Who gets what in offshore drilling?

Deepwater spending to rise fast over next 5 years; shallow water to decline slightly

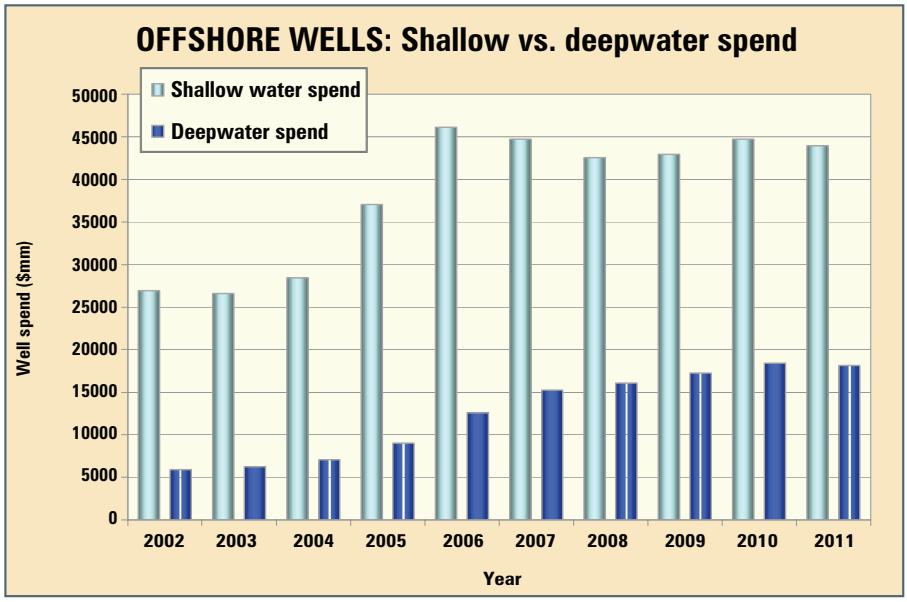
By Michael R Smith, Energyfiles

THE ULTIMATE OBJECTIVE of drilling, both onshore and offshore, is to establish the presence of commercial accumulations of hydrocarbons, assess their volume and create a conduit for them to be produced to the surface. Oil and gas accumulations can be inferred to exist in subsurface structures, mostly with seismic data, but the only way to be absolutely sure of their presence, and to measure and produce the recoverable hydrocarbons, is to drill wells.

Geoscientists and engineers choose surface and subsurface locations to best achieve these objectives, then spend billion of dollars each year on drilling wells — demonstrably the most important individual cost sector in oil and gas operations. Offshore drilling now represents just under half of all expenditure in nearly all operating regions, with oil companies using numbers of wells as a principal guide for financial planning.

The updated "World Offshore Drilling Spend Forecast 2007-2011" from **Douglas-Westwood** estimates that drilling attracts nearly 45% of offshore capital expenditure and that, by 2011, the market will be worth about $62 billion, having grown from $58 billion in 2006. However, offshore expansion is becoming more unevenly spread than ever. In particular, most growth is identified in deep waters where, by 2011, expenditure will have increased to $18 billion, whereas shallow water drilling will have declined slightly, as shown in Figure 1.

The bulk of the spending on drilling is paid to the offshore service industry, so companies that offer drilling services must develop strategies and policies on equipment, people and funds to meet the changing demand. They need to determine where, when and how much global investment capital will be required. But they also need to know who gets what.



Well Category	Sector	Sub-Sector
EXPLORATION APPRAISAL DEVELOPMENT (producers, injectors, deviated, extended reach, horizontal sidetracks, multilateral, etc.) *SHALLOW WATER DEEP WATER*	RIGS	*Jackups* *Semisubmersibles* *Drillships* *Platforms and tenders*
	ENGINEERING	*General mob/demob* *Location services* *Drilling fluids* *Drilling bits* *Directional and MWD/LWD services* *Casing and cementing* *Other rents and materials* *General engineering services* *Testing, completion, and abandonment*
	GEOSCIENCE	*Wireline logging and coring* *Mud logging* *General geoscience services*
	SUPPORT	*Transport* *Other support Services*

Figure 1 (above) shows that more growth is expected in deepwater expenditures, increasing to $18 billion by 2011, whereas shallow water drilling will have declined slightly. Table 1 (left) separates drilling costs into key services, allowing cost analysis to suit basic elements of service sector suppliers.

