



Smart Strip

Electrical Savings and Usability

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Date: October 27, 2008

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Abstract

This document is intended to set out BC Hydro Power Smart's evaluation of a new energy efficient power bar product called Smart Strip. The Smart Strip came to BC Hydro's attention in about July 2007, by September 2007 a small employee pilot was carried out on the Smart Strip to determine the electrical energy savings it offered per computer desktop workstation. During this pilot despite construction causing several complete building power outages and employees being transferred leaving vacant workstations, a confidence level in the data did support meaningful electrical energy savings offered by the Smart Strip. At the request of Power Smart to BC Hydro's office of the CIO BC Hydro's IT outsource company called Accenture carried out a study on the Smart Strip working alongside a computer power management software program called Faronics Power Save. The results of this study are that the two products were recommended to be installed on every computer workstation at BC Hydro. The Smart Strip was approved for BC Hydro Power Smart Product Incentive Program in June 2008 which is \$7 per power bar and 100 kWh/yr in electrical savings is claimed per Smart Strip.

Acknowledgements

The author of this report wishes to thank: BC Hydro Power Smart Action Conservation team for identifying the Smart Strip Product: BC Hydro Power Smart Commercial Marketing who had the vision to support this product with a \$7 incentive, and to the team players within Power Smart Engineering especially to Ira Rowlands and to all the participants of our Smart Strip pilot as without their efforts, support and very high standards this report would not have been possible. Special thanks are made to BC Hydro's office of the Chief Information Officer for authorization for a report done by Accenture on the Smart Strip and special thanks to Accenture for completing the report.

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1. Introduction

BC Hydro was the first utility in Canada to identify an energy conservation opportunity by offering a \$7 incentive for the Smart Strip Energy Efficient Power Bar. Almost every computer in British Columbia is expected to have a power bar surge protector. If this assumption is correct there are at least 3 million power bars protecting computers in B.C. Power bars are also used in residential homes for protecting electronic equipment such as home entertainment centers. We estimate there may be as many as 4 million surge protector power bars in B.C. alone. If 45% of these power bars uses a Smart Strip and using our electrical energy saving metric of 100 kWh/yr in savings for this product, the potential savings for the Smart Strip to B.C. are 180 GWh/yr. This is enough energy saved each year to supply over 16,000 homes in British Columbia.

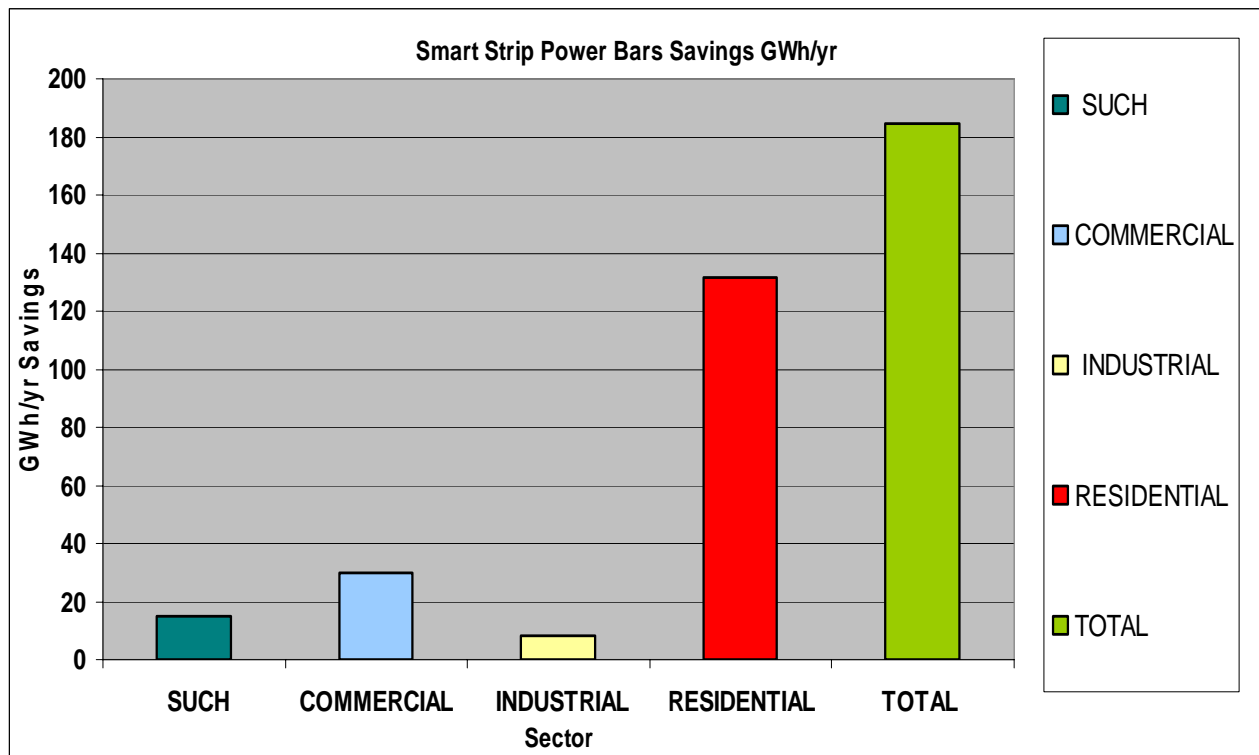


Fig. 1 Smart Strip Potential GWh/yr Energy Savings in British Columbia /1/

Across Canada the smart strip may offer potential electrical energy savings of about 1,400 GWh/yr and across the USA as much as 12,400 GWh/yr which is enough energy saved to supply 1 million homes in the USA /2/.

Ontario Power Authority was close to follow BC Hydro's lead in offering incentives for the Smart Strip and in October 2008 offered a \$5 incentive /3/. The first Canadian container load for the Smart Strip arrived in Toronto in the first week of October 2008.

2. Discussion of the Methodology, Assumptions and Data Sources

This document offers a discussion of methodology, assumptions, data sources, application reviews, inspections, invoice checks, and any other mechanisms used to ensure the integrity of the data for assessing the smart strip energy efficient power bar.

2.1 Overview of Smart Strip Technology

The Smart Strip switches off plug load using current sensors and switching devices which switch off plug load when electrical current drops below threshold low levels. It may be used on electrical home appliances or in commercial offices, universities, hospitals or schools.

Smart Strip monitors the flow of electricity to the controlled outlet and when there is a significant drop, it switches off the power to the controlled outlets. When the control outlet goes into sleep or off mode the controlled appliance is also switched into sleep mode or is shut off automatically saving electrical energy and money.

The primary function of any power bar is to provide some level of power surge protection to electrical devices plugged into them. The smart strip is different from other power bars in this respect.

