CLIMATE SAVERS COMPUTING INITIATIVE WHITE PAPER

www.climatesaverscomputing.org

What is the Initiative? And what are its Objectives?

Started by Google and Intel, the Climate Savers Computing Initiative brings together industry, consumers, government, and conservation organizations to significantly increase the energy efficiency of computers and servers. Believe it or not, the average desktop PC wastes over half the power delivered to it. Servers are slightly more efficient but still squander about one-third of the power consumed. This wasted electricity unnecessarily increases the cost to power computers and also increases the emissions of greenhouse gases. Improving the energy efficiency of computers is one of the most cost-effective ways to reduce electricity consumption and the greenhouse gas emissions that contribute to climate change.

Through more efficient design optimized for power consumption alongside speed, capacity and cost, together with use of power-saving technologies, the electricity required to power computers can be significantly reduced while at the same time increasing their computing capabilities. As participants in this program, computer and component manufacturers commit to produce products that meet specified power-efficiency targets, and enterprise participants commit to purchase power-efficient computing products. In addition, the Initiative will educate consumers and IT personnel about power management of computers and show individuals how they can reduce the electrical footprint of their computers without any resulting loss of productivity.

Increased deployment of high-efficiency systems combined with education and power management technologies will save money, reduce energy consumption, and reduce greenhouse gas emissions. By 2010, the focused effort of technology providers and committed participants will lead to about a 50 percent reduction in annual power consumption by computers, and committed participants in the Initiative could collectively save $5.5 billion in energy costs.[i]

Who can participate and how do they participate in the Initiative?

The Initiative offers the following opportunities to participate:

- Computer and component manufacturers and software vendors commit to develop products that meet or exceed the latest ENERGY STAR specification.
- System Buyers, who commit to choosing systems that meet or exceed the latest ENERGY STAR specification for a majority of their PC and volume server computer purchases, and to using power-management tools on PCs. System Buyers include any organizations that buy PCs and/or servers, including corporations, government institutions, universities and energy companies.
- Non-governmental organizations (NGOs) commit to educating end-users about the benefits of energy-efficient computers and power-management tools for home use.

Consumers are encouraged to participate by using power-management capabilities on their PCs and by choosing systems that meet or exceed the latest ENERGY STAR specification for any future PC purchases.

Background

Technology exists today that can both improve the efficiency of a computer's power delivery and reduce the energy consumed when the computer is in inactive states. The Climate Savers Computing Initiative will focus on deploying and using these technologies and capabilities.

In a typical desktop PC, more than half of the power coming out of the wall is wasted as heat and never reaches the processor, memory, disks, or other components.[ii] In offices, homes, and data centers, the added heat from inefficient computers can increase the demand on air-conditioners and cooling systems, making the computing equipment even more expensive to run. Servers are typically more efficient than desktops, but still waste 30-40 percent of the input power. With proven technology and at a modest additional cost, the vast majority of these energy losses can be eliminated. This initiative aims to rapidly drive adoption of high-efficiency systems in both consumer and business markets.

In addition, there is a significant opportunity to reduce overall energy consumption by putting systems into a lower power consuming state when they are inactive for long periods of time. Even though most of today's desktop PCs are capable of automatically transitioning to a sleep or hibernate state when inactive, about 90 percent of systems have this functionality disabled.[iii] Climate Savers Computing promotes efforts to increase the use and effectiveness of power-management features by educating computer users on the benefits of using power management and by working with software vendors and IT departments to implement best practices. For a typical business desktop user, implementing aggressive power management policies alone, with no compromise to productivity, could save 60 percent of the electricity consumed.[iv]

How can my organization get involved?

If your organization is interested in supporting this goal, please join us and commit to the Climate Savers Computing guidelines. By adhering to the efficiency criteria, participants will save money through reduced electrical and air-conditioning costs and manufacturers and system vendors will benefit from increased demand for their products. Additionally, in supporting this initiative, participants will help combat climate change and may benefit from positive brand association as a result.

We list participating companies and organizations on the program web site and in other marketing materials. We expect the Initiative to continue generating significant press coverage, and all of the Climate Savers Computing participants will benefit from this exposure. We offer a logo that participating manufacturers can use to identify qualifying products and that enterprise members can place on their website indicating their participation in the program.

