

Measuring PUE at Multiple Levels

Power Usage Effectiveness (PUE), published by Green Grid, has emerged as the recognized standard to measure the energy efficiency of data centers. By theory, the concept of PUE is pretty straightforward – it’s a ratio of the total power delivered to a data center facility and the power finally delivered to the IT equipment.

$$\text{PUE} = \text{Total Facility Power} / \text{IT Equipment power}$$

This tells us how much extra energy is needed for each usable kWh for the IT equipment due to the power going into cooling, power distribution losses etc. The more efficient the data center, the closer the PUE value to 1. According to Uptime Institute, a typical data center has an average PUE of 2.5 and with more efficient equipment and adoption of best practices most facilities could achieve 1.6 PUE.

Given the humongous number of devices in a data center, with multiple metering points and various complexities in measuring power at certain levels, PUE measurement can be much more than simple arithmetic. The PUE can change depending on where measurements are made, when they are made and the time span the measurements are made in.

Green Grid has now standardized the way PUE is measured. The methodology and frequency of PUE measurement should be part of the data center’s overall efficiency program. Depending on size, scale and tier of a data center, its efficiency program can mainly be at three levels of maturity namely Basic, Intermediate and Advanced. Green Grid has recommended three levels of PUE calculation corresponding to the maturity levels as illustrated in the table below.

Measurement Methodology & Frequency	Maturity Levels		
	Basic (Level 1)	Intermediate (Level 2)	Advanced (Level 3)
Total Facility Power	Data center input power	Data center input power less shared HVAC	Data center input power less shared HVAC plus building lighting, security
IT Power	UPS	PDU	Server
Frequency of measurement	Monthly/weekly	Daily	Continuous

For Basic and Intermediate measurement, it is recommended that the measurements be taken at the same time of the day which will ensure that the data center load trend is same. Even for weekly or monthly measurements, the same day of the week or month should be considered to ensure load consistency.

Improving energy efficiency of a data center is a continual process and this can happen through gradual maturity in the energy efficiency program. So the data center has to keep on improving the way it measures its PUE. With maturity comes complexity in measurement and that is when automation of the PUE measurement process with GFS Crane DCIM can be of immense help to data center managers and operators.

Power Measurement and Multi-level PUE Calculation through GFS Crane DCIM

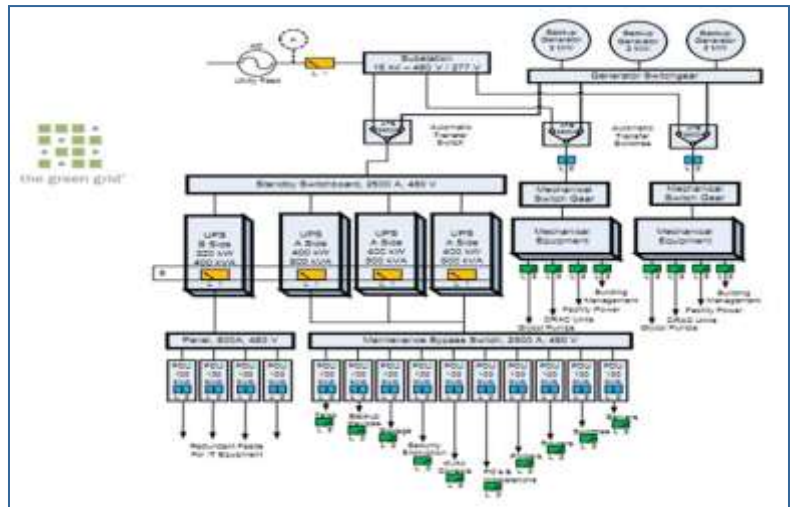
In order to calculate PUE of a data center accurately, it is absolutely important to measure power consumption data from all related equipment.

GFS Crane DCIM comes with the unique capability of measuring power consumption from every device that can possibly be part of a data center’s ecosystem. There are two types of power metering methods that GFS Crane DCIM uses – hard metering and soft metering

Hard metering is the measurement of power consumption of a device using external hardware sensors. Hard metering can be done using energy meters, intelligent PDUs or by integrating with an existing Building Management System (BMS), where equipment power consumption is already being captured by the BMS.

For measuring power consumption of servers, GFS Crane DCIM has a unique offering called soft metering of power, where the software uses the built-in Intel DCM Energy Director Module to measure server power without any external energy meter.

Due to its powerful power metering capabilities at all levels of the data center’s power chain, GFS Crane DCIM can be configured to measure PUE at all three levels, as recommended by Green Grid. The PUE calculated by GFS Crane is based on two sets of data captured from the devices – instantaneous or real time data and historical data. While the real time PUE tells the data center about its actual health at any given point in time, the historical PUE helps in doing trend and impact analysis due to certain changes in the data center topology. This eventually helps in predicting failures or doing capacity planning for the data center.



The PUE measured at the different levels can then be compared through a common dashboard which can help in identifying the losses or inefficiencies at different levels. From this comparative analysis, the data center can take corrective action based on actual data to improve the PUE and hence the efficiency of the entire data center or a particular portion of the power chain.

