WELL COST OPTIMISATION

in the

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iWells Management Consultancy: iWells, Dubai, UAE is specialised in drilling oil and gas wells with focus on well optimisation, technical and operational integrity, effective drilling execution strategies, risk mitigation and prevention, integration of multi-disciplined approach to deliver complex projects through a defined well delivery process and establishing Integrated Project Management concepts in the industry.

J. Muthu Kumar, Managing Director, iWells: + 30 years of experience in well construction (drilling, testing and completion) in all drilling environment with +12 years in running integrated project management contracts. Founder of iWells and lead manager to deliver its objectives.

1. Operating Model in the US$ 35 bbl Market

The oil and gas industry enjoyed a successful run in a +US$ 60/bbl world for more than a decade except for a short period in 2008-2009 during the world wide economic melt down when the oil prices fell below US$ 40/bbl. The last 5 years had seen an unprecedented and exceptional run at +US$ 100/bbl world which provided high returns for oil exporters and investors. The high margin of returns allowed investors to expand the drilling activities and venture in to highly complex and extreme environments which created a high demand for rigs, services, equipment and manpower.

The average cost of an offshore well had risen by 100-150% from 2003 until 2014. Due to high crude oil price, the oil and gas companies were able to afford such increased well costs without much focus on cost optimisation or attempts to reduce the cost of rig and services which increased by more than 100% of the 2005-2007 costs. In addition, the costs of services were driven by oil and gas companies using specialised services and expensive technology to drill complex and minimum tolerance wells. Due to low focus on optimisation and efficiency, engineering and process driven issues, inadequate performance values and improperly managed learning curves added further costs to the well.

How does it relate to the current scenario of US$ 35/bbl? Unlike 2008-2009 where the low oil prices existed only for a short duration, the current fall in oil prices is expected to be a long term phenomenon. The latest OPEC Dec 2015 World Oil Outlook report predicts a US$ 5 /bbl increase per year to reach US$ 70/bbl (real terms) in 2020 and this outlook is based on predicted growth in economy and demand for oil. However, predictions and trends in the oil business had failed in the past as oil is not just about a demand-supply model like any other commodity and hence OPEC's prediction of a consistent US$ 5/bbl increase in the mid-term per year may not come true. Some predictions like that of Goldman Sachs indicate oil prices falling to US$ 20/bbl mark at least for a short duration in the near future.

Oil and Gas Companies are the hardest hit due to the fall in the oil prices to the current levels. With significant cut to their revenues, cash flow and ROI, many projects are dropped or investment decisions are delayed indefinitely. There is a fundamental shift from volume to value as many Operators are focusing on increasing production efficiency to existing wells rather than drilling new wells.

However, despite the lower ROI, several Operators need to drill new wells to sustain volume due to declining production levels, need of cash flow to manage debts/other financial commitments and comply with minimum work programme commitments to the Governments to avoid penalties. Some Operators continue to drill new development wells to take advantage of the market conditions to save significant well costs (holding the production until oil prices turn back). Few others, especially oil importing countries, take advantage of the low cost environment to drill exploratory wells for new commercial discoveries. Although rare, few oil and gas companies have to continue drilling due to committed minimum contract duration for the rig and services (to avoid significant penalty for early termination).

The service companies including the rig contractors, associated service providers, tangibles suppliers and manufacturers enjoyed a long comfortable high cost oil environment for almost 12 years (except in 2009).

Both the Operators and Service Providers understand that the oil prices and the market will eventually turn back and the need to be ready for ramping up resources quickly. The service providers strive to sustain the highly trained, skilled and quality personnel by staying in business despite costs falling in to new lows that they have not experienced for almost a decade.

Hence, it is difficult for the oil and gas companies and service providers to stay competitive in the current market conditions unless their entire strategy is shifted from a US$ 100/bbl thought process to a US$ 35/bbl model.

However, in today's world despite the low cost environment, they cannot compromise on technical and operational performance, must comply with safety, statutory, environment and regulatory standards and where applicable host communities/local content requirements (which requires serious consideration to business models in several countries).

The oil and gas companies and service providers must then work on a paradigm shift to their business and operating model to effectively manage the massive shifts in global market conditions (cannot be at local level), reduced funding and cash flow levels and potential lack of quality due to forced low cost operations. The paradigm shift must include positive engagement to achieve innovative contract models, development and adoption of efficient technology and excellence in execution. Jointly both the Operators and Service Providers must turn the market complexity and uncertainty into an opportunity for growth with the support of the Government Regulatory Bodies.