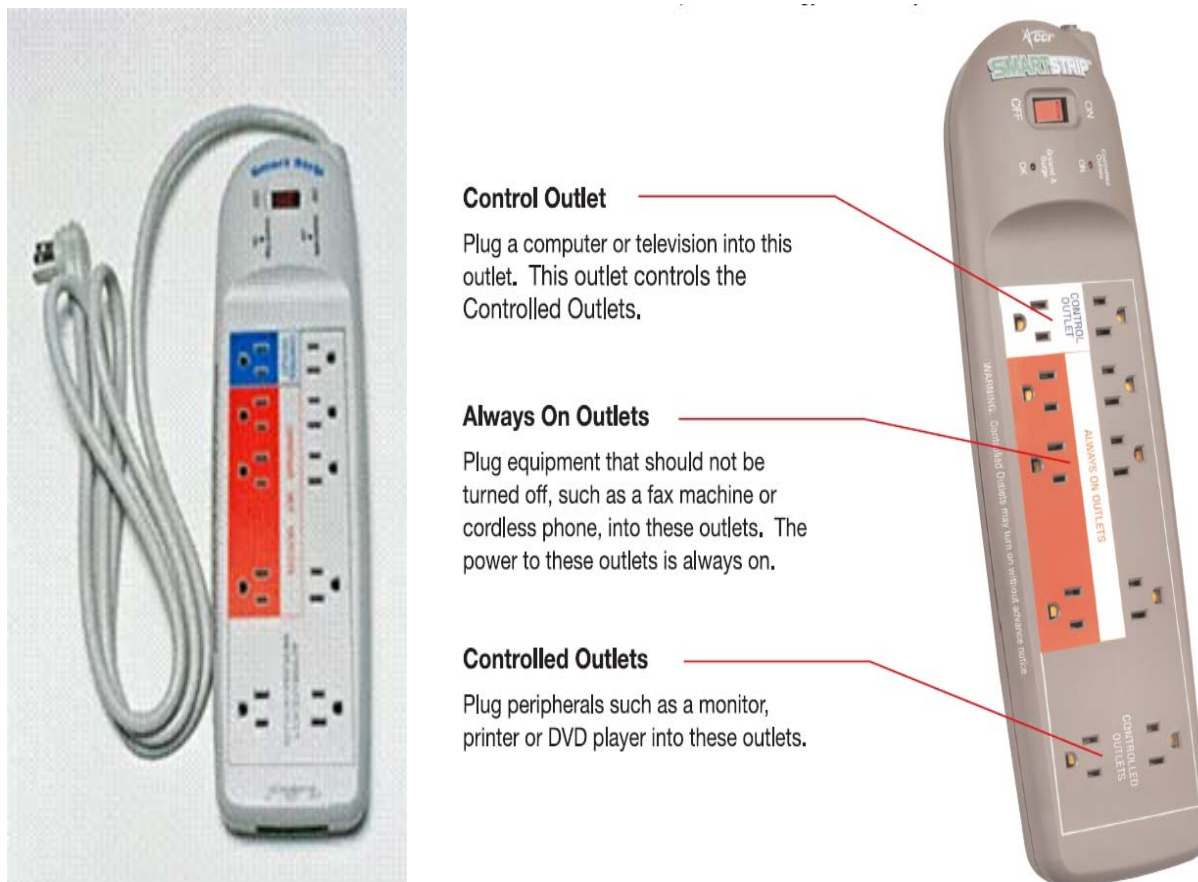


Fig. 2 Smart Strip Energy Efficient Power Bar



There two types of surge protection power bars;

- (1) MOV (Metal Oxide Varistors) based and these work by clamping transients to the neutral which exceed a design voltage transient threshold, and
- (2) LC circuits (coils, transformers & capacitors) work on electric networks that contain both inductive and capacitive elements. This form of surge protector is often referred to as a surge suppressor and they essentially protect electronic equipment by swishing voltage transients through filters.

2.2 Technical Specifications

The Smart Strip uses the MOV surge protection method. The MOV surge protectors are disposable & cheap. They are designed to take one hit & then be replaced. Surge protector companies are now putting life expectancies on them & suggesting replacement every few years. This new suggestion comes at the time that sales of surge protectors are falling quickly this could be nothing more than a marketing ploy to sell more surge protectors. Some equipment that is 20 years old is still being protected using the original MOV surge protection & they still function correctly. MOV's have been used as surge protectors in such applications ranging from entertainment through to full industrial equipment and for many years. Surge protectors are tuned to pass 50/60 hertz & absorb a range of higher frequencies.

Table 1. Smart Strip Technical Specifications /4/

	 <p>Smart Strip 10: the Ten-Outlet Power Strip</p>	 <p>Smart Strip 7: the Seven-Outlet Power Strip</p>
Energy Saver Specs	<ul style="list-style-type: none"> • Safe Passive Current Sensor • Patent-Pending Protective Hysteresis Circuit • 2 RC Filters Eliminate 	<ul style="list-style-type: none"> • Safe Passive Current Sensor • Patent-Pending Protective Hysteresis Circuit • Uses very low power

	<p>False Switching</p> <ul style="list-style-type: none"> • Uses very low power when The Switched Outlets Are Off • Uses Less Than 1 Watt When Fully Energized 	<p>when The Switched Outlets Are Off</p> <ul style="list-style-type: none"> • Uses Less Than 1 Watt When Fully Energized
Switch	Recessed, lighted power switch	Recessed, lighted power switch
Mount	4 way wall mountable	4 way wall mountable
Plug	45 degree angled space saver plug	45 degree angled space saver plug
Outlets	<p>Ten outlets total:</p> <p>1 Control - Always Hot</p> <p>3 Constant Hot: 1 Transformer, 2 Standard</p> <p>6 Switched: 3 Transformer, 3 Standard</p>	<p>Seven outlets total:</p> <p>1 Control (Always Hot)</p> <p>2 Constant Hot</p> <p>4 Switched (1 Transformer-spaced, 3 Standard)</p>
UL	UL 1449 Rating 120 Volt 50/60 Hz	UL 1449 Rating 120 Volt 50/60 Hz
Joules	<p>2225 joules three-way protection:</p> <p>1000 joules live to neutral</p> <p>775 joules live to ground</p> <p>450 joules neutral to ground</p>	<p>1225 joules three-way protection:</p> <p>775 joules live to neutral</p> <p>225 joules live to ground</p> <p>225 joules neutral to ground</p>
Amps	84,000 Amp, three-way	48,000 Amp, three-way

	protection: 36,000 amps live-neutral 24,000 amps live-ground 24,000 amps neutral-ground	protection: 24,000 amps live-neutral 12,000 amps live-ground 12,000 amps neutral-ground
Volts	130 volt, three-way protection	330 volt, three-way protection
Circuit Breaker	15 amp circuit breaker	15 amp circuit breaker
Fuses	2 Thermal/Current & 2 trace land fuses	2 Thermal/Current & 2 trace land fuses
Filtering	EMI/RFI filtering: 2 Spike Blocking Bar coil chokes .1ufd film box capacitor	EMI/RFI filtering: .1ufd film box capacitor
Noise reduction	Up to 60db line noise reduction	Up to 40db line noise reduction
Indicator	Patent pending status indicator	Patent pending status indicator
Cord	6-Foot, 14 gauge, heavy-duty power cord	6-Foot,14 gauge, heavy-duty power cord

2.3 Sources for Determining Plug kW Load

There are a number of primary hardware electrical plug loads which are generally found in two main areas; (1) the workplace and (2) residential homes. The following section describes sources for determining IT hardware electrical loads in data centres.

2.3.1 Plug Load

Electrical plug load hardware includes but is not limited to: battery chargers, desktop lamps, under desk heaters, desktop fans, copiers and printers and essentially is a term used to describe any electrical device which is plugged into an electrical wall outlet. Electrical plug load hardware electrical consumption is normally easy to determine as it is specified in the general specifications from OEMs. The power consumption for electrical plug load may be given by simply using the power factor for the single phase and system can be calculated as follows:

$$P_{real} = V \cdot I \cdot \cos(\varphi)$$

Where:

P_{real}	Power in Watts
V	Voltage in Volts
I	Current in Amps
$\cos(\varphi)$	Power factor

Plug load electrical demand can be determined by several Measurement and Verification (M&V) general protocols. Consumer power meters are available which are easy to use and may be plugged into an electrical outlet and then the power bar simply plugged into the meter.

