

Subsea - leveraging technology innovation to mitigate operational risks

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Energy Demand

The World Energy Outlook (WEO) report forecasts oil demand to increase by 16 per cent between 2012 and 2035, from 87.4 million barrels per day in 2012 to 101.4 Mbb/d in 2035. According to the report, the share of oil in the primary energy mix is expected to continue to be the largest single component, and the growth will be mainly driven by expected increase in demand in China, India and the Middle East. Natural gas demand is expected to increase by 48 per cent between 2011 and 2035, with the growth in demand for natural gas expected to exceed that of any other individual fuel. The report forecasts the share of natural gas in the primary energy mix to increase from 21 per cent to 24 per cent between 2011 and 2035, with the largest absolute increases in demand expected to be in China, the Middle East and North America.

Oil and Gas Supply

Oil supply is projected to reach 101 Mbb/d in 2035, an increase of 12 Mbb/d from 2012 levels. Key components of the increase are expected to be unconventional oil (expected increase of 10 Mbb/d over the period) and natural gas liquids (“NGLs”) accompanying the increase in global gas output (expected increase of 5 Mbb/d over the period). Unconventional oil and NGLs are expected to fill the gap between increasing global demand and conventional crude oil production. Conventional crude oil production’s share of oil production is expected to decrease from 80 per cent in 2012 to 66 per cent in 2035, despite a forecast increase in offshore deepwater conventional crude oil production. The report forecasts an increase in natural gas production between 2011 and 2035 in every region except Europe, where robust production from Norway is not expected to be sufficient to offset the expected decline in production of maturing fields in other parts of the North Sea and onshore Netherlands. Conventional gas as a whole is expected to contribute 52 per cent of the increase in production, with the

rest expected to come from unconventional sources.

Oil and Gas Prices

According to the WEO, the price of Brent crude oil has averaged more than USD 110 per barrel since 2011, a sustained period of high oil prices that is without parallel in oil market history. It is expected that high oil prices will persist, with the average oil price forecast to reach USD 113 per barrel in 2020 and USD 128 per barrel in 2035. Although international trade in natural gas continues to expand rapidly, there is no single global pricing benchmark for natural gas as there is for oil. Rather, there are three major regional markets; North America, Asia-Pacific and Europe, with prices established by different mechanisms. Large geographical spreads in natural gas prices are expected to persist during the outlook period, albeit with a degree of convergence brought about by increasing LNG supplies, increasing short-term trading and greater operational flexibility. The 2013 WEO report forecasts that gas prices in 2035 will reach USD 6.8 per million Btu in North America, USD 12.7 in Europe and USD 14.9 in Asia-Pacific. Natural gas prices in Japan are forecasted to be more than double those in the United States in 2035, meaning that the spread is expected to be much narrower than observed recently, but much greater than before U.S. production of shale gas began increasing in the last decade.

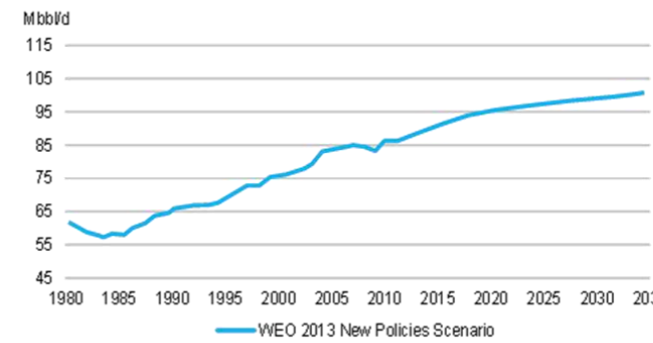
E&P Spending Outlook
According to Barclays Equity Research Survey, based on spending plans of more than 300 oil and gas companies, 2014 global E&P spending is forecasted to grow by approximately 6 per cent to a record high of USD 712 billion. This would represent the fifth consecutive year of annual worldwide spending gains since the 2009 economic downturn. The strongest gains are expected to come from North America and the Eastern Hemisphere. Spending for European E&P companies is expected to be slightly

lower in 2014 compared to prior expectations in December 2013. This is largely due to lower expectations in capital expenditures growth for BG, EnQuest, and Statoil. Barclays Equity Research forecasts that European E&P companies will be challenged to increase production while lowering spending, and instead expect these companies to focus on technological improvements and technological/operational or organisational efficiency measures in the coming years, in order to maximise returns from expenditures. This capital discipline is driven by a short-term focus on cash returns due to equity market pressure, and Barclays estimates investor focus and preference will ultimately shift back to production growth (from cash flow growth).

