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Lenovo ThinkServer Energy Manager User Guide

ThinkThink**ThinkServer**Think

Note: Before using this information and the product it supports, ensure that you read and understand
Appendix A "Notices" on page 27.

Table of Contents

1. Getting Started

1.1 Overview

Lenovo ThinkServer Energy Manager is a power and temperature management solution for data centers. It enables you to monitor and manage power consumption and temperature in your data center through the management console.

1.2 System Requirements

1.2.1 Lenovo ThinkServer Energy Manager

Energy Manager is intended to be installed on the following operating systems:
- Microsoft Windows Server 2008
- Microsoft Windows Server 2008 R2
- Microsoft Windows Server 2012
- Microsoft Windows Server 2012 R2
- Red Hat Enterprise Linux 6 (RHEL6) Server
- Novell SUSE Linux Enterprise Server 11 (SLES 11)

It is expected to be browsed on the web browsers listed below:
- Mozilla Firefox 25
- Google Chrome 31
- Microsoft Internet Explorer 9 and above

It is recommended to install the software on a system with at least:
- A dual-core processor of 2.6 GHz or higher
- 8GB RAM
- 80GB of hard drive space

1.2.2 Network Configuration

Energy Manager communicates with the devices through multiple protocols including IPMI, SSH, SNMP, WS-MAN, HTTPS, and DCOM (WMI). These protocols should be allowed by the network firewall and the operating system firewall between Energy Manager and the devices.

1.3 Install/Uninstall Lenovo ThinkServer Energy Manager

Install Energy Manager:
1. For Windows OS, run the installer directly and follow graphic wizard to complete installing.
2. For Linux OS, unzip the pack and then launch the executable to complete installing. For more detail, please refer to the install guide in the pack.

Uninstall Energy Manager:
1. For Windows OS, uninstall Energy Manager from Control Panel.
2. For Linux OS, go to the installation directory and run ./uninstall.

ⓘ **WARNING**

All data and configurations will be deleted after uninstalling Energy Manager. If you want to back-up and restore your data and configurations, You may use command line tool in TEM.

1. The backup tool (backup.sh for Linux, backup.bat for Windows) could be found in the bin folder. You need to specify a backup folder as the argument of the backup tool. The tool would back up your configuration and data to the folder you specified.
2. The restore tool (restore.sh for Linux, restore.bat for Windows) could be found in the bin folder. You need to specify a backup folder as the argument of the restore tool. The tool would restore your configuration and data from the folder you specified.

Currently, Energy Manager installer doesn't support upgrade, migration, and recovery.

1.4 Launching Lenovo ThinkServer Energy Manager

There are two ways to launch Energy Manager.
1. By typing the URL directly in the address bar of a browser.
   Enter the following default URL in your web browser to launch the Energy Manager if TLS is enabled:
   https://localhost:8643/energymanager/
   Or the URL below if TLS is not enabled:
   http://localhost:8688/energymanager/
2. By clicking the Energy Manager shortcut if Energy Manager is installed on a Windows server.

1.5 Setting up the Hierarchy

Lenovo ThinkServer Energy Manager provides several ways to set up the data center hierarchy (data centers, rooms, rows, racks, and devices):

- Datacenter Management: To create a data center hierarchy manually from scratch, start from 'Datacenter Management' on the left side navigation menu. View power and temperature data by selecting items in the hierarchy once the devices are added.
- Discovery: To discover devices in the network, start from 'Discovery and Import' on the left side navigation menu. After discovery please check devices in 'Devices and Racks' on the left side navigation menu and add them to the hierarchy in 'Datacenter Management'.

- Import devices or the hierarchy: To import devices or the hierarchy from an Excel file, start from the 'Import' button in 'Devices and Racks'. Please refer to Importing Devices to learn how to create the Excel file.

To view power and temperature data of the devices, they must be added into the hierarchy (in racks).

2   License

The license mechanism of Energy Manager limits the number of the devices in the hierarchy. You can find the number of available licenses and used licenses by clicking 'About' in the banner area of Energy Manager.

You may use Energy Manager with either the TSMP Server Option Bundle or the Node License Pack.

The TSMP Server Option Bundle means that the following devices can be managed without consuming the licensed device number
- Lenovo ThinkServer server with TSMP
- Unmanaged device (Energy Manager does not communicate with these devices at all)

The Node License Pack means that you may purchase license from Lenovo to manage devices besides Lenovo ThinkServer servers with TSMP. You need to follow the steps below to get the Node License Pack:
a) Purchase Node License Pack from Lenovo and get Token(s) which contain(s) a licensed device number.
b) Request a license file by submitting the Token(s) and the Root Key to Lenovo. The Root Key can be retrieved from the 'About' dialog.
c) Get the license file from Lenovo.
d) Import the license file by clicking the link 'Import new licenses' in the 'About' dialog.

For a newly installed Energy Manager, only the TSMP Server Option Bundle is available unless the end user imports a license file. It means that if you need to manage devices besides Lenovo ThinkServer servers with TSMP, you have to purchase the Node License Pack. Otherwise you would get error message "Please check Available License Count in About dialog".

A license file is bounded to a Root Key. It means that a license file can only be imported to an Energy Manager instance with the same Root Key shown in the 'About' dialog. The Root Key is generated based on the OS information. If an OS is reconfigured (e.g., network configuration change) or reinstalled, the Root Key might change accordingly. This implies that you may need to request a new license file based on the new Root Key.

Only one license is available for an Energy Manager instance. Importing a new license file will overwrite the existing one.

