

Energy efficient P6000 EVA Family

Technical white paper

Table of contents

Overview	2
Saving energy	2
Saving cost	3
P6300/P6500 EVA and EVA 4400/6400 comparisons	4
Getting the Energy Star® rating for data center storage	5
Integrating into the Data Center Smart Grid	6
Summary	6



Overview

There is tremendous focus on the financial aspects of power and cooling costs. And there is a growing concern about the effects of energy usage on the global environment. The new P6000 Enterprise Virtual Array (EVA) family addresses these concerns by providing improved energy efficiency compared to the previous generations of EVAs. This white paper explains the new power saving features of the P6000 EVAs and provides quantification of the possible power savings.

Saving energy

Energy efficiency is built in to the P6000 EVA family. It offers hardware that inherently operates more efficiently, and software that optimizes storage capacity to reduce the number of disks needed. In addition, the P6000 EVA family provides tools that allow users to estimate power consumption before constructing a configuration, and then monitor actual power consumption after the configuration is built.

- **Smart cooling fans:** Internal temperature sensors and smart logic conserve energy by spinning the fans no faster than necessary to reliably cool the components. During periods of low system activity or low ambient air temperatures, the fan speed can be safely reduced.
- **High-efficiency power supplies:** Power supplies in the controller enclosures meet the 80 PLUS Silver¹ rating (for example, 89 percent efficient at 50 percent rated load, 230 VAC), whereas power supplies in the external drive enclosures meet 80 PLUS Gold¹ rating (for example, 92 percent efficient at 50 percent rated load, 230 VAC).
- **Low-power disk drives options:** Support of SFF (2.5-inch) and 7.2K rpm mid-line SAS provide configuration options for reduced power and higher capacity operation.
- **Advanced RAID:** Compared to RAID-1 (mirroring), higher levels of RAID offer improved capacity utilization based on the RAID group size and the number of parity disks. The EVA P6300 and P6500 offer advanced RAID levels 5, 0+5, and 6.
- **Snapshots:** EVA Vsnap saves disk space by creating logical copies of data that are virtually capacity-free.
- **Thin provisioning:** Provides the ability to fully provision volumes for applications while physically allocating only the data that has actually been written. This reduces the amount of unused capacity.
- **Dynamic Capacity Management (DCM):** A comprehensive software solution that automates storage provisioning by “rightsizing” the file system and storage volumes, and improves capacity utilization.
- **LUN migration:** Dynamic LUN/RAID migration allows the user to change the characteristics of an existing LUN, such as disk type, RAID type, and LUN size, while the host I/O operation is active. Migrating less frequently used data from high-performance enterprise 15K rpm drives to 7.2K rpm mid-line drives is an example of a storage-tiering operation that can effectively reduce the overall power consumption.
- **Monitored Power Distribution Unit (PDU):** An HP rack mounted monitored PDU with optional PDU Management Module for remote monitoring (Web access) allows IT and Facility personnel to monitor current draw at the rack and within three zones of each PDU.

See <http://h18004.www1.hp.com/products/servers/proliantstorage/power-protection/power-distribution/powermonitoring/index.html>

¹ 80 PLUS is a power supply certification rating for computer power supply units. See: <http://www.plugloadsolutions.com/80PlusPowerSupplies.aspx>.

- **Power Calculator:** This tool encompasses all possible configurations of the P6300/P6500 EVA family and provides calculations of both idle and active power consumption based on a database of power measurements. The tool is available at:
<http://h18004.www1.hp.com/products/solutions/power/index.html>

Saving cost

Energy efficiency improvements and better capacity utilization of storage can provide significant cost savings in both operating expenses (opex) and capital expenses (capex). These are for power, cooling, and space. Some useful cost factors are:

- The average cost of electricity in the U.S. (all sectors, July 20, 2010) is \$0.105 per kilowatt-hour
See http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_a.html
- For every 1 KW of electricity required to power IT equipment in a data center, it takes an estimated additional 1.5 KW of electricity to run the facilities cooling equipment (1.5x factor)
- It costs \$5320 per month per 10 KW installation for data center power, cooling, and space²

To understand comparative cost numbers for a variety of energy-efficiency features consider a full 42U rack filled with a P6500 EVA system. Based on the drive type(s) selected, the total power consumed can range from 3 KW to 6 KW. For simplicity, a baseline-rack power consumption of 5 KW is assumed, and with it a data center installed cost of \$2660 per month.

Configuration	Estimated % power saved	Installed power	Data center cost
Full EVA 2m rack	Baseline	5 KW	\$2660/mo.
High efficiency power supplies and smart fans	15%	4.25 KW	\$2260/mo.
Advanced Raid (1 → 5)	50%	2.5 KW	\$1330/mo.
LUN migration e.g., move 50% of capacity from enterprise to mid-line drives	25%	3.75 KW	\$1995/mo.
Move all data from LFF to SFF drives Assume same capacity and speed	30%	3.5 KW	\$1860/mo.
Capacity optimization methods (COM), various	Variable, up to 80%	1 KW	\$532/mo.

² Based on a 1st order approximation by Patel and Shah at HP Labs.

