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XP vs. Vista: Consider the Power Savings

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Enterprises with an abundance of Windows XP desktop PCs and laptops can reduce power consumption costs and carbon dioxide emissions by half in switching to Windows Vista. When considering a total cost of ownership analysis for a Vista implementation, IT decision makers should understand how the two operating systems affect power consumption and consider the savings.

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Executive Summary

Enterprises with an abundance of Windows XP desktop PCs and laptops can reduce power consumption costs and carbon dioxide emissions by half in switching to Windows Vista. In this research note, we describe the results of lab tests performed by Info-Tech Research Group that compare power consumption for Windows XP versus Windows Vista.

Main points of discussion include:

- » The power consumption of XP and Vista under high and low power states.
- » The effect of Aero on Vista power consumption.
- » Improvements of sleep mode in Windows Vista.
- » Group Policy differences between XP and Vista.
- » Power running costs of XP and Vista under two scenarios.
- » How power consumption translates into carbon dioxide emission reductions.

This note discusses only one aspect of an upgrade, which is the change in power consumption of the OS; it does not focus on the broader issue of the total cost of ownership analysis of a potential upgrade to Windows Vista.



Technology Point

Windows Vista provides a seamless power management user experience and reduces overall electricity usage due to improved default settings. A power consumption analysis was performed in Info-Tech Research Group's lab using two desktop tower PCs and two notebooks. All four machines were preloaded with both Windows XP Professional and Windows Vista Ultimate in a dual-boot configuration.

The results of this study indicate that:

- » Businesses can save up to \$11 per system, per year (up to \$47,000 per year for a company with 5000 desktops) by using Vista over XP. This savings flows from the default power management settings in Vista.
- » Less power consumption means less carbon dioxide emissions. For a company with 5000 Vista desktops, the electricity savings would result in a 288 tonne reduction of carbon dioxide emissions compared to the emissions generated by the electricity consumption of 5000 XP desktops.
- » Though graphically rich, the Aero interface does not significantly increase the electricity consumed by Vista machines.

Note that power savings flow from default power management settings. It is true that similar settings can be centrally enabled with XP – however, this is not widely practiced. The cost to implement, lower reliability, and slower time to resume are all implementation inhibitors. Changes with Vista have addressed these issues.

For more information on assessing organizational fit with Vista, refer to the ITA Premium research notes, ["Vista Migration: Survey the Water Before Diving In,"](#) ["How Does Vista Rate? Lessons from Early Implementers,"](#) and ["Five Defining Factors of Vista Migration."](#)

Testing Methodology

Prior to testing, both notebooks were left powered off and plugged in overnight to ensure full battery charge. Testing on the desktop tower PCs examined the power consumption of the tower only and not the power consumed by a monitor.

The two types of computers used were:

- » HP Compaq dc7700 (desktop)
- » HP Compaq nc6400 (laptop)

Running the same tests on two copies of the same hardware ensured consistent results.



Info-Tech used its own testing facility onsite at its London, Ontario location. Power consumption was examined using a PowerXplorer PX5 from [Dranetz-BMI](#) with a LEM Lem~Flex RR3035A flexible current probe.

Info-Tech successfully tested each computer in seven different power states:

- » Low power
 - Sleep
 - Hibernate
 - Standby
- » High power
 - On-idle
 - Screensaver
 - MP3 playing
 - Document typing

The results for Vista are based on Aero being switched off. The use of Aero has a negligible difference on the power consumption during any of the four power states tested. See “Effect of Aero” for more details.

Power Measurement Results

Info-Tech’s tests found a negligible difference in electrical draw between the two operating systems in either a low or high power consumption state. The key to reducing overall power consumption is to minimize the amount of time the PC spends in high power consumption states while not in use by the user.

- » With some small variations, both systems consume similar amounts of electricity when running in low power or high power states.
- » Tests revealed a difference of no more than plus or minus two watt hours while in use. Thus, the operating system itself does not have a significant influence, but rather the state of the PC.
- » Windows Vista helps minimize the amount of time a PC unnecessarily spends idling since the PC will enter Sleep mode by default. Windows XP will remain in On-idle by default while not in use, effectively consuming an unnecessary amount of power. Please see “Sleep Mode in Windows Vista” for further information on the improved power settings, and “Running Costs” for the impact this has on overall power consumption.