Examples of these meters are; the Kill a watt meter, EED Watts up and the Kill a watt power strip and the PL-100 Power Analyser /5/. These are basically plug and play type meters which anyone may use and they are readily available from many consumer retail outlets and from online stores.

Several high profile reports have been written on plug load. Among these /X/ says among offices only (for which we were able to estimate number of employees, or occupants), the

average equipment density, in *units per employee*, was approximately 3 units of office equipment and 6 units of miscellaneous equipment per employee, for a sum of about 9 electrical plug-load devices per employee; note that this includes equipment found in common areas such as kitchens, print centers, and utility closets.

The National Renewable Energy Laboratory /6/ report on plug load in a building suggested daytime total plug load was 19 kW which represented 27% of the entire buildings' electrical daytime plug load demand, while at night it fell to 10 kW which was about 25% of this building night time plug load.

On the Energy Star website /7/ they say external power adapters, also known as power supplies, are crucial to the operation of virtually all small electronic devices. As many as 1.5 billion are in use in the U.S. — that's about five for every person.

The total electricity flowing through all types of external and internal power supplies is about:

- 300 billion kWh/year, and
- 11% of the national electric bill

Translating these figures to British Columbia equates to about 4,350 GWh/yr in electrical consumption. This is a very significant form of plug load and devices like the smart strip may help reduce waste associated with it. 27% of the power supplies fall in the sleep and standby inactive periods so products like smart strip could help reduce this energy. Even a 20% reduction in the power being wasted when power supplies are in standby and sleep modes could be as high as 230 GWh/yr in potential energy savings.

A new product which is being planned for release next year called the Green Plug /8/ and /9/ which switches off devices once they have fully charged. This product has another attractive feature and that is it knows what output voltage to give on each device plugged into it from iPod's to TV's. The essential key component of this new product is an intelligent chip which enables these features. BC Hydro will look forward to reviewing the Green Plug once it's commercially available.

2.3.2 BC Hydro Power Smart Action Conservation Smart Strip Pilot

In July 2007 BC Hydro Action Conservation teams recommended that the new smart strip product be pilot tested. By September 2007 about 15 volunteers offered to participate in the smart strip pilot. Kill a Watt meters were used to measure the electrical energy consumption of computer workstations before and after the smart strip were installed.

There was construction going on in the main building where this pilot was done in that 6 new floors were built onto of the building while regular office work carried on as usual in it. This lead to a number of power outages which had to be accommodated in the pilot. Another issue which affected this pilot is that once construction was complete several members of staff participating in the pilot moved office locations. For this reason the final number of participants in the pilot fell to nine.

Table 2. BC Hydro Action Conservation Smart Strip Pilot

BC Hydro - Power Smart																			
Smart Strip Plug/Phantom Load Pilot Central Park and Patterson																			
Name	Floor	Plug	Phantom		Pre-Monitoring											Energy	Energy	Energy	Energy
			Load	Power	Meter Install	Reading	Hours	kWh	SS			Further Readings			BEFORE	AFTER	SAVINGS	SAVINGS	
Employee		Load W	W	Factor	Dates 2007	Dates			installed	Hours	kWh	Dates	Hours	kWh	kWh/yr	kWh/yr	kWh/yr	%	
1	CP08	107	4	62%	6-Sep	22-Sep	378	5.00	12-Oct	294	5.82	03-Dec	1232	9.08	141.0	64.6	76	54.2%	
2	CP08	54	2	28%	6-Sep	22-Sep	378	4.79	12-Oct	294	2.84	03-Dec	1232	13.31	99.5	94.6	5	4.8%	
3	CP08	123	4	25%	6-Sep	22-Sep	363	16.62	12-Oct	294	13.44	03-Dec	1232	38.4	400.8	273.0	128	31.9%	
4	CP08	236	6	35%	6-Sep	22-Sep	374	75.14	12-Oct	294	69.49	03-Dec	1232	174.2	1,896.6	1,238.6	658	34.7%	
5	CP11	64	4	76%	6-Sep	22-Sep	378	6.09	12-Oct	294	5.08	03-Dec	312	3.2	145.6	89.8	56	38.3%	
6	CP07	194	1	37%	6-Sep	22-Sep	378	10.60	12-Oct	297	11.42	03-Dec	1232	20.07	285.8	142.7	143	50.1%	
7	CP07	57	1	41%	6-Sep	22-Sep	378	5.31	12-Oct	297	4.52	03-Dec	1232	14.91	127.6	106.0	22	16.9%	
8	CP07	143	2	30%	6-Sep	22-Sep	378	14.79	12-Oct	297	11.62	03-Dec	1179	43.32	342.7	321.9	21	6.1%	
9	Pat	116	3	61%	14-Sep	22-Sep	378	7.39	14-Oct	743	21.91	03-Dec	312	5.34	229.0	149.9	79.17	16.9%	
															407.6	275.7	131.95	28.2%	

The result of this pilot suggested the average power savings per smart strip in this group was 131.85 kWh/yr which represented about 28% in electrical savings.

The BC Hydro Power Smart Action Conservation Smart Strip Pilot had 18 volunteer participants on three floors of our Central Park building and with a few more participants at a separate building called Patterson.

In terms of the smart strip's usability the following educational issues were found necessary to teach participants:

1. The computers and laptops must be plugged into the red colour coded sockets only. If not they loose network connectivity.
2. It's advisable to tell end users to plug their LCD screens into the blue colour coded socket. Unless LCD screens actually shut down they will not switch off the plug load.
3. End users should ensure their LVD screens when in sleep mode go into shut down mode and not screen saver mode. This may be done in windows – below screen shot.
4. Never adjust the potentiometer screw on the side of the smart strip as our experience is that the need to adjust this only means the smart strip is defective and needs be returned. The first batch we received all needed this adjustment and we ended up sending them all back and in the second batch on smart strip was defective. Smart Strip say they have resolved this issue now.
5. The smart strip saves energy only by reducing the on time of plug load.
6. Some end users by-passes the smart strip to leave their under desk heaters on 24/4. We should encourage end users to always have as much and is possible their entire desktop plug load controlled by the smart strip.
7. Not every workstation has plug load and there is no point adding a smart strip on these. However future plug load may occur on any workstation and it may be an idea to deploy them on every workstation.

3. BC Hydro Power Smart DSM Programs

BC Hydro currently offers three broad Power Smart programs. These are:

1. Power Smart Partners Program
2. Product Incentive Program
3. High Performance Buildings Program

In addition to this there are smaller specialised programs which fall into the Power Smart Partners Programs such as; The Server Virtualization Program, The High Bay Energy Efficient Lighting Program and the Continuous Building Optimization Program.

3.1 Power Smart Partners Program

BC Hydro's Power Smart partners Program is open to its largest business customers both industrial and commercial (i.e., those who use over \$50,000 of electricity per year), who are prepared to: Improve overall electrical energy efficiency, sign a Power Smart Partner (PSP) Program agreement outlining their commitment, energy-efficiency target and the Energy Champion who will be responsible for carrying out the plan and commit matching dollars to identify energy-saving opportunities. Generous incentives are paid out in this program up to 60% of project costs and providing pay back from electrical energy savings is not much shorter than 2 years or longer than 10 years.