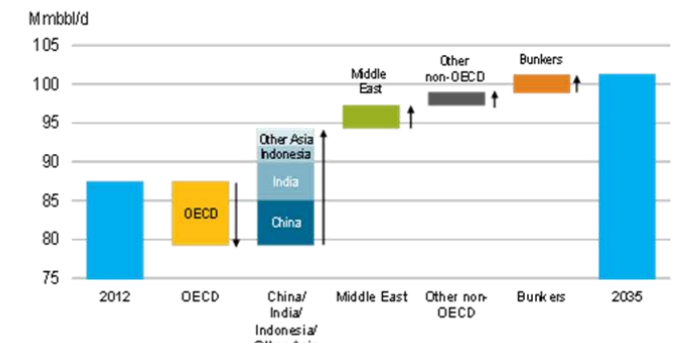
Offshore Focus

In 2013 approximately 30 per cent of global oil supply was produced offshore. Offshore production is expected to continue to increase as ongoing depletion of major conventional onshore fields continues, and developing subsea processing technology helps drive investment into deepwater production, hence attracting a growing share of E&P capital expenditure. According to Rystad Energy, total offshore capital expenditure is estimated to increase from USD 221 billion in 2013 to USD 330 billion in 2019, representing a compound annual growth rate (CAGR) of 7 per cent. Furthermore, approximately 52 per cent of total offshore capital expenditure during 2014 to 2018 is expected to target deepwater (water depth between 125 and 1,500 metres) or ultra-deepwater (water depth greater than 1,500 metres) projects. In addition to the established deepwater regions in Brazil, West Africa and the U.S. Gulf of Mexico, the newly discovered offshore gas provinces in East Africa and the Eastern Mediterranean are also located at water depths greater than 1,000 metres. Africa and South America are the regions expected to show the strongest growth in offshore capital

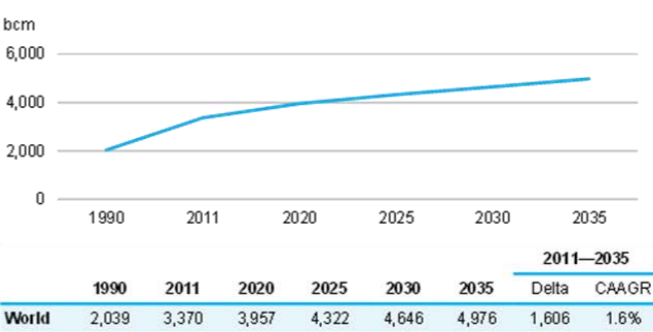
World Oil Demand



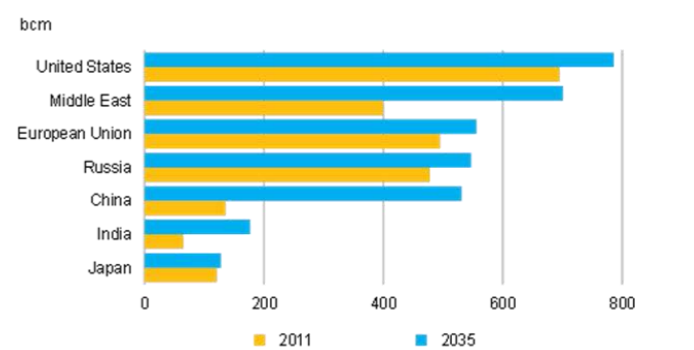
Growth in World Oil Demand by Region, 2012–2035



