



GREEN IT

THE GREEN DATA CENTER WHERE ECOLOGY MEETS ECONOMY

We truly live in an information age. Data Centers serve a very important purpose—they provide the global community with nearly unlimited access to almost any kind of information we can imagine. The problem is that they consume great amounts of power, which can cause emissions that impact our environment.

The argument can be made that the Data Center itself can facilitate enough online transactions to prevent people from using their cars or consuming precious resources that will more than outweigh the impact of running the computing equipment necessary to serve data across the net. But, we can do more to protect our environment.

Eco-friendliness is mission-critical to our future. That said, the industry feels that the way forward is to make Data Centers GREEN. There are a number of initiatives that Wipro supports in this paper to help foster the convergence between the economy of conserving power and the ecology of maximizing computing resources to reduce environmental impact.

Abstract

We truly live in an information age. Data Centers serve a very important purpose—they provide the global community with nearly unlimited access to almost any kind of information we can imagine. The problem is that they consume great amounts of power, which can cause emissions that impact our environment.

The argument can be made that the Data Center itself can facilitate enough online transactions to prevent people from using their cars or consuming precious resources that will more than outweigh the impact of running the computing equipment necessary to serve data across the net. But, we can do more to protect our environment.

Eco-friendliness is mission-critical to our future. That said, the industry feels that the way forward is to make Data Centers GREEN. There are a number of initiatives that Wipro supports in this paper to help foster the convergence between the economy of conserving power and the ecology of maximizing computing resources to reduce environmental impact.

This paper will critically examine the means to maximize your Data Center's efficiency by providing you with a green perspective of your computing environment. Our goal is to give you the tools so you don't waste unnecessary power serving applications people don't use. Going green also means increasing the effectiveness of power consumed in cooling the systems of your Data Center.

Once you are able to look at your entire Data Center environment—it becomes clear how you can make it operate leaner and more efficiently. The way forward is to follow a green path where no processing cycle goes to waste. The result allows you to provide the same level of information from your Data Center, but with significantly less environmental impact.

Contents

Introduction_____	1
▪ Environmental Impact_____	1
▪ What if... _____	1
How does Wipro define a "Green" Data center? _____	2
▪ Green Data Center metrics_____	2
How to make the Data Center greener_____	3
▪ Reduce Wasted Energy_____	3
▪ Consolidation and Virtualization_____	3
▪ Managing Energy Efficiency_____	5
▪ Capacity Planning_____	5
Conclusion_____	6

Introduction

Both business and environmental goals are merging. Reducing both cooling and energy consumption equates to money saved. Companies go green not just because it is the right thing to do or that it is “expected” but because it reduces costs and increases earnings potential. Reducing the power requirements for Data Centers can mean less operating expenses and greater efficiency.

A Data Center answers the fundamental need for information. You can accomplish this goal by being good to the environment as well as your bottom line. This paper will demonstrate how “going green” is good for both the economy as well as the ecology!

In today’s environment, it is very clear that we must go green. However, following the path is not always easy. Many companies are either highly encouraged or forced to go green sooner. This is often due to regulations imposed by governmental agencies.

Environmental Impact

In the next couple of years, Data Centers are likely to release as much carbon in the atmosphere as the entire airline industry. This often makes Data Centers a target of environmentalists. However, it is important to note that over the long run, the byproducts resulting from a Data Center are far less damaging than the alternative.

What if...

For example, let’s say eBay did not exist. People would find it necessary to get in their cars and physically drive to the auction house. The emissions produced by all of these vehicles would far exceed the emissions produced from a Data Center. The idea is that a good Data Center can digitize multiple business processes in an online environment as opposed to the “real world.” The end result is that Data Centers produce a more “ecologically friendly” environment that actually does good.

A Data Center answers the fundamental need for information. You can accomplish this goal by being good to the environment as well as your bottom line. This paper will demonstrate how “going green” is good for both the economy as well as the ecology!

How does Wipro define a “Green” Data Center ?

