Tivoli. IBM Tivoli Data Center Optimization for Energy Management
IBM Tivoli Monitoring for Energy Management Reporting and Optimization

Version 1.0

IBM

User's Guide

Tivoli® IBM Tivoli Data Center Optimization for Energy Management
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Chapter 1. Data Center Optimization for Energy Management

IBM® Tivoli® Monitoring for Energy Management Reporting and Optimization

Tivoli Data Center Optimization for Energy Management (Data Center Optimization) provides the ability to examine energy usage and estimated cost and make recommendations for the data center.

Data Center Optimization is a reporting and modeling feature available to users of Tivoli products. You can use it to create reports for energy management costs. These reports can be itemized by resource (such as servers, storage, network devices, and facilities in the data center). It has a modeling and recommendation engine to help optimize data centers, based on power usage and associated costs. Using these results, you can perform "what if" calculations, to determine power savings alternatives and associated costs.

Chapter 2. Installation and removal

Prerequisites and considerations

Data Center Optimization uses other Tivoli products as a basis for gathering data to generate models and reports. You install it as a plugin, or console module, on top of IBM Tivoli Common Reporting Version 1.1.1, which is included with IBM Tivoli Monitoring. Before you install Data Center Optimization, you must first install Tivoli Common Reporting. Then you can install Data Center Optimization on the system where you installed Tivoli Common Reporting.

Data Center Optimization supports all operating systems that are supported by Tivoli Common Reporting.

To collect power data, Data Center Optimization requires that you have IBM Tivoli Monitoring for Energy Management version 6.20.01 installed.

Data Center Optimization requires that you have IBM Tivoli Monitoring V6.2 Fixpack 1 or later fixpacks or V6.2.1 installed in your network, and configured to store information into Tivoli Data Warehouse (which is also included in IBM Tivoli Monitoring). Tivoli Data Warehouse is the source for all data that is displayed in Data Center Optimization and must be configured in order to create reports. You can use the version of Tivoli Monitoring that is included with IBM Tivoli Monitoring for Energy Management.

For more information about Tivoli Monitoring, Tivoli Common Reporting, and IBM Tivoli Monitoring for Energy Management, see the Tivoli Monitoring and OMEGAMON® XE Information Center at the following address:

http://publib.boulder.ibm.com/infocenter/tivihelp/v15r1/index.jsp

Installing

1. Access the product installation image, which is either a CD or a compressed package (.zip or .tar file). If the image is a compressed package, extract it to a temporary location that you can install from.
2. From a command line, change to the root directory of the installation image and run the following command, depending on your operating system.
   - **AIX®:** DCOFEM_AIX.BIN
   - **HP/UX:** DCOFEM_HPUX.BIN
   - **Linux®:** DCOFEM_LINUX.BIN
   - **Solaris:** DCOFEM_SOLARIS.BIN
   - **Windows®:** DCOFEM_WINDOWS.EXE

   The installation wizard opens.
3. Accept the License Agreement, and then click **Next**.
4. Enter a destination folder, or click **Choose** to browse to the location of the folder, and then click **Next**.
5. For the IBM Tivoli Common Reporting Version 1.1.1 installation location, complete the following fields and click **Next**.
   - TCR/TIP Install Location

- Port
- Profile Name
- Server Name
- User Name
- Password

6. Complete the following fields for the Tivoli Data Warehouse and click **Next**.
   - Select DB Product type
   - Hostname/IP
   - Port
   - DB Name
   - Schema Name
   - User Name
   - Password
   - If DB product type is Oracle/MS SQL then please provide path of the respective jdbc/odbc library path

7. Review the installation parameters. To change any settings, click **Previous** to return to a prior input panel. If they are correct, click **Install**.

Removing

About this task

In Windows, you can remove **Data Center Optimization for Energy Management** in the Windows **Add or Remove Programs** dialog.

To remove the application in Linux or alternatively in Windows, do the following:

1. Navigate to the installation directory.
2. In the Uninstall_TDCOFEM subdirectory, run the Uninstall TDCOFEM program. The Uninstall wizard opens.
3. Click **Next**.
4. Enter your Tivoli Common Reporting username and password and click **Next**.
5. Click **Uninstall**.

Results

Data Center Optimization is removed.

Note: In some circumstances, the uninstall command terminates with a ″JVM not found″ message. Follow these steps to fix this problem.

1. In the same directory as the uninstall program, edit the Un-install_TDCOFEM.lax file and replace the **lax.nl.current.vm** property value to the correct JVM path. For example:

   ```
   lax.nl.current.vm=tcr_root\\Jre\\jre\\bin\\java.exe
   ```

2. Save and close the file.
3. Start the uninstallation process again.

Chapter 3. Getting started

After installing Tivoli Common Reporting, you can use your Web browser to work with reports.

Starting Tivoli Data Center Optimization for Energy Management

To use Data Center Optimization, you must first start Tivoli Common Reporting.

About this task

Follow these steps to start the server using the command line tools in both Windows and Linux. In Windows, you can also start Tivoli Common Reporting from the system start menu. Use your browser to access the console for Data Center Optimization.

1. From a command prompt, change to the *tcr_root*/bin directory.
2. Run one of the following commands, depending on your operating system.
   - On **UNIX®:** `startTCRserver.sh`
   - On **Windows:** `startTCRserver.bat`
3. Open your Web browser and navigate to the following address:

   `https://hostname:30343/ibm/console/logon.jsp`

   where *hostname* is the TCP/IP host name of the system where Data Center Optimization is installed (or `localhost` if you are running the Web browser on the same system).

   By default, Tivoli Common Reporting uses port 30343. If you encounter conflicts, you can change the port assignments configured in the embedded application server. For more information, search for **Setting port numbers** in the WebSphere® documentation at http://publib.boulder.ibm.com/infocenter/wasinfo/v6r0/index.jsp

4. On the console login page, type your Tivoli Common Reporting user ID and password. This can be the user ID and password that you specified during the installation process, or it can be a user ID and password provided to you by an administrator.

   When the console work area opens, the build number appears in the About Tivoli Data Center Optimization for Energy Management panel.

About Tivoli Monitoring for Energy Management Reporting and Optimization _ ☐

```
Tivoli Monitoring for Energy Management Reporting and Optimizat
Build Number: dcofem1.0-200810090824BUILD_ID=dcofem1.0-
----------------------------------------------

LICENSED MATERIALS PROPERTY OF IBM
5724-V08
(C) Copyright International Business Machines Corp. 200

All Rights Reserved

US Government Users Restricted Rights - Use, duplicatio
restricted by GSA ADP Schedule Contract with IBM Corp.
trademark of the IBM Corp.
```

Figure 1. About Tivoli Data Center Optimization for Energy Management

5. In the navigation pane, expand the **Energy** node to expose the Data Center Optimization pages.

Figure 2. Console navigation

> **Note:** Your user name must be assigned to the reportView or
> reportAdministrator roles to access the Data Center Optimization pages. See
> Chapter 7, "Administration," on page 65 for details.

Stopping Tivoli Common Reporting

Follow these steps to stop the server.

1. From a command prompt, change to the *tcr_root*/bin directory.
2. Run one of the following commands, depending on your operating system.
   - On **UNIX:** stopTCRserver.sh
   - On **Windows:** stopTCRserver.bat

A window opens prompting for your administrative credentials.

3. Enter your administrative user name and password for Tivoli Common Reporting.

Results

Tivoli Common Reporting is stopped and users cannot log into the console.

Importing energy data

About this task

When you create reports, Data Center Optimization obtains data from Tivoli Data Warehouse. Therefore, you must set up and configure IBM Tivoli Monitoring for Energy Management to collect power information and add and persist the energy data collected from the agents to the Tivoli Data Warehouse.

Collecting CPU utilization and efficiency data

If you plan to run recommendation reports in Data Center Optimization you must be collecting CPU utilization data for the systems that are to be included in the reports. This is because Data Center Optimization examines this data to discover underutilized servers in the networks. There are two ways to obtain this data. The first is to use IBM Tivoli Monitoring for Energy Management agents, which collect the CPU efficiency data for some systems. The second is to use the Tivoli Monitoring Operating System Agents for data collection.

If you are using the second option, you must install and configure the Tivoli Monitoring Operating System Agents for data collection to the Tivoli Data Warehouse. For more information, refer to the Tivoli Monitoring Information Center at the following address:

http://publib.boulder.ibm.com/infocenter/tivihelp/v15r1/index.jsp

Synchronizing operating-system and power data

About this task

If you are using the Tivoli Monitoring Operating System Agents for data collection, described in the previous section, then you must perform a configuration step to synchronize the operating system name of each server with that server's name within IBM Director. In order for the reporting mechanism to be able to correlate the power usage data and operating system usage data, the system names used in the operating system must be the same as the system names used in IBM Tivoli Monitoring for Energy Management. The system names are typically the IP host names. IBM Director, the source of data for IBM Tivoli Monitoring for Energy Management, enables you to name the systems as desired. To name the systems:

1. Open the IBM Director Console.
2. Click **All Managed Objects**.
3. Right click on the **Name** column in the **All Managed Objects** table, and select **Rename**.
4. Type a new name for that system that matches the name, typically the hostname, returned from the Tivoli Monitoring Operating System Agent.

Setting energy rates and carbon unit energy mixes

About this task

Select **Energy** → **Optimization for Energy Management** → **Preferences**. Click **Energy Rate Plans**.

Follow the instructions in Chapter 5, "Defining power rates and carbon unit energy mixes," on page 21 to set up the appropriate rates and mixes in your data center. This data is used as a basis for calculating the estimated cost and carbon unit emissions from the Data Center Optimization reports.
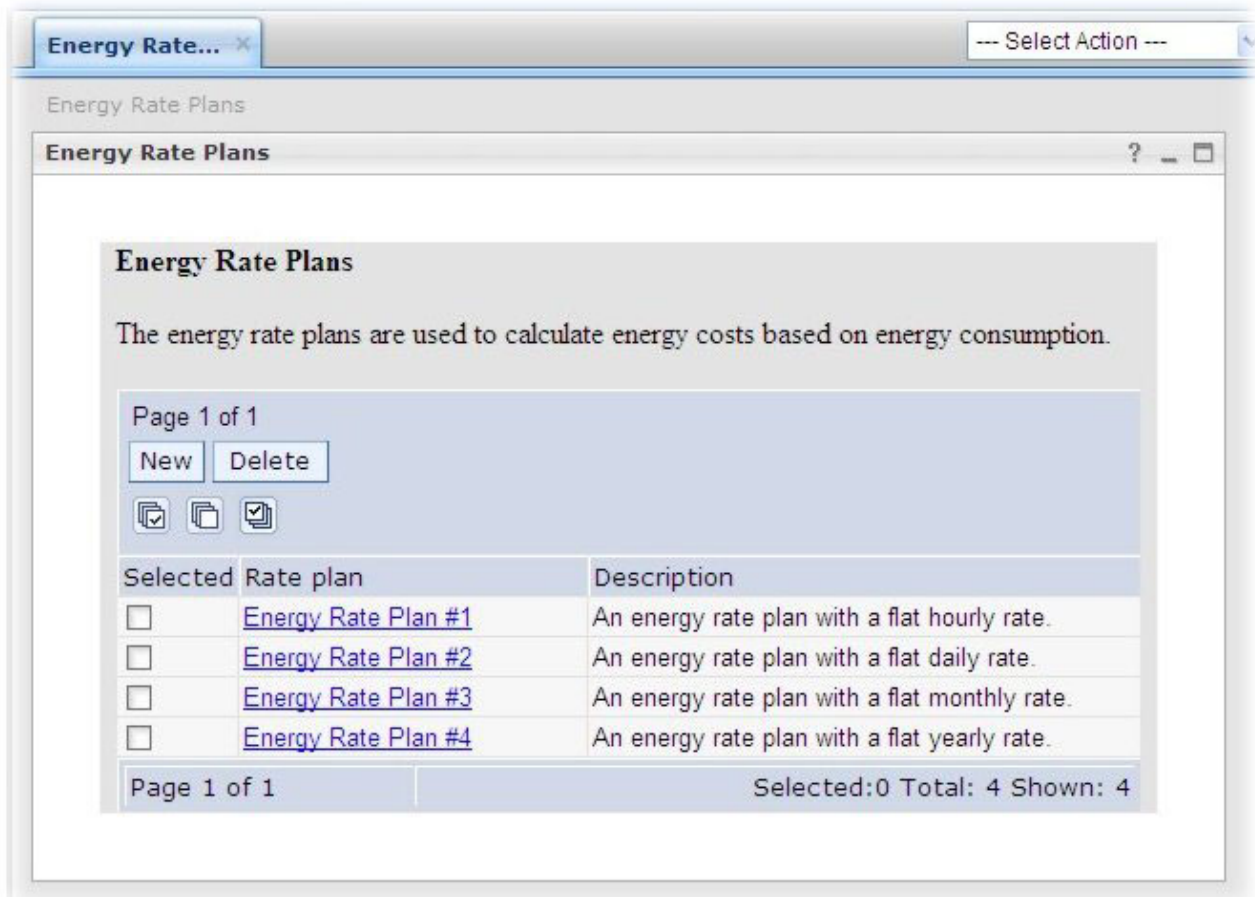
Figure 3. Energy Rate Plans page

Chapter 4. Working with Server Settings

Access **Energy** → **Preferences** → **Server Settings** to:

- import servers and groups
- classify servers
- create and modify server groups and server pools
- associate servers with IDPUs and energy meters

Import servers and groups

1. Select **Energy > Optimization for Energy Management > Preferences**.
2. Click **Server Settings**.

   The page appears with the Warehouse Data tab showing. Depending on the data that is available in the data warehouse, you can also see tabs for Server Group, Server Pool, IPDU, Energy Meter, and UPS.

3. Click the plus sign (+) to the left of **Data Refresh Settings** to expand it.
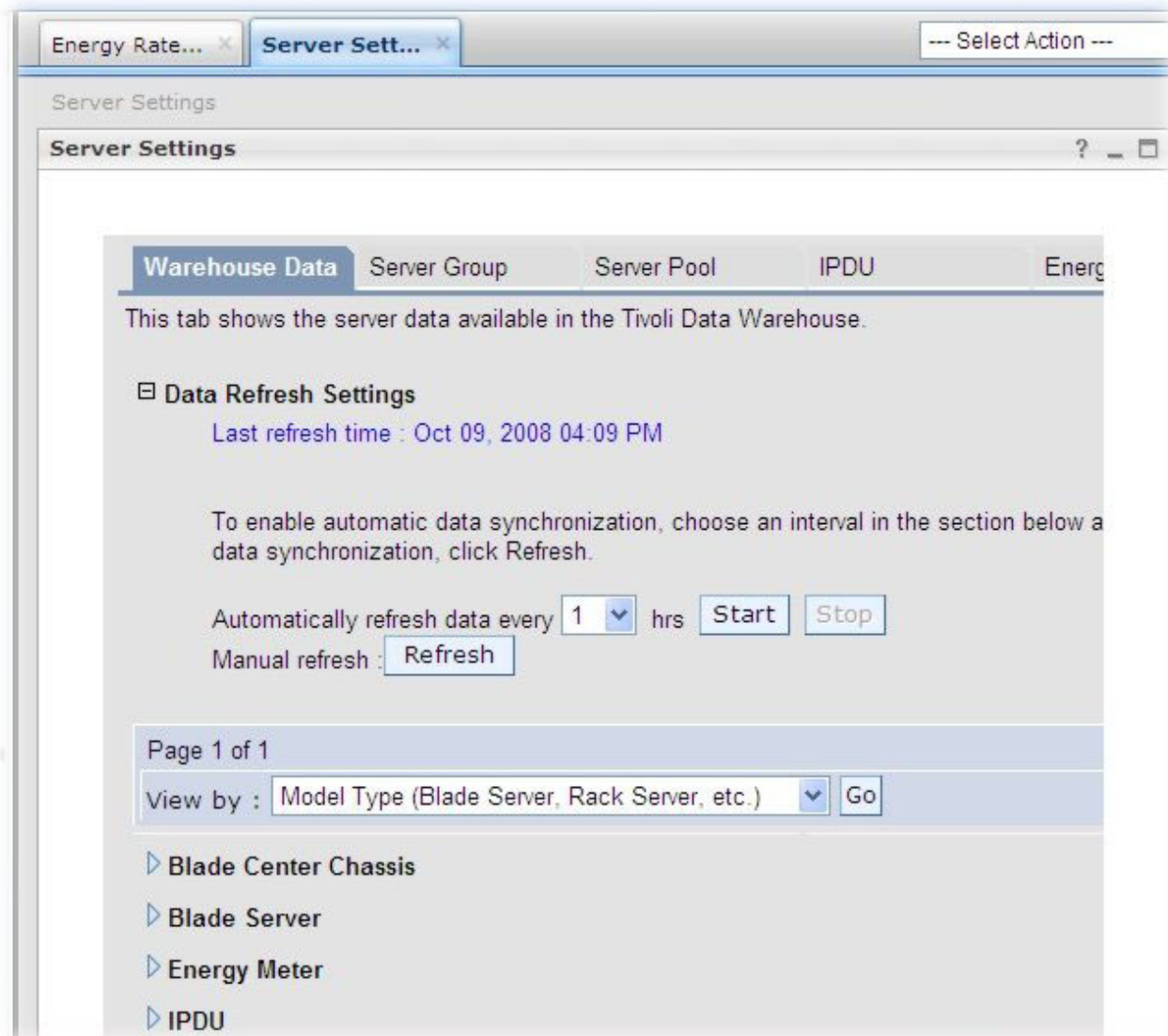
Figure 4. **Server Settings** *page*

4. If you want server and group data to synchronize automatically at a specified interval, enter the length of the interval in the **hrs** field and click **Start**.

5. Click **Refresh** to manually synchronize the Server and Group information from Tivoli Data Warehouse. The systems and groups will be imported immediately without any further prompting.

Classifying servers

About this task

The Warehouse Data tab on the **Server Settings** page enables you to classify servers by device type and to designate whether a server is critical to your data center, which would exclude the server from standby or power-down recommendations in Data Center Optimization's recommendations reports.

1. Select **Energy** ⇾ **Optimization for Energy Management** ⇾ **Preferences**.

2. Click **Server Settings**.

The page appears with the **Warehouse Data** tab showing.
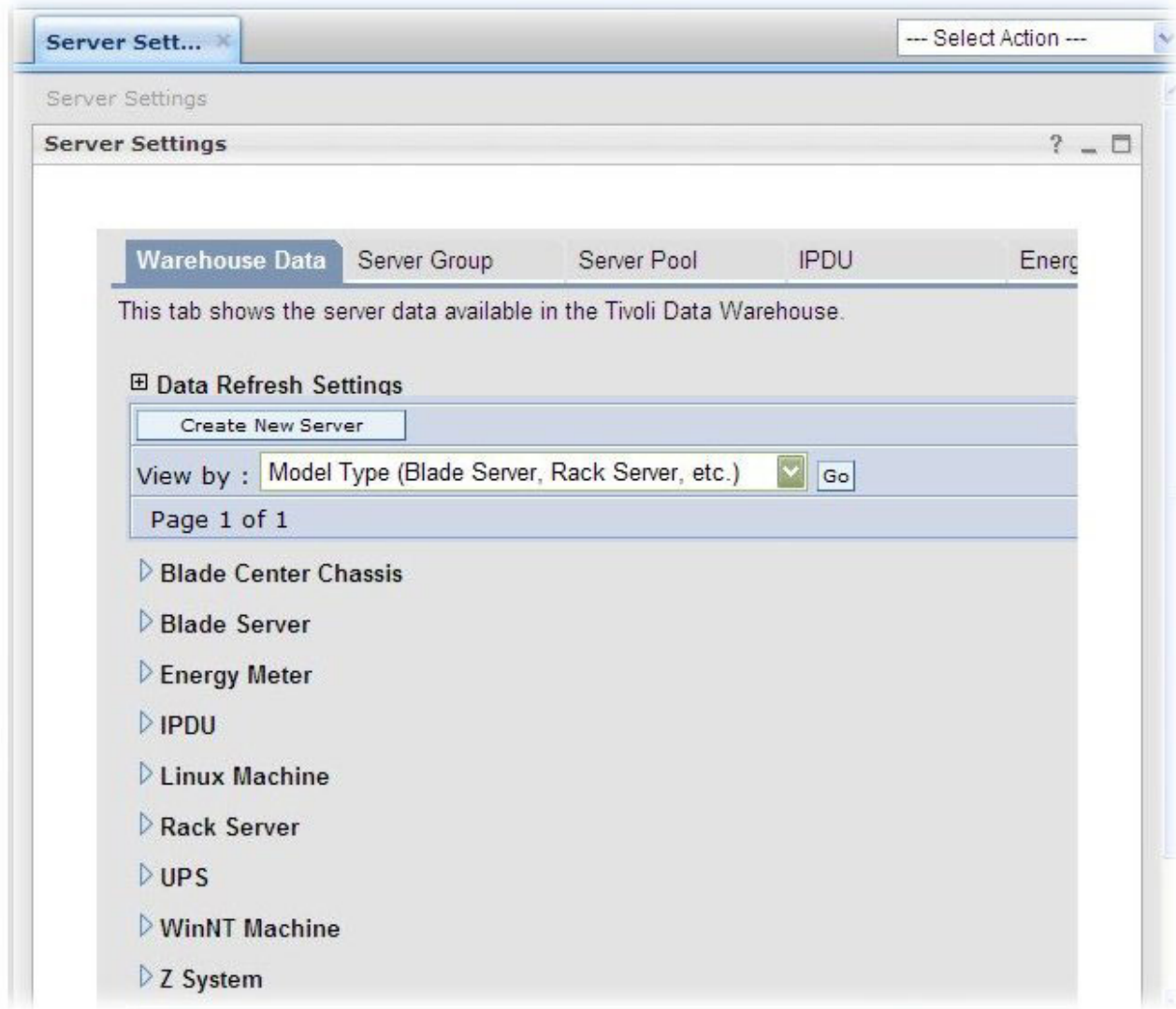
Figure 5. Warehouse Data tab

3. In the **View by:** field, click the down arrow and select whether you want to view the servers by model type, device type, or operating system (OS) type.