3.2 Product Incentive Program (PIP)

The Power Smart Product Incentive Program provides financial incentives for business customers to replace existing inefficient technologies with energy-efficient products. The program has been expanded to include additional technologies eligible for incentives.

This offer is open to BC Hydro commercial business customers. This is also opened to BC Hydro residential strata customers applying for a project in the common areas of their property. Businesses and residential strata common areas in the City of New

Westminster are also eligible for this program. Customers with street lighting accounts are only eligible for ornamental street lighting technologies.

The PIP project must: meet the minimum criteria of \$50 total financial incentives per application, only use approved products identified in BC Hydro's online e.Catalog and be installed by qualified installers. New construction projects are not eligible to receive funding under this program.

3.3 High Performance Buildings Program

The Power Smart High Performance (new) Building (HPB) Program provides incentives and tools to assist – building owners, developers, architects and their design teams create high performance, energy efficient buildings with the benefits of lower operational costs, lower environmental impacts and higher profitability.

There are three different Power Smart offers within the High Performance Building (HPB) program:

3.3.1 Whole Building Design – intended for new commercial or multi-unit residential building projects.

Requirements:

- At least 50,000 square feet.
- Electricity-intense facilities such as arenas, refrigerated warehouses or grocery stores.
- Multi-Unit Residential Buildings.

3.3.2 New multi-unit residential buildings

– intended to promote ENERGY STAR® products.

Requirements/Incentives:

To receive a \$150 rebate per suite, install the following:

- ENERGY STAR compact fluorescent lighting in 40 per cent of the suite.
- One ENERGY STAR refrigerator.
- One ENERGY STAR dishwasher.
- One ENERGY STAR ventilation fan.

To receive an additional \$50 rebate per suite, install:

- One ENERGY STAR clothes washer.

3.3.3 Energy-Efficient Lighting Design – intended for new commercial development projects.

Requirements:

- Over 6,000 sq. ft. for energy efficient lighting design.
- New commercial buildings such as warehouses, offices, retail, multi-unit residential buildings, and government facilities.

Incentives:

- A \$1,000 incentive for creating a lighting design that meets or exceeds ASHRAE/IESNA 90.1 – 2004 code /11/.
- A capital incentive to install the new lighting. The incentive will be based on the total electrical savings of the energy-efficient design.**
- An incentive of up to \$3,000 will be paid for a daylight study. Limited number of studies available.

4. The Smart Strip BC Hydro Power Smart Incentive

The smart strip power bar was seen as an ideal new product for BC Hydro's Product Incentive Program. Metrics were given to Power Smart Marketing by Power Smart Engineering and it was recommended to use 100 kWh/yr as the average energy savings per smart strip. This figure was smaller than the approximately 132 kWh/yr savings per smart strip which was found from the Action Conservation pilot. Several US and Canadian utilities were approached to comment on this energy saving amount of 100 kWh/yr and from their response BC Hydro Power Smart agreed to use it. Following its review process BC Hydro Power Smart decided to give a \$7 incentive per smart strip under its Product Incentive Program.

In addition to the smart strip incentives were also awarded to digital timer controlled programmable power bars.

Power Smart Engineering gave the following product criteria for the smart strip /10/:

CRITERIA FOR EFFICIENT POWER BARS FOR COMPUTER WORKSTATIONS

The Program incentive applies to efficient power bars used for commercial computer workstations:

Technical Requirements for Timer Based Smart Power Bars:

1. The timer based power bar must use digital timer and not mechanical controls.
2. The timer power bar must be programmable.
3. The timer power bar must include a digital LED screen.
4. These power bars are not recommended to shut down computers or control equipment.

Technical Requirements for Current Sensor Smart Power Bars:

1. Include Safe Passive Current Sensor based switching.

2. The current sensor power bar must automatically switch off peripheral plug load from its control plug outlet.
3. The current sensor power bar must prohibit false switching for example by incorporating resistor-capacitor circuit filters.
4. Computers should be plugged into the colour coded (often coloured red) power bar sockets where they will be left powered on.

Additional Technical Requirements for Efficient Power Bars:

1. The smart power bar must be CSA, cUL or UL approved.
2. The smart power bar must have a 3-prong grounded plug outlet.
3. The smart power bar must offer electrical 3-way surge protection as follows: (1) Live to neutral (2) live to ground and (3) neutral to ground.

5. BC Hydro and Accenture Smart Strip Report

Power Smart Engineering tested the smart strip alongside a desktop power management software program called Power Save which is produced by a local Vancouver company called Faronics. These two products complimented themselves. It was observed that one desktop with plug load was consuming about 120W but then Faronics sent the workstation into a deep sleep mode and through the control offered by the smart strip the entire workstation desktop fell to 3W of power consumption. Then when a user returned to the desk and hit the keys Control, Alt and delete the entire workstation became alive in just a few seconds to 120W again.

Power Smart Engineering requested to the BC Hydro office of the Chief Information Officer that they have their IT outsourcing company called Accenture write a technical report on the compatibility of the smart strip with Faronics Power Save software with BC

Hydro desktops. Approval was given to complete this report which is attached in Appendix A entitled BC Hydro Workstation Power Management Project Product Evaluation Version 1.6 June 6, 2008, Prepared By: Kevin Ho / Darin Nishi.

This report concluded that Accenture recommend these two products be deployed on every desktop workstation at BC hydro.

6 Commercial Smart Strip Market

The smart strip has until October 2008 been mainly been marketed by online sales through the US Distributor Bits. Ltd. In October 2008 the first container of smart strips arrived in Toronto, Canada with all the Canadian markings and CUL stickers. At the time of writing this report one retail chain in British Columbia is reported to be selling the smart strip and this is Zellers.

In terms of the market penetration for the smart strip as of October 2008 it's in the infancy stage of growth.

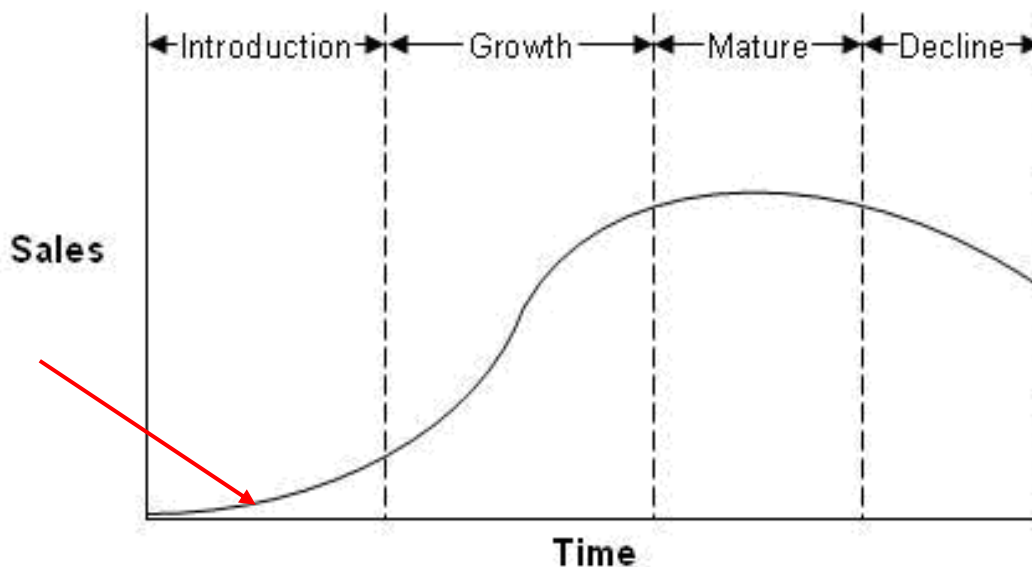


Fig. 3 Market penetration for Smart Strip in British Columbia as of October 2008

One main barrier which may limit the growth of the smart strip market is education. Many consumers when they see a smart strip have no idea what it is and perceive it alongside any other power bar. The second educational barrier this product has is that consumers don't understand that it saves energy only by switching off plug load. Most consumers won't even know what the term plug load even means. Educational marketing will be an essential feature to have this product penetrates into the market place.

