Volume 18 | February 2011

The DATACENTER Journal

Where IT, Facilities and Design Meet

SERVICE, SERVICE and MORE SERVICE

The Importance of **Customer Surveys**

Ensuring Customer Satisfaction – **What to expect from your Co-lo provider**

Be a part of "Our Community"
Join My Data Center Space at
www.datacenterjournal.com

IN THIS ISSUE

All rights reserved. No portion of DATA CENTER Journal may be reproduced without written permission from the Executive Editor. The management of DATA CENTER Journal is not responsible for opinions expressed by its writers or editors. We assume that all rights in communications sent to our editorial staff are unconditionally assigned for publication. All submissions are subject to unrestricted right to edit and/or to comment editorially.

AN EDM2R ENTERPRISES, INC. PUBLICATION ALPHARETTA, GA 30022
PHONE: 678-762-9366 FAX: 866-708-3068 | WWW.DATACENTERJOURNAL.COM
DESIGN : NEATWORKS, INC ALPHARETTA, GA 30022
TEL: 678-392-2992 | WWW.NEATWORKSINC.COM

DESIGN CORNER

Benchmarking Data Centers through LEED 2009

BY BRIAN RICHARD, KAPIL UPADHYAYA AND BRANDON McDANIEL

The value of benchmarking lies in its ability to set goals like investment, operation costs and carbon savings. However, benchmarking complex processes is often a challenging exercise. For one, it's difficult to separate these processes into components due to interdependencies; secondly, there can be large variations in components from process to process. Datacenter operation easily falls into the above type of processes.

INTRODUCTION

There are two types of ratings which have become standard practice for buildings: Design Rating, which evaluates design of buildings; and Operational Rating, which evaluates operation of buildings. Presently, due to the complex nature of datacenter buildings, there is no consistent metric adopted by the industry. Notably, operational cost of datacenters stands-out far above that of other building types due to high energy consumption. This is why many performance metrics for datacenters focus on energy consumption.

BENCHMARKING TOOLS

The following table shows all the metrics and performance criteria being used by the datacenter industry:The 'bytes/Btu' metric is probably the most appropriate energy metric as it truly relates the datacenter process, that of computing, to energy consumption. As mentioned earlier, all of the above except LEED NC focus solely on energy consumption.

Tool	Organization	Metric	Comments
Target Finder	EPA's Energy Star	Btu/sf	Design Energy Use Intensity (EUI)
Portfolio Manager	EPA's Energy Star	Btu/sf	Operational EUI
(Under development)	Green Grid Consortium	bytes/Btu	Data Center Energy Productivity
DC-PRO	DOE	Btu/Btu	Power Use Effectiveness
LEED NC	USGBC	Btu/sf; other metrics for water, waste, etc.	Design EUI; other metrics include assessment of site, materials, indoor air-quality and water consumption

ENERGY EFFICIENCY MEASURES

Energy efficiency measures in datacenters target loads, operations, cooling equipment, air-side and water-side systems. Some of the "best practices" are:

- Server Load / Computing Operations

High efficiency power supplies and virtualization technology are constantly evolving, as are variable speed servers. A well defined Load Management Program also contributes significantly to energy efficiency.

- **Cooling Equipment**

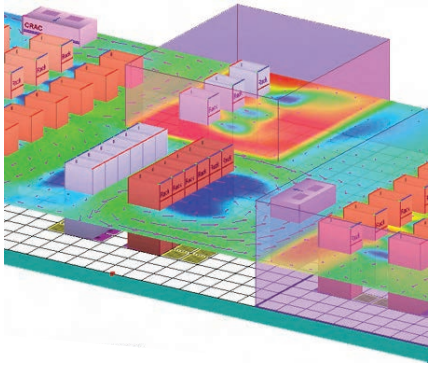
Measures in this category include: liquid cooling with high wattage per rack, optimized chilled water plants, free cooling, heat recovery and variable-speed distribution fans.

