

WHITE PAPER / **POWERING THE DATA MACHINE**

THE PATH TO FASTER, SMARTER AND MORE SUSTAINABLE DATA CENTERS

by Robert Bonar, PE, LEED AP AND Michael Bell, PE, LEED AP

Nearly all recent technological advancements share something in common — they require data. Hundreds of millions of high-resolution photos and videos are taken each day. Corporations are tracking browsing habits and buying profiles for every person online. Smart homes, virtual reality, movie streaming and business analytics — it's all data.



The world's population has grown increasingly data hungry. From the beginning of time until 2003, humans had created 5 billion gigabytes of information. By 2012, that same amount of data was being created every two days. Studies show the digital universe will continue to more than double every two years, reaching an estimated 44 trillion gigabytes by 2020 — much of that from emerging markets.

Data processing and storage has become a necessary utility, like electricity or water. The digital revolution has created an insane level of pressure to develop more powerful data centers — and more of them. The shift to the cloud demands a still larger commitment to data center infrastructure.

In a world increasingly dependent on data, solutions that get facilities online faster and lower the total cost of ownership create a competitive edge and a reliable foundation for company growth. Here are five critical elements to developing faster, smarter and more sustainable data centers.

LOCATION, LOCATION, LOCATION

How can companies be assured their data centers are in the right place? With strategic evaluation of the elements that combine to create a great site: proximity, climate, land costs, utility infrastructure (present and future), constructability, environment, permitting, economic incentives, community buy-in and more.

Site selection criteria for data centers and power generation facilities is remarkably similar. And, of course, access to reliable power is a key need for data centers — so knowledge of both facility types is a significant asset.

Companies historically located data centers on low-priced land with access to affordable power, so these buildings often ended up far from the locations where data was in demand. But as consumer expectations tighten on streaming speeds and cloud computing response times, we're seeing data storage providers trend towards a fleet that answers the demands of their unique population — whether it's a federal, consumer or enterprise population.

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Providers are building larger-than-ever data centers to meet storage expectations, while developing smaller facilities in metropolitan areas for activities that require agility and quick response times. Large or small, tactical siting is key. When a company's physical assets sync with its strategic plan, a fleet containing a mix of large and small facilities can help deliver data faster than the speed of light. Understanding a company's strategic goals can help match the specific need with the ideal site.

INTEGRATION WITH GENERATION

A decade ago, a 10-MW data center was considered large. Today, 100-MW centers are becoming more common — and some are as large as 600 MW. These facilities require an enormous amount of energy, so even a small variation in utility rates can make a big difference in operational costs.

When there is more integration between data centers and the utilities that serve them, we're seeing success for both parties. Data centers benefit when their power source is near; utilities benefit with a reliable customer for their electricity. (When it's made sense, we've worked with utilities who have incentivized rates for clients based on the reliable load a facility would provide.) Experience in both worlds can bridge the gap, from strategic siting to getting power to the site quickly during construction.

In fact, locating a data center near a power generation facility, existing or planned, may mean lower development and operational costs. Essential infrastructure like transmission and water lines are already in place. The two facility types often have similar needs — renewables and intermittent loads, for instance — so matchmaking can prevent double building and encourage shared costs. And when additional substations and power lines are needed, it helps to have strong relationships already in place.

COOLING THE CLOUD

Data centers generate a high level of heat density, especially with the shift to cloud computing. The need for water to cool those spaces is intense, and water usage efficiency (WUE) has become as vital as power usage effectiveness (PUE). A better approach to cooling can reduce operational costs by up to 50 percent while decreasing environmental impact.

Increasingly, companies are seeking out specialists in combined heat and power (CHP) systems. Widely deployed in healthcare, biotech and refinery markets, CHP is a well-tested solution for sustainable power generation. It also happens to provide two of a data center's most vital needs — energy and steam (water) — which makes these systems a perfect on-site partner.

