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**An Investigation into Sustainable Computer Hardware for the New SUB Project**

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# An Investigation into Sustainable Computer Hardware for the New SUB Project

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# TABLE OF CONTENTS

# ABSTRACT

The University of British Columbia is planning the construction of a new Student Union Building which is intended to meet the LEED Platinum rating, the highest level of sustainability for a building. To reach this goal, many aspects of sustainability must be considered, one of which is computer hardware. This report focusses on the sustainability of hardware throughout its lifespan including selecting new hardware, using the hardware and disposing of the hardware. To recommend the most sustainable practices, a triple-bottom line assessment is used to take into account the economic, environmental and social impacts of various alternatives.

The computer hardware for the new Student Union Building can be made sustainable by obtaining it second-hand to lengthen the lifetime before it is disposed of or by purchasing products using environmental guidelines. Throughout its lifetime computer hardware can be operated sustainably by avoiding unnecessary power consumption while it is not in use. Finally, when hardware has reached the end of its life it can be disposed of through qualified recyclers to ensure it is dealt with properly.

# LIST OF ILLUSTRATIONS

# GLOSSARY

**Downcycling**       - The recycling of materials from one product to create an inferior
                       product.

**Embodied Energy**   - The total amount of mass and energy used in the work of making   a
                       product.

**E-Waste**           - Electronic Waste; a discarded electronic device.

**Thin Client**       - A type of networking computer terminal which relies on most of
                       its function being on the server.


# LIST OF ABBREVIATIONS

**AMS**    - Alma Mater Society

**CRT**    - Cathode Ray Tube

**CSCI**   - Climate Savers Computing Initiative

**EPEAT**  - Electronic Products Environmental Assessment Tool

**LAN**    - Local Area Network

**LEED**   - Leadership in Energy and Environmental Design

**LCD**    - Liquid Crystal Display

**UBC**    - University of British Columbia

**OECD**   - Organisation for Economic Co-operation and Development

# 1.0 INTRODUCTION

The University of British Columbia (UBC) is embarking on a $110 million project involving the production of a brand new Student Union Building (SUB). This building is aimed to be a pinnacle of sustainability, with LEED Platinum rating, in all aspects of its affairs, including sustainable computer hardware. Each aspect of the building must be sustainable in every way and thus must be maintained socially, environmentally, and economically. Using a triple bottom line assessment, this report analyzes the lifecycle of sustainable computer hardware including the purchase and selection, sustainable maintenance, and recycling and disposal of hardware.

Computer hardware is a significant part of university life and setting a green, eco-friendly example can spread knowledge and awareness of the vital issues of sustainability. It is important for the new SUB to feature sustainability certified products from environmentally conscious manufacturers. This leads onto using the hardware in an energy efficient, responsible, and environmentally aware manner. As the lifespan of the computers end, disposal and recycling is a vital stage in ensuring minimal damage to the environment and continuing the lifespan of the materials used in initial production. The following report outlines these mentioned topics in detail and includes recommendations weighing all the aspects of our triple bottom line assessment. Ultimately, these recommendations will be considered in the choosing of computers by the Alma Mater Society (AMS) in the new SUB.

# 2.0 PURCHASE AND SELECTION OF NEW HARDWARE

Since the SUB is being built from the ground up, brand new, there will be a significant need for new computer hardware to be implemented for student use, faculty use, and business use. In this section, reviews and analysis of methods of obtaining hardware, as well as sustainability standards will be explored to allow the AMS to make an informed decision about what computer hardware to choose. Under these topics, the analysis will be broken down into social and environmental sustainability factors. When considering selection of computers, price is an evident factor in the realism of the implementation, thus economic factors will also be considered.

## 2.1     OBTAINING USED HARDWARE

The SUB's requirements for computers are mediocre and are not in the realms of top end computing. With public student use of computers, the power and speed of the hardware can be average, allowing significant freedom when considering re-using old hardware. Many faculties across UBC require high speed computers capable of multitasking, including the Computer Science and Statistics Departments, as well as specific research laboratories. These higher grade computers slowly age and degrade in relative speed. As these computers degrade and become obsolete for their high end purpose, they are disposed of and replaced, these computers can be moved into the SUB as fully functional computers. Also, there are many sellers across Canada that are selling pre-used products that could easily fit the needs of the new SUB; therefore, extending the lifespan of landfill destined products.

