Downsizing

Substantial Capex reductions possible within five years

‘topsides’

Floor space on 5th Avenue or in downtown Tokyo can be expensive, to be sure. But even such exclusive locations can’t compete with the stormy North Sea or the remote waters off the west coast of Africa when it comes to cost per square meter. That is why oil and gas companies operating in such areas are desperate to minimize the size and weight of their deepwater floating production systems and other ‘topside’ offshore structures.

The answer lies with new technologies that allow equipment to be built which is better, smaller, lighter, and much less of a drain on capital expenditure (Capex). ABB believes that the industry can aspire to cost reductions in development Capex of up to 50 percent within three to five years.

The continued exploitation of deepwater acreages at depths beyond 1000 meters is supported by the industry’s confidence in the ability of technology to deliver enabling solutions and, particularly, to achieve development Capex targets of under US$ 3/bbl. Whereas much has been written about the achievements and the role of technology in the areas of subsurface, subsea, riser systems and hull systems, little attention has been given until now to the opportunities to be gained from the development of topsides.

In a typical large deepwater field development, the topsides package can represent up to 25 percent of the total development Capex 1. The capital this locks up can be substantial, especially when it is considered that many West African developments today require investments in excess of US$ 2 billion. In ABB’s view, there is abundant potential

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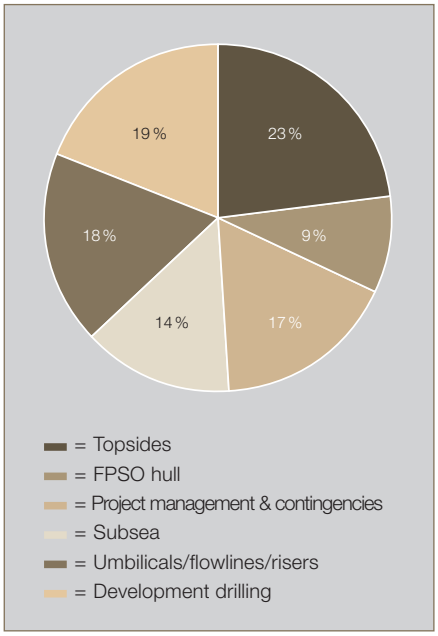

here for system optimization and the introduction of technologies that save cost, footprint and weight while enhancing performance.

Ways to reduce Capex

Given the two general categories of deepwater platform – dry completion units and floating production systems – a strong case can be made for combining system innovations and new methods to reduce the weight and size topsides and so gain a significant saving.

The crux of the issue is an increasing trend in topsides weight, footprint and complexity. Any initiative aimed at transforming the topsides must encompass a number of diverse objectives. Clearly, weight and footprint reduction are key targets, and here we are looking at substantial targets of up to 50 %. Equally important are:

- Green solutions – the opportunity to significantly reduce energy consumption and both liquid and gaseous emissions (by around 20 percent) and to achieve high reliability (95 percent) without investing in standby (redundant) equipment.
- Flexibility – a highly flexible approach to processing to take account of varying reservoir fluid assays.
- Demanning opportunities – arising from simplified topsides.
- Enhanced modularity in design – to reduce preinvestment and allow progressive adjustment throughout the field life.
- Automation – as yet underexploited, but offering significant opportunities when advanced process control concepts are applied.
- Power systems – the emergence of high-voltage direct current (HVDC) technology and offshore power grid concepts is providing fresh opportunities for topsides transformation.

Achievements in context

One way to look at the specific achievements to date is to see them in the context of the topsides as a whole.

Looking at a typical breakdown of the main contributors to a topsides' weight – taking, as an example, an FPSO[1]-based field development off the coast of West Africa – it can be seen that a few core systems account for around 80 percent of the total weight. These are: oil processing, gas injection and dehydration, power generation, water injection and the heating/cooling medium.