BC Hydro and Ontario Power Authority are the only known utilities currently offering incentives for the smart strip.

The following North American electric utilities are currently reviewing the smart strip for potential incorporation into their Demand Side Management (DSM) programs;

The Pacific Gas & Electric, San Diego Gas & electric, Southern California Edison, Focus on Energy (Wisconsin), Long Island Power Authority, NYSERDA, and Northeast Energy Efficiency Partnerships, Inc.

7 Effective Measure Life of the Smart Strip

Power Smart Engineering is recommending a 4 year Effective Measure Life for the smart strip. There are no standards governing the life expectancy for power bar surge protections. Surge protector manufacturers suggest changing their MOV products every 4 years and PSE recommended that the EML for EE MOV Power Bars to be 4 years.

8 Glossary of Terms

ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
DSM	Demand Side Management
ECM	Energy Conservation Measure
EE	Energy Efficient
EML	Effective Measure Life
Energy Star	A United States government program to promote energy efficient consumer products. Natural Resources Canada purchased the rights to use the Energy Star program in Canada.
IESNA	Illuminating Engineering Society of North America
KAM	BC Hydro Key Account Manager
LBNL	Lawrence Berkeley National Laboratories.
M&V	Measurement and Verification
MOV	Metal oxide Varistor
NSERDA	New York State Energy Research and Development Authority
OEM	Original equipment manufacturer, or OEM, is a term that refers to containment-based re-branding, namely where one company uses a component of another company within its product, or sells the product of another company under its own brand. OEM refers to the company that originally manufactured the product.
Power Management Software	Enables servers and computers to be powered down during periods of low or no work loads.

PS	BC Hydro Power Smart
PSE	Power Smart Engineering
QA	Quality Assurance

9 References

- /1/ 2007 BC Annual Population
<http://www.bcstats.gov.bc.ca/DATA/pop/pop/BCPop.asp>
- /2/ Population for USA <http://www.census.gov/population/www/popclockus.html>
- /3/ Ontario Power Authority \$5 Smart Strip Incentive
<http://www.earthtimes.org/articles/show/woods-industries-canada-launches-the-eco-logicaltm-smart-strip-surge-protector,560692.shtml>
- /4/ <http://www.greenandmore.com/smart-strip-energy-saving-power-strips.html>
- /5/ <http://www.powermeterstore.com>
- /6/ Preliminary Energy Analysis of the Pennsylvania Department of Environmental Protection's Cambria Office Building, Ebensburg, PA
www.nrel.gov/docs/fy03osti/33106.pdf
- /7/ Energy Star website External Power Adapters
http://www.energystar.gov/index.cfm?c=ext_power_supplies.power_supplies_consumers
- /8/ Green Plug is the first developer of digital technology that enables real-time collaboration between electronic devices and their power sources.
<http://www.greenplug.us/>
- /9/ Youtube The Green Plug Presentation
http://www.youtube.com/watch?v=_OtLry2NJXE
- /10/ POWER SMART PRODUCT INCENTIVE PROGRAM Product Performance Criteria, BC Hydro Power Smart Internal Document Page 18.
- /11/ ASHRAE/IESNA 90.1 – 2004 code.

APPENDIX A

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BC Hydro Workstation

Power Management Project

Product Evaluation

Version 1.6

June 6, 2008

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10 Executive Summary

In its constant effort to reduce energy consumption and conserve the environment, BC Hydro has requested Accenture to evaluate the benefits and effectiveness of Faronics Power Save and Smart Strip Power Strip. Faronics Power Save lowers energy consumption and saves money by effectively managing the power usage on workstations with various inactivity definitions. Smart Strip Power Strips are intelligent power bars that automatically shut down any electrical device whose power is dependant on a 'control' device such as a workstation.

Through our rigorous testing we confirmed that Faronics Power Save is able to:

- Coexist with Microsoft Windows XP Power Options,
- Effectively manage power on Microsoft Windows based systems,
- Configure power options remotely on a workstation,
- Produce energy saving report
- Remotely shut down, reboot, and wake up workstations using Wake-on-LAN technology.

Through our other testing we also confirmed that the Smart Strip Power Strip is able to:

- Control the "automatically switched" outlets with the "control" outlet
- Provide constant power with the "constant hot" outlets

Faronics offers a one-time software license charge which includes the first year's maintenance of \$12 per seat. Additional annual software maintenance charge is \$2.40 per seat (20%). The Smart Strip Power Strips have a MSPR ranging from \$30.95 - \$43.95 USD.

Faronics Power Save not only manages power options efficiently on Windows platforms and provide detailed energy savings reporting, it also offers additional features such as task scheduling, remote computer restart and shutdown, and Wake on LAN. Although the management console doesn't have enough features to keep the operational effort down, it can still be an effective and easy to use power management tool.

Smart Strip Power Strips would complement Faronics workstation power management by further reducing power consumption and reducing the environmental impact by automatically turning off all peripherals associated with the 'control' outlet. As the cost to replace every power bar in BC Hydro would be extensive the Power Strip could be the new standard for BC Hydro and be ordered as new requests arise.

11 Background

Currently, a high profile initiative at BC Hydro is their Power Smart program. This program's goal is to develop a conservation culture and teach British Columbians to conserve energy which in turns saves energy costs and reduces the environmental impact. Although current computers and LCD panels used in BC Hydro offices have become Energy Star compliant there is still more that can be done to save energy. Microsoft Windows XP provides power options such as "turn off monitor", "turn off hard drive", and "put system in standby mode" after inactivity, but at this time the only power option that the BC Hydro desktop has enabled is to "turn off monitor" after 20 minutes due to the lack of efficient and central administration and management.

A third-party software, Faronics Power Save, was recently identified as a potential candidate to bridge the gap and enable effective power management on the BC Hydro desktop platform. In addition to Faronics Power Save, an innovative power bar, Smart Strip Power Strip, was also identified as another possible means to reduce power consumption even further. BC Hydro has requested Accenture to evaluate the benefits and effectiveness of the two aforementioned products.

12 Product Features

a. Faronics Power Save

Power Save uses intelligent energy management to ensure workstations are available when system resources are required, while conserving power during productivity downtimes. Power Save provides organizations with real financial and energy savings on every computer deployed, as well as centralized workstation power status control. Advanced features include real-time savings reports, policy scheduling, and customizable activity settings based on CPU, disk, and application activity. With Faronics' Power Save, it is possible to make the workstation standby, hibernate or even shutdown based on customizable inactivity definitions. Computers managed by Faronics Power Save can also be restarted, shut down, or waken up by Wake on LAN (WoL).

