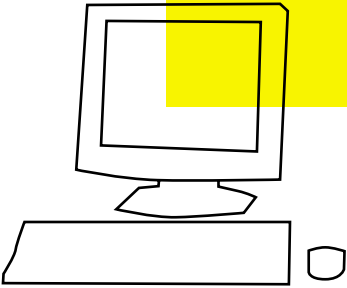
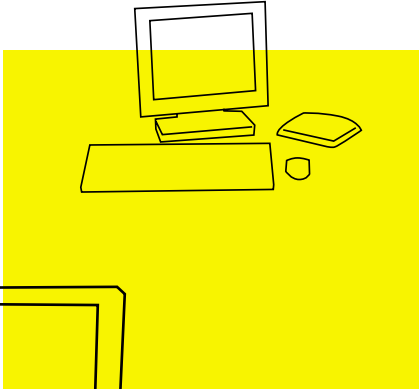


Desktop Energy Consumption

A Comparison of Thin Clients and PCs

Prepared For Wyse Technology Inc.



Overview

In these times of economic uncertainty, businesses need to think about how to maximize profits—not just by increasing sales, but also by minimizing costs wherever possible. A major cost of running a business in the modern economy comes from supporting a business' information technology (IT) infrastructure. With thousands of computers, hundreds of servers, dozens of software applications, the energy to power the computers and a full-time IT staff to keep things running, businesses spend millions of dollars on IT each year. Probably the most well-known and expensive part of this infrastructure is the personal computer (PC).

Over the past ten years, PCs have become an essential part of business. People need computers to do their jobs, plain and simple. However, computing has evolved since the creation of the personal computer, and businesses now have the option of turning to PC-alternative devices such as thin clients to deliver business-class computing at a fraction of the cost. Thin-client devices provide businesses with cost saving opportunities that are difficult or impossible to measure in the traditional PC environment.

The purpose of this paper is to quantify one such cost: the cost of energy consumption of business desktop devices. Energy consumption is a major concern for businesses and the global population as a whole, and an important part of a bigger IT concern called total cost of ownership. This paper will illustrate the significant cost difference between personal computers and thin clients, and the possible financial benefits for businesses.

Power Consumption and Total Cost of Ownership

Total Cost of Ownership (TCO) is a model for explaining the costs of purchasing and maintaining a computing environment. The purchase price of the computers themselves is only one part of TCO, and not the greatest one. Other costs include repairing computer hardware, installing and updating software, covering any down time, and powering the computing infrastructure. As you can see from even this brief list, TCO represents more than just a computer's purchase price: it represents the ongoing costs of *maintaining* that computer.

TCO can be hard to measure, because the cost of ownership is not necessarily a matter of dollars and cents: it's a measure of how much time you spend on maintenance when you could be doing other things. But power *is* a matter of dollars and cents. The money spent on power bills is part of TCO.

Server-Based Computing and Thin Clients

One way to reduce TCO is to use *server-based computing*, a computing model in which applications run on a central back-end server and are displayed on desktop devices. A single server can support dozens of devices. Server-based computing reduces TCO in several ways. It allows network administrators to maintain applications on a single server or small group of servers instead of on every desktop device. It allows access to application suites from any device connected to the server without having to install the applications on each individual device. Both PCs and thin clients can be used in a server-based computing environment; however thin clients are the preferred desktops for server-based computing.

Thin-client devices are simple computers designed to run applications from a central server. For example, both PCs and thin clients display the same commonly used Windows desktop interface to the end-user, and have the same features such as keyboard, mouse, serial and parallel ports and network connectivity. At the same time, thin clients are very different. They have lower microprocessor requirements and lower memory requirements than PCs while providing an identical end-user experience. Thin clients are literally smaller, some the size of a CD case, and most lack removable drives (or any drives), making it impossible for those using them to steal electronic data on floppy disk or introduce viruses to the network.