**Social Sustainability Implications**

The computer requirements for the SUB will be met as well as low additional costs for obtaining the computers. There will be fewer fees needed to support the usage of computers throughout the SUB. Since the computers are being given to the SUB, there is no control from the AMS to gauge and determine the environmental impacts of the computers being used throughout the maintaining and disposal stages. If the AMS becomes strict with what used computers will be implemented, there will be a very low amount of computers able to be used.

**Environmental Sustainability Implications**

By obtaining and re-using old hardware that has been once used throughout UBC, the lifecycle of the computer hardware becomes greatly extended.  This allows the total amount of raw materials and natural resources to be greatly reduced.  This does not change the effect that the pollution and toxins from the materials will cause but the total amount will be reduced.  As the new SUB being the highest stature in terms of sustainability, reusing old products does not send a significant enough of message of eliminating and preventing pollution.

**Economical Sustainability Implications**

Selecting pre-used equipment always is beneficial financially especially if the equipment is just being transported from other places on the UBC campus.  Products can also be bought pre-used from external markets throughout Canada for significantly decreased prices relative to newly bought equipment.

**2.2     SELECTING NEW HARDWARE USING EPEAT GUIDELINES**

A prime rating system called the Electronics Products Environmental Assessment Tool (EPEAT) rates various hardware on a list of standards under eight topics (EPEAT, 2009).  There are three levels of certification, Gold, Silver, and Bronze based upon how many environmental regulations are met (EPEAT, 2009). For the new SUB to withhold the goal of highest of sustainability standards, the gold certification for all computers is strongly advised (EPEAT, 2009).  In Canada sixty desktop computers meet the gold standard (refer to Appendix). Certified products can be identified by the EPEAT coloured logo as seen in Figure 1.1.
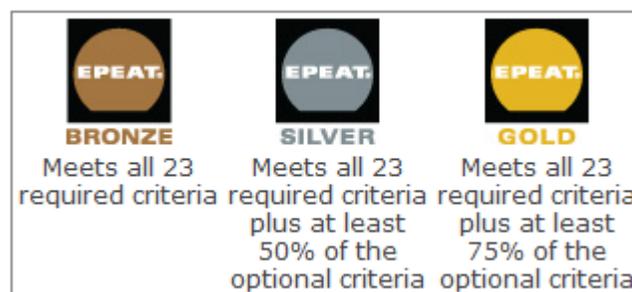


**Figure 2.1 –The criterion logos of EPEAT by EPEAT®**

Energy Star strives to reduce amount of energy consumed and aims to make electronic devices more efficient when dealing with energy usage (Energy Star, 2009).  EPEAT also works

alongside Energy Star which has a standard of requirements that a product can either pass or fail. As of July 1st, Energy Star 5.0 is the minimum standard to achieve Energy Star recognition; thus, EPEAT will soon only allow products that meet Energy Star 5.0 to become Gold certified (EPEAT, 2009).

**Social Sustainability Implications**

Sustainability is newly being accepted into the university student lifestyle and by advertising and promoting the EPEAT standards and by leading by example; the knowledge and ideas can be passed throughout the thousands of students.   In 2008 there were a total of 44,982 students on campus and the majority of these students own a computer (UBC PA, 2009).  These vast numbers can be influenced to go greener by having access to the use and the knowledge about more sustainable computer selection.

**Environmental Sustainability Implications**

By setting a hard standard that all computers chosen by the AMS to be used in the SUB makes purchasing much easier and without confusion.  The lists in appendices A and B outline the exact Canadian EPEAT Gold Computers that can be purchased that meet at least 75% of EPEAT environmental standards (EPEAT, 2009).  This ranking is based on eight environmental categories including topics that revolve around materials used in the product, lifespan and energy conservation, and as well as end of life management.   Such impacts of the standards being abided have aimed to reduce use of toxins, reduce use of mercury, preclude disposal of hazardous waste, decrease the total amount of solid waste headed towards landfills, reduce energy consumption, and reduce greenhouse gas emissions (EPEAT,2009).

**Economic Sustainability Implications**

EPEAT Gold standard applies to a significant amount of purchasable computers that are readily available throughout Canada.  These computers range in prices and when bought in bulk can easily be manageable.

# 3.0 SUSTAINABLE USE OF COMPUTER HARDWARE

Computers in the new Student Union Building will be in continuous operation daily until they are replaced.  The computers represent a significant contribution to the electricity the new SUB requires.  Therefore reducing the energy consumption during daily operation could produce significant energy savings.  By reducing the demand for electricity, the carbon produced in powering the new SUB can be reduced as well, leading to a more sustainable university campus.  To reduce the energy required by the computers in the SUB after choosing energy efficient computer in the first place, there are settings that can be modified to increase the efficiency of the computers.  This section will examine methods to reduce the energy consumption of the new SUB computers while in everyday operation as well as the economic, environmental, and social impacts of these methods.