4. Click **Go**. The page reloads the view to reflect your selection.

5. Click the triangle icon next to a list item to expand it.

6. Modify the details of the desired models, devices or operating systems as appropriate.

7. Check the box in the **Critical** column for each server you would like to exclude from standby or power-off recommendations in Data Center Optimization's reports.

Creating servers

About this task

The Warehouse Data tab on the **Server Settings** page enables you to create and delete user-defined servers and associate them to power devices. This is useful for servers in the data center that do not have any agents configured to collect data. By associating a user-defined server with its power supply, it can be included in the baseline report.

1. Select **Energy → Optimization for Energy Management → Preferences** in the console navigation.
2. Click **Server Settings**. The page is opened with the **Warehouse Data** tab showing.
3. Click **Create New Server**. The Add Server dialog is opened.
4. Enter the server name and select a model type. The device type is initially set to Server, but you can change this later.
5. Click **OK** to save your changes.

Results

The warehouse data information is updated with the new server added.

You can delete user-defined servers on this page by clicking the Delete icon in the server list.

Figure 6. Server list on Server Settings page

You can add user-defined servers to the following power devices:
- Energy meter
- IPDU

User-defined servers cannot be added to server groups or server pools.

Adding new server groups

About this task

A server group is a logical collection of servers in the data center that share common characteristics, such as the same operating system, the same model name, the same IP address range, the same physical location in the data center, etc. To add a new server group:

1. Select **Energy → Optimization for Energy Management → Preferences**.
2. Click **Server Settings**.

3. Click the **Server Group** tab.
4. Click **New**.
5. Enter the new server group name in the field provided, and click **OK**. The new server name appears in the list.

Adding servers to a server group

About this task

To add servers to an existing server group:
1. Select **Energy** → **Optimization for Energy Management** → **Preferences**.
2. Click **Server Settings**.
3. Click the **Server Group** tab.
4. Expand the server group you want to add servers to by clicking the triangle icon to the left of the group name. The list of servers, if any, in the group appears.
5. Click **Add Server**.

   The Select Server dialog appears with a list of server types.
6. Click to expand the server type you want. The names of the individual servers appear below the server type heading.
7. Check the boxes to the left of the servers you want to add to the group. Click **Select All** to select all servers of that type.
8. Click **OK**. The page refreshes and a message appears confirming that the selected servers were added to the server group.
9. Click **Save Changes**.

Deleting server groups

About this task

To delete server groups:
1. Select **Energy** → **Optimization for Energy Management** → **Preferences**.
2. Click **Server Settings**.
3. Click the **Server Group** tab.
4. To delete an **individual server group** from the list:
   a. Expand the server group by clicking the triangle icon to the left of the group name. The list of servers in the group appears.
   b. Click the **Delete Group** icon.

      A prompt appears that reads, "Are you sure you want to delete this group? All server data under it will also be removed."

      To proceed with deleting the server group, click **OK**. If you do not want to delete the server group, click **Cancel**.
   c. After you click **OK**, the page refreshes and the deleted group is gone from the server group list. A message confirms that the server group was deleted.
5. To delete **all server groups** from the list:
   a. Click **Delete All**.

      A prompt appears that reads "Are you sure you want to delete all the user-defined groups?"

      To proceed with deleting all server groups, click **OK**. If you do not want to delete all server groups, click **Cancel**.

b. After you click **OK**, the page refreshes and the server group list is empty. A message confirms that all server groups were deleted.

Deleting servers from server groups

About this task

To delete servers from server groups:

1. Select **Energy** → **Optimization for Energy Management** → **Preferences**.
2. Click **Server Settings**.
3. Click the **Server Group** tab.
4. Expand the server group by clicking the triangle icon to the left of the group name. The list of servers in the group appears.
5. Click the Delete icon to the right of the server name you want to delete.

   A prompt appears that reads "Are you sure you want to remove the server from this group?"

   To proceed with deleting the server from the group, click **OK**. If you do not want to delete the server from the group, click **Cancel**.After you click **OK**, the page refreshes and a message confirms that the server was deleted.
6. Click **Save Changes**.

Adding new server pools

About this task

A server pool is a collection of servers in the data center that are designated to run the same workload or application. To add a new server pool:

1. Select **Energy** → **Optimization for Energy Management** → **Preferences**.
2. Click **Server Settings**.
3. Click the **Server Pool** tab.
4. Click **New**.
5. Enter the new server pool name in the field provided, and click **OK**. The page refreshes and the new server pool name appears in the list.

Adding servers to a server pool

About this task

To add servers to an existing server pool:

1. Select **Energy** → **Optimization for Energy Management** → **Preferences**.
2. Click **Server Settings**.
3. Click the **Server Pool** tab.
4. Expand the server pool you want to add servers to by clicking the triangle icon to the left of the pool name. The list of servers, if any, in the pool appears.
5. Click **Add Server**.

   The Select Server dialog appears with a list of server types.
6. Click to expand the server type you want. The names of the individual servers appear below the server type heading.
7. Check the boxes to the left of the servers you want to add to the pool. Click the Select All icon to select all servers of that type.

8. Click **OK**. The page refreshes and a message appears confirming that the selected servers were added to the server pool.
9. Click **Save Changes**.

Deleting server pools

About this task

To delete server pools:
1. Select **Energy** ⇢ **Optimization for Energy Management** ⇢ **Preferences**.
2. Click **Server Settings**.
3. Click the **Server Pool** tab.
4. To delete an **individual server pool** from the list:
   a. Expand the server pool by clicking the triangle icon to the left of the pool name. The list of servers in the pool appears.
   b. Click the **Delete Pool** trash-can icon to the right of the **Pool name** field.

      A prompt appears that reads, "Are you sure you want to delete this pool? All server data under it will also be removed."

      To proceed with deleting the server pool, click **OK**. If you do not want to delete the server pool, click **Cancel**.
   c. After you click **OK**, the page refreshes and a message confirms that the server pool was deleted.
5. To delete **all server pools** from the list:
   a. Click **Delete All**.

      A prompt appears that reads "Are you sure you want to delete all the server pools?"

      To proceed with deleting all server pools, click **OK**. If you do not want to delete all server pools, click **Cancel**.
   b. After you click **OK**, the page refreshes and the server pool list is empty. A message confirms that all server pools were deleted.

Adding servers to IPDUs

About this task

The **IPDUs** tab allows association of servers to IPDU outlets for correlating power and machine usage.
1. Select **Energy** ⇢ **Optimization for Energy Management** ⇢ **Preferences**.
2. Click **Server Settings**.
3. Click the **IPDU** tab.
4. Click the triangle to the left of the IPDU name in the list to expand it. A table listing the existing IPDU outlets and their corresponding servers appears.
5. Click **Add Server** in the row of the IPDU outlet to which you want to add servers. The **Select Server** dialog appears with a list of server types.
6. Click to expand the server type you want. The names of the individual servers appear below the server type heading.
7. Check the boxes to the left of the servers you want to add to the group. Click **Select All** to select all servers of that type.
8. Click **OK**. The page refreshes and a message appears confirming that the selected servers were added to the IPDU outlet.

Deleting servers from IPDUs

About this task

To delete servers:

1. Select **Energy → Optimization for Energy Management → Preferences**.
2. Click **Server Settings**.
3. Click the **IPDU** tab.
4. To delete an **individual server** from an IPDU outlet:
   a. Expand the IPDU by clicking the triangle icon to the left of the IPDU name. The list of servers in the IPDU outlets appears.
   b. Click the **Delete Server** trash-can icon to the right of the name in the **Server** column.

      A prompt appears that reads, "Are you sure you want to remove the server from this IPDU outlet?"

      To proceed with deleting the server, click **OK**. If you do not want to delete the server, click **Cancel**.
   c. After you click **OK**, the page refreshes and a message confirms that the server was deleted from the IPDU outlet.
5. To delete **all servers** from an IPDU outlet:
   a. Click **Delete All**.

      A prompt appears that reads "Are you sure you want to remove all the server references from this IPDU?"

      To proceed with deleting all servers from the IPDU outlet, click **OK**. If you do not want to delete all servers, click **Cancel**.
   b. After you click **OK**, the page refreshes and a message confirms that all the servers were deleted from the IPDU outlet.

Adding servers to UPS

About this task

The **UPS** tab allows association of servers to UPS outlets for correlating power and machine usage.

1. Select **Energy → Optimization for Energy Management → Preferences**.
2. Click **Server Settings**.
3. Click the **UPS** tab.
4. Click the triangle to the left of the UPS name in the list to expand it. A table listing the existing UPS outlets and their corresponding servers appears.
5. Click **Add Server** in the row of the UPS outlet to which you want to add servers. The **Select Server** dialog appears with a list of server types.
6. Click to expand the server type you want. The names of the individual servers appear below the server type heading.
7. Check the boxes to the left of the servers you want to add to the group. Click **Select All** to select all servers of that type.
8. Click **OK**. The page refreshes and a message appears confirming that the selected servers were added to the UPS outlet.

Adding servers to energy meters

About this task

The **Energy Meter** tab allows association of servers to energy meters for correlating power and machine usage.

1. Select **Energy** → **Optimization for Energy Management** → **Preferences**.
2. Click **Server Settings**.
3. Click the **Energy Meter** tab.
4. Click the triangle to the left of the energy meter name in the list to expand it. A table listing the existing energy meters and their corresponding servers appears.
5. Click **Add Server**. The **Select Server** dialog appears with a list of server types.
6. Click to expand the server type you want. The names of the individual servers appear below the server type heading.
7. Check the boxes to the left of the servers you want to add. Click **Select All** to select all servers of that type.
8. Click **OK**. The page refreshes and a message appears confirming that the selected servers were associated to the energy meter.

Chapter 5. Defining power rates and carbon unit energy mixes

For Data Center Optimization for Energy Management to correctly calculate power rates and carbon units associated with the power usage of your data center, you must enter the power rates for your data center, as well as the carbon unit energy mix in your area from the power company.

To look up carbon information for your ZIP code, access the U.S. Environmental Protection Agency's Power Profiler at http://www.epa.gov/cleanenergy/energy-and-you/how-clean.html.

Defining energy rates

About this task

Enter the appropriate energy rates for your data center so that Data Center Optimization can correctly calculate the cost associated with your data center usage. Select **Energy** → **Optimization for Energy Management** → **Preferences** → **Energy Rate Plans**.

Figure 7. Energy Rate Plans page

You can add, edit, and delete energy rates. An energy rate is made up of one or more rate components. Click a **Rate Plan** link to see the rate elements associated with the energy rate.
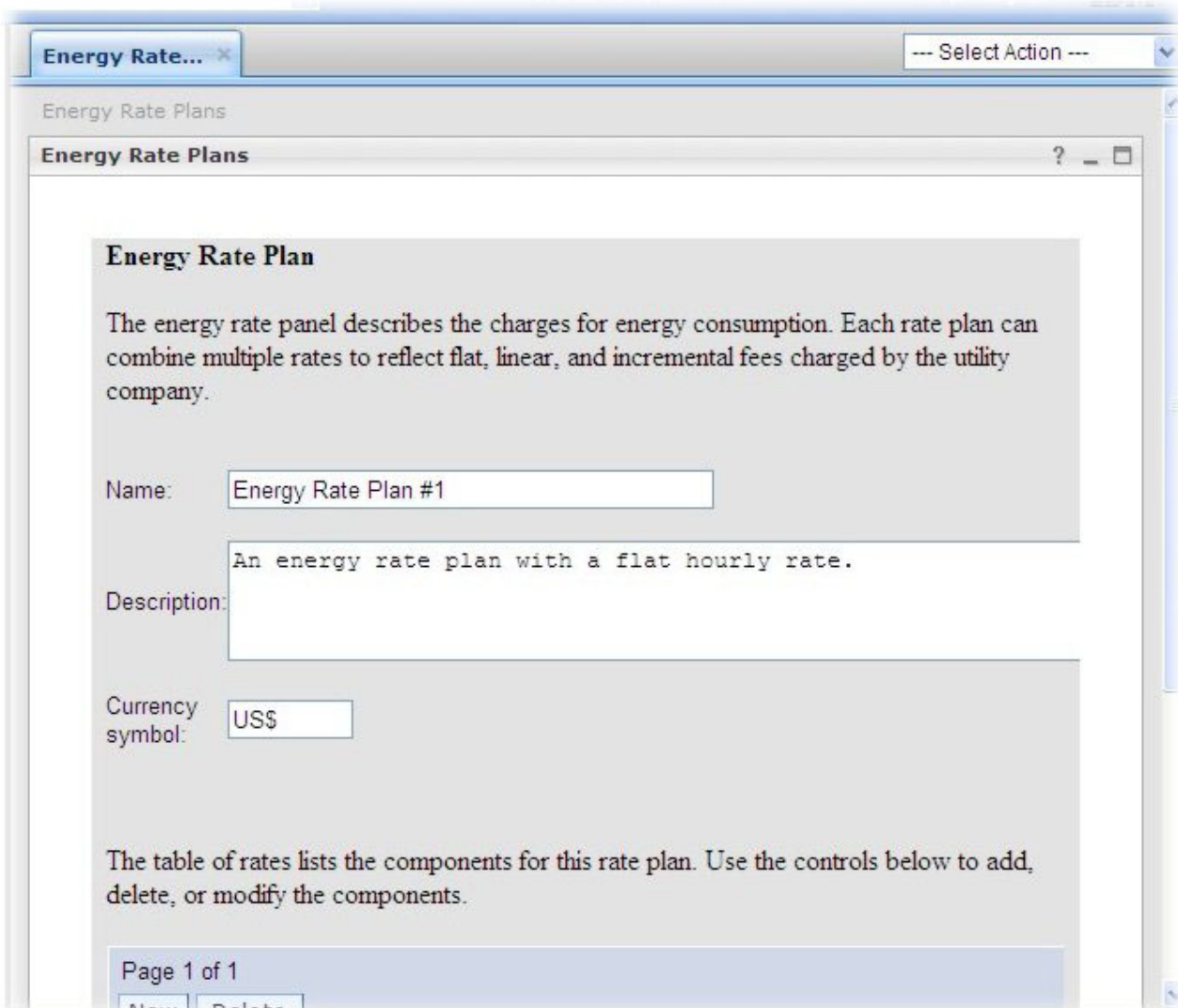
Figure 8. Energy Rate Plan detail page

To change rate component properties, click **New** to add a rate component, or the link of an existing rate component to modify it.

Figure 9. Energy Rates page

In the **Rate Type** field, Flat is selected. A flat rate reflects costs that are independent of the amount of energy consumed at the data center

Defining carbon unit energy mixes

About this task

In order for Data Center Optimization to correctly calculate power rates and carbon units associated with the power usage of your data center, you must enter the carbon unit energy mix. You can obtain this data from your energy supplier.

Energy Mixes

The energy mix table manages the information used during carbon unit calculations. The list below displays all energy mixes available for report generation.

Page 1 of 1

New | Delete

Selected	Name	Description
☐	Coal	Coal: 100%
☐	Gas	Gas: 100%
☐	Nuclear	Nuclear: 100%
☐	Renewable	Renewable: 100%

Page 1 of 1	Total: 4 Shown: 4
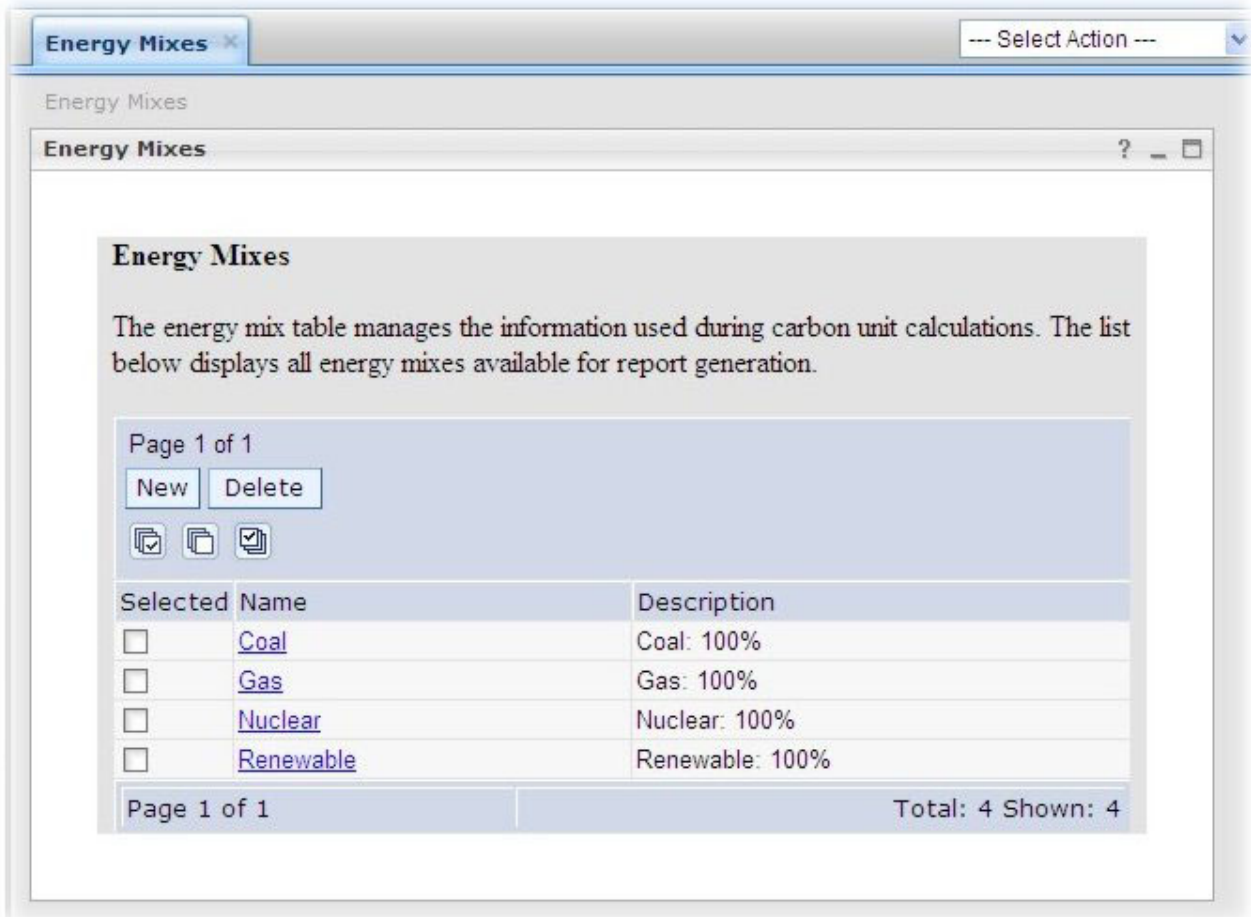
Figure 10. Energy Mixes page

To create a new energy mix, Select **Energy** → **Optimization for Energy Management** → **Energy Mixes** and click **New**. Enter the correct energy mix information for your data center.
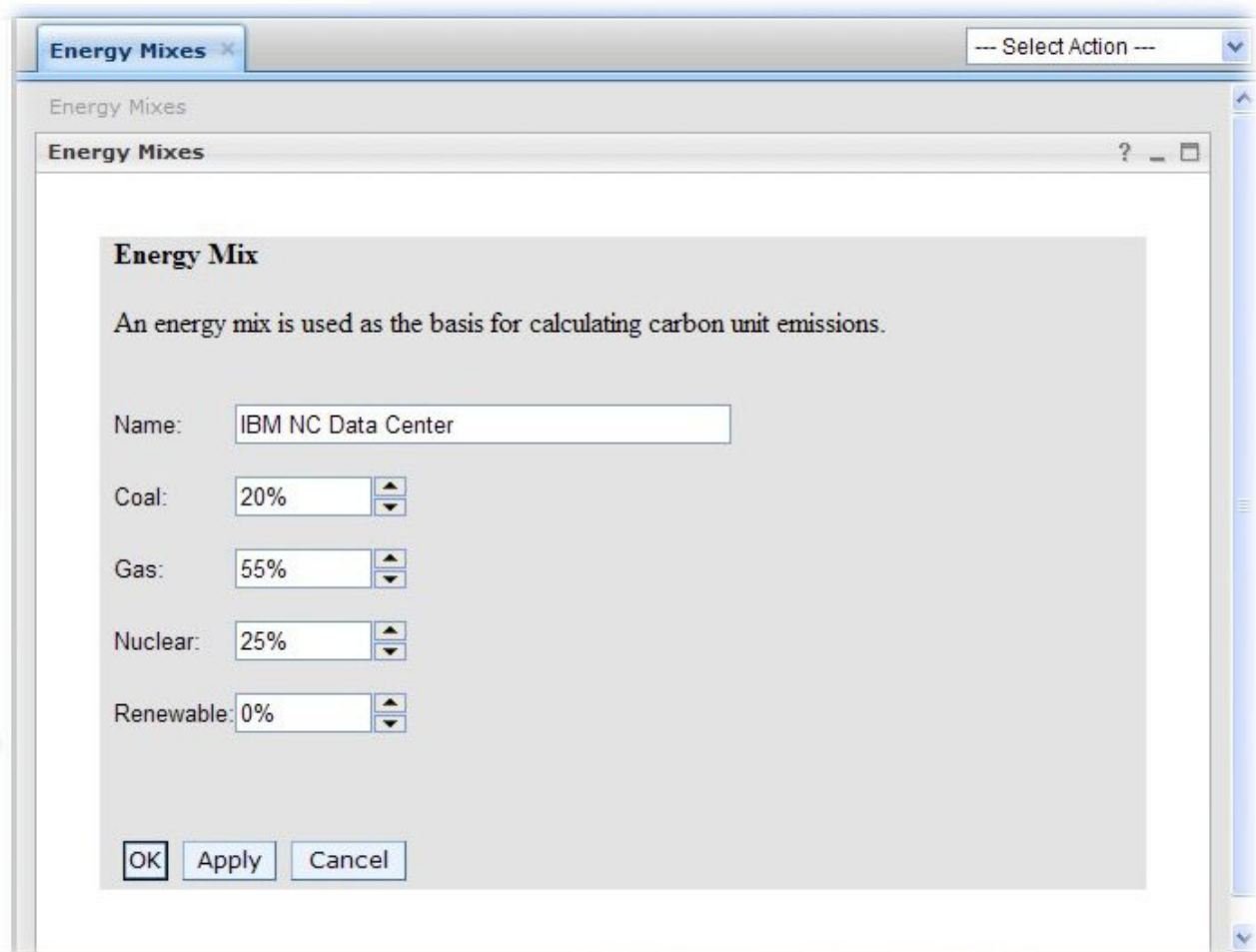
Figure 11. Energy Mix entry page

Using Data Analyzer Settings

Use the Data Analyzer Settings to specify how often to analyze your energy data for patterns to be used in the recommendations reports provided by Data Center Optimization for Energy Management. The **Analysis schedule** default of 2 hours is usually adequate but other intervals may be selected.