CHP systems need an outlet for waste heat. In hospitals, the free steam might be used for building heat or equipment sterilization. In data centers, it's used to generate chilled water for free server cooling through a steam turbine or steam absorption chiller. And because the facilities are adjacent, transmission costs are nonexistent.

SUSTAINABLE GROWTH

Data centers have earned a reputation as energy hogs, accounting for about 2 percent of total energy consumption in the United States since 2010. Yet the technology companies who rely on them are some of the most sustainably-minded corporate citizens in the U.S.

These companies have already made great strides in increasing energy efficiency in data centers, from CHP systems to software that puts servers in low-power mode

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when not in heavy use. Those and other efforts have resulted in a dramatic slowing of power usage growth, moving from 24 percent between 2005 and 2010 to only 4 percent growth between 2010 and 2014. This efficiency is not only great for the planet, it has saved companies as much as \$60 billion over the past decade.

Increasingly, companies are choosing green-friendly solutions for energy — including solar, wind and hydroelectric — to either directly power data centers or offset the energy used from more traditional sources. We've helped clients balance their power usage mix by generating an equal amount of green energy for every megawatt they consume from coal or oil. Seeking out a one-stop shop for both data center development and renewable power generation can save time and effort.

SPEED THROUGH PROJECT DELIVERY

Computing time is money, so data centers must come online quickly and efficiently to meet the rapidly escalating need. Partnering internal staff with an integrated design-build delivery team helps companies fast-track data center projects by reducing owner risk, increasing cooperation, reducing owner staffing and establishing an environment for design and construction innovation.

Integrated design-build isn't common yet in the data center world, but its popularity has grown exponentially in other markets during the past two decades. It streamlines the process to a finely-honed mechanism, reducing costs, accelerating the schedule, and improving quality and safety. By compressing the middle of the schedule, a team can stack and package critical paths such as permitting and long-lead-time procurement items, reducing change orders and bottlenecks.

It's an especially effective approach when design and construction solutions are deployable in multiple locations, as with hybrid, modular or pre-fab data centers. Integrated delivery methods can shorten the project schedule by as much as 35 percent, allowing clients to meet previously impossible deadlines.

In some situations, the integrated design-build team can also operate as a developer and equity partner, handling all aspects of site selection and bringing in funding partners. It's the most dramatic way to lessen the burden of constant data center deployment, allowing a company to focus on its core business.

A POWERFUL PERSPECTIVE

Data is a complex and ever-evolving business — and so are data centers. Each of these elements overlap and interconnect to deliver dramatic advantages. How can companies assemble the puzzle pieces to capitalize on these potential benefits?

As the nation's top consulting firm for electric power generation, Burns & McDonnell brings a fresh perspective to data centers. We understand the inexorable connection between these two worlds, and the benefits a synergistic approach can bring in delivering data centers with incredible speed to market and at a low cost of ownership. Learn how our distinctive approach can help get data centers online quickly, efficiently and sustainably — with minimal headaches for you.

BIOGRAPHIES

ROBERT BONAR, PE, LEED AP, is a regional practice lead for Burns & McDonnell. With more than 25 years of experience, he specializes in managing design, construction, commissioning and operations. His work in data center design and construction senior management has spanned the United States, Latin America, Europe and Asia on large-scale design and construction projects. The bulk of his career has been spent on design-build projects for commercial, industrial, mission critical, higher education and multi-family. Robert has a Bachelor of Science in Engineering and Mechanical Engineering from Lehigh University and an MBA in Finance from Vanderbilt University-Owen Graduate School of Management.

MICHAEL BELL, PE, LEED AP BD+C, is a project manager at Burns & McDonnell with more than eight years of experience in mission critical facilities. He has worked on a variety of facilities in almost every major data center market in North America, cultivating a well-rounded perspective. Michael serves on the board for the AFCOM chapters in Denver and Kansas City and contributes to various data center forums. Michael has a Bachelor of Science in Architectural Engineering from Kansas State University.