We will also aggregate the total number of purchase and production commitments from participating companies as part of the program to show the strength of this initiative. We'll continue to work with your organization in the future to identify opportunities to educate the world about the advantages of high-efficiency and power-managed systems and to highlight your organization's participation in this initiative.

General FAQ

Technical Details

The baseline requirement for all Climate Savers Computing qualified PCs, laptops, and workstations is meeting the current effective ENERGY STAR specification. Bronze, Silver, and Gold level systems must also meet the additional power supply unit (PSU) energy efficiency requirements outlined below.

Climate Savers Computing requirements for PCs and workstations:

1. **Climate Savers Computing Base:** Current effective ENERGY STAR specification. This specification includes an 80% minimum efficiency for the power supply unit (PSU) at 20%, 50% and 100% of rated output; a power factor of at least 0.9 at 100% of rated output; and meeting the maximum power requirements in standby, sleep and idle modes.
2. **Climate Savers Computing Bronze:** Current effective ENERGY STAR specification PLUS an 85% minimum efficiency rating for the PSU at 50% of rated output (and 82% minimum efficiency at 20% and 100% of rated output) and a power factor of at least 0.9 at 50% of rated output.
3. **Climate Savers Computing Silver:** Current effective ENERGY STAR specification PLUS an 88% minimum efficiency rating for the PSU at 50% of rated output (and 85% minimum efficiency at 20% and 100% of rated output) and a power factor of at least 0.9 at 50% of rated output.
4. **Climate Savers Computing Gold:** Current effective ENERGY STAR specification PLUS a 90% minimum efficiency rating for the PSU at 50% of rated output (and 87% minimum efficiency at 20% and 100% of rated output) and a power factor of at least 0.9 at 50% of rated output.

Climate Savers Computing requirements for Volume Servers:

1. **Climate Savers Computing Bronze:** Volume servers must have 85% minimum efficiency rating for the PSU at 50% of rated output (and 81% minimum efficiency at 20% and 100% of rated output), and a power factor of at least 0.9 at 50% of rated output.
2. **Climate Savers Computing Silver:** Volume servers must have 89% minimum efficiency rating for the PSU at 50% of rated output (and 85% minimum efficiency at 20% and 100% of rated output) and a power factor of at least 0.9 at 50% of rated output.
3. **Climate Savers Computing Gold:** Volume servers must have 92% minimum efficiency rating for the PSU at 50% of rated output (and 88% minimum efficiency at 20% and 100% of rated output) and a power factor of at least 0.9 at 50% of rated output.

System manufacturers participating in the Climate Savers Computing Initiative have committed to working to develop products that meet or exceed the Initiative's Program Criteria. The following system types are currently included in the Climate Savers Computing specifications:

- Clients (typically featuring multi-output PSUs)

- Workstations (typically featuring multi-output PSUs)
- Single, dual and 4 socket-servers in pedestal and rack form factors (redundant and non-redundant powered)
- Blade servers capable of having up to four processors
- *Note that Climate Savers Computing has not defined a separate client specification for laptop computers. Laptops are covered by the ENERGY STAR external PSU requirements.*

The tables below outline the required efficiency levels for power supply units (both multi-output and single-output) at various loading conditions and power factor levels. In order for systems to comply with Climate Savers Computing specifications, systems must feature power supplies at the efficiency levels outlined in the charts below.

Multi-output Power Supply Unit*

Loading Condition	**Base** *Target efficiency level starting July 2007*		**Bronze** *Target efficiency level starting July 2008*		**Silver** *Target efficiency level starting July 2009*		**Gold** *Target efficiency level starting July 2010*	
	Efficiency	**Power Factor**	**Efficiency**	**Power Factor**	**Efficiency**	**Power Factor**	**Efficiency**	**Power Factor**
20%	80%		82%		85%		87%	
50%	80%		85%	0.9	88%	0.9	90%	0.9
100%	80%	0.9	82%		85%		87%	

**Multi- output PSU refers to desktop and server application power supplies in non-redundant applications.*

Single-output Power Supply Unit**

Loading Condition	**Bronze** *Target efficiency level starting June 2007*		**Silver** *Target efficiency level starting June 2008*		**Gold** *Target efficiency level starting June 2010*	
	Efficiency	**Power Factor**	**Efficiency**	**Power Factor**	**Efficiency**	**Power Factor**
20%	81%		85%		88%	
50%	85%		89%	0.9	92%	0.9
100%	81%	0.9	85%		88%	

***Single output PSU typically refers to volume servers power supplies in redundant configurations (1U/2U single, dual, four-socket and blade servers).*

The metrics for lower power single-output PSUs (PSU using less than 500 watts) are being re-evaluated; however, today they are included under the present specifications.