Click **Start** to initialize the Data Analyzer to run at the selected interval. Select the check boxes next to the recommendations you want the Data Analyzer to provide advice for.

--- Select Action ---

Data Analyzer Settings ? _ □

These settings are used for scheduling and running data analysis periodically on the data available in your Tivoli Data Warehouse.
Click on Start button to start the data analysis. This activates the scheduler as well.

Note: If the Start button remains disabled after completing the analysis, then it indicates that the scheduler is activated and it will analyze data again at the next scheduled time. The Stop button will be disabled when the analysis is in progress. Once the analysis is completed, the Stop button is enabled which allows you to stop the scheduler (if needed). Use Restart button to stop the running analysis immediately and start afresh with latest scheduler settings.

Tivoli Data Warehouse contains data from Nov 01, 2008 to Nov 11, 2008

Analyzer : [Start] [Stop] [Restart]

Last analyzed on : Nov 12, 2008 02:21 PM

Progress	: 100.0 %
Analyzer status	: Completed the analysis
Data analyzed from	: Nov 12, 2008
Data analyzed to	: Nov 01, 2008

Scheduler Settings

Analyzer is scheduled to run [Every 2 hours ▼] from the time the analysis is started.

Collect data for the last [30] days from the time the analysis is started or from the last analyzed date (if present).

Support the following recommendation modes :
  ☑ Dynamic power saving mode recommendation
  ☑ Standby mode recommendation
  ☑ Power-down mode recommendation

[Save]

Figure 12. Data Analyzer Settings page

Chapter 6. Reports

Data Center Optimization for Energy Management provides the following report types:

- "ITM for Energy Management Active Energy Manager Agent reports" on page 31
- Baseline Power report
- CPU Utilization report
- "Data Center Infrastructure Efficiency (DCiE)" on page 50
- "Eaton Power Xpert Device reports" on page 53
- "Historical Power Trend report" on page 56
- "Power Savings Recommendation Report: Dynamic Power Savings Recommendation for Servers" on page 57
- "Data Center Power Usage Comparison report" on page 61

For more information on each of these reports, see "Report types" on page 31.

Note: Report results are based on variable factors and assumptions and are estimates of potential savings only. Actual results may vary significantly from these estimates.

Generating a report

About this task

When power and operating system data is being collected in the Tivoli Data Warehouse, the energy rates and carbon unit energy mixes have been defined, and the servers have been imported, you are ready to generate reports. Generated reports will be shown in a new browser window. The report can be saved on your local system or on the server of your choosing by using your browser controls. Data Center Optimization does not store reports after they are created.

Note: Ensure that the browser is configured not to block popup windows.

To generate a report, do the following:
1. Use a Web browser to open the Tivoli Common Reporting login page.
2. Select **Energy** → **Optimization for Energy Management** → **Reports**.
3. Click **Generate Report**.

Figure 13. Generate Report page

4. Select the **Data Center Power Usage** template under the Baseline Power report.

5. Select the appropriate items in the **Rate Plan** and **Carbon Unit Energy Mix** fields

Figure 14. Report Settings page

6. Select one or more servers or devices from the resource list, if applicable.
7. Select the report type (HTML or PDF) that you want and click **Generate Report**.

   The report opens in a new browser window.
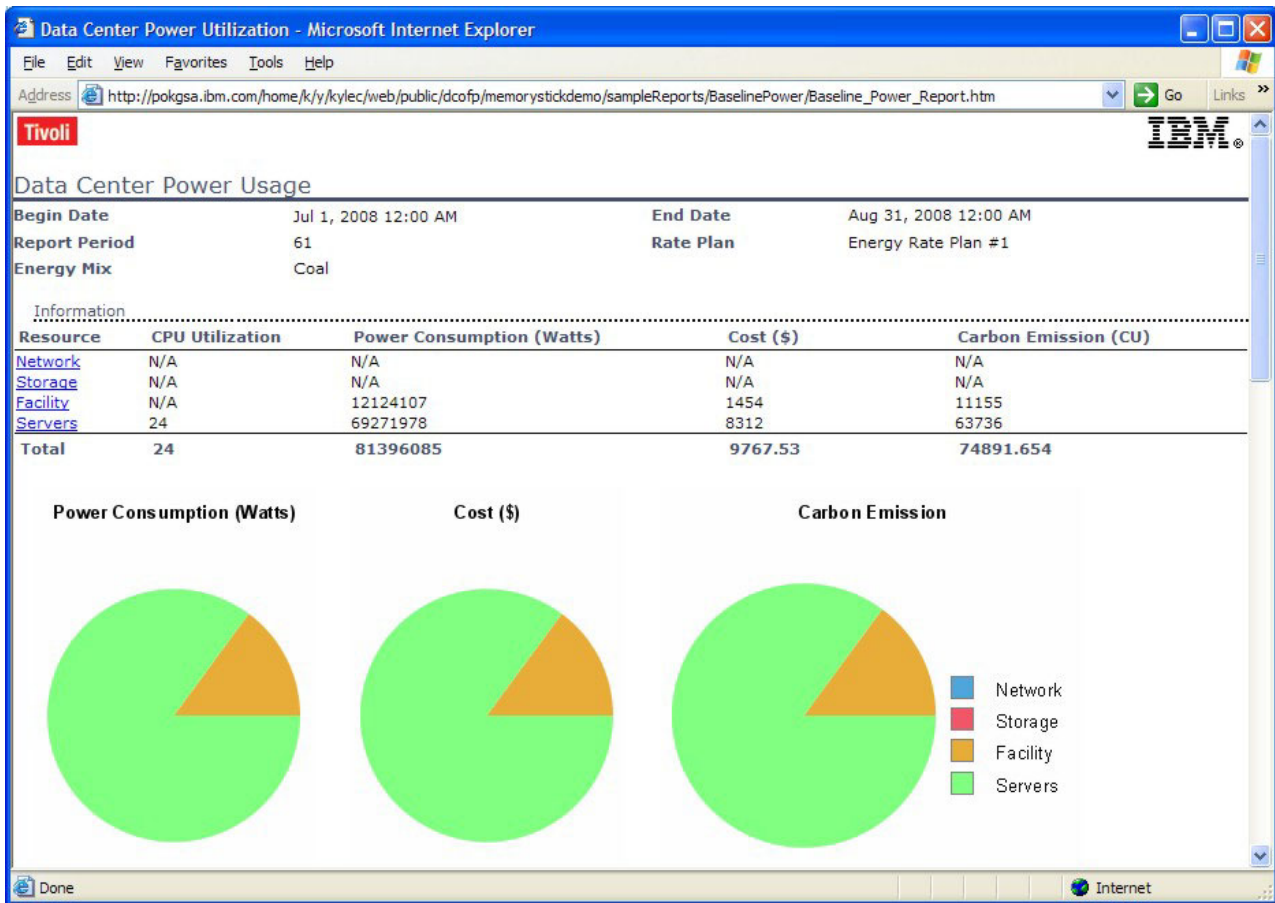
Figure 15. Report output

Working with reports

Generated reports will be shown in a new browser window. Note that the Web browser should be configured not to block popup windows. The report can be saved on your local system or on the server of your choosing by using your browser controls. Data Center Optimization does not store reports after they are created.

The reports enable you to drill down for in-depth details on each data category captured in the report by clicking **Expand Details**. Additionally, for generated graphs that do not have labeled data points, you can hover your mouse cursor over points on the graphs to view details on the data plotted on the graph.

Specifying servers in a report

Some reports require you to specify which servers should be included in the report. Click the link under **Resource Settings** to identify the servers to include.

When specifying servers and devices in a report, the responsibility is on the user to only include the machines, PDUs, UPSs, and energy meters they want to include in

the report. This is especially important when meters and PDUs are connected downstream from each other, which may cause the power to be counted twice within a report.

Report templates

You can save a report as a template, in order to use the parameters for future reports. If you save a report as a template, it will be displayed in the report category.

Report types

Data Center Optimization provides eight report types.

ITM for Energy Management Active Energy Manager Agent reports

The reports for ITM for Energy Management Active Energy Manager Agent reports (AEM) show servers in your data center which use the most energy and have the highest heat gain. There is also an exception report that shows servers in your data center that are not properly collecting power and heat data.

There are two sets of Active Energy Manager reports: "AEM BladeCenter reports" and "AEM Rack Server reports" on page 38.

AEM BladeCenter reports

This section contains information useful in understanding and running the four reports for BladeCenters managed by Active Energy Manager. This set of reports is identical to the set of Active Energy Manager Rack Server reports, except these report BladeCenter® measurements.

The set of BladeCenter reports includes:
* "AEM BladeCenter Exception"
* "AEM BladeCenter Heat Gain Distribution" on page 33
* "AEM BladeCenter Top Heat Gain" on page 35
* "AEM BladeCenter Top Energy Use" on page 37

AEM BladeCenter Exception: This report identifies all machines that are excluded from one or more AEM BladeCenter reports. Typically, a machine is excluded from a report due to all-zero or negative data. Associated with each machine listed are the most significant reasons for being excluded from reports.

Report purpose

The purpose of this report is to help administrators identify machines that have issues that prevent the machines from being monitored correctly. The machines on this report have been excluded from one or more AEM BladeCenter reports due to their inconsistent data. If you believe a machine is incorrectly excluded from a report, then this report should help explain why the machine is not included.

Report parameters

Report Period (calculated based on the local time stamp when the data was stored in Tivoli Data Warehouse):

- **Date Period**: Choose from a pre-defined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
- **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.
- **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.

Report output

The report lists machines and the reasons the machines are excluded from one or more of the AEM BladeCenter reports. Typically, this is due to all-zero or negative data. The report is displayed in table format, with the table having the following columns:

- Machine Type: the type of the machine.
- Machine ID: the ID of the machine.
- Reason: a reason the machine is listed in this report and excluded from other AEM BladeCenter reports. The possible reasons are as follows:
  - Ambient and Exhaust Temperatures are zero or negative
  - Ambient Temperature is zero or negative
  - Exhaust Temperature is zero or negative
  - Exhaust Temperature is less than Ambient Temperature
  - Accumulated Energy AC and Accumulated Energy DC are zero or negative

  Each row of the table can contain one reason per machine. Thus, if more than one reason for the machine being listed exists, the same machine may appear more than once in the table.

Tivoli   **IBM.**

Active Energy Manager BladeCenter Exception Report

These are the parameters used by this report

| Start Date | May 28, 2008 12:00 AM | End Date | Jun 27, 2008 11:59 PM |
| Report Period | Last 30 days | | |

Active Energy Manager BladeCenters with Missing, Inconsistent, Zero-Value Data

Machine Type	Machine Id	Reason
Blade Center Chassis	Gdcwin01Chassis100	Ambient and Exhaust Temperatures are zero or negative.
Blade Server	Blade Server 10@Power Domain 2@Gdcwin01Chassis100	Accumulated Energy AC and Accumulated Energy DC are zero or negative.
Blade Server	Blade Server 11@Power Domain 2@Gdcwin01Chassis100	Accumulated Energy AC and Accumulated Energy DC are zero or negative.
Blade Server	Blade Server 12@Power Domain 2@Gdcwin01Chassis100	Accumulated Energy AC and Accumulated Energy DC are zero or negative.
Blade Server	Blade Server 13@Power Domain 2@Gdcwin01Chassis100	Accumulated Energy AC and Accumulated Energy DC are zero or negative.
Blade Server	Blade Server 14@Power Domain 2@Gdcwin01Chassis100	Accumulated Energy AC and Accumulated Energy DC are zero or negative.
Blade Server	Blade Server 8@Power Domain 2@Gdcwin01Chassis100	Accumulated Energy AC and Accumulated Energy DC are zero or negative.
Blade Server	Blade Server 9@Power Domain 2@Gdcwin01Chassis100	Accumulated Energy AC and Accumulated Energy DC are zero or negative.

This report shows the Active Energy Manager BladeCenters which are being excluded from other reports due to problem data.

June 27, 2008 2:17:40 PM EDT   1   /   1

Figure 16. AEM BladeCenter Exception report

Report usage

This report can be useful to help identify machines that have issues which prevent the machines from being monitored correctly. The simplest reason a machine may appear in this report is due to the machine not having the correct features or firmware levels to work with IBM Director and the IBM Tivoli Monitoring for Energy Management AEM agent. Another reason that the machine may be listed in this report is that it may be malfunctioning and need to be repaired.

AEM BladeCenter Heat Gain Distribution: The AEM BladeCenter Heat Gain Distribution report shows how many times a particular heat gain was seen for all the monitored BladeCenters during the reporting period. The shape of the curve shows you how the heat gain values are distributed, and can help you gauge whether a particular heat gain value is common or unusual. The heat gain is calculated for each machine by subtracting the measured ambient temperature from the measured exhaust temperature. The distribution curve is smoothed by rounding the heat gains to integer values.

Report purpose

The purpose of this report is to visually show how common or unusual a heat gain value is across all the BladeCenters during a time period. If the heat gains are normally distributed, you see a standard bell curve. The bell curve shows you the most common value and gives you a feel for how wide or narrow the range of values are. If the heat gains are not normally distributed, then what do you see instead? Are there multiple peaks? Are there a few values that are unusually high or low? This report does not tell you whether anything is wrong or prescribe any needed changes. It is designed to attract your attention to any heat gain that looks unusual.

Report parameters

Temperature Grouping Range: You can choose how much the data should be smoothed when it is graphed. The data is smoothed by rounding it to the nearest grouping range value. The range of each group is specified by an integer between 1 and 4. The default is the Normal: 2 Degree Grouping Range, which rounds all temperatures to the nearest even degree, that is to say 0, 2, 4, and so on. Choosing the correct grouping range for your data will depend on the amount of time you are including in the analysis, and the types of trends you wish to view. For example, the Sharp: 1 Degree Grouping Range will round to the values 0, 1, 2, and so on, and will provide sharper detail in the graph, but the greater detail may include abnormal data that might skew the overall pattern to some extent. Ranges 3 and 4 smooth the graph more by rounding temperatures to larger interval values, which in turn, might help reveal larger trends in the data. Longer periods of time often smooth themselves out automatically.

Date Range (calculated based on the local time stamp when the data was stored in the Tivoli Data Warehouse):
- **Report Period**: Choose from a pre-defined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
- **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.
- **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.

Report output

The report contains a graph of the number of samples recorded for each heat gain. The vertical axis contains the number of samples which contained a particular heat value, and the horizontal axis contains the degrees of heat gain, in Celsius. By hovering your mouse over a node on the graph in the HTML version of the report, a pop-up will be displayed that contains the Category of the machines being represented by the node, the heat gain in degrees at the node, and the number of

samples recorded for the node. Below the graph, a table exists containing all of the information represented in the graph. The table contains the below fields:

- Category – The category of the machines being monitored. In this case, Blade Center.
- Heat Gain Degrees C – The amount of heat gained in Celsius.
- Sample Count – The number of samples recorded for the heat gain.

Tivoli   IBM.

Active Energy Manager BladeCenter Heat Gain Distribution

These are the parameters used by this report

| Start Date | May 26, 2008 12:00 AM | End Date | Jun 25, 2008 11:59 PM |
| Report Period | Last 30 days | Temperature Grouping Range | 2 |

Heat Gain Distribution Curve

Category	Heat Gain Degrees C	Sample Count
Blade Center	6	30
Blade Center	8	159
Blade Center	10	209
Blade Center	12	324
Blade Center	14	265

This report shows the distribution curve of heat gain by Active Energy Manager BladeCenters.

Figure 17. AEM BladeCenter Heat Gain Distribution report

Report usage

This report can be used to observe the overall heat gain of BladeCenters monitored by Active Energy Manager. Using this report in conjunction with the AEM BladeCenter Top Heat Gain report can help clarify whether a heat gain in either report is an issue. For instance, this report may indicate that an unusually high heat gain was recorded. By using the AEM BladeCenter Top Heat Gain report, you can view the particular machines with the same heat gain value recorded, and then further determine whether it is an issue. In another case, a machine may appear on the AEM BladeCenter Top Heat Gain report because it has the highest heat gain. By taking into account this report, you may see that the high heat gain is similar to other machines of the same type, and that no real issue exists.

AEM BladeCenter Top Heat Gain: The AEM BladeCenter Top Heat Gain report displays the top 20 heat gain values during a user-specified time period for all BladeCenters being monitored by Active Energy Manager.

Report purpose

This report allows administrators to identify the machines and dates that have had the top 20 highest heat gain temperatures recorded during the user-specified time period. The report can be used to help identify machines with potential issues, and identify trends that can be used to target preventative maintenance.

Report parameters

Date Range (calculated based on the local time stamp when the data was stored in the Tivoli Data Warehouse):
- **Report Period**: Choose from a pre-defined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
- **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.
- **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.

Report output

This report contains a graph of the top 20 highest heat gain readings. Because the top 20 heat gains are selected for the report, the graph can show, at one extreme, one machine over 20 days, or at the other extreme 20 machines on one day. It is more likely to show several machines over several days, with the pattern of machines and days providing insight into the heating and cooling behaviors of the data center.

The vertical axis contains the heat gain degrees in Celsius, and the horizontal axis contains the time periods in which the heat gain temperatures were recorded. By hovering your mouse over a node on the graph in the HTML version of the report, a pop-up window will display the Maximum Heat Gain, Machine Type, Machine ID, and the Time Period in which the heat gain was recorded. All nodes that result from the same machine are connected via line segments. Below the graph, a table shows detailed information represented in the graph. The table contains the following fields:
- Category: the category of the machine, in this case, BladeCenter
- Machine Type: the type of the machine
- Machine ID: the ID of the machine
- Time Period: the time period in which the heat gain was recorded
- Maximum Heat Gain: the value of the heat gain that was recorded

Top Heat Gain by Active Energy Manager BladeCenters

These are the parameters used by this report

Start Date	May 26, 2008 12:00 AM	**End Date**	Jun 25, 2008 11:59 PM
Report Period	Last 30 days		
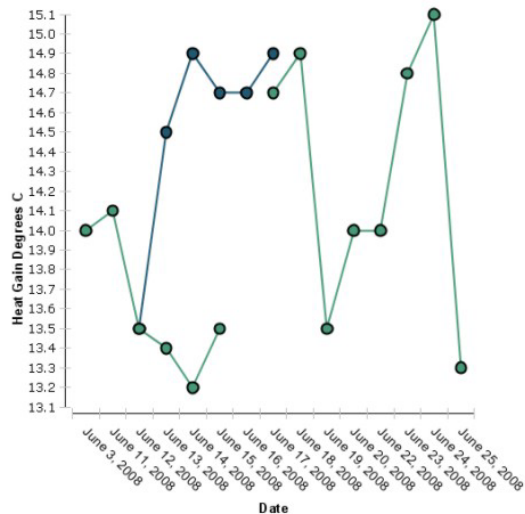
Heat Gain

Category	Machine Type	Machine Id	Time Period	Maximum Heat Gain
Blade Center	Blade_Center_Chassis	ame3-3	Jun 12, 2008	13.5
Blade Center	Blade_Center_Chassis	ame3-3	Jun 13, 2008	14.5
Blade Center	Blade_Center_Chassis	ame3-3	Jun 14, 2008	14.9
Blade Center	Blade_Center_Chassis	ame3-3	Jun 15, 2008	14.7
Blade Center	Blade_Center_Chassis	ame3-3	Jun 16, 2008	14.7
Blade Center	Blade_Center_Chassis	ame3-3	Jun 17, 2008	14.9
Blade Center	Blade_Center_Chassis	ame4-mm	Jun 3, 2008	14
Blade Center	Blade_Center_Chassis	ame4-mm	Jun 11, 2008	14.1

Figure 18. AEM BladeCenter Top Heat Gain report

Report usage

A primary use of this report is to identify machines that are heating the air more than other machines of the same type and might need to be examined further. For example, if one machine begins to show up on the report more than other machines, perhaps someone has left a rack door open or failed to replace a blanking panel. Perhaps recent cabling has disrupted the normal air flow and the rack is getting contaminated cooling air. This report will not tell you what is wrong, tell you how much heat energy is being put into the air, or make any recommendations for action. Its purpose is to identify differences between similar machines so that you can know where to direct your attention.

Using this report in conjunction with the AEM BladeCenter Heat Gain Distribution report can help clarify whether a heat gain in either report is an issue. For instance, the AEM BladeCenter Heat Gain Distribution report may indicate that an unusually high heat gain was recorded. By using this report, you can view the particular machines with the same heat gain value recorded, and then further determine whether it is an issue. In another case, a machine might be displayed on this report because it has the highest heat gain. By taking into account the AEM BladeCenter Heat Gain Distribution report, you may see that the high heat gain is similar to other machines of the same type, and that no real issue exists.

AEM BladeCenter Top Energy Use: The AEM BladeCenter Top Energy Use report displays the top 20 machines with the most kilowatt hours used during a user-specified time period.

Report purpose

The purpose of this report is to allow administrators to identify which machines are using the most energy and when they are using the energy.

