Power Usage Efficiency In West Bengal State Data Centre:

Analysing Power Consumption Efficiency Improvement

Data Centres consume a considerable amount of power for their smooth functioning and can cause significant loss of money and energy with lack of proper infrastructure management. Findings and strategies contextual to West Bengal State Data Centre for optimizing the utilization of power energy resources discussed here.

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West Bengal State Data Centre (WBSDC), envisioned as the shared, reliable and secure infrastructure services centre for hosting and managing the e-Governance Applications of State and its constituent departments has been developed as a part of Mission Mode Project under the National e-Governance Plan (NeGP). WBSDC strives to ensure following of common principles and policies towards the realization of this vision.

As one of the pivotal constituents of National e-Governance Plan (NeGP), a series of various Government Departments applications are being hosted at WBSDC. The WBSDC is a key supporting element of e-Government Initiatives & businesses for delivering services to the citizens with greater reliability, availability and serviceability of the Government Departments. SDC facilitates consolidation of services, applications and infrastructure, Central data repository, Secure Data Storage and Online Delivery of Services. The goal of SDC is to provide the most efficient state-of-the-art facilities for application hosting in all fields of WBSDC infrastructure such as Power Supply, Building Management System, Server Hosting, Network System (both passive and active), Security Infrastructure, Monitoring System etc. In the article, we will discuss the Power Supply system & Energy Management Plan in WBSDC and the way it is used to create an energy efficient solution.

PUE & DCiE

The benefits of determining data centre infrastructure efficiency as part of an effective energy management plan are widely recognized. The standard metrics of Power Usage Effectiveness (PUE) and its reciprocal Data Centre Infrastructure Efficiency (DCiE) have emerged as recognized standards.

Power Usage Efficiency (PUE)

The PUE metric is the most popular method of calculating energy efficiency. Although it is the most effective in comparison to other metrics, the PUE comes with its share of flaws. One real problem is PUE does not account for the climate or weather conditions within the cities the data Centres are built. In particular, it does not account for different normal temperatures outside the data Centre. For example, a data Centre located in Kashmir cannot be effectively compared to a data Centre in Kolkata. A colder climate results in a lesser need for a massive cooling system. Cooling systems account for roughly 30 percent of consumed energy in a facility, while the data Centre equipment accounts for nearly 50 percent. Due to this, the Kashmir data Centre may have a final Power Usage Effectiveness of 1.8 and the data Centre in kolkata may have a ratio of 2.7, but the Kolkata data Centre may be running overall more efficiently.

Having a facility that uses 1,00,000 kW of total power of which 80,000 kW is used to power your IT equipment, would generate a PUE of 1.25. The 100,000 kW of total facility power divided by the 80,000 kW of IT power.

Data Centre Infrastructure Efficiency- (DCiE)

DCiE is a performance improvement metric used to calculate the energy efficiency of a data Centre. DCiE is the reciprocal of PUE. It is calculated as a percentage by taking the total power of the IT equipment and dividing it by the total power into the data Centre multiplied by 100.

Example: Having that same facility that

uses 1,00,000 kW of total power of which 80,000 kW is used to power your IT equipment, would generate a DCiE of 80%. The 80,000 kW of IT power divided by the 100,000 kW of total facility power Multiplied by 100 to derive percentage.
PUE / DCiE are efficiency benchmarks comparing your data Centre's infrastructure to your existing IT load. The initial benchmarking of PUE / DCiE yields an efficiency score and sets a testing framework for the facility to repeat. Comparing initial and subsequent scores, data Centre managers can gauge the impact of what should be ongoing efficiency efforts. At any given time, they are comparing the power currently used for the IT equipment a company needs with the power used by the infrastructure which keeps that IT equipment cooled, powered, backed-up, and protected.
Finally, the purpose of PUE and DCiE is to provide easy to be interpreted values which can help to determine:

- Opportunities to improve a data centre's operational efficiency.
- Opportunities to re-purpose energy for additional IT equipment.