Effect of Aero

Info-Tech conducted a separate test to evaluate the power usage of a PC with the Windows Aero experience. The four high consumption tests were rerun on both of the HP nc6400 laptops over five-minute periods. The use of Aero has a negligible difference on the power consumption during any of the four power states tested. Please see Table 1 below.

Table 1. Aero Power Consumption Comparison (in Watts)

Source: Info-Tech Research Group

	On-idle	Screensaver	MP3 Playing	Doc typing
Windows Vista without Aero	26.46	26.76	30.94	27.94
Windows Vista with Aero	26.22	26.65	31.10	28.17
Difference	(0.24)	(0.11)	0.17	0.22

Certain effects enabled by Aero, such as live preview, may increase power consumption while being used. Info-Tech's tests indicate that unless these effects are heavily used, users are highly unlikely to see much difference in overall power consumption.

Sleep Mode in Windows Vista

Unlike Windows XP, which offered the different Standby and Hibernate modes, Windows Vista Sleep mode combines both modes to simplify the entire process for users. In Vista, Sleep is a new power state that offers the quick-resume benefits of Standby with the data protection benefits of Hibernation. In the past, if users wanted to save power or preserve battery life by turning off their computers, they would have to wait a long time for it to start back up again. Vista has enabled a new experience that allows users to quickly resume activity, while still preserving battery life and saving power. In Vista, the default sleep mode is Hybrid Sleep (fast S4) on desktops and sleep (S3) on laptops. S3 is an Advanced Configuration and Power Interface (ACPI) standard, where all active documents, programs, and settings are saved to memory. Just enough power is enabled to keep the memory active, while none is used for any other component.

Changes with Windows Vista promote the viability of the Sleep mode being used in a corporate environment. End users are provided with a faster, seamless experience, which leads to higher acceptance and usage.



XP Sleep Mode

XP Sleep mode is not used widely in a corporate environment because:

- » **Standby mode is not activated by default.** The user is required to enable the Sleep mode as the default in Windows XP is to keep the system idling. In Windows Vista, a PC will automatically enter Sleep mode after 60 minutes of idling.
- » **Activating Standby is not intuitive.** The setting is not easily found by users since it is buried in advanced power-management menus.
- » **No centralized management.** Standby in XP is not centrally manageable via Group Policy. Administrators have to install a third-party tool in order to centrally manage Standby in XP, which takes time to implement and may not always be reliable.
- » **Reliability is low.** Since XP is not capable of reliably detecting when a PC is idle, a corporate-wide rollout is more unlikely.
- » **Time to resume is slow.** The time to resume from Standby in XP is quite high at five seconds. This time has been considerably reduced with Vista, at around two seconds.

Group Policy

There are notable differences between the Group Policy settings of Windows XP and Windows Vista. Vista provides approximately 3,000 settings that can be controlled by Group Policy, which is about double the settings available in XP's initial release. The most relevant point is that all power management settings have been Group Policy enabled. This enables IT to control the settings of PCs and notebooks being managed through Active Directory, at the individual system level or the group level. For notebooks, settings can be specified for periods when the notebook is on and also when it is running on battery power.

A few of the specifications include:

- » Screensaver timeout
- » Monitor off timeout
- » Hard disk off timeout
- » Sleep timeout
- » Hibernate timeout



Businesses that want to update machines overnight can use Microsoft's System Center Configuration Manager (SMS 2007). SMS 2007 can use Wake-on-LAN features built into PCs to power up the machines, update, and then power down.

Running Costs

Due to the improved default power management settings in Windows Vista, Info-Tech did a comparative analysis of power consumed by Windows Vista versus Windows XP under two scenarios:

- » Scenario 1: Some user initiated power management.
- » Scenario 2: Default settings that the OS ships with.

The former represents what Info-Tech considers the average example, whereas the latter is the best case scenario for savings.

Scenario 1: XP vs. Vista with Some User Initiated Power Management

User Assumptions:

- » 75% of employees use a desktop PC; 25% use a laptop.
- » 50% of employees leave their PC on at the end of the day.
- » 25% of employees leave their PC on over the weekend.