Report parameters

Date Range (calculated based on the local time stamp when the data was stored in the Tivoli Data Warehouse):

- **Report Period**: Choose from a pre-defined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
- **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.
- **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.

Report output

This report contains a graph of the 20 machines with the most energy used. The vertical axis contains the amount of energy used in Kilowatt hours, and the horizontal axis contains the time periods in which the energy use was recorded. By hovering your mouse over a node on the graph in the HTML version of the report, a pop-up will display the Energy Consumed, Machine Type, Machine ID, and the Time Period in which the energy consumed was recorded. Below the graph, a table exists detailing the information represented in the graph. The table contains the following fields:

- Category: the category of the machine; in this case, BladeCenter
- Machine Type: the type of the machine
- Machine ID: the ID of the machine
- Time Period: the time period in which the energy consumed was recorded
- Energy Consumed kWh: the amount of energy consumed in kilowatt hours

Top Energy Use by Active Energy Manager BladeCenters

These are the parameters used by this report

Start Date	May 26, 2008 12:00 AM	**End Date**	Jun 25, 2008 11:59 PM
Report Period	Last 30 days		

Kilowatt Hours Used

Category	Machine Type	Machine Id	Time Period	Energy Consumed kWh
Blade Center	Blade_Server	IBM 799861X 100352A@Power Domain 1@KirklandPsaver	Jun 24, 2008	51.6
Blade Center	Blade_Server	IBM 799861X 100355A@Power Domain 2@KirklandPsaver	Jun 24, 2008	46.88
Blade Center	Blade_Server	IBM 8832L1X KPVWA53@Power Domain 2@harlem2-mgr.watson.ibm.com	May 21, 2008	35.65
Blade Center	Blade_Server	IBM 884241X KPGKF4V@Power Domain 1@harlem2-mgr.watson.ibm.com	May 21, 2008	35.65
Blade Center	Blade_Server	IBM 8853AC1 KQBTTK4@Power Domain 2@ame4-mm	May 21, 2008	61.64
Blade Center	Blade_Server	IBM 8853AC1 KQBTTK5@Power Domain 2@ame3-3	May 21, 2008	37.09

Figure 19. AEM BladeCenter Top Energy Use report

Report usage

You may not see every date and every machine listed on this report. Because this report lists only the top 20 machines by energy consumption, a particular machine may not have had the largest consumption on a particular day, or a particular day may not have had energy consumption by any machine large enough to get in to the top 20.

The pattern of which machines are displayed on which days should help you understand when you are using the most energy and why. In turn, this information can then be used to identify issues and create a more optimal allocation of resources. For instance, if you observe that one machine is consuming the most energy every day, it may indicate that resources are incorrectly distributed or that some malfunction exists. In another instance, a certain set of machines might be displayed every Friday and it might be beneficial to take that into account when scheduling maintenance.

AEM Rack Server reports

This section contains information useful in understanding and running the four reports for Rack Servers managed by Active Energy Manager. This set of reports is identical to the set of Active Energy Manager BladeCenter reports, except that these report Rack Server measurements.

The set of Rack Server reports includes:

- "AEM Rack Server Exception"
- "AEM Rack Server Heat Gain Distribution" on page 40
- "AEM Rack Server Top Heat Gain" on page 42
- "AEM Rack Server Top Energy Use" on page 45

AEM Rack Server Exception: This report identifies all machines that are excluded from one or more Data Center Optimization for Energy Management AEM Rack Server reports. Typically, a machine is excluded from a report due to all-zero or negative data. Associated with each machine listed, are the most significant reasons for being excluded from reports.

Report purpose

The purpose of this report is to help administrators identify machines that have issues that prevent the machines from being monitored correctly. The machines on this report have been excluded from one or more AEM Rack Server reports due to their inconsistent data. If you believe a machine is incorrectly excluded from a report, then this report helps explain why the machine is not included.

Report parameters

Date Range (calculated based on the local time stamp when the data was stored in Tivoli Data Warehouse):
- **Report Period**: Choose from a predefined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
- **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.
- **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.

Report output

The report lists machines and the reasons the machines are excluded from one or more of the Data Center Optimization for Energy Management AEM Rack Server reports. Typically, this is due to all-zero or negative data. The report is displayed in table format, with the table having the following columns:
- Machine Type: the type of the machine
- Machine ID: the id of the machine
- Reason: a reason the machine is listed in this report and excluded from other Tivoli Monitoring for Energy Management AEM Rack Server reports. The possible reasons are as follows:
  - Ambient and Exhaust Temperatures are zero or negative
  - Ambient Temperature is zero or negative
  - Exhaust Temperature is zero or negative
  - Exhaust Temperature is less than Ambient Temperature
  - Accumulated Energy AC and Accumulated Energy DC are zero or negative

Active Energy Manager Rack Server Exception Report

These are the parameters used by this report

| Start Date | May 28, 2008 12:00 AM | End Date | Jun 27, 2008 11:59 PM |
| Report Period | Last 30 days | | |

Active Energy Manager Rack Servers with Missing, Inconsistent, Zero-Value Data

Machine Type	Machine Id	Reason
Rack Server	GDCBMC04	Accumulated Energy AC and Accumulated Energy DC are zero or negative.
Rack Server	GDCBMC04	Ambient and Exhaust Temperatures are zero or negative.
Rack Server	GDCBMC05	Accumulated Energy AC and Accumulated Energy DC are zero or negative.
Rack Server	GDCBMC05	Ambient and Exhaust Temperatures are zero or negative.
Rack Server	GDCBMC08	Accumulated Energy AC and Accumulated Energy DC are zero or negative.
Rack Server	GDCBMC08	Ambient and Exhaust Temperatures are zero or negative.
Rack Server	GDCBMC10	Accumulated Energy AC and Accumulated Energy DC are zero or negative.
Rack Server	GDCBMC10	Ambient and Exhaust Temperatures are zero or negative.
Rack Server	GDCWIN11	Accumulated Energy AC and Accumulated Energy DC are zero or negative.
Rack Server	GDCWIN11	Ambient and Exhaust Temperatures are zero or negative.
Rack Server	Pacific01mm	Accumulated Energy AC and Accumulated Energy DC are zero or negative.
Rack Server	Pacific01mm	Ambient and Exhaust Temperatures are zero or negative.
Rack Server	swatrtp31-2.tivlab.raleigh.ibm.com	Accumulated Energy AC and Accumulated Energy DC are zero or negative.
Rack Server	swatrtp31-2.tivlab.raleigh.ibm.com	Ambient and Exhaust Temperatures are zero or negative.
Rack Server	swatstorage-2	Accumulated Energy AC and Accumulated Energy DC are zero or negative.
Rack Server	swatstorage-2	Ambient and Exhaust Temperatures are zero or negative.

This report shows the Active Energy Manager Rack Servers which are being excluded from other reports due to problem data.

June 27, 2008 2:37:47 PM EDT   1   /   1

Figure 20. AEM Rack Server Exception report

Each row of the table can contain one reason per machine. Thus, if more than one reason for the machine being listed exists, the same machine may appear more than once in the table.

Report usage

This report can be useful to help identify machines that have issues which prevent the machines from being monitored correctly. The simplest reason a machine might be displayed in this report is due to the machine not having the correct features or firmware levels to work with IBM Director and the Tivoli Monitoring for Energy Management AEM agent. Another reason that the machine may be listed in this report is that it may be malfunctioning and need to be repaired.

AEM Rack Server Heat Gain Distribution: The AEM Rack Server Heat Gain Distribution report shows how many times a particular heat gain was seen for all the monitored Rack Servers during the reporting period. The shape of the curve shows you how the heat gain values are distributed, and can help you gauge whether a particular heat gain value is common or unusual. The heat gain is calculated for each machine by subtracting the measured ambient temperature from the measured exhaust temperature. The distribution curve is smoothed by rounding the heat gains to integer values.

Report purpose

The purpose of this report is to visually show how common or unusual a heat gain value is across all the Rack Servers during a time period. If the heat gains are normally distributed, you see a standard bell curve. The bell curve shows you the most common value and gives you a feel for how wide or narrow the range of values are. If the heat gains are not normally distributed, then what do you see instead? Are there multiple peaks? Are there a few values that are unusually high or low? This report does not tell you whether anything is wrong or prescribe any needed changes. It is designed to attract your attention to any heat gain that looks unusual.

Report parameters

Temperature Grouping Range: You can choose how much the data should be smoothed when it is graphed. The data is smoothed by rounding it to the nearest grouping range value. The range of each group is specified by an integer between 1 and 4. The default is the Normal: 2 Degree Grouping Range, which rounds all temperatures to the nearest even degree, that is to say 0, 2, 4, and so on. Choosing the correct grouping range for your data will depend on the amount of time you are including in the analysis, and the types of trends you wish to view. For example, the Sharp: 1 Degree Grouping Range will round to the values 0, 1, 2, and so on, and will provide sharper detail in the graph, but the greater detail might include abnormal data that might skew the overall pattern to some extent. Ranges 3 and 4 smooth the graph more by rounding temperatures to larger interval values, which in turn, might help reveal larger trends in the data. Longer periods of time often smooth themselves out automatically.

Date Range (calculated based on the local time stamp when the data was stored in Tivoli Data Warehouse):

- **Report Period**: Choose from a pre-defined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
- **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.
- **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.

Report output

The report contains a graph of the number of samples recorded for each heat gain. The vertical axis contains the number of samples that contained a particular heat value, and the horizontal axis contains the degrees of heat gain, in Celsius. By hovering your mouse over a node on the graph in the HTML version of the report, a pop-up window is displayed that contains the category of the machines being represented by the node, the heat gain in degrees at the node, and the number of samples recorded for the node. Below the graph, a table exists containing all of the information represented in the graph. The table contains the following fields:

- Category: the category of the machines being monitored. In this case, Blade Center
- Heat Gain Degrees C: the amount of heat gained in Celsius
- Sample Count: the number of samples recorded for the heat gain

Active Energy Manager Rack Server Heat Gain Distribution

These are the parameters used by this report

Start Date	May 26, 2008 12:00 AM	**End Date**	Jun 25, 2008 11:59 PM
Report Period	Last 30 days	**Temperature Grouping Range**	2

Heat Gain Distribution Curve
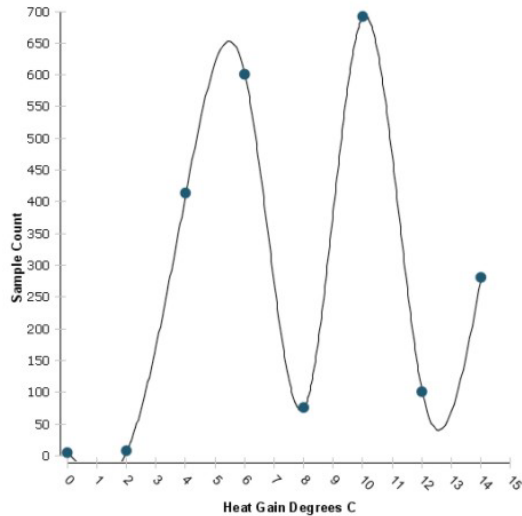
Category	Heat Gain Degrees C	Sample Count
Rack Server	0	5
Rack Server	2	8
Rack Server	4	414
Rack Server	6	601
Rack Server	8	76
Rack Server	10	692
Rack Server	12	101
Rack Server	14	281

Figure 21. AEM Rack Server Heat Gain Distribution report

Report usage

This report can be used to observe the overall heat gain of Rack Servers monitored by Active Energy Manager. Using this report in conjunction with the AEM Rack Server Top Heat Gain report can help clarify whether a heat gain in either report is an issue. For instance, this report can indicate that an unusually high heat gain was recorded. By using the AEM Rack Server Top Heat Gain report, you can view the particular machines with the same heat gain value recorded, and then further determine whether it is an issue. In another case, a machine might be displayed on the AEM Rack Server Top Heat Gain report because it has the highest heat gain. By taking into account this report, you may see that the high heat gain is similar to other machines of the same type, and that no real issue exists.

AEM Rack Server Top Heat Gain: The AEM Rack Server Top Heat Gain report displays the top 20 heat gain values during a user-specified time period for all Rack Servers being monitored by Active Energy Manager.

Report purpose

This report allows administrators to identify the machines and dates that have had the top 20 highest heat gain temperatures recorded during the user-specified time period. The report can be used to help identify machines with potential issues, and identify trends that can be used to target preventative maintenance.

Report parameters

Date Range (calculated based on the local time stamp when the data was stored in Tivoli Data Warehouse):
- **Report Period**: Choose from a pre-defined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
- **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.
- **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.

Report output

This report contains a graph of the top 20 highest heat gain readings. Because the top 20 heat gains are selected for the report, the graph can show, at one extreme, one machine over 20 days, or at the other extreme 20 machines on one day. It is more likely to show several machines over several days, with the pattern of machines and days providing insight into the heating and cooling behaviors of the data center.

The vertical axis contains the heat gain degrees in Celsius, and the horizontal axis contains the time periods in which the heat gain temperatures were recorded. By hovering your mouse over a node on the graph in the HTML version of the report, a pop-up window is displayed showing the Maximum Heat Gain, Machine Type, Machine ID, and the Time Period in which the heat gain was recorded. All nodes that result from the same machine are connected using line segments. Below the graph, a table exists detailing the information represented in the graph. The table contains the following fields:
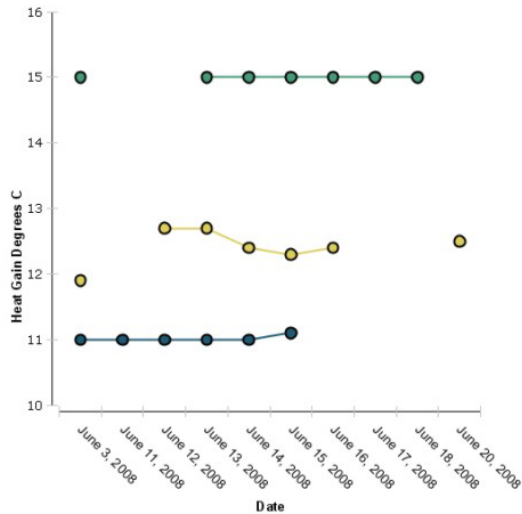- Category: the category of the machine; in this case, BladeCenter.
- Machine Type: the type of the machine
- Machine ID: the ID of the machine
- Time Period: the time period in which the heat gain was recorded
- Maximum Heat Gain: the value of the heat gain that was recorded

Top Heat Gain by Active Energy Manager Rack Servers

These are the parameters used by this report

| Start Date | May 26, 2008 12:00 AM | End Date | Jun 25, 2008 11:59 PM |
| Report Period | Last 30 days | | |

Heat Gain

Category	Machine Type	Machine Id	Time Period	Maximum Heat Gain
Rack Server		BMC2500	Jun 3, 2008	15
Rack Server		BMC2500	Jun 13, 2008	15
Rack Server		BMC2500	Jun 14, 2008	15
Rack Server		BMC2500	Jun 15, 2008	15
Rack Server		BMC2500	Jun 16, 2008	15
Rack Server		BMC2500	Jun 17, 2008	15

Figure 22. AEM Rack Server Top Heat Gain report

Report usage

A primary use of this report is to identify machines that are heating the air more than other machines of the same type and might need to be examined further. For example, if one machine begins to show up on the report more than other machines, perhaps someone has left a rack door open or failed to replace a blanking panel. Perhaps recent cabling has disrupted the normal air flow and the rack is getting contaminated cooling air. This report will not tell you what is wrong, tell you how much heat energy is being put into the air, or make any recommendations for action. Its purpose is to identify differences between similar machines so that you can know where to direct your attention.

Using this report in conjunction with the AEM Rack Server Heat Gain Distribution report can help clarify whether a heat gain in either report is an issue. For instance, the AEM Rack Server Heat Gain Distribution report may indicate that an unusually high heat gain was recorded. By using this report, you can view the particular machines with the same heat gain value recorded, and then further determine whether it is an issue. In another case, a machine might be displayed on this report because it has the highest heat gain. By taking into account the AEM Rack Server Heat Gain Distribution report, you might see that the high heat gain is similar to other machines of the same type, and that no real issue exists.

AEM Rack Server Top Energy Use: The AEM Rack Server Top Energy Use report displays the top 20 machines with the most kilowatt hours used during a user-specified time period.

Report purpose

The purpose of this report is to allow administrators to identify which machines are using the most energy and when they are using the energy.

Report parameters

Date Range (calculated based on the local time stamp when the data was stored in Tivoli Data Warehouse):
- **Report Period**: Choose from a pre-defined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
- **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.
- **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.

Report output

This report contains a graph of the 20 machines with the most energy used. The vertical axis contains the amount of energy used in Kilowatt hours, and the horizontal axis contains the time periods in which the energy use was recorded. By hovering your mouse over a node on the graph in the HTML version of the report, a pop-up window shows the Energy Consumed, Machine Type, Machine ID, and the Time Period in which the energy consumed was recorded. Below the graph, a table exists detailing the information represented in the graph. The table contains the following fields:
- Category: the category of the machine; in this case, BladeCenter
- Machine Type: the type of the machine
- Machine ID: the ID of the machine
- Time Period: the time period in which the energy consumed was recorded
- Energy Consumed kWh: the amount of energy consumed in kilowatt hours

Top Energy Use by Active Energy Manager Rack Servers

These are the parameters used by this report

| Start Date | May 26, 2008 12:00 AM | End Date | Jun 25, 2008 11:59 PM |
| Report Period | Last 30 days | | |

Kilowatt Hours Used

Category	Machine Type	Machine Id	Time Period	Energy Consumed kWh
Rack Server		BMC2500	May 29, 2008	13.17
Rack Server		BMC2500	May 30, 2008	13.63
Rack Server		BMC2500	May 31, 2008	14.4
Rack Server		BMC2500	Jun 1, 2008	15.03
Rack Server		BMC2500	Jun 2, 2008	15.22
Rack Server		BMC2500	Jun 3, 2008	10.53
Rack Server		BMC2500	Jun 16, 2008	8.17
Rack Server		GDCBMC01	May 21, 2008	10.89

Figure 23. AEM Rack Server Top Energy Use report

Report usage

You may not see every date and every machine listed on this report. Because this report lists only the top 20 machines by energy consumption, a particular machine might not have had the largest consumption on a particular day, or a particular day may not have had energy consumption by any machine large enough to get into the top 20.

The pattern of what machines appear on what days should help you understand when you are using the most energy and why. In turn, this information can then be used to identify issues and create a more optimal allocation of resources. For instance, if you observe that one machine is consuming the most energy every day, it might indicate that resources are incorrectly distributed or that some malfunction exists. In another instance, a certain set of machines may appear every Friday and it could be beneficial to take that into account when scheduling maintenance.

Baseline Power report: Data Center Power Usage

This report shows the power usage summary and details of the selected machines in the data center.

Report purpose

The Data Center Power Usage report provides you with a high-level view of power usage, estimated power cost, and carbon emissions from your data center. You can click links to detailed information in the Servers, Facility, Network, and Storage categories.

Report parameters
- Report Period (calculated based on the local time stamp when the data was stored in the Tivoli Data Warehouse):
  - **Date Period**: Choose from a pre-defined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
  - **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.
  - **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.
  - **Summarization type**: Choose which type of summarization level should be used in generating the report: Default (based on the number of days), Hourly, Daily, Weekly, Monthly, Quarterly, or Yearly.
- Energy Consumption Settings
  - **Energy rate plan**: Choose one of the options as defined in **Preferences -> Energy Rates**.
  - **Energy mix**: Choose one of the options as defined in **Preferences -> Carbon Unit Settings**.
- Resource Settings: Select the servers or facilities to include in the report.

Report output

The report lists the data center's total power usage for the specified period, broken down by server, facility, network and storage. Pie charts present the total power usage and server power usage, with charts displaying the number of servers by type, power consumption, cost, and carbon emissions. The **Expand Details** option provides tables with the following columns:
- Server name: the name of the server.
- Chassis: the Blade server's chassis type.
- Power Consumption: the power in kilowatt hours consumed by the server in the specified report period.
- Cost: the cost of the power consumed by the server in the specified period.
- Carbon Emission: the level of CO_2 generated by the server in the specified period.
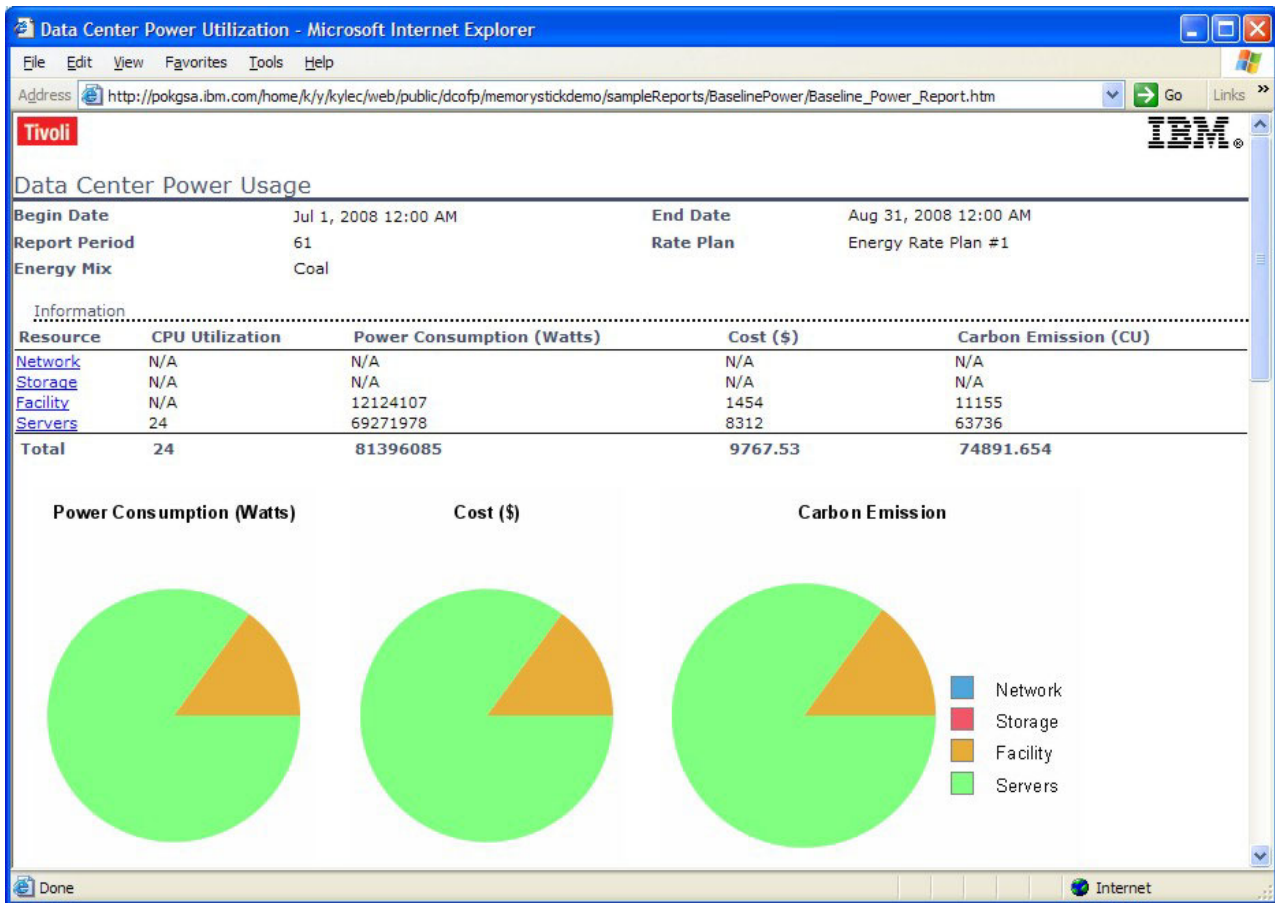
Figure 24. Baseline Power report

Report usage

Use this report to gain a high-level overview of the power consumed by the servers in your data center, and the estimated costs and carbon emission levels.

