DATA CENTERS

Going Forward Means Going Vertical

SOLUTION

SMALLER FOOTPRINT
TALLER BUILDINGS
MODULAR SYSTEMS

DEMAND
POWER
LAND COST
UTILIZATION
CONNECTION DEVICES
VISIBILITY
CONSTRUCTION COST
HEIGHT
COMPLEXITY

10 ACRES

AVAILABILITY
RELIABILITY
TIME

20 ACRES

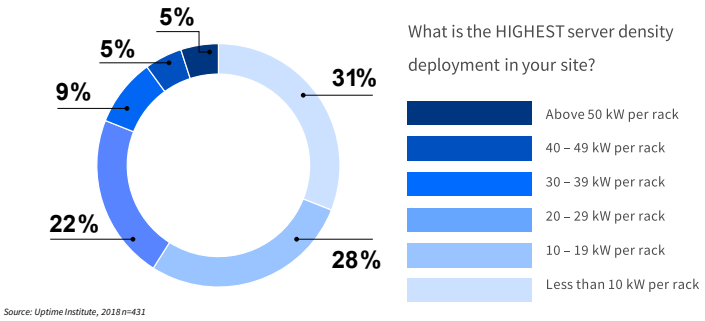
AVISON YOUNG Intelligent Real Estate Solutions

CALLISONRTKL™

M.C. DEAN™ BUILDING INTELLIGENCE

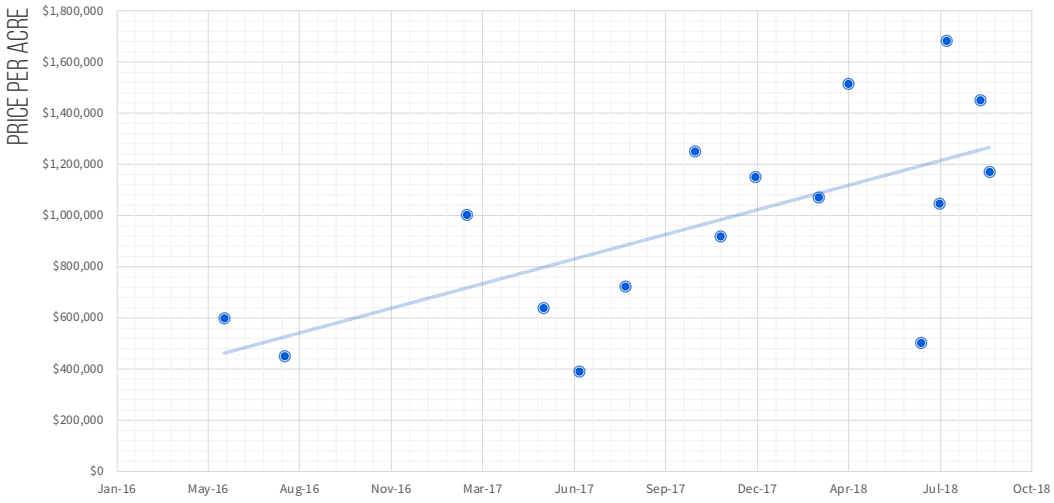
INTRODUCTION

The world's data needs are expanding exponentially. In fact, by 2025, data centers are projected to draw 1/5 of all the world's power. We need more capacity and greater power density in more data centers to meet market demand. But with a scarcity of sites that are suitable in terms of size, power reliability and location, building more data centers is easier said than done. The industry must rethink the legacy one-story box and go vertical to make the most sustainable use of financial and real estate assets.



Source: Uptime Institute, 2018 n=431

There are, of course, challenges to going in a new direction and thinking up. Continuing to build one-story data centers is quick, easy and typically works within existing zoning regulations. With extreme demand of this industry, though, we've analyzed these challenges and modeled different building heights and programs to show that going up is the smart way to go.

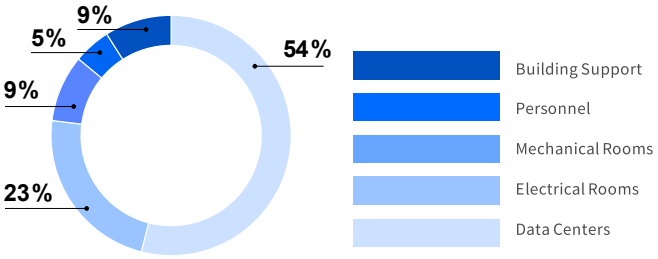


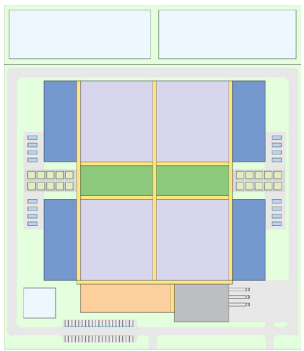
LAND SALES COMPS
DATA CENTER ALLEY, NORTHERN VIRGINIA

DESIGN SOLUTIONS

Our models of typical data center programming and scenarios show that three-story facilities tend to hit the "sweet spot" between land cost, construction cost, and price-per-megawatt today and for the foreseeable future.

