Tuesday, June 7, 2011

Power Supply Losses and the Impact of Rising Efficiencies

When comparing two power supply efficiency specifications, for example, one with a 90% efficiency and the other with a 94% efficiency, there is a tendency to think "there's only a 4% difference."

However, reviewing the **wasted power** (as heat) between the two supplies reveals a more dramatic difference.

As a reminder, the formula for the efficiency of a power supply is:

(Output Power ÷ Input Power) x 100 = Efficiency (%)

And the wasted or lost power within a power supply, due to its inefficiencies, is calculated as follows:

(Output Power ÷ Efficiency) - Output Power = Wasted Power (Watts)

A. Let's see what the wasted power or losses would be within a **400W** power supply that is **90%** efficient:

(400W ÷ 0.90) - 400W = **44.4W (wasted power)**

B. Now, let's compare the same **400W** power supply if it's **94%** efficient:

(400W ÷ 0.94) - 400W = **25.5W (wasted power)**

The above calculations (A & B) demonstrate that a 90% efficient power dissipates or wastes an additional 19W internally compared to a 94% efficient unit (44.4W – 25.5W = 18.9W). Imagine that this extra 19-watts is a large power resistor within the power supply, radiating heat and negatively affecting thermal management, component derating, and the resultant MTBF and actual field life for the power supply. The payback for employing high-efficiency power supplies now becomes readily apparent.

Chart 1 below shows the internal power losses (wasted power) versus efficiency for the 400W power supplies described above and for efficiencies between those mentioned. From this chart you can see that if a company claims (exaggerates) a 94% efficiency rating, but in reality only achieves 92% they have to ensure that their internal components can operate correctly with an extra 9.3W of heat dissipation (34.8W – 25.5W = 9.3W). And, as mentioned previously the actual field life of the supply will be compromised.

Chart 1

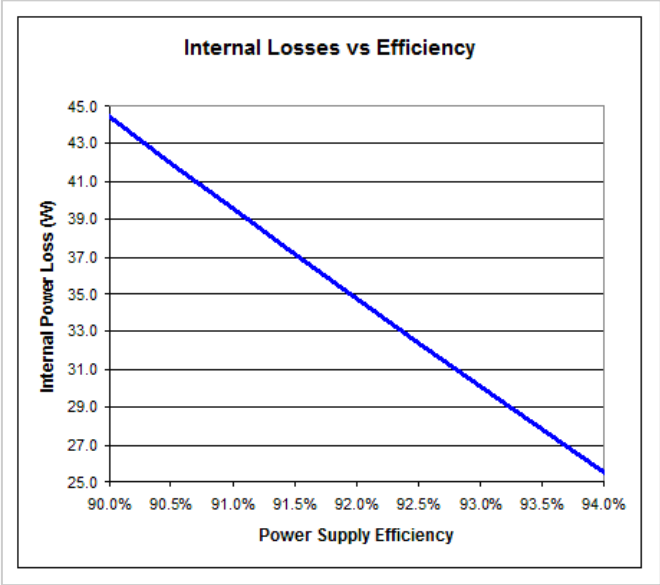
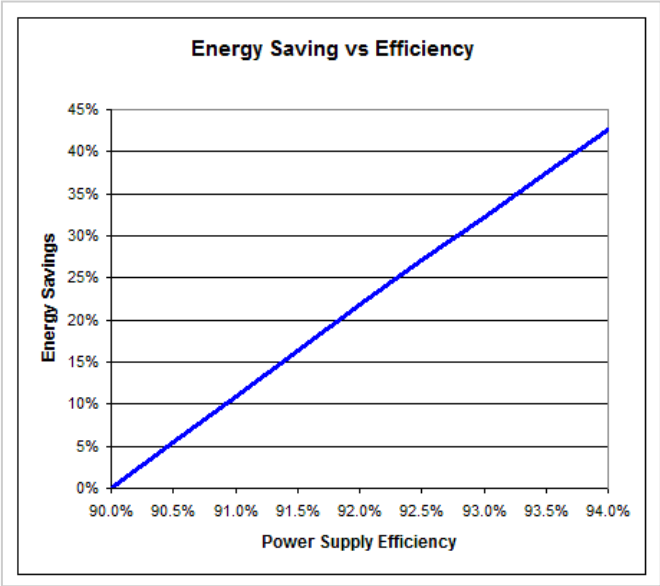


Chart 2 below shows the percentage Energy Savings of a 94% efficient unit compared to a baseline of a 90% efficient unit. By improving the Efficiency by just 4%, it results in nearly a 43% energy savings! The math from above calculations: [1 - (25.5W ÷ 44.4W)] = 42.5%!

Chart 2



The takeaway is, purchase power supplies from a reputable power supply company that employs conservative component deratings and states realistic efficiency ratings.

Posted by Power Guy