CPU Utilization report

The CPU Utilization report shows the CPU utilization on one or more systems in your data center.

Report purpose

The purpose of this report is to show administrators the utilization levels of the servers in their data center so they can adjust server load accordingly or investigate reasons for large fluctuations in server utilization.

Report parameters

- Report Period (calculated based on the local time stamp when the data was stored in the Tivoli Data Warehouse):
    - **Date Period**: Choose from a pre-defined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
    - **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.

- **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.
- **Summarization type**: Choose which type of summarization level should be used in generating the report: Default (based on the number of days), Hourly, Daily, Weekly, Monthly, Quarterly, or Yearly.
- Low CPU usage threshold range (%)
  - **From**: Enter the starting value for defining the threshold for low utilization in the report.
  - **To**: Enter the ending value for defining the threshold for low utilization in the report.
- Medium CPU usage threshold range (%)
  - **From**: Enter the starting value for defining the threshold for medium utilization in the report.
  - **To**: Enter the ending value for defining the threshold for medium utilization in the report.
- High CPU usage

  Lower threshold value (%): Enter the starting value for defining the threshold for high utilization in the report.
- Resource Settings: Select the servers or server groups to include in the report.

Report output

The report contains a bar graph illustrating the percentages of the servers used or free for the time period specified in the report criteria. Click **Expand Details** to view a table of utilization data.
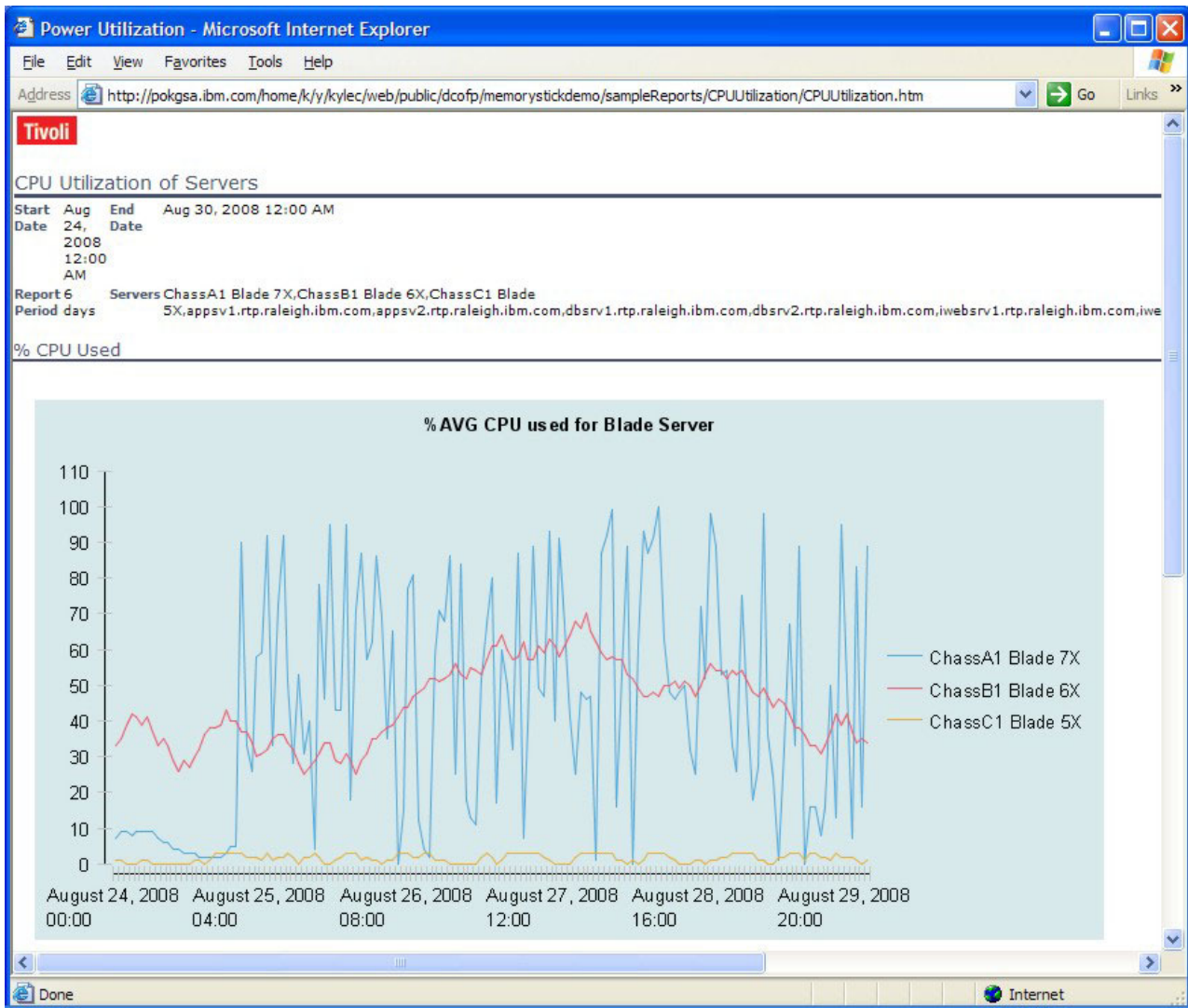
Figure 25. CPU Utilization report

Report usage

This report is useful when looking for or validating underutilized servers, or investigating discrepancies in server utilization.

Data Center Infrastructure Efficiency (DCiE)

Data centers (facility and IT) are hitting power caps and are under pressure to reduce energy consumption and better utilize assets and equipment such as transformers, power supplies, power distribution units, etc.

The Data Center Infrastructure Efficiency, or DCiE, is a standard supported by the Green Grid, and is defined as the percentage of total facility power used by the IT equipment power, or (IT equipment power / total facility power) X 100. The Power Usage Effectiveness, or PUE, is the reciprocal of the DCiE, and defined as the Total Facility Power divided by the IT Equipment Power.

Report purpose

This report totals the power usage of your data center's servers, facilities, networks and storage and calculates your data center's DCiE and power PUE based on the total facility power used by the IT equipment selected for the report.

Report parameters

- Report Period (calculated based on the local time stamp when the data was stored in the Tivoli Data Warehouse):
  - **Summarization type**: Choose which type of summarization level should be used in generating the report: Default (based on the number of days), Hourly, Daily, Weekly, Monthly, Quarterly, or Yearly.
  - **Date Period**: Choose from a pre-defined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
  - **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.
  - **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.
- Resource Settings: Select the servers or facilities to include in the report.

Report output

The report presents a pie chart showing the total power usage in kilowatts for the servers, facilities, networks, and storage in your data center. A table lists the power usage in kilowatts for each of these, as well as:

- the total power used by IT equipment in the data center
- the total power used by the facility
- the DCiE percentage (the percentage of total facility power used by the IT equipment power)
- the PUE (the total facility power divided by the IT equipment power)
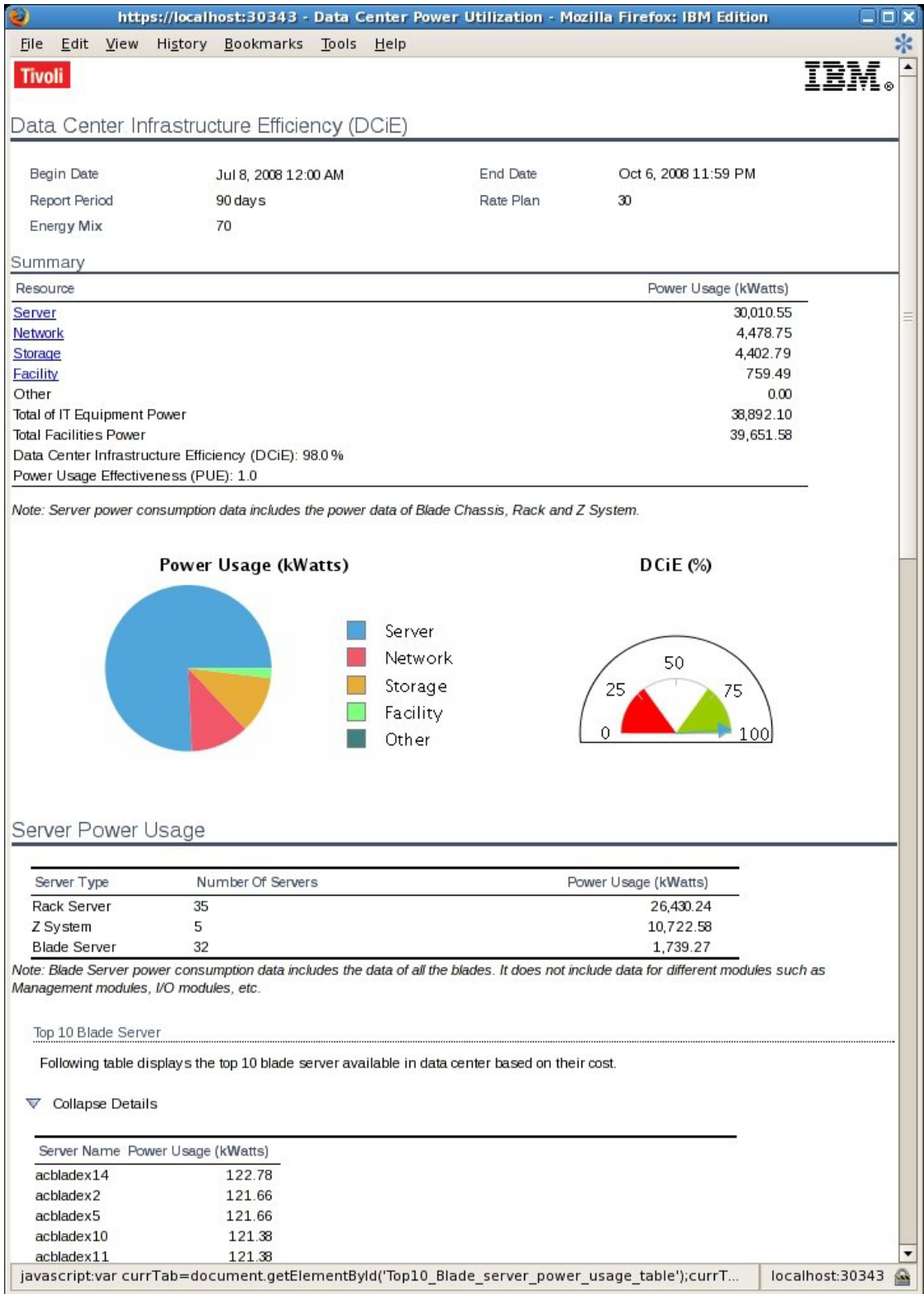
Figure 26. Data Center Infrastructure Efficiency (DCiE) report

Report usage

This report helps you to visualize the overall power efficiency of your data center and to identify possible areas of power inefficiency to be investigated.

Eaton Power Xpert Device reports

The Eaton Power Xpert Device reports show the "Eaton Breaker Top Percent of Capacity report" on page 54. This report shows which breakers are coming close to their operating limit. There is also an "Eaton Breaker Exception report." This report shows which devices are missing data and would therefore not be shown on the Eaton Breaker Top Percent of Capacity report. A device might be missing data because it is not in use or because it does not have the correct firmware level to communicate with the data agents.

Eaton Breaker Exception report

This report identifies all breakers that are excluded from one or more Eaton reports. Typically, a breaker is excluded from a report due to all-zero or negative data. Associated with each machine listed is the reason for being excluded from reports.

Report purpose

The purpose of this report is to help administrators identify breakers that have an issue that prevents them from being monitored correctly. The breakers on this report have been excluded from one or more Eaton reports due to their inconsistent data. If you believe a breaker is incorrectly excluded from a report, then this report should help explain why the breaker is not included.

Report parameters

Date Range (calculated based on the local time stamp when the data was stored in Tivoli Data Warehouse):

* **Report Period**: Choose from a pre-defined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
* **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.
* **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.

Report output

The report lists breakers and the reason the breakers are excluded from one or more of the Eaton Breaker reports. The reason a breaker is included in this report is due to zero or negative data. The report is displayed in table format, with the table having the following columns:

* Machine Type: the type of breaker
* Machine ID: the Node, Panel, and Breaker
* Reason: the reason the breaker is listed in this report and excluded from other Eaton Breaker reports is due to Data Center Optimization obtaining a zero or negative value for the breaker's percent load.

Eaton Breaker Exception Report

These are the parameters used by this report

| Start Date | May 28, 2008 12:00 AM | End Date | Jun 27, 2008 11:59 PM |
| Report Period | Last 30 days | | |

Eaton Breakers with Missing, Inconsistent, Zero-Value Data

Machine Type	Machine Id	Reason
Breaker	E8:PDU155:PDU, 1, 1	Percent Load is zero or negative.
Breaker	E8:PDU155:PDU, 1, 3	Percent Load is zero or negative.
Breaker	E8:PDU155:PDU, 1, 4	Percent Load is zero or negative.
Breaker	E8:PDU155:PDU, 1, 5	Percent Load is zero or negative.
Breaker	E8:PDU155:PDU, 1, 6	Percent Load is zero or negative.
Breaker	E8:PDU155:PDU, 1, 7	Percent Load is zero or negative.
Breaker	E8:PDU155:PDU, 1, 9	Percent Load is zero or negative.

This report shows the Eaton Breakers which are being excluded from other reports due to problem data.

June 27, 2008 2:17:08 PM EDT   1   /   1

Figure 27. Eaton Breaker Exception report

Report usage

This report can be useful to help identify breakers that have issues which prevent the breakers from being monitored correctly. The simplest reason a breaker might be listed in this report is due to the breaker not having the correct features or firmware levels to work with the Eaton agent. Another reason the breaker might be listed in this report is it might not be used at the moment and may represent future capacity.

Eaton Breaker Top Percent of Capacity report

The Eaton Breaker Top Percent of Capacity report displays the 20 breakers which have used the most capacity during the user-specified time period.

Report purpose

The purpose of this report is to allow administrators to identify breakers that are nearest to their operating limit during a user-specified time period. This information can then be used to identify trends relating to power consumption, and can be used to enable an improved allocation of resources among the available breakers. This report will not tell you what the best allocation of resources are, or which machines are using too much of the available capacity. Its purpose is to identify the capacity used at breakers so you can make better decisions about risk and capacity.

Report parameters

Date Range (calculated based on the local time stamp when the data was stored in Tivoli Data Warehouse):

- **Report Period**: Choose from a pre-defined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
- **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.
- **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.

Report output

This report contains a bar chart of the 20 breakers with the most capacity used during the time period. The vertical axis contains the Node, Panel, and Breaker for each breaker, and the horizontal axis contains the amount of capacity used, from 0 to 100. Below the graph, a table exists detailing the information represented in the graph. The table contains the following fields:

- Node: the node identification of the breaker
- Panel: the panel used to identify the breaker
- Breaker: the breaker ID of the breaker
- Maximum Percent Capacity: the percentage of capacity used by the breaker

Figure 28. Eaton Breaker Top Percent of Capacity report

Report usage

You might not see every breaker listed on this report. Because this report only lists the top 20 breakers by the amount of capacity used, a particular breaker may have not used a large enough amount of capacity to make it in the top 20.

This report can help identify machines which are using too many resources. For instance, if a breaker is near capacity, you can then determine which machines are downstream from the breaker and need to be examined. Another use for this

report is to enable a better allocation of resources among available breakers. For instance, if a certain breaker is near maximum capacity, the machines downstream from the breaker can be identified, and certain machines can be relocated to other available breakers with less capacity being used.

Historical Power Trend report

The Historical Power Trend report shows the power used by the Blade centers, the facility, the rack server, or the Z System in the data center.

Report purpose

Report parameters

- Report Period (calculated based on the local time stamp when the data was stored in the Tivoli Data Warehouse):
  - **Date Period**: Choose from a pre-defined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
  - **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.
  - **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.
  - **Summarization type**: Choose which type of summarization level should be used in generating the report: Default (based on the number of days), Hourly, Daily, Weekly, Monthly, Quarterly, or Yearly.
- Resource Settings: Select the servers, Z systems or facilities to include in the report.

Report output

The report presents a pie chart showing the power usage in kilowatts for each of the servers, facilities or Z Systems included in the report, as well as line graphs showing the average input power in kilowatts for each server, facility or Z System. The **Expand Details** option provides tables with the following columns:

- Name: the name of the server, facility or Z System.
- TimeStamp: the date and time of the power usage reading.
- AVG Average Input Power AC (kWatts)
- SUM Average Input Power AC (kWatts)
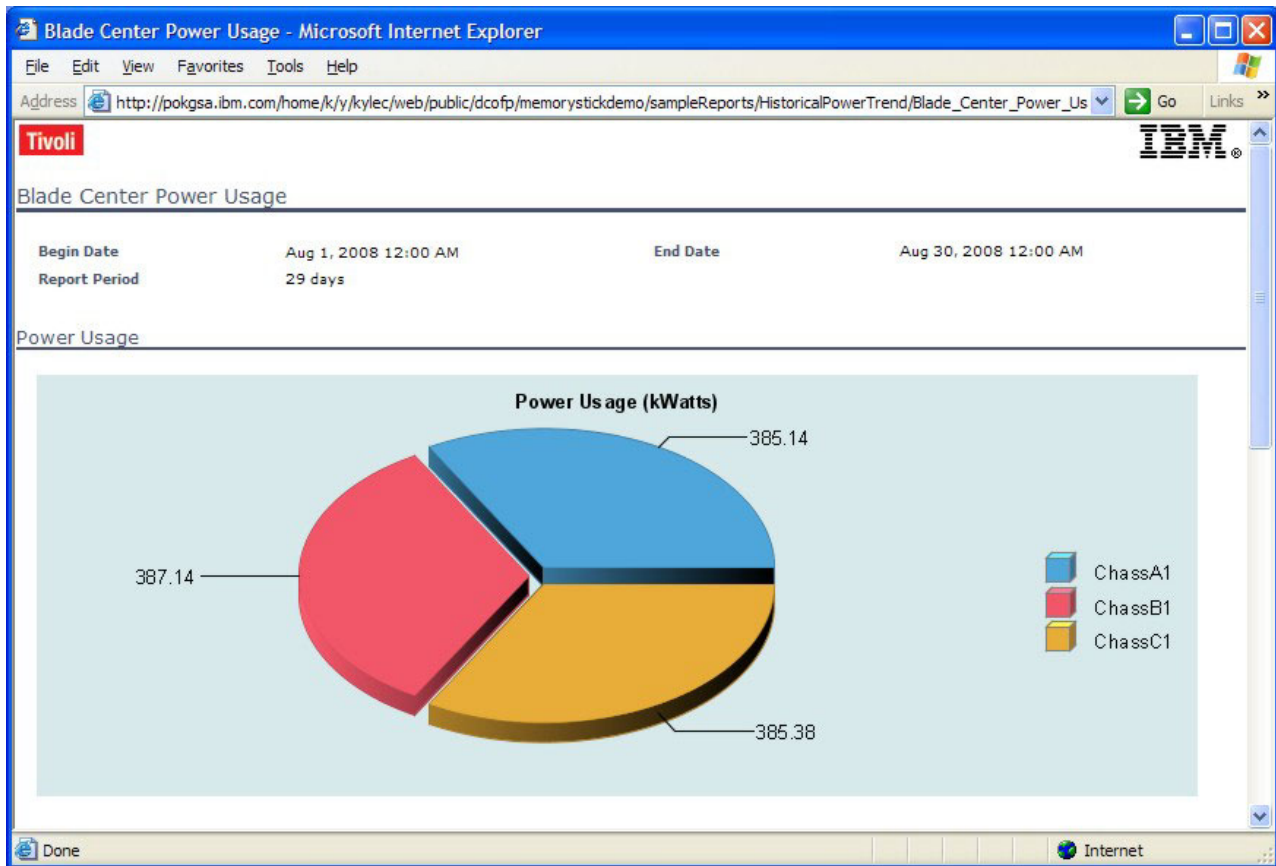
Figure 29. Historical Power Trend report

Report usage

This report is useful for viewing trends in power consumption in a data center by date and time.