P6300/P6500 EVA and EVA 4400/6400 comparisons

The improved power supplies and the new 10K SFF SAS drives in the P6300/P6500 EVAs provide significant power savings over the EVA 4400/6400s. The following are some example configurations comparing the two families with 10K and 15K rpm drives. The power numbers for the arrays were obtained using the [power calculator](#), at 230 volts, under heavy workload.

Example 1:

P6300 EVA with (96) 600 GB 10K SFF SAS drives	EVA 4400 with (96) 10K LFF FC drives
57.5 TB	57.5 TB
Room for 154 more SFF drives, with 6 more SFF enclosures	No room for more LFF drives
965 watts	1594 watts
\$2,219 per year for power and cooling* at \$0.105/KW	\$3,665 per year for power and cooling* at \$0.105/KW
\$1,446 per year power and cooling cost savings	

Example 2:

P6500 EVA with (216) 600 GB 10K SFF SAS drives	EVA 6400 with (216) 10K LFF FC drives
129.5 TB	129.5 TB
Room for 234 more SFF drives, with 8 more SFF drive enclosures	No room for more LFF drives
2050 watts	3569 watts
\$4,714 per year for power and cooling* at \$0.105/KW	\$8,306 per year for power and cooling* at \$0.105/KW
\$3,592 per year power and cooling cost savings	

Note that in the examples above for the P6300 and P6500 EVAs, the power savings are due to controller and drive enclosure power supplies plus a major power saving contribution due to the 10K SFF SAS drives compared to the 10K LFF SAS drives.

Example 3:

P6300 EVA with (96) 600 GB 15K LFF SAS drives	EVA 4400 with (96) 15K LFF FC drives
57.5 TB	57.5 TB
Room for 24 more SFF drives, with 2 more LFF drive enclosures	No room for more LFF drives
2252 watts	2368 watts
\$5,178 per year for power and cooling* at \$0.105/KW	\$5,452 per year for power and cooling* at \$0.105/KW
\$274 per year power and cooling cost savings	

*Cooling estimated at an additional 1.5 KW for each KW of power used

Example 4:

P6500 EVA with (216) 600 GB 15K LFF SAS drives	EVA 6400 with (216) 15K LFF FC drives
129.5 TB	129.5 TB
Room for 24 more SFF drives, with 2 more LFF drive enclosures	No room for more LFF drives
4947 watts	5339 watts
\$11,375 per year for power and cooling* at \$0.105/KW	\$12,275 per year for power and cooling* at \$0.105/KW
\$900 per year power and cooling cost savings	

*Cooling estimated at an additional 1.5 KW for each KW of power used

Note that in the examples above for the P6300 and P6500 EVAs, the power savings are due to controller and drive enclosure power supplies only. The 15K LFF SAS and 15K LFF FC drives draw the same power, so there is no power-saving contribution by the disk drives. Thus the power savings are not as significant as with the 10K drives.

Getting the Energy Star[®] rating for data center storage

Energy Star ratings have become common for home appliances. It is an important factor when considering the purchase of new appliances. Customers want to know that they are buying appliances that will help keep their energy costs down. A similar rating is being developed for data center storage. The U.S. Environmental Protection Agency (EPA) is currently developing an Energy Star specification for data center storage. The release of v1.0 of the specification may be as early as June 2011. Based on the preliminary nature of the specification, the eligibility requirements can presently only be defined in general terms.

“Must have” checklist items:

- High-efficiency power supplies—expected Silver rated 80 PLUS for single-output, and expected Bronze rated 80 PLUS for multi-output
- Input power consumption and inlet air temperature reporting over a standard network
Note: inlet air temperature reporting is less likely to be required for v1.0
- A link to a detailed power calculator
- Power and performance data for at least one benchmark chosen by the storage vendor

Competitive test metrics—(Only the top 25 percent will receive the Energy Star rating):

- Performance—power data based on a suite of idle and active rating metrics, specific to several storage product categories (e.g., online)
- Certification testing requiring IOC/IEC accredited test labs and third-party certification

While it is too early for HP to claim top 25 percent with respect to the competitive test metrics, the P6000 EVA family will be capable of satisfying the checklist items of Energy Star.

Integrating into the Data Center Smart Grid

The next-generation data center is expected to continue to become more energy and cost conscious. The facilities, plus server, storage, and network IT equipment, are all likely to contribute to this goal. In addition to energy-saving features being designed into the IT equipment, there are expectations for sensor placement, power discovery, visualization, and power management. The tone is set by the simple phrase: "You can't manage what you can't monitor." The P6000 EVA family has incorporated several state-of-the-art features that begin to enable the common management of enterprise systems in the HP Data Center Smart Grid vision.

Summary

The new P6000 EVA family is more power efficient than previous EVAs and will help users keep their energy consumption and cooling costs low. With the new power saving features for the P6000 EVA family, HP is ready to pursue the new EPA Energy Star ratings for data center storage as soon as the EPA specification is complete. And the P6000 EVA Family is ready to help support customers with the HP Data Center Smart Grid vision.

To learn more about the new power-saving features of the P6000 EVA family and data center storage supported by the HP Data Center Smart Grid click on:

http://www8.hp.com/mx/es/solutions/article_detail.html?compURI=tc:183-285493



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