## 3.1 METHODS TO INCREASE SUSTAINABILITY

**Turning Off Displays**

A simple yet effective method of decreasing computer energy consumption is turning off the display while not in use.  A screen saver continues using power to produce an image while the computer is inactive while stand-by cuts much of the power associated with displaying an image.   A standard CRT display accounts for approximately 60% of the computers energy consumption (BC Hydro, 2009) and while an LCD display is more efficient it still requires significant energy.  An average Energy Star rated LCD monitor consumes between 15 to 35W.  While in a stand-by mode, Energy Star qualified LCD monitors are required to draw at most 2W (Energy Star, 2009).   By setting the SUB computers to automatically switch their displays to stand-by mode after a period of inactivity the energy consumption can be decreased.  The Climate Savers Computing Initiative (CSCI) and Energy Star recommend displays be shut down after 15 minutes or less of inactivity, however due to the frequent use of the SUB computers the time period could be decreased to increase energy savings.  In addition to stand-by when inactive, displays can be set to lower brightness settings to conserve more energy.

The following table compares the energy consumed by an Energy Star qualified LCD display with and without stand-by over a one hour period assuming the display is in use 50% of the time and inactive during the rest.

| | Time active | Time Inactive | Energy consumed |
|---|---|---|---|
| **Without Stand-By** | 0.5 h (at 35W) | 0.5 h (at 35W) | 0.035 kWh |
| **With Stand-By** | 0.5 h (at 35W) | 0.5 h (at 2W) | 0.0185 kWh |
| | | Energy Saved | 0.0165 kWh per computer per hour |

**Table 3.1 – Energy comparisons for Stand-By settings**

**Shutting Down Hard Drives and Enabling Standby When Inactive**

Other methods of reducing power consumption are shutting down the hard drive and setting a computer to a sleep or stand-by mode. The hard drives of a computer constitute a significant portion of a computer's total energy consumption. By setting the SUB computers to shut down the hard drives when not in use more energy can be saved. Also, while a computer is inactive it can enter a sleep mode, which conserves energy and allows work to be resumed within several seconds. The CSCI and Energy Star recommends that a computer's hard drive be shut down after 15 minutes of inactivity and the computer sleep after 30 minutes. These time periods could be shortened to increase the amount of energy saved by the SUB computers. An Energy Star qualified computer uses approximately 30 to 65W while in use depending on the computer while sleep mode consumes 1 to 3W (Energy Star, 2009).

The following table compares the energy consumed by a computer with and without sleep mode enabled over a one hour period assuming the computer is in use 50% of the time and inactive the rest.

| | Time active | Time Inactive | Energy consumed |
|---|---|---|---|
| **Without Sleep** | 0.5 h (at 65W) | 0.5 h (at 65W) | 0.065 kWh |
| **With Sleep** | 0.5 h (at 65W) | 0.5 h (at 3W) | 0.034 kWh |
| | | Energy Saved | 0.031 kWh per computer per hour |

**Table 3.2 – Energy comparisons for Sleep Mode**

**Shutting Down at Night**

Computers that are not in use at night the can be shut down to conserve electricity. The computers in the SUB can be set to shut down or sleep at a certain time each night to ensure energy savings. As well computers can be set to start up at a specified time in the morning so there is no waiting period before use. Computers that may require administrative work during off hours can be remotely woken up using Wake-On LAN software (Energy Star, 2009).

The following table shows the energy savings per hour available from shutting down computers during the night.

| | Time Inactive | Energy consumed |
|---|---|---|
| **Without Shut Down** | 1 h (at 65W) | 0.065 kWh |
| **With Shut Down** | 1 h (at 0W) | 0 kWh |
| | Energy Saved | 0.065 kWh per computer per hour |

**Table 3.3 – Energy comparisons for Shut Down**

## 3.2 IMPACTS OF ENERGY CONSERVATION METHODS:

### Social

The methods of reducing energy consumption by computers in the new SUB stated above should have minimal social impacts.  Inactive computers that have entered sleep mode or turned off their displays automatically will require several seconds to restart, however this inconvenience should not deter people from using the computers.  Additionally, computers that have shut down for the night can be automatically restarted in the morning so that they are ready for use without any delay.

