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MODULAR CONSTRUCTION IN OFFSHORE ENERGY

With So Many Advantages for Oil and Gas and Beyond, Why Not Modular?

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Technology advances in flexibleww construction have increased significantly in recent years, leading to applications in a wide range of industries with rigorous performance specifications and technical requirements such as Oil and Gas, wind, and marine energy production. To cite but one example, the development cycle of a conventional Offshore Floating Production System (FPS) can range anywhere from five to seven years from blueprint to first oil. However, through the use of modular construction and standardized designs, many operators have been able to reduce time to first oil to just three years after beginning construction, while improving the overall operating flexibility of their facilities.

STICK-BUILT VERSUS MODULAR CONSTRUCTION

Before we proceed with an examination of the benefits of modular construction to the offshore energy industry, let's level set by establishing some shared definitions. Historically, the most common method of construction has been stick-built, also known as "on-site construction." Like any build, a traditional stick-built structure is typically designed by an architect and approved by the customer. The raw materials are then delivered to the job site, frequently shipped in multiple loads throughout the duration of the project, and then cut to size, as the building or critical infrastructure is assembled on site.

In contrast to stick-built, modular construction involves prefabrication of material and integrating equipment and systems into modules offsite in a controlled manufacturing facility. The manufacturing setting ensures more stringent quality control as building components are less affected by environmental elements. More on that later. Once constructed, the modules are delivered to an offshore platform or building site where they can be installed and eventually commissioned.

ADVANTAGES OF MODULAR CONSTRUCTION IN OFFSHORE ENERGY

Modular construction techniques have been used throughout the offshore energy industry, and particularly in the Oil and Gas sector, for decades. However, as the industry copes with fluctuating commodity prices and continues to look for new ways to increase operational efficiency, reduce costs and

maintain profitability, modular design-build solutions are becoming even more common.

Most notably, when time is money, modularized construction can reduce an offshore energy project's development schedule on a number of levels. First, the chance of running into delays caused by weather or other environmental factors is minimized by assembling modules using prefabricated parts offsite in a designated facility. Next, building offsite affords operators the ability to perform work on multiple areas of a facility simultaneously, which is not always possible when using the traditional stick-built approach as the amount of work space onsite is often limited, or when tasks need to be performed sequentially. Lastly, by performing work offsite, operators can create certainty around critical path items by moving them offsite for prefabrication bettering the overall project schedule, and also mitigating the chance of trickle-down delays.

Additionally, prefabricating modules provide significant advantages to quality control and assurance. Metal expansion and contraction caused by variations in temperature can impact the structural integrity of welds manufactured in an outside, onsite environment. In contrast, plant fabrication, performed offsite and often indoors, produces weld reject rates that are substantially lower. Prefabrication also allows for the testing of modules before arriving onsite, which means that any problems with equipment or systems can be identified and quickly resolved in the factory, significantly reducing costs during the installation and commissioning phase of a project.

ACCESS TO A SAFER AND MORE TALENTED WORKFORCE

Particularly critical in the Oil and Gas industry, where in developing or emerging markets the pool of experienced tradespeople such as welders and electricians can be limited, modular construction offers immediate access to the talent required to build large-scale facilities. By selecting an offsite module fabrication facility in a region where there is an adequate supply of skilled labor, offshore energy firms not only gain access to trained professionals but also lower their operational expenditures. That's because with a stick-built approach, the challenge of securing skilled craftsmen and women can very often inflate costs due to the need to provide travel allowances and housing accommodations to set them up in remote locations.

Prefabricating offshore energy facility components also reduces the number of individuals required to work onsite, which can simplify construction activities and increase overall safety. This is especially the case with expansion and upgrade projects, as it reduces the need to perform construction work in close proximity to ongoing facility operations. Additionally, modular construction and prefabrication can minimize the need to shut down parts of an existing plant, thus reducing downtime and increasing production. It also levels the labor that is left onsite reducing the peaks and valleys that are often hard to manage.

SUBSEA, THE IOT AND THE EDGE

In the subsea sector, the use of modular design-build methods continues to gain traction in the form of Modular Cable Landing Stations (MCLS) sited around the world. This is especially useful in harsh or remote environments, and in emerging markets where there is an absence of existing data centers near cable landing points into which cable system owner-operators can directly connect their networks in Point of Presence (PoP) to PoP configurations.