SECTOR BREAKDOWN

Two major categories of wells remain: exploratory wells, which can be subdivided into wildcat and appraisal wells; and development wells, which, if successful, will be produced through a surface or subsea completion. Depending on number, type and geometry, the different procedures used to drill these wells determine the expenditure shares that service contractors can expect.

Over the years, offshore drilling techniques have remained generally similar to those onshore. The only significant difference is the rig support system — rigs either sit on the seabed or they float — with deep waters, of course, requiring more sophisticated floating support systems. Furthermore, notwithstanding regular improvements to materials and techniques, to sensing devices, to data acquisition, monitoring and interpretation systems and to the engineering hardware used in the drilling process, the basic objective of offshore wells and the equipment and services they require have remained broadly unchanged.

On this basis, the cost of drilling may be subdivided into categories and four main sectors — rigs, engineering, geoscience and support. Costs for each can be further separated into key services as shown in Table 1, permitting cost

analysis to suit the basic elements of service sector suppliers.

Nevertheless, as deep waters expand and as marginal and satellite accumulations become increasingly important in mature offshore regions, some services, such as directional drilling techniques and subsea technologies, are seeing extraordinarily rapid growth while others, like traditional electric logging and platform drilling, may be in decline.

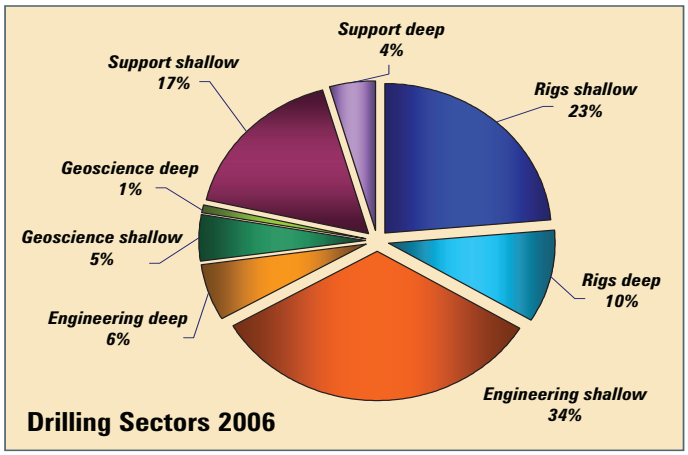


Figure 2: In 2006, the rig sector made up 33% of global drilling costs, a share that has grown substantially in recent years as dayrates strengthened and well paths became more demanding.

VARIABLES

The time spent drilling to reach a planned objective is the most important determinant of the value of services. Drilling days depend on the category of well, the objective depth and the location (relating to its geology, maturity and the relative availability of equipment and personnel).

For example, development well costs often rise in very mature areas where increasing numbers of time-consuming extended-reach and horizontal wells are required to achieve commercial flows. What is more, the measured depth of a well has an exponential relationship with costs, with drilling speeds reducing and difficulties increasing at greater depths and offsets. The trade-off for mature areas is that they have easy access to equipment and remedial solutions to account for drilling hazards are already in place.

Although with global communication, it may be assumed that well costs are almost independent of geographic location, they are not independent of environment. For example, higher mobile drilling costs in deeper waters result from a need for sophisticated and larger units, frequent stoppages due to weather and a greater incidence of hazards. Since the number of deepwater (especially development) wells will increase over the next five years, there will be an upward trend to unit drilling costs.

Thus, in the **Energyfiles** expenditure model, wells are analysed according to drilling days, location, which rig type is used and whether a well is deep or shallow water. Overlain on these influences are estimated inflationary (or deflationary) movements over the period. Thus, each well has its own cost structure derived from summing individual analyses of the cost of services used within the sector breakdown. Figure 2 shows an estimate of the share of global expenditure determined to have been allocated to each of eight drilling cost sectors in 2006.

SPENDING SHARES

The rig sector comprised 33% of costs in 2006, a share that has grown substantially in recent years allied to higher dayrates and more demanding well paths. In 2006, there was a disproportionately large surge in rig costs as the high-specification rigs that most companies required were in short supply.