In addition to efficiency specifications, members must use power management features such as the "sleep" or "hibernate" settings on client computers, whenever possible. The Initiative's

power management policies recommend computers turn off the display and hard drive after 15 minutes of inactivity, and put the system into "sleep" mode after 30 minutes of inactivity. Members are given a one-year grace period for planning and piloting power management before broad deployment. At the conclusion of the one-year grace period, members are expected to meet the full requirements for power management deployment.

Note: While we encourage both manufacturers and purchasers to deliver and purchase products that meet each year's criteria as quickly as business objectives allow, members can implement these metrics at any point during the span of the criteria year.

How is efficiency measured?

Efficiency of power supplies will be measured using the same protocol as for ENERGY STAR.[v]

How much will the Initiative reduce greenhouse-gas emissions?

By 2010, the Initiative seeks to reduce global CO2 emissions from the operation of computers by 54 million tons per year, equivalent to the annual output of 11 million cars or 10-20 coal fired power plants. This reduction in emissions is calculated based on IDC projections of desktop and server volumes in the years 2007-2011, using a baseline of 295 kWh/year energy consumption for a typical desktop in the first half of 2007, and assuming market penetration of 60 percent of desktop units shipped in 2010 being ENERGY STAR, 25 percent meeting the 85 percent PSU efficiency standard, 10 percent meeting the 88 percent standard, and 5 percent meeting the 90 percent standard; it also assumes that 80 percent of desktop PCs shipped in 2010 use power management features. Under these assumptions, total power consumption for PCs shipped in 2010 will be reduced by over 50 percent, for a total savings of 62 billion kWh in 2010, worth over $5.5 billion (at an average cost of $0.0885/kWh). Note: the total savings in 2010 is based on power consumed by units shipped in 2007, 2008, 2009, and 2010.

FAQ for Computer and Server Manufacturers

How do I participate?

Computer vendors can participate in the Climate Savers Computing Initiative by committing to produce systems that meet or exceed the latest ENERGY STAR specification. Similarly, component vendors can participate by committing to producing power supplies, DC-DC converters, and motherboards that meet or exceed the efficiency standards. The efficiency standards listed apply to systems sold in the specified time periods. Software vendors can also provide robust power management tools and advocate power management best practices. Computer makers should require all the vendors of preloaded software to conform to power management guidelines.

How will efficiency be measured?

System manufacturers will be responsible for measuring and reporting efficiency of their own systems. The Initiative can also, at its discretion, conduct tests on products that are listed or labeled as qualifying products to validate the claim.

The protocol for measuring efficiency of the power supply is described in the General FAQ (above).

What are the benefits of participating?

Participants will accrue branding benefits from participation in the program if they self-certify compliance with the applicable criteria, and may also benefit from consumer demand for energy-efficient computing devices. There may also be co-marketing opportunities for participants with other Climate Savers Computing Initiative participants. In addition, by designing more energy efficient systems, participating organizations will help combat climate change.

Participants are listed on the program web site and in marketing materials.

We expect the Initiative to continue generating significant press coverage, and all of the Climate Savers Computing participants will benefit from this exposure. We offer a logo that participating manufacturers can use to identify qualifying products and that enterprise members can place on their website indicating their participation in the program. We will also continue to work with your organization in the future to identify opportunities to educate the world about the advantages of high-efficiency and power-managed systems and to highlight your organization's participation in this initiative.

FAQ for Organizations Making Purchasing Commitments

To participate in the Initiative your company must commit to prioritizing computer energy-efficiency through the optimization of existing systems (e.g., by widespread deployment of power-management tools), and for future computer purchases requiring more energy-efficient systems. For 2007 through July 2008, participants should specify that all new corporate PCs meet the ENERGY STAR rating, and similarly require 85 percent minimum power-supply efficiency and 88 percent minimum motherboard conversion efficiency for volume server purchases. The Initiative asks participants to quantify the estimated number of PCs and servers purchased in each category. In addition, we are asking for commitments in the following years for systems with increasing levels of efficiency (see table below). We expect that the price premium to meet the high-efficiency target ratings in any year will be less than $30 per system and will decline toward zero over time. The details of commitments requested from Initiative participants are described below.