Typical Usage:

- » percent of day doing light tasks: 50%
- » percent of day doing medium intensity tasks: 10%
- » percent of day spent idling: 40%

Power settings:

- » Windows XP:
 - percent of users that enable the standby/sleep mode: 15% (default: 0%)
 - percent of users that enable the hibernate mode: 10% (default 0%)
- » Windows Vista:
 - percent of users that enable the standby/sleep mode: 90% (default 100%)
 - percent of users that enable the hibernate mode: 90% (default 100%)

In the Windows XP default settings, the PC will idle when not being used and will not go into Sleep mode. In Windows Vista, the system automatically goes into Sleep mode after 60 minutes of idling, and hibernate mode after an additional 18 hours. All figures are based on a cost of \$0.0975 per unit (kWh).



Although costs will vary, our research suggests that this is an average cost for small power businesses in North America.

Table 2. Average Annual Running Costs of XP vs. Vista

Source: Info-Tech Research Group

	HP dc7700	HP nc6400
Windows XP	\$ 22.42	\$ 10.96
Windows Vista	\$ 11.47	\$ 6.31
Annual Saving	\$ 10.94	\$ 4.64

Per PC, using scenario 1 assumptions.

Table 3. Average Annual Running Costs and Potential Savings of XP vs. Vista

Source: Info-Tech Research Group

	250 users	1000 users	5000 users
Windows XP	\$ 4,888.03	\$ 19,552.11	\$ 97,760.56
Windows Vista	\$ 2,546.12	\$ 10,184.46	\$ 50,922.31
Annual Saving	\$ 2,341.91	\$ 9,367.65	\$ 46,838.25

Company scenarios, using scenario 1 assumptions.

Scenario 2: XP vs. Vista with No User Initiated Power Management

In an organization where all users leave their PCs on at the end of the day and use the default power settings that the OS ships with, the savings are even more dramatic. Please see Tables 4 and 5 below.

User Assumptions:

- » 75% of employees use a desktop PC; 25% use a laptop.
- » 100% of employees leave their PC on at the end of the day.
- » 100% of employees leave their PC on over the weekend.

Typical Usage:

- » percent of day doing light tasks: 50%
- » percent of day doing medium intensity tasks: 10%
- » percent of day spent idling: 40%



Power settings:

- » Windows XP:
 - percent of users that enable the standby/sleep mode: 0% (default: 0%)
 - percent of users that enable the hibernate mode: 0% (default 0%)
- » Windows Vista:
 - percent of users that enable the standby/sleep mode: 100% (default 100%)
 - percent of users that enable the hibernate mode: 100% (default 100%)

Table 4. Annual Running Costs of XP vs. Vista

Source: Info-Tech Research Group

	HP dc7700	HP nc6400
Windows XP	\$ 46.15	\$ 22.31
Windows Vista	\$ 12.61	\$ 7.62
Annual Saving	\$ 33.54	\$ 14.70

Per PC, using scenario 2 assumptions.

Table 5. Annual Running Costs and Potential Savings of XP vs. Vista

Source: Info-Tech Research Group

	250 users	1000 users	5000 users
Windows XP	\$ 10,047.86	\$ 40,191.46	\$ 200,957.29
Windows Vista	\$ 2,840.56	\$ 11,362.22	\$ 56,811.10
Annual Saving	\$ 7,207.31	\$ 28,829.24	\$ 144,146.18

Company scenarios, using scenario 2 assumptions.

In an organization with Windows Vista where power management is set up via Group Policy, more savings can be realized. For example, an organization can set the PCs to Sleep after only 20 minutes of idling instead of the default 60 minutes. An additional annual savings of up to \$2.17 per PC can be realized. Although the savings are not as large as the examples listed above, Info-Tech recommends that organizations enable these settings to fully minimize electricity costs.



Carbon Dioxide Emissions

According to the [Energy Information Administration](#), each kWh of electricity consumed in the United States equates to 0.60 kg of carbon dioxide emissions. Using this figure, we can apply the power consumption results into carbon dioxide emissions.

Carbon dioxide emissions can be reduced due to the default power management settings in Windows Vista. For a single PC, the range is 28 to 67 kg. When this is applied to an organization of up to 5000 users, the savings are dramatic, at up to 288 tonnes. This is the equivalent of taking 71 cars off the road (Source: [Zerofootprint](#)). Please see Tables 6 and 7 below. Please note that the hardware used will also affect emissions.

