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**STREAMLINING OFFSHORE CONSTRUCTION WITH A MODULAR APPROACH**

Offshore and onshore fabrication: Opportunities for major savings

feature story | 35

As the oil and gas sector continues to expand, the industry is looking for ways to streamline offshore construction. One of the key strategies is the use of a modular approach, which involves fabricating components onshore and then transporting them to the offshore site. This approach offers several advantages, including reduced costs, improved safety, and faster installation times.

For many Middle East EPCs and their clients, getting to the construction phase more quickly is a key goal. The use of a modular approach offers a number of benefits, including:

- Reduced costs: Onshore fabrication is generally less expensive than offshore fabrication.
- Improved safety: Working onshore is safer than working offshore.
- Faster installation: Components can be pre-assembled onshore, reducing installation time on the offshore site.

As the industry continues to grow, the use of a modular approach is expected to become an increasingly important part of offshore construction. This approach offers a number of benefits, including reduced costs, improved safety, and faster installation times.

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# STREAMLINING OFFSHORE CONSTRUCTION WITH A MODULAR APPROACH

Offshore and onshore fabrication: Opportunities for major savings





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A modular approach to offshore construction can save time and money by reusing designs for similar projects. Pictured here is a drilling platform under construction.

A trend that is driven by oil and gas exploration, production and midstream organisations is the standardisation and reuse of designs. Energy firms are looking for engineering, procurement and construction companies (EPCs) to lead the way and adopt a modular design approach, including offshore construction, to save significant amounts of time and money for energy projects in Qatar and the wider Middle East region, writes Ossama Tawfick of AspenTech.

Project overruns in the oil, gas and petrochemical industries have cost impacts that extend over the lifetime of the delivered asset, pressuring companies to deliver on schedule and remain profitable. Implementing standardisation designs and adopting a modular approach to process units reduces design, schedule and cost uncertainty and, therefore, saves significant amounts of time and money.

For many Middle East EPCs and their clients, getting to the construction phase more quickly is the aim. With the use of model-based software applications, process designs can be created for reuse in a modular fashion on similar projects and based on varying locations, applications and scale, thereby increasing overall project management efficiency.

Capital projects that overrun their budgets are a strategic issue in the oil and gas industries today. Modular design offers opportunities for savings and the options for onsite fabrication and offsite shop modular fabrication in order to add engineering accuracy and quality efficiency. Modular designs make costs more predictable while reducing uncertainties, such as local labour force dynamics and local resource availability. An integrated engineering software system that comprises integrated engineering modelling and analysis tools can uniquely support the concepts of repeatable design, standardised design and modular design. This ensures that the data does not need to be re-entered between individual engineering tools and to enable the optimisation of a design across the feasibility study, conceptual engineering and front-end engineering design (FEED) workflow.

Many engineering and construction

companies (E&Cs) have modular capabilities, including the design and installation of facilities for upstream oil and gas processing, downstream refining, mining and minerals processing and chemical industries. With an offshore construction project, for example, the installation of structures in a marine environment would typically be pre-commissioned onshore. To optimise the costs and risks of installing large offshore platforms, different construction strategies have been developed.

A fully constructed facility onshore can be towed and installed at the site floating on its own buoyancy. Bottom-founded structures are lowered to the seabed by de-ballasting, while floating structures are held in position with substantial mooring systems. The size of offshore lifts can be reduced by making the construction modular with each module being constructed onshore and then lifted using a crane vessel into place onto the platform. In essence, the use of standardised and modular designs helps engineering companies reduce costs and capital cost uncertainties on projects.

### Streamlining projects

Breaking the habit of reinventing solutions associated with traditional engineering methods can be difficult. Onsite build can be time consuming and costly where there are logistics constraints and unpredictable local

labour conditions. Historically, engineers have often used traditional tools, such as Excel spreadsheets to model and calculate their project schedules, costs, risks and scope. However, by using specialist integrated engineering software, the strategy behind standardised modularisation offers a different approach and involves dividing a plant into modules that are then reused multiple times. EPCs can reduce direct project costs (related to product equipment units, logistics and installation) by 10 percent or more, and project engineering, procurement and construction delivery can be significantly expedited.

Project design is the first key area to embrace a modular approach and reuse standardised design modules for oil and gas plants. Many oil and gas companies design and build customised projects

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Workers at the building site of the Pearl Gas to Liquids (GTL) system in Doha, Qatar. Construction of Pearl GTL was completed on schedule with the complex starting up end of Q1 2011. (Image Arabian Eye)



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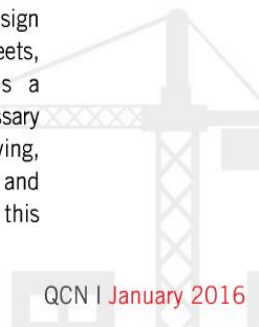
**By capturing process technologies and best practice designs in reusable templates, engineers can apply them repeatedly for dramatic time savings in future projects.**

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to specific locations with geological conditions. A more effective way of working in design is to reuse existing engineering templates, which unite the work. This is a typical licensor workflow business model that has also proven to be highly successful. It has conventionally been thought that upstream oil projects had to be custom-designed for a particular oilfield and crude oil fingerprint. However, recent experiences with modular design approaches have proven to be successful.

