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How Much **Energy** Is Your Server Using? And How Much Could an Energy-Efficient One **Save You**?

Exploring the Results of the First SAP Server Power Benchmark

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With rising energy costs and more companies running multiple servers to support the business, switching to more energy-efficient servers seems like an obvious way to cut costs. But how can a company be sure that the energy-efficient server it chooses is truly a sustainable one?

To help, SAP, in close cooperation with its partners, introduced the SAP server power standard application benchmark, which tests a vendor's server, allowing that vendor to demonstrate the server's efficiency — and enabling customers to evaluate just how sustainable a server is before purchasing it.

Note that this benchmark is unlike previous SAP standard application benchmarks, which focused on measuring server performance and scalability, with no care given to potential energy consumption or system costs. The SAP server power benchmark measures — and shows companies the balance between — the two "contradictory" targets of low energy consumption and high performance.

We have covered this new benchmark in a previous Performance & Data Management Corner column,[1] but now let's explore the results from one of our partners, which has earned the first SAP server power standard application benchmark: Fujitsu.[2]

> Fujitsu's SAP server power benchmark achieved an average consumption of 18.3 watts to obtain a throughput of 1,000 SAPS.

A Detailed Look at Fujitsu's Benchmarking Experience

In its SAP server power standard application benchmark, Fujitsu tested the Fujitsu PRIMERGY RX300 S6 server. (See **Figure 1** on page 86 for a look at the software and systems involved in this test.) Fujitsu used the following elements to achieve its certified benchmark result of 18.3 watts/kSAPS:

- A modern, multi-core CPU that enabled features like speed stepping, turbo boost, and hyper threading. These features help ensure high performance while using low levels of electrical power consumption.
- Efficient, low-voltage main memory modules.
- An optimized memory size, which results in less power consumption. With 72 GB of main memory, the memory was smaller than that typically used in other benchmarks with this number of users — here, 4,700 sales and distribution (SD) benchmark users.

[1] See "How Much Is Your Hardware Really Costing You? How SAP Is Helping Usher in a New Era of Sustainable Systems and Servers" by Clarissa Götz and Sebastian Schmitt in the July-September 2010 issue of *SAPinsider* (sapinsider.wispubs.com).

[2] Fujitsu was certified on February 14, 2011 (SAP certificate number 2011008; www.sap.com/solutions/benchmark/pdf/Cert2011008.pdf).

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- A high-efficiency power supply (one with 92% efficiency).
- Efficient solid-state drive disks for the operating system and the log file. (The SAP server power standard application benchmark does not incorporate the storage system into its measurements, but for Fujitsu's certification, all the components installed in the server — including the local disks and corresponding controller — were included in the measurement.)
- An energy-saving disk controller without cache.
- A Microsoft Windows operating system running the "Enhanced Power Settings" power plan. This power plan is also shipped with every Windows-based Fujitsu server.

FIGURE 1 ▼ The solutions used during Fujitsu's benchmark test

SAP Business Suite software	Enhancement package 4 for SAP ERP 6.0
Relational database management system (RDBMS)	Microsoft SQL Server 2008 Enterprise Edition
Operating system	Windows 2008 R2 Datacenter x64
Central server	Fujitsu PRIMERGY RX300 S6 Two processors, 12 cores, 24 threads Intel Xeon X5675 processor, 3.06 GHz 72 GB main memory CSTC Gold 800W power supply 2x64 GB SSDSA2SH064G1G10 solid state drives

FIGURE 2 ▼ The results of Fujitsu's SAP server power benchmark

Power efficiency indicator — server	18.3 watts/kSAPS
Average throughput over all load levels	11,810 SAPS
Minimum ambient temperature of server	69.08 degrees Fahrenheit (20.6 Celsius)
Number of benchmark users at the 100% load level	4,700 SD benchmark users

The SAP Server Power Benchmark: A Refresher

The key performance indicator of the SAP server power standard application benchmark is the power efficiency value, represented as watts per kilo SAPS (watts/kSAPS), or the amount of watts that are consumed per 1,000 SAPS.* Here, a smaller value equals less power consumption for the defined load and, as a result, greater energy efficiency.

In the SAP server power standard application benchmark, the throughput and the electrical power consumption are measured with a predefined series of measurements at nine load levels (in other words, nine single SAP sales and distribution (SD) standard application benchmarks being run in an interconnected mode, thereby ensuring that the system load will not drop between benchmark runs). These load levels range from idle to 100% load.

A system running a minimum load (one user on each SAP instance) is called "active idle." The 100% load level equals the maximum number of SD benchmark users who can be running on the same server with a response time that stays below one second.

* The SAP Application Performance Standard (SAPS) is a hardware-independent unit that describes the performance of a system configuration in the SAP environment.

Fujitsu's Results

Figure 2 shows an at-a-glance overview of some of Fujitsu's test results; let's take a closer look at some of the key performance indicators.

Power Consumption Versus Throughput

Figure 3 shows the relative consumed electrical power compared to the relative throughput that Fujitsu achieved in this benchmark. I would like to call readers' attention to three items in this graphic:

- During the active idle phase (the first point on the graph), the system utilization and the power consumption remain at a very low level.
- The relative throughput ascends slowly and continuously between about 10% and 65%, meaning that power consumption increases at a low, predictable rate.
- At load levels of about 65% and above, the relative throughput curve gets steeper. This means that the system is providing increased performance, but with an above-average increase of electrical power consumption.

Energy Efficiency Levels

As I noted earlier, Fujitsu's certified SAP server power benchmark is 18.3 watts/kSAPS. This is the average energy efficiency factor across all load levels. However, if you break these load levels down and chart the individual results from each level, you can observe a very interesting effect (see **Figure 4**).