It's also important to note that while new cable builds by Over-the-Top (OTT) providers continue to receive the lion's share of industry attention, not all subsea cable systems are long-haul transoceanic networks with two to three cable landing stations. For example, the Hawaiki Transpacific Submarine Cable System when complete will have cable landings in Sydney, Australia; Oahu, Hawaii; Pacific City, Oregon; and American Samoa.

Undoubtedly, MCLS — by providing a permanent, structural steel and concrete building that is non-combustible and built to withstand the harshest environments, including heavy wind and seismic loads — can provide the solution to a complex cable network in a region known to be vulnerable to extreme weather events.

MCLS have the benefits of a Containerized Cable Landing Station (CCLS) solution but possess higher quality and durability than traditional site-built stations that containers cannot provide. Like other modular construction applications, the best MCLS are built in a controlled envi-

ronment by experienced labor that integrates design flexibility to meet a project's specific technical requirements.

Given that the International Data Corporation (IDC) predicts that by next year, 45 percent of data created by the Internet of Things (IoT) will be stored, processed and analyzed at the edge of the network, prefabricated, modular solutions are also the perfect solution for both edge and micro data centers. Especially when we consider the IHS Markit forecast that the IoT market will grow from more than 15 billion devices in 2015 to more than 75 billion in 2025, it becomes clear that modular design-build methods will be the methodology as it was for the telecom companies growing their cellular networks with modular cellular equipment enclosures in the last few decades.

Traditional "stick build" construction, whereby various components are transported to a site and then laboriously put together into a final product, will not be able to keep pace with the rapid transformations of the Internet of Everything (IoE) and its demands of low latency connectivity at the edge of the network. Bottom line, there will be just too many things, too much data and too little time for the construction of stick-built, monolithic data centers, but modular edge and micro data centers can quickly answer the call, especially those modular building systems that are able to scale quickly without disrupting data transmissions in the operating facility.

Additionally, with the introduction of more and more Artificial Intelligence (AI) and machine learning applications into the Oil and Gas industry, the use of modular edge and micro data centers, especially in remote, arid or marine environments, will become critical. The use of real-time sensors feeding data into AI systems is already prevalent in oil production operations, including forecasting, the optimization of supply chain and the automation of routine tasks.

#NOTACONTAINER

Some people often associate modular construction with prefabricated residential homes, while in the telecom sector, IT administrators and engineers frequently think of containerized data centers. Let me be clear: Containerized data centers are delivered in an actual shipping container or a structure of similar size. However, they are not modular data centers.

Modular data centers are buildings built to customer specifications offsite and shipped in pieces for site installation. The finished product can be as solid, secure, and functional as any other traditionally-built structure. Containerized data centers are retrofitted ISO containers, or constructed to fit the same format, primarily to save cost and provide simpler shipping. The priorities are different: modular systems are designed and built to provide the functionality and usability of a building, while taking advantage of efficiency and consistency of factory production methods; containerized systems force components into a specific format for ease of transportation.

Moreover, containerized data center vendors typically prefer or even require the use of specific equipment and hardware vendors, locking companies in to a single ecosystem. They are also small and cramped to work in— about the size of a semi-trailer — and for that reason are better suited for temporary deployments. There are also constraints in how a company will be able to expand as its capacity needs grow.

A modular data center can be easily modified by simply increasing the floor space and changing layout configurations. With a containerized data center, you're limited to adding another unit, in effect, creating a double-wide trailer. Modular data centers also offer concurrent maintainability and support for a wider variety of hardware if fabricated by a design-build firm and not a manufacturer of equipment. Depending on the implementation, different components can easily be combined with packaged components such as full racks, while prefabricated power systems can be added as additional power capacity is needed. Cooling systems can also be prefabricated, including pumps, chillers, plumbing, condensers, and air handlers.

Modular design-build techniques and prefabricated components can be customized to accommodate virtually any industrial need or technical requirement. Guided by a knowledgeable and experienced partner in modular construction, companies in any vertical, including Oil and Gas, can leverage the benefits of this paradigm shift to accelerate project schedules, reduce costs, increase productivity and become more competitive in an increasingly globalized marketplace. STF

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