World Natural Gas Demand

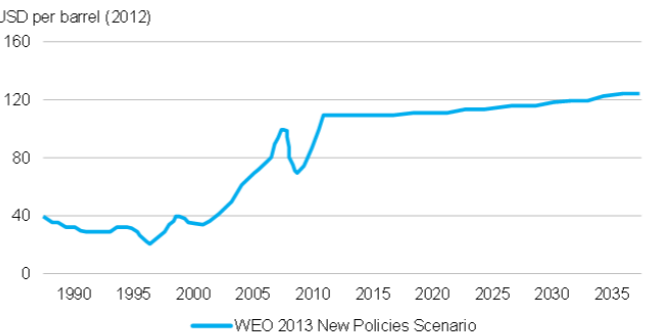


Natural Gas Demand in Selected Regions

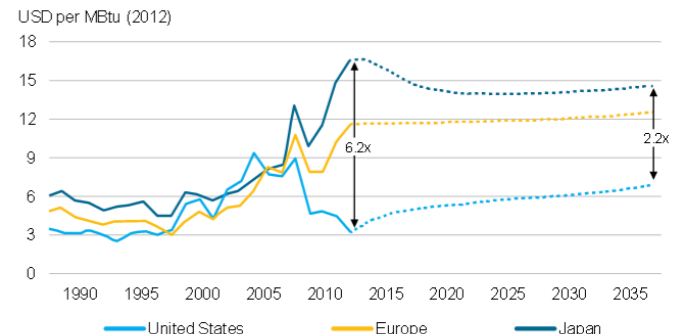


Substantial increase in Oil and Gas demand driven by developing markets
Source: World Energy Outlook 2013 ©OECD/IEA 2013

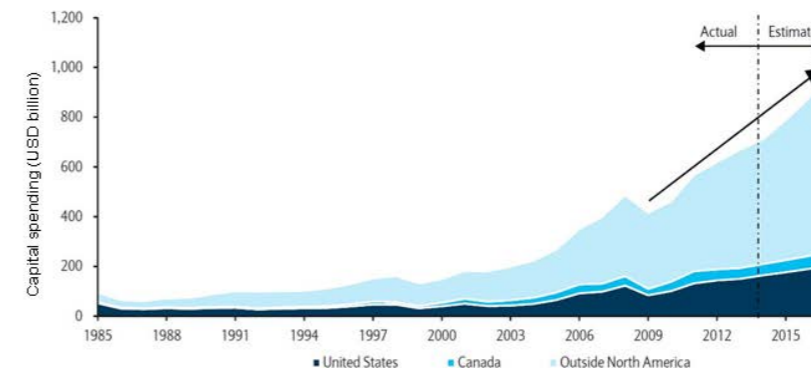
IEA Crude Oil Price Forecast



Natural Gas Price Forecast by Region



Barclays Equity Research Global E&P Spending Outlook



Short-term dip in E&P spent due to equity market pressure
Long term shift to production growth to respond to energy demand

Sustained high pricing of oil and strong regional demand for gas will attract investments
Source: World Energy Outlook 2013 ©OECD/IEA & Barclays Equity Research, Global 2014 E&P Spending Update

expenditure from 2013 to 2019, at a CAGR of 15 per cent and 12 per cent, respectively. For both regions, this is expected to mainly be due to a significant increase in capital expenditure in ultra-deepwater, at a CAGR of 43 per cent and 19 per cent. East Africa is also expected to emerge as a new subsea focus region due to the recent gas discoveries that are planned to come on-stream later this decade. The region is expected to see a significant increase in capital expenditure from USD 16 million in 2013 to USD 8.5 billion in 2019, with ultra-deepwater expected to represent the largest share. The outlook for deepwater spending outlined above is supported by In-field Systems, which sees the majority of incremental demand for subsea installations during the forecast period coming from deepwater and ultra-deepwater fields.

Furthermore, the upcoming deliveries of deepwater capable drilling units are expected to remove a key bottleneck (rig availability) to offshore developments. June 13, 2014 the global offshore competitive

drilling rig fleet, including drillship, jack-up and semisubmersible types, consisted of 861 units, up from 806 units a year earlier. The expansion of the rig fleet will likely help to lower field development costs in the coming years, given the lower costs of deepwater drilling services in the current market. With drilling accounting for approximately 40 to 50 per cent of offshore field development costs, it is anticipated that the expected reduction in drilling costs to be a significant driver of lower overall development costs and, therefore, to contribute to improving oil companies' return on projects.

The Importance of Technology Innovation

Recent period of rapid growth in E&P investments resulted in significant inflation of the cost base and accumulated inefficiencies in project execution. The technology innovation is expected to enable complex field developments (higher water depth, longer step-outs, higher pressure and temperature). However, the technology innovation will also be instrumental to offset the infla-

tion of the cost baseline and improve efficiency. The advancements of the subsea technology is not the only form of innovation. Arguably simplification, standardization and operational efficiency gains are not any easier than incremental technology advancements and may at times require much more technology innovation.

Aker Solutions has developed on this thinking and introduces several key technology initiatives to address standardization, cost efficiency and operational efficiency.