### Environmental

Introducing these energy saving methods will not only save money by saving electricity, it will benefit the environment as well.  Decreasing the demand for electricity will reduce the production and release of carbon dioxide into the atmosphere during generation of electricity.

### Economic

If the above methods of reducing power consumption are put into action the energy savings will be considerable.  By setting the computers and their displays to sleep after a period of inactivity .0505 kWh of energy can be saved per computer per hour.  Over a year of operation of one computer (assuming 2000 hours of operation) the total energy saved would be 101 kWh per computer.  At a rate of $0.10 per kWh this would equate to $10.10 saved per computer.  By shutting down computers while inactive at night, .065 kWh can be saved per computer per hour.  Assuming the computers are off for 16 hours each night for a year, at $0.10 per kWh, a cost of approximately $38.00 per computer per year could be avoided.

# 4.0 RECYCLING AND DISPOSAL OF HARDWARE

With the construction of the new SUB, methods concerning the disposal of old computer hardware must be considered. Two major methods of doing this in a sustainable manner are through re-use and recycling. We will provide an in-depth analysis of these two approaches using a triple-bottom-line model, considering the social, environmental, and economic aspects of each. In the interest of sustainability, simply discarding old hardware will not be considered as an option, however, we will provide statistical comparisons to such a method to gauge the effectiveness of our choices.

## 4.1 RE-USE OF OLD HARDWARE

Several options exist for reusing hardware from the current SUB. Based on the university's decision on how it will use the old building, much of the hardware can remain there, minimizing issues in all aspects of our assessment. However, the university has not come to a concrete decision and thus we must consider alternatives such as relocating the SUB hardware to other facilities on campus or donating it to local organizations. The majority of computers in the SUB are Sun Microsystems Thin Clients (Sun Rays), terminals designed to provide a user access to a central server's resources. Individual terminals cannot be used effectively on their own and thus the hardware benefits most from being moved all together or integrated into another such system.

**Social:**

To ensure social sustainability, we must consider the ethical impacts our decisions have on others. For re-use, it is important to determine the ethical implications of who receives the hardware, whether it is another building on campus or an organization. One such local organization is Free Geek Vancouver, a group dedicated to ethical disposal of electronic hardware. Free Geek prioritizes re-use of hardware as the most conservative method, but also offers recycling services (FGV, 2009). Relocating the hardware to another campus facility, however, directly benefits students and staff of UBC and enables us to monitor the use and impact it has, where donating to an organization does not allow this.

**Environmental:**

By means of reusing the SUB's computer hardware, we are most efficiently able to reduce the impact on the environment by avoiding recycling processes directly, preventing both chemicals from being released into the environment and energy costs. Re-use is the most conservative approach to handling old hardware; there is no risk of downcycling, and additionally reducing the need for purchasing new terminals, each with an embodied energy of approximately 362g, 31 megajoules (Sun Microsystems, 2009). The only impact on the environment is by transportation of the hardware, which is easily limited by dealing locally.

**Economic:**

Re-using the SUB hardware has the most beneficial economic impacts, not only does it eliminate potential recycling fees and transportation costs, but by reducing the need for new computer hardware, $335.00, the price of a new Sun Ray 2 Thin Client, can be saved per terminal.

## 4.2 RECYCLING OLD HARDWARE

**Social:**

Recycling computer hardware has many controversial social implications, and to minimize any potential harm, the university must be fully accountable for its decision. Many local options exist for recycling hardware. Free Geek Vancouver prioritizes recycling "Regionally and Ethically", promising to recycle as locally as possibly. Where this is not possible, the organization will only send hardware to OECD (Organization for Economic Co-operation and Development) countries that have an authorized sustainable recycling process (FGV, 2009). OECD countries are considered financially responsible, allowing e-waste to be diverted from landfills and underdeveloped countries (OECD, 2009).

Another possibility lies in observing others' solutions. Western Canada based company, London Drugs, boasts an effective electronics recycling program through a partnership with Genesis Recycling (LD, 2009). Genesis Recycling is based in Aldergrove, BC and performs all

recycling on site (GR, 2009). Such a system is optimal in terms of social sustainability as all recycled hardware is fully accounted for, where organizations like Free Geek lose track of its hardware past OECD borders. UBC's current method of e-waste disposal is through Free Geek and Encorp Pacific Recycling (UBC Waste Management, 2009). While Encorp features a variety of recyclers (Genesis is one), not all are local (EP, 2009). Some of these recycling facilities are located in the US as well as Belgium, resulting in excessive transportation and lack of accountability once materials cross borders.