Because changing your organization's purchasing requirements and implementing power management can be a significant undertaking, Climate Savers Computing offers new members a one-year grace period for compliance with the program criteria. The first-year 'on-boarding' period gives new members an opportunity to ramp up to the criteria requirements of the following year.

Details of requested purchase commitments

The tables below lists the minimum percentage of total procurements requested from Climate Savers Computing Initiative participants at each efficiency level in a given year.

Minimum PC efficiency targets and purchase commitment levels.

	Member's first year	July '07 – June '08	July '08 – June '09	July '09 – June '10	July '10 – June '11
Base (most recent version of ENERGY STAR PC specification)	≥50%	100%	100%	100%	100%
Bronze (ENERGY STAR + 85% PSU)			≥20%	≥80%	100%
Silver (ENERGY STAR + 88% PSU)				≥20%	≥80%
Gold (ENERGY STAR + 90% PSU)					≥20%
Advanced Power Management	Planning & piloting	100%	100%	100%	100%

For example, in year 2 all of your purchases should fulfill the ENERGY STAR 4.0 requirements, and at least 20 percent of them should be at least 85 percent efficient.

Volume server minimum efficiency targets and purchase commitment levels.

	Member's first year	July '07 – June '08	July '08 – June '09	July '09 – June '10	July '10 – June '11
Bronze (85% PSU or most recent version of ENERGY STAR server spec (when available))	≥10%	≥20%	≥80%	≥80%	100%
Silver (89% PSU)			≥20%	≥40%	100%
Gold (92% PSU)					≥20%

These purchasing criteria exclude non-standard workstations and specific-function platforms. The purchasing criteria are based on availability of PCs and servers that meet the program criteria at a price the member company considers reasonable, while also fulfilling the member's business needs and allowing them to work with their supplier(s) of choice.

Members may request technical assistance and receive sample language to help in incorporating these purchasing criteria into their IT procurement policies.

In addition to efficiency specifications, members must use power management features such as the "sleep" or "hibernate" settings on client computers, whenever possible. The initial Initiative's power management policies recommend computers turn off the display and hard drive after 15 minutes of inactivity, and put the system into "sleep" mode after 30 minutes of inactivity. Members are given a one-year grace period for planning and piloting power management before broad deployment. At the conclusion of the one-year grace period, members are expected to meet the full requirements for power management deployment.

What will it cost? And what will it save?

Initially, high-efficiency systems may cost slightly more than standard systems; we expect that difference to be less than $30 per system (the cost premium today for Energy Star desktops appears to be about $20). However, we are confident that as unit volumes increase these costs will come down to near zero. Even at modestly higher cost, the more efficient systems will pay for themselves in reduced energy costs. For example, a savings of just 20-30 watts in power consumption translates into a savings of 60kWh per year for a desktop that is on 2000 hours per year (40 hours/week, 50 weeks/year). At $0.0885/kWh, that translates into a savings of $5.31 in direct energy costs. Factoring in the savings on air-conditioning costs, the total savings is over $7/year. At a cost premium of $20-30, this additional efficiency will pay for itself in a few years. Systems that remain turned on all the time typically pay for themselves within the first year of use. The savings for servers will typically be significantly higher than for desktops, resulting in a much shorter payback period.

Also, today's computers, such as desktops and notebooks, have many power saving capabilities built into them. Examples are the "sleep" and "hibernate" modes that can significantly reduce the amount of energy consumed during inactive states. When these capabilities are utilized during periods of inactivity, it reduces the overall amount of energy consumed by computers by up to 60 percent. This could translate to a savings of up to $11-$15 per year at $0.0885/kWh. Factoring in the savings on air-conditioning costs, the total savings would be approximately $18-26/year.

In addition, products that meet or exceed the efficiency standards of the Initiative will qualify for existing utility rebates under the 80-PLUS program and the ENERGY STAR program; these rebates can partially or completely offset the cost differential. We will work with utilities and regulators with the goal of making these rebates available to all purchasers of high-efficiency computers and of enhancing the rebates for systems that exhibit the highest levels of efficiency.