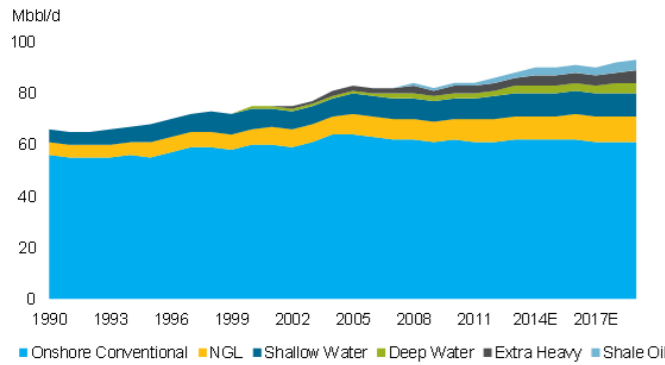
eField

As part of this effort, Aker Solutions is developing a new suite of technology driven services under the eField name. These services are designed to assist the oil companies to leverage data from existing and new field sensors and systems by providing a set of proactive support, maintenance and performance management tools.

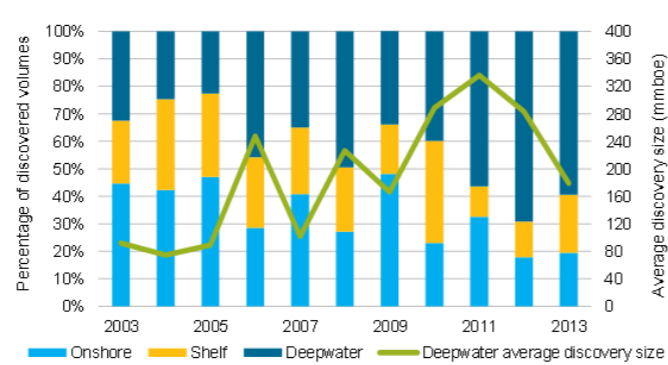
Through eField offering, we strive to support our customers in managing up-time of delivered equipment and making informed decisions on

optimizing its performance. The foundation of eField is fit-for-purpose hardware and instrumentation. This is the hardware layer of the eField system. Each subsea asset designed by Aker Solutions is carefully examined for expected lifetime wear and tear patterns in conjunction with maintenance programs. Based on the thorough understanding of equipment design and operation through the lifecycle, the need for Condition Monitoring instrumentation is derived. eField is utilizing all existing process instrumentation normally supplied with the asset to extract relevant data for Condition Monitoring and Performance Optimization workflows. However, where standard process instrumentation is not sufficient, dedicated eField instrumentation is added to cater for specific needs of Condition Monitoring and Performance Optimization workflows. The choice of Condition Monitoring instrumentation and its placement / mounting is done with in-depth knowledge of subsea equipment design and condition monitoring / performance optimization needs.

