PRODUCT BRIEF
Intel® Products
Energy Efficiency

Helping Utilities Promote Energy-efficient Computing

Increasing Power Conservation Through Promotion of Energy-efficient Intel® Products in Utility Rebate Programs

Today's high cost of energy and the availability of federal stimulus dollars for energy efficiency programs make it an ideal time for utilities to offer customers incentives for investing in energy-efficient computers and servers.

Computers today are used in virtually every aspect of business. From servers in data centers to employee desktop and laptop PCs, all these computers convert power into useful work. With so many servers and computers in use, they have a measurable effect on energy consumption—even as they enhance productivity and save energy in so many other ways. Conscious of computing's increasing energy cost, environmental impact, and load on power generation facilities, Intel is delivering new levels of energy efficiency in all of its products. Going a step further, Intel is working with many utilities to develop incentive programs to increase the adoption of these new energy-efficient products and to help reduce their impact on the power grid and climate warming.

A Perfect Time for Offering Incentive and Rebate Programs

Today's high cost of energy and the availability of federal stimulus dollars for energy efficiency programs make it an ideal time for utilities to offer customers incentives for investing in energy-efficient computers and servers. Federal agencies are directing funds to utilities to support these incentives,[1] and Congress is expected to provide additional funding for these programs in upcoming energy bill legislation.[2] Also, state legislation requires many utilities to devote a portion of revenue to fund energy efficiency programs, including encouraging the purchase of energy-efficient IT equipment such as servers, PCs, and power management software.

Customers are also applying increasing pressure on utilities to use greener power sources, and many utilities want to contribute to their communities through energy conservation. One of the most effective solutions is to reduce power demand by helping customers improve their energy efficiency. Conservation is widely recognized as cheaper than finding new sources of power generation.

The Computing Industry's Role

The computing industry has become increasingly more eco-aware in response to growing environmental concerns around the world, particularly with respect to global warming. Through the development of energy-efficient products and the formation of industry groups such as The Green Grid and Climate Savers Computing Initiative, the industry is helping businesses and organizations conserve energy while continuing to increase the computing capacity of their data centers and PCs.

Servers based on the new Intel® Xeon® processor 5500 series can automatically and intelligently balance performance and power consumption.

Table 1. Power Usage Comparison[5]

	Intel® Pentium® 4 Processor 630 (2005)	Intel® Core™2 Duo Processor E8500 (2009)
ENERGY USE IN WATTS (W)		
Active	110 W	66 W
Idle	70 W	51 W
Sleep mode	4 W	3 W
Off	2.5 W	1.5 W

Table 2. Utility Incentive Rebate Examples for PCs

Replacing a Dual-Processor PC Based on Intel® Pentium® Processor with an Intel® Core™2 Processor-based PC	
SAVINGS	**INCENTIVE EXAMPLE**
Up to ~300 kilowatt hours (kWh) per replaced PC per year	$0.10 per kWh x 300 kWh = USD 30 one-time rebate per replaced PC

Replacing with a PC Based on Intel® Core™2 Processor with vPro™ Technology	
SAVINGS	**INCENTIVE EXAMPLE**
Up to ~400 kWh per replaced PC per year	$0.10 per kWh x 400 kWh = USD 40 one-time rebate per replaced PC

Increasing IT and Data Center Efficiency

A good example of the computing industry's efforts in energy efficiency is Intel's continuing innovation in processor technology. For example, servers based on the new Intel® Xeon® processor 5500Δ series can automatically and intelligently balance performance and power consumption. This enables servers to adapt in real time to application workloads and user demands, delivering optimal performance and energy efficiency. What's more, the Intel Xeon processor 5500 series is so powerful and energy efficient that it makes replacement of even recent 2005 technology-based servers financially smart. For instance, a business could perform a 9:1 consolidation—replacing 184 servers based on the older Intel® Xeon® processor (3.8 GHz) with just 21 servers based on the Intel Xeon processor 5500 series—and see up to an estimated 90-percent reduction in energy cost, while still meeting the same business computing demands (see Figure 1).[3]

The gains are so great that many companies may decide not to wait until equipment end-of-life to take advantage of such energy-efficient products. This processor series is optimized for the type of virtualization and consolidation projects many utilities seek to encourage through one-time rebates such as "up to a set amount per replaced server." (Virtualization is a method of partitioning one physical server computer into multiple "virtual" servers and is often used to improve server utilization and reduce the number of physical servers.)

