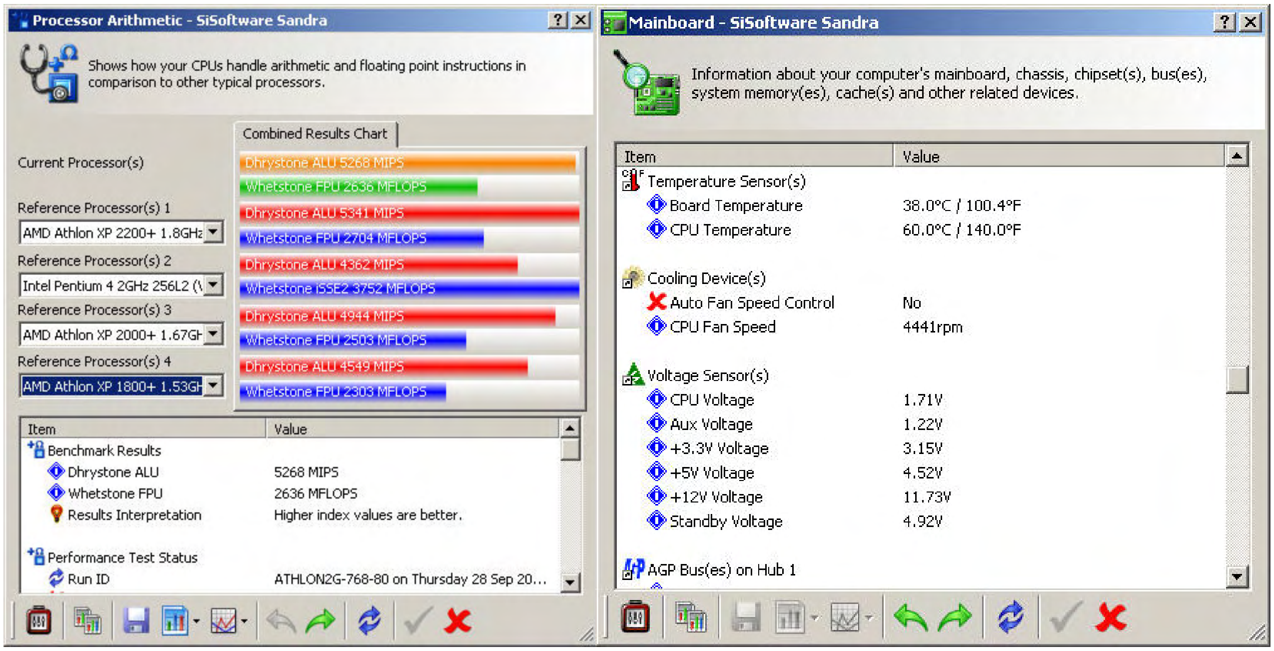
18 October 2006

How much electricity does a computer consume?



What sort of computer did the tests assess? It is a generic computer with an AMD Athlon 2000 CPU, 768MB of memory, a separate or "dedicated" AGP video card, and an 80GB hard drive. The monitor, a 15-inch Sony LCD, is significantly more economical than a CRT ("television-tube") monitor would be.

In other words, it is relatively old technology, mitigated only by a modern LCD monitor. (*Its owner has long since relegated everything except the monitor to "emergency-only" status.*) Nonetheless, it is still representative of much of the technology currently in use. Thus, its use in this experiment is valid.

Two other points are also worth noting, as indicated in this page's illustrations…

- For its age, this is still a relatively fast, electricity-gobbling computer. For example, its "Dhrystone" score (measuring arithmetic operations) is second fastest in its field of contemporaries. Its "Whetstone" score (measuring floating-point operations) is third fastest. Such scores further justify using this machine as a representative sample of computers that are still likely in general use.

- Except for using a Sony LCD monitor, this is an electrically inefficient computer. For example, its CPU (running at 60 degrees Celsius, despite a 4,441-rpm CPU-fan) requires 1.71 volts. In contrast, a 2006-model dual-core AMD Opteron 170 workstation/server runs at roughly the same temperature, with only a 3,000-rpm fan, and uses only 1.35 volts — despite two very fast processor-cores!

Putting it simply, if any computer is going to turn in a bad test score — in terms of electricity consumption — this one surely will. What, though, do the test results reveal?

To review procedures, MTCC 1170 explores these topics in separate articles:

- the UPM Electronic Energy Meter; and,
- the method for causing *Windows XP* to put a computer into "sleep-mode" — reducing electricity consumption, heat-output, **and** monitor-wear.

The adjoining picture shows a UPM Electronic Energy Meter at work. Connected to the meter, via a block-tap, are the test computer and its LCD monitor.

Starting on the bottom-most scale, we see that the attached computer had been operating for slightly more than nine minutes.

This was long enough for the computer to have gone into partial sleep mode. That is, the monitor had shut off, but the hard drive was still spinning. The computer had consumed 0.01 kilowatt-hours and was then running at 119 Watts.

What are the costs of running in sleep-mode — as shown? Assume the computer ran in sleep-mode for 10 hours per day for one year, and that electricity cost $0.058 per kilowatt-hour: ((119 x 10 x 365)/1000) x 0.058 = $25.19. This approximates the best-scenario cost of leaving a computer operating when no one is using it. What, then, are the costs of actually using this computer?

The second illustration shows results after slightly more than one hour and 37 minutes' operation. The computer had now consumed 0.20 kilowatt-hours of electricity. It was currently off sleep-mode, but was not performing any tasks. At that level of operations, but without the benefit of sleep-mode, it was running at 134 watts.

With the assumptions that we used above, operating costs would be: ((134 x 10 x 365)/1000) x 0.058 = $28.37. If the monitor had been an older "television tube" type of monitor, rather than LCD, costs would have been much higher. (*Surely, then, this experiment's secondary benefit is its demonstration of the LCD monitor's high electrical efficiency.*)

As for the total experiment, it ran for exactly three hours. During that time, the old computer performed a few short tasks. Mostly, these entailed downloading and installing a few long-overdue upgrades. What, then, was electrical consumption when the computer was actually working?

Maximum consumption, attained during those upgrades, was 164 Watts. After three hours of mixed operations (mostly in sleep-mode), the old computer had consumed 0.37 kilowatt-hours of electricity.

At first glance, the difference between sleep-mode (119 watts) and operating mode (134 to 164 watts) is insignificant. Why, then, is sleep-mode worthwhile?

- The LCD monitor gave much better results than an older "television tube" type of monitor would have given. However, this supports the argument for replacing older monitors with LCD monitors.
- Like all appliances, computers are part of an indoor ecosystem. During sleep-mode, computers produce much less heat. These lower operating temperatures reduce demand for air conditioning.
- LCD monitors use backlights that have a rated life of around 10,000 hours. When users are away from their desks, sleep-mode turns off an LCD's backlight and extends the unit's useful life.