**Environmental:**

By diverting computer hardware from landfills, environmental impacts are limited to energy consumption for the recycling process, and transportation emissions.

**Economic:**

The recycling approach requires money based on the project group's dedication to social sustainability. The most ideal approach is through partnership with Genesis Recycling in terms of social accountability, however, as opposed to Free Geek, fees are entwined with responsibility.  Figure 4.1 is a list of fees for specific hardware components recycled by Genesis.

| Product Type | Description: | Recycle Fee | Unit |
|---|---|---|---|
| CRT Display | CRT, Flat Panel, or TV Tuner | $8.00 | ea. |
| Computer, Desktop | Desktop or Tower Computer system | $6.00 | ea. |
| Computer, Laptop | Laptop or Notebook Computer system | $10.00 | ea. |
| Computer, Server | Computer Server or comparable | $10.00 | ea. |
| Printer, Personal | Personal Laser or inkjet printer | $6.00 | ea. |
| Printer, Workgroup | Freestanding (Large)Workgroup Printer | $20.00 | ea. |
| Photocopier, Desktop | Small desktop photocopier, All in One unit | $15.00 | ea. |
| Photocopier, Freestanding | Freestanding (Large)Workgroup Printer | $35.00 | ea. |
| Networking Equipment | Routers, Switches, Hubs, etc | $6.00 | ea. |
| UPS, Small | Less than 1000 V/A | $10.00 | ea. |
| UPS, Large | Greater than 1000 V/A | $20.00 | ea. |
| Handheld Devices | Cellular Phone, PDA, Blackberry, MP3, etc | $6.00 | ea. |
| Computer, Storage | Drive Array, Tape Backup, | $10.00 | ea. |
| Audio Equipment | Amplifiers, VCR, CD/DVD Player, etc | $5.00 | ea. |

**Figure 4.1 – A list of recycling fees by Genesis Recycling Ltd.**

# 5.0 CONCLUSION AND RECOMMENDATIONS

Through our triple-bottom-line analysis it is recommended that all new hardware purchases take EPEAT standards into consideration to minimize both power consumption and production requirements. Where possible, however, hardware should be acquired by means of previously used equipment to minimize both costs and environmental effects. To benefit both economic and environmental criteria, computer hardware in the SUB can be set to enter low power states during periods of inactivity and completely shut off at night. Concerning old hardware, it is recommended to relocate all hardware possible to other facilities on campus, especially as many campus computer labs currently use the same equipment as the SUB. Any computer hardware deemed obsolete should be recycled through Genesis Recycling to enable full accountability for our e-waste and minimize the negative social impacts. Any hardware not able to be recycled through Genesis can be sent to Free Geek for re-use or distribution to a variety of recycling facilities

# REFERENCES

BC Hydro. *Turn Equipment Off When Not in Use.* (2009). Retrieved November 14, 2009, from http://www.bchydro.com/guides_tips/green_your_business/office_guide/Turn_equipment_off_when_not_in_use_.html#Monitors

Encorp Pacific (Canada). (2008). *The Electronics Recycling Process.* Retrieved November 14, 2009, from http://www.encorp.ca/cfm/index.cfm?It=939&Id=12&Se=40

Energy Star. *Energy Star Displays Product List.* (2009). Retrieved November 14, 2009, from http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=MO

Energy Star. *Wake On Local Area Network.* Retrieved November 14, 2009, from http://www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_wol

EPEAT. *Green Electronics Made Easy. (2009).* Retrieved November 14, 2009, from http://www.epeat.net/Criteria.aspx

Genesis Recycling Ltd. *Genesis Recycling.* (2006). Retrieved November 14, 2009, from http://www.genesisrecycling.ca/

London Drugs. *Recycling Programs.* (2004). Retrieved October 17, 2009, from http://www.londondrugs.com/Cultures/en-US/Content/CorporateInfo/NewsEvents/ld_recycling.htm

Organisation for Economic and Co-operation and Development. *OECD Country Web Sites.* (2008). Retrieved November 14, 2009, from http://www.oecd.org/countrieslist/0,3351,en_33873108_33844430_1_1_1_1_1,00.html

Ramsey, Bill. *Hazardous Waste Disposal Issues for IT*.(2006). Berea, K.Y. Retrieved November 14, 2009, from: http://www.ascue.org/files/proceedings/2006/p180.pdf

