SIEMENS

Power Monitoring and Analytics

Energy Efficiency for your data center – Application Sheet.
Data center solutions from Siemens for the factories of the 21st century.

Power monitoring and analytics help identify efficiency levers caused by power losses, unbalanced power paths and different types of loads represented by power factor cos φ

Customer Challenge

Power monitoring and analytics in data centers are important elements in order to improve efficiency and safeguard continuous operation. A holistic view of the entire power distribution chain with its related electrical suppliers and consumers therefore becomes essential and represents the starting point of a suitable comprehensive solution for power load management.

In terms of power, several aspects and elements have to be considered, monitored and finally managed by concrete actions. As with other efficiency improvement measures, gaining transparency is key, and power monitoring solutions will help achieve this goal. Transparency of the power distribution layout and related loads paired with specific expertise forms the basis for identifying efficiency improvement levers. The results of implementing them can decrease energy bills and/or contribute to safer operation. For instance, a reduction of reactive power can immediately decrease energy bills whereas phase load balancing will safeguard operation by avoiding any unnecessary tripping of circuit breakers due to uneven phase load distribution.

Power monitoring displays a wide range of values and KPIs. Some of the elements should be monitored and analyzed continuously to safeguard operation. Others, such as total harmonic distortion (THD), have to be analyzed based on incidents. In the following chapter three of the most important topics for daily operation are explained in more detail.

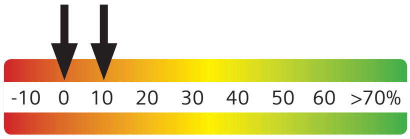
Power Losses

Each electrical component along the power supply line generates losses; some of them can be influenced while others are practically impossible to influence. Typically, planners use the full-load specification for a data center to plan a comprehensive solution, including sizing of equipment. In reality many data centers (e.g. colocation) do not use the full power infrastructure capacity when they run out of rack space. Therefore a potential gap might result and the infrastructure does not run in an ideal constellation regarding power losses.
Power losses are a combination of one or more areas of inefficiencies. In terms of physics, there are three main types of losses:

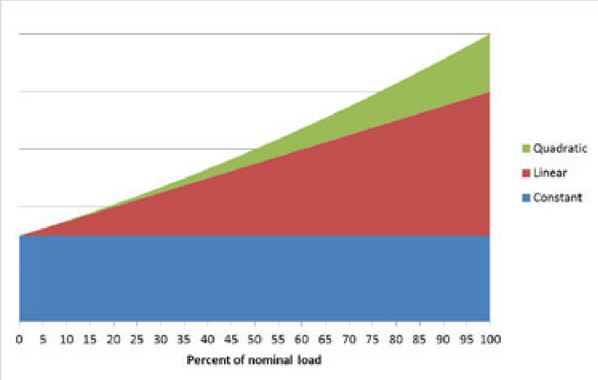
- Constant losses – no-load losses
- Linear losses – mainly due to losses in electronic components
- Quadratic losses – Joule effect

Typically, UPS systems and transformers, followed by power cables, are the biggest producers of losses in a data center. The total loss of a UPS is a combination of no-load losses, linear losses and quadratic losses. Transformers produce no-load losses and quadratic losses whereas power cables are virtually only affected by the Joule effect. An alternative to cables are bus systems which cause fewer losses. An analysis of the affected components will provide different improvement measures.
In order to determine the optimal operation point, the losses over load profile of these different components need to be analyzed.

Estimated savings potential



These values are guidelines only based on data from actual Siemens projects. The energy savings potential must be calculated individually for each project.



Phase balancing

In a worst case scenario where all loads are on one phase only, the power loss can be six times higher compared to a balanced phase distribution situation. If the load is not properly balanced between the three phases, the loss of one feed might lead to an immediate tripping of the overloaded phase. Dedicated management platforms with power monitoring and management capabilities (e.g. DCIM, BMS, EPMS) help manage the phase distribution to the different phases within the racks where most of the phase unbalancing potentially starts.

Power factor (cos φ)

The power factor of an AC electrical power system is defined as the ratio between the real power flowing to the load and the apparent power in the circuit. It is represented as the angle between both.
Phase displacement generated by capacities and inductances creates reactive power which must be taken care of while dimensioning cables, transformers etc.

In case reactive power gets too high, the utility company might install a reactive power meter and charge you for reactive power. In this case, a reactive power compensation system should be considered. Traditionally, more inductance loads were present. This has changed, especially with IT equipments which tend to have a more capacitive load. Many utilities accept having an inductive load of up to 10%, but usually not on capacitive loads. Having the appropriate transparency over the types of loads helps identify actions for potential efficiency improvement levers.

Siemens offers:

- Expertise for power monitoring solution design
- Power monitoring devices
- Power management applications to consolidate values retrieved from monitoring devices and for data analytics
- DCIM and BMS solutions (Data Center Infrastructure Management, Building Management System)
- Analyzing power loads and deriving efficiency improvement levers

Highlights

- Increased availability through transparency and awareness
- Reduction of reactive power and losses
- Power monitoring solution to help identify efficiency levers
- Improvement of stable operation and increased reliability
- Avoidance of unnecessary investment
- Reduced energy cost

Siemens Switzerland Ltd
Building Technologies Division
International Headquarters
Gubelstrasse 22
6301 Zug
Switzerland
Tel +41 41 724 24 24