Power Savings Recommendation Report: Dynamic Power Savings Recommendation for Servers

The Power Savings Recommendation report invokes the modeling and analyzing aspects of Data Center Optimization. The Dynamic Power Savings Recommendation for Servers report applies to servers that can run in Dynamic Power Savings mode, such as IBM BladeCenter and IBM Rack servers.

- The recommendations are made based on recurring patterns in the historical data in Tivoli Data Warehouse.
- The confidence level of a recommendation describes the reliability of the recurring patterns in the optimization interval. This confidence level is determined by the quality and quantity of the operational data available in Tivoli Data Warehouse. The quantity here refers to the number of data points available for analysis and the quality reflects the amount of noise in the data.
- The risk level of a recommendation describes the uncertainties associated with the implementing the recommended actions in the optimization interval. Risk is calculated differently for the different types of recommendations.

Report purpose

The report provides recommendations for putting servers into Dynamic Power Savings mode for times during which the CPU use and variance is below the specified threshold. When generating the report, Data Center Optimization evaluates the specified servers during the specified time period, and searches for servers with low unvarying CPU use. The report also estimates the cost associated with putting the server into Dynamic Power Savings mode for that period of time.

Note: You cannot use user-defined servers that are associated with iPDU, UPS, or Meters.

Report parameters

- Analysis Date Range (calculated based on the local time stamp when the data was stored in the Tivoli Data Warehouse):
  - **Date Period**: Choose from a pre-defined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
  - **Start Date**: Choose a start date from the calendar and a start time from a time widget. Start time is optional.
  - **End Date**: Choose an end date from the calendar and an end time from a time widget. End time is optional.
  - **Summarization type**: Choose which type of summarization level should be used in generating the report: Default (based on the number of days), Hourly, Daily, Weekly, Monthly, Quarterly, or Yearly.
- Forecast Period
  - **From**: Choose a start date from the calendar for the recommendation forecast.
  - **To**: Choose an end date from the calendar for the recommendation forecast.
- Optimization inputs
  - **Optimization interval**: Enter the time interval for implementing the energy optimization recommendations, in hours or days.
  - **Risk level**: Enter the risk level with which to filter the recommendations included in this report. Enter a value between 0 and 100, where 0 represents very low risk and 100 represents very high risk. The risk measure represents the presence of sudden spikes in CPU utilization. Since variance of CPU utilization is used to make DPS recommendations, some spikes may be smoothened out. However a very big spike that occurs periodically, even if it occurs only once during a period, is a source of risk in enabling DPS. Hence in this case, the risk level indicates the presence of sudden spikes in CPU utilization during the period for which DPS is recommended to be turned on.
  - **Confidence level**: Enter the confidence level with which to filter the recommendations included in this report. Enter a value between 0 and 100, where 0 represents very low confidence and 100 represents very high confidence. This confidence measure is based on the number of data-points available in a hourly time-window and the number of pattern recurrences in the analysis period.
- Power cost computation

  Rate plan: Choose the rate plan to be used to compute power cost savings. Rate plans are defined in **Preferences** → **Energy Rates**.
- Resource Settings: Select the servers or server groups to include in the report.

Report output

The report consists of a line graph that indicates which servers can be put into Dynamic Power Savings mode, based on historical system load.
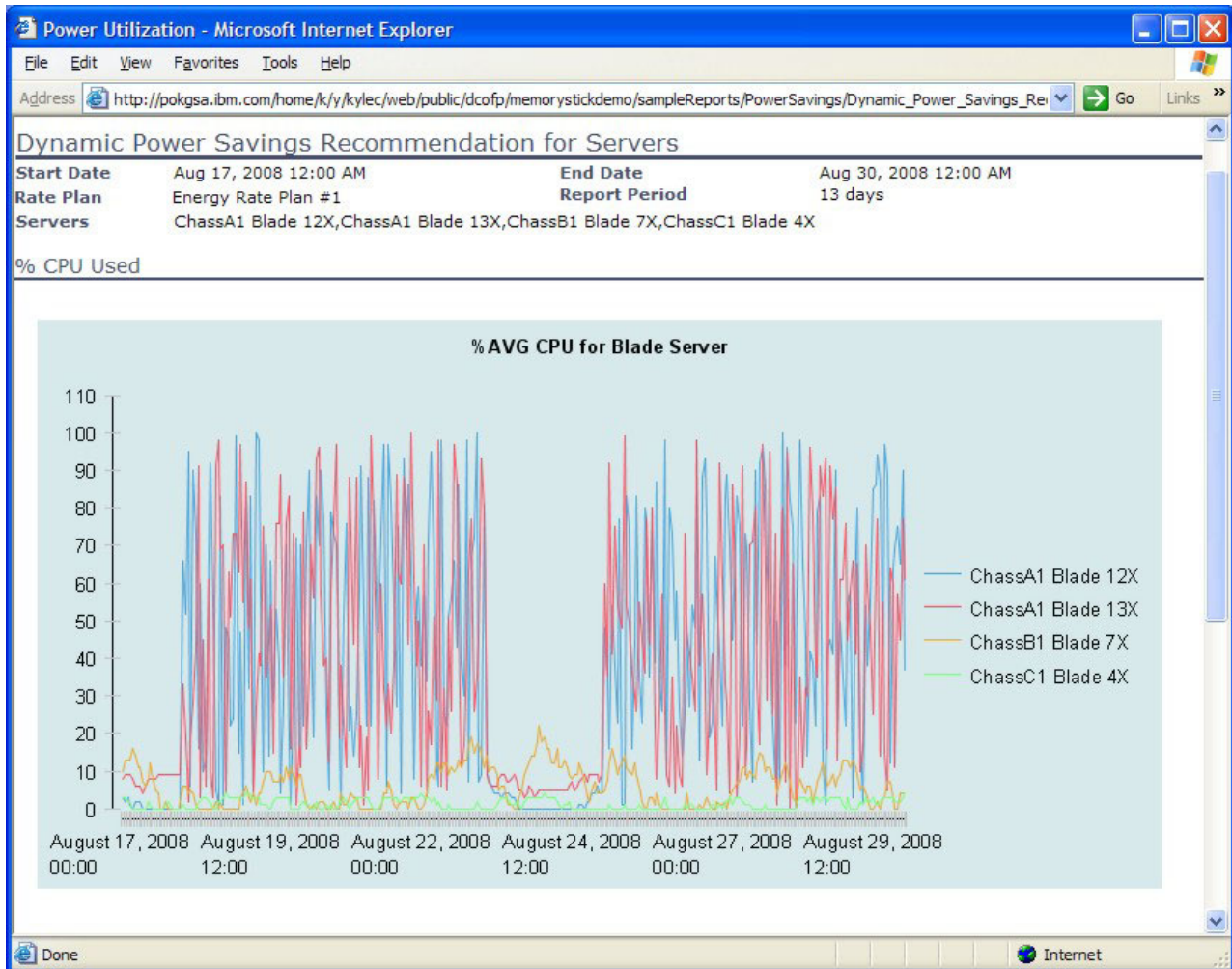
Figure 30. Dynamic Power Savings Recommendation for Servers report

Report usage

Use this report to identify opportunities for saving energy and associated costs by determining which servers can be put into Dynamic Power Savings mode.

Power Savings Recommendation Report: Standby Recommendation report

The Standby Recommendation report invokes the modeling and analyzing functions of Data Center Optimization.

- The recommendations are made based on recurring patterns in the historical data in Tivoli Data Warehouse.
- The confidence level of a recommendation describes the reliability of the recurring patterns in the optimization interval. This confidence level is determined by the quality and quantity of the operational data available in

Tivoli Data Warehouse. The quantity here refers to the number of data points available for analysis and the quality reflects the amount of noise in the data.

- The risk level of a recommendation describes the uncertainties associated with the implementing the recommended actions in the optimization interval. Risk is calculated differently for the different types of recommendations.

Report purpose

The report provides recommendations for putting servers into Standby mode or turning them off, based on the specified thresholds for CPU use and variance. When generating this report, Data Center Optimization evaluates the specified servers during the specified time period, and searches for servers with low unvarying CPU use.

Note: You cannot use user-defined servers that are associated with iPDU, UPS, or Meters.

Report parameters

- Analysis Date Range (calculated based on the local time stamp when the data was stored in Tivoli Data Warehouse):
  - **Date Period**: Choose from a pre-defined date range such as Last Week, Current Month, Last 30 Days, etc. If both a start and end date are entered, this field is ignored.
  - **Start Date**: Choose a start date from the calendar and a start time from a time widget. Start time is optional.
  - **End Date**: Choose an end date from the calendar and an end time from a time widget. End time is optional.
  - **Summarization type**: Choose which type of summarization level should be used in generating the report: Default (based on the number of days), Hourly, Daily, Weekly, Monthly, Quarterly, or Yearly.
- Forecast Period
  - **From**: Choose a start date from the calendar for the recommendation forecast.
  - **To**: Choose an end date from the calendar for the recommendation forecast.
- Optimization inputs
  - **Optimization interval**: Enter the time interval for implementing the energy optimization recommendations, in hours or days.
  - **Risk level**: Enter the risk level with which to filter the recommendations included in this report. Enter a value between 0 and 100, where 0 represents very low risk and 100 represents very high risk. This risk measure is based on the distance between the average CPU utilization and the predefined thresholds (defined in RecommendationInfo.xml). Hence, risk is an indication of how close the actual observed utilization over time is to the threshold. If the utilization is too close to the threshold, the probability of exceeding it in the future is high (that is, there is little tolerance to changes in the utilization that may put it beyond the threshold).
  - **Confidence level**: Enter the confidence level with which to filter the recommendations included in this report. Enter a value between 0 and 100, where 0 represents very low confidence and 100 represents very high confidence. This confidence measure is based on the quality of the data determined by the variations in the CPU utilization around the average value and the number of pattern recurrences in the analysis period.
- Power cost computation

Rate plan: Choose the rate plan to be used to compute power cost savings. Rate plans are defined in **Preferences -> Energy Rates**.

- Resource Settings: Select the servers or server groups to include in the report.

Report output

The generated report shows the CPU utilization of the specified servers, during the specified time range. The report also shows recommendations of which servers can be put into standby mode or powered off, during specific times of the day.
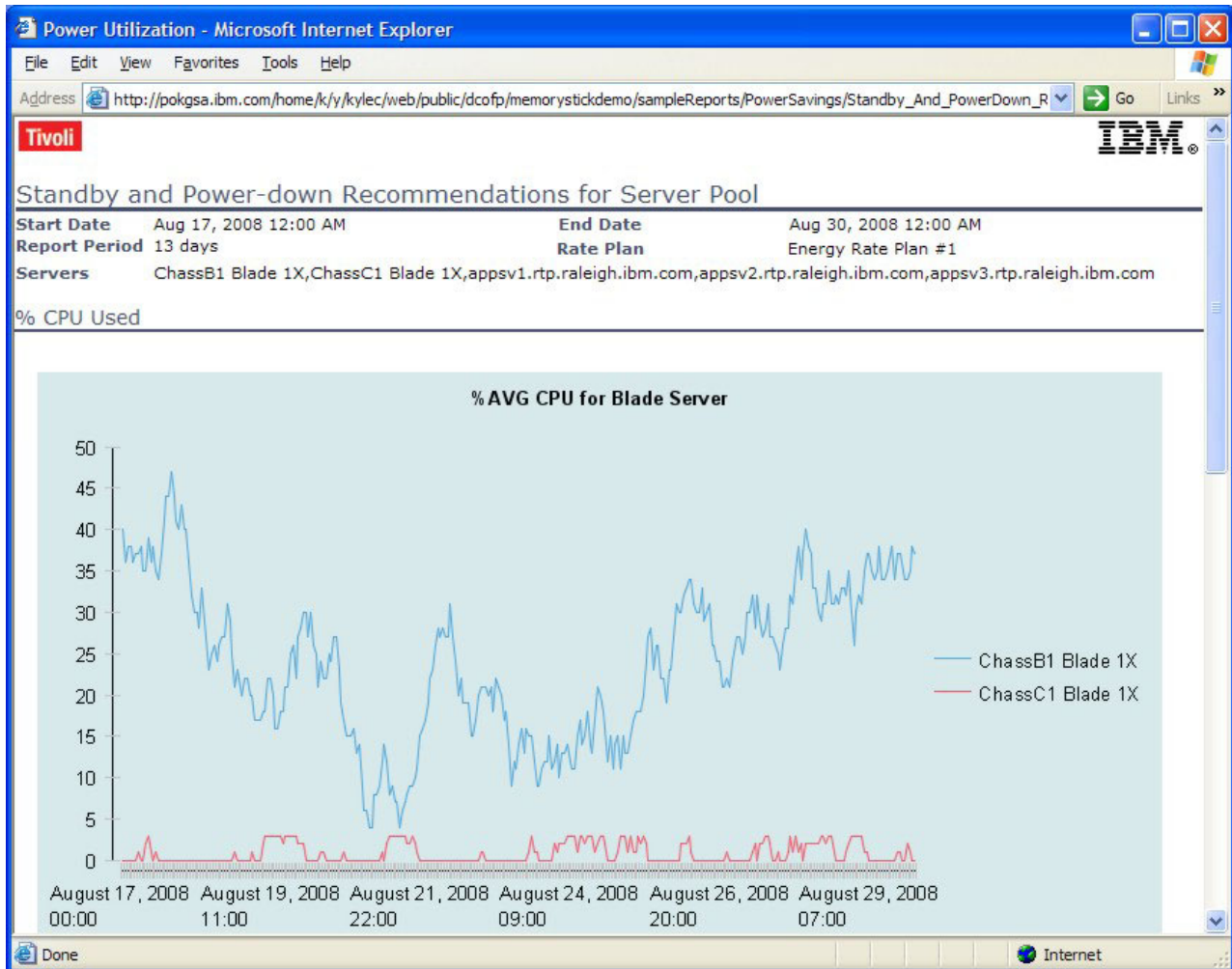
Figure 31. Standby Recommendation report

Report usage

Use this report to identify opportunities for saving energy and associated costs by determining which servers can be put into Standby mode.

Data Center Power Usage Comparison report

The Power Usage Comparison report enables you to view and compare two time periods with the same information that is included in the Baseline Power report.

Report parameters

- **Summarization type**: Choose which type of summarization level should be used in generating the report: Default (based on the number of days), Hourly, Daily, Weekly, Monthly, Quarterly, or Yearly.
- Energy Consumption Settings
  - **Rate plan**: Choose one of the options as defined in **Preferences → Energy Rates**.
  - **Carbon unit energy mix**: Choose one of the options as defined in **Preferences → Carbon Unit Settings**.
- First Date Period (calculated based on the local time stamp when the data was stored in Tivoli Data Warehouse):
  - **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.
  - **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.
- Second Date Period (calculated based on the local time stamp when the data was stored in Tivoli Data Warehouse):
  - **Start Date**: Choose a start date from a calendar and a start time from a time widget. Start time is optional.
  - **End Date**: Choose an end date from a calendar and an end time from a time widget. End time is optional.

Report output

The report presents a series of bar graphs comparing the power consumption in watts, the cost, and the carbon emission levels by storage, network, facility and serer for the two specified time periods.
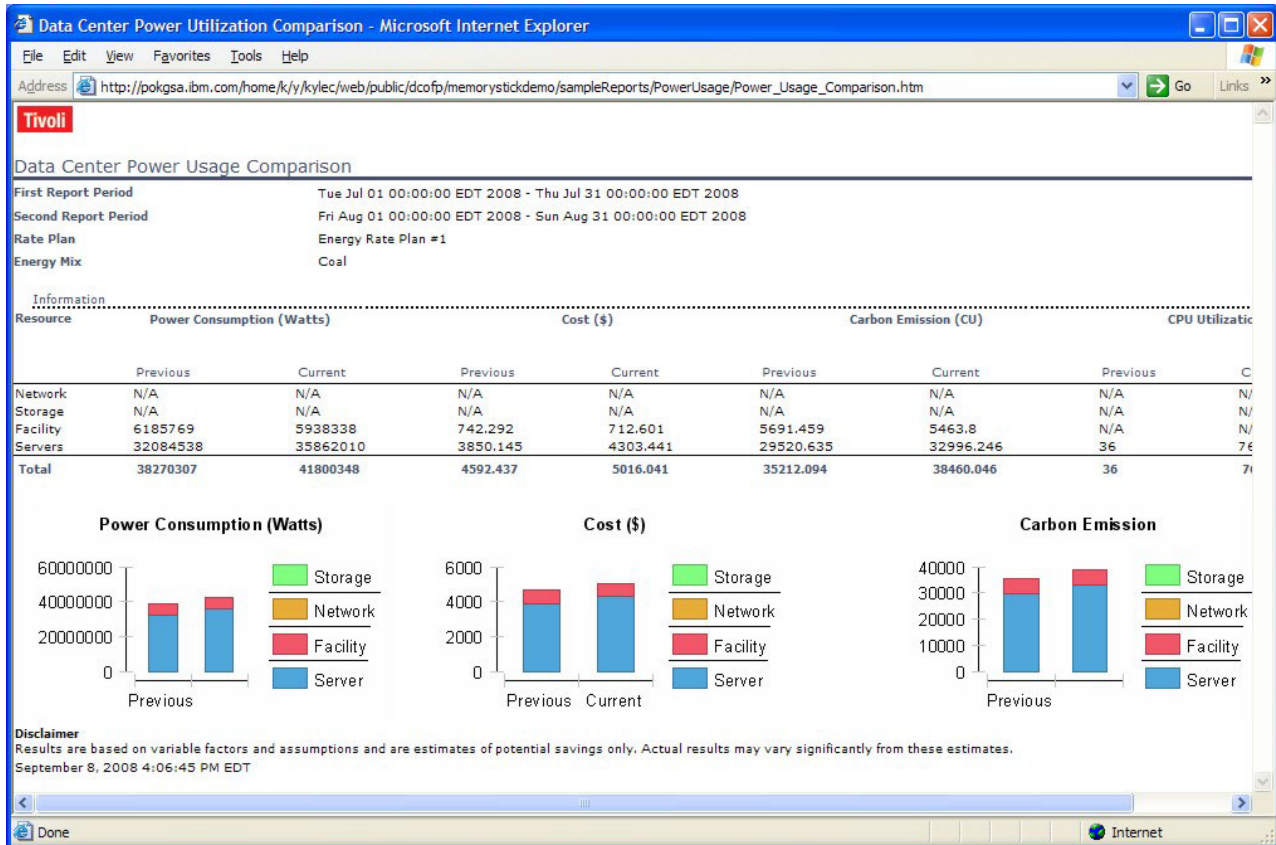
Figure 32. Data Center Power Usage Comparison report

Report usage

This report may be used to compare energy-use numbers before optimization with numbers reported after optimization, to see if the desired value was achieved after the optimization was applied.

Chapter 7. Administration

Administrative tasks for Tivoli Common Reporting include user administration, starting and stopping the server, and managing reports, report sets, and other objects in the data store.

User administration is based on the user and group management features of the application server. Use the Users and Groups tasks in the console navigation to create new users and groups and add them to roles. Refer to the console help for more information.
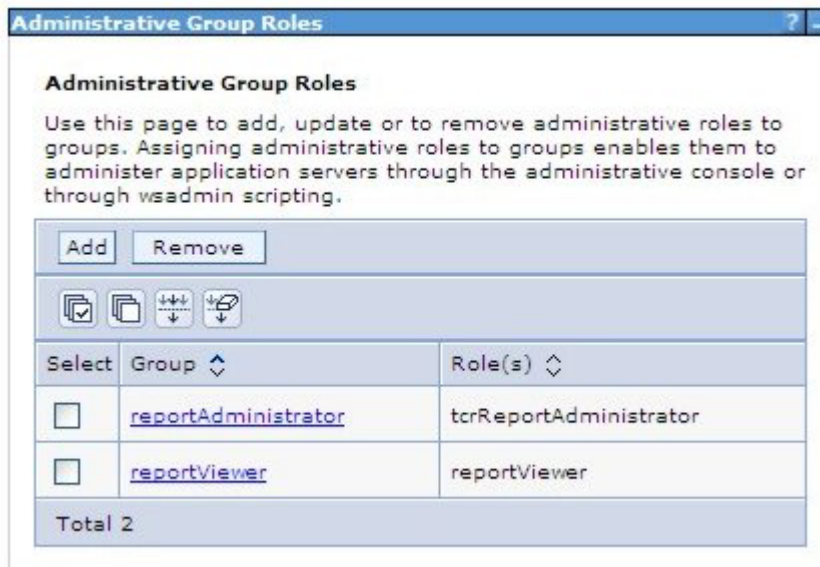
Figure 33. Administrative Group Roles page

User roles and groups

User permissions for Tivoli Common Reporting are managed with roles and groups. A role represents a set of permissions, and a group represents a group of users who have the same role or roles.

Tivoli Common Reporting defines the following user roles specific to reports:

reportViewer
> These users have permission to view and run reports, but not to make persistent changes to objects in the data store. A user with the reportViewer role can perform the following tasks:
> * Create reports
> * View reports
> * View and delete report templates
> * View, create, edit, and delete energy rates
> * View, create, edit, and delete carbon unit energy mixes
> * Define and update server groups

The reportViewer group is defined for this level of access.

reportAdministrator

These users have permission to create, delete, and modify configuration settings. In addition to the reportViewer tasks, a user with the reportAdministrator role can perform the following tasks:

• Update Tivoli Data Warehouse Settings

The reportAdministrator group is defined for this level of access.

For more information about users, roles, and groups, refer to the online help in the console banner.

Tivoli Data Warehouse settings

Click **Energy** ‣ **Configuration** ‣ **Database Settings** to update the settings for the Tivoli Data Warehouse that acts as the source for the Data Center Optimization reports. Use this panel to update the database product, user, password, and location for your Tivoli Data Warehouse.