3 Using Lenovo ThinkServer Energy Manager

3.1 Dashboard

The Dashboard provides the overall health status of the data center. It shows the current power and cooling status, the historical power and temperature trend, the hot rooms and hotspots, the power and space capacity information, and the critical events.

You may customize the dashboard by adding, deleting, or moving gadgets in it.

To add a gadget to the dashboard, click the 'Select Gadgets' button on the top right corner. In the popup dialog, check the gadget you need and then click the 'OK' button.

To delete a gadget, move your mouse over the gadget and click the button on its top corner.

To move a gadget, move your mouse to the title of the gadget. When the mouse pointer changes to the cursor of the moving icon, you may drag the gadget and drop it to the desire location.

To reset the dashboard to the default status, click the 'Select Gadgets' button on the top right corner. In the popup dialog, click the 'Reset to default' link.

To specify gadget option, you may move your mouse to the gadget and click the button of the spanner icon (which will be shown if the gadget is configurable) on the top of the gadget. Then specify the gadget options in the popup dialog.

Most of the data in the dashboard are refreshed automatically each minute.

3.2 Datacenter Management

3.2.1 Overview

Datacenter Management displays all the entities managed.

Energy Manager manages entities in the following hierarchy:
Data Center > Room > Row > Rack > Device > Blade

The hierarchy at the blade level is only available for HP and DELL enclosures.

When you create a hierarchy:

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- A room can only be added to a data center.
- A row can only be added to a room.
- A rack can only be added to a row.
- A device can only be added to a rack.
- A blade can be added to either a rack or a chassis (displayed in Device list).

3.2.2 Creating the Hierarchy

On the 'Datacenter Management' page, click '+' in the Data Center list to add a DC. Specify the name in the popup dialog, and then click OK.

A DC is added successfully.

Select a DC and click '**+**' in the Room list to add a room to it. Specify the name of the room in the popup dialog, and then click OK.

Similarly, you may add rows to a room.

Select a row and click '+' in the Rack list to add a rack to it. Specify the name of the rack in the popup dialog, configure the space capacity and total power capacity, check the box 'PDU Power as Rack Power' if you want to use the power reading of PDU(s) in the rack as the IT equipment power of the rack, and click OK to add the rack.

NOTE
The two fields 'Name' and 'Total Power Capacity' are mandatory when a rack is added. The input text boxes in Energy Manager are marked with bold border if they are required.

3.2.3 Adding Devices

Select a rack and click '+' in the Device list.

The popup dialog shows all the devices that do not exist in the current hierarchy. Select the devices you want to add to the rack, and then click OK.

Click the name of the device in the 'Device List' page, and then you can go to the Hierarchy page of the selected device directly.

You may also add a new device to a rack by navigating to the 'Add New Device' tab in the popup dialog, and specifying the information of the device as described in Adding a Device Manually.

NOTE

If you do not specify 'Size of Device' and 'De-rated Power', default values (1 for 'Size of Device' and 400 for 'De-rated Power') are set for the server after you click OK. Default values for Various device types are different.

Use WMI to communicate with Microsoft Windows servers, Energy Manager should be deployed on a Windows server with Microsoft* Visual C++ 2010 Redistributable installed. The down-level logon name format, e.g. domain\username should be used in the credential for WMI communication.

Use SSH to communicate with devices, Energy Manager depends on the command 'hostname' to identify a Linux server. If the command is not available, the system cannot be managed by Energy Manager. Energy Manager depends on the command 'dmidecode' to retrieve the system information such as the device model and the product serial. If the command is not available (or the permission of executing the command is denied), the information cannot be retrieved from the system.

3.2.4 Hierarchy Management

In the 'Hierarchy' tab on the 'Datacenter Management' page, each entity can be edited or deleted (recursively with the sub-groups and devices) using the icon of editing or the icon of deletion.

To edit an entity:
  a) Select the entity.
  b) Click the edit icon in the list.
  c) Edit its information.
  d) Click OK.

To delete one or more entities:
  a) Select the entity/entities.
  b) Click the delete icon in the list.

You may also click the move icon to change the hierarchy:
  a) Select the entity/entities.
  b) Click the move icon in the list.
  c) In the popup dialog, select the entity in the hierarchy as the destination.
  d) Click OK.

After the above steps, the devices selected have been moved to the destination. You may move rooms/rows/racks similarly.

📓 NOTE

You can go to the 'Hierarchy' tab by clicking the hyperlinks on entities. In most cases, the entities in UI are labeled with the hyperlinks to the 'Hierarchy' tab.

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3.2.5 Summary

The 'Summary' tab on the 'Datacenter Management' page displays detailed information about each entity, including temperature, power, space and events, etc.

3.2.5.1 Summary of a DC

The 'Summary' tab of the DC selected on the 'Datacenter Management' page displays the following information:

- The highest inlet temperature
- The power capacity currently consumed against the power unused
- The space capacity currently consumed against the space unused
- The total numbers of racks and devices in the DC

In most cases, the thermometer in the 'Temperature' graph is shown in green. The pie charts in the 'Power' and 'Space' graphs show the power and space capacity of the data center selected. The unused capacity is in green and the capacity in use is in orange.

The 'Events' tab lists all the events for the DC.

NOTE

The thermometer in the 'Temperature' graph may turn red if the 'Highest Inlet Temperature' becomes higher than 27 degrees.
The pie charts in the 'Power' and 'Space' graphs may turn red if the amount in use is greater than the capacity configured.