Key features:

- Intelligent Configuration Settings
 - Definitions can be based on CPU, disk, keyboard, mouse and application activity
 - Employ energy saving actions when CPU or disk activity falls below a defined level
 - Prevent the workstation from employing power saving actions when a particular application is running
- Enterprise Control
 - Faronics Core Console provides unified workstation management capabilities
 - Workstation grouping makes managing large deployments easy
- Flexible Scheduling
 - Options to turn off the monitor, and standby, hibernate or shutdown the computer
 - Schedule Wake-on-LAN, shutdown, or restart events
 - Promotes user needs in tandem with energy conservation
- Savings Reports
 - Generate enterprise power consumption and savings reports through Faronics Core Console



- Detailed workstation utilization reporting allows you to see how much power you are saving based upon your regional electricity cost

b. Smart Strip Power Strip

The Smart Strip Power Strip senses when computer or television turns off and automatically powers-down all peripheral devices (printers, monitors, speakers, DVD players, anything...). It's done by plugging the 'control' device into the blue outlet and plugging all peripheral devices connected to it into the white outlets. When what's in the blue outlet comes on, what's in the white outlets turns on - when what's in the blue outlet turns off, all power is cut to the white outlets. There are also some red 'hot' outlets that always supply electricity to devices plugged into them, whether the 'control' device is on or off.

Every device that is plugged in is always drawing electricity - whether a lot or a little, it adds up over 24 hours of every day. This continuous, low-level energy use is called a 'phantom load.' It is estimated that as much as 43 billion kWh each year is wasted by phantom loads throughout the United States (no statistics for Canada). The Power Strip Smart Strip can help eliminate the phantom loads of peripheral devices - most commonly those associated with computers or home entertainment centers.



13 Evaluation Results – Faronics Power Save

A thorough evaluation of Power Save was conducted against several BC Hydro and Accenture desktops (see Appendix A for the complete tests).

a. System Requirements

Console Requirements

The following system requirements must be met to successfully install Faronics Core Console

- 32- and 64-bit editions of Windows XP SP2 and Windows Vista
- Windows Server 2003
- Microsoft .NET 2.0
- Microsoft MMC 3.0
- Microsoft SQL Server Express Edition (SP2).

Workstation Requirements

The Faronics Core Workstation Agent can be installed on any computer running the following Microsoft Windows operating systems:

- Windows 2000 SP4
- 32- or 64-bit editions of Windows XP SP2
- 32- or 64-bit editions of Windows Vista
- Windows Server 2003
- Microsoft Internet Explorer 6 (IE6), or greater, be installed

b. Test Environment

The Faronics Core Console with the Power Save Loading was installed on a test server while several BC Hydro and Accenture workstations were installed with Faronics Core workstation agent and Power Save Installer. Windows Performance monitor was used to monitor the

performance of a workstation after the installation of Faronics client software. The four main counters of interest were:

- Memory – Pages/second
- Physical Disk – Average Disk Queue Length
- Processor - % Processor time
- Network Interface – Bytes total/sec

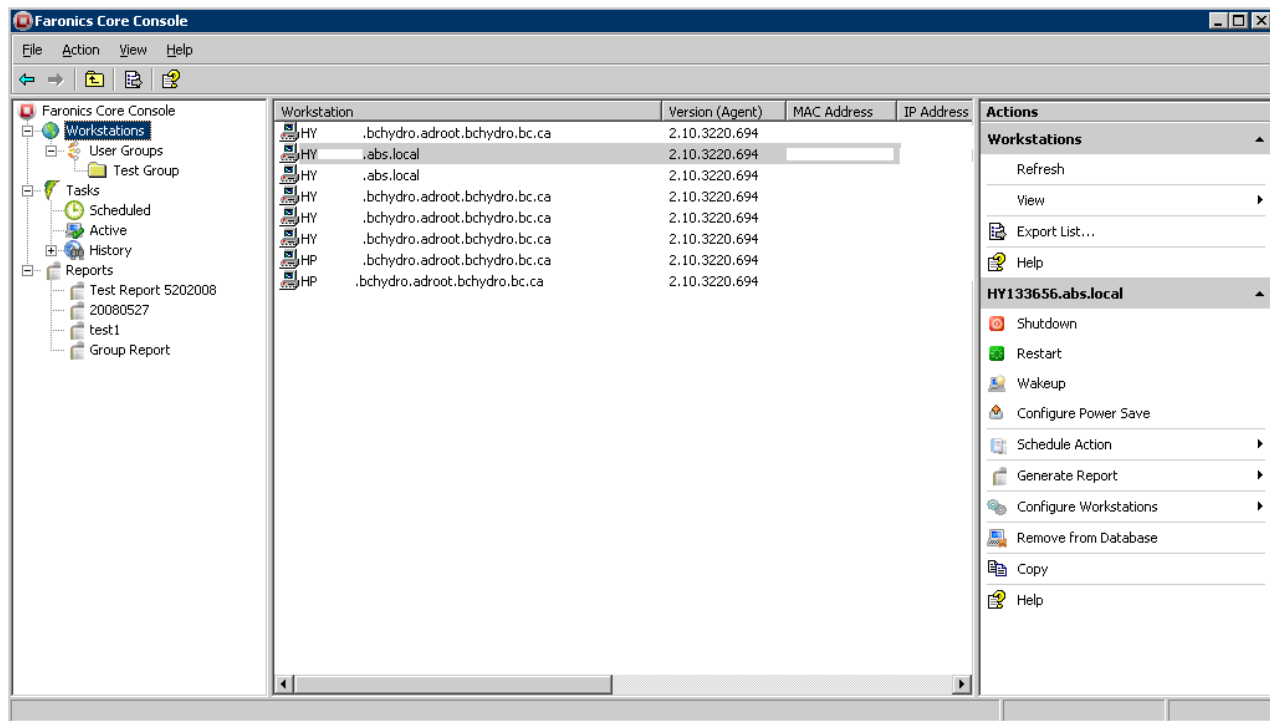
There was no noticeable degradation of performance during the evaluation (see Appendix B) and the workstation performed normally.

c. Management Console

The Faronics Core Console uses Windows XP's Microsoft Management Console (MMC) snap in and is easy to navigate. Within the console there are three areas to navigate: workstations, tasks and reports. The workstation option houses all workstations with the agent and the power save installer installed on it. Any action (e.g. shutdown, wakeup, configure power save) required on the workstation is done in this option. The tasks option is where any scheduled tasks are viewed. All task history is found here and can be exported. When a report is generated they can be found in the Reports option. Just like scheduled tasks, reports can be exported. Once the workstation agent software was installed on our test workstations all agents successfully checked into the master console and were able to be remotely controlled.

While its simple interface is appreciated, the project team also immediately identified three missing critical pieces, which would definitely lead to higher operational cost.

- **No integration with any directory service:** instead, it keeps its own database and asset information and offers the ability to create groups. This means that Faronics Power Save is not able to leverage existing Organization Units or Groups in the BCHYDRO domain and that it would add additional workload to its day-to-day administration.
- **No search function:** it is hard to effectively look for particular targets in a large number of workstations.