PUE	DCiE	Level of Efficieny
3.0	33%	Very Inefficient
2.5	40%	Inefficient
2.0	50%	Average
1.5	67%	Efficient
1.2	83%	Very Efficient

PUE AND DCiE AT WBSDC

In line with the PUE & DCiE requirement for power analysis, following measurements were taken at WBSDC for its IT equipments from all three phases of power supply from UPS:

Power Consumption Details			
	Supply Phase1	Supply Phase 2	Supply Phase 3
UPS-1 (128KW)			
POWER (KW)	7	6	7
Total Power	20KW		
UPS-2 (128KW)			
POWER (KW)	8	12	11
Total Power	31KW		
UPS-3 (128KW)			
POWER (KW)	8	7	7
Total Power	22KW		

From the above table, the total load from IT equipments is 73 KW for the WBSDC, whereas the supply power is 360 KW. With this we arrive at the following calculation for PUC & DCiE:

Sl. No.	PUC/ DCiE	Calculation
1	PUC	4.93
2	DCiE	20.18%

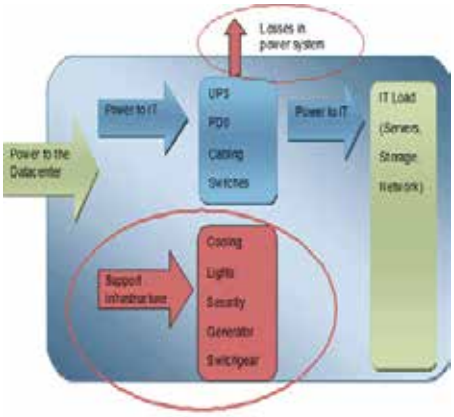
With the above calculation, WBSDC falls under highly inefficient data Centre category, as the power consumption by the IT equipments is very less than the actual power provisioning.

HOW TO INCREASE POWER USAGE EFFICIENCY IN WBSDC?

A PUE value of 4.93 is quite unusual for a data Centre. It means that for every watt required to power a server, 4.93 watts of power is consumed. Since we pay for every watt of power entering the data Centre, every watt of overhead represents an additional cost. Reducing this overhead will reduce the overall operating costs for the data Centre.

The three ways in which we can bring about a change and improve data Centre energy efficiency include:

- Reducing the power going to the support infrastructure
- Reducing losses in the power system.
- Providing supply to more IT equipments to create balance between supply and utilization.



- This way we can ensure that more of the power entering the data Centre should make it to the IT load; consequently, improving data Centre energy efficiency and reducing the PUE.

Elaboration of Total power consumption in WBSDC

Even considering the total consumed load

Sl.	Equipments	Load
1	Total Load Consumption for server/ IT equipments	73KW
2	Total [illegible] for PAC	66KW
3	Total [illegible] for Utilities & BMS	16KW
	Total	155KW

at WSBSDC of 155 KW vis-à-vis total supplied load of 360 KW, there is a huge gap of almost 200 KW+ identified.

Prevention measures:

To have more efficient data centre power utilization, following two points may be considered:

- The stated load can be used for additional IT resources which will be provisioned at WBSDC in future and effectively, this will bring in a more energy efficient system in terms of power utilization.
- The Supply load may be reduced considerably to have a more energy efficient system.

WAY FORWARD

As per the above calculations and observations, it was concluded that WBSDC was inefficient in terms of energy and to overcome the problem, remedies must be taken upfront. There are future requirements for hosting applications and IT equipments at WBSDC. As there is ample room for power supply at WBSDC, the future provisioning of power supply must be done using existing supply instead of provisioning additional supply. Vis-à-vis, supply control may also be incorporated by initially reducing the total supply to a considerable capacity for serving the existing requirements and further, as and when the infrastructure grows, the requirements would be increased on an on-demand basis.

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