3.2.5.2 Summary of a Room

The 'Summary' tab of the room selected on the 'Datacenter Management' page displays the information below:

- The highest inlet temperature
- The power capacity currently consumed against the power unused
- The space capacity currently consumed against the space unused
- The total numbers of racks and devices in the room

The 'Summary' of a room is similar to the 'Summary' of a DC.

The 'Events' tab lists all the events for the room.

3.2.5.3 Summary of a Row

The 'Summary' tab of the row selected on the 'Datacenter Management' page displays the information below:

- The highest inlet temperature
- The power capacity currently consumed against the power unused
- The space capacity currently consumed against the space unused
- The total numbers of racks and devices in the row

The 'Summary' of a row is similar to the 'Summary' of a DC.

The 'Events' tab lists all the events for the row.

3.2.5.4 Summary of a Rack

The 'Summary' tab of the rack selected on the 'Datacenter Management' page displays the information below:
- Visualized rack and all devices in the rack
- The highest inlet temperature
- The power capacity currently consumed against the power unused
- The space capacity currently consumed against the space unused
- The total numbers of devices in the rack

The 'Lowest Inlet Temperature' and the 'Highest Inlet Temperature' of all the devices in the rack are shown above the rack visualized. Colored rectangles represent the devices in the rack you've selected, and rectangles with no colors represent the free space. When the inlet temperature of a device is higher than 27 degrees, the color of the device turns yellow.

When your mouse hovers over a device, the color changes and the details of the selected device are shown.

You can select a device by clicking on the corresponding rectangle in the visualized rack figure, and then the Summary of a Device is showed.

The 'Events' tab lists all the events for the rack.

3.2.5.5 Summary of a Device

The 'Summary' tab of the device selected on the Datacenter Management page displays the information below:
- Visualized rack and all devices in the rack
- The highest inlet temperature
- Power
- Space
- The details of the device

The 'Summary' of a device is different from that of the other hierarchy level.
- The 'Temperature' graph displays its highest inlet temperature.
- The 'Power' graph shows its current power.
- The 'Space' graph displays the space that it occupies.

The light gray rectangle in the visualized rack highlights the device selected. The dark gray rectangles represent the other devices of the rack and the empty rectangles with no color represent the free space.

You can select a device by clicking on the corresponding rectangle in the visualized rack figure, and then the information for the selected device will appear on the tabs. The selected rectangle will be in light gray (or yellow if the inlet temperature is higher than 27 degrees), while the others will be in dark gray. When you move your mouse over the selected device, it is highlighted with blue color.

In the "Device" tab, you can power on, power off, or reconnect to the device by clicking the corresponding link. You can access the management console of the device by clicking the link in the row "Management Console URL" if the device supports the capability.

The 'Events' tab lists all the events for the device.

🗋 NOTE

To refresh the properties and status of the selected device, you can click 'Reconnect' on the 'Summary' tab.

3.2.6 Temperature/Power

Select an entity on the 'Datacenter Management' page and then click the 'Power/Temperature' tab to view its power and temperature details.

Power and temperature data is plotted in the figures with the corresponding data granularities. CPU utilization data is plotted if the in-band OS information is specified for the given server.

In the temperature figure:
  * The 'Highest Inlet Temperature' is plotted in pink.
  * The 'Lowest Inlet Temperature' is plotted in green.
  * The 'Average Inlet Temperature' is plotted in brown.

In the power figure:
  * The 'Highest Power Consumption' is plotted in red.
  * The 'Lowest Power Consumption' is plotted in brown.
  * The 'IT Equipment Power' is plotted in cyan (blue-green).

CPU utilization data will be shown only if the OS credential is specified for a device.

You can view the power/temperature values by moving your mouse over the data points in the curves.

By default, the power and temperature figures display the trending data of the recent hour. You can click the arrow buttons '<' and '>' to view the data in the previous and

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next time window, or switch to display the data in the time window of a different size by clicking the corresponding buttons.

You can save the measurement data in an Excel file so that the managers can analyze the data in a more convenient manner. To accomplish that, click the 'Export data' link on the top of the 'Temperature/Power' tab, choose the start and end time for data exporting, and then click OK.

📄 **NOTE**
The corresponding data granularity of a different time window size is different, and is explicitly shown in the figures.

The 'Power/Temperature' tab also provides energy consumption metrics for the selected entity:
- 'IT Equipment Energy' gives the total energy consumption of all the IT devices.
- 'Facility Energy', calculated based on the 'IT Equipment Energy' and PUE (PUE=Total Facility Energy / IT Equipment Energy, could be specified in Settings page), estimates the energy consumption for facility devices.
- 'Energy Consumed (Total)' gives the total energy consumption from the IT devices and the facility (e.g., the cooling system).

📄 **NOTE**
After a policy is enforced on the entity selected, 'Requested Power Cap' is plotted in purple in the power trending graph.

📄 **NOTE**
Energy Manager will approximate rack level power consumption if some servers in the rack cannot be reached. If a server is not physically in a rack or it does not consume power at all (e.g., is not connected to the power source), you may need to delete the server from the rack immediately for a better power data accuracy.

3.2.7 Policies
You can use policies to limit the amount of power that an entity consumes. Each policy applies to either a group entity in the hierarchy or a device.

Energy Manager provides several policy types:
- 'Custom Power Limit' limits the total power consumption of an entity. When the policy applies to a group entity in the hierarchy, Energy Manager actively reallocates the power budgets to the individual servers within the group in each monitoring cycle. It attempts to minimize the gap between the power demands of each entity and the overall power allocation for the group, in order to minimize the performance impact of the group power capping. Energy Manager monitors the power consumption data of the servers, estimates the power demand of the servers, and reallocates the power budgets with a sophisticated

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approach by applying a heuristic discriminative approach to solve a probabilistic model. In general, Energy Manager reacts quickly by allocating more power to servers to get new tasks running properly. If the total power demand of the group exceeds the group power constraint, Energy Manager implements a balanced power allocation. The policies are commonly applied to increase the server density with respect to power or cooling capacity.