2. Well Cost Optimisation in the US$ 35 bbl Market

What ever the reason for drilling new wells, the ultimate goal for every Operator in the US$ 35/bbl world is to drill and complete the wells at a low cost. However, if the low cost is not defined appropriately, Operators run the risk of drilling cheap wells of low quality which would become expensive in the long run. The right definition of a low cost well is "to drill and complete the wells at the lowest cost possible without compromising safety, environment, objectives and quality". This definition is termed as "Effective Cost of Well" or "ECW". The ECW translates in to the most practical optimal cost of a well that can be achieved without compromising the factors listed above.

ECW is critical to understand as despite the oil prices falling by more than 65-75% from its level of $100-115/= per bbl to $35/= today, cost of (1) rig and services, (2) steel, (3) fuel, (4) products and consumable and (5) qualified manpower have not come down beyond 15-35%. While rig and services had reached the higher range of 20-35%, the tangibles are within 15-20% as of today.

Assuming all other factors constant, purely based on the reduction in rig, services and tangibles cost, a well can be drilled today at 15-20% less cost than drilled at US$ 100/bbl level.

Is this adequate to improve cash flow and ROI at US$ 35/bbl oil price? It may be good for NOCs (and IOCs where applicable) which operate at low production cost/bbl or has no cash flow issues. However, it is definitely inadequate for many mid-sized/small independents with higher production cost/bbl, debt and financial commitments or in deep water/HPHT environment where the threshold for sustainable well costs is much lower than what can be achieved by reduction of rig, services and tangibles cost alone.

Hence, well cost optimisation at US$ 35/bbl world requires as a minimum the following:

(1) Sustainable cost reductions of rig, services and tangibles to the lowest practical level without compromising the quality.

(2) Efficient operations to reduce the number of days towards technical limit.

(3) Effective management of inventory, consumables and products to minimise the back up and contingency levels.

(4) Creating a baseline cost model to allow real time cost monitoring, efficient tracking and budget control. Average well cost model is inadequate to optimise cost in real time.

(5) As more than 50-60% of the well cost is related to time (days in a well), understanding the cost model to optimise the focus areas to achieve significant cost reduction requires a dedicated cost engineering team (many Operators delegate this to a Drilling Engineer as part of his job profile but this has proved to be inadequate due to lack of focus on cost).

(6) Being resilient to adapt quickly to changing market conditions to encourage un-conventional and out of the box thinking to improve efficiency and enhance value.

(7) Best practices, technical and operational integrity as a culture in the company to reduce costs by improving quality at low costs and not by discounted prices alone.

(8) As internal as well as external resistance to optimise / reduce well costs is a likely occurrence, Senior Management support for any such initiative is a must.

(9) Senior Management must create certain critical attitudes to become a primary nature of the decision makers through (a) informed decisions with all possible data from multiple sources, (b) efficient decision making process at the right and appropriate time, (c) Instilling credibility and trust through proper and appropriate delegation of authority to de-centralise

decision taking process and (d) Company wide visibility with empowerment, adequate tools and processes to drive the corporate message to the lowest level of management.

By applying the principles listed above in an integrated well delivery optimisation plan involving all the stakeholders of the process, it is possible to reduce the well costs by 30-45% (or more) than that of of the US$ 100/bbl levels.

The above steps might seem difficult to achieve but truthfully they are not that difficult. The US$ 35/bbl environment and lower ROI must be adequate to encourage all the stakeholders in oil and gas companies to focus their attention on the well cost optimisation. Unless initiatives are taken with a clear baseline strategy to achieve a paradigm shift in the thought process of the entire team, the realisation of reducing cost by 30-45% (or more) will not be possible.

3. Well Cost Model

For cost optimisation, the well cost model must be distributed in logical categories to develop specific and effective optimisation or cost reduction strategies. Although several formats are used in the industry, a practical model is presented below:

(1) Time Dependent Costs – Rig and Services

Applies to all the services including the rig that is on day rate. A good optimisation can occur if the time dependent costs are segregated section wise to avoid an average value/day for the entire well.

(2) Time Dependent Costs – Manpower, Fuel and Others

Manpower segregated for (a) office based, (b) shore base based, (c) rig based and (d) call out consultants' section wise.

Fuel, water and other utility costs as per operational mode – drilling, testing, completion, logging, rig move etc. to arrive at a better accuracy rather than well average.

(3) Depth Dependent Costs

Applies to all the cost that vary with depth like (a) cementing additives, (b) drilling fluids chemicals, (c) completion chemicals, (d) bits, (e) all consumables/repair/redressing etc. are split section wise with detailed contingency model.

(4) Fixed Costs

Applies to all costs that are fixed for the well. Most of them are incurred before the spud like (a) mobilisation, (b) rig positioning – offshore, (c) site construction – onshore, (d) site survey, (e) insurance, (f) cost of preparation until spud etc.