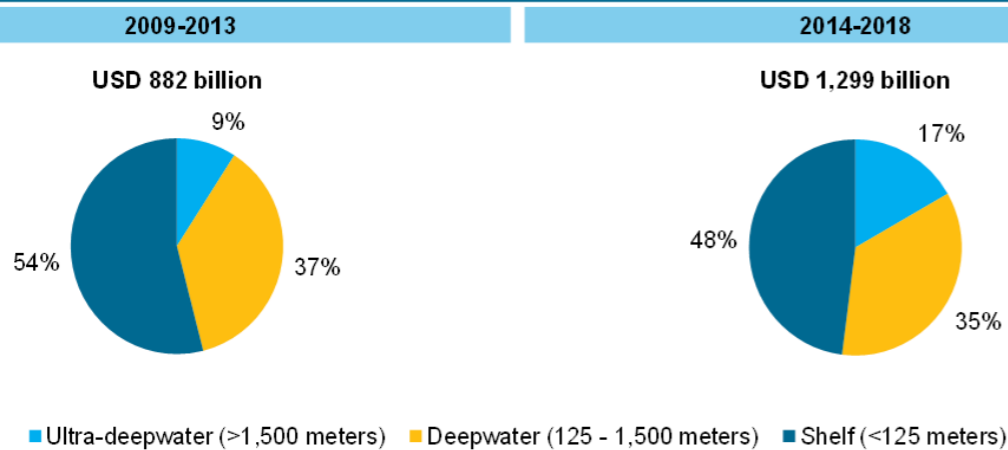
Global Oil Production Forecast



Hydrocarbon Discovery Volumes by Water Depth



Global Offshore Capex by Water Depth, 2009-2018



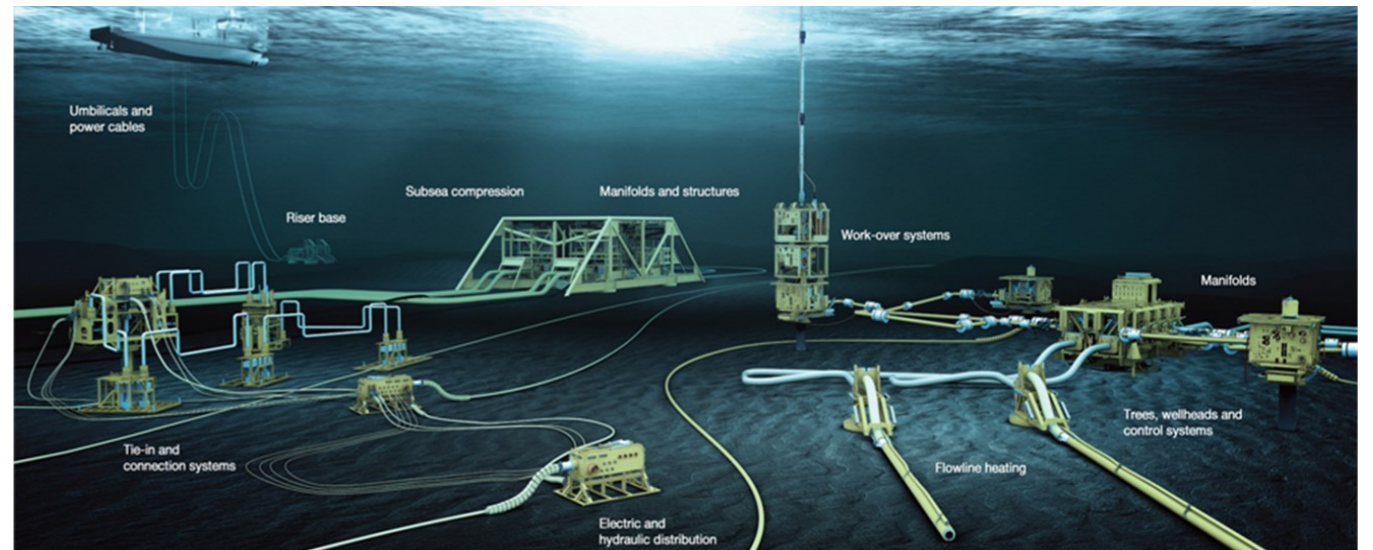
Offshore market will be dominated by recent deep water discoveries securing strong growth in subsea markets
 Source: Infield Systems Oil Production Overview as of August 2014 / Wood Mackenzie as of September 2014 & Rystad Energy DCube database, (July 2014)

While eField instrumentation provides means to physically acquire and store data, software applications contain all the logic to perform equipment up-time and performance management. Software applications are developed to focus on individual tasks – such as calculating real-time performance metric for one type of equipment. With this architecture, new applications can be easily added to the overall system, with minimal disruption to the rest of the system allowing for simplified

maintenance and upgrade of the eField system. **Summary** In a long term perspective the world's energy demand will grow supporting an increase of oil and gas price. Unconventional hydrocarbons will play an increasingly significant role in addressing the world's energy demand, but will not offset all the declining production. Conventional development will shift offshore, driving annual growth rates

of offshore developments at around 7%. Moreover, new technology development will enable deepwater developments bringing the growth of around 16% CAGR for subsea markets, mainly within the main markets, in Africa and Brazil. With the growing complexity of offshore developments, the need for proactive technology-enabled service offerings will emerge. Through the eField offering, Aker Solutions is prepared to play a more active role in helping clients manage the

operational, HSE and financial risks better, as they move towards more complex developments. *This article includes and is based, inter alia, on forward-looking information and statements that are subject to risks and uncertainties that could cause actual results to differ. Please refer to Aker Solutions' website for more details on the information disclaimer.*



Strong focus on subsea technologies will offer a compelling solution to enable deep water development



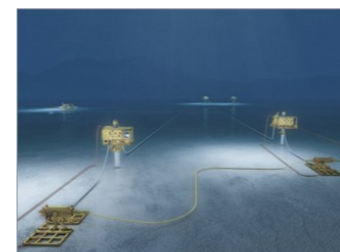
Monitoring built in

- Performance & condition monitoring “baked” into hardware
- Re-using existing sensors / data
- New dedicated sensors where they make sense



Role based and Fit for purpose diagnostic tools

- Streamlined GUIs for operators & front line service
- More powerful analysis for experts – clients & Aker Solutions



Automated & secure multi-domain data integration

- Highly customizable security & remote connectivity options
- Online access extended to ERP data
- Multi-domain data through lifecycle – FAT, operations, maintenance, repair

Vision: Real-time monitoring, rapid troubleshooting & advanced optimization in a distributed setting