- **No API provided to its users for future customization:** this means that no administration work can be automated to save operational costs.

d. Coexistence with Microsoft Windows XP Power Options

Once Faronics Power Save is installed on a workstation it works in combination with Windows' own power management settings. If both Faronics Power Save and Windows XP Power Options have set different thresholds for the same setting (e.g. turn off monitor), the lower threshold will be honoured.

e. Power Management – Monitor

The Faronics Power Save workstation agent was successfully able to manage the workstation monitor. When set to turn off the monitor after a predetermined amount of time the monitor successfully turned off and successfully recovered after keyboard/mouse activity.

f. Power Management – Workstation without Inactivity Definition

Faronics Power Save successfully managed the workstation without a specific inactivity definition. The agent was successfully able to put a workstation into standby and hibernation mode as well as completely shut the workstation down. The workstation was able to recover from each mode.

g. Power Management – Workstation with Inactivity Definition

The inactivity definitions were successfully run on all test workstations. There are three types of inactivity definitions: disk utilization, CPU utilization and applications running. When the workstation usage falls under a predefined percentage the agent will be activated. Also, if a specific application (e.g. winword.exe) is running Power Save will not be activated.

h. Power Management – Multiple Power Option Configurations

Faronics Power Save is able to manage multiple power option configurations at one time, either individually or by the use of user groups. The best practice would be to put machines with the same power option requirement into one user group and then assign a configuration to the group. The ability to manage multiple option configurations can be useful in handling exceptions.

i. Reporting

Reporting is available on the Faronics Console and can be used to report on a specific workstation or multiple workstations as well as for a specific time frame. The summary report displays the power estimates used for the specified time frame, number of hours the monitor and PC were in standby, and how many hours the PC was turned off. There is also a summary of the total savings. See Appendix C for a screenshot of a sample report.

j. Remote Start, Shutdown, and WOL

Via the console, there is the ability to shutdown, restart and wakeup a specific or group of computers. During testing we were only able to shutdown the workstation if it was sitting at the login screen. If a user was logged into the workstation it would start the shutdown process but then freeze and not completely shutdown. There was also another finding that when WoL on a workstation was in standby mode we had to enable “Allow this device to bring the computer out of standby” option on the NIC card to be able to wake up a workstation in standby mode. Also, if a workstation goes into standby mode by Power Save and then woken up by WoL the agent still thinks it’s still in standby mode. When in this scenario Power Save will not react to any inactivity setting after this point. Only after the keyboard is touched or mouse is moved the machine’s status will be taken out of standby mode. Again, with tests conducted on an unaltered version of Windows XP the issues found on our CDS3 build did not occur. Our contacts at Faronics also mentioned that these behaviours have not been seen at other client sites. They have offered technical support to do an on-site visit to investigate and resolve the issues before production implementation.

k. Scheduling

There are five scheduled activities than can be applied to the workstations. They are: shutdown, restart, wake up, enable Power Save and disable Power Save. All scheduled actions were successful and worked as expected.

14 Evaluation Results – Smart Strip Power Strips

In addition to the Faronics software, Smart Strip Power Strips were also tested (Appendix A).

a. Main Switch

The Power Strip was plugged into a wall outlet and a monitor was plugged into the “constant hot” outlet. The device was successfully turned off and on and the device also turned off when the main switch was switched off.

b. Control Outlet & Automatically Switched Outlets

A workstation was plugged into the “control” outlet and a monitor was plugged into one of the “automatically switched” outlets. When the workstation attached to the “control” outlet was powered on with the power button the monitor would automatically power on as well. The monitor would also turn off when the workstation attached to the “control” outlet was powered off with the power button.

c. Control Outlet & Constant Hot Outlets

A workstation was plugged into the “control” outlet and a monitor was plugged into the “constant hot” outlet. When the workstation plugged into the “control” outlet was powered on with the power button the monitor plugged into the “constant hot” outlet did not turn on with it. This was the expected result.

d. Tel / Modem / Fax In & Out Ports

The Tel/Modem/Fax in & out Ports were not tested as our telephone PAX system did not work with the Power Strip.

15 Financial Summary

a. Faronics Power Save /Smart Strip Power Strip Cost

Manufacturer	Products / Modules	Budgetary Pricing	
		One-Time License Charges (Including 1st Year Maintenance)	Software Annual Maintenance
Faronics	Power Save	\$12 / seat	\$2.40 / seat

Manufacturer	Products / Modules	Budgetary Pricing	
		One-Time Charges	Annual Maintenance
Smart Strip	Power Strip	MSRP \$30.95-43.95 USD (Depending on Model)	N/A

* MSRP may be lower than \$20 USD in the near future

* Standard power bars cost between \$16 - \$29 CDN

b. Server Hardware

A dedicated Windows 2003 Server box with Microsoft SQL 2005 Server is required to host the Faronics Console. As there are no specific server hardware requirements for Power Save, running a standard IBM System x3650 Quad Core 3.0GHz Server with dual CPUs, three 73GB hard drives and 4GBs of memory would be acceptable.

16 Appendices

Appendix A

Test Script - Faronics PowerSave

Please provide comments for any items that fail testing. Use the additional pages at the end of this document if more space is needed.

Tester Name: Darin Nishi
Test Date: 27/05/2008
Test Machine HY#: HY133657

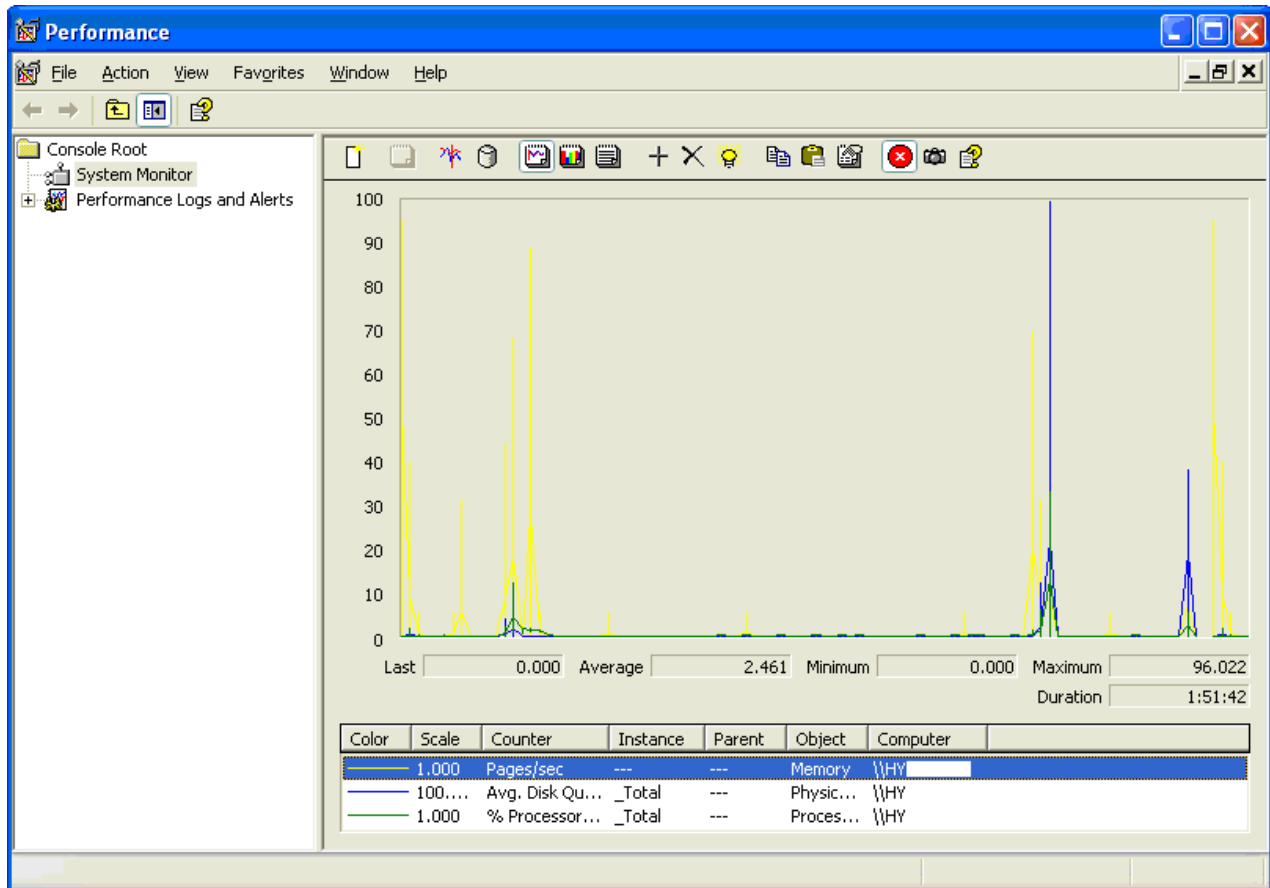
Step #	Description	Expected Results	Comments	Pass 1		Pass 2		Pass 3	
				Pass	Fail	Pass	Fail	Pass	Fail
1.0	Prerequisites								
	Faronics Core Console w/ Power Save Loadin with the following setting: - Turn off monitor after 10 min of inactivity - Reduce power after 30 minutes of inactivity (Standby) - No inactivity definitions	n/a	CDS3 Machines HY126062 HY133653 HY133657 EUDT Machines HY133656 HY133654 Timbaktu username/password psave:psave						
	Two test workstations with Faronics Core workstation agent and Power Save installer installed	n/a	Power Save coexists with Windows Power management. Basically whatever threshold is reached first will win.						
2.0	Power Management - Monitor								
	How Power Save manages power for workstation monitors								
	How monitors recover from shutdown	Monitor turns on after activity		X					
3.0	Power Management - Workstation without Inactivity Definition								
	How Power Save manages power for workstations (standby)		To restart PC hit keyboard or mouse	X					
	How Power Save manages power for workstations (hibernate)		To restart press power button	X					
	How Power Save manages power for workstations (shutdown)			X					
	How workstations recover from standby, hibernate, and shutdown								
4.0	Power Management - Remote Configuration								
	How Faronics Console manages power on individual workstations remotely								
5.0	Power Management - Workstation with Inactivity Definition								
	How Power Save manages power for workstations with inactivity definition on disk activity			X					
	How Power Save manages power for workstations with inactivity definition on CPU activity			X					
	How Power Save manages power for workstations with predetermined applications		Tested with notepad open.	X					
6.0	Reporting								
	How report on energy saving is generated		Can report individually or multiple workstations	X					