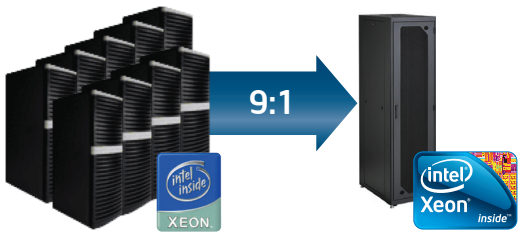
Energy-efficient PCs

Using the latest energy-efficient PCs and taking advantage of capabilities offered by Intel® vPro™ technology further enables organizations to reduce power consumption because:

- Newer PCs consume significantly less power due to improved processor efficiency and other system-level improvements.
- Laptops generally consume less power than desktop PCs.
- Intel vPro technology enables remote PCs that are in sleep mode or powered off to be securely and reliably powered back up for off-hours maintenance. As a result, organizations can now power PCs completely off, knowing they can be powered back up at any time for patching or updates.

Newer PCs Use Less Power

Replacing older computers with desktop PCs based on Intel® Core™2 Duo processors with Intel vPro technology puts a more energy-efficient PC on each desk (see Table 1). Intel Core 2 Duo processors operate at very low voltages and use power more efficiently, so less unnecessary heat is generated and less cooling is required for these high-performance systems. These processors help PCs meet ENERGY STAR* requirements. Utilities should encourage the replacement of older desktop PCs through financial incentives, such as the examples shown in Table 2.



2005
184 Single-core Intel® Xeon® Processor-based Servers

2009
21 Intel® Xeon® Processor 5500 Series-based Servers

Estimated Business Benefits	
SAVINGS	
Lower Operating Costs Power/Cooling	USD 81,000 per Year Savings
Lower Software Costs OS Licensing	USD 146,000 per Year Savings

Estimated IT Benefits	
REDUCTIONS	
Floor Space	89% Reduction
Annual Energy Costs	90% Reduction

Figure 1. Replacing previous generation servers can significantly reduce energy and other costs of operating a data center.[4] Many utilities, such as Arizona Public Service Company (APS), encourage this type of server replacement through one-time rebates based on energy savings and a cap of "up to a set amount per replaced server."

Replacing Desktops with Laptops for More Power Savings

Laptop PCs based on Intel® Centrino® 2 with vPro™ technology have been further optimized for energy efficiency, enabling organizations to gain significant power savings by switching users from desktop to laptop PCs. Depending on the current state of desktop PC power management and the number of users moving to laptops, these savings can be substantial, helping to offset the additional cost of acquiring laptop PCs.

Figure 3 outlines the potential power savings of five platforms, showing the incremental advantages of moving from an unmanaged desktop computer to a managed mobile computer with Intel Centrino 2 with vPro technology.

Intel® vPro™ Technology Enables Remote Shutdown

Intel vPro technology—a combination of processor technologies, hardware enhancements, management features, and security technologies built into laptop and desktop PCs—offers the ability to remotely shut down PCs at the end of the workday and to boot them remotely for patching and servicing.[7] PCs that were previously left running can be turned off when not in use, without requiring changes in user behavior. This can produce great energy savings.