The concept of offsite fabrication and modularisation in engineering and design can be scaled from small to large projects, such as a floating production, storage and offloading vessels scaled to the oil and gas flow characteristics of the particular well. Something like a compressor module could be standardised because the same equipment design can be reused on many other vessels. For larger facilities, such as liquefied natural gas (LNG) plants, the focus moves to replicating modules that make up the plant. Another example could be less need for heavy lifting equipment and scaffolding, which would save space and costs.

Many companies have successfully adopted modular standardisation to apply common design specifications and guidelines across each project such as a refinery or production platform. The use of libraries containing design templates, which include datasheets, equipment lists and line lists is a powerful way of avoiding unnecessary duplication of data entry and copying, helping minimise engineering time and reducing costly overruns. Key to this







While many energy companies design and build customised projects to specific locations with geological conditions, a more effective way is to reuse existing engineering templates, which unitise the work. (Image Arabian Eye/ Corbis)

strategy is aligning the engineering stages from conceptual design through basic engineering to detailed design. Collaboration across the project teams is essential to leverage important documentation.

### Leveraging technology saves time

Offsite modular assembly is becoming the preferred method of construction in industrial development. This highly efficient process alleviates the challenges typically associated with tight project schedules, changing site conditions and availability of skilled field labour and minimises variability in quality of the finished product. The safe and correct assembly of equipment, such as columns and reboilers, is critical to performance and reliability. Units derived from fabrication workshops, such as steel casings, stacks and ducts, burners, piping, etcetera, can be pre-assembled

for shipping anywhere around the world and modular construction can be more easily executed with available onsite skills.

As modular design and construction projects become the adopted standard, powerful and integrated engineering tools can help engineers to complete datasheets much quicker and allow the ability to communicate with all stakeholders working on the project. Many EPCs have standardised on AspenTech's aspenONE Engineering software suite, which contains process modelling analysis and design tools that are integrated and accessible through process simulators. Engineers can optimise process designs for energy use, capital and operating costs and product yield through the use of activated energy, economics and equipment design during the modelling process.

EPCs continually seek ways to improve workflow and streamline processes. Aspen HYSYS is the tool of choice with engineers using a modular approach to design. It comprehensively provides access to over 1000 assays representing global production, as well as to the world's most extensive property database. Process units targeted for reuse can be captured as templates and quickly accessed from within the process model when the next project is in design. The tool helps deliver faster project execution, meeting increasing demands and minimising performance degradation, while complying to strict environmental and product quality standards.

For EPCs, it is imperative to deliver accurate cost estimation earlier into the concept design and basic design stages. Implementing standard practices and methods ensures design

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**In essence, modularisation expedites project execution by compressing project schedules, and integrates global design teams for faster on-time delivery.**

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quality, reduces maintenance costs and meets safety compliance. Crucially, it is also important to capture design knowledge to improve the ability of less experienced engineers in delivering high-quality designs. A scalable basic engineering software platform enables global organisations to seamlessly and accurately bring together all aspects of FEED and basic engineering. Now it is possible to achieve a great competitive advantage by delivering process data packages for licensed technologies and other repeatable designs in half the time currently required.

By capturing process technologies and best practice designs in reusable templates, engineers can apply them repeatedly for dramatic time savings in future projects. In addition, robust capital cost estimating software is powerful for evaluating the efficacy of modules for projects. The software provides estimators with an early look at resource constraints, such as craft, labour and fabrication equipment and then enable them to easily evaluate and quickly shop versus field fabrication, including a whole host of trade-off scenarios.

### Modularisation streamlines schedules

With capital project investments under scrutiny in the Middle East, modularisation increases project management efficiency and presents opportunities for trade-offs between onsite fabrication and shop modular fabrication. When modular construction is considered, lead times can be improved and the shop fabricator can efficiently fabricate and then ship. Therefore, early and accurate conceptual design becomes even more important to achieve fast-track designs. Offsite modular assembly is an effective method of construction to help oil, gas and petrochemical companies manage projects more profitably.

Standardised modular design gives EPCs the opportunity to gain a competitive position and take advantage of the unique characteristics of integrated engineering modelling and analysis software tools. This



supports the concept of repeatable designs, which save time to re-enter data and to enable optimisation of a design across the feasibility study, conceptual engineering and FEED workflow. The software tools also help knowledge sharing across the organisation and allow efficient access for project delivery teams to streamline and deliver accurate engineering solutions that meet deadlines. In essence, modularisation expedites project execution by compressing project schedules, and integrates global design teams for faster on-time delivery. **QCN**



The Pearl Gas to Liquids (GTL) is one of the largest GTL plants in the world. Pictured here is its building site before completion. (Image Arabian Eye)



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