Here we see that a low system load results in a low efficiency (meaning that the idle share of the system makes up the largest part of the power consumption). However, as load levels increase, the efficiency improves. The efficiency doesn't stop significantly improving until it has reached a load level of about 65%. This means that the

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system shows the optimal energy efficiency level at this load level. When combined with the data around power consumption versus throughput explored previously, it becomes clear that customers will get the most value — that is, the best balance between performance and energy efficiency — out of Fujitsu's server when they run a load of about 65%, an attainable goal for companies.

So, What Do These Numbers Really Mean?

It can be difficult to conceptualize exactly what these benchmarking numbers mean, so let's compare the energy consumption of an average car to that of an SAP system consuming 18.3 watts/kSAPS. First, let's set some standard definitions for this comparison:

- Energy content of gasoline: 36.6 kilowatts (kWh) for every US gallon of gasoline (or 9.7 kWh/liter)
- Amount of gasoline that the car consumes: 2.55 US gallons of gasoline for every 100 miles (or 6 liters for every 100 kilometers)
- Yearly travel of the car: 18,641 miles (or 30,000 kilometers) per year

With these figures, we can determine that driving this car results in an energy consumption of 93.3 kWh for every 100 miles traveled (or 58 kWh for every 100 kilometers traveled). For an SAP system consuming 18.3 watts/kSAPS, this means that:

- For the same amount of energy a car consumes in 100 miles, the SAP system can execute 102 million SAP SD postings (or, for 100 kilometers of travel, the system can execute 63.4 million SAP SD postings).
- For the same amount of energy that a car consumes in a year, the system can execute 19 billion SAP SD postings.

It's impressive to see just how far energy can go when companies use efficient servers!

More Benchmark Results to Come

I'm very excited to see the results of this first completed SAP server power standard application benchmark. SAP is already working with several other companies to benchmark their server efficiency as well. It will be interesting to learn the outcomes of other benchmarks and see how they compare to Fujitsu's results. Making a server's efficiency and effectiveness transparent is a win for the companies running the benchmarks, but it's even more of a win for customers, who can use these results to benefit from an optimal balance of high performance and low power consumption. In fact, SAP itself will use these benchmark results to aid in its own hardware purchasing decisions. Learn more at **www.sap.com/benchmark** and **www.sap.com/solutions/benchmark/power-benchmarks.epx**.

FIGURE 3 ▼ Fujitsu's relative power consumption compared to the relative throughput

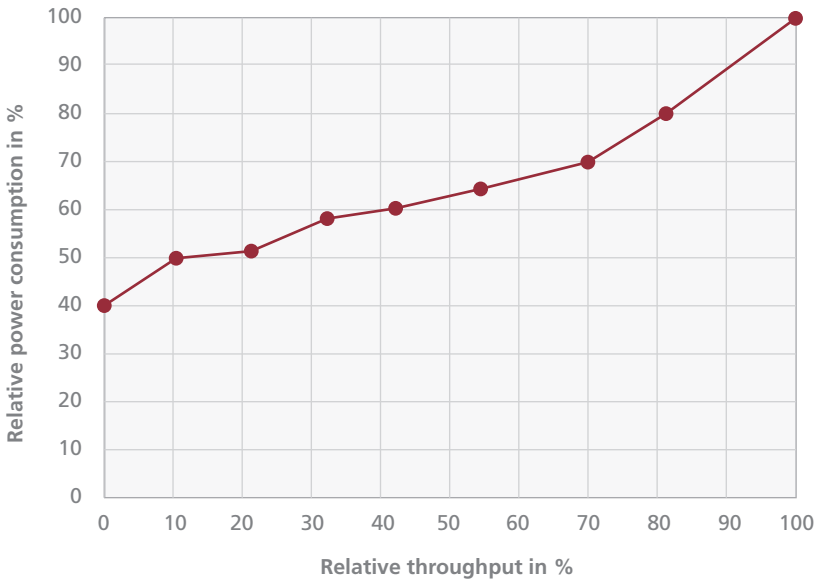
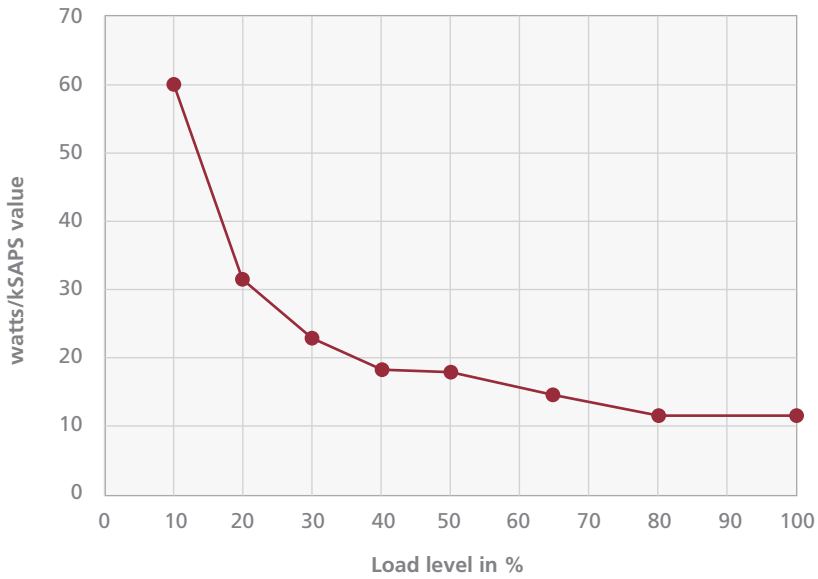


FIGURE 4 ▼ Fujitsu's energy output versus its load level



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