Table 6. Average Annual Carbon Dioxide Emissions (kg)

Source: Info-Tech Research Group

	HP dc7700	HP nc6400
Windows XP	137.95	67.43
Windows Vista	70.61	38.86
Annual Saving	67.34	28.57

Per PC, using scenario 1 assumptions.

Table 7. Average Annual Carbon Dioxide Emissions (kg)

Source: Info-Tech Research Group

	250 users	1000 users	5000 users
Windows XP	30,080.17	120,320.69	601,603.47
Windows Vista	15,668.40	62,673.62	313,368.08
Annual Saving	14,411.77	57,647.08	288,235.39

Company scenarios, using scenario 1 assumptions.

The above numbers are lower in Canada and the UK. According to [Environment Canada](#), each kWh of electricity consumed in Canada equates to 0.22 kg of carbon dioxide emissions. [Defra](#) claims that every kWh of electricity consumed in the UK equates to 0.43 kg of carbon dioxide emissions.



Key Takeaways

1. **Windows Vista can reduce electricity costs.** Businesses can save up to \$11 per system, per year by switching to Windows Vista, due to the default power management settings. For a company with 5000 users, this means up to \$47,000 of bottom line dollars can be saved annually.
2. **The Vista Sleep state is more reliable than XP.** Computers resume from Sleep in two seconds, which is about the same time it takes a screen to resume from Idle mode in Windows XP.
3. **Power consumption reduction translates into direct CO2 savings.** Carbon dioxide emissions are reduced by up to 67 kg of carbon dioxide per desktop PC, per year. For a company with 5000 users, this is 288 tonnes of carbon dioxide emissions reduced.
4. **Aero graphics have no effect on overall power consumption.** Organizations should take advantage of Aero since it does not have a significant impact on electricity usage.

Bottom Line

Businesses running a fleet of Windows XP desktop PCs and laptops can reduce power consumption costs and carbon dioxide emissions by half in switching to Windows Vista. IT decision makers should understand how the two operating systems affect power consumption and consider the savings when conducting a total cost of ownership analysis for a Windows Vista implementation.

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Appendix A: Computer Specifications

Desktop PCs:

HP Compaq dc7700:

- » p/n: RT901UT
- » Intel Core 2 Duo E6400 @ 2.13Ghz
- » Intel Q963 chipset
- » Intel Q963/965 Integrated Graphics Controller
- » 160 GB hard drive
- » 1GB RAM

HP Compaq dc7700:

- » p/n: RG582AW
- » Intel Core 2 Duo E4400 @ 2.00 Ghz
- » Intel Q963 chipset
- » Intel Q963/965 Integrated Graphics Controller
- » 80 GB hard drive
- » 1GB RAM

Notebooks (2):

HP Compaq nc6400:

- » p/n: RM100AW
- » Intel Core 2 Duo Mobile T5600 @ 1.83Ghz
- » Intel 945GM chipset
- » Intel Mobile 945GM/GU Integrated Graphics Controller
- » 80GB hard drive
- » 1GB RAM



Appendix B: The Seven Power States

Low Power:

- » **Sleep.** The computers were put into Sleep mode and power consumption was measured and averaged over five minutes.
- » **Hibernate.** The computers were put into Hibernate mode and power consumption was measured and averaged over five minutes.
- » **Standby.** The computers were turned off using the Windows Start button and power consumption was measured and averaged over five minutes.

High Power:

- » **On-idle.** The computers were turned on and allowed to boot into the operating system. After exactly five minutes from switching the computers on, power consumption was measured and averaged over a further five minutes.
- » **Screensaver.** The computers' screensaver settings were adjusted to come on after the on-idle test was complete. Power consumption was measured and averaged over a further five minutes.
- » **MP3 playing.** An MP3 track was played with volume settings turned to zero while power consumption was measured and averaged over the following five minutes. The MP3 track chosen was more than five minutes long and had a wide dynamic range.
- » **Microsoft Word document typing.** Approximately 1,000 characters were typed into a Microsoft Word 2003 document over the course of five minutes. Power consumption was measured and averaged over this process.