- 'Minimum Power' throttles power consumption of an entity as much as possible. Use this policy to prolong business continuity in the case of an emergency. The Minimum Power would set the frequency of CPUs to the lowest level, and then it may impact your server performance.

You can go to the 'Policies' page or to the 'Policies' tab on the 'Datacenter Management' page to view the policies.

3.2.7.1 Creating a Policy for a Device

On the 'Datacenter Management' page, select a device and click 'Add' in the 'Policies' tab.

In the popup dialog, specify the policy name and select the policy type from the drop-down list:

- If you choose 'Custom Power Limit', Energy Manager will generate an alert when the actual power consumption is higher than the threshold you configured.
- If you choose 'Minimum Power', Energy Manager throttles the device power to the minimum (so you do not need to specify a threshold).
- Navigate to the 'Schedule' tab to schedule the policy, and then click OK.

You may check the policy in the 'Policies' tab or on the 'Policies' page.

NOTE

'Reserve Budget' is used for devices without power capping capability and is discounted from the power cap.

3.2.7.2 Creating a Policy for a Group

When enforcing a Custom Power Limit at the group level, you may configure the priorities of its members. Excess power is distributed to the devices according to their priorities.

For each member, you can choose one of the priority levels:

- Low
- Medium (Default)
- High
- Critical: Energy Manager reserves the de-rated power for this entity.

Priority lists are policy-specific and an entity may have different priorities in different policies. However, during policy calculation, a higher priority of an entity in one policy may override a lower priority set to the same entity in another policy.

You may view all the policies on the 'Policies' page to disable, edit, or delete policies.

3.2.7.3 Enabling/Disabling Policy

To enable/disable a policy:
  a) Click the policy's 'Enable'/'Disable' link.
  b) The 'Status' of the policy turns green/red.

3.2.7.4 Editing Policies

To edit a policy:
  a) Click 'Edit' for the selected policy.
  b) Update policy details in the popup dialog.
  c) Click OK.

3.2.7.5 Deleting Policies

To delete a policy:
  a) Go to the 'Policies' page or the 'Policies' tab on the 'Datacenter Management' page.
  b) Choose the policies to delete by selecting the check boxes and click Delete button.
  c) Click OK.

3.2.8 Thresholds

Custom events are triggered when a power or temperature threshold is configured on groups or devices. The 'Thresholds' tab in the 'Datacenter Management' page manages the event threshold configurations, against which the collected data is compared with (in the unit of Watts for power and Celsius degrees for temperature). An event will be triggered when the 'Condition' is met.

To configure a power threshold:
  a) Click 'Datacenter Management', select a server, and select the Thresholds tab.
  b) Under 'Power Thresholds', click 'Edit' in the 'IT Equipment Power' event.
  c) Enter the value of Threshold, and then click OK.
  d) Once the power draw of the server increases over the threshold you configured, an event is triggered and listed in 'Summary' tab. You can check the details by moving your mouse over its 'Description'.

Configuring temperature thresholds is similar.

3.3   Groups

3.3.1 Overview

On the 'Groups' page, the devices you are interested in can be sorted and put into one custom group. You can manage, monitor, and configure the devices in the groups the same way as in the Hierarchy.

3.3.2 Operations on Groups

3.3.2.1 Adding groups

On the 'Groups' page, click the '+' button under the 'Group List' to add a group. Specify the name and an optional description in the popup dialog, and then click OK.

You will see your group added to the 'Group List'.

Select a group and click the '+' button under 'Device Name' to add a device to it. Select device/ rack/ row/ room/ data center in the popup dialog, and then click OK. If a rack is selected, all the devices in the rack will be added to the group.

 NOTE

If you want to add all the devices of a given Data Center/Room/Row/Rack to a group, you can check the box for that Data Center/Room/Row/Rack, and then click OK.

3.3.2.2 Editing/deleting groups

In the 'Group List', click the edit button to edit the selected groups and delete button to delete groups.

In the Device table, click the delete icon to delete devices.

The four tabs 'Summary', 'Temperature/Power', 'Policies', and 'Thresholds', are similar to those of the 'Datacenter Management' page.

3.4   Energy Optimization

3.4.1 Overview

'Energy Optimization' analyzes different data to help you optimize the energy efficiency in your DC. The features are 'Cooling Analysis', 'Low-Utilization Servers', 'Server Power Characteristics', and 'Workload Placement', as described below.

3.4.2 Cooling Analysis

In the 'Cooling Analysis' page, the 'Temperature Histogram' figure for the room selected provides the real-time monitoring data of the inlet temperatures. The X-axis shows the temperature values and the Y-axis gives the percentages of servers with the

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corresponding temperature values. 'Sample Size' shows the number of the devices with the temperature data monitored in the selected room.

The current cooling status is evaluated with suggestions given, along with possible actions and the Benefits of taking these actions.

For example, when servers with inlet temperatures higher than 27 degrees are detected, they will be displayed in the 'Hotspots' list.