High-performance processing

Through research and development conducted over several years, ABB has created high-performance, compact systems in the separation area. These include the 4C (Compact Concentric Cylindrical Cyclone) and the IEC (Inline Electrostatic Coalescer) separation systems. This R&D activity studied the fundamental physics of the separation process and, by means of advanced simulation, measurement techniques and bench scale tests, has enhanced both the quality and the speed of separation of the gas, oil, water and particulates phases. The technology has been installed on a floating production system off the West African coast. The potential exists here to reduce equipment weight by over 40 percent.

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To complement the separation technology suite, ABB has also developed a compact degassing and flotation system dubbed CODEFLO 2. In light of government plans targeting a 'zero discharge level' for discharges into the sea, the purpose of the CODEFLO system is to remove oil and gas from the produced water to specified levels before discharge. The system consists of three main steps: degassing, coagulation and flotation. Incorporating a maximum of four vessels, it is built with off-the-shelf mechanical equipment, one of the key factors con-

2 ABB is developing a compact degassing and flotation system, dubbed CODEFLO.

tributing to lower investment and shorter delivery time. Offshore tests are currently under way in the North Sea. The high turndown and the expectation of a low 10 ppm oil in water discharge level, combined with a relatively small footprint, make this an exciting addition to the technologies available to the offshore industry for reducing liquid emissions.

Innovative gas handling

Gas handling systems on platforms can be complex, large and heavy. In its search for new solutions, ABB is reviewing the possibility of applying membrane technology to topsides gas-processing unit operations.

Through the application of gas-processing membranes for dehydration, hydrocarbon dew-pointing, fuel gas conditioning, nitrogen removal, CO_2 removal, etc, ABB hope to reconfigure the gas processing flowsheet. The resulting membrane systems yield several advantages, including reduction of weight and footprint. Membranes require little attention in operation, and so can potentially support the demanning of platforms. The membranes can also eliminate use of chemicals, such as the glycols and amines employed in conventional gas-treatment systems, thus enhancing the environmental quality of unit operations.

Subsea helps topsides

Another option for reducing the topsides weight is the judicious application of subsea technology. The subsea slug catcher, for example, has many advantages, including a significant reduction in slugging, reduced gas lift and a higher compression inlet pressure at the topsides. All of these benefits translate into a lower topsides weight and simplified separation and compression systems.

In the case of risers for dry completion units, particularly in deepwater developments, the need for riser payloads on topsides is a major determinant of the size, weight and cost of the hull system. The development of rigid and dynamic composites, which have the potential to significantly reduce weight, is another area in which ABB is working to enhance the economics of floating production systems.

Power concepts

ABB, drawing on its electrical engineering technology portfolio, also invests in and examines ways to maximize HVDC[2] technology for offshore power delivery. HVDC Light technology, for example, is specifically targeted for compact deployment offshore, and ABB is currently delivering HVDC Light solutions to a number of offshore projects.

ABB is also involved in technologies for a wide range of distributed power concepts, such as wind generation and microturbines, as well as R&D work on fuel cells. These technologies have the potential to provide maximum flexibility for the topsides designer.

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Automation as a driving force

Central to many of these innovations is the importance of automation for the topsides. As topside processes/systems intensify in weight and volume, the need for dynamic stability in the process becomes a key consideration.

Part of the answer is a smart, real-time, control management application available from a suite of advanced process control applications. A range of enhanced oil production (EOP) applications is specifically focused on the management of flow assurance and improved recovery, and offers a significant saving in operating costs.

ABB – bringing it all together

All of the efforts described here have to go hand in hand with progress in project execution as well as ongoing improvements in product design and suitability for offshore installation. Most important of all, the new technology must tie in reliably and seamlessly with conventional technology and execution approaches.

In order to meet the objectives it has set itself, ABB pursues a sustained process of technology development, focused on elements that offer maximum potential. It is through this approach to execution, incremental system engineering improvements and technology assimilation that the industry can expect to see significant cost reductions in the next five years.

[1] Floating, Production, Storage and Offloading

[2] For long-distance transmission HVDC has significant advantages over AC power, the main one being that it delivers a higher percentage of the transmitted power.

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