- **Air Delivery**

An integrated design process involving IT and HVAC engineer can avoid airflow design failures. Follow-ups between the two during operation ensure successful execution of design. Additional considerations include: overhead supply with VAVs, capping of cold aisles and blank-off plates in racks.

- **Use of Air-Side & Water-Side Economizers**

Depending on the climate, these can provide low-energy cooling, plant redundancy, whileavoiding particulates in datahall.



While the above measures represent "best practices" for energy efficiency in datacenters, there are other aspects that make datacenters resource intensive: high equipment density, low pollutant levels, emergency power backup and expensive energy contracts. To achieve a truly sustainable datacenter program, designers and operators need to integrate site selection, materials & resources and indoor environment quality in the overall design and operation strategy. Presently, LEED is the only rating system that benchmarks all of the above. LEED 2009 vs. LEED 2.2

The LEED rating system has undergone a significant metamorphosis in the last decade from the point of being geared towards office buildings to being inclusive of all building types. The success of LEED lies in its ability to exhaustively address sustainability issues under the following categories – Sustainable Sites (SS), Water Efficiency (WE), Energy and Atmosphere (EA), Materials & Resources (MR) and Indoor Environmental Quality (IEQ). A 'Design Rating' like LEED-CS or LEED-NC acts as a third-party quality-control mechanism for building/system designers. The other factor for LEED's success is its post-occupancy program, LEED-EBOM, which if adopted serves as the 'Operational Rating' and provides a third-party quality-control for building managers. The LEED rating system thus establishes benchmarks for design and operation processes thereby offering a roadmap of continuous improvement.

Until LEED 2.2, many sustainability issues were given equal weight age. However, with LEED 3.0 there is a marked increase in weight age carried by some of the site and energy credits. Credits are now more aligned between all LEED rating systems (NC, CS, Schools) under a common criteria. Each rating system is now standardized to 100 points with an additional six (6) points for Innovation and Design and four (4) points for Regional Priority. This standardization allows for easier comparison of performance of LEED Projects from different rating systems.

Comparison of Maximum Points Awarded between LEED-NC V2.2 & LEED 2009:

Category	LEED-NC v2.2	LEED-NC & Major Renovations 2009
Sustainable Sites (SS)	14	26
Water Efficiency (WE)	5	10
Energy & Atmosphere (EA)	17	35
Materials & Resource	13	14
Indoor Environmental Quality	15	15
Innovation & Design	5	5
Regional Credits	0	5
Total points	69	110

On an average, each LEED point has gone down in value from about 1.4% to 0.9%.

Energy efficiency programs, alone, fall short of addressing some other important resource conservation strategies for datacenters. LEED 2009 currently remains the best rating system to benchmark datacenters. New construction or renovation projects, that opt for a LEED rating system now, will be able to benchmark many resources while still having the opportunity to adapt later to newer rating systems.

However, EA and SS credits have gained value as is described below:

a. EA Credit 1 – Optimize Energy Performance, has the highest increase in points. Now "19 points" are possible (compared to "10" previously) with a range of energy cost percentage savings from 12% to 48%. More increments have been added. This will help datacenter design because there are now more increments available for the taking. The Optimize Energy Performance credit has 50% more weight age than previously while baseline systems have remained unchanged for datacenters. This is due to lack of specific guidelines for modeling datacenter systems.
Because of a higher weight age to this credit, Design dependency (equipment, floor layout and data hall HVAC distribution), Operational dependency (day to day operations and stacking procedure) and "best practices" can play a major role in achieving more points. Other credits that have gone up by 1 point, gained value and are dependent on EA1 are: EA Credit 2 (Onsite Renewable Energy) and EA Credit 6 (Green Power).

b. EA Credit 5.1, 5.2 - Measurement & Verification, has up to "6 points" (compared to "1" previously). It has gained almost 65% more weight age. It will be easily achieved in datacenters (though typically difficult on most buildings) because most of these employ separate metering and an energy management program.