Reducing the power consumption of PCs and servers has secondary benefits throughout an organization and the larger community. It reduces electrical and air-conditioning loads in office buildings, data centers, and homes, thus reducing the strain on the regional generation facilities and the electrical grid. Last but certainly not least, it reduces emissions of greenhouse gases and other pollutants.

FAQ for Consumers

How do I participate in the Climate Savers Computing Initiative?

Individuals can participate by pledging their commitment to use power management and to purchase computing equipment that meets the Program Criteria. During 2007 you can look for the ENERGY STAR logo for energy-efficient equipment. Individuals can also visit the Initiative web site for power management configuration settings, and to pledge their support for the program.

How can I find energy-efficient systems?

You can find a listing of compliant products through our online product catalog at www.climatesaverscomputing.org. With more than 350 products, the catalog offers

individuals and enterprises a comprehensive and searchable listing of Climate Savers Computing-compliant desktop PCs, laptops, servers, power supplies, power supply components, motherboards and power management software.

What will it cost? And what will it save?

Initially, high-efficiency systems may cost slightly more than standard systems; we expect that difference to be below $30 per system (the cost premium today for Energy Star desktops appears to be about $20). However, we are confident that as unit volumes increase these costs will come down to near zero. Even at modestly higher costs, the more efficient systems will pay for themselves in reduced energy costs. For example, a savings of just 20-30 watts in power consumption translates into a savings of $5.31 per year in direct energy costs at an electricity price of $0.0885/kWh. In an air-conditioned home, the total savings increases to over $7/year, so that the high-efficiency system will pay for itself in a few years. Systems that remain turned on all the time typically pay for themselves within the first year of use.

In addition, products that meet or exceed the Climate Savers Computing efficiency standards will qualify for existing utility rebates under the 80-PLUS program and the Energy Star program; these rebates can partially or completely offset the cost differential. We will work with utilities and regulators with the goal of making these rebates available to all purchasers of high-efficiency computers and of enhancing the rebates for systems that exhibit the highest levels of efficiency.

Reducing the power consumption of PCs and servers has secondary benefits throughout the larger community. It reduces electrical and air-conditioning loads in office buildings, data centers, and homes, thus reducing the strain on the regional generation facilities and the electrical grid. Last but not least, it reduces emissions of greenhouse gases and other pollutants.

FAQ for Environmental Organizations

How can my organization participate?

Participation involves public support of the Initiative, along with outreach to businesses and individual members of your organization to educate them on the benefits of energy efficiency for computers and to encourage them to join the Climate Savers Computing Initiative. In addition, environmental organizations should make the same commitments for their own PC and server purchases, and for use of power-management tools, as requested of corporate participants.

What are next steps?

We'd like to work with your organization to identify further marketing and outreach opportunities related to Climate Savers Computing to help educate both consumer and corporate purchasers about the advantages of high-efficiency systems.

[i] *Based on IDC projections of desktop and server units shipped, a baseline of typical desktop and server power consumption in the first half of 2007, and an average power cost of $0.0885/kWh.*

[ii] *The power supply in a typical desktop PC today is 65-70% efficient. Coupled with the other typical resistive and conversion device (voltage-regulator modules) losses on the motherboard, such designs reduce the system power efficiency of a typical PC to 45-55%. (Power supply efficiency has been studied by EPRI and Ecos Consulting; see http://www.efficientpowersupplies.org for more information on their findings. Motherboard efficiency has not been studied as extensively as power supply efficiency; the numbers quoted here are based on measurements made by Google and Intel of a variety of motherboards.)*

[iii] *According to studies funded by the US EPA, less than 10% of computers in commercial settings use computer power management. (See http://enduse.lbl.gov/info/LBNL-53729_REV.pdf for the results of a study of 16 commercial buildings; see also http://www.energystar.gov/ia/products/power_mgt/North_Thurston_Case_Study.pdf and http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/computer/Computer-PowerMnmt.pdf. for additional comments on the extent of power management usage.)*

[iv] *See ENERGY STAR* System Implementation, a whitepaper published by Intel with technical collaboration from the US EPA, February 2007 (available at http://www.intel.com/design/core2duo/316478.pdf).*

[v] *See http://www.energystar.gov/index.cfm?c=revisions.computer_spec for details on the Energy Star 4.0 specification for computers.*