If you need to refresh the temperature data, click 'Refresh' on the top right corner.
📘 NOTE
The colors and the temperature (°C) range in the "Temperature Histogram":
  • Red: temperature>32
  • Orange: 27<temperature<=32
  • Yellow: 22<temperature<=27
  • Green: 17<temperature<=22
  • Blue: temperature<=17

3.4.3 Low-Utilization Servers

TEM evaluates and tries to identify low-utilization servers based on out-of-band power data. With a set of heuristics, server utilization is estimated according to the power history with all the raw data collected. Given the statistics of utilization data estimated, low utilization servers are identified.

On the 'Energy Optimization' page, click 'Low-Utilization Servers'.

By clicking 'Analyze', low utilization servers will be identified and listed as potential targets for consolidation to optimize energy efficiency. The time that the analysis was done is shown in the bottom left of the screen.

If there are a large number of servers, utilization analysis may take a long time. You may leave this page and perform other operations while the analysis runs in the background.

The 'Daily Utilization Pattern' tab shows the result of analyzing server utilization patterns based on the historical monitoring data. This can help with server consolidation. For example, if one server is busy at night and idle in the daytime, while another is busy in the daytime and idle at night, you may consider consolidating the workload of the two servers and shutting down one of them.

3.4.4 Server Power Characteristics
Click 'Server Power Characteristics' on the 'Energy Optimization' page. You will see the screen displayed. The X-axis shows the power values and the Y-axis shows the server

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model. The power values next to the bars present the power ranges measured for different server models.

For example, a certain bar of 128 – 139 means that, for all the servers with a certain model (e.g., Intel Corporation-S5500WB) managed, the lowest power observed was 128 watts and the highest power observed was 139 watts.

You may check the detailed power characteristics by clicking each bar. Two histograms would be showed in a popup dialog. One is peak power histogram, the other is active idle power histogram. You would get information about how the peak power and active idle power are distributed.

3.4.5 Workload Placement

Workload placement analysis evaluates how likely the servers are able to accommodate a new workload based on the resource need of the workload as well as the resource utilization and availability of the servers. The analysis applies to servers with CUPS monitoring capability.

You need to know a given workload combination (CPU, MEM, IO), e.g., a web server which provides web page service to 100 concurrent web users is running, and the workload might be 32, 20, 20. You may check CUPs trending to know related workload data.

3.4.6 Advanced Power Model

The power model for a certain server takes its utilization data as the input to predict its power consumption. To add a power model, you need to select a server with both monitored power and utilization data. At least 100 monitored data points are required. Once a power model is added, you can predict its power consumption for given workload (a combination of utilization data).

3.5   Discovery and Import

3.5.1 Discovering Devices

Click 'Add Discovery Task' in the 'Discovery and Import' page.

Select the protocol type from the drop-down list, and input the IP range. The default 'Subnet Mask' is 255.255.255.0. You may provide some additional information based on the 'Protocol type' you choose.

Choose from 7 protocol types available in the drop-down list: IPMI, SNMPv1v2c, SNMPv3, WS-MAN, HTTPS, SSH, and INBAND_PROTOCOL.

Click OK to run the discovery task.

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Energy Manager supports to run multiple discovery tasks at the same time. If you have too many discovery tasks running at the same time, the performance of TEM would be impact potentially.

After the discovery progress reaches 100%, you may restart or remove the task by clicking the 'Run Again' or 'Remove' button.

The devices discovered will be added to the 'Device List' automatically.
 NOTE
If some devices are in the network you specified and are not discovered by TEM, check the following:
  • Network connectivity
  • Device status
  • Device credential you specified.

3.5.2 Importing Devices

You may import devices with or without hierarchy information to Energy Manager. To import devices, you need to compile an Excel file which contains device and hierarchy information. Depending on device type, some columns are required. For example: Name, type, and address would be required for any IPMI based servers. Other columns would be optional.

A downloadable Excel file template (hierarchy_template_for_import. xls) can be found on the website with the TEM package.

The following table lists the description of each column of excel spreadsheet:

Item	Description
name	Entity display name. It is a required column for any devices.
type	Supported protocol types include IPMI, SNMPv1v2c, SNMPv3, WS-MAN, SSH, and INBAND_PROTOCOL. For unmanaged device, it should be 'Unmanaged server', 'Unmanaged network device', or 'Unmanaged storage device'. It is a required column for any devices.
address	IP address
username	Username to communicate with the device
password	Password to communicate with the device
snmpcommunitystring	Community string for accessing the SNMP-based platform via the SNMP V1 protocol
snmpencryptionpassword	The password for encryption for the SNMP-based platform

httpsport	The HTTPS port for the device
sshport	The SSH port for the entity
distinguishedname	The UCS DN of the entity (used for identifying and discriminating UCS devices in Energy Manager)
key	The IPMI key for the device
de-ratedpower	De-rated power for managed or unmanaged devices
size	Size of the device
location	Physical location of the device in a rack
authenticateentity	To decide whether to authenticate the Dell CMC device in WS-MAN connection. Valid value is either ''rue' or 'false'
model	Device model for unmanaged devices
ostype	OS type for IPMI devices. Valid values include Windows, Linux, Xen, and ESX
osaddress	OS IP address
osusername	OS user name
ospassword	OS password
typicalpower	Typical power used for power estimation with a static value
idlepower	Idle power used in utilization-based power estimation
peakpower	Peak power used in utilization-based power estimation
dc	Data center
room	The room that the device belongs to
row	The row that the device belongs to
rack	The rack that the device belongs to
enclosure	The enclosure containing the blade server

You may start to import device by clicking the 'Add Import Task' button in the 'Discovery and Import' page or the 'Import' button in the 'Devices and Racks' page. Whatever the button you click, you will go through the same importing progress.