Figure 34. Database Settings page

Changing the power model for various machine types

The recommendation report for placing machines on standby/shutdown use a power model that defines the relationship between CPU utilization and power consumed for particular machine types. Currently this power model is determined by prior knowledge of machine types and a generic set of values are used for each machine type. These values are stored in the PowerModelInfo.xml file in the C:/Program Files/ibm/tcr/eWas61/systemApps/isclite.ear/ DCOFP_PortletUI.war/datastore directory if you installed Data Center Optimization the default directory. You may wish to change some values in the power models for the individual server types to better tune the recommendations you receive. To edit the values, make sure you shut down the application first and then open the above file in a text editor.

This file has individual PowerModel nodes, each representing the model for a particular type of server. Each PowerModel node contains a ServerType child node that defines the type of server and multiple DataPoints node each of which contains a data point. Each data point has two components: one representing the percentage of CPU utilization (CPU_USED), and one representing the power consumed in watts (POWER_USED). For CPU_USED, specify any decimal value between 0 and 100. For POWER_USED, specify any positive decimal value.

A sample fragment is shown below:

```
<tns:PowerModel>
      <tns:ServerType>Blade Center Chassis</tns:ServerType>
      <tns:DataPoints>
            <tns:DataPoint type="float">
                  <tns:Name>CPU_USED</tns:Name>
                  <tns:Value>0.1</tns:Value>
            </tns:DataPoint>
            <tns:DataPoint type="float">
                  <tns:Name>POWER_USED</tns:Name>
                  <tns:Value>140</tns:Value>
            </tns:DataPoint>
      </tns:DataPoints>
```

You can:
*   Change the value of POWER_USED for a particular CPU_USED value that already occurs as one of the data points
*   Add a new data point by adding a new DataPoints node under the PowerModel node for the same server type. You may cut and paste an existing DataPoints fragment and just change the values
*   Delete a data point by removing the DataPoints node under the PowerModel for that server type
*   Create a power model for a new server type. Cut and paste an existing PowerModel node and change the ServerType value

Common directory locations

This topic describes path name conventions used as variables throughout this documentation.

Data Center Optimization installation directory

dco_root describes the location where Data Center Optimization is installed. This location can be specified during installation. If not specified, the following default locations are used.

- On **UNIX:** /opt/ibm/tdcofem
- On **Windows:** C:\Program files\IBM\TDCOFEM

Tivoli Common Reporting installation directory

tcr_root describes the location where Tivoli Common Reporting is installed. If not specified, the following default locations are used.

- On **UNIX:** /opt/ibm/tcr
- On **Windows:** C:\Program Files\IBM\tcr

Tivoli Common Reporting profile directory

tcr_profile_root describes the location of the application server profile that is used for Tivoli Common Reporting. This location is in the /profiles/*profile_name* subdirectory of the Tivoli Common Reporting installation directory, where *profile_name* is the profile name created during installation. If not specified, the default is `tcrProfile`.

Chapter 8. Troubleshooting

Use these flow charts to diagnose errors in a component of Data Center Optimization for Energy Management.

Installation problems

Use this flow chart to troubleshoot errors you might encounter when you are
trying to install Data Center Optimization for Energy Management.
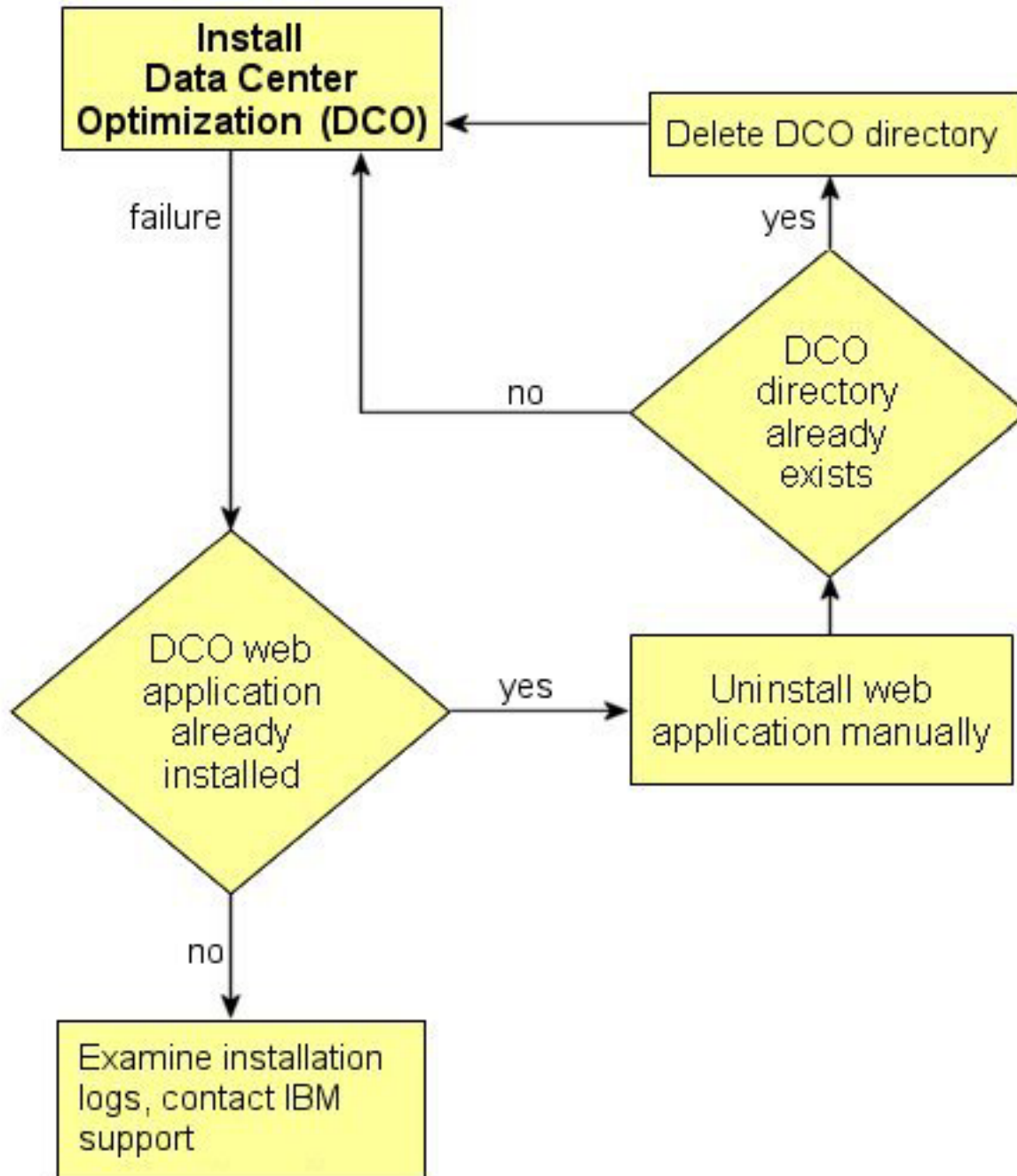
Figure 35. Installation: : troubleshooting flow chart

Notes:

- If Data Center Optimization is already installed and you need to reinstall, first run the following command to remove the previous installation from the *tcr_profile*/bin directory.

  ```
  wsadmin -f dco_root/Undeploywar.jacl
  ```

  Restart Tivoli Common Reporting after removing Data Center Optimization.
- Make sure the target installation directory is removed before restarting the installation program.
- If Data Center Optimization has not been installed, refer to the installation logs, which are described in "Gathering log files" on page 73.

Report generation problems

Use this flow chart to troubleshoot errors you might encounter when you are trying to generate reports.
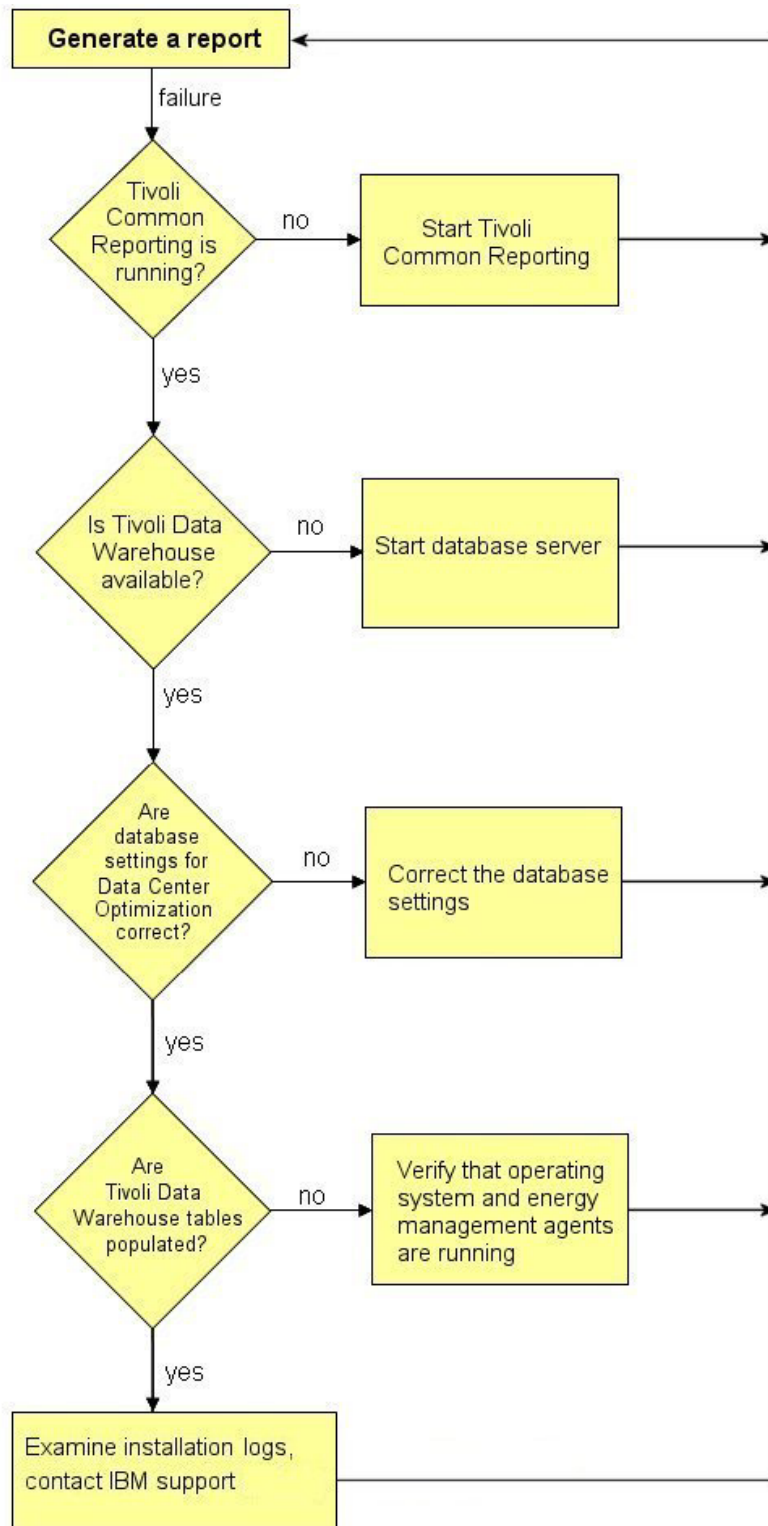
Figure 36. Report generation: troubleshooting flow chart

Notes:
- To determine if the database settings are correct, open **Energy** → **Optimization for Energy Management** → **Configuration** → **Database Settings** and click **Test Connection** on the Configuration Settings page. If a message is returned showing a connection error, you can correct the database settings on the same page.
- Logs files are described in "Gathering more diagnostic information."

Gathering more diagnostic information

You can configure the application server to record trace information that be used to troubleshoot problems with Data Center Optimization.

For most troubleshooting purposes, set the `com.ibm.dcofp.*` component to log trace information at the `Finer` level. More detailed settings can impact performance and should only be set if advised by level 3 support. To set the trace level, follow these steps.

1. Log in to the Tivoli Common Reporting console.
2. In the console navigation, click **Troubleshooting** → **Logs and Trace**. The Logging and Tracing page is opened with a table showing available servers.
3. Click the link for the Tivoli Common Reporting server, **tcrServer**. The General Properties page for the server's log and trace settings is opened.

   Note: The default server name for Tivoli Common Reporting is `tcrServer`. A different server name is shown if it was specified during installation.
4. Click **Diagnostic Trace**.

   The Diagnostic Trace Service page is opened with the Configuration tab selected. Changes made from the Configuration tab take effect only after the server is restarted. To set trace levels without restarting the server, select the Runtime tab before continuing. Make sure **Enable Log** is selected on the trace settings.
5. Click **Change Log Detail Levels**.
6. Click `com.ibm.dcofp.*` in the component list and select the logging level you that want to use for this component. The log settings should include this string when you are finished:

   `com.ibm.dcofp.*=finer`
7. Click **OK** to return to the Diagnostic Trace Service properties. A message is displayed at the top of that page prompting you to save your changes.
8. Click **Save**.

Gathering log files

Use the following log files to help troubleshoot problems with Data Center Optimization.

- **Installation logs**

  `dco_root/Tivoli_Data_Center_Optimization_for_Energy_Management_InstallLog.log`
  `dco_root/logs/*.log`
- **Runtime logs**

```
tcr_profile/logs/tcrServer/
SystemOut.log
tcr_profile/logs/tcrServer/
SystemErr.log
tcr_profile/logs/tcrServer/
trace.log
```

- **Data Center Optimization settings**

  These logs include updates that are made in the Preferences folder, such as rate plans or server settings.

  ```
  tcr_root//systemApps/isclite.ear/DCOFP_PortletUI.war/datastore/*.xml
  tcr_root//systemApps/isclite.ear/DCOFP_PortletUI.war/datastore/targets/*
  ```

Appendix A. Installation messages

These messages are written during installation of Data Center Optimization.

CTGOA0001E   Unable to copy *tempLogFile***file to TDCOfEM install log directory at** *tdcofem_logs***. The error information is:** *error_message*

Explanation: The TDCOfEM installation log file is created in a temporary folder. The attempt to copy that log file to the TDCOfEM install path failed and the installation cannot proceed.

CTGOA0002E   The installation application could not find the TCR installation path. The associated error message is: *error message*

CTGOA0003E   The installation application could not establish a connection to the Tivoli Data Warehouse. The additional error message is: *error message*

Explanation: As part of the TDCOfEM installation process, it attempts to validate a connection to the Tivoli Data Warehouse. The installation can progress normally.

Administrator response: Once the installation is completed, log on to TCR and use the TDCOfEM database settings panel to correct the configuration settings.

CTGOA0004E   The TDCOfEM web application file could not be copied to *tcr_dir***. The associated error message is:** *error message*

CTGOA0005E   TDCOfEM was not successfully deployed to TCR server. The associated error message, if available from the operating system, is: *error message*

CTGOA0006E   The undeployment of the TDCOfEM web application failed. The associated error message, if available is: *error message*

CTGOA0007E   The TCR server startup failed due to error: *error message*

CTGOA0008E   The TCR server shutdown failed due to error: *error message*

CTGOA0009E   TDCOfEM installation was not successful.

CTGOA0010E   TDCOfEM uninstallation was not successful.

CTGOA0200W   Java Runtime Environment version verification failed, version *java_version* **is not supported.**

Explanation: The product requires Java 1.5 or 1.6 to work properly. The installation module will not complete with the current version of the Java Runtime Environment.

Administrator response: If you have one of the supported versions of the Java Runtime Environment already installed, it is likely that they are not the default JRE. You can either add the location of the "java" application to the PATH environment variable or add "LAX_VM %TCR_DIR%/java/jre/bin/java" to the list of parameters passed to the installation program.

CTGOA0201W   The web application for TDCOfEM is already deployed onto Tivoli Common Reporting. The directory location is *tdcofem_web_app_location*

Explanation: During the installaton of TDCOfEM, the install application deploys the TDCOfEM web application onto the Tivoli Common Reporting server. A previously existing copy of the web application was found and the installation cannot proceed.

Administrator response: The first verification is to verify whether TDCOfEM is already not installed. If the application is already installed, you will need to uninstall it before you can deploy it again. If TDCOfEM is not installed, it is possible that a previous removal has failed and missed to remove the web application, in which case you use the following command to manually uninstall the web application: %TCR_DIR/eWas61/bin/wsadmin -username tcr_userid -password tcr_password -f %TDCO_DIR%/Undeploywar.jacl

CTGOA0202W   TCR installation path not found at *tcr_install_dir*

Explanation: The TDCOfEM installation program attempts to find the location of TCR automatically, but that automatic detection failed.

Administrator response: None, the installation proceeds without automatic filling of the field for TCR installation directory.

CTGOA0203W   TDCOfEM already exists in the provided installation path at *tdcofem_path*

Explanation: The TDCOfEM installation program checks for the existence of other content inside the directory designated for the installation. If the check finds other files in the directory, the installation is interrupted.

Administrator response: Clear the contens of the target directory or indicate a different directory for TDCOfEM installation.

CTGOA0204W   Incorrect character *invalid_char* **in the installation path** *install_path***.**

Explanation: The operating system has limitations on the characters allowed for directory names and the installation cannot proceed.

Administrator response: Remove the illegal character from the path name and try the installation again.

CTGOA0205W   The TCR directory *tcr_dir* **is not correct.**

Explanation: The TDCOfEM installation cannot proceed without the correct location of the TCR installation directory.

Administrator response:

Appendix B. Data Analyzer messages

These messages are generated by the Data Analyzer.

CTGOB0001E   Model controller initialization failed due to : *error message*

Explanation: Attempt to connect to the database may have failed. The connection settings should be checked in the configuration page.

User response: Check if the DB connection settings are set correctly in the configuration page. Check if the server is running at the specified host. If not, contact the administrator to restart the server.

Administrator response: Check if the server is running on the specified host. Restart the server if the server is not running.

CTGOB0002E   Error in generating PIT Recommendations due to : *error message*

Explanation: This error has occurred while fetching the Point In Time Recommendations.

CTGOB0003E   Error in generating DPS PIT recommendations due to : *error message*

Explanation: This error has occurred while fetching the Point In Time recommendations for Dynamic Power Savings mode.

CTGOB0004E   Error in generating Server Pool Standby PIT recommendations due to : *error message*

Explanation: This error has occurred while fetching the Point In Time recommendations for Server Pool Standby mode.

CTGOB0005E   Workspace initialization failed due to : *error message*

Explanation: Attempt to connect to the database may have failed. The connection settings should be checked in the configuration page.

User response: Check if the DB connection settings are set correctly in the configuration page. Check if the server is running at the specified host. If not, contact the administrator to restart the server.

Administrator response: Check if the server is running on the specified host. Restart the server if the server is not running.

CTGOB0006E   Error while initializing the recommendation runtime space. The system error is : *error message*

Explanation: This error has occurred while fetching the recommendations from the Recommendation definition file.

CTGOB0007E   Error while initializing the target runtime space. The system error is : *error message*

Explanation: This error has occurred while fetching the targets from the Target definition file or while loading the power data for each of the targets.

CTGOB0008E   Failed to register the controller : *controller name*. **The system error is :** *error message*

Explanation: This error has occurred while loading the controller class.

CTGOB0009E   Failed to register the command : *command name*. **The system error is :** *error message*

Explanation: This error has occurred while loading the command class.

CTGOB0010E   Error occurred when trying to invoke method : *method name* **from class** *class name* **The system error is :** *error message*

Explanation: This error has occurred while loading the class using Class object and invoking the method in it. There may be a class/method access issue.

CTGOB0011E   Error occurred when Command Controller was trying to execute the command : *command name*. **The system error is :** *error message*

Explanation: This error has occurred while the command controller was executing a command. There may be a class/method access issue.

CTGOB0012E   Error occurred while accessing data of server node attribute. Invalid attribute is present in command context : *cmd context id*.

Explanation: This error has occurred while the server

CTGOB0013E • CTGOB0205W

node data accessor was processing the command context. This may be due to invalid input set in the command context of the server node.

CTGOB0013E   Atomic time box is not set or an invalid value is set for the atomic time box

Explanation: This error has occurred while the server node data accessor was processing the command context. This may be due to invalid atomic time box set in the command context of the server node.

CTGOB0014E   There is no energy rate plan named *energy rate* **in the system.**

Explanation: This messsage is produced upon report generation and indicates that the energy rate selected by the user was no longer available in the system. This situation is extremely rare and usually the result of another user concurrently modifying the configuration for energy rate plans.

Administrator response: Verify that the energy rate plan actually exists in the system. If so, report the problem to IBM support.

CTGOB0015E   There is no carbon unit mix named *carbon unit mix* **in the system.**

Explanation: This messsage is produced upon report generation and indicates that the carbon unit mix selected by the user was no longer available in the system. This situation is extremely rare and usually the result of another user concurrently modifying the configuration for energy rate plans.

Administrator response: Verify that the carbon unit mix actually exists in the system. If so, report the problem to IBM support.

CTGOB0016E   The given risk level *risk type* **is not a valid number.**

Explanation: This messsage is produced when non-integer risk value is passed to the recommendation builder.

Administrator response: Report the problem to IBM support.

CTGOB0017E   The given confidence level *confidence type* **is not a number.**

Explanation: This messsage is produced when non-integer confidence value is passed to the recommendation builder.

Administrator response: Report the problem to IBM support.

CTGOB0018E   Warehouse Database connection has failed.

Explanation: Attempt to connect to the database may have failed. Check the connection settings in the configuration page.

User response: Check if the DB connection settings are set correctly in the configuration page. Check if the server is running at the specified host. If not, contact the administrator to restart the server.

Administrator response: Check if the server is running on the specified host. Restart the server if the server is not running.

CTGOB0200W   Unknown recommendation: *recommendation name*

Explanation: This message indicates that the recommendation name provided is not present in the Recommendation definition file.

CTGOB0201W   In Command Controller, when running a command, the iterator *iterator name* **is not initialized.**

Explanation: This message indicates that the iterator is not initialized before evaluating the command.

