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Volume 18, Issue 10

## Bringing Agility to Data Center Infrastructure

By: [Lucas Beran](#)

Data center physical infrastructure (DCPI) manufacturers are increasingly citing labor inefficiencies in data center construction, pressuring margins and inhibiting product shipments. Whether caused by COVID lockdowns or disruptions related to supply chains, new data center construction and modernization work now requires additional site visits to complete projects. Thus, already complex and congested construction schedules must be modified, ultimately leading to delays and extra work for everyone involved. And with pandemic-induced digital transformation driving all-time high demand for data center services, as well as DCPI vendors sitting on record backlogs, the timing could not be worse. That's why in navigating this unique environment, the data center industry is increasingly installing prefabricated modular data centers (PMDCs).



PMDC solutions pre-integrate data center infrastructure in ISO containers or similarly constructed modules. While PMDCs are highly customizable to fit a wide range of applications and deployment scenarios, they can be segmented into three different types of solutions: all-in-one, IT and physical infrastructure (also referred to as facility) modules.

All-in-one modules are the simplest form of a PMDC. These modules are integrated with IT (compute, networking and storage) and physical infrastructure (power and thermal management) to provide a holistic, all-in-one data center solution. When an all-in-one PMDC is delivered, it is as a “plug and play” solution, which simplifies installation and reduces the need for on-site expertise in data center construction and management. No additional infrastructure is required, with the PMDC being operational in days if not hours after delivery.

IT and physical infrastructure modules are more specialized than all-in-one modules. IT and physical infrastructure modules deliver a single element of data center infrastructure and require

on-site integration with the infrastructure of a stick-built facility (brick and mortar) or integration of both IT and physical infrastructure modules. An IT module delivers pre-integrated IT infrastructure, or the “white space” of a data center, while a physical infrastructure module delivers critical power to support the IT infrastructure. IT modules are always delivered in completely enclosed modules to control and secure the operating environment of the IT infrastructure. The enclosure can be an ISO container form factor, which is easy to transport. Due to size limitations, though, most PMDCs use custom-sized enclosures that are similar in look and feel to an ISO container. Similarly, physical infrastructure modules can be shipped in enclosures, but for additional flexibility in operation and maintenance access, they are just as often mounted on a skid for integration.

## Speed to deployment, scalability and sustainability

The primary benefit of deploying a PMDC is accelerating speed to deployment. Traditional stick-built data center construction can take anywhere from 18 to 24 months. A PMDC deployment can significantly reduce that time to six to nine months, because the construction and integration of data center infrastructure happens off-site, in a factory controlled and designed for PMDC construction. Pulling cables, mechanical and electrical integration, and testing is also done off-site. There are no weather delays or competing schedules of different construction crews, safety is increased in a factory environment, and the risk of failures is reduced.

PMDCs are also highly scalable and repeatable, enabling data center deployments to occur as demand grows. It is notoriously difficult to forecast data center capacity requirements, particularly when looking at capacity needs toward the end of a data center’s life cycle. Even the most sophisticated cloud and colocation data center service providers can fall tens or even hundreds of megawatts (MWs) short on capacity if market dynamics outpace expectations. Conversely, when demand for data center services falls, service providers can be stuck with overcapacity, driving down prices of cloud and colocation data center services. Thus, the combination of speed to deployment and the scalability benefits of PMDCs allows for right-sizing data center deployments based on today’s needs, with the capability of scaling to meet future

demand as it occurs. The use of PMDCs significantly limits the risks associated with overbuilding or underbuilding data center capacity.

One of the less discussed but increasingly more important benefits of PMDC construction is the impact on sustainability. Sustainability has become a top-of-mind decision-making criterion for data center owners and operators. Customers, investors and regulators are also demanding more action from the data center industry on sustainability due to the industry’s anticipated growth. Historically, data center owners and operators have focused on reducing scope 1 and scope 2 greenhouse gas (GHG) emissions generated directly by operating data centers and indirectly through electricity purchases. However, scope 3 GHG emissions, indirect emissions from supply-chain operations, drive most data-center-related GHG emissions.

PMDC data center construction reduces scope 3 GHG emissions for a data center owner or operator, consuming less than half the water and generating less than half the waste of a stick-built data center facility. The controlled construction environment allows materials to be used more efficiently, and they don’t need to be transported to and from construction sites. In

addition, PMDC construction relies more heavily on steel than concrete, in contrast to stick-built facilities, and concrete carries a large amount of embodied carbon. Lastly, PMDC assets can be reused, should they no longer be needed by the original owner, or recycled into other materials at the end of life.

## Shorter ROI and lower TCO

The cost associated with PMDC deployments is often misunderstood. End users tend to believe PMDCs carry a higher price tag than stick-built facilities, while PMDC suppliers tend to over-market cost savings associated with them. In reality, PMDCs cost about the same as stick-built facilities, so capital expenditure (CAPEX) savings are not a major driver of PMDC deployments. The cost benefits of a PMDC deployment become more apparent when considering the return on investment (ROI) and operational expenditure (OPEX).

PMDCs begin their operational lives months, even up to a year, sooner than stick-built alternatives due to their speed-to-deployment advantage. Thus, a PMDC asset likely contributes to revenue generation months ahead of when a stick-built facility would, shortening a PMDC owner's ROI. Because PMDC infrastructure designs are so tightly coupled, they are almost always designed to operate more efficiently than stick-built facilities. This efficiency reduces the cost—and environmental burden—of energy losses associated with less efficient power or cooling designs. With lower operating costs and shorter ROI, PMDCs boast a lower total cost of ownership (TCO) relative to stick-built facilities.

## Overcoming today's data center construction challenges

The last two years have dramatically altered the data center landscape, accelerating years of digital transformation to months, leaving the data center industry playing catch-up. The challenges of COVID lockdowns, supply-chain disruptions, and technology transitions have limited the new construction and enterprise modernization needed for sustainable data center growth. The key benefits of deploying PMDCs—accelerated speed to deployment, scalable and repeatable designs, and lower scope 3 GHG emissions—are a compelling response to today's challenges. Better yet, while some might think these benefits come at a cost, PMDCs require a similar CAPEX to that of stick-built facilities but have a lower OPEX, driving a favorable TCO.

PMDC construction is set to become increasingly common, as enterprises and governments deploy all-in-one PMDC solutions for modernizing on-premises needs, and cloud and colocation service providers use a combination of IT and physical infrastructure modules to utilize stranded space and power, and to build and scale data centers of tens of MWs. PMDC suppliers, particularly DCPI vendors and system integrators, should anticipate and plan for the growing demand for PMDCs. Enterprises, cloud and colocation service providers that are struggling to modernize infrastructure and right-size data center capacity should look no further than PMDCs to help them navigate today's challenging data center construction environment.