

## Looking into the future with

## Sjoerd Brouwer, Shell E&amp;P

By Mike Killalea, editor

SJOERD BROUWER IS wells activity leader for Shell E&P.

**DC:** What do you and Shell see as leading technologies we need to develop in order to find and retrieve hydrocarbons in the future?

**BROUWER:** Many of the reservoirs we are going to work on will be in deeper water, tight in terms of permeability, or



Sjoerd Brouwer

mature reservoirs where we are trying to get to the last drop of oil and gas. That will be the focus of technology development.

For deepwater, that means we need machines that can actually drill and complete in much deeper waters

than what we have currently. We need rig technologies that allow us to work with smaller crews, more automation and more safety. And these technologies should reduce the unit cost for subject developments. It's the development of new rig technologies that will make the difference.

I do see a bright future for innovative companies like **Huisman** that are actively plugging new technologies. Companies without heavy capital investments in the current fleet will be bringing most of these innovations. There is a measure of conservatism in the major drilling contractors in the uptake of new technologies. With current oil prices, they can afford to build big machines. However, the margins will get smaller — reserves will be much more difficult to get — so these high rig rates aren't sustainable. The way out of it is technology.

To date, operators have focused on subsurface/well design. The time required to drill and complete have come down, thus putting the focus on rig equipment, efficiency improvements and where we can gain efficiency in rig moves, both offshore and on land. There are very long mobilization times between loca-

tions, and technology can help shorten those times. Both on land and offshore, we need rigs that can be moved quicker from A to B than is currently the case.

**DC:** Is that for all classes of offshore rigs?

**BROUWER:** Drilling performance goes up, and innovative designs, such as multilaterals, increase the output per well. As a consequence, one will generally see well project durations get shorter. Yet because of growing demand and reliance on offshore production, I think that trend will continue. So with more movements per rig between projects, leaner and quicker machines will be big assets.

It's a similar case on land. We are still losing a large proportion of our time on rig moves. There are new concepts

approach to well design from a subsurface point of view will not fully address the potential of the technology. We are optimizing our casing strings, and we are doing a lot in bit technology and logging technology — but then we still have the same expensive rigs to drill, so a large cost element of casing drilling will remain unchanged. It's imperative to get the total supply chain of technologies matched to each other to get the real benefits from niche technologies.

For tight gas, underbalanced drilling and fracturing technologies have already helped us. Tight gas will also require more dense drilling patterns and accurate hole placement. That makes me believe there is a demand for new technologies in the area of hole surveying and possibly directional drilling.

**Q:** Where's the future of the industry?

**A:** Deeper water, tighter permeabilities and mature reservoirs.

through **Drillmar** and other companies with small, lean hoists that can still drill to significant depths. These new concepts will enable better safety performance, and those developments will be enhanced.

**DC:** What about subsurface?

**BROUWER:** Casing drilling definitely has a lot of potential. I believe expandables are still not yet getting the uptake to make them competitive on price, but they definitely turn previously inaccessible reservoirs accessible. We need to learn how to drill in depleted reservoirs. A combination of expandables and casing drilling might be feasible in the future and a means to unlock currently inaccessible reserves.

**DC:** What are some problems with casing drilling and expandables? Is it the economics?

**BROUWER:** It's important to take a total systems approach. Just limiting our

**DC:** Are rotary steerable going to play a significant role?

**BROUWER:** I think so, when they're cost-effective. In some applications, they provide better performance than traditional techniques. I do see a role for rotary steerable — but I hope there would be technology where we can get more power to the bit by using different approaches to making hole.

**DC:** What would you envision for that?

**BROUWER:** That is not clear, but the prospect of getting electrical motors downhole is attractive.

**DC:** What are the problems with electrical motors?

**BROUWER:** Size, cooling and reactive torque, to name a few. A medium to transport the cuttings is always needed, so fluids will always be there. On the other hand, we've got submersible pumps. I think they can be resolved.

I think it's the constraining hole sizes and getting efficient motors to make that happen.

**DC:** On the completions side, are there any revolutionary advances, beyond the fracturing issues we've already discussed?

**BROUWER:** There's statistical evidence that ultimate recovery from platform wells on land operations is higher than for subsea developments. Subsea wells are obviously getting less attention when it comes to working them over or maintaining them, because the only way for well interventions is to use drilling rigs, which is generally very expensive. It would be very promising to have dedicated "tailor made" intervention vessels that are "lean and mean" and economical.

Subsurface, why not expandable completions? It's still pie in the sky, but I can imagine the industry using expandable completions. If you look at the most current diameters for completions, 3 1/2 in., one could even put them on a reel. That would be very powerful. You can run the completions much faster and expand them. I know there are some practical hurdles and some economical ones, but I think that if we look in 10 years time, we will see them.

**DC:** What about coiled tubing?

**BROUWER:** Coiled tubing is useful and used extensively especially on the well maintenance side. As a drilling tool, it has never really lived up to expectations. The major stumbling block is getting enough energy down the hole and having enough strength to absorb the torque. That's why coiled tubing — at least in the drilling arena — never made the breakthrough. In a sense I'm disappointed it didn't.