Ecologically responsible members of an organization look to define an accurate

Its all about reducing the amount of emissions by maximizing the usefulness of the data center so that no energy cycle goes to waste.

measurement that combines all the topics covered in this white paper to produce work with the greatest efficiency possible. Wipro is working to define a green data center with a metric that can determine the good ratio of useful work completed vs. ecological impact caused to the environment.

Green Data Center Metrics

What is a good metric to measure a green Data Center? Wipro’s recommended metric is the Power Usage Effectiveness, which is known as the Green Grid standard. Determining and improving this metric will help the organization determine and create a more efficient computing model. This translates to delivering more effective services for every dollar spent.

This measurement determines the effectiveness of your Data Center by measuring the energy used by the IT equipment as well as all the ancillary equipment. . The objective is to make the environment better while also getting useful work done.

$$PUE = \frac{\text{TOTAL FACILITY POWER}}{\text{TOTAL IT EQUIPMENT}}$$

POWER

Total Facility Power (TFP) is the power being provided to the Data Center

Total IT Equipment Power (IEP) is the power used by the IT equipment in the Data center such as Storage equipment, Servers, Networking equipments, Desktops, Laptops, KVM Switches, and Display Units etc. Considering increased computing demands as well as high-density computational environments, the power distribution defined by PUE is the most critical factor.

For example, if you’re PUE score is 2, then the Data Center’s power demand is two times greater than the energy required for powering the IT equipment. A PUE value approaching 1.0 indicates 100% efficiency (i.e. All Power used by IT Equipment only), which is however impossible to achieve, since some power would be taken up by ancillary equipment, Data Center lighting and due to distribution losses.

You might ask, “How much did I impact the environment for every unit of useful work accomplished by my Data Center? It really isn’t measuring how much you degrade the environment, but rather reducing the amount of emissions by maximizing the usefulness of the Data Center so that no energy cycle goes to waste.

Wipro's Recommendation

Wipro's recommended PUE for a Green Data Center is in the range of 1.4 to 1.6. When the PUE increases beyond 1.6, it is indicative of the need to improve energy efficiency.

How to make the Data Center greener

i. Reduce Wasted Energy

There are ways in which you can make your Data Center greener just by getting rid of server applications that "eat" energy, but are not producing any business benefits.

Consolidation of multiple applications and application instances on a single server provides numerous benefits which include

Generally about 10% of a company's applications are not doing any useful work.

increased server utilization, elimination of redundancies, increased performance and reduced maintenance costs. This would eliminate the applications which exist in the inventory and are not being used. Generally about 10% of a company's applications are not doing any useful work. There could also be redundancies in IT utilisation as a by-product of mergers and acquisitions which need to be rationalized.

Wipro Recommendations

Wipro offers a comprehensive Application Rationalization solution that addresses both IT and Business problems through an end-to-end transformation approach. The recommended steps are:

- Perform a detailed analysis of the application inventory and build a repository of application inventory
- Map applications
- Conduct a 360 degree assessment and develop

scores for business value, technical value, cost and risk

- Identify opportunities to decommission, migrate, consolidate and modernize, based on the scores
- Lastly, design an application life cycle assessment or APM process integrated with internal investment budgeting and control

ii. Consolidation and Virtualization

Virtualization can make your Data Center leaner just by driving server utilization up. Most applications are running on machines with more horsepower than the program could ever possibly use. You can solve this problem by running multiple applications on just one server running virtualization software. Instead of running 10 servers at only 5% utilization, you can run just one server running at 80% utilization and unplug all the rest.

Case Study

Company	Power Transmission & Distribution, Retail Power, and Natural Gas
Location	UK
Objective	Outsource their Data Center Management and Transformation
Goal	Factor Environmental Parameters into their plans
Revenue	Over \$1 Billion (USD)
Personnel	Employs over 1500 people
Global Locations	20 subsidiaries in the UK

