



# Driving Up Data Center Energy Efficiency with Scalable Server-Level Power Management and Control

Lenovo® Smart Grid Technology leverages Intel® Data Center Manager and Node Manager to achieve world-class server power efficiency.

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Lenovo is helping data center managers maximize power efficiency at the server and device level while also scaling energy management to the rack and data center levels. Leveraging Intel® Data Center Manager and Node Manager, Lenovo® Smart Grid Technology can manage up to 1,000 nodes and provides policy-based control to significantly lower energy consumption.

The dynamic approach to managing and adjusting power takes advantage of Intel® Xeon® processor micro-architecture. Lenovo Smart Grid combines information technology and energy technology to deliver a centralized, remote management solution that helps control operating costs without impacting data center performance.

## Intelligent Power Policy Recommendation

The first step towards data center energy efficiency involves monitoring and analyzing the real-time power consumption patterns. The Lenovo Smart Grid console gives a detailed view of power usage for ThinkServers and other data center devices that support Intel Data Center Manager and Node Manager technology. The agentless solution implements closed-loop full-process management including the ability to:

- Discover and import a data center device
- Monitor the device's power consumption
- Learn how power consumption varies over time
- Implement power-saving policies
- Analyze the results of the power-saving policies
- Recommend power policy adjustments

On a device-by-device basis, Smart Grid uses the collected power consumption data to evolve the most appropriate power management policy and lower the device's consumption.

The solution scales to address large data centers, and also allows flexible analysis and control of power management by rack, row, or groups.

## Performance-Aware Dynamic Power Control

After observing power consumption and adjusting power policies, data center managers can use Lenovo Smart Grid to introduce additional controls. Power capping capabilities allow the definition of an upper limit for power consumption, which can be configured for specific servers or groups of servers.

Lenovo Smart Grid power consumption trend data greatly assists data center managers in terms of setting the upper power limits, and avoids reliance on vendor-provided, worst-case power consumption specifications. Instead, power caps can be based on actual observed power consumption behaviors for specific system configurations, workloads, and time of day.

## Driving Up Data Center Energy Efficiency with Scalable Server-Level Power Management and Control

Although server performance is tied to power consumption levels, power caps can be implemented with minimal impact on server performance. Tests<sup>1</sup> have shown that reducing power by almost 20% has no noticeable impact on performance. For more aggressive capping, Lenovo Smart Grid monitors server performance indicators every five minutes; alerts are generated if performance exceeds a defined threshold and caps can be adjusted accordingly based on power policies and service level requirements.

Power capping and subsequent power monitoring provide tools for data center managers that want to evaluate and optimize performance-per-watt results throughout the data center. Server configurations can be studied to determine the power level that delivers the best energy value. While data center managers may not want to utilize power capping in this manner during times of peak workloads, it can be highly effective for cost controls during night hours or for large compute-intensive applications that can be slowed slightly without impacting the user experience.

During times of power outages, when workloads shift to disaster recovery sites with fewer server resources, power capping can be used to accommodate more mission-critical applications or to prioritize power allocations. Power capping to drive up performance-per-watt will also extend the life of UPS units during outages.

### Browser-Based, Non-Invasive Solution

The server/browser architecture makes Lenovo Smart Grid easy to deploy and use. No agents are required on the monitored servers, and once installed on a server, results are accessible using a web browser.

Power consumption data can be viewed for specific periods of time, and the intuitive views make it easy to extract information about average and peak usage. Data center results can also be broken down by server, rack, row, or room.

### Conclusions

With today's high energy costs, the average 400W server takes \$800 or more out of the annual data center operating budget. IT and facilities management teams are under extreme pressure to cut these costs by driving up server efficiency. Lenovo Smart Grid's power monitoring and control capabilities offer visibility into dynamic power consumption behaviors in the data center, and closed-loop feedback that allows accurately tailoring power policies for optimal energy use.

Besides optimizing energy efficiency and lowering energy costs, data center managers are using energy management solutions like Lenovo Smart Grid, based on Intel Data Center Manager and Node Manager, to:

- Increase uptime by avoiding power spikes that can lead to equipment outages
- Improve server rack densities by adjusting power and workloads
- Introduce energy charge-backs based on actual consumption by workloads
- Educate users and promote more "green" IT services
- Shift workloads across multiple data centers around the world, taking advantage of lower energy costs (off-peak rates) in other time zones

### About Lenovo Smart Grid

Lenovo Smart Grid Technologies compliment the world-class energy efficiency of the company's ThinkServer systems. New rack designs, ENERGY STAR certifications, 80+ Gold-rated power choices, and Smart Grid make the latest ThinkServers up to 45% more efficient than previous generation servers.

### About Intel Data Center Manager

Intel® Data Center Manager (Intel® DCM) provides accurate, real time power and thermal monitoring and management for individual servers, group of servers, racks and IT equipment such as PDUs in the data center. It's a capability that is useful for both IT and facility administrators, which allows them to work jointly to reduce their energy footprint.

<sup>1</sup>"Preserving Performance While Saving Power Using Intel® Intelligent Power Node Manager and Intel® Data Center Manager," Intel white paper, [http://software.intel.com/sites/datacentermanager/node\\_manager\\_white\\_paper\\_bmw.pdf](http://software.intel.com/sites/datacentermanager/node_manager_white_paper_bmw.pdf)

For more information on Intel® Data Center Manager, visit [www.datacentermanager.intel.com](http://www.datacentermanager.intel.com)

For more information on Lenovo® Smart Grid Technology, visit [support.lenovo.com/en\\_SE/downloads/detail.page?DocID=DS029844](http://support.lenovo.com/en_SE/downloads/detail.page?DocID=DS029844)

Intel® Node Manager technology requires a computer system with an Intel® Xeon® processor, supported Intel® Enterprise chipset, BIOS, and other requirements documented in the applicable Platform Design Guideline documentation and applications enabled for virtualization technology. Functionality, performance or other power capping technology benefits will vary depending on hardware and software configurations.

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