There are many more benefits, but in short, thin-client devices are *designed* to cost less than PCs to run and maintain. Using thin client devices with server-based computing reduces TCO even more than server-based computing with PCs.

PCs Versus Thin Clients: Power Consumption Results

An additional factor makes thin-client devices even more attractive than PCs: they use significantly less power. For this study, we tested three Wyse Winterm thin clients and two desktop PCs to measure any noticeable differences in energy consumption in a simulated real-world environment.

Wyse Winterm 3200LE Windows-based terminal - a simple Windows CE-based thin-client device intended for those using office productivity applications. This terminal supports RDP 5 (used by Windows 2000 Terminal Services) and ICA 3 (used to connect to terminal servers running MetaFrame).

Wyse Winterm 3630LE Windows-based terminal – a Windows CE-based thin client device integrated into a high quality, ergonomically designed TFT LCD 15-inch panel.

Wyse Winterm 8230LE Windows custom-application terminal – A Windows NT Embedded- thin client designed for those who want the advantages of a Windows-Based terminal but need access to some applications that must run locally.

In addition to the three thin clients, we tested two modern PCs: one 1GHz system with 128MB RAM, and one 1.5GHz system with 384MB RAM. Both PCs were running Windows 2000.

The devices were metered with a Brand Electronics Model 21-1850 CI power meter while running applications (e-mail, Web browsing, spreadsheet and word processing) from a terminal server via the ICA protocol. The tests measured power draw at the following stages:

Device plugged in but not turned on

Device powered on

Device connected to terminal server and running applications

Device disconnected from terminal server

Device powered down but still plugged in

Testing found that the amount of power each device drew depended on what the device was doing at the time. For example, a model 3200LE Wyse Winterm device used an average of 4 watts of power while plugged in but not powered on, but an average of about 6 watts when actively connected to a terminal server and running applications. Device power usage fluctuated little during each of the measured periods (shown in Table 1). That is, although the amounts listed in the table are averages, the device power use was very constant when the devices were already running and varied only a little while the devices were powering up or down.

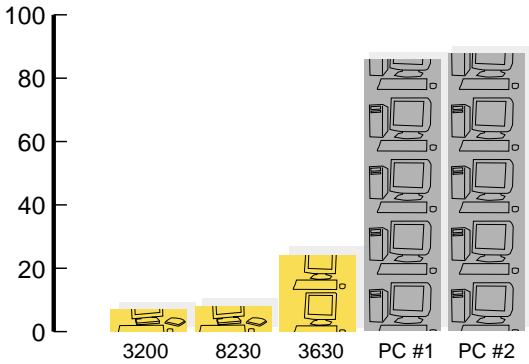
Table 1: Average power usage among Wyse Winterm Thin Clients

	3200	3630	8230
Plugged In	5 watts	8.27 watts	6.6 watts
Powered On	6.7	26.4	7.6
Running applications from ICA session	7.07	24.07	8
Logged out	7	23.8	8
Powered Down device	5.8	9.6	7.7

Chart 1 shows the average power usage for each device when running applications from a terminal server.

That's what the thin clients look like in terms of power consumption. Now, let's compare them with PCs to see the difference between power consumption. We tested the devices without attaching a desktop monitor so that we could determine the actual power consumption of the devices themselves.

Chart 1: Power usage for thin client devices (without display)

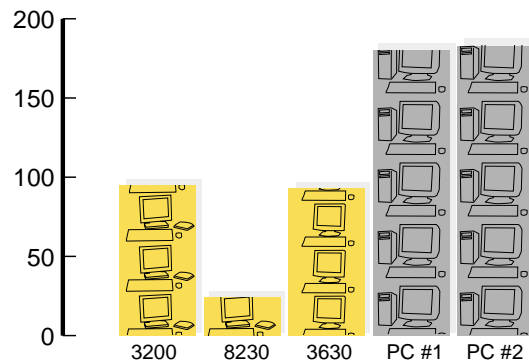


As you can see from Chart 1, thin clients use much less power when running applications than PCs. But it is unrealistic to attempt to gauge the power consumption and cost savings of PCs versus thin clients without including a monitor for two main reasons. First, you will never use a thin client or a PC without a monitor.