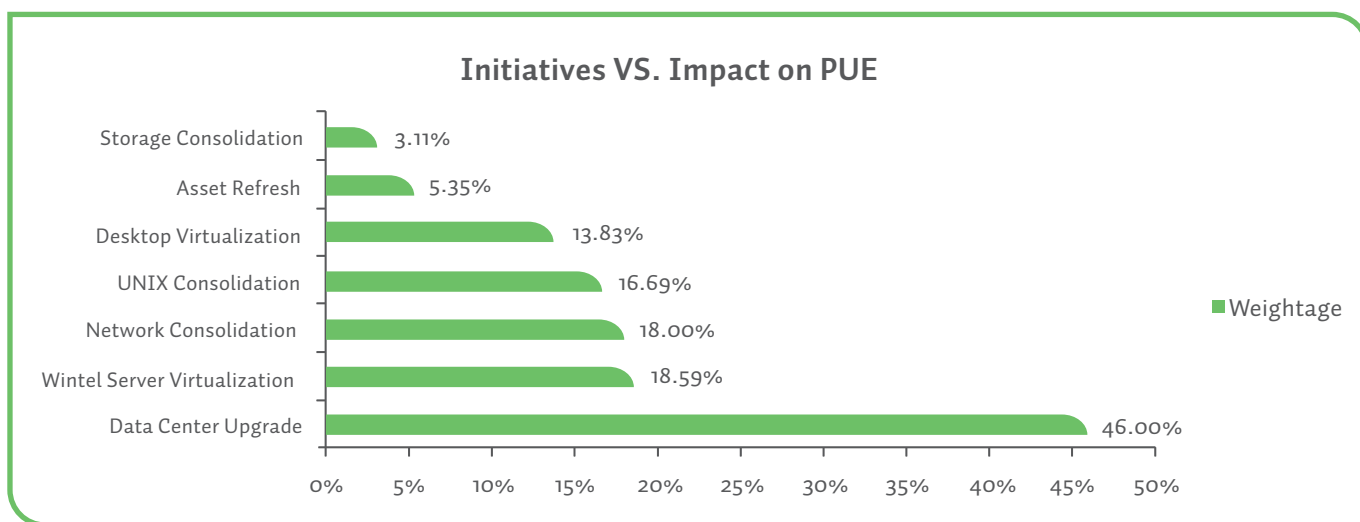
In the following case, Wipro has taken several prominent initiatives to reduce the Data Center PUE. The client had an IT estate where the Total Facility Power was 1259 KWh (including power used both by IT equipment as well as ancillary items such as chillers and lighting), then the total power consumed ONLY by the IT equipment is 547 kWh—generating a PUE value of $1259/547 = 2.3$.

In the following chart, you can see the percentage impact of various Consolidation and Virtualization initiatives on

the PUE.

In the below graph, weightage is based on Wipro's industry expertise. This metric is represented that resolving any one of these initiatives can reduce PUE by the corresponding percentage on the graph. This percentage can vary proportionally to the Data Center volumetric.

This client reduced 80% Windows Based Intel Servers through the consolidation of 47 Wintel Servers to 10 Wintel Servers.



Energy Savings Resulting from Server Consolidation:

DESCRIPTION	ORIGINAL	REVISED
Number of Servers	47	10
Power (kWh/year)	288,204	61,320
Cooling (BTU/Hour)	112,288	23,891
Carbon Emissions	34	7
Racks	5	1
Total Savings		80%

Wipro Recommendations

Storage, servers, and network equipment can all be consolidated based on both peak and average utilization. Consolidating several underutilized machines into high-end devices as well as rationalizing several instances of Operating Systems, Databases, and Applications can also bring down your PUE.

Wipro's Green Data Center deals with end-to-end server, storage, and network technology services. This includes assessments, virtualization planning, evaluation & selection of product solutions, system integration, testing, and management. Energy is also conserved by using components including occupancy sensors, auto vents, ambiators, and building management sensors.

iii. Managing Energy Efficiency

Usually, running an efficient system, where not a single Watt is wasted, can dramatically cut costs. "Chillers" and Computer Room Air Conditioners (CRACs) consume a great deal of energy moving air around to keep the Data Center cool. CRACs draw in air and force it under a raised floor. The air then comes out through planned perforated floor tiles. Air is drawn into the server and then evacuated out of the back of the server. The CRAC draws the hot air back into the unit and cools it down for recirculation. Problems can result when hot air is continually drawn back into the server where it can cause damage to the IT equipment.