Test Script - Smart Strip Power Strips

Please provide comments for any items that fail testing. Use the additional pages at the end of this document if more space is needed.

Tester Name: Darin Nishi
Test Date: 05/21/2008
Test Machine HY#: HY133657 (CDS3)

Step #	Description	Expected Results	Comments	Pass 1		Pass 2		Pass 3	
				Pass	Fail	Pass	Fail	Pass	Fail
1.0	Main Switch		To see if the main switch can turn on / off the power bar						
1.0.1	Plug the Smart Strip Power Strips power bar to a wall outlet	n/a							
1.0.2	Turn the main switch on (if it is currently off)	the main switch lights up		X					
1.0.3	Plug the power cord of a electronic device (e.g. computer monitor) to one of the "constant hot" outlets and turn the device on	the device is turned on	Used monitor for testing.	X					
1.0.4	Turn the device off	the device is turned off		X					
1.0.5	Turn the main switch off	the main switch goes out		X					
1.0.6	Turn the device on	the device doesn't turn on		X					
2.0	Control Outlet & Automatically Switched Outlets		To see if the control outlet and the automatically switched outlets work together						
2.0.1	Plug the Smart Strip Power Strips power bar to a wall outlet	n/a							
2.0.2	Turn the main switch on (if it is currently off)	the main switch lights up		X					
2.0.3	Plug the power cord of a computer to the "control" outlet and plug the power cord of a monitor to one of the "automatically switched" outlets	n/a	Also plugged in desktop fan into "automatically switched" plug						
2.0.4	Make sure the computer and the monitor are both turned off now	n/a							
2.0.5	Turn on the computer by using its power button	The computer is powered up		X					
2.0.6	See if the monitor is also turned on now	The monitor is powered up		X					
2.0.7	Shutdown the computer either from Windows or with the power button	the computer shuts down		X					
2.0.8	See if the monitor is also turned off now	the monitor turns off		X					
2.0.9	Repeat step 3 to 8 with a different "automatically swithed" outlet	same expected results		X					
3.0	Constant Hot Outlets		To see if the constant hot outlets are always on						
3.0.1	Plug the Smart Strip Power Strips power bar to a wall outlet	n/a							
3.0.2	Turn the main switch on (if it is currently off)	the main switch lights up		X					
3.0.3	Plug the power cord of a computer to the "control" outlet and plug the power cord of a monitor to one of the "constant hot" outlets	n/a							
3.0.4	Make sure the computer and the monitor are both turned off now	n/a							
3.0.5	Turn on the computer by using its power button	The computer is powered up		X					
3.0.6	See if the monitor is also turned on now	The monitor is not powered up		X					
3.0.7	Turn the monitor on if it is currently not on	n/a							
3.0.8	Shutdown the computer either from Windows or with the power button	the computer shuts down		X					
3.0.9	See if the monitor is also turned off now	the monitor doesn't turn off		X					
3.0.10	Turn the monitor off if it is currently on	n/a							

a. Appendix BPerformance Monitor Results

b. Appendix C

Sample Single Workstation Report

Power Save Report: 5/15/2008 to 5/20/2008

Report summary:		Power estimates used for this report:	
Start Time:	Thu, May 15, 2008 12:00 AM	Monitor On:	60
End Time:	Tue, May 20, 2008 11:01 AM	Monitor Standby:	15
Report created:	Tue, May 20, 2008 11:01 AM	Computer On:	150
Number of workstations:	1	Computer Standby:	10
Average savings:	\$1.53	Electricity cost:	\$0.07 / kWh
Total power savings:	\$1.53		

Name	Monitor Standby		PC Standby		PC Off		Savings
	days	hours	days	hours	days	hours	
1 HY .bchydro	4	22.81	4	21.93	0	0.00	\$1.53
Total savings:							\$1.53

The values presented in this report are estimates. Time in power saving modes is based on the workstation actions that reported to the console. Savings amounts are calculated based on the user-selected estimates for power usage and electricity cost.

Sample Multiple Workstation Report

Power Save Report: 6/1/2008 to 6/2/2008

Report summary:		Power estimates used for this report:	
Start Time:	Sun, Jun 01, 2008 12:00 AM	Monitor On:	60
End Time:	Mon, Jun 02, 2008 9:25 AM	Monitor Standby:	15
Report created:	Mon, Jun 02, 2008 9:25 AM	Computer On:	150
Number of workstations:	3	Computer Standby:	10
Average savings:	\$0.18	Electricity cost:	\$0.07 / kWh
Total power savings:	\$0.54		

Name	Monitor Standby		PC Standby		PC Off		Savings
	days	hours	days	hours	days	hours	
1 HY .bchydro	1	9.37	1	9.37	0	0.00	\$0.43
2 HY .bchydro	0	0.53	0	0.00	0	0.13	\$0.00
3 HY .bchydro	1	9.36	0	0.00	0	0.12	\$0.11
Total savings:							\$0.54

The values presented in this report are estimates. Time in power saving modes is based on the workstation actions that reported to the console. Savings amounts are calculated based on the user-selected estimates for power usage and electricity cost.