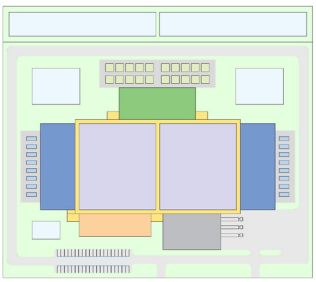
Whether a data center is one, two, three or four stories, the program typically works out in a similar ratio.





BASELINE DESIGN

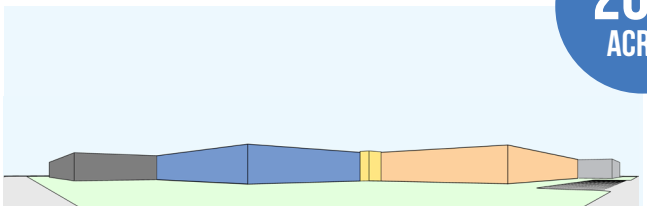
For comparison to a vertical model, the typical data center program with a one-story building that sits on approximately 20 acres of land is our baseline.



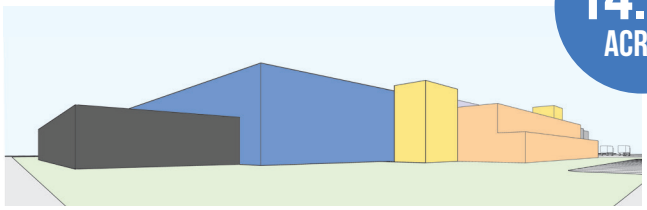
THE START OF GOING VERTICAL

As the building moves into a two-story configuration, the plot of land can be smaller, leading to a lower price per square foot and megawatt.

20.8 ACRES



14.66 ACRES



CHALLENGES

CHALLENGE 1: REAL ESTATE SUITABILITY AND AVAILABILITY

In prime markets, there are increasingly fewer viable sites and locations to build data centers. Land, once seen as a commodity, must now be seen as a scarce resource. Historically, there have been a number of metrics owners and developers have used to assess sites:

- At least 20 acres
- Connectivity to affordable, reliable power
- Sufficient water capacity for cooling
- Proximity to robust fiber connectivity
- Accessibility to a major peering point
- Environmental resiliency to natural disasters
- Proper zoning and accommodating entitlement processes

With all these considerations in mind, Loudoun County, Virginia has risen to the top as the global hub for data centers. Like any other product, with great demand comes lower supply and higher costs. In this case, the product is real estate and, more specifically, sites large enough to accommodate data center facilities. Land prices in "Data Center Alley" have increased 4-5 times in the last three years and there are fewer large sites available. As these trends spread to other markets, the most sustainable option for the future of data centers is to go vertical. With the exponential growth of data demand and the increased difficulty of redesigning an existing building, it makes sense to go vertical from the very beginning, whether a site is 20 or 400 acres.

CHALLENGE 2: DESIGN AND STRUCTURAL INTEGRITY

Every community has similar concerns when it comes to data centers: limit sprawl and minimize disruption to the landscape. These concerns are amplified when going vertical because a one-story box is usually less noticeable than an 80-foot tall building. So, what does that mean for data center owners? It means it is becoming increasingly important, and even mandatory, to engage an architect and think about how the building looks, not just how it functions.

Structurally, going vertical can be a challenge compared to the typical one-story data center as well. Each 2x5 cabinet weighs as much as a Toyota Camry and with the goal of column-less design, that means a more robust and potentially restrictive structure.

Whether the data center is being built in Loudoun or another major market like Chicago or Atlanta, design teams and owners also have to be aware of seismic and other natural disaster concerns.

What it all comes down to is selecting a seasoned architecture/engineering/contractor team that understands the market, the building type and the demand.

CHALLENGE 3: COST

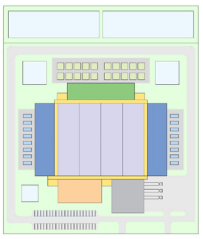
Cost can be seen as a deterrent to going vertical. The bottom line is that going vertical may have more upfront costs but saves a significant amount of money in the long run and delays the need to acquire more sites. As suitable sites become less available and land costs skyrocket, planning for the inevitable expansion with a two- or three-story building from the start makes financial sense, which our design models show.

CHALLENGE: 4: CONSTRUCTION SCHEDULE

For hyperscale solutions for companies like Google, Amazon and Facebook, technological advancements and innovations are moving so fast that an 18-month construction schedule is a non-starter. Working with a knowledgeable team is crucial to getting the construction schedule down to as little as six months through detailed virtual design, prefabricated modules and understanding all aspects of the building type. We also understand how crucial it is in this high-growth market that everything is scalable and flexible to save time not just now, but in future expansion periods.