Sun Microsystems. *Sun Ray 2 Virtual Display Client.* (2009). Retrieved November 15, 2009 from http://shop.sun.com/is-bin/INTERSHOP.enfinity/WFS/Sun_Catalogue-Sun_Catalogue_CA-Site/en_US/-/CAD/ViewCatalog-Browse?CatalogCategoryID=crhIBe.doFYAAAEUBEw5G_c2&PriceIt=true&FromRedirect=true

Sun Microsystems. *Sustainable Computing.* (2005). Retrieved November 14, 2009, from http://uk.sun.com/specials/sustainability/pdf/sustainable_computing_opinion_wp.pdf

University of British Columbia: Public Affairs. *UBC Facts & Figures.(2009).* Retrieved November 14, 2009, from http://www.publicaffairs.ubc.ca/services-for-media/ubc-facts-figures/#top

University of British Columbia Waste Management. *E-waste.* (2008). Retrieved November 8, 2009, from http://www.recycle.ubc.ca/ewaste.htm

Wattzon. *Embodied Energy Database.* (2009). Retrieved November 14, 2009, from http://www.wattzon.com/stuff/items/

Williams, Eri & Sasaki, Yukihiro. (2003). Energy Analysis of End-of-Life Options for Personal Computers: Resell, Upgrade, Recycle. *Electronics and the Environment, 2003. IEEE International Symposium on.* Retrieved November 17, 2009 from IEEE database.

# APPENDIX

**The following are the EPEAT Gold Standard Desktop Computers in Canada:**

HP Compaq dc5800 Small Form Factor - ENERGY STAR®
HP Compaq dc5850 Microtower PC ENERGY STAR® PC
HP Compaq dc5850 Small Form Factor ENERGY STAR® PC
HP Compaq dc7900 Small Form Factor PC ENERGY STAR®
HP Compaq dc7900 Convertible Minitower PC ENERGY STAR®
HP Compaq dc7900 Ultra-slim Desktop PC
DELL OptiPlex 960 Mini-Tower
DELL OptiPlex 960 Desktop
DELL OptiPlex 960 Small Form Factor
Lenovo ThinkCentre M58 Tower
Lenovo ThinkCentre M58 SFF
Lenovo ThinkCentre M58 Eco USFF
Lenovo ThinkCentre M58p Tower
Lenovo ThinkCentre M58p SFF
MDG Prism Vx8400i
Lenovo ThinkCentre M58p Eco USFF
MDG Prism Vx7400i
CIARATECH DISCOVERY DQ45CB
CIARATECH Discovery BOXDQ35JOE
CIARATECH Enterprise BOXDQ35JOE
DELL Studio Hybrid
DELL OptiPlex FX160
CIARATECH Enterprise DX48BT2
DELL Optiplex 760, 780, small form factor
DELL Optiplex 760, 780 Desktop
DELL OptiPlex 360 Desktop
DELL Optiplex 760, 780, minitower
DELL OptiPlex 760 Ultra Small Form Factor
DELL OptiPlex 360 MiniTower
MDG Prism Vx8600i
MDG Prism Vx8500i

Northern Micro Spirit P5Q45-AS
DELL OptiPlex 160
Lenovo ThinkCentre M58e Tower
Lenovo ThinkCentre M58e SFF
CIARATECH ENTERPRISE DQ45CB
HP Compaq 6000 Pro Small Form Factor PC ENERGY STAR®
HP Compaq 6005 Pro Small Form Factor PC ENERGY STAR®
HP Compaq 6000 Pro Microtower PC ENERGY STAR®
HP Compaq 6005 Pro Microtower PC ENERGY STAR®
DELL Optiplex 380Mini-Tower
DELL Optiplex 380 Desktop
DELL optiplex 380 Small Form Factor
HP rp5700 Business Desktop PC ENERGY STAR
Northern Micro Spirit P5Q35-AS
Northern Micro Spirit P5Q35-AS SFF
MDG Prism Gx6750i
HP Compaq dc7800 Convertible Minitower ENERGY STAR®
HP Compaq dc7800 Small Form Factor ENERGY STAR®
HP Compaq dc7800 Ultra-slim Desktop PC
MDG Prism Vx6850i
MDG Prism Vx6750i
MDG Prism Gx6850i
Lenovo ThinkCenter A62 Desktop
Lenovo ThinkCentre A62 Tower
MDG Prism Vx8200i
Lenovo ThinkCentre A58 Tower
Lenovo ThinkCentre A58 SFF
Northern Micro Spirit P5B945G-AS
HP Compaq dc5800 Microtower PC ENERGY STAR®