For example, if a standard PC uses 160 watts (W) per hour and is on for 24 hours, it uses 3.84 kilowatt-hours (kWh) per day. By simply scheduling PCs to turn off at 10:00 p.m. and power back on at 5:00 a.m. every day, a company achieves a savings of 7 hours of power usage per day or the equivalent of 1.12 kWh per day per PC. Multiply this savings by 365 days and by 5,000 PCs and a company with this many machines could achieve a savings of 2.044 GWh. If the price of a kWh is USD 0.11, this would equal an annual dollar savings of USD 224,840—a significant value for any organization and something that most utilities would want to encourage.[8] See the sidebar story to find out one organization is using Intel vPro technology to reduce PC energy use.

Case Study of a Utility Incentive Program

Obviously, there are many ways to construct an incentive program to encourage energy efficiency in data center servers and PCs. A good example is the program assembled by Arizona Public Service Company (APS) with technical and promotional assistance from Intel.

APS, an investor-owned utility, is the largest electric utility in Arizona with over 1 million customers in 11 of 15 counties. Under the Arizona Administrative Code, electric and gas utilities must file energy conservation plans that include, as minimum requirements:

- Customer education and assistance programs to help customers reduce their energy consumption and costs.
- Participation in energy conservation programs sponsored by governmental agencies.

APS programs implemented since April 2005 have achieved a lifetime savings of more than 1,759,000 megawatt-hours (MWh).

The APS Solutions for Business program offers incentives for a range of energy efficiency strategies. Customers can choose from a prescriptive list of typical energy efficiency measures with fixed rebate levels (such as lighting rebates, ranging from USD 5 to USD 75 per unit). Or, customers may choose to create their own custom incentives, which are funded at a one-time USD 0.11 per annual kWh savings with a 50-percent measure cost cap. Custom incentives can cover efficient equipment, such

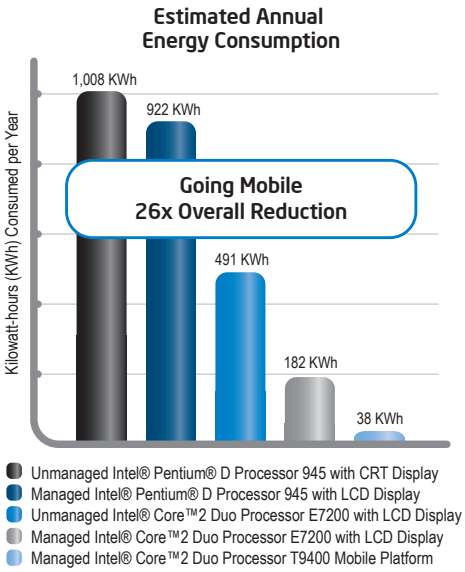


Figure 3. Reducing power consumption with more efficient computer platforms. Replacing unmanaged desktop PCs with managed mobile computers with Intel® vPro™ technology can significantly reduce power consumption.[6]

REDUCING ENERGY CONSUMPTION WITH INTEL® vPRO™ TECHNOLOGY

The State of Indiana's newly consolidated Indiana Office of Technology (IOT) decided to convert 20,000 desktop systems to PCs with Intel® vPro™ technology within four years to reduce operational costs. By simply turning off PCs with Intel vPro technology when not in use, IOT projects power cost savings of over USD 1.2 million across four years. By eliminating 80 percent of technician deskside visits, IOT projects reduction of over 850,000 pounds of CO_2 emissions across four years.^

For more studies demonstrating the energy savings with Intel vPro technology, visit: http://communities.intel.com/docs/DOC-1494.

^ "Reducing 856,000 Pounds of CO_2 Emissions through Remote Services and Off-Hours Power Management," Intel Corporation, August 2008.