CTGOB0202W   In Command Controller, the iterator is not a list, so executing the command *iterator name* **only once.**

Explanation: This message indicates that the iterator is not a list and will execute the command only once.

CTGOB0203W   In server pool data collector, the context does not contain server pool name input parameter value.

Explanation: This message indicates that the command context does not contain the required server pool information.

CTGOB0204W   In Standby/Powerdown point-in-time recommendation generator, the context does not contain a valid server pool name

Explanation: This message indicates that the command context does not contain the required server pool information.

CTGOB0205W   In Standby/Powerdown point-in-time recommendation generator, the context does not contain a valid time range

Explanation: This message indicates that the command context does not contain the required time range information.

CTGOB0206W In Standby/Powerdown point-in-time recommendation generator, the context does not contain a valid frequency type

Explanation: This message indicates that the command context does not contain the required frequency type information.

CTGOB0207W In Standby/Powerdown point-in-time recommendation generator, null CPU data obtained for server

Explanation: This message indicates that the server node contains no CPU information

CTGOB0208W Unsupported data granularity for this model type *model type*

Explanation: This message indicates that the time span granularity (Hourly, Daily, etc) provided is not available for that model type (Blade Server, Rack Server, etc).

Appendix C. Console messages

These are messages that are generated from the Data Center Optimization console user interface.

CTGOC0001E   Error: Connection to the database has failed. Verify the connection details and try again. The cause for the error, if specified by the system, is: *error message*

Explanation: The attempt to connect to the database has failed. Check the connection settings in the Configuration page.

User response: Check the database connection settings in the Configuration page. Ensure that the server is running on the specified host. If it is not, ask the administrator to restart the server.

Administrator response: Ensure that the server is running on the specified host. Start the server if it is not running.

CTGOC0002E   Error: Unable to save data to the configuration file. The cause for the error, if specified by the system, is: *error message*

Explanation: Attempt to save to the configuration properties file has failed. The dcofp.properties file may be missing.

User response: Contact Support for assistance.

Administrator response: Contact Support for assistance.

CTGOC0003E   Error: Unable to reset the configuration data. The cause for the error, if specified by the system, is: *error message*

Explanation: Reset tries to reload the properties file into the runtime object discarding all unsaved data. The dcofp.properties file may be corrupted.

User response: Contact Support for assistance.

Administrator response: Contact Support for assistance.

CTGOC0004E   Error: Unable to save changes to the Target file. The cause for the error, if specified by the system, is: *error message*

Explanation: The attempt to save to the Target definition file has failed. The TargetInfo.xml file may be missing or corrupted.

User response: Contact Support for assistance.

Administrator response: Contact Support for assistance.

CTGOC0005E   Error: Unable to add new group called *group name* **to the Target file. The cause for the error, if specified by the system, is:** *error message*

Explanation: The attempt to add new server group to the Target definition file has failed. The TargetInfo.xml file may be missing or corrupted.

User response: Contact Support for assistance.

Administrator response: Contact Support for assistance.

CTGOC0006E   Error: Unable to delete server group *group name* **from the Target definition file. The cause for the error, if specified by the system, is:** *error message*

Explanation: The attempt to delete a server group in the Target definition file has failed. The TargetInfo.xml file may be missing or corrupted.

User response: Contact Support for assistance.

Administrator response: Contact Support for assistance.

CTGOC0007E   Error: Unable to delete all the server information from the Target definition file. The cause for the error, if specified by the system, is: *error message*

Explanation: The attempt to delete all the server information from the Target definition file has failed. The TargetInfo.xml file may be missing or corrupted.

User response: Contact Support for assistance.

Administrator response: Contact Support for assistance.

CTGOC0008E   Error: Unable to import server information from the Tivoli Data Warehouse. The cause for the error, if specified by the system, is: *error message*

Explanation: The attempt to import server information from the Tivoli Data Warehouse has failed. This may be caused by a connection failure to the Tivoli Data Warehouse.

User response: Ensure that the database connection settings are correct in the Configuration page. Ensure that the server is running at the specified host. If it is not, ask your administrator to restart the server.

Administrator response: Ensure that the server is running on the specified host. Start the server if it is not running.

CTGOC0009E   An error occurred when setting the From Date Range of the Report Period. The cause for the error, if specified by the system, is: *error message*

Explanation: The attempt to set the From Date Range has failed.

User response: Contact Support for assistance.

Administrator response: Contact Support for assistance.

CTGOC0010E   An error occurred when setting the To Date Range of the Report Period. The cause for the error, if specified by the system, is: *error message*

Explanation: The attempt to set the To Date Range has failed.

User response: Contact Support for assistance.

Administrator response: Contact Support for assistance.

CTGOC0011E   Error: Failed to delete template file *template file name*

Explanation: An attempt to delete a template file has failed. It is possible that the file was already deleted.

CTGOC0012E   An error occurred while attempting to save changes to the report template *templateName* **Error while parsing the date range :** *fromDate* **-** *toDate* **The cause for the error, if specified by the system, is:** *error message*

Explanation: This error may be caused by an incorrect date format.

CTGOC0013E   An error occurred while attempting to save changes to the report template *templateName* **Error while parsing the template parameter value of type date :** *date* **The cause for the error, if specified by the system is:** *error message*

Explanation: This error may be caused by an incorrect date format.

CTGOC0014E   The Design File setting is missing in the report template : *templateName* **Report cannot be generated without the design file.**

Explanation: This error may be caused by a corrupt report template file.

CTGOC0015E   An error occurred while retrieving the Date Range from the Report Template for the Report Generator. The cause for the error, if specified by the system, is: *error message*

Explanation: This error may be caused by an incorrect date format.

CTGOC0016E   An error occurred while attempting to invoke the Report Generator. The cause for the error, if specified by the system is: *error message*

Explanation: This error may be caused by incorrect input for the Report Generator.

CTGOC0017E   An error occurred while attempting to add the selected servers to server group :*group name***. The cause for the error, if specified by the system, is:** *error message*

Explanation: This error may be caused by a corrupted definition file.

CTGOC0018E   An error occurred while attempting to retrieve the server group list from the Target definition file. The cause for the error, if specified by the system, is: *error message*

Explanation: This error may be caused by a corrupted definition file. Contact Support for assistance.

CTGOC0019E   An error occurred while attempting to load the report template : *report template* **The cause for the error, if specified by the system, is:** *error message*

Explanation: This error may be caused by a missing template file. Refer to the server log for information or contact Support for assistance.

CTGOC0020E   An error occurred while attempting to copy the selected server information into the report template. The cause for the error, if specified by the system, is: *error message*

Explanation: This error may be caused by a corrupted template file. Refer to the server log for information or contact Support for assistance.

CTGOC0021E **An error occurred while loading the parameters of the report template. The cause for the error, if specified by the system, is:** *error message*

Explanation: This error may be caused by a corrupted template file. Refer to the server log for information or contact Support for assistance.

CTGOC0022E **An error occurred while trying to delete the report template :** *report template* **The cause for the error, if specified by the system, is:** *error message*

Explanation: This error may be caused by a missing template file. Refer to the server log for information or contact Support for assistance.

CTGOC0023E **An error occurred while resetting the report template when the Cancel button was clicked. The cause for the error, if specified by the system, is:** *error message*

Explanation: This error may be caused by a missing or corrupted template file. Refer to the server log for information or contact Support for assistance.

CTGOC0024E **An error occurred while saving the changes to the report template :** *report template file* **The cause for the error, if specified by the system, is:** *error message*

Explanation: This error may be caused by a missing or corrupted template file. Refer to the server log for information or contact Support for assistance.

CTGOC0025E **An error occurred while trying to add new Server Pool :** *server pool name* **The cause for the error, if specified by the system, is:** *error message*

Explanation: This error may be caused by a missing or corrupted template file. Refer to the server log for information or contact Support for assistance.

CTGOC0026E **Unable to delete server pool** *group name* **from the Target definition file. The cause for the error, if specified by the system, is:** *error message*

Explanation: The attempt to delete the server pool in the Target definition file has failed. The TargetInfo.xml file may be missing or corrupted.

User response: Contact Support for assistance.

Administrator response: Contact Support for assistance.

CTGOC0027E **An error occurred while retrieving a valid date range from the database. The cause for the error, if specified by the system, is:** *error message*

Explanation: This error may be caused by an incorrect date format.

User response: Contact Support for assistance.

Administrator response: Contact Support for assistance.

CTGOC0028E **Failed to load target server information from the datastore. System reason is:** *error message*

Explanation: During system startup, the application attempts to read the latest information about server groups from the Tivoli Data Warehouse. This operation failed, possibly because the database could not be accessed.

Administrator response: Check Energy -> Configuration -> Database settings to ensure your current database settings are correct.

CTGOC0029E **Data synchronization thread failed. System reason is:** *error message*

Explanation: When the auto refresh of server data is set, it attempts to read the latest information about server groups from the Tivoli Data Warehouse. This operation failed, possibly because the database could not be accessed.

Administrator response: Check Energy -> Configuration -> Database settings to ensure your current database settings are correct.

CTGOC0030E **An error occurred when the Start button on the Targets page was clicked to enable the automatic data synchronization. System reason is:** *error message*

Explanation: When the auto refresh of server data is set, it attempts to read the latest information about server groups from the Tivoli Data Warehouse. This operation failed, possibly because the database could not be accessed.

Administrator response: Check Energy -> Configuration -> Database settings to ensure your current database settings are correct.

CTGOC0031E **An error occurred when the Stop button on the Targets page was clicked to disable the automatic data synchronization. System reason is:** *error message*

Explanation: When the auto refresh of server data is

turned off, it attempts to stop/interrupt a running thread. This operation failed, most likely because the thread could not be stopped.

CTGOC0032E An error occurred while checking for data requirements in the Tivoli Data Warehouse for the selected report template. System reason is: *error message*

Explanation: This operation involves checking for required tables in the Tivoli Data Warehouse. This data is cached in the QueryInfo.xml. There may be a problem reading this definition file.

CTGOC0033E An error occurred while loading the Data Analyzer controller. System reason is: *error message*

Explanation: This operation involves initializing the Data Analyzer controller. There may be a problem reading this object.

CTGOC0034E An error occurred while loading the status of the Data Analyzer. System reason is: *error message*

Explanation: This operation involves accessing a runtime object to retrieve the status of the model controller in the data analyzer. There may be a problem reading this object.

CTGOC0035E An error occurred while loading the recommendation items from the model controller's workspace in the data analyzer. System reason is: *error message*

Explanation: This operation involves accessing the model controller's workspace in the data analyzer. There may be a problem reading this object.

CTGOC0036E An error occurred while starting the data analysis. System reason is: *error message*

Explanation: This problem may occur if the objects in the model controller's workspace are not initialized correctly and fail to start the timer task.

CTGOC0037E An error occurred while stopping the data analysis. System reason is: *error message*

Explanation: This problem may occur if the objects in the model controller's workspace are in use and fail to stop the timer task.

CTGOC0038E An error occurred while restarting the data analysis. System reason is: *error message*

Explanation: This problem may occur if the objects in the model controller's workspace are in use and fail to stop the timer task, or if the objects are initialized incorrectly the timer task may fail to start.

CTGOC0039E An error occurred while trying to save the data analysis settings into the model controller's runtime workspace. System reason is: *error message*

Explanation: This problem may occur if the objects in the model controller's workspace are in use and are causing a synchronization problem in the timer tasks.

CTGOC0040E An error occurred while retrieving the build number from the properties file. The cause for the error, if specified by the system, is: *error message*

Explanation: This error may be caused by an input/output access issue of the properties file.

CTGOC0041E An error occurred while removing a reference of the server *server name* **from** *group name***. The cause for the error, if specified by the system, is:** *error message*

Explanation: This error occurs when trying to remove a server reference from a server group, server pool or IPDU. The error may caused by an input/output access issue of the datastore files.

Appendix D. Reporting messages

This message can be written during report generation.

CTGOD0001E   Error while generating the report :
  Report name **The cause for the error, if specified by the system is:** *error message*

Explanation: This error may be caused by a connection failure to the Tivoli Data Warehouse. The installer may have failed to install the database drivers. Refer to the install log.

User response: Ensure that the database server is running on the specified host. If not, request that your administrator restart the server.

Administrator response: Ensure that the database server is running on the specified host. If not, request that your administrator restart the server.

Appendix E. Configuration datastore messages

These messages are written when configuration data is updated.

CTGOE0001E   Unable to save definitions for carbon unit calculation to file: *filename*. **The cause for the error, if specified by the system is:** *error message*

Explanation: Upon user request, the system will write all carbon unit energy mix information to the configuration datastore. This message indicates that the attempt to write to the specified file has failed.

Administrator response: Typical causes for the failure are lack of permissions to write to the file or a full filesystem. The message should contain a reference to the information reported by the underlying operating system specifying the nature of the problem.

CTGOE0002E   Unable to load definitions for carbon unit calculation from file: *file_name*. **The error message reported by the operating system, if any, is:** *error_msg*

Explanation: The carbon unit definitions are loaded upon system startup and used in various reports. The system cannot read the file.

User response: Report the problem to the system administrator, including the filename location and the error message associated with this message.

Administrator response: Inspect the error message for additional information about the failure and for system permissions to access the file.

CTGOE0003E   Unable to parse definitions for carbon unit calculation from file: *file_name*. **The error message reported by the parser, if any, is:** *error_msg*

Explanation: The carbon unit definitions are loaded upon system startup and used in various reports. The system can read the file from disk, but cannot understand its contents. A possible cause is that a previous attempt to write the file did not complete successfully and left a corrupted version of the file on disk.

User response: Report the problem to the system administrator, including the filename location and the error message associated with this message.

Administrator response: Attempt to restore the last carbon unit energy mix definitions from backup.

CTGOE0004E   Unable to save definitions for energy rate plans to file: *filename*. **The cause for the error, if specified by the system is:** *error message*

Explanation: Upon user request, the system will write all energy rate plans to the configuration datastore. This message indicates that the attempt to write to the specified file has failed.

Administrator response: Typical causes for the failure are lack of permissions to write the file or a full file system. The message should contain a reference to the information reported by the underlying operating system specifying the nature of the problem.

CTGOE0005E   Unable to load definitions for energy rate plans from file: *file_name*. **The error message reported by the operating system, if any, is:** *error_msg*

Explanation: The energy rate plan definitions are loaded upon system startup and used in various reports. The system cannot read the file.

User response: Report the problem to the system administrator, including the filename location and the error message associated with this message.

Administrator response: Inspect the error message for additional information about the failure and for system permissions to access the file.

CTGOE0006E   Unable to parse definitions for energy rate plans from file: *file_name*. **The error message reported by the parser, if any, is:** *error_msg*

Explanation: The energy rate plans are loaded upon system startup and used in various reports. The system can read the file from disk, but cannot understand its contents. A possible cause is that a previous attempt to write the file did not complete successfully and left a corrupted version of the file on disk.

User response: Report the problem to the system administrator, including the filename location and the error message associated with this message.

Administrator response: Attempt to restore the last energy rate plan definitions from backup.

CTGOE0007E   Report Info definition file *filename* **does not exist.**

Explanation: The report info definition file is added during installation. This file contains the default data which is required for generating reports. This file is never deleted by the application. The application will fail to function without this file.

User response: Contact the system administrator and request that the report info definition be restored from the last available backup.

Administrator response: Restore the report info definition from the last available backup.

CTGOE0008E **Unable to load definitions to file:** *file_name*. **The error message reported by the operating system, if any, is:** *error_msg*

Explanation: The definition is loaded upon logging into the application and used for report generation. The system cannot read the file.

User response: Report the problem to the system administrator, including the filename location and the error message associated with this message.

Administrator response: Inspect the error message for additional information about the failure and for system permissions to access the file.

CTGOE0009E **Unable to parse definitions from file:** *file_name*. **The error message reported by the parser, if any, is:** *error_msg*

Explanation: The definitions are loaded upon system startup and used in various reports. The system can read the file from disk, but cannot understand its contents. A possible cause is that a previous attempt to write the file did not complete successfully and left a corrupted version of the file on disk.

User response: Report the problem to the system administrator, including the filename location and the error message associated with this message.

Administrator response: Attempt to restore the definitions from backup.

CTGOE0010E **Unable to save definitions to file:** *filename*. **The cause for the error, if specified by the system is:** *error message*

Explanation: Upon user request, the system will write all information to the configuration datastore. This message indicates that the attempt to write to the specified file has failed.

Administrator response: Typical causes for the failure are lack of permissions to write to the file or a full filesystem. The message should contain a reference to the information reported by the underlying operating system specifying the nature of the problem.

CTGOE0011E **Report Template file** *filename* **does not exist.**

Explanation: The template file is missing from the datastore. It may have been deleted manually, but its reference has remained in the ReportInfo definition file.

Administrator response: Remove the template reference from the ReportInfo file or attempt to restore the definitions from backup.

CTGOE0012E **This error occurred while trying to retrieve data from the DataQuery :** *name* **The cause for the error, if specified by the system is:** *error message*

Explanation: The database may not contain the information required by the query. Refer to the log for more details.

Administrator response: Check the availability of data in the database.

CTGOE0013E **This method** *method_name* **used by the DataQuery does not exist. The cause for the error, if specified by the system is:** *error message*

Explanation: This method needs to be present in the QueryHandler class.

CTGOE0014E **The error occurred when the method** *method_name* **was executed by the DataQuery. The cause for the error, if specified by the system is:** *error message*

Explanation: This error can occur if the Data Center Optimization for Energy Management libraries are corrupted. Contact Support for assistance.

Administrator response: Attempt to restore the libraries from backup.

CTGOE0015E **The error occurred when the method** *method_name* **was executed by the DataQuery. The access level of the method needs to be corrected. The cause for the error, if specified by the system is:** *error message*

Explanation: This error can occur if the Data Center Optimization for Energy Management libraries are corrupted. Contact your administrator for assistance.

Administrator response: Attempt to restore the libraries from backup.

CTGOE0016E **An error occurred while retrieving the minimum date of the records in the database. The cause for the error, if specified by the system is:** *error message*

Explanation: An error occurred while retrieving the minimum date of the records in the database. Check the log for the exception that was generated by the query. There may be incorrect parameters in the query.

CTGOE0017E   An error occurred while retrieving the maximum date of the records in the database. The cause for the error, if specified by the system is: *error message*

Explanation: An error occurred while retrieving the maximum date of the records in the database. Check the log for the exception that was generated by the query. There may be incorrect parameters in the query.

CTGOE0018E   Failed to construct node data accessor query.

Explanation: This error occurs while building an SQL query string which is partially read from a properties file. Contact Support for assistance.

CTGOE0019E   Error : *param value* **is not a valid** *param type* **type.**

Explanation: This error occurs when user tries to generate report with invalid input, like integer or float values containing alphabetic characters.

CTGOE0020E   Error : *date1 name* **should be earlier than the** *date2 name*

Explanation: This is a validation failure message displayed after validating the date range parameters.

CTGOE0021E   Unable to create targets directory under the datastore directory.

Explanation: This may be due to restricted permission settings. Check the permissions on the datastore directory.

CTGOE0022E   Unable to delete the target file : *file name*

Explanation: This may be due to restricted permission settings. Check the permissions on the datastore directory.

CTGOE0200W   Carbon unit definitions file *filename* **does not exist.**

Explanation: The carbon unit definitions are loaded upon system startup and used in various reports. This file was somehow deleted from the system.

System action: The system will create a new file with default definitions so that the rest of the system can continue operating.

User response: Contact the system administrator and

request that the carbon unit energy mix definitions be restored from the last available backup.

Administrator response: Restore the carbon unit energy mix definitions from the last available backup.

CTGOE0201W   Energy rate plan definitions file *filename* **does not exist.**

Explanation: The energy rate plan definitions are loaded upon system startup and used in various reports. This file was somehow deleted from the system.

System action: The system will create a new file with default definitions so that the rest of the system can continue operating.

User response: Contact the system administrator and request that the file be restored from the last available backup.

Administrator response: Restore the file from the last available backup.

Appendix F. Common messages

These messages can be written by any component within Data Center Optimization.

CTGOF0001E   Error: Connection to the database has failed. Verify the connection details and try again. The cause for the error, if specified by the system is: *error message*

Explanation: The attempt to connect to the database has failed. Check the connection settings in the Configuration page.

User response: Check the database connection settings in the Configuration page. Ensure that the server is running at the specified host. If it is not, request that your administrator restart the server.

Administrator response: Check if the server is running on the specified host. Restart the server if the server is not running.

CTGOF0002E   Error while checking for closed database connection. The cause for the error, if specified by the system is: *error message*

Explanation: Error occurred while checking for closed database connection.

User response: Ensure that the database connection settings are correct in the Configuration page. Ensure that the server is running at the specified host. If it is not, request that your administrator restart the server.

Administrator response: Ensure that the server is running on the specified host. Restart the server if it is not running.

CTGOF0003E   An error occurred while trying to close the database connection. The cause for the error, if specified by the system is: *error message*

Explanation: An error occurred while trying to close the database connection.

CTGOF0004E   An error occurred while executing the SQL query : *query* **The cause for the error, if specified by the system is:** *error message*

Explanation: An error occurred while executing the SQL query. Check the log for the exception that was generated by the query. There may be incorrect parameters in the query.

CTGOF0005E   An error occurred while retrieving the target information from the database. The cause for the error, if specified by the system is: *error message*

Explanation: An error occurred while retrieving the target information from the database. Check the log for the exception that was generated by the query. There may be incorrect parameters in the query.

CTGOF0008E   Unable to locate the application context path : *context path* **The cause for the error, if specified by the system is:** *error message*

Explanation: The application name set in the context path is incorrect. Contact Support for assistance.

CTGOF0009E   Unable to load the properties file : *prop file* **The cause for the error, if specified by the system is:** *error message*

Explanation: This error occurs if the properties file is missing. Contact Support for assistance.

CTGOF0010E   Unable to save to the properties file : *prop file* **The cause for the error, if specified by the system is:** *error message*

Explanation: This error occurs if the properties file is missing. Contact Support for assistance.

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