Rigs are costed by applying average dayrates, subdivided into shallow and deep water rig types as appropriate. The global well database is apportioned into rig type by estimating the percentage of exploratory and development wells in each country that use jackups, semisubmersibles, drillships or platform/tenders in shallow waters, and semisubmersibles and drillships in deep waters.

Around 30% of all wells are drilled using jackups, and their costs are rising due to the advent of new advanced rigs replacing floating units in greater than 100 m water depth and growth of deeper reservoir gas drilling. Around a quarter of all wells are drilled using semisubmersibles, in both shallow and deep waters and for all well types. Semisubmersibles have the widest range of use, although very few are used in the Middle East. Around 5% of wells are drilled using drillships, mostly in deep waters. Close to 25% of deepwater wells use drillships.

The remaining offshore wells are drilled using platform rigs, nearly all of which are shallow water development wells. The numbers are declining in all the larger regions as new offset developments need to be drilled distant from fixed installations, as new platforms employ pre-drilling to speed up first oil, and as cantilever jackups are used to reduce topsides weight. Numbers are, in part, maintained through improved horizontal and extended-reach techniques, which lead to additional but higher-cost platform wells.

Finally, mobilisation/demobilisation costs depend on whether a rig comes from a distant location or port, a local location or port or a nearby job, and on where the rig departs to after the drilling programme. In the model, such costs are fixed by well category. Figure 3 shows an estimate of the share of global expenditure determined to have been allocated to each of the rig cost sectors in 2006.

OTHER SECTOR SPENDS

Engineering costs take the highest share of overall costs (40% in 2006), with eight cost sectors. Location services are used to spud a well safely and accurately, as well as maintain location on site. Fluids and waste management, bits, and directional/LWD services are then used throughout the "drilling ahead" period.

Casing and cementing guarantees the integrity of a well, ensuring trouble-free drilling and testing, if required. Other services and materials do not easily fit into these subsectors. They may include special drilling tools that are not part of the rig contract, tools for remedial work such as fishing (and specialised personnel), rental of a BOP and other safety valves, equipment for hazardous gases that may be found, water and fuel.

General engineering services include all supervision by the company drilling engineer, office-based drilling, petroleum and reservoir engineers and drilling management, as well as the post-well preparation of a drilling report. Finally, testing a well, after its logs and shows indicate a potential oil- or gas-bearing reservoir, followed by completion (if the well is planned for production) or abandonment (if it will not be entered into again) are included.

Geoscience costs make up only a small proportion of a well's total cost (6% in

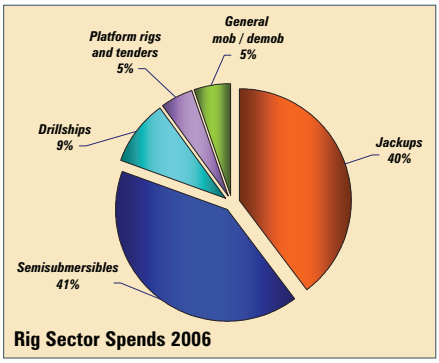


Figure 3 shows that within the 2006 rig cost sector, jackups and semisubmersibles take up the bulk of the spending. Together, those two rig types drill about 55% of all offshore wells.

2006) even though the main purpose of exploratory wells is to determine the geology. Wireline logging and coring are planned and overseen by geoscience personnel, and mud logging is primarily a geoscience technology as well. General geoscience services include all supervision, office-based personnel and exploration management, as well as post-well preparation of a geological report and composite log.

Support, mostly transport, commands a large percentage of well costs (21% in 2006) due to heavy demand for workboats, supply boats and helicopters in the offshore environment. Permanent rentals are very costly, and many drilling programmes in remote locations require the services of one or more fixed wing aircraft to move personnel and supplies to a nearby port or helicopter base. Other support services, such as insurance coverage, chargeable amounts for accounting and some direct licensing costs may also be incorporated.