The devices without hierarchy information would be imported into the 'Device List'.

3.6   Devices and Racks

3.6.1 Overview
The 'Devices and Racks' page contains all the devices discovered, imported, and manually added. On this page, you can edit the device information, e.g., the 'Name', the

'Description', etc. You can also delete a device from the list, or apply a filter to show a subset of the devices only.

If a device in the table is showed with a hyperlink, you may go to hierarchy view of the device by clicking the hyperlink. Otherwise you may need to add the device to hierarchy in Datacenter Management page.

3.6.2 Adding a Device Manually

Click 'Add' to add a new device to the 'Device List'.

There are nine device types available in the drop-down list: 'Server', 'PDU', 'UPS', 'Network device', 'Chassis', 'Storage Device', 'Unmanaged server', 'Unmanaged network device', and 'Unmanaged storage device'.

Specify the 'Name' and the 'IP Address' (or the 'Hostname') of the new device in the popup dialog. You may also need to provide some additional information based on the 'Device Type' you selected. For example, if you chose 'Server' as the 'Device Type', you have to choose a protocol from 'IPMI', 'SSH', and 'WMI', then type in the related information. For servers managed through IPMI protocol, you may specify the in-band OS information to retrieve CPU utilization data along with the power and temperature data.

Click OK and you will see a new device successfully added to the device list.

📘 NOTE

You need to enter either the 'IP Address' or the 'Hostname', but not both.
If you choose 'Server' as the device type and 'SSH' or 'WMI' as the protocol, Energy Manager will communicate with the OS of the device using the corresponding username and password. In that case Energy Manager can be configured to retrieve the utilization information from the OS to estimate power consumption dynamically.
For the device type of 'Network Device', Energy Manager supports Cisco switches with Cisco EnergyWise technology enabled.

3.6.3 PDU Configuration

If you add a PDU with outlet level power monitoring capability, you can specify unmanaged devices as the associating devices. By doing this, you can get the power reading of the devices without power monitoring capability by referring to the PDU outlet power.

Click the 'Associate Device' link on the 'Device' tab of the 'Summary' page of the PDU. Click the drop-down list and choose an unmanaged device for the corresponding outlet, and then click OK.

3.6.4 Adding an Unmanaged Device

If you choose 'Unmanaged server', 'Unmanaged network device', or 'Unmanaged storage device' as the device type, you can configure 'Power Estimator' to estimate the power of the device(s) (as unmanaged devices do not have power monitoring capabilities). You can configure the estimator by specifying a typical power value or looking up through the power profiles.

To configure the power estimator through power profile lookup, go to the 'Datacenter Management' page, select the 'Hierarchy' tab, and then add the unmanaged device to a rack and select the device. Click the 'Edit' link on the 'Summary' tab and a popup dialog box appears. You can select the profile from the list and Energy Manager will fill in the peak power and active idle power automatically based on your selection. Clicking OK finishes the configuration process of the 'Power Estimator'.

If your device does not match the profiles in the list, or you know the typical power of your device, you can:
Fill in the peak power and active idle power directly.
Click 'Add' in the popup dialog to add a power profile. Select from 3 types of power profiles available in the drop-down list: 'Server', 'Network Device', and 'Storage Device'.

You can edit or delete a power profile by clicking the corresponding buttons.

You can also check, edit and delete all the power profiles on the 'Power Profile' tab of the 'Settings' page.

📘 NOTE

After adding an unmanaged device into a rack, an event will appear in the 'Events' list to remind you to configure a power estimator for it.

You can configure the 'Power Estimator' for devices of the same type in batches:
If you have specified an unmanaged device for a PDU, you can see the information for the PDU on the last line of the 'Device list'. For example, you can get its power information from Outlet1 of PDU with an IP address of 10.239.98.30. You can click the Clear link to disassociate this information.

3.6.5 Filtering Devices

You can apply a filter to show only specific devices:
   a) Go to the 'Devices' tab on 'Devices and Racks' page.
   b) Specify device name/address (partial or full).
   c) Click 'Search'.

Click 'Clear' to clear the filtering text box.

3.6.6 Editing a Device

Select the devices you want to edit and click 'Edit' to edit a device.

You can change the name and other information of the devices.

 NOTE

'Device Type' and 'Protocol' cannot be edited. 'IP Address'/'Hostname', and credential are based on device configuration, which cannot be changed arbitrarily.

3.6.7 Deleting Devices

To delete single device or multiple devices:
   a) Go to the 'Devices' tab on the 'Devices and Racks' page.
   b) Select the check boxes to specify which devices to delete.
   c) Click 'Delete'.
Click OK.

3.6.8 Advanced Search Devices

You may search devices by the three conditions
   • Device Model
   • Communication status
   • Capability

You may specify one or more conditions for the search, the logical relations between the conditions are 'and'. For the 'Capability' condition, the logical relations between different options are 'or'.

3.6.9 Search for Available Racks

You may specify device information to search for available racks in which to install the device. Go to the 'Racks' tab on the 'Devices and Racks' page. Enter the 'Device Size' and 'Device De-rated Power', and then click Search. Then the racks matching the requirements will be listed.

 NOTE

The search for space capacity considers the continuous space of a rack. It works only when the information for continuous rack space is available. You need to specify the location of all devices currently in a rack to make the continuous rack space information available.

3.7   Policies

All the policies in the hierarchy are displayed in the table. You may manipulate these policies in the table.

See Policies to learn how to configure policies.