(5) Tangible Costs

Applies to all tangibles like casings, tubing, accessories, completion jewelry, wellhead and x-mas trees, liner hangers, completion screens etc.

Cost split in detail for each section including landing and inventory holding costs.

(6) Contingent Cost

This is critical to avoid too much or too low contingency. Split contingency for:

(a) time in days based on estimated NPT
(b) time in days based on geological uncertainties – non NPT
(c) average spread rate
(d) mitigation cost for losses, fishing (fishing equipment on standby), stuck pipe (release liquids) etc.
(d) port and logistic
(e) waiting on weather and
(f) others.

4. Well Cost Reduction to Achieve "Effective Cost of Well" or "ECW"

iWells identifies Seven (7) steps to achieve ECW. They are:

(1) Reduction in Number of Days

Based on the Well Cost Model distribution in Section 3 above, the Time Dependent Costs (1 and 2) contribute to 50-60% of the total well cost. The percentage is higher for offshore and/or deep water/HPHT operations. Hence any reduction to the total time in days on the well will have a significant effect on costs.

Hence, foremost in providing a large amount of saving is reduction of number of days required to drill and complete the wells.

As a first step, the time estimate must be

based on a P10, P50 and P90 model based on:

(a) detailed analysis of offset well performance to make the learning curve less steep or as low as practically possible;
(b) by carving out good practices used in the offset wells that improved the well performance and mitigation for those that created operational NPT or specific well problems;
(c) by analysing unresolved problems and inconsistencies of the offset wells to develop mitigation plans for new wells;
(d) to ensure that the time estimates is appropriate by understanding the limitations and boundary conditions of the engineering and execution teams, the rig and services engaged;
(e) through a set of defined well delivery criteria and parameters instead of average estimate models;

The P50 is generally considered to be Most Likely Case ("MLC") but they are not always the practical time that can be truly achieved. Hence from the P50 and P10 values, a Most Practical and Possible Time ("MPPT") must be derived.

The MPPT is not a technical limit but lies some where between the P10 and P50 values. Achieving the MPPT time in a well must be one of the primary goals/objectives of the well KPI.

(2) Executable Well Program

To achieve MPPT, an "Executable Well Program" or "EWP" is required. The EWP shall be based on as a minimum:

(a) Subsurface optimisation for well targets to reduce complexity and uncertainty.
(b) Stabilise the well delivery plans by avoiding last minute changes or too many options in the plan which makes the planning inefficient.
(c) Well trajectory optimisation with adequate target tolerance derived from proper subsurface model to minimise time spent on anti-collision (if any) and directional control due to complex trajectories.
(d) Standardise well design for back to back wells to reduce learning curves, minimise well complexity and improve operational efficiency. Avoid experimental or information seeking well plans if possible unless justified.
(e) Casing point selection and casing policy based on detailed risk analysis and design rather than practice.
(f) Effective management strategy of hole stability, stress mechanisms, optimal mud design etc. by proper analysis and studies rather than by practice.
(g) The execution of EDCP requires several initiatives, the foremost being the buy in of the team and integration of multi-disciplines to become an effective team for execution.

(3) Execution of EWP

(a) Complete synergy between Operator, Rig and Service Company teams to eliminate "us" and "they" attitude to work as an integrated team.
(b) Workshops, interface meetings, DWOPs and CWOPs for team buy in to the drilling and completion philosophy.
(c) Ambitious targets are resisted by Senior Management as well as Execution Teams. However, setting tight ambitious targets with a push to perform is critical for cost reduction. If the team capabilities are inadequate, then the limitations or boundary conditions must be expanded ruthlessly instead of struggling with a low capacity team (this worked in a US$ 100/bbl world but will not in a US$ 35/bbl world).
(d) Adequate process driven models combining design and practices rather than only practice based execution approach.
(e) Project risk register with a properly analysed probability matrix and mitigation plan that can be implemented rather than on paper. Being prepared for mitigation will prove to be economical instead of waiting for equipment and services when the risk occurred.
(f) EWP and MPPT cannot be achieved unless efforts are taken to reduce the NPT by rig and service company equipment to be within defined limits/targets.

(4) NPT Reduction and Rig Effective Day Rate EDR

At US$ 35/bbl, rigs and services are available at 25-35% lower cost than that of the US$ 100/bbl market. However, cost alone does not make the rig and services cheaper. The rig day rate must be compared based on "Effective Day Rate" or "EDR".