c. SS Credit 2 - Development Density & Community Connectivity, has up to "5 points" (compared to "1" previously).
Its favorable for datacenters built within heavily populated/developed cities and away from rural areas. Greenfield datacenters (LEED-NC) will not benefit from this point. It is not cost-effective to build them in densely populated areas due to higher real-estate prices. This point will benefit retrofitted datacenters (LEED-CI). A datacenter located in a suburban rather than an urban area can be negatively affected by this credit.

d. SS Credit 4.1 – Alternative Transportation – Public Transportation, has up to "6 points" (compared to "1" previously).
Its favorable for datacenters located in urban areas of city rather than residential areas. HOWEVER, few datacenters are retrofitted or built new in urban areas due to real-estate prices (for new construction), constraints in multi-story ceiling heights (existing buildings) and oddly shaped buildings which make for in-effective use of space (i.e. can't effectively fit very many racks in the space). Ideal space as of late has been populated areas of cities containing one or two story office buildings. These buildings typically are not in close proximity to rail stations or proposed rail stations due to the lack of workers in the area. The same reasoning applies to availability of bus stops. It is our opinion that the increased value of this point will hurt rather than help data center construction. A datacenter located in a suburban rather than an urban area can be negatively affected by this credit.

e. SS Credit 4.3 – Alternative Transportation – Low-Emitting and Fuel Efficient Vehicles, has up to "3 points"" (compared to "1" previously). Points should be easily obtainable as have always been in this case with datacenters. Retrofitted datacenters usually have large parking lots with more space than needed. Number of employees is small that 5% of parking for fuel efficient vehicles is easily obtained. It will be easily achieved in new construction as well. Discounted parking rate (at least 20%) can be given in lieu of preferred parking.

f. SS Credit 4.4 – Alternate Transportation – Parking Capacity, has up to "2 points" (compared to "1" previously). This point is dependent on site-design to provide carpool parking similar to low-emitting parking. It will be easily obtained for datacenter design/construction due to low number of employees.

Finally, Region Priority Credit has been introduced now that reward a point for addressing specific issues in different regions of the country. For example in downtown Houston, TX the following will earn an extra point: stormwater quality control, stormwater quantity control, 75% construction waste diversion, an extra 1% over energy saving threshold.

ENVIRONMENTAL PERFORMANCE CRITERIA GUIDE FOR NEW DATACENTERS

The EPCG represents an ideal adaptation of the LEED rating system for datacenters. The guide was developed based on LEED2.2 by LBNL on behalf of California Energy Commission. The salient features of this guide include omission of certain credits, inclusion and modification of others, and also some redistribution of credit weight age.

The following credits/pre-requisites are omitted:
- Alternative Transportation (SS)
- Rapidly Renewable Materials (MR)
- Certified wood (MR)
- Environmental Tobacco Smoke Control (IEQ)
- Low-emitting materials (IEQ)
- Indoor chemical and pollution source control (IEQ)
- Controllability of systems - thermal comfort (IEQ)
- Thermal comfort (IEQ)
- Daylighting and Views (IEQ)

The following credits are added:
- Pre-requisite2 Fuel Storage and Handling, Storm Water Discharge Protection -(to prevent oil spills during re-fueling)
- Site Development, Impacts to Local Infrastructure (to promote

sites closer to generation facilities)
- Site Development, Noise Impacts (to reduce noise generation)
- Site Development, Air Quality and Emissions Impacts (to reduce emissions)
- Pre-requisite4 Minimum Energy Metering (to promote metering & trending)
- Enhanced Energy Sub-metering & Automated Reporting of Metrics of Performance (promote ongoing measurement and verification)
- Datacenter Acoustic Environment (to promote acoustically designed white spaces).

The EPCG retains the core structure of LEED2.2 while making relevant modifications. It represents the next adaptation that USGBC may incorporate in "LEED for Datacenters".

CONCLUSION

Energy efficiency programs, alone, fall short of addressing some other important resource conservation strategies for datacenters. LEED 2009 currently remains the best rating system to benchmark datacenters. New construction or renovation projects, that opt for a LEED rating system now, will be able to benchmark many resources while still having the opportunity to adapt later to newer rating systems. The current shortcomings in LEED can be overcome by certain modifications more attuned towards datacenters. LEED 2009 can be viewed as a step closer in the direction. ■

REFERENCES

ASHRAE 90.1, 2007, Energy Standard for Buildings Except Low-Rise Residential Buildings.