3.8   Events and Thresholds

3.8.1 Overview

The 'Events and Thresholds' page enables you to view the predefined events or custom events for DC management and all the thresholds applied to different entities. Clicking 'Events and Thresholds' on the left side menu brings up the 'Events and Thresholds' page. The page lists all events and thresholds. The 'Events' list can be further filtered by time or severity level, as defined below:

Severity Level	Icon	Description
Custom		Associated with all custom events.
Critical		For errors that may cause Energy Manager to stop working properly.
Error		For errors on specific nodes, or non-critical errors in Energy Manager .
Warning		For events that warn that an error may soon occur.
Informative		For events that do not report errors.

📓 NOTE

There are different 'Events' tabs in Energy Manager:
- The 'Events' page lists all the predefined events and custom events.
- The 'Events' tab on the 'Dashboard' page only lists the critical events and threshold based events.
- The 'Events' tab in the 'Datacenter Management' page lists all the events applying to the specific group or device.

📓 NOTE

Some typical events are listed below along with simple troubleshooting tips.

Event Type	Description	Troubleshooting
PLATFORM _OPERATIO N_FAILED	May be caused by platform issues, including: platform error, platform unstable or platform temporarily busy. Typical error notes may include: 1 Plugin Operation Exception: command code:34, completion code: ffffff83, failure reason: ERROR_COMPLETION_CODE, detailed message: Response for command: 0x34, NetFn[LUN: 0x1C. Completion code: 0x83 Unknown completion code-125. Additional data 0 bytes:… 2 Platform operation failed: System is on, but ME power measurement is suspended. 3 Platform operation failed: Thermal is not supported in the node : … 4 Platform operation failed: NM3.0 get cups	Check the status and the power and temperature trending of the device. If the status and the trending are displayed normally, you can ignore the event. If they are abnormal, you can try the following actions to solve it: • Cycle AC power of the managed device. • Update the BIOS/BMC firmware to the latest version.

	data error. Plugin Operation Exception: …… 5 Platform operation failed: NM 3.0 get cups data error. Receive timeout, state =TIMEOUT 6 Platform operation failed: NM Airflow temperature measurement is pending in the node:…	
INTERNAL_ ERROR	May be caused by platform issues, including: platform error, platform temporarily busy or some unsupported actions. Typical error notes may include: Set average period for POWER with value:60 failed!	• Cycle AC power of the managed device. • Update the BIOS/BMC firmware to the latest version.
COMMUNI CATION_WI TH_NODE_ FAILED	May be caused by a communication issue with the managed device. Typical error notes may include: 1 Receive timeout, state = TIMEOUT 2 IPMI session has not been created!	• Check the network status, such as NIC port and network cable, to make sure the device is reachable. • Reset the BMC.
CANT_SET_ NODE_EVE NT	May be caused by a communication or platform issue. Typical error notes may include: Failed to subscribe Predefined-Events with nodeId: 46 Error: Failed to receive test event from node…	• Check the network status, such as NIC port and network cable, to make sure the device is reachable. • Update BMC firmware to the latest version.

3.8.2 Filtering Events

To view specific events, you can filter the events by specified time period or severity level.

To filter events by a certain date range:
  a) Go to the 'Events and Thresholds' page.
  b) Select 'Date Range'.
  c) Specify start time and end time.
  d) Click 'Filter'

To filter events by a certain severity level:
  a) Go to the 'Events and Thresholds' page.
  b) Select 'Severity'.
  c) Select one or more severity levels.
  d) Click 'Filter'.

Filtering events by the 'Entity Name', the 'Event Type', or the 'Description' is similar to filtering by the date and the severity.

Energy Manager automatically deletes old events if there are more than 200,000 events listed. You can also manually delete events.

3.8.3 Deleting Events

To delete events:
a) Go to the 'Events and Thresholds' page.
b) Choose the event to delete by selecting the check boxes and click 'Delete' button.
c) Click OK.

To delete all events:
a) Go to the 'Events and Thresholds' page.
b) Click 'Delete All'.

3.8.4 Thresholds

All thresholds in hierarchy are displayed in a table. You may manipulate these thresholds in the table. Energy Manager would not validate input when you edit threshold in the table considering that these thresholds might be showed in multiple pages.

See Thresholds to know how to set threshold.

3.9   Settings

3.9.1 Overview

The 'Settings' page provides tabs for configuring Energy Manager, including 'User Management', 'SNMP Trap', and 'Predefined Event'.

3.9.2 User Management

In the 'User Management' tab, you can create, edit, or delete users. 'Administrator' role and 'Guest' role could be granted to a user. A user of 'Guest' role does not have permissions to modify anything in Energy Manager. TEM supports Microsoft Active Directory user and group. You may assign a role for a Microsoft Active Directory user or group, and then login to TEM with the Active Directory account. You need to specify domain name and credentials to access the Active Directory server.

3.9.3 Password

On the 'Password' tab, you can change your login password once you fill in the correct old password.

To change the login password:
a) Go to the 'Settings' page.
b) Fill in the old password.

c) Fill in the new password.
d) Confirm the new password.
e) Click Save.

3.9.4 SNMP Trap

In the 'SNMP Trap' tab you can assign a recipient to receive the events triggered, making it easier to manage the events in 3r^d-party event management systems. Energy Manager events are defined in the Management Information Base (MIB) file. And the MIB file is installed at "<installation path> \conf\DCMConsole-MIB-V1.mib".
To add a trap receiver:
a) Go to the 'Settings' page.
b) Click 'Add Receiver'.
c) Fill in the 'Destination IP Address or Hostname', 'Port', and 'Community String'.
d) Click OK.