What I said about getting leaner drilling machines — if we would have coiled tubing drilling under control, that would be a way to make surface equipment leaner than it is now.

**DC:** How about managed pressure drilling? Does that go in the direction of

not having to use the largest drillships and being able to use small rigs?

**BROUWER:** That also requires a total systems approach, and in this case, it's around making the surface BOP concept work.

Developments such as dynamic annular pressure control are very rewarding, and I would expect that, depending on the

**Q:** *Where is rig design heading?*

**A:** *Smaller crews, more automation and decreased costs for developments.*

type of reservoirs, these would percolate into the more conventional drilling areas and into land — once the investments for developing these technologies have been recovered and they are being marketed at lower prices.

**DC:** That's been an issue with rotary steerables as well.

**BROUWER:** Yes, very much so. There is a high premium on new technology where innovative companies are trying to monetize their leading edge quickly. Also, I can somehow sense that a replacement for cement is going to be promoted one of these days. We have swollen elastomers now, which proved superior for zonal isolation. We must ask ourselves: Is there a moment in time when we can do away with cement altogether? However, that still requires a lot of research.

**DC:** That's a far-term goal then?

**BROUWER:** It's the total system approach I was talking about. You will have to look at how all the components make up the well construction system, for example, it has to make sense when you drill and complete a well with expandable technology.

**DC:** Why would that be more beneficial?

**BROUWER:** Because you can drill slimmer wells and reduce rig size, which fits the aspiration to have smaller, leaner drilling rigs.

**DC:** You need a lot of synergies working together to make the engine run.

**BROUWER:** That's the name of the game. To a certain extent, with the way

we have organized our business, it is very much silo'ed in the sense that every provider is looking at a niche technology, or they elect to look at things on a technology-by-technology basis. But economical and drilling margins are getting smaller, and taking a full systems approach will prove to be good business.

I expect that modern IT technology, with the kind of opportunities it has opened in our day-to-day lives, is bound to affect the way we operate. You see that already in the real-time operations, which open up opportunities to improve the quality of our operations because we can mobilize more experts around the decision-making for well planning and operations. But it also requires a change in the skills and attitudes of people to accept that way of working. From that point of view, the technology is already there, but I don't think we are fully exploiting it yet. We are having to come to grips with the changes it requires in our approach to planning and operations.

To which extent can we make use of smart well technology to help us with optimizing our field developments? Reservoir engineers are demanding that we drill horizontal sections, but their models can't predict how long these should be. This often leads to drillers having to take risks to deliver wells with long horizontals, perhaps longer than necessary. In many cases, we're pushing our luck. The feedback of reservoir performance is needed to further optimize. If you can make more fit-for-purpose wells, if you can respond to that with our surface equipment and make it more fit-for-purpose, you are going to realize the vision of leaner drilling machines.

**Q:** *What is the challenge for expandables?*

**A:** *Lack of uptake to be competitive on price.*

**DC:** Modeling and reservoir characterization help you drill better, but how do you model and characterize the reservoir without drilling?

**BROUWER:** That's the big question. Our friends in geophysics and reservoir engineering are busy with that, but I can't see that happening.

**DC:** Several years ago smart wells and multilaterals were the subject of a lot of publicity and excitement, but they've gone to a very low profile now. You don't hear very much about smart wells or things like TAML 4. Is that work still ongoing or has it been largely side-tracked?

**BROUWER:** I believe we can no longer afford to drill wells that are not smart. There are so many different interpretations of what is a smart well. However, future developments will be smart in the sense that they allow real-time operations. Tight gas is a challenge, as is heavy oil. We need to bring technologies down the wellbore that help us to produce those reservoirs economically. A certain level of smartness down the wellbore will be necessary.

Driven by those difficult reservoirs, there are a lot of demands on smart well technology. But it will be tailored to reservoir needs, as will be the case, for example, where we have stacked reservoirs and can't afford commingle-flow reservoirs, which are watered out. Smart wells will enable us to keep those fields in production longer. A challenge to get regulators to accept the technology.

Coming back to my point about subsea wells and well intervention possibilities, I think we will find the highest degrees of smartness in the years to come.

**DC:** So do you have a definition of a smart well?

**BROUWER:** I think a smart well is a well that allows us to observe or influence production real-time downhole.

I honestly believe that for the industry, there is no escape from technology. The pressure is on for companies like Shell that have to rely on its ability to develop difficult oil and gas profitably and in a sustainable manner. We never thought we would produce hydrocarbons at more than 10,000 ft water depth, but we used our knowledge, capabilities and leader-

**Q:** *What do rotary steerables need?*

**A:** *More power to the bit.*

ship to make business from deepwater developments.

That gives me confidence that as an industry we will be able to access and develop reserves that are currently not booked, but the industry needs to work

across the interfaces between disciplines, service companies, governments, etc., to create the competitive environment that breeds innovation and delivers technologies that will fuel the world economy in a profitable and sustainable manner.

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