UTILITIES OFFERING INCENTIVES FOR POWER MANAGEMENT OF NETWORKED COMPUTERS

- Arizona Public Service Company
- Austin Energy
- Avista
- BC Hydro
- Bonneville Power Administration
- Idaho Power
- Los Angeles Department of Water & Power
- Manitoba Hydro
- Northeast Utilities
- Energy Trust of Oregon
- Pacific Gas and Electric
- Sacramento Muni Utility District
- San Diego Gas and Electric
- Seattle City Light
- Silicon Valley Power
- Snohomish PUD
- Southern California Edison

As of July 2009

as energy-efficient computers and monitors; virtualization software solutions; and energy control software, such as solutions tapping Intel vPro technology and data center optimization. With Intel's assistance, APS developed its energy-efficient IT technology rebate program, and Intel helped promote it by participating in the APS Energy Efficiency Training Series.

Incentives for Power Management of Networked Computers

In addition to incentives for refreshing servers in data centers and reducing the number of servers through consolidation, many utilities now offer rebates for companies that use power management technologies (such as those employing Intel vPro technology) for networked computers. APS, for instance, not only offers rebates on more efficient PCs and monitors, but also on energy control software.

Utilities seeking ways to use available federal funds for energy efficiency programs, as well as comply with state regulations, should develop incentive programs for the replacement of older server and desktop systems with more energy-efficient server, desktop, and laptop systems. Additional incentive should be provided for managed desktop and laptop systems equipped with Intel vPro technology.

How Intel Can Help

Intel business development managers can help utilities take advantage of federal and state programs designed to encourage the use of energy-efficient IT equipment and can help specify which Intel® products and technologies should be pre-qualified for rebates and incentives. They also can participate in sales calls or presentations at seminars and other promotional events sponsored by a utility to educate utility customers on the energy efficiency advantages of the latest IT technologies for business.

Intel can also provide text, diagrams, and data for program literature that show how specific Intel products can help customers qualify for a utility's rebate program. Giving examples of the approximate savings a customer can expect is always an effective way to stimulate participation.

FOR MORE INFORMATION

To learn more about how Intel can help start or expand your incentive program for energy-efficient data centers, servers, and clients, contact eco-tech@intel.com.

Find a helpful return on investment (ROI) estimator for Intel vPro technology at www.intel.com/business/business-pc/roi/demo.htm.

Estimate savings from refreshing older servers with Intel® Xeon® processor-based servers at www.intel.com/go/xeonestimator.

Check out more solutions for government and business at: **http://ipip.intel.com/go/fedgov**

[Δ] Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See www.intel.com/products/processor_number for details. Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel® products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, visit Intel Performance Benchmark Limitations.

[1] Energy Services Reliable Energy Solutions Bulletin, www.wapa.gov/ES/pubs/esb/2009/jun/jun091.htm.

[2] News release, American Council for an Energy-Efficient Economy, April 21, 2009. www.aceee.org/press/0904analysis.htm.

[3] Based on comparison between two-socket single-core Intel® Xeon® processor (3.80 GHz) with 2M L2 cache and two-socket Intel® Xeon® processor X5570-based servers. Calculation includes analysis based on performance, power, cooling, electricity rates, OS annual license costs and estimated server costs. This assumes 8 kW racks, $0.10 per kWh, cooling costs are 2x the server power consumption costs, OS license cost of USD 900 per year per server, per server cost of USD 6,900 based on estimated list prices and estimated server utilization rates. All dollar figures are approximate. Performance and power comparisons are based on measured SPECjbb2005* benchmark results (Intel Corporation, Feb 2009). Platform power was measured during the steady state window of the benchmark run and at idle. Performance gain compared to baseline was 9x while the platform power was 0.8x.

- Baseline platform: Intel server platform with two 64-bit Intel Xeon processor (3.80 GHz) with 2M L2 Cache, 800 FSB, 8x 1GB DDR2-400 memory, 1 hard drive, 1 power supply, Microsoft Windows Enterprise Server 2003* SP1, BEA JRockit* build P27.4.0-windows-x86_64 run with 2 JVM instances
- New platform: Intel server platform with two quad-core Intel® Xeon® processor X5570, 2.93 GHz, 8 MB L3 cache, 6.4 QPI, 12 GB memory (6x 2GB DDR3-1333), 1 hard drive, 1 power supply, Microsoft Windows Enterprise Server 2008* SP1, BEA JRockit build P27.4.0-windows-x86_64 run with 2 JVM instances

[4] Ibid.