LEED Reference Guide for Green Building Design & Construction, 2009 Edition, USGBC.

New Construction & Major Renovation, Version 2.2 Reference Guide, Second Ed. September 2006, USGBC.

Save Energy Now, DOE Datacenter Energy Efficiency Program

http://www1.eere.energy.gov/industry/saveenergynow/pdfs/doe_data_centers_presentation.pdf

USGBC, www.usgbc.org

ABOUT THE AUTHORS

Brian Richard, AIA, NCARB is a Magna Cum Laude Honors graduate from the University of Louisiana at Lafayette, and a registered architect in Texas, Louisiana, New Mexico, and Virginia. He has been practicing in Science & Technology industries across the globe for over a decade, with projects ranging from large-scale research and development laboratories to small-scale real time operating centers. With his expertise into built and tangible solutions, Brian excels at Data Center design by integrating multiple disciplines and intellectually property. **(brianr@kirksey.com)**

Kapil Upadhyaya, LEED AP, is a Master of Science and working as a Building Energy Analyst for Kirksey EcoServices. He has facilitated an integrated design process on more than 30 LEED projects doing energy, envelope and daylighting analysis while creating energy efficiency benchmarks for buildings. **(kapilu@kirksey.com)**

Kirksey specializes in architecture, interior design, master planning and sustainable design & consulting. It has rapidly expanded in the national and global marketplaces. What began as a small commercial architecture firm in 1971 has evolved into a diverse organization of 11 focused practice groups -- Science/Technology, Commercial, Community/Religious, Country Clubs & Spas, Education, Government, Healthcare, Hospitality, Interior Architecture, Residential and Retail -- each supported by departments of Design, EcoServices (kirkseyGREEN™), Technology and Marketing.

Brandon McDaniel, LEED AP, is a Mechanical Engg. graduate with over 10 years of experience in design, construction and commissioning of mechanical systems for mission critical and industrial facilities. He has seven Mission Critical LEED projects to his credit that include 4 LEED Gold. Brandon also holds expertise in power generation for critical environments as well as for large-scale industrial projects. **(bmcdaniel@criticalprojectservices.com)**

Critical Project Services is a full-service, Consulting Management firm dedicated to the Mission Critical Industry. Our diverse experience in all facets of the design, procurement, construction and commissioning of mission critical projects enables Critical Project Services to perform a significant role in the management of all aspects of a project or program. Our unique ability to offer such a diverse array of services allows us to transcend typical industry boundaries and foster a unified project environment. This ability translates to not only a project that operates as a finely-tuned machine, but also to real cost and schedule savings.

CB®
CoolBalance

An Energy Saving Product

Stop wasting your cooling air!

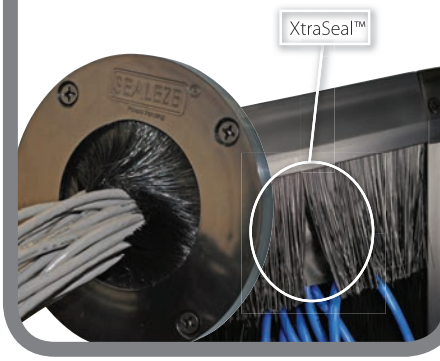
XtraSeal™ Technology provides a unique sealing system to eliminate loss of cool air into the hot aisle.

More Sizes– Faster ROI

Ideal for retrofitting existing data centers or new installations. In-Floor and Surface mount sizes from 5 x 5 inches to 10 x 24 inches, 4 and 6 inch circular seals.

Lower cost results in a faster return on your investment. Independent effectiveness testing* confirms our concept, so why pay more for the same results?

*Report available upon request



www.coolbalance.biz
800.787.7325
email: coolbalance@sealeze.com

SEALEZE
A Unit of Jason Incorporated
www.sealeze.com