Second, this comparison does not allow for the fact that some thin clients, such as the Winterm 3630 device tested above, have a built-in display and cannot be tested without including the power consumption of the display.

Therefore, in chart two we attached an average, business class CRT desktop monitor to the Winterm 3200, 8230 and two PCs. This monitor used 85 Watts of power. With this addition, all five of the devices now include the power consumption of both a monitor and the device. This 85 Watts is excluded from the power consumption of the Winterm 3630, because as stated before, the power consumption from the integrated LCD display is already accounted for.

Chart 2: Power usage by thin client devices (with display)



Clearly, the thin clients continue to use less power than the personal computer, however the testing now shows how much less power a thin client with an integrated LCD display uses compared to all of the other devices tested. The total power consumption numbers for both PCs and non-integrated thin clients will vary based on the type of monitor used, however it is clear from Chart 1 (top) that the actual power consumption of the thin-client devices themselves is considerably less than PCs.

Implications for Power Savings

So what are the ramifications for businesses? Clearly you don't measure power usage for single units; you measure it for dozens, hundreds, or thousands of devices. Table 2 shows the average wattage used on the client side while the device is powered up and working, but on different sizes of networks.

Table 2: Power requirements for networks using thin client devices (with monitors)

Client Device Type	Single Unit	100 Computers	1,000 Computers	5,000 Computers
3200	92 watts	9,200 watts	92,000 watts	460,000
3630	24 watts	2400 watts	24,000 watts	120,000 watts
8230	93 watts	9,300 watts	93,000 watts	465000 watts
PC	170 watts	17,000 watts	170,000 watts	850,000 watts

Notice that the numbers represent the draw required by 100, or 1,000, or 5,000 computers *at any given time*. To figure out how much that comes to on a yearly basis, perform the following calculation for each type of client computer in your network:

$n * p * h * 52$ = the number of kWh your client computers use each year where:

n is the number of desktop devices

p is the power (in kilowatts) used by each device

h is the number of hours each week that the devices are turned on

52 is the number of weeks in a year

Multiply the result by the power costs in a given region, and businesses can see how a change in power consumption of desktop devices affects the amount of money spent each year on power. For example, assume that a network has 5,000 clients and those clients are on 50 hours a week. If these clients are PCs, then they're using 2,210,000 kilowatt-hours each year. At 0.20 per kilowatt-hour, that comes to \$442,000 to power the devices each year. Make those devices the Wyse Winterm 3630LE, however, and the numbers drop significantly: those 5,000 devices use 312,000 kilowatts each year for an annual cost of \$62,400—one-seventh the cost of powering the PCs. It is possible to lower the power consumption costs of computing environments through the use of desktop monitors that consume less power, however the cost savings are minimal in comparison to changing from a PC to a thin-client environment

Conclusions

Based on the results of this study, it is clear that thin-client devices are more energy-efficient than personal computers, with some models using 85 percent less power than their PC rivals in real world environments. This energy efficiency translates into significant, measurable cost savings for businesses both in the short term and the long term, whether an organization is using dozens, hundreds or thousands of desktop devices. Finally, the ability to deploy desktop devices with integrated liquid crystal displays (LCDs) affords businesses an even greater opportunity to reduce the energy consumption of their IT environment.

About The Authors

Steve Greenberg is the founder and President of Thin Client Computing in Scottsdale, Arizona. As a leading expert in server-based computing, he has designed mission-critical solutions for a wide variety of Fortune 500 companies.

Christa Anderson is senior contributing editor to Windows 2000 Magazine and author/co-author of several books, including the forthcoming [Automated Deployments and Scripted Management](#) and [Mastering Windows 2000](#), both from Sybex. Anderson has been covering the thin-client/server-based computing market as a journalist and consultant for more than seven years.