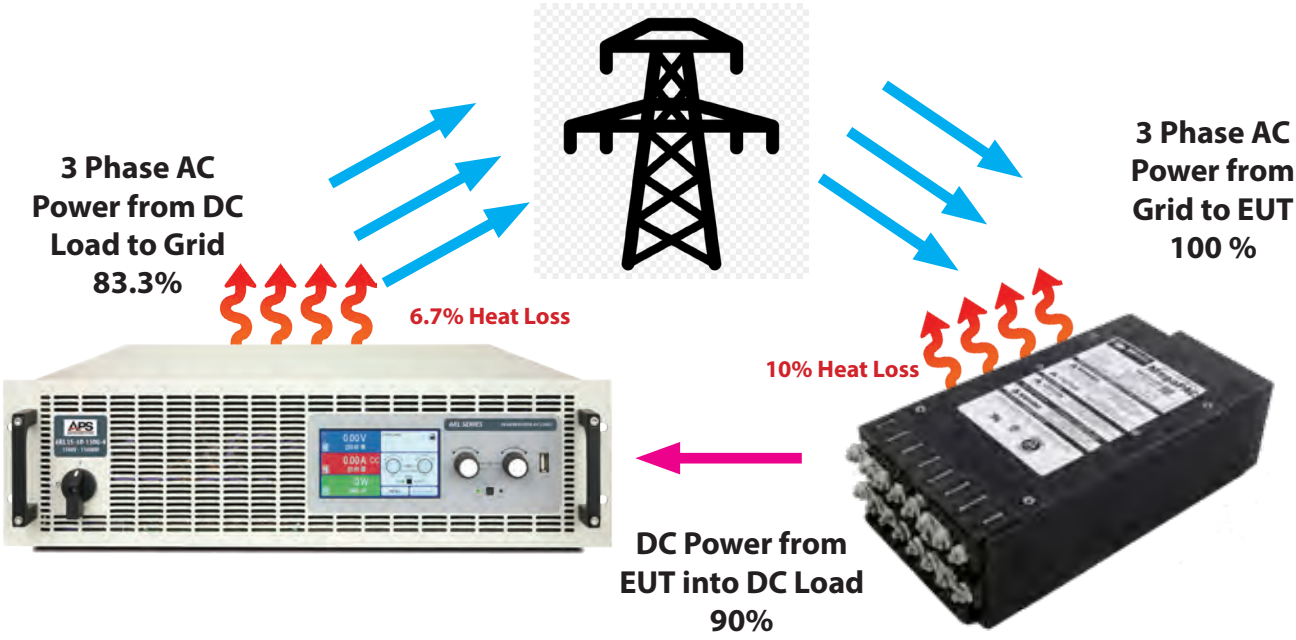

Figure 2: Overview of Sources of Energy Loss and Overall Energy Consumption

5.0 Summary

Energy savings derived from using regenerative DC loads can quickly add up, especially for higher power product testing and/or burn-in applications.

For technical information and overview of available voltage, current and power combinations for 6RL Series DC loads, see the product information page at https://adaptivepower.com/products/ac-dc-loads/6rl-series-re-generative-dc-loads/ or call PPST Solutions toll free at +1 (888) 239-1619.

Figure 3: 6RL15-8-510-4 Regenerative DC Load

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