[5] "Using Total Cost of Ownership to Determine Optimal PC Refresh Lifecycles," Wipro Consulting Service Product Strategy and Architecture Practice, May 2009. (See: www.intel.com/apac/business/pdf/IndustryWhitepaperUsingTCODetermineOptimalPCRefreshLifecyclesMay2009.pdf, p 17.)

[6] Intel® Pentium® D Processor 945 (3.4 GHz, 800 MHz FSB, 2x 2 MB L2 cache), with Intel® 945G chipset on Intel® D945GPM board, Intel Chipset Software Installation File 8.1.1.1010, Dual Channel Micron* PC2-5300U 2x 1GB of DDR2 667 5-5-5-15, Seagate Barracuda* 320 GB NCQ SATA2 7200RPM, Microsoft Windows Vista* Ultimate RTM Build 6000 NTFS.

Intel® Core™2 Duo processor E7200 (2.33GHz, 1333MHz FSB, 4MB L2 Cache), Intel® DQ45CB motherboard with Intel® Q45 Express chipset; 1333MHz FSB, Intel integrated graphics, 2x1GB Micron* DDR2-667 5-5-5-15, Seagate* 320GB/16MB cache/7200rpm, Windows* XP* Professional with SP3.

Intel® Core™2 Duo processor T9400 (2.40 GHz/4 MB) with 2 GB (1x 1 GB) Dual Channel DS Hynix* DDR2 667 5-5-5-15 memory on Lenovo ThinkPad T400*, Intel® GM45 Chipset (Intel Chipset 8.7.0); BIOS Default Setup, Intel® Graphics Media Accelerator X4300 (Intel Integrated driver 14.37.0.5009) Resolution 1440x900x32-bit color, Hitachi Travelstar HTS722020K9SA00* 200 GB 5400 RPM SATA, AD v. 6250, Microsoft Windows XP Professional* with SP3 build 6000, System Power Management Policy: AC/High, LCD Size: 15.5" widescreen; Battery Capacity rated at 56 watt-hours

- Desktop display power draw values gathered from spec sheets of 10 models of each type of display (CRT and LCD). Assumed values are: CRT (95 W active, 5 W asleep), LCD (55 W active, 5 W asleep)
- Energy Cost: 0.0865 cents per KWh, which is the U.S. average for industrial and commercial customers as of December, 2008. Source: U.S. Department of Energy, www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html
- Intel EEP methodology is described here: www.intelcapabilitiesforum.net/EEP/
- Performance tests/ratings are provided assuming specific computer systems and/or components and reflect the approximate performance of Intel® products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. This data may vary from other material generated for specific marketing requests.
- CO_2 reduction amount calculation: assume 1.54 lbs. of CO_2 per KWh (source: US Department of Energy, www.eia.doe.gov/cneaf/electricity/page/co2_report/co2report.html)

[7] Intel® vPro™ technology includes powerful Intel® Active Management Technology (Intel® AMT). Intel AMT requires the computer system to have an Intel® AMT-enabled chipset, network hardware and software, as well as connection with a power source and a corporate network connection. Setup requires configuration by the purchaser and may require scripting with the management console or further integration into existing security frameworks to enable certain functionality. It may also require modifications of implementation of new business processes. With regard to notebooks, Intel AMT may not be available or certain capabilities may be limited over a host OS-based VPN or when connecting wirelessly, on battery power, sleeping, hibernating or powered off. For more information, see www.intel.com/technology/platform-technology/intel-amt/.

[8] "Power Savings and Intel® vPro™ Processor Technology," by Darren Baker, Siemens IT Solutions and Services, 2007.

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