Figure 4 shows summed sector spends. After a period of flat spending, it picked up through 2005 and 2006, while well numbers grew at a slower rate. The added growth was due to the surge in oil prices (that inflated well costs), global tightness in the availability of high-technology equipment and personnel, and wells that took longer and cost more to drill. Service companies had built up scarce new spare capacity to accommodate even a small expansion of drilling days. An adequate supply of modern drilling equipment requires capital outlays long before it will be used.

All sectors are expected to be roughly flat through 2009, followed by modest oil price-driven increases in spending after 2009, especially directed at deepwater development projects. However, an expansion in the number of rigs should keep dayrates stable. The fact that drilling numbers are forecast to begin a downward trend in 2010 will restrict overall spends at the end of the period whilst per-well spends increase.

THE CHANGING WORLD

Most oilfield professionals older than 45 remember the 1983 Mukluk well, drilled 10 km offshore Alaska in the shallow waters of the Beaufort Sea 40 km northwest of the US's largest oil field, Prudhoe Bay. At the time, forecasters were predicting unbroken oil price growth, and the owners of Mukluk, led by **Sohio**, a company that was run and is now owned by **BP**, built a gravel island in this remote location to test a structure believed to contain 1 or 2 billion barrels of oil. But the well was dry; the structure probably breached. Mukluk ultimately cost more than $120 million to drill, plus $1.5 billion spent on exploration leases in the area. It still ranks as the most expensive dry hole ever.

Unrealised at the time, failures at Mukluk and at other expensive wells in that era were to mark the beginning of risk-averse drilling strategies and focus on technology. Back then, a semisubmersible rig was sited over a seismic velocity pull-up in the belief that it represented a subsurface structure. A well like that would never be drilled today.

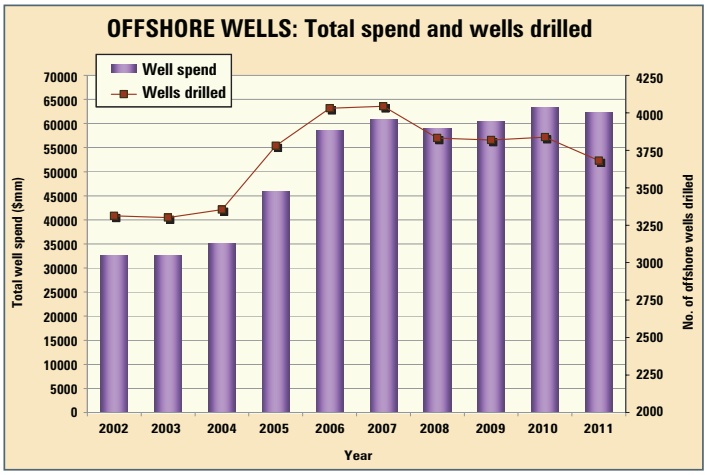


Figure 4: After a period of flat spending, sector spends increased in 2005-2006 while well numbers grew at a slower rate. All sectors are expected to be roughly flat through 2009, then increase modestly after that, mostly in deepwater developments.

But identifying the right technologies is critical. For example, spending on directional drilling and LWD services is expected to grow by 12% over the next five years. All wells require directional tools to ensure that the bit follows its intended subsurface path, but development wells, because they must follow a thin reservoir rather than simply pass through it, or because they are extended reach from a distant surface location, have an increasing demand for directional services. Accompanied by LWD for monitoring bit location and for real-time geological evaluation, such services are adding a significant cost increment to the engineering sector.

New technologies used to reduce dry hole numbers and increase individual production rates will lead to a wider distribution of the money used for drilling. Conversely, although there are new activities associated with drilling, many of which improve its economics, rigs are more costly than ever, and new drilling technologies are very expensive with high start-up costs that has lead to a consolidation of service providers. It is almost impossible for a new (probably under-capitalised) company to operate in this high-tech environment.

Meanwhile shortages of opportunity, the profitability of the industry and the historic actions of OPEC with its oil conservation policies, have ensured that even the most expensive and marginal of offshore drilling projects go ahead. Except in extreme situations, or where geological risk is unacceptable, high well costs are rarely an absolute deterrent to drilling. The share-out of spending will continue.

This is the first part of two articles discussing spending in the offshore drilling sector. The second will appear later in the year looking at geographical distribution. A detailed analysis is available in the report from which both articles are derived.