EDR includes the cost of effectiveness of the rig instead of only the direct rates quoted. EDR is estimated based on the following as a minimum:

(a) the rig performance capability;
(b) NPT records of at least the last 4 wells or 12 months of operations;
(c) rig preventive maintenance and spares program;
(d) the crew efficiency;
(e) operating experience in the country of operation; and
(f) synergy with other rigs or contractors;

As part of the advanced supply chain management and optimisation process, oil and gas companies must work closely with rig and service contractors to achieve drilling optimisation:

(a) to remove idle time;
(b) minimise flat times;
(c) minimise the use of third party services;
(d) reduce the use of expensive downhole equipment unless justified; and
(e) increase drilling efficiency;

This will be a challenge in day rate contracts as there is no incentive for the service providers to participate in such optimisation unless prompted by innovative incentive schemes or long term partnership deals.

Oil and Gas Companies must create a platform of trust with participating service providers to ensure long term deals based on performance. This must be combined with innovative incentive models that reward good performance aligned with company objectives of achieving the MPPT over the fixed day rates.

MPPT can be achieved only if the selection of rig and services is made to achieve less than 5% of equipment based NPT. If the actual NPT levels go above 10% in early wells, then procedures must be established to minimise the NPT in subsequent wells without a steep learning curve.

Deploying dedicated QA/QC engineers through out the campaign with clear directive to closely monitor the maintenance and quality control as per the well requirement and not as per the maintenance schedule of the rig and service companies would be an advantage.

If stacked rigs are mobilised, oil and gas companies must insist on few critical things like:
(a) evaluation of the effective work done during stacked period – analyzing the contractor's definition of warm or cold stacked rigs instead of assuming general industry practice for stacked rigs;
(b) a 3rd party inspection with scope designed for stacked rigs from a drilling contractor as well as Operator's perspective;
(c) pressure testing to working pressure of all pressure equipment;
(d) tensile and torque testing of equipment at least at semi-load condition if possible before mobilisation;
(e) all rubbers new in the system;
(f) closing out critical components arising out of 3rd party inspection;

Engaging with all the service companies with dedicated focal points is a critical step. Champions are to be created for each service to ensure full focus, responsibility and accountability.

(5) Rig and Services Cost

The drive to reduce the cost of the rig and services must be to take advantage of the current market conditions by aggressive and innovative commercial models.

However, as discussed in Section (4) above, reduction in day rate alone will not return efficient deliverables.

One must remember that driving the costs below the minimum threshold value of a rig or a service will lead to negative results thereby increasing the well costs far higher than savings achieved.

(6) Depth Dependent Cost

Reducing the cost of consumables like drilling fluids, cement chemicals and bits is an essential part of well cost optimisation.

High focus must be given to manage the consumables effectively with minimum excess and waste to ensure the costs are optimal. Recycling SOBM to re-use in subsequent sections and wells to reduce preparation of new additional volumes and effective utilisation of fuel on the rig and vessels have potential for significant well cost savings.

The drilling and completion fluids design, cement slurry design, bit and BHA models must be optimised based on detailed analysis and studies rather than following blindly the earlier field practices.

(7) Real Time Optimisation

Real time monitoring, optimisation and mitigation as the well is being drilled is a critical component of well cost reduction. Reporting a NPT incident is inadequate. A real time analysis of every NPT by a dedicated engineer (off the main stream) to find out the underlying cause and to develop optimised solutions at the earliest is the only way to avoid repetition of the problem and to motivate the crew to work more efficiently.

A dedicated well site engineer on the rig and a cost engineer at the base to support the office based real time optimisation engineer will add value to the plan.

8. Conclusions

The path to achieve well cost reduction by 30-45% is difficult. However, it is possible subject to:

(a) initiative from the Senior Management to create the culture in the company and incentives to remove the internal resistance to optimisation;

(b) drive to reduce the cost of the rig and services by taking advantage of the current market conditions by aggressive and innovative commercial models;

(c) change to the organization culture to be flexible, innovative and adaptive to deliver wells at ECW;

(d) paradigm shift to the thought process from a US$ 100/bbl working model to a US$ 35/bbl environment to achieve improvement and efficiency;

(e) integration of multi-disciplines including the rig and services to achieve an integrated well delivery optimisation model;

(f) planning and execution through a process driven model, to achieve the objective as in (d) above, that starts early in the planning stage instead of implementing it late during execution;

If the efforts are driven with integrity and dedicated focus without resistance to change, then there is a high potential to reduce the well cost by 30-45% than that of the US$ 100/bbl market.

9. Further Contacts:

For further discussions

or
support in developing detailed models for planning and execution

or
presentations to the management

or
training / work shops to the execution teams

please contact iWells Management Consultancy at:

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