Cooling is one such system which can help reduce

the overall Data Center expense.

Wipro Recommendations

Wipro designs Data Centers for Customers that take into consideration various factors such as the air flow, areas of heat generation and cooling. A few key aspects of Data Center design are:

- The concept of "Hot Aisle Containment" can help reduce energy consumption. There will be a self contained glass unit located behind the server row which captures heat. The air conditioning is located either in or above the row designed to take hot air within its enclosure and push it into a general row. The idea is not to move the cold air very far because the air can be cooled right at the source—all while using less energy!
- Repositioning floor tiles to efficiently manage cold airflow
- Install seals and grommets in the ceiling, walls, and floors (this reduces bypass airflow)
- Install "blanking plates" in the server cabinets to direct airflow more efficiently
- Seal cracks and crevices around power distribution devices
- Reduce the number of CRAC's by moving cold air where it needs to go instead of cooling the Data Center over capacity.
- Locate the data center in a place where air or water cooling techniques can be efficiently adopted; the result can be most favorable to economic and ecology considerations.

iv. Capacity Planning

CIO's face a constant challenge in determining future requirements of hardware and software for a network, datacenter or even a Web site due to the pace of business growth, dynamic changes in the business environment, mergers and acquisitions and even divestments. As a result most Data Center equipment is built for larger capacity than necessary, which again consumes more power than necessary.

Usage of an efficient demand management and capacity planning process to ensure availability of the right processing power and storage at the right time will greatly increase the Data Center efficiency.

Wipro Recommendations

Wipro works with Customers to design, build, integrate, manage and evolve at an optimized demand management and capacity planning process. This process obtains inputs from the Customer's strategic planning exercise and then converts this into an operational IT Plan and hence the Demand.

From a technology standpoint, Wipro recommends Thin Provisioning, a green storage technology that dramatically cuts disk capacity, energy, and floor space costs while substantially alleviating storage and system administration on Storage Area Network; Capacity is dedicated and configured in small increments from a single, non dedicated, comprehensively scalable pool—enabling customers to provision storage efficiently and without waste.

Conclusion

We are at the crossroads where ecology meets economy. Data Centers are a very necessary fabric of our IT society. Although critics state that their mere existence can adversely impact our environment, it can be successfully argued in this paper that Data Centers do more good than harm. Without the online nature of information distribution, people would be forced to use far more natural resources just to accomplish daily activities that are now done online.

Furthermore, there are a number of techniques described in this paper such as virtualization and cooling conservation that can make a new or existing Data Center work leaner while at the same time being more energy efficient.

Data Centers are an important fact of life—making them go greener is good for your wallet as well as the environment...

About the Authors

Vishwas Bhat

Area of expertise: IT Infrastructure

Vishwas works as a Senior Manager with the Global IT outsourcing practice in Wipro. He is part of a team working on global projects with end-to-end IT services scope.

Vishwas contributes regularly to several Green IT initiatives like Data Center Consolidation, Server Virtualization, Storage consolidation and Virtualization, Desktop Virtualization, Intel vPro rollouts and other cutting edge technologies.

Viraj Mitra

Area of expertise: IT Outsourcing

Viraj is a Practice Consultant with the Global IT outsourcing practice in Wipro. He is involved in designing asset management and transition strategies in global IT services projects.

Viraj actively contributes to several practice development initiatives such as Green IT strategies for Wipro and Unified Service Desk.

Anand Ramakrishnan

Area of expertise: IT Outsourcing

Anand is the Practice Head of the Global IT outsourcing practice in Wipro. He has been with Wipro for more than 7 years and has performed many roles across the company including leading solutioning and transitioning for large projects. Prior to that, he has worked as a program director, project manager and large bids manager for ERP and CRM for Asia Pacific and Middle East geographies.

Anand's significant area of interest is IT outsourcing and he has been an active promoter of practice development initiatives around Green IT strategies.