Aiming for an integrated approach

Schlumberger suggests incorporating EOR into field management practices as a norm, rather than leaving it until the end-of-life of a field. Brian Davis reports.

Faced with the growing recovery challenges of maturing fields and the impact of more unconventional oil operations, increasing recovery factors is a key area of industry focus. ‘New technologies play a significant role in developing this new integrated paradigm,’ says Omer Gurpinar, Technical Director of Enhanced Oil Recovery (EOR) for Schlumberger.

With 35 years of experience in reservoir optimisation, Gurpinar highlights significant enhancements in reservoir characterisation, modelling capabilities, EOR chemicals, monitoring and control systems, and the complexities of flow physics. ‘Traditionally the industry looked at EOR as something separate from field development, to be carried out at the end-of-field life. We don’t look at it this way anymore. EOR – or “dealing with recovery challenges” – should be considered all the way in the life of a field from early development to abandonment,’ he says.

EOR accounts for a tiny amount of production (about 1% according to BP), but Gurpinar argues that far more multiphase schemes are actually going on globally to boost recovery. ‘More and more water flood recovery projects are being converted to low salinity or surfactant, for example,’ he says, also warning that no one size fits all.

Traditionally, EOR programmes take several years to deploy. However, Schlumberger is focused on cutting the lead time for EOR schemes from concept to implementation to just one year. ‘Because unless you set a very challenging goal, history will repeat itself again and again,’ says Gurpinar. Furthermore, Schlumberger is developing new planning, monitoring and control systems for full-field implementation, to accelerate EOR projects with more reliable tests.

Multi-scale reservoir models can be developed with advanced EOR proof of concept technologies like MicroPilot single well in-situ EOR design. ‘It’s still early days. We are developing new technologies that improve reservoir characterisation. Admittedly one well test can’t tell you everything, but single well tests are the only way to honour the reservoir characteristics for better EOR design,’ notes Gurpinar. Parallel to new field tests, EOR enhancements in the Petrel E&P software platform can also support analysis of EOR design and management.

Having read over 4,000 SPE papers on EOR, Gurpinar recognises that most EOR projects haven’t delivered on the promise as ‘what worked in the lab didn’t happen in the reservoir’. He suggests the problem is often nothing to do with EOR but field management. ‘Most fields are developed with primary production in mind. If anticipated recovery challenges are brought into the picture earlier, for example, wells and completions and many other fundamental development features would be done differently and that might help success of EOR projects in the long run.’

Improved visualisation and modelling

Better reservoir characterisation is being achieved with advanced computer visualisation systems, like Petrel, Digital Rocks and integration of cross-well electromagnetic imaging data to history matching, providing more accurate understanding of multiphase saturation distribution for oil reservoirs undergoing EOR-agent flooding.

‘One of the reasons EOR was so complex and expensive (particularly offshore) and didn’t deliver, was that even simple measurements were deferred to the end. We need a change of mindset, with simple but surgical and fast test and analysis at the beginning of the cycle so we know the highest recovery that can be achieved,’ says Gurpinar.

He claims: ‘EOR-based reservoir characterisation provides smaller granularity for understanding porosity and mineral distribution. Models are larger and faster, but there is still need for better understanding of recovery physics and more analysis of different flow systems. Using Digital Rock, for example, we are able to understand EOR flow systems far better than one can achieve with standard finite difference simulators.’

Gurpinar recommends that most tests should be done in reservoir conditions, eliminating ‘lab to field’ errors – using systems like MicroPilot and single horizontal well quick pilot systems.

There is also a marked shortage of EOR experience, he remarks. ‘Even when experienced people have access to EOR reservoir models, there is a lack of tools for detailed analysis, which is now being addressed by software like the Petrel platform, INTERSECT hi-res reservoir simulator (developed in collaboration by Schlumberger, Chevron and Total), the Eclipse reservoir simulator, and new smart EOR guided systems.’

Gurpinar also decries the lack of reliable EOR monitoring and control technology. Accordingly, Schlumberger is developing new fibre optic and sensor developments and different modelling techniques, so operators can feel more comfortable that things are going right in the field.

Gurpinar anticipates that ‘within 10 years, 30% of oil production will come from fields under EOR, because even the world’s largest oil fields are being challenged by recovery today. Most major fields are in decline or producing a lot of water or gas, so EOR-related activities are set to grow dramatically. Considering all the technology advances underway we should not be shy to set goals to double recovery factors.’