To edit/delete/test a trap receiver:
a) Go to the 'Settings' page.
b) Click the links Edit/Delete/Test in the Action column.

3.9.5 Email Subscription

In "Email Subscription" tab you can subscribe TEM event through email, making it easier to get TEM alert.
To subscribe event:
a) Go to the 'Settings' page.
b) Click 'Add Subscriber'.
c) Fill in email server configuration.
d) Check "Subscribe threshold-based events only" if you only care about threshold based event
e) Click OK.

To edit/delete/test a subscription:
a) Go to the 'Settings' page.
b) Click the links Edit/Delete/Test in the Action column.

3.9.6 Predefined Event

The 'Predefined Event' tab lists all the events predefined in Energy Manager. It includes the 'Predefined Event Type' and 'Severity' of events. You can select the predefined events you are interested in by checking the corresponding boxes and clicking Save.
 NOTE
Some predefined event types with a severity of Error, such as "The device returns operation failure to Energy Manager", may trigger many events being logged. If the status and the power and temperature trending of the device appear normal, and you don't want so many events being logged, you can deselect this event type.

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NOTE

The Dashboard displays all Critical and Custom events. For environment monitoring you should pay attention to the Dashboard events first. Events under Datacenter Management, which include all event severities for an entity, including non-critical events, are helpful when diagnosing device and network issues. For events' troubleshooting, you can refer to the typical events NOTE under "Events and Thresholds".

3.9.7 Power Profile

All the power profiles are listed in 'Power Profile' tab on the 'Settings' page. You can manage the power profiles conveniently in the tab. The original server power profile data comes from the benchmark result page of SPECpower_ssj(R) and the benchmark name SPECPower_ssj(R) are registered trademarks of the Standard Performance Evaluation Corporation. The power profile is used to help estimating power consumption of devices without power monitoring capability. Because Lenovo ThinkServer provides more accurate monitored power data, they are not in power profile table.

Click the 'Add' or 'Delete' button to add a new power profile or to delete an existing power profile.

Click the hyperlink 'More' to edit the corresponding power profile.

3.9.8 Miscellaneous

You may configure the following options for your preferences:
- Maximum Healthy Temperature: The color (blue or orange) in dashboard would be affected by this option. Recommended value is 27 °C. This setting option does not impact all the temperature based threshold.
- Enable/ disable playing sound for custom and critical events.
- Enable/ disable blinking the browser title for custom and critical events.
- Specify 'Power Usage Effectiveness' of your datacenter. PUE=Total Facility Energy / IT Equipment Energy. It is used to estimate Metrics in Temperature / Power page.
- Enable/ disable Predictive Power Capping. Predictive Power Capping is a policy where excursions over the limit are not allowed. The important aspect of this feature is that you are willing to sacrifice performance by overly constraining power to avoid violating the power cap. If it is enabled, power policies on all the servers with Intel® Intelligent Power Node Manager 3.0 will be impacted.

NOTE

The blink of the browser title may behave differently in different web browsers and operating system settings.

3.10 Emergency Power Reduction

3.10.1 Overview

In an emergency event, e.g., a DC-level power failure forcing the DC to run on a backup power supply, you can enable 'Emergency Power Reduction' (EPR) to throttle the power of the devices down to an extremely low level to prolong the service time.

You may need different throttling actions for different devices. You can specify the emergency power reduction action for a device when it is added. You can also modify the EPR action by editing the device after it has been added. When a room is placed in emergency power reduction, different devices are throttled differently.

There are three EPR actions to choose from the drop-down list: 'Minimize power consumption' (default), 'Shut down' and 'No action'. You can choose 'No action' for critical devices, but 'Minimize power consumption' or even 'Shutdown' for others.

🗋 NOTE

Applying Emergency Power Reduction may throttle the power consumption of the devices down to an extremely low level, or even shut the devices down, which will impact the performance. Use the function only in emergencies. Please check the EPR actions carefully before applying EPR.

3.10.2 Enabling EPR

Click 'Emergency Power Reduction', choose a data center or a room in the popup dialog, and then click OK.

All the devices with power capping capability in this group are throttled with respect to the EPR action specified by the manager. You can specify the EPR action by editing the devices. Then an icon for EPR appears on top right of the page. You can check the device list in EPR by clicking the icon.

3.10.3 Disabling EPR

To disable the action of emergency power reduction, click 'Emergency Power Reduction', uncheck the corresponding data centers or rooms, and then click OK.

Click OK in the popup dialog.

4 Appendix: Compatibility of non-Lenovo Platforms

Lenovo ThinkServer Energy Manager is compatible with Intel Datacenter Manager. Non-Lenovo servers will operate with Energy Manager because it leverages industry standard protocols to communicate with the server. Customers may use this tool in a mixed vendor environment. Lenovo will not provide service and support for Non-Lenovo systems.

For Intel DCM compatible systems please refer to below website:
http://www.intel.com/content/www/us/en/software/intel-node-manager-ready-servers.html

5 Glossary

TSMP	Lenovo ThinkServer System Manager Premium
BMC	Board Management Controller
DC	Data Center
DCM	Data Center Manager
NM	Intelligent Power Node Manager
PDU	Power Distribution Unit
RMI	Remote Method Invocation
RAM	Random Access Memory
SNMP	Simple Network Management Protocol
SSH	Secure Shell
TLS	Transport Layer Security
UI	User Interface
UPS	Uninterruptible Power Supply
Cisco UCS	Cisco Unified Computing System
GUI	Graphical User Interface
CUPS	Compute Utilization Per Second

6 Appendix A. Notices

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