CHALLENGE 5: OPERATIONS AND LOGISTICS

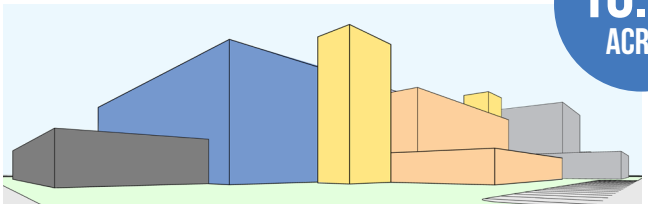
In a typical one-story data center, accessing the loading dock and all the equipment is as straight-forward as possible. When building upward, this can become more of a challenge, particularly when it comes to multi-tenant, co-location facilities. Whatever the program and set-up of the building, there are always design options that can solve these challenges, but finding the right team, with a flexible and innovative mindset, is key.

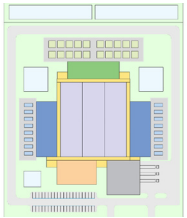


THE "SWEET SPOT"

At a building height of three stories, the site can be half the size of the one needed for a one-story data center. The price per square foot and price per megawatt is nearly identical to the two-story building, all while staying below 1.0 FAR. With all that in mind, our model shows the three-story data center to offer the best balance between cost and future flexibility.

10.47 ACRES

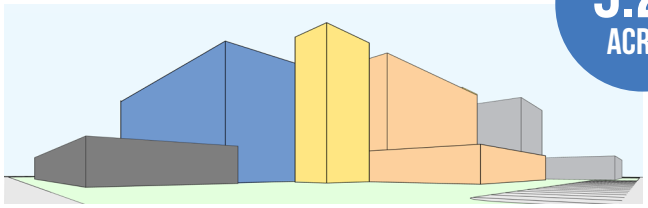




TRUE VERTICAL– FOUR+ STORIES

As data center owners move to create more power density on their existing sites, four-story configurations may become more common. The acreage is only slightly less than the three-story facility and the price per megawatt is higher. Building to four stories is still a viable option for going vertical, but many localities will require a special exception and/or a public engagement process to go above 1.0 FAR regulations.

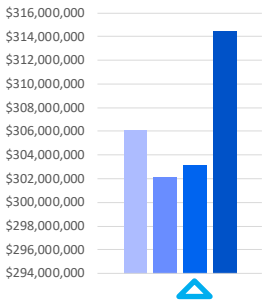
9.28 ACRES



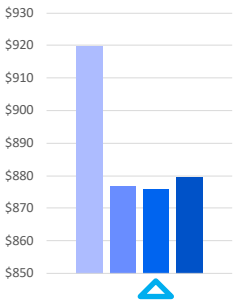
SUMMARY OF DESIGN OPTIONS

FIXED PRICE COST ANALYSIS

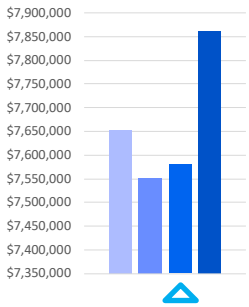
Total Cost

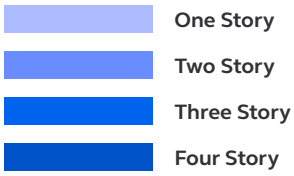


Cost per SF



Cost per MW

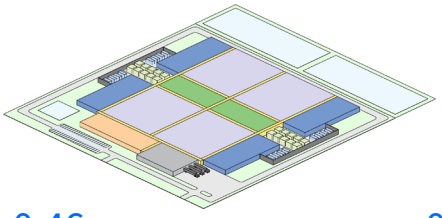




** Estimated Land Price per Acre is $1,500,000*

SIDE-BY-SIDE COMPARISON

1 Story // 20.08 Acres



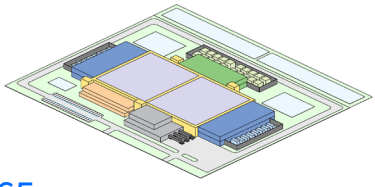
0.46
Floor Area Ratio

332,756 ft²
Building Footprint

332,756 ft²
Total Building Area

2.39
MW per Acre

2 Story // 14.66 Acres



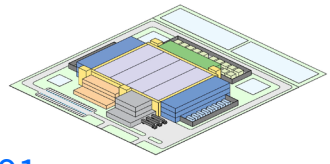
0.65
Floor Area Ratio

176,565 ft²
Building Footprint

344,560 ft²
Total Building Area

3.27
MW per Acre

3 Story // 10.47 Acres



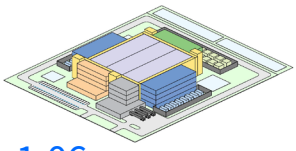
0.91
Floor Area Ratio

121,331 ft²
Building Footprint

346,093 ft²
Total Building Area

4.58
MW per Acre

4 Story // 9.28 Acres



1.06
Floor Area Ratio

97,412 ft²
Building Footprint

357,548 ft²
Total Building Area

5.17
MW per Acre

CONCLUSION

As data centers develop land at internet speed, sustainable use of this resource is crucial. Our design models are based on current scenarios and our industry expertise, but every data center project is a little different. Three stories is currently the best option to maximize land use, but that may not always be the case for different sites across the country. What will remain a constant is that working with a knowledgeable, experienced team that can collaborate from the start is the